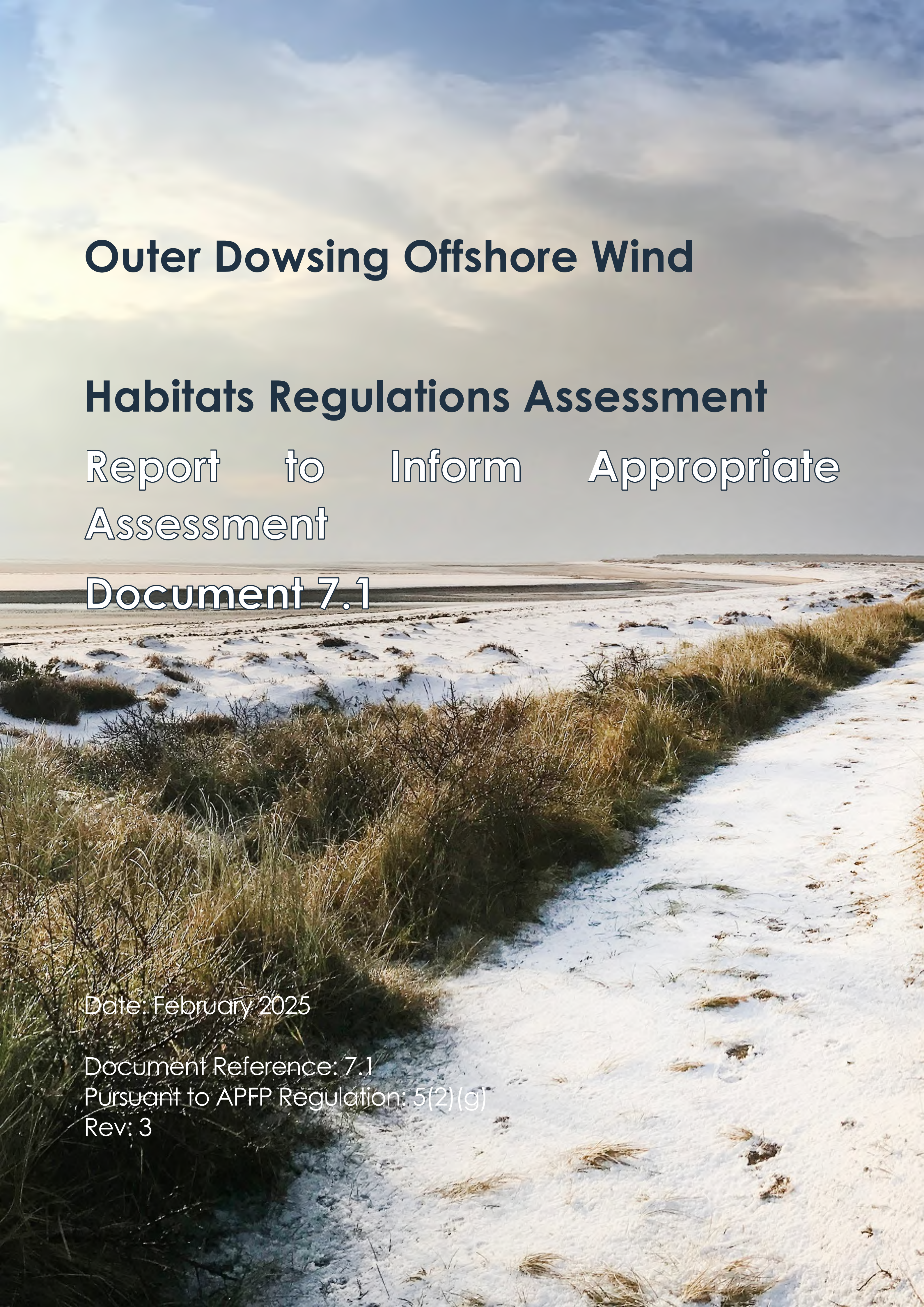

Outer Dowsing Offshore Wind

Habitats Regulations Assessment

Report to Inform Appropriate Assessment

Document 7.1

Date: February 2025

Document Reference: 7.1
Pursuant to APFP Regulation: 5(2)(g)
Rev: 3

Company:	**Outer Dowsing Offshore Wind**	Asset:	**Whole Asset**
Project:	**Whole Windfarm**	Sub Project/Package:	Whole Asset
Document Title or Description:	Report to Inform Appropriate Assessment		
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Rev No.	**Date**	**Status / Reason for Issue**	**Author**	**Checked by**	**Reviewed by**	**Approved by**
1.0	March 2024	DCO Application	GoBe/ SLR	Outer Dowsing	Shepherd & Wedderburn	Outer Dowsing
2.0	July 2024	Response to Section 51 advice	GoBe/ SLR	Outer Dowsing	Outer Dowsing	Outer Dowsing
3.0	February 2025	Deadline 4 submission	GoBe/ SLR	Outer Dowsing	Shepherd & Wedderburn	Outer Dowsing

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Acronyms & Definitions

Abbreviations / Acronyms

Acronym	Expanded name
AA	Appropriate Assessment
ADD	Acoustic Deterrent Device
AEoI	Adverse Effect on Integrity
AIL	Abnormal Indivisible Loads
ANCB	Appropriate Nature Conservation Body
ANS	Artificial Nesting Structure
AOE	Alde Ore Estuary
AOWFL	Aberdeen Offshore Windfarm Limited
AQMP	Air Quality Management Plan
BAEF	Boston Alternative Energy Facility
BDMPS	Biologically Defined Minimum Population Scales
BEIS	Department for Business, Energy & Industrial Strategy (now the Department for Energy Security and Net Zero (DESNZ))
BERR	Business, Enterprise and Regulatory Reform
BESS	British Energy Security Strategy
BLP	Brink Linked Platform
BND	Bottlenose Dolphin
BTO	British Trust for Ornithology
CBRA	Cable Burial Risk Assessment
CCS	Carbon Capture and Storage
CCW	Countryside Council for Wales
CEA	Cumulative Effects Assessment
Cefas	Centre for Environment, Fisheries and Aquaculture Science
CI	Confidence Interval
CMS	Construction Method Statement
CPS	Counterfactual of Population Size
CRM	Collision Risk Modelling
cSAC	candidate Special Area of Conservation
CSIP	Cetacean Strandings Investigation Programme
DBS	Dogger Bank South
DCO	Development Consent Order
DECC	Department of Energy & Climate Change, now the Department for Energy Security and Net Zero (DESNZ)
Defra	Department for Environment, Food and Rural Affairs (Defra, not DEFRA)
DEP	Dudgeon Extension Project
DESNZ	Department for Energy Security and Net Zero, formerly Department of Business, Energy and Industrial Strategy (BEIS), which was previously Department of Energy & Climate Change (DECC)
DML	Deemed Marine Licence
DP	Decommissioning Programme

Acronym	Expanded name
EC	European Commission
ECC	Export Cable Corridor
ECJ	European Court of Justice
EDR	Effective Deterrent Radius
EEA	European Economic Area
EIA	Environmental Impact Assessment
EMF	Electromagnetic Frequency
EMS	Ecological Method Statement
EOWDC	European Offshore Wind Development Centre
EPP	Evidence Plan Process
EPS	European Protected Species
ES	Environmental Statement
ETG	Expert Topic Group
EU	European Union
FCS	Favourable Conservation Status
FFC	Flamborough and Filey Coast
GBS	Gravity Base Structure
GS	Grey Seal
GT R4 Ltd	The Applicant. The special project vehicle created in partnership between Corio Generation (a wholly owned Green Investment Group portfolio company), Gulf Energy Development and TotalEnergies
HP	Harbour Porpoise
HRA	Habitat Regulations Assessment
HS	Harbour Seal
IAMMWG	Inter-Agency Marine Mammal Working Group
ICES	International Committee on the Exploration of the Sea
INNS	Invasive Non-Native Species
IROPI	Imperative Reasons of Overriding Public Interest
JNCC	Joint Nature Conservation Committee
LSE	Likely Significant Effect
LWT	Lincolnshire Wildlife Trust
MarESA	Marine Evidence based Sensitivity Assessment
MDS	Maximum Design Scenario
MFE	Mass Flow Excavator
MHWS	Mean High Water Springs
ML	Marine Licence
MLA	Marine Licence Application
MLWS	Mean Low Water Springs
MMF	Mean-Max Foraging
MMMP	Marine Mammal Mitigation Protocol
MMO	Marine Mammal Organisation
MPCP	Marine Pollution Contingency Plan
MSL	Mean Seal Level
MU	Management Unit

Acronym	Expanded name
MWH	Minke Whale
NE	Natural England
NPS	Natural Policy Statement
NRMM	Non-Road Mobile Machinery
NSIP	Nationally Significant Infrastructure Project
ODOW	Outer Dowsing Offshore Wind
OFTO	Offshore Transmission Owner
OP	Offshore Platform
ORBA	Offshore Restricted Build Area
ORCP	Offshore Reactive Compensation Platform
ORJIP	Offshore Renewables Joint Industry Programme
OSS	Offshore Substation
OWEZ	Offshore Windpark Egmond aan Zee
OWF	Offshore Windfarm
PCH	Proportion at Collision Height
PCW	Phocid Carnivores in Water
PDV	Phocine distemper virus
PEIR	Preliminary Environmental Impact Report
PEMP	Project Environmental Management Plan
PPEIRP	Pollution Prevention and Emergency Incident Response Plan
pSPA	potential Special Protected Area
PTS	Permanent Threshold Shift
PVA	Population Viability Analysis
RBBP	Rare Breeding Birds Panel
RIAA	Report to Inform Appropriate Assessment
RMS	Root-Mean-Square
RSPB	Royal Society for the Protection of Birds
SAC	Special Area of Conservation
SACO	Supplementary Advice on Conservation Objectives
SCI	Sites of Community Importance
SCOS	Special Committee on Seals
SD	Standard Deviation
SEA	Strategic Environmental Assessment
SEL	Sound Exposure Level
SEP	Sheringham Extension Project
SIP	Site Integrity Plan
SMP	Seabird Monitoring Programme
SMRU	Sea Mammal Research Unit
SMRUC	Sea Mammal Research Unit Consulting
SNCB	Statutory Nature Conservation Body
SNS	Southern North Sea
SOSS	Strategic Ornithological Support Service
SOW	Sofia Offshore Wind
SPA	Special Protection Area

Acronym	Expanded name
SPL	Sound Pressure Level
SPMP	Scour Protection Management Plan
SSC	Suspended Sediment Concentration
SSS	Side Scan Sonar
SSSI	Site of Special Scientific Interest
TCE	The Crown Estate
TJB	Transition Joint Bay
TTS	Temporary Threshold Shift
UK	United Kingdom
UXO	Unexploded Ordnance
VHF	Very High Frequency
VMP	Vessel Management Plan
WD	White Beaked Dolphin
WTG	Wind Turbine Generator
WWT	Wildfowl and Wetland Trust
ZoI	Zone of Influence

Terminology

Term	Definition
400kV cables	High-voltage cables linking the OnSS to the NGSS.
400kV cable corridor	The 400kV cable corridor is the area within which the 400kV cables connecting the onshore substation to the NGSS will be situated.
The Applicant	GT R4 Ltd. The Applicant making the application for a DCO. The Applicant is GT R4 Limited (a joint venture between Corio Generation, TotalEnergies and Gulf Energy Development (GULF)), trading as Outer Dowsing Offshore Wind. The project is being developed by Corio Generation (a wholly owned Green Investment Group portfolio company), TotalEnergies and GULF.
Array area	The area offshore within which the generating stations (including wind turbine generators (WTG) and inter array cables), offshore accommodation platforms, offshore transformer substations and associated cabling are positioned.
Baseline	The status of the environment at the time of assessment without the development in place.
Biodiversity Net Gain	An approach to development that leaves biodiversity in a measurably improved state than it was previously. Where a development has an impact on biodiversity, developers are encouraged to provide an increase in appropriate natural habitat and ecological features over and above that being affected, to ensure that the current loss of biodiversity through development will be halted and ecological networks can be restored.
Cable Circuit	A number of electrical conductors necessary to transmit electricity between two points bundled as one cable or taking the form of

Term	Definition
	separate cables, and may include one or more auxiliary cables (normally fibre optic cables).
Cable ducts	A duct is a length of underground piping which is used to house the Cable Circuits.
Compensatory Measures	Stage 3 of the Habitats Regulations Assessments (see Derogation) involves the development of compensation measures for any features which the report to inform appropriate assessment was unable to conclude no adverse effect on integrity on.
Connection Area	An indicative search area for the NGSS.
Cumulative effects	The combined effect of the Project acting cumulatively with the effects of a number of different projects, on the same single receptor/resource.
Cumulative impact	Impacts that result from changes caused by other past, present or reasonably foreseeable actions together with the Project.
deemed Marine Licence (dML)	A marine licence set out in a Schedule to the Development Consent Order and deemed to have been granted under Part 4 (marine licensing) of the Marine and Coastal Access Act 2009.
Derogation	Stage 3 of the Habitats Regulations Assessments which is triggered once it is determined that you cannot avoid adversely affecting the integrity of a designated site. Involves assessing if alternative solutions are available to achieve the same goals as the project, if there are imperative reasons of overriding public interest, and if compensatory measures will be required.
Development Consent Order (DCO)	An order made under the Planning Act 2008 granting development consent for a Nationally Significant Infrastructure Project (NSIP) from the Secretary of State (SoS) for Department for Energy Security and Net Zero (DESNZ).
Effect	Term used to express the consequence of an impact. The significance of an effect is determined by correlating the magnitude of an impact with the sensitivity of a receptor, in accordance with defined significance criteria.
EIA Directive	European Union 2011/92/EU (as amended by Directive 2014/52/EU)
EIA Regulations	Infrastructure Planning (Environmental Impact Assessment) Regulations 2017
Environmental Impact Assessment (EIA)	A statutory process by which certain planned projects must be assessed before a formal decision to proceed can be made. It involves the collection and consideration of environmental information, which fulfils the assessment requirements of the Environmental Impact Assessment (EIA) Regulations, including the publication of an Environmental Statement (ES).
Environmental Statement (ES)	The suite of documents that detail the processes and results of the Environmental Impact Assessment (EIA).
Evidence Plan	A voluntary process of stakeholder consultation with appropriate Expert Topic Groups (ETGs) that discusses and, where possible,

Term	Definition
	agrees the detailed approach to the Environmental Impact Assessment (EIA) and information to support Habitats Regulations Assessment (HRA) for those relevant topics included in the process, undertaken during the pre-application period.
Export cables	High voltage cables which transmit power from the Offshore Substations (OSS) to the Onshore Substation (OnSS) via an Offshore Reactive Compensation Platform (ORCP) if required, which may include one or more auxiliary cables (normally fibre optic cables).
Habitats Regulations Assessment (HRA)	A process which helps determine likely significant effects and (where appropriate) assesses adverse impacts on the integrity of European conservation sites and Ramsar sites. The process consists of up to four stages of assessment: screening, appropriate assessment, assessment of alternative solutions and assessment of imperative reasons of over-riding public interest (IROPI) and compensatory measures.
Haul Road	The track within the onshore ECC which the construction traffic would use to facilitate construction.
Impact	An impact to the receiving environment is defined as any change to its baseline condition, either adverse or beneficial.
Indicative Working Width	The indicative working width within the Onshore Export Cable Corridor (ECC), required for the construction of the onshore cable route.
Inter-array cables	Cable which connects the wind turbines to each other and to the offshore substation(s), which may include one or more auxiliary cables (normally fibre optic cables).
Interlink cables	Cable which connects the Offshore Substations (OSS) to one another, which may include one or more auxiliary cables (normally fibre optic cables).
Intertidal	The area between Mean High Water Springs (MHWS) and Mean Low Water Springs (MLWS).
Joint bays	An excavation formed with a buried concrete slab at sufficient depth to enable the jointing of high voltage power cables.
Landfall	The location at the land-sea interface where the offshore export cables and fibre optic cables will come ashore.
Link boxes	Underground metal chamber placed within a plastic and/or concrete pit where the metal sheaths between adjacent export cable sections are connected and earthed.
Maximum Design Scenario	The maximum design parameters of the combined project assets that result in the greatest potential for change in relation to each impact assessed.
Mitigation	Mitigation measures, or commitments, are commitments made by the Project to reduce and/or eliminate the potential for significant effects to arise as a result of the Project. Mitigation measures can be embedded (part of the project design) or secondarily added to reduce impacts in the case of potentially significant effects.

Term	Definition
National Grid Onshore Substation (NGSS)	The National Grid substation and associated enabling works to be developed by the National Grid Electricity Transmission (NGET) into which the Project's 400kV Cables would connect.
National Policy Statement (NPS)	A document setting out national policy against which proposals for Nationally Significant Infrastructure Projects (NSIPs) will be assessed and decided upon.
Offshore Export Cable Corridor (ECC)	The Offshore Export Cable Corridor (Offshore ECC) is the area within the Order Limits within which the export cables running from the array to landfall will be situated.
Offshore Restricted Build Area	The ORBA covers the northern section of the array area and would restrict the installation of WTGs and OPs. For the avoidance of doubt, this area may still be used for cable installation and ancillary operations during construction (and decommissioning) and operations and maintenance. Additionally, Project parameters including number of structures, foundation types, and cable parameters will remain unchanged. As such, no change is being proposed to the extent of the array area, as defined within the draft Development Consent Order (DCO).
Offshore Reactive Compensation Station (ORCP)	A structure attached to the seabed by means of a foundation, with one or more decks and a helicopter platform (including bird deterrents) housing electrical reactors and switchgear for the purpose of the efficient transfer of power in the course of HVAC transmission by providing reactive compensation
Offshore Substation (OSS)	A structure attached to the seabed by means of a foundation, with one or more decks and a helicopter platform (including bird deterrents), containing— (a) electrical equipment required to switch, transform, convert electricity generated at the wind turbine generators to a higher voltage and provide reactive power compensation; and (b) housing accommodation, storage, workshop auxiliary equipment, radar and facilities for operating, maintaining and controlling the substation or wind turbine generators
Onshore Export Cable Corridor (ECC)	The Onshore Export Cable Corridor (Onshore ECC) is the area within which, the export cables running from the landfall to the onshore substation will be situated.
Onshore Infrastructure	The combined name for all onshore infrastructure associated with the Project from landfall to grid connection.
Onshore substation (OnSS)	The Project's onshore HVAC substation, containing electrical equipment, control buildings, lightning protection masts, communications masts, access, fencing and other associated equipment, structures or buildings; to enable connection to the National Grid
Outer Dowsing Offshore Wind (ODOW)	The Project.

Term	Definition
Order Limits	The area subject to the application for development consent, the limits shown on the works plans within which the Project may be carried out.
Pre-construction and post-construction	The phases of the Project before and after construction takes place.
The Planning Inspectorate	The agency responsible for operating the planning process for Nationally Significant Infrastructure Projects (NSIPs).
Preliminary Environmental Information Report (PEIR)	The PEIR was written in the style of a draft Environmental Statement (ES) and provided information to support and inform the statutory consultation process during the pre-application phase.
The Project	Outer Dowsing Offshore Wind, an offshore wind generating station together with associated onshore and offshore infrastructure.
Project Design envelope	A description of the range of possible elements that make up the Project's design options under consideration, as set out in detail in the project description. This envelope is used to define the Project for Environmental Impact Assessment (EIA) purposes when the exact engineering parameters are not yet known. This is also often referred to as the "Rochdale Envelope" approach.
Receptor	A distinct part of the environment on which effects could occur and can be the subject of specific assessments. Examples of receptors include species (or groups) of animals or plants, people (often categorised further such as 'residential' or those using areas for amenity or recreation), watercourses etc.
Study Area	Area(s) within which environmental impact may occur – to be defined on a receptor-by-receptor basis by the relevant technical specialist.
Subsea	Subsea comprises everything existing or occurring below the surface of the sea.
Transboundary impacts	Transboundary effects arise when impacts from the development within one European Economic Area (EEA) state affects the environment of another EEA state(s)
Transition Joint Bay (TJBs)	The offshore and onshore cable circuits are jointed on the landward side of the sea defences/beach in a Transition Joint Bay (TJB). The TJB is an underground chamber constructed of reinforced concrete which provides a secure and stable environment for the cable.
Trenchless technique	Trenchless technology is an underground construction method of installing, repairing and renewing underground pipes, ducts and cables using techniques which minimize or eliminate the need for excavation. Trenchless technologies involve methods of new pipe installation with minimum surface and environmental disruptions. These techniques may include Horizontal Directional Drilling (HDD), thrust boring, auger boring, and pipe ramming, which allow ducts to be installed under an obstruction without breaking open the ground and digging a trench.

Term	Definition
Wind turbine generator (WTG)	A structure comprising a tower, rotor with three blades connected at the hub, nacelle and ancillary electrical and other equipment which may include J-tube(s), transition piece, access and rest platforms, access ladders, boat access systems, corrosion protection systems, fenders and maintenance equipment, helicopter landing facilities and other associated equipment, fixed to a foundation
WTG area	Following the introduction of the offshore restricted build area, the WTG area is a reduced area within the array area within which WTG and offshore platforms may be constructed.

Reference Documentation

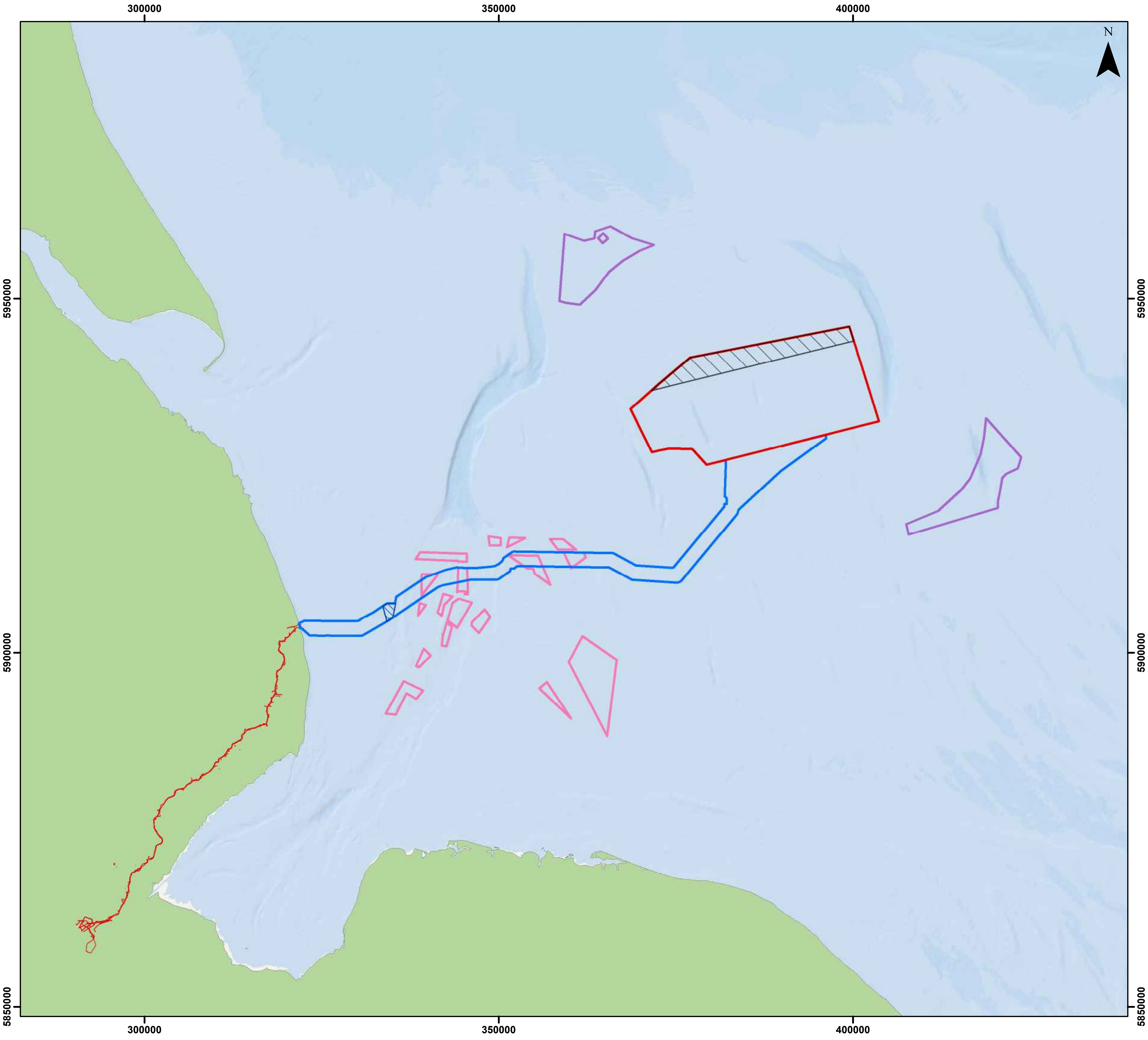
Document Number	Examination Reference	Title
6.1.1	**APP-056**	Introduction
6.1.2	APP-057	Need, Policy and Legislative Context
6.1.3	APP-058	Project Description
6.1.4	APP-059	Site Selection and Consideration of Alternatives
6.1.7	APP-062	Marine Physical Processes
6.1.9	APP-064	Benthic Subtidal and Intertidal Ecology
6.1.10	APP-065	Fish and Shellfish Ecology
6.1.11	APP-066	Marine Mammals
6.1.12	AS1-040	Offshore and Intertidal Ornithology
6.1.19	AS1-046	Onshore Air Quality
6.1.21	APP-076	Onshore Ecology
6.1.22	APP-077	Onshore Ornithology
6.1.26	APP-081	Noise and Vibration
6.3.4.1	APP-145	Landfall Assessment & Offshore Export Cable Corridor (ECC) Route Optioneering
6.3.7.1	APP-150	Physical Processes Technical Baseline
6.3.9.1	APP-154	Benthic Ecology Technical Report (Array)
6.3.9.2	APP-155	Benthic Ecology Technical Report (Export Cable Corridor)
6.3.9.3	APP 156	Intertidal Technical Report
6.3.9.5	APP-158	Envision Data Analysis
6.3.10.1	APP-159	Fish and Shellfish Ecology Technical Baseline
6.3.11.1	APP-160	Marine Mammals Technical ~~Baselin~~Baseline
6.3.11.2	APP-161	Underwater Noise Assessment
6.3.12.1	AS1-064	Intertidal and Offshore Ornithology Technical Baseline
6.3.12.2	APP-163	Collision Risk Modelling
6.3.12.3	APP-164	Displacement Assessment
6.3.12.4	APP-165	Population Viability Analysis
6.3.12.5	AS1-099	Offshore Ornithology Apportioning Appendix
6.3.22.1	APP-200	Ornithology Desk Study
6.3.22.2	APP-201	Ornithology Desk Study (Confidential)
6.3.22.3	APP 202-204	Winter 2022-23 Bird Survey Report
6.3.22.4	APP-205-206	Breeding Bird Survey
6.3.22.5	APP-207	Bird Species List
7.2	APP-239 Updated at Deadline 4	HRA Screening Report
7.3	AS1-099 Updated at Deadline 4	Screening Matrices
7.4	APP-241 Updated at Deadline 4	Integrity Matrices
7.5	APP-242 Updated at Deadline 4	Without Prejudice Derogation Case
7.6	APP-243 Updated at Deadline 4	Without Prejudice Benthic Compensation Strategy

Document Number	Examination Reference	Title
7.6.1	APP-244 Updated at Deadline 4	Without Prejudice Sandbank Compensation Plan
7.6.2	APP-246 Updated at Deadline 4	Without Prejudice Biogenic Reef Compensation Plan
7.6.3	APP-248 Updated at Deadline 4	Without Prejudice Benthic Compensation Measures Evidence and Roadmaps
7.7	APP-249 Updated at Deadline 4	Ornithology Compensation Strategy
7.7.1	APP – 250 Updated at Deadline 4	Kittiwake Compensation Plan
7.7.2	APP-252 Updated at Deadline 4	Guillemot Compensation Plan
7.7.3	APP-254 Updated at Deadline 4	Razorbill Compensation Plan
7.7.4	APP-256 Updated at Deadline 4	Artificial Nesting Structure (ANS) Evidence Base and Roadmap
7.7.5	APP-257 Updated at Deadline 4	Predator Control Evidence Base and Roadmap
7.7.6	APP-259 Updated at Deadline 4	Additional Measures for Guillemot and Razorbill Evidence Base and Roadmap
7.8	APP-260	The Crown Estate Kittiwake Strategic Compensation Plan
7.9	APP-264	Compensation Funding Statement
8.6.1	APP-279	Outline Marine Mammal Mitigation Protocol for Piling Activities
8.6.2	APP-280	Outline Marine Mammal Mitigation Protocol for Unexploded Ordnance Clearance
8.7	APP-281	In Principal Southern North Sea Special Area of Conservation Site Integrity Plan
8.20	AS1-105	Outline Vessel Management Plan
8.22	APP-296	Outline Biogenic Reef Mitigation Plan

1 Introduction

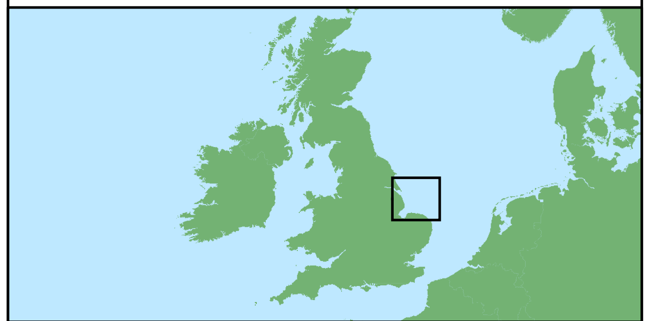
1.1 Background to the Project

2. This document comprises the Report to Inform Appropriate Assessment (RIAA) for Outer Dowsing Offshore Wind (hereafter 'the Project'). GT R4 Limited (trading as Outer Dowsing Offshore Wind) hereafter referred to as the 'Applicant', is proposing to develop the Project. The Project will include both offshore and onshore infrastructure including an offshore generating station (windfarm) approximately 54km from the Lincolnshire coastline, export cables to landfall, Offshore Reactive Compensation Platforms (ORCPs), onshore cables, connection to the electricity transmission network, ancillary and associated development, and areas for the delivery of up to two Artificial Nesting Structures (ANS) and the creation of a biogenic reef (if these compensation measures are deemed to be required by the Secretary of State (SoS)) (see Volume 1, Chapter 3: Project Description (document reference 6.1.3) for full details).



Legend

- Array Area
- Offshore Restricted Build Area
- Offshore Export Cable Corridor
- ORCP Area
- Artificial Nesting Structure Area
- Biogenic Reef Restoration Area
- Onshore Order Limits



Coordinate System: WGS 1984 UTM Zone 31N

0 10 20 km

Scale: 1:500,000

A3 Page Size

RIAA

Offshore and Onshore Project Boundary

Figure 1.1

OUTER DOWSING OFFSHORE WIND

Date: 15/01/2025
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Document Path: Z:\GIS\GIS_Projects\0152 Outer Dowsing EIA\GIS\Figures\Deadline 4\RIAA\ODOW_0152_EX_RIAA_Fig1.1_Project_Areas.mxd

1.2 Purpose of the RIAA

1.2.1 RIAA Context

~~2.~~3. The European Commission's guidance on the assessment of plans and projects significantly affecting designated sites, identifies a staged process to the assessment (Section 2.6~~Section 2.7~~). In the UK these stages are referred to as the Habitats Regulations Assessment (HRA), with this report being of particular relevance to Stage 2 (Appropriate Assessment (AA) by providing relevant information for the Competent Authority (in this case the SoS for the Department for Energy Security and Net Zero (DESNZ)) to undertake their AA.

~~3.~~4. In the UK, terrestrial areas of the UK and territorial waters out to 12 nautical miles (nm), are covered under The Conservation of Habitats and Species Regulations 2017. Waters beyond 12nm, to the extent of the British Fishery Limits and UK Continental Shelf Designated Area, are covered under The Conservation of Offshore Marine Habitats and Species Regulations 2017. Collectively, these two sets of regulations are referred to herein as the "Habitats Regulations". The Habitats Regulations protect designated areas of ecological importance including Special Areas of Conservation (SACs) for the protection of flora, fauna, and habitats, and Special Protection Areas (SPAs) for the protection of rare, vulnerable and migratory birds. These sites are all considered to be part of a National Site Network throughout the UK, with conservation objectives set for each site to ensure their designated features are protected.

~~4.~~5. For additional information on the legislative context behind this assessment see Section 2.

1.2.2 Purpose of this Document

~~5.~~6. This document has been produced as part of the overall Habitat Regulations Assessment process for the Project and draws on the HRA Screening Report (Document Reference 7.2). Screening was originally undertaken in 2022, and issued to consultees in August 2022, to accompany the Project's Scoping Report. Feedback on the draft screening report was received and the screening report was updated and used to inform the draft RIAA, which was subsequently issued to consultees in June 2023. Feedback on the draft RIAA was received and used to draft this final RIAA. A summary of the consultation process to date with detail on comments received and how/where these are addressed is provided in this report in Section 4.

7. This document summarises the conclusions on the potential for a Likely Significant Effect (LSE), as drawn in the Screening Report and cognisant of consultee comments, with respect to the conservation objectives of the screened in European and Ramsar sites. Where the potential for an LSE cannot be ruled out, the potential for an Adverse Effect on Integrity (AEoI) alone and/or in-combination has been determined. It is the information on the potential for an AEoI that is required by the SoS although all potential LSEs have been addressed (as identified within the HRA Screening Report, Document Reference 7.2) in order for the SoS to undertake the AA (hence the document title 'Report to Inform Appropriate Assessment', or RIAA, applied here).

8. This document has been updated at the request of Natural England and as agreed by the Applicant with the Examining Authority (ExA) to capture changes made by the Applicant to the Project during the Examination phase. The Applicant provided environmental reports for these updates throughout the Examination as appropriate, confirming that no changes made altered the previously drawn conclusions within the RIAA. As such, this version updates the values presented within the RIAA submitted within the Application arising from the following project changes:

- The introduction of an Offshore Restricted Build Area (ORBA) over the northern section of the Project array area; and
- The removal of the northern section of the offshore Export Cable Corridor (ECC).

9. Further updates contained herein are focused on:

- a revised in-combination assessment to reflect changes to project status or capture any new plans, projects or activities which have been progressed since the point of the Application;
- minor errata including those previously identified by interested parties
- updates to relevant policy and guidance;
- updates to "Natural England's" approach for certain assessment values where further information has been provided by that organisation post-Application; and
- additional detail which has been requested by Natural England to facilitate their appraisal of the potential for an AEoI for red-throated diver within the Greater Wash SPA.

10. The Applicant confirms that none of the updates as set out above have changed the conclusions previously drawn at the point of Application.

1.3 Project Literature

~~6.~~11. This RIAA is part of a suite of documents prepared for the Development Consent Order (DCO) Application. Key documents issued include technical reports (both for site-specific surveys but also modelling and desk-based studies), with many of these being the key source documents for the information presented herein, and Environmental Statement (ES) Chapters. For ease of reference, and to minimise repetition, the main sources of Project literature for the current report are as follows:

- Part 6, Volume 1 (Chapters):
  - Chapter 1: Introduction (document reference 6.1.1);
  - Chapter 2: Need, Policy and Legislative Context (document reference 6.1.2);
  - Chapter 3: Project Description (document reference 6.1.3);
  - Chapter 4: Site Selection and Consideration of Alternatives (document reference 6.1.4);
  - Chapter 7: Marine Physical Processes (document reference 6.1.7);
  - Chapter 9: Benthic Subtidal and Intertidal Ecology (document reference 6.1.9);

- Chapter 10: Fish and Shellfish Ecology (document reference 6.1.10);
    - Chapter 11: Marine Mammals (document reference 6.1.11);
    - Chapter 12: Offshore and Intertidal Ornithology (document reference 6.1.12);
    - Chapter 19: Onshore Air Quality (document reference 6.1.19);
    - Chapter 21: Onshore Ecology (document reference 6.1.21);
    - Chapter 22: Onshore Ornithology (document reference 6.1.22); and
    - Chapter 26: Noise and Vibration (document reference 6.1.26).
- Part 6, Volume 3 (Appendices):
    - Appendix 4.1: Landfall Assessment & Offshore Export Cable Corridor (ECC) Route Optioneering (document reference 6.3.4.1);
    - Appendix 7.1: Physical Processes Technical Baseline (document reference 6.3.7.1) and modelling annexes;
    - Appendix 9.1: Benthic Ecology Technical Report (Array) (document reference 6.3.9.1);
    - Appendix 9.2: Benthic Ecology Technical Report (Export Cable Corridor) (document reference 6.3.9.2);
    - Appendix 9.3: Intertidal Technical Report (document reference 6.3.9.3);
    - Appendix 10.1: Fish and Shellfish Ecology Technical Baseline (document reference 6.3.10.1);
    - Appendix 11.1: Marine Mammals Technical Baseline (document reference 6.3.11.1);
    - Appendix 11.2: Underwater Noise Assessment (document reference 6.3.11.2)
    - Appendix 12.1: Intertidal and Offshore Ornithology Technical Baseline (document reference 6.3.12.1);
    - Appendix 12.2: Collision Risk Modelling (document reference 6.3.12.2);
    - Appendix 12.3: Displacement Assessment (document reference 6.3.12.3);
    - Appendix 12.4: Population Viability Analysis (document reference 6.3.12.4);
    - Appendix 12.5: Offshore Ornithology Apportioning Appendix (document reference 6.3.12.5);
    - Appendix 22.1: Ornithology Desk Study (document reference 6.3.22.1);
    - Appendix 22.2: Ornithology Desk Study (Confidential) (document reference 6.3.22.2);
    - Appendix 22.3: Winter 2022-23 Bird Survey Report (document reference 6.3.22.3);
    - Appendix 22.4: Breeding Bird Survey (document reference 6.3.22.4); and
    - Appendix 22.5 Bird Species List (document reference 6.3.22.5).
- Part 7, Document 7.2: HRA Screening Report;

- Part 7, Document 7.3: Screening Matrices;
- Part 7, Document 7.4: Integrity Matrices;
- Part 7: Document 7.5: Without Prejudice Derogation Case;
- Part 7, Document 7.6: Without Prejudice Benthic Compensation Strategy;
  - Document 7.6.1: Without Prejudice Sandbank Compensation Plan;
  - Document 7.6.2: Without Prejudice Biogenic Reef Compensation Plan;
  - Document 7.6.3: Without Prejudice Benthic Compensation Measures Evidence and Roadmaps;
- Part 7, Document 7.7: Ornithology Compensation Strategy;
  - Document 7.7.1: Kittiwake Compensation Plan;
  - Document 7.7.2: Guillemot Compensation Plan;
  - Document 7.7.3: Razorbill Compensation Plan;
  - Document 7.7.4: Artificial Nesting Structure (ANS) Evidence Base and Roadmap;
  - Document 7.7.5: Predator Control Evidence Base and Roadmap; and
  - Document 7.7.6: Additional Measures for Guillemot and Razorbill Evidence Base and Roadmap;
- Part 7, Document 7.8: The Crown Estate Kittiwake Strategic Compensation Plan; and
- Part 7, Document 7.9: Compensation Funding Statement.
- Part 8 (Other Documents):
  - Outline Marine Mammal Mitigation Protocol for Piling Activities (document reference: 8.6.1)
  - Outline Marine Mammal Mitigation Protocol for Unexploded Ordnance Clearance (document reference: 8.6.2)
  - In Principal Southern North Sea Special Area of Conservation Site Integrity Plan (document reference: 8.7)
  - Outline Vessel Management Plan (document reference: 8.20)
  - Outline Biogenic Reef Mitigation Plan (document reference 8.22).

~~7.~~12. It is noted in the Nationally Significant Infrastructure Projects: Advice on Habitat Regulations Assessments~~Advice Note 10~~ (the Planning Inspectorate, 2024a~~2~~), the Environmental Impact Assessment (EIA) and HRA apply differently to decision making; the ES provided as part of the DCO application informs the decision (its findings must be taken into consideration) whereas the DCO can only be granted if the decision-mak~~ernito~~er has followed the stages prescribed by the Habitats Regulations. Therefore, the information contained in the above chapters and documents has been used to inform the assessments undertaken here in the RIAA, with the RIAA following the prescribed stages and with the distinct legal and evidentiary requirements of the Habitats Regulations firmly in mind, the new guidance has also been considered in the amendments to the RIAA updated in January 2025.

1.4 Implications of Previous OWF Decisions

~~8.~~13. Other Offshore Windfarm (OWF) projects have previously been consented despite having conclusions of AEoI, when factoring the provision of ecological compensation under the derogation process. The first OWF project in the UK whose HRA required progression beyond 'Stage 2' was Hornsea Three which was granted development consent on the 31st of December 2020. The AEoI identified from Hornsea Three was on kittiwake (*Rissa tridactyla*) at the Flamborough and Filey Coast (FFC) Special Protection Area (SPA) in-combination with other plans and projects, and on sandbanks in relation to the North Norfolk Sandbanks and Saturn Reef Special Area of Conservation (SAC) and The Wash and North Norfolk Coast SAC both alone and in-combination with other plans and projects. Hornsea Three was consented under the provision that adequate compensation would be provided for the features with a conclusion of AEoI, as stated in paragraph 6.60 of the Hornsea Three SoS decision letter:

> *'Given' the updated compensation measures for kittiwake provided by the Applicant and the sandbank compensation measures outlined above, the Secretary of State is confident that adequate compensation is proposed and will be in place to offset any impacts to features of Natura 2000 sites from the Development.'*

~~9.~~14. Subsequent to the Hornsea Three decision, several other projects have been consented with similar compensation requirements for ornithology (as a result of in-combination collision mortalities) and subtidal sandbank habitats (as a result of Project alone and in-combination permanent loss associated with cable protection), including Norfolk Boreas, Norfolk Vanguard, and Hornsea Four. These projects were given development consent on the 10th of December 2021, the 11th February 2022 and the 12th July 2023 respectively. The AEoI identified for both of the Norfolk projects was for lesser black-backed gulls at the Alde-Ore Estuary SPA/Ramsar in-combination, kittiwake at the ~~Flamborough and Filey Coast~~FFC SPA in-combination, and Annex 1 reef and sandbank features of the Haisborough, Hammond and Winterton SAC from the development alone and in-combination with other plans and projects. Hornsea Four concluded AEoI on the kittiwake and guillemot (*Uria aalge*) feature at the ~~Flamborough and Filey Coast~~FFC SPA in-combination only. Hornsea Three, Norfolk Boreas, Norfolk Vanguard, and Hornsea Four were consented under the provision that adequate compensation would be provided for the features with a conclusion of AEoI. This is stated in paragraph 5.56 of the Norfolk Boreas SoS Decision letter;

> *'Having considered the additional information presented post-examination, the Secretary of State is able to conclude that appropriate compensation measures can be secured and delivered through the DCO as set out in Schedule 19 and that the requirements of the derogation provisions under the Habitats Regulations and Offshore Habitats Regulations have been met.'*

~~10.~~15. paragraph 5.55 of the Norfolk Vanguard SoS Decision letter;

> *'Having considered the additional information presented to him, the Secretary of State is able to conclude that appropriate compensation measures can be secured and delivered through the DCO as set out in Schedule 17 and that the requirements of the derogation provisions under the Habitats Regulations and Offshore Habitats Regulations have been met.'*

~~11.~~16. and paragraph 7.18 of the Hornsea Four SoS Decision letter;

> *'Having considered the overall planning balance, and having concluded that it is possible to secure a package of measures that would provide compensation for the effects of the Proposed Development and to ensure the overall coherence of the UK NSN, the Secretary of State concludes that the significant benefits associated with the Proposed Development in contributing to the urgent need for low-carbon energy infrastructure of the type proposed outweigh the harms identified, and therefore concludes that consent should be granted to the Proposed Development.'.*

~~12.~~17. These three projects were all consented after the SoS was content that there were no alternative solutions and there was an imperative need of overriding public interest (IROPI), with the development of compensatory measures for those features identified above.

~~13.~~18. Additionally, the Round 4 Plan-Level HRA undertaken by The Crown Estate (TCE) concluded an AEoI for kittiwake for the ~~Flamborough and Filey Coast~~FFC SPA (specifically for collision risk in-combination with other plans and projects). The outcome of this document informs the need for compensation to be undertaken for a species at a Round 4 Plan level, the first instance of this happening in the UK. As part of the derogation for the TCE Round 4 Plan-Level HRA, a Kittiwake Strategic Compensation Plan Steering Group was established to develop adequate compensation measures for kittiwake predicted to be impacted by Round 4 projects. The Kittiwake Strategic Compensation Plan was approved by TCE on 14th February 2024 and has been submitted alongside the DCO Application (document reference 7.7.1).

1.5 Application of a "Without Prejudice" Derogation Case

~~14.~~19. As a consequence of consultation with a range of statutory nature conservation bodies through the Evidence Plan Process which highlighted the potential for AEoI arising from the Project (see Section 4~~4~~), a series of documents has been drafted, including a "without prejudice" draft derogation case, containing the necessary information to inform the SoS's derogation process under the Habitats Regulations. This series of documents, to be submitted as part of the DCO application, does not form part of the RIAA and instead informs the next stage of the HRA process (i.e., HRA Stage 3: Derogation, should that stage be triggered) as referenced in Section 2.6.~~2.7.~~

2 Structure of the RIAA

~~15.~~20. This document is set out in a number of stages that mirror the prescribed HRA process, with the overall structure of the document summarised below:

- Section 1~~1~~: Introduction. Providing a background to the Project, including the purpose of the Project and where additional Project related information (including baseline environment and impact assessment) can be found;
- Section 2~~2~~: Structure of the RIAA. Providing an overview of the structure of the document and section headings as well as the legislative context for the document;
- Section 3~~3~~: Roles and Responsibilities. Identifying key individuals and organisations with a role in the HRA process;
- Section 4~~4~~: Consultation. Summarising the consultation undertaken, with whom, when, the issues raised, how and where these have been addressed. Including the Evidence Plan and need for transboundary consultation;
- Section 5~~5~~: Project Overview. Drawing on the information presented in relevant chapters of the ES, providing the maximum design scenario (MDS) for each receptor group including temporal and spatial aspects as well as information on site selection and alternatives;
- Section 6~~6~~: Mitigation. To include Project specific mitigation included per receptor group;
- Section 7~~7~~: HRA Screening. Summarising the conclusions on screening;
- Section 8~~8~~: Summary of Designated Sites. Summarising site-specific information for all designated sites screened in;
- Section 9~~9~~: Assessment of Adverse Effect Alone. Determination of whether the Project alone will result in an adverse effect;
- Section 10~~10~~: Assessment of Adverse Effect In-Combination. Determination of whether the Project in-combination with other plans and Projects will result in an adverse effect;
- Section 11~~11~~: Transboundary Statement;
- Section 12~~12~~: Conclusion of the Assessment. Summarising the conclusions on adverse effect, alone and/or in-combination; and
- Section 13~~13~~: References. Legislation, Policy and Guidance

2.1 Legislative Context and Government Policy

~~16.~~21. In addition to the Habitats Regulations discussed in Section 1.2~~1.2~~, UK Government policy (Office of the Deputy Prime Minister (ODPM) Circular 06/2005) states that internationally important wetlands designated under the Convention on Wetlands 1971, called the Ramsar Convention (Ramsar sites) are afforded the same protection as SPAs and SACs for the purpose of considering development proposals that may affect them. The Government also affords the same level of protection to potential SPAs (pSPAs) and possible SACs (cSACs) and to sites identified, or required, as compensatory measures for adverse effects on any of the above sites, through planning policy such as the National Planning Policy Framework.

~~17.~~22. Further guidance can be found within the UK National Policy Statements (NPSs). These are statements produced by DESNZ which, amongst other things, set out certain policies relating to the mitigation of, and adaption to, climate change. There are six Energy NSPs in total however those of relevance to the Project are:

- NPS for Overarching Energy (EN-1) (DESNZ, 2023a);
- NPS for Renewable Energy (EN-3) (DESNZ, 2023b);
- NPS for Electricity Networks (EN-5) (DESNZ, 2023c); and

~~18.~~23. Of particular note is EN-3 (DESNZ, 2023b), as it relates directly to the development and implementation of renewable energy (including offshore wind developments).

2.2 EU-Exit Regulations

~~19.~~24. The UK left the European Union (EU) (Brexit) on Exit Day, 31st January 2020, followed by Completion Day on 31st December 2020. The EU Exit Regulations (2019) establish any EU Exit-related changes to the Habitats Regulations (2017), with these considered to have no material implications on the requirement or process for a HRA of the Project.

~~20.~~25. After Brexit, UK sites designated under the Habitats Regulations became part of the National Site Network (as defined in the interpretation sections of the Habitat Regulations (2017)), with a focus on maintaining ecological coherence throughout the UK. As this RIAA assesses both National Site Network sites and European Natura 2000 sites, where appropriate they have been referred to together as designated sites.

2.3 Energy Act 2023

~~21.~~26. The Energy Act was introduced into Parliament on 6 July 2022. The Energy Act builds on the commitments in the British Energy Security Strategy (BESS) to invest in homegrown energy and maintain the diversity and resilience of the UK energy supply while working towards net zero by 2050. The BESS, published in April 2022 sets out an increased ambition for up to 50 gigawatts (GW) of offshore wind, including up to 5GW of floating wind, by 2030. The BESS outlined a series of measures which collectively will accelerate deployment whilst protecting the marine environment. These include:

- Establishing a fast-track consenting route to reduce the offshore wind consent time from up to four years down to one year for priority cases where quality standards are met.
- Strengthening the National Policy Statement for Renewable Energy to reflect the importance of energy security and net zero.
- Developing an Offshore Wind Environmental Improvement Package to address the impacts of offshore wind infrastructure in the marine environment. The package will speed up the consenting process whilst protecting the environment, and will include measures to:
  - deliver Offshore Wind Environmental Standards (previously called nature-based design standards in the BESS);
  - develop regulations and guidance to streamline the HRA and Marine Conservation Zone (MCZ) assessment process for offshore wind projects;

- deliver environmental compensatory measures across one or more offshore wind projects to compensate for adverse environmental effects on protected sites that cannot be otherwise avoided, reduced or mitigated;
- implement a Marine Recovery Fund (MRF); and
- introduce strategic monitoring to improve our understanding of the marine environment and the measures needed to further protect it.

~~22.~~27. Of the five measures in the Act, three require primary legislation which were introduced through Government amendments to the Energy Bill at the House of Lords Committee Stage. These are to enable:

- making of regulations about the assessment of the environmental effects on protected sites of offshore wind developments' marine infrastructure, and about compensatory measures for adverse environmental effects;
- strategic compensatory measures to be taken or secured; and
- making of regulations to introduce one or more MRF, and to allow for delegation of the operation and management of the funds to other bodies.

~~23.~~28. These powers enable improved assessment of the environmental effects of offshore wind developments' marine infrastructure on protected sites, and earlier assessment to allow adequate time to resolve discrepancies in evidence and data. Where compensatory measures are required for impacts to the national site network or a protected marine area, these amendments allow compensation to be delivered by developers working together if that is more appropriate through "strategic compensation".

2.4 Case Law and Recent Examples

~~24.~~29. Specific case law of note includes the following recent rulings by the European Court of Justice (ECJ):

~~25.~~30. Case C-323/17 People Over Wind and Peter Sweetman v Coillte Teoranta and Case C-164/17 Edel Grace and Peter Sweetman v An Bord Pleanála; (referred to together hereafter as "People over Wind"); and

~~26.~~31. Case C-461/17 Holohan v An Bord Pleanála (referred to hereafter as "Holohan").

~~27.~~32. The People over Wind rulings relate to how screening for potential LSE is carried out, specifically that mitigation cannot be taken into account at that stage (but remains applicable for the determination of adverse effect). The Holohan ruling relates to the importance of species and habitats which are not a reason for the designation of the site but are relevant to the conservation objectives of the site (e.g. prey items of a designated species). Both of these rulings have been taken into consideration during preparation of the HRA Screening Report and the RIAA.

~~28.~~33. Additionally, recent consents awarded to offshore wind projects have included decisions of relevance to the Project (See Section 1.4~~1.4~~).

2.5 Guidance Documents

~~29.~~34. Several guidance documents are available regarding the HRA process and associated topics. Some of these have been issued at European level, others at UK level (or constituent country). Documents are available that provide guidance on the whole HRA process, part of that process, or are relevant to a particular receptor. A range of HRA guidance has been used in drafting and therefore is considered relevant to the current RIAA. This includes documents specific to individual topics (and that may be applied to technical reports and/or ES chapters that underpin the RIAA) up to and including documents that advise on overall HRA process. Some of the key guidance documents considered are listed below:

- Department of Energy and Climate Change (DECC) (2021). Changes to the Habitats Regulations 2017;
- Department of Communities and Local Government (DCLG) (2006). Guidance on 'Planning for the Protection of European Sites: Appropriate Assessment';
- Department of Energy and Climate Change (DECC) (2015). Guidelines on the Assessment of Transboundary Impacts of Energy Developments on Natura 2000 Sites Outside the UK;
- English Nature (1997). Habitats Regulations Guidance Note (HRGN 1): The Appropriate Assessment (Regulation 48) The Conservation (Natural Habitats &c) Regulations, 1994;
- English Nature (1999): Habitats Regulations Guidance Note (HRGN 3): The Determination of Likely Significant Effect under the Conservation (Natural Habitats &c) Regulations, 1994;
- English Nature (2001): Habitats Regulations Guidance Note (HRGN 4): Alone or in combination;
- European Commission (2001). Assessment of Plans and Projects Significantly Affecting Natura 2000 Sites;
- European Commission (2001). Methodological Guidance on the Provisions of Article 6(3) and (4) of the Habitats Directive 92/43/EEC;
- European Commission (2011). Guidance Document on Wind Energy Developments and Natura 2000;
- European Commission (2018). Managing Natura 2000 sites. The Provisions of Article 6 of the 'Habitats' Directive 92/43/EEC;
- European Commission (2020). Guidance Document on Wind Energy Developments and EU Nature Legislation;
- Joint Nature Conservation Committee (JNCC) (2010). Statutory nature conservation agency protocol for minimising the risk of injury to marine mammals from piling noise;
- JNCC (2017). Guidelines for minimising the risk of injury to marine mammals from geophysical surveys;
- JNCC (2010). Guidelines for minimising the risk of injury to marine mammals from using explosives;

- Ministry of Housing, Communities and Local Government (MHCLG) (2019). Guidance on the Use of Habitats Regulations Assessment;
- Natural England and JNCC (2013). Interim Advice on HRA Screening for Seabirds in the Non-Breeding Season;
- Natural England and JNCC (2017). Joint Statutory Nature Conservation Bodies (SNCB) Interim Displacement Advice Note - Advice on How to Present Assessment Information on the Extent and Potential Consequences of Seabird Displacement from Offshore Windfarm Developments;
- Opinion of the Commission (2007). Guidance Document on Article 6(4) of the Habitats Directive 92/43/EEC - Clarification of the Concepts of: Alternative Solutions, Imperative Reasons of Overriding Public Interest, Compensatory Measures;

~~The Planning Inspectorate (2024a19). Advice Note 17: Cumulative Effects Assessment Relevant to Nationally Significant Infrastructure Projects; and~~

- The Planning Inspectorate (2024a~~b2~~). ~~-~~The Nationally Significant Infrastructure Projects: Advice on Habitat Regulations Assessments; and
- The Planning Inspectorate (2024b). Nationally Significant Infrastructure: Advice on Cumulative Effects Assessment~~. Advice Note 10: Habitat Regulations Assessment Relevant to Nationally Significant Infrastructure Projects.~~

2.6 The HRA Process

~~30.~~35. The Habitats Regulations require that whenever a project that is not directly connected to, or necessary for the management of, a site within the National Site Network is likely to have a significant effect on the site (directly, indirectly, alone and/or in-combination with other plans or projects), then an AA must be undertaken by the Competent Authority (Regulation 63 of the Habitats Regulations and Regulation 28 of the Offshore Habitats Regulations). The AA must be carried out before consent or authorisation can be given for the Project.

~~31.~~36. The~~-~~ Nationally Significant Infrastructure Projects: Advice on Habitat Regulations Assessments ~~Planning Inspectorate Advice Note 10~~ (the Planning Inspectorate, 2024a~~b2~~) ~~'Habitats Regulations Assessment relevant to nationally significant infrastructure projects' (Version 9, August 2022),~~ defines HRA as a step-by-step process which determines potential LSE and (where appropriate) assesses adverse impacts on the integrity of a designated site, examines alternative solutions, and provides justification of IROPI. Once IROPI is established, then compensatory measures can be developed.

~~32.~~37. HRA includes a three-stage process, as summarised below:

- **HRA Stage 1 - Screening:** Screening for potential LSE (alone and/or in-combination with other projects or plans);
- **HRA Stage 2 - Appropriate Assessment:** Assessment of implications of identified potential LSEs on the conservation objectives of a designated site to ascertain if the proposal will adversely affect the integrity of a designated site; and

- **HRA Stage 3 - Derogation:** Where it cannot be ascertained that the proposal will not adversely affect the integrity of a designated site, alternative solutions must be considered to see if the Project qualifies for consent. Subsequently, where it can be demonstrated that there are no alternative solutions to the Project, the Project may still be carried out if the competent authority is satisfied that the scheme must be carried out for imperative reasons of overriding public interest. The final part of Stage 3 is the consideration of whether adequate compensatory measures can be secured.

~~33.~~38. All three stages of the process are referred to as the HRA to clearly distinguish the whole process from the one step within it referred to as the 'AA'. The first stage (Screening), as noted above (and summarised in paragraph 35~~33~~), has been undertaken for the Project alone and in-combination, with a summary of the conclusions available in Table 7.1 (summarising the conclusions of the full Screening Report). Where the Screening process concludes the potential for a LSE, then there is a requirement for an AA (Stage 2). Stage 1 Screening for the Project has identified the possibility of LSE for certain sites, features and effects. The required Stage 2 AA will be conducted by the scale SoS, with the information necessary to inform that assessment provided in this RIAA.

~~34.~~39. The integrity of a site has been defined in guidance as relating to the site's conservation objectives. These are based on the ecological requirements of the species and habitats present and should define the desired conservation condition of these species and habitat types (European Commission (EC), 2018). An adverse effect on integrity is likely to be one which prevents the site from making the same contribution to favourable conservation status as it did at the time of designation.

~~35.~~40. The Nationally Significant Infrastructure Projects: Advice on Habitat Regulations Assessments (the Planning Inspectorate, 2024a~~b~~) ~~Planning Inspectorate Advice Note 10~~ includes a number of points to be considered under Stage 2 and as such have been considered in this RIAA. These points are defined as follows (including the section where each is considered):

- Evidence about the Project's impacts on the integrity of protected sites (consideration of adverse effect alone is presented in Section 9);
- A description of any commitments/mitigation measures proposed which avoid or reduce each impact, and any residual effect (mitigation measures, which apply to the assessment of integrity but not during screening, are set out in Section 6~~6~~, with conclusions on adverse effect summarised in Section 9);
- A schedule indicating the timing of mitigation measures in relation to the progress of the development (timing of mitigation measures, where relevant, is included in Section 6 with conclusions on adverse effect summarised in Section 9;
- Cross references to the relevant draft DCO requirements and provisions that secure these mitigation measures, and identification of any factors that might affect the certainty of their implementation (as highlighted in Section 6 on mitigation);

- A statement as to which (if any) effects constitute an adverse impact on the integrity of designated sites either alone and/or in combination with other plans or projects and therefore need to be included within the AA (a summary of the conclusions on the potential for an adverse effect alone and/or in-combination is provided in Sections 9 and 10); and
- Evidence to demonstrate that the applicant has fully consulted and had regard to comments received by the relevant ~~Statutory~~ Appropriate Nature Conservation Bodies (A~~S~~NCBs) during pre-application consultation (consultation is described in Section 4).

~~36.~~41. Stage 3 of the HRA process is required where a conclusion of AEoI is drawn following Stage 2. Stage 3 provides a derogation which would allow a plan or project to be approved in limited circumstances even though it would, or may have, an AEoI on a European site. The derogation process applies to sites protected under the Habitats Regulations.

~~37.~~42. Through the derogation process, a plan or project can only proceed provided several sequential tests are met:

- There must be no feasible alternative solutions to the plan or project which are less damaging to the affected European site(s); and
- There must be IROPI for the plan or project to proceed.

~~38.~~43. If the above two tests are met, then the appropriate authority must secure that any necessary compensation measures are taken. All necessary compensatory measures must be secured to ensure that the overall coherence of the network of European sites is protected.

3 Roles and Responsibilities

~~39.~~44. As established above in Section 1.2, the purpose of a RIAA is to provide the information to the Competent Authority (in this case the SoS for DESNZ), incorporating the outcome of consultation with the relevant A~~S~~NCBs (in this case Natural England and JNCC) to enable the Competent Authority to undertake the AA. Consultation with A~~S~~NCBs (and other relevant bodies) prior to Application provides the process through which assurances can be sought that all potential effects have been addressed appropriately and in sufficient detail. Consultation during Examination will result in Statements of Common Ground (SoCG) that identify areas of agreement and disagreement between Applicant and ~~S~~ANCBs (and other relevant bodies). Wider consultation (including the role of the Evidence Plan Process (EPP)) is discussed below in Section 4.

4 Consultation

~~40.~~45. Full details on the consultation process undertaken for the Project is detailed within Volume 1, Chapter 6: Consultation, however a brief summary relevant to the RIAA is described within this section. The primary method of consultation on HRA matters for the Project, to date, has been through the EPP, as detailed below in Section 4.3~~4.3~~. The stakeholders who were consulted through the Expert Topic Group (ETG) meetings include (in alphabetical order):

- Drainage Board(s);
- Environment Agency;
- Lincolnshire County Council;
- Lincolnshire Wildlife Trust;
- Local Planning Authorities;
- Marine Management Organisation;
- Natural England;
- Royal Society for the Protection of Birds; and
- The Planning Inspectorate (observer role).

~~41.~~46. A summary of consultation is provided in Table 4.1. Natural England were consulted on the HRA Screening Report in August 2022. Natural England concluded in their response that, while there are some concerns regarding offshore and intertidal ornithology and subtidal and intertidal ecology, the impact pathways to designated sites identified were considered appropriate. The key issues raised are presented in Table 4.1 and have been considered when drafting this RIAA and addressed in the relevant sections.

4.1 Consultation on the Screening Report

47. Feedback on the HRA Screening Report (document reference 7.2) was received from Natural England on 9th and 23rd September 2022. These comments and the Project's responses are presented within Table 4.1.

Table 4-1~~4.14-14.1~~ Consultation comments from Natural England responding to the Project's HRA Screening Report

Date and consultation phase/type	Consultation and key issues raised	Section where comment addressed
Offshore and Intertidal Ornithology		
Scoping Opinion (Natural England, 9 September 2022)	The project states that the designated sites assessed within the study are all those likely to be impacted. Natural England note that breeding Sandwich tern (*Thalasseus sandvicensis*) are a feature of the North Norfolk Coast (NNC) SPA, therefore Natural England advises that the Applicant includes North Norfolk Coast SPA in the list of key designated sites for ornithology.	Sandwich tern from the NNC SPA have been included in the assessment in Section 7.
Discretionary Advice Service response to the HRA Screening Report (Natural England, 23 September 2022)	Natural England note a lack of clarity in the report as regards screening criteria for ornithological features and as regards which ornithological features are being screened in from which SPAs and for which impacts. Natural England request greater detail and clarity before we can comment fully.	A full list of features and impacts screened into the HRA assessment is provided in Section 7. Screening criteria are described in the HRA Screening Report (document reference 7.2).
Discretionary Advice Service response to the HRA Screening Report (Natural	Natural England note that distant SPAs screened in should not be limited to those determined solely by the breeding season/foraging ranges of their ornithological features, but also account for the potential for the project to interact with birds from much more distant SPAs during the migration and non-breeding seasons.	This has been addressed within Section 7 and Table 7.1

Date and consultation phase/type	Consultation and key issues raised	Section where comment addressed
England, 23 September 2022)		
Discretionary Advice Service response to the HRA Screening Report (Natural England, 23 September 2022)	Natural England note that all migratory waterbird features appear to be screened out of the assessment and recommend a more precautionary approach.	Migratory waterbird features at SPAs within 100km of the Project array area have been assessed in S~~s~~ection 9.3.
Discretionary Advice Service response to the HRA Screening Report (Natural England, 23 September 2022)	Natural England note that some ornithological features have been screened out despite being within mean-max foraging range +1 Standard Deviation (SD). Natural England recommend that these features be screened into the assessment due to potential breeding connectivity: sandwich tern as North Norfolk Coast SPA and lesser black-backed gull at the Alde-Ore Estuary SPA.	Sandwich tern at the North Norfolk Coast SPA have been assessed for collision risk in Section 9.3 and 10.3, Lesser black-backed gull has been assessed for collision risk in Section 9.3 and 10.3.
Discretionary Advice Service response to the HRA	Natural England note a lack of detail provided in this report as regards survey methodology, methods for estimating abundance and densities, methods of assessment for impacts and approach to in-combination assessment. Natural England	A full list of features and impacts screened into the HRA assessment is provided in Section 7. The approach to in-combination assessment can be found in Section 10.3. Data collection methods and methods of calculating abundances

Date and consultation phase/type	Consultation and key issues raised	Section where comment addressed
Screening Report (Natural England, 23 September 2022)	is unable to comment on these matters at this time but will welcome further engagement.	are described in the Technical Baseline. Approaches to Collision Risk Modelling (CRM), displacement, Population Viability Analysis (PVA) and migratory CRM (mCRM) are described in the relevant appendices (document references 6.3.12.2, 6.3.12.3, 7.1.2 and 6.3.12.5 respectively).
Discretionary Advice Service response to the HRA Screening Report (Natural England, 23 September 2022)	Natural England note that common scoter (*Melanitta nigra*) is also a potentially sensitive feature of the Greater Wash SPA and would like to see it included for consideration as a key species for the ECC Area of Search (AoS).	Common scoter at the Greater Wash SPA have been assessed for displacement impacts in the ECC in Section 9.3.
Discretionary Advice Service response to the HRA Screening Report (Natural England, 23 September 2022)	Table 7.6.6 - Disturbance & Displacement: Intertidal ECC during the Operation and Maintenance phase has been scoped out due to the fact that it is "highly localised and episodic (i.e., limited to any maintenance or repair of the export cables)". Natural England is not only concerned about the additional displacement from turbines on the distribution of red-throated divers within the Greater Wash SPA, but also from associated activities, and welcomes the following embedded mitigation for Red Throated Diver (RTD): "Construction and operational maintenance vessels will follow a route from their home port	Red-throated diver at the Greater Wash SPA have been assessed for displacement impacts in the ECC in Section 9.3.

Date and consultation phase/type	Consultation and key issues raised	Section where comment addressed
	that avoids high concentrations of red-throated diver (a species known to be sensitive to disturbance by boat traffic).” Natural England highlights our increasing concerns in relation to disturbance and/or displacement of red-throated divers features from the more persistent presence of offshore windfarm and oil and gas related vessel activity which could make a meaningful contribution to in-combination effects to the Greater Wash SPA and indeed the adjacent Outer Thames Estuary SPA depending on the transit route. As such, we advise appropriate consideration of both seasonal timing of construction and Operation and Maintenance (O&M) works and vessel transit route is included within the application. Natural England recommends that where possible, any construction and O&M activities avoid the months of November to March inclusive. Vessel transit routes outside of existing navigation routes through the Greater Wash SPA and Outer Thames Estuary, depending on the port of origin, should also be avoided during these winter months. Natural England advises as minimum use of best practice measures between 1st November and 31st March to mitigate and therefore minimise disturbance to red-throated diver namely: Selecting routes (when transiting to site) that avoid aggregations of red-throated diver and common scoter, where practicable. Restricting (to the extent possible) vessel movements when transiting to the site to existing navigation routes (where the densities of divers are typically relatively low).	

Date and consultation phase/type	Consultation and key issues raised	Section where comment addressed
	Avoidance of over-revving of engines (to minimise noise disturbance); and Briefing of vessel crew on the purpose and implications of these vessel management practices (through, for example, tool-box talks).	
Discretionary Advice Service response to the HRA Screening Report (Natural England, 23 September 2022)	Natural England hold the opinion that whilst the landfall area of search still includes waterbird SPAs like the Humber, it is premature to scope out intertidal cable operations and maintenance at this stage.	The Project's updated position on intertidal birds and migratory collision risk species is provided in Section 7.
Subtidal and Intertidal Benthic Ecology		
Discretionary Advice Service response to the HRA Screening Report (Natural England, 23 September 2022)	Natural England notes that Likely Significant Effect (LSE) can't be excluded for Inner Dowsing Race Bank and North Ridge SAC. We have been reviewing the Offshore Wind leasing Round 4 Plan Level HRA (and associated docs) and note that for Inner Dowsing Race Bank and North Ridge (IDRBNR) SAC there is a mitigation requirement to avoid all irreparable damage to this site. Due to the proposed overlap between the Project transmission assets with IDRBNR SAC; the identified impact pathway from cable protection and the Secretary of States Adverse Effect on Integrity decision for Hornsea Project 3,	The applicant notes Natural England's comment. Further consultation has been undertaken through the Evidence Plan Process (EPP) and is presented below in Table 4.2 and Table 4.3.

Date and consultation phase/type	Consultation and key issues raised	Section where comment addressed
	Norfolk Boreas and Norfolk Vanguard from the placement of cable protection on Annex I sandbanks; Natural England urges the Project to have further consultation with The Crown Estate on this matter, before the export cable route is finalised.	
Discretionary Advice Service response to the HRA Screening Report (Natural England, 23 September 2022)	Natural England notes that the ECC includes several designated sites in the marine and coastal environment and depending on installation methodology impact pathways to sites features can't be excluded. Thorough assessment is required and continuation of progress on identifying mitigation and where required compensation measures.	The applicant notes Natural England's comment regarding sites within the ECC. A reflection of those sites considered to have an impact pathway is presented within Section 7, with mitigation presented in Section 6.
Onshore Ecology & Ornithology		
Discretionary Advice Service response to the HRA Screening Report (Natural England, 23 September 2022)	*"As per above our previous comments (29th July 2022): The concern would be the PEIR being submitted in Q1 before the full suite of surveys have been completed. The full impacts cannot be assessed, and therefore correctly mitigated for, without the full survey results".*	A full season of winter bird surveys has been completed and results are presented in Appendix 22.3 (document reference 6.3. A full season of Breeding bird survey results are presented in Appendix 22.4.
Discretionary Advice Service	Screening Distances Applied for Receptors.	Winter bird surveys were completed covering land within 400m of the 300m-wide PEIR Boundary For the majority of the

Date and consultation phase/type	Consultation and key issues raised	Section where comment addressed
response to the HRA Screening Report (Natural England, 23 September 2022)	"Natural England welcomes the consideration of extending the survey area if potential additional pathways are identified at a later stage. It should be noted that the scoping area should be based on the potential for species to be present within the area, the Impact Risk Zone (IRZ) for designated sites as available on Magic, the ecology, i.e., foraging areas of designated species of sites in proximity to the proposed development area. Fragmentation and disruption to habitats should also be considered and assessed. As previously commented (29th July 2022), if it cannot be determined that areas are not functionally linked to a designated sites for passage and over wintering Annex I birds then surveys should be carried out".	route, this covers a wider area than the Onshore Order Limits plus a 400m buffer. Screening for designated sites was based on a 15km search area around the proposed onshore ECC at the time of screening, which covered a greater area than the Onshore Order Limits. The screening area has been extended where there is evidence of connectivity, for example to include the North Norfolk SPA in relation to non-breeding pink-footed goose.
Discretionary Advice Service response to the HRA Screening Report (Natural England, 23 September 2022)	"Until finalised project parameters and pollution contingency plans are provided Natural England advise that the potential risk of pollution to affect habitat quality is considered for LSE. For Saltfleetby-Theddlethorpe Dunes & Gibraltar Point SAC".	This pathway has been included in the RIAA in Section 9.5.
Discretionary Advice Service response to the HRA	"Natural England advises that the 'loss of or decline in populations of scarce invertebrates and plants' is added to Table 5.6.1, and is considered for LSE during construction regarding Gibraltar Point Ramsar".	The Onshore Order Limits are now 4.15km away from Gibraltar Point Ramsar at the closest point. The potential impact pathway of construction phase pollution has been

Date and consultation phase/type	Consultation and key issues raised	Section where comment addressed
Screening Report (Natural England, 23 September 2022)		screened in in relation to this designated site, refer to Table 7.1 Screening.
Discretionary Advice Service response to the HRA Screening Report (Natural England, 23 September 2022)	"We advise that consideration is given to the loss or damage to habitats during the construction and decommissioning stages for Saltfleetby-Theddlethorpe Dunes & Gibraltar Point SAC".	The Onshore Order Limits are now 4.15km away from Saltfleetby-Theddlethorpe Dunes & Gibraltar Point SAC at the closest point. The potential impact pathway of loss or changes to habitat quality in relation to this designated site have been screened in, refer to Table 7.1.
Discretionary Advice Service response to the HRA Screening Report (Natural England, 23 September 2022)	Natural England advise that consideration is given to the pollution from site run-off affecting habitat quality for Saltfleetby Theddlethorpe Dunes & Gibraltar Point SAC.	The Onshore Order Limits are now 4.15km away from Saltfleetby-Theddlethorpe Dunes & Gibraltar Point SAC at the closest point. The potential impact pathway of construction phase pollution has been screened in in relation to this designated site, refer to Table 7.1.

4.2 Transboundary Consultation

47. The Nationally Significant Infrastructure Projects: Advice on Habitat Regulations Assessments (the Planning Inspectorate, 2024a~~b~~) guides applicants to consider transboundary effects by including 'a statement which identifies (with reasons) whether significant effects are likely in respect of European sites in devolved administrations or within EEA States' and 'evidence of agreement between the applicant and relevant ANCBs (including those in devolved administrations and/or relevant bodies in EEA States, where applicable) on the scope, methodologies, interpretation, and conclusions of the screening assessment' within their applications. That position is stated by DECC in their 2015 guidance on transboundary impacts on Natura 2000. DECC (2015) also add that 'the format and extent of transboundary consultation is for the applicant to agree with the Planning Inspectorate'.

~~42. The Planning Inspectorate Advice Note 10 (the Planning Inspectorate, 2022) notes that where an application is 'likely to have a significant effect (either alone and/or in-combination) on a Natura 2000 site in another Member State, the applicant should obtain and provide all relevant information, as reasonably practicable with their DCO application'. That position is stated by DECC in their 2015 guidance on transboundary impacts on Natura 2000. DECC (2015) also add that 'the format and extent of transboundary consultation is for the applicant to agree with the Planning Inspectorate'.~~

~~43.~~48. This RIAA is intended to provide the information necessary for transboundary consultation on HRA matters, initially through the identification of transboundary sites where potential LSE applies in relation to the Project alone in the Screening Report, followed by consideration of potential LSE in-combination (and, for example, drawing on evidence provided as part of recent DCO Examination stages for similar offshore wind projects in the same region and the transboundary projects identified during that process) and then by the determination of adverse effect alone and/or in-combination made here within the RIAA. The Inspectorate undertook a full transboundary screening exercise alongside the EIA scoping stage, and no relevant responses were received by other European Economic Area states. Watching briefs were requested, however, no changes were requested by relevant consultees.

4.3 The Evidence Plan Process (EPP)

~~44.~~49. The EPP has been followed during the drafting of this RIAA and has involved a number of relevant authorities and stakeholders, although not all have provided comment directly on the HRA process. The stakeholders that have been involved in the Evidence Plan Process (as relevant to the RIAA) are listed above in paragraph 42~~40~~.

~~45.~~50. The EPP was conducted through a series of ETG meetings held prior to the DCO Application; comments on the RIAA are summarised in Table 4.2 below. It should be noted that the Scoping Opinion (and all associated consultation) did not consider the recent design changes (as described in paragraph 7~~8~~), the HRA Screening assessment has not considered the additional mitigatory measures introduced post submission (namely the introduction of the ORBA, resulting in a revised (WTG) area within the array area where turbines may be constructed) at this stage but this information and updated distances are included in the updated Screening Report for completeness~~.~~. Comments relevant to the wider ES have been incorporated into the relevant documents on which the RIAA draws and have been taken into account indirectly during the preparation of the RIAA where relevant (this includes any comments received in the Scoping Opinion that are of relevance to designated sites and therefore the RIAA). Such comments are summarised within the following documents (including reference to where and how each comment has been addressed):

- Comments made in relation to subtidal and intertidal benthic ecology are summarised in Table 9.2 of Volume 1, Chapter 9: Benthic Subtidal and Intertidal Ecology (document reference 6.1.9);
- Comments made in relation to marine mammals are summarised in Table 11.2 of Volume 1, Chapter 11: Marine Mammals (document reference 6.1.11);
- Comments made in relation to offshore ornithology are summarised in Table 12.2 of Volume 1, Chapter 12: Offshore and Intertidal Ornithology (document reference 6.1.12);
- Comments made in relation to migratory fish are summarised in Table 10.1 of Volume 1, Chapter 10: Fish and Shellfish Ecology (document reference 6.1.10);
- Comments made in relation to onshore ecology are summarised in Table 21.4 of Volume 1, Chapter 21: Onshore Ecology (document reference 6.1.21); and
- Comments made in relation to onshore ornithology are summarised in Table 22.2 of Part 6, Volume 1, Chapter 22: Onshore Ornithology (document reference 6.1.22).

Table 4-2~~4.24-24.2~~: Relevant consultation comments from the Scoping Opinion and ETGs which have been incorporated into the RIAA

Date and consultation phase/type	Consultation and key issues raised	Section where comment addressed
Offshore and Intertidal Ornithology		
Scoping Opinion – Impact assessment Methodology (The inspectorate, 9 September 2022)	The Project states that designated sites assessed within the study are all those likely to be impacted. The inspectorate notes that the ES should also assess any likely significant effects to the North Norfolk Coast SPA based on the proximity of the Proposed Development and the presence of breeding sandwich tern at the SPA.	The North Norfolk Coast SPA is screened into the assessments. This is assessed in Sections 9.3 & 10.3.
Scoping Opinion (Natural England, 30 August 2022)	Natural England advise that designated sites including Flamborough and Filey Coast and the Greater Wash SPAs should be scoped in and the impacts on prey availability referred to/signposted in the Designated Sites section of the report.	Flamborough and Filey Coast and the Greater Wash have been screened into the assessments. This is assessed in Sections 9.3 & 10.3.
Scoping Opinion – Impact assessment Methodology (The inspectorate, 9 September 2022)	The Project states that the designated sites assessed within the study are all those likely to be impacted. Natural England note that breeding sandwich tern are a feature of the NNC SPA, therefore NE advises that the Applicant includes North Norfolk Coast SPA in the list of key designated sites for ornithology.	The North Norfolk Coast SPA is screened into the assessments. This is assessed in Sections 9.3 & 10.3.
Scoping Opinion (Natural England, 9 September 2022)	Natural England note that common scoter is also a potentially sensitive feature of the Greater Wash SPA and advise that it is included for consideration as a key species for the ECC AoS.	Common scoter has been included for consideration as a key species within the ECC AoS. This is assessed in Sections 9.3 & 10.3.
Offshore Ornithology Expert Topic Group (Natural England, 29 September 2022)	For apportioning, the Project proposes to use the best practice interim guidance from NatureScot (2018). Natural England advises that the apportioning assessment should also draw on and reflect the findings of any colony-specific tracking data.	The Project has used the NatureScot methodology and colony-specific tracking data to inform apportioning. This has been included within Appendix 7.1.1.

Date and consultation phase/type	Consultation and key issues raised	Section where comment addressed
Offshore Ornithology Expert Topic Group (Natural England, 29 September 2022)	The Project do not intend to include PVA as part of the analysis at PEIR. Natural England advise that it might be useful for the PEIR to take an initial view on which species are likely to be subject to PVA, so stakeholders can consider this.	PVA has been included for relevant species conclusions within the assessments in Sections ~~This is assessed in Sections~~ 9.3 & 10.3.
Offshore Ornithology and Derogation and Compensation ETG (Natural England, 28 November 2022)	The Project proposes it will retrospectively apply the new avoidance rates to previous projects for the cumulative impact assessment in the future, though at this stage new avoidance rates have only been applied for the Project alone impacts. Natural England now support the use of the stochastic CRM (sCRM, McGregor et al 2018) as per the draft updated CRM parameters. With regards to applying variance within the flight height distributions, Natural England advise the project to use the default option within the application, which uses the Johnston (2014) bootstrap samples to draw from in the simulation.	This advice has been noted and taken into consideration for the assessment. Information can be found in Section 9.3.
Offshore Ornithology and Derogation and Compensation ETG (Natural England, 28 November 2022)	The Project is not considering gannet (*Morus bassanus*) as a species at risk of needing compensation. Natural England agreed the revised avoidance rates are likely to reduce the need to provide compensation. However, Natural England are unable to confirm at this stage due to data from round 4 projects not yet available.	Gannet assessment can be found in ~~Section~~ Sections 9.3 & 10.3. The Applicant welcomes the confirmation from Natural England (letter dated 24/01/2024) that a without prejudice case is not required for gannet.
Offshore Ornithology and Derogation and Compensation ETG (Natural England, 28 November 2022)	Regarding apportioning, Natural England is of the opinion that even for FFC, some kittiwake could be attributed to non-SPA colonies. Natural England confirmed to have impact from compensated project be considered as zero.	Kittiwake assessment can be found in Section and the Apportioning Appendix (Appendix 7.1.2).
Offshore Ornithology and Derogation and Compensation	Use Biologically Defined Maximum Population Scale (BDMPS) from Furness (2015) for non-breeding season apportioning.	Full apportioning methodology can be found in Appendix 7.1.2.

Date and consultation phase/type	Consultation and key issues raised	Section where comment addressed
ETG (Natural England, 28 November 2022)		
Offshore Ornithology and Derogation and Compensation ETG (Natural England, 28 November 2022)	The Project proposes that Sandwich tern are screened in for collision but not for displacement. Natural England agree with the project that Sandwich tern are screened in for collision but not for displacement	This methodology has been agreed and is assessed in Sections ~~This is assessed in Sections~~ 9.3 & 10.3.
Subtidal and Intertidal Benthic Ecology		
Scoping Opinion (Marine Management Organisation (MMO), 26 August 2022)	The MMO advises that the ECC is routed to avoid designated sites that protect benthic features. If this is not feasible, then impacts on the protected benthic features within these sites should be minimised.	The Applicant notes the MMOs comment. Information on the site selection process (including ECC routing) is summarised within Section 5.3 of the RIAA and within Volume 1, Chapter 4: Site Selection and Consideration of Alternatives (document 6.1.4). Descriptions of the impacts and mitigation applied to minimise effects can be found within Section ~~This is assessed in Sections~~ 7.1 & 6 respectively.
Evidence Plan Meeting ETG 12 October 2022	Cefas accepted the measures in place to prevent the introduction of marine Invasive Non-Native Species (INNS). However, Cefas confirmed the installation of infrastructure would create hard habitats and requested the Project consider the potential for infrastructure to be colonised by INNS and consider connection between structures.	The Applicant notes Cefas' comment. The assessment of INNS and hard substrates is considered within Sections 9.1 & 10.1.
Marine Mammals		

Date and consultation phase/type	Consultation and key issues raised	Section where comment addressed
Scoping opinion (The Inspectorate, 9 September 2022)	Mitigation measures The ES should include consideration of measures to manage potential cumulative disturbance in the event that there is multiple piling or other noisy activities taking place simultaneously in the Southern North Sea (SNS) SAC. It is also recommended an outline Site Integrity Plan (SIP) be provided with the Application.	The Applicant notes The Inspectorate's comment. The mitigation considered for this assessment is presented within Section 6. Discussion around the use of a SIP is within Section 9.2~~09.2~~ and 10.2. An Outline SIP has been submitted alongside the Application (document reference 8.7).
Scoping Opinion (Natural England, 30 August 2022)	Natural England agrees that the listed embedded mitigation protocols are relevant to the marine mammal assessment, however we advise that more measures may be required to manage disturbance in the SNS SAC in the event that construction takes place simultaneously with other OWF construction or noisy activities in the SAC. These plans and contingencies will need to be outlined in detail as part of the ES. Furthermore, a Site Integrity Plan (SIP) will need to be produced which will specify exactly how these plans will be implemented as part of marine licence. We reserve the right to comment on the suitability of these documents in mitigating impacts when they are submitted as part of the consultation process.	The Applicant notes NE's comment. The mitigation considered for this assessment is presented within Section 6. Discussion around the use of a SIP is within Section 0~~9.2~~ and 10.2. An Outline SIP has been submitted alongside the Application (document reference 8.7).
Onshore Ecology & Ornithology		
Scoping opinion (The Inspectorate, 9 September 2022)	Confidential Annexes. *"Public bodies have a responsibility to avoid releasing environmental information that could bring about harm to sensitive or vulnerable ecological features. Specific survey and assessment data relating to the presence and locations of species such as badgers, rare birds and plants that could be subject to disturbance, damage, persecution, or commercial exploitation resulting from publication of the information, should be provided in the ES as a*	A confidential annex has been produced for the ornithology desk study (Vol 3, Appendix 22.2 (document reference 6.3.22.2)). Where within this RIAA there are references to sensitive information, then those references will be

Date and consultation phase/type	Consultation and key issues raised	Section where comment addressed
	confidential annex. All other assessment information should be included in an ES chapter, as normal, with a placeholder explaining that a confidential annex has been submitted to the Inspectorate and may be made available subject to request".	redacted prior to publication, with an unredacted version provided to the Inspectorate.
Scoping Opinion (Natural England, 30 August 2022)	*"More generally, Natural England advises that 24-months of survey effort is the minimum expected evidence standard for bird and marine mammal data, to have any certainty to draw conclusions from and inform requirements for mitigation measures".*	A full year of winter bird surveys has been completed. A second season of winter bird surveys has been undertaken and a summary of the results are included in Volume 3 Appendix 22.7: Winter Bird Survey 2023-24 Preliminary Summary (document reference 6.3.22.7), the surveys carried out over the second year have confirmed no change to predicted residual effects for those species utilising functionally linked land, specifically dark-bellied brent goose, pink-footed goose, lapwing, golden plover and curlew .
Scoping Opinion (Natural England, 30 August 2022)	*"Natural England flags potential impacts on SPA functionally land as a likely risk i.e., geese, golden plover etc. for the cable route".*	Potential impacts to functionally linked land for SPA and Ramsar qualifying species have been assessed in Sections 9.5 and 10.5.
Scoping Opinion (Natural England, 30 August 2022)	*"Natural England advises that air quality impacts to designated sites should be considered".*	Potential air quality impacts to onshore designated sites have been assessed in Sections 9.5 and 10.5.

Date and consultation phase/type	Consultation and key issues raised	Section where comment addressed
Scoping Opinion (Natural England, 30 August 2022)	*"Natural England advises that it is the Applicant's responsibility to determine whether there is sufficient information/evidence to exclude areas from surveys. As previously commented to the applicant (29th July 2022), if it cannot be determined that areas are not functionally linked to a designated sites for passage and over wintering Annex I birds then surveys should be carried out. Our standard advice would be two years of survey data to be obtained to inform possible mitigation measures. Given the proposed submission dates of Autumn 2023 this will be difficult. If less than two years of data is collected, then consideration should be given to extending the 400m buffer area either side of the cable corridor in order to obtain further data to help demonstrate the relative importance of the cable corridor with the surrounding habitats".*	Winter bird surveys have been completed covering land out to 400m either side of the 300m-wide PEIR Boundary corridor, along the full length of the route, inclusive of the Landfall and OnSS options (detailed in Volume 3, Appendix 22.3 (). This means that for the majority of the route corridor, the survey corridor spans 1,100m and the final survey buffer typically varies from 400m to 620m in width. In addition to the extension of the 400m survey buffer, data have been collected from those route corridors removed from the final project design. These data have helped to inform the relative importance of the cable corridor with the surrounding habitats. A summary of the season two non-breeding bird results, covering September 2023 to late February 2024, is presented in Appendix 22.7

4.4 Consultation on the RIAA

~~46.~~51. Feedback on the draft RIAA (Outer Dowsing Offshore Wind, 2023) was received from Natural England on 20 July 2023. These comments and the Project's responses are presented within Table 4.3.

Table 4-3~~4.34-34.3~~: Comments received from Natural England relating to the draft RIAA

NE Comment	NE Recommendation	Project Response
Natural England cannot yet agree on the stage 2 conclusions presented within the draft Report to Inform Appropriate Assessment (RIAA) for both projects alone and in combination impacts. This is because it has been informed by PEIR Chapter11: Marine mammals of the PEIR for which we have currently have considerable number of comments	The Draft RIAA needs to be revised upon consideration of our detailed comments (see below) on the PEIR Chapter 11: Marine mammals.	This RIAA has been revised in order to align with the Marine Mammal ES Chapter which has been updated with respect to the comments made on ES Chapter 11: Marine mammals.
The maximum design scenario detailed in Table 11.7 of Chapter 11 of the PEIR states that there will be a maximum of 2 monopile events per day of which there could be a maximum of 2 simultaneous piling events/day. Similarly in S~~s~~ection 11.3.27 of the RIAA it indicates that 'Piling may be consecutive (single piling event per 24-hours) or concurrent (up to two piling rigs per 24-hours);'. In the Underwater Noise Assessment (Volume 2, Appendix 3.2) sequential modelling is also referred to but is not mentioned in these design scenarios. It is not clear how sequential piling fits into the described scenarios.	The submitted ES should provide clarification on the different piling scenarios. And make sure that terminology is clearly defined and used consistently across reports.	Within the ES and RIAA, both sequential and concurrent modelling has been assessed. The terms concurrent and simultaneous are different terms for the same scenario. These are both presented within the RIAA, with concurrent / simultaneous piling representing the largest spatial impact. Sequential piling represents the largest temporal impact.
Berwickshire and North Northumberland Coast SAC has only been screened in for vessel presence disturbance for the in- combination assessment, and not for any other impact or for the project alone assessment. Insufficient justification has been provided as to why certain impact pathways have been screened out for this site. Natural England advise that this SAC for Grey seals should be fully considered in the assessment.	The submitted RIAA should provide justification for screening out other impact pathways for the Berwickshire and North Northumberland Coast SAC Grey seal feature.	The screening for the project has been updated following comments received on the draft HRA Screening Report. Please see Section 7 and the HRA Screening Report (Document reference 7.2) for full screening rationale.

NE Comment	NE Recommendation	Project Response
Additionally, as the inshore bottlenose dolphin associated with the Moray Firth SAC are being considered in the assessment (see previous comments), we recommend that the Moray Firth SAC should also be screened into the HRA. Whilst the authority for the provision of advice on SACs located within Scotland is with NatureScot, populations of bottlenose dolphin associated with this MPA have been recorded frequently in English waters	Screen in the bottlenose dolphin populations of the Moray Firth SAC for LSE (Likely Significant Effect).	The screening for the project has been updated following comments received on the draft HRA Screening Report, including screening in the Moray Firth SAC for LSE. Please see Section 7 and the HRA Screening Report (Document reference 7.2) for full screening rationale.
Changes to prey have only been screened in for Harbour Porpoise and the SNS SAC and not for any other sites/features in the project alone assessment. There should be consideration of how changes to prey could impact seals foraging at sea outside of their SAC boundary.	Screen in relevant seal SACs into the submitted RIAA or provide justification as to why 'Changes to Prey' has been screened out for Grey and Harbour seal SACs.	The screening and assessments have been updated to include Changes to Prey for all marine mammal sites, including those for grey and harbour seals. Please see Section 7.
Natural England notes that the carbon capture and storage projects will be assessed in-combination in the final RIAA.	To note.	Noted. The carbon capture and storage projects within the identified ZoIs are considered within Section 10 and identified within Table 10.1.
Natural England welcome that a Draft Site Integrity Plan (SIP) will be provided at the DCO (Development Consent Order) Stage. We will comment on this when it is provided.	Agreement.	This is noted by the project.
Statement that the Humber Estuary SAC is designated for Harbour seals but is designated for Grey seals.	Correct this in the submitted RIAA.	This has been noted and amended throughout.
Natural England cannot agree on the conclusions of the HRA (Stage 2) for both the project alone and in combination. This is because it has been informed by PEIR	The HRA within the submitted RIAA needs to be revised upon	This RIAA has been revised in order to align with the Marine Mammal ES Chapter which has been updated

NE Comment	NE Recommendation	Project Response
Chapter 11: Marine mammals for which we have a considerate number of comments (see above comments).	consideration of our comments on the volume 1, chapter 11: Marine mammals of the PEIR	with respect to the comments made on ES Chapter 11: Marine mammals.
The conclusion that the Project alone does not have an AEoI (Adverse Effect on Integrity) on the viability of Harbour porpoise, Grey and Harbour seal as a result of mortality or injury resulting from percussive piling references the mitigation detailed in the piling MMMP. Natural England have made comments on the piling MMMP and therefore cannot agree to this conclusion at this stage.	Address Natural England's comments regarding the piling MMMP and provide a UXO MMMP as part of the submitted ES.	This is noted by the project. The piling MMMP and UXO MMMP have been discussed in the relevant ETGs and have been provided to NE as part of the ES.
Additionally Natural England have not had sight of the UXO MMMP so cannot agree that the mitigation referred to will be suitable to sufficiently reduce the risk of auditory injury. Therefore, Natural England cannot agree with the conclusion that the Project alone does not have an AEOI on the viability of these species as a result of mortality or injury resulting from UXO clearance.	Address Natural England's comments regarding the piling MMMP and provide a UXO MMMP as part of the submitted ES.	This is noted by the project. The piling MMMP and UXO MMMP have been discussed in the relevant ETGs and have been provided to NE as part of the ES.
Natural England notes that no project level separation distance (for piling) has been set but that 'there remains potential for a separation distance to be applied to the Project as mitigation, if required.' Natural England request to be included in any further discussions regarding a potential piling separation distance.	To note.	This is noted by the Project.
There are multiple incidences throughout the RIAA where Harbour seals have been mistakenly mentioned in sections that are focusing on Grey seals.	Amend in the submitted RIAA.	This has been amended throughout.

NE Comment	NE Recommendation	Project Response
Insufficient justification has been presented as to why for the O&M stage of the project alone assessment, seals have been screened out for underwater noise impacts.	Screen in or provide justification for screening out in the submitted RIAA.	The screening for the project has been updated following comments received on the draft HRA Screening Report. Please see Section 7 and the HRA Screening Report (Document reference 7.2) for full screening rationale.
As Natural England have advised that changes to prey should be assigned a 'Low' significance as opposed to 'Negligible' (see previous PEIR comments), this impact should also be considered in-combination.	Include 'Changes to Prey' in the in-combination assessment in the submitted RIAA.	The screening for the project has been updated following comments received on the draft HRA Screening Report. Please see Section 7 and the HRA Screening Report (Document reference 7.2for full screening rationale.
Para. states that the time period considered for the in-combination assessment is 2022-2030 inclusive. For the cumulative assessment in Chapter 11 S~~s~~ection 11.8.5 it states that the time period considered is 2022-2032 inclusive. It is unclear why these two periods differ.	The submitted RIAA should provide clarification on why time periods differ for the cumulative assessment and the in-combination assessment or make these assessments consistent.	The RIAA has been aligned with other project documentation and the range used is 2023-2031 inclusive.
Dogger Bank South (East and West) are not included on this map.	Add these OWFs to Figure 11.2.	All figures have been updated to reflect appropriate projects for all receptors.
The Harbour seal population associated with the Wash and North Norfolk Coast SAC has undergone a notable decline in recent years. Natural England has updated their supplementary advice to conservation objectives (SACOs) relating to this site and we consider this feature to be unfavourable. As a result, developers must ensure that their proposals do not hinder the population's ability to recover to a favourable status. Natural England consider that whilst this unfavourable	Further discussion of the assessment of Harbour seal associated with the WNNC SAC is needed in future ETG (Expert Topic Group) meetings in light of the current population decline, and agreement on a suitable impact	As discussed within the ETG dated the 11th of September 2023, the assessment of for Harbour seal at the Wash and North Norfolk Coast SAC has been updated to include the most recent data as presented in SCOS, 2022, detailed within Section 0~~9.2~~.

NE Comment	NE Recommendation	Project Response
condition has been considered to a certain extent within the HRA, its significance has been downplayed and it has not been sufficiently considered within the assessment. Further discussion is needed on how this can be appropriately included in the assessment. For example, whether the threshold for a significant impact should be set lower for this specific SAC population, given the "Restore" target and the requirement to not hinder the conservation objectives.	assessment method sought to inform the submitted ES.	
The impacts of temporary increases of suspended sediment are described to disturb benthic habitats in the immediate vicinity of the works. However, 10.2.18 then suggests that there is no potential for AEoI on the conservation objectives for the IDRBNR SAC. Natural England's advice on operations for power cable laying, burial and protection for this site suggests that the constituent broadscale habitats which contribute to Annex I sandbank habitat are sensitive to light smothering and siltation rate changes. We therefore disagree with this assessment, given that the cable route passes through Annex I sandbank habitat and will therefore be within the suggested 0-50m immediate vicinity range	Natural England advise that further consideration is required for this impact to be considered as not AEoI on Annex I sandbank habitat within the IDRBNR SAC.	The temporary increases in suspended sediment discussed within Section 9.1 & 10.1, including smothering and siltation rate changes in relation to the Inner Dowsing Race Bank and North Ridge SAC. It is considered that while there may be impacts to the Inner Dowsing, Race Bank and North Ridge SAC, the highly localised and limited temporal scale of the impact, the origins of the material being from the feature itself, the resilience, tolerance, low vulnerability and the high recoverability of the feature, mean that there is no adverse effect on sandbank features at the IDRBNR SAC.
The assessment of the impact of physical habitat loss/disturbance due to construction and decommissioning on Annex I sandbank features focuses on the recovery of the physical structure of the habitat with limited justification on the impacts that the removal of the habitat would have on the biological communities present within the sandbanks. We would also like to draw you attention to post-construction monitoring surveys conducted at	Natural England is unable to agree with any conclusions until sufficient evidence has been provided that the impacts of the project will not hinder the conservation objectives	The Applicant understands that the Dudgeon post-construction surveys demonstrate that there is no significant change in benthic community structure from the development of an offshore windfarm (MMT, 2019 in Royal HaskoningDHV, 2020). However, the Applicant is unable to access the formal post-construction monitoring reports which NE refer to as they are not currently publicly available and are

NE Comment	NE Recommendation	Project Response
Dudgeon OWF which suggested that there was a marked decrease in sand wave height and an increase in migration rate since construction.	for the designated feature and suggest that the best way to demonstrate this is to ensure that impacts which may impinge on feature attributes for the designated feature are considered and we required mitigation measures adopted.	therefore unable to comment on the stated changes. Notwithstanding this, additional evidence has been added within Section 9.1.
The Project has drawn the conclusion of No AEoI for the impact of temporary physical habitat loss/disturbance and long- term habitat loss on Annex I biogenic reef within IDRBNR SAC	Natural England notes that these conclusions are based upon an as yet conducted pre-construction surveys and appropriate mitigation measures which cannot be agreed until the extent of the reef is known. We advise that the conclusion of No AEoI needs to be drawn from evidence in hand, and mitigation measures that can be reasonably considered, based upon empirical evidence, to conclude no impact to the designated feature. If the project	The assessment for temporary physical habitat loss/disturbance and long-term habitat loss on the IDRBNR SAC include the development of a biogenic reef mitigation plan (Document reference 7.6.3), which details mitigation for benthic features including a commitment to micrositing around any areas of identified *S. Spinulosa* reef identified. Furthermore, geophysical data for the project confirms that there is no biogenic reef along the proposed route so there will be no direct overlap with any features of the designated site. This geophysical interpretation has been reinforced by secondary analysis of the geophysical and benthic survey data which reconfirms that there was no evidence of biogenic reef within the export cable corridor. Therefore, were biogenic reef to form prior to construction, this is likely to only occur within a part of the export cable corridor, enabling micrositing to be undertaken to avoid any Annex 1 Biogenic Reef.

NE Comment	NE Recommendation	Project Response
	cannot provide this then AEoI can't be excluded beyond reasonable scientific doubt.	
Subject to suitable mitigation measures being implemented within the PEMP, Natural England agrees with the conclusion of No AEoI due to the impacts of INNS introduction from the impact of vessel movement during construction, O&M and Decommissioning phases of the project. However, we question how vessel closest approach has been calculated given that no construction port has been agreed yet.	Please clarify how closest vessel approach to designated sites calculations were made.	Potential vessel routes will pass through the SAC, however due to standard international maritime organisation rules and regulations and control measures outlined within the PEMP, release of ballast water will not occur within or near the relevant designated sites. Furthermore, for the purposes of the assessment, it has been assumed that ports on the Humber may be used as construction and operational basis however this will not be confirmed until post-consent.
This report should focus on the impact that the project will have to the designated features of the site. The likely increase of biodiversity and biomass due to the new hard substrate habitat would be considered as a negative if it impacts on any of the designated features of the site. As per our latest supplementary advice on the conservation objectives for the site (9th May 2023), we consider that the installation of hard structure installed within the IDRBNR SAC is likely hindering site integrity and compromising the ability of the site to meet conservation objectives,	Please amend statement so that it focuses on the impacts to designated features only.	The assessment within Section 9.1 considers the impact to designated features within the site. The previous reference to increases in biodiversity and biomass was an incidental reference noting an effect which may arise with the introduction of hard substrate.
Natural England welcomes the provision to discuss alternative, feasible options for cable installation. We would like to draw your attention to the latest supplementary advice on the conservation objectives for the site. We consider that the installation of hard structure	We advise that the statement made by the project to seek options that demonstrably avoid adverse effects on site	The project has committed to solely using removable cable protection over the sandbank features of the IDRBNR SAC, therefore as detailed in Section 9.1, the Applicant is confident that there will be no AEoI on the SAC.

NE Comment	NE Recommendation	Project Response
installed within the IDRBNR SAC is likely hindering site integrity and compromising the ability of the site to meet conservation objectives.	integrity does not necessarily align with our position as provided in our supplementary advice for the site.	
The use of the word significant should only be used for statistical qualification and be associated with a confidence value. The phrase “significant enough” is not a suitable qualifier.	Please amend wording.	Amended to remove significant wording.
In light of the statement within Natural England’s supplementary advice on conservation objectives regarding the impacts of developments consented as the result of lawful decisions by the competent authority on site integrity, we disagree with the conclusion that that there is no potential for AEOI in relation to changes to the physical process. Further, the proportion of the site IDRBNR SAC impacted by possible changes to physical processes is not a suitable measure to rule out AEoI on its own.	The project needs to demonstrate that development will not impact on the sediment transportation pathways that already exist within the Annex I Sandbank features within the IDRBNR SAC. Further information on the current physical processes which maintain the Annex I sandbank feature specific to the IDRBNR SAC can be found in our supplementary advice to conservation objectives. Please amend conclusion based upon our latest conservation advice for	Additional evidence has been provided within the assessment in Section 9.1 to reflect the conservation advice on the IDRBNR SAC with respect to consented projects. Additional text around local sediment pathways has been added to the assessment in relation to the IDRBNR SAC to ensure the conclusion of no AEoI.

NE Comment	NE Recommendation	Project Response
	the site and demonstrate that sediment transportation pathways which maintain the feature will not be disrupted.	
There is no clear rationale why Sheringham Shoal OWF has been excluded from the in-combination assessment.	Natural England advises that Sheringham shoal is included within the in-combination assessment or rationale for its exclusion is included.	Sheringham Shoal is excluded in-combination for all receptors aside from offshore and intertidal ornithology as it is already operational and it is considered to be part of the baseline for any potential in-combination effects from the Project. It is considered in-combination for offshore and intertidal ornithology given the nature of potential effects including barrier effects, collision risk, and ongoing disturbance and displacement.
We note that the applicant's assessment of No AEoI for the impact of physical habitat loss/disturbance for in-combination effects focusses on the impact of the developments, primarily on Race bank sandbank, whilst the project is due to also impact on the North Ridge sandbank.	We advise that the in-combination effects of the development should consider the impacts of the designated features within the IDRBNR SAC as a whole as well as on individual elements of one feature.	The assessment presented within Section 9.1 has been updated to reflect the IDRBNR SAC as a whole.
We note that the inclusion of the provision to take note of the pre-construction survey when planning O&M works is presented as a mitigation measure for in-combination effects of physical habitat loss/disturbance.	Natural England would like to note that this provision wasn't included within the mitigating factors for alone effects of	The alone assessment has been updated to include this mitigation measure. Maintenance schedules will be provided within the Operations and Maintenance Plan which will be a requirement of the relevant dMLs, rather than being individually secured within the DCO.

NE Comment	NE Recommendation	Project Response
	the same impact. Additionally, we would advise that given the O&M phase may last for several decades, there is a need for maintenance to be informed by more than solely pre-construction surveys. The required monitoring schedule and any associated need for maintenance activity to be informed by these surveys should be secured within the DCO.	Any necessary monitoring would be agreed with the MMO during the approval of the OMP post-consent.
The Wash SPA and Ramsar We advise that the red line boundary of the onshore cable corridor crosses land that is considered as functionally linked to designated features of The Wash SPA including but not exclusively pink footed geese (PFG).	We advise that the assessment of 2 years of survey data on the distribution of passage and overwintering Annex I birds from The Wash SPA and Ramsar is required to inform any impact assessment and mitigation measures in order to ascertain the risk of AEoI occurring. We advise that there is a risk of further examination	Comments are noted. The Year 1 winter bird survey data are presented and assessed within this RIAA. . A summary of the season two winter bird survey results for the period September 2023 to late February 2024 is presented in ES Appendix 22.7. Data available from outwith the 400m buffer of the Order Limits (up to 620m) has helped to inform the relative importance of the cable corridor with the surrounding habitats. Mitigation measures for SPA qualifying features have been included in the OLEMS (ES Part 8), such as seasonal working restrictions. This builds on and refines the range of measures/options included in ES Chapter 22 Onshore Ornithology. Additional, specific

NE Comment	NE Recommendation	Project Response
	and/or determination delays if this critical data is not available at the time of Application. We further advise that we expect to see an Outline Annex I species mitigation management plan for designated features of the SPA which have been identified as foraging outside of the SPA within the Project's Red Line Boundary. NB: This advice is consistent with advice provided on all other NSIPs potentially impacting on interest features of Coastal SPAs.	measures to avoid the risk of significant effects on Annex 1 birds have also been included.

5 Project Overview

5.1 Introduction

~~47.~~52. The RIAA draws on Volume 1, Chapter 3: Project Description which includes a 'Project Design Envelope' developed to include necessary flexibility to accommodate further project refinement and optimisation during detailed design, post consent. The proposed windfarm array area is 436km^2, located approximately 54km east from the Lincolnshire coastline at its closest point. The Project will include both offshore and onshore infrastructure including an offshore generating station (windfarm), export cables to landfall, ~~Offshore Reactive Compensation Platforms (~~ORCPs~~)~~, onshore cables, connection to the electricity transmission network, ancillary and associated development, ~~and~~ areas for the delivery of up to two Artificial Nesting Structures (ANS) and the creation of a biogenic reef (if these compensation measures are deemed to be required by the Secretary of State) (see Volume 1, Chapter 3: Project Description for full details) (Figure 9.1).

~~48.~~53. Full details on the Project description are presented within the ES in Volume 1, Chapter 3: Project Description (document 6.1.3). For a number of aspects of the Project, a range of options are being considered, particularly during the construction phase. To manage the potential for impact, and in line with both the ES and the Planning Inspectorate Advice Note 9: Rochdale Envelope (the Planning Inspectorate, 2018), the Project elements that represent the MDS for each topic (the 'Project Design Envelope') have been identified and taken forward. The key project design parameters considered within this RIAA are described in Section 5.2~~5.2~~ and 5.4~~5.4~~ below.

5.2 Project Description

54. Full details on the Project description are presented within the ES in Volume 1, Chapter 3: Project Description (document 6.1.3).

55. The ORBA is proposed to cover the northern part of the array area, comprising an area that is approximately 2km wide at the north-east corner and approximately 3.5km at the northwest corner Figure 1.1). In total, the ORBA covers an area of 71.3km^2, which represents 16.4% of the array area. No WTGs or Offshore Platforms (OPs) (including offshore substations and accommodation platforms) will be installed in the ORBA, however, the area may be used for cable installation and ancillary operations during construction (and decommissioning).

~~49.~~56. Following the introduction of the ORBA, the area within which the WTGs and OPs will be constructed is referred to in the following assessment as the WTG area, this term is used throughout this RIAA.

~~50.~~57. A proposed maximum of 100 Wind Turbine Generators (WTGs) will be installed within the ~~array~~ WTG area. Electricity generated will be transported to the coastline via offshore export cables which will make landfall within the cable corridor on the Lincolnshire coast, at Wolla Bank, on the Lincolnshire coastline.

~~51.~~58. The foundation type used for the main offshore structures (e.g. Offshore Substations (OSSs), WTGs, ORCP's and accommodation platform) will depend on the final detailed site investigations, engineering design studies and the procurement process. Given the uncertainty regarding these conditions and the final project design, four types of foundation are being considered: monopiles, gravity base structure (GBS) foundations, pin piled jacket foundations, and suction bucket jacket foundations. In the event that GBS foundations are utilised, a maximum of 50% of WTG foundations could be GBS type, along with all foundations for the other structures (up to 59 GBS foundations in total) with the remaining foundations being an alternative foundation type.

~~52.~~59. Scour protection will be put in place around the foundations (where required for engineering purposes), with several methods considered including rock placement, concrete mattresses, frond mattresses, rock bags, seabed spacers, and rock berms. The level and type of scour protection will vary depending on the foundation type selected with the MDS described within Section 9~~9~~.

~~53.~~60. Several cable installation methodologies are being considered for the installation of offshore cables, including jet-trenching, pre-cut and post-lay trenching, mechanical trenching, dredging (Trailing Hopper Suction Dredging, and backhoe dredging or water injection dredging), mass flow excavation/controlled flow excavation, rock cutting, burial sledge, jet sledding (hybrid of jet trencher and cable plough), and vertical injector burial. The cables will either be directly buried using the above techniques or pulled into a duct/pipe that will be installed using the above techniques.

~~54.~~61. As far as practicable, all offshore cables will be buried to a sufficient depth below the seabed, informed by the findings of a Cable Burial Risk Assessment (CBRA) as part of the final project design process. A preliminary CBRA has been undertaken by the Project for the section of the cable route which passes through the Inner Dowsing, Race Bank and North Ridge SAC. The results of this CBRA have been used to update the project design, with the Project able to commit to a maximum of 5% of the cable length over the sandbanks within the Inner Dowsing, Race Bank and North Ridge SAC requiring cable protection in a worst-case, and a commitment that all cable protection used on the sandbanks within the SAC will be removable.

62. Where it is not possible to bury cables (array, interlink and export) to an adequate depth it may be necessary to install cable protection to prevent scour forming around cables and to minimise the risk of cable exposure, to protect the cable asset from damage to the cables from forces and movement damaging the cables over time resulting in additional works, and to ensure cables are not snagged by other sea users. An analysis of the requirement for the cables to cross existing infrastructure (such as cables and pipelines) is provided within the ES. It is notable that the ECC does not require any cable crossings within the Inner Dowsing, Race Bank and North Ridge SAC.

~~55.~~63. The onshore elements of the Project will comprise the landfall, the onshore ECC, the OnSS and the 400kV cable corridor (collectively, the "onshore infrastructure"). The landfall is where the offshore export cables will come ashore to meet the onshore export cables. These will be joined at a Transition Joint Bay (TJB) compound which will be situated onshore. The OnSS will be used to make the power generated by the windfarm suitable for transfer to the National Grid. The onshore export cables will link the landfall to the OnSS where the power will be transferred to the National Grid via 400kV cables. The onshore ECC and 400kV cable corridor will be buried underground. The onshore ECC has a maximum length of approximately 70 km and the 400kV cable corridor has a maximum length of 4km.

~~56.~~64. The indicative onshore infrastructure is presented in ES Volume 2 Figure 3.4: Indicative Onshore Infrastructure (document reference 6.2.3.4).

5.3 Consideration of Alternatives

~~57.~~65. The Applicant has undertaken a comprehensive site selection process which a is presented in full in Part 6, Volume 1, Chapter 4: Site Selection and Consideration of Alternatives (document reference 6.1.4) and also discussed within Document 7.5: Derogation Case.

~~58.~~66. The site selection process began early in the Project's development phases and involved early engagement with stakeholders, together with a range of engineering, environmental, and socioeconomic considerations.

5.3.1 Consultation on site selection

~~59.~~67. Consideration has been given to a range of alternatives in developing the Project. This has informed key decisions within the Project, including technical and engineering options and environmental issues when considering, for example, micro-siting and route changes when developing the export cable corridor.

~~60.~~68. Consultation has been a key part of this process in developing the Project and has helped to define the Project with options and alternatives discussed with key stakeholders, both through Evidence Plan meetings, workshops and through the feedback received through public events.

~~61.~~69. The design refinement process was iterative, taking account of the latest site-specific data, alongside formal and informal consultation with statutory stakeholders and local communities. The design of the project developed continually throughout the pre-application process in response to consultation feedback, survey data and engineering design. Consideration was given to technical, commercial and environmental issues informed by data analysis and constraints mapping prior to presentation and consultation with key stakeholders (see full details within Part 6, Volume 1, Chapter 4: Site Selection and Consideration of Alternatives (document reference 6.1.4)).

~~62.~~70. Full details of the Project's consultation is presented within Document 5.1: Consultation Report (document reference 5.1) and ES Volume 1, Chapter 6: Technical Consultation (document reference 6.1.6). where consultation was carried out in relation to individual technical topics, this is provided within each of the technical chapters of the ES.

5.4 Maximum Design Scenario (MDS)

~~63.~~71. The MDS is referred to throughout the ES and here in the RIAA. This approach ensures that the scenario that would have the greatest impact (e.g. largest footprint, longest exposure, or tallest dimensions, depending on the topic) is assessed; this provides confidence that any other (lesser) scenarios will have an impact that gives rise to a significance of effects that is less than or no greater than that assessed for the MDS.

~~64.~~72. The HRA Screening Report (Document Reference: Part 7, Volume 2) identified a number of receptor groups as follows:

- benthic and intertidal ecology;
- marine mammals;
- offshore and intertidal ornithology;
- migratory fish;
- onshore ecology; and
- onshore ornithology.

~~65.~~73. These groups align with the receptor groups considered within the ES, and therefore the MDSs used within the RIAA are the same as those presented within each topic-specific chapter of the ES. Where a receptor group is screened in for potential LSE, these chapters are drawn on here. The receptor groups are outlined above, together with the relevant MDS table within each of the corresponding ES chapter:

- Table 5.12 from Part 6, Volume 1, Chapter 9: Benthic Subtidal and Intertidal Ecology (document reference 6.1.9);
- Table 4.7 from Part 6, Volume 1, Chapter 10: Fish and Shellfish Ecology (document reference 6.1.10);
- Table 1.7 from Part 6, Volume 1, Chapter 11: Marine Mammals (document reference 6.1.11);
- Table 12.8 from Part 6, Volume 1, Chapter 12: Offshore and Intertidal Ornithology (document reference 6.1.12);
- Table 21.13 from Part 6, Volume 1, Chapter 21: Onshore Ecology (document reference 6.1.21); and
- Table 22.7 from Part 6, Volume 1, Chapter 22: Onshore Ornithology (document reference 6.1.22).

~~66.~~74. The MDS, as it applies to each receptor group, is listed at the beginning of each assessment and draws on the information presented in the tables listed above in the individual ES chapters. For clarity regarding the differences between receptor groups, the information is presented according to individual Project parameters, including a note regarding why the scenario is relevant to that receptor. Where relevant, the information includes any designed-in features which, whilst also providing mitigation, are integral to the design or physical characteristics of the Project.

5.5 Construction Programme

~~67.~~75. It is anticipated, that if granted consent, the windfarm will be operational by 2030, with offshore construction potentially commencing in 2027 and preparatory works undertaken from 2026 at the earliest. An indicative construction programme is provided in document 6.1.3 of the ES which has been used to inform the detailed assessments as required (including in-combination and cumulative assessments). The delivery of compensation measures and associated activities could commence prior to the start of construction phase of other offshore elements of the Project. Note that these dates are indicative at this stage.

5.6 Operations and Maintenance, and Decommissioning Programme

~~68.~~76. The full project description is provided in Part 6, Volume 1, Chapter 3: Project Description (document reference 6.1.3), with Operation and Maintenance (O&M) addressed in Section 9 of that chapter.

~~69.~~77. The overall O&M strategy will be finalised once the O&M base location and technical specification of the Project are known, including WTG type, electrical export option and final project layout. Maintenance operations will be undertaken throughout the operational life of the Project (anticipated approximately 35 years) and will be both preventive (scheduled) and corrective (unexpected repairs).

~~70.~~78. The onshore O&M requirements for the onshore export cables will be largely corrective (because there is limited requirement for preventative maintenance on the onshore cables), accompanied by infrequent on-site inspections of the onshore export cables. O&M requirements for the OnSS will be both preventative and corrective.

~~71.~~79. At the end of the operational lifetime of the offshore windfarm, it is anticipated as a worst case for potential impacts that all of the offshore structures above the seabed level, together with all subsea cables, will be completely removed. Onshore, it is expected that cables would be left in-situ to avoid adverse effects on the environment and local communities.

~~72.~~80. The decommissioning sequence will generally be the reverse of the construction sequence and involve similar types and numbers of vessels and equipment. The decommissioning plan and programme will be updated during the Project's lifespan to take account of changing best practice and new technologies. The approach and methodologies employed at decommissioning will be compliant with the legislation and policy requirements at the time of decommissioning.

6 Mitigation

~~73.~~81. The information on the mitigation being proposed for each receptor and in relation to individual potential impacts arising from the Project is set out in the individual topic chapters of the ES. The mitigation relevant to the RIAA is summarised below in Table 6.1 including the route for securing each measure. Mitigation is not taken into account during the consideration of potential LSE; however it is a consideration during the determination of the potential for adverse effect within the design scenario assessed. The approach ensures the RIAA is compliant with the People over Wind ruling referenced in Section 2.

Table 6-1~~6.16-16.1~~: Mitigation of relevance to the RIAA

Mitigation	Details of Measure Relevant to the RIAA
Benthic Subtidal and Intertidal Ecology	
Project Design	A Scour Protection and Cable Protection Management Plan (SPCPMP) and a Cable Specification and Installation Plan (CSIP) will be developed which will consider the need for scour protection and cable protection as well as cable installation methods and mitigation; and Scour protection may be installed where required for engineering purposes. Scour protection may take the form of rock/gravel placement, concrete mattresses, flow energy dissipation devices, protective aprons or coverings, ecological based solutions and bagged solutions
Cable Burial Risk Assessment (CBRA)	Where possible, subsea cable burial will be the preferred option for cable protection. Cable burial will be informed by the cable burial risk assessment (CBRA) – which will take account of the presence of designated sites – and detailed within the Cable Specification and Installation Plan (CSIP). An outline CSIP has been prepared in support of the Application (document reference 8.5), which will be finalised post-consent.
Pollution prevention	A Project Environmental Management Plan (PEMP) will be developed post-consent and adopted, which will cover the construction and O&M phases of the Project. This will be secured through a Condition in the deemed Marine Licence. This PEMP will include a Marine Pollution Contingency Plan (MPCP), which provides protocols to cover accidental spills and potential contaminant release, and provide key emergency contact details.
Marine Invasive Non-Native Species (INNS) control	Relevant best practice guidelines will be followed and implemented through the PEMP, which will be in line with the Outline PEMP (document 8.4) to minimise marine Invasive non-native species (INNS) introduction/spread. Any vessels used for the delivery of materials to site will adhere to industry legislation, codes of conduct and/or best practice to reduce the risk of introduction or spread of invasive non-native species. In the event that GBS foundations are selected for use on the Project, a Biosecurity Plan will be developed to minimise marine INNS introduction/spread.
Pre-construction Annex I habitat survey and Biogenic Reef Mitigation Plan	Within the Inner Dowsing, Race Bank and North Ridge SAC, cables will microsited around any identified areas of biogenic reef found within the pre-construction surveys. A Biogenic Reef Mitigation Plan will be developed post consent following pre-construction surveys which will identify any reef and confirm relevant mitigation measures to be implemented.
EMF and cable protection	Where possible, cables will be buried to reduce the impacts of electromagnetic field (EMF) on sensitive receptors and minimise the requirement for additional cable protection.

Mitigation	Details of Measure Relevant to the RIAA
Decommissioning Programme	Development of, and adherence to, a Decommissioning Programme.
Marine Mammals	
Project design	Identification of maximum hammer energy to be used during pile driving (6,600 kJ for monopile, 3,500 kJ for pin-pile). Inclusion of soft-start and ramp up procedures for pile driving. Maximum of 2 simultaneous piling events.
Pollution Prevention	A Project Environmental Management Plan (PEMP) will be developed post-consent and adopted, which will cover the construction and O&M phases of the Project. This will be secured through a Condition in the deemed Marine Licence. This PEMP will include a Marine Pollution Contingency Plan (MPCP), which provides protocols to cover accidental spills and potential contaminant release, and provide key emergency contact details.
In Principle SNS SAC Site Integrity Plan (SIP)	Detail on mitigation measures surrounding the potential effects on the SNS SAC for harbour porpoise, specifically underwater noise impacts in-combination.
Marine Mammal Mitigation Protocol (MMMP) for piling	Implementation of a piling Marine Mammal Mitigation Protocol (MMMP) (to minimize the risk of auditory injury to negligible levels).
MMMP for UXO	Implementation of a UXO MMMP (to minimize the risk of auditory injury to negligible levels).
Vessel Management Plan (VMP)	Development of, and adherence to, a Vessel Management Plan (VMP) (including defined vessel navigational routes, a vessel code of conduct to reduce collision risk and minimize disturbance and identification and avoidance of sensitive areas where practicable);
Decommissioning Programme	Development of, and adherence to, a Decommissioning Programme.
Decommissioning MMMP	Implementation of a decommissioning MMMP (to minimize the risk of auditory injury to negligible levels);
Offshore and Intertidal Ornithology	
Site selection	The site refinements have been developed considering the distribution of key seabird species across the Project array to determine areas where impacts can be reduced.

Mitigation	Details of Measure Relevant to the RIAA
Minimum tip height	The design of the Project includes an air gap of 40m at Mean Seal Level (MSL). This provides a greater air gap than the minimum required of 22m Mean High Water Springs (MHWS) and is included in the design to reduce the potential collision risk to offshore ornithological receptors.
Best practice protocol	Best practice protocol will be utilised during construction, operation and maintenance and decommissioning works to minimise disturbance of offshore ornithological receptors, especially red-throated divers and common scoter, through the following: Where possible, minimising vessel traffic during the most sensitive time in October to March; Where possible, restricting vessel movement to existing navigation routes; Where possible, maintaining direct transit routes, minimising transit distances through areas used by key species; Avoidance of rafting birds when necessary to go outside of navigational routes, and where possible avoid disturbance to areas with consistently high diver density; Avoidance of over-revving engines to minimise noise disturbance; and Briefing of vessel crew on the purpose and implications of these vessel management practices.
Cable Burial Risk Assessment (CBRA)	Where possible, subsea cable burial will be the preferred option for cable protection. Cable burial will be informed by the cable burial risk assessment (CBRA) – which will take account of the presence of designated sites – and detailed within the Cable Specification and Installation Plan (CSIP). An outline CSIP has been prepared in support of the Application (document reference 8.5), which will be finalised post-consent.
Pollution Prevention	A Project Environmental Management Plan (PEMP) will be developed post-consent and adopted, which will cover the construction and O&M phases of the Project. This will be secured through a Condition in the deemed Marine Licence. This PEMP will include a Marine Pollution Contingency Plan (MPCP), which provides protocols to cover accidental spills and potential contaminant release, and provide key emergency contact details.
Marine INNS control	Relevant best practice guidelines will be followed and implemented through the PEMP, which will be in line with the Outline PEMP (document 8.4) to minimise marine Invasive non-native species (INNS) introduction/spread. Any vessels used for the delivery of materials to site will adhere to industry legislation, codes of conduct and/or best practice to reduce the risk of introduction or spread of invasive non-native species. In the event that GBS foundations are selected for use on the Project, a Biosecurity Plan will be developed to minimise marine INNS introduction/spread.
Decommissioning Programme	Development of, and adherence to, a Decommissioning Programme (DP).

Mitigation	Details of Measure Relevant to the RIAA
Introduction of the ORBA	The ORBA was introduced in order to reduce the potential effects on both guillemot and razorbill.
Onshore Ecology and Ornithology	
Embedded Mitigation	
Project Design	Careful siting of the onshore infrastructure to avoid direct impacts to designated sites with ornithological interest features, including SPAs, Ramsar sites, ornithological SSSIs and RSPB reserves. Where the onshore ECC unavoidably crosses LWSs and LWT reserves (which include small areas of two Annex 1 habitats: embryonic shifting dunes and dunes with sea buckthorn, and which may have functional linkage), trenchless techniques will be used. These sites will also be avoided by construction infrastructure such as the haul road. Avoidance of direct impacts on key areas of sensitivity including Priority Habitats (for example coastal sand dunes and reedbeds) which may support concentrations of sensitive bird species. Commitment to no beach access construction.
Habitat reinstatement	Habitats removed during construction of the onshore ECC and 400kV cable corridor will be reinstated as soon as practicable upon completion of works. Reinstatement of temporarily impacted land to its previous use/ quality so far as practicable with permanent loss limited to the footprint of the OnSS, permanent access tracks (at the OnSS and to the TJB sites at landfall) and link box man hole covers. To minimise the impact to soil/ agricultural quality these would be restored to previous levels as soon as reasonably practicable in accordance with best practice and the Outline Code of Construction Practice (CoCP) (document reference 8.1).
Outline Landscape and Ecology Management Strategy (OLEMS)	An Outline Landscape and Ecology Management Strategy (OLEMS) has been submitted as part of the DCO Application (document reference 8.10) and updated during examination ((document reference 8.10 version 2.0)). The OLEMS provides landscape mitigation detailed principles for the onshore elements of the Project, as well as mitigation strategies for species and habitats based on the Environmental Statement (ES). The OLEMS sets out the key landscape and ecology principles to inform the future Landscape Management Plan (LMP) and Ecology Management Plan (EMP), which would then be conditioned as a requirement of the Development Consent Order (DCO) Application. As required by the DCO, the EMP will include the following specific plans: ▪ A protected species mitigation management plan; ▪ A nesting birds management plan; and,

Mitigation	Details of Measure Relevant to the RIAA
	▪ A non-native invasive species management plan.
Best Practice Air Quality and Hydrological Measures	Measures to control emissions are included within the Outline Air Quality Management Plan (AQMP) (document 8.1.2), provided as part of the Outline CoCP. The outline CoCP contains the Surface Water Drainage Strategy (document 8.1.5) and includes: ▪ Requirement for a flood response plan; and ▪ Measures to control runoff, for example sediment fences, containment of storage areas and treatment of any runoff. Measures to minimise the risk of a pollution event are contained within the Outline Pollution Prevention and Emergency Incident Response Plan (PPEIRP) within the Outline CoCP (Document Ref 8.1.4). All construction work will be managed in line with the Pollution Prevention and Emergency Response Plan (PP~~R~~EIRP) to be drafted in line with the Outline PPREIRP as included in the Outline CoCP (document 8.1.4). Measures include spill procedures and use of spill kits. Construction will also be managed in line with Control of Water Pollution from Construction Sites – Guidance for Consultants and Contractors CIRIA (C532) (CIRIA, 2001). The standards that would be expected to meet any licence or environmental permit for works in relation to the water environment will be applied for all works (e.g. drilling, crossing, culverting, passing under or through) affecting the sea defence structures, main rivers and other watercourses.
Minimising disturbance to non-breeding waterbirds and breeding Schedule 1 birds within Anderby Marsh and Wolla Bank Reedbed LWT Reserve	The landfall construction area will be set back a minimum of 80m from the Anderby Marsh LWT Reserve. A 4m high earth bund will be constructed on three sides of the landfall construction area to provide noise attenuation to mitigate potential disturbance to ornithological receptors at Anderby Marsh LNR (additional to the existing Roman Bank landscape feature). This is illustrated in Appendix 26.4, Figure 26.3 (document reference 6.3.26.4 [APP-217]). At the conclusion of the construction phase, the earth bund will be removed. During its presence, however, it will be seeded with a mix of wildflower seeds. The 4m high earth bund will also provide a screen to Wolla Bank Reedbed LWT Reserve which is located approximately 200m to the south-east of the construction compound.

Mitigation	Details of Measure Relevant to the RIAA
Minimising disturbance to non-breeding waterbirds using FLL	There will be a perimeter subsoil and topsoil bund, of approximately 1.5m height, at either side of the open trenched sections which will provide a degree of visual and acoustic screening between those works and the surrounding landscape. This is shown in Plate 8.1 of Part 1, Chapter 3 Project Description. No impact piling will be used for trenchless crossings; rotary/ silent piling will be utilised at the landfall HDD, with vibratory sheet piling at the CICs to facilitate the trenchless crossings along the onshore ECC and 400kV cable corridor where required.
Operational activities	Operational practices will incorporate measures to prevent pollution and increased flood risk, including emergency spill response procedures, clean up and control of any potentially contaminated surface water runoff. These measures will be included within an Environmental Management Plan (EMP). The EMP will include specific measures to avoid potential impact to protected or notable species or sensitive habitats. Where unplanned operational or maintenance works are required, appropriate mitigation measures would be developed and agreed with relevant consultees prior to works taking place
Additional Mitigation	
Decommissioning activities	Provision of a decommissioning plan in advance of decommissioning works will be a requirement of the DCO, to include protection of ecological features, based on up-to-date survey information and relevant guidance in place at the time of decommissioning.
Otter	Reasonable avoidance measures would be used to reduce the risk of committing an offence under the protecting legislation. These will include pre-construction surveys, to confirm the status of all holts/ places of shelter within 30m of the detailed design of the temporary and permanent works footprint. Design of compounds in close proximity to watercourses used by otter will seek to segregate noise and visual disturbance from the watercourse through sympathetic design. Culverts installed in watercourses used by otters will incorporate a mammal ledge to ensure otters and other riparian mammals can continue to commute along the channel. Where disturbance effects cannot be avoided, an A45 licence will be sought from NE.

Mitigation	Details of Measure Relevant to the RIAA
Minimising disturbance to non-breeding birds within SPAs and Ramsar sites	ODOW has committed to avoiding any construction activity within a minimum of 400m of The Wash SPA and Ramsar (relevant to The Haven crossing), during the period of October to March inclusive. This will avoid disturbance impacts to non-breeding birds within those designated sites boundaries. The Wash SPA and Ramsar is located 180m from the onshore Order Limits at the closest point. The restricted area will extend from Wyberton Roads up to the field boundary east of Southfield Lane~~to CIC 247~~, as shown in ES Volume 2, Figure 22.4 (document reference 6.2.22.4 [APP-113]). This extends beyond the areas within 400m of The Wash, as described below in relation to brent geese. Should the BAEF Wyberton Roads (South) compensation site be completed in advance of, or during, the construction phase for the Project, there will be a seasonal restriction to construction works[1] within 400m of that compensation site, as shown in ES Volume 2, Figure 22.1 (document reference 6.2.22.1 [APP-113]). In that scenario, no works within that area will be undertaken during the period of November to February inclusive. In the event that the BAEF Wyberton Roads (South) compensation site is only completed during the construction phase for the Project, then construction works already underway at the point of completion would be allowed to continue.
Minimising disturbance to non-breeding waterbirds and breeding Schedule 1 birds within Anderby Marsh LWT Reserve	~~S~~Rotary and silent piling methods rather than impact piling will be adopted at the landfall. Noisier plant will be located at the western end of the compound wherever possible. Construction of the bund, will be undertaken within the months of August/ September between the core breeding and non-breeding seasons. March will be avoided for constructing the mitigation bund at the landfall. However, ODOW will focus on completing the 'soft start' works during this period. These preparatory works, which include ground preparation, land drainage, fencing, signage, access haul road, material storage, and establishment of laydown for welfare, are crucial for ensuring a smooth start to the Bund work. ~~Site establishment, including creation of the bund, will be undertaken in August/September, following the breeding bird season and ahead of the winter season.~~

[1] Not including construction vehicle movements.

Mitigation	Details of Measure Relevant to the RIAA
Minimising disturbance to non-breeding waterbirds using FLL	Seasonal Restriction In addition to the seasonal restriction in relation to The Wash SPA boundary, there will be a seasonal restriction to works to cover land within 400m of core areas used by foraging brent geese at The Haven. Year 1 surveys recorded dark-bellied brent goose from the Order Limits plus 400m buffer predominantly from November through to March, with lower numbers in October. WeBS data from those sectors overlapping with or close to the Order Limits, for dark-bellied brent goose, shows peak numbers in January and low abundances in other months (sector counts of 40 or less). This indicates that a seasonal restriction for this species of November to March inclusive would be appropriate, which is within the October to March restriction for this area. Data from the additional visit in April 2024 indicates that brent geese are still present at the River Haven at a notable abundance in this month and therefore works within 400m of the Haven, as illustrated in Figure 52 of Addendum: Winter Bird Survey 2023/24 (document reference 13.2), during April will be limited to soft start works. Soft start works in April will entail site preparations and establishment of the haul road and work areas. No drilling will take place in April. Within the October to March seasonally restricted area works would be limited to vegetation clearance and maintenance, in order to avoid clearance during the nesting bird season and to minimise the risk of birds establishing nests within the working area. The Applicant commits to employing an Ecological Clerk of Works (ECoW) to undertake a survey for brent geese within the seasonally restricted area prior to vegetation clearance works commencing in a discreet area. No clearance works will commence whilst brent geese are present within 400m of the area to be cleared. Once clearance works have commenced, they will continue until works have been completed in that location. Usual agricultural operations will continue in the seasonally restricted area. Essential non-intrusive survey works would also be permitted within the seasonally restricted periods. Localised Working

Mitigation	Details of Measure Relevant to the RIAA
	For conventional cross-country construction methodologies involving soil handling, the primary construction period is March – October. There will be no trenched excavation works for duct installation[2] between November to February (inclusive), works will continue at trenchless crossing sites and joint bays that can be accessed by temporary haul roads and hard-standings. In order to minimise the potential for disturbance, and provide even greater certainty to the conclusions, additional mitigation has been included in the form of a commitment to localised working. Winter works will be carried out by several small teams at discrete locations along the route, such as joint bay, link boxes, trenchless crossings, cable installation (pulling) and other non-intrusive earth works (e.g. cable testing). Assuming a works area of 100m at these sites and 10 sites, this would account for approximately 1,000m of works or (1km / 70km) or 1.4% of the cable corridor at any one time. Activity on the remaining 98.6% of the corridor will be confined to the operatives taking daily access to the work site where this involves the use of a haul road and moving the drilling plant to the next site once the work at any location is complete. During the summer months (April to September inclusive, weather dependent), works will take place at between 20 to 30 locations at any time, or approximately 5% of the cable corridor. During October and March, summer works will progressively be completed/started and transitioned between summer and winter working. Disturbance to non-breeding waterbirds is likely to be most critical during periods of prolonged cold weather, when they may be unable to feed in their usual foraging areas and may face reduced prospects for survival. A scheme is in place to minimise the level of disturbance from wildfowl shooting in frozen conditions (JNCC, 2019). Similar measures would be imposed here, with the works suspended after seven consecutive days on which the ground was frozen (as measured at a nearby weather station). Any suspension of works would last for a minimum

[2] Works that will not be subject to this restriction include emergency response (fencing/trench failures)/general maintenance (de watering etc)/security

Mitigation	Details of Measure Relevant to the RIAA
	of seven days (or, as agreed by the ECoW) thereafter and any lifting of the suspension will take into consideration the need for a period of recovery for waterbirds after the end of the severe weather itself.
Minimising temporary loss of FLL	Areas where works are not due to take place that year will be left un-stripped. Trenching for duct installation across farmland will be carried out between March and October and will be followed by 'partial land reinstatement' involving reinstating the topsoil, leaving only the haul road, where this is required. Where practical, following partial reinstatement the project will plant a cover crop until the point at which the landowner is ready to start the normal cropping rotation. The intention is to return land to agriculture as soon as possible. The 'where practical' in this instance refers to the fact that in some circumstances the Project may be in the position that the land can be handed back to the landowner to continue agricultural practices earlier than anticipated in which case there will be no opportunity plant a cover crop. Under this circumstance these areas of land are being reinstated to previous use and this habitat is no longer impacted. Where a cover crop is required; this will be in the form of a grass or clover mix variety which will be confirmed following the Applicants pre-commencement soil surveys and in line with the Outline Soil Management Plan (document 8.1.3, Version 2). Anticipated reinstatement figures are as follows: ▪ Winter Year 0 (prior to mobilisation) – Localised vegetation clearance only and enabling works at some access locations. ▪ Winter Year 1 – 35% stripped, with 3-5% (of whole corridor) partially reinstated. ▪ Winter Year 2 – 70% stripped, 40% (of whole corridor) has been partially reinstated. ▪ Winter Year 3 – 70% stripped (as 30% un-stripped as avoided through trenchless works), 80% of which fully reinstated to previous agricultural use. ▪ Winter Year 4 – 100% fully reinstated to previous agricultural use. The cover crop habitat will be retained and managed for the duration of the construction period, until such time as it is restored to the previous land use.
Protection of breeding Schedule 1 birds	Species listed on Schedule 1 of the Wildlife and Countryside Act (1981) as amended are afforded legal protection from disturbance at the nest site, as well as protection of dependent young. Surveys would take place during

Mitigation	Details of Measure Relevant to the RIAA
	each breeding season in which construction occurs in order to identify the approximate locations of nesting Schedule 1 birds and to review the mitigation measures to ensure they are sufficient to avoid disturbance. In order to protect ground nesting birds which may choose to nest in short vegetation or bare ground, such areas will be checked for the presence of nests by the ECoW prior to works commencing during the breeding bird season, as detailed in the OLEMS. Where an active nest is located, an appropriate stand-off zone as determined by the ECoW will be demarcated and avoided until it has been confirmed by the ECoW that the nesting attempt has ended.

7 Stage 1: Summary of HRA Screening

7.1 Screening Undertaken for the Project Alone

~~74.~~82. As noted in Section 2.6 above, the first stage of the HRA process is Screening, this being the process followed to identify the potential for LSE from the Project, alone and or in-combination with other plans or projects, on designated sites. Screening for the Project alone was initially undertaken alongside the EIA Scoping process, with the draft Screening Report issued in August 2022 for consultation. Subsequently, a final screening report was submitted with the DCO Application~~has been drafted~~ based on consultation received on the draft report (document reference 7.2). The screening report (document reference 7.2) has been subsequently updated following the design changes as outlined in Paragraph 8. The distances to designated sites have been updated following the removal of the northern route of the ECC affecting the distance to ORCP and distance to ECC. This has not altered the sites screened in or out of the assessment or the potential effects considered. The distances to designated sites have also been updated to include the distance to WTG area following the introduction of the ORBA. This is for completeness only and these distances have not been taken into account at the Screening stage. Minor corrections have also been undertaken, additionally, potential disturbance of red-throated diver and common scoter designated at the Greater Wash SPA has been screened in to the operation of the ORCP on request from Natural England (RR-045 – F6).

~~75.~~83. The Screening Report (document reference 7.2) included detail on all consultation carried out during the Screening process (as summarised within Section 4). The Screening Matrix incorporated all final decisions on HRA Screening (document reference 7.3).~~, following the structure provided in the Inspectorates Advice Note 10.Nationally Significant Infrastructure Projects: Advice on Habitat Regulations Assessments (the Planning Inspectorate, 2024b).~~

~~76.~~84. The Screening information for the Project alone is summarised in Table 7.1, as adapted from the Screening Matrix (document reference 7.3). Table 7.1 summarises, on a site-by-site basis, the features screened in for potential LSE from the Project alone. Information on sites/features/effects screened out from potential LSE is contained within the Screening Report (document reference 7.2) and Screening Matrix (document reference 7.3) but is not reproduced in full here in the interests of brevity. The Screening Report (document reference 7.2) also includes screening for potential LSE for onshore ecology and migratory fish, which confirmed that no potential for LSE alone has been identified for migratory fish.

Table 7-1~~7.17-17.1~~: Sites and features screened in for the assessment of the Project

Designated Site	Distance to the Project (km): Array Area	Distance to the Project (km): WTG Area	Distance to the Project (km): Offshore ECC	Distance to the Project (km): ANS	Distance to the Project (km): Biogenic Reef	Distance to the Project (km): ORCP	Features screened in.	Potential for Likely Significant Effect Identified. Construction	Potential for Likely Significant Effect Identified. Operation	Potential for Likely Significant Effect Identified. Decommissioning
Benthic Subtidal and Intertidal Ecology										
North Norfolk Sandbanks and Saturn Reef SAC	6.0	6.8~~56.6~~	17.8~~730.3~~	0.0~~59.0~~	44.2~~11.2~~	72.6~~332.0~~	▪ Reefs; and ▪ Sandbanks which are slightly covered by sea water all of the time	▪ Suspended sediment/ deposition; ▪ Indirect Pollution; ▪ Accidental Pollution; ▪ INNS; and ▪ Changes to physical processes.	▪ Suspended sediment/ deposition; ▪ Indirect pollution; ▪ Accidental Pollution; ▪ INNS; and ▪ Changes to physical processes.	▪ Suspended sediment/ deposition; ▪ Indirect Pollution; ▪ Accidental Pollution; ▪ INNS; and ▪ Changes to physical processes.
Inner Dowsing, Race Bank, and North Ridge SAC	17.3	17.3	0.0	30.0	0.0	0.0	▪ Reefs; and ▪ Sandbanks which are slightly covered by sea water all of the time	▪ Physical habitat loss/disturbance; ▪ Suspended sediment/ deposition; ▪ Indirect Pollution; ▪ Accidental Pollution; ▪ INNS; and ▪ Changes to physical processes.	▪ Physical habitat loss/ disturbance; ▪ Suspended sediment/ deposition; ▪ Indirect Pollution; ▪ Accidental Pollution; ▪ INNS; ▪ Changes to physical processes; and ▪ EMF.	▪ Physical habitat loss/ disturbance; ▪ Suspended sediment/ deposition; ▪ Indirect Pollution; ▪ Accidental Pollution; ▪ INNS; and ▪ Changes to physical processes.
The Wash and North Norfolk Coast SAC	47.8	47.8	13.4	50.54	8.7~~0.0~~	19.3	▪ Sandbanks which are slightly covered by sea water all of the time; ▪ Mudflats and sandflats not covered by seawater at low tide; ▪ Large shallow inlets and bays; ▪ Reefs; ▪ *Salicornia* and other annuals colonizing mud and sand; and ▪ Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)	▪ Suspended sediment/ deposition; ▪ Indirect Pollution; ▪ Accidental Pollution; ▪ INNS; and ▪ Changes to physical processes.	▪ Suspended sediment/ deposition; ▪ Indirect Pollution; ▪ Accidental Pollution; ▪ INNS; and ▪ Changes to physical processes.	▪ Suspended sediment/ deposition; ▪ Indirect Pollution; ▪ Accidental Pollution; ▪ INNS; and ▪ Changes to physical processes.
Humber Estuary Ramsar	54.0	54.0	12.5	47.5	~~18.2~~20.9	18.7~~15.3~~	▪ Dune systems with humid dune slacks, ▪ Estuarine waters;	▪ Suspended sediment/ deposition; ▪ Indirect Pollution; ▪ Accidental Pollution;	▪ Suspended sediment/ deposition; ▪ Indirect Pollution; ▪ Accidental Pollution;	▪ Suspended sediment/ deposition; ▪ Indirect Pollution;

	Distance to the Project (km)						Features screened in.	Potential for Likely Significant Effect Identified.		
							▪ Intertidal mud and sand flats; ▪ Saltmarshes; and ▪ Coastal brackish/saline lagoons	▪ INNS; and ▪ Changes to physical processes.	▪ INNS; and ▪ Changes to physical processes.	▪ Accidental Pollution; ▪ INNS; and ▪ Changes to physical processes.
Humber Estuary SAC	54.4	54.4~~54.4~~	18.9~~18.9~~	47.5~~47.5~~	24.3~~23.8~~	23.8~~19.7~~	▪ Estuaries; ▪ Mudflats and sandflats not covered by seawater at low tide; ▪ Sandbanks which are slightly covered by sea water all the time; ▪ *Salicornia* and other annuals colonizing mud and sand; and ▪ Atlantic salt meadows.	▪ Suspended sediment/ deposition; ▪ Indirect Pollution; ▪ Accidental Pollution; ▪ INNS; and ▪ Changes to physical processes.	▪ Suspended sediment/ deposition; ▪ Indirect Pollution; ▪ Accidental Pollution; ▪ INNS; and ▪ Changes to physical processes.	▪ Suspended sediment/ deposition; ▪ Indirect Pollution; ▪ Accidental Pollution; ▪ INNS; and ▪ Changes to physical processes.
Gibraltar Point Ramsar	62.9	62.9	13.4	70.6~~56~~	11.7~~.6~~	19.3	▪ Estuarine mudflats; ▪ Sandbanks; ▪ Saltmarsh; and ▪ Dunes	▪ Suspended sediment/ deposition; ▪ Indirect Pollution; ▪ Accidental Pollution; ▪ INNS; and ▪ Changes to physical processes.	▪ Suspended sediment/ deposition; ▪ Indirect Pollution; ▪ Accidental Pollution; ▪ INNS; and ▪ Changes to physical processes.	▪ Suspended sediment/ deposition; ▪ Indirect Pollution; ▪ Accidental Pollution; ▪ INNS; and ▪ Changes to physical processes.
The Wash Ramsar	66.3	66.3	16.5	74.0	13.8	22.8~~7~~	▪ Saltmarshes; ▪ Estuaries; ▪ Major intertidal banks of sand and mud; ▪ Shallow water; and ▪ Deep channels	▪ Suspended sediment/ deposition; ▪ Indirect Pollution; ▪ Accidental Pollution; ▪ INNS; and ▪ Changes to physical processes.	▪ Suspended sediment/ deposition; ▪ Indirect Pollution; ▪ Accidental Pollution; ▪ INNS; and ▪ Changes to physical processes.	▪ Suspended sediment/ deposition; ▪ Indirect Pollution; ▪ Accidental Pollution; ▪ INNS; and ▪ Changes to physical processes.
Marine Mammals										
Southern North Sea SAC	0.0	0.0	1.1	0.0	36.0~~34.7~~	~~47.342~~48.2~~.5~~	▪ Harbour Porpoise (*Phocoena phocoena*)	▪ Underwater noise; ▪ Vessel disturbance; ▪ Collision risk; ▪ Indirect pollution; ▪ Accidental pollution; ▪ Habitat loss; and ▪ Changes to prey.	▪ Underwater noise; ▪ Vessel disturbance; ▪ Collision risk; ▪ Indirect Pollution; ▪ Accidental pollution; ▪ Habitat loss; and ▪ Changes to prey.	▪ Underwater noise; ▪ Vessel disturbance; ▪ Collision risk; ▪ Indirect Pollution; ▪ Accidental pollution; ▪ Habitat loss; and ▪ Changes to prey.

	Distance to the Project (km)						Features screened in.	Potential for Likely Significant Effect Identified.		
Humber Estuary SAC	54.4	54.4	18.9	47.5	24.3~~3.8~~	23.8~~19.7~~	▪ Grey Seal (*Halichoerus grypus*)	▪ Underwater noise; ▪ Vessel disturbance; ▪ Changes to prey; ▪ Disturbance at haul out; and ▪ Vessel collision risk.	▪ Underwater noise; ▪ Vessel disturbance; ▪ Changes to prey; ▪ Disturbance at haul out; and ▪ Vessel collision risk.	▪ Underwater noise; ▪ Vessel disturbance; ▪ Changes to prey; ▪ Disturbance at haul out; and ▪ Vessel collision risk.
Humber Estuary Ramsar	54.0	54.0	12.5	47.5	20.9~~18.2~~	18.7~~15.3~~	▪ Grey Seal (*H. grypus*)	▪ Underwater noise; ▪ Vessel disturbance; ▪ Changes to prey; ▪ Disturbance at haul out; and ▪ Vessel collision risk.	▪ Underwater noise; ▪ Vessel disturbance; ▪ Changes to prey; ▪ Disturbance at haul out; and ▪ Vessel collision risk..	▪ Underwater noise; ▪ Vessel disturbance; ▪ Changes to prey; ▪ Disturbance at haul out; and ▪ Vessel collision risk.
The Wash and North Norfolk Coast SAC	47.8	47.8	13.4	50.54	~~0~~8.7~~.0~~	19.3	▪ Harbour Seal (*Phoca vitulina*)	▪ Underwater noise; ▪ Vessel disturbance; ▪ Changes to prey; and ▪ Vessel collision risk.	▪ Underwater noise; ▪ Vessel disturbance; ▪ Changes to prey; and ▪ Vessel collision risk.	▪ Underwater noise; ▪ Vessel disturbance; ▪ Changes to prey; and ▪ Vessel collision risk.
Berwickshire and North Northumberland Coast SAC	260.4	260.7~~84~~	264.5~~62.1~~	235.7	262~~59~~.8~~2~~	267.2~~02.1~~	▪ Grey Seal (*H. grypus*)	▪ Underwater noise; ▪ Vessel disturbance; ▪ Changes to prey; and ▪ Vessel collision risk.	▪ Underwater noise; ▪ Vessel disturbance; ▪ Changes to prey; and ▪ Vessel collision risk.	▪ Underwater noise; ▪ Vessel disturbance; ▪ Changes to prey; and ▪ Vessel collision risk
Moray Firth SAC	535.7	537.3~~5536.0~~	~~547.35435~~546.9~~.9~~	512.1~~3512.3~~	544.1~~4540.1~~	549.0~~8.9543.9~~	▪ Bottlenose dolphin (*Tursiops truncatus*)	▪ Underwater noise; ▪ Vessel disturbance; ▪ Vessel collision risk.; and ▪ Changes to prey.	▪ Underwater noise; ▪ Vessel disturbance; ▪ Vessel collision risk;~~.~~ and ▪ Changes to prey.	▪ Underwater noise; ▪ Vessel disturbance; ▪ Vessel collision risk~~.~~; and ▪ Changes to prey.
Transboundary sites for seals; Bancs des Flandres SAC; Doggersbank (Netherlands) SAC Klaverbank SCI; Noordzeekustone SCI; SBZ 1 SCI; SBZ 2 SCI; SBZ 3 SCI;	Various	Various	Various	Various	Various	Various	▪ Harbour seal (*P. vitulina*); and ▪ Grey seal (*H. grypus*)	▪ Underwater noise; ▪ Vessel disturbance; ▪ Changes to prey; and ▪ Vessel collision risk.	▪ Underwater noise; ▪ Vessel disturbance; ▪ Changes to prey; and ▪ Vessel collision risk.	▪ Underwater noise; ▪ Vessel disturbance; ▪ Changes to prey; and ▪ Vessel collision risk.

	Distance to the Project (km)						Features screened in.	Potential for Likely Significant Effect Identified.		
Vlaamse Banked SCI; Vlakte van de Raan SCI; Voordelta SCI; Waddenzee SCI; and Westerschelde & Saeftinghe SCI.										
Offshore and Intertidal Ornithology										
Greater Wash SPA	24.8	24.8~~7~~	0.0	24.0	0.0	0.0	▪ Common scoter; ▪ Little gull (*Hydrocoloeus minutus*); ▪ Red-throated diver (*Gavia stellata*); and ~~▪ Little tern (*Sternula albifrons*);~~ ~~▪~~ Common tern (*Sterna hirundo*). ~~; and~~ ▪ ~~Sandwich tern~~	▪ N/A	▪ Collision risk on migration due to the presence of turbines	▪ N/A
							▪ Common scoter; and ▪ Red-throated diver	▪ Direct disturbance and displacement due to work activity and vessel movements in both the offshore and intertidal zones. ▪ Indirect effects through effects on habitats and prey species.	▪ Direct disturbance and displacement in the array area plus 4km buffer due to the presence of turbines (red-throated diver only).	▪ Direct disturbance and displacement due to work activity and vessel movements in both the offshore and intertidal zones. ▪ Indirect effects through effects on habitats and prey species.
The Wash SPA[3]	66.3	66.3 ~~48.4~~	16.5 ~~13.4~~	74.0 ~~50.4~~	13.8 ~~0.0~~	22.8 ~~19.3~~	▪ Pintail *Anas acuta* ▪ Widgeon *Anas penelope* ▪ Gadwall *Anas strepera* ▪ Pink-footed goose *Anser brachyrhynchus* ▪ Turnstone *Arenaria interpres* ▪ Brent goose	~~▪ Collision risk on migration due to the presence of turbines~~	▪ Collision risk on migration due to the presence of turbines	~~▪ Collision risk on migration due to the presence of turbines~~

[3] This site was included in this Screening table as an errata, it had previously been assessed in the RIAA and is not included as a result of any changes to the Project.

	Distance to the Project (km)						Features screened in.	Potential for Likely Significant Effect Identified.		
							Branta bernicula bernicula ▪ Goldeneye *Bucephala clangula* ▪ Sanderling *Calidris alba* ▪ Dunlin *Calidris alpina alpina* ▪ Red knot *Calidris canutus* ▪ Bewick's swan *Cygnus columbianus* ▪ Oystercatcher *Haematopus ostralegus* ▪ Bar-tailed godwit *Limosa lapponica* ▪ Black-tailed godwit *Limosa limosa islandica* ▪ Common scoter *Melanitta nigra* ▪ Curlew *Numenius arquata* ▪ Grey plover *Pluvialis squatarola* ▪ Little tern *Sternula albifrons* ▪ Common tern *Sterna hirundo* ▪ Shelduck *Tadorna tadorna* ▪ Redshank *Tringa totanus*			
Humber Estuary SPA and Ramsar	54.0	54.0	12.5	47.5	20.9~~18.2~~	18.7~~675.3~~	▪ Avocet (*Recurvirostra avosetta*); ▪ Bar-tailed godwit (*Limosa lapponica*); ▪ Bittern (*Botaurus stellaris*); ▪ Black-tailed godwit (*L. limosa*); ▪ Dunlin (*Calidris alpina*); ▪ Golden plover (*Pluvialis apricaria*);	~~Collision risk on migration due to the presence of turbines~~	▪ Collision risk on migration due to the presence of turbines~~N/A~~	~~Collision risk on migration due to the presence of turbines~~

	Distance to the Project (km)						Features screened in.	Potential for Likely Significant Effect Identified.		
							▪ Hen harrier (*Circus cyaneus*); ▪ Knot (*Calidris canutus*); ▪ Little tern; ▪ Marsh harrier (*Circus aeruginosus*); ▪ Redshank (*Tringa to~~e~~tanus*); ▪ Ruff (*Philomachus pugnax*); ▪ Shelduck (*Tadorna tadorna*); ▪ Pink-footed goose (*Anser brachyrhynchus*); ▪ Wigeon (*Anas penelope*); ▪ Ringed plover (*Charadrius hiaticula*); ▪ Curlew (*Numenius arquata*); ▪ Sanderling (*Calidris alba*); ▪ Oystercatcher (*Haematopus ostralegus*); ▪ Dark-bellied brent goose *(Branta bernicla bernicla);* ▪ Mallard (*Anas platyrhynchos*); ▪ Pochard (*Aythya farina*); ▪ Goldeneye (*Bucephala clangula*); and ▪ Scaup (*Aythya marila*).			
North Norfolk Coast SPA	56.4	56.4	29.9	59.0	1~~0~~6.0~~.8~~	31.4	▪ Sandwich tern	▪ N/A	▪ Collision risk due to the presence of turbines	▪ N/A
							▪ Bittern; ▪ Pink-footed goose; ▪ Dark-bellied brent goose; ▪ Wigeon; ▪ Marsh harrier; ▪ Avocet; ▪ Knot;	▪ N/A	▪ Collision risk on migration due to the presence of turbines	▪ N/A

	Distance to the Project (km)						Features screened in.	Potential for Likely Significant Effect Identified.		
							▪ Common tern; and ▪ Little tern.			
Gibraltar Point SPA[4]	62.9	~~63.1~~62.9	13.4~~3~~	70.6	11.7	19.3	▪ Sanderling *Calidris alba* ▪ Bar-tailed godwit *Limosa lapponica* ▪ Grey plover *Pluvialis squatarola* ▪ Little tern *Sternula albifrons*	▪ N/A	▪ Collision risk on migration due to the presence of turbines	▪ N/A
Flamborough and Filey Coast SPA	93.5	93.5	95.9~~2.0~~	70.7	92.7~~88.8~~	97~~2~~.3~~0~~	▪ Kittiwake; ▪ Gannet; and ▪ Herring gull* (*Larus argentatus*)	▪ N/A	▪ Collision risk due to the presence of turbines	▪ N/A
							▪ Guillemot; ▪ Razorbill (*Alca torda*); ▪ Gannet; and ▪ Puffin (*Fratercula arctica*).	▪ Direct disturbance and displacement due to work activity and vessel movements in both the offshore and intertidal zones.	▪ Direct disturbance and displacement in the array area plus 2km buffer due to the presence of turbines.	▪ Direct disturbance and displacement due to work activity and vessel movements in both the offshore and intertidal zones.
Alde-Ore Estuary SPA & Ramsar	147.3	147.3~~2~~	131.4~~3~~	136.2	112.~~0.~~6~~4~~	139.2	▪ Lesser black-backed gull (*Larus fuscus*)	▪ N/A	▪ Collision risk due to the presence of turbines	▪ N/A
Coquet Island SPA	258.6	258.8~~258.6~~	260~~1~~.9~~0258.8~~	233.9~~233.9~~	259.8~~256.3~~	263.9~~8258.8~~	▪ Sandwich tern (non-breeding)	▪ N/A	▪ Collision risk due to the presence of turbines	▪ N/A
							▪ Common tern	▪ N/A	▪ Collision risk on migration due to the presence of turbines	▪ N/A
							▪ Puffin	▪ Direct disturbance and displacement due to work activity and vessel movements in both the offshore and intertidal zones.	▪ Direct disturbance and displacement in the array area plus 2km buffer due to the presence of turbines.	▪ Direct disturbance and displacement due to work activity and vessel movements in both the offshore and intertidal zones.
Farne Islands SPA	285.8	286.4~~5285.8~~	291.7~~8289.1~~	261.3~~261.3~~	289.7~~8285.9~~	294.2~~0289.1~~	▪ Kittiwake ▪ Sandwich tern (non-breeding)	▪ N/A	▪ Collision risk due to the presence of turbines.	▪ N/A

[4] This site was included in this Screening table as an errata, it had previously been assessed in the RIAA and is not included as a result of any changes to the Project.

	Distance to the Project (km)						Features screened in.	Potential for Likely Significant Effect Identified.		
							▪ Guillemot ▪ Puffin	▪ Direct disturbance and displacement due to work activity and vessel movements in both the offshore and intertidal zones.	▪ Direct disturbance and displacement in the array area plus 2km buffer due to the presence of turbines.	▪ Direct disturbance and displacement due to work activity and vessel movements in both the offshore and intertidal zones.
Scottish SPAs	Various	Various	Various	Various	Various	Various	▪ Gannet ▪ Guillemot ▪ Razorbill ▪ Puffin	▪ Direct disturbance and displacement due to work activity and vessel movements in both the offshore and intertidal zones	▪ Direct disturbance and displacement in the array area plus 2km buffer due to the presence of turbines.	▪ Direct disturbance and displacement due to work activity and vessel movements in both the offshore and intertidal zones.
							▪ Gannet ▪ Kittiwake	▪ N/A	▪ Collision risk due to the presence of turbines	▪ N/A
Migratory Fish										
Humber Estuary SAC	54.4	54.4	18.9	47.5	24.3~~.8~~	23.8~~19.7~~	▪ Sea lamprey (*Petromyzon marinus*); and ▪ River lamprey (*Lampetra fluviatilis*)	▪ Underwater noise	▪ N/A	▪ Underwater noise
Onshore Ecology and Ornithology										
	Distance to Project (km)							Potential for Likely Significant Effect identified		
Designated Site	Array Area	WTG Area	Onshore ECC	ANS	Biogenic Reef	ORCP	Features screened in	Construction	Operation	Decommissioning
Humber Estuary SPA	54.0	54.0~~42.6~~	12.5	47.5	20.9~~18.2~~	18.7~~65.3~~	▪ Bittern (non-breeding and breeding); ▪ Shelduck (non-breeding); ▪ Marsh harrier (breeding); ▪ Hen harrier (non-breeding); ▪ Avocet (non-breeding and breeding); ▪ Golden plover (non-breeding); ▪ Knot (non-breeding); ▪ Dunlin (non-breeding); ▪ Ruff (non-breeding); ▪ Black-tailed godwit (non-breeding); ▪ Bar-tailed godwit (non-breeding); ▪ Redshank (non-breeding);	▪ Loss of foraging, roosting and nesting habitat inside and outside the SPA for birds; ▪ Disturbance/ displacement of birds inside and outside the SPA; and ▪ Pollution from site run-off affecting habitat quality and resources.	▪ Disturbance/ displacement of birds arising from vehicles and workers accessing onshore structures for maintenance.	▪ Disturbance/ displacement of birds inside and outside SPA; and ▪ Pollution from site run-off affecting habitat quality

	Distance to the Project (km)						Features screened in.	Potential for Likely Significant Effect Identified.		
							▪ Little tern (breeding); and ▪ Waterbird assemblage			
Humber Estuary Ramsar	54.0	54.0~~2.6~~	12.5	47.5	20.9~~18.2~~	18.7~~5.3~~	Onshore Ramsar Features: ▪ Criterion 1- dune systems and humid dune slacks; ▪ Criterion 5 – assemblages of international importance (waterfowl, non-breeding season); ▪ Criterion 6 – species/populations occurring at levels of international importance: ▪ Shelduck; ▪ Golden plover; ▪ Knot; ▪ Dunlin; ▪ Black-tailed godwit; ▪ Bar-tailed godwit; and ▪ Redshank.	▪ Loss of estuary habitats such as dune systems and dune slacks; ▪ Loss of foraging, roosting and nesting habitat within the site and surrounding area; ▪ Disturbance of birds within and outside the site; ▪ Possible loss of estuary habitats; and ▪ Pollution from site run-off affecting habitat quality and resources.	▪ Damage to habitats and disturbance/ displacement of birds arising from vehicles and workers accessing onshore structures for maintenance.	▪ Disturbance/ displacement of birds within and outside the site; and ▪ Pollution from site run-off affecting habitat quality.
Humber Estuary SAC	54.4	54.4~~53.0~~	18.979~~18.5~~	47.54~~7.5~~	24.3~~23.8~~	23.8~~19.7~~	▪ H1110. Sandbanks which are slightly covered by sea water all the time; Subtidal sandbanks; ▪ H1130. Estuaries; ▪ H1140. Mudflats and sandflats not covered by seawater at low tide; Intertidal mudflats and sandflats; ▪ H1150. Coastal lagoons; ▪ H1310. Salicornia and other annuals colonising mud and sand; Glasswort and other annuals colonising mud and sand; ▪ H1330. Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*); ▪ H2110. Embryonic shifting dunes ▪ H2120. Shifting dunes along the shoreline with	▪ Possible loss of or damage to Annex I estuary habitats; and ▪ Pollution from site run-off affecting habitat quality.	▪ Damage to habitats from operations and maintenance activities.	▪ Pollution from site run-off affecting habitat quality.

	Distance to the Project (km)						Features screened in.	Potential for Likely Significant Effect Identified.		
							Ammophila arenaria (white dunes); ▪ Shifting dunes with marram ▪ H2130. Fixed dunes with herbaceous vegetation (grey dunes); Dune grassland; and ▪ H2160. Dunes with *Hippophae rhamnoides*; Dunes with sea-buckthorn.			
Saltfleetby-Theddlethorpe Dunes & Gibraltar Point SAC	54.5	54.5 ~~53.2~~	4.15 (Gibraltar Point)	51.5	11.4 ~~1.6~~	18.0 ~~15.5~~	Annex I habitats: ▪ 2110 Embryonic shifting dunes; ▪ 2120 "Shifting dunes along the shoreline with *Ammophila arenaria* (""white dunes"")"; ▪ 2130 "Fixed coastal dunes with herbaceous vegetation (""grey dunes"")" Priority feature; ▪ 2160 Dunes with *Hippophae rhamnoides*; and ▪ 2190 Humid dune slacks.	▪ Disturbance and loss of Annex I habitats present within the SAC; ▪ Disturbance to species present within the SAC; ▪ Reduction of habitat quality; ▪ Pollution from site run-off.	▪ Damage to habitats from operations and maintenance activities.	▪ Disturbance and loss of Annex I habitats present within the SAC; ▪ Disturbance to species present within the SAC; and ▪ Reduction of habitat quality. ▪ Pollution from site run-off.
The Wash SPA	66.3	66.3~~65.4~~	~~16.5~~0.18~~0.18~~	74.0~~74.0~~	13.8~~3.8~~	22.8~~722.7~~	▪ Bewick's swan (non-breeding); ▪ Pink-footed goose (non-breeding); ▪ Dark-bellied brent goose (non-breeding); ▪ Shelduck (non-breeding) ▪ Wigeon (non-breeding); ▪ Gadwall (non-breeding); ▪ Pintail (non-breeding); ▪ Common scoter (non-breeding); ▪ Goldeneye (non-breeding); ▪ Oystercatcher (non-breeding); ▪ Grey plover (non-breeding); ▪ Knot (non-breeding);	▪ Loss of foraging, roosting, and nesting habitat within the site and surrounding area; ▪ Disturbance of birds within and outside the SPA; and ▪ Pollution from site run-off affecting habitat quality.	▪ Disturbance/ displacement of birds arising from vehicles and workers accessing onshore structures for maintenance	▪ Disturbance/ displacement of birds outside SPA; and ▪ Pollution from site run-off affecting habitat quality.

	Distance to the Project (km)						Features screened in.	Potential for Likely Significant Effect Identified.		
							▪ Sanderling (non-breeding); ▪ Dunlin (non-breeding); ▪ Black-tailed godwit (non-breeding); ▪ Bar-tailed godwit (Non-breeding); ▪ Curlew (Non-breeding); ▪ Redshank (Non-breeding); ▪ Turnstone (Non-breeding); ▪ Common tern (Breeding); ▪ Little tern (Breeding); and ▪ Waterbird assemblage			
The Wash Ramsar	66.3	66.3~~65.4~~	0.18	74.0~~74.0~~	13.8~~3.8~~	22.8~~722.7~~	▪ Criterion 1 – Saltmarshes, major intertidal banks of sand and mud, shallow water, and deep channels; ▪ Criterion 3 – inter-relationship between saltmarshes, intertidal sand, mudflats, and estuarine waters; ▪ Criterion 5 – Bird assemblages of international importance; ▪ Criterion 6 – Bird species/ populations occurring at levels of international importance: Species with peak counts in spring/autumn: ▪ Redshank; ▪ Curlew (breeding); ▪ Oystercatcher (wintering); ▪ Grey plover (wintering); ▪ Knot (wintering); and ▪ Sanderling. Species with peak counts in winter: ▪ Black-headed gull; ▪ Eider; ▪ Bar-tailed godwit; ▪ Shelduck; ▪ Dark-bellied brent goose; ▪ Dunlin;	▪ Possible loss of or damage to estuary habitats; ▪ Loss of foraging and roosting habitat within the site and surrounding area; ▪ Disturbance of birds within and outside the site; and ▪ Pollution from site run-off affecting habitat quality.	▪ Damage to habitats and disturbance/ displacement of birds arising from vehicles and workers accessing onshore structures for maintenance.	▪ Disturbance/ displacement of birds outside the site; and ▪ Pollution from site run-off affecting habitat quality.

	Distance to the Project (km)						Features screened in.	Potential for Likely Significant Effect Identified.		
							▪ Pink-footed goose; ▪ Golden plover; and ▪ Lapwing. Species with peak counts in spring/autumn: ▪ Black-tailed godwit; and ▪ Ringed plover.			
The Wash & North Norfolk Coast SAC	47.8	47.8~~9~~	0.01	50.5~~4~~	~~0.0~~8.7	19.3	▪ 1330 Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*); ▪ 1420 Mediterranean and thermo-Atlantic halophilous scrubs (*Sarcocornetea fruticosi*); ▪ 1150 Coastal lagoons *Priority feature; and ▪ Otter.			
Greater Wash SPA	24.8	24.8~~3.5~~	0.0	24.0	0.0	0.0	Breeding bird species: ▪ Sandwich tern; ▪ Common tern; and ▪ Little tern.	▪ Loss of foraging and nesting habitat inside and outside the SPA for birds; ▪ Possible impact on migratory bird species using the site; ▪ Disturbance of birds within and outside the SPA; and ▪ Pollution from site run-off affecting habitat quality and foraging resources.	▪ Disturbance/ displacement of birds arising from vehicles and workers accessing onshore structures for maintenance.	▪ Disturbance/ displacement of birds within and outside SPA; and ▪ Pollution from site run-off affecting habitat quality and foraging resources.
Gibraltar Point SPA	62.9	62.9~~62.0~~	4.15	70.6~~70.6~~	11.7~~11.6~~	19.3~~19.3~~	▪ Grey plover (Non-breeding); ▪ Sanderling (Non-breeding); ▪ Bar-tailed godwit (Non-breeding); and ▪ Little tern (Breeding).	▪ Loss of foraging, roosting and nesting habitat within the site and surrounding area; ▪ Disturbance of birds within and outside the SPA; and ▪ Pollution from site run-off affecting habitat quality.	▪ Disturbance/ displacement of birds arising from vehicles and workers accessing onshore structures for maintenance.	▪ Disturbance/ displacement of birds outside SPA; and ▪ Pollution from site run-off affecting habitat quality.
Gibraltar Point Ramsar site	62.9	62.9~~62.0~~	4.15	70.6~~5~~ ~~70.6~~	11.7~~11.6~~	19.3~~19.3~~	▪ Onshore Ramsar Features: ▪ Ramsar Criterion 1: Coastal habitats – estuarine mudflats, sandbanks, and saltmarsh;	▪ Loss of or damage to estuary habitats; ▪ Loss of foraging and roosting habitat for birds within the site and surrounding area;	▪ Damage to habitats and disturbance/ displacement of birds arising from vehicles and workers accessing onshore structures for maintenance.	▪ Loss of or damage to estuary habitats; ▪ Disturbance/ displacement of birds within and

	Distance to the Project (km)						Features screened in.	Potential for Likely Significant Effect Identified.		
							▪ Ramsar Criterion 2: Red Data book invertebrates – including: ▪ Athetis pallustris, (marsh moth, terrestrial) ▪ Dexiopsis lacustris, (a fly, terrestrial) ▪ Eupithecia extensaria (scarce pug moth, terrestrial) ▪ Gymnacyla canella (a moth, terrestrial) ▪ Haematapota bigoti (a horsefly, terrestrial) ▪ Haliplus mucronatus (a water beetle, aquatic) ▪ Phaonia fusca (a fly, terrestrial) ▪ Pherbellia dorsata (a snail killing fly, terrestrial) ▪ Rymosia connexa (a fly, terrestrial) ▪ Salticella fasciata (a snail killing fly, sand dunes) ▪ Spilogona biseriate (a fly, terrestrial) and ▪ Brachytron pratense (hairy dragonfly, aquatic) ▪ Notable plant species, including: ▪ Althaea officinalis (Marshmallow, emergent) ▪ Calystegia soldanella (Sea bindweed, sand dunes) ▪ Eryngium maritimus (Sea holly, sand dunes) ▪ Festuca arenaria (Rush-leaved fescue, sand dunes) ▪ Frankenia laevis (Sea heath, salt marsh) ▪ Parapholis incurve (Curved hard-grass, salt marsh, shingle)	▪ Disturbance of birds within and outside the site; ▪ Pollution from site run-off affecting habitat quality; and ▪ Loss of or decline in populations of scarce invertebrates and plants.		outside the site; and ▪ Pollution from site run-off affecting habitat quality.

	Distance to the Project (km)						Features screened in.	Potential for Likely Significant Effect Identified.		
							▪ Ranunculus baudotii (Brackish water crowfoot, ditches etc) ▪ Salicornia pusilla (Salicornia, saltmarsh) ▪ Sarcocornia perennis (Perennial glasswort, saltmarsh) ▪ Silene maritima (Sea campion, shingle) ▪ Suaeda vera (Shrubby sea-blite, shingle). ▪ Ramsar criterion 5: Waterfowl. ▪ Ramsar criterion 6: Grey plover, sanderling, bar-tailed godwit, dark-bellied brent goose.			
North Norfolk Coast SPA	56.4	56.4-	24	59.0	16.0	31.4	▪ Pink-footed goose	▪ Loss of foraging and roosting habitat for birds outside the SPA; and ▪ Disturbance of birds outside the site.	▪ Disturbance/ displacement of birds arising from vehicles and workers accessing onshore structures for maintenance	▪ Disturbance/ displacement of birds outside the SPA.
North Norfolk Coast Ramsar	56.4	56.4-	24	59.0	16.0	31.4	▪ Pink-footed goose	▪ Loss of foraging and roosting habitat for birds outside the Ramsar site; and ▪ Disturbance of birds outside the site.	▪ Disturbance/ displacement of birds arising from vehicles and workers accessing onshore structures for maintenance	▪ Disturbance/ displacement of birds outside the Ramsar.

7.2 Screening Undertaken for the Project In-Combination

~~77.~~85. The Habitats Regulations include a requirement for the Competent Authority to carry out an AA in respect of the likely significant effects of a plan or project alone and or in-combination with other plans or projects, where these are not directly connected with or necessary to the management of the site. Screening for the Project alone based on the broader cable corridor is summarised above in 7.1, with screening for the Project in-combination undertaken within the Screening Report (document reference 7.2) and the conclusions confirmed here.

~~78.~~86. The following list has been applied to the Project when identifying plans and projects for consideration in-combination (taking account of relevant advice such as ~~(~~the Planning Inspectorate, 2024b ~~, such as the Inspectorates Advice Note 10,~~ which addresses which plans and projects to include, with the addition of relevant projects in operation):

- Projects in operation (that do not form part of the baseline or have an ongoing impact);
- Projects that are under construction;
- Permitted application(s) not yet implemented;
- Submitted application(s) not yet determined;
- All refusals subject to appeal procedures not yet determined;
- Projects on the Planning Inspectorate's programme of projects; and
- Projects identified in the relevant development plan (and emerging development plans - with appropriate weight being given as they move closer to adoption) recognising that much information on any relevant proposals will be limited and the degree of uncertainty which may be present.

~~79.~~87. Carbon Capture, Usage and Storage (CCUS) licences were awarded in September 2023, with several within the vicinity of the Project. In addition to these licences, CCUS activities also require a storage agreement for lease granted by TCE, enabling applicants to proceed with a Permit application and a lease if successful. At the time of writing, none have been awarded for the areas licensed in September 2023, including those listed in Table 10.23 and Table 10.24. As such, no information is currently publicly available on the scope or timing of potential works associated with CCUS activities, and there is therefore insufficient data on which to undertake a quantitative or semi-quantitative assessment. As such, no assessment has been made of potential cumulative effects with carbon storage licences CS017, CS018, and CS028.'

~~80.~~88. A review of such plans and projects has been conducted for the Project, with each individual topic chapter for the ES having undertaken screening of the full list of projects, plans and activities, to identify those relevant to individual receptor groups for the corresponding cumulative effects assessment. The relevant cumulative plan/project screening tables to the receptor groups within the RIAA are presented within the ES chapters as follows:

- Table 9.19 from Part 6, Volume 1, Chapter 9: Benthic Subtidal and Intertidal Ecology (document reference 6.1.9);

- Table 10.17 from Part 6, Volume 1, Chapter 10: Fish and Shellfish Ecology (document reference 6.1.10);
- Table 11.35 from Part 6, Volume 1, Chapter 11: Marine mammals (document reference 6.1.11);
- Table 12.45 from Part 6, Volume 1, Chapter 12: Offshore and intertidal ornithology (document reference 6.1.12);
- Table 21.16 from Part 6, Volume 1, Chapter 21: Onshore Ecology (document reference 6.1.21); and
- Table 20.23 from Part 6, Volume 1, Chapter 22: Onshore Ornithology (document reference 6.1.22).

~~81.~~89. With respect to in-combination effects within the HRA process, the Screening Report (document reference 7.2) identified the broad categories of plans and projects to be considered within this RIAA. Further details are provided in Section 10, Assessment of Adverse Effects In-Combination. The specific plans and projects relevant to individual receptors draw on those identified within the individual ES chapters, as highlighted above, together with any additional plans or projects relevant to the designated site(s) under consideration. The intention of in-combination screening is to determine, for the plans and projects relevant to each receptor group, which designated sites may be affected by a spatial and/or temporal overlap of effect from a relevant plan or project.

~~82.~~90. The in-combination assessment not only applies to sites where a potential for LSE was identified for the project alone, but also to sites where no potential for LSE was identified (with connectivity to the Project). This is because there ~~is~~ may be a potential contribution to an in-combination effect from an aspect of the Project that is not significant when considered alone, but may become more relevant in-combination. Therefore, wherever a pathway for effect exists to a designated site, it is considered in-combination regardless of the LSE alone conclusions.

~~83.~~91. The determination of potential LSE in-combination takes into account the following:

- Level of detail available for project/plans;
- Potential for an effect-pathway-receptor link;
- Potential for a physical interaction; and
- Potential for temporal interaction.

~~84.~~92. The approach applied to screening in-combination is outlined below.

~~85.~~93. A tiered approach has been applied to the in-combination assessment to reflect the different levels of certainty associated with the Project design and timeframes for the plans and projects screened into assessment. The allocated 'Tiers' reflect the current stage of the relevant plans and projects within the planning and development process. This allows the in-combination impact assessment to consider several future development scenarios, each with a differing potential for being ultimately built out. Appropriate weight may therefore be given to each scenario (Tier) in the decision-making process when considering the potential in-combination impact associated with the Project.

~~86.~~94. The tiering structure applied is in common with that within relevant ES chapters, with the benthic ecology and migratory fish approach provided below in Table 7.2. For both offshore ornithology and marine mammals, a more detailed tiering structure has been applied to allow for the specific concerns for those receptors to be fully addressed and to ensure that there is a clear understanding of the level of confidence in the in-combination assessment within the RIAA. The tiering structure applied for marine mammals and offshore ornithology is defined in Table 7.3 and Table 7.4 respectively. In particular, it is noted that within Tier 1 there is significant variability in project certainty between a project in planning but not yet submitted to the Inspectorate, a project under construction and a project in operation, as regards the 'final' scheme design and construction programme (noting that the assessment made here draws on the 'consented' and not 'as built' Project Design Envelope). Experience from other offshore wind projects over many years indicates that the Project as assessed on application (in terms of maximum design scenario and the overall construction window) is almost always subject to change and is generally much greater in terms of impact/timeframe than the final project as defined at the point of construction - e.g. fewer turbines, more clearly defined (and often shorter) construction window, etc.

Table 7-2~~7.2~~7-~~27.2~~: Tiers applied for Benthic Subtidal and Intertidal Ecology, and migratory fish

Tier	Description
Tier 1	Projects operational or under construction; Consented projects (not yet under construction); and Projects with consent applications but not yet determined.
Tier 2	Projects on the Inspectorate's Programme of Projects where a Scoping Report has been submitted.
Tier 3	Projects on the Inspectorate's Programme of Projects where a Scoping Report has not been submitted; Projects identified in the relevant Development Plan; and Projects identified in other plans and programmes which set the framework for future development consents/approvals, where such development is reasonably likely to come forward.

Table 7-3~~7.3~~7-~~37.3~~: Description of tiers of other developments considered within the marine mammal cumulative effect assessment (Natural England, 2022).

Tier	Consenting or Construction Stage
1	Built and operational projects are included within the cumulative assessment where they have not been included within the environmental characterisation survey, i.e. they were not operational when baseline surveys were undertaken, and/or where any residual impact may not have yet fed through to and been captured in estimates of "baseline" conditions.
2	Tier 1 + projects under construction.
3	Tier 2 + projects that have been consented (but construction has not yet commenced).
4	Tier 3 + projects that have an application submitted to the appropriate regulatory body that have not yet been determined.

Tier	Consenting or Construction Stage
5	Tier 4 + projects that have produced a PEIR and have characterisation data within the public domain.
6	Tier 5 + projects that the regulatory body are expecting an application to be submitted for determination (e.g. projects listed under the Inspectorate programme of projects).
7	Tier 6 + projects that have been identified in relevant strategic plans or programmes.

Table 7-4~~7.4~~7.4~~7.4~~: Tiers applied for offshore and intertidal birds.

Tier	Sub-Tier	Description of stage of development of project
Tier 1	Tier 1a	Project under operation
	Tier 1b	Project under construction
	Tier 1c	Permitted applications, whether under the Planning Act 2008 or other regimes, but not yet implemented
	Tier 1d	Submitted applications, whether under the Planning Act 2008 or other regimes, but not yet determined
Tier 2	N/A	Project is on the Inspectorate's Programme of Projects where a Scoping Report has been submitted
Tier 3	Tier 3a	Projects on the Inspectorate's Programme of Projects where a Scoping Report has not been submitted
	Tier 3b	Identified in the relevant Development Plan (and emerging Development Plans with appropriate weight being given as they move closer to adoption) recognising that much information on any relevant proposals will be limited
	Tier 3c	Identified in other plans and programmes (as appropriate) which set the framework for future development consents/approvals, where such development is reasonably likely to come forward

7.2.1 Benthic Subtidal and Intertidal Ecology

~~87.~~95. The Screening Report (document reference 7.2) has identified the designated sites and relevant plans and projects to include for in-combination assessment. On a highly precautionary basis, the screening range used to identify projects was 20km from the designated sites identified to have a pathway for connectivity, based on the tidal ellipse identified at screening (which has now been evidenced to be larger than the sediment modelling ranges). For Benthic Subtidal and Intertidal Ecology, the plans and projects screened into the in-combination assessment are provided in Table 7.5.

Table 7-5~~7.5~~7.5~~7.5~~: Plans and projects identified for the Benthic Subtidal and Intertidal Ecology in-combination assessment

Development type	Project	Status	Tier
Offshore Windfarm	Sheringham Shoal Extension	Consented~~Under Examination~~	Tier 1
	Dudgeon Extension	Consented~~Under Examination~~	Tier 1

Development type	Project	Status	Tier
	Inner Dowsing	Active/In Operation	Tier 1[5]
	Lincs	Active/In Operation	Tier 1
	Triton Knoll	Active/In Operation	Tier 1
	Dudgeon	Active/In Operation	Tier 1
	Race Bank	Active/In Operation	Tier 1
	Lynn	Active/In Operation	Tier 1
Aggregate Production Area	Outer Dowsing Westminster Gravels Ltd (515/2)	Operation 01/01/2015 - 31/12/2029	Tier 1
	Outer Dowsing Westminster Gravels Ltd (515/1)	Operation 01/01/2015 - 31/12/2029	Tier 1
	Hanson Aggregates Marine Ltd (106/2)	Operation	Tier 1
	Hanson Aggregates Marine Ltd (106/3)	Operation	Tier 1
	Hanson Aggregates Marine Ltd (106/1)	Operation	Tier 1
	Hanson Aggregates Marine Ltd (400)	Operation	Tier 1
	Hanson Aggregates Marine Ltd (1805)	Exploration and Option Area	Tier 3~~1~~
	Tarmac Marine Ltd (197)	Operation	Tier 1
	Tarmac Marine Ltd (493)	Operation	Tier 1
	Tarmac Marine Ltd (481/1)	Operation	Tier 1
	Van Oord Ltd (481/2)	Operation	Tier 1
Sea Disposal Site	Race Bank Disposal Site	Disused[6] ~~ActiveActive~~	Tier 1
	Hornsea Disposal Area 1	Active	Tier 1
Subsea Cables and Pipelines ~~Subsea Cables and Pipelines~~	Eastern Green Link 3 (EGL3)	Proposed	Tier 2~~1~~
	Eastern Green Link 4 (EGL4)	Proposed	Tier 2~~1~~
	Gas Shearwater to Bacton Seal Line (Shell)	Active/In Operation	Tier 1

[5] Tier 1 criteria include development under construction; permitted or submitted applications, whether under the PA2008 or other regimes, but not yet implemented (the Inspectorate, 2019).
[6] Publicly available information states that this site is currently active, however, through consultation with the MMO, Cefas have confirmed that this site is now closed.

Development type	Project	Status	Tier
	Viking Link ~~CCS Pipeline~~HVDC Interconnector	Active~~Proposed~~	Tier 1
	Hornsea 1 OFTO	Active	Tier 1
	Hornsea 2 OFTO	Active	Tier 1
	Triton Knoll	Active	Tier 1
	Dudgeon OFTO	Active	Tier 1
	Race Bank OFTO	Active	Tier 1
	Lincs	Active	Tier 1
	Inner Dowsing	Active	Tier 1
	Lynn	Active	Tier 1
Oil and Gas Subsurface	Elgood to Blythe Gas Export Pipeline and Elgood to Blythe Umbilical Pipeline	Active	Tier 1
Carbon Capture and Storage (CCS)	SNS Area 1	~~In-planning~~Early Planning	Tier 3
	SNS Area 2	Early Planning	Tier 3
	SNS Area 3	Early Planning ~~In-planning~~	Tier 3
	SNS Area 4	~~In-planni~~ Early Planning ~~ng~~	Tier 3
	SNS Area 5	Early Planning ~~In-planning~~	Tier 3
	SNS Area 6	~~In-planning~~ Early Planning	Tier 3
	SNS Area 7	~~In-planni~~ Early Planning ~~ng~~	Tier 3
	SNS Area 8	Early Planning ~~In-planning~~	Tier 3
	NNS Area 1	~~In-planning~~ Early Planning	Tier 3
	NNS Area 2	~~-plannin~~ Early Planning ~~g~~	Tier 3
	EIA Area 1	In-planning Early Planning	Tier 3
	CNS Area 1	~~In-planni~~ Early Planning ~~ng~~	Tier 3
	CNS Area 2	Early Planning ~~In-planning~~	Tier 3

7.2.2 Marine mammals

~~88.~~96. The Screening Report (document reference 7.2) identified the designated sites and relevant plans and projects to include for in-combination assessment. On a highly precautionary basis, the screening range used to identify projects was based on the species specific MUs. For Marine Mammals, the plans and projects screened into the in-combination assessment are provided in Table 7.6.

Table 7-6~~7.67-67.6~~ Marine mammal in-combination short list. HP = harbour porpoise, HS = harbour seal and GS = grey seal, BND = bottlenose dolphin. 'Y' indicates that the Project is within the species-specific MU, 'N' indicates that the Project is not within the species-specific MU (and is thus screened out for that specific species)

Development Type	Project	Status	Tier	HP	BND	HS	GS
Offshore windfarm	The Project	-	-	y	y	y	y
	Arven	Pre-planning Application~~Concept/Early planning~~	6	y	y	n	n
	Aspen	Pre-planning Application	6	y	y	n	n
	Ayre	Concept/Early planning	6	y	y	n	n
	Beech	Concept/Early Planning~~Pre-planning Application~~	6	y	y	n	n
	Berwick Bank	In Planning~~Consent application under determination~~	4	y	y	n	n
	Blyth Demonstration Phases 2&3	Consented	3	y	y	n	n
	Borkum Riffgrund 3	Under Construction	2	y	y	n	n
	Borkum Riffgrund West 2	Under Construction	2	y	y	n	n
	Bowdun	Pre-planning Application~~Concept/Early Planning~~	6	y	y	n	n
	Broadshore	Pre-planning Application~~Concept/Early Planning~~	6	y	y	n	n
	Caledonia	In Planning~~Concept/Early Planning~~	4~~6~~	y	y	n	n
	CampionWind	Concept/Early Planning	6	y	y	n	n

Development Type	Project	Status	Tier	HP	BND	HS	GS
	Cedar	Concept/Early Planning	6	y	y	n	n
	Cenos	~~Concept/Early Planning~~ In Planning	4~~6~~	y	y	n	n
	Culzean	Consented~~cept/Early Planning~~	3~~6~~	y	y	n	n
	Dogger Bank A	Under Construction	2	y	y	y	y
	Dogger Bank B	Under Construction	2	y	y	y	y
	Dogger Bank C	Under Construction	2	y	y	y	y
	Dogger Bank South (East)	In Planning~~Pre-planning Application~~	4~~5~~	y	y	y	y
	Dogger Bank South (West)	In Planning~~Pre-planning Application~~	4~~5~~	y	y	y	y
	Dudgeon Extension	Consented~~Under Examination~~	3~~4~~	y	y	y	y
	Dunkerque	~~Application submitted~~~~Concept~~In Planning~~/Early Planning~~	4~~6~~	y	y	n	n
	East Anglia 1N	Consented	3	y	y	y	y
	East Anglia 2	Consented	3	y	y	y	y
	East Anglia 3	Consented	3	y	y	y	y
	EnBW He Dreiht	Under Construction~~Approved~~	2	y	y	n	n
	Endurance	Area for Lease	6	y	y	y	y
	Fecamp	Under Construction	2	y	y	n	n
	Five Estuaries	In Planning~~Pre-planning Application~~	4~~5~~	y	y	y	y
	Flora	Concept/Early Planning	6	y	y	y	y

Development Type	Project	Status	Tier	HP	BND	HS	GS
	Forthwind Ltd	Consented	3	y	y	n	n
	Gebied 1 Noord (1-n)	Option Area	7	y	y	n	n
	Gebied 1 Zuid (1-z)	Option Area ~~Concept/Early Planning~~	7	y	y	n	n
	Gebied 2 Noord (2-n)	Option Area	7	y	y	n	n
	Gebied 2 Zuid (2-z)	Option Area	7	y	y	n	n
	Gebied 5 Oost (5-o)	Option Area	7	y	y	n	n
	Gode Wind 3	Under Construction	2	y	y	n	n
	Green Volt	Consented~~Determination~~	3~~4~~	y	y	n	n
	Harbour Energy North	Concept/Early Planning	6	y	y	n	n
	HKN Kavel V	Under Construction~~Approved~~	2~~4~~	y	y	n	n
	HKW Noord – NKW N	Concept/Early Planning	6	y	y	n	n
	HKZ Kavel III	Under Construction	2	y	y	n	n
	HKZ Kavel IV	Under Construction	2	y	y	n	n
	Hollandse Kust Noord	Active~~Under Construction~~	1~~2~~	y	y	n	n
	Hollandse Kust (West)	~~Concept/Early Planning~~Consented	6	y	y	n	y
	Hollandse Kust (Zuid)	Active~~Under Construction~~	1~~2~~	y	y	n	n
	Hollandse Kust west zuidelijk deel	Concept/Early Planning	6	y	y	n	n
	Hollandse Kust Zuid Holland III	Under Construction	2	y	y	n	n
	Hornsea 3	Consented	3	y	y	y	y
	Hornsea 4	Consented	3	y	y	y	y
	IJmuiden Ver	Concept/Early Planning	6	y	y	n	n
	IJmuiden Ver Noord	Under Construction~~Concept/Early Planning~~	2~~6~~	y	y	n	n

Development Type	Project	Status	Tier	HP	BND	HS	GS
	Inch cape	Under Construction	2	y	y	n	n
	Jyske Banke	Concept/Early Planning	6	y	y	n	n
	MarramWind	Pre-planning application	6	y	y	n	n
	Moray west	Under Construction	2	y	y	n	n
	Morven BP E1	Pre-planning Application	6	y		n	n
	Muir Mhor	In Planning~~Pre-planning application~~	4~~6~~	y	y	n	n
	N-10.1	Development Zone	7	y	y	n	n
	N-10.2	Development Zone	7	y	y	n	n
	N-3.7	Development Zone	7	y	y	n	n
	Atlantis 1 (N-6.6)	Concept/Early Planning~~Development Zone~~	6~~7~~	y	y	n	n
	N-6.7	Development Zone	7	y	y	n	n
	Global Tech II (N-7.2)	Concept/Early Planning	6	y		n	n
	N-9.1	Development Zone	7	y	y	n	n
	N-9.2	Development Zone	7	y	y	n	n
	N-9.3	Development Zone	7	y	Y	n	n
	N-9.4	Development Zone	7	y	Y	n	n
	Neart Na Gaoithe	Under Construction	2	y	y	n	n
	Nordlicht I	Consented~~cept/Early Planning~~	3~~6~~	y	y	n	n
	Nordsee Cluster A (N-3.8)	Pre-Construction~~Concept/Early Planning~~	6	y	y	n	n

Development Type	Project	Status	Tier	HP	BND	HS	GS
	Nordsee Cluster B (N-3.5)	Pre-Construction~~Concept/Early Planning~~	6	y	y	n	n
	Nordsee Cluster B (N-3.6)	Pre-Construction~~Concept/Early Planning~~	6	y	y	n	n
	Nordsren I	Concept/Early Planning	6	y	y	n	n
	Nordsren II	Concept/Early Planning~~Pre-planning Application~~	6	y	y	n	n
	Nordsren II vest	Concept/Early Planning	6	y	y	n	n
	Nordsren III	Concept/Early Planning	6	y	y	n	n
	Nordsren III vest	Concept/Early Planning	6	y	y	n	n
	Norfolk Boreas	Consented	3	y	y	y	y
	Norfolk Vanguard East	Consented	3	y	y	y	y
	Norfolk Vanguard West	Consented	3	y	y	y	y
	North Falls	In Planning~~Pre-planning Application~~	4~~5~~	y	y	y	y
	Ossian	Consent ~~Application~~ Application under Determination	1	y	n	n	n
	Parc eolien pose au large de la Normadie (AO4)	Concept/Early Planning	6	y		n	n
	Pentland floating demonstrator	Consented	3	y	y	n	n
	Perpetuus Tidal Energy	Under Construction	2	y		n	n
	Rampion 2	In Planning~~Under Examination~~	4	y	n	y	y

Development Type	Project	Status	Tier	HP	BND	HS	GS
	Scaraben	~~Concept/Early Planning~~Pre Planning Application.	6	y	y	n	n
	Scroby Sands	Active	1	y	y	y	y
	SeaGreen Offshore Windfarm	Active	1	y	y	n	n
	Stoura~~ealtainn~~	Concept/Early Planning	6	y	y	n	n
	Seastar	Active	1	y	y	n	n
	Sheringham Shoal Extension	Consented~~Under Examination~~	3~~4~~	y	y	y	y
	Sinclair	~~Concept/Early Planning~~Pre ~~Planning~~Pre-Planning Application	6	y	y	n	n
	Sofia	Under Construction	2	y	y	y	y
	Stromar	Pre-planning application~~Concept/Early Planning~~	6	y	y	n	n
	Thor	Under Construction	2	y	y	n	n
	Triton Knoll	Active~~Under Construction~~	1~~2~~	y	y	n	n
	Vesterhav Nord	Active~~Under Construction~~	1~~2~~	y	y	n	n
	Vesterhav Syd	Active~~Under Construction~~	1~~2~~	y	y	n	n
	West of Orkney	~~Application submitted~~In Planning	4	y		n	n
CCS	SNS Area 1	~~Licensing Round~~Early Planning	7	y	y	y	y
	SNS Area 2	Early Planning~~Licensing Round~~	7	y	y	y	y
	SNS Area 3	Early Planning~~Licensing Round~~	7	y	y	n	n

Development Type	Project	Status	Tier	HP	BND	HS	GS
	SNS Area 4	Early Planning~~In-planning~~	7	y		Y	Y
	SNS Area 5	Early Planning~~Licensing Round~~	7	y	y	y	y
	SNS Area 6	Early Planning~~Licensing Round~~	7	y	y	y	y
	SNS Area 7	Early Planning~~Licensing Round~~	7	y	y	y	y
	SNS Area 8	Early Planning~~Licensing Round~~	7	y	y	y	y
	NNS Area 1	Early Planning~~Licencing Round~~	7	y	y	n	n
	NNS Area 2	Early Planning~~Licencing Round~~	7	y	y	n	n
	EIA Area 1	Early Planning~~In-planning~~	7	y		n	n
	CNS Area 1	Early Planning~~Licensing Round~~	7	y	y	n	n
	CNS Area 2	Early Planning~~Licensing Round~~	7	y	y	n	n
Cables and Pipelines	Gas Shearwater to Bacton Seal Line	~~Pre-planning Application~~Active/In operation	6	y	y	y	y
	Eastern Greenlink (EGL3) Peterhead to South Humber	Proposed	6	y	y	n	n
	Eastern Greenlink (EGL4) South East Scotland to South Humber	Proposed	6	y	y	n	n
	Viking Link Interconnector	Active	2	y	y	n	n
	Aminth Interconnector	Proposed	6	y	n	y	y
	Continental Link Interconnector	Proposed	6	y	n	y	y
	Seismic Survey 1	n/a	7	y	y	y	y

Development Type	Project	Status	Tier	HP	BND	HS	GS
Seismic Surveys	Seismic Survey 2	n/a	7	y	y	y	y
	Seismic Survey 3	n/a	7	y	y	n	n
	Seismic Survey 4	n/a	7	y	y	n	n

7.2.3 Offshore and Intertidal Ornithology

~~89.~~97. The Screening Report (document reference 7.2) identified the designated sites and relevant plans and projects to include for in-combination assessment.

~~90.~~98. In terms of plans and projects to be considered, the conclusions of the screening for other plans and projects considered relevant for offshore and intertidal ornithology are provided in Table 7.7.

Table 7-7~~7.77-77.7~~: Projects considered relevant to the in-combination assessment for offshore and intertidal ornithology.

Project	Status	Tier
Beatrice	Active	1a
Blyth Demonstration Site	Active	1a
Dudgeon	Active	1a
East Anglia One	Active	1a
EOWDC	Active	1a
Galloper	Active	1a
Greater Gabbard	Active	1a
Gunfleet Sands	Active	1a
Hornsea Project One	Active	1a
Hornsea Project Two	Active	1a
Humber Gateway	Active	1a
Hywind	Active	1a
Kentish Flats	Active	1a
Kentish Flats Extension	Active	1a
Kincardine	Active	1a
Lincs, Lynn & Inner Dowsing	Active	1a
London Array	Active	1a
Methil	Active	1a
Race Bank	Active	1a
Rampion	Active	1a
Scroby Sands	Active	1a
Sheringham Shoal	Active	1a
Teesside	Active	1a
Thanet	Active	1a
Westermost Rough	Active	1a
Triton Knoll	Active	1a
Moray East	Active	1b
Neart na Gaoithe	Under Construction	1b
Seagreen Alpha	Active	1b
Seagreen Bravo	Active	1b
Dogger Bank A	Under Construction	1b
Dogger Bank B	Under Construction	1b
Sofia	Under Construction	1b
Firth of Forth Alpha	Under Construction	1b

Project	Status	Tier
Firth of Forth Bravo	Consented	1c
East Anglia Three	Consented	1c
Dogger Bank C	Under Construction	1c
Hornsea Three	Consented	1c
Inch Cape	Under Construction	1c
Moray West	Under Construction	1c
Norfolk Boreas	Consented	1c
Norfolk Vanguard	Consented	1c
East Anglia ONE North	Consented	1c
East Anglia TWO	Consented	1c
Hornsea Four	Consented	1c
Green Volt	Consented~~Consent application under determination~~	1c~~d~~
Dudgeon Extension Project	~~Under Examination~~Consented	1d
Sheringham Shoal Extension Project	~~Under Examination~~Consented	1d
Rampion 2	Under Examination	1d
Berwick Bank	Consent application under determination	1d
West of Orkney	Consent application under determination	1d
Five Estuaries	~~Pre-~~In P~~p~~lanning ~~application~~	1d~~2~~
Dogger Bank South (East and West)	~~Pre-planning application~~In Planning	1d~~2~~
North Falls	Consent application under determination~~Pre-planning Application~~	1d~~2~~
Caledonia	Consent application under determination~~Pre-planning application~~	1d~~2~~
Cenos	Consent application under determination~~Pre-planning Application~~	1d~~2~~
Muir Mhor	Consent application under determination~~Pre-planning Application~~	1d~~2~~
Ossian	Consent application under determination~~Pre-planning Application~~	1d~~2~~
Salamander	Consent application under determination~~Pre-planning Application~~	1d~~3a~~
Dogger Bank D	Pre-planning Application	2
Buchan Offshore Wind	Pre-planning Application	2
MarramWind	Pre-planning Application	2
Morven	Pre-planning Application	2
Scaraben	Pre-planning Application	2
Sinclair	Pre-planning Application	2
Stromar	Pre-planning Application	2
Bowdun	Pre-planning Application	2
Cerulean	Pre-planning Application	3a
Ayre	Concept/Early planning	3a
Bellrock	Concept/Early planning	3a
~~Bowdun~~	~~Concept/Early planning~~	~~3a~~

Project	Status	Tier
CampionWind	Concept/Early planning	3a

7.2.4 Migratory fish

~~91.~~99. The Screening Report (document reference 7.2) identified the designated sites and relevant plans and projects to include for in-combination assessment (plans or projects which are located within 100km of the designated site). For migratory fish, the only site identified is the Humber Estuary SAC.

~~92.~~100. In terms of plans and projects to be considered, the conclusions of the screening for other plans and projects considered relevant for migratory fish are provided in Table 7.8.

Table 7-8~~7.8~~7-8~~7.8~~: Projects considered relevant to the in-combination assessment for migratory fish.

Development type	Project	Status	Tier
Offshore Windfarm	Scroby Sands	Active/In Operation	Tier 1
	Norfolk Boreas	Consented	Tier 1
	Sheringham Shoal Extension	Consented~~Under Examination~~	Tier 1
	Dudgeon Extension	Consented~~Under Examination~~	Tier 1
	Dudgeon	Active/In Operation	Tier 1
	Lincs	Active/In Operation	Tier 1
	Race Bank	Active/In Operation	Tier 1
	Inner Dowsing	Active/In Operation	Tier 1
	Triton Knoll	Active/In Operation	Tier 1
	Hornsea Project Three	Consented	Tier 1
	Hornsea Project Four	Consented	Tier 1
	Lynn	Active/In Operation	Tier 1
	Dogger Bank South (East)	In-planning	Tier 2
Aggregate Production Area	Westminster Gravels Ltd (515/2)	Operation	Tier 1
	Westminster Gravels Ltd (515/1)	Operation	Tier 1
	Hanson Aggregates Marine Ltd (106/2)	Operation	Tier 1
	Hanson Aggregates Marine Ltd (106/3)	Operation	Tier 1
	Hanson Aggregates Marine Ltd (106/1)	Operation	Tier 1
	Hanson Aggregates Marine Ltd (400)	Operation	Tier 1

Development type	Project	Status	Tier
	Hanson Aggregates Marine Ltd (1805)	Exploration and Option Area	Tier 1
	Tarmac Marine Ltd (197)	Operation	Tier 1
	Tarmac Marine Ltd (493)	Operation	Tier 1
	Tarmac Marine Ltd (481/1)	Operation	Tier 1
	Van Oord Ltd (481/2)	Operation	Tier 1
Cables and Pipelines	Eastern Green Link 3 (EGL3)~~Eastern Link Cable (National Grid).~~	Proposed	Tier 2
	Eastern Green Link 4 (EGL4)	Proposed	Tier 2
	Viking Link Interconnector	Active/In Operation	Tier 1
	Aminth Cables	Proposed	Tier 3
	Continental Link (MPI)	Proposed	Tier 3

7.2.5 Onshore Ecology and Ornithology

~~93.~~101. The Screening Report (document reference 7.2) identified the designated sites and relevant plans and projects to include for in-combination assessment. In terms of plans and projects to be considered, the conclusions of the screening for other plans and projects considered relevant for onshore ecology are provided in Table 7.9.

Table 7-9~~7.97-97.9~~: Projects identified at Screening to be considered within the onshore ecology and ornithology in-combination~~cumulative~~ impact assessment.

Development type	Project	Status and details	Tier
Energy	Boston Alternative Energy Facility (BAEF)	South of Boston, by The Haven. DCO granted on 6 July 2023.	1
Solar	Heckington Fen Solar Park	DCO application submitted in 2023. Located 17km NW of the Project, to the west of Boston.	1
Gas	Transition to Integrated Gas and Renewable Energy (TIGRE) Project 1	Located entirely offshore, more than 12 nm. Gas fired power station connecting in to offshore substation. Pre-application.	2

Development type	Project	Status and details	Tier
Onshore cable	Triton Knoll Electrical System	The works, which commenced in September 2018, involved laying 57km of 220kV underground cable from the project's landfall location near Anderby Creek to the newly constructed Triton Knoll Onshore Substation near Bicker Fen. Completed October 2021.	1
Offshore wind	Triton Knoll Offshore Windfarm (TKOWF)	Offshore construction commenced in January 2020, 20 miles off the coast of Lincolnshire. Turbine commissioning was successfully completed in January 2022	1
Offshore wind	Hornsea Project Four	Application granted in July 2023. Onshore cable route in East Yorks.	1
Offshore wind	Hornsea Project Three	Offshore windfarm. Has received DCO.	1
Offshore wind	Hornsea Project Two	Operational offshore windfarm.	1
Offshore wind	Hornsea Project One	Operational offshore windfarm.	1
Quays and industrial facility	Able Marine Energy Park	320 ha of developable land and 1300m of new deep water quays, specifically designed for the offshore wind sector. on the south bank of the Humber Estuary. DCO issued in 2013 and site operational.	1
Quays and industrial facility	Able Marine Energy Park – Material Change 1	To move an area (referred to as "Mitigation Area A" in the 2014 Order) proposed for ecological mitigation to a new site.	1

Development type	Project	Status and details	Tier
		Change granted.	
Quays and industrial facility	Able Marine Energy Park – Material Change 2	To alter the alignment of the quay, removing the specialist berth at the southern end of the quay and setting back the quay line at the northern end, creating a barge berth. The Application also seeks changes to the 2014 Order to allow amendments to dredging and sediment disposal patterns arising from the new quay alignment, and the option of a more efficient construction methodology, identified during the design process. I Proposed changes have been authorised.	1
Energy	South Humber Bank Energy Centre	The construction and operation of an energy from waste plant of up to 95 megawatts gross capacity. DCO granted in 2021. The project website advises that construction of SHBEC will commence as early as 2022. The construction phase is expected to last for approximately 36 months, with the EfW power station entering operation in 2025.	1
Highways	A160-A180 Port of Immingham Improvement	The project would widen the existing single carriageway section of the A160 to dual carriageway, Granted in February 2015. Given the time	Excluded.

Development type	Project	Status and details	Tier
		since approval, this project can be excluded from the assessment.	
Offshore wind	Dogger Bank South Offshore Windfarms (East and West)	Offshore of East Yorkshire. Onshore study area north of Hull. Plan to publish the PEIR April-June 2024.	
Pipeline	Humber Low Carbon Pipelines	New onshore pipeline infrastructure to transport the captured carbon emissions from the region's industrial emitters for safe storage in the North Sea, and enable industries to fuel-switch from fossil fuels to low-carbon hydrogen. PEIR submitted 2022. The application was withdrawn in January 2024.	1
Energy	North Killingholme Power Project	The proposal is for a new thermal generating station that will operate either as a Combined Cycle Gas Turbine (CCGT) plant or as an Integrated Gasification Combined Cycle (IGCC) plant, with a total electrical output of up to 470 Mwe. Granted in 2014.	1
Pipeline	River Humber Gas Pipeline Replacement Project	The replacement of a 42 natural gas transmission pipeline, housed within a tunnel beneath the Humber Estuary commencing approximately 2 miles north east of Goxhill, North Lincolnshire, terminating approximately 1 mile	1

Development type	Project	Status and details	Tier
		south east of Paull, East Riding of Yorkshire Decided 2016.	
Highways	A63 Castle Street Improvement Hull	The Scheme comprises improvements to approximately 1.5km of the A63 and connecting side roads in Hull between Ropery Street and the Market Place/Queen Street junction. Granted in 2020.	1
Energy	Medworth Energy from Waste Combined Heat and Power (CHP) Facility	An Energy from Waste combined heat and power facility with a maximum gross capacity of 58MW. Examination in 2024. Located ~24km from the Project and 16km from the Wash SPA and Ramsar.	1
Over Head Line	Eastern Green Link 3 (EGL3)	Proposed	2
Over Head Line	Eastern Green Link 4 (EGL4)	Proposed	2

8 Summary of Designated Sites

~~94.~~102. Summary information on each designated site screened in for potential LSE alone and/or in combination is provided in the Screening Report (document reference 7.2), including the designated feature(s), key literature sources describing the site and the features/effects screened for potential LSE. The conservation objectives for each site are also provided in addition to being presented at the beginning of each alone assessment.

9 Stage 2: Assessment of Adverse Effect Alone

~~95.~~103. Where potential for LSE on a designated site has been identified, there is a requirement to consider whether those effects will adversely affect the integrity of the site in view of its conservation objectives. The information is presented below according to the following receptor groupings:

- Benthic Subtidal and Intertidal Ecology;
- Marine Mammals;
- Offshore Ornithology;
- Migratory Fish; and
- Onshore Ecology and Ornithology.

~~96.~~104. The assessment approach applied here is to first summarise each designated site screened in for potential LSE in turn, highlighting the feature(s) screened in together with the site's conservation objectives and the effects identified as potentially resulting in LSE. To minimise the potential for repetition, the determination of AEoI that follows is made on a receptor-by-receptor basis, however the relevant sites (and their features) are identified for each receptor, together with the relevant effects.

~~97.~~105. The nature of each relevant effect is then described (e.g. in terms of scale, duration, frequency, etc), drawing on the relevant project literature, and summarising the relevant conclusion from the ES. A conclusion on AEoI is then drawn for each site feature screened in, with these conclusions summarised on a site-by-site basis in Table 12.1.

9.1 Benthic Subtidal and Intertidal Ecology

106. The Benthic Subtidal and Intertidal Ecology alone assessment has been updated February 2025 to consider:

- The introduction of an Offshore Restricted Build Area (ORBA) over the northern section of the Project array area;
- The removal of the northern section of the offshore Export Cable Corridor (ECC); and
- Minor errata including those previously identified by interested parties.

9.1.1 Assessment criteria

~~98.~~107. This RIAA has been prepared in accordance with Nationally Significant Infrastructure Projects: Advice on Habitat Regulations Assessments ~~Advice Note 10: Habitats Regulations Assessment Relevant to Nationally Significant Infrastructure Projects~~ (the Inspectorate, 2024~~17~~), with the method for determining potential impact with respect to Benthic Subtidal and Intertidal Ecology being compliant with the Chartered Institute of Ecology and Environmental Management (CIEEM) guidelines (CIEEM, 2016).

~~99.~~108. The assessment criteria and conclusions presented within Part 6, Volume 1, Chapter 9: Benthic Subtidal and Intertidal Ecology (document reference 6.1.9) have been drawn on to inform this report when considering the potential for adverse effects on site integrity with respect to intertidal and benthic ecology features, with the ES conclusions on significance being considered here specifically in the context of the conservation objectives of the designated sites being assessed. The final assessment for each effect is based upon expert judgement. Where possible, parameters are quantified and predicted changes presented.

~~100.~~109. Full details of the assessment criteria and assignment of significance applied within the ES are provided within Section 3.6 of Part 6, Volume 1, Chapter 9: Benthic Subtidal and Intertidal Ecology (document reference 6.1.9), and take account of the following:

- Sensitivity/importance of the environment (drawing on MarLIN and MarESA sensitivity categories);
- Magnitude of impact (the degree of change from baseline, in terms of spatial extent, duration, timing, seasonality and/or frequency); and
- Significance of potential effect in terms of large/moderate/slight and negative/beneficial (defined in a matrix combining sensitivity and magnitude).

9.1.2 Maximum Design Scenario

~~101.~~110. Table 9.1 below summarises the Maximum Design Scenario(s) considered for Benthic Subtidal and Intertidal Ecology as described in Table 9.10 within Part 6, Volume 1, Chapter 9: Benthic Subtidal and Intertidal Ecology (document reference 6.1.9). The full project description is provided in Part 6, Volume 1, Chapter 3: Project Description (document reference 6.1.3) for full reference.

Table 9-1~~9.19-19.1~~: Maximum Design Scenario for Benthic Subtidal and Intertidal Ecology from the Project Alone

Potential effect	Maximum design scenario assessed	Justification
Construction		
Temporary habitat disturbance	**Total subtidal temporary habitat disturbance = 24,959,021m²** ~~**Array Area**~~ **Foundation Seabed Preparation = 972,300 m²** ▪ 100 small WTGs (jacket foundations with suction buckets) = 820,000m² (8,200m² per foundation x 100) ▪ Four small Offshore Substation (OSS) (jacket foundations with suction buckets) = 78,400m² ▪ One accommodation platform (jacket foundations with suction buckets) = 19,600m² ▪ Two ORCPs (jacket foundations with suction buckets) = 39,200m² ▪ Two Artificial Nesting Structures (ANS) (Gravity Base Structure (GBS) foundations) = 15,100m² **Jack-up Vessels (JUV) and anchoring operations = 1,160,243m²** ▪ 388 anchoring operations during WTG installation, with a maximum disturbance of 800m² per operation = 310,400m² ▪ 16 anchoring operations a maximum disturbance of 800m² per operation for installation of four OSS, one accommodation platform and two ORCPs = 12,800m² ▪ 16 anchoring operations with a maximum disturbance of 800m² per operation for installation of two ANS = 12,800 m² ▪ JUV operations for installation of 100 small WTGs (1,613m² disturbance per operation) (511 operations) = 824,243m² **Cable seabed preparation = 22,826,478 m²**	The MDS for subtidal temporary disturbance relates to seabed preparation for foundations and cables, operations and anchoring operations, and cable installation. It should be noted that where boulder clearance overlaps with sandwave clearance, the boulder clearance footprint will be within the sandwave clearance footprint. The MDS for jacket foundations with suction buckets results in the largest total area of habitat disturbance out of all the available foundation scenarios. An MDS for intertidal temporary habitat disturbance is not included as the Horizontal Directional Drilling (HDD) exit pits will be

Potential effect	Maximum design scenario assessed	Justification
	▪ Total area of seabed disturbed by sandwave clearance for inter-array cables = 4,047,830m^2 ▪ Total area of seabed disturbed by boulder clearance for inter-array cables = 7,472,916m^2 ▪ Total area of seabed disturbed by sandwave clearance for interlink cables = 1,327,219m^2 ▪ Total area of seabed disturbed by boulder clearance for interlink cables =2,450,250 m^2 ▪ Total area of seabed disturbed by sandwave clearance in offshore ECC = 3,214,397m^2 Total area of seabed disturbed by boulder clearance in offshore ECC = 4,313,866m^2 **Cable burial** ▪ Impact will occur fully within combined footprint from sandwave and boulder clearance **<u>Biogenic reef creation</u>** ▪ Creation of a biogenic reef within the biogenic reef areas	designed to a target of 500m below MLWS and as such there will be no direct effects on the intertidal.
Temporary increase in suspended sediment and sediment deposition	**Total subtidal sediment volume = 34,643,122m^3** **Foundation seabed preparation = 2,432,100m^3** ▪ 100 small WTGs = 2,020,000 m^3; o 50% of which are GBS foundations = 36,300 m^3 per WTG o 50% of which are suction bucket jacket foundations = 4,100 m^3 per WTG ▪ Four small OSS (GBS foundations) = 194,000m^3 ▪ One Accommodation platform (GBS foundations) = 48,500m^3	The MDS for foundation installation results from the largest volume suspended from seabed preparation and presents the worst case for WTG installation. For cable installation, the MDS results from the greatest volume from sandwave clearance and installation. This also

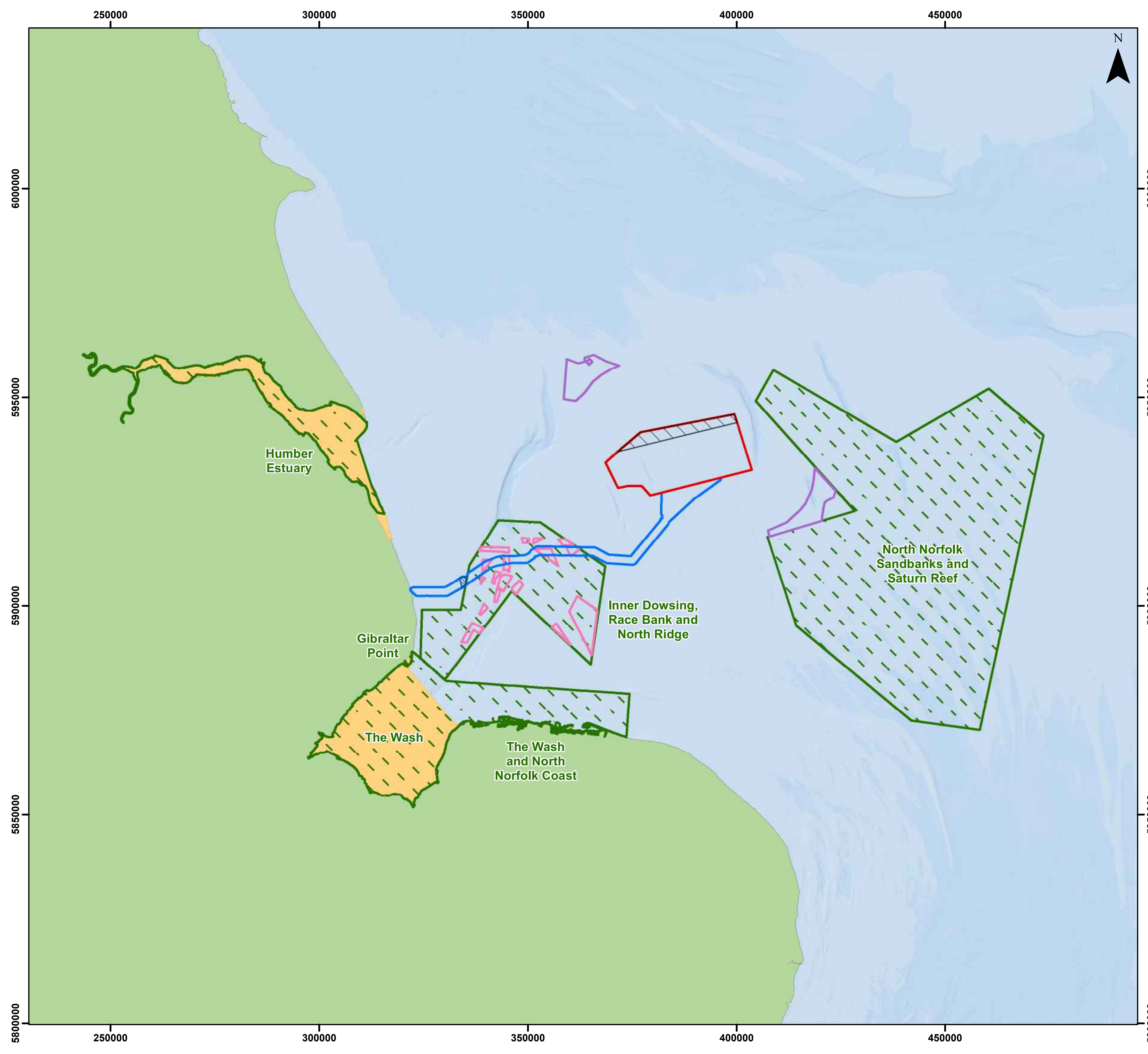
Potential effect	Maximum design scenario assessed	Justification
	▪ Two ORCPs = (GBS foundations) 97,000m^3 (48,500m^3 per offshore platform foundation) ▪ Two ANS = (GBS foundations) = 72,600 m^3 (36,300 m^3 per foundation). **Foundation installation (drill spoil volumes) = 987,400m^3** ▪ 100 WTG foundations (pin pile jacket foundations) = 780,000m^3 ▪ Four small OSS (pin pile jacket foundations) = 109,600m^3 ▪ One Accommodation platform (pin pile jacket foundations) = 27,400m^3 ▪ Two ORCPs (pin pile jacket foundations) = 54,800m^3 ▪ Two ANS (pin pile jacket foundations) = 15,600m^3 **Sandwave clearance for cable installation = 16,134,129m^3** ▪ Sandwave clearance for 377.4km of array cables resulting in the suspension of 7,819,671 m^3 of sediment ▪ Sandwave clearance for 123.75km of interlink cables resulting in the suspension of 2,563,945 m^3 of sediment ▪ Sandwave clearance for 440km of export cables resulting in the suspension of 5,750,513m^3 of sediment **Cable trenching = 15,058,720m^3** ▪ Installation of 377.4km of inter-array cables using mass flow excavation, resulting in the suspension of 6,038,720m^3 of sediment. ▪ Installation of 123.75km of interlink cables using mass flow excavation, resulting in the suspension of 1,980,000m^3 of sediment. ▪ Installation of 440km of export cables using mass flow excavation, resulting in the suspension of 7,040,000m^3 of sediment.	assumes the largest number of cables and the greatest burial depth. The HDD exit pits will be designed to a target of 500m below MLWS and as such there will be no additional effect from intertidal construction activities, however, the assessment considers the potential effects of suspended sediment and sediment deposition on the intertidal from offshore construction. The maximum volume of bentonite which could be released as part of the HDD activities is considered. For this assessment, it is considered that the bentonite would not be captured and is released into the marine environment.

Potential effect	Maximum design scenario assessed	Justification
	Total nearshore sediment volume = 30,000m^3 ▪ Six offshore trenchless technique exit pits require excavation of 30,000m^3 which will be side cast onto the adjacent seabed. Backfilling of exit pits will recover a similar amount from the surrounding seabed, as required. **HDD drilling fluid release** ▪ Maximum volume and mass of drilling fluid released per HDD conduit: 773m^3 fluid (138,000kg bentonite); and ▪ Period of release: 12 hours with estimated release rate of 3,195g/s. **Biogenic reef creation** Creation of a biogenic reef within the biogenic reef areas	
Accidental /Indirect Pollution	The MDS for indirect pollution is the same as for the suspended sediment potential effect above. The MDS for accidental pollution refers to: ▪ Max total construction vessels: 131 ▪ Max total round trips: 4,471 ▪ Indicative peak vessels on-site in a given 5km2 area simultaneously: 8 ▪ Offshore construction indicative dates: 2027-2029 ▪ Max round trips over 3 years: 13,413	This scenario represents the maximum total seabed disturbance and therefore the maximum amount of contaminated sediment that may be released into the water column during construction activities. The maximum numbers of vessels and associated vessel movements represents the maximum potential for accidental pollution
Operation and Maintenance		

Potential effect	Maximum design scenario assessed	Justification
Physical habitat loss/ Disturbance	**Total habitat loss = 4,594,670m²** ▪ Turbine total structure footprint including scour protection, based on 100 GBS (small WTG-type) foundations = 1,230,000m² ▪ Structure footprint of four small OSS (jacket foundations with suction buckets) = 78,400m² ▪ One Accommodation platform (jacket foundations with suction buckets) = 19,600m² ▪ Two ORCPs platform (jacket foundations with suction buckets) = 39,200m² ▪ Two ANS (GBS foundations) = 24,600m² ▪ Total area of seabed covered by cable protection required for inter-array cable crossings (rock berm) = 240,000m² (30 crossings) ▪ Total area of seabed covered by cable protection required for interlink cable crossings (rock berm) = 128,000m² (16 crossings) ▪ Total area of seabed covered by cable protection required for export cable crossings (rock berm) = 304,000m² (38 crossings) ▪ Total area of seabed covered by inter-array cable protection, assuming 23% of the cable requires protection = 1,031,000m² ▪ Total area of seabed covered by interlink cable protection, assuming 19% of the cable requires protection = 279,000m² ▪ Total area of seabed covered by export cable protection, assuming 21% of the cable requires protection = 1,220,870m² **IDRBNR SAC** ▪ Removable cable protection (mattresses/rock bags) on sandbank features within SAC = 5,760 m² ▪ Total cable protection outside sandbank features within the SAC = 227,558 m²	The MDS is defined by the maximum area of seabed lost as a result of the placement of structures, scour protection, cable protection and cable crossings. The MDS also considers that scour protection is required for all foundations. Habitat loss from drilling and drill arisings is of a smaller magnitude than presence of project infrastructure. Additional justification for the IDRBNR SAC mitigation is presented within Section 6 and detailed within the Sandbank Compensation Plan (document 7.6.1) and Biogenic Reef Compensation Plan (document 7.6.2).

Potential effect	Maximum design scenario assessed	Justification
	Biogenic reef creation ▪ Creation of a biogenic reef within the biogenic reef areas ▪ **Total direct disturbance to seabed from repair/replacement activities = 6,367,098m^2** ▪ Total seabed area disturbed by WTG maintenance activities (component replacements, anode/ladder replacements, J-tube repairs) = 3,582,000m^2 ▪ Total seabed area disturbed by ANS maintenance activities= 78,858m^2 ▪ Total seabed area disturbed by offshore platform maintenance activities (OSS, ORCP and accommodation platform) = 313,740m^2 ▪ Total seabed disturbance from array cable repairs or remedial burial = 945,000m^2 ▪ Total seabed disturbance from ECC repairs or remedial burial = 1,111,500m^2 ▪ Total seabed disturbance from interlink cable repairs or remedial burial = 336,000m^2	
Increased risk of introduction or spread of marine INNS	**Total surface area of introduced hard substrate in the water column = 46,221,434m^2** ▪ Total area of introduced hard substrate at seabed level = 4,594,670m^2 ▪ Total surface area of subsea portions of WTG foundations (GBS foundations) in contact with the water column = 40,728,200m^2 ▪ Total surface area of subsea portions of four small OSS (GBS foundations) in contact with the water column = 48,000m^2 ▪ Total surface area of subsea portions of one accommodation platform (GBS foundations) in contact with the water column = 12,000m^2 ▪ Total surface area of subsea portions of two ORCP (GBS foundations) in contact with the water column = 24,000m^2	Maximum scenario for introduced hard substrate is as for the maximum scenario for loss of habitat.

Potential effect	Maximum design scenario assessed	Justification
	▪ Total surface area of subsea portions of two ANS (GBS foundations) in contact with the water column = 814,564m^2 Total of 2,480 annual round trips for all O&M vessels	
Changes in physical processes	See MDS presented in Chapter 7: Marine Physical Processes (Document reference 6.1.7)	
EMF effects generated by inter-array and export cables	▪ Up to 377.42km of inter-array cables, operating up to 132kV ▪ Up to 123.75km of interlink cables, operating from 66kV – 275kV. ▪ Up to 440km of export cable, operating at up to 275kV ▪ Cable burial depth (Inter-array, interlink and export cable) = 0 – 3m	Maximum scenario for EMF is defined by the maximum length of cables installed.
Decommissioning		
Physical habitat loss /disturbance	MDS is identical (or less) to that of the construction phase. Temporary habitat disturbance = **24,959,021**m^2**.**	MDS is identical (or less) to that of the construction phase.
Temporary increase in suspended sediment and sediment deposition	MDS is identical (or less) to that of the construction phase. Total subtidal sediment volume = **34,643,122m^3**	MDS is identical (or less) to that of the construction phase.



Legend

- Array Area
- Offshore Restricted Build Area
- Offshore Export Cable Corridor
- ORCP Area
- Artificial Nesting Structure Area
- Biogenic Reef Restoration Area
- Ramsar Site
- Special Areas of Conservation

Coordinate System: WGS 1984 UTM Zone 31N

0 25 50 km

Scale: 1:850,000

A3 Page Size

RIAA

Designated Sites Considered for Benthic and Intertidal Ecology

Figure 9.1

OUTER DOWSING OFFSHORE WIND

Date: 15/01/2025
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Contains ESRI Basemapping; Esri, Garmin, GEBCO, NOAA NGDC, and other contributors

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9.1.3 Description of significance

~~102.~~111. A description of the significance of project level effects upon the receptors grouped under 'Benthic Subtidal and Intertidal Ecology', as relevant to the designated sites and associated features that were screened in for potential LSE, is provided below. Conclusions on AEoI are drawn from the description of significance as relevant to each site and effect.

~~103.~~112. As described in Table 7.1, there are six SACs which have the potential for LSE for Benthic Subtidal and Intertidal Ecology features (Table 7.1) and one Ramsar site, the Humber Estuary Ramsar, which has approximately the same area as the Humber Estuary SAC (Figure 9.1). The sites are discussed below in relation to the LSE identified.

9.1.4 Construction and decommissioning

9.1.4.1 Temporary increases in suspended sediment/deposition

~~104.~~113. This section addresses the potential for AEoI from effects associated with the dispersion of suspended sediments and any associated deposition and smothering, expected from foundation and cable installation works (including intertidal works) and seabed preparation works (including, for example, sandwave clearance). This assessment should be read in conjunction with Part 6, Volume 1, Chapter 9: Benthic Subtidal and Intertidal Ecology, and Part 6, Volume 1, Chapter 7: Marine Physical Processes which provides the detailed offshore physical environment assessment (including project specific modelling of sediment plumes). Table 5.12 within Part 6, Volume 1, Chapter 9: Benthic Subtidal and Intertidal Ecology presents the MDS associated with increases in SSC and deposition for Benthic Subtidal and Intertidal Ecology receptors.

~~105.~~114. The potential for an AEoI as a result of temporary increases in suspended sediment /deposition during construction and decommissioning relates to the following designated sites and relevant features (i.e. those features screened in for potential LSE):

- Inner Dowsing, Race Bank, and North Ridge SAC;
    - Reefs; and
    - Sandbanks which are slightly covered by sea water all of the time.
- North Norfolk Sandbanks and Saturn Reef SAC;
    - Reefs; and
    - Sandbanks which are slightly covered by sea water all of the time.
- ~~Inner Dowsing, Race Bank, and North Ridge SAC;~~
    - ~~Reefs; and~~
    - ~~Sandbanks which are slightly covered by sea water all of the time.~~
- The Wash and North Norfolk Coast SAC;
    - Sandbanks which are slightly covered by sea water all of the time;
    - Mudflats and sandflats not covered by seawater at low tide;

- Large shallow inlets and bays;
- Reefs;
- *Salicornia* and other annuals colonizing mud and sand; and
- Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)

- Humber Estuary Ramsar;
  - Dune systems with humid dune slacks,
  - Estuarine waters;
  - Intertidal mud and sand flats;
  - Saltmarshes; and
  - Coastal brackish/saline lagoons.
- Humber Estuary SAC;
  - Estuaries;
  - Mudflats and sandflats not covered by seawater at low tide;
  - Sandbanks which are slightly covered by sea water all the time;
  - *Salicornia* and other annuals colonizing mud and sand; and
  - Atlantic salt meadows.
- Gibraltar Point Ramsar; and
  - Estuarine mudflats;
  - Sandbanks;
  - Saltmarsh; and
  - Dunes.
- The Wash Ramsar.
  - Saltmarshes;
  - Estuaries;
  - Major intertidal banks of sand and mud;
  - Shallow water; and
  - Deep channels.

~~106.~~115. The conservation objectives for these sites are as follows:

- The objectives are to ensure that, subject to natural change, the integrity of the site is maintained or restored as appropriate, and that the site contributes to achieving the Favourable Conservation Status of its qualifying features, by maintaining or restoring:
  - the extent and distribution of qualifying natural habitats and habitats of the qualifying species;

- the structure and function (including typical species) of qualifying natural habitats;
- the structure and function of the habitats of the qualifying species;
- the supporting processes on which qualifying natural habitats and the habitats of qualifying species rely;
- the populations of each of the qualifying species; and
- the distribution of qualifying species within the site.

~~107.~~116. Sediment plumes caused by seabed preparation and construction activities are expected to be restricted to within a single tidal excursion from the point of release, which is captured by the benthic ecology study area and secondary zones of influence (ZoIs) (Part 6, Volume 1, Chapter 9: Benthic Subtidal and Intertidal Ecology). Sediment plumes are expected to quickly dissipate after cessation of the construction activities, due to settling and wider dispersion with the concentrations reducing quickly over time to background levels (i.e., within a couple of tidal cycles). Sediment deposition will consist primarily of coarser sediments deposited close to the source (a few hundred meters), with a small proportion of silt deposition (reducing exponentially from source).

~~108.~~117. Part 6, Volume 1, Chapter 9: Benthic Subtidal and Intertidal Ecology supports this and details that the results of the modelling can be summarised broadly in terms of three main zones of effect: 0-50 m, 50 to 500 m and 500 m to the tidal excursion buffer distance. As can be expected, the highest increase in SSC and greatest likely thickness of deposition will occur in the 0-50 m zone, where all gravel sized sediment and also a large proportion of sands that are not resuspended high into the water column will settle. As distance increases the thickness of deposition and levels of SSC is likely to decrease with mainly fines remaining in suspension.

~~109.~~118. There is the potential for an increase in SSCs and subsequent deposition to result from construction and decommissioning operations. The conservation objectives for the sites are identified above, with these taken into account when concluding the potential for effect.

~~110.~~119. Temporary, intermittent and localised increases in SSC could potentially affect the benthos e.g. through lower light levels, with deposition potentially leading to smothering. Temporary increases in SSC and associated sediment deposition are expected from activities including seabed preparation, sediment disposal and the cable installation works. Volume 2, Annex 7.1: Marine Physical Processes Technical Baseline provides a full description of the physical assessment, Part 6, Volume 1, Chapter 7: Marine Physical Processes assessed the increase in suspended sediments, with the subsequent effect on benthic habitats and species assessed in Part 6, Volume 1, Chapter 9: Benthic Subtidal and Intertidal Ecology. A summary of the existing baseline and the maximum design scenarios associated with the impact are summarised below in paragraphs 115~~112~~ *et seq*.

~~111.~~120. Background surface SSCs within the Project array area are known to vary seasonally, with higher concentrations occurring during spring tides and storm conditions, with the greatest concentrations encountered close to the bed. Within the array area, surface SSCs are generally low, with concentrations up to 5mg/l recorded between the period 1998 to 2015 (Cefas, 2016). Within the nearshore zone of the offshore ECC, SSCs are much higher, being directly under the influence of terrestrial sources from the Humber Estuary and Holderness Cliffs, such that concentrations reach around 60mg/l, between the period 1998 to 2015 (Cefas, 2016). These concentrations also coincide with the winter months when a greater frequency of storm events and fluvial inputs (including storm runoff) can be expected to occur. During the summer months, for example July, maximum values are of the order of 12mg/l (Cefas, 2016). Site specific turbidity data from a metocean buoy currently deployed in the array area show similar concentrations, with surface values of approximately 5mg/l, rising to up to 12mg/l in the mid-water, and up to 18mg/l lower in the water column during the summer months.

~~112.~~121. Part 6, Volume 1, Chapter 9: Benthic Subtidal and Intertidal Ecology states that the maximum distance and as such the overall spatial extent that any resultant plume might be reasonably experienced can be estimated as the spring tidal excursion distance. Specifically, MFE, seabed levelling and sandwave clearance activities may produce sediment plumes with SSC up to thousands of mg/l, however these concentrations will be spatially restricted and of short-lived. Elevated SSC may be advected by tidal currents up to 20km away, although these concentrations will be low. In the vast majority of cases, elevated SSC will be indistinguishable from background levels after 20 hours from the start of activities and can therefore be considered temporary and localised. Associated deposition from sediment plumes is generally in the order of tens to low hundreds of mm within several hundreds of metres from the point of disturbance. Sediment deposition following MFE activities of up to 50mm is expected in the immediate vicinity of the active disturbance. With thicknesses between 5 and 20mm deposited up to 600m away from the active disturbance area, reducing to low tens of mm downstream of the disturbance. Sediment deposition is generally not measurable beyond 3km to 5km away from the associated activities and is therefore generally small-scale and restricted to the near-field. This deposition is likely to become integrated into the local sediment transport regime and will be redistributed by tidal currents, with the sediment that settles onto the features originating from the same sandbank, therefore not altering the characteristics of the habitat on any significant biological or physical level.

~~113.~~122. Furthermore, the sandbanks in the SAC experience an influx of sediments from the north, and therefore the inhabiting fauna are likely to be relatively tolerant to habitat disturbances and the physical structure of the banks and associated benthic communities is likely to be renewed from any disturbance (JNCC and Natural England, 2010). The likely biotopes present within the Annex I habitat 'Sandbanks which are slightly covered by seawater all the time' are deemed to be of low vulnerability and medium to high recoverability to habitat disturbance. Therefore, it is considered that while there may be impacts within both the North Norfolk Sandbanks and Saturn Reef SAC (ANS construction only), and the Inner Dowsing, Race Bank and North Ridge SAC, the highly localised nature and limited temporal scale of the impact, the origins of the material being from the feature itself, the resilience, tolerance, low vulnerability and the high recoverability of the feature, it is considered that there is no adverse effect on sandbank features at any of the identified sites.

~~114.~~123. As described within Part 6, Volume 1, Chapter 9: Benthic Subtidal and Intertidal Ecology, due to the presence of the designated *Sabellaria spinulosa* reef feature, there may be impacts within both the North Norfolk Sandbanks and Saturn Reef SAC, and the Inner Dowsing, Race Bank and North Ridge SAC. The smothering and deposition impacts that are most likely to significantly disturb benthic communities are considered to be in the immediate vicinity of the works (0-50m). For the Inner Dowsing, Race Bank and North Ridge SAC, smothering and deposition impacts ~~this will~~ may occur where the offshore ECC and the SAC directly overlap~~s~~; in this case ~~, which results in a~~ there is a total overlap of 59.3km^2 (7.02% of the site). ~~, which is 8.37.0% of the site~~~~When considering the~~ When considering a 50m disturbance range, the total area of ~~this results in a total area of~~ overlap between the offshore ECC and the 50m disturbance range from the SAC is ~~of~~ 62.3km^2 (7.37% of the site), and therefore ~~the~~ impacts are likely to be highly localised ~~within this site, meaning the impacts are considered to be highly localised.~~. For the North Norfolk Sandbanks and Saturn Reef SAC, smothering and deposition impacts ~~this willmay~~ may occur where the ANS borders the SAC; there is ~~, which has~~ no direct overlap between the ANS and ~~with~~ the SAC. When considering the 50m disturbance range, ~~this results in a total~~ the total area of overlap between the ANS and the 50m disturbance range from the SAC is ~~of~~ 0.29km^2 (0.008% of the site), and therefore ~~the~~ impacts are also likely to be highly localised ~~within this site.~~. *S. Spinulosa* reef are considered to have some level of tolerance, resilience and recoverability to SSC effects. Therefore, it is considered that there is no adverse effect on the reef feature at these sites.

~~115.~~124. No impacts to the Wash and North Norfolk Coast SAC and Norfolk Sandbanks and Saturn Reef SAC are expected due to the distance from construction activities, where SSC are not expected to be present at concentrations sufficient to negatively impact benthic features and there will be no measurable thickness of deposition.

~~116.~~125. It is concluded that given the short-term and temporary nature of the construction and decommissioning works, the reversibility of effect, recoverability of receptors, localised nature of effects and distance between the high concentration areas and the designated sites, and implementation of relevant mitigation (Table 6.1); that the sites conservation objectives will be maintained in the long-term for the identified sites. There is, **therefore, no potential for AEoI, having regard to the conservation objectives of the Inner Dowsing, Race Bank and North Ridge SAC, North Norfolk Sandbanks and Saturn Reef SAC, The Wash and North Norfolk Coast SAC, Humber Estuary Ramsar, Humber Estuary SAC, Gibraltar Point Ramsar, and The Wash Ramsar, in relation to suspended sediment/deposition from the Project alone during construction and decommissioning and therefore, subject to natural change, the designated features will be maintained in the long-term.**

9.1.4.2 Physical habitat loss/disturbance

~~117.~~126. The potential for an AEoI as a result of physical habitat loss and disturbance on benthic subtidal and intertidal habitats during construction and decommissioning relates to the following designated site and the associated, relevant features:

- Inner Dowsing, Race Bank, and North Ridge SAC
    - Reefs; and
    - Sandbanks which are slightly covered by sea water all of the time.

~~118.~~127. This section addresses the potential for AEoI from effects associated with physical habitat loss/disturbance from construction and decommissioning activities from the Project. This assessment should be read in conjunction with Part 6, Volume 1, Chapter 9: Benthic Subtidal and Intertidal Ecology, and Part 6, Volume 1, Chapter 7: Marine Physical Processes which provides the detailed offshore physical environment assessment (including project specific modelling of sediment plumes). Table 5.12 within Part 6, Volume 1, Chapter 9: Benthic Subtidal and Intertidal Ecology also presents the MDS associated with habitat disturbance. The sites and features identified for this impact are identified within Table 7.1 and the conservation objectives are listed above (paragraph 110~~107~~).

~~119.~~128. The Offshore ECC passes directly through the Inner Dowsing, Race Bank and North Ridge SAC, crossing two of the designated sandbank features within the SAC, the North Ridge sandbank and the Inner Dowsing sandbank. The maximum total area within the SAC that is expected to be disturbed by sandwave clearance is approximately 4.63km^2 which equates to circa 0.55% of the total area of the SAC. The total area of the designated sandbank features intersected by the offshore ECC is approximately 19.2km^2, which equates to circa 5.3% of the designated sandbanks. However, the duration of the impact is limited to the duration of construction activities only, and therefore is considered to be short-term and intermittent. Furthermore, any material dredged from within the SAC will be deposited back within the SAC. Following re-settlement of the deposited sediments, they will be immediately available again for transport at the naturally occurring rate and direction, controlled entirely by natural processes. As such, the sediment will have immediately re-joined the natural sedimentary environment within the local area and so by definition is not 'lost from the system' due to the dredging/spoil disposal process. Due to the dynamic nature of the sandwaves, these morphological features are considered to have moderate levels of recoverability (Part 6, Volume 1, Chapter 7: Marine Physical Processes).

~~120.~~129. The patterns of processes governing the overall evolution of the systems (the flow regime, water depths and sediment availability) are at a much larger scale than, and so would not be affected by, the proposed local works. As a result, the proposed clearance is not likely to influence the overall form and function of the system and eventual recovery via natural processes is therefore expected. The rate of recovery would vary in relation to the rate of sediment transport processes, faster infill and recovery rates will be associated with higher local flow speeds and more frequent wave influence (Part 6, Volume 1, Chapter 7: Marine Physical Processes). Pre- and repeated post-construction monitoring of the Race Bank offshore cable route (DONG Energy, 2017) has demonstrated partial recovery of sandwave crest features, following sandwave clearance, within a four-month period for which data are presently available. The sediment type and distribution is anticipated to return to the pre-impacted state over time.

~~121.~~130. The benthic communities on sandbanks also have the potential to be impacted by the construction of the Project. However, post-construction monitoring from other offshore windfarm projects suggests that while they may be some minor changes in the community structure and abundance (e.g. a decrease in 'CR.HCR.XFa.FluCoAs.SmAs – *Flustra foliacea*, small solitary and colonial ascidians on tide-swept circalittoral bedrock or boulders' communities from Dudgeon Offshore Windfarm), there is no significant differences in benthic communities or sediment composition between pre and post construction (MMT,2019). Therefore, it is considered that will be no adverse effect on the conservation objectives for the sandbanks which are slightly covered by sea water all of the time feature of the Inner Dowsing, Race Bank and North Ridge SAC.

~~122.~~131. The SAC is also designated for *S. Spinulosa* reef, yet whilst this was not recorded during the ground-truth site-specific ground-truth investigations of the construction corridor or array area boundary according to the Gubbay et al. (2007) and Hendrick and Foster-Smith (2006) criteria, the geophysical data of the site did not allow any further delineation on the extent of potential *S. Spinulosa* features within the construction corridors (as detailed in paragraph 9.4.107 of Part 6, Volume 1, Chapter 9: Benthic Subtidal and Intertidal Ecology).

~~123.~~132. Whilst *S. Spinulosa* reef was not recorded during the site-specific ground-truth investigations and subsequent analysis undertaken by Envision (document reference 6.9.3.3), due to the ephemeral nature of features, a pre-construction monitoring survey will be undertaken (as detailed within the In Principle Monitoring Plan (document reference 8.03)) to determine whether any reef is present within the installation corridors at the post-consent phase. If at this stage reef is located within the Order Limits, a Biogenic Reef Mitigation Plan will be developed by the Project for approval by the MMO in consultation with Natural England to identify the most appropriate measures to minimise impacts to potential reef features. For this reason, the magnitude of the impact on potential *S. Spinulosa* reef as a designated feature of the IDRBNR SAC is regarded as Low.

~~124.~~133. The biotope '*S. Spinulosa* on stable circalittoral mixed sediment' (MC2211) is described as having a 'medium' MarESA sensitivity to a disturbance of this nature. Encrusting *S. Spinulosa* and patchy occurrences of potential *S. Spinulosa* reef were prevalent across the array and offshore ECC and are known to occur throughout the wider region in both reef and encrusting form. The species is fixed to the substratum, so substratum abrasion and disturbance is likely to lead to mortality. However, *S. Spinulosa* is most frequently found in disturbed sediment conditions and is a r-strategist (a life strategy which allows a species to deal with the vicissitudes of climate and food supply by responding to suitable conditions with a high rate of reproduction. R-strategists are continually colonizing habitats of a temporary nature). *S. Spinulosa* occurs in high densities on subtidal gravels that would be expected to be disturbed every year or perhaps once every few years due to storms. Areas where *S. Spinulosa* had been lost due to winter storms appeared to recolonize up to a maximum thickness of 2.4cm during the following summer (R. Holt, pers. Comm. In Jones et al., 2000). Recoverability is therefore expected to be high for the species.

~~125.~~134. Research from the marine aggregate industry revealed that the recovery time for *S. Spinulosa* community structure can range from two to seven years, depending on the intensity of dredging (Cooper et al., 2007). Samples revealed significant increase in abundance, species count, and total biomass less than a year after dredging operations had concluded (Cooper et al., 2007). Additionally, a year after the dredging, there was an abundance of juvenile *S. Spinulosa* which may have survived to form a reef, according to SSS data (Cooper et al., 2007). Additionally, in a study of the Wash, the more established *S. Spinulosa* reef were found in areas of the ground that had been clearly damaged by dredging action and it was hypothesised that the exposed sediments are more suitable for colonisation (Foster-Smith and White, 2001).

~~126.~~135. *S. Spinulosa* reefs are often only approximately 10cm thick, surface abrasion can, therefore, severely damage and/or remove a reef and whilst recoverability is expected to be high where this *S. Spinulosa* occurs in high densities, a precautionary sensitivity assessment of high has been attributed to *S. Spinulosa* reef.

~~127.~~136. To ensure impacts to this feature are avoided, a precautionary approach will be applied by undertaking pre-construction surveys for this feature (Table 6.1). If at this stage reef is located within the offshore ECC where it passes through the IDRBNR SAC, implementation of mitigation options will be agreed with Natural England to identify the most appropriate measures to minimise impacts to potential reef structures, including option such as micrositing of infrastructure. Therefore, due to the high recoverability of the species, negligible magnitude of the impact following the implementation of project specific mitigation, and short-term and intermittent nature of the effects associated with the construction and decommissioning works, it is considered that there is no adverse effect on the conservation objectives for the reef feature of the Inner Dowsing, Race Bank and North Ridge SAC.

~~128.~~137. It is concluded that given the short-term and temporary nature of the construction and decommissioning works, the reversibility of effect, recoverability of receptors, localised nature of effects, and implementation of relevant mitigation; that the sites conservation objectives will be maintained in the long-term. **There is, therefore, no potential for an AEoI, having regard to the conservation objectives of Inner Dowsing, Race Bank and North Ridge SAC, in relation to physical habitat loss/disturbance from the Project alone during construction and decommissioning and therefore, subject to natural change, the designated features will be maintained in the long-term.**

9.1.4.3 Accidental and Indirect Pollution

~~129.~~138. The potential for an AEoI as a result of accidental and indirect pollution on benthic and intertidal habitats during construction and decommissioning relates to the following designated sites and their relevant features:

- Inner Dowsing, Race Bank, and North Ridge SAC
  - Reefs; and
  - Sandbanks which are slightly covered by sea water all of the time.
- North Norfolk Sandbanks and Saturn Reef SAC
  - Reefs; and
  - Sandbanks which are slightly covered by sea water all of the time.
- ~~Inner Dowsing, Race Bank, and North Ridge SAC~~
  - ~~Reefs; and~~
  - ~~Sandbanks which are slightly covered by sea water all of the time.~~
- The Wash and North Norfolk Coast SAC
  - Sandbanks which are slightly covered by sea water all of the time;

- Mudflats and sandflats not covered by seawater at low tide;
  - Large shallow inlets and bays;
  - Reefs;
  - Saliconia and other annuals colonizing mud and sand; and
  - Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)
- Humber Estuary Ramsar
  - Dune systems with humid dune slacks,
  - Estuarine waters;
  - Intertidal mud and sand flats;
  - Saltmarshes; and
  - Coastal brackish/saline lagoons
- Humber Estuary SAC
  - Estuaries;
  - Mudflats and sandflats not covered by seawater at low tide;
  - Sandbanks which are slightly covered by sea water all the time;
  - *Salicornia* and other annuals colonizing mud and sand; and
  - Atlantic salt meadows.
- Gibraltar Point Ramsar
  - Estuarine mudflats;
  - Sandbanks;
  - Saltmarsh; and
  - Dunes
- The Wash Ramsar
  - Saltmarshes;
  - Estuaries;
  - Major intertidal banks of sand and mud;
  - Shallow water; and
  - Deep channels

~~130.~~139. The potential for an AEoI as a result of an increase in accidental and indirect pollution on benthic subtidal and intertidal habitats during construction and decommissioning relates to the sites identified as presented within Table 7.1, with the conservation objectives listed above (paragraph 110~~107~~). Due to the similar nature of accidental and indirect pollution, the two effects have been grouped together in this assessment for clarity and ease of understanding.

~~131.~~140. The potential for accidental pollution to affect benthic subtidal and intertidal habitats was not considered in the ES assessments (Part 6, Volume 1, Chapter 9: Benthic Subtidal and Intertidal Ecology), given there was no pathway for effect when factoring the Project specific mitigation (specifically the PEMP and supporting MPCP, as detailed within Table 6.1), beyond consideration of the potential for contaminants to be released from sediments disturbed during construction or decommissioning activities). It is noted that this mitigation will be secured in the DCO. For full details on the mitigation please see Table 6.1.

~~132.~~141. There is potential for sediment bound contaminants, such as metals, hydrocarbons and organic pollutants, to be released into the water column and lead to an effect on benthic ecology receptors, as a result of construction and decommissioning activities and associated sediment mobilisation. As detailed within Part 6, Volume 1, Chapter 9: Benthic Subtidal and Intertidal Ecology, the impact of direct and indirect seabed disturbances leading to the release of sediment contaminants is considered to be of negligible magnitude due to sediment contaminants being below both guideline and action levels, where relevant (i.e. levels are below those deemed to have the potential to result in deleterious effects on fauna).

~~133.~~142. The implementation of the PEMP, produced in consultation with relevant bodies, in addition to sediment bound contaminants across the site being below both guideline and action levels, enables the conclusion that there is, **therefore, no potential for an AEoI to the conservation objectives of the designated features at the North Norfolk Sandbanks and Saturn Reef SAC, Inner Dowsing, Race Bank and North Ridge SAC, The Wash and North Norfolk Coast SAC, Humber Estuary Ramsar, Humber Estuary SAC, Gibraltar Point Ramsar, and The Wash Ramsar sites in relation to accidental and indirect pollution from the Project alone during construction and decommissioning and therefore, subject to natural change, the designated features will be maintained in the long-term.**

9.1.4.4 INNS

~~134.~~143. The potential for an AEoI as a result of INNS on benthic subtidal and intertidal habitats during construction and decommissioning relates to the following designated sites and their relevant features:

- Inner Dowsing, Race Bank, and North Ridge SAC
  - Reefs; and
  - Sandbanks which are slightly covered by sea water all of the time.
- North Norfolk Sandbanks and Saturn Reef SAC
  - Reefs; and

    - Sandbanks which are slightly covered by sea water all of the time.
- ~~Inner Dowsing, Race Bank, and North Ridge SAC~~
    - ~~Reefs; and~~
    - ~~Sandbanks which are slightly covered by sea water all of the time.~~
- The Wash and North Norfolk Coast SAC
    - Sandbanks which are slightly covered by sea water all of the time;
    - Mudflats and sandflats not covered by seawater at low tide;
    - Large shallow inlets and bays;
    - Reefs;
    - Saliconia and other annuals colonizing mud and sand; and
    - Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)
- Humber Estuary Ramsar
    - Dune systems with humid dune slacks,
    - Estuarine waters;
    - Intertidal mud and sand flats;
    - Saltmarshes; and
    - Coastal brackish/saline lagoons
- Humber Estuary SAC
    - Estuaries;
    - Mudflats and sandflats not covered by seawater at low tide;
    - Sandbanks which are slightly covered by sea water all the time;
    - *Salicornia* and other annuals colonizing mud and sand; and
    - Atlantic salt meadows.
- Gibraltar Point Ramsar
    - Estuarine mudflats;
    - Sandbanks;
    - Saltmarsh; and
    - Dunes
- The Wash Ramsar
    - Saltmarshes;
    - Estuaries;

- Major intertidal banks of sand and mud;
- Shallow water; and
- Deep channels

~~135.~~144. There is a risk that the Project could increase the spread of INNS through the movement of vessels in and out of the benthic subtidal study area, particularly if work vessels arrive from outside the UK. This applies to the sites identified as presented within Table 7.1, with the conservation objectives listed above (paragraph 110~~107~~).

~~136.~~145. There will be up to 5,128 round trips to and from port during the construction phase (a combination of all maximum construction vessel return trips), which will contribute to the risk of introduction or spread of INNS in ballast water should any of these contain ballast water and arrive from a non UK port). It should be noted that it is by no means certain that any vessel will arrive from a non-UK port and/or contain ballast water, especially given the type of vessels involved and the proximity of the Project to UK ports. A series of mitigation measures are, nonetheless, proposed including a PEMP (incorporating a marine biosecurity plan should GBS foundations be utilised) (see Table 6.1) which will ensure that the risk of potential introduction and spread of INNS is appropriately managed.

146. There is a lack of evidence to date from other offshore windfarm developments within the North Sea having had any adverse effects on key species and habitats through increasing the spread of INNS. The distance to the site is also a variable when considering potential effects. For all the identified sites apart from the North Norfolk Sandbanks and Saturn Reef SAC and Inner Dowsing, Race Bank and North Ridge SAC, the majority of the vessel movements associated with the array area will be greater than 45km away, therefore allowing for very limited potential for linkage between any INNS and the sites. For the North Norfolk Sandbanks and Saturn Reef SAC and Inner Dowsing, Race Bank and North ridge SAC, the majority of vessel movements would be approximately 6km and 17km away respectively. However, the conclusions of the ES for all of the sites considered above is that the magnitude would be negligible and that regardless of sensitivity of a feature the overall significance is negligible, therefore having no significance of effect.

~~137.~~

147. It is concluded that due to the lack of evidence of any adverse effect from INNS and offshore windfarms, the proposed mitigation, and the ES conclusion of negligible significance, there is a low risk of promoting the spread of INNS. The conclusion is supported by the lack of any overlap between the array area and any SACs, where the majority of vessel movements will occur (within the array area boundary and therefore offering further limited potential for a linkage between any INNS and the SACs).

~~138.~~148. This all supports the conclusion that the conservation objectives for the designated sites will be maintained in the long-term. **There is, therefore, no potential for an AEoI to the conservation objectives of the designated features at the North Norfolk Sandbanks and Saturn Reef SAC, Inner Dowsing, Race Bank and North Ridge SAC, The Wash and North Norfolk Coast SAC, Humber Estuary Ramsar, Humber Estuary SAC, Gibraltar Point Ramsar, and The Wash Ramsar sites in relation to spread of INNS from the Project alone during construction and decommissioning and therefore, subject to natural change, the designated features will be maintained in the long-term**.

9.1.4.5 Changes to physical processes

~~139.~~149. The potential for an AEoI as a result of changes to physical processes on benthic subtidal and intertidal habitats during construction and decommissioning relates to the following designated sites and their relevant features:

- Inner Dowsing, Race Bank, and North Ridge SAC
  - Reefs; and
  - Sandbanks which are slightly covered by sea water all of the time.
- North Norfolk Sandbanks and Saturn Reef SAC
  - Reefs; and
  - Sandbanks which are slightly covered by sea water all of the time.
- ~~Inner Dowsing, Race Bank, and North Ridge SAC~~
  - ~~Reefs; and~~
  - ~~Sandbanks which are slightly covered by sea water all of the time.~~
- The Wash and North Norfolk Coast SAC
  - Sandbanks which are slightly covered by sea water all of the time;
  - Mudflats and sandflats not covered by seawater at low tide;
  - Large shallow inlets and bays;
  - Reefs;
  - Saliconia and other annuals colonizing mud and sand; and
  - Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)
- Humber Estuary Ramsar
  - Dune systems with humid dune slacks,
  - Estuarine waters;
  - Intertidal mud and sand flats;
  - Saltmarshes; and
  - Coastal brackish/saline lagoons

- Humber Estuary SAC
  - Estuaries;
  - Mudflats and sandflats not covered by seawater at low tide;
  - Sandbanks which are slightly covered by sea water all the time;
  - *Salicornia* and other annuals colonizing mud and sand; and
  - Atlantic salt meadows.
- Gibraltar Point Ramsar
  - Estuarine mudflats;
  - Sandbanks;
  - Saltmarsh; and
  - Dunes
- The Wash Ramsar
  - Saltmarshes;
  - Estuaries;
  - Major intertidal banks of sand and mud;
  - Shallow water; and
  - Deep channels

~~140.~~150. The potential for an AEoI as a result of changes to physical processes during construction and decommissioning relates to the sites identified as presented within Table 7.1, with the conservation objectives listed above (paragraph 110~~107~~). The process of sediment removal activities, including dredging and disposal, may introduce changes to the local hydrodynamics and wave regime, resulting in changes to the sediment transport pathways and associated effects on benthic ecology. Scour and increases in flow rates can change the characteristics of the sediment potentially making the habitat less suitable for some species.

~~141.~~151. Part 6, Volume 1, Chapter 7: Marine Physical Processes and Environmental Report for the ORBA (PD1-081) considers the potential for changes to processes (including the result to designated sites during the construction and decommissioning stage of the Project). No direct or indirect interaction with physical processes at any SACs are noted, with the marine processes chapter of the ES stating ‘the tidal current regime will not be measurably impacted as a result of the localised levelling and although the volume of sediment available in each local system will be locally redistributed by the levelling, it will not change in an overall net sense. As the controlling factors will also not change’.

~~142.~~152. Additionally, it is considered within Part 6, Volume 1, Chapter 7: Marine Physical Processes that any levelled areas are not considered likely to create a barrier to sediment movement and displaced material will not be removed from the sedimentary system. Evidence drawn from aggregate dredging activities indicates that if any changes occur to the flow conditions or wave regime, these are localised in close proximity to the dredge pocket (with widths and lengths of several kilometres). The proposed works will be at a much smaller scale and footprint, with trench widths expected to be in the order of 30m. This means there is likely to be little to no influence on the flow or wave regime, which in turn means no change to the regional scale sediment transport processes across the array area and offshore ECC (including within the designated sites).

~~143.~~153. Furthermore, The Race Bank monitoring data (DONG Energy, 2017) indicates that locally levelled sandwaves continue to evolve in a manner that is consistent with recovery towards a new natural equilibrium state in the months to years post-levelling. There was evidence of partial to complete sandwave recovery at ten of the twelve monitoring sites within five months of levelling, consistent with the site being an active and dynamic sedimentary environment that is conducive to the development, maintenance and migration of sandwave bedforms (RPS, 2018). Local perturbations to existing sandwaves that do not change the fundamental conditions of the setting (i.e. the tidal and wave regime and the volume of mobile sediment present) will not prevent continued evolution of the features through the same naturally occurring processes and the features will therefore recover towards a new equilibrium state over time. This is corroborated by evidence of sandwave regeneration after dredging by Larsen et al. (2019), with sandwave height at Race Bank OWF observed to have regenerated to approximately 65% after 300 days and a prediction of full recovery (98%) after three years. Based on these sources, natural sedimentary processes are expected to continue after operations have taken place, leading to continued development of sandwave features and the recovery towards a new equilibrium state. Therefore, with respect to cable protection measures (of particular relevance to the Inner Dowsing, Race Bank, and North Ridge SAC as the ECC passes through the site), it is considered that there will be no effect on existing transport processes, with some minor changes to sediment substrate.

~~144.~~154. With respect to the conservation advice provided by Natural England on the Inner Dowsing, Race Bank and North Ridge SAC (Natural England, 2024~~3~~), impacts from Race Bank OWF infrastructure have been identified as likely to result in lasting change and/or loss of the Annex I sandbank feature, based primarily on the placement of cable protection with no guarantee that the protection will be removed. In light of this advice, the Applicant has committed to only removable cable protection being used where required over the sandbanks within the SAC, such as rock bags and concrete mattresses. These are able to be removed with only short-term disturbance to the seabed as outlined in Peritus International Ltd. (2022). Although present for the operational period of the Project, the use of less intrusive methods of cable protection are considered to result in barely discernible change to the form of the sandbanks, with effects restricted to the near-field and immediately adjacent far-field areas. Therefore the Marine Physical Processes chapter within the ES (Document 6.1) concludes that the magnitude of impact is low with respect to cable protection.

~~145.~~155. It is generally considered that the patterns of processes governing the overall evolution of the systems are at a much larger scale than the proposed works, and any changes to seabed morphology are not considered likely to influence the overall form and function of the system. Additionally, the range of effects are considered to be limited and therefore, there is, no potential for an AEoI to the conservation objectives of the designated features at the North Norfolk Sandbanks and Saturn Reef SAC, The Wash and North Norfolk Coast SAC, Humber Estuary Ramsar, Humber Estuary SAC, Gibraltar Point Ramsar, and The Wash Ramsar sites in relation to changes to physical processes from the Project alone during construction and decommissioning and therefore, subject to natural change, the designated features will be maintained in the long-term.

~~146.~~156. Additional consideration is given to Inner Dowsing, Race Bank and North Ridge SAC as the ECC passes directly through the site. However, it is considered that the designated features have a moderate capacity to accommodate the proposed form of change. **Therefore, combined with the limited potential for impacts associated with changes in physical processes, there is no potential for an AEoI to the conservation objectives of the designated features at the Inner Dowsing, Race Bank and North Ridge SAC in relation to changes to physical processes from the Project alone during construction and decommissioning and therefore, subject to natural change, the designated features will be maintained in the long-term.**

9.1.5 O&M

9.1.5.1 Physical habitat loss /disturbance

~~147.~~157. The potential for an AEoI as a result of an increase in physical habitat loss/disturbance on benthic subtidal and intertidal habitats during O&M relates to the following designated sites and their relevant features:

- Inner Dowsing, Race Bank, and North Ridge SAC
  - Reefs; and
  - Sandbanks which are slightly covered by sea water all of the time.

- North Norfolk Sandbanks and Saturn Reef SAC
  - Reefs; and
  - Sandbanks which are slightly covered by sea water all of the time.
- ~~Inner Dowsing, Race Bank, and North Ridge SAC~~
  - ~~Reefs; and~~
  - ~~Sandbanks which are slightly covered by sea water all of the time.~~
- The Wash and North Norfolk Coast SAC
  - Sandbanks which are slightly covered by sea water all of the time;
  - Mudflats and sandflats not covered by seawater at low tide;
  - Large shallow inlets and bays;
  - Reefs;
  - Saliconia and other annuals colonizing mud and sand; and
  - Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)
- Humber Estuary Ramsar
  - Dune systems with humid dune slacks,
  - Estuarine waters;
  - Intertidal mud and sand flats;
  - Saltmarshes; and
  - Coastal brackish/saline lagoons
- Humber Estuary SAC
  - Estuaries;
  - Mudflats and sandflats not covered by seawater at low tide;
  - Sandbanks which are slightly covered by sea water all the time;
  - *Salicornia* and other annuals colonizing mud and sand; and
  - Atlantic salt meadows.
- Gibraltar Point Ramsar
  - Estuarine mudflats;
  - Sandbanks;
  - Saltmarsh; and
  - Dunes
- The Wash Ramsar

- Saltmarshes;
- Estuaries;
- Major intertidal banks of sand and mud;
- Shallow water; and
- Deep channels

~~148.~~158. The potential for an AEoI as a result of physical habitat loss/ disturbance during operation and maintenance relates to the sites identified as presented within Table 7.1, with the conservation objectives listed above (paragraph 110~~107~~). The presence of the WTG and OSS foundations and the associated scour protection, along with the cable protection measures used at cable crossings and areas where cable burial is not possible, will lead to a change from a sedimentary habitat to one characterised by hard substrate. This will be long-term habitat loss (for the 35-year design life duration of the Project) and is therefore considered an impact of the operational phase of the development. It is assessed here as habitat loss and a potential adverse effect (due to the potential shift in the baseline condition).

~~149.~~159. While the impact will be locally significant and comprise a long-term change (for the operational lifetime of the project) in seabed habitat within the footprint of the structures and scour and cable protection, the effect is limited to the direct footprint of the area affected and is therefore highly localised. A change of subtidal sediment biotopes to rock or artificial hard substratum would alter the character of the biotope leading to reclassification and the loss of the sedimentary community. However, anything outside of the direct footprint will not be affected. Therefore, it is considered that for all sites identified with the exception of Inner Dowsing, Race Bank and North Ridge SAC, as there is no physical overlap with any of the identified designated sites, there will be no material deposited and there will be no impact on any of the designated features. **Therefore there is no potential for AEoI in relation to changes to physical habitat loss/disturbance to the North Norfolk Sandbanks and Saturn Reef SAC, the Inner Dowsing Race Bank and North Ridge SAC, The Wash and North Norfolk Coast SAC, Humber Estuary Ramsar, Humber Estuary SAC, Gibraltar Point Ramsar, and The Wash Ramsar from the Project alone during O&M and therefore, subject to natural change, the designated features will be maintained in the long-term.**

~~150.~~160. For the Inner Dowsing, Race Bank and North Ridge SAC, the ECC passes directly through the site so there is potential for habitat loss from the presence of cable protection. However, the loss of habitat that might occur within the SAC has a discreet amount of overlap (59.3~~70.1~~km^2, which is 7.02~~8.3~~% of the offshore SAC). Given the current conservation status of *S. Spinulosa* reef features (unfavourable - Inadequate) and the lack of resistance to habitat loss of *S. Spinulosa* reef, it is considered that there could be a potential effect to this feature from cable protection.

~~151.~~161. The Project has developed an Outline Biogenic Reef Mitigation Plan (Document reference 8.22), which includes a commitment to micrositing around any areas of identified *S. Spinulosa* reef within the SAC (as also set out within the Outline Cable Specification and Installation Plan (document reference 8.5)). This will minimise the impact to any potential *S. Spinulosa* reef. Furthermore, geophysical data for the project confirms that there is no biogenic reef along the proposed route so there will be no direct overlap with any features of the designated site. This geophysical interpretation has been reinforced by secondary analysis (Envision, 2024) of the geophysical and benthic survey data which reconfirms that there was no evidence of biogenic reef within the export cable corridor. Were biogenic reef to form prior to construction, this is likely to only occur within a part of the export cable corridor, enabling micrositing to be undertaken to avoid any Annex 1 Biogenic Reef. It is therefore anticipated that all habitat loss to *S. Spinulosa* reef features within the SAC will be avoided, and therefore there will be no physical habitat loss/disturbance with the designated biogenic reef features. **Therefore, it is considered that there is no AEoI on the Inner Dowsing, Race Bank and North Ridge SAC from the Project alone during O&M with respect to the biogenic reef features and therefore, subject to natural change, the designated feature will be maintained in the long-term.**

~~152.~~162. With respect to the sandbank features of the Inner Dowsing, Race Bank and North Ridge SAC, the total area of the designated sandbank features that will be impacted by removable cable protection is 5,760m^2 (approximately 1.59% of the designated sandbanks features). As both the cable and cable protection from the SAC are removable at the end of the operational life of the project, it ensures that the physical presence of the structures and any associated habitat loss will be long-term and temporary, rather than permanent. Furthermore, while there is a possibility of remedial cable repairs and associated maintenance activity, any works would have a significantly smaller footprint than for the construction phase and be limited discrete events. Therefore, based on the low footprint of the cable protection on designated features, the removal of structures at the end of the lifetime of the project, and the lack of significant impacts from any cable maintenance activities, **there is no AEoI on the Inner Dowsing, Race Bank and North Ridge SAC from the Project alone during O&M with respect to the sandbank features and therefore, subject to natural change, the designated feature will be maintained in the long-term.**

9.1.5.2 Accidental and Indirect Pollution

~~153.~~163. The potential for an AEoI as a result of an increase in accidental and indirect pollution on benthic subtidal and intertidal habitats during O&M relates to the following designated sites and their relevant features:

- Inner Dowsing, Race Bank, and North Ridge SAC
  - Reefs; and
  - Sandbanks which are slightly covered by sea water all of the time.
- North Norfolk Sandbanks and Saturn Reef SAC
  - Reefs; and

- Sandbanks which are slightly covered by sea water all of the time.
- ~~Inner Dowsing, Race Bank, and North Ridge SAC~~
  - ~~Reefs; and~~
  - ~~Sandbanks which are slightly covered by sea water all of the time.~~
- The Wash and North Norfolk Coast SAC
  - Sandbanks which are slightly covered by sea water all of the time;
  - Mudflats and sandflats not covered by seawater at low tide;
  - Large shallow inlets and bays;
  - Reefs;
  - Saliconia and other annuals colonizing mud and sand; and
  - Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)
- Humber Estuary Ramsar
  - Dune systems with humid dune slacks,
  - Estuarine waters;
  - Intertidal mud and sand flats;
  - Saltmarshes; and
  - Coastal brackish/saline lagoons
- Humber Estuary SAC
  - Estuaries;
  - Mudflats and sandflats not covered by seawater at low tide;
  - Sandbanks which are slightly covered by sea water all the time;
  - *Salicornia* and other annuals colonizing mud and sand; and
  - Atlantic salt meadows.
- Gibraltar Point Ramsar
  - Estuarine mudflats;
  - Sandbanks;
  - Saltmarsh; and
  - Dunes
- The Wash Ramsar
  - Saltmarshes;
  - Estuaries;

- Major intertidal banks of sand and mud;
- Shallow water; and
- Deep channels

~~154.~~164. The potential for an AEoI as a result of accidental/indirect pollution during operation and maintenance relates to the sites identified as presented within Table 7.1, with the conservation objectives listed above (paragraph 110~~107~~).

~~155.~~165. The potential for accidental pollution to affect benthic subtidal and intertidal habitats was not considered in the ES assessments (Part 6, Volume 1, Chapter 9: Benthic Subtidal and Intertidal Ecology), given there was no pathway for effect when factoring the Project specific mitigation (specifically the PEMP and supporting MPCP, as detailed within Table 6.1). It is noted that this mitigation will be secured in the DCO. For full details on the mitigation please see Table 6.1.

~~156.~~166. The implementation of a PEMP (Table 6.1), produced for approval and in consultation with relevant bodies, and provided for in the DCO as above, enables the conclusion that **there is, therefore, no potential for an AEoI to the conservation objectives) of the designated features at the North Norfolk Sandbanks and Saturn Reef SAC, Inner Dowsing, Race Bank and North Ridge SAC, The Wash and North Norfolk Coast SAC, Humber Estuary Ramsar, Humber Estuary SAC, Gibraltar Point Ramsar, and The Wash Ramsar sites in relation to accidental and indirect pollution from the Project alone during O&M and therefore, subject to natural change, the designated features will be maintained in the long-term.**

9.1.5.3 INNS

~~157.~~167. The potential for an AEoI as a result of the spread of INNS during O&M relates to the following designated sites and the relevant features (i.e. those features screened in for potential LSE):

- Inner Dowsing, Race Bank, and North Ridge SAC
  - Reefs; and
  - Sandbanks which are slightly covered by sea water all of the time.
- North Norfolk Sandbanks and Saturn Reef SAC
  - Reefs; and
  - Sandbanks which are slightly covered by sea water all of the time.
- ~~Inner Dowsing, Race Bank, and North Ridge SAC~~
  - ~~Reefs; and~~
  - ~~Sandbanks which are slightly covered by sea water all of the time.~~
- The Wash and North Norfolk Coast SAC
  - Sandbanks which are slightly covered by sea water all of the time;
  - Mudflats and sandflats not covered by seawater at low tide;

- Large shallow inlets and bays;
- Reefs;
- *Salicornia* and other annuals colonizing mud and sand; and
- Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)

- Humber Estuary Ramsar
  - Dune systems with humid dune slacks,
  - Estuarine waters;
  - Intertidal mud and sand flats;
  - Saltmarshes; and
  - Coastal brackish/saline lagoons
- Humber Estuary SAC
  - Estuaries;
  - Mudflats and sandflats not covered by seawater at low tide;
  - Sandbanks which are slightly covered by sea water all the time;
  - *Salicornia* and other annuals colonizing mud and sand; and
  - Atlantic salt meadows.
- Gibraltar Point Ramsar
  - Estuarine mudflats;
  - Sandbanks;
  - Saltmarsh; and
  - Dunes
- The Wash Ramsar
  - Saltmarshes;
  - Estuaries;
  - Major intertidal banks of sand and mud;
  - Shallow water; and
  - Deep channels

~~158.~~168. There is a risk that the Project could increase the spread of INNS through the introduction of hard substrate into a sedimentary habitat and also the movement of vessels in and out of the benthic subtidal study area (should those vessels arrive from a non UK port). The potential for an AEoI as a result of INNS during operation and maintenance relates to the sites identified as presented within Table 7.1, with the conservation objectives listed above (paragraph 110~~107~~).

169. As for consideration of INNS ~~within the array area~~, as presented in Part 6, Volume 1, Chapter 9: Benthic Subtidal and Intertidal Ecology, a maximum habitat change of up to 2,404,184 m^2 will be introduced into the benthic subtidal ecology study area as a result of the presence of the windfarm structures, which will provide new habitat for potential colonisation by INNS. The majority of this will be within the Project ~~array~~ WTG area ~~-~~ and therefore at least 45km distant from all designated sites apart from the North Norfolk Sandbanks and Saturn Reef SAC and Inner Dowsing, Race Bank and North Ridge SAC (therefore providing limited potential for linkage to those SACs). For the North Norfolk Sandbanks and Saturn Reef SAC and Inner Dowsing, Race Bank and North Ridge SAC, the work within the array area will be approximately 6 and 17km away respectively, resulting in some potential for linkage from INNS. With respect to the section of the cable that overlaps with the Inner Dowsing, Race Bank and North Ridge SAC, the area of overlap is considered to be limited and therefore the amount of substrate introduced is also considered to be limited. There is a wide-spread presence of marine INNS across the southern North Sea, however there is a lack of evidence to date from other OWF developments within the North Sea having had any adverse effects on key species and habitats through increasing the spread of marine INNS.

~~159.~~

~~160.~~170. However, in relation to all sites, there will be up to 2,480 round trips to port by operational and maintenance vessels per year, which will contribute to the risk of introduction or spread of INNS (noting that these vessels will be stationed at a UK O&M base and therefore most would not be coming in from a non-UK port, limiting the potential to introduce INNS).

~~161.~~171. The ES concluded that the magnitude of the impact from the potential introduction of INNS for the O&M phase was considered to be negligible, whereas the sensitivity of the receptors within the benthic study area were deemed to be at a worst case "high", given the lack of evidence for a potential impact of this nature, reflecting that at worst-case benthic receptors have 'none' or 'low' resistance (tolerance) to an impact of this nature. Overall, the ES concluded that the significance of the residual effect is minor adverse.

172. It should be noted that the Project has embedded environmental measures which includes following best practice guidelines and standard operating practices (as managed through the PEMP and biosecurity plan as required), which will ensure that the risk of potential introduction and spread of marine INNS from the introduction of hard substrate and increased vessel activity is minimised.

~~162.~~

~~163.~~173. It is concluded that due to the lack of evidence of any adverse effect from INNS and offshore windfarms, the location of the Project relative to the designated sites (including the distance between ~~array area,~~ WTG area, where the majority of hard substrate will be introduced, and the features), the UK base for O&M vessels (limiting INNS opportunities) and the proposed mitigation, there is a low risk of the introduction of and or promotion of the spread of INNS. It is considered that the sites conservation objectives will be maintained in the long-term. **There is, therefore, no potential for an AEoI to the conservation objectives of the designated features of the identified sites in relation to spread of INNS from the Project alone during O&M and therefore, subject to natural change, the designated features will be maintained in the long term.**

9.1.5.4 Changes to physical processes

~~164.~~174. The potential for an AEoI as a result of an increased potential for changes to physical processes on benthic subtidal and intertidal habitats during O&M relates to the following designated sites and their relevant features:

- Inner Dowsing, Race Bank, and North Ridge SAC
  - Reefs; and
  - Sandbanks which are slightly covered by sea water all of the time.
- North Norfolk Sandbanks and Saturn Reef SAC
  - Reefs; and
  - Sandbanks which are slightly covered by sea water all of the time.
- ~~Inner Dowsing, Race Bank, and North Ridge SAC~~
  - ~~Reefs; and~~
  - ~~Sandbanks which are slightly covered by sea water all of the time.~~
- The Wash and North Norfolk Coast SAC
  - Sandbanks which are slightly covered by sea water all of the time;
  - Mudflats and sandflats not covered by seawater at low tide;
  - Large shallow inlets and bays;
  - Reefs;
  - Saliconia and other annuals colonizing mud and sand; and
  - Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)
- Humber Estuary Ramsar
  - Dune systems with humid dune slacks,
  - Estuarine waters;
  - Intertidal mud and sand flats;
  - Saltmarshes; and

- Coastal brackish/saline lagoons
- Humber Estuary SAC
  - Estuaries;
  - Mudflats and sandflats not covered by seawater at low tide;
  - Sandbanks which are slightly covered by sea water all the time;
  - *Salicornia* and other annuals colonizing mud and sand; and
  - Atlantic salt meadows.
- Gibraltar Point Ramsar
  - Estuarine mudflats;
  - Sandbanks;
  - Saltmarsh; and
  - Dunes
- The Wash Ramsar
  - Saltmarshes;
  - Estuaries;
  - Major intertidal banks of sand and mud;
  - Shallow water; and
  - Deep channels

~~165.~~175. The potential for an AEoI as a result of changes to physical processes during operation and maintenance relates to the sites identified as presented within Table 7.1, with the conservation objectives listed above (paragraph 110~~107~~).

~~166.~~176. The presence of foundations, scour protection and cable protection material may introduce changes to the local hydrodynamic and wave regime, resulting in changes to the sediment transport pathways and associated effects on benthic subtidal and intertidal ecology. Scour and increases in flow rates can change the characteristics of the sediment potentially making the habitat less suitable for some species.

~~167.~~177. Part 6, Volume 1, Chapter 7: Marine Physical Processes and Environmental Report for the ORBA (PD1-081) has determined that the impacts on hydrodynamic and wave regimes will be not significant to coastal and physical processes and will therefore not result in any significant changes to sediment transport. Therefore, it is considered that given the distance between the Project and all sites (with the exception of Inner Dowsing, Race Bank and North Ridge SAC) is enough that there will be no direct or indirect effects. For the Inner Dowsing, Race Bank and North Ridge SAC, the ECC passes directly through the site and therefore there may be changes to the local hydrodynamic regime due to the addition of cable protection. In areas of active sediment transport (indicated by the presence of mobile bedforms such as sandwaves and megaripples), following installation, and under favourable hydrodynamic conditions, an initial period of sediment accumulation would be expected to occur, creating a smooth slope against the cable protection. Once any void spaces have been infilled, saltation is expected to be largely unaffected by the presence of the cable protection such that existing transport process (including bedform migration) will remain unaffected (Part 6, Volume 1, Chapter 7: Marine Physical Processes).

~~168.~~178. Therefore, based on both the lack of significant changes to physical processes (as considered within Part 6, Volume 1, Chapter 7: Marine Physical Processes, and Part 6, Volume 1, Chapter 9: Benthic Subtidal and Intertidal Ecology) and the small proportion of the site impacted (circa ~~8.3~~7.0% of the SAC), **there is no potential for AEoI to the conservation objectives of the designated features of the identified sites in relation to changes to physical processes from the Project alone during O&M and, subject to natural change, the designated features will be maintained in the long-term.**

9.1.5.5 EMF

~~169.~~179. The potential for an AEoI as a result of EMF on benthic subtidal and intertidal habitats during O&M relates to the following designated sites and their relevant features:

- Inner Dowsing, Race Bank, and North Ridge SAC
  - Reefs; and
  - Sandbanks which are slightly covered by sea water all of the time.
- The Wash and North Norfolk Coast SAC
  - Sandbanks which are slightly covered by sea water all of the time;
  - Mudflats and sandflats not covered by seawater at low tide;
  - Large shallow inlets and bays;
  - Reefs;
  - Saliconia and other annuals colonizing mud and sand; and
  - Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)
- Humber Estuary Ramsar
  - Dune systems with humid dune slacks,

        - Estuarine waters;
        - Intertidal mud and sand flats;
        - Saltmarshes; and
        - Coastal brackish/saline lagoons
    - Humber Estuary SAC
        - Estuaries;
        - Mudflats and sandflats not covered by seawater at low tide;
        - Sandbanks which are slightly covered by sea water all the time;
        - *Salicornia* and other annuals colonizing mud and sand; and
        - Atlantic salt meadows.
    - Gibraltar Point Ramsar
        - Estuarine mudflats;
        - Sandbanks;
        - Saltmarsh; and
        - Dunes

~~170.~~180. The potential for an AEoI as a result of EMF during operation and maintenance relates to the sites identified as presented within Table 7.1, with the conservation objectives listed above (paragraph 110~~107~~).

~~171.~~181. EMF are generated by the current that passes through an electric cable. It is known that EMF can be detected by fish and elasmobranchs, and it is thought that many benthic invertebrates can also detect EMF. Three types of fields are generated by underwater electric cables: electric fields (E-fields), magnetic fields (B-fields) and induced electric fields (iE-fields). Standard industry practice is for the cables used to have sufficient shielding to contain the E-fields generated and the cable system descriptions for the inter-array and export cables have abided by this (Volume 1, Chapter 3). Shielding and/or burial does not reduce the B-fields and it is these fields that allow the formation of iE-fields. As such, further reference here to EMF is limited to B-fields and associated iE-fields.

~~172.~~182. EMFs will be generated by subsea cables and may be detectable above background levels in close proximity to the cables. Although burial does not mask EMFs it increases the distance between species that may be affected by EMFs and the source. As the cable will be buried or protected, any behavioural responses are likely to be mitigated to a negligible level, therefore resulting in no AEoI on any of the designated sites, including the Inner Dowsing, Race Bank and North Ridge SAC, as despite the overlap between the ECC and the site, the impacts are considered so highly localised that there will be no effect on the receptors or any benthic communities that may exist in and around the features. **Therefore, there is no potential for AEoI to the conservation objectives of the designated features of the identified sites in relation to changes to EMF from the Project alone during O&M and, subject to natural change, the designated features will be maintained in the long-term.**

9.2 Marine Mammals

183. The Marine Mammals alone assessment has been updated February 2025 to consider:

- The introduction of an Offshore Restricted Build Area (ORBA) over the northern section of the Project array area;
- The removal of the northern section of the offshore Export Cable Corridor (ECC); and
- Minor errata including those previously identified by interested parties.

9.2.1 Assessment criteria

~~173.~~184. The assessment of the risk of injury in marine mammals follows the draft 2010 advice issued by JNCC, the Countryside Council for Wales (CCW) and Natural England, titled 'The protection of marine European Protected Species from injury and disturbance'. In the UK, EPS include all species of cetacean, turtles and Atlantic sturgeon - and the same definition for injury is applied here for seals. The risk of injury is seen as deriving from physical (e.g. collision) and underwater noise (defined as the onset of a permanent threshold shift, or PTS (i.e. permanent reduction in hearing sensitivity)).

~~174.~~185. The assessment of disturbance for harbour porpoise draws on A~~S~~NCB guidance, issued as final in May 2020 (JNCC et al., 2020). As regards piling, JNCC et al., (2020) draw on a body of literature, namely Dahne et al., (2013) and Tougaard et al., (2014), the latter being a report produced by an expert group convened under the Habitats and Wild Birds Directives - Marine Evidence Group. The Tougaard et al., (2014) report drew on a number of empirical sources, including Dahne et al., (2013), but also Brandt et al., (2011) (contained within Popper & Hawkins, 2012)), Braasch et al., (2013) and Thompson et al., (2010). These studies reported direct observations during windfarm construction at projects across Europe, thus enabling an Effective Deterrent Radius (EDR) of 26km to be established for percussive piling (monopiles). The EDR is defined by Tougaard et al. as reflecting the overall loss of habitat that would occur if all animals vacated an area with a radius of the EDR around the pile driver, being equivalent to the mean loss of habitat per animal. More noise-tolerant animals will lose less than this mean area, while less noise-tolerant animals would lose more. It is acknowledged in the JNCC advice that there is, however, the potential for a reduced EDR should project specific details allow. For example, the final advice (JNCC et al., 2020) provided an EDR for pin-pile of 15km and an EDR for monopiles with noise abatement of 15km.

~~175.~~186. For seismic survey (air guns), the 2020 advice identified an EDR of 12km, reducing to 5km for high resolution geophysical survey. It is understood that should further evidence be provided, then the relevant EDR could be refined further, however at this time the RIAA has assumed an EDR of 5km applies.

~~176.~~187. The advice from JNCC et al (2020) also notes a precautionary 26km EDR for high order detonation of UXOs. For low order detonation there is no recommended EDR (JNCC, 2020), as such a 5km EDR has been assumed based on the suggestion proposed by Sofia Offshore Windfarm Marine Licence Application for UXO detonation (Marine Licence MLA/2020/00489). Low order detonation is the primary method of clearance for the Project, with high order clearance maintained as a contingency measure, this is in line with the A~~S~~NCB joint interim position statement[7] which recommends that low noise alternatives should be prioritised. Although there is no empirical evidence of harbour porpoise avoidance, UXOs are one of the loudest sources of underwater noise. JNC (2020) further notes that although a one-off explosion would probably be of a too short duration to cause widespread displacement, these detonations are usually part of campaigns with potentially several detonations in the same general area over several days.

~~177.~~188. In summary, the EDRs applied here are as follows:

- An EDR of 26km from the location of piling (monopiles);
- An EDR of 15km from the location of piling (pin-pile);

[7] Available at: https://www.gov.uk/government/publications/marine-environment-unexploded-ordnance-clearance-joint-interim-position-statement/marine-environment-unexploded-ordnance-clearance-joint-interim-position-statement Accessed on: 12.04.2023

- An EDR of 5km for geophysical survey (unless air guns are specifically mentioned in the survey methodology) from the location of activity;
- An EDR of 26km from high-order UXO clearance; and
- An EDR of 5km from low order UXO clearance.

~~178.~~189. The spatial aspect of disturbance in harbour porpoise within the Southern North Sea SAC, as defined through the relevant EDRs, has a defined limit above which disturbance would be considered significant. That limit (confirmed in JNCC et al., 2020) is 20% of the relevant SAC area (defined as that part of the SAC that was designated on the basis of higher persistent densities for that season (summer defined as April to September inclusive, winter as October to March inclusive)) on any given day (determined here as a calendar day).

~~179.~~190. That spatial aspect is accompanied by a temporal element, as defined through the use of the temporal threshold, effectively 10% of the relevant area when averaged across a season (defined as per the spatial threshold).

~~180.~~191. For seals, the approach to assessing disturbance follows that used within the ES (as defined in Section 1.6 of Part 6, Volume 1, Chapter 11: Marine Mammals), as considered in the context of potential for site connectivity and the conservation objectives of the relevant sites. That approach effectively requires a density value for each species together with noise modelling results and a dose response curve.

~~181.~~192. In terms of the number of grey seals that may be affected and how these animals may relate to individual designated sites, the assessment for grey seals draws on the following:

- Consideration of site connectivity - grey seal are wide ranging animals and are not necessarily defined as 'Humber grey seals' for example – utilising data on grey seal tagging at sea; and
- Consideration of the grey seal population- how it has increased since site designation and the contribution made by the proportion of seals at sea when haul out counts are made.

~~182.~~193. In terms of the number of harbour seals that may be affected and how these animals may relate to individual designated sites, the assessment for harbour seals draws on the following:

- Consideration of harbour seal population - how it has decreased in recent years, the 2019 count for the east coast of England was 25% lower than the mean of the previous 5 years and the 2020 and 2021 counts confirm continued decline (SCOS, 2022)

9.2.2 Maximum Design Scenario

~~183.~~194. Table 9.2 below summarises the Maximum Design Scenario(s) considered for marine mammals, as described in Table 11.7 within Part 6, Volume 1, Chapter 11: Marine Mammals. The full project description is provided in Part 6, Volume 1, Chapter 3: Project Description for full reference.

Table 9-2~~9.29-29.2~~: Maximum Design Scenario for Marine Mammals from the Project Alone

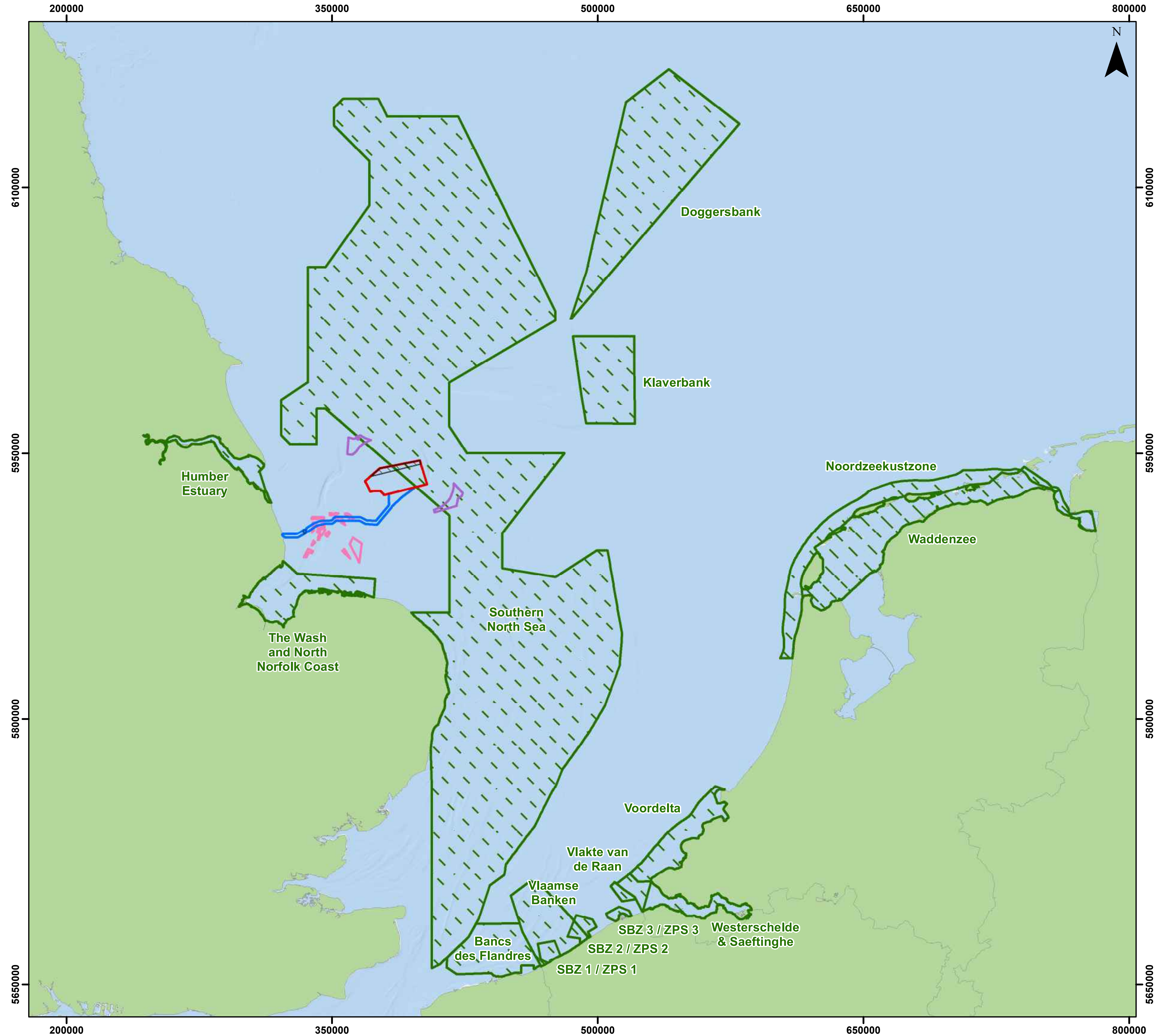
Potential effect	Maximum design scenario assessed	Justification
Construction		
Underwater noise from UXO clearance	▪ Max number of clearance events within 24 hours: 2 ▪ Indicative duration: 25 days ▪ MDS clearance method: high-order detonation ▪ Max charge size: 800kg + donor ▪ Low order (deflagration) charge: 0.5kg UXO clearance: late 2026 or early 2027	Estimated maximum design. A detailed UXO survey will be completed prior to construction. The type, size and number of possible detonations and duration of UXO clearance operations is not known at this stage. The Applicant is not seeking to license the disposal of UXO in this application, but it is included in the impact assessment.
Underwater noise from piling	Monopile WTG: ▪ 100 WTG foundations = 100 monopiles total ▪ Max 14m pile diameter ▪ Max hammer energy: 6,600kJ ▪ Max 6 hours per pile ▪ Max 12 hours piling per day ▪ Max 2 simultaneous piling events ▪ 2 monopiles/day = 50 piling days ▪ 1 monopile/day = 100 piling days Monopile Offshore Platforms (OPs): ▪ Max 2 ORCPs, 4 OSS & 1 AC = 7 monopiles total ▪ Max pile diameter 14m ▪ Max hammer energy 6,600kJ ▪ Max 6 hours piling per monopile ▪ 1 monopile/day = 7 piling days Monopile ANS:	The maximum number of piled foundations, and the maximum number of piling days would represent the temporal maximum design scenario. The maximum predicted impact range for underwater noise for piled foundations would represent the spatial maximum design scenario. The ORCPs will be positioned within the Offshore ECC ORCP Area – there will be no simultaneous piling between the ORCP foundations and foundations in the ~~array~~ WTG area.

Potential effect	Maximum design scenario assessed	Justification
	- Max 2 ANS = 2 monopiles total - Max 8m pile diameter - Max hammer energy: 3,500kJ - Max 4 hours per pile - Max 1 pile per day 1 monopile/day = 2 piling days Multi-leg pin-piled jacket WTG: - Max 100 WTG foundations 4 legs per foundation (1 pin pile per leg) - Max 400 pin piles total - Max pin pile diameter 5m - Max hammer energy 3,500kJ - Max 4 hours piling per pile - Max 24 hours piling per day (6 piles) - Max 2 simultaneous piling events 4 pin piles/day = 100 piling days 6 pin piles/day = 67 piling days Multi-leg pin piled jacket OPs: - Max 2 ORCPs, 4 OSS & 1 AC - Max 24 piles/OP (8 legs, each with 3 piles) - Max 168 pin piles total - Max pin pile diameter 5m - Max hammer energy 3,500kJ - Max 2 legs (6 pin piles) per day 2 legs (6 pin piles)/day = 28 days piling	

Potential effect	Maximum design scenario assessed	Justification
	Multi-leg pin piled jacket ANS: ▪ Max 2 ANS ▪ 4 pins per jacket = 8 pin piles total ▪ Max 5m pile diameter ▪ Max hammer energy: 3,500kJ ▪ Max 4 hours per pile ▪ Max 4 piles per day ▪ 4 pin piles/day = 2 piling days Piling: Q3 2027 – Q2 2029 Max piling days: ▪ Monopile: 100 (WTG) + 7 (OPs) + 2 (ANS) = 107 piling days total ▪ Pin pile: 100 (WTG) + 28 (OPs) + 2 (ANS) = 130 piling days total	
Underwater noise from other construction activities	▪ Seabed preparation: levelling and/or dredging of soft mobile sediments. ▪ Cable route clearance methods: mass flow excavation, dredging. ▪ Cable burial methods: jet trenching, pre-cut and post-lay ploughing, mechanical trenching, dredging, max flow excavation, vertical injection and rock cutting. ▪ Geophysical/Seismic surveys Offshore construction indicative dates: 2027 - 2029	Maximum potential for underwater noise impacts from pre-construction works.

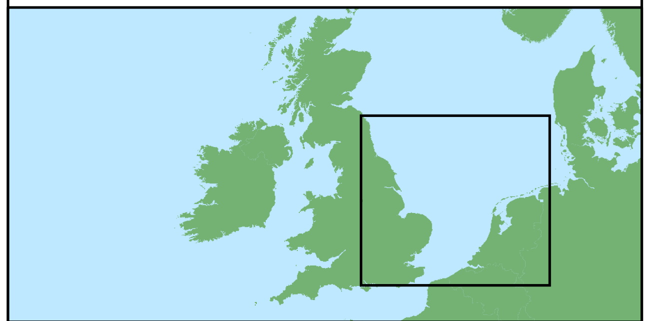
Potential effect	Maximum design scenario assessed	Justification
Collision risk from vessels Disturbance from vessels	▪ Max total construction vessels: 131 ▪ Max total round trips: 4,471 ▪ Indicative peak vessels on-site in a given 5km^2 area simultaneously: 8 ▪ Offshore construction indicative dates: 2027-2029 Max round trips over 3 years: 13,413	The maximum numbers of vessels and associated vessel movements represents the maximum potential for collision risk and disturbance
Indirect impacts from prey	Assessment is based on the MDS presented in Volume 1, Chapter 10: Fish and Shellfish Ecology.	
Accidental / Indirect pollution	Assessment is based on the MDS presented within Volume 1, Chapter 10: Fish and Shellfish Ecology.	
Habitat loss	Assessment is based on the MDS presented within Volume 1, Chapter 10: Fish and Shellfish Ecology.	
Disturbance at haul out sites	Assessment is based on distances to vessel transit routes and landfall	
O&M		
Operational noise	Operational noise from offshore windfarms to date has been found to be not significant for marine mammals. However, the size of WTGs planned at the Proposed Development do not have empirical data for operational noise and therefore operational noise has been scoped in as a precaution. An updated assessment of predicted SPL from 16MW and 30MW turbines (proposed for the Project) presented in Volume 1, Appendix 3.2: Underwater Noise Report.	
Collision risk from vessels Disturbance from vessels	▪ Annual round trips: 2,480	▪ Annual round trips: 2,480
Indirect impacts on prey	Assessment is based on the MDS presented in Volume 1, Chapter 10: Fish and Shellfish Ecology.	
Accidental / Indirect pollution	Assessment is based on the MDS presented within Volume 1, Chapter 10: Fish and Shellfish Ecology.	

Potential effect	Maximum design scenario assessed	Justification
Decommissioning		
Underwater noise	Maximum levels of underwater noise during decommissioning would be from underwater cutting required to remove structures. This is much less than pile driving and therefore impacts would be less than as assessed during the construction phase. Piled solutions assumed to be cut off at or below seabed	
Collision risk from vessels	Assumed to be similar vessel types, numbers and movements to construction phase (or less).	Assumed to be similar vessel types, numbers and movements to construction phase (or less).
Disturbance from vessels		
Changes to prey	Assessment is based on the MDS presented in Volume 1, Chapter 10: Fish and Shellfish Ecology.	
Accidental / Indirect pollution	Assessment is based on the MDS presented within Table 9.1.	



Legend

- Array Area
- Offshore Restricted Build Area
- Offshore Export Cable Corridor
- ORCP Area
- Artificial Nesting Structure Area
- Biogenic Reef Restoration Area
- Special Areas of Conservation (SAC/SCI)



Coordinate System: WGS 1984 UTM Zone 31N

0 50 100 km

Scale: 1:2,000,000

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RIAA

Designated Sites Considered for Marine Mammals

Figure 9.2

OUTER DOWSING OFFSHORE WIND

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9.2.3 Description of significance

~~184.~~195. A description of the significance of project level effects upon the receptors grouped under 'marine mammals', as relevant to the designated sites and their associated features screened in for potential LSE, is provided below. Conclusions on AEoI are drawn from the description of significance as relevant to each site and effect.

9.2.4 Construction and decommissioning

9.2.4.1 Underwater noise

~~185.~~196. The following assessment primarily focuses on the potential for effect during the construction phase. The Screening Report (document reference 7.2) determined that the potential for LSE in relation to underwater noise during decommissioning would be similar to and potentially less than those outlined in the construction phase. Effectively, that potential for effect during decommissioning would fall within, and be no worse than, the degree of effect during construction, with any such decommissioning being subject to the relevant licensing requirements at that time. Therefore, the conclusions for the construction phase are considered to also apply to decommissioning. The sites and features identified for this impact are identified within Table 7.1 and Figure 9.2.

~~186.~~197. There are a number of sources of underwater noise associated with the Project alone during construction, with these identified within Part 6, Volume 1, Chapter 11: Marine Mammals, with those screened in for potential LSE here (in line with Section 7~~7~~ of the current report) being:

- Underwater noise from percussive piling;
- Underwater noise during UXO clearance;
- Underwater noise from geophysical and seismic survey; and
- Seabed preparation and cable installation activities (including dredging, drilling, cable laying, rock placement and trenching).

~~187.~~198. The approach taken by this RIAA is to assess each of these effects individually, with a conclusion of the effect from underwater noise drawn based on all four effects. The importance of underwater noise for marine mammals (including harbour porpoise, harbour seal, grey seal and bottlenose dolphin) is discussed in Part 6, Volume 1, Chapter 11: Marine Mammals and Volume 2, Annex 3.2: Underwater Noise Assessment. That information, together with the underwater noise that may result from the above activities (as discussed within both those reports) and how that may affect marine mammals, is drawn on here in the context of the conservation objectives for each relevant designated site. Each of these effects are discussed in turn below, including the relevance for the features identified.

Underwater noise from percussive piling

Project mitigation

~~188.~~199. Project specific mitigation for pile driving is identified in Table 6.1 and includes the following:

- A maximum of two simultaneous piling events;
- A maximum hammer energy of 6,600 kJ and 3,500 kJ for monopiles and pin-pile respectively; and
- A piling MMMP will be developed in accordance with the Outline MMMP (Part 8, Document 8.4) and will be implemented during construction. The piling MMMP will include measures to ensure the risk of instantaneous permanent threshold shift (PTS) to marine mammals is negligible and will be in line with the latest relevant available guidance. The piling MMMP will include details of soft starts to be used during piling operations with lower hammer energies used at the beginning of the piling sequence before increasing energies to the higher levels.

~~189.~~200. Following best and established practice, the above measures are primarily focused on managing and mitigating any risk of PTS (injury) in marine mammals and applies to all identified sites and species. In addition to the above, for harbour porpoise at the SNS SAC, the In Principle SNS SAC SIP (which will be provided alongside the DCO Application), provides certainty that harbour porpoise risk with respect to disturbance will be managed appropriately going forward. The key points addressed within the SIP are discussed and considered within the assessments below.

Project level underwater noise

~~190.~~201. Underwater noise during construction of the Project has been studied specifically through the following, including that of direct relevance to marine mammals:

- Part 6, Volume 1, Chapter 11: Marine Mammals; ~~and~~
- Part 6, Volume 2, Appendix 3.2: Underwater Noise Assessment; and
- Offshore Restricted Build Area and Revision to the Offshore Export Cable Corridor Appendix C Underwater Noise Modelling Report (PD1-085).~~.~~

~~191.~~202. Part 6, Volume 2, Appendix 3.2: Underwater Noise Assessment provides the technical evidence base for underwater noise, with the ES chapter providing the context for marine mammals (including for harbour porpoise, harbour seal, grey seal and bottlenose dolphin), in relation to the potential for injury. Auditory injury is addressed in the ES through consideration of the risk of onset of PTS. The threshold values applied for PTS (with the background to the various thresholds provided in Section 11.5.6,~~4.7~~ of Part 6, Volume 1, Chapter 11: Marine Mammals) in relation to impulsive noise within the ES are provided in Table 9.3 below.

Table 9-39.39 ~~39.3~~: Thresholds for PTS in marine mammals (Southall et al., (2019))

Species	PTS Onset Weighted SELcum (dB re 1 µPa2s)	Unweighted SELpeak (dB re 1 µPa2s)
Impulse Noise		
Harbrour porpoise	155	202
Bottlenose dolphin	185	230

Species	PTS Onset Weighted SELcum (dB re 1 µPa2s)	Unweighted SELpeak (dB re 1 µPa2s)
Harbour/grey seals	185	218

~~192.~~203. Natural England and JNCC (JNCC et al., 2020) advise that a buffer of 26km around the source location is used to determine the impact area from pile driving for monopiles and 15km for pin-pile with respect to disturbance of harbour porpoise in the Southern North Sea SAC , with that approach applied here in the context of the 20% daily/10% seasonal thresholds described in the Screening Report (document reference 7.2). For harbour seals and grey seals, Part 6, Volume 1, Chapter 11: Marine Mammals describes the disturbance response in Section 4.7. The assessment of harbour seal and grey seal response to disturbance presented here draws on the findings of Part 6, Section 11.6~~6~~, Volume 1, Chapter 11: Marine Mammals in the context of the relevant designated sites and their conservation objectives.

~~193.~~204. The assessment of potential impact from risk of onset of PTS in harbour porpoise is presented in Section ~~4.7~~11.66 of Part 6, Volume 1, Chapter 11: Marine Mammals and Section 4.3 of Habitats Regulation Assessment for the ORBA (PD1-091). The assessment draws on results from underwater noise modelling at three separate locations and one simultaneous piling scenario of two locations. Of the three locations, the northeast location is considered to have the greatest propagation rate and therefore is the location of primary concern for harbour porpoise. The ranges presented are unmitigated ranges – i.e. these represent the maximum in the absence of any mitigation. It is important to note that the Project is committed to a piling MMMP (as referenced here in Table 6.1, and delivered through the DMLs), with Section ~~4.7~~11.6.1.3 of the ES finding that the mitigation will reduce the potential for impact with regards PTS in harbour porpoise, harbour seal and grey seal to negligible and therefore 'not significant as defined in the assessment of significance matrix and is therefore not considered further in this assessment'.

205. As an unmitigated maximum value, the MDS predicted PTS onset impact ranges for harbour porpoise would reach 0.27~~37~~, 0.42~~51~~, and 0.58~~9~~km for the southwest, northwest, and northeast locations respectively from monopiles (instantaneous PTS, SPLpeak). For pin piles, the distances were 0.23~~31~~, 0.36~~44~~, and 0.49~~51~~km for the same three locations respectively (instantaneous PTS, SPLpeak). For cumulative PTS (SELcum), the impact ranges are 0.65~~1.4~~, 1.6~~2.2~~, and 3.0~~4~~km for the southwest, northwest, and northeast locations respectively for monopiles, and 0.23~~73~~, 0.93~~1.4~~, and 2.0~~3~~km for pin-pile at the same locations. The maximum unmitigated number of harbour porpoise predicted to be within the PTS onset impact area, and therefore at risk of auditory injury, for any individual piling is 36~~64~~ animals (<0.01~~2~~% of the MU) from monopiles in the northeast location (cumulative PTS), and ~~736~~ 456 from simultaneous piling of monopiles at the northeast and southwest locations at the same time (0.132~~21~~% of the MU). For pin piles, the maximum number of porpoise predicted to be ~~disturbed~~ within the PTS onset impact area was ~~29~~ 16 at the northeast location, and ~~641~~ 365 at the northeast and southwest locations simultaneously (0.005~~1~~ and 0.105~~9~~% of the MU respectively).

~~194.~~

~~195.~~206. The effect of the planned mitigation within the piling MMMP (a combination of the soft start approach and use of ADDs) on the potential impact ranges is described in Section 11.6.1.3~~7~~ of Part 6, Volume 1, Chapter 11: Marine Mammals, which will reduce the risk of PTS-onset to negligible levels. It is also considered highly likely that the presence of vessels and associated activity will ensure that the vicinity of the pile is free of harbour porpoise by the time that piling begins.

~~196.~~207. The risk of onset of PTS in harbour seal and grey seal is considered in Part 6, Volume 1, Chapter 11: Marine Mammals in Section 11.6.1.3~~7~~. The modelling locations are the same as those for harbour porpoise, with the ranges similarly being unmitigated. It is important to note that the Project is committed to a piling MMMP (as referenced here in Table 6.1, and secured through the DMLs), with Section ~~4.7~~11.6.1.3 of the ES finding that the mitigation will reduce the potential for impact with regards PTS in seals to negligible.

~~197.~~208. As an unmitigated maximum value, the predicted PTS onset impact ranges for harbour seal and grey seal for the MDS piling scenario presented within ES for all instances and at all locations is at most 100 m. The maximum number of harbour seal or grey seal predicted to be within the PTS onset impact area, and therefore at risk of auditory injury, is <1 animal. In the context of the predicted range of unmitigated risk of onset of PTS, together with the planned mitigation within the piling MMMP the conclusion drawn is of negligible adverse significance for both seal species, which is not significant in EIA terms.

Project level underwater noise – MDS piling scenario and disturbance

~~198.~~209. Part 6, Volume 1, Chapter 11: Marine Mammals and Section 4.3 of Habitats Regulation Assessment for the ORBA (PD1-091) also considers the potential for behavioural disturbance to occur, and the potential impact on harbour porpoise, harbour seal, grey seal and bottlenose dolphin (Section 11.6.1.6 ~~4.7~~). For the purposes of the RIAA, the assessment presented here for harbour porpoise and bottlenose dolphin is based on the relevant EDR (~~paragraph 9.3.5~~paragraph 182), and therefore is in a context of habitat availability and not numbers of animals. However, the assessment of disturbance here for harbour and grey seals uses a quantification of impacts to individuals based on the at-sea usage data (as presented in the ES), with these numbers then considered in relation to populations of the relevant designated sites. A summary of the information presented for harbour seal and grey seal within the ES is provided below.

~~199.~~210. For harbour seals, the highest disturbance levels for monopiles were predicted for simultaneous piling on the northeast and southwest locations, where a maximum of ~~35~~ 28 harbour seals are predicted to be disturbed for the installation process, which represents 0.~~72~~58% of the reference population (not all of which will be associated with a specific designated site). The equivalent number for pin-pile at the same locations is ~~30~~ 24 animals (0.49~~62~~% of the population), which represents the highest level of disturbance in temporal terms. Such disturbance will be intermittent within an overall 12-month period. In the context of the low density of harbour seals within the area, and an area considered of low importance for foraging for the species, any such short term and temporary disturbance and displacement was found in the ES to represent a negligible adverse significance, which is not significant in EIA terms.

~~200.~~211. For bottlenose dolphins, the predicted highest disturbance levels for piling events were predicted for both single piling in the north west and simultaneous piling in the north east and south west locations, where a maximum of 79~~4~~ bottlenose dolphins are predicted to be disturbed for the installation process. This represents 3.91~~0.2~~% of the reference population (which is not within the same MU as the Moray Firth SAC). In the context of the low density of bottlenose dolphins within the area, any such short term and temporary disturbance and displacement was found in the ES to represent negligible adverse significance, which is not significant in EIA terms.

~~201.~~212. For grey seals, the highest potential disturbance levels on a spatial basis were also predicted for simultaneous piling at the northeast and southwest locations, where an estimated ~~615~~ 514 (62~~75~~-954~~1139~~) grey seals have the potential to be disturbed, which represents ~~1.16~~0.78% of the reference population (i.e., all other foundation locations would result in a reduced level of effect). The equivalent number for pin-pile at the same location is ~~534~~ 440 animals (~~1.01~~0.67% of the population) which represents the highest level of disturbance in temporal terms. As above for harbour seals, not all of these seals will be associated with a designated site.

~~202.~~213. Overall, the ES found that the predicted impact (in the context of the number of animals that may be affected and both duration and frequency of effect) were such that although there is potential for a risk of a decline in fertility and survival of 'weaned of the year' for a very small proportion of the grey seal population if those animals are repeatedly displaced from foraging areas, it is not expected that the predicted level, frequency and duration of impact would be sufficient to result in a population level change. Given that grey seals are expected to return to their previous behavioural states/activities after the impact has ceased (within 2 hours), it is not expected that this will result in any significant impact on survival or fertility rates unless the same individual is exposed repeatedly across numerous days (Booth et al., 2019). In the unlikely event that individuals were repeatedly disturbed across the 12- month construction period, any effect on vital rates are expected to be limited to 1 breeding cycle for a very limited proportion of the management unit, and as such the magnitude is assessed as minor in the ES, since vital rates are very unlikely to be impacted to the extent that the population trajectory would be altered.

~~203.~~214. This type of short-term, intermittent and temporary behavioural response will affect only a very small proportion of the population and, while energetic requirements may be slightly increased by the need to transit to another foraging location, survival and reproductive rates are very unlikely to be impacted.

~~204.~~215. Overall, the ES found that for grey and harbour seals, the effect from piling on behavioural disturbance is of slight adverse significance, which is not significant in EIA terms.

Consideration of harbour porpoise

~~205.~~216. A single site for harbour porpoise has been screened in for assessment - the SNS SAC.

~~206.~~217. The consideration of the risk of onset of PTS for harbour porpoise given above draws on Part 6, Volume 1, Chapter 11: Marine Mammals, which is presented in the context of the total population of animals within the MU. The conservation objectives are as follows:

- To ensure that the integrity of the site is maintained and that it makes the best possible contribution to maintaining Favourable Conservation Status (FCS) for harbour porpoise in UK waters. In the context of natural change, this will be achieved by ensuring that:
  - Harbour porpoise is a viable component of the site;
  - There is no significant disturbance of the species; and
  - The condition of supporting habitats and processes, and the availability of prey is maintained.

~~207.~~218. The JNCC Advice notes the following relevant points as regards harbour porpoise population, numbers and viability within the site:

'The variability of harbour porpoise distribution and abundance within sites is in part due to their mobility and wide-ranging nature as well as natural and anthropogenic changes in habitat and prey. Relevant and Competent Authorities are not required to undertake any actions to ameliorate changes in the condition of the site if it is shown that the changes result wholly from natural causes. It is therefore important to contextualise any apparent deterioration of harbour porpoise presence in the site in terms of natural variability and the abundance and distribution patterns at the population level (i.e. MU)' and

'The harbour porpoise in UK waters are considered part of a wider European population and the highly mobile nature of this species means that the concept of a 'site population' is not considered an appropriate basis for expressing Conservation Objectives for this species. Site based conservation measures will complement wider ranging measures that are in place for the harbour porpoise.'

~~208.~~219. Together with the final point, perhaps most pertinently, made under the description of Conservation Objective 1 (which deals with viability and therefore injury risk):

'Unacceptable levels can be defined as those having an impact on the favourable Conservation Status (FCS) of the populations of the species in their natural range. The reference population for assessments against this objective is the MU population in which the SAC is situated (IAMMWG 2015).'

~~209.~~220. Therefore, the number of animals that may be at risk to onset of PTS (as presented above) has not been compared to any population attributed to the SNS SAC, because the number of harbour porpoise using the site naturally varies. Rather, the assessment considers whether any such PTS risk could impact on the FCS of the MU population (which in the context of the first conservation objective refers to measures that *'restrict the survivability and reproductive potential of harbour porpoise using the site'*).

~~210.~~221. Mitigation for risk of onset of PTS (injury) is provided for within the MMMP process (Table 6.1) a process that is secured within the DML and requires sign off and regulator agreement and approval prior to works occurring. Mitigation for disturbance risk is provided for separately within the In-principle SNS SIP which will be provided alongside the DCO Application (Table 6.1).

~~211.~~222. Given that the MMMP will provide for appropriate mitigation to minimise the risk of injury or mortality in harbour porpoise during pile driving to a level considered not significant in EIA terms even as a maximum (requiring prior approval by the regulator), with that conclusion drawn with respect to the MU population, it is concluded that the Project alone does not have the potential to restrict the survivability and reproductive potential of harbour porpoise using the site. **There will not, therefore, be an AEoI on the viability of harbour porpoise as a result of mortality or injury resulting from pile driving at the Project alone during construction and decommissioning in relation to the SNS SAC and therefore, subject to natural change, harbour porpoise will be maintained as a 'viable component' of the site in the long-term.**

~~212.~~223. The second conservation objective for the SNS SAC refers to *'no significant disturbance of the species'*, and as highlighted above that disturbance is assessed here through the application the relevant EDR, which for monopiles is 26km but for pin-pile is 15km.

~~213.~~224. The seasonal nature of the SNS SAC is important here, with the Project ~~array~~ WTG area being more than 26km distant from the winter extents of the SNS SAC at its closest point. As such, any noisy activity within the Project ~~array~~WTG area that takes place in the winter season (October-March inclusive) would fall outside the need for assessment here. Any noisy activity within the Project's ~~array~~ WTG area during the summer season (April-September inclusive) would, however, require consideration through the HRA process.

~~214.~~225. For pile driving within the Project ~~array~~ WTG area, the maximum overlap from a single monopile foundation location within the summer extents of the SNS SAC would be 1631.2~~1726.3~~km^2 from the northeast location (6.04~~3.47~~% of the summer extents) or depending on location of the foundation as low as 149.2km^2 from the southwest location (0.55%). For pin piled foundations, that reduces to a maximum of 690.9~~9~~km^2 from the northeast location (2.45~~6~~%)~~-~~, with no overlap from the southwest location. There is therefore capacity within the threshold (20% per 24-hours), when considering the Project alone, for piling to occur at more than one foundation location per 24-hours.

~~215.~~226. As a 'maximum design scenario for disturbance from piling', piling could occur at up to two separate foundation locations per 24-hours, termed concurrent piling. No project level separation distance has been set (which would limit the distance between two concurrent piling events and therefore limit the combined footprint of effect).

~~216.~~227. For pile driving within the Project ~~array~~ WTG area, the maximum overlap with the summer area of the SNS SAC from concurrent piling is 1641.2~~2084.6~~km^2 from the northeast and southwest locations (6.07~~7.71~~% of the summer extents) or depending on location of the foundation as low as 149.2km^2 from the southwest and north-southwest location (0.55%). For pin piled foundations, that reduces to a maximum of 660.9~~974.9~~km^2 from the northeast and southeast locations (~~3.61~~2.45%), with ~~with~~ no overlap from either the southwest or north southwest locations. No overlap with the winter extents would result from pile driving within the Project ~~array~~WTG area, regardless of the type or number of foundations. Additionally, there is no overlap with the SAC (either season) from piling at the ORCP area.

~~217.~~228. For the 10% temporal value, the anticipated duration of pile driving is within an overall window of 12 months. For assessment purposes, and as a maximum design scenario for the 10% temporal value, it is therefore assumed that pile driving of monopiles would occur within the ~~array~~ WTG area by a single piling rig, which for worst case assessment purposes has been assumed to occur each day of a single summer season. Should concurrent piling be utilised, or more than one foundation installed in a day, the number of days required for piling would fall (and in any case, logistics dictate that there will be non-piling days to account for weather and trips to port etc). The maximum seasonal effect in the summer from piling in the array only (assuming the maximum ~~3.47~~6.04% per day for every day of the season), would therefore be ~~3.47~~6.04%, ~~well~~ within the 10% seasonal threshold.

~~218.~~229. As the ORCP does not overlap with the SAC, the consideration of effects looks at the numbers of individuals impacted. The number of harbour porpoise potentially disturbed by unmitigated piling for the Offshore Reactive Compensation Platform (ORCP) is 601 individual which works out to <0.17% of the MU. While this individual may be associated with the SAC population, underwater noise effects from the ORCP will not result in any loss of habitat availability within the site and therefore will have no impact on the conservation objectives at the site in relation to disturbance.

~~219.~~230. With respect to the ANS areas, the maximum overlap from a single monopile foundation location within the summer extents of the SNS SAC would be 1922.79km^2 from the southern ANS (7.12~~5.45~~% of the summer extents) or depending on location of the foundation as low as 496.65km^2 from the northern ANS location (1.84%).

~~220.~~231. As a 'maximum design scenario for disturbance from piling', piling could occur at up to two separate foundation locations per 24-hours, termed concurrent piling. No project level separation distance has been set (which would limit the distance between two concurrent piling events and therefore limit the combined footprint of effect).

~~221.~~232. For pile driving within the ANS areas, the maximum overlap with the summer area of the SNS SAC from concurrent piling is 2177.7km^2 from the southern ANS (8.06% of the summer extents) or depending on location of the foundation as low as 496.65 km^2 from the northern ANS (1.84%).

~~222.~~233. No overlap with the winter extents would result from pile driving within the Project ~~array~~ WTG area, regardless of the type or number of foundations.

~~223.~~**234.** **Therefore, it is concluded that there will not be an AEoI in relation to disturbance on the Conservation Objective for harbour porpoise for the SNS SAC as a result of pile driving from the Project alone during construction and decommissioning under any pile driving scenario and therefore, subject to natural change, in the long-term, there will be no significant disturbance of harbour porpoise.**

~~224.~~235. The third conservation objective is focused on maintaining the supporting habitats and processes, together with availability of harbour porpoise prey, within the SNS SAC. The Advice on Activities refers to supporting habitats as 'the characteristics of the seabed and water column' in the context of 'ensuring prey is maintained within the site'. Potential for supporting habitats and processes to be affected are considered within Part 6, Volume 1, Chapter 7: Marine Physical Processes. That chapter has concluded the potential for effect to be slight adverse at most (and therefore not significant in EIA terms). The scale of any potential such effect is also found to be localised to the Project and therefore spatially much smaller than the overall SNS SAC and of trivial consequence for physical processes at that scale.

~~225.~~236. Although specific prey species for harbour porpoise in the SNS SAC are unknown, sandeels are a known prey item for harbour porpoise, with herring also taken. The potential for impact to sandeel and herring are addressed in full in Section 4.7 of Part 6, Volume 1, Chapter 10: Fish and Shellfish Ecology. Sandeel and herring are the primary focus of the assessment made. The scale, frequency and duration of construction works resulted in a conclusion of slight adverse at most and is therefore not significant in EIA terms. Part 6, Volume 1, Chapter 11: Marine Mammals further considers fish and marine mammals during construction in the context of a potential reduction in foraging ability, resulting from issues around turbidity, visibility and the ability to locate prey. The magnitude of the impact is concluded to be negligible and have no significant effect. Given the conclusions in the ES, in the wider context of the scale of the SNS SAC relative to the scale of the Project, no potential for adverse effect has been identified.

~~226.~~237. There is, **therefore, no AEoI to the supporting habitats and processes relevant to harbour porpoise and their prey for the SNS SAC as a result of pile driving from the Project alone during construction and decommissioning and therefore, subject to natural change, the availability and density of suitable harbour porpoise prey will be maintained in the long-term.**

Consideration of bottlenose dolphin

~~227.~~238. Bottlenose dolphin are screened in for potential LSE with respect to underwater noise caused by piling during construction and decommissioning for the following sites:

- Moray Firth SAC;

~~228.~~239. The conservation objectives for the designated sites and relevant features comprise of the following;

- Maintain the population of bottlenose dolphins as a viable component of the designated site;
- Maintain the distribution of bottlenose dolphin throughout the designated site;

- Maintain the supporting habitats and process relevant to bottlenose dolphin and the availability of prey for bottlenose dolphin.

~~229.~~240. Of the above conservation objectives, the proposed activities have negligible potential to impact the distribution of bottlenose dolphin within the designated site, so the assessment will consider the other 2 conservation objectives.

~~230.~~241. The maximum impact range for PTS-onset is predicted to be <100m for all locations for bottlenose dolphins, which results in no predicted impact on bottlenose dolphins due to their density. This means there is negligible (adverse) effect on bottlenose dolphins for the proposed activities.

~~231.~~242. The maximum impact range for TTS-onset thresholds is predicted to be <50m at all locations for bottlenose dolphins, which results in no predicted impact on bottlenose dolphins due to their density. This means there is negligible (adverse) effect on bottlenose dolphins for the proposed activities.

~~232.~~243. The maximum disturbance potential is from single pile installation ANS, where it is predicted approximately 84 bottlenose dolphins may experience disturbance per day. This equates to approximately 4.15% of the MU population (different MU to the designated site) and is based on the worst case scenario of numbers present.

~~233.~~244. The ES concludes that due to the size of the GNS MU which the works are located within and the "offshore ecotype" population behaviour, the likelihood of the same individual bottlenose dolphins returning repeatedly on piling days to the extent that the population would be impacted is viewed as highly unlikely. The piling may result in short-term and/or intermittent and temporary behavioural impacts on a small proportion of the population. It is considered to be a low (adverse) magnitude. With consideration of the above conservation objectives it is recognised that the designated site lies within a different bottlenose dolphin MU from the GNS MU where the activities are being carried out it, there is however potential for the population to cross between MU's. With consideration of the distance from the site to the other MU and designated site (>500km), there is, **therefore, no AEoI to the bottlenose dolphin at the Moray Firth SAC as a result of pile driving from the Project alone during construction and decommissioning and therefore, subject to natural change, the availability and density of bottlenose dolphin will be maintained in the long-term.**

~~234.~~245. The above conclusions are based upon the conclusions made in Part 6, Volume 1, Chapter 11: Marine Mammals and consideration for the distance from the designated site.

Consideration of harbour seal

~~235.~~246. Harbour seal are screened in for potential LSE with respect to underwater noise during construction and decommissioning for the following sites:

- The Wash and North Norfolk Coast SAC; and
- Transboundary sites (specifically Doggersbank (Netherlands) SAC and Klaverbank SCI).

~~236.~~247. Variable information exists on the conservation objectives, with the following drawn from UK sites where, subject to natural change, the following applies:

- The extent and distribution of qualifying natural habitats and habitats of the qualifying species;
- The structure and function (including typical species) of qualifying natural habitats;
- The structure and function of the habitats of the qualifying species;
- The supporting processes on which qualifying natural habitats and the habitats of qualifying species rely;
- The populations of each of the qualifying species; and
- The distribution of qualifying species within the site.

~~237.~~248. The objectives for transboundary sites are:

- Conserve the area and quality of supporting habitat; and
- Conserve the population size.

~~238.~~249. Of the above conservation objectives, it is clear that the transboundary objectives are contained within those for the UK sites - therefore the assessment that follows is presented following the UK conservation objective requirements to minimise repetition.

~~239.~~250. As regards the conservation objectives that address the natural habitats of harbour seal (the first four bullet points for UK site conservation objectives), these are concerned with the physical habitat and the species contained within. The potential for impact on the physical habitat is considered within Part 6, Volume 1, Chapter 7 Marine Physical Processes. That chapter has concluded at most a minor adverse effect (which is not significant in EIA terms) and that does not extend to the designated sites themselves. Similarly, Part 6, Volume 1, Chapter 11: Marine Mammals further considers fish and marine mammals during construction in the context of a potential reduction in foraging ability, resulting from issues around turbidity, visibility and the ability to locate prey. The magnitude of the impact is concluded to be negligible and have no significant effect. Given the conclusions in the ES, in the wider context of the scale of the available habitat and the distribution of harbour seal at sea relative to the Project (Russell, 2017), all relative to the scale of the Project, no potential for adverse effect has been identified.

~~240.~~251. There is, **therefore, no AEoI to the supporting habitats relevant to harbour seal and their prey for the Wash and North Norfolk Coast SAC, Doggersbank (Netherlands) SAC or Klaverbank SCI as a result of pile driving from the Project alone during construction and decommissioning and therefore, subject to natural change, the supporting habitat for harbour seal and their prey will be maintained in the long-term.**

~~241.~~252. The potential to affect the population and distribution of harbour seal is considered within Part 6, Volume 1, Chapter 11: Marine Mammals with respect to potential for injury (risk of onset of PTS) and disturbance. The following assessment takes account of that, in the context of the relevant SACs and their conservation objectives.

~~242.~~253. As for consideration of harbour porpoise above, the risk of onset of PTS in all marine mammal species will be addressed in the MMMP (Table 6.1), which will provide for appropriate mitigation to minimise the risk of injury or mortality in harbour seal during percussive piling operations (with prior approval by the regulator). Additionally, Part 6, Volume 1, Chapter 11: Marine Mammals considers that there will be <1 harbour seal predicted to experience PTS from piling.

~~243.~~254. There is, **therefore, no AEoI to the harbour seal feature for the Wash and North Norfolk Coast SAC, Doggersbank (Netherlands) SAC or Klaverbank SCI as a result of pile driving from the Project alone during construction and decommissioning and therefore, subject to natural change, the feature will be maintained in the long-term.**

~~244.~~255. Part 6, Volume 1, Chapter 11: Marine Mammals considers the number of harbour seal potentially disturbed by unmitigated pile driving at each modelled location for both monopiles and pin piles. The highest disturbance level for monopiles were predicted for simultaneous piling on the northeast and southwest locations, where an estimated 28 harbour seals are predicted to be disturbed for the installation process, which represents 0.58% of the reference population (not all of which will be associated with a specific designated site). The equivalent number for pin-pile at the same locations is 24 animals (0.49% of the population), which represents the highest level of disturbance in temporal terms. The number of harbour seal potentially disturbed by unmitigated piling for the ORCP is 154 individuals which works out to 3.16% of the MU. For the ANS areas, the number of harbour seal potentially disturbed by unmitigated piling is 9 individuals, or 0.18% of the relevant MU.

~~245.~~256. In relation to harbour seals associated with the Wash and Norfolk Coast SAC, and to place the population level numbers in context, the JNCC cites the harbour seal population at the Wash as being 7% of the UK total, which is given by the JNCC as 48,000-56,000. These numbers would indicate that the Wash population stands at around 3,360-3,920. If all the harbour seal disturbed originate from the Wash, that would indicate that in an unmitigated scenario and for the worst case noted above of 154 individual seals (ORCP), between 3.9% and 4.6% of the Wash SAC population of harbour seal may be temporarily disturbed. SCOS (SCOS, 2022) identifies that the harbour seal population of the Wash has been relatively constant since 2012 (following recovery from phocine distemper) until 2019, when it fell by approximately 19% (considered to have occurred across a 2-year period). The mean population count between 2019 and 2022 for the Wash and North Norfolk Coast SAC was 2,758. Should the lower population of 2,758 be applied, that would result in up to 5.6% being subject to temporary disturbance depending on pile type and location. However, when factoring in "at-sea" seals (following the scalar presented in Russel et al., 2016), the population estimate using the 2019-2022 count for the Wash and North Norfolk Coast SAC is 3,530 harbour seals. Using this population estimate, the worst case piling scenario (piling at the ORCP) would result in 4.4% of the population being subject to temporary disturbance.

~~246.~~257. For the Doggersbank and Klaverbank SCIs, there are an estimated 6,000 harbour seal in the Dutch section of the North Sea and Wadden Sea. No population level for either SCI has been sourced (the standard data forms both read a population of zero). The conservation objectives refer to the population of the species and the distribution of that species within the site. As any effect is predicted to be at distance from both transboundary harbour seal sites, it will not considered to have a direct effect on the distribution of individuals within the sites. If all disturbed individuals (154 from the ORCP) were attributed to the Dutch section of the North Sea and Wadden Sea (with an estimated population of 6,000 individuals) in the context of the population, even as an unrealistic worst case that would still only be 2.6%.

~~247.~~258. It is worth noting however, that while the worst-case impact does come from piling at the ORCP, given the scale of the works required this will only be over a limited temporal period. With 24 piles per foundation for the ORCP, with 6 piles a day, there is a maximum potential for 8 days at the above disturbance rates for the ORCP area. Therefore, the majority of the disturbance caused by the Project on a temporal scale will be from the ~~array~~ WTG area, where 21 seals are likely to be disturbed (0.43% of the MU, 0.59% of the Wash and North Norfolk Coast SAC, and 0.35%). It is considered within Part 6, Volume 1, Chapter 11: Marine Mammals that for even the most vulnerable harbour seals (the 'weened of the year' following the post weening fast) there must be ~60 days of repeated disturbance before there was expected to be any significant effect on the probability of survival. It is also considered unlikely that individual harbour seals would repeatedly return to a site where they had been previously displaced from in order to experience this number of days of repeated disturbance. Therefore, when factoring in the temporal scale of the disturbance, it is considered that the proportionate level of disturbance will be closer to the ~~array~~ WTG area values rather than the ORCP values, meaning that it is highly unlikely for any significant disturbance effects on the population associated with any of the identified designated sites.

~~248.~~259. Part 6, Volume 1, Chapter 11: Marine Mammals also found that the area of sea within which noise from the array is sufficient to result in disturbance of harbour seal has a low density of harbour seals and is not considered an important foraging ground for the species. Whilst the area affected by the ORCP piling has a relatively higher density of harbour seal, this would be for a maximum of two foundations and therefore the duration of the works is very short. Therefore, any disturbance and displacement is unlikely to result in a significant reduction in energy intake. In addition, as noted in the ES chapter, data collated during windfarm construction has shown that harbour seal density quickly recovers once piling has ceased, and so any disturbance that does occur is likely to be short lived and temporary in nature. Further, the number of animals temporarily affected is small in the context of both the overall population and at designated site level populations (where known).

~~249.~~260. There is, therefore, no AEoI on the harbour seal population and distribution with respect to the Wash and North Norfolk Coast SAC, Doggersbank (Netherlands) SAC, Doggersbank SCI and Klaverbank SCI as a result of pile driving from the Project alone during construction and decommissioning and therefore, subject to natural change, the population of harbour seal will be maintained in the long-term.

Consideration of grey seal

~~250.~~261. Grey seal are screened in for potential LSE with respect to underwater noise during construction and decommissioning for the following sites:

- Humber Estuary SAC;
- Humber Estuary Ramsar;
- Berwickshire and North Northumberland Coast SAC; and
- Transboundary sites (Bancs des Flandres SAC, Doggersbank (Netherlands) SAC, Klaverbank SCI, Noordzeekustone SCI, SBZ 1 SCI, SBZ 2 SCI, SBZ 3 SCI, Vlaamse Banked SCI, Vlakte van de Raan SCI, Voordelta SCI, Waddenzee SCI, and Westerschelde & Saeftinghe SCI)

~~251.~~262. Variable information exists on the conservation objectives, with the following drawn from UK sites where, subject to natural change, the following applies:

- the extent and distribution of qualifying natural habitats and habitats of the qualifying species;
- the structure and function (including typical species) of qualifying natural habitats;
- the structure and function of the habitats of the qualifying species;
- the supporting processes on which qualifying natural habitats and the habitats of qualifying species rely;
- the populations of each of the qualifying species; and
- the distribution of qualifying species within the site.

~~252.~~263. The objectives for transboundary sites are:

- Conserve the area and quality of supporting habitat; and
- Conserve the population size.

~~253.~~264. Of the above conservation objectives, it is clear that the transboundary objectives are contained within those for the UK sites - therefore the assessment that follows is presented following the UK conservation objective requirements to minimise repetition.

~~254.~~265. As regards the conservation objectives that address the natural habitats of grey seal (the first four bullet points for UK site conservation objectives), these are concerned with the physical habitat and the species contained within. The potential for impact on the physical habitat is considered within Part 6, Volume 1, Chapter: 7 Marine Physical Processes Chapter. That chapter has concluded at most a minor adverse effect (which is not significant in EIA terms) and that does not extend to the designated sites themselves. Similarly, Part 6, Volume 1, Chapter 11: Marine Mammals further considers fish and marine mammals during construction in the context of a potential reduction in foraging ability, resulting from issues around turbidity, visibility and the ability to locate prey. The magnitude of the impact is concluded to be negligible and have no significant effect. Additionally, all of the transboundary sites are at a significant distance (the closest project is Klaverbank, which is 95.9km away from the array). Given the conclusions in the ES, in the wider context of the scale of the available habitat and the distribution of grey seal at sea relative to the Project (Russell, 2017), all relative to the scale of the Project, no potential for adverse effect has been identified.

~~255.~~266. **There is, therefore, no AEoI to the supporting habitats relevant to grey seal and their prey for the Humber Estuary SAC, Humber Estuary Ramsar, Berwickshire and North Northumberland Coast SAC Bancs des Flandres SAC, Doggersbank (Netherlands) SAC, Klaverbank SCI, Noordzeekustone SCI, SBZ 1 SCI, SBZ 2 SCI, SBZ 3 SCI, Vlaamse Banked SCI, Vlakte van de Raan SCI, Voordelta SCI, Waddenzee SCI, and Westerschelde & Saeftinghe SCI as a result of percussive piling from the Project alone during construction and decommissioning and therefore, subject to natural change, the supporting habitat for grey seal and their prey will be maintained in the long-term.**

~~256.~~267. The potential to affect the population and distribution of grey seal is considered within Part 6, Volume 1, Chapter 11: Marine Mammals with respect to potential for injury (risk of onset of PTS) and disturbance. The following assessment takes account of that, in the context of the relevant SACs and their conservation objectives.

~~257.~~268. As for consideration of harbour seal above, the risk of onset of PTS in all marine mammal species will be addressed in the MMMP (Table 6.1), which will provide for appropriate mitigation to minimise the risk of injury or mortality in grey seal during percussive piling operations (with prior approval by the regulator). Additionally, Part 6, Volume 1, Chapter 11: Marine Mammals considers that there will be <1 grey seal predicted to experience PTS from piling. **There is, therefore, no AEoI to grey seal for the Humber Estuary SAC, Humber Estuary Ramsar, Berwickshire and North Northumberland Coast SAC Bancs des Flandres SAC, Doggersbank (Netherlands) SAC, Klaverbank SCI, Noordzeekustone SCI, SBZ 1 SCI, SBZ 2 SCI, SBZ 3 SCI, Vlaamse Banked SCI, Vlakte van de Raan SCI, Voordelta SCI, Waddenzee SCI, and Westerschelde & Saeftinghe SCI as a result of mortality or injury resulting from percussive piling from the Project alone during construction and decommissioning and therefore, subject to natural change, the grey seal feature will be maintained in the long-term.**

~~258.~~269. Part 6, Volume 1, Chapter 11: Marine Mammals considers the number of grey seal potentially disturbed by unmitigated pile driving at each modelled location for both monopiles and pin piles. The highest disturbance levels for monopiles within the array were predicted for simultaneous piling on the northeast and southwest locations, where an estimated 514~~02~~ grey seals are predicted to be disturbed for the installation process, which represents 0.78~~7~~% of the reference population (not all of which will be associated with a specific designated site). The equivalent number for pin-pile at the same locations is 440~~14~~ animals (0.67~~3~~% of the population), which represents the highest level of disturbance in temporal terms. The number of grey seal potentially disturbed by unmitigated piling for the ORCP is 214 individuals which works out to 0.33% of the MU. For the ANS areas, the number of grey seal potentially disturbed by unmitigated piling is up to 724 individuals, or 1.11% of the relevant MU.

~~259.~~270. In relation to grey seals associated with the Humber Estuary SAC, and to place the population level numbers in context, SCOS, 2023 cites the grey seal population for Donna Nook (a close proxy to the Humber Estuary SAC) as being 3,463. However, when factoring in “at-sea” seals (following the scalar presented in SCOS, 2022), the population estimate is 13,769 seals. If all the grey seals disturbed originate from the Humber Estuary SAC, that would indicate that in an unmitigated scenario and for the worst case noted above of 724 individual seals (~~concurrent piling of northeast and southwest location~~piling for ANS), which is approximately 5.3% of the Humber Estuary SAC population of grey seal may be temporarily disturbed.

~~260.~~271. As no population estimate is given for the Humber Estuary Ramsar, due to the close proximity with the Humber Estuary SAC, the SAC population estimate (13,769 as above) is used. If all the grey seal disturbed originate from the Humber Estuary Ramsar, that would indicate that in an unmitigated scenario and for the worst case noted above of 724 individual seals (~~concurrent piling of northeast and southwest location~~piling for ANS), which is approximately 5.3% of the Humber Estuary Ramsar population of grey seal, may be temporarily disturbed.

~~261.~~272. In relation to grey seals associated with the Berwickshire and North Northumberland Coast SAC, the latest haul out numbers (SCOS, 2023) show the count at being 4,251. However, when factoring in “at-sea” seals (following the scalar presented in SCOS, 2022), the population estimate is 16,903 seals. If all the grey seals disturbed originated from the Berwickshire and North Northumberland Coast SAC, that would indicate an unmitigated scenario and worst-case scenario (as noted above) of 724 individual seals (~~concurrent piling of northeast and southwest locations~~piling of ANS) being temporarily disturbed, equating to approximately 4.3% of the Berwickshire and North Northumberland Coast SAC grey seal population potentially being temporarily disturbed.

~~262.~~273. For the transboundary grey seal sites, population estimates have been sourced where available (from the standard data forms) for sites in Dutch waters (Doggersbank (Netherlands) SAC (gives a population of 0), Klaverbank SCI (gives a population of 0), Westerschelde & Saeftinghe SCI (1-20), Voordelta SCI (50-200), Noordzeekustzone SCI (2,040) and Waddenzee SCI (1,800)). For the site in French waters (Bancs des Flandres SCI (none given)) and those in Belgian waters (Vlaamse Banken SCI (gives a population of 0), SBZ 1 SCI (gives a population of 0), SBZ 2 SCI (gives a population of 0), SBZ 3 SCI (gives a population of 0 and Vlakte van de Raan SCI (0-400)). Given the absence of numbers for a lot of sites and large range for those sites with numbers, a qualitative approach is taken to this assessment for grey seals.

~~263.~~274. The highest disturbance levels for monopiles were predicted for ~~simultaneous~~ piling ~~on the northeast and southwest locations~~for the north west ANS, where an estimated 724 grey seals are predicted to be disturbed for the installation process. Due to the generalist diet, mobility, life history and adequate fat stores of grey seals, it is considered that grey seals would require moderate-high levels of repeated disturbance before there was any effect on fertility rates to reduce fertility. Grey seals are capital breeders and store energy in a thick layer of blubber, which means that, in combination with their large body size, they are tolerant of periods of fasting as part of their normal life history.

~~264.~~275. It is worth noting, that while the worst-case impact does come from piling in the ANS areas, given the scale of the works required this will only be over a limited temporal period. With 4 piles per foundation for the ANS, with 4 piles a day, there is a maximum potential for 2 days at the above disturbance rates for the ANS. Therefore, the majority of the disturbance caused by the Project on a temporal scale will be from the ~~array~~ WTG area, where 514~~02~~ seals are likely to be disturbed (0.78~~7~~% of the MU, 3.73~~65~~% of the Humber Estuary SAC and Ramsar, and ~~2.97~~3.03% of the Berwickshire and North Northumberland Coast SAC). It is considered within Part 6, Volume 1, Chapter 11: Marine Mammals that for even the most vulnerable grey seals (the 'weened of the year' following the post weening fast) there must be ~60 days of repeated disturbance before there was expected to be any significant effect on the probability of survival. It is also considered unlikely that individual grey seals would repeatedly return to a site where they had been previously displaced from in order to experience this number of days of repeated disturbance. Therefore, when factoring in the temporal scale of the disturbance, it is considered that the proportionate level of disturbance will be closer to the ~~array~~ WTG area values rather than the ORCP values, meaning that it is highly unlikely for any significant disturbance effects on the population associated with any of the identified designated sites.

~~265.~~276. Part 6, Volume 1, Chapter 11: Marine Mammals also found that the area of sea within which noise sufficient to result in disturbance of grey seal has a low density of grey seals, and is not considered an important foraging ground for the species. Grey seals are also highly adaptable to a changing environment and are capable of adjusting their metabolic rate and foraging tactics, to compensate for different periods of energy demand and supply (Beck et al., 2003; Sparling et al., 2006). Grey seals are also very wide ranging and are capable of moving large distances between different haul out and foraging regions (Russell et al., 2013). Therefore, any disturbance and displacement is unlikely to result in a significant reduction in energy intake. In addition, as noted in the ES chapter, data collated during windfarm construction has shown that grey seal density quickly recovers once piling has ceased, and so any disturbance that does occur is likely to be short lived and temporary in nature. This type of short-term, intermittent and temporary behavioural response will affect only a very small proportion of the overall population for short, intermittent periods.

~~266.~~277. **There is, therefore, no AEoI for the grey seal population and distribution with respect to the Humber Estuary SAC, Humber Estuary Ramsar, Berwickshire and North Northumberland Coast SAC, Bancs des Flandres SAC, Doggersbank (Netherlands) SAC, Klaverbank SCI, Noordzeekustone SCI, SBZ 1 SCI, SBZ 2 SCI, SBZ 3 SCI, Vlaamse Banked SCI, Vlakte van de Raan SCI, Voordelta SCI, Waddenzee SCI, and Westerschelde & Saeftinghe SCI as a result of piling from the Project alone during construction and decommissioning and therefore, subject to natural change, the population of grey seal will be maintained in the long-term.**

Underwater noise from UXO clearance

~~267.~~278. Experience from other OWF projects in the southern North Sea suggests that there is the potential for UXO to occur within the array and export cable corridor for the Project and that it is likely that UXO clearance work may be required in some cases; this would need to be confirmed by site-specific pre-construction surveys and a separate Marine Licence (with associated EPS Licence application) will be applied for pre-construction for the clearance of any UXO, if required.

~~268.~~279. It should be noted that the preferred action for the Applicant is for no UXO clearance to occur; however, should UXO be detected during the pre-construction geophysical survey, clearance (including a detonation option) may be required prior to construction as a safety measure. Any required UXO clearance would take place within the pre-construction phase (broadly 2025 - 2028), with the proposed date for piling being 2027. Therefore, the earliest any such clearance may occur is anticipated to be in early 2026.

~~269.~~280. As there is no certainty regarding the number, location or nature of any UXO found (and requiring clearance) precautionary assumptions are made here for assessment purposes, based on experience at other offshore wind projects. On a precautionary basis, UXO clearance for the purposes of this assessment is considered to involve the high-order detonation of the UXO in situ to make it safe to undertake construction works in the surrounding area. However, it should be noted that it is expected that low order techniques will be used as the primary clearance method at the point of activities occurring, following the trend towards this method as best-practice within the industry. This is expected to result in a significantly reduced magnitude of effect.

~~270.~~281. Consideration of impact from UXO is made on a risk of injury basis (defined as risk of onset of PTS) and a disturbance element. Part 6, Volume 1, Chapter 11: Marine Mammals considers how onset of PTS is defined and predicted in Section 11.3.6.1~~4.7~~, with that information not repeated here. Depending on the charge weight of the UXO, it is clear (based on Table 11.15 of that Chapter) that the potential range of PTS for an unmitigated high order detonation is potentially high. The occurrence of PTS caused by UXO would be unrecoverable. Therefore, should UXO clearance be required for the Project, it is expected that in line with the ES there will be a requirement to implement a UXO specific MMMP to ensure that the risk of PTS is reduced to negligible. The exact mitigation measures contained with the UXO MMMP are yet to be determined and will be agreed with the Marine Management Organisation (MMO) in consultation with Natural England.

~~271.~~282. Further, although UXO clearance is not currently proposed, if it is required, the primary method of clearance would likely be using low-order detonation (small shape charge to penetrate the casing and vaporize the explosive material) as stated as the preferential method in the position statement on UXO clearance (Department for Business, Energy, and Industrial Strategy, now known as the Department for Energy Security and Net Zero, 2022) as opposed to the commonly used high-order detonation where the explosive material is detonated. It is known that low-order deflagration detonations produce underwater noise that is over 20dB lower than high-order detonation (Robinson et al., 2020).

~~272.~~283. Natural England and JNCC advise that a buffer of 26km around the source location is used to determine the impact area from high-order UXO clearance with respect to disturbance of harbour porpoise in the Southern North Sea SAC. In line with the justification presented within Part 6, Volume 1, Chapter 11: Marine Mammals a 5km buffer for low-order has been used. In the absence of agreed metrics for the use of other marine mammal species for disturbance and given a lack of empirical data on the likelihood of response to explosives, this 26km radius has been applied for high-order detonations (considered to be the worst case), and a 5km buffer for low-order detonations. This approach is consistent with Part 6, Volume 1, Chapter 11: Marine Mammals.

~~273.~~284. Section 11.6.1.1~~4.7~~ of Part 6, Volume 1, Chapter 11: Marine Mammals concluded the significance of impact for all marine mammals from the risk of PTS from UXO detonation to be negligible, rising slightly to minor for disturbance in harbour porpoise, harbour seal and grey seal.

~~274.~~285. In HRA terms, the potential for impact will further depend on the location(s) of any UXO relative to a designated site, particularly for harbour porpoise and the SNS SAC. The assessment below is made for each of the designated sites and marine mammal species screened in for potential LSE for underwater noise during construction and decommissioning.

Consideration of harbour porpoise

~~275.~~286. The only designated site screened in for harbour porpoise is the SNS SAC. The conservation objectives for that site are given in paragraph 211~~207~~.

~~276.~~287. Given that the anticipated requirement for a UXO-MMMP (Table 6.1) will provide for appropriate mitigation to minimise the risk of injury or mortality in harbour porpoise during UXO clearance (with prior approval by the regulator), **it is concluded that the Project alone does not have an AEoI on the viability of harbour porpoise as a result of mortality or injury (the first conservation objective) resulting from UXO clearance at the Project alone during construction and decommissioning in relation to the SNS SAC and therefore ensures that, subject to natural change, harbour porpoise will be maintained as a 'viable component' of the site in the long-term.**

~~277.~~288. The second conservation objective for the SNS SAC refers to 'no significant disturbance of the species', and as highlighted above that disturbance is assessed here through the application of the 26km EDR.

~~278.~~289. The seasonal nature of the SNS SAC is important here, with the Project ~~array~~ array and WTG areas being more than 26km distant from the winter extents of the SNS SAC at its closest point. As such, any UXO clearance within the array area that takes place in the winter season (October-March inclusive) would fall outside the need for assessment here. Any UXO clearance within the Project Order Limits~~-~~ during the summer season (April-September inclusive) would, however require consideration through the HRA process. For UXO clearance within the offshore ECC, any that fall within 26km of the SNS SAC boundary would require consideration through the HRA process - with seasonal variability depending on UXO location relative to the seasonal extents of the SNS SAC. Towards the western end of the export cable corridor, provided any UXO are more than 26km distant from the SNS SAC boundary (summer and/or winter seasonal extents), there would similarly be areas where HRA considerations would not apply or only apply in the summer season. The assessment below is made based on maximum design scenario assumptions.

~~279.~~290. For UXO clearance within the Project ~~array~~ WTG area, the maximum overlap (based on high-order detonations with the largest charge size as dictated by the MDS described in Table 6.1) per individual UXO clearance with the summer extents of the SNS SAC would be 1,726.3km^2 from the closest point of the WTG area ~~northeast location~~ (6.38% of the summer extents). Should five UXO be cleared within a single day, located such to result in the maximum possible footprint within the summer extents, that could result in up to 31.9% of the summer extent being affected. Such locations would be managed through the SIP process to avoid any such threshold exceedance. There is therefore capacity within the threshold (20% per 24-hours) for more than one UXO detonation to occur within the Project ~~array~~ WTG area, with the maximum number of potential detonations that could be cleared within the threshold being dependant on size, location, method of clearance and in-combination risk. The use of a SIP will ensure that should multiple UXO be cleared per day, locations would be managed to ensure the thresholds would not be exceeded.

~~280.~~291. For a UXO detonation within the export cable corridor, the potential for overlap with the summer or winter extents of the SNS SAC varies with proximity (the further west the UXO is located, the smaller the potential for overlap). For UXO clearance in the overall export cable corridor, the values in the summer season vary (depending on location) between 0km^2 (0%) and 149km^2 (0.55%). There is no overlap at all with the winter season area. As noted above, it is clear that capacity exists for clearance of more than one UXO within the Offshore ECC per 24-hours without exceeding the 20% daily threshold (dependant on location and in-combination risk), with the use of a SIP ensuring that should multiple UXO be cleared per day, locations would be managed to ensure the thresholds would not be exceeded.

~~281.~~292. For the 10% temporal value, it is pertinent to note that on any given day the 10% value could only be exceeded if multiple UXO were detonated within that timeframe, as a single UXO as a maximum would result in 6.38% of the SAC affected. Should UXO clearance be undertaken at a rate greater than one per day (including up to the five per day noted above), this would reduce the seasonal contribution by condensing the timeframe of works.

~~282.~~293. Whilst there is no information on the number of UXO that could be required to be cleared, for the purposes of a realistic assessment, it has been assumed that up to 50 UXO detonations may be required, with one per day as a worst case. The maximum seasonal effect in the summer (assuming up to 6.83% per day for up to 50 days of the 183 day season) would therefore be 1.87%, with no maximum seasonal effect on the SNS SAC winter area. This value is precautionary (assuming a worst case of effect each time) and well within the 10% seasonal threshold.

~~283.~~294. **Therefore, it is concluded that there will not be an AEoI in relation to disturbance on the Conservation Objective for harbour porpoise for the SNS SAC as a result of UXO clearance from the Project alone and therefore, subject to natural change, in the long-term, there will be no significant disturbance of harbour porpoise.**

~~284.~~295. The third conservation objective is focused on maintaining the supporting habitats and processes, together with availability of harbour porpoise prey, within the SNS SAC. The Advice on Activities (JNCC, 2019) refers to supporting habitats as 'the characteristics of the seabed and water column' in the context of 'ensuring prey is maintained within the site'. Potential for supporting habitats and processes to be affected are considered within Part 6, Volume 1, Chapter 7: Marine Physical Processes. That chapter has concluded at most a minor adverse effect (which is not considered significant in EIA terms). For example, the chapter concluded no measurable effect on wave conditions at the coast and no impact on longshore drift. The scale of any potential effect on habitat and physical processes specific to the SNS SAC from individual UXO clearance would be highly localised to the UXO, contained within the scale of any wider project level effect, would be spatially much smaller than the overall SNS SAC and therefore of trivial consequence for physical processes at that scale. Potential for prey species to be affected are considered within Part 6, Volume 1, Chapter 10: Fish and Shellfish Ecology. As the impacts to prey are highly localised, short-term and recoverable that chapter considers that there is no significance of effects on fish species. Additionally, as marine mammals are generalist feeders it is considered that even in the unlikely event that there is a minor impact on fish species, it will not result in a population level effect on any marine mammal species.

~~285.~~296. There is, **therefore, no AEoI to the supporting habitats and processes relevant to harbour porpoise and their prey for the SNS SAC as a result of UXO clearance from the Project alone during construction and decommissioning and therefore, subject to natural change, the availability and density of suitable harbour porpoise prey will be maintained in the long-term.**

Consideration of harbour seal

~~286.~~297. The sites for which harbour seal are screened in for potential LSE with respect to underwater noise are highlighted under the assessment for piling above, including confirmation that the conservation objectives as applied to UK sites encompass the relevant measures for transboundary sites. Therefore, the assessment that follows is presented following the UK conservation objective requirements to minimise repetition.

~~287.~~298. As regards the conservation objectives that address the natural habitats of harbour seal, these are concerned with the physical habitat and the species contained within. The potential for impact on the physical habitat is considered within Part 6, Volume 1, Chapter 7: Marine Physical Processes. That chapter has concluded slight adverse significance in all cases (which is not significant in EIA terms), certainly insufficient to reach any habitat designated for harbour seal. Similarly, Part 6, Volume 1, Chapter 11: Marine Mammals found the potential for effect in relation to harbour seal prey availability to be negligible at most, with the effect therefore not taken forward further in the assessment, as it will not lead to a significant effect. The harbour seal SACs are all located at distance from the Project (at least 90.5km for the closest, the Klaverbank SCI), with the potential for effect on the habitats within the sites therefore inconsequential.

~~288.~~299. **There is, therefore, no AEoI to the supporting habitats relevant to harbour seal and their prey as a result of UXO clearance from the Project alone during construction and decommissioning and therefore, subject to natural change, the supporting habitat for harbour seal prey will be maintained in the long-term.**

~~289.~~300. The potential to affect the population and distribution of harbour seal is considered within Part 6, Volume 1, Chapter 11: Marine Mammals with respect to potential for injury (risk of onset of PTS) and disturbance.

~~290.~~301. As for consideration of harbour porpoise above, the risk of onset of PTS in all marine mammal species will be addressed by the anticipated requirement for a UXO-specific MMMP, which will provide for appropriate mitigation to minimise the risk of injury or mortality in harbour seal during UXO clearance (requiring prior approval by the regulator). **Therefore, it is concluded that the Project alone during construction and decommissioning does not have an AEoI on harbour seal as a result of mortality or injury resulting from UXO clearance at the Project alone.**

~~291.~~302. Part 6, Volume 1, Chapter 11: Marine Mammals considers that using TTS-onset as a proxy for disturbance is the most appropriate method for considering disturbance for grey seal. Table 11.18 within that chapter presents the impact ranges, number of animals disturbed and the percentage of the MU impacted, for a range of UXO charge sizes. The counts will vary with the size of UXO, however given the very short duration, intermittent nature and high reversibility of the effect, the significance was concluded to be slight, which is not significant in EIA terms.

~~292.~~303. With respect to the potential to affect harbour seals associated with a specific designated site, neither the Klaverbank SCI citation nor the Doggersbank (Netherlands) citation provide a population size. For the Wash and North Norfolk SAC, the citation has a population of 1,001-10,000. SCOS (2018) found that the population had risen between 2006 and 2012, with the more recent SCOS 2022 indicating a declining Wash population of around 2,758, or 3,530 when factoring in “at-sea” seals (following Russel et al., 2016).

~~293.~~304. The ES considered that harbour seal are not at risk of PTS from UXO detonations, however numbers were calculated for the risk of disturbance during UXO clearance (considering high-order detonation on the largest charge size considered as the worst case), with 276 harbour seals disturbed (equivalent to 5.7% of the Management Unit reference population). With respect to the Wash and North Norfolk SAC citation population, 276 individuals represents approximately 7.8% of the population (based on a population of 3,530).

~~294.~~305. It is considered within Part 6, Volume 1, Chapter 11: Marine Mammals that for even the most vulnerable harbour seals (the 'weened of the year' following the post weening fast) there must be ~60 days of repeated disturbance before there was expected to be any significant effect on the probability of survival. Given the discrete nature of UXO events, it is considered that there would be no likelihood for this threshold do be reached. It is also considered unlikely that individual harbour seals would repeatedly return to a site where they had been previously displaced from in order to experience this number of days of repeated disturbance. Furthermore, Part 6, Volume 1, Chapter 11: Marine Mammals also found that the area of sea within which noise from the Project is sufficient to result in disturbance of harbour seal has a low density of harbour seals, and is not considered an important foraging ground for the species. Overall, it is generally considered that even if any disturbance that does occur is likely to be short lived and temporary in nature. Further, the number of animals temporarily affected is small in the context of both the overall population and at designated site level populations (where known). Therefore, considering the low potential for disturbance from very short term, temporary and intermittent occurrences, all located within an area of sea not considered important for harbour seals, means that the potential for effect is considered not significant.

~~295.~~306. There is, **therefore, no AEoI for the harbour seal population and distribution with respect to the Wash and North Norfolk Coast SAC, Doggersbank (Netherlands) SAC and Klaverbank SCI as a result of UXO clearance from the Project alone during construction and decommissioning and therefore, subject to natural change, the population of harbour seal will be maintained in the long-term.**

Consideration of grey seal

~~296.~~307. The sites for which grey seal are screened in for potential LSE with respect to underwater noise are highlighted under the assessment for piling above, including confirmation that the conservation objectives as applied to UK sites encompass the relevant measures for transboundary sites. Therefore, the assessment that follows is presented following the UK conservation objective requirements to minimise repetition.

~~297.~~308. As regards the conservation objectives that address the natural habitats of grey seal (the first four bullet points for UK site conservation objectives), these are concerned with the physical habitat and the species contained within. The potential for impact on the physical habitat is considered within Part 6, Volume 1, Chapter 7: Marine Physical Processes. That chapter has concluded minor adverse significance in all cases (which is not significant in EIA terms), certainly insufficient to reach any habitat designated for grey seal. Similarly, Part 6, Volume 1, Chapter 11: Marine Mammals found the potential for effect in relation to grey seal prey availability to be negligible at most, with the effect therefore not taken forward further in the assessment, as it will not lead to a significant effect. Given the distance between designated sites and the Project, combined with the large overall habitat availability, the minor or negligible changes found in the ES, no significant effect for grey seal habitat or prey, and in the context of relevant designated sites, no potential for significant or adverse effect has been identified.

~~298.~~309. There is, **therefore, no AEoI to the supporting habitats relevant to grey seal and their prey for the Humber Estuary SAC and Ramsar, Berwickshire and North Northumberland Coast SAC, Doggersbank (Netherlands) SAC, Klaverbank SCI, Bancs des Flandres SCI, Vlaamse Banken SCI, SBZ 1 SCI, SBZ 2 SCI, SBZ 3 SCI, Vlakte van de Raan SCI, Westerschelde & Saeftinghe SCI, Voordelta SCI, Noordzeekustzone SCI and Waddenzee SCI from the Project alone from UXO clearance and therefore, subject to natural change, the supporting habitat for grey seal prey will be maintained in the long-term.**

~~299.~~310. The potential to affect the population and distribution of grey seal is considered within Part 6, Volume 1, Chapter 11: Marine Mammals with respect to potential for injury (risk of onset of PTS) and disturbance.

~~300.~~311. As for consideration of harbour porpoise, and harbour seal above, the risk of onset of PTS in all marine mammal species will be addressed by the anticipated requirement for a UXO-MMMP, which will provide for appropriate mitigation to minimise the risk of injury or mortality in grey seal during UXO clearance (requiring prior approval by the regulator). **Therefore, it is concluded that the Project alone during construction and decommissioning does not have an AEoI on grey seal as a result of mortality or injury resulting from UXO clearance at the Project alone.**

~~301.~~312. Part 6, Volume 1, Chapter 11: Marine Mammals considers that using TTS-onset as a proxy for disturbance is the most appropriate method for considering disturbance for grey seal. Table 11.18 within that chapter presents the impact ranges, number of animals disturbed and the percentage of the MU impacted, for a range of UXO charge sizes. The counts will vary with the size of UXO, however given the very short duration, intermittent nature and high reversibility of the effect, the significance was concluded to be minor, which is not significant in EIA terms.

~~302.~~313. The ES considered that grey seal are not at risk of PTS from UXO detonations, however numbers were calculated for the risk of disturbance during UXO clearance (considering high-order detonation on the largest charge size considered as the worst case), with 1,805 grey seals disturbed (equivalent to 2.8% of the Management Unit reference population). With respect to the Humber Estuary SAC citation population, 1,805 individuals represents approximately 13.1% of the population (based on a population of 13,769).

~~303.~~314. It is considered within Part 6, Volume 1, Chapter 11: Marine Mammals that for even the most vulnerable harbour seals (the 'weened of the year' following the post weening fast) there must be ~60 days of repeated disturbance before there was expected to be any significant effect on the probability of survival. Given the discrete nature of UXO events, it is considered that there would be no likelihood for this threshold do be reached. It is also considered unlikely that individual harbour seals would repeatedly return to a site where they had been previously displaced from in order to experience this number of days of repeated disturbance.

~~304.~~315. Furthermore, Part 6, Volume 1, Chapter 11: Marine Mammals also found that the area of sea within which noise sufficient to result in disturbance of grey seal has a low density of grey seals, and is not considered an important foraging ground for the species. Grey seals are also highly adaptable to a changing environment and are capable of adjusting their metabolic rate and foraging tactics, to compensate for different periods of energy demand and supply (Beck et al., 2003; Sparling et al., 2006). Grey seals are also very wide ranging and are capable of moving large distances between different haul out and foraging regions (Russell et al., 2013). Therefore, any disturbance and displacement is unlikely to result in a significant reduction in energy intake. Overall, it is generally considered that even if any disturbance that does occur is likely to be short lived and temporary in nature. Further, the number of animals temporarily affected is small in the context of both the overall population and at designated site level populations (where known). Therefore, considering the low potential for disturbance from very short term, temporary and intermittent occurrences, all located within an area of sea not considered important for grey seals, means that the potential for effect is considered not significant.

~~305.~~316. Each individual UXO clearance will result in a very short term source of noise, occurring intermittently across the construction phase. The number of animals that may be disturbed as a result of a single clearance is a worst case for a coastal UXO clearance. As noted above, should grey seals respond to the noise in terms of temporary displacement, alternative feeding grounds are available. Such a very short duration, intermittent and fully reversible effect on such a small proportion of individual site populations is therefore not considered sufficient to result in more than a short term, localised and temporary change in the distribution of grey seal associated with individual designated sites.

~~306.~~317. There is**, therefore, no AEoI for grey seal population and distribution with respect to the Humber Estuary SAC and Ramsar, Berwickshire and North Northumberland Coast SAC, Doggersbank (Netherlands) SAC, Klaverbank SCI, Bancs des Flandres SCI, Vlaamse Banken SCI, SBZ 1 SCI, SBZ 2 SCI, SBZ 3 SCI, Vlakte van de Raan SCI, Westerschelde & Saeftinghe SCI, Voordelta SCI, Noordzeekustzone SCI and Waddenzee SCI from the Project alone during UXO clearance and therefore, subject to natural change, the population of grey seal will be maintained in the long-term.**

Consideration of bottlenose dolphin

~~307.~~318. The sites for which bottlenose dolphin are screened in for potential LSE with respect to underwater noise are highlighted under the assessment for piling above, including confirmation that the conservation objectives as applied to UK sites encompass the relevant measures for transboundary sites. Therefore, the assessment that follows is presented following the UK conservation objective requirements to minimise repetition.

~~308.~~319. Based on the largest modelled charge size for UXO clearance and the of PTS, there is no predicted direct impact on bottlenose dolphins based on conclusions made in Part 6, Volume 1, Chapter 11: Marine Mammals. The unmitigated magnitude of these impacts are therefore considered to be negligible (adverse) for bottlenose dolphin, and UXO detonation is not a pathway for impact on the designated sites, there is negligible risk of LSE.

~~309.~~320. When using the 26km EDR for disturbance from high order detonations, the ES concludes that approximately 89 bottlenose dolphins would be disturbed by the clearance works, equating to 4% of the MU (not the same MU as the designated site). When using the 5km EDR for disturbance from low order detonations , the ES concludes that its likely no bottlenose dolphins will be disturbed by low-order UXO clearance. It is recognised that despite the bottlenose dolphin MU in association with the designated site being different from the MU where the activities are being carried out is located, there is the potential for the population to cross between MU's. However, with consideration of the distance from the site to the other MU and designated site, this risk and pathway is concluded to be a negligible risk.

~~310.~~321. Overall, with consideration of the distance from the designated site, the small proportion of the MU expected to be disturbed by the clearance, and that the disturbance will be short-term/ intermittent, we conclude that there is**, therefore, no AEoI on the conservation objectives for bottlenose dolphin with respect to the Moray Firth SAC from the Project alone during UXO clearance and therefore, subject to natural change, the population of bottlenose dolphin will be maintained in the long-term.**

Underwater noise from geophysical and seismic survey

~~311.~~322. Geophysical survey, by definition, results in the emission of underwater noise. The pre-construction geophysical survey for the Project is likely to occur within the pre-construction phase, broadly 2026 - 2027, however no specific information is yet available (in terms of timing, nature, extent or duration). As noted above, the use of a SIP ensures that the assessment for the SNS SAC will be revisited for the Project according to the timeframe set out within the In-principle SNS SAC SIP and will therefore include geophysical survey known at that time.

~~312.~~323. The type of geophysical survey carried out for OWFs is not typically considered likely to result in PTS in marine mammals, as such a risk is mainly derived from surveys in water >200m and/or using airguns (not typical of OWFs within the North Sea). If a risk were deemed to be present (which would be related to the type and nature of any seismic survey eventually proposed) that risk would be addressed through appropriate licensing measures at that time. **With respect to PTS risk for all marine mammal species, a conclusion of no AEoI for all sites and marine mammal features screened in can therefore be drawn from geophysical and seismic surveys.**

~~313.~~324. In the final guidance on noise disturbance in the SNS SAC, it was determined that some types of marine survey can be sufficient to result in an EDR, with airgun surveys connected to an EDR of 12km and some sub-bottom profiler and multi-beam surveys connected to an EDR of 5km. It is clear that the need for an individual geophysical survey to be subject to HRA would need to be assessed on a case-by-case basis (to be addressed for the Project through the SIP process, as noted above). CSA (2020) demonstrated that the maximum distance to the disturbance threshold (120dB SPLrms) was 141m for a medium sub-bottom profiler so it is not anticipated to result in any significant disturbance or contribution to the thresholds. Additionally, whilst the frequencies of the equipment may overlap with the auditory band for harbour porpoise, they are in the mid to high frequency range so the level of attenuation is rapid. The equipment often used focused beam widths (less than 15 degrees) which limits horizontal propagation within the water column therefore minimising potential disturbance further.

~~314.~~325. To that end, the potential for disturbance in marine mammals from geophysical surveys (given that any such surveys for the Project would not be expected to contribute to the thresholds) are addressed further in the in-combination section only (where plans for such surveys are known). Overall, it is concluded that **there is no potential for AEoI on the conservation objectives for harbour porpoise at the SNS SAC from underwater noise from UXO clearance.**

Underwater noise from seabed preparation and cable installation

~~315.~~326. While percussive piling and UXO clearance will be the worst case noise source during the construction phase, there will also be several other construction activities that will produce underwater noise. These include dredging, drilling, cable laying, rock placement and trenching (vessel disturbance is assessed separately).

~~316.~~327. A simple assessment of the noise impacts from non-piling noise is presented in Volume 2, Annex 3.2: Underwater Noise Assessment. Using the non-impulsive weighted SELcum PTS and TTS thresholds from Southall et al., (2019) resulted in estimated PTS and TTS impact ranges of <100 m for all marine mammals species for each non-piling construction activity. These values mean that animals would have to stay within these very small ranges for 24-hours before they experienced injury, which is an extremely unlikely scenario as it is far more likely that any marine mammal within the injury zone would move away from the vicinity of the vessel and the construction activity.

~~317.~~328. The potential effects of cabling techniques used in the offshore windfarm industry was reviewed in a report by Business, Enterprise and Regulatory Reform (BERR) in association with DEFRA (BERR and DEFRA, 2008). The report reviewed various cable types and installation methods including burial ploughs, machines, ROVs and sleds and the burial methods themselves including jetting, rock ripping, and dredging. The review concluded that it would be "highly unlikely that cable installation would produce noise at a level that would cause a behavioural reaction in marine mammals". It is also highly likely that the presence of vessels will act as a deterrent and disturb marine mammals out of the area before any non-piling construction activity begins (as has been documented for harbour porpoise, Brandt et al., 2018). The minimal potential for impact is supported by the conclusion in the ES (Part 6, Volume 1, Chapter 11: Marine Mammals which summarises impacts scoped out of assessment), which found that no likely significant effects were identified at ES and therefore the effect will not be considered in detail within the ES.

~~318.~~329. Given the minimal potential for impact, **a conclusion of no AEoI to the conservation objectives for all marine mammals at all identified sites in relation to underwater noise during seabed preparation and cable laying from the Project alone during construction and decommissioning has been drawn and therefore, subject to natural change, the marine mammal features associated with all relevant sites will be maintained in the long-term.**

9.2.4.2 Vessel disturbance

~~319.~~330. The potential for an AEoI as a result of vessel disturbance on marine mammals during construction and decommissioning relates to the following designated sites and the relevant feature (i.e. those features screened in for potential LSE):

- Southern North Sea SAC (harbour porpoise);
- Moray Firth SAC (bottlenose dolphin)
- Humber Estuary SAC (grey seal);
- Berwickshire and North Northumberland Coast SAC (grey seal);
- The Wash and North Norfolk Coast SAC (harbour seal);
- Humber Estuary Ramsar (grey seal);
- Transboundary harbour seal sites (Doggersbank (Netherlands) SAC and Klaverbank SCI); and
- Transboundary grey seal sites (Bancs des Flandres SAC, Doggersbank (Netherlands) SAC, Klaverbank SCI, Vlaamse Banken SCI, SBZ 1 SCI, SBZ 2 SCI, SBZ 3 SCI, Vlakte van de Raan SCI, Westerschelde & Saeftinghe SCI, Voordelta SCI, Noordzeekustzone SCI, Waddenzee SCI).

~~320.~~331. The potential for LSE during decommissioning would be similar to and potentially less than those outlined in the construction phase. The potential for vessel related disturbance on marine mammals alone has been assessed within the existing project literature (see Part 6, Volume 1, Chapter 11: Marine Mammals), with a summary of that provided here.

~~321.~~332. The area surrounding the Project already experiences a reasonable amount of vessel traffic throughout the year. In the summer there is an average of 64-65 unique vessels per day passing through the study area (array area + 10nm buffer), and 10 unique vessels per day through the array area with less in the winter (see Part 6, Volume 1, Chapter 15: Shipping and Navigation). Therefore, the introduction of vessels during construction is not a novel impact for marine mammals present in the area.

~~322.~~333. Increased vessel traffic during construction has the potential to result in disturbance of marine mammals. Disturbance from vessel noise is only likely where noise from vessel movements is greater than the background ambient noise. The busiest period during construction in terms of vessel traffic would be when up to ten vessels are present in a given 5km^2 construction area. This level of activity is unlikely to occur across the entire array area at any one time, rather this intensity is expected across approximately three or four 5km^2 blocks. The piling window is expected to fall within the window of approximately Q4 2027 - Q4 2029. During the period of piling operations, it is considered unlikely that vessel noise will impact marine mammal receptors at levels additional to the piling activity itself.

~~323.~~334. The magnitude and characteristics of vessel noise varies depending on ship type, ship size, mode of propulsion, operational factors and speed. Vessels of varying size produce different frequencies, generally becoming lower frequency with increasing size. The distance at which animals may react is difficult to predict and behavioural responses can vary a great deal depending on context.

~~324.~~335. There are very few studies that indicate a critical level of activity in relation to harbour porpoise density, but an analysis presented in Heinänen and Skov (2015) suggested that harbour porpoise density was significantly lower in areas with vessel transit rates of greater than 80 per day. Vessel traffic in the array area, even considering the addition of construction traffic (a maximum of ten at any one time), will still be below this figure.

~~325.~~336. It is therefore not expected that the level of vessel activity during the construction of the Project would cause a significant increase in the risk of disturbance by vessels or collision risk with vessels. The adoption of a vessel management plan (Table 6.1) that includes preferred transit routes and guidance for vessel operations in the vicinity of marine mammals and around seal haul-outs will minimise the potential for any impact. The impact is predicted to be of local, short-term duration and intermittent. It is expected that any marine mammals that are disturbed as a result of vessel presence will return to the area once the vessel disturbance has ended.

~~326.~~337. It is worth noting that overall, Part 6, Volume 1, Chapter 11: Marine Mammals found that the effect (in terms of disturbance) is of minor adverse significance, which is not significant in EIA terms.

Consideration of harbour porpoise

~~327.~~338. Harbour porpoise are screened in for potential LSE with respect to vessel disturbance during construction and decommissioning for the following sites:

- The Southern North Sea SAC

~~328.~~339. The existing vessel traffic movements within the Project array area (an average of ten unique vessels per day passing through the array area in the summer and a reduced number in the winter), combined with up to ten vessels per $5km^2$ block during construction, remains well below the approximately 80 movements per day cited in Heinänen and Skov (2015) as having potential to lead to a negative effect on harbour porpoise density.

~~329.~~340. The relevant conservation objectives for harbour porpoise are presented within paragraph 211~~207~~.

~~330.~~341. The first two conservation objectives address risk of injury and disturbance. Part 6, Volume 1, Chapter 11: Marine Mammals found (in the context of existing shipping levels, the increase in those levels proposed during construction at the Project and the relevant project mitigation) the increased vessel traffic associated with construction (and decommissioning) of the Project is insufficient to result in mortality, injury or significant disturbance in marine mammals. That conclusion is supported at a site-based level by Heinänen and Skov (2015) as above.

~~331.~~342. The third conservation objective is focused on maintaining the supporting habitats and processes, together with availability of harbour porpoise prey, within the SNS SAC. The Advice on Activities refers to supporting habitats as 'the characteristics of the seabed and water column' in the context of 'ensuring prey is maintained within the site'. Shipping will not lead to a direct impact on the habitats and processes. Impacts to prey species are considered separately within the Changes to Prey assessment, which concluded no AEoI to the supporting prey species for harbour porpoise within the SNS SAC.

~~332.~~343. There is, **therefore, no AEoI relevant to harbour porpoise for the SNS SAC from vessel disturbance from the Project alone during construction and decommissioning and therefore, subject to natural change, the harbour porpoise will be maintained in the long-term.**

Consideration of harbour seal and grey seal

~~333.~~344. Harbour seal and grey seal are screened in for potential LSE with respect to vessel disturbance during construction and decommissioning for the following sites:

- The Wash and North Norfolk Coast SAC (harbour seal);
- Humber Estuary SAC (grey seal);
- Humber Estuary Ramsar (grey seal);
- Berwickshire and North Northumberland Coast SAC (grey seal);
- Transboundary harbour seal sites (Doggersbank (Netherlands) SAC and Klaverbank SCI); and
- Transboundary grey seal sites (Bancs des Flandres SAC, Doggersbank (Netherlands) SAC, Klaverbank SCI, Vlaamse Banken SCI, SBZ 1 SCI, SBZ 2 SCI, SBZ 3 SCI, Vlakte van de Raan SCI, Westerschelde & Saeftinghe SCI, Voordelta SCI, Noordzeekustzone SCI, Waddenzee SCI).

~~334.~~345. The potential for LSE during decommissioning would be similar to and potentially less than those outlined in the construction phase. The relevant conservation objectives for harbour seal and grey seal are presented in paragraphs 241~~237~~ and 255~~251~~ respectively.

~~335.~~346. As regards the conservation objectives that address the natural habitats of harbour seal and grey seal, these are concerned with the physical habitat and the species contained within. The potential for impact on the physical habitat is considered within Part 6, Volume 1, Chapter 7: Marine Physical Processes. That chapter has concluded slight adverse significance in all cases (which is not significant in EIA terms) and certainly insufficient to reach habitats designated for harbour and grey seal. Similarly, Part 6, Volume 1, Chapter 11: Marine Mammals found the potential for effect in relation to harbour seal and grey seal prey availability to be negligible at most, with the effect therefore not taken forward further in the assessment, as it will not lead to a significant effect.

~~336.~~347. There is, **therefore, no AEoI to the supporting habitats relevant to both harbour seal and grey seal and their prey for the designated sites identified above due to vessel disturbance from the Project alone during construction and decommissioning and therefore, subject to natural change, the supporting habitat for harbour seal and grey seal prey will be maintained in the long-term.**

~~337.~~348. The potential to affect the population and distribution of harbour seal and grey seal (the remaining conservation objectives) is considered within Part 6, Volume 1, Chapter 11: Marine Mammals with respect to potential for mortality, injury (risk of onset of PTS) and disturbance. No indication was found that disturbance from shipping can result in risk of onset of PTS in marine mammals, with consideration given to the risk of disturbance below.

~~338.~~349. As regards the risk of disturbance, it is clear from the summary presented above (which draws on Part 6, Volume 1, Chapter 11: Marine Mammals) that (in the context of existing shipping levels, the increase in those levels proposed during construction at the Project and the relevant project mitigation) the increased vessel traffic associated with construction (and decommissioning) of the Project is insufficient to result in mortality, injury or significant disturbance in marine mammals. Therefore, even if all such disturbance were attributed to a single SAC population, no significant effect would result.

~~339.~~350. There is, **therefore, no AEoI relevant to both harbour seal and grey seal and their prey for the designated sites identified above due to vessel disturbance from the Project alone during construction and decommissioning and therefore, subject to natural change, the harbour seal and grey seal will be maintained in the long-term.**

Consideration of bottlenose dolphin

~~340.~~351. Bottlenose dolphin are screened in for potential LSE with respect to vessel disturbance during construction and decommissioning for the following sites:

- Moray Firth SAC (bottlenose dolphin);

~~341.~~352. Modelling of the impacts of vessel disturbance on bottlenose dolphins within the Moray Firth SAC concluded it has no negative impact on the local population (Lusseau et al., 2011).

~~342.~~353. It is recognised that there is the potential for the population associated with the Moray Firth SAC to travel into the GNS MU, this would likely be a small proportion of the population. However, with consideration that the works are located within the GNS MU and are >500km from the designated site, there is, **therefore, no AEoI relevant to bottlenose dolphin for the Moray Firth SAC due to vessel disturbance from the Project alone during construction and decommissioning and therefore, subject to natural change, the bottlenose dolphin feature will be maintained in the long-term.**

9.2.4.3 Vessel Collision risk

~~343.~~354. The potential for an AEoI as a result of vessel collision risk with marine mammals during construction and decommissioning relates to the following designated sites and the relevant feature (i.e. those features screened in for potential LSE):

- Southern North Sea SAC (harbour porpoise);
- Moray Firth SAC (bottlenose dolphin);
- Humber Estuary SAC (grey seal);
- Berwickshire and North Northumberland Coast SAC (grey seal);
- The Wash and North Norfolk Coast SAC (harbour seal);
- Humber Estuary Ramsar (grey seal);
- Transboundary harbour seal sites (Doggersbank (Netherlands) SAC and Klaverbank SCI); and
- Transboundary grey seal sites (Bancs des Flandres SAC, Doggersbank (Netherlands) SAC, Klaverbank SCI, Vlaamse Banken SCI, SBZ 1 SCI, SBZ 2 SCI, SBZ 3 SCI, Vlakte van de Raan SCI, Westerschelde & Saeftinghe SCI, Voordelta SCI, Noordzeekustzone SCI, Waddenzee SCI).

~~344.~~355. The potential for LSE during decommissioning would be similar to and potentially less than those outlined in the construction phase. It should be noted that the potential for collision risk is limited to individuals that may come into direct contact with vessels, in comparison to consideration of, for example, disturbance from underwater noise, where individuals could be disturbed at distance from source. The sites screened in for potential LSE for collision risk are therefore limited to those where potential for direct connectivity between individuals from a designated site and the Project array, Offshore ECC, ANS areas, ORCP areas, biogenic reef areas, and/or vessel transit routes are identified.

~~345.~~356. The potential for vessel collision risk with marine mammals alone has been assessed within the existing project literature (see Part 6, Volume 1, Chapter 11: Marine Mammals), with a summary of that provided here.

~~346.~~357. The area surrounding the Project already experiences a reasonable amount of vessel traffic throughout the year, with an average of ten vessels per day passing through the array area in the summer and a reduced number in winter (see Part 6, Volume 1, Chapter 15: Shipping and Navigation). Therefore, the introduction of additional vessels during construction is not a novel impact for marine mammals present in the area.

~~347.~~358. During construction of the windfarm, a potential source of impact from increased vessel activity is physical trauma from collision with a boat or ship. These injuries include blunt trauma to the body or injuries consistent with propeller strikes. The risk of collision of marine mammals with vessels would be directly influenced by the type of vessel and the speed with which it is travelling (Laist et al., 2001) and indirectly by ambient noise levels underwater and the behaviour the marine mammal is engaged in.

~~348.~~359. There is currently a lack of information on the frequency of occurrence of vessel collisions as a source of marine mammal mortality. There is little evidence from marine mammals stranded in the UK that injury from vessel collisions is an important source of mortality. The UK Cetacean Strandings Investigation Programme (CSIP) documents the annual number of reported strandings and the cause of death for those individuals examined at post-mortem. The CSIP data shows that very few strandings have been attributed to vessel collisions, therefore, while there is evidence that mortality from vessel collisions can and does occur, it is not considered to be a key source of mortality highlighted from post-mortem examinations. However, it is important to note that the strandings data are biased to those carcases that wash ashore for collection and therefore may not be representative.

~~349.~~360. Harbour porpoises, dolphins and seals are relatively small and highly mobile, and given observed responses to noise, are expected to detect vessels in close proximity and largely avoid collision. Predictability of vessel movement by marine mammals is known to be a key aspect in minimising the potential risks imposed by vessel traffic (e.g. Nowacek et al., 2001; Lusseau, 2003; 2006). The vessel management plan (Table 6.1) will ensure that vessel traffic moves along predictable routes and will define how vessels should behave in the presence of marine mammals.

~~350.~~361. Further, it is highly likely that a proportion of vessels will be stationary or slow moving throughout construction activities for significant periods of time. Therefore, the actual increase in vessel traffic moving around the site and to/from port to the site will occur over short periods of the offshore construction activity.

~~351.~~362. Overall, Part 6, Volume 1, Chapter 11: Marine Mammals found that the effect is of minor adverse significance, which is not significant in EIA terms.

Consideration of harbour porpoise

~~352.~~363. Harbour porpoise are screened in for potential LSE with respect to vessel disturbance during construction and decommissioning for the following sites:

- The Southern North Sea SAC

~~353.~~364. The existing vessel traffic movements within the Project ~~array area~~boundary (an average of ten vessels per day passing through the array area in the summer and a reduced number in the winter), combined with up to ten vessels per 5km^2 block during construction, remains below the approximately 80 movements per day cited in Heinänen and Skov (2015) as having potential to lead to a negative effect on harbour porpoise density.

~~354.~~365. The relevant conservation objectives for harbour porpoise are presented within paragraph 211~~207~~.

~~355.~~366. The first two conservation objectives address risk of injury and disturbance. Part 6, Volume 1, Chapter 11: Marine Mammals found (in the context of existing shipping levels, the increase in those levels proposed during construction at the Project and the relevant project mitigation) the increased vessel traffic associated with construction (and decommissioning) of the Project is insufficient to result in an increase in the risk of mortality or injury in marine mammals as a result of collisions. That assessment applies equally to harbour porpoise associated with the SNS SAC, given the localised nature of any effect together with the location of that effect relative to the SAC.

~~356.~~367. The third conservation objective is focused on maintaining the supporting habitats and processes, together with availability of harbour porpoise prey, within the SNS SAC. Vessel collision risk does not have the potential to affect such habitats or processes.

~~357.~~368. There is, **therefore, no AEoI relevant to harbour porpoise for the SNS SAC due to vessel collision risk from the Project alone during construction and decommissioning and therefore, subject to natural change, the harbour porpoise will be maintained in the long-term.**

Consideration of harbour seal and grey seal

~~358.~~369. Harbour seal and grey seal are screened in for potential LSE with respect to vessel collision risk during construction and decommissioning for the following sites:

- The Wash and North Norfolk Coast SAC (harbour seal);
- Humber Estuary SAC (grey seal);
- Humber Estuary Ramsar (grey seal);
- Berwickshire and North Northumberland Coast SAC (grey seal);
- Transboundary harbour seal sites (Doggersbank (Netherlands) SAC and Klaverbank SCI); and
- Transboundary grey seal sites (Bancs des Flandres SAC, Doggersbank (Netherlands) SAC, Klaverbank SCI, Vlaamse Banken SCI, SBZ 1 SCI, SBZ 2 SCI, SBZ 3 SCI, Vlakte van de Raan SCI, Westerschelde & Saeftinghe SCI, Voordelta SCI, Noordzeekustzone SCI, Waddenzee SCI).

~~359.~~370. The relevant conservation objectives for harbour seal and grey seal are presented in paragraphs 241~~237~~ and 255~~251~~ respectively.

~~360.~~371. Part 6, Volume 1, Chapter 11: Marine Mammals found (in the context of existing shipping levels, the increase in those levels proposed during construction at the Project and the relevant project mitigation) the increased vessel traffic associated with construction (and decommissioning) of the Project is insufficient to result in an increase in the risk of mortality or injury in marine mammals as a result of collisions.

~~**361.**~~**372.** There is, **therefore, no AEoI relevant to grey or harbour seal for the identified sites vessel collision risk from the Project alone during construction and decommissioning and therefore, subject to natural change, the grey and harbour seal feature at these sites will be maintained in the long-term.**

Consideration of bottlenose dolphin

~~362.~~373. Bottlenose dolphin are screened in for potential LSE with respect to vessel collision risk during construction and decommissioning for the following sites:

- Moray Firth SAC (bottlenose dolphin);

~~363.~~374. The relevant conservation objectives for bottlenose dolphin are presented in paragraph 233~~229~~.

~~364.~~375. Part 6, Volume 1, Chapter 11: Marine Mammals found (in the context of existing shipping levels, the increase in those levels proposed during construction at the Project, and the relevant project mitigation) the increased vessel traffic associated with construction (and decommissioning) of the Project is insufficient to result in an increase in the risk of mortality or injury in marine mammals as a result of collisions.

~~365.~~376. Furthermore, it is recognised that whilst there is the potential for the population associated with the Moray Firth SAC to travel into the GNS MU, this would likely be a small proportion of the population. With consideration that the works are located within the GNS MU and are >500km from the designated site, we conclude there is negligible LSE risk of vessel collision impacting the population associated with Moray Firth SAC.

~~366.~~377. There is therefore, no AEoI relevant to bottlenose dolphin for the identified sites from the Project alone during construction and decommissioning and therefore, subject to natural change, the grey and harbour seal feature at these sites will be maintained in the long-term.

Disturbance at seal haul-outs

~~367.~~378. The potential for an AEoI as a result of disturbance at seal haul-out during the construction and decommissioning relates to the following designated site and the relevant feature (i.e. those features screened in for potential LSE).

- Humber Estuary SAC (grey seal);
- Humber Estuary RAMSAR (grey seal).

~~368.~~379. The potential for LSE during the decommissioning would be similar to and potentially less than those outlined in the construction phase. The potential for the disturbance at seal haul-outs was considered within the ES (Part 6, Volume 1, Chapter 11: Marine Mammals).

~~369.~~380. The nearest known haul-out sites are all >1km from the landfall site of the export cables, and the individuals there are already exposed to relatively high levels of vessel activity. It is therefore considered that there will be minimal impact to seals at haul-out locations caused by the additional vessels that may be present due to the construction (or decommissioning) works.

~~370.~~381. We conclude that with consideration that the additional vessel movement will be short-term, intermittent and where possible vessel traffic associated with the project will follow existing shipping routes, it is considered unlikely that the activities will result in a significant impact on the designated feature, with the ES concluding a low (adverse) magnitude of impact.

~~371.~~382. The implementation of the VMP will mitigate the low impact resulting in only very short-term and recoverable effects. Overall, it is concluded that there would be **no AEoI with regards to disturbance to seal haul-outs.**

9.2.4.4 Indirect pollution

~~372.~~383. The potential for an AEoI as a result of indirect pollution on marine mammals during construction and decommissioning relates to the following designated site and the relevant feature (i.e. those features screened in for potential LSE).

- Southern North Sea SAC (harbour porpoise).

~~373.~~384. The potential for LSE during decommissioning would be similar to and potentially less than those outlined in the construction phase. The potential for indirect pollution to affect marine mammals was not considered in the ES (Part 6, Volume 1, Chapter 11: Marine Mammals), given the Project specific mitigation and conclusion of no significant effect, which enabled the effect to be scoped out from assessment in the ES. The reason for that is given as the development of a MPCP, which will form part of a wider PEMP.

~~374.~~385. It is noted that this mitigation will be secured in the DCO. For full details on the mitigation please see Table 6.1.

~~375.~~386. The implementation of the PEMP, produced for approval and in consultation with relevant bodies, and provided for in the DCO as above, enables the conclusion that there is, **therefore, no AEoI to marine mammals in relation to indirect pollution from the Project alone and therefore, subject to natural change, the marine mammal feature will be maintained in the long-term with respect to the potential for indirect pollution during construction and decommissioning.**

9.2.4.5 Accidental Pollution

~~376.~~387. The potential for an AEoI as a result of accidental pollution on marine mammals during construction and decommissioning relates to the following designated site and the relevant feature (i.e. those features screened in for potential LSE).

- Southern North Sea SAC (harbour porpoise).

~~377.~~388. The potential for LSE during decommissioning would be similar to and potentially less than those outlined in the construction phase. The potential for accidental pollution to affect marine mammals was not considered in the ES (Part 6, Volume 1, Chapter 11: Marine Mammals), given the Project specific mitigation and conclusion of no significant effect, which enabled the effect to be scoped out from assessment in the ES. The reason for that is given as the development of a MPCP, which will form part of a wider PEMP.

~~378.~~389. It is noted that this mitigation will be secured in the DCO. For full details on the mitigation please see Table 6.1.

~~379.~~390. The implementation of the PEMP, produced for approval and in consultation with relevant bodies, and provided for in the DCO as above, enables the conclusion that there is, **therefore, no AEoI to marine mammals in relation to accidental pollution from the Project alone during construction and decommissioning and therefore, subject to natural change, the marine mammal feature will be maintained in the long-term with respect to the potential for accidental pollution.**

9.2.4.6 Habitat loss

~~380.~~391. The maximum area of disturbance (and therefore loss of available habitat) to the site is 1726.3km, as caused by concurrent piling, equating to 6.38% of the winter area of the site. Given the highly mobile nature of the species, the widely available comparable habitat, and the generalist/opportunist nature of harbour porpoise (Part 6, Volume 1, Chapter 11: Marine Mammals, Pierce et al., 2007), meaning that they will be unlikely to be particularly sensitive to displacement from foraging grounds, means that it is considered that there is no adverse effect from a loss of available supporting habitat on harbour porpoise.

~~381.~~392. Furthermore, there is evidence that suggests that the presence of man-made structures and resulting reef formation attracts harbour porpoise and can have beneficial effects through increased foraging activities (Fernandex-Betelu, 2022). It is therefore considered that any supporting habitat lost in the long term by the physical presence of monopile structures, would not have an adverse effect on harbour porpoise at this site.

~~382.~~393. There is, **therefore, no AEoI resulting from supporting habitat loss at the SNS SAC from the Project alone during construction and decommissioning and therefore, subject to natural change, the marine mammal feature will be maintained in the long-term with respect to the potential for effect from habitat loss**.

9.2.4.7 Changes to prey

~~383.~~394. The potential for an AEoI as a result of changes to prey on marine mammals during construction and decommissioning relates to the following designated site and the relevant feature (i.e. those features screened in for potential LSE):

- Southern North Sea SAC (harbour porpoise).
- Humber Estuary SAC (grey seal);
- Humber Estuary RAMSAR (grey seal);
- Wash & North Norfolk Coast (harbour seal);
- Berwickshire and North Northumberland Coast SAC (grey seal);
- Moray Firth (bottlenose dolphin);
- Transboundary harbour seal sites (Doggersbank (Netherlands) SAC and Klaverbank SCI); and
- Transboundary grey seal sites (Bancs des Flandres SAC, Doggersbank (Netherlands) SAC, Klaverbank SCI, Vlaamse Banken SCI, SBZ 1 SCI, SBZ 2 SCI, SBZ 3 SCI, Vlakte van de Raan SCI, Westerschelde & Saeftinghe SCI, Voordelta SCI, Noordzeekustzone SCI, Waddenzee SCI).

~~384.~~395. The relevant conservation objectives for all of the designated UK sites are cited in The Screening Report (document reference 7.2).

~~385.~~396. The potential for adverse effects from changes to prey species for marine mammals during construction and decommissioning is considered in Part 6, Volume 1, Chapter 11: Marine Mammals. The key effects that may result in changes to prey are underwater noise, vessel disturbance, collision risk or accidental pollution. The prey species in consideration are recorded in Part 6, Volume 1, Chapter 11: Marine Mammals, Table 11.59~~61~~. It is not expected that the level of any of these effects during the construction and decommissioning phases of the Project would result in an AEoI for any marine mammal prey species. It is recognised that fishing pressure may be reduced during construction due to the required safety distances within 500m of the construction, with species being displaced into the surrounding area. However, this is should not lead to a change in populations of the protected features, with impacts being localised and foraging still being carried out by the species. These impacts are considered to be negligible, and are very short-term and recoverable, with no impact on survival or reproduction rates to the extent that the population trajectory would be altered.

~~386.~~397. The assessments presented within the ES and this RIAA conclude no potential for underwater noise to impact to any marine mammal designated sites by impacting designated features prey species. The adoption of a vessel management plan (Table 6.1), that includes preferred transit routes and guidance for vessel operations in the vicinity of harbour porpoise, will minimise the potential for any impact from vessel disturbance and collision risk. The adoption of the PEMP will ensure that there is no adverse effect from indirect or accidental pollution on prey species.

~~387.~~398. This therefore enables the conclusion that there is no AEoI to the protected features (harbour porpoise, harbour seal, grey seal, bottlenose dolphin) in relation to changes to prey from the Project alone during construction and decommissioning and therefore, subject to natural change, the features will be maintained in the long-term with respect to the potential for changes to prey.

9.2.5 O&M

9.2.5.1 Underwater noise

~~388.~~399. The potential for an AEoI as a result of underwater noise on marine mammals during O&M relates to the following designated site and the relevant feature (i.e. those features screened in for potential LSE):

- Southern North Sea SAC (harbour porpoise);
- Humber Estuary SAC (grey seal);
- Humber Estuary RAMSAR (grey seal);
- Berwickshire and North Northumbria Coast SAC (grey seal);
- The Wash and North Norfolk Coast SAC (harbour seal);
- Moray Firth SAC (bottlenose dolphin);

- Transboundary harbour seal sites (Doggersbank (Netherlands) SAC and Klaverbank SCI); and
- Transboundary grey seal sites (Bancs des Flandres SAC, Doggersbank (Netherlands) SAC, Klaverbank SCI, Vlaamse Banken SCI, SBZ 1 SCI, SBZ 2 SCI, SBZ 3 SCI, Vlakte van de Raan SCI, Westerschelde & Saeftinghe SCI, Voordelta SCI, Noordzeekustzone SCI, Waddenzee SCI).

~~389.~~400. The relevant conservation objectives for harbour porpoise, grey seal, harbour seal and bottlenose dolphin are cited in paragraphs 211~~207~~, 233~~229~~, 241~~237~~, and 256~~252~~ respectively.

~~390.~~401. Operational WTGs will produce underwater noise as a result of vibration from the rotating machinery in the turbines, which is transmitted through the structure of the pile and foundations.

~~391.~~402. The MMO (2014) review of post-consent monitoring at OWFs found that available data on the operational WTG noise, from the UK and abroad, in general showed that noise levels from operational WTGs are low and the spatial extent of the potential impact of the operational WTG noise on marine receptors is generally estimated to be small, with behavioural response only likely at ranges close to the WTG. This is supported by several published studies which provide evidence that marine mammals are not displaced from operational windfarms. For example, a number of reviews have concluded that operational windfarm noise will have negligible effects (Madsen et al., 2006; Teilmann et al., 2006; CEFAS, 2010; Brasseur, et al., 2012). In addition, studies have shown that porpoise are detected regularly within operational offshore windfarms (Diederichs et al., 2008; Scheidat et al., 2011) and may be attracted to offshore windfarms for increased foraging opportunities (Lindeboom et al., 2011).

~~392.~~403. The potential for operational noise to affect marine mammals is noted in Part 6, Volume 1, Chapter 11: Marine Mammals, where it is concluded that no likely significant effect is considered. Specifically, that the non-impulsive weighted SELcum PTS and TTS thresholds from Southall et al., (2019) resulted in estimated PTS and TTS impact ranges of <100 m for all marine mammal species (being the minimum range feasible when producing modelled outputs for the SELcum values – in other words the potential range of effect is within that distance, not necessarily out to that distance). Given the evidence of their presence in and around existing operational offshore windfarms, marine mammals are deemed to be of low vulnerability and have high recoverability to the impact of operational noise.

~~393.~~404. Specifically in relation to the conservation objectives for the SNS SAC, it is considered that there is no risk of injury resulting from PTS in harbour porpoise. The risk of injury (defined as onset of PTS) as well as the risk of TTS is given as occurring in a range of <100m, a highly precautionary range, and within which the animal would need to stay for a 24-hour period for sufficient noise exposure to result in an effect. Such an occurrence is extremely unlikely and would be atypical behaviour for such a highly mobile species. It should be noted that as the range of risk of onset of TTS is also <100m, the range of onset of PTS would be well within that limit (although the models are not sensitive enough to enable such differentiation at such close range to source).

~~394.~~405. With respect to the potential for disturbance to result in displacement of individuals, and given existing evidence which demonstrates that harbour porpoise are not displaced from offshore windfarms in general following construction, it is therefore anticipated that, in line with a number of studies conducted to date, any such disturbance response would be in close proximity to turbines only.

~~395.~~406. The final consideration is that of risk to habitat and prey from operational noise. Underwater noise is not considered a risk to the habitat of harbour porpoise. The risk to harbour porpoise prey, in terms of fish, is also considered (see Part 6, Volume 2, Annex 3.2: Underwater Noise Assessment), finding that the risk of TTS (over a period of 12 hours) is 150m. Further consideration is given to fish in Part 6, Volume 1, Chapter 10: Fish and Shellfish Ecology, including during operation, with a behavioural response only expected at very close range.

~~396.~~407. It can therefore be concluded that **there is no AEoI to all marine mammal species in relation to operational noise from the Project alone during O&M and therefore, subject to natural change, the marine mammal features will be maintained in the long-term.**

9.2.5.2 Vessel disturbance

~~397.~~408. The potential for an AEoI as a result of vessel disturbance on marine mammals during O&M relates to the following designated sites and the relevant feature (i.e. those features screened in for potential LSE):

- Southern North Sea SAC (harbour porpoise);
- Humber Estuary SAC (greygrey seal);
- The Wash and North Norfolk Coast SAC (harbour seal);
- Humber Estuary Ramsar (grey seal);
- Moray Firth (bottlenose dolphin);
- Transboundary harbour seal sites (Doggersbank (Netherlands) SAC and Klaverbank SCI); and
- Transboundary grey seal sites (Bancs des Flandres SAC, Doggersbank (Netherlands) SAC, Klaverbank SCI, Vlaamse Banken SCI, SBZ 1 SCI, SBZ 2 SCI, SBZ 3 SCI, Vlakte van de Raan SCI, Westerschelde & Saeftinghe SCI, Voordelta SCI, Noordzeekustzone SCI, Waddenzee SCI).

~~398.~~409. The relevant conservation objectives for harbour porpoise, grey seal, harbour seal and bottlenose dolphin are cited in paragraphs 211~~207~~, 233~~229~~, 241~~237~~, and 256~~252~~ respectively.

~~399.~~410. The potential for vessel disturbance (and any associated vessel collision risk) in marine mammals during O&M is considered in Part 6, Volume 1, Chapter 11: Marine Mammals. It is not expected that the level of vessel activity during the O&M of the Project would cause a significant increase in the risk of disturbance by vessels. The adoption of a Vessel Management Plan (VMP) (Table 6.1) that includes preferred transit routes and guidance for vessel operations in the vicinity of marine mammals and around seal haul-outs, will minimise the potential for any impact.

~~400.~~411. Given the localised, temporary and intermittent nature of the effect, the conclusions of the ES are considered to be directly relevant to the designated sites under consideration. As such, given that the O&M vessel movements are not expected to result in a significant change on existing conditions, and in light of the conclusions drawn above with r**espect to vessel disturbance during O&M, of no AEoI for all marine species screened in (when potential for vessel related disturbance is greater), it can be concluded that the same conclusion of no AEoI applies equally during the operation & maintenance phase of works.**

9.2.5.3 Collision risk

~~401.~~412. The potential for an AEoI as a result of collision risk on marine mammals during O&M relates to the following designated sites and the relevant feature (i.e. those features screened in for potential LSE):

- Southern North Sea SAC (harbour porpoise);
- Humber Estuary SAC (grey seal)
- The Wash and North Norfolk Coast SAC (harbour seal);
- Humber Estuary Ramsar (grey seal);
- Moray Firth (bottlenose dolphin);
- Transboundary harbour seal sites (Doggersbank (Netherlands) SAC and Klaverbank SCI); and
- Transboundary grey seal sites (Bancs des Flandres SAC, Doggersbank (Netherlands) SAC, Klaverbank SCI, Vlaamse Banken SCI, SBZ 1 SCI, SBZ 2 SCI, SBZ 3 SCI, Vlakte van de Raan SCI, Westerschelde & Saeftinghe SCI, Voordelta SCI, Noordzeekustzone SCI, Waddenzee SCI).

~~402.~~413. The relevant conservation objectives for harbour porpoise, grey seal, harbour seal and bottlenose dolphin are cited in paragraphs 211~~207~~, 233~~229~~, 241~~237~~, and 256~~252~~ respectively.

~~403.~~414. Part 6, Volume 1, Chapter 11: Marine Mammals notes that given the conclusions drawn at ES (of no likely significant effect), the potential for vessel collision with marine mammals will not be considered in detail in the ES. Specifically, it is not expected that the level of vessel activity during O&M would cause an increase in the risk of mortality from collisions. The adoption of a vessel management plan (Table 6.1) will minimise the potential for any impact.

~~404.~~415. In the context of existing shipping levels, the increase in vessel traffic proposed during O&M at the Project (in the context of relevant project mitigation) is insufficient to result in an increase in the risk of mortality or injury in marine mammals as a result of collisions. That assessment applies equally to all marine mammals and therefore includes harbour porpoise, harbour seals, and grey seals that may be associated with the identified sites. **Therefore, there is no AEoI to marine mammals in relation to collision risk from the Project alone during O&M and therefore, subject to natural change, the marine mammal feature will be maintained in the long-term with respect to the potential for collision risk.**

9.2.5.4 Indirect pollution

~~405.~~416. The potential for an AEoI as a result of indirect pollution on marine mammals during O&M relates to the following designated site and the relevant feature (i.e. those features screened in for potential LSE):

- Southern North Sea SAC (harbour porpoise).

~~406.~~417. The potential for indirect pollution to affect marine mammals was not considered in the ES (Part 6, Volume 1, Chapter 11: Marine Mammals), given the Project specific mitigation and conclusion of no significant effect, which enabled the effect to be scoped out from assessment in the ES. The reason for that is given as the development of a Marine Pollution Contingency Plan (MPCP), which will form part of a wider PEMP. A similar approach to screening out the effect has not been applied to the RIAA.

~~407.~~418. It is noted that this mitigation will be secured in the DCO. For full details on the mitigation please see Table 6.1.

~~408.~~419. The implementation of the PEMP, produced in consultation with relevant bodies, and provided for in the DCO as above, enables the conclusion that there is, therefore, **no AEoI to marine mammals in relation to indirect pollution from the Project alone during O&M and therefore, subject to natural change, the marine mammal feature will be maintained in the long-term with respect to the potential for indirect pollution.**

9.2.5.5 Accidental Pollution

~~409.~~420. The potential for an AEoI as a result of accidental pollution on marine mammals during O&M relates to the following designated site and the relevant feature (i.e. those features screened in for potential LSE):

- Southern North Sea SAC (harbour porpoise).

~~410.~~421. The potential for accidental pollution to affect marine mammals was not considered in the ES (Part 6, Volume 1, Chapter 11: Marine Mammals), given the Project specific mitigation and conclusion of no significant effect, which enabled the effect to be scoped out from assessment in the ES. The reason for that is given as the development of a MPCP, which will form part of a wider PEMP. A similar approach to screening out the effect has not been applied to the RIAA.

~~411.~~422. It is noted that this mitigation will be secured in the DCO. For full details on the mitigation please see Table 6.1.

~~412.~~423. The implementation of the PEMP, produced in consultation with relevant bodies, and provided for in the DCO as above, enables the conclusion that there is, **therefore, no AEoI to marine mammals in relation to accidental pollution from the Project alone during O&M and therefore, subject to natural change, the marine mammal feature will be maintained in the long-term with respect to the potential for accidental pollution.**

9.2.5.6 Habitat loss

~~413.~~424. There is evidence that suggests that the presence of man-made structures and resulting reef formation attracts harbour porpoise and can have beneficial effects through increased foraging activities (Fernandex-Betelu, 2022). It is therefore considered that any supporting habitat lost in the long term by the physical presence of monopile structures, would not have an adverse effect on harbour porpoise at this site.

~~414.~~425. There is, **therefore, no AEoI resulting from supporting habitat loss at the SNS SAC from the Project alone during operation and maintenance and therefore, subject to natural change, the marine mammal feature will be maintained in the long-term with respect to the potential for effect from habitat loss**.

9.2.5.7 Changes to prey

~~415.~~426. The potential for an AEoI as a result of changes to prey on marine mammals during O&M relates to the following designated site and the relevant feature (i.e. those features screened in for potential LSE):

- Southern North Sea SAC (harbour porpoise).
- Humber Estuary SAC (grey seal);
- Humber Estuary RAMSAR (grey seal);
- Wash & North Norfolk Coast (harbour seal);
- Berwickshire and North Northumberland Coast SAC (grey seal);
- Moray Firth (bottlenose dolphin);
- Transboundary harbour seal sites (Doggersbank (Netherlands) SAC and Klaverbank SCI); and
- Transboundary grey seal sites (Bancs des Flandres SAC, Doggersbank (Netherlands) SAC, Klaverbank SCI, Vlaamse Banken SCI, SBZ 1 SCI, SBZ 2 SCI, SBZ 3 SCI, Vlakte van de Raan SCI, Westerschelde & Saeftinghe SCI, Voordelta SCI, Noordzeekustzone SCI, Waddenzee SCI).

~~416.~~427. The potential for adverse effects from changes to prey species in marine mammals during O&M is considered in Part 6, Volume 1, Chapter 11: Marine Mammals. They key effects that may result in changes to prey are underwater noise, vessel disturbance, collision risk or accidental pollution. It is not expected that the level of any of these effects during the O&M of the Project would result in an AEoI for any marine mammal prey species and therefore marine mammal receptors. The assessments presented within the ES and this RIAA conclude no potential for underwater noise to impact any receptors. The adoption of a vessel management plan (Table 6.1), that includes preferred transit routes and guidance for vessel operations in the vicinity of marine mammals and around seal haul-outs, will minimise the potential for any impact from vessel disturbance and collision risk. The adoption of the PEMP will ensure that there is no adverse effect from indirect or accidental pollution.

~~417.~~428. **This therefore enables the conclusion that there is no AEoI to marine mammals in relation to changes to prey from the Project alone during O&M, and therefore, subject to natural change, the marine mammal feature will be maintained in the long-term with respect to the potential for changes to prey.**

9.3 Offshore and Intertidal Ornithology

9.3.1 Introduction

429. The Offshore and Intertidal Ornithology alone assessment has been updated February 2025 to consider:

- ~~-~~The introduction of an Offshore Restricted Build Area (ORBA) over the northern section of the Project array area;
- The removal of the northern section of the offshore Export Cable Corridor (ECC);
- Minor errata including those previously identified by interested parties;
- Updates to "Natural England's" approach for certain assessment values where further information has been provided by that organisation post-Application; and
- Additional detail which has been requested by Natural England to facilitate their appraisal of the potential for an AEoI for red-throated diver within the Greater Wash SPA.

9.3.1.1 Assessment Criteria

~~418.~~430. The offshore ornithological assessment has been based on relevant guidance for conducting HRA and assessing offshore windfarms (e.g. European Commission, 2011; Maclean et al., 2009; Natural England, 2010;~~-~~ the Planning Inspectorate, 2024b~~the Inspectorates Advice Note Ten~~) and has applied the criteria contained in that guidance where relevant to the interest features under consideration.

~~419.~~431. The precautionary criteria used for screening is presented in the Project's Screening Report (document reference 7.2). The relevant guidance and literature used to identify the species sensitive to disturbance and/or displacement; and/or a sensitive to collision with the array were Bradbury et al., 2014; Furness and Wade, 2012; Furness *et al.,* 2013; Dierschke et al., 2016 and A~~S~~NCB guidance 2022. Bird usage of UK waters and of specific sites and habitats varies throughout the year depending on the requirements of the species. Therefore, to increase accuracy the assessments are split into relevant biological seasons (bio-seasons) for each species (e.g. breeding, spring/autumn migration, wintering). Site-specific data from the array area and 4km buffer, were used to identify the species more susceptible to impacts during different bio-seasons.

~~420.~~432. The determination of AEoI is based on the factors that contribute to the definition of maintaining integrity, namely that the ecological structure and function of the site is not adversely affected, that the ability of the habitat to sustain the bird species that are interest features is not adversely affected (i.e. that breeding, roosting and foraging locations are maintained and that food sources are maintained) and that the population of the interest feature is maintained both in numbers and across the area of the site.

~~421.~~433. An adverse effect on integrity cannot immediately be ruled out where predicted impacts (either ~~in~~ project alone or in-combination) equate to an increase in baseline mortality of greater than 1% of the relevant population. If the increase in baseline mortality exceeds 1%, then further consideration of the significance of the mortality is required to determine if an adverse effect can be ruled out, e.g. through population modelling (Population Viability Analysis (PVA)). This approach is recommended by Natural England (Parker *et al.*, 2022c) and can incorporate known population trends and density dependence, where it is considered appropriate, to assess the impacts on a population more accurately. PVA and migratory Collision Risk Modelling (mCRM) have been undertaken ~~since PEIR~~ on the relevant species and sites to inform this assessment. The results of the PVA to inform the RIAA are presented in Appendix 7.1.2. The results of the mCRM can be found in Part 6, Volume 2, Appendix 12.4: Migratory Collision Risk Assessment Appendix.

9.3.1.2 Description of Significance

A description of the significance of project level effects upon the receptors grouped under ‘offshore ornithology’, as relevant to the designated sites and their associated features screened in for potential LSE, is provided below. Conclusions on AEoI are drawn from the description of significance as relevant to each site and effect.

9.3.1.3 Description of Designation

~~422.~~434. The description of designated sites and the conservation objects for each site can be found in The Screening Report (document reference 7.2). Table 9.4 highlights the relevant conservation objectives for seabird species within designated sites. Migratory species assessed for collision impacts during migration are provided in Table 9.74~~Table 9.39~~.

Table 9-4~~9.49-49.4~~ Designated sites for ornithological receptors with conservation objectives associated with each feature.

Site	Feature	Conservation Objective
Greater Wash SPA	Red-throated diver	With regard to the SPA and the individual species and/or assemblage of species for which the site has been classified (the ‘Qualifying Features’ listed below), and subject to natural change; ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site
	Common scoter	
FFC SPA	Guillemot	
	Razorbill	
	Puffin*	
	Gannet	

Site	Feature	Conservation Objective
	Kittiwake	contributes to achieving the aims of the Wild Birds Directive, by maintaining and/or restoring; ▪ The extent and distribution of the habitats of the qualifying features; ▪ The structure and function of the habitats of the qualifying features; ▪ The supporting processes on which the habitats of the qualifying features rely; ▪ The population of each of the qualifying features; and ▪ The distribution of the qualifying features within the site.
	Herring Gull	
Alde-ore Estuary SPA & Ramsar	Lesser Black-backed Gull	
North Norfolk Coast SPA	Sandwich tern	
Coquet Island SPA	Puffin*	
	Sandwich tern	
Farne Island SPA	Kittiwake*	
	Guillemot	
	Puffin*	
	Sandwich Tern	
Scottish sites		
Buchan Ness to Collieston Coast SPA	Guillemot*; Kittiwake*	"To avoid deterioration of the habitats of the qualifying species (listed below) or significant disturbance to the qualifying species, thus ensuring that the integrity of the site is maintained; and To ensure for the qualifying species that the following are maintained in the long-term: ▪ Population of the species as a viable component of the site; ▪ Distribution of the species within site; ▪ Distribution and extent of habitats supporting the species; ▪ Structure, function and supporting processes of habitats supporting the species; and ▪ No significant disturbance of the species.
Calf of Eday SPA	Guillemot*; Kittiwake*	
Copinsay SPA	Guillemot*; Kittiwake*	
East Caithness Cliffs SPA	Guillemot*; Razorbill*; Kittiwake*	
Fair Isle SPA	Guillemot*; Razorbill*; Puffin*; Kittiwake*; Gannet*	
Forth Islands (UK) SPA	Guillemot; Razorbill; Puffin; Kittiwake; Gannet	
Foula SPA	Guillemot; Razorbill*; Puffin; Kittiwake*	
Fowlsheugh SPA	Guillemot; Razorbill*; Kittiwake*	
Hermaness, Saxa, Vord and Valla Field SPA	Guillemot*; Puffin;	

Site	Feature	Conservation Objective
	Kittiwake*; Gannet	
Hoy SPA	Guillemot*; Puffin*; Kittiwake*	
Marwick Head SPA	Guillemot*; Kittiwake*	
North Caithness Cliffs SPA	Guillemot; Razorbill*; Puffin*; Kittiwake*	
Noss SPA	Guillemot; Puffin*; Kittiwake*; Gannet	
Rousay SPA	Guillemot*; Kittiwake*	
St Abb's Head SPA	Guillemot*; Razorbill*; Kittiwake*	
Sumburgh Head SPA	Guillemot*; Kittiwake*	
Troup, Pennan and Lion's Heads SPA	Guillemot; Razorbill*; Kittiwake*	
West Westray	Guillemot; Razorbill*; Kittiwake*	

*Species listed as Assemblage features

9.3.1.4 Maximum design scenario

~~423.~~435. Table 9.5 below summarises the Maximum Design Scenario(s) considered for ornithological receptors, as described in Part 6, Volume 1, Chapter 12: Offshore and Intertidal Ornithology. The full project description is provided in Part 6, Volume 1, Chapter 3: Project Description for full reference.

Table 9-5~~9.59-59.5~~: Maximum Design Scenario for Ornithology from the Project Alone

Potential effect	Maximum design scenario assessed	Justification
Construction phase		
Disturbance and displacement: Offshore ECC.	Construction Vessels within ECC: ▪ 3 cable laying vessels (20 return trips); ▪ 3 cable jointing vessels (16 return trips); ▪ 3 cable burial vessels (16 return tips); ▪ 16 support vessels (1,070 return trips); ▪ 16 helicopter return trips; and ▪ Single phase of offshore construction over approximately four years.	The assumption is that vessels would be in situ from start to finish, so any disturbance events would be throughout entire period.
Disturbance and displacement: Intertidal ECC. Including Artificial Nest Structure (ANS), Biogenic reef seeding and ORCPs.	Construction Vessels within ECC: ▪ 3 cable laying vessels (20 return trips); ▪ 3 cable jointing vessels (16 return trips); ▪ 3 cable burial vessels (16 return tips); ▪ 16 support vessels (1,070 return trips); ▪ 16 helicopter return trips; and ▪ Single phase of offshore construction over approximately four years. ▪ Construction vessels making return trips to the ANS, biogenic reef and ORCP location(s). Two ORCPs = GBS foundations ▪ Two ANS = monopile foundations ▪ One Biogenic reef ▪ Maximum extent of buoyed construction area	The assumption is that the process would be undertaken by trenchless methods, so no open trenching, cable laying and burial of the export cable would be required. No exit pits will be made within the intertidal ECC. Therefore, MDS activities to be assessed are limited to monitoring activities or emergency response, though they are to take place over a maximum of a 24 month period.

Potential effect	Maximum design scenario assessed	Justification
	▪ 16 anchoring operations with a maximum disturbance of 800m^2 per operation for installation of two ORCPs = 12,800m^2 ▪ 16 anchoring operations with a maximum disturbance of 800m2 per operation for installation of two ANS = 12,800m^2 ▪ 10 return trips for installation of the biogenic reef, and four monitoring return trips	
Disturbance, displacement and barrier effects: Array.	Construction Vessels within a~~A~~rray a~~A~~rea: ▪ Max total construction vessels: 131 ▪ Max total round trips per year: 5,128 ▪ Up to 10 construction vessels in a given 5km^2 area simultaneously. Single phase of offshore construction over approximately 4 years (2026 – 2029).	The maximum estimated number of development areas within the array area with vessels operating concurrently would cause the greatest disturbance to birds on site.
Indirect impacts on IOFs due to effects on prey species habitat loss: Array.	See MDS for Fish and Shellfish Ecology assessment (Volume 1, Chapter 10 - Fish and Shellfish Ecology) and for the Benthic Subtidal and Intertidal Ecology assessment (Volume 1, Chapter 9 - Benthic Subtidal and Intertidal Ecology).	Indirect effects on birds could occur through changes to any of the species and habitats considered within the fish and shellfish ecology or Benthic Subtidal and Intertidal Ecology assessments. The maximum indirect impact on birds would result from the maximum direct impact on fish, shellfish and benthic species and habitats. The maximum design scenario is therefore as per justifications in Volume 1, Chapter 10 - Fish and Shellfish Ecology and Volume 1, Chapter 9 - Benthic Subtidal and Intertidal Ecology.

Potential effect	Maximum design scenario assessed	Justification
Indirect impacts on IOFs due to effects on prey species habitat loss: Offshore ECC.	See MDS for Fish and Shellfish Ecology assessment (Part 6, Volume 1, Chapter 10 - Fish and Shellfish Ecology) and for the Benthic Subtidal and Intertidal Ecology assessment (Part 6, Volume 1, Chapter 9 - Benthic Subtidal and Intertidal Ecology).	Indirect effects on birds could occur through changes to any of the species and habitats considered within the Fish and Shellfish Ecology or Benthic Subtidal and Intertidal Ecology assessments. The maximum indirect impact on birds would result from the maximum direct impact on fish, shellfish and benthic species and habitats. The maximum design scenario is therefore as per justifications in Volume 1, Chapter 10 - Fish and Shellfish Ecology and Volume 1, Chapter 9 - Benthic Subtidal and Intertidal Ecology.
O&M		
Disturbance and displacement: WTG area and ORCP~~Array~~.	~~Array~~ WTG Area: ▪ WTG deployment across the ~~full array~~WTG area (~~436km²~~365km²). WTGs: ▪ Up to 100 WTGs; ORCP O&M: ▪ 1,339 vessel return trips to WTGs per year; ▪ 409 vessel return trips to WTG foundations per year; ▪ 55 vessel return trips to offshore platforms (structural scope) per year;	Displacement would be assumed from the ~~entire array area that contains~~ WTG areas and other associated structures, which maximises the potential for disturbance and displacement. Displacement is also assessed from presence of ORCP. Assessment of extent/varying displacement from ~~array~~ WTG area and a buffer is species specific due to their sensitivity levels.

Potential effect	Maximum design scenario assessed	Justification
	▪ 115 vessel return trips to offshore platforms (electrical scope) per year; ▪ 388 crew transfer shifts per year; ▪ A total of 2,480 total vessel return trips per year. The same number is considered for helicopter return trips per year; and ▪ Vessels include: CTVs, service operation vessels, supply vessels, cable and remedial protection vessels, and JUVs.	
Collision risk: ~~Array~~WTG area.	~~Array~~ WTG Area: ▪ WTG deployment across the full ~~array~~ WTG area (365km^2~~436km^2~~) area. WTGs: ▪ 100 WTGs; ▪ Minimum height of lowest blade tip above MSL: 40m; and ▪ Rotor blade diameter: 236m.	This represents the maximum number of the largest WTGs, which represents the greatest total swept area to be considered for collision risk.
Indirect impacts on IOFs due to impacts on prey species habitat loss: Array.	See MDS for Fish and Shellfish Ecology assessment (Volume 1, Chapter 10 - Fish and Shellfish Ecology) and for the Benthic Subtidal and Intertidal Ecology assessment (Volume 1, Chapter 9 - Benthic Subtidal and Intertidal Ecology).	Indirect effects on birds could occur through changes to any of the species and habitats considered within the Fish and Shellfish Ecology or Benthic Subtidal and Intertidal Ecology assessments. The maximum indirect impact on birds would result from the maximum direct impact on fish, shellfish and benthic species and habitats. The maximum design scenario is therefore as per justifications in Volume 1, Chapter 10 - Fish and Shellfish Ecology) and Volume 1, Chapter 9 - Benthic Subtidal and Intertidal Ecology.
Decommissioning phase		

Potential effect	Maximum design scenario assessed	Justification
Disturbance, displacement and barrier effects: Array.	MDS is identical (or less) to that of the construction phase	MDS is identical (or less) to that of the construction phase
Disturbance and displacement: Offshore ECC.	MDS is identical (or less) to that of the construction phase	MDS is identical (or less) to that of the construction phase
Indirect impacts on IOFs due to impacts on prey species habitat loss: ECC.	See MDS for Fish and Shellfish Ecology assessment (Volume 1, Chapter 10 - Fish and Shellfish Ecology) and for the Benthic and Intertidal Ecology assessment (Volume 1, Chapter 9 - Benthic Subtidal and Intertidal Ecology).	Indirect effects on birds could occur through changes to any of the species and habitats considered within the Fish and Shellfish Ecology or Benthic Subtidal and Intertidal Ecology assessments. The maximum indirect impact on birds would result from the maximum direct impact on fish, shellfish and benthic species and habitats. The maximum design scenario is therefore as per justifications in Volume 1, Chapter 10 - Fish and Shellfish Ecology) and Volume 1, Chapter 9 - Benthic Subtidal and Intertidal Ecology.

9.3.1.5 Approach to Construction and Decommissioning

Disturbance and Displacement

~~424.~~436. There is potential for adverse effects on seabirds through disturbance originating from construction activities including the installation of foundations, towers, blades, export cables and other infrastructure and the movement of vessels and helicopters during the construction phase of the Project. This disturbance may result in displacement of birds from the OWF site, driving a temporary habitat loss and resultant reduction in area available to birds for feeding, resting and moulting.

~~425.~~437. The effect of disturbance and displacement from construction are considered to be short-term, temporary and reversable in nature, with birds returning to the area following the end of construction activity. Effects are likely to predominantly affect birds foraging within the construction area, with the extent of effects depending on the activities taking place.

~~426.~~438. The screening process and consultation with Natural England has identified the features and sites to have potential for disturbance and displacement during the construction and decommissioning phases (LSE cannot be ruled out) as those presented in Table 9.6 below.

Table 9-6~~9.69-69.6~~: Sites identified for potential AEoI within the construction and decommissioning phase with information on designated features, impacts and bio-season.

Site	Feature	Bio-season
The Greater Wash SPA	Red-throated diver	Non-breeding
	Common scoter	Non-breeding
FFC SPA	Guillemot	Breeding and non-breeding
	Razorbill	Breeding and non-breeding
	Puffin*	Breeding and non-breeding
	Gannet	Breeding and non-breeding
Farne Islands SPA	Guillemot	Non-breeding
	Puffin	Non-breeding
Coquet Island SPA	Puffin*	Breeding and non-breeding
Scottish SPAs		
Buchan Ness to Collieston Coast SPA	Guillemot*	Non-breeding
Calf of Eday SPA	Guillemot*	Non-breeding
Copinsay SPA	Guillemot*	Non-breeding
East Caithness Cliffs SPA	Guillemot*; Razorbill*	Non-breeding
Fair Isle SPA	Guillemot*; Razorbill*; Puffin*	Non-breeding
Forth Islands (UK) SPA	Guillemot; Razorbill; Puffin; Gannet	Non-breeding
Foula SPA	Guillemot; Razorbill*; Puffin	Non-breeding
Fowlsheugh SPA	Guillemot; Razorbill*	Non-breeding
Hermaness, Saxa, Vord and Valla Field SPA	Guillemot*; Puffin; Gannet	Non-breeding
Hoy SPA	Guillemot*; Puffin*	Non-breeding
Marwick Head SPA	Guillemot*	Non-breeding

Site	Feature	Bio-season
North Caithness Cliffs SPA	Guillemot; Razorbill*; Puffin*	Non-breeding
Noss SPA	Guillemot; Puffin*	Non-breeding
Rousay SPA	Guillemot*	Non-breeding
St Abb's Head SPA	Guillemot*; Razorbill*	Non-breeding
Sumburgh Head SPA	Guillemot*	Non-breeding
Troup, Pennan and Lion's Heads SPA	Guillemot; Razorbill*	Non-breeding
West Westray	Guillemot; Razorbill*	Non-breeding

* Species listed as Assemblage features

~~427.~~439. Assessments of bird disturbance and displacement from activities associated with the Project's site are based on several measures. A scoring system for disturbance factors is available from Garthe and Hüppop (2004) and is widely used in OWF EIAs. In Scottish waters, Furness and Wade (2012) have developed disturbance ratings for certain species, in addition to a scoring system based on habitat flexibility and conservation importance. These factors were used to define an index value that highlights the sensitivity of a species to disturbance and displacement. Bradbury et al., (2014) provided an update to the Furness and Wade (2012) paper to consider seabirds in English waters.

~~428.~~440. Disturbance from construction activities will affect bird species differently, with some species being more susceptible to effects such as displacement. For example, Dierschke et al., (2016) note a variation in avoidance and displacement behaviour between species, whilst others were instead attracted to offshore windfarms. Divers have also been shown to avoid shipping, with red-throated diver flushing at a median value of 400m and a maximum of 2km (Bellebaum et al., 2006) and are therefore at risk of displacement from cable laying vessels and construction of other infrastructure (e.g. ORCP, Biogenic reefs and ANS) within the ECC during construction of the Project. Gannet and auk species have also been noted to avoid construction activities (i.e. are displaced), and so are also at risk of displacement from construction works in the array area.

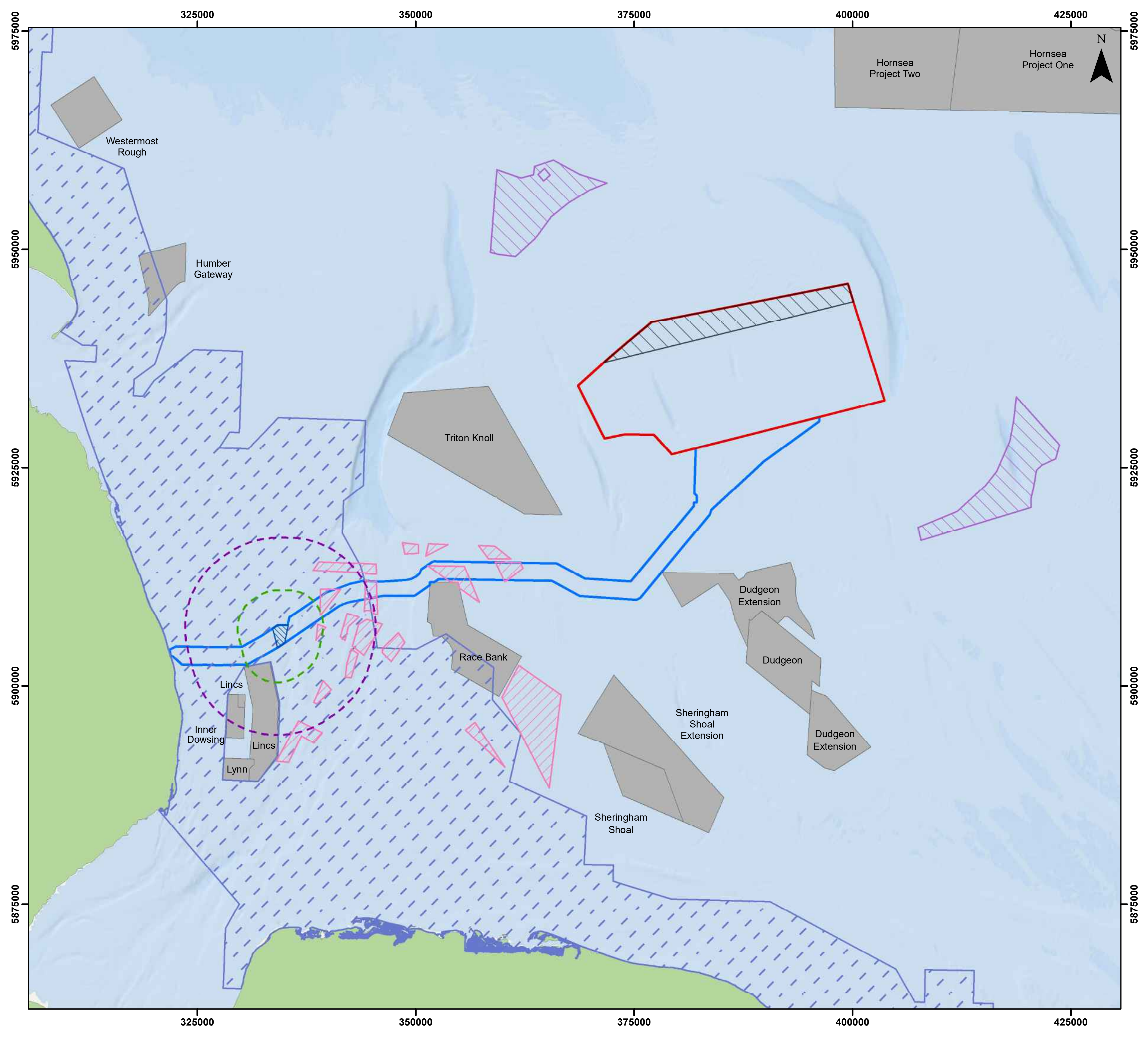
~~429.~~441. The assessment for displacement has been carried out for the Project based on a set of scenarios that recognise construction activities being restricted both temporally and spatially:

- Export cable laying activities being undertaken by a maximum of three vessel clusters simultaneously, across the entire ECC;
- Any potential displacement to auks and gannet likely to only occur within the array area, where vessels and construction activities are present; and
- Construction activities restricted both temporally and spatially to approximately four-years for a single phase of offshore construction.

~~430.~~442. Where construction activities do not occur, such as locations without WTG foundation, cables, OSS or ORCP installation, such areas shall remain largely uninfluenced by construction activities. There is little evidence to provide definitive empirical displacement rates for the construction phase of OWFs. However, studies have noted that displacement rates for auks are either comparable to the operational phase or significantly lower (Royal HaskoningDHV, 2013; Vallejo et al., 2017). Similarly, Krijgsveld et al., (2011) demonstrate flight paths of gannets are higher for operating vs non-operating turbines. Based on this evidence, and the above presented temporal and spatial restrictions of the construction and decommissioning phase in comparison to the operational phase, it is considered that the level of displacement used for assessment for auks and gannet would be half of that of the operational phase. Notably, for red-throated diver, a precautionary approach was taken with a displacement rate of 100%. A precautionary mortality rate of 1% is also used for all species, with a range of 1-10% presented for auk species, red-throated diver and common scoter (as requested by Natural England, with the Applicant's preferred approach based on 1% mortality).

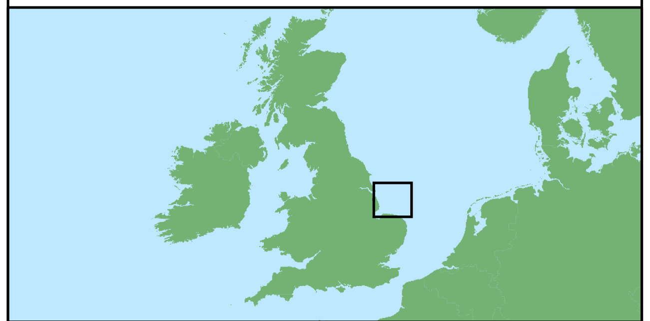
~~431.~~443. A summary of the displacement and mortality rates used for the assessment of disturbance and displacement during the construction and decommissioning phases is presented in Table 9.7 below. Reference should be made to the operation and maintenance phase for a full description and justification of the displacement and mortality rates used.

~~432.~~444. For auk species and gannet, birds within the array and 2km buffer were assumed to be at risk of displacement as per the latest A~~S~~NCB advice (MIG-Birds, 2022). A separate assessment for red-throated diver and common scoter was undertaken on impacts from vessel disturbance as well as construction activities within the ECC, biogenic reef and ORCP areas. This assessment used density data for these species within the Greater Wash SPA from Lawson et al., (2016), to estimate displacement mortality and habitat loss for these species. The ornithological study area for the ORCP areas can be seen in Figure 9.3. Considering the array area and ANS areas are >10km from the Greater Wash SPA there is considered to be no functional linkage and therefore consideration of displaced birds arising from construction activities within these two sites are not included in the assessment.



Legend

- Offshore Restricted Build Area
- Array Area
- Offshore Export Cable Corridor
- ORCP Area
- 4km Buffer from ORCP Area
- 10km Buffer from ORCP Area
- Artificial Nesting Structure Area
- Biogenic Reef Restoration Area
- Offshore Wind Farm Sites
- Greater Wash Special Protection Area



Coordinate System: WGS 1984 UTM Zone 31N

0 10 20 km

Scale: 1:400,000

A3 Page Size

RIAA

Ornithological Study Area for the ORCP Area

Figure 9.3

OUTER DOWSING OFFSHORE WIND

Date: 15/01/2025
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Revision: 0.1

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Table 9-7~~9.79~~ ~~79.7~~: Displacement rates used for assessment in the construction and decommissioning phase. Displacement rates from the array area in the construction and decommissioning phase are half those of O&M.

Species	Displacement rate	Mortality rate
Gannet	35% (plus a range of 30% to 40%)	1%
Auk species	25% (plus a range of 15% to 35%)	1% (plus a range of 1% to 10%)
Red-throated diver	100% (plus a range of 90% to 100%)	1% (plus a range of 1% to 10%)
Common scoter	100% (plus a range of 90% to 100%)	1% (plus a range of 1% to 10%)

~~433.~~445. The displacement assessments undertaken for this RIAA are considered to be over-precautionary based on the following:

- The population assessed within each bio-season was taken as the mean of the peaks from each survey year. This makes the assumption that such a high population is maintained for each of the months within the bio-season, whereas in reality the abundance of each species is likely to be considerably less for much of the bio-season. This is particularly true during migratory bio-seasons when there may be a single large peak abundance of birds travelling through the array area during one month;
- The maximum extent of displacement considered for each species within the assessment is likely to be greater than actually experienced;
- The 1% mortality of displaced birds is highly unlikely, as the species assessed in this RIAA are not solely dependent upon the area within the Project array and buffer for all their foraging needs either within the breeding or non-breeding bio-seasons;
- The apportionment assumptions are highly precautionary. For example, the assumption that 100% of adult gannets within the array during the breeding season are breeding birds from FFC SPA.

9.3.1.6 Approach to O&M

Disturbance and Displacement

~~434.~~446. The construction and presence of WTGs has the potential to disturb and displace seabirds that would normally reside within and around the area of sea where the Project is proposed to be developed.

~~435.~~447. There is a variation in responses from seabird species to the presence of offshore windfarms and the associated infrastructure, including shipping activity related to maintenance activities and the presence of WTGs. As offshore windfarms are relatively new features in the marine environment, there is limited evidence of the long-term effects of displacement and disturbance of operational infrastructure.

~~436.~~448. A scoring system for disturbance factors was developed by Garthe and Hüppop (2004), which has been used widely throughout offshore windfarm HRAs. Furness and Wade (2012) developed a similar system with disturbance ratings for seabird species which was applied alongside scores for habitat flexibility and conservation importance to define an index value that highlights each species' sensitivity to displacement and disturbance.

~~437.~~449. The potential for disturbance and displacement to result in an AEoI relates to the designated sites and the relevant features in Table 9.8.

Table 9-8~~9.89~~ ~~89.8~~: Sites and features identified for potential AEoI for disturbance and displacement impacts within the O&M phase.

Site	Feature	Bio-season
The Greater Wash SPA	Red-throated diver	Non-breeding
	Common scoter	Non-breeding
FFC SPA	Guillemot	Breeding and non-breeding
	Razorbill	Breeding and non-breeding
	Puffin*	Breeding and non-breeding
	Gannet	Breeding and non-breeding
Farne Islands SPA	Guillemot	Non-breeding
	Puffin	Non-breeding
Coquet Island SPA	Puffin*	Breeding and non-breeding
Scottish SPAs		
Buchan Ness to Collieston Coast SPA	Guillemot*	Non-breeding
Calf of Eday SPA	Guillemot*	Non-breeding
Copinsay SPA	Guillemot*	Non-breeding
East Caithness Cliffs SPA	Guillemot*; Razorbill*	Non-breeding
Fair Isle SPA	Guillemot*; Razorbill*; Puffin*	Non-breeding
Forth Islands (UK) SPA	Guillemot; Razorbill; Puffin; Gannet	Non-breeding
Foula SPA	Guillemot; Razorbill*; Puffin	Non-breeding
Fowlsheugh SPA	Guillemot; Razorbill*	Non-breeding
Hermaness, Saxa, Vord and Valla Field SPA	Guillemot*; Puffin; Gannet	Non-breeding
Hoy SPA	Guillemot*; Puffin*	Non-breeding
Marwick Head SPA	Guillemot*	Non-breeding
North Caithness Cliffs SPA	Guillemot; Razorbill*; Puffin*	Non-breeding
Noss SPA	Guillemot; Puffin*	Non-breeding
Rousay SPA	Guillemot*	Non-breeding
St Abb’s Head SPA	Guillemot*; Razorbill*	Non-breeding
Sumburgh Head SPA	Guillemot*	Non-breeding
Troup, Pennan and Lion’s Heads SPA	Guillemot; Razorbill*	Non-breeding
West Westray	Guillemot; Razorbill*	Non-breeding
Buchan Ness to Collieston Coast SPA	Guillemot*	Non-breeding

~~438.~~450. Natural England and JNCC issued a joint Interim Displacement Guidance Note (Natural England and JNCC 2012), which provides recommendations for presenting information to enable the assessment of displacement effects in relation to offshore windfarm developments. This has been superseded by a joint SNCB interim displacement advice note (SNCBs 2022), which provides the latest advice for UK development applications on how to consider, assess and present information and potential consequences of seabird displacement from offshore windfarms. These guidance notes have shaped the assessment provided for each site and their interest features presented below.

~~439.~~451. A summary of the rates of displacement and mortality used in the assessment of disturbance and displacement during the O&M phase are presented in Table 9.9 below.

~~440.~~452. For gannets, available evidence indicates a low level of sensitivity to ship and helicopter traffic (Garthe and Hüppop, 2004; Furness and Wade, 2012). A study by Krijgsveld et al., (2011) using radar and visual observations to monitor the post-construction effects of the OWEZ established that 64% of gannets avoided entering the windfarm (macro-avoidance). The results of the post-consent monitoring surveys for Thanet OWF found that gannet densities reduced within the site in the third year, but the report did not quantify this (Royal Haskoning DHV, 2013). A more recent study by APEM (APEM, 2014) provided evidence that during their migration most gannets would avoid flying into areas with operational WTGs (macro-avoidance), with the estimated macro-avoidance being 95%. Based on available evidence, a displacement rate of 70% is used, though a range of 60% to 80% is also presented to reflect the most recent A~~S~~NCB guidance (MIG-Birds, 2022). A mortality rate of 1% was selected for gannet, based on expert judgement supported by additional evidence that suggests that gannet have a large mean-maximum (315km) and maximum (709km) foraging range (Woodward et al., 2019) and feed on a variety of different prey items that provide sufficient alternative foraging opportunities despite the potential loss of habitat within the Project array area and 2km buffer. This mortality rate was not presented as part of a range (as has been presented for displacement rates), in agreement with Natural England.

~~441.~~453. Auk species (guillemot, razorbill and puffin) show a medium level of sensitivity to ship and helicopter traffic (Garthe and Hüppop, 2004; Furness and Wade, 2012; Langston, 2010; and Bradbury et al., 2014). A review by Dierschke et al., (2016) has summarised auk displacement responses in relation to OWFs across thirteen European OWF sites, comparing changes in seabird abundance between baseline and post-construction surveys. From the review, the outcomes for auks was 'weak displacement' but highly variable across all OWFs. Since the publication of this review, there have been a number of additional OWF sites which have reported displacement effects on auks (APEM, 2017; Webb et al., 2017; Vanermen et al., 2019; Peschko et al., 2020; MacArthur Green, 2021). Additionally, a review undertaken by APEM (APEM, 2022), found highly variable displacement rates for auks, ranging from attraction to displacement effects. However, conclusions from the study reported a displacement rate of up to 50% for the array area and 2km buffer would be most applicable, and also suitably precautionary. This rate is also supported by a review of OWF data in the German North Sea undertaken by Peschko et al. (2020). Monitoring of post-construction displacement at Beatrice OWF concluded that guillemots and razorbills were not displaced by individual WTGs, suggesting that displacement effects were weak to non-existent. In fact, analyses of razorbill distributions suggested a weak attraction effect (BOWL 2023). Consequently, the displacement rate of 50% was considered appropriate for the assessment, with a range of 30% to 70% also presented as recommended in the most recent A~~S~~NCB guidance (MIG-Birds, 2022) as advised by Natural England (Parker et al., 2022c). Also, as per A~~S~~NCB guidance, a mortality range of 1-10% was presented, with 1% used as the Applicant's approach based on available evidence suggesting that this rate is appropriate and represents a precautionary approach for the assessment of auks (Norfolk Boreas Limited, 2019; SPR, 2019; Ørsted, 2018; Kooten et al., 2019). The Applicant also refers to its comments on displacement rates set out in Rates of displacement in guillemot and razorbill (REP2-059).

~~442.~~454. Risk of displacement from activities associated with the ANS, biogenic reefs and ORCPs is also considered. Impacts from these activities are anticipated to result from vessel disturbance and the presence of the ORCPs within the Greater Wash SPA. Direct disturbance from the ANS structure, and array are not considered because there is no functional linkage between these areas and the Greater Wash SPA for divers and seaduck species. Many species considered for displacement are not sensitive to vessel disturbance (for example guillemot, razorbill and puffin), so displacement risk is confined to common scoter and red-throated diver. Impacts from displacement related to ANS, biogenic reef and ORCP monitoring and maintenance will be restricted to very low levels of vessel traffic (for example, potentially a single vessel for the monitoring of ANS), so impacts in areas where bird numbers are anticipated to be low already (as the ORCPs will be located within 10km of other OWF projects) are anticipated to be very low indeed.

Table 9-9~~9.99 99.9~~: Displacement and mortality rates used for assessment during the O&M phase

Species	Displacement rate	Mortality rate
Gannet	70% (plus a range of 60% to 80%)	1%
Auk species	50% (plus a range of 30% to 70%)	1% (plus a range of 1% to 10%)
Red-throated diver	100% (plus a range of 90% to 100%)	1% (plus a range of 1% to 10%)

~~443.~~455. The detailed methods and results of the displacement assessment are presented in the Displacement Annex (Part 6, Volume 2, Appendix 12.3: Displacement Assessment Annex).

~~444.~~456. The assessments provided within this RIAA include a number of assumptions that contribute to the predicted impacts and potential effects being considered very precautionary, including:

- The population within each bio-season being the mean of the peaks from each survey year. This makes the assumption that such a high population is maintained for each of the months within the bio-season, whilst the actual abundance of each species is likely to be less than this for much of the bio-season;
- The maximum extent of displacement assessed for each species is likely to be greater than actually experienced within the array area and buffer;
- The maximum of 10% mortality of birds displaced during the non-migratory breeding bio-season is highly unlikely, as the species assessed in this RIAA are not solely dependent upon the area within the Project array area and buffer for all their foraging needs; and
- That adult birds that are actively breeding will respond to displacement by putting themselves to further stress to the extent of dying rather than ceasing to breed (i.e. abandoning eggs or young) and surviving to breed in a later year.
- In line with advice from Natural England, assessments based upon the upper (and lower) 95% confidence intervals, using additional bespoke bioseasons and apportioning in the case of guillemot and razorbill, with updated adult proportions for all species considered have been presented; each of which add precaution to the assessments.

Collision Risk

~~445.~~457. The potential for mortality resultant from collision risk to result in an AEoI relates to the designated sites and the relevant features found in Table 9.10. Herring gull has been assessed as part of the seabird assemblage of FFC SPA.

~~446.~~458. In addition, a large number of migratory species have been assessed for collision risk on migration. Migratory waterbirds have been assessed using the stochastic collision risk tool (McGregor, 2018) and using Migropath~~(McGregor, 2018)~~. Seabirds, little gull and common tern, have been assessed for collision on migration using Broadfront modelling (document 12.5: Migratory Bird Collision Risk Modelling). Assessment for migratory features can be found in ~~SectionParagraph~~ Paragraph 733~~XX.~~.

Table 9-10~~9.109~~ ~~109.10~~: Sites and features identified for potential AEoI for collision risk impacts within the O&M phase.

*assemblage feature

Site	Feature	Bio-season
North Norfolk Coast SPA	Sandwich tern	Breeding and non-breeding
FFC SPA	Kittiwake	Breeding and non-breeding
	Gannet	Breeding and non-breeding
	Herring gull*	Breeding and non-breeding
Alde-Ore Estuary SPA & Ramsar	Lesser black-backed gull	Breeding and non-breeding
Coquet Island	Sandwich tern	Non-breeding
Farne Island SPA	Kittiwake	Breeding and non-breeding
	Sandwich tern	Non-breeding
Scottish sites		
Buchan Ness to Collieston Coast SPA	Kittiwake	Non-breeding
Calf of Eday SPA	Kittiwake	Non-breeding
Copinsay SPA	Kittiwake	Non-breeding
East Caithness Cliffs SPA	Kittiwake	Non-breeding
Fair Isle SPA	Kittiwake	Non-breeding
Forth Islands (UK) SPA	Kittiwake; Gannet	Non-breeding
Foula SPA	Kittiwake	Non-breeding
Fowlsheugh SPA	Kittiwake	Non-breeding
Hermaness, Saxa, Vord and Valla Field SPA	Kittiwake	Non-breeding
Hoy SPA	Kittiwake	Non-breeding
Marwick Head SPA	Kittiwake	Non-breeding
North Caithness Cliffs SPA	Kittiwake	Non-breeding
Noss SPA	Kittiwake	Non-breeding
Rousay SPA	Kittiwake	Non-breeding
St Abb's Head SPA	Kittiwake	Non-breeding
Sumburgh Head SPA	Kittiwake	Non-breeding
Troup, Pennan and Lion's Heads SPA	Kittiwake	Non-breeding
West Westray	Kittiwake	Non-breeding

~~447.~~459. There is a potential collision risk to birds which fly through the Project ~~array~~ WTG area whilst foraging for food, commuting between breeding sites and foraging areas, or when on migration. The risk to birds arises from colliding with the WTG rotors and associated infrastructure resulting in injury or fatality.

~~448.~~460. Collision Risk Modelling (CRM) has been used to estimate the potential risk to birds associated with the proposed development. The approach to CRM is presented in Part 6, Volume 2, Appendix 12.2: Collision Risk Modelling Assessment Annex, and provides the methods, data input and results of the CRM. Modelling has been carried out using the Stochastic Collision Risk Model (sCRM) developed by Marine Scotland Science (McGregor, 2018) applied through the 'Shiny app' interface using the density of flying birds measured by 18 months of digital aerial survey to produce predictions of mortality for particular species across set time periods (biological seasons) and on an annual basis. This most recent version of the Band (2012) CRM has been designed specifically to address uncertainty in developments and other key input parameters as progressed initially by Masden (2015) for application to the assessment of collision risk to seabirds from offshore windfarm developments.

~~449.~~461. The sCRM accounts for a number of different species-specific behavioural aspects of birds being assessed, including the height at which birds fly, their ability to avoid moving or static structures and how active they are diurnally and nocturnally, respectively. Details of these considerations are also provided Part 6, Volume 2, Appendix 12.2: Collision Risk Modelling Assessment Annex.

~~450.~~462. The assessment of collision risk follows an evidence led approach making use of a mixture of site-specific data collected from within the Project array area and the most recent literature on seabirds and their behaviour in relation to OWFs (Part 6, Volume 2, Appendix 12.2: Collision Risk Modelling Assessment Annex).

~~451.~~463. Within this report the Shiny app outputs for Band Option 2 only are presented, which applies a uniform distribution of bird flights between the lowest and the highest levels of the rotors. The proportion at collision height (PCH) was determined from the results of the Strategic Ornithological Support Service (SOSS02) project (Cook et al., 2012) that analysed the flight height measurements taken from boat surveys conducted around the UK. The project was updated following Johnston et al., (2014), and the revised published spreadsheet is used to determine the 'generic' percentage of flights at PCH for each species based on the proposed project's wind turbine parameters. This Band Option has been relied upon as the model to carry through to the assessment of collision risk for kittiwake, gannet and Sandwich tern collision risk assessments.

Precautionary nature of CRM

~~452.~~464. The behavioural parameters used (as described in paragraph 9.4.33 and Part 6, Volume 2, Appendix 12.2: Collision Risk Modelling Assessment) were based on the most recent guidance for Natural England (Natural England, 2022), notably accounting for updates to avoidance rates and nocturnal activity factors provided in this recent guidance, apart from where more recent advice from Natural England (i.e. during examination – RR-045) recommends updated nocturnal activity factors (NAFs) and avoidance rates for collision risk species (gannet, lesser black-backed gull, herring gull, kittiwake, and Sandwich tern). These values are provided in Part 6, Volume 2, Appendix 12.2: Collision Risk Modelling Assessment Annex.

~~453.~~465. It should be noted that these parameters are considered precautionary based on available evidence. Considering avoidance rates, a study funded by the Offshore Renewables Joint Industry Programme (ORJIP), studied birds around Thanet OWF over 2 years (between 2014 and 2016). The study found that of 12,000 birds recorded during the two-year period, only 6 birds (all gull species) were reported to have collided with WTGs (Skov et al., 2018). Further review undertaken for gannet by both Cook (2018) and APEM (2014) have found that actual gannet avoidance rates are likely higher than the rate used, with APEM reporting an actual avoidance rate as high as 100% during migratory periods (though a rate of 0.995 was suggested as more realistically appropriate).

~~454.~~466. Additionally, a recent report undertaken at Aberdeen Offshore Windfarm Limited (AOWFL, 2023) at the European Offshore Wind Development Centre (EOWDC) found that collision rates of birds are likely to be significantly lower than predicted based on input parameters, implying further precaution of the current methodology used. The two-year study used a combination of video and radar to look at turbine avoidance and found that no collisions or even narrow escapes were recorded in over 10,000 bird videos, highlighting that avoidance rates are likely to be even higher in reality.

~~455.~~467. Considering flight speeds, a review undertaken for Norfolk Boreas Offshore Windfarm (Royal HaskoningDHV, 2020) estimated that the flight speed of 13.1m/sec used for kittiwake is an overestimate, and that a value of 10.8m/s (±0.9) is more realistic based on a range of monitoring methods. A study undertaken by Skov et al., (2018) estimated an even lower value of 8.7 m/s (±3.2 m/s) to be more appropriate, and also suggested a value of 13.3m/s (± 4.2m/s) would be more appropriate for gannet than the currently used 14.9m/s, and a value of 9.8m/s (± 3.6 m/s) for large gull species. These data were based on large sample sizes of bird species recorded in the Thanet OWF. This assessment has followed the current guidance; however, it is of note that if these lower flight speeds and lower nocturnal activity factors were used in the models then the collision rates would be lowered considerably. Therefore, it is considered that the CRM input parameters used in the assessment of collision risk to seabirds for the Project and those from other projects at the in-combination level, incorporate a high degree of precaution.

Assessment Data

~~456.~~468. Information used to inform the apportioning of impacts to individual SPAs is provided in Appendix 7.1.1: Offshore and Intertidal Ornithology Apportioning, including the following:

- Bio-seasons used for the assessment;
- Adult proportions of relevant SPAs;
- The proportion of adults apportioned to each SPA in the breeding and non-breeding bio-seasons; and
- SPA population sizes (both citation counts and more recent counts where relevant).
- Construction and Decommissioning Assessment.

~~457.~~469. This apportioning appendix (Appendix 1: Ornithology Apportioning; Table 11) also clearly lays out the any ~~species specific~~species-specific differences in methodologies between the Applicant's and Natural England's preferred approaches.

9.3.2 C&D Assessment

9.3.2.1 Disturbance and Displacement

Coquet Island SPA – Puffin

~~458.~~470. Puffin has been screened in for the construction and decommissioning phase to assess the potential for an AEoI from displacement from the Project alone in relation to the following conservation objectives for this species, as an assemblage feature of the FFC SPA (Document 7.2):

- Maintain the population of each qualifying feature.

~~459.~~471. Although puffin is only a named feature of the seabird assemblage, for the purpose of this assessment it has been considered in a similar manner to qualifying species, though the conclusion is not whether an AEoI would result from the Project alone on puffin as a feature, but more as an important component of the seabird assemblage. The citation count is 31,686 and the latest population estimate is 50,058 individuals based on the most recent 2019 colony counts.

~~460.~~472. The Project ~~array~~ WTG area is located 258.8~~8~~km from Coquet Island SPA which is within the mean max plus 1 standard deviation (SD) foraging distance of 265.4km (Woodward et al., 2019) and has therefore been screened in for the breeding bio-season for the months of April to July and the non-breeding bio-season defined as August to March by Furness (2015) (presented in Appendix 7.1.1: Offshore and Intertidal Ornithology Apportioning).

Breeding Bio-season

~~461.~~473. During the breeding bio-season, the number of puffins estimated to occur in the ~~array~~ WTG area and 2km buffer is 666~~760~~ individuals. Assuming the proportion of adult birds in the array is 55~~49~~%, the total number of breeding adults in the array at risk of displacement is 366 ~~372~~ (366.3)~~372.4)~~ during the full breeding bio-season.

474. Of these 366~~72~~ breeding adults, 78.2% are predicted to be breeding birds from Coquet Island SPA (Appendix 7.1.1). Therefore, 289~~7294~~ (288~~6~~.6~~293.5~~) breeding adults at risk of displacement are attributed to Coquet Island SPA. Assuming a displacement rate of 25% and a mortality rate of 1%, the consequent mortality is estimated at less than one (0.7) breeding adults. However, based on advice from ~~S~~ANCBs (MIG-Birds, 2022), a displacement range of 15% to 35% is also presented in Table 9.11.

~~462.~~475. Using Natural England's preferred approach, with 100% apportioned as adults, 52~~1~~5 (524.8) birds are apportioned to the Coquet Island SPA. Assuming a displacement rate of 35% and a mortality rate of 2%, the consequent mortality is estimated at four (3.7) breeding adults.

~~463.~~476. Based on the citation count of 31,686 breeding adults and annual background mortality of 2,978.5~~8~~ individuals, the addition of less than one predicted breeding adult mortality would represent a 0.~~0~~048~~2419~~% increase in baseline mortality during the breeding bio-season. The addition of four mortalities from the application of Natural England's preferred approach would represent an increase in baseline mortality of 0.~~043~~247%.

477. As the population of puffin has changed significantly since the citation population count the potential impact on the population is more reasonably assessed against the latest population count undertaken in 2019, consisting of 50,058 individuals and an annual background mortality of 4705.5 individuals. On this basis, less than one (0.7~~9~~) mortality would represent a 0.015~~9~~% increase in baseline mortality during the breeding bio-season.

Non-breeding Bio-season

~~464.~~478. In the non-breeding bio-season the mean-peak number of puffins estimated to occur in the ~~array~~ WTG area and 2km buffer is 414~~637 (636.5)~~ individuals. On the basis that ~~5.3~~10.6~~10.6~~% of these puffins within the ~~array~~ WTG area are deemed to be breeding adults from Coquet Island SPA during the non-breeding bio-season (Appendix 7.1.1), the total abundance of breeding adults from the SPA estimated to be displaced from array plus 2km buffer is ~~22~~44.0~~68 (67.7)~~ (Table 9.11). Based on 25% displacement and 1% mortality, the total predicted consequent mortality from being displaced is estimated at less than one (0.1~~02~~) individual during the non-breeding bio-season. However, based on advice from A~~S~~NCBs (MIG-Birds, 2022), a displacement range of 15% to 35% is also presented in Table 9.11.

~~465.~~479. This estimated mortality equates to an increase in baseline mortality of 0.004~~210~~% in the non-breeding bio-season relative to the citation count and increase of 0.002~~14~~% based on the most recent counts.

Annual Total

~~466.~~480. Across all bio-seasons, the number of puffins estimated to occur in the ~~array~~ WTG area and a 2km buffer is 1,080~~396 (1,396.5)~~ individuals, with 311 (310.7)~~361 (361.2)~~ of these being breeding adults from the Coquet Island SPA. The total predicted displacement consequent mortality throughout the construction & decommissioning of the Project is less than one (0.8~~79~~) breeding adult from Coquet Island SPA per annum across all bio-seasons. Displacement consequent mortalities based on the range advocated by A~~S~~NCBs (15% displacement to 35% displacement, 1 to 10% mortality) are displayed in Table 9.11.

481. The predicted mortality of one breeding adult from Coquet Island SPA per annum across all bio-seasons represents an increase in baseline mortality of 0.028~~2657~~% based on the citation count and 0.018~~723~~% when considering the recent count. This level of impact, below 0.1% increase in baseline mortality, is considered to make no material contribution to any changes in population or mortality and would be indistinguishable from natural fluctuations in the population.

~~467.~~482. Under Natural England's preferred approach, across all bio-seasons the total number of adults apportioned to the Coquet Island SPA is 546~~3~~.~~0~~8, giving an annual predicted mortality of ~~1.3~~1.4 birds. This would represent an increase on baseline mortality of 0.~~044~~134% and 0.085% (using 35% displacement and 2% mortality).

~~468.~~**483.** **Therefore, the potential for an AEoI to the conservation objectives of the puffin as an assemblage feature of Coquet Island SPA in relation to disturbance and displacement effects in the construction & decommissioning phase from the Project alone can be ruled out as, subject to natural change, puffin will be maintained as a feature in the long-term.**

Table 9-11~~9.119-119.11~~ Range-based displacement mortalities during the construction and decommissioning phases for puffin at Coquet Island SPA based on the values advocated by A~~SNCBA~~NCBs for the most recent counts (Seabird Monitoring Programme, 2019).

Bio-season	Abundance of adults apportioned to SPA (plus 2km buffer)	Estimated increase in mortality (breeding adults per annum)			% increase in baseline mortality (~~recent~~ citation count)			% increase in baseline mortality (recent count)		
		25% displacement, 1% mortality	35% displacement, 2% mortality	15-35% displacement, 1 - 10% mortality	25% displacement, 1% mortality	35% displacement, 2% mortality	15-35% displacement, 1 – 10% mortality	25% displacement, 1% mortality	35% displacement, 2% mortality	15-35% displacement, 1 – 10% mortality
Applicant approach										
Breeding	28~~6~~8.6~~293.5~~	0.7	2.0	0.4~~4~~ – 10.1~~3~~	0.048~~0.01519~~	0.136	0.029 - 0.678~~0.00911 – 0.21066~~	0.015	0.043	0.009 – 0.215
Non-breeding	44.0~~22.067.7~~	0.1~~0.02~~	0.3	0.1~~01~~ – 1.5~~0.82.4~~	0.004~~0.0014~~	0.010	0.002 - 0.052~~0.0012 – 0.01456~~	0.002	0.007	0.001 – 0.033
Annual Total	**332.7~~310.761.2~~**	**0.7~~9~~**	**2.3**	**0.5~~45~~ – 11.6~~1.12.6~~**	**0.028~~0.01623~~**	**0.078**	**0.017 – 0.391~~0.014 – 0.332~~**	**0.018**	**0.049**	**0.011 – 0.248**
~~SNCB~~A~~A~~NCB approach										
Breeding	~~521.0~~524.8	1.3	3.7	0.8 - 18.4~~2~~	0.088~~0.043~~	0.247	0.053 - 1.233~~0.026 – 0.602~~	0.044	0.123	0.017 - 0.391

Bio-season	Abundance of adults apportioned to SPA (plus 2km buffer)	Estimated increase in mortality (breeding adults per annum)			% increase in baseline mortality (~~recent~~ citation count)			% increase in baseline mortality (recent count)		
		25% displacement, 1% mortality	35% displacement, 2% mortality	15-35% displacement, 1 - 10% mortality	25% displacement, 1% mortality	35% displacement, 2% mortality	15-35% displacement, 1 – 10% mortality	25% displacement, 1% mortality	35% displacement, 2% mortality	15-35% displacement, 1 – 10% mortality
Non-breeding	44.0~~22.0~~ ~~0.0~~ ~~0.0 – 0.8~~ ~~0.001~~	0.1~~0.001 – 0.014~~	0.3	0.1 – 1.5	0.004	0.010	0.002 - 0.052	0.002	0.007	0.002 – 0.033
Annual Total	**568.9~~543.0~~**	**1.4~~1.3~~**	**4.0**	**0.~~8~~9 - 19.9~~0~~**	**0.048~~0.044~~**	**0.134**	**0.029 – 0.669 ~~0.027 - 0.616~~**	**0.030**	**0.085**	**0.018 - 0.423**

Farne Islands SPA – Guillemot

~~469.~~484. Guillemot has been screened in for the construction and decommissioning phase to assess the potential for an AEoI from displacement from the Project alone in relation to the following conservation objectives for this species, as a feature of the Farne Island SPA (Document 7.2):

- Maintain the population of each qualifying feature.

~~470.~~485. Based on the above the conservation objective for the Farne Island SPA the specific target for the guillemot feature is as follows based on Natural England's case-specific advice (Natural England 2021):

- Maintain the size of the breeding population at a level which is above 32,875 breeding pairs (65,750 breeding adults), whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent. The latest colony population estimate is 64,042 breeding adults based on the most recent 2019 colony count.

~~471.~~486. The Project ~~array~~ WTG area is located 286.5~~4.2~~km from the Farne Island SPA which is beyond the mean max plus 1SD foraging distance of 153.7km (Woodward et al., 2019) and has therefore been screened out for the breeding bio-season. However, there is non-breeding connectivity, defined as August to February by Furness (2015) (Appendix 7.1.1).

Non-breeding Bio-season

~~472.~~487. In the non-breeding bio-season the mean-peak number of guillemots estimated to occur in the ~~array~~ WTG area and 2km buffer is 9,066~~11,208 (11,208.0)~~ individuals.

488. On the basis that 3.7% of these guillemots within the ~~array~~ WTG area are deemed to be breeding adults from the Farne Islands SPA during the non-breeding bio-season (Appendix 7.1.1), the total abundance of breeding adults estimated to be displaced from array plus 2km buffer and attributable to this SPA is 338 (338.4~~)418 (418.3)~~). Based on 25% displacement and 1% mortality, the total predicted consequent mortality from being displaced is estimated at one (0.8~~91.0~~) individual during the non-breeding bio-season. However, based on advice from ~~SNCB~~ANCBs (MIG-Birds, 2022), a displacement range of 15% to 35% is also presented in Table 9.12.

489. Using Natural England's preferred approach, 160 (159.7) birds are apportioned to the Farne Islands SPA. Assuming a displacement rate of 35% and a mortality rate of 2%, the consequent mortality is estimated at one (1.1) breeding adult.

~~473.~~ Using the Applicant's approach,

~~474.~~490. ~~B~~based on a citation population of 65,751 breeding adults and an annual background mortality of 4,010.8 breeding adults per annum, the addition of less than~~approximately~~ one predicted breeding adult mortality would represent an increase in baseline mortality of 0.021~~6~~%. Using the Natural England Approach, the addition of one predicted mortality would increase the baseline mortality by 0.028%. Displacement consequent mortalities based on the range advocated by ~~SNCB~~ANCBs (15% displacement to 35% displacement, 1 to 10% mortality) are displayed in Table 9.12.

~~475.~~491. As the population of guillemot has changed since the citation population count, the potential impact on the population is more reasonably assessed against the latest population count undertaken in 2023, consisting of 46,332 individuals and an annual background mortality of 2,826.3 individuals. On this basis, the level of predicted effect would represent a 0.030~~6~~% increase in baseline mortality in the non-breeding bio-season. Using the Natural England Approach, the predicted impact would result in a 0.040% increase the baseline mortality. This level of impact is considered to make no material contribution to any changes in population or mortality as it would be indistinguishable from natural fluctuations in the population.

~~476.~~492. **Therefore, the potential for an AEoI to the conservation objectives of the guillemot feature of Farne Island SPA in relation to disturbance and displacement effects in the construction and decommissioning phase from the Project alone can be ruled out as, subject to natural change, guillemot will be maintained as a feature in the long-term.**

Table 9-12~~9.129-129.12~~: Range-based displacement mortalities during the construction and decommissioning phases for guillemot at Farne Island SPA based on the values advocated by Natural England for the most recent counts (Seabird Monitoring Programme, 2019).

Bio-season	Abundance of adults apportioned to SPA (plus 2km buffer)	Estimated increase in mortality (breeding adults per annum)			% increase in baseline mortality (citation count)			% increase in baseline mortality (recent count)		
		25% displacement, 1% mortality	35% displacement, 2% mortality	15-35% displacement, 1-10% mortality	25% displacement, 1% mortality	35% displacement, 2% mortality ~~25% displacement, 1% mortality~~	15-35% displacement, 1 – 10% mortality	25% displacement, 1% mortality	35% displacement, 2% mortality~~25% displacement, 1% mortality~~	15-35% displacement, 1 – 10% mortality
Applicant's Approach										
Non-breeding	3~~8~~38.4~~41 8.3~~	0.89~~1.0~~	2.4	0.5~~6~~ – 11.9~~24.6~~	0.021	0.059~~0.0216~~	0.013~~207~~ – 0.296~~4154~~	0.030	0.084~~0.0306~~	0.018~~21~~ – 0.4~~2~~19~~90~~
~~SNCB~~ANCB Approach										
Non-breeding	159.7	0.4	1.1	0.3 – 5.6	0.010	0.028	0.006 – 0.140	0.014	0.040	0.009 – 0.198

Farne Islands SPA – Puffin

~~477.~~493. Puffin has been screened in for the construction and decommissioning phase to assess the potential for an AEoI from displacement from the Project alone in relation to the following conservation objectives for this species, as an assemblage feature of the Farne Island SPA (Document 7.2):

- Maintain the population of each qualifying feature.

~~478.~~494. Puffin is a named feature of the seabird assemblage, and for the purpose of this assessment it has been considered in a similar manner to qualifying species, though the conclusion is not whether an AEoI would result from the Project alone on puffin as a feature, but more as an important component of the seabird assemblage. The latest population estimate is 43,752 apparently occupied burrows (AOB) based on the most recent 2019 colony counts. This equates to 87,504 individuals.

~~479.~~495. The Project ~~array~~ WTG area is located 286.5~~4.2~~km from the Farne Islands SPA which is beyond the mean max plus 1SD foraging distance of 265.4km (Woodward et al., 2019) and has therefore been screened out for the breeding bio-season. However, there is non-breeding connectivity, defined as August to March by Furness (2015) (Appendix 7.1.1).

Non-breeding Bio-season

~~480.~~496. In the non-breeding bio-season the mean-peak number of puffin estimated to occur in the ~~array~~ WTG area and 2km buffer is 414 ~~637 (636.5)~~ individuals.

497. On the basis that 34.5~~17.234.5~~% of these puffins within the ~~array~~ WTG area are deemed to be breeding adults from the Farne Island SPA during the non-breeding bio-season (Appendix 7.1.1), the total abundance of breeding adults from array plus 2km buffer attributed to the Farne Islands SPA is ~~71~~143 (~~71.3~~142.6) ~~220 (219.6)~~. Based on 25% displacement and 1% mortality, the total predicted consequent mortality from being displaced is estimated at less than one (0.4~~25~~) individual during the non-breeding bio-season. Based on advice from ~~SNCB~~ANCBs (MIG-Birds, 2022), a displacement range of 15% to 35% is also presented in Table 9.13.

498. Using Natural England's preferred approach, 143 (142.6) birds are apportioned to the Farne Islands SPA. Assuming a displacement rate of 35% and a mortality rate of 2%, the consequent mortality is estimated at one (1.0) breeding adult.

~~481.~~

~~482.~~499. Based on a citation population of 76,798 breeding adults and an annual background mortality of 7,219 breeding adults per annum, the addition of less than one predicted breeding adult mortality would represent an increase in baseline mortality of 0.005~~037~~%. Using the Natural England Approach, the addition of one predicted mortality would increase the baseline mortality by 0.014%. Displacement consequent mortalities based on the range advocated by ~~SNCB~~ANCBs (15% displacement to 35% displacement, 1 to 10% mortality) are displayed in Table 9.13.

~~483.~~500. As the population of puffin has changed since the citation population count, the potential impact on the population is more reasonably assessed against the latest population count undertaken in 2019, consisting of 87,504 individuals and an annual background mortality of 8,225.4 individuals. On this basis, this would represent a 0.004~~26~~% increase in baseline mortality in the non-breeding bio-season. Using the Natural England Approach, the predicted impact would result in a 0.012% increase the baseline mortality. This level of impact is considered to make no material contribution to any changes in population or mortality as it would be indistinguishable from natural fluctuations in the population.

~~484.~~501. **Therefore, the potential for an AEoI to the conservation objectives of the puffin as an assemblage feature of Farne Island SPA in relation to disturbance and displacement effects in the construction and decommissioning phase from the Project alone can be ruled out, subject to natural change, puffin will be maintained as a feature in the long-term.**

Table 9-13~~9.139-139.13~~: Range-based displacement mortalities during the construction and decommissioning phases for puffin at Farne Island SPA based on the values advocated by Natural England for the most recent counts (Seabird Monitoring Programme, 2019).

Bio-season	Abundance of adults apportioned to SPA (plus 2km buffer)	Estimated increase in mortality (breeding adults per annum) ~~Estimated increase in mortality (breeding adults per annum)~~ ~~% increase in baseline mortality (citation count)~~			Increase in baseline mortality (citation count)			Increase in baseline mortality (recent count)~~% increase in baseline mortality (recent count)~~		
		25% displacement, 1% mortality	35% displacement, 2% mortality	25-35% displacement, 1-10% mortality	25% displacement, 1% mortality	35% displacement, 2% mortality	15-35% displacement, 1 – 10% mortality	25% displacement, 1% mortality	35% displacement, 2% mortality	15-35% displacement, 1 – 10% mortality
Non-breeding	142.6~~7~~ ~~1.3219.6~~	0.4~~254~~	~~0.5~~1.0	0.2~~154~~ – 5.0~~2.87.6~~	0.005~~37~~	0.~~0~~012~~7~~	0.003~~24~~ – 0.069~~4298~~	0.005~~26~~	0.0012~~6~~	0.003~~14~~ – 0.061~~2884~~

Flamborough and Filey Coast SPA – Guillemot

~~485.~~502. Guillemot has been screened in for the construction and decommissioning phase to assess the potential for an AEoI from displacement from the Project alone in relation to the following conservation objectives for this species, as a feature of the FFC SPA (Document 7.2):

- Maintain the population of each qualifying feature.

~~486.~~503. Based on the above the conservation objective for the FFC SPA the specific target for the guillemot feature is as follows based on Natural England's case-specific advice (Natural England 2021):

- Maintain the size of the breeding population at a level which is above 41,607 breeding pairs (83,214 breeding adults), whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent. The latest colony population estimate is 149,980 breeding adults based on the most recent 2022 colony count.

~~487.~~504. The Project ~~array~~ WTG area is located 9~~2.8~~3.5km from the FFC SPA which is within the mean max plus 1SD foraging distance of 73.2±80.5km (Woodward et al., 2019) and has therefore been screened in for the breeding bio-season for the months of March to July and the non-breeding bio-season defined as August to February by Furness (2015) (Appendix 7.1.1).

Breeding Bio-season

~~488.~~ During the breeding bio-season, the number of guillemots estimated to occur in the ~~array~~ WTG area and 2km buffer is 11,364~~16,445 (16,445.3)~~ individuals. Assuming the proportion of adult birds in the array is 57%, and that 50% of these adults are apportioned to FFC SPA (the Applicant's approach, based on the assumption that the breeding bio-season numbers (based on April peaks much higher than in any other breeding season month) are inflated by non-breeding birds or those associated with other colonies. See the Apportioning Appendix 7.1.1 for fuller details), the total number of breeding adults in the array at risk of displacement is 3,239 (3,238.9)~~4,687 (4,686.9)~~ during the full breeding bio-season.

~~489.~~505. Assuming a displacement rate of 25% and a mortality rate of 1%, the consequent mortality is estimated at eight (8.1)~~12 (11.7)~~ breeding adults. However, based on advice from ~~SNCB~~ANCBs (MIG-Birds, 2022), a displacement range of 15% to 35% is also presented in Table 9.14.

~~490.~~506. Based on a citation population of 83,214 breeding adults and annual background mortality of 5,076.1 individuals, the addition of eight~~12~~ predicted breeding adult mortalities would represent a 0.~~159~~160~~203~~% increase in baseline mortality during the breeding bio-season.

~~491.~~507. As the population of guillemot has increased since the citation population count the potential impact on the population is more reasonably assessed against the latest population count undertaken in 2022, consisting of 149,980 individuals and an annual background mortality of 9,148.8 individuals. On this basis, this would represent a 0.089~~8157~~% increase in baseline mortality during the breeding bio-season.

~~492.~~508. Applying Natural England's preferred apportioning approach (assuming that all birds are apportionable to FFC SPA and that all birds are adult) and applying a displacement rate of 35% and a mortality rate of 2%, the mortality attributed to FFC SPA is ~~28~~80 (~~28.4~~79.5)~~41 (41.1)~~. Against baseline mortality at the scale of the citation count, this is an increase in mortality of ~~0.560~~1.567~~810~~%. Against baseline mortality at the scale of the most recent colony count, this represents an increase in baseline mortality of 0.~~310~~870~~449~~%.

Non-breeding Bio-season

~~493.~~509. In the non-breeding bio-season the mean-peak number of guillemots estimated to occur in the ~~array~~ WTG area and 2km buffer is 9,066~~11,208~~ individuals.

~~494.~~510. On the basis that 4.4% of these guillemots within the ~~array~~ WTG area are deemed to be breeding adults from the FFC during the non-breeding bio-season (Appendix 7.1.1), the total abundance of breeding adults estimated to be displaced from the array plus 2km buffer is 400~~95~~ (400.0)~~94.5)~~ . Based on 25% displacement and 1% mortality, the total predicted consequent mortality from being displaced is estimated at one (1.0~~2~~) individual during the non-breeding bio-season. However, based on advice from ~~SNCB~~ANCBs (MIG-Birds, 2022), a displacement range of 15% to 35% is also presented in Table 9.14.

511. This consequent estimated mortality equates to an increase in baseline mortality of 0.020~~1924~~% in the non-breeding bio-season relative to the citation population and 0.011~~4~~% relative to the most recent count.

512. Under Natural England's preferred approach, the mean-peak number of guillemots estimated to occur in the ~~array~~WTG area and 2km buffer across the non-breeding season is 13,345 individuals.

513. On the basis that 68.5% of these guillemots within the ~~array~~WTG area are deemed to be breeding adults from the FFC during the post-breeding bio-season and 4.41% are deemed to be from FFC SPA in the non-breeding season (Appendix 7.1.1), the total abundance of breeding adults estimated to be displaced from the array plus 2km buffer is 6,399 (6399.1). Based on ~~2~~35% displacement and ~~1~~2% mortality, the total predicted consequent mortality from being displaced is estimated at ~~16~~45 (~~15.9~~44.8) individuals during the non-breeding bio-season. However, based on advice from ~~SNCB~~ANCBs (MIG-Birds, 2022), a displacement range of 15% to 35% is also presented in Table 9.14~~Table 9.14~~.

514. This consequent estimated mortality equates to an increase in baseline mortality of 0.~~315~~882% in the non-breeding bio-season relative to the citation population and 0.~~175~~489% relative to the most recent count.

Annual Total

~~495.~~515. Across all bio-seasons, the number of guillemots estimated to occur in the ~~array~~ WTG area and a 2km buffer is 20,430~~7,653 (27,653.3)~~ individuals, with 3,639 (3,638.8)~~5,181 (5,181.4)~~ of these being breeding adults from the FFC SPA using the applicant's approach to apportioning, and 17,763 ~~24,70916,940 (16,939.8)~~ using Natural England's preferred approach to apportioning. The total predicted displacement consequent mortality throughout the construction & decommissioning of the Project is nine (9.1)~~13 (12.9)~~ breeding adults per annum across all bio-seasons using the applicant's approach, and ~~44~~ 124 (~~44.4~~124.3~~2 (42.3~~) using Natural England's. Displacement consequent mortalities based on the range advocated by ~~SNCB~~ANCBs (15% displacement to 35% displacement, 1 to 10% mortality) are displayed in Table 9.14.

~~496.~~516. Using the applicant's approach, the predicted mortality of nine~~13~~ breeding adults from FFC SPA per annum across all bio-seasons represents an increase in baseline mortality of 0.179~~255~~% when considering the citation population or an increase in baseline mortality of 0.~~100~~099~~42~~% when considering the recent count. This level of impact would be indistinguishable from natural fluctuations in the population.

517. Using Natural England's preferred approach, the predicted mortality of 124 ~~442~~ breeding adults from FFC SPA across all bio-seasons represents an increase on baseline mortality of 2.450~~0.87734~~% when considering the citation population, and 1.359~~0.48663~~% when considering the most recent count. This level of impact would be indistinguishable from natural fluctuations in the population.

~~497.~~518. It is noted that this increase in baseline mortality is greater than 1%. Please see the O&M section for a more detailed review of project alone impacts to the guillemot feature of FFC SPA. Please note that a PVA has been ~~The PVA~~ carried out for the O&M phase for guillemot at FFC SPA using~~ed~~ NE's highly precautionary rates (70% and 2%, compared to 35% and 2% for C&D) which shows that any impact to guillemot would be inconsequential. It is considered therefore that any impacts during the C&D phase would also be inconsequential and that there is no requirement for an additional PVA to be carried out. ~~and still did not pose a risk to the project over 35 years (threshold: <0.995 CGR; PVA result: 0.998). Since this threshold is not exceeded, any additional impact from the C&D phase would be inconsequential and does not require further PVA assessment.~~

~~498.~~519. **Therefore, the potential for an AEoI to the conservation objectives of the guillemot feature of FFC SPA in relation to disturbance and displacement effects in the construction and decommissioning phase from the Project alone can be ruled out as, subject to natural change, guillemot will be maintained as a feature in the long-term.**

Table 9-14~~9.149-149.14~~: Range-based displacement mortalities during the construction and decommissioning phases for guillemot at FFC SPA based on the values advocated by ~~SNCB~~ANCBs for both citation population counts and most recent counts (Seabird Monitoring Programme, 2022).

Bio-season	Abundance of adults apportioned to SPA (plus 2km buffer)	Estimated increase in mortality (breeding adults per annum)			% increase in baseline mortality (citation count)			% increase in baseline mortality (recent count)		
		25% displacement, 1% mortality	35% displacement, 2 % mortality	15-35% displacement, 1-10% mortality	25% displacement, 1% mortality	35% displacement, 2 % mortality	15-35% displacement, 1 – 10% mortality	25% displacement, 1% mortality	35% displacement, 2 % mortality	15-35% displacement, 1 – 10% mortality
~~SNCB~~ANCB Approach										
Breeding	11,364.0~~16,445.3~~	28.4~~41.1~~	79.5	17.0~~24.7~~ – 379.7~~6575.5~~	0.560~~0.560810~~	1.567	0.366~~486~~ - 7.835~~40 11.339~~	0.311~~0.310449~~	0.870	0.187~~6270~~ – 4.348~~06.291~~
Post-breeding~~Non-breeding~~	6,210.3~~13,345494.5~~	15.5~~15.91.2~~	43.5	9.3 – 217.4~~9.50.7 - 222.617.3~~	0.306~~0.315024~~	0.856	0.183 – 4.282~~0.189015 - 4.4100.341~~	0.170~~0.175014~~	0.475	0.102 – 2.376~~0.105008 - 2.4500.189~~
Non-breeding	188.8	0.5	1.3	0.3 – 6.6	0.009	0.026	0.005 – 0.130	0.005	0.014	0.003 – 0.072
Annual Total	**17,763.3~~24,70916,939.8~~**	**44.4~~44.342.3~~**	124.3	**26.6 – 621.7~~226.55.3 – 602.2592.2~~**	0.875~~0.875834~~	2.450	**0.525 – 12.248~~0.55501 - 12.25011.680~~**	0.485~~0.485463~~	1.359	**0.291 – 6.796~~0.291278 –~~**

Bio-season	Abundance of adults apportioned to SPA (plus 2km buffer)	Estimated increase in mortality (breeding adults per annum)			% increase in baseline mortality (citation count)			% increase in baseline mortality (recent count)		
		25% displacement, 1% mortality	35% displacement, 2 % mortality	15-35% displacement, 1-10% mortality	25% displacement, 1% mortality	35% displacement, 2 % mortality	15-35% displacement, 1 – 10% mortality	25% displacement, 1% mortality	35% displacement, 2 % mortality	15-35% displacement, 1 – 10% mortality
										~~6.4816.790~~
Applicant Approach										
Breeding	3,238.8~~4,686.9~~	8.1~~11.7~~	22.7	4.9~~7.0~~ - 113.4~~63.8~~	0.160~~0.159231~~	0.447	0.096~~5139~~ – 2.233~~263.232~~	0.089~~0.088128~~	0.248	0.053~~77~~ – 1.239~~2793~~
Non-breeding	400.0~~94.5~~	1.0~~2~~	2.8	0.6~~7~~ - 14.0~~7.3~~	0.020~~0.01924~~	0.055	0.012~~15~~ - 0.267~~6341~~	0.011~~0.0114~~	0.031	0.007~~68~~ - 0.153~~489~~
Annual Total	**3,638.8~~5181.4~~**	**9.1~~12.9~~**	25.5	**5.5~~7.7~~ - 127.4~~180.6~~**	0.179~~0.255178~~	0.502	**0.108~~653~~ – 2.509~~4923.573~~**	0.099~~0.099142~~	0.278	**0.060~~5985~~ – 1.392~~86982~~**

Flamborough and Filey Coast SPA – Razorbill

~~499.~~520. Razorbill has been screened in for the construction and decommissioning phase to assess the potential for an AEoI from displacement from the Project alone in relation to the following conservation objectives for this species, as a feature of the FFC SPA (Document 7.2):

- Maintain the population of each qualifying feature.

~~500.~~521. Based on the above the conservation objective for the FFC SPA the specific target for the razorbill feature is as follows based on Natural England's case-specific advice (Natural England 2021):

- Maintain the size of the breeding population at a level which is above 10,570 breeding pairs (21,140 breeding adults), whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent. The latest colony population estimate is 61,346 breeding adults based on the most recent 2022 colony count.

~~501.~~522. The Project ~~array~~ WTG area is located 93.5~~2.8~~km from the FFC SPA which is within the mean max plus 1SD foraging distance of 88.7 ± 75.9km (Woodward et al., 2019) and has therefore been screened in for the breeding season (April-July), the post-breeding migration bio-season (August to October), the return migration bio-season (January-March), and the winter bio-season (November to December) as defined by Furness (2015) (Appendix 7.1.1).

Breeding Bio-season

~~502.~~523. During the breeding bio-season, the number of razorbills estimated to occur in the ~~array~~ WTG area and 2km buffer is 3,159~~596 (3,596.2)~~ individuals. Assuming the proportion of adult birds in the array is 57%, the total number of breeding adults in the array at risk of displacement is 1,801 (1,800.6)~~2,050 (2,049.7)~~ during the breeding bio-season.

~~503.~~524. Of these 1,801~~2,050~~ breeding adults, 100% are predicted to be breeding birds from FFC SPA (Appendix 7.1.1). Therefore, 1,801~~2,050)~~ breeding adults at risk of displacement are attributed to FFC SPA. Assuming a displacement rate of 25% and a mortality rate of 1%, the consequent mortality is estimated at five (4.5~~5.1~~) breeding adults. However, based on advice from ~~SNCB~~ANCBs (MIG-Birds, 2022), a displacement range of 15% to 35% is also presented in Table 9.15.

~~504.~~525. Using Natural England's preferred apportioning approach and apportioning all birds as adults, with a displacement rate of 35% and a mortality rate of 2% gives a mortality of ~~eightnine~~22 (~~7.9~~22.1~~8.99~~) birds.

~~505.~~526. Based on a citation population of 21,140 breeding adults and annual background mortality of 2,220 (2,219.7) individuals, the addition of five predicted breeding adult mortalities would represent a 0.202~~31~~% increase in baseline mortality during the breeding bio-season. The addition of ~~eightnine~~22 mortalities would represent an increase to baseline mortality of 0.~~355~~996~~405~~%.

~~506.~~527. As the population of razorbill has increased significantly since the citation population count the potential impact on the population is more reasonably assessed against the latest population count undertaken in 2022, consisting of 61,346 individuals and an annual background mortality of 6441.3 individuals. On this basis, this would represent a 0.069~~80~~% increase in baseline mortality during the breeding bio-season using the applicant's approach, and 0.~~122~~343~~0~~% using the apportioning approach preferred by Natural England.

Non-breeding Bio-season

~~507.~~528. The mean-peak number of razorbills estimated to occur in the ~~array~~ WTG area and 2km buffer is estimated at 6,210 individuals in the return migration, 2,391 (2,390.5) individuals during the post-breeding migration bio-season and 1,956 individuals in the winter bio-season.

~~508.~~529. On the basis that 3.4% of these razorbills within the ~~array~~ WTG area are deemed to be breeding adults from the FFC during the return migration and post-breeding bio-seasons (Appendix 7.1.1), the total abundance of breeding adults estimated to be displaced from the array plus 2km buffer is ~~210~~ 174 (~~209~~173.5~~.9~~) during the return migration, ~~81~~ 74 (~~80~~73.8) during the post-breeding migration and ~~18~~ 50 (~~17~~58.8~~.9~~) in the winter bio-season. Under Natural England's preferred approach, these numbers are the same apart from for the post-breeding bio-season, for which the bespoke apportioning approach of 70.8% adults from FFC SPA gives an apportioned abundance of 1,542.6

~~509.~~530. Based on 25% displacement and 1% mortality, the total predicted consequent mortality from being displaced is estimated at less than one (0.4~~45~~) individual during return migration, less than one (0.2) during the post-breeding migration and less than one (0.1~~2~~) in the winter bio-season. However, based on advice from ~~SNCB~~ANCBs (MIG-Birds, 2022), a displacement range of 15% to 35% is also presented in Table 9.15. Using Natural England's bespoke apportioning approach gives a post-breeding bio-season mortality of ~~3.9~~10.8 individuals.

~~510.~~531. This estimated mortality equates to an increase in baseline mortality of 0.020~~4~~% in the return-migration bio-season, 0.008~~9~~% in the post-breeding bio-season (0.~~174~~486 under Natural England's preferred ~~appraoch~~approach) and 0.005~~68~~% in the winter bio-season based on the citation population, ~~-~~and 0.007~~8~~%, 0.003% and 0.002~~1~~% respectively relative to the most recent counts.

~~511.~~532. This equates to a total consequent mortality from displacement across the entire non-breeding bio-season of less than one (0.7) breeding adult per annum. This represents an increase of 0.033~~5~~% in baseline mortality of the citation population and 0.012% increase using the most recent count.

Annual Total

~~512.~~533. Across all bio-seasons, the number of razorbills apportioned to FFC SPA from~~estimated to occur in~~ the ~~array~~ WTG area and a 2km buffer is 2,097 ~~14,153 (14,152.7)~~ individuals, ~~with 2,358 (2358.4) of these being breeding adults from the FFC SPA~~ using the applicant's approach to apportioning, and 4,923~~3,905 (3904.7)~~ using Natural England's preferred apportioning. The total predicted displacement consequent mortality throughout the construction and decommissioning of the Project is five~~six~~ (5.2~~9~~) breeding adults from FFC SPA per annum across all bio-seasons using the applicant's approach, or ~~12~~35 (~~12.3~~34.5)~~10 (9.9)~~ using Natural England's preferred approach. Displacement consequent mortalities based on the range advocated by ~~SNCB~~ANCBs (15% displacement to 35% displacement, 1 to 10% mortality) are displayed in Table 9.15.

~~513.~~534. The predicted mortality of five~~less than six~~ breeding adults from FFC SPA per annum across all bio-seasons represents an increase in baseline mortality of 0.203~~3766~~% when considering the citation population or an increase of 0.~~081~~070~~92~~% when considering the most recent count. This level of impact would be indistinguishable from natural fluctuations in the population.

535. Assessing increases on baseline mortality using Natural England's preferred apportioning gives increases of ~~0.55445~~1.553% against the baseline mortality at the time of citation, and 0.~~191~~535~~39~~% against the baseline mortality from the most recent count. These changes would be indistinguishable from natural fluctuations in baseline mortality levels. As the increase to baseline mortality is less than 1% when considered against the most recent count from the FFC SPA, further assessment through PVA is not required.

~~514.~~

~~515.~~536. Therefore, the potential for an AEoI to the conservation objectives of the razorbill feature of FFC SPA in relation to disturbance and displacement effects in the construction and decommissioning phase from the Project alone can be ruled out as, subject to natural change, razorbill will be maintained as a feature in the long-term.

Table 9-15~~9.159-159.15~~: Range-based displacement mortalities during the construction and decommissioning phases for razorbill at FFC SPA based on the values advocated by ~~SNCB~~ANCBs for both citation population counts and most recent counts (Aitken et al., (2017) Seabird Monitoring Programme.

Bio-season	Abundance of adults apportioned to SPA (plus 2km buffer)	Estimated increase in mortality (breeding adults per annum)			% increase in baseline mortality (citation count)			% increase in baseline mortality (recent count)		
		25% displacement, 1% mortality	35% displacement, 2% mortality	15-35% displacement, 1-10% mortality	25% displacement, 1% mortality	35% displacement, 2% mortality	15-35% displacement, 1 – 10% mortality	25% displacement, 1% mortality	35% displacement, 2% mortality	15-35% displacement, 1 – 10% mortality
~~SNCB~~ANCB Apportioning										
Breeding	3,159.0~~3,1593,596~~	7.9~~9.0~~	22.1	4.7~~5.4~~ - 110.6~~125.9~~	0.356~~0.355405~~	0.996	0.214~~343~~ – 4.981~~705.670~~	0.123~~0.1220~~	0.343	0.073~~2~~ - 1.717~~08680~~
Post-breeding migration	1,542.6~~1,542.680.8~~	3.9~~0.2~~	10.8	2.3~~0.1~~ - 54.0~~62.8~~	0.174~~0.174009~~	0.486	0.104~~005~~ – 2.433~~60.127~~	0.060~~0.06003~~	0.168	0.036~~02~~ – 0.838~~40044~~
Winter	48.8	0.1	0.3	0.1 – 1.7	0.005	0.015	0.004 – 0.077	0.002	0.005	0.001 – 0.027
Return-breeding migration	173.5~~173.5209.9~~	0.4~~5~~	1.2	0.3~~23~~ – 6.1~~5.67.4~~	0.020~~0.02024~~	0.055	0.012~~4~~ – 0.274~~80331~~	0.007~~0.0078~~	0.019	0.004~~5~~ – 0.095~~8114~~

Bio-season	Abundance of adults apportioned to SPA (plus 2km buffer)	Estimated increase in mortality (breeding adults per annum)			% increase in baseline mortality (citation count)			% increase in baseline mortality (recent count)		
		25% displacement, 1% mortality	35% displacement, 2% mortality	15-35% displacement, 1-10% mortality	25% displacement, 1% mortality	35% displacement, 2% mortality	15-35% displacement, 1 – 10% mortality	25% displacement, 1% mortality	35% displacement, 2% mortality	15-35% displacement, 1 – 10% mortality
~~Winter~~	4923.9~~48.817.9~~	~~0.10~~	34.5	~~0.0 – 1.40.6~~	0.555~~0.0062~~	1.553	~~0.0041 – 0.08428~~	0.191~~0.0021~~	0.535	~~0.0010 – 0.02810~~
Annual Total	**4,923~~4,923.33904.7~~**	**12.3~~9.9~~**	**34.5**	**7.4~~25.9~~ - 172.2~~138.6~~**	0.555~~**0.555445**~~	**1.553**	**0.334~~3267~~ – 7.764~~706.230~~**	0.382~~**0.191139**~~	0.535	**0.1154~~4082~~ - 2.766~~6741.946~~**
Applicant Apportioning										
Breeding	1,801~~2,050~~	4.5~~5.1~~	12.6	2.7~~3.1~~ - 63.0~~71.8~~	0.203~~0.202231~~	0.568	0.122~~1139~~ – 2.839~~283.232~~	0.070~~0.06980~~	0.196	0.042~~8~~ – ~~1.114~~0.988~~66~~
Post-breeding migration	73.8~~80.8~~	0.2	0.5	0.1 - 2.6~~8~~	0.008~~0.009~~	0.023	0.005 – 0.117~~27~~	0.003~~0.003~~	0.008	0.002 – 0.040~~4~~
Winter	48.8	0.1	0.3	0.8 – 1.7	0.005	0.015	0.004 – 0.077	0.002	0.005	0.001 – 0.027

Bio-season	Abundance of adults apportioned to SPA (plus 2km buffer)	Estimated increase in mortality (breeding adults per annum)			% increase in baseline mortality (citation count)			% increase in baseline mortality (recent count)		
		25% displacement, 1% mortality	35% displacement, 2% mortality	15-35% displacement, 1-10% mortality	25% displacement, 1% mortality	35% displacement, 2% mortality	15-35% displacement, 1 – 10% mortality	25% displacement, 1% mortality	35% displacement, 2% mortality	15-35% displacement, 1 – 10% mortality
Return-breeding migration	173.5~~209.9~~	0.4~~5~~	1.2	0.3~~23~~ ~~-~~– 6.1~~5.67.4~~	0.020~~0.0204~~	0.055	0.012~~4~~ – 0.274~~80331~~	0.0070~~0.0078~~	0.019	0.004~~5~~ – 0.095~~8114~~
~~Winter~~	~~48.8 17.9~~	~~0.10~~	14.7	~~0.0 – 1.40.6~~	0.236~~0.0062~~	0.661	~~0.0041 – 0.08428~~	0.081~~0.0021~~	0.228	~~0.0010 – 0.02810~~
Annual Total	**~~2358.4~~2,097.1**	**5.2~~.9~~**	**12.6**	**3.1~~05~~ ~~-~~– 73.4~~2.882.5~~**	**0.203~~0.23766~~**	**0.568**	**0.142~~59~~ – 3.306~~19719~~**	**0.070~~0.08192~~**	**0.196**	**0.055 – 1.140~~36281~~**

Flamborough and Filey Coast SPA – Puffin

~~516.~~537. Puffin has been screened in for the construction and decommissioning phase to assess the potential for an AEoI from displacement from the Project alone in relation to the following conservation objectives for this species, as an assemblage feature of the FFC SPA (Document 7.2):

- Maintain the population of each qualifying feature.

~~517.~~538. Although puffin is a named feature of the seabird assemblage, as opposed to a qualifying feature, for the purpose of this assessment it has been considered in a similar manner to qualifying species, though the conclusion is not whether an AEoI would result from the Project alone on puffin as a feature, but more as an important component of the seabird assemblage. The latest population estimate is 4,279 based on the most recent 2018 colony counts.

~~518.~~539. The Project ~~array~~ WTG area is located 93.5~~2.9~~km from the FFC SPA which is within the mean max plus 1SD foraging distance of 137.1 ± 128.3km (Woodward et al., 2019) and has therefore been screened in for the breeding bio-season for the months of April to July and the non-breeding bio-season defined as August to March by Furness (2015) (Appendix 7.1.1).

Breeding Bio-season

~~519.~~540. During the breeding bio-season, the number of puffins estimated to occur in the ~~array~~ WTG area and 2km buffer is 666~~760 (760.0)~~ individuals. Assuming the proportion of adult birds in the array is 55~~49~~%, he total number of breeding adults in the array at risk of displacement is 366 (366.3)~~72 (372.4)~~ during the full breeding bio-season.

~~520.~~541. Of these 372 breeding adults, 21.2% are predicted to be breeding birds from FFC SPA (Appendix 7.1.1). Therefore, 78 (77.7)~~79 (78.9)~~ breeding adults at risk of displacement are attributed to FFC SPA. Assuming a displacement rate of 25% and a mortality rate of 1%, the consequent mortality is estimated at less than one (0.2) breeding adults. However, based on advice from ~~SNCB~~ANCBs (MIG-Birds, 2022), a displacement range of 15% to 35% is also presented in Table 9.16.

542. Based on the most recent counts of 4,279 breeding adults and annual background mortality of 261.0 individuals, the addition of less than one predicted breeding adult mortalities would represent a 0.067~~75~~% increase in baseline mortality during the breeding bio-season.

~~521.~~543. Using Natural England's preferred approach 141 (141.2) breeding adults are apportioned to FFC SPA. This gives a mortality of ~~0.4~~1.0 and an increase on baseline mortality of 0.~~122~~346%.

Non-breeding Bio-season

~~522.~~544. In the non-breeding bio-season the mean-peak number of puffins estimated to occur in the ~~array~~ WTG area and 2km buffer is 414~~637 (636.5)~~ individuals.

~~523.~~545. On the basis that 0.~~4~~8~~8~~% of these puffins within the ~~array~~ WTG area are deemed to be breeding adults from the FFC during the non-breeding bio-season (Appendix 7.1.1), the total abundance of breeding adults estimated to be displaced from the array plus 2km buffer is 3.4~~less than two (1.7)five (5.2).~~. Based on 25% displacement and 1% mortality, the total predicted consequent mortality from being displaced is estimated at less than one (0.0) individual during the non-breeding bio-season. However, based on advice from ~~SNCB~~ANCBs (MIG-Birds, 2022), a displacement range of 15% to 35% is also presented in Table 9.16.

~~524.~~546. This consequent estimated mortality equates to an increase in baseline mortality of 0.00~~2~~3~~4~~% in the non-breeding bio-season relative to the most recent count.

Annual Total

~~525.~~547. Across all bio-seasons, the number of puffins estimated to occur in the ~~array~~ WTG area and a 2km buffer is 1,080~~397 (1,396.5)~~ individuals. The total predicted consequent mortality from being displaced attributed to FFC SPA throughout the construction and decommissioning of the Project is less than one (0.~~2~~2) breeding adult from FFC SPA per annum across all bio-seasons. Under Natural England's preferred approach, the annual predicted mortality is ~~0.46~~1.0. Displacement consequent mortalities based on the range advocated by ~~SNCB~~ANCBs (15% displacement to 35% displacement, 1 to 10% mortality) are displayed in Table 9.16.

~~526.~~548. The predicted mortality of less than one (0.2) breeding adult from FFC SPA per annum across all bio-seasons is considered to make no material contribution to any changes in population or mortality as it represents an increase in baseline mortality of 0.070~~06787~~% when considering the recent count, and 0.~~134192~~350% using ~~n~~Natural England's preferred approach, this level of impact would be indistinguishable from natural fluctuations in the population.

~~527.~~549. Therefore, the potential for an AEoI to the conservation objectives of the puffin as an assemblage feature of FFC SPA in relation to disturbance and displacement effects in the construction and decommissioning phase from the Project alone can be ruled out as, subject to natural change, puffin will be maintained as an assemblage feature in the long-term.

Table 9-16~~9.169-169.16~~: Range-based displacement mortalities during the construction and decommissioning FFC SPA phases for puffin based on the values advocated by ~~SNCB~~ANCBs for the most recent counts (Aitken et al., (2017) Seabird Monitoring Programme).

Bio-season	Abundance of adults apportioned to SPA (plus 2km buffer)	Estimated increase in mortality (breeding adults per annum)			% increase in baseline mortality (recent count)		
		25% displacement, 1% mortality	35% displacement, 2% mortality	15-35% displacement, 1-10% mortality	25% displacement, 1% mortality	35% displacement, 2% mortality	15-35% displacement, 1 – 10% mortality
Applicant approach							
Breeding	77.7~~78.9~~	0.2	0.5	0.1 – 2.7~~86~~	0.067~~0.06775~~	0.188	0.040~~5~~ – 0.939~~81.050~~
Non-breeding	~~1.7~~3.4~~5.2~~	0.0	0.0	0.0 – 0.1~~67 0.2~~	0.003~~10.00212~~	0.008~~4~~	0.00~~1~~2~~7~~ – 0.0~~21~~83~~8168~~
Annual Total	**~~84.179.4~~81.1**	**0.2**	**0.6**	**0.1 – 2.~~7~~8~~3.52.7~~**	**0.070~~690.06987~~**	0.196~~2~~	**0.041~~52~~ – 0.~~596~~960~~9661.218~~**
~~SNCB~~ANCB approach							
Breeding	141.2	0.4	1.0	0.2 ~~-~~– 4.9~~5.6~~	0.122~~0.122~~	0.341	0.073 - 1.707~~8~~
Non-breeding	3.4~~1.7~~	0.0~~0.0~~	0.0~~0.0~~	0.0 – 0.1~~0.0 – 0.67~~	0.003~~0.0010.002~~	0.008~~0.004~~	0.002 – 0.083~~0.001 – 0.0281~~
Annual Total	**144.6~~2.9~~**	**0.4**	**1.0**	**0.2 ~~-~~– 5.0~~6.3~~**	0.125~~30.124~~	0.3~~46~~50	**0.075~~4~~ - 1.74~~2~~8~~36~~**

Flamborough and Filey Coast SPA – Gannet

~~528.~~550. Gannets were screened in for the construction and decommissioning phase to assess the potential for an AEoI from displacement from the Project ~~array~~ WTG area in relation to the following conservation objectives for this species, as a feature of the FFC SPA (Document 7.2):

- Maintain the population of each of the qualifying features.

~~529.~~551. Based on the above the conservation objective for the FFC SPA the specific target for the gannet feature is as follows based on Natural England's case-specific advice (Natural England 2021):

- To maintain the size of the breeding population at a level which is above 8,469 breeding pairs (16,938 breeding adults), whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent. The latest count is 26,784 adults based on the 2017 survey (Aitken et al., 2017).

~~530.~~552. The Project ~~array~~ WTG area is located 93.5~~2.9~~km from the FFC SPA, which is within the mean-maximum plus 1SD foraging distance of 315.2 ± 194.2km (Woodward et al., 2019) and has therefore been screened in for the breeding season. In the non-breeding season, breeding gannets are not constrained by requirements to visit nests to incubate eggs or provision for chicks. It is therefore assumed that individuals will range more widely than during the breeding season, and therefore gannet has also been screened in for the non-breeding season. Gannets recorded during digital aerial surveys are therefore considered to come from a range of breeding colonies in the UK and further afield, as presented in Appendix 7.1.1.

~~531.~~553. The different bio-seasons for consideration of assessing potential risk from displacement on birds from FFC SPA includes the breeding season (March - September), the post-breeding migration bio-season (September to November) and the return migration bio-season (December to March), as defined by Furness (2015) (there is no migration free winter bio-season).

Breeding Bio-season

~~532.~~554. During the breeding bio-season, the number of gannets estimated to occur in the ~~array~~ WTG area and 2km buffer is 554~~635 (634.8)~~ individuals. Assuming the proportion of adult birds in the array is 90~~2~~% (based on adult proportions of aged birds from the site-specific DAS data) , the total number of breeding adults in the array at risk of displacement is 499 (498.8)~~589 (588.8)~~ during the breeding bio-season.

~~533.~~555. Of these 499~~589~~ breeding adults, 100% are predicted to be breeding birds from FFC SPA (Appendix 7.1.1). Therefore, 499~~584~~ breeding adults at risk of displacement are attributed to FFC SPA (Table 9.17)). Assuming a displacement rate of 35% and a mortality rate of 1%, the consequent mortality is estimated at less than two (1.7~~2.0~~) breeding adults. However, based on advice from ~~SNCB~~ANCBs (MIG-Birds, 2022), a displacement range of 30% to 40% is also presented in Table 9.17.

~~534.~~556. Based on a citation population of 16,938 breeding adults and annual background mortality of 1,372 individuals, the addition of less than two (1.7~~2.0~~) predicted breeding adult mortalities would represent a 0.127~~49~~% increase in baseline mortality during the breeding bio-season.

~~535.~~557. As the population of gannets has increased significantly since the citation population count the potential impact on the population is more reasonably assessed against the latest population count undertaken in 2023, consisting of 15,233 apparently occupied sites, or 30,466 individuals and an annual background mortality of 2,467.7 individuals. On this basis, this would represent a 0.070~~82~~% increase in baseline mortality during the breeding bio-season.

Non-breeding season

~~536.~~558. The mean-peak number of gannets estimated to occur in the ~~array~~ WTG area and 2km buffer is estimated at 496 (495.5~~6.0~~) and 69~~91~~ (69.0~~(90.5~~) individuals during the return migration and the post-breeding migration bio-season, respectively.

~~537.~~559. On the basis that 6.2% of the gannets within the ~~array~~ WTG area are deemed to be breeding adults from FFC SPA during the return migration and 4.8% during the post-breeding migration (Appendix 7.1.1), the total abundance of breeding adults estimated to be displaced from the array plus 2km buffer is 4 (4.3)~~24 (24.0)~~ during the return migration and 24 (24.0)~~six (5.6)~~ during the post-breeding migration.

~~538.~~560. Based on 35% displacement and 1% mortality, the total predicted consequent mortality from being displaced is estimated at less than one (0.1) individual during the return migration bio-season and less than one (0.0) individual during the post-breeding migration bio-season. However, based on advice from ~~SNCB~~ANCBs (MIG-Birds, 2022), a displacement range of 30% to 40% is also presented in Table 9.17.

~~539.~~561. This estimated mortality equates to an increase in baseline mortality of 0.001~~8~~% in the return-migration bio-season, and 0.006~~1~~% in the post-breeding bio-season using the baseline mortality from the citation count. The return migration and post-breeding bio-season increase in baseline mortality is 0.001~~0~~% and 0.004% respectively, based on the most recent population.

~~540.~~562. This equates to a total mortality from displacement across the entire non-breeding bio-season of less than one (0.2~~1~~) breeding adult per annum. This represents an increase of 0.007~~9~~% in baseline mortality of the citation population and 0.004~~0~~% increase using the most recent count.

Annual Total

~~541.~~563. Across all bio-seasons, the number of gannets estimated to occur in the ~~array~~ WTG area and a 2km buffer is 1,119 (1,118.7)~~1,221 (1,221.3)~~ individuals, with 527 (527.1)~~619 (619.1)~~ of these being breeding adults from the FFC SPA. The total predicted displacement consequent mortality throughout the construction and decommissioning of the Project is less than two (1.9~~2.2~~) breeding adults from FFC SPA per annum across all bio-seasons. Displacement consequent mortalities based on the range advocated by ~~SNCB~~ANCBs (30% displacement to 40% displacement, 1% mortality) are displayed in Table 9.17.

~~542.~~564. The predicted mortality of two breeding adult from FFC SPA per annum across all bio-seasons represents an increase in baseline mortality of 0.135~~57~~% when considering the citation population or an increase of 0.075~~87~~% when considering the recent colony count. Based on the recent SMP count this level of impact is considered to make no material contribution to any changes in population or mortality and be indistinguishable from natural fluctuations in the population.

~~543.~~565. **Therefore, the potential for an AEoI to the conservation objectives of the gannet feature of FFC SPA in relation to disturbance and displacement effects in the construction and decommissioning phase from the Project alone can be ruled out as, subject to natural change, gannet will be maintained as a feature in the long-term.**

Table 9-17~~9.17~~9-17~~9.17~~: Range-based displacement mortalities during the construction and decommissioning phases for gannet at FFC SPA based on the values advocated by ~~SNCB~~ANCBs for both citation population counts and most recent Seabird Monitoring Programme counts (Butcher *et al.,* 2023).

Bio-season	Abundance of adults apportioned to SPA (plus 2km buffer)	Estimated increase in mortality (breeding adults per annum)		% increase in baseline mortality (citation count)		% increase in baseline mortality (recent count)	
		35% displacement, 1% mortality	30-40% displacement, 1% mortality	35% displacement, 1% mortality	30-40% displacement, 1% mortality	35% displacement, 1% mortality	30-40% displacement, 1% mortality
Breeding	498.8~~588.8~~	1.7~~82.0~~	1.5~~7~~ - 2.1~~2.3~~	0.127	0.108~~27~~ – 0.145~~170~~	0.070	0.06~~7~~0 – 0.080~~93~~
Post-breeding migration	24.0	0.1	0.1 – 0.1~~1.1~~	0.006	0.005~~1~~ – 0.007~~1~~	0.004	0.003~~0~~ – 0.005~~0~~
Return migration	4.3~~5.6~~	0.0	0.0 – 0.0	0.001	0.001~~6~~ – 0.001~~9~~	0.001	0.001~~0~~ – 0.001~~0~~
Annual Total	**527.1~~618.5~~**	**1.8~~92.1~~**	**1.6~~8~~ – ~~3.2~~2.2~~2.4~~**	**0.134~~158~~**	**0.11~~3~~4 – 0.153~~80~~**	**0.075~~82~~**	**0.064~~70~~ – 0.086~~93~~**

Greater Wash SPA - Common Scoter (ECC, Biogenic reef, ORCP and ANS)

566. The conservation objective for the Greater Wash SPA is to ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the aims of the Wild Birds Directive, by maintaining or restoring:

- The extent and distribution of the habitats of the qualifying features;
- The structure and function of the habitats of the qualifying features;
- The supporting processes on which the habitats of the qualifying features rely;
- The population of each of the qualifying features; and
- The distribution of the qualifying features within the site.

The ~~presence~~construction of the ORCP and Project related construction ~~operational~~ vessel traffic (including the ECC and Biogenic Reef)~~associated with the Project have~~has the potential to affect common scoter associated with the Greater Wash SPA. This section considers the magnitude of impact on common scoter from the presence of vessel traffic and the construction of the ORCP and ECC~~ and relevant operational vessel traffic~~. The ANS is 24km from the Greater Wash SPA, therefore there is no connectivity with the Greater Wash SPA and the ANS, therefore, has not been considered further.

~~The RIAA (AS1-095) considered a worst-case scenario of impacts during construction and decommissioning due to the ORCPs. The Applicant maintains that the assessment presented in the RIAA (AS1-095) is robust and is proportional to the risks both from installation and operation of the ORCPs. The removal of the northern ORCP area will not change the conclusions of the impacts on the Common scoter feature of the Greater Wash SPA.~~

~~Within their RR, Natural England has requested a more detailed assessment of the effects of the ORCP on common scoter, specifically during the O&M phase. Therefore, an additional confirmatory analysis has been undertaken to address these concerns, specifically the uncertainty surrounding the effects of static structures on common scoter. This has been provided in the O&M Section.~~

567. Common scoter has been screened in for the assessment of the construction and decommissioning phase to assess the impacts from disturbance and displacement from the Project alone on the basis of its sensitivity to vessel presence during the process of the Offshore export cable laying, creation of the biogenic reef and ORCP construction, particularly ~~and~~ in relation to those parts of the Offshore ECC in shallower water, closer to the coast, where common scoter are most likely to be found.

568. The laying of the Offshore export cable between the array/WTG area and the cable landfall area for the Project would involve cable laying vessels being in situ for the entire offshore construction period of up to 48-months, potentially occurring in two consecutive non-breeding periods.

569. ~~ANS, b~~Biogenic reef and ORCP construction is likely to be restricted to single vessels or vessel clusters, at different periods from cable laying, so disturbance from these activities is anticipated to be small scale, short term and temporary. The ANS structures are beyond 10km from the Greater Wash SPA and therefore there is no anticipated impact from these structures on common scoter using the SPA.

570. In order to assess the potential impact on common scoter a displacement effect distance has to be determined. A 2km buffer surrounding any cable laying vessel ~~will~~has been used to assess the extent of any displacement based on that being the agreed distance for red-throated diver and that common scoter is also known to be sensitive to disturbance by vessels. Given the ORCP will be situated on the cable corridor, the impacts of construction of the ORCP are encompassed within the following quantitative assessment.

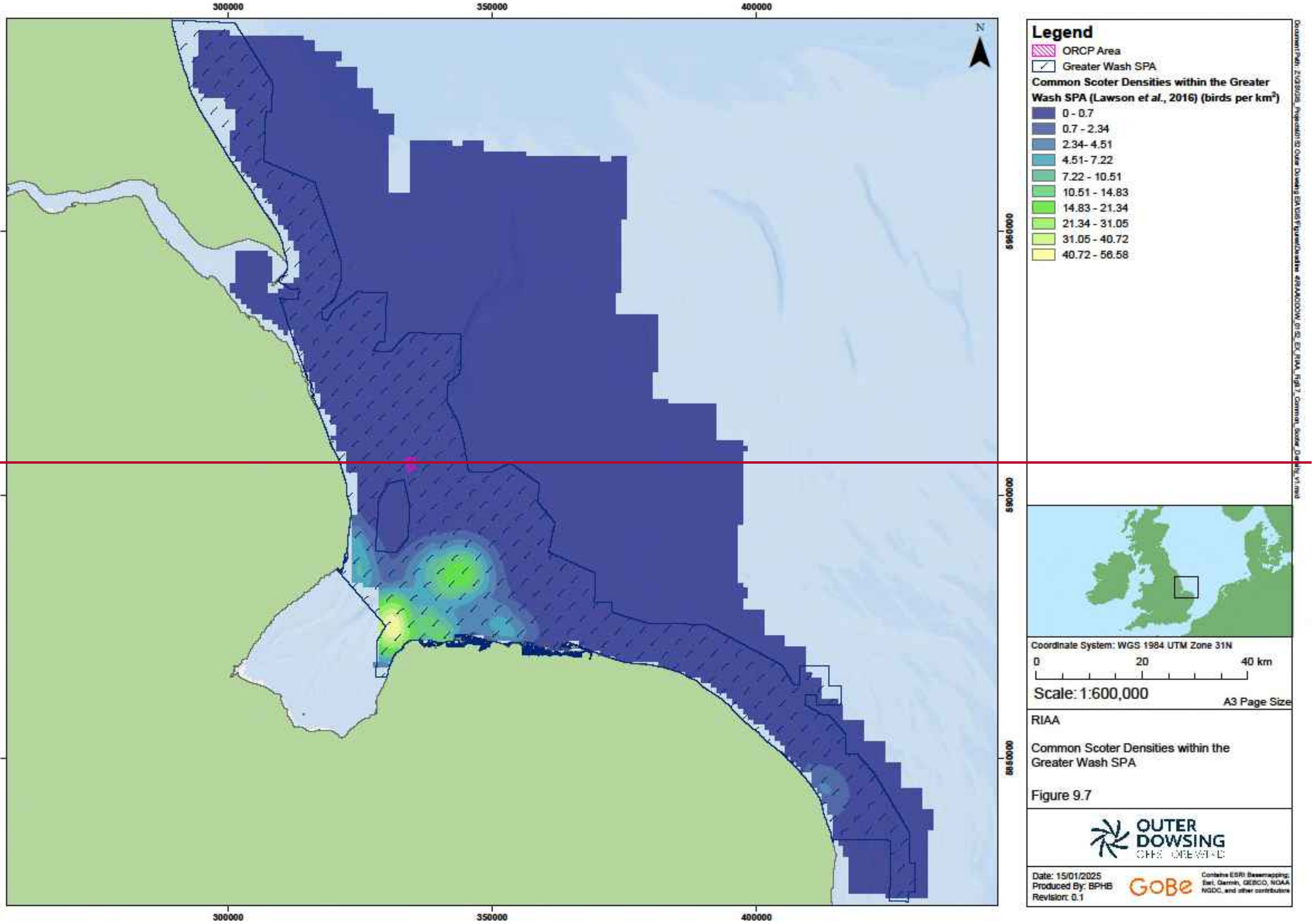
571. Based on data by Lawson *et al.*~~,~~ (2016), an average density of 0.004 and a maximum density of 0.029 common scoters are estimated to be present within the Project Offshore ECC (nothing the ORCP is within the ECC boundary). Based on a 2km buffer around each of the ~~three~~ construction vessels, the area disturbed per vessel was calculated to be circa 12.6 km^2.~~,~~ A worst-case scenario is based on three construction vessels operating at one time, resulting in a total worst-~~-~~case area of circa 37.7 km^2 from which birds could be displaced. This is considered a precautionary approach, since vessels are unlikely to be spaced 2km apart at a given time, and there is also likely to be less than three vessels present at a time.

~~Based on data by Lawson et al., (2016), an average density of 0.004 and a maximum density of 0.029 common scoters are estimated to be present within the Project Offshore ECC. Based on a 2km buffer around each of the three construction vessels, the area disturbed per vessel was calculated to be circa 12.6km^2, resulting in a total worst case area of circa 37.7km^2 from which birds could be displaced. This is considered a precautionary approach, since vessels are unlikely to be spaced 2km apart at a given time, and there is also likely to be less than three vessels present at a time.~~

572. Based on the average density of 0.004 birds/km^2, and the total disturbance of area of circa 37.7 km^2, less than one (0.1) common scoters are at risk of displacement. Considering a displacement rate of 100%, and a mortality rate of 1%, this results in less than one (0.0) predicted displacement consequent mortalities. Considering a displacement range of 90% to 100% and a mortality range of 1% to 10%, the total displacement consequent mortality is estimated as 0.0 to 0.0 birds. This would represent a <0.001% increase even at the worst-case scenario of 100% displacement and 10% mortality, and therefore the impact is considered to make no material contribution to any changes in populations or baseline mortality.

~~Based on data by Lawson et al., (2016), an average density of 0.004 and a maximum density of 0.029 common scoters are estimated to be present within the Project Offshore ECC. Based on a 2km buffer around each of the three construction vessels, the area disturbed per vessel was calculated to be circa 12.6km^2, resulting in a total worst case area of circa 37.7km^2 from which birds could be displaced. This is considered a precautionary approach, since vessels are unlikely to be spaced 2km apart at a given time, and there is also likely to be less than three vessels present at a time.~~

~~Based on the average density of 0.004 birds, and the total disturbance of area of circa 37.7km2, less than one (0.1) common scoters are at risk of displacement. Considering a displacement rate of 100%, and a mortality rate of 1%, this results in less than one (0.0) predicted displacement consequent mortalities. Considering a displacement range of 90% to 100% and a mortality range of 1% to 10%, the total displacement consequent mortality is estimated as 0.0 to 0.0 birds. This would represent a <0.001% increase even at the worst-case scenario of 100% displacement and 10% mortality, and therefore the impact is considered to make no material contribution to any changes in populations or baseline mortality.~~



~~Figure 9-49.4. Common scoter densities within the Greater Wash SPA~~

~~This section considers the magnitude of impact on common scoter from the presence of the ORCP and relevant operational vessel traffic.~~

573. ~~The location of the ORCP is not identified as a highly utilized location for common scoter (Lawson *et al.*, 2016; Figure 9.4Figure XX indicates a hotspot of common scoter on the edge of the Wash (near the coast), not in close proximity to the ORCP. Based on data by Lawson et al. (2016), an average density of 0.011 and a maximum density of 0.013 common scoters per km^2 are estimated to be present within the ORCP. Due to the lack of spatial overlap between the common scoter feature and the ORCP, any potential impact from the presence of the ORCP will not adversely affect the integrity of The Greater Wash SPA in relation to its conservation objectives. In particular, the density of common scoter is very low and this species has much higher utilisation in other inshore areas of the SPA. Therefore, the presence of the ORCP will not cause any meaningful change in the distribution of this species within the SPA.~~

~~544.~~1. ~~Common scoter has been screened in for the assessment of the construction and decommissioning phase to assess the impacts from disturbance and displacement from the Project alone on the basis of its sensitivity to vessel presence during the process of the Offshore export cable laying and in relation to those parts of the Offshore ECC in shallower water, closer to the coast, where common scoter are most likely to be found.~~

~~545.~~1. ~~The laying of the Offshore export cable between the array area and the cable landfall area for the Project would involve cable laying vessels being in situ for the entire offshore construction period of up to 48-months, potentially occurring in two consecutive non-breeding periods.~~

~~546.~~1. ~~ANS, biogenic reef and ORCP construction is likely to be restricted to single vessels or vessel clusters, at different periods from cable laying, so disturbance from these activities is anticipated to be small scale, short term and temporary. The ANS structures are beyond 10km from the Greater Wash SPA and therefore there is no anticipated impact from these structures on common scoter using the SPA.~~

~~547.~~1. ~~In order to assess the potential impact on common scoter a displacement effect distance has to be determined. A 2km buffer surrounding any cable laying vessel will be used to assess the extent of any displacement based on that being the agreed distance for red-throated diver and that common scoter is also known to be sensitive to disturbance by vessels.~~

~~548.~~1. ~~Based on data by Lawson et al., (2016), an average density of 0.004 and a maximum density of 0.029 common scoters are estimated to be present within the Project Offshore ECC. Based on a 2km buffer around each of the three construction vessels, the area disturbed per vessel was calculated to be circa 12.6km^2, resulting in a total worst case area of circa 37.7km^2 from which birds could be displaced. This is considered a precautionary approach, since vessels are unlikely to be spaced 2km apart at a given time, and there is also likely to be less than three vessels present at a time.~~

~~549.1. Based on the average density of 0.004 birds, and the total disturbance of area of circa 37.7km², less than one (0.1) common scoters are at risk of displacement. Considering a displacement rate of 100%, and a mortality rate of 1%, this results in less than one (0.0) predicted displacement consequent mortalities. Considering a displacement range of 90% to 100% and a mortality range of 1% to 10%, the total displacement consequent mortality is estimated as 0.0 to 0.0 birds. This would represent a <0.001% increase even at the worst-case scenario of 100% displacement and 10% mortality, and therefore the impact is considered to make no material contribution to any changes in populations or baseline mortality.~~

~~550.~~574. Densities of birds in the ~~biogenic reef~~ECC and ORCP areas are anticipated to be lower than the densities described by Lawson *et al.*~~,~~ (2016), ~~as~~ where these areas are now located within 10km buffers of other OWF projects (e.g. Lincs OWF) which were not operational at the time the Lawson *et al.,* (2016) dataset was collected~~overlap with the Greater Wash SPA, these areas are located within 10km buffers of other OWF projects~~. As such, displacement impacts from these activities are expected to be lower than those described for the ECC.

575. There is, therefore, no potential for an AEoI to the population conservation objective~~s~~ of the common scoter feature of Greater Wash SPA in relation to disturbance and displacement effects in the construction and decommissioning phase from the Project alone and therefore, subject to natural change, common scoter will be maintained as a feature in the long-term.

576. In addition to maintaining the common scoter~~red-throated diver~~ population, the conservation objectives also state to maintain the following :

- The extent and distribution of the habitats of the qualifying features;
- The structure and function of the habitats of the qualifying features; and
- The supporting processes on which the habitats of the qualifying features rely.

577. Furthermore, potential effects on prey species namely, molluscs~~sandeels, herring and sprat,~~ that are key prey species for common scoter~~various seabirds~~, and the habitats that support these species have been covered within Chapter 10: Fish and Shellfish Ecology and Chapter 9: Benthic Subtidal and Intertidal Ecology, respectively. Impacts (including impacts from piling) were found to be non-significant therefore, it is reasonable to assume, regardless of the sensitivity of the receptor, any potential indirect effects on common scoter are extremely low.

578. There is, therefore, no potential for AEoI from vessel traffic in the C&D phase from ODOW with regard to the **extent and distribution, the structure and function, and the supporting processes on which the habitats of which the common scoter feature relies on, and therefore, subject to natural change, common scoter will be maintained as a feature in the long-term.**

~~551.~~579. The final conservation objective of the common scoter feature of the Greater Wash SPA is maintaining, or restoring, the distribution of the qualifying feature within the site.

~~552.~~580. Following guidance from Natural England a best practice protocol to minimise disturbance to common scoter will be adopted. For example:

- Minimise vessel traffic between November and March ~~1st~~ inclusive.
- Restrict vessel movements where possible to existing navigation routes.

- Avoid areas of higher densities of common scoter when using routes outside the established navigation routes is necessary.
- Avoid over-revving of engines to minimise noise disturbance.
- Briefing vessel crews as to best practice protocol to minimise disturbance to wildlife.

~~553.~~581. With these mitigation measures in place, which aim to avoid disturbance during peak months of common scoter presence, the impacts presented above (an increase in baseline mortality of <0.001%, even at the worst-case scenario of 100% displacement and 10% mortality, making no material contribution to changes in population or baseline mortality) are further reduced and potentially~~are highly~~ unlikely to occur. The displacement impacts on common scoter that will occur due to the installation of the export cable within the Greater Wash SPA are low in magnitude, temporary and reversible.

582. There is, therefore, no potential for impacts from vessel traffic in the ~~ECC, ANS, biogenic reef and ORCP areas during the~~ C&D phase from ODOW alone to adversely affect the distribution of the common scoter~~ or the supporting habitat on which they rely~~, and therefore, subject to natural change, common scoter will be maintained as a feature in the long-term.

Greater Wash SPA – Red-throated Diver (ECC, Biogenic reef, ORCP and ANS)

583. Red-throated diver were screened in for the construction and decommissioning phase to assess the potential for an AEoI from displacement from the construction of the ECC and ORCP. The conservation objective for the Greater Wash SPA is to ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the aims of the Wild Birds Directive, by maintaining or restoring:

- The extent and distribution of the habitats of the qualifying features;
- The structure and function of the habitats of the qualifying features;
- The supporting processes on which the habitats of the qualifying features rely;
- The population of each of the qualifying features; and
- The distribution of the qualifying features within the site.

584.

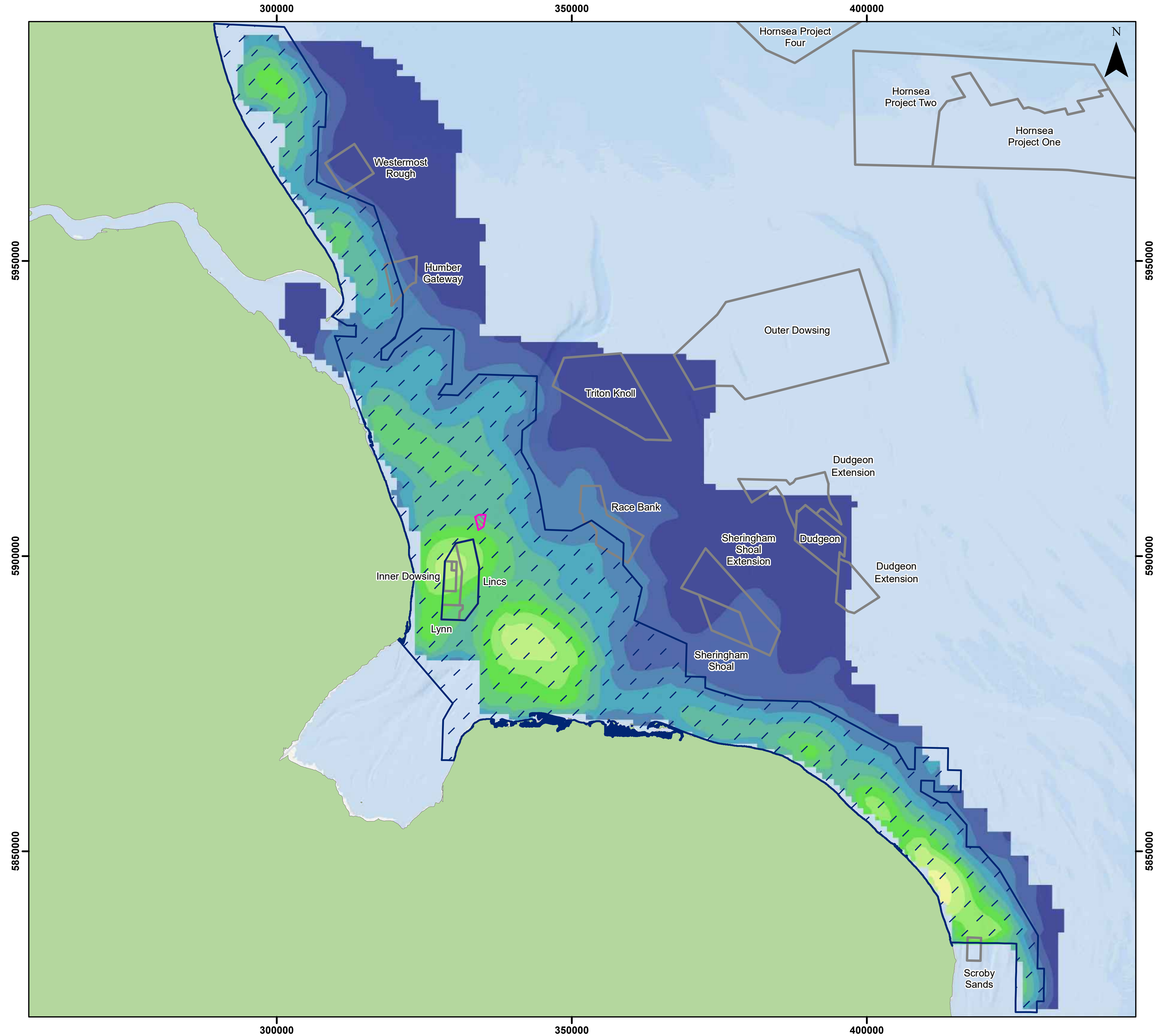
585. The ECC route and ORCP ~~will run~~ directly ~~through~~overlap with the Greater Wash SPA, therefore~~. R~~ there is potential connectivity with the red-throated diver feature of the SPA, in particular to the parts of the offshore ECC which is closer to the coast, within shallower water where red-throated diver are most likely to be found. Red-throated diver have therefore ~~has~~ been screened in for the impact assessment for the construction and decommissioning phase to assess the potential impacts from disturbance and displacement from the Project alone, due to their sensitivity to vessel presence during the process of the offshore export cable laying and construction of infrastructure (including the ORCP). The ANS is 24km from the Greater Wash SPA, therefore there is no connectivity with the Greater Wash SPA and the ANS, therefore, has not been considered further. ~~in relation to those parts of the offshore ECC in shallower water, closer to the coast, where red-throated diver are most likely to be found.~~

~~The presence of the ORCP and operational vessel traffic associated with the Project have the potential to affect red-throated diver associated with the Greater Wash Special Protection Area (SPA). The RIAA (AS1-095) considered a worst-case scenario of impacts during construction and decommissioning due to the ORCPs. The Applicant maintains that the assessment presented in the RIAA (AS1-095) is robust and is proportional to the risks both from installation and operation of the ORCPs. The removal of the northern ORCP area will not change the conclusions of the RIAA (AS1-095).~~

~~1. Within their relevant representations, Natural England has requested a more detailed assessment of the impacts of the ORCP on red-throated diver, specifically during the O&M phase (RR-045 – F6). Therefore, an additional assessment has been undertaken to address these concerns, specifically the uncertainty surrounding the effects of static structures on red-throated diver.~~

~~The construction of the ORCP and Project related construction vessel traffic has the potential to affect red-throated diver associated with the Greater Wash SPA. This section considers the magnitude of impact on red-throated diver from the presence of vessel traffic and the construction of the ORCP. Within their RR, Natural England has requested a more detailed assessment of the effects of the ORCP on red-throated diver, specifically during the O&M phase. Therefore, an additional confirmatory analysis has been undertaken to address these concerns, specifically the uncertainty surrounding the effects of static structures on red-throated diver. This has been provided in the O&M Section.~~

586. To reduce potential impacts, the location of the ORCP ~~area overlaps with the Greater Wash SPA, the offshore ECC, and consequently the ORCP area~~ was sited to avoid high density areas of red-throated diver based on data by Lawson *et al.* (2016). Figure 9.5~~Figure XX~~ shows the distribution of red-throated diver within the Greater Wash SPA and the lower level of overlap with the proposed ORCP area. Based on data by Lawson *et al.* (2016), an average density of 0.409 and a maximum density of 0.467 red-throated diver per km^2 are estimated to be present within the ORCP area.

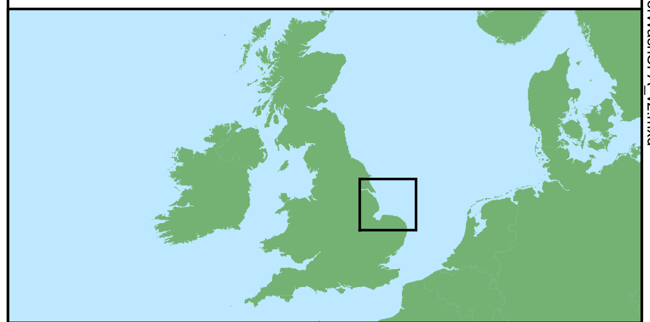


Legend

- ORCP Area
- Greater Wash SPA
- Offshore Wind Farm Boundaries

Red-throated Diver Densities within the Greater Wash SPA (Lawson *et al.*, 2016) (birds per km^2)

- 0 - 0.05
- 0.05 - 0.11
- 0.11 - 0.19
- 0.19 - 0.28
- 0.28 - 0.39
- 0.39 - 0.51
- 0.51 - 0.67
- 0.67 - 0.87
- 0.87 - 1.35
- 1.35- 3.38



Coordinate System: WGS 1984 UTM Zone 31N

0 20 40 km

Scale: 1:600,000

A3 Page Size

RIAA

Red-throated Diver Densities within the Greater Wash SPA

Figure 9.4

OUTER DOWSING OFFSHORE WIND

Date: 15/01/2025
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Revision: 0.1

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Document Path: Z:\GIS\GIS_Projects\0152 Outer Dowsing EIA\GIS\Figures\Deadline 4\RIAA\ODOW_0152_EX_RIAA_Fig9.4_RedThroated_Diver_Density_GreaterWashSPA_v2.mxd

~~554.1. Red-throated diver has been screened in for the impact assessment for the construction and decommissioning phase to assess the impacts from disturbance and displacement from the Project alone, due to their sensitivity to vessel presence during the process of the offshore export cable laying and construction of infrastructure in relation to those parts of the offshore ECC in shallower water, closer to the coast, where red-throated diver are most likely to be found.~~

~~555.~~587. The laying of the export cable between the ~~array~~WTG area and the cable landfall area for Outer Dowsing would involve cable laying vessels being in situ for the entire offshore construction period of up to 48 months, potentially occurring in two consecutive non-breeding periods. Therefore, presence of the offshore export cable laying vessel was identified as potentially displacing red-throated divers during the construction phase of the Project.

~~556.~~588. ~~ANS~~The~~,~~ biogenic reef and ORCP construction is likely to be restricted to single vessels or vessel clusters, at different periods from cable laying.~~, so d~~Disturbance from these activities is anticipated to be small scale, short term and temporary. Given the ORCP will be situated on the cable corridor, the impacts of construction of the ORCP are encompassed within the following quantitative assessment. This assessment has been ~~will be~~ based upon visual effects causing the displacement of red-throated divers. Other construction activities such as piling have not been considered here as there is no direct evidence of impact from this activity, and the presence of vessels carrying out the piling would displace any birds within a two kilometre radius, thus reducing any potential effect.

~~557. The ECC route will run directly through the Greater Wash SPA. To assess the potential for individuals being within the offshore ECC, a separate method for estimating the potential abundance and density of this species was developed and agreed for use with Natural England (Section 4.34.3).~~

~~558.~~589. Based on data on red-throated diver densities presented by Lawson *et al.,* (2016), an average density of 0.2 birds/km^2 and a maximum density of 0.7 birds/km^2 are estimated to be present within the Project ECC (noting the ORCP is within the ECC boundary). Based on a 2km buffer around each of the ~~three~~ construction vessels, the area disturbed per vessel was calculated to be circa 12.6km^2.~~,~~ A worst-case scenario is based on three construction vessels operating at one time, resulting in a total worst case area of circa 37.7km^2 from which birds could be displaced. This is considered a precautionary approach, since in reality vessels are unlikely to be spaced 2km apart at a given time, and there is also likely to be less than three vessels present at a time.

~~559.~~590. Based on the average density of 0.2 birds/ km^2, and the total disturbance of area of circa 37.7km^2, a total of 9 (8.8) red-throated divers are at potential risk of displacement. Based on a displacement rate of 100% and a mortality rate of 1%, this results in a predicted mortality of less than one (0.1) birds per annum. Considering a displacement range of 90% to 100% and a mortality range of 1% to 10%, the ~~total displacement~~ consequent range of potential mortality is estimated as 0.1 to 0.9 birds.

~~560.~~591. Considering the impact on the citation population of 1,407 ~~breeding adults~~individuals, with a background mortality of 330.4 individuals per annum, the addition of less than one (0.1) mortality per annum (this predicted impact is used as it represents both the Applicant and Natural England's preferred approach) would represent a 0.026% increase in baseline mortality. Considering the more recent 2016 population count of 1,787 ~~breeding adults~~individuals (Lawson *et al.*, 2016), with a background mortality of 419.7~~20~~ individuals per annum, the addition of less than one mortality would represent a 0.021% increase in baseline mortality. This level of impact is considered to make no material contribution to any changes in populations or baseline mortality.

~~561.~~592. Densities of birds in the ~~biogenic reef and~~ECC and ORCP areas are anticipated to be lower than the densities described by Lawson *et al*.~~,~~ (2016)~~, because~~ as these areas are now located within 10 km ~~buffers~~ of other operational OWF projects (e.g. Lincs OWF) where diver densities have been shown to be reduced (HiDef, 2017). The average of three years of post-construction data showed the displacement effect from the Lincs OWF boundary decreased significantly at 8 km. However, this distance varied yearly, with measurable effects observed at 5 km, 7 km, and 9 km in the first, second, and third years, respectively. Displacement within the ~~array~~WTG area was estimated at 59–93% (83% in Phase 6). At 2 km, displacement was 71%, dropping to 34% at the maximum significant distance of 8km. As such, a proportion of the birds occupying areas impacted by the existing OWF (and associated buffers) will already have been displaced, and therefore potential displacement impacts from the~~se activities~~ construction of the ECC and ORCP are expected to be lower~~-~~, and therefore negligible, based on the baseline disturbance from Lincs OWF~~than those described for the ECC~~.

~~562.~~593. There is, therefore, no potential for an AEoI to the population conservation objective of the red-throated diver feature of Greater Wash SPA in relation to disturbance and displacement effects in the construction and decommissioning phase from the Project alone and therefore, subject to natural change, red-throated diver will be maintained as a feature in the long-term.

594. In addition to maintaining the red-throated diver population, the conservation objectives also state to maintain, or restore, the following:

- The extent and distribution of the habitats of the qualifying features;
- The structure and function of the habitats of the qualifying features; and
- The supporting processes on which the habitats of the qualifying features rely.

~~563.~~595. Red-throated diver are opportunistic feeders with a diet composed primarily of fish supplemented with crustaceans, polychaetes molluscs and aquatic insects (Madsen, 1957; Palmer, 1962; Kleinschmidt et al., 2019). As such this species is considered to have a reasonably varied diet. ~~Moreover, based on tracking data, red-throated diver have a small foraging range (mean-max +1SD of 9km) (Woodward et al., 2019).~~ This species tends to forage close to the shore during rough and windy conditions however red-throated diver can travel further offshore to forage under calm conditions (Furness, 1983).

596. Following the evidence presented regarding the adaptability of red-throated diver foraging behaviours, changes to prey species and abundance and availability is likely to cause minimal impact to foraging habitat use. Red-throated diver are opportunistic feeders with a diet composed primarily of fish supplemented with crustaceans, polychaetes molluscs and aquatic insects (Madsen, 1957; Palmer, 1962; Kleinschmidt *et al.*, 2019). As such this species is considered to have a reasonably varied diet. Therefore, the adaptability of red-throated diver foraging behaviours, changes to prey species and abundance and availability is likely to cause minimal impact to foraging habitat use.

~~564.~~597.

~~565.~~598. Furthermore, potential effects on prey species namely, sandeels, herring and sprat, that are key prey species for various seabirds, and the habitats that support these species have been covered within Chapter 10: Fish and Shellfish Ecology and Chapter 9: Benthic Subtidal and Intertidal Ecology, respectively. Impacts (including impacts from piling) were found to be non-significant therefore, it is reasonable to assume, regardless of the sensitivity of the receptor, any potential indirect effects on red-throated diver ~~is~~are extremely low.

599. There is, therefore, no potential for AEoI from vessel traffic in the C&D phase from ODOW with regard to the **extent and distribution, the structure and function, and the supporting processes on which the habitats of which red-throated diver features rely on, and therefore, subject to natural change, red-throated diver will be maintained as a feature in the long-term**.

600. The final conservation objective of the red-throated diver feature of the Greater Wash SPA is maintaining, or restoring, the distribution of the qualifying feature within the site.

~~566.~~601. Following guidance from Natural England a best practice protocol to minimise disturbance on red-throated divers will be adopted as set out within the Outline Vessel Management Plan (document reference 8.20). For example:

- Where possible, minimise vessel traffic between November and March inclusive.
- Restrict vessel movements where possible to existing navigation routes.
- Avoid areas of higher densities of red-throated divers when using routes outside the established navigation routes is necessary.
- Avoid over-revving of engines to minimise noise disturbance.
- Briefing vessel crew on the purposes of the Working in Proximity to Wildlife document.

602. With these mitigation measures in place, which aim to avoid disturbance during peak months of red-throated diver presence, the impacts presented above (an increase on baseline mortality of 0.1, making no material contribution to changes in population or baseline mortality) are further reduced and potentially, unlikely to occur. Moreover, disturbance from construction and decommissioning activities is temporary and reversible in nature. On top of this, there is already baseline disturbance from the Lincs OWF, estimated up to 8km from the array area (paragraph 584). The 8km buffer overlaps with the majority of the ECC, in particular the parts of the offshore ECC which is closer to the coast, within shallower water where red-throated diver are most likely to be found (see Figure 9-8 in Section 9.3.3). Additionally, Race Bank OWF potential disturbance buffers also overlap with the ECC (see Figure 9-8 in Section 9.3.3). There is, therefore, no significant impacts to the distribution of red-throated diver within the SPA, based on the area already being within the displacement buffers of Lincs OWF.

~~567.~~ The potential displacement impacts on red-throated diver that ~~will~~ may occur due to the installation of the ~~export cable~~ECC and ORCP within the Greater Wash SPA are low in magnitude, temporary and reversible in nature. Joint with the use of vessel best practice measures and the baseline disturbance from nearby OWFs,

t~~T~~here is~~, therefore,~~ **no potential for AEoI from vessel traffic in the C&D phase from ODOW with regard to the distribution of the red-throated divers~~or the supporting habitat on which they rely~~, and therefore, subject to natural change, red-throated diver will be maintained as a feature in the long-term.**

~~568.~~603.

9.3.3 O&M Assessment

9.3.3.1 Disturbance and Displacement

Coquet Island SPA – Puffin

~~569.~~604. Puffin has been screened in for the O&M phase to assess the potential for an AEoI from displacement from the Project alone in relation to the following conservation objectives for this species, as an assemblage feature of the Coquet Island SPA (Document 7.2):

- Maintain the population of each qualifying feature.

~~570.~~605. Although puffin is only a named feature of the seabird assemblage, for the purpose of this assessment it has been considered in a similar manner to qualifying species, though the conclusion is not whether an AEoI would result from the Project alone on puffin as a feature, but more as an important component of the seabird assemblage. The citation count is 31,686 breeding adults and the latest population estimate is 25,029 breeding pairs (50,058 breeding adults) based on the most recent 2019 colony counts.

~~571.~~606. The Project ~~array~~ WTG area is located 258.8km from Coquet Island SPA which is within the mean-max plus 1SD foraging distance of 265.4km (Woodward et al., 2019) and has therefore been screened in for the breeding bio-season for the months of April to July and the non-breeding bio-season defined as August to March by Furness (2015) (Appendix 7.1.1).

Breeding Bio-season

607. During the breeding bio-season, the number of puffins estimated to occur in the ~~array~~ WTG area and 2km buffer is ~~760~~ 666 (~~760~~666.0) individuals. Assuming the proportion of adult birds in the array is 55~~49~~%, the total number of breeding adults in the array at risk of displacement is ~~372~~ 366 (~~372~~366.~~4~~3) during the full breeding bio-season. Using Natural England's preferred approach, and assuming an adult proportion of 100%, the total number of birds at risk of displacement in the breeding season is 666.

608. Under the Applicant's approach, of these 366 breeding adults, 78.8% are predicted to be breeding birds from Coquet Island SPA (Appendix 7.1.1). Therefore, 288 (288.6) breeding adults at risk of displacement are attributed to Coquet Island SPA (Table 9.18). Assuming a displacement rate of 50% and a mortality rate of 1%, the consequent mortality is estimated at less than two (1.4) breeding adults. However, based on advice from ~~SNCB~~ANCBs (MIG-Birds, 2022), a displacement range of 30% to 70% is also presented in Table 9.18.

~~572.~~

~~573. Of these 372 breeding adults, 78.8% are predicted to be breeding birds from Coquet Island SPA (Appendix 7.1.1). Therefore, 293 (293.4) breeding adults at risk of displacement are attributed to Coquet Island SPA (Table 9.18). Assuming a displacement rate of 50% and a mortality rate of 1%, the consequent mortality is estimated at less than two (1.5) breeding adults. However, based on advice from SNCBs (MIG-Birds, 2022), a displacement range of 30% to 70% is also presented in Table 9.18.~~

~~574.~~609. Based on the citation count of 31,686 breeding adults and annual background mortality of 2,9788~~.5~~ individuals, the addition of less than two predicted breeding adult mortalities would represent a 0.048~~50~~% increase in baseline mortality during the breeding bio-season.

610. As the population of puffin has changed significantly since the citation population count the potential impact on the population is more reasonably assessed against the latest population count undertaken in 2019, consisting of 50,058 individuals and an annual background mortality of 4,705~~.5~~ individuals. On this basis, this would represent a 0.031% increase in baseline mortality during the breeding bio-season.

611. Under Natural England's preferred approach, of these 666 birds, 78.8% are predicted to be breeding birds from Coquet Island SPA (Appendix 7.1.1). Therefore, 525 breeding adults (524.8) at risk of displacement are attributed to Coquet Island SPA (Table 9.18). Assuming a displacement rate of 70% and a mortality rate of 2%, the consequent mortality is estimated at seven (7.35) breeding adults. However, based on advice from ~~SNCB~~ANCBs (MIG-Birds, 2022), a displacement range of 30% to 70% is also presented in Table 9.18.

~~575.~~612. Based on the citation count of 31,686 breeding adults and annual background mortality of 2,97~~8~~8.5 individuals, the addition of seven predicted breeding adult mortalities would represent a 0.247% increase in baseline mortality during the breeding bio-season. As the population of puffin has changed significantly since the citation population count the potential impact on the population is more reasonably assessed against the latest population count undertaken in 2019, consisting of 50,058 individuals and an annual background mortality of 4,705.5 individuals. On this basis, this would represent a 0.~~0~~156% increase in baseline mortality during the breeding bio-season.

Non-breeding Bio-season

~~576.~~613. In the non-breeding bio-season the mean-peak number of puffins estimated to occur in the ~~array~~ WTG area and 2km buffer is ~~636~~ 414 (~~636~~414~~.5~~.0) individuals.

~~577.~~614. On the basis that ~~10~~ 10.6~~.6~~% of these puffins within the ~~array~~ WTG area are deemed to be breeding adults from Coquet Island SPA during the non-breeding bio-season (Appendix 7.1.1), the total abundance of breeding adults estimated to be displaced from the array plus 2km buffer is ~~68~~ 44 (~~67.7~~44.0) (Table 9.18). Based on 50% displacement and 1% mortality, the total predicted consequent mortality from being displaced is estimated at less than one (0.2~~3~~) individual during the non-breeding bio-season. However, based on advice from ~~SNCB~~ANCBs (MIG-Birds, 2022), a displacement range of 30% to 70% is also presented in Table 9.20~~Table 9.19~~.

~~578.~~615. This consequent estimated mortality equates to an increase in baseline mortality of 0.0~~1~~07% in the non-breeding bio-season relative to the citation count and increase of 0.005~~6~~% based on the most recent counts.

Annual Total

~~579.~~616. Across all bio-seasons, the number of puffins estimated to occur in the ~~array~~ WTG area and a 2km buffer is ~~1,397~~1,080 (1,~~396.5~~080.0) individuals, with ~~358~~ 333 (~~358~~332.7~~.1~~) of these being breeding adults from the Coquet Island SPA. The total predicted consequent mortality from being displaced attributed to Coquet Island SPA throughout the operational life of the Project is less than two (1.7~~8~~) breeding adult from Coquet Island SPA per annum across all bio-seasons. Displacement consequent mortalities based on the range advocated by ~~SNCB~~ANCBs (30% displacement to 70% displacement, 1 to 10% mortality) are displayed in Table 9.20~~Table 9.19~~ and Table 9.20~~Table 9-20~~.

617. The predicted mortality of less than two (1.7~~8~~) breeding adults from Coquet Island SPA per annum across all bio-seasons represents an increase of 0.056~~60~~% based on the citation count and 0.035~~8~~% when considering the recent count. This level of impact would be indistinguishable from natural fluctuations in the population.

618. Under Natural England's preferred approach, the number of puffins estimated to occur in the ~~array~~WTG area and a 2km buffer is 1,080 (1,080.0) individuals, with 568.9 of these being breeding adults from the Coquet Island SPA. The total predicted consequent mortality from being displaced attributed to Coquet Island SPA throughout the operational life of the Project is less than eight (7.7) breeding adults from Coquet Island SPA per annum across all bio-seasons. Displacement consequent mortalities based on the range advocated by ~~SNCB~~ANCBs (30% displacement to 70% displacement, 1 to 10% mortality) are displayed in Table 9.20~~Table 9.19~~ and -Table 99.21~~Table 99-21~~.

619. The predicted mortality eight (8.0) breeding adults from Coquet Island SPA per annum across all bio-seasons represents an increase of 0.267% based on the citation count and 0.~~058163~~169% when considering the recent count. This level of impact would be indistinguishable from natural fluctuations in the population.

~~580.~~

~~581.~~620. **Therefore, the potential for an AEoI to the conservation objectives of the puffin as an assemblage feature of Coquet Island SPA in relation to disturbance and displacement effects in the O&M phase from the Project alone can be ruled out as, subject to natural change, puffin will be maintained as a feature in the long-term.**

Table 9-18~~9.189-189.18~~: Range-based displacement mortalities during the operational and maintenance phases for puffin at Coquet Island SPA using the Applicant's approach to apportioning, based on the values advocated by ~~SNCB~~ANCBs for the citation and most recent counts (Aitken et al., (2017) (Seabird Monitoring Programme)). The lower confidence interval (LCI) and the upper confidence interval (UCI) are presented as requested by ~~SNCB~~ANCBs. The Applicant's Approach is boldened.

Bio-season	Abundance of adults apportioned to SPA (plus 2km buffer)	Estimated increase in mortality (breeding adults per annum)			% increase in baseline mortality (citation count)			% increase in baseline mortality (recent count)		
		50% displacement, 1% mortality	70% displacement, 2% mortality	30-70% displacement, 1- 10% mortality	50% displacement, 1% mortality	70% displacement, 2% mortality	30-70% displacement, 1 – 10% mortality	50% displacement, 1% mortality	70% displacement, 2% mortality	30-70% displacement, 1 – 10% mortality
Mean										
Breeding	288.6~~293.5~~	**1.44**~~1.5~~	4.04	0.87 - 20.21~~0.9 – 20.5~~	0.048	0.136	0.029 - 0.678	0.031~~0.031~~	0.086	0.018 - 0.429~~0.019 – 0.437~~
Non-breeding	44.05~~67.7~~	**0.22**~~0.3~~	0.62	0.13 - 3.08~~0.2 – 4.7~~	0.007	0.021	0.004 - 0.104	0.005~~0.007~~	0.013	0.003 - 0.066~~0.004 – 0.101~~
Annual Total	332.69 ~~358.1~~	**1.66**~~1.8~~	4.66	1.00 - 23.29~~1.1 – 25.3~~	0.056	0.156	0.034 - 0.782	0.035~~0.038~~	0.099	0.021 - 0.495~~0.023 – 0.537~~
LCI										
Breeding	181.6	0.91	2.54	0.54 - 12.71	0.030	0.085	0.018 - 0.427	0.019	0.054	0.012 - 0.27
Non-breeding	31.18	0.16	0.44	0.09 - 2.18	0.005	0.015	0.003 - 0.073	0.003	0.009	0.002 - 0.046

Bio-season	Abundance of adults apportioned to SPA (plus 2km buffer)	Estimated increase in mortality (breeding adults per annum)			% increase in baseline mortality (citation count)			% increase in baseline mortality (recent count)		
		50% displacement, 1% mortality	70% displacement, 2% mortality	30-70% displacement, 1- 10% mortality	50% displacement, 1% mortality	70% displacement, 2% mortality	30-70% displacement, 1 – 10% mortality	50% displacement, 1% mortality	70% displacement, 2% mortality	30-70% displacement, 1 – 10% mortality
Annual Total	212.77	1.06	2.98	0.64 - 14.89	0.036	0.100	0.021 - 0.5	0.023	0.063	0.014 - 0.317
UCI										
Breeding	416.1	2.08	5.82	1.25 - 29.12	0.070	0.196	0.042 - 0.978	0.044	0.124	0.027 - 0.619
Non-breeding	60.65	0.30	0.85	0.18 - 4.25	0.010	0.029	0.006 - 0.143	0.006	0.018	0.004 - 0.09
Annual Total	476.71	2.38	6.67	1.43 - 33.37	0.080	0.224	0.048 - 1.12	0.051	0.142	0.03 - 0.709

Table 9-19~~9.199-19~~: Range-based displacement mortalities during the operational and maintenance phases for puffin at Coquet Island SPA using the ~~SNCB~~ANCB approach to apportioning, based on the values advocated by ~~SNCB~~ANCBs for the citation and most recent counts (Aitken et al., (2017) (Seabird Monitoring Programme)). The lower confidence interval (LCI) and the upper confidence interval (UCI) are presented as requested by ~~SNCB~~ANCBs. The Natural England preferred approach is boldened.

Bio-season	Abundance of adults apportioned to SPA (plus 2km buffer)	Estimated increase in mortality (breeding adults per annum)			% increase in baseline mortality (citation count)			% increase in baseline mortality (recent count)		
		50% displacement, 1% mortality	70% displacement, 2% mortality	30-70% displacement, 1- 10% mortality	50% displacement, 1% mortality	70% displacement, 2% mortality	30-70% displacement, 1 – 10% mortality	50% displacement, 1% mortality	70% displacement, 2% mortality	30-70% displacement, 1 – 10% mortality
Mean										
Breeding	524.8	2.62	**7.35**	1.57 - 36.74	0.088	0.247	0.053 - 1.233	0.056	0.156	0.033 - 0.781
Non-breeding	44.0	0.22	**0.62**	0.13 - 3.08	0.007	0.021	0.004 - 0.104	0.005	0.013	0.003 - 0.066
Annual Total	568.9	2.84	**7.96**	1.71 - 39.82	0.095	0.267	0.057 - 1.337	0.060	0.169	0.036 - 0.846
LCI										
Breeding	330.2	1.65	4.62	0.99 - 23.11	0.055	0.155	0.033 - 0.776	0.035	0.098	0.021 - 0.491
Non-breeding	31.2	0.16	0.44	0.09 - 2.18	0.005	0.015	0.003 - 0.073	0.003	0.009	0.002 - 0.046

Bio-season	Abundance of adults apportioned to SPA (plus 2km buffer)	Estimated increase in mortality (breeding adults per annum)			% increase in baseline mortality (citation count)			% increase in baseline mortality (recent count)		
		50% displacement, 1% mortality	70% displacement, 2% mortality	30-70% displacement, 1- 10% mortality	50% displacement, 1% mortality	70% displacement, 2% mortality	30-70% displacement, 1 – 10% mortality	50% displacement, 1% mortality	70% displacement, 2% mortality	30-70% displacement, 1 – 10% mortality
Annual Total	361.3	1.81	5.06	1.08 - 25.29	0.061	0.170	0.036 - 0.849	0.038	0.108	0.023 - 0.538
UCI										
Breeding	756.5	3.78	10.59	2.27 - 52.95	0.127	0.356	0.076 - 1.778	0.080	0.225	0.048 - 1.125
Non-breeding	60.6	0.30	0.85	0.18 - 4.25	0.010	0.029	0.006 - 0.143	0.006	0.018	0.004 - 0.09
Annual Total	817.1	4.09	11.44	2.45 - 57.2	0.137	0.384	0.082 - 1.92	0.087	0.243	0.052 - 1.216

Table 9-20~~9.209~~~~209.19~~: Puffin displacement matrix at Coquet Island SPA (WTG~~array~~ area plus two km buffer) with light blue shading indicating the displacement range advocated by A~~SNCBA~~NCBs, and dark blue indicating the Applicant's approach.

Annual (2km Buffer)	Mortality Rate (%)												
Displaced (%)	1	2	5	10	20	30	40	50	60	70	80	90	100
10	0 ~~0~~	1 ~~1~~	1 ~~2~~	3 ~~4~~	7 ~~7~~	10 ~~11~~	13 ~~14~~	17 ~~18~~	20 ~~21~~	23 ~~25~~	27 ~~29~~	30 ~~32~~	33 ~~36~~
20	1 ~~1~~	1 ~~1~~	2 ~~4~~	7 ~~7~~	13 ~~14~~	20 ~~21~~	27 ~~29~~	33 ~~36~~	40 ~~43~~	47 ~~50~~	53 ~~57~~	60 ~~64~~	67 ~~72~~
30	1 ~~1~~	2 ~~2~~	3 ~~5~~	10 ~~11~~	20 ~~21~~	30 ~~32~~	40 ~~43~~	50 ~~54~~	60 ~~64~~	70 ~~75~~	80 ~~86~~	90 ~~97~~	100 ~~107~~
40	1 ~~1~~	3 ~~3~~	4 ~~7~~	13 ~~14~~	27 ~~29~~	40 ~~43~~	53 ~~57~~	67 ~~72~~	80 ~~86~~	93 ~~100~~	106 ~~115~~	120 ~~129~~	133 ~~143~~
50	2 ~~2~~	3 ~~4~~	5 ~~9~~	17 ~~18~~	33 ~~36~~	50 ~~54~~	67 ~~72~~	83 ~~90~~	100 ~~107~~	116 ~~125~~	133 ~~143~~	150 ~~161~~	166 ~~179~~
60	2 ~~2~~	4 ~~4~~	6 ~~11~~	20 ~~21~~	40 ~~43~~	60 ~~64~~	80 ~~86~~	100 ~~107~~	120 ~~129~~	140 ~~150~~	160 ~~172~~	180 ~~193~~	200 ~~215~~
70	2 ~~3~~	5 ~~5~~	7 ~~13~~	23 ~~25~~	47 ~~50~~	70 ~~75~~	93 ~~100~~	116 ~~125~~	140 ~~150~~	163 ~~175~~	186 ~~201~~	210 ~~226~~	233 ~~251~~
80	3 ~~3~~	5 ~~6~~	8 ~~14~~	27 ~~29~~	53 ~~57~~	80 ~~86~~	106 ~~115~~	133 ~~143~~	160 ~~172~~	186 ~~201~~	213 ~~229~~	240 ~~258~~	266 ~~286~~
90	3 ~~3~~	6 ~~6~~	9 ~~16~~	30 ~~32~~	60 ~~64~~	90 ~~97~~	120 ~~129~~	150 ~~161~~	180 ~~193~~	210 ~~226~~	240 ~~258~~	269 ~~290~~	299 ~~322~~
100	3 ~~4~~	7 ~~7~~	10 ~~18~~	33 ~~36~~	67 ~~72~~	100 ~~107~~	133 ~~143~~	166 ~~179~~	200 ~~215~~	233 ~~251~~	266 ~~286~~	299 ~~322~~	333 ~~358~~

-Table 99-21~~9.219-21~~: Puffin displacement matrix at Coquet Island SPA (WTG~~array~~ area plus two km buffer) with light blue shading indicating the displacement range advocated by A~~SNCBA~~NCBs, and dark blue indicating the Natural England's preferred approach.

Annual (2km Buffer)	Mortality Rate (%)												
Displaced (%)	1	2	5	10	20	30	40	50	60	70	80	90	100
10	1	1	2	6	11	17	23	28	34	40	46	51	57
20	1	2	3	11	23	34	46	57	68	80	91	102	114
30	2	3	5	17	34	51	68	85	102	119	137	154	171
40	2	5	7	23	46	68	91	114	137	159	182	205	228
50	3	6	9	28	57	85	114	142	171	199	228	256	284
60	3	7	10	34	68	102	137	171	205	239	273	307	341
70	4	8	12	40	80	119	159	199	239	279	319	358	398
80	5	9	14	46	91	137	182	228	273	319	364	410	455
90	5	10	15	51	102	154	205	256	307	358	410	461	512
100	6	11	17	57	114	171	228	284	341	398	455	512	569

Farne Island SPA – Guillemot

~~582.~~621. Guillemot has been screened in for the O&M phase to assess the potential for an AEoI from displacement from the Project alone in relation to the following conservation objectives for this species, as a feature of the Farne Island SPA (Document 7.2):

- Maintain the population of each qualifying feature.

~~583.~~622. Based on the above the conservation objective for the Farne Island SPA the specific target for the guillemot feature is as follows based on Natural England's case-specific advice (Natural England 2021):

- Maintain the size of the breeding population at a level which is above 32,875 breeding pairs (65,751~~0~~ breeding adults), whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent. The latest population estimate is 46,332 breeding adults based on the most recent 2019 colony count.

623. The Project ~~array~~ WTG area is located 286.5~~4.2~~km from the Farne Island SPA which is beyond the mean max plus 1SD foraging distance of 153.7km (Woodward et al., 2019) and has therefore been screened out for the breeding bio-season. However, there is non-breeding connectivity, defined as August to February by Furness (2015) (presented in Appendix 7.1.1).

~~584.~~624. The assessment has been carried out using design~~-~~ and model-based abundance estimates, with the results presented in Table 9.22 to Table 9.25.~~Tables XX - XX.~~ The model-based abundance estimates were used in the Applicant's approach and are presented in text. Due to the increased rate of apportionment to FFC SPA for guillemot during the bespoke post~~e~~-breeding bio-season (August – September) (100%) the apportionment to the Farne Islands SPA population ~~are~~is therefore lower ~~for the~~when using the Natural England approach compared with the Applicant's approach.

Non-breeding Bio-season

~~585.~~625. In the non-breeding bio-season the mean-peak number of guillemots estimated to occur in the ~~array~~ WTG area and 2km buffer is ~~11,208~~9,066 individuals.

626. On the basis that 3.7% of these guillemots within the ~~array~~WTG area are deemed to be breeding adults from the Farne Islands SPA during the non-breeding bio-season (Appendix 7.1.1), the total abundance of breeding adults estimated to be displaced from the array plus 2km buffer is 338 (338.4). Based on 50% displacement and 1% mortality, the total predicted consequent mortality from being displaced is estimated at less than two (1.7) individuals during the non-breeding bio-season (Table 9.22~~Table 9.20~~). However, based on advice from ~~SNCB~~ANCBs (MIG-Birds, 2022), a displacement range of 30% to 70% is also presented in Table 9.22~~Table 9-22~~, Table 9.26~~Table 9-26~~ and Table 9.27~~Table 9-27~~.

627. Under Natural England's preferred approach, the impacts during the non-breeding season are different as a result of the introduction of the bespoke post-breeding bio-season for guillemot at FFC SPA, in which all birds in the array during August and September are apportioned to FFC SPA. In this scenario the mean-peak number of guillemots estimated to occur in the ~~array~~WTG area and 2km buffer is 4,279, based upon the mean of peaks for the non-breeding season excluding the months of August and September. On the basis that 3.7% of these guillemots within the ~~array~~WTG area are deemed to be breeding adults from the Farne Islands SPA during the non-breeding bio-season (Appendix 7.1.1), the total abundance of breeding adults estimated to be displaced from the array plus 2km buffer is 160 (159.7). Based on 70% displacement and 2% mortality, the total predicted consequent mortality from being displaced is estimated at two (2.2) individuals during the non-breeding bio-season (Table 9.24~~Table 9-24Table 9-~~). However, based on advice from ~~SNCB~~ANCBs (MIG-Birds, 2022), a displacement range of 30% to 70% is also presented in Table 9.24~~Table 9-24Table 9-~~, Table 9.28~~Table 9-28~~ and Table 9.29~~Table 9-29~~.

628. Using the Applicant's approach, based on a citation population of 65,751 breeding adults and an annual background mortality of 4,011 breeding adults per annum, the addition of two predicted breeding adult mortalities would represent an increase in baseline mortality of 0.0~~34~~42%. Displacement consequent mortalities based on the range advocated by ~~SNCB~~ANCBs (30% displacement to 70% displacement, 1 to 10% mortality) are displayed in Table 9.26~~Table 9.21~~.

~~586. On the basis that 3.7% of these guillemots within the array area are deemed to be breeding adults from the Farne Islands SPA during the non-breeding bio-season (Appendix 7.1.1), the total abundance of breeding adults estimated to be displaced from the array plus 2km buffer is 418 (418.3). Based on 50% displacement and 1% mortality, the total predicted consequent mortality from being displaced is estimated at two (2.1) individuals during the non-breeding bio-season (Table 9.20). However, based on advice from SNCBs (MIG-Birds, 2022), a displacement range of 30% to 70% is also presented in Table 9.20.~~

~~587. Based on a citation population of 65,751 breeding adults and an annual background mortality of 4010.8 breeding adults per annum, the addition of two predicted breeding adult mortalities would represent an increase in baseline mortality of 0.052%. Displacement consequent mortalities based on the range advocated by SNCBs (30% displacement to 70% displacement, 1 to 10% mortality) are displayed in Table 9.21.~~

629. As the population of guillemot has changed since the citation population count, the potential impact on the population is more reasonably assessed against the latest population count undertaken in 2019, consisting of 46,332 individuals and an annual background mortality of 2,826~~.3~~ individuals. On this basis, this would represent a 0.~~074~~060% increase in baseline mortality in the non-breeding bio-season. This level of impact would be indistinguishable from natural fluctuations in the population.

630. Using Natural England's preferred approach, based on a citation population of 65,751 breeding adults and an annual background mortality of 4,011 breeding adults per annum, the addition of two predicted breeding adult mortalities would represent an increase in baseline mortality of 0.056%. Displacement consequent mortalities based on the range advocated by ~~SNCB~~ANCBs (30% displacement to 70% displacement, 1 to 10% mortality) are displayed in Table 9.24~~Table 9-23~~.

~~588.~~631. As the population of guillemot has changed since the citation population count, the potential impact on the population is more reasonably assessed against the latest population count undertaken in 2019, consisting of 46,332 individuals and an annual background mortality of 2,826 individuals. On this basis, this would represent a 0.079% increase in baseline mortality in the non-breeding bio-season. This level of impact would be indistinguishable from natural fluctuations in the population.

~~589.~~632. **Therefore, the potential for an AEoI to the conservation objectives of the guillemot feature of Farne Island SPA in relation to disturbance and displacement effects in the O&M phase from the Project alone can be ruled out and therefore, subject to natural change, guillemot will be maintained as a feature in the long-term.**

Table 9-22~~9.229~~ ~~9.20~~: Range-based displacement mortalities during the operational and maintenance phases for guillemot at Farne Island SPA based on the values advocated by ~~SNCB~~ANCBs for the citation and most recent counts (2019 Seabird Monitoring Programme), ~~-~~ using model-based abundance estimates with the Applicant Approach boldened. The lower confidence interval (LCI) and the upper confidence interval (UCI) are presented as requested by ~~SNCB~~ANCBs.

Bio-season	Abundance of adults apportioned to SPA (plus 2km buffer)	Estimated increase in mortality (breeding adults per annum)			% increase in baseline mortality (citation count)			% increase in baseline mortality (recent count)		
		50% displacement, 1% mortality	70% displacement, 2% mortality~~30-70% displacement, 1-10% mortality~~	30-70% displacement, 1-10% mortality	50% displacement, 1% mortality	70% displacement, 2% mortality~~30-70% displacement, 1 – 10% mortality~~	30-70% displacement, 1 – 10% mortality	50% displacement, 1% mortality	70% displacement, 2% mortality ~~30-70% displacement, 1 – 10% mortality~~	30-70% displacement, 1 – 10% mortality
Mean (model)										
Non-breeding	338.4~~418.3~~	**1.69**~~2.1~~	4.74~~1.3 – 29.3~~	1.02 - 23.68	~~0.0330.052~~0.042	0.118~~0.031 – 0.730~~	0.025 - 0.591	0.0~~18~~60~~0.074~~	0.~~0~~168~~52~~ ~~0.044 – 1.036~~	0.036 - 0.838
LCI (model)										
Non-breeding	209.1	1.05	2.93	0.63 - 14.64	0.026~~1~~	0.073	0.016 - 0.365	0.037~~0.011~~	0.104~~0.032~~	0.022 - 0.518
UCI (model)										
Non-breeding	597.5	2.99	8.37	1.79 - 41.83	0.0~~59~~74	0.209	0.045 - 1.043	0.106~~0.033~~	0.296~~0.091~~	0.063 - 1.48

Table 9-23~~9.239~~: Range-based displacement mortalities during the operational and maintenance phases for guillemot at Farne Island SPA based on the values advocated by ~~SNCB~~ANCBs for the citation and most recent counts (2019 Seabird Monitoring Programme), using design-based abundance estimates with the Applicant Approach boldened. The lower confidence interval (LCI) and the upper confidence interval (UCI) are presented as requested by ~~SNCB~~ANCBs.

Bio-season	Abundance of adults apportioned to SPA (plus 2km buffer)	Estimated increase in mortality (breeding adults per annum)			% increase in baseline mortality (citation count)			% increase in baseline mortality (recent count)		
		50% displacement, 1% mortality	70% displacement, 2% mortality	30-70% displacement, 1- 10% mortality	50% displacement, 1% mortality	70% displacement, 2% mortality	30-70% displacement, 1 – 10% mortality	50% displacement, 1% mortality	70% displacement, 2% mortality	30-70% displacement, 1 – 10% mortality
Mean (design)										
Non-breeding	343.9	**1.72**	4.81	1.03 - 24.07	0.043~~0.034~~	0.120	0.026 - 0.6	0.061~~0.019~~	0.170~~0.053~~	0.037 - 0.852
LCI (design)										
Non-breeding	260.5	1.30	3.65	0.78 - 18.23	0.032~~0.026~~	0.091	0.019 - 0.455	0.046~~0.014~~	0.129~~0.040~~	0.028 - 0.645
UCI (design)										
Non-breeding	449.4	2.25	6.29	1.35 - 31.46	0.056~~0.044~~	0.157	0.034 - 0.784	0.080~~0.025~~	0.223~~0.069~~	0.048 - 1.113

Table 9-24~~9.249-~~: Range-based displacement mortalities during the operational and maintenance phases for guillemot at Farne Island SPA based on the values advocated by ~~SNCB~~ANCBs for the citation and most recent counts (2019 Seabird Monitoring Programme), using model-based abundance estimates with the Natural England's preferred approach is boldened. The lower confidence interval (LCI) and the upper confidence interval (UCI) are presented as requested by ~~SNCB~~ANCBs.

Bio-season	Abundance of adults apportioned to SPA (plus 2km buffer)	Estimated increase in mortality (breeding adults per annum)			% increase in baseline mortality (citation count)			% increase in baseline mortality (recent count)		
		50% displacement, 1% mortality	70% displacement, 2% mortality	30-70% displacement, 1- 10% mortality	50% displacement, 1% mortality	70% displacement, 2% mortality	30-70% displacement, 1 – 10% mortality	50% displacement, 1% mortality	70% displacement, 2% mortality	30-70% displacement, 1 – 10% mortality
Mean (model)										
Non-breeding	159.7~~338.4~~	0.8~~1.7~~	**2.2~~4.7~~**	0.5 - 11.2~~1.0 - 23.7~~	0.020~~0.042~~	0.056~~0.118~~	0.012 - 0.279~~0.025 - 0.591~~	0.028~~0.060~~	0.079~~0.168~~	0.017 - 0.395~~0.036 - 0.838~~
LCI (model)										
Non-breeding	131.5~~209.1~~	0.7~~1.0~~	1.8~~2.9~~	0.4 - 9.2~~0.6 - 14.6~~	0.016~~0.026~~	0.046~~0.073~~	0.01 - 0.229~~0.016 - 0.365~~	0.023~~0.037~~	0.065~~0.104~~	0.014 - 0.326~~0.022 - 0.518~~
UCI (model)										
Non-breeding	195.0~~597.5~~	1.0~~3.0~~	2.7~~8.4~~	0.6 - 13.7~~1.8 - 41.8~~	0.024~~0.074~~	0.068~~0.209~~	0.015 - 0.34~~0.045 - 1.043~~	0.035~~0.106~~	0.097~~0.296~~	0.021 - 0.483~~0.063 - 1.48~~

Table 9-25~~9.259-25~~: Range-based displacement mortalities during the operational and maintenance phases for guillemot at Farne Island SPA based on the values advocated by ~~SNCB~~ANCBs for the citation and most recent counts (2019 Seabird Monitoring Programme), using design-based abundance estimates with the Natural England's preferred approach is boldened. The lower confidence interval (LCI) and the upper confidence interval (UCI) are presented as requested by ~~SNCB~~ANCBs.

Bio-season	Abundance of adults apportioned to SPA (plus 2km buffer)	Estimated increase in mortality (breeding adults per annum)			% increase in baseline mortality (citation count)			% increase in baseline mortality (recent count)		
		50% displacement, 1% mortality	70% displacement, 2% mortality	30-70% displacement, 1- 10% mortality	50% displacement, 1% mortality	70% displacement, 2% mortality	30-70% displacement, 1 – 10% mortality	50% displacement, 1% mortality	70% displacement, 2% mortality	30-70% displacement, 1 – 10% mortality
Mean (design)										
Non-breeding	162.3~~343.9~~	0.8~~1.7~~	**2.3~~4.8~~**	0.5 - 11.4~~1 – 24.1~~	0.020~~0.043~~	0.057~~0.120~~	0.012 - 0.283~~0.026 – 0.6~~	0.029~~0.061~~	0.080~~0.170~~	0.017 - 0.402~~0.037 – 0.852~~
LCI (design)										
Non-breeding	131.0~~260.5~~	0.7~~1.3~~	1.8~~3.6~~	0.4 - 9.2~~0.8 – 18.2~~	0.016~~0.032~~	0.046~~0.091~~	0.01 - 0.229~~0.019 – 0.455~~	0.023~~0.046~~	0.065~~0.129~~	0.014 - 0.325~~0.028 – 0.645~~
UCI (design)										
Non-breeding	198.2~~449.4~~	1.0~~2.2~~	2.8~~6.3~~	0.6 - 13.9~~1.3 – 31.5~~	0.025~~0.056~~	0.069~~0.157~~	0.015 - 0.346~~0.034 – 0.784~~	0.035~~0.080~~	0.098~~0.223~~	0.021 - 0.491~~0.048 – 1.113~~

Table 9-26~~9.269-269.21~~: Guillemot displacement matrix at Farne Island SPA (~~array~~ WTG area plus two km buffer) using the mean model-based abundance estimate, with light blue shading indicating the displacement range advocated by ~~SNCB~~ANCBs, and dark blue indicating the Applicant's approach.

Annual (2km Buffer)	Mortality Rate (%)												
Displaced (%)	1	2	5	10	20	30	40	50	60	70	80	90	100
10	0 ~~0~~	1 ~~1~~	2 ~~2~~	3 ~~4~~	7 ~~8~~	10 ~~12~~	14 ~~17~~	17 ~~21~~	20 ~~25~~	24 ~~29~~	27 ~~33~~	30 ~~37~~	34 ~~41~~
20	1 ~~1~~	1 ~~2~~	3 ~~4~~	7 ~~8~~	14 ~~17~~	20 ~~25~~	27 ~~33~~	34 ~~41~~	41 ~~50~~	47 ~~58~~	54 ~~66~~	61 ~~75~~	68 ~~83~~
30	1 ~~1~~	2 ~~2~~	5 ~~6~~	10 ~~12~~	20 ~~25~~	30 ~~37~~	41 ~~50~~	51 ~~62~~	61 ~~75~~	71 ~~87~~	81 ~~100~~	91 ~~112~~	102 ~~124~~
40	1 ~~2~~	3 ~~3~~	7 ~~8~~	14 ~~17~~	27 ~~33~~	41 ~~50~~	54 ~~66~~	68 ~~83~~	81 ~~100~~	95 ~~116~~	108 ~~133~~	122 ~~149~~	135 ~~166~~
50	2 ~~2~~	3 ~~4~~	8 ~~10~~	17 ~~21~~	34 ~~41~~	51 ~~62~~	68 ~~83~~	85 ~~104~~	102 ~~124~~	118 ~~145~~	135 ~~166~~	152 ~~187~~	169 ~~207~~
60	2 ~~2~~	4 ~~5~~	10 ~~12~~	20 ~~25~~	41 ~~50~~	61 ~~75~~	81 ~~100~~	102 ~~124~~	122 ~~149~~	142 ~~174~~	162 ~~199~~	183 ~~224~~	203 ~~249~~
70	2 ~~3~~	5 ~~6~~	12 ~~15~~	24 ~~29~~	47 ~~58~~	71 ~~87~~	95 ~~116~~	118 ~~145~~	142 ~~174~~	166 ~~203~~	189 ~~232~~	213 ~~261~~	237 ~~290~~
80	3 ~~3~~	5 ~~7~~	14 ~~17~~	27 ~~33~~	54 ~~66~~	81 ~~100~~	108 ~~133~~	135 ~~166~~	162 ~~199~~	189 ~~232~~	217 ~~265~~	244 ~~299~~	271 ~~332~~
90	3 ~~4~~	6 ~~7~~	15 ~~19~~	30 ~~37~~	61 ~~75~~	91 ~~112~~	122 ~~149~~	152 ~~187~~	183 ~~224~~	213 ~~261~~	244 ~~299~~	274 ~~336~~	305 ~~373~~
100	3 ~~4~~	7 ~~8~~	17 ~~21~~	34 ~~41~~	68 ~~83~~	102 ~~124~~	135 ~~166~~	169 ~~207~~	203 ~~249~~	237 ~~290~~	271 ~~332~~	305 ~~373~~	338 ~~415~~

Table 9-27~~9.279-27~~: Guillemot displacement matrix at Farne Island SPA (~~array~~WTG area plus two km buffer) using the UCI model-based abundance estimate, with light blue shading indicating the displacement range advocated by ~~SNCB~~ANCBs, and dark blue indicating the Applicant's approach.

Annual (2km Buffer)	Mortality Rate (%)												
Displaced (%)	1	2	5	10	20	30	40	50	60	70	80	90	100
10	1	1	3	6	12	18	24	30	36	42	48	54	60
20	1	2	6	12	24	36	48	60	72	84	96	108	120
30	2	4	9	18	36	54	72	90	108	125	143	161	179
40	2	5	12	24	48	72	96	120	143	167	191	215	239
50	3	6	15	30	60	90	120	149	179	209	239	269	299
60	4	7	18	36	72	108	143	179	215	251	287	323	359
70	4	8	21	42	84	125	167	209	251	293	335	376	418
80	5	10	24	48	96	143	191	239	287	335	382	430	478
90	5	11	27	54	108	161	215	269	323	376	430	484	538
100	6	12	30	60	120	179	239	299	359	418	478	538	598

Table 9-28~~9.289-28~~: Guillemot displacement matrix at Farne Island SPA (~~array~~WTG area plus two km buffer) using the mean model-based abundance estimate, with light blue shading indicating the displacement range advocated by ~~SNCB~~ANCBs, and dark blue indicating Natural England's preferred approach.

Annual (2km Buffer)	Mortality Rate (%)												
Displaced (%)	1	2	5	10	20	30	40	50	60	70	80	90	100
10	0	0	1	2	3	5	6	8	10	11	13	14	16
20	0	1	2	3	6	10	13	16	19	22	26	29	32
30	0	1	2	5	10	14	19	24	29	34	38	43	48
40	1	1	3	6	13	19	26	32	38	45	51	57	64
50	1	2	4	8	16	24	32	40	48	56	64	72	80
60	1	2	5	10	19	29	38	48	57	67	77	86	96
70	1	2	6	11	22	34	45	56	67	78	89	101	112
80	1	3	6	13	26	38	51	64	77	89	102	115	128
90	1	3	7	14	29	43	57	72	86	101	115	129	144
100	2	3	8	16	32	48	64	80	96	112	128	144	160

Table 9-29~~9.299-29~~: Guillemot displacement matrix at Farne Island SPA (~~array~~WTG area plus two km buffer) using the UCI model-based abundance estimate, with light blue shading indicating the displacement range advocated by ~~SNCB~~ANCBs, and dark blue indicating Natural England's preferred approach.

Annual (2km Buffer)	Mortality Rate (%)												
Displaced (%)	1	2	5	10	20	30	40	50	60	70	80	90	100
10	0	0	1	2	4	6	8	10	12	14	16	18	20
20	0	1	2	4	8	12	16	20	23	27	31	35	39
30	1	1	3	6	12	18	23	29	35	41	47	53	59
40	1	2	4	8	16	23	31	39	47	55	62	70	78
50	1	2	5	10	20	29	39	49	59	68	78	88	98
60	1	2	6	12	23	35	47	59	70	82	94	105	117
70	1	3	7	14	27	41	55	68	82	96	109	123	137
80	2	3	8	16	31	47	62	78	94	109	125	140	156
90	2	4	9	18	35	53	70	88	105	123	140	158	176
100	2	4	10	20	39	59	78	98	117	137	156	176	195

Table 9-30~~9.309-30~~: Guillemot displacement matrix at Farne Island SPA (~~array~~WTG area plus two km buffer) using the mean design-based abundance estimate, with light blue shading indicating the displacement range advocated by ~~SNCB~~ANCBs, and dark blue indicating the Applicant's approach.

Annual (2km Buffer)	Mortality Rate (%)												
Displaced (%)	1	2	5	10	20	30	40	50	60	70	80	90	100
10	0	1	2	3	7	10	14	17	21	24	28	31	34
20	1	1	3	7	14	21	28	34	41	48	55	62	69
30	1	2	5	10	21	31	41	52	62	72	83	93	103
40	1	3	7	14	28	41	55	69	83	96	110	124	138
50	2	3	9	17	34	52	69	86	103	120	138	155	172
60	2	4	10	21	41	62	83	103	124	144	165	186	206
70	2	5	12	24	48	72	96	120	144	169	193	217	241
80	3	6	14	28	55	83	110	138	165	193	220	248	275
90	3	6	15	31	62	93	124	155	186	217	248	279	310
100	3	7	17	34	69	103	138	172	206	241	275	310	344

Table 9-31~~9.319-31~~: Guillemot displacement matrix at Farne Island SPA (WTG~~array~~ area plus two km buffer) using the UCI design-based abundance estimate, with light blue shading indicating the displacement range advocated by ~~SNCB~~ANCBs, and dark blue indicating the Applicant's approach.

Annual (2km Buffer)	Mortality Rate (%)												
Displaced (%)	1	2	5	10	20	30	40	50	60	70	80	90	100
10	0	1	2	4	9	13	18	22	27	31	36	40	45
20	1	2	4	9	18	27	36	45	54	63	72	81	90
30	1	3	7	13	27	40	54	67	81	94	108	121	135
40	2	4	9	18	36	54	72	90	108	126	144	162	180
50	2	4	11	22	45	67	90	112	135	157	180	202	225
60	3	5	13	27	54	81	108	135	162	189	216	243	270
70	3	6	16	31	63	94	126	157	189	220	252	283	315
80	4	7	18	36	72	108	144	180	216	252	288	324	360
90	4	8	20	40	81	121	162	202	243	283	324	364	405
100	4	9	22	45	90	135	180	225	270	315	360	405	449

OUTER DOWSING OFFSHORE WIND

-Table 99-32~~9.329-32~~: Guillemot displacement matrix at Farne Island SPA (~~array~~WTG area plus two km buffer) using the mean design-based abundance estimate, with light blue shading indicating the displacement range advocated by ~~SNCB~~ANCBs, and dark blue indicating Natural England's preferred approach.

Annual (2km Buffer)	Mortality Rate (%)												
Displaced (%)	1	2	5	10	20	30	40	50	60	70	80	90	100
10	0	0	1	2	3	5	6	8	10	11	13	15	16
20	0	1	2	3	6	10	13	16	19	23	26	29	32
30	0	1	2	5	10	15	19	24	29	34	39	44	49
40	1	1	3	6	13	19	26	32	39	45	52	58	65
50	1	2	4	8	16	24	32	41	49	57	65	73	81
60	1	2	5	10	19	29	39	49	58	68	78	88	97
70	1	2	6	11	23	34	45	57	68	80	91	102	114
80	1	3	6	13	26	39	52	65	78	91	104	117	130
90	1	3	7	15	29	44	58	73	88	102	117	131	146
100	2	3	8	16	32	49	65	81	97	114	130	146	162

-Table 99-33~~9.339~~-: Guillemot displacement matrix at Farne Island SPA (~~array~~WTG area plus two km buffer) using the UCI design-based abundance estimate, with light blue shading indicating the displacement range advocated by ~~SNCB~~ANCBs, and dark blue indicating Natural England's preferred approach.

Annual (2km Buffer)	Mortality Rate (%)												
Displaced (%)	1	2	5	10	20	30	40	50	60	70	80	90	100
10	0	0	1	2	4	6	8	10	12	14	16	18	20
20	0	1	2	4	8	12	16	20	24	28	32	36	40
30	1	1	3	6	12	18	24	30	36	42	48	54	59
40	1	2	4	8	16	24	32	40	48	55	63	71	79
50	1	2	5	10	20	30	40	50	59	69	79	89	99
60	1	2	6	12	24	36	48	59	71	83	95	107	119
70	1	3	7	14	28	42	55	69	83	97	111	125	139
80	2	3	8	16	32	48	63	79	95	111	127	143	159
90	2	4	9	18	36	54	71	89	107	125	143	161	178
100	2	4	10	20	40	59	79	99	119	139	159	178	198

Farne Island SPA – Puffin

~~590.~~633. Puffin has been screened in for the O&M phase to assess the potential for an AEoI from displacement from the Project alone in relation to the following conservation objectives for this species, as an assemblage feature of the Farne Island SPA:

- Maintain the population of each qualifying feature.

~~591.~~634. Although puffin is only a named feature of the seabird assemblage, for the purpose of this assessment it has been considered in a similar manner to qualifying species, though the conclusion is not whether an AEoI would result from the Project alone on puffin as a feature, but more as an important component of the seabird assemblage. The latest population estimate is 43,752 apparently occupied burrows, and as such, 87,504 individuals, based on the most recent 2019 colony counts.

~~592.~~635. The Project ~~array~~ WTG area is located 28~~4~~6.5~~.2~~km from the Farne Islands SPA which is beyond the mean max plus 1SD foraging distance of 265.4km (Woodward et al., 2019) and has therefore been screened out for the breeding bio-season. However, there is non-breeding connectivity, defined as August to March by Furness (2015) (Appendix 7.1.1).

Non-breeding Bio-season

~~593.~~636. In the non-breeding bio-season the mean-peak number of puffins estimated to occur in the ~~array~~ WTG area and 2km buffer is ~~637~~ 666 (~~636~~666.~~5~~0) individuals.

~~594.~~637. On the basis that ~~34~~34.5% ~~.5%~~ of these ~~guillemots~~ puffin within the ~~array~~ WTG area are deemed to be breeding adults from the Farne Island SPA during the non-breeding bio-season (Appendix 7.1.1), the total abundance of Farne's breeding adults estimated to be displaced from the array plus 2km buffer is ~~219~~71.3~~.6.~~. Based on 50% displacement and 1% mortality, the total predicted consequent mortality from being displaced is estimated at less than one (0.7~~361.01~~) individual during the non-breeding bio-season. However, based on advice from ~~SNCB~~ANCBs (MIG-Birds, 2022), a displacement range of 30% to 70% is also presented in Table 9.34~~Table 9-34~~ and Table 9.35~~Table 9-35Table 9.22~~.

638. Using Natural England's preferred approach, 71 (71.3) birds are apportioned to the Farne Islands SPA. Assuming a displacement rate of 70% and a mortality rate of 2%, the consequent mortality is estimated at two (2.0) breeding adult.

639. Based on a citation population of 76,798 breeding adults and an annual, background mortality of 7,219 breeding adults per annum, the addition of one predicted breeding adult mortality would represent an increase in baseline mortality of 0.0~~15~~10%. Based on the Natural England preferred approach, there would be an increase of 0.028% in baseline mortality. Displacement consequent mortalities based on the range advocated by ~~SNCB~~ANCBs (30% displacement to 70% displacement, 1 to 10% mortality) are displayed in Table 9.34~~Table 9-34~~ and Table 9.35~~Table 9-35~~Table 9.35~~Table 9.23~~.

~~595.~~

~~596.~~640. As the population of puffin has changed since the citation population count, the potential impact on the population is more reasonably assessed against the latest population count undertaken in 2019, consisting of 43,752 apparently occupied burrows, and therefore 87,504 individuals, with an annual background mortality of 8,225~~.4~~ individuals. On this basis, this would represent a 0.009~~13~~% increase in baseline mortality in the non-breeding bio-season. When using the Natural England approach, the potential impact would result in a 0.024% increase in baseline mortality. This level of impact is considered to make no material contribution to any changes in populations or baseline mortality and would be indistinguishable from natural fluctuations in the population.

~~597.~~641. Therefore, the potential for an AEoI to the conservation objectives of the puffin as an assemblage feature of Farne Island SPA in relation to disturbance and displacement effects in the O&M phase from the Project alone can be ruled out and therefore, subject to natural change, puffin will be maintained as a feature in the long-term.

~~Table 9.22: Range-based displacement mortalities during the operational and maintenance phases for puffin at Farne Island SPA based on the values advocated by SNCBs for the most recent counts (2019, Seabird Monitoring Programme).~~

~~Bio-season~~	~~Abundance of adults apportioned to SPA (plus 2km buffer)~~	~~Estimated increase in mortality (breeding adults per annum)~~		~~% increase in baseline mortality (citation count)~~		~~% increase in baseline mortality (recent count)~~	
		~~50% displacement, 1% mortality~~	~~30-70% displacement, 1-10% mortality~~	~~50% displacement, 1% mortality~~	~~30-70% displacement, 1 – 10% mortality~~	~~50% displacement, 1% mortality~~	~~30-70% displacement, 1 – 10% mortality~~
~~Non-breeding~~	~~219.6~~	~~1.1~~	~~0.7 – 15.4~~	~~0.015~~	~~0.009 – 0.210~~	~~0.013~~	~~0.007 – 0.182~~

Table 9-34~~9.349-34~~: Range-based displacement mortalities during the operational and maintenance phases for puffin at Farne Island SPA based on the values advocated by ~~SNCB~~ANCBs for the citation and most recent counts (2019 Seabird Monitoring Programme). The lower confidence interval (LCI) and the upper confidence interval (UCI) are presented as requested by ~~SNCB~~ANCBs.

Bio-season	Abundance of adults apportioned to SPA (plus 2km buffer)	Estimated increase in mortality (breeding adults per annum)			% increase in baseline mortality (citation count)			% increase in baseline mortality (recent count)		
		50% displacement, 1% mortality	70% displacement, 2% mortality	30-70% displacement, 1- 10% mortality	50% displacement, 1% mortality	70% displacement, 2% mortality	30-70% displacement, 1 – 10% mortality	50% displacement, 1% mortality	70% displacement, 2% mortality	30-70% displacement, 1 – 10% mortality
Mean										
Non-breeding	142.6	0.7	2.0	0.4 - 10	0.010	0.028	0.006 - 0.138	0.009	0.024	0.005 - 0.121
LCI										

Bio-season	Abundance of adults apportioned to SPA (plus 2km buffer)	Estimated increase in mortality (breeding adults per annum)			% increase in baseline mortality (citation count)			% increase in baseline mortality (recent count)		
		50% displacement, 1% mortality	70% displacement, 2% mortality	30-70% displacement, 1- 10% mortality	50% displacement, 1% mortality	70% displacement, 2% mortality	30-70% displacement, 1 – 10% mortality	50% displacement, 1% mortality	70% displacement, 2% mortality	30-70% displacement, 1 – 10% mortality
Non-breeding	101.0	0.5	1.4	0.3 - 7.1	0.007	0.020	0.004 - 0.098	0.006	0.017	0.004 - 0.086
UCI										
Non-breeding	196.4	1.0	2.7	0.6 - 13.7	0.014	0.038	0.008 - 0.19	0.012	0.033	0.007 - 0.167

Table 9-35~~9.359-359.23~~: Puffin displacement matrix at Farne Island SPA (array plus two km buffer), with light blue shading indicating the displacement range advocated by ~~SNCB~~ANCBs, and dark blue indicating the Applicant's approach.

Annual (2km Buffer)	Mortality Rate (%)												
Displaced (%)	1	2	5	10	20	30	40	50	60	70	80	90	100
10	0 ~~0~~	0 ~~0~~	0 ~~1~~	1 ~~2~~	3 ~~4~~	4 ~~7~~	6 ~~9~~	7 ~~11~~	9 ~~13~~	10 ~~15~~	11 ~~18~~	13 ~~20~~	14 ~~22~~
20	0 ~~0~~	1 ~~1~~	1 ~~2~~	3 ~~4~~	6 ~~9~~	9 ~~13~~	11 ~~18~~	14 ~~22~~	17 ~~26~~	20 ~~31~~	23 ~~35~~	26 ~~40~~	29 ~~44~~
30	0 ~~1~~	1 ~~1~~	1 ~~3~~	4 ~~7~~	9 ~~13~~	13 ~~20~~	17 ~~26~~	21 ~~33~~	26 ~~40~~	30 ~~46~~	34 ~~53~~	39 ~~59~~	43 ~~66~~
40	1 ~~1~~	1 ~~2~~	2 ~~4~~	6 ~~9~~	11 ~~18~~	17 ~~26~~	23 ~~35~~	29 ~~44~~	34 ~~53~~	40 ~~61~~	46 ~~70~~	51 ~~79~~	57 ~~88~~
50	1 ~~1~~	1 ~~2~~	2 ~~5~~	7 ~~11~~	14 ~~22~~	21 ~~33~~	29 ~~44~~	36 ~~55~~	43 ~~66~~	50 ~~77~~	57 ~~88~~	64 ~~99~~	71 ~~110~~
60	1 ~~1~~	2 ~~3~~	3 ~~7~~	9 ~~13~~	17 ~~26~~	26 ~~40~~	34 ~~53~~	43 ~~66~~	51 ~~79~~	60 ~~92~~	68 ~~105~~	77 ~~119~~	86 ~~132~~
70	1 ~~2~~	2 ~~3~~	3 ~~8~~	10 ~~15~~	20 ~~31~~	30 ~~46~~	40 ~~61~~	50 ~~77~~	60 ~~92~~	70 ~~108~~	80 ~~123~~	90 ~~138~~	100 ~~154~~
80	1 ~~2~~	2 ~~4~~	3 ~~9~~	11 ~~18~~	23 ~~35~~	34 ~~53~~	46 ~~70~~	57 ~~88~~	68 ~~105~~	80 ~~123~~	91 ~~141~~	103 ~~158~~	114 ~~176~~
90	1 ~~2~~	3 ~~4~~	4 ~~10~~	13 ~~20~~	26 ~~40~~	39 ~~59~~	51 ~~79~~	64 ~~99~~	77 ~~119~~	90 ~~138~~	103 ~~158~~	116 ~~178~~	128 ~~198~~
100	1 ~~2~~	3 ~~4~~	4 ~~11~~	14 ~~22~~	29 ~~44~~	43 ~~66~~	57 ~~88~~	71 ~~110~~	86 ~~132~~	100 ~~154~~	114 ~~176~~	128 ~~198~~	143 ~~220~~

Flamborough and Filey ~~C~~coast SPA – Guillemot

~~598.~~642. Guillemot has been screened in for the O&M phase to assess the potential for an AEoI from displacement from the Project alone in relation to the following conservation objectives for this species, as a feature of the FFC SPA (Document 7.2):

- Maintain the population of each qualifying feature.

~~599.~~643. Based on the above the conservation objective for the FFC SPA the specific target for the guillemot feature is as follows based on Natural England's case-specific advice (Natural England 2021):

- Maintain the size of the breeding population at a level which is above 41,607 breeding pairs (83,214 breeding adults), whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent. The latest colony population estimate is 149,980 breeding adults based on the most recent 2022 colony count.

644. The Project ~~array~~ WTG area is located ~~92.9km~~93.5km from the FFC SPA which is within the mean max plus 1SD foraging distance of 153.7km (Woodward et al., 2019) and has therefore been screened in for the full breeding bio-season for the months of March to July and the non-breeding bio-season defined as August to February by Furness (2015) (Appendix 7.1.1).

~~600.~~645. The assessment has been carried out using design- and model-based abundance estimates, with the results presented in Table 9.36 to Table 9.39~~Tables XX - XX~~. The model-based abundance estimates were used in the Applicant's approach and are presented in text.

Breeding Bio-season – Applicant's approach

646. During the breeding bio-season, the number of guillemots estimated to occur in the ~~array~~WTG area and 2km buffer is 11,364 individuals. Using the Applicant's apportioning approach and assuming the proportion of adult birds in the array is 57%, the total number of breeding adults in the array at risk of displacement is 6,478 (6,477.6) during the full breeding bio-season.

647. Of these 6,478 breeding adults, 50% are predicted to be breeding birds from FFC SPA (Appendix 7.1.1). Therefore, 3,239 (3,238.8) breeding adults at risk of displacement are attributed to FFC SPA. Assuming a displacement rate of 50% and a mortality rate of 1%, the consequent mortality is estimated at 16 (16.2) breeding adults.

648. Based on a citation population of 83,214 breeding adults and annual background mortality of 5,076 individuals, the addition of 16 predicted breeding adult mortalities would represent a 0.319% increase in baseline mortality during the breeding bio-season.

649. As the population of guillemot has increased significantly since the citation population count the potential impact on the population is more reasonably assessed against the latest population count undertaken in 2022, consisting of 149,980 individuals and an annual background mortality of 9148.8 individuals. On this basis, an additional 16 mortalities would represent a 0.177% increase in baseline mortality during the breeding bio-season.

~~601. During the breeding bio-season, the number of guillemots estimated to occur in the array area and 2km buffer is 16,445 individuals. Using the applicant's apportioning approach and assuming the proportion of adult birds in the array is 57%, the total number of breeding adults in the array at risk of displacement is 9,373.6 during the full breeding bio-season.~~

~~602. Of these 9373.6 breeding adults, 50% are predicted to be breeding birds from FFC SPA (Appendix 7.1.1). Therefore, 4,686.2 breeding adults at risk of displacement are attributed to FFC SPA. Assuming a displacement rate of 50% and a mortality rate of 1%, the consequent mortality is estimated at 23 (23.4) breeding adults.~~

~~603. Based on a citation population of 83,214 breeding adults and annual background mortality of 5,076 individuals, the addition of 23 predicted breeding adult mortalities would represent a 0.462% increase in baseline mortality during the breeding bio-season.~~

~~As the population of guillemot has increased significantly since the citation population count the potential impact on the population is more reasonably assessed against the latest population count undertaken in 2022, consisting of 149,980 individuals and an annual background mortality of 9148.8 individuals. On this basis, an additional 23 mortalities would represent a 0.256% increase in baseline mortality during the breeding bio-season.~~

Breeding Bio-season – Natural England approach

650. During the breeding bio-season, the number of guillemots estimated to occur in the ~~array~~WTG area and 2km buffer is 11,364 individuals. Using Natural England's preferred adult apportioning approach, 100% of the birds are assumed to be adult, and therefore 11,364 are at risk of displacement.

651. Using Natural England's preferred approach to apportioning, 100% are apportioned to FFC SPA. Therefore, with 100% assumed to be adults and 100% apportioned to FFC SPA, at 70% displacement and 2% mortality, the impact is estimated to be 159 (159.1) individuals.

652. Based on a citation population of 83,214 breeding adults and annual background mortality of 5,076 individuals, the addition of 159 breeding adult mortalities would represent an increase on baseline mortality of 3.314%.

653. As the population of guillemot has increased significantly since the citation population count the potential impact on the population is more reasonably assessed against the latest population count undertaken in 2022, consisting of 149,980 individuals and an annual background mortality of 9,148.8 individuals. On this basis, an additional 159 mortalities would represent a 1.739% increase in baseline mortality during the breeding bio-season.

654. The Applicant does not consider that 100% apportionment to FFC SPA or the assumption that all birds within the array are breeding adults to be appropriate. The assumptions made in the Natural England Approach have been made purely on a precautionary basis and do not ~~consider the evidence to~~ provide a proportionate assessment of the impacts. For further details on this please see 19.8 Levels of precaution in the assessment and compensation calculations for offshore ornithology [REP2-057].

~~604. During the breeding bio-season, the number of guillemots estimated to occur in the array area and 2km buffer is 16,445 individuals. Using Natural England's preferred apportioning approach, 100% of the birds are assumed to be adult, and therefore 16,445 are at risk of displacement.~~

~~605. Using Natural England's preferred approach to apportioning, 100% are apportioned to FFC SPA. Therefore, with 100% assumed to be adults and 100% apportioned to FFC SPA, at 50% displacement and 1% mortality, the impact is estimated to be 82 (82.2).~~

~~606. Based on a citation population of 83,214 breeding adults and annual background mortality of 5,076 individuals, the addition of 82 breeding adult mortalities would represent an increase on baseline mortality of 1.619%~~

~~607. As the population of guillemot has increased significantly since the citation population count the potential impact on the population is more reasonably assessed against the latest population count undertaken in 2022, consisting of 149,980 individuals and an annual background mortality of 9148.8 individuals. On this basis, an additional 82 mortalities would represent a 0.898% increase in baseline mortality during the breeding bio-season.~~

Non-breeding season – Applicant's Approach

655. In the non-breeding bio-season the mean-peak number of guillemots estimated to occur in the ~~array~~WTG area and 2km buffer is 9,066 individuals.

On the basis that 4.41% of these guillemots within the ~~array~~WTG area are deemed to be breeding adults from the FFC during the non-breeding bio-season (Appendix 7.1.1), the total abundance of breeding adults estimated to be displaced from the array plus 2km buffer is 400 (399.8). Based on 50% displacement and 1% mortality, the total predicted consequent mortality from being displaced is estimated at two (2.0) individuals during the non-breeding bio-season. However, based on advice from ~~SNCB~~ANCBs (MIG-Birds, 2022), a displacement range of 30% to 70% is also presented in Table 9.36.~~Table 9.36: Range-based displacement mortalities during the operational and maintenance phases for guillemot at FFC SPA based on the values advocated by ANCBs for the citation and most recent counts (Aitken et al., 2017 Seabird Monitoring Programme), using model-based abundance estimates with the Applicant Approach boldened. The lower confidence interval (LCI) and the upper confidence interval (UCI) are presented as requested by ANCBs.~~

~~Bio-season~~	~~Abundance of adults apportioned to SPA (plus 2km buffer)~~	~~Estimated increase in mortality (breeding adults per annum)~~			~~% increase in baseline mortality (citation count)~~			~~% increase in baseline mortality (recent count)~~		
		~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1-10% mortality~~	~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1 – 10% mortality~~	~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1 – 10% mortality~~
~~Mean (Modelled)~~										
~~Breeding~~	~~3238.8~~	**~~16.19~~**	~~45.34~~	~~9.72 – 226.72~~	~~0.319~~	~~0.893~~	~~0.191 - 4.466~~	~~0.177~~	~~0.496~~	~~0.106 - 2.478~~

~~Bio-season~~	~~Abundance of adults apportioned to SPA (plus 2km buffer)~~	~~Estimated increase in mortality (breeding adults per annum)~~			~~% increase in baseline mortality (citation count)~~			~~% increase in baseline mortality (recent count)~~		
		~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1-10% mortality~~	~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1 – 10% mortality~~	~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1 – 10% mortality~~
~~Non-breeding~~	~~400.0~~	~~**2.00**~~	~~5.60~~	~~1.20 – 28.00~~	~~0.039~~	~~0.110~~	~~0.024 - 0.552~~	~~0.022~~	~~0.061~~	~~0.013 - 0.306~~

~~Bio-season~~	~~Abundance of adults apportioned to SPA (plus 2km buffer)~~	~~Estimated increase in mortality (breeding adults per annum)~~			~~% increase in baseline mortality (citation count)~~			~~% increase in baseline mortality (recent count)~~		
		~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1-10% mortality~~	~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1–10% mortality~~	~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1–10% mortality~~
~~Annual Total~~	~~3638.8~~	~~**18.19**~~	~~50.94~~	~~10.92 - 254.71~~	~~0.358~~	~~1.004~~	~~0.215 - 5.018~~	~~0.199~~	~~0.557~~	~~0.119 - 2.784~~
~~LCI (Modelled)~~										

~~Bio-season~~	~~Abundance of adults apportioned to SPA (plus 2km buffer)~~	~~Estimated increase in mortality (breeding adults per annum)~~			~~% increase in baseline mortality (citation count)~~			~~% increase in baseline mortality (recent count)~~		
		~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1-10% mortality~~	~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1 – 10% mortality~~	~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1 – 10% mortality~~
~~Breeding~~	~~2380.3~~	~~11.90~~	~~33.32~~	~~7.14 – 166.62~~	~~0.234~~	~~0.657~~	~~0.141 - 3.283~~	~~0.130~~	~~0.364~~	~~0.078 - 1.821~~

~~Bio-season~~	~~Abundance of adults apportioned to SPA (plus 2km buffer)~~	~~Estimated increase in mortality (breeding adults per annum)~~			~~% increase in baseline mortality (citation count)~~			~~% increase in baseline mortality (recent count)~~		
		~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1-10% mortality~~	~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1 – 10% mortality~~	~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1 – 10% mortality~~
~~Non-breeding~~	~~247.3~~	~~1.24~~	~~3.46~~	~~0.74 – 17.31~~	~~0.024~~	~~0.068~~	~~0.015 - 0.341~~	~~0.014~~	~~0.038~~	~~0.008 - 0.189~~

~~Bio-season~~	~~Abundance of adults apportioned to SPA (plus 2km buffer)~~	~~Estimated increase in mortality (breeding adults per annum)~~			~~% increase in baseline mortality (citation count)~~			~~% increase in baseline mortality (recent count)~~		
		~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1-10% mortality~~	~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1 – 10% mortality~~	~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1 – 10% mortality~~
~~Annual Total~~	~~2627.6~~	~~13.14~~	~~36.79~~	~~7.88 – 183.93~~	~~0.259~~	~~0.725~~	~~0.155 - 3.623~~	~~0.144~~	~~0.402~~	~~0.086 - 2.01~~
~~UCI (Modelled)~~										

~~Bio-season~~	~~Abundance of adults apportioned to SPA (plus 2km buffer)~~	~~Estimated increase in mortality (breeding adults per annum)~~			~~% increase in baseline mortality (citation count)~~			~~% increase in baseline mortality (recent count)~~		
		~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1-10% mortality~~	~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1 – 10% mortality~~	~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1 – 10% mortality~~
~~Breeding~~	~~4447.6~~	~~22.24~~	~~62.27~~	~~13.34 - 311.33~~	~~0.438~~	~~1.227~~	~~0.263 - 6.133~~	~~0.243~~	~~0.681~~	~~0.146 - 3.403~~

~~Bio-season~~	~~Abundance of adults apportioned to SPA (plus 2km buffer)~~	~~Estimated increase in mortality (breeding adults per annum)~~			~~% increase in baseline mortality (citation count)~~			~~% increase in baseline mortality (recent count)~~		
		~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1-10% mortality~~	~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1–10% mortality~~	~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1–10% mortality~~
~~Non-breeding~~	~~706.4~~	~~3.53~~	~~9.89~~	~~2.12–49.45~~	~~0.070~~	~~0.195~~	~~0.042-0.974~~	~~0.039~~	~~0.108~~	~~0.023-0.54~~

~~Bio-season~~	~~Abundance of adults apportioned to SPA (plus 2km buffer)~~	~~Estimated increase in mortality (breeding adults per annum)~~			~~% increase in baseline mortality (citation count)~~			~~% increase in baseline mortality (recent count)~~		
		~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1-10% mortality~~	~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1–10% mortality~~	~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1–10% mortality~~
~~Annual Total~~	~~5154.0~~	~~25.77~~	~~72.16~~	~~15.46-360.78~~	~~0.508~~	~~1.421~~	~~0.305-7.107~~	~~0.282~~	~~0.789~~	~~0.169-3.943~~

~~Table 9.37: Range-based displacement mortalities during the operational and maintenance phases for guillemot at FFC SPA based on the values advocated by ANCBs for the citation and most recent counts (Aitken et al., 2017 Seabird Monitoring Programme), using model-based abundance estimates with the Natural England preferred approach boldened. The lower confidence interval (LCI) and the upper confidence interval (UCI) are presented as requested by ANCBs.~~

~~Bio-season~~	~~Abundance of adults apportioned to SPA (plus 2km buffer)~~	~~Estimated increase in mortality (breeding adults per annum)~~			~~% increase in baseline mortality (citation count)~~			~~% increase in baseline mortality (recent count)~~		
		~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1-10% mortality~~	~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1 – 10% mortality~~	~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1 – 10% mortality~~
~~Mean (Modelled)~~										
~~Breeding~~	~~11,364.2~~	~~56.82~~	**~~159.10~~**	~~34.09 - 795.49~~	~~1.119~~	~~3.134~~	~~0.672 - 15.671~~	~~0.621~~	~~1.739~~	~~0.373 - 8.695~~

~~Bio-season~~	~~Abundance of adults apportioned to SPA (plus 2km buffer)~~	~~Estimated increase in mortality (breeding adults per annum)~~			~~% increase in baseline mortality (citation count)~~			~~% increase in baseline mortality (recent count)~~		
		~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1-10% mortality~~	~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1–10% mortality~~	~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1–10% mortality~~
~~Post-breeding~~	~~6,210.3~~	~~31.05~~	~~**86.94**~~	~~18.63 - 434.72~~	~~0.612~~	~~1.713~~	~~0.367 - 8.564~~	~~0.339~~	~~0.950~~	~~0.204 - 4.752~~

~~Bio-season~~	~~Abundance of adults apportioned to SPA (plus 2km buffer)~~	~~Estimated increase in mortality (breeding adults per annum)~~			~~% increase in baseline mortality (citation count)~~			~~% increase in baseline mortality (recent count)~~		
		~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1-10% mortality~~	~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1 – 10% mortality~~	~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1 – 10% mortality~~
~~Non-breeding~~	~~189.8~~	~~0.94~~	**~~2.64~~**	~~0.57 – 13.21~~	~~0.019~~	~~0.052~~	~~0.011 - 0.26~~	~~0.010~~	~~0.029~~	~~0.006 - 0.144~~

~~Bio-season~~	~~Abundance of adults apportioned to SPA (plus 2km buffer)~~	~~Estimated increase in mortality (breeding adults per annum)~~			~~% increase in baseline mortality (citation count)~~			~~% increase in baseline mortality (recent count)~~		
		~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1-10% mortality~~	~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1 – 10% mortality~~	~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1 – 10% mortality~~
~~Annual Total~~	~~17,763.3~~	~~88.82~~	**~~248.69~~**	~~53.29 - 1243.43~~	~~1.750~~	~~4.899~~	~~1.05 - 24.496~~	~~0.971~~	~~2.718~~	~~0.582 - 13.591~~
~~LCI (Modelled)~~										

~~Bio-season~~	~~Abundance of adults apportioned to SPA (plus 2km buffer)~~	~~Estimated increase in mortality (breeding adults per annum)~~			~~% increase in baseline mortality (citation count)~~			~~% increase in baseline mortality (recent count)~~		
		~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1-10% mortality~~	~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1 – 10% mortality~~	~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1 – 10% mortality~~
~~Breeding~~	~~8,352.0~~	~~41.76~~	~~116.93~~	~~25.06 - 584.64~~	~~0.823~~	~~2.304~~	~~0.494 - 11.518~~	~~0.456~~	~~1.278~~	~~0.274 - 6.39~~

~~Bio-season~~	~~Abundance of adults apportioned to SPA (plus 2km buffer)~~	~~Estimated increase in mortality (breeding adults per annum)~~			~~% increase in baseline mortality (citation count)~~			~~% increase in baseline mortality (recent count)~~		
		~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1-10% mortality~~	~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1 – 10% mortality~~	~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1 – 10% mortality~~
~~Post-breeding~~	~~3,839.9~~	~~19.19~~	~~53.74~~	~~11.52 - 268.72~~	~~0.378~~	~~1.059~~	~~0.227 - 5.294~~	~~0.210~~	~~0.587~~	~~0.126 - 2.937~~

~~Bio-season~~	~~Abundance of adults apportioned to SPA (plus 2km buffer)~~	~~Estimated increase in mortality (breeding adults per annum)~~			~~% increase in baseline mortality (citation count)~~			~~% increase in baseline mortality (recent count)~~		
		~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1-10% mortality~~	~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1–10% mortality~~	~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1–10% mortality~~
~~Non-breeding~~	~~155.4~~	~~0.78~~	~~2.18~~	~~0.47–10.88~~	~~0.015~~	~~0.043~~	~~0.009-0.214~~	~~0.008~~	~~0.024~~	~~0.005-0.119~~

~~Bio-season~~	~~Abundance of adults apportioned to SPA (plus 2km buffer)~~	~~Estimated increase in mortality (breeding adults per annum)~~			~~% increase in baseline mortality (citation count)~~			~~% increase in baseline mortality (recent count)~~		
		~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1-10% mortality~~	~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1–10% mortality~~	~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1–10% mortality~~
~~Annual Total~~	~~12,346.3~~	~~61.73~~	~~172.85~~	~~37.04-864.24~~	~~1.216~~	~~3.405~~	~~0.73-17.026~~	~~0.675~~	~~1.889~~	~~0.405-9.446~~
~~UCI (Modelled)~~										

~~Bio-season~~	~~Abundance of adults apportioned to SPA (plus 2km buffer)~~	~~Estimated increase in mortality (breeding adults per annum)~~			~~% increase in baseline mortality (citation count)~~			~~% increase in baseline mortality (recent count)~~		
		~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1-10% mortality~~	~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1–10% mortality~~	~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1–10% mortality~~
~~Breeding~~	~~15,606.7~~	~~78.03~~	~~218.48~~	~~46.82 - 1092.4~~	~~1.537~~	~~4.304~~	~~0.922 - 21.521~~	~~0.853~~	~~2.388~~	~~0.512 - 11.94~~

~~Bio-season~~	~~Abundance of adults apportioned to SPA (plus 2km buffer)~~	~~Estimated increase in mortality (breeding adults per annum)~~			~~% increase in baseline mortality (citation count)~~			~~% increase in baseline mortality (recent count)~~		
		~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1-10% mortality~~	~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1 – 10% mortality~~	~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1 – 10% mortality~~
~~Post-breeding~~	~~10,967.3~~	~~54.84~~	~~153.54~~	~~32.9 - 767.71~~	~~1.080~~	~~3.025~~	~~0.648 - 15.124~~	~~0.599~~	~~1.678~~	~~0.36 – 8.391~~

~~Bio-season~~	~~Abundance of adults apportioned to SPA (plus 2km buffer)~~	~~Estimated increase in mortality (breeding adults per annum)~~			~~% increase in baseline mortality (citation count)~~			~~% increase in baseline mortality (recent count)~~		
		~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1-10% mortality~~	~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1 – 10% mortality~~	~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1 – 10% mortality~~
~~Non-breeding~~	~~231.6~~	~~1.15~~	~~3.23~~	~~0.69 - 16.14~~	~~0.023~~	~~0.064~~	~~0.014 - 0.318~~	~~0.013~~	~~0.035~~	~~0.008 - 0.176~~

~~Bio-season~~	~~Abundance of adults apportioned to SPA (plus 2km buffer)~~	~~Estimated increase in mortality (breeding adults per annum)~~			~~% increase in baseline mortality (citation count)~~			~~% increase in baseline mortality (recent count)~~		
		~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1-10% mortality~~	~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1–10% mortality~~	~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1–10% mortality~~
~~Annual Total~~	~~26,804.5~~	~~134.02~~	~~375.25~~	~~80.41 - 1876.25~~	~~2.640~~	~~7.393~~	~~1.584 - 36.963~~	~~1.465~~	~~4.102~~	~~0.879 - 20.508~~

~~Table 9.38: Range-based displacement mortalities during the operational and maintenance phases for guillemot at FFC SPA based on the values advocated by ANCBs for the citation and most recent counts (Aitken et al., 2017 Seabird Monitoring Programme), using design-based abundance estimates with the Applicant Approach boldened. The lower confidence interval (LCI) and the upper confidence interval (UCI) are presented as requested by ANCBs.~~

~~Bio-season~~	~~Abundance of adults apportioned to SPA (plus 2km buffer)~~	~~Estimated increase in mortality (breeding adults per annum)~~			~~% increase in baseline mortality (citation count)~~			~~% increase in baseline mortality (recent count)~~		
		~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1-10% mortality~~	~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1 – 10% mortality~~	~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1 – 10% mortality~~
~~Mean (Design)~~										
~~Breeding~~	~~4095.7~~	**~~20.48~~**	~~57.34~~	~~12.29 - 286.7~~	~~0.403~~	~~1.130~~	~~0.242 - 5.648~~	~~0.224~~	~~0.627~~	~~0.134 - 3.134~~

~~Bio-season~~	~~Abundance of adults apportioned to SPA (plus 2km buffer)~~	~~Estimated increase in mortality (breeding adults per annum)~~			~~% increase in baseline mortality (citation count)~~			~~% increase in baseline mortality (recent count)~~		
		~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1-10% mortality~~	~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1–10% mortality~~	~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1–10% mortality~~
~~Non-breeding~~	~~406.6~~	**~~2.03~~**	~~5.69~~	~~1.22 – 28.46~~	~~0.040~~	~~0.112~~	~~0.024 - 0.561~~	~~0.022~~	~~0.062~~	~~0.013 - 0.311~~

~~Bio-season~~	~~Abundance of adults apportioned to SPA (plus 2km buffer)~~	~~Estimated increase in mortality (breeding adults per annum)~~			~~% increase in baseline mortality (citation count)~~			~~% increase in baseline mortality (recent count)~~		
		~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1-10% mortality~~	~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1–10% mortality~~	~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1–10% mortality~~
~~Annual Total~~	~~4502.3~~	**~~22.51~~**	~~63.03~~	~~13.51-315.16~~	~~0.443~~	~~1.242~~	~~0.266-6.209~~	~~0.246~~	~~0.689~~	~~0.148-3.445~~
~~LCI (Design)~~										

~~Bio-season~~	~~Abundance of adults apportioned to SPA (plus 2km buffer)~~	~~Estimated increase in mortality (breeding adults per annum)~~			~~% increase in baseline mortality (citation count)~~			~~% increase in baseline mortality (recent count)~~		
		~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1-10% mortality~~	~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1 – 10% mortality~~	~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1 – 10% mortality~~
~~Breeding~~	~~3068.0~~	~~15.34~~	~~42.95~~	~~9.2 - 214.76~~	~~0.302~~	~~0.846~~	~~0.181 - 4.231~~	~~0.168~~	~~0.469~~	~~0.101 - 2.347~~

~~Bio-season~~	~~Abundance of adults apportioned to SPA (plus 2km buffer)~~	~~Estimated increase in mortality (breeding adults per annum)~~			~~% increase in baseline mortality (citation count)~~			~~% increase in baseline mortality (recent count)~~		
		~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1-10% mortality~~	~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1 – 10% mortality~~	~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1 – 10% mortality~~
~~Non-breeding~~	~~307.9~~	~~1.54~~	~~4.31~~	~~0.92 – 21.55~~	~~0.030~~	~~0.085~~	~~0.018 - 0.425~~	~~0.017~~	~~0.047~~	~~0.01 – 0.236~~

~~Bio-season~~	~~Abundance of adults apportioned to SPA (plus 2km buffer)~~	~~Estimated increase in mortality (breeding adults per annum)~~			~~% increase in baseline mortality (citation count)~~			~~% increase in baseline mortality (recent count)~~		
		~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1-10% mortality~~	~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1 – 10% mortality~~	~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1 – 10% mortality~~
~~Annual Total~~	~~3375.9~~	~~16.88~~	~~47.26~~	~~10.13 - 236.32~~	~~0.333~~	~~0.931~~	~~0.2 - 4.655~~	~~0.185~~	~~0.517~~	~~0.111 - 2.583~~
~~UCI (Design)~~										

~~Bio-season~~	~~Abundance of adults apportioned to SPA (plus 2km buffer)~~	~~Estimated increase in mortality (breeding adults per annum)~~			~~% increase in baseline mortality (citation count)~~			~~% increase in baseline mortality (recent count)~~		
		~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1-10% mortality~~	~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1–10% mortality~~	~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1–10% mortality~~
~~Breeding~~	~~5320.7~~	~~26.60~~	~~74.49~~	~~15.96-372.45~~	~~0.524~~	~~1.467~~	~~0.314-7.337~~	~~0.291~~	~~0.814~~	~~0.174-4.071~~

~~Bio-season~~	~~Abundance of adults apportioned to SPA (plus 2km buffer)~~	~~Estimated increase in mortality (breeding adults per annum)~~			~~% increase in baseline mortality (citation count)~~			~~% increase in baseline mortality (recent count)~~		
		~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1-10% mortality~~	~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1 – 10% mortality~~	~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1 – 10% mortality~~
~~Non-breeding~~	~~531.3~~	~~2.66~~	~~7.44~~	~~1.59 - 37.19~~	~~0.052~~	~~0.147~~	~~0.031 - 0.733~~	~~0.029~~	~~0.081~~	~~0.017 - 0.407~~

~~Bio-season~~	~~Abundance of adults apportioned to SPA (plus 2km buffer)~~	~~Estimated increase in mortality (breeding adults per annum)~~			~~% increase in baseline mortality (citation count)~~			~~% increase in baseline mortality (recent count)~~		
		~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1-10% mortality~~	~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1 – 10% mortality~~	~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1 – 10% mortality~~
~~Annual Total~~	~~5852.0~~	~~29.26~~	~~81.93~~	~~17.56 - 409.64~~	~~0.576~~	~~1.614~~	~~0.346 - 8.07~~	~~0.320~~	~~0.896~~	~~0.192 - 4.478~~

~~Table 9.39: Range-based displacement mortalities during the operational and maintenance phases for guillemot at FFC SPA based on the values advocated by ANCBs for the citation and most recent counts (Aitken et al., 2017 Seabird Monitoring Programme), using design-based abundance estimates with the Natural England preferred approach boldened. The lower confidence interval (LCI) and the upper confidence interval (UCI) are presented as requested by ANCBs.~~

~~Bio-season~~	~~Abundance of adults apportioned to SPA (plus 2km buffer)~~	~~Estimated increase in mortality (breeding adults per annum)~~			~~% increase in baseline mortality (citation count)~~			~~% increase in baseline mortality (recent count)~~		
		~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1-10% mortality~~	~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1 – 10% mortality~~	~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1 – 10% mortality~~
~~Mean (Design)~~										
~~Breeding~~	~~14,371.0~~	~~71.86~~	~~201.19~~	~~43.11 - 1005.97~~	~~1.416~~	~~3.964~~	~~0.849 - 19.818~~	~~0.785~~	~~2.199~~	~~0.471 - 10.996~~

~~Bio-season~~	~~Abundance of adults apportioned to SPA (plus 2km buffer)~~	~~Estimated increase in mortality (breeding adults per annum)~~			~~% increase in baseline mortality (citation count)~~			~~% increase in baseline mortality (recent count)~~		
		~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1-10% mortality~~	~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1–10% mortality~~	~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1–10% mortality~~
~~Post-breeding~~	~~6,312.3~~	~~31.56~~	~~88.37~~	~~18.94-441.86~~	~~0.622~~	~~1.741~~	~~0.373-8.705~~	~~0.345~~	~~0.966~~	~~0.207-4.83~~

~~Bio-season~~	~~Abundance of adults apportioned to SPA (plus 2km buffer)~~	~~Estimated increase in mortality (breeding adults per annum)~~			~~% increase in baseline mortality (citation count)~~			~~% increase in baseline mortality (recent count)~~		
		~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1-10% mortality~~	~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1 – 10% mortality~~	~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1 – 10% mortality~~
~~Non-breeding~~	~~191.9~~	~~0.96~~	~~2.69~~	~~0.58 – 13.43~~	~~0.019~~	~~0.053~~	~~0.011 - 0.265~~	~~0.010~~	~~0.029~~	~~0.006 - 0.147~~

~~Bio-season~~	~~Abundance of adults apportioned to SPA (plus 2km buffer)~~	~~Estimated increase in mortality (breeding adults per annum)~~			~~% increase in baseline mortality (citation count)~~			~~% increase in baseline mortality (recent count)~~		
		~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1-10% mortality~~	~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1 – 10% mortality~~	~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1 – 10% mortality~~
~~Annual Total~~	~~20,875.1~~	~~104.38~~	~~292.25~~	~~62.63 - 1461.26~~	~~2.056~~	~~5.757~~	~~1.234 - 28.787~~	~~1.141~~	~~3.194~~	~~0.685 - 15.972~~
~~LCI (Design)~~										

~~Bio-season~~	~~Abundance of adults apportioned to SPA (plus 2km buffer)~~	~~Estimated increase in mortality (breeding adults per annum)~~			~~% increase in baseline mortality (citation count)~~			~~% increase in baseline mortality (recent count)~~		
		~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1-10% mortality~~	~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1–10% mortality~~	~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1–10% mortality~~
~~Breeding~~	~~10,765.0~~	~~53.83~~	~~150.71~~	~~32.3–753.55~~	~~1.060~~	~~2.969~~	~~0.636-14.845~~	~~0.588~~	~~1.647~~	~~0.353-8.237~~

~~Bio-season~~	~~Abundance of adults apportioned to SPA (plus 2km buffer)~~	~~Estimated increase in mortality (breeding adults per annum)~~			~~% increase in baseline mortality (citation count)~~			~~% increase in baseline mortality (recent count)~~		
		~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1-10% mortality~~	~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1–10% mortality~~	~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1–10% mortality~~
~~Post-breeding~~	~~4,780.6~~	~~23.90~~	~~66.93~~	~~14.34-334.64~~	~~0.471~~	~~1.319~~	~~0.283-6.593~~	~~0.261~~	~~0.732~~	~~0.157-3.658~~

~~Bio-season~~	~~Abundance of adults apportioned to SPA (plus 2km buffer)~~	~~Estimated increase in mortality (breeding adults per annum)~~			~~% increase in baseline mortality (citation count)~~			~~% increase in baseline mortality (recent count)~~		
		~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1-10% mortality~~	~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1 – 10% mortality~~	~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1 – 10% mortality~~
~~Non-breeding~~	~~154.9~~	~~0.77~~	~~2.17~~	~~0.46 – 10.84~~	~~0.015~~	~~0.043~~	~~0.009 - 0.214~~	~~0.008~~	~~0.024~~	~~0.005 - 0.119~~

~~Bio-season~~	~~Abundance of adults apportioned to SPA (plus 2km buffer)~~	~~Estimated increase in mortality (breeding adults per annum)~~			~~% increase in baseline mortality (citation count)~~			~~% increase in baseline mortality (recent count)~~		
		~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1-10% mortality~~	~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1 – 10% mortality~~	~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1 – 10% mortality~~
~~Annual Total~~	~~15,700.5~~	~~78.50~~	~~219.81~~	~~47.1-1099.04~~	~~1.547~~	~~4.330~~	~~0.928 - 21.651~~	~~0.858~~	~~2.403~~	~~0.515 - 12.013~~
~~UCI (Design)~~										

~~Bio-season~~	~~Abundance of adults apportioned to SPA (plus 2km buffer)~~	~~Estimated increase in mortality (breeding adults per annum)~~			~~% increase in baseline mortality (citation count)~~			~~% increase in baseline mortality (recent count)~~		
		~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1-10% mortality~~	~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1 – 10% mortality~~	~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1 – 10% mortality~~
~~Breeding~~	~~18,669.0~~	~~93.35~~	~~261.37~~	~~56.01 - 1306.83~~	~~1.839~~	~~5.149~~	~~1.103 - 25.745~~	~~1.020~~	~~2.857~~	~~0.612 - 14.284~~

~~Bio-season~~	~~Abundance of adults apportioned to SPA (plus 2km buffer)~~	~~Estimated increase in mortality (breeding adults per annum)~~			~~% increase in baseline mortality (citation count)~~			~~% increase in baseline mortality (recent count)~~		
		~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1-10% mortality~~	~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1 – 10% mortality~~	~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1 – 10% mortality~~
~~Post-breeding~~	~~8,249.5~~	~~41.25~~	~~115.49~~	~~24.75 - 577.46~~	~~0.813~~	~~2.275~~	~~0.488 - 11.376~~	~~0.451~~	~~1.262~~	~~0.271 - 6.312~~

~~Bio-season~~	~~Abundance of adults apportioned to SPA (plus 2km buffer)~~	~~Estimated increase in mortality (breeding adults per annum)~~			~~% increase in baseline mortality (citation count)~~			~~% increase in baseline mortality (recent count)~~		
		~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1-10% mortality~~	~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1 – 10% mortality~~	~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1 – 10% mortality~~
~~Non-breeding~~	~~234.3~~	~~1.17~~	~~3.28~~	~~0.7 - 16.4~~	~~0.023~~	~~0.065~~	~~0.014 - 0.323~~	~~0.013~~	~~0.036~~	~~0.008 - 0.179~~

~~Bio-season~~	~~Abundance of adults apportioned to SPA (plus 2km buffer)~~	~~Estimated increase in mortality (breeding adults per annum)~~			~~% increase in baseline mortality (citation count)~~			~~% increase in baseline mortality (recent count)~~		
		~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1-10% mortality~~	~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1 – 10% mortality~~	~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1 – 10% mortality~~
~~Annual Total~~	~~27,152.8~~	~~135.76~~	~~380.14~~	~~81.46 - 1900.69~~	~~2.675~~	~~7.489~~	~~1.605 - 37.444~~	~~1.484~~	~~4.155~~	~~0.89 - 20.775~~

~~Table 9.24 .~~

656. This estimated mortality equates to an increase in baseline mortality of 0.039% in the non-breeding bio-season relative to the citation population and 0.02~~7~~2% relative to the most recent count.

Post-breeding season- Natural England Approach

657. Natural England have advised that a bespoke approach is adopted for assessment of impacts of guillemot during their post-breeding dispersal. This approach defines August and September as a discreet bio-season (deviating from the standard approach as defined in Furness 2015), for which a bespoke adult apportioning rate of 68.5% has been created, with all birds being apportioned to FFC SPA as opposed to the 4.41% derived from the Furness 2015 biologically defined minimum population scale (BDMPS).

658. During the bespoke post-breeding season the mean-peak number of guillemots estimated to occur in the ~~array~~WTG area and 2km buffer is 9,066 individuals. On the basis that 68.5% of the guillemots within the ~~array~~WTG area are deemed to be breeding adults from the FFC during this period, the total estimated to be at risk of displacement is 6,210.3 individuals. Based on 70% displacement and 2% mortality, the total predicted consequent mortality from being displaced is estimated at 87 (86.9) individuals during the post-breeding bio-season.

659. This consequent estimated mortality equates to an increase in baseline mortality of 1.713% in the post-breeding bio-season relative to the citation population and 0.950% relative to the most recent count.

660. The Applicant does not consider that the bespoke bio-season is appropriate for assessment of post breeding impacts on guillemots from FFC SPA. The Applicant also considers that the use of a 70% displacement rate and a 2% mortality rate to assess impacts from a one-off diversion resulting from the presence of a windfarm, at a time when birds are not energetically constrained, to be extremely precautionary. For further details on this please see 19.9 Consideration of bio-seasons in the assessment of guillemot [REP2-058] ~~XXX~~.

Non-breeding season – Natural England approach

661. Under Natural England's preferred approach, the impacts during the non-breeding season are different as a result of the introduction of the bespoke post-breeding bio-season for guillemot at FFC SPA, in which all birds in the array during August and September are incorporated. Therefore ~~the~~ under Natural England's preferred approach the non-breeding season assessment is informed by the mean of peaks from the rest of the non-breeding season, i.e. October to February.

662. On the basis that 4.41% of the guillemots within the ~~array~~WTG area are deemed to be breeding adults from the FFC during the non-breeding bio-season (Appendix 7.1.1), the total abundance of breeding adults estimated to be displaced from the array plus 2km buffer is 189 (188.8). Based on 70% displacement and 2% mortality, the total predicted mortality from being displaced is estimated at 3 (2.6) individuals during the non-breeding bio-season.

663. This consequent estimated mortality equates to an increase in baseline mortality of 0.052% in the non-breeding bio-season relative to the citation population and 0.029% relative to the most recent count.

~~608. In the non-breeding bio-season the mean-peak number of guillemots estimated to occur in the array area and 2km buffer is 11,208 individuals.~~

~~609. On the basis that 4.4% of these guillemots within the array area are deemed to be breeding adults from the FFC during the non-breeding bio-season (Appendix 7.1.1), the total abundance of breeding adults estimated to be displaced from the array plus 2km buffer is 495 (494.5). Based on 50% displacement and 1% mortality, the total predicted consequent mortality from being displaced is estimated at less than three (2.5) individuals during the non-breeding bio-season. However, based on advice from SNCBs (MIG-Birds, 2022), a displacement range of 30% to 70% is also presented in Table 9.24.~~

~~610. This consequent estimated mortality equates to an increase in baseline mortality of 0.049% in the non-breeding bio-season relative to the citation population and 0.027% relative to the most recent count.~~

Annual Total

664. Across all bio-seasons, the number of guillemots estimated to occur in the ~~array~~WTG area and a 2km buffer is 20,430 individuals, with 3,638 apportioned as breeding birds from FFC SPA using the A~~a~~pplicant's approach (assuming 57% are adult and 50% should be apportioned to the SPA), and 24,709 with 17,763 apportioned to FFC SPA using Natural England's preferred method (assuming 100% are adult and 100% are apportioned to the SPA). The total predicted consequent mortality attributed from FFC SPA from displacement throughout the operational life of the Project using the Applicant's approach with a 50:1 displacement and mortality rate is 18.2 (Applicant's apportioning approach) or 248.7 breeding adults per annum across all bio-seasons using (Natural England's apportioning approach with a 70:2 displacement and mortality rate). Displacement consequent mortalities based on the range advocated by ~~SNCB~~ANCBs (30% displacement to 70% displacement, 1 to 10% mortality) are displayed in Table 9.36~~Table 9-36~~, Table 9.40~~Table 9-40~~ and Table 9.41~~Table 9-41~~ for the Applicant's approach and Table 9.37~~Table 9-37~~, Table 9.42~~Table 9-42~~ and Table 9.43~~Table 9-43~~ for Natural England's preferred approach.

~~611. Across all bio-seasons, the number of guillemots estimated to occur in the array area and a 2km buffer is 27,653 individuals, with 5,181 apportioned as breeding birds from FFC SPA using the applicant's approach (assuming 57% are adult and 50% should be apportioned to the SPA), and 16,939 using Natural England's preferred method (assuming 100% are adult and 100% should be apportioned to the SPA). The total predicted consequent mortality attributed from FFC SPA from displacement throughout the operational life of the Project for a 50:1 displacement and mortality ratio is 25.9 (applicant's apportioning approach) or 84.9 (Natural England's apportioning approach) breeding adults per annum across all bio-seasons. Displacement consequent mortalities based on the range advocated by SNCBs (30% displacement to 70% displacement, 1 to 10% mortality) are displayed in Table 9.25.~~

665. The predicted mortality of 18.2 breeding adults from FFC SPA per annum across all bio-seasons represents an increase of 0.358% on baseline mortality when considering the citation population or an increase of 0.199% when considering the recent count. This would be indistinguishable from natural fluctuations in the baseline mortality.

~~612. The predicted mortality of 25.9 breeding adults from FFC SPA per annum across all bio-seasons represents an increase of 0.510% when considering the citation population or an increase of 0.280% when considering the recent count. This would be indistinguishable from natural fluctuations in the baseline mortality.~~

666. The predicted mortality of 248.7 breeding adults from FFC SPA per annum across all bio-seasons (using Natural England's preferred approach to apportioning of 100% adults and 100% to FFC SPA with a 70:2 displacement/mortality ratio, and using the bespoke approach to bio-seasons outlined above), represents an increase in baseline mortality of 4.899% when considering the citation population or an increase of 2.718% when considering the recent count.

667. As the increase in baseline mortality exceeds 1% for the citation and most recent count using the Natural England preferred approach, further consideration is given in the form of PVA (Appendix 7.1.2).

668. PVA was undertaken on a range of scenarios for the Project alone impacts for both the Applicant and Natural England approach (as presented in Appendix 7.1.2 and Table 10.29~~Table 10-28~~ (Section 10.3)). For each scenario, counterfactual of population growth (CGR) and counterfactual of population size (CPS) have been presented from the model outputs, measuring the changes in annual growth rate and population size respectively at the end of the impacted period of 35 years relative to a baseline scenario. The impact on adult survival is also presented, calculated as the number of mortalities divided by the relevant population size used in the PVA analysis.

~~The PVA carried out for the O&M phase for guillemot at FFC SPA used NE's highly precautionary rates (70% and 2%, compared to 35% and 2% for C&D) and still did not pose a risk to the project over 35 years (threshold: <0.995 CGR; PVA result: 0.998). Since this threshold is not exceeded, any additional impact from the C&D phase would be inconsequential and does not require further PVA assessment.~~

~~613.~~ The worst-case scenario of 70% displacement and 2% mortality would represent a 0.1% annual reduction in population growth rate which would be considered indistinguishable from natural fluctuations in the population. Considering the Applicant's approach of 50% displacement and 1% mortality which is more ecologically likely, the predicted impact represents a <0.1% annual reduction in population growth rate compared with a baseline scenario (Table 10.29~~Table 10-28~~; ~~(~~ Section 10.3)~~)~~. ~~The predicted mortality of 84.9 breeding adults from FFC SPA per annum across all bio-seasons (using Natural England's preferred approach to apportioning of 100% adults and 100% to FFC SPA for a 50:1 displacement/mortality ratio), represents an increase of 1.673% when considering the citation population or an increase of 0.927% when considering the recent count. In the context of the most recent population estimate, this would be indistinguishable from natural fluctuations in the baseline mortality.~~

669.

~~614. When considering Natural England's preferred displacement and mortality rates (70:2), the predicted mortality using Natural England's preferred apportioning approach is 237.7 breeding adults from FFC SPA across all bio-seasons. This represents an increase on baseline mortality of 4.683% when considering the citation population or an increase of 2.598% when considering the recent count. In the context of the most recent population estimate, and considering that the population has shown consistent growth over the previous 20 years, this would be indistinguishable from natural fluctuations in the baseline mortality.~~

~~615.~~670. Therefore, the potential for an AEoI to the conservation objectives of the guillemot feature of FFC SPA in relation to disturbance and displacement effects in the O&M phase from the Project alone can be ruled out and therefore, subject to natural change, guillemot will be maintained as a feature in the long-term.

Table 9-36~~9.369-36~~: Range-based displacement mortalities during the operational and maintenance phases for guillemot at FFC SPA based on the values advocated by ~~SNCB~~ANCBs for the citation and most recent counts (Aitken et al., 2017 Seabird Monitoring Programme), using model-based abundance estimates with the Applicant Approach boldened. The lower confidence interval (LCI) and the upper confidence interval (UCI) are presented as requested by ~~SNCB~~ANCBs.

Bio-season	Abundance of adults apportioned to SPA (plus 2km buffer)	Estimated increase in mortality (breeding adults per annum)			% increase in baseline mortality (citation count)			% increase in baseline mortality (recent count)		
		50% displacement, 1% mortality	70% displacement, 2% mortality	30-70% displacement, 1- 10% mortality	50% displacement, 1% mortality	70% displacement, 2% mortality	30-70% displacement, 1 – 10% mortality	50% displacement, 1% mortality	70% displacement, 2% mortality	30-70% displacement, 1 – 10% mortality
Mean (Modelled)										
Breeding	3238.8	**16.19**	45.34	9.72 - 226.72	0.319	0.893	0.191 - 4.466	0.177	0.496	0.106 - 2.478
Non-breeding	400.0	**2.00**	5.60	1.20 – 28.00	0.039	0.110	0.024 - 0.552	0.022	0.061	0.013 - 0.306
Annual Total	3638.8	**18.19**	50.94	10.92 - 254.71	0.358	1.004	0.215 - 5.018	0.199	0.557	0.119 - 2.784
LCI (Modelled)										
Breeding	2380.3	11.90	33.32	7.14 - 166.62	0.234	0.657	0.141 - 3.283	0.130	0.364	0.078 - 1.821
Non-breeding	247.3	1.24	3.46	0.74 - 17.31	0.024	0.068	0.015 - 0.341	0.014	0.038	0.008 - 0.189
Annual Total	2627.6	13.14	36.79	7.88 - 183.93	0.259	0.725	0.155 - 3.623	0.144	0.402	0.086 - 2.01
UCI (Modelled)										

Bio-season	Abundance of adults apportioned to SPA (plus 2km buffer)	Estimated increase in mortality (breeding adults per annum)			% increase in baseline mortality (citation count)			% increase in baseline mortality (recent count)		
		50% displacement, 1% mortality	70% displacement, 2% mortality	30-70% displacement, 1- 10% mortality	50% displacement, 1% mortality	70% displacement, 2% mortality	30-70% displacement, 1 – 10% mortality	50% displacement, 1% mortality	70% displacement, 2% mortality	30-70% displacement, 1 – 10% mortality
Breeding	4447.6	22.24	62.27	13.34 - 311.33	0.438	1.227	0.263 - 6.133	0.243	0.681	0.146 - 3.403
Non-breeding	706.4	3.53	9.89	2.12 - 49.45	0.070	0.195	0.042 - 0.974	0.039	0.108	0.023 - 0.54
Annual Total	5154.0	25.77	72.16	15.46 - 360.78	0.508	1.421	0.305 - 7.107	0.282	0.789	0.169 - 3.943

Table 9-37~~9.379-37~~: Range-based displacement mortalities during the operational and maintenance phases for guillemot at FFC SPA based on the values advocated by ~~SNCB~~ANCBs for the citation and most recent counts (Aitken et al., 2017 Seabird Monitoring Programme), using model-based abundance estimates with the Natural England preferred approach boldened. The lower confidence interval (LCI) and the upper confidence interval (UCI) are presented as requested by ~~SNCB~~ANCBs.

Bio-season	Abundance of adults apportioned to SPA (plus 2km buffer)	Estimated increase in mortality (breeding adults per annum)			% increase in baseline mortality (citation count)			% increase in baseline mortality (recent count)		
		50% displacement, 1% mortality	70% displacement, 2% mortality	30-70% displacement, 1- 10% mortality	50% displacement, 1% mortality	70% displacement, 2% mortality	30-70% displacement, 1 – 10% mortality	50% displacement, 1% mortality	70% displacement, 2% mortality	30-70% displacement, 1 – 10% mortality
Mean (Modelled)										
Breeding	11,364.2	56.82	**159.10**	34.09 - 795.49	1.119	3.134	0.672 - 15.671	0.621	1.739	0.373 - 8.695
Post-breeding	6,210.3	31.05	**86.94**	18.63 - 434.72	0.612	1.713	0.367 - 8.564	0.339	0.950	0.204 - 4.752
Non-breeding	189.8	0.94	**2.64**	0.57 - 13.21	0.019	0.052	0.011 - 0.26	0.010	0.029	0.006 - 0.144
Annual Total	17,763.3	88.82	**248.69**	53.29 - 1243.43	1.750	4.899	1.05 - 24.496	0.971	2.718	0.582 - 13.591
LCI (Modelled)										
Breeding	8,352.0	41.76	116.93	25.06 - 584.64	0.823	2.304	0.494 - 11.518	0.456	1.278	0.274 - 6.39

Bio-season	Abundance of adults apportioned to SPA (plus 2km buffer)	Estimated increase in mortality (breeding adults per annum)			% increase in baseline mortality (citation count)			% increase in baseline mortality (recent count)		
		50% displacement, 1% mortality	70% displacement, 2% mortality	30-70% displacement, 1- 10% mortality	50% displacement, 1% mortality	70% displacement, 2% mortality	30-70% displacement, 1 – 10% mortality	50% displacement, 1% mortality	70% displacement, 2% mortality	30-70% displacement, 1 – 10% mortality
Post-breeding	3,839.9	19.19	53.74	11.52 - 268.72	0.378	1.059	0.227 - 5.294	0.210	0.587	0.126 - 2.937
Non-breeding	155.4	0.78	2.18	0.47 - 10.88	0.015	0.043	0.009 - 0.214	0.008	0.024	0.005 - 0.119
Annual Total	12,346.3	61.73	172.85	37.04 - 864.24	1.216	3.405	0.73 - 17.026	0.675	1.889	0.405 - 9.446
UCI (Modelled)										
Breeding	15,606.7	78.03	218.48	46.82 - 1092.4	1.537	4.304	0.922 - 21.521	0.853	2.388	0.512 - 11.94
Post-breeding	10,967.3	54.84	153.54	32.9 - 767.71	1.080	3.025	0.648 - 15.124	0.599	1.678	0.36 - 8.391
Non-breeding	231.6	1.15	3.23	0.69 - 16.14	0.023	0.064	0.014 - 0.318	0.013	0.035	0.008 - 0.176
Annual Total	26,804.5	134.02	375.25	80.41 - 1876.25	2.640	7.393	1.584 - 36.963	1.465	4.102	0.879 - 20.508

Table 9-38~~9.389-38~~: Range-based displacement mortalities during the operational and maintenance phases for guillemot at FFC SPA based on the values advocated by ~~SNCB~~ANCBs for the citation and most recent counts (Aitken et al., 2017 Seabird Monitoring Programme), using design-based abundance estimates with the Applicant Approach boldened. The lower confidence interval (LCI) and the upper confidence interval (UCI) are presented as requested by ~~SNCB~~ANCBs.

Bio-season	Abundance of adults apportioned to SPA (plus 2km buffer)	Estimated increase in mortality (breeding adults per annum)			% increase in baseline mortality (citation count)			% increase in baseline mortality (recent count)		
		50% displacement, 1% mortality	70% displacement, 2% mortality	30-70% displacement, 1- 10% mortality	50% displacement, 1% mortality	70% displacement, 2% mortality	30-70% displacement, 1 – 10% mortality	50% displacement, 1% mortality	70% displacement, 2% mortality	30-70% displacement, 1 – 10% mortality
Mean (Design)										
Breeding	4095.7	**20.48**	57.34	12.29 - 286.7	0.403	1.130	0.242 - 5.648	0.224	0.627	0.134 - 3.134
Non-breeding	406.6	**2.03**	5.69	1.22 - 28.46	0.040	0.112	0.024 - 0.561	0.022	0.062	0.013 - 0.311
Annual Total	4502.3	**22.51**	63.03	13.51 - 315.16	0.443	1.242	0.266 - 6.209	0.246	0.689	0.148 - 3.445
LCI (Design)										
Breeding	3068.0	15.34	42.95	9.2 - 214.76	0.302	0.846	0.181 - 4.231	0.168	0.469	0.101 - 2.347
Non-breeding	307.9	1.54	4.31	0.92 - 21.55	0.030	0.085	0.018 - 0.425	0.017	0.047	0.01 - 0.236
Annual Total	3375.9	16.88	47.26	10.13 - 236.32	0.333	0.931	0.2 - 4.655	0.185	0.517	0.111 - 2.583
UCI (Design)										

Bio-season	Abundance of adults apportioned to SPA (plus 2km buffer)	Estimated increase in mortality (breeding adults per annum)			% increase in baseline mortality (citation count)			% increase in baseline mortality (recent count)		
		50% displacement, 1% mortality	70% displacement, 2% mortality	30-70% displacement, 1- 10% mortality	50% displacement, 1% mortality	70% displacement, 2% mortality	30-70% displacement, 1 – 10% mortality	50% displacement, 1% mortality	70% displacement, 2% mortality	30-70% displacement, 1 – 10% mortality
Breeding	5320.7	26.60	74.49	15.96 - 372.45	0.524	1.467	0.314 - 7.337	0.291	0.814	0.174 - 4.071
Non-breeding	531.3	2.66	7.44	1.59 - 37.19	0.052	0.147	0.031 - 0.733	0.029	0.081	0.017 - 0.407
Annual Total	5852.0	29.26	81.93	17.56 - 409.64	0.576	1.614	0.346 - 8.07	0.320	0.896	0.192 - 4.478

Table 9-39~~9.399-39~~: Range-based displacement mortalities during the operational and maintenance phases for guillemot at FFC SPA based on the values advocated by ~~SNCB~~ANCBs for the citation and most recent counts (Aitken et al., 2017 Seabird Monitoring Programme), using design-based abundance estimates with the Natural England preferred approach boldened. The lower confidence interval (LCI) and the upper confidence interval (UCI) are presented as requested by ~~SNCB~~ANCBs.

Bio-season	Abundance of adults apportioned to SPA (plus 2km buffer)	Estimated increase in mortality (breeding adults per annum)			% increase in baseline mortality (citation count)			% increase in baseline mortality (recent count)		
		50% displacement, 1% mortality	70% displacement, 2% mortality	30-70% displacement, 1- 10% mortality	50% displacement, 1% mortality	70% displacement, 2% mortality	30-70% displacement, 1 – 10% mortality	50% displacement, 1% mortality	70% displacement, 2% mortality	30-70% displacement, 1 – 10% mortality
Mean (Design)										
Breeding	14,371.0	71.86	201.19	43.11 - 1005.97	1.416	3.964	0.849 - 19.818	0.785	2.199	0.471 - 10.996
Post-breeding	6,312.3	31.56	88.37	18.94 - 441.86	0.622	1.741	0.373 - 8.705	0.345	0.966	0.207 - 4.83
Non-breeding	191.9	0.96	2.69	0.58 - 13.43	0.019	0.053	0.011 - 0.265	0.010	0.029	0.006 - 0.147
Annual Total	20,875.1	104.38	292.25	62.63 - 1461.26	2.056	5.757	1.234 - 28.787	1.141	3.194	0.685 - 15.972
LCI (Design)										
Breeding	10,765.0	53.83	150.71	32.3 - 753.55	1.060	2.969	0.636 - 14.845	0.588	1.647	0.353 - 8.237

Bio-season	Abundance of adults apportioned to SPA (plus 2km buffer)	Estimated increase in mortality (breeding adults per annum)			% increase in baseline mortality (citation count)			% increase in baseline mortality (recent count)		
		50% displacement, 1% mortality	70% displacement, 2% mortality	30-70% displacement, 1- 10% mortality	50% displacement, 1% mortality	70% displacement, 2% mortality	30-70% displacement, 1 – 10% mortality	50% displacement, 1% mortality	70% displacement, 2% mortality	30-70% displacement, 1 – 10% mortality
Post-breeding	4,780.6	23.90	66.93	14.34 - 334.64	0.471	1.319	0.283 - 6.593	0.261	0.732	0.157 - 3.658
Non-breeding	154.9	0.77	2.17	0.46 - 10.84	0.015	0.043	0.009 - 0.214	0.008	0.024	0.005 - 0.119
Annual Total	15,700.5	78.50	219.81	47.1 - 1099.04	1.547	4.330	0.928 - 21.651	0.858	2.403	0.515 - 12.013
UCI (Design)										
Breeding	18,669.0	93.35	261.37	56.01 - 1306.83	1.839	5.149	1.103 - 25.745	1.020	2.857	0.612 - 14.284
Post-breeding	8,249.5	41.25	115.49	24.75 - 577.46	0.813	2.275	0.488 - 11.376	0.451	1.262	0.271 - 6.312
Non-breeding	234.3	1.17	3.28	0.7 - 16.4	0.023	0.065	0.014 - 0.323	0.013	0.036	0.008 - 0.179
Annual Total	27,152.8	135.76	380.14	81.46 - 1900.69	2.675	7.489	1.605 - 37.444	1.484	4.155	0.89 - 20.775

~~Table 9.24: Range-based displacement mortalities during the O&M phases for guillemot at FFC SPA based on the values advocated by SNCBs for both citation population counts and most recent counts (Aitken et al., (2017) Seabird Monitoring Programme).~~

~~Bio-season~~	~~Abundance of adults apportioned to SPA (plus 2km buffer)~~	~~Estimated increase in mortality (breeding adults per annum)~~		~~% increase in baseline mortality (citation count)~~		~~% increase in baseline mortality (recent count)~~	
		~~50% displacement, 1% mortality~~	~~30-70% displacement, 1-10% mortality~~	~~50% displacement, 1% mortality~~	~~30-70% displacement, 1 – 10% mortality~~	~~50% displacement, 1% mortality~~	~~30-70% displacement, 1 – 10% mortality~~
~~SNCB Approach~~							
~~Breeding~~	~~16,445.3~~	~~82.2~~	~~49.3 - 1,150.8~~	~~1.619~~	~~0.971 – 22.66~~	~~0.898~~	~~0.539 – 12.572~~
~~Non-breeding~~	~~494.5~~	~~2.5~~	~~1.5 - 34.5~~	~~0.049~~	~~0.029 – 0.686~~	~~0.024~~	~~0.014 - 0.336~~
~~Annual Total~~	**~~16,939.5~~**	**~~84.7~~**	**~~50.8 - 1,185.8~~**	**~~1.668~~**	**~~1.001 - 23.352~~**	**~~0.927~~**	**~~0.556 – 12.978~~**
~~Applicant Approach~~							
~~Breeding~~	~~4686.9~~	~~23.4~~	~~14.0 - 327.6~~	~~0.462~~	~~0.277 – 6.468~~	~~0.256~~	~~0.154 – 3.584~~
~~Non-breeding~~	~~494.5~~	~~2.5~~	~~1.5 - 35~~	~~0.049~~	~~0.029 - 0.686~~	~~0.024~~	~~0.014 - 0.336~~
~~Annual Total~~	**~~5181.4~~**	**~~25.9~~**	**~~15.5 - 362.6~~**	**~~0.511~~**	**~~0.306 – 7.154~~**	**~~0.280~~**	**~~0.168 – 3.920~~**

Table 9-40~~9.409-409.25~~: Guillemot displacement matrix at Flamborough and Filey SPA (~~array~~WTG area plus two km buffer) using the mean model-based abundance estimate, with light blue shading indicating the displacement range advocated by ~~SNCB~~ANCBs, and dark blue indicating the Applicant's approach.~~Guillemot displacement matrix at FFC SPA (array plus two km buffer), with light blue shading indicating the displacement range advocated by SNCBs, and dark blue indicating the Applicant's approach.~~

Annual (2km Buffer)	Mortality Rate (%)												
Displaced (%)	1	2	5	10	20	30	40	50	60	70	80	90	100
10	4 ~~5~~	7 ~~10~~	18 ~~26~~	36 ~~52~~	73 ~~104~~	109 ~~155~~	146 ~~207~~	182 ~~259~~	218 ~~311~~	255 ~~363~~	291 ~~414~~	327 ~~466~~	364 ~~518~~
20	7 ~~10~~	15 ~~21~~	36 ~~52~~	73 ~~104~~	146 ~~207~~	218 ~~311~~	291 ~~414~~	364 ~~518~~	437 ~~622~~	509 ~~725~~	582 ~~829~~	655 ~~932~~	728 ~~1,036~~
30	11 ~~16~~	22 ~~31~~	55 ~~78~~	109 ~~155~~	218 ~~311~~	327 ~~466~~	437 ~~622~~	546 ~~777~~	655 ~~932~~	764 ~~1,088~~	873 ~~1,243~~	982 ~~1,399~~	1,092 ~~1,554~~
40	15 ~~21~~	29 ~~41~~	73 ~~104~~	146 ~~207~~	291 ~~414~~	437 ~~622~~	582 ~~829~~	728 ~~1,036~~	873 ~~1,243~~	1,019 ~~1,451~~	1,164 ~~1,658~~	1,310 ~~1,865~~	1,456 ~~2,072~~
50	18 ~~26~~	36 ~~52~~	91 ~~130~~	182 ~~259~~	364 ~~518~~	546 ~~777~~	728 ~~1,036~~	910 ~~1,295~~	1,092 ~~1,554~~	1,274 ~~1,813~~	1,456 ~~2,072~~	1,637 ~~2,331~~	1,819 ~~2,590~~
60	22 ~~31~~	44 ~~62~~	109 ~~155~~	218 ~~311~~	437 ~~622~~	655 ~~932~~	873 ~~1,243~~	1,092 ~~1,554~~	1,310 ~~1,865~~	1,528 ~~2,176~~	1,747 ~~2,487~~	1,965 ~~2,797~~	2,183 ~~3,108~~
70	25 ~~36~~	51 ~~73~~	127 ~~181~~	255 ~~363~~	509 ~~725~~	764 ~~1,088~~	1,019 ~~1,451~~	1,274 ~~1,813~~	1,528 ~~2,176~~	1,783 ~~2,538~~	2,038 ~~2,901~~	2,292 ~~3,264~~	2,547 ~~3,626~~
80	29 ~~41~~	58 ~~83~~	146 ~~207~~	291 ~~414~~	582 ~~829~~	873 ~~1,243~~	1,164 ~~1,658~~	1,456 ~~2,072~~	1,747 ~~2,487~~	2,038 ~~2,901~~	2,329 ~~3,316~~	2,620 ~~3,730~~	2,911 ~~4,144~~
90	33 ~~47~~	65 ~~93~~	164 ~~233~~	327 ~~466~~	655 ~~932~~	982 ~~1,399~~	1,310 ~~1,865~~	1,637 ~~2,331~~	1,965 ~~2,797~~	2,292 ~~3,264~~	2,620 ~~3,730~~	2,947 ~~4,196~~	3,275 ~~4,662~~

Annual (2km Buffer)	Mortality Rate (%)													
100	36 ~~52~~	73 ~~104~~	182 ~~259~~	364 ~~518~~	728 ~~1,036~~	1,092 ~~1,554~~	1,456 ~~2,072~~	1,819 ~~2,590~~	2,183 ~~3,108~~	2,547 ~~3,626~~	2,911 ~~4,144~~	3,275 ~~4,662~~	3,639 ~~5,181~~

Table 9-41~~9.419-41~~: Guillemot displacement matrix at Flamborough and Filey SPA (~~array~~WTG area plus two km buffer) using the UCI model-based abundance estimate, with light blue shading indicating the displacement range advocated by ~~SNCB~~ANCBs, and dark blue indicating the Applicant's approach.

Annual (2km Buffer)	Mortality Rate (%)												
Displaced (%)	1	2	5	10	20	30	40	50	60	70	80	90	100
10	5	10	26	52	103	155	206	258	309	361	412	464	515
20	10	21	52	103	206	309	412	515	618	722	825	928	1,031
30	15	31	77	155	309	464	618	773	928	1,082	1,237	1,392	1,546
40	21	41	103	206	412	618	825	1,031	1,237	1,443	1,649	1,855	2,062
50	26	52	129	258	515	773	1,031	1,288	1,546	1,804	2,062	2,319	2,577
60	31	62	155	309	618	928	1,237	1,546	1,855	2,165	2,474	2,783	3,092
70	36	72	180	361	722	1,082	1,443	1,804	2,165	2,525	2,886	3,247	3,608
80	41	82	206	412	825	1,237	1,649	2,062	2,474	2,886	3,299	3,711	4,123
90	46	93	232	464	928	1,392	1,855	2,319	2,783	3,247	3,711	4,175	4,639
100	52	103	258	515	1,031	1,546	2,062	2,577	3,092	3,608	4,123	4,639	5,154

Table 9-42~~9.429-42~~: Guillemot displacement matrix at Flamborough and Filey SPA (WTG~~array~~ area plus two km buffer) using the mean model-based abundance estimate, with light blue shading indicating the displacement range advocated by ~~SNCB~~ANCBs, and dark blue indicating Natural England's preferred approach.

Annual (2km Buffer)	Mortality Rate (%)												
Displaced (%)	1	2	5	10	20	30	40	50	60	70	80	90	100
10	18	36	89	178	355	533	711	888	1,066	1,243	1,421	1,599	1,776
20	36	71	178	355	711	1,066	1,421	1,776	2,132	2,487	2,842	3,197	3,553
30	53	107	266	533	1,066	1,599	2,132	2,664	3,197	3,730	4,263	4,796	5,329
40	71	142	355	711	1,421	2,132	2,842	3,553	4,263	4,974	5,684	6,395	7,105
50	89	178	444	888	1,776	2,664	3,553	4,441	5,329	6,217	7,105	7,993	8,882
60	107	213	533	1,066	2,132	3,197	4,263	5,329	6,395	7,461	8,526	9,592	10,658
70	124	249	622	1,243	2,487	3,730	4,974	6,217	7,461	8,704	9,947	11,191	12,434
80	142	284	711	1,421	2,842	4,263	5,684	7,105	8,526	9,947	11,368	12,790	14,211
90	160	320	799	1,599	3,197	4,796	6,395	7,993	9,592	11,191	12,790	14,388	15,987
100	178	355	888	1,776	3,553	5,329	7,105	8,882	10,658	12,434	14,211	15,987	17,763

Table 9-43~~9.439-43~~: Guillemot displacement matrix at Flamborough and Filey SPA (~~array~~WTG area plus two km buffer) using the UCI model-based abundance estimate, with light blue shading indicating the displacement range advocated by ~~SNCB~~ANCBs, and dark blue indicating ~~indicating~~ Natural England's preferred approach.

Annual (2km Buffer)	Mortality Rate (%)												
Displaced (%)	1	2	5	10	20	30	40	50	60	70	80	90	100
10	27	54	134	268	536	804	1,072	1,340	1,608	1,876	2,144	2,412	2,680
20	54	107	268	536	1,072	1,608	2,144	2,680	3,216	3,752	4,289	4,825	5,361
30	80	161	402	804	1,608	2,412	3,216	4,021	4,825	5,629	6,433	7,237	8,041
40	107	214	536	1,072	2,144	3,216	4,289	5,361	6,433	7,505	8,577	9,649	10,721
50	134	268	670	1,340	2,680	4,021	5,361	6,701	8,041	9,381	10,721	12,062	13,402
60	161	322	804	1,608	3,216	4,825	6,433	8,041	9,649	11,257	12,866	14,474	16,082
70	188	375	938	1,876	3,752	5,629	7,505	9,381	11,257	13,134	15,010	16,886	18,762
80	214	429	1,072	2,144	4,289	6,433	8,577	10,721	12,866	15,010	17,154	19,299	21,443
90	241	482	1,206	2,412	4,825	7,237	9,649	12,062	14,474	16,886	19,299	21,711	24,123
100	268	536	1,340	2,680	5,361	8,041	10,721	13,402	16,082	18,762	21,443	24,123	26,804

Table 9-44~~9.449-44~~: Guillemot displacement matrix at Flamborough and Filey SPA (~~array~~WTG area plus two km buffer) using the mean design-based abundance estimate, with light blue shading indicating the displacement range advocated by ~~SNCB~~ANCBs, and dark blue indicating the Applicant's approach.

Annual (2km Buffer)	Mortality Rate (%)												
Displaced (%)	1	2	5	10	20	30	40	50	60	70	80	90	100
10	5	9	23	45	90	135	180	225	270	315	360	405	450
20	9	18	45	90	180	270	360	450	540	630	720	810	900
30	14	27	68	135	270	405	540	675	810	945	1,081	1,216	1,351
40	18	36	90	180	360	540	720	900	1,081	1,261	1,441	1,621	1,801
50	23	45	113	225	450	675	900	1,126	1,351	1,576	1,801	2,026	2,251
60	27	54	135	270	540	810	1,081	1,351	1,621	1,891	2,161	2,431	2,701
70	32	63	158	315	630	945	1,261	1,576	1,891	2,206	2,521	2,836	3,152
80	36	72	180	360	720	1,081	1,441	1,801	2,161	2,521	2,881	3,242	3,602
90	41	81	203	405	810	1,216	1,621	2,026	2,431	2,836	3,242	3,647	4,052
100	45	90	225	450	900	1,351	1,801	2,251	2,701	3,152	3,602	4,052	4,502

Table 9-45~~9.459-45~~: Guillemot displacement matrix at Flamborough and Filey SPA (~~array~~WTG area plus two km buffer) using the UCI model-based abundance estimate, with light blue shading indicating the displacement range advocated by ~~SNCB~~ANCBs, and dark blue indicating the Applicant's approach.

Annual (2km Buffer)	Mortality Rate (%)												
Displaced (%)	1	2	5	10	20	30	40	50	60	70	80	90	100
10	6	12	29	59	117	176	234	293	351	410	468	527	585
20	12	23	59	117	234	351	468	585	702	819	936	1,053	1,170
30	18	35	88	176	351	527	702	878	1,053	1,229	1,404	1,580	1,756
40	23	47	117	234	468	702	936	1,170	1,404	1,639	1,873	2,107	2,341
50	29	59	146	293	585	878	1,170	1,463	1,756	2,048	2,341	2,633	2,926
60	35	70	176	351	702	1,053	1,404	1,756	2,107	2,458	2,809	3,160	3,511
70	41	82	205	410	819	1,229	1,639	2,048	2,458	2,867	3,277	3,687	4,096
80	47	94	234	468	936	1,404	1,873	2,341	2,809	3,277	3,745	4,213	4,682
90	53	105	263	527	1,053	1,580	2,107	2,633	3,160	3,687	4,213	4,740	5,267
100	59	117	293	585	1,170	1,756	2,341	2,926	3,511	4,096	4,682	5,267	5,852

Table 9-46~~9.469-46~~: Guillemot displacement matrix at Flamborough and Filey SPA (WTG~~array~~ area plus two km buffer) using the mean design-based abundance estimate, with light blue shading indicating the displacement range advocated by ~~SNCB~~ANCBs, and dark blue indicating Natural England's preferred approach.

Annual (2km Buffer)	Mortality Rate (%)												
Displaced (%)	1	2	5	10	20	30	40	50	60	70	80	90	100
10	21	42	104	209	418	626	835	1,044	1,253	1,461	1,670	1,879	2,088
20	42	84	209	418	835	1,253	1,670	2,088	2,505	2,923	3,340	3,758	4,175
30	63	125	313	626	1,253	1,879	2,505	3,131	3,758	4,384	5,010	5,636	6,263
40	84	167	418	835	1,670	2,505	3,340	4,175	5,010	5,845	6,680	7,515	8,350
50	104	209	522	1,044	2,088	3,131	4,175	5,219	6,263	7,306	8,350	9,394	10,438
60	125	251	626	1,253	2,505	3,758	5,010	6,263	7,515	8,768	10,020	11,273	12,525
70	146	292	731	1,461	2,923	4,384	5,845	7,306	8,768	10,229	11,690	13,151	14,613
80	167	334	835	1,670	3,340	5,010	6,680	8,350	10,020	11,690	13,360	15,030	16,700
90	188	376	939	1,879	3,758	5,636	7,515	9,394	11,273	13,151	15,030	16,909	18,788
100	209	418	1,044	2,088	4,175	6,263	8,350	10,438	12,525	14,613	16,700	18,788	20,875

Table 9-47~~9.479-47~~: Guillemot displacement matrix at Flamborough and Filey SPA (~~array~~WTG area plus two km buffer) using the UCI design-based abundance estimate, with light blue shading indicating the displacement range advocated by ~~SNCB~~ANCBs, and dark blue indicating Natural England's preferred approach.

Annual (2km Buffer)	Mortality Rate (%)												
Displaced (%)	1	2	5	10	20	30	40	50	60	70	80	90	100
10	27	54	136	272	543	815	1,086	1,358	1,629	1,901	2,172	2,444	2,715
20	54	109	272	543	1,086	1,629	2,172	2,715	3,258	3,801	4,344	4,887	5,431
30	81	163	407	815	1,629	2,444	3,258	4,073	4,887	5,702	6,517	7,331	8,146
40	109	217	543	1,086	2,172	3,258	4,344	5,431	6,517	7,603	8,689	9,775	10,861
50	136	272	679	1,358	2,715	4,073	5,431	6,788	8,146	9,503	10,861	12,219	13,576
60	163	326	815	1,629	3,258	4,887	6,517	8,146	9,775	11,404	13,033	14,662	16,292
70	190	380	950	1,901	3,801	5,702	7,603	9,503	11,404	13,305	15,206	17,106	19,007
80	217	434	1,086	2,172	4,344	6,517	8,689	10,861	13,033	15,206	17,378	19,550	21,722
90	244	489	1,222	2,444	4,887	7,331	9,775	12,219	14,662	17,106	19,550	21,994	24,437
100	272	543	1,358	2,715	5,431	8,146	10,861	13,576	16,292	19,007	21,722	24,437	27,153

Flamborough and Filey coast SPA – Razorbill

~~616.~~671. Razorbill has been screened in for the O&M phase to assess the potential for an AEoI from displacement from the Project alone in relation to the following conservation objectives for this species, as a feature of the FFC SPA (Document 7.2):

- Maintain the population of each qualifying feature.

~~617.~~672. Based on the above the conservation objective for the FFC SPA the specific target for the razorbill feature is as follows based on Natural England's case-specific advice (Natural England 2021):

- Maintain the size of the breeding population at a level which is above 10,570 breeding pairs (21,140 breeding adults), whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent. The latest colony population estimate is 61,346 breeding adults based on the most recent 2022 colony count.

~~618.~~673. The Project ~~array~~ WTG area is located 9~~2.9~~3.5km from the FFC SPA which is within the mean max plus 1SD foraging distance of 164.6km (Woodward et al., 2019) and has therefore been screened in for the breeding season (April to July), the post-breeding migration bio-season (August to October), the return migration bio-season (January to March), and the winter bio-season (November to December) as defined by Furness (2015) (Appendix 7.1.1).

Breeding Bio-season

674. During the breeding bio-season, the number of razorbills estimated to occur in the ~~array~~WTG area and 2km buffer is 3,159 individuals. Assuming the proportion of adult birds in the array is 57% (Appendix 7.1.1), the total number of breeding adults in the array at risk of displacement is 1,801 (1,800.6) during the breeding bio-season.

675. Of these 1,801 breeding adults, 100% are predicted to be breeding birds from FFC SPA (Appendix 7.1.1). Therefore, 1,801 breeding adults at risk of displacement are attributed to FFC SPA (Table 9.48~~Table 9.26~~). Assuming a displacement rate of 50% and a mortality rate of 1%, the consequent mortality is estimated at nine (9.0) breeding adults. However, based on advice from ~~SNCB~~ANCBs (MIG-Birds, 2022), a displacement range of 30% to 70% is also presented in Table 9.48~~Table 9.26~~.

676. Based on a citation population of 21,140 breeding adults and annual background mortality of 2,219.7 individuals, the addition of nine predicted breeding adult mortalities would represent a 0.406% increase in baseline mortality during the breeding bio-season.

~~619. During the breeding bio-season, the number of razorbills estimated to occur in the array area and 2km buffer is 3,596 (3,596.2) individuals. Assuming the proportion of adult birds in the array is 57% (Appendix 7.1.1), the total number of breeding adults in the array at risk of displacement is 2,050 (2049.8) during the breeding bio-season.~~

~~620. Of these 2,050 breeding adults, 100% are predicted to be breeding birds from FFC SPA (Appendix 7.1.1). Therefore, 2,050 breeding adults at risk of displacement are attributed to FFC SPA (Table 9.26). Assuming a displacement rate of 50% and a mortality rate of 1%, the consequent mortality is estimated at less than 10.2 breeding adults. However, based on advice from SNCBs (MIG-Birds, 2022), a displacement range of 30% to 70% is also presented in Table 9.26.~~

~~621. Based on a citation population of 21,140 breeding adults and annual background mortality of 2,219.7 individuals, the addition of 10 predicted breeding adult mortalities would represent a 0.462% increase in baseline mortality during the breeding bio-season.~~

677. As the population of razorbill has increased significantly since the citation population count the potential impact on the population is more reasonably assessed against the latest population count undertaken in 2022, consisting of 61,346 individuals and an annual background mortality of 6,441.3 individuals. On this basis, this would represent a 0.~~159~~140% increase in baseline mortality during the breeding bio-season.

Breeding Bio-season – Natural England approach

678. During the breeding bio-season, the number of razorbill estimated to occur in the ~~array~~WTG area and 2km buffer is 3,159 individuals. Using Natural England's preferred adult apportioning approach, 100% of the birds are assumed to be adult, and therefore 3,159 are at risk of displacement.

679. Using Natural England's preferred approach to apportioning, 100% are apportioned to FFC SPA. Therefore, with 100% assumed to be adults and 100% apportioned to FFC SPA, at 70% displacement and 2% mortality, the impact is estimated to be 44 (44.2) individuals.

680. Based on a citation population of 21,140 breeding adults and annual background mortality of 2,219.7 individuals, the addition of 44 predicted breeding adult mortalities would represent a 1.992% increase in baseline mortality during the breeding bio-season.

681. As the population of razorbill has increased significantly since the citation population count the potential impact on the population is more reasonably assessed against the latest population count undertaken in 2022, consisting of 61,346 individuals and an annual background mortality of 6,441.3 individuals. On this basis, this would represent a 0.687% increase in baseline mortality during the breeding bio-season.

~~622.~~682. The Applicant does not consider that 100% apportionment to FFC SPA or the assumption that all birds within the array are breeding adults to be appropriate. The assumptions made in the Natural England Approach have been made purely on a precautionary basis and do not consider the evidence to provide a proportionate assessment of the impacts. For further details on this please see~~-~~ REP2-057 – 19.8 Levels of precaution in the assessment and compensation calculation for offshore ornithology, REP2-058 – 19.9 Consideration of bio-seasons in the assessment of guillemot and REP2-059 – 19.10 Rated of displacement in guillemot and razorbill~~XXX~~.

Non-breeding Bio-season – Applicant's Approach

683. The mean-peak number of razorbills estimated to occur in the ~~array~~WTG area and 2km buffer is estimated at 5,134 individuals in the return migration period, 2,185 individuals during the post-breeding migration bio-season and 1,779 individuals in the winter bio-season.

684. Using the Applicant's approach, on the basis that 3.4% of razorbills within the ~~array~~WTG area and buffer are deemed to be breeding adults from the FFC during the migration bio-seasons, and 0.9% breeding adults from the FFC during the winter (Appendix 7.1.1), the total abundance of breeding adults estimated to be displaced from the array plus 2km buffer is 174 (173.5) during the return migration, 74 (73.8) during the post-breeding migration and 49 (48.8) in the winter bio-season (Table 9.48~~Table 9.26~~).

685. Based on 50% displacement and 1% mortality, the total predicted consequent mortality from being displaced is estimated at one (0.9) individual during return migration, less than one (0.4) during the post-breeding migration and less than one (0.2) in the winter bio-season. However, advice from ~~SNCB~~ANCBs (MIG-Birds, 2022) indicates a displacement range of 30% to 70% is also presented in Table 9.48~~Table 9.26~~.

686. This estimated mortality equates to an increase in baseline mortality of 0.039% in the return-migration bio-season, 0.017% in the post-breeding bio-season and 0.011% in the winter bio-season based on the citation population and 0.013% in the return-migration bio-season, 0.006% in the post-breeding bio-season and 0.004% in the migration free winter bio-season relative to the most recent counts.

~~623. The mean-peak number of razorbills estimated to occur in the array area and 2km buffer is estimated at 6,210 (6,210.0) individuals in the return migration, 2,391 (2,390.5) individuals during the post-breeding migration bio-season and 1,956 (1,956.0) individuals in the winter bio-season.~~

~~624. On the basis that 3.4% of razorbills within the array area and buffer are deemed to be breeding adults from the FFC during the migration bio-seasons, and 0.9% breeding adults from the FFC during the winter (Appendix 7.1.1), the total abundance of breeding adults estimated to be displaced from the array plus 2km buffer is 209 (208.8) during the return migration, 81 (81.3) during the post-breeding migration and 18 (17.7) in the winter bio-season (Table 9.26).~~

~~625. Based on 50% displacement and 1% mortality, the total predicted consequent mortality from being displaced is estimated at one (1.0) individual return migration, less than one (0.4) during the post-breeding migration and less than one (0.1) in the winter bio-season. However, advice from SNCBs (MIG-Birds, 2022) indicates a displacement range of 30% to 70% is also presented in Table 9.26.~~

~~626. This estimated mortality equates to an increase in baseline mortality of 0.047% in the return-migration bio-season, 0.018% in the post-breeding bio-season and 0.004% in the winter bio-season based on the citation population and 0.016% in the post-breeding migration bio-season, 0.006% in the post-breeding bio-season and 0.001% in the migration free winter bio-season relative to the most recent counts.~~

687. This equates to a total consequent mortality from displacement across the entire non-breeding bio-season of less than two (1.~~4~~5) breeding adult per annum. This represents an increase of 0.~~063~~067% in baseline mortality of the citation population and 0.~~033~~023% increase using the most recent count.

Non-breeding Bio-season – Natural England's Approach

688. Impacts using Natural England's preferred approach differ due to a highly precautionary adult proportion of 100% throughout the annual cycle, apart from a bespoke apportioning rate of 70.6% that is applied to the post-breeding bio-season. This rate apportions 70.6% of razorbills within the survey area as adults from the FFC SPA. In addition, impacts under Natural England's preferred approach are calculated using a displacement rate of 70% and a mortality rate of 2%.

~~Therefore, the number of razorbills estimated to occur in the array area and 2km buffer is estimated at 5,134 individuals in the return migration, 2,185 individuals during the post-breeding migration bio-season and 1,779 individuals in the winter bio-season.~~

689. Using Natural England's approach, the total abundance of breeding adults ~~estimated to be displaced~~ at risk of displacement from the array plus 2km buffer is 174 (173.5) during the return migration, 1,542.6 during the post-breeding migration and 49 (48.8) in the winter bio-season (Table 9.49~~Table 9-33~~).

690. Based on 70% displacement and 2% mortality, the total predicted consequent mortality from being displaced is estimated at two (2.4) individuals during return migration, 22 (21.6) during the post-breeding migration and less than one (0.7) in the winter bio-season.

691. This estimated mortality equates to an increase in baseline mortality of 0.109% in the return-migration bio-season, 0.973% in the post-breeding bio-season and 0.031% in the winter bio-season based on the citation population and 0.038% in the post-breeding migration bio-season, 0.335% in the post-breeding bio-season and 0.011% in the migration free winter bio-season relative to the most recent counts.

692. This equates to a total consequent mortality from displacement across the entire non-breeding bio-season of 25 (24.7) breeding adult per annum. This represents an increase of 1.113% in baseline mortality of the citation population and 0.384% increase using the most recent count.

~~627.~~

Annual Total

693. Across all bio-seasons, the number of razorbills estimated to occur in the ~~array~~WTG area and a 2km buffer is 12,257 individuals, with 2,096.8 being breeding adults from the FFC SPA. Using the Applicant's approach the total predicted consequent mortality from being displaced attributed to FFC SPA throughout the operational life of the Project is 10 (10.5) breeding adults from FFC SPA per annum across all bio-seasons. Displacement consequent mortalities based on the range advocated by ~~SNCB~~ANCBs (30% displacement to 70% displacement, 1 to 10% mortality) are displayed in Table 9.48~~Table 9-48~~, Table 9.50~~Table 9-50~~ and Table 9.51~~Table 951~~.

694. The predicted mortality of 10 breeding adults from FFC SPA per annum across all bio-seasons represents an increase in baseline mortality of 0.472% when considering the citation population or an increase of 0.163% when considering the recent count. This level of impact would be indistinguishable from natural fluctuations in the population.

695. Under Natural England's preferred approach,~~-~~ the total predicted consequent mortality from being displaced attributed to FFC SPA throughout the operational life of the Project is 69 (68.9) breeding adults from FFC SPA per annum across all bio-seasons. Displacement consequent mortalities based on the range advocated by ~~SNCB~~ANCBs (30% displacement to 70% displacement, 1 to 10% mortality) are displayed in Table 9.49~~Table 9-49~~, Table 9.52~~-Table 952~~ and Table 9.53~~Table 9-53~~Table 9.48.

696. The predicted mortality of 69 breeding adults from FFC SPA per annum across all bio-seasons represents an increase in baseline mortality of~~-~~ 3.106% when considering the citation population or an increase of 1.070% when considering the recent count.

697. As the increase in baseline mortality exceeds 1% for the citation and most recent count using the Natural England preferred approach, further consideration is given in the form of PVA (Appendix 7.1.2).

698. PVA was undertaken on a range of scenarios for the Project alone impacts for both the Applicant and Natural England approach (as presented in Appendix 7.1.2 and Table 10.29 (Section 10.3)). For each scenario, counterfactual of population growth (CGR) and counterfactual of population size (CPS) have been presented from the model outputs, measuring the changes in annual growth rate and population size respectively at the end of the impacted period of 35 years relative to a baseline scenario. The impact on adult survival is also presented, calculated as the number of mortalities divided by the relevant population size used in the PVA analysis.

Based on the outputs of the PVA, the level of impact would be indistinguishable from natural fluctuations in the population.

~~The PVA carried out for the O&M phase for razorbill at FFC SPA used NE's highly precautionary rates (70% and 2%, compared to 35% and 2% for C&D) and still did not pose a risk to the project over 35 years (threshold: <0.995 CGR; PVA result: 0.999). Since this threshold is not exceeded, any additional impact from the C&D phase would be inconsequential and does not require further PVA assessment.~~

~~628. Across all bio-seasons, the number of razorbills estimated to occur in the array area and a 2km buffer is 14,153 (14,152.6) individuals, with 2,358.4 being breeding adults from the FFC SPA. The total predicted consequent mortality from being displaced attributed to FFC SPA throughout the operational life of the Project is 12 (11.8) breeding adult from FFC SPA per annum across all bio-seasons. Displacement consequent mortalities based on the range advocated by SNCBs (30% displacement to 70% displacement, 1 to 10% mortality) are displayed in Table 9.27.~~

~~629.~~699. ~~The predicted mortality of 12 breeding adults from FFC SPA per annum across all bio-seasons represents an increase in baseline mortality of 0.531% when considering the citation population or an increase of 0.183% when considering the recent count~~ ~~This level of impact would be indistinguishable from natural fluctuations in the population.~~. ~~This level of impact would be indistinguishable from natural fluctuations in the population.~~

~~630.~~700. Therefore, the potential for an AEoI to the conservation objectives of the razorbill feature of FFC SPA in relation to disturbance and displacement effects in the O&M phase from the Project alone can be ruled out, and therefore, subject to natural change, razorbill will be maintained as a feature in the long-term.

Table 9-48~~9.489-489.26~~: Range-based displacement mortalities during the operational and maintenance phases for razorbill at FFC SPA based on the values advocated by ~~SNCB~~ANCBs for the citation and most recent counts (2019 Seabird Monitoring Programme), with the Applicant Approach boldened. The lower confidence interval (LCI) and the upper confidence interval (UCI) are presented as requested by ~~SNCB~~ANCBs.

Bio-season	Abundance of adults apportioned to SPA (plus 2km buffer)	Estimated increase in mortality (breeding adults per annum)			% increase in baseline mortality (citation count)			% increase in baseline mortality (recent count)		
		50% displacement, 1% mortality	70% displacement, 2% mortality	30-70% displacement, 1-10% mortality	50% displacement, 1% mortality	70% displacement, 2% mortality	30-70% displacement, 1 – 10% mortality	50% displacement, 1% mortality	70% displacement, 2% mortality	30-70% displacement, 1 – 10% mortality
~~SNCB Apportioning~~										
Mean										
Breeding	1800.6~~3,596.2~~	**9.00**~~18.0~~	25.21	5.40 - 126.04~~10.8 – 251.7~~	0.406~~0.810~~	1.136	0.243 - 5.678~~0.486 – 11.341~~	0.140~~0.276~~	0.391	0.084 - 1.957~~0.167 – 3.908~~
Post-breeding migration	73.8~~80.8~~	**0.37**~~0.4~~	1.03	0.22 - 5.17~~0.2 – 5.7~~	0.017~~0.018~~	0.047	0.01 - 0.233~~0.011 – 0.255~~	0.006~~0.006~~	0.016	0.003 - 0.08~~0.004 – 0.088~~
Return-breeding migration	48.8~~209.9~~	**0.24**~~1.0~~	0.68	0.15 - 3.42~~0.6 – 14.7~~	0.011~~0.047~~	0.031	0.007 - 0.154~~0.028 – 0.662~~	0.004~~0.016~~	0.011	0.002 - 0.053~~0.010 - 0.228~~

Bio-season	Abundance of adults apportioned to SPA (plus 2km buffer)	Estimated increase in mortality (breeding adults per annum)			% increase in baseline mortality (citation count)			% increase in baseline mortality (recent count)		
		50% displacement, 1% mortality	70% displacement, 2% mortality	30-70% displacement, 1-10% mortality	50% displacement, 1% mortality	70% displacement, 2% mortality	30-70% displacement, 1 – 10% mortality	50% displacement, 1% mortality	70% displacement, 2% mortality	30-70% displacement, 1 – 10% mortality
Winter	173.5~~17.9~~	**0.87**~~**0.1**~~	2.43	0.52 - 12.15~~0.0 – 1.25~~	0.039~~0.004~~	0.109	0.023 - 0.547~~0.002 – 0.056~~	0.013~~0.001~~	0.038	0.008 - 0.189~~0.001 – 0.019~~
Annual Total	2096.8~~3904.7~~	**10.48**~~**19.5**~~	29.36	6.29 - 146.78~~11.7 – 273.3~~	0.472~~0.880~~	1.322	0.283 - 6.612~~0.528 – 12.314~~	0.163~~0.303~~	0.456	0.098 - 2.279~~0.182 – 4.243~~
LCI~~Applicant Apportioning~~										
Breeding	1103.0~~2,049.8~~	5.51~~10.2~~	15.44	3.31 - 77.21~~6.1 – 143.5~~	0.248~~0.462~~	0.696	0.149 - 3.478~~0.277 – 6.464~~	0.086~~0.159~~	0.240	0.051 - 1.199~~0.095 – 2.228~~
Post-breeding migration	31.5~~80.8~~	0.16~~0.4~~	0.44	0.09 - 2.2~~0.2 – 5.7~~	0.007~~0.018~~	0.020	0.004 - 0.099~~0.011 – 0.255~~	0.002~~0.006~~	0.007	0.001 - 0.034~~0.004 – 0.088~~
Return-breeding migration	36.7~~209.9~~	0.18~~1.0~~	0.51	0.11 - 2.57~~0.6 – 14.7~~	0.008~~0.047~~	0.023	0.005 - 0.116~~0.028 – 0.662~~	0.003~~0.016~~	0.008	0.002 - 0.04~~0.010 – 0.228~~

Bio-season	Abundance of adults apportioned to SPA (plus 2km buffer)	Estimated increase in mortality (breeding adults per annum)			% increase in baseline mortality (citation count)			% increase in baseline mortality (recent count)		
		50% displacement, 1% mortality	70% displacement, 2% mortality	30-70% displacement, 1-10% mortality	50% displacement, 1% mortality	70% displacement, 2% mortality	30-70% displacement, 1 – 10% mortality	50% displacement, 1% mortality	70% displacement, 2% mortality	30-70% displacement, 1 – 10% mortality
Winter	120.8~~17.9~~	0.60~~0.1~~	1.69	0.36 - 8.46~~0.0 – 1.25~~	0.027~~0.004~~	0.076	0.016 - 0.381~~0.002 – 0.056~~	0.009~~0.001~~	0.026	0.006 - 0.131~~0.001 – 0.019~~
Annual Total	1292.0~~2358.4~~	6.46~~11.8~~	18.09	3.88 - 90.44~~7.1 – 165.1~~	0.291~~0.531~~	0.815	0.175 - 4.074~~0.319 – 7.437~~	0.100~~0.183~~	0.281	0.06 - 1.404~~0.110 – 2.563~~
UCI										
2685.8	13.43	37.60	8.06 - 188.01	0.605	1.694	0.363 - 8.47	0.208	0.584	0.125 - 2.919	2685.8
130.0	0.65	1.82	0.39 - 9.1	0.029	0.082	0.018 - 0.41	0.010	0.028	0.006 - 0.141	130.0
61.8	0.31	0.87	0.19 - 4.33	0.014	0.039	0.008 - 0.195	0.005	0.013	0.003 - 0.067	61.8
229.8	1.15	3.22	0.69 - 16.09	0.052	0.145	0.031 - 0.725	0.018	0.050	0.011 - 0.25	229.8
3107.5	15.54	43.50	9.32 - 217.52	0.700	1.960	0.42 - 9.8	0.241	0.675	0.145 - 3.377	3107.5

Table 9-49~~9.499-49~~: Range-based displacement mortalities during the operational and maintenance phases for razorbill at FFC SPA based on the values advocated by ~~SNCB~~ANCBs for the citation and most recent counts (2019 Seabird Monitoring Programme), with Natural England's preferred approach boldened. The lower confidence interval (LCI) and the upper confidence interval (UCI) are presented as requested by ~~SNCB~~ANCBs.

Bio-season	Abundance of adults apportioned to SPA (plus 2km buffer)	Estimated increase in mortality (breeding adults per annum)			% increase in baseline mortality (citation count)			% increase in baseline mortality (recent count)		
		50% displacement, 1% mortality	70% displacement, 2% mortality	30-70% displacement, 1-10% mortality	50% displacement, 1% mortality	70% displacement, 2% mortality	30-70% displacement, 1 – 10% mortality	50% displacement, 1% mortality	70% displacement, 2% mortality	30-70% displacement, 1 – 10% mortality
Mean										
Breeding	3159.0	15.80	**44.23**	9.48 - 221.13	0.712	1.992	0.427 - 9.962	0.245	0.687	0.147 - 3.433
Post-breeding migration	1542.6	7.71	**21.60**	4.63 - 107.98	0.347	0.973	0.208 - 4.865	0.120	0.335	0.072 - 1.676
Return - breeding migration	48.8	0.24	**0.68**	0.15 - 3.42	0.011	0.031	0.007 - 0.154	0.004	0.011	0.002 - 0.053
Winter	173.5	0.87	**2.43**	0.52 - 12.15	0.039	0.109	0.023 - 0.547	0.013	0.038	0.008 - 0.189

Bio-season	Abundance of adults apportioned to SPA (plus 2km buffer)	Estimated increase in mortality (breeding adults per annum)			% increase in baseline mortality (citation count)			% increase in baseline mortality (recent count)		
		50% displacement, 1% mortality	70% displacement, 2% mortality	30-70% displacement, 1- 10% mortality	50% displacement, 1% mortality	70% displacement, 2% mortality	30-70% displacement, 1 – 10% mortality	50% displacement, 1% mortality	70% displacement, 2% mortality	30-70% displacement, 1 – 10% mortality
Annual Total	4923.9	24.62	**68.94**	14.77 - 344.68	1.109	3.106	0.665 - 15.528	0.382	1.070	0.229 - 5.351
LCI										
Breeding	1935.0	9.68	27.09	5.81 - 135.45	0.436	1.220	0.262 - 6.102	0.150	0.421	0.09 - 2.103
Post-breeding migration	658.0	3.29	9.21	1.97 - 46.06	0.148	0.415	0.089 - 2.075	0.051	0.143	0.031 - 0.715
Return - breeding migration	36.7	0.18	0.51	0.11 - 2.57	0.008	0.023	0.005 - 0.116	0.003	0.008	0.002 - 0.04
Winter	120.8	0.60	1.69	0.36 - 8.46	0.027	0.076	0.016 - 0.381	0.009	0.026	0.006 - 0.131
Annual Total	2750.5	13.75	38.51	8.25 - 192.54	0.620	1.735	0.372 - 8.674	0.214	0.598	0.128 - 2.989
UCI										

Bio-season	Abundance of adults apportioned to SPA (plus 2km buffer)	Estimated increase in mortality (breeding adults per annum)			% increase in baseline mortality (citation count)			% increase in baseline mortality (recent count)		
		50% displacement, 1% mortality	70% displacement, 2% mortality	30-70% displacement, 1- 10% mortality	50% displacement, 1% mortality	70% displacement, 2% mortality	30-70% displacement, 1 – 10% mortality	50% displacement, 1% mortality	70% displacement, 2% mortality	30-70% displacement, 1 – 10% mortality
Breeding	4712.0	23.56	65.97	14.14 - 329.84	1.061	2.972	0.637 - 14.86	0.366	1.024	0.219 - 5.121
Post-breeding migration	2716.0	13.58	38.02	8.15 - 190.12	0.612	1.713	0.367 - 8.565	0.211	0.590	0.126 - 2.952
Return-breeding migration	61.8	0.31	0.87	0.19 - 4.33	0.014	0.039	0.008 - 0.195	0.005	0.013	0.003 - 0.067
Winter	229.8	1.15	3.22	0.69 - 16.09	0.052	0.145	0.031 - 0.725	0.018	0.050	0.011 - 0.25
Annual Total	7719.6	38.60	108.07	23.16 - 540.37	1.739	4.869	1.043 - 24.344	0.599	1.678	0.36 - 8.389

Table 9-50~~9.509-509.27~~: Razorbill displacement matrix at FFC SPA (~~array~~ WTG area plus 2km buffer),~~-~~ using the mean abundance estimate, with light blue shading indicating the displacement range advocated by ~~SNCB~~ANCBs, and dark blue indicating the Applicant's approach.~~with light blue shading indicating the displacement range advocated by SNCBs, and dark blue indicating the Applicant's approach.~~

Annual (2km Buffer)	Mortality Rate (%)												
Displaced (%)	1	2	5	10	20	30	40	50	60	70	80	90	100
10	2 ~~2~~	4 ~~5~~	10 ~~12~~	21 ~~24~~	42 ~~47~~	63 ~~71~~	84 ~~94~~	105 ~~118~~	126 ~~142~~	147 ~~165~~	168 ~~189~~	189 ~~212~~	210 ~~236~~
20	4 ~~5~~	8 ~~9~~	21 ~~24~~	42 ~~47~~	84 ~~94~~	126 ~~142~~	168 ~~189~~	210 ~~236~~	252 ~~283~~	294 ~~330~~	335 ~~377~~	377 ~~425~~	419 ~~472~~
30	6 ~~7~~	13 ~~14~~	31 ~~35~~	63 ~~71~~	126 ~~142~~	189 ~~212~~	252 ~~283~~	315 ~~354~~	377 ~~425~~	440 ~~495~~	503 ~~566~~	566 ~~637~~	629 ~~708~~
40	8 ~~9~~	17 ~~19~~	42 ~~47~~	84 ~~94~~	168 ~~189~~	252 ~~283~~	335 ~~377~~	419 ~~472~~	503 ~~566~~	587 ~~660~~	671 ~~755~~	755 ~~849~~	839 ~~943~~
50	10 ~~12~~	21 ~~24~~	52 ~~59~~	105 ~~118~~	210 ~~236~~	315 ~~354~~	419 ~~472~~	524 ~~590~~	629 ~~708~~	734 ~~825~~	839 ~~943~~	944 ~~1,061~~	1,048 ~~1,179~~
60	13 ~~14~~	25 ~~28~~	63 ~~71~~	126 ~~142~~	252 ~~283~~	377 ~~425~~	503 ~~566~~	629 ~~708~~	755 ~~849~~	881 ~~991~~	1,006 ~~1,132~~	1,132 ~~1,274~~	1,258 ~~1,415~~
70	15 ~~17~~	29 ~~33~~	73 ~~83~~	147 ~~165~~	294 ~~330~~	440 ~~495~~	587 ~~660~~	734 ~~825~~	881 ~~991~~	1,027 ~~1,156~~	1,174 ~~1,321~~	1,321 ~~1,486~~	1,468 ~~1,651~~
80	17 ~~19~~	34 ~~38~~	84 ~~94~~	168 ~~189~~	335 ~~377~~	503 ~~566~~	671 ~~755~~	839 ~~943~~	1,006 ~~1,132~~	1,174 ~~1,321~~	1,342 ~~1,509~~	1,510 ~~1,698~~	1,677 ~~1,887~~
90	19 ~~21~~	38 ~~42~~	94 ~~106~~	189 ~~212~~	377 ~~425~~	566 ~~637~~	755 ~~849~~	944 ~~1,061~~	1,132 ~~1,274~~	1,321 ~~1,486~~	1,510 ~~1,698~~	1,698 ~~1,910~~	1,887 ~~2,123~~
100	21 ~~24~~	42 ~~47~~	105 ~~118~~	210 ~~236~~	419 ~~472~~	629 ~~708~~	839 ~~943~~	1,048 ~~1,179~~	1,258 ~~1,415~~	1,468 ~~1,651~~	1,677 ~~1,887~~	1,887 ~~2,123~~	2,097 ~~2,358~~

~~-~~Table 9-51~~9.51~~: Razorbill displacement matrix at FFC SPA (~~array~~ WTGarea plus 2km buffer), using the UCI abundance estimate, with light blue shading indicating the displacement range advocated by ~~SNCB~~ANCBs, and dark blue indicating the Applicant's approach.

Annual (2km Buffer)	Mortality Rate (%)												
Displaced (%)	1	2	5	10	20	30	40	50	60	70	80	90	100
10	3	6	16	31	62	93	124	155	186	218	249	280	311
20	6	12	31	62	124	186	249	311	373	435	497	559	621
30	9	19	47	93	186	280	373	466	559	653	746	839	932
40	12	25	62	124	249	373	497	621	746	870	994	1,119	1,243
50	16	31	78	155	311	466	621	777	932	1,088	1,243	1,398	1,554
60	19	37	93	186	373	559	746	932	1,119	1,305	1,492	1,678	1,864
70	22	44	109	218	435	653	870	1,088	1,305	1,523	1,740	1,958	2,175
80	25	50	124	249	497	746	994	1,243	1,492	1,740	1,989	2,237	2,486
90	28	56	140	280	559	839	1,119	1,398	1,678	1,958	2,237	2,517	2,797
100	31	62	155	311	621	932	1,243	1,554	1,864	2,175	2,486	2,797	3,107

~~-~~Table 9-52~~9.5252~~: Razorbill displacement matrix at FFC SPA (~~array~~WTG area plus 2km buffer), using the mean abundance estimate, with light blue shading indicating the displacement range advocated by ~~SNCB~~ANCBs, and dark blue indicating Natural England's preferred approach.

Annual (2km Buffer)	Mortality Rate (%)												
Displaced (%)	1	2	5	10	20	30	40	50	60	70	80	90	100
10	5	10	25	49	98	148	197	246	295	345	394	443	492
20	10	20	49	98	197	295	394	492	591	689	788	886	985
30	15	30	74	148	295	443	591	739	886	1,034	1,182	1,329	1,477
40	20	39	98	197	394	591	788	985	1,182	1,379	1,576	1,773	1,970
50	25	49	123	246	492	739	985	1,231	1,477	1,723	1,970	2,216	2,462
60	30	59	148	295	591	886	1,182	1,477	1,773	2,068	2,363	2,659	2,954
70	34	69	172	345	689	1,034	1,379	1,723	2,068	2,413	2,757	3,102	3,447
80	39	79	197	394	788	1,182	1,576	1,970	2,363	2,757	3,151	3,545	3,939
90	44	89	222	443	886	1,329	1,773	2,216	2,659	3,102	3,545	3,988	4,432
100	49	98	246	492	985	1,477	1,970	2,462	2,954	3,447	3,939	4,432	4,924

Table 9-53~~9.539-53~~: Razorbill displacement matrix at FFC SPA (~~array~~WTG area plus 2km buffer), using the UCI abundance estimate, with light blue shading indicating the displacement range advocated by ~~SNCB~~ANCBs, and dark blue indicating Natural England's preferred approach.

Annual (2km Buffer)	Mortality Rate (%)												
Displaced (%)	1	2	5	10	20	30	40	50	60	70	80	90	100
10	8	15	39	77	154	232	309	386	463	540	618	695	772
20	15	31	77	154	309	463	618	772	926	1,081	1,235	1,390	1,544
30	23	46	116	232	463	695	926	1,158	1,390	1,621	1,853	2,084	2,316
40	31	62	154	309	618	926	1,235	1,544	1,853	2,161	2,470	2,779	3,088
50	39	77	193	386	772	1,158	1,544	1,930	2,316	2,702	3,088	3,474	3,860
60	46	93	232	463	926	1,390	1,853	2,316	2,779	3,242	3,705	4,169	4,632
70	54	108	270	540	1,081	1,621	2,161	2,702	3,242	3,783	4,323	4,863	5,404
80	62	124	309	618	1,235	1,853	2,470	3,088	3,705	4,323	4,941	5,558	6,176
90	69	139	347	695	1,390	2,084	2,779	3,474	4,169	4,863	5,558	6,253	6,948
100	77	154	386	772	1,544	2,316	3,088	3,860	4,632	5,404	6,176	6,948	7,720

Flamborough and Filey coast SPA – puffin

~~631.~~701. Puffin has been screened in for the O&M phase to assess the potential for an AEoI from displacement from the Project alone in relation to the following conservation objectives for this species, as an assemblage feature of the FFC SPA (Document 7.2):

- Maintain the population of each qualifying feature.

~~632.~~702. Puffin is a named feature of the seabird assemblage, and for the purpose of this assessment it has been considered in a similar manner to qualifying species, though the conclusion is not whether an AEoI would result from the Project alone on puffin as a feature, but more as an important component of the seabird assemblage. The latest population estimate is 3,080 based on the most recent 2022 colony counts.

~~633.~~703. The Project ~~array~~ WTG area is located 9~~2.9~~3.5km from the FFC SPA which is within the mean max plus 1SD foraging distance of 265.4km (Woodward et al., 2019) and has therefore been screened in for the breeding bio-season for the months of April to July and the non-breeding bio-season defined as August to March by Furness (2015) (Appendix 7.1.1).

Breeding Bio-season

~~634.~~704. During the breeding bio-season, the number of puffins estimated to occur in the ~~array~~ WTG area and 2km buffer is ~~760~~ 666 (~~760~~666.0) individuals. Assuming the proportion of adult birds in the array is ~~49~~55% (Furness 2015), the total number of breeding adults in the array at risk of displacement is ~~372~~366.3~~.4~~ during the full breeding bio-season.

~~635.~~ Of these ~~372~~ 366 breeding adults, 21.2% are predicted to be breeding birds from FFC SPA (Appendix 7.1.1). Therefore, ~~78~~77.7~~.9~~ breeding adults at risk of displacement are attributed to FFC SPA~~(~~

~~636.~~

~~Bio-season~~	~~Abundance of adults apportioned to SPA (plus 2km buffer)~~	~~Estimated increase in mortality (breeding adults per annum)~~			~~% increase in baseline mortality (recent count)~~		
		~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1-10% mortality~~	~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1 – 10% mortality~~
~~Mean~~							

~~Bio-season~~	~~Abundance of adults apportioned to SPA (plus 2km buffer)~~	~~Estimated increase in mortality (breeding adults per annum)~~			~~% increase in baseline mortality (recent count)~~		
		~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1-10% mortality~~	~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1 – 10% mortality~~
~~Breeding~~	~~77.7~~	**~~0.39~~**	~~1.09~~	~~0.23 - 5.44~~	~~0.134~~	~~0.376~~	~~0.08 - 1.878~~
~~Non-breeding~~	~~1.7~~	**~~0.01~~**	~~0.02~~	~~0.01 - 0.12~~	~~0.003~~	~~0.008~~	~~0.002 - 0.041~~
~~Annual Total~~	~~79.4~~	**~~0.40~~**	~~1.11~~	~~0.24 - 5.56~~	~~0.137~~	~~0.384~~	~~0.082 - 1.919~~
~~LCI~~							
~~Breeding~~	~~48.9~~	~~0.24~~	~~0.68~~	~~0.15 - 3.42~~	~~0.084~~	~~0.236~~	~~0.051 - 1.181~~
~~Non-breeding~~	~~1.2~~	~~0.01~~	~~0.02~~	~~0 - 0.08~~	~~0.002~~	~~0.006~~	~~0.001 - 0.029~~

~~Bio-season~~	~~Abundance of adults apportioned to SPA (plus 2km buffer)~~	~~Estimated increase in mortality (breeding adults per annum)~~			~~% increase in baseline mortality (recent count)~~		
		~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1-10% mortality~~	~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1 – 10% mortality~~
~~Annual Total~~	~~50.1~~	~~0.25~~	~~0.70~~	~~0.15 - 3.5~~	~~0.086~~	~~0.242~~	~~0.052 - 1.21~~
~~UCI~~							
~~Breeding~~	~~111.9~~	~~0.56~~	~~1.57~~	~~0.34 - 7.84~~	~~0.193~~	~~0.541~~	~~0.116 - 2.706~~
~~Non-breeding~~	~~2.4~~	~~0.01~~	~~0.03~~	~~0.01 - 0.16~~	~~0.004~~	~~0.011~~	~~0.002 - 0.057~~
~~Annual Total~~	~~114.3~~	~~0.57~~	~~1.60~~	~~0.34 - 8~~	~~0.197~~	~~0.553~~	~~0.118 - 2.763~~

~~637.~~ ~~Table 9.28~~ (Table 9.56)~~)~~. Assuming a displacement rate of 50% and a mortality rate of 1%, the consequent mortality is estimated at less than one (0.4) breeding adults. However, based on advice from ~~SNCB~~ANCBs (MIG-Birds, 2022), a displacement range of 30% to 70% is also presented in~~-~~Table 9-56

~~Bio-season~~	~~Abundance of adults apportioned to SPA (plus 2km buffer)~~	~~Estimated increase in mortality (breeding adults per annum)~~			~~% increase in baseline mortality (recent count)~~		
		~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1-10% mortality~~	~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1 – 10% mortality~~
~~Mean~~							
~~Breeding~~	~~77.7~~	**~~0.39~~**	~~1.09~~	~~0.23 - 5.44~~	~~0.134~~	~~0.376~~	~~0.08 - 1.878~~
~~Non-breeding~~	~~1.7~~	**~~0.01~~**	~~0.02~~	~~0.01 - 0.12~~	~~0.003~~	~~0.008~~	~~0.002 - 0.041~~
~~Annual Total~~	~~79.4~~	**~~0.40~~**	~~1.11~~	~~0.24 - 5.56~~	~~0.137~~	~~0.384~~	~~0.082 - 1.919~~
~~LCI~~							
~~Breeding~~	~~48.9~~	~~0.24~~	~~0.68~~	~~0.15 - 3.42~~	~~0.084~~	~~0.236~~	~~0.051 - 1.181~~
~~Non-breeding~~	~~1.2~~	~~0.01~~	~~0.02~~	~~0 - 0.08~~	~~0.002~~	~~0.006~~	~~0.001 - 0.029~~

~~Bio-season~~	~~Abundance of adults apportioned to SPA (plus 2km buffer)~~	~~Estimated increase in mortality (breeding adults per annum)~~			~~% increase in baseline mortality (recent count)~~		
		~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1-10% mortality~~	~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1 – 10% mortality~~
~~Annual Total~~	~~50.1~~	~~0.25~~	~~0.70~~	~~0.15 - 3.5~~	~~0.086~~	~~0.242~~	~~0.052 - 1.21~~
~~UCI~~							
~~Breeding~~	~~111.9~~	~~0.56~~	~~1.57~~	~~0.34 - 7.84~~	~~0.193~~	~~0.541~~	~~0.116 - 2.706~~
~~Non-breeding~~	~~2.4~~	~~0.01~~	~~0.03~~	~~0.01 - 0.16~~	~~0.004~~	~~0.011~~	~~0.002 - 0.057~~
~~Annual Total~~	~~114.3~~	~~0.57~~	~~1.60~~	~~0.34 - 8~~	~~0.197~~	~~0.553~~	~~0.118 - 2.763~~

~~638.~~705. ~~Table 9.28~~ .

706. Based on the most recent count of 3,080 breeding adults and annual background mortality of ~~289.5~~290 individuals, the addition of less than one predicted breeding adult mortalities would represent a 0.134~~6~~% increase in baseline mortality during the breeding bio-season.

Breeding Bio-season – Natural England's Approach

707. Under Natural England's preferred approach the proportion of adult birds in the array is 100%, therefore the total number of breeding adults in the array at risk of displacement is 666 during the full breeding bio-season.

708. Of these 666 breeding adults, 21.2% are predicted to be breeding birds from FFC SPA (Appendix 7.1.1). Therefore, 141.2 breeding adults at risk of displacement are attributed to FFC SPA~~-~~ (Table 9.55)~~(Table 9.55Table 9-36)~~. Assuming a displacement rate of 70% and a mortality rate of 2%, ~~why~~ the consequent mortality is estimated at two (2.0) breeding adults. However, based on advice from ~~SNCB~~ANCBs (MIG-Birds, 2022), a displacement range of 30% to 70% is also presented in Table 9.55~~-Table 9.55Table 9-36~~.

709. Based on the most recent count of 3,080 breeding adults and annual background mortality of 290 individuals, the addition of two predicted breeding adult mortalities would represent a 0.683% increase in baseline mortality during the breeding bio-season.

~~639.~~

Non-breeding season

~~640.~~710. In the non-breeding bio-season the mean-peak number of puffins estimated to occur in the ~~array~~ WTG area and 2km buffer is ~~637~~ 414 (~~636~~414.0~~.5~~) individuals.

~~641.~~ On the basis that 0.~~8241~~83% of these puffins within the ~~array~~ WTG area are deemed to be breeding adults from the FFC during the non-breeding bio-season (Appendix 7.1.1), the total abundance of breeding adults estimated to be displaced from the array plus 2km buffer is ~~five two (1.75.1)~~3.4 (

~~Bio-season~~	~~Abundance of adults apportioned to SPA (plus 2km buffer)~~	~~Estimated increase in mortality (breeding adults per annum)~~			~~% increase in baseline mortality (recent count)~~		
		~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1-10% mortality~~	~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1 – 10% mortality~~
~~Mean~~							
~~Breeding~~	~~77.7~~	**~~0.39~~**	~~1.09~~	~~0.23 - 5.44~~	~~0.134~~	~~0.376~~	~~0.08 - 1.878~~

~~Bio-season~~	~~Abundance of adults apportioned to SPA (plus 2km buffer)~~	~~Estimated increase in mortality (breeding adults per annum)~~			~~% increase in baseline mortality (recent count)~~		
		~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1-10% mortality~~	~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1 – 10% mortality~~
~~Non-breeding~~	~~1.7~~	**~~0.01~~**	~~0.02~~	~~0.01 - 0.12~~	~~0.003~~	~~0.008~~	~~0.002 - 0.041~~
~~Annual Total~~	~~79.4~~	**~~0.40~~**	~~1.11~~	~~0.24 - 5.56~~	~~0.137~~	~~0.384~~	~~0.082 - 1.919~~
~~LCI~~							
~~Breeding~~	~~48.9~~	~~0.24~~	~~0.68~~	~~0.15 - 3.42~~	~~0.084~~	~~0.236~~	~~0.051 - 1.181~~
~~Non-breeding~~	~~1.2~~	~~0.01~~	~~0.02~~	~~0 - 0.08~~	~~0.002~~	~~0.006~~	~~0.001 - 0.029~~
~~Annual Total~~	~~50.1~~	~~0.25~~	~~0.70~~	~~0.15 - 3.5~~	~~0.086~~	~~0.242~~	~~0.052 - 1.21~~
~~UCI~~							

~~Bio-season~~	~~Abundance of adults apportioned to SPA (plus 2km buffer)~~	~~Estimated increase in mortality (breeding adults per annum)~~			~~% increase in baseline mortality (recent count)~~		
		~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1-10% mortality~~	~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1 – 10% mortality~~
~~Breeding~~	~~111.9~~	~~0.56~~	~~1.57~~	~~0.34 - 7.84~~	~~0.193~~	~~0.541~~	~~0.116 - 2.706~~
~~Non-breeding~~	~~2.4~~	~~0.01~~	~~0.03~~	~~0.01 - 0.16~~	~~0.004~~	~~0.011~~	~~0.002 - 0.057~~
~~Annual Total~~	~~114.3~~	~~0.57~~	~~1.60~~	~~0.34 - 8~~	~~0.197~~	~~0.553~~	~~0.118 - 2.763~~

~~642.~~ ~~Table 9.28~~Table 9.54). Based on 50% displacement and 1% mortality, the total predicted consequent mortality from being displaced is estimated at less than one (0.0) individual during the non-breeding bio-season. However, based on advice from ~~SNCB~~ANCBs (MIG-Birds, 2022), a displacement range of 30% to 70% is also presented in

~~Bio-season~~	~~Abundance of adults apportioned to SPA (plus 2km buffer)~~	~~Estimated increase in mortality (breeding adults per annum)~~			~~% increase in baseline mortality (recent count)~~		
		~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1-10% mortality~~	~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1 – 10% mortality~~
~~Mean~~							
~~Breeding~~	~~77.7~~	**~~0.39~~**	~~1.09~~	~~0.23 - 5.44~~	~~0.134~~	~~0.376~~	~~0.08 - 1.878~~
~~Non-breeding~~	~~1.7~~	**~~0.01~~**	~~0.02~~	~~0.01 - 0.12~~	~~0.003~~	~~0.008~~	~~0.002 - 0.041~~
~~Annual Total~~	~~79.4~~	**~~0.40~~**	~~1.11~~	~~0.24 - 5.56~~	~~0.137~~	~~0.384~~	~~0.082 - 1.919~~
~~LCI~~							
~~Breeding~~	~~48.9~~	~~0.24~~	~~0.68~~	~~0.15 - 3.42~~	~~0.084~~	~~0.236~~	~~0.051 - 1.181~~
~~Non-breeding~~	~~1.2~~	~~0.01~~	~~0.02~~	~~0 - 0.08~~	~~0.002~~	~~0.006~~	~~0.001 - 0.029~~

~~Bio-season~~	~~Abundance of adults apportioned to SPA (plus 2km buffer)~~	~~Estimated increase in mortality (breeding adults per annum)~~			~~% increase in baseline mortality (recent count)~~		
		~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1-10% mortality~~	~~50% displacement, 1% mortality~~	~~70% displacement, 2% mortality~~	~~30-70% displacement, 1 – 10% mortality~~
~~Annual Total~~	~~50.1~~	~~0.25~~	~~0.70~~	~~0.15 - 3.5~~	~~0.086~~	~~0.242~~	~~0.052 - 1.21~~
~~UCI~~							
~~Breeding~~	~~111.9~~	~~0.56~~	~~1.57~~	~~0.34 - 7.84~~	~~0.193~~	~~0.541~~	~~0.116 - 2.706~~
~~Non-breeding~~	~~2.4~~	~~0.01~~	~~0.03~~	~~0.01 - 0.16~~	~~0.004~~	~~0.011~~	~~0.002 - 0.057~~
~~Annual Total~~	~~114.3~~	~~0.57~~	~~1.60~~	~~0.34 - 8~~	~~0.197~~	~~0.553~~	~~0.118 - 2.763~~

~~643.~~711. ~~Table 9.28~~ Table 9.55.

~~644.~~712. This consequent estimated mortality equates to an increase in baseline mortality of 0.00~~3~~7~~009~~% in the non-breeding bio-season relative to the most recent count.

Annual Total

~~645.~~713. Across all bio-seasons, the number of puffins estimated to occur in the ~~array~~ WTG area and a 2km buffer is ~~1,396.5~~1080.0 individuals, with ~~83 79~~81 (~~8379.4~~81.1) being breeding adults from the FFC SPA. The total predicted consequent mortality from being displaced attributed to FFC SPA throughout the operational life of the Project is less than one (0.4) breeding adult from FFC SPA per annum across all bio-seasons. Displacement consequent mortalities based on the range advocated by ~~SNCB~~ANCBs (30% displacement to 70% displacement, 1 to 10% mortality) are displayed in Table 9.54~~Table 9.54Table 9-~~ and Table 9.56~~Table 9.56Table 9-Table 9.56Table 9.29~~.

714. The predicted mortality of less than one breeding adult from FFC SPA per annum across all bio-seasons represents an increase of 0.1~~437~~40~~5~~% when considering the recent count. This level of impact would be indistinguishable from natural fluctuations in the population.

715. Under Natural England's preferred approach, across all bio-seasons the number of puffins estimated to occur in the ~~array~~WTG area and a 2km buffer is 1,080.0 individuals, with 14~~2.9~~4.6 being breeding adults from the FFC SPA. The total predicted consequent mortality from being displaced attributed to FFC SPA throughout the operational life of the Project is two breeding adult (2.0) from FFC SPA per annum across all bio-seasons. Displacement consequent mortalities based on the range advocated by ~~SNCB~~ANCBs (30% displacement to 70% displacement, 1 to 10% mortality) are displayed in~~-~~ Table 9.56 and Table 9.57~~Table 9.55Table 9- and Table 9.57Table 9-57Table 9.55~~.

716. The predicted mortality of two breeding adults from FFC SPA per annum across all bio-seasons represents an increase of 0.69~~1~~9% when considering the recent count. This level of impact would be indistinguishable from natural fluctuations in the population.

~~646.~~

~~647.~~**717. Therefore, the potential for an AEoI to the conservation objectives of the puffin as an assemblage feature of FFC SPA in relation to disturbance and displacement effects in the O&M phase from the Project alone can be ruled out and therefore, subject to natural change, puffin will be maintained as a feature in the long-term.**

Table 9-54~~9.549~~: Range-based displacement mortalities during the operational and maintenance phases for puffin at FFC SPA based on the values advocated by ~~SNCB~~ANCBs for the citation and most recent counts (Aitken et al., (2017) Seabird Monitoring Programme), with the Applicant Approach boldened. The lower confidence interval (LCI) and the upper confidence interval (UCI) are presented as requested by ~~SNCB~~ANCBs.

Bio-season	Abundance of adults apportioned to SPA (plus 2km buffer)	Estimated increase in mortality (breeding adults per annum)			% increase in baseline mortality (recent count)		
		50% displacement, 1% mortality	70% displacement, 2% mortality	30-70% displacement, 1-10% mortality	50% displacement, 1% mortality	70% displacement, 2% mortality	30-70% displacement, 1 – 10% mortality
Mean							
Breeding	77.7	**0.39**	1.09	0.23 - 5.44	0.134	0.376	0.080 - 1.878
Non-breeding	3.42~~1.7~~	**0.02~~0.01~~**	0.05~~0.02~~	0.0 - 0.2~~0.01 - 0.12~~	0.006~~0.003~~	0.017~~0.008~~	0.004 - 0.083~~0.002 - 0.041~~
Annual Total	81.1~~79.4~~	0.41~~**0.40**~~	1.14~~1.11~~	0.24 - 5.68~~0.24 - 5.56~~	0.140~~0.137~~	0.392~~0.384~~	0.08~~2~~3 - 1.962~~19~~
LCI							
Breeding	48.9	0.24	0.68	0.15 - 3.42	0.084	0.236	0.051 - 1.181
Non-breeding	2.42~~1.2~~	0.01~~0.01~~	0.03~~0.02~~	0.01 - 0.17 ~~0 - 0.08~~	0.004~~0.002~~	0.012~~0.006~~	0.003 - 0.059~~0.001 - 0.029~~
Annual Total	51.3~~50.1~~	0.26~~0.25~~	0.72~~0.70~~	0.15 - 3.59~~0.15 - 3.5~~	0.089~~0.086~~	0.248~~0.242~~	0.053 ~~0.052~~ - 1.240~~1.21~~
UCI							
Breeding	111.9	0.56	1.57	0.34 - 7.84	0.193	0.541	0.116 - 2.706
Non-breeding	4.71~~2.4~~	0.02~~0.01~~	0.07~~0.03~~	0.01 - 0.33~~0.01 - 0.16~~	0.008~~0.004~~	0.023~~0.011~~	0.005 - 0.114~~0.002 - 0.057~~

Bio-season	Abundance of adults apportioned to SPA (plus 2km buffer)	Estimated increase in mortality (breeding adults per annum)			% increase in baseline mortality (recent count)		
		50% displacement, 1% mortality	70% displacement, 2% mortality	30-70% displacement, 1-10% mortality	50% displacement, 1% mortality	70% displacement, 2% mortality	30-70% displacement, 1 – 10% mortality
Annual Total	116.6~~114.3~~	0.58~~0.57~~	1.63~~1.60~~	0.35 - 8.17~~0.34 – 8~~	0.201~~0.197~~	0.564~~0.553~~	0.121 ~~0.118~~ - 2.820 ~~2.763~~

~~Table 9.28: Range-based displacement mortalities during the operational and maintenance phases for puffin at FFC SPA based on the values advocated by SNCBs for the most recent counts (Aitken et al., (2017) Seabird Monitoring Programme)~~

~~Bio-season~~	~~Abundance of adults apportioned to SPA (plus 2km buffer)~~	~~Estimated increase in mortality (breeding adults per annum)~~		~~% increase in baseline mortality (recent count)~~	
		~~50% displacement, 1% mortality~~	~~30-70% displacement, 1-10% mortality~~	~~50% displacement, 1% mortality~~	~~30-70% displacement, 1 – 10% mortality~~
~~Breeding~~	~~78.9~~	~~0.4~~	~~0.2 – 5.5~~	~~0.136~~	~~0.082 – 1.909~~
~~Non-breeding~~	~~5.2~~	~~0.0~~	~~0.0 – 0.0~~	~~0.009~~	~~0.005 – 0.126~~
~~**Annual Total**~~	~~**84.1**~~	~~**0.4**~~	~~**0.2 – 5.5**~~	~~**0.145**~~	~~**0.087 – 2.035**~~

Table 9-55~~9.559-~~: Range-based displacement mortalities during the operational and maintenance phases for puffin at FFC SPA based on the values advocated by ~~SNCB~~ANCBs for the citation and most recent counts (Aitken et al., (2017) Seabird Monitoring Programme), with Natural England's preferred approach boldened. The lower confidence interval (LCI) and the upper confidence interval (UCI) are presented as requested by ~~SNCB~~ANCBs.

Bio-season	Abundance of adults apportioned to SPA (plus 2km buffer)	Estimated increase in mortality (breeding adults per annum)			% increase in baseline mortality (recent count)		
		50% displacement, 1% mortality	70% displacement, 2% mortality	30-70% displacement, 1-10% mortality	50% displacement, 1% mortality	70% displacement, 2% mortality	30-70% displacement, 1 – 10% mortality
Mean							
Breeding	141.2	0.71	**1.98**	0.42 - 9.88	0.244	0.683	0.146 - 3.414
Non-breeding	3.42~~1.7~~	0.02~~0.01~~	**0.05~~0.02~~**	0.0 - 0.2~~0.01 - 0.12~~	0.006~~0.003~~	0.017~~0.008~~	0.004 - 0.083~~0.002 - 0.041~~
Annual Total	144.6~~142.9~~	0.72~~0.71~~	**2.02~~2.00~~**	0.43 - 10.12~~0.43 - 10~~	0.250~~0.247~~	0.699~~0.691~~	0.15 - 3.496~~0.148 - 3.455~~
LCI							
Breeding	88.8	0.44	1.24	0.27 - 6.22	0.153	0.430	0.092 - 2.148
Non-breeding	2.42~~1.2~~	0.01~~0.01~~	0.03~~0.02~~	0.01 - 0.17 ~~0 - 0.08~~	0.004~~0.002~~	0.012~~0.006~~	0.003 - 0.059~~0.001 - 0.029~~
Annual Total	91.2~~90.0~~	0.46~~0.45~~	1.28~~1.26~~	0.27 - 6.39~~0.27 - 6.3~~	0.158~~0.155~~	0.441~~0.435~~	0.095 - 2.206~~0.093 - 2.177~~
UCI							
Breeding	203.5	1.02	2.85	0.61 - 14.25	0.351	0.984	0.211 - 4.921

Bio-season	Abundance of adults apportioned to SPA (plus 2km buffer)	Estimated increase in mortality (breeding adults per annum)			% increase in baseline mortality (recent count)		
		50% displacement, 1% mortality	70% displacement, 2% mortality	30-70% displacement, 1-10% mortality	50% displacement, 1% mortality	70% displacement, 2% mortality	30-70% displacement, 1 – 10% mortality
Non-breeding	4.71~~2.4~~	0.02~~0.01~~	0.07~~0.03~~	0.01 - 0.33~~0.01 – 0.16~~	0.008~~0.004~~	0.023~~0.011~~	0.005 - 0.114~~0.002 - 0.057~~
Annual Total	208.2~~205.9~~	1.04~~1.03~~	2.92~~2.88~~	0.62 - 14.58~~0.62 – 14.41~~	0.360~~0.356~~	1.007~~0.996~~	0.216 - 5.035~~0.213 - 4.978~~

Table 9-56~~9.569-9.29~~: Puffin displacement matrix at FFC SPA (array plus two km buffer), with light blue shading indicating the displacement range advocated by ~~SNCB~~ANCBs, and dark blue indicating the Applicant's approach.

Annual (2km Buffer)	Mortality Rate (%)												
Displaced (%)	1	2	5	10	20	30	40	50	60	70	80	90	100
10	0 ~~0 0~~	0 ~~0 0~~	0 ~~0 0~~	1 ~~1 1~~	2 ~~2 2~~	2 ~~2 3~~	3 ~~3 3~~	4 ~~4 4~~	5 ~~5 5~~	6 ~~6 6~~	6 ~~6 7~~	7 ~~7 8~~	8 ~~8 8~~
20	0 ~~0 0~~	0 ~~0 0~~	0 ~~1 1~~	2 ~~2 2~~	3 ~~3 3~~	5 ~~5 5~~	6 ~~6 7~~	8 ~~8 8~~	10 ~~10 10~~	11 ~~11 12~~	13 ~~13 13~~	15 ~~14 15~~	16 ~~16 17~~
30	0 ~~0 0~~	0 ~~0 1~~	1 ~~1 1~~	2 ~~2 3~~	5 ~~5 5~~	7 ~~7 8~~	10 ~~10 10~~	12 ~~12 13~~	15 ~~14 15~~	17 ~~17 18~~	19 ~~19 20~~	22 ~~21 23~~	24 ~~24 25~~
40	0 ~~0 0~~	1 ~~1 1~~	1 ~~2 2~~	3 ~~3 3~~	6 ~~6 7~~	10 ~~10 10~~	13 ~~13 13~~	16 ~~16 17~~	19 ~~19 20~~	23 ~~22 23~~	26 ~~25 27~~	29 ~~29 30~~	32 ~~32 33~~
50	0 ~~0 0~~	1 ~~1 1~~	1 ~~2 2~~	4 ~~4 4~~	8 ~~8 8~~	12 ~~12 13~~	16 ~~16 17~~	20 ~~20 21~~	24 ~~24 25~~	28 ~~28 29~~	32 ~~32 33~~	36 ~~36 38~~	41 ~~40 42~~
60	0 ~~0 1~~	1 ~~1 1~~	1 ~~2 3~~	5 ~~5 5~~	10 ~~10 10~~	15 ~~14 15~~	19 ~~19 20~~	24 ~~24 25~~	29 ~~29 30~~	34 ~~33 35~~	39 ~~38 40~~	44 ~~43 45~~	49 ~~48 50~~
70	1 ~~1 1~~	1 ~~1 1~~	2 ~~3 3~~	6 ~~6 6~~	11 ~~11 12~~	17 ~~17 18~~	23 ~~22 23~~	28 ~~28 29~~	34 ~~33 35~~	40 ~~39 41~~	45 ~~44 47~~	51 ~~50 53~~	57 ~~56 58~~
80	1 ~~1 1~~	1 ~~1 1~~	2 ~~3 3~~	6 ~~6 7~~	13 ~~13 13~~	19 ~~19 20~~	26 ~~25 27~~	32 ~~32 33~~	39 ~~38 40~~	45 ~~44 47~~	52 ~~51 53~~	58 ~~57 60~~	65 ~~63 67~~
90	1 ~~1 1~~	1 ~~1 2~~	2 ~~4 4~~	7 ~~7 8~~	15 ~~14 15~~	22 ~~21 23~~	29 ~~29 30~~	36 ~~36 38~~	44 ~~43 45~~	51 ~~50 53~~	58 ~~57 60~~	66 ~~64 68~~	73 ~~71 75~~
100	1 ~~1 1~~	2 ~~2 2~~	2 ~~4 4~~	8 ~~8 8~~	16 ~~16 17~~	24 ~~24 25~~	32 ~~32 33~~	41 ~~40 42~~	49 ~~48 50~~	57 ~~56 58~~	65 ~~63 67~~	73 ~~71 75~~	81 ~~79 84~~

Table 9-57~~9.579-57~~: Puffin displacement matrix at FFC SPA (array plus two km buffer), with light blue shading indicating the displacement range advocated by ~~SNCB~~ANCBs, and dark blue indicating Natural England’s preferred approach.

Annual (2km Buffer)	Mortality Rate (%)												
Displaced (%)	1	2	5	10	20	30	40	50	60	70	80	90	100
10	0 ~~0~~	0 ~~0~~	0 ~~1~~	1 ~~1~~	3 ~~3~~	4 ~~4~~	6 ~~6~~	7 ~~7~~	9 ~~9~~	10 ~~10~~	12 ~~11~~	13 ~~13~~	14 ~~14~~
20	0 ~~0~~	1 ~~1~~	1 ~~1~~	3 ~~3~~	6 ~~6~~	9 ~~9~~	12 ~~11~~	14 ~~14~~	17 ~~17~~	20 ~~20~~	23 ~~23~~	26 ~~26~~	29 ~~29~~
30	0 ~~0~~	1 ~~1~~	1 ~~2~~	4 ~~4~~	9 ~~9~~	13 ~~13~~	17 ~~17~~	22 ~~21~~	26 ~~26~~	30 ~~30~~	35 ~~34~~	39 ~~39~~	43 ~~43~~
40	1 ~~1~~	1 ~~1~~	2 ~~3~~	6 ~~6~~	12 ~~11~~	17 ~~17~~	23 ~~23~~	29 ~~29~~	35 ~~34~~	40 ~~40~~	46 ~~46~~	52 ~~51~~	58 ~~57~~
50	1 ~~1~~	1 ~~1~~	2 ~~4~~	7 ~~7~~	14 ~~14~~	22 ~~21~~	29 ~~29~~	36 ~~36~~	43 ~~43~~	51 ~~50~~	58 ~~57~~	65 ~~64~~	72 ~~71~~
60	1 ~~1~~	2 ~~2~~	3 ~~4~~	9 ~~9~~	17 ~~17~~	26 ~~26~~	35 ~~34~~	43 ~~43~~	52 ~~51~~	61 ~~60~~	69 ~~69~~	78 ~~77~~	87 ~~86~~
70	1 ~~1~~	2 ~~2~~	3 ~~5~~	10 ~~10~~	20 ~~20~~	30 ~~30~~	40 ~~40~~	51 ~~50~~	61 ~~60~~	71 ~~70~~	81 ~~80~~	91 ~~90~~	101 ~~100~~
80	1 ~~1~~	2 ~~2~~	3 ~~6~~	12 ~~11~~	23 ~~23~~	35 ~~34~~	46 ~~46~~	58 ~~57~~	69 ~~69~~	81 ~~80~~	93 ~~91~~	104 ~~103~~	116 ~~114~~
90	1 ~~1~~	3 ~~3~~	4 ~~6~~	13 ~~13~~	26 ~~26~~	39 ~~39~~	52 ~~51~~	65 ~~64~~	78 ~~77~~	91 ~~90~~	104 ~~103~~	117 ~~116~~	130 ~~129~~
100	1 ~~1~~	3 ~~3~~	4 ~~7~~	14 ~~14~~	29 ~~29~~	43 ~~43~~	58 ~~57~~	72 ~~71~~	87 ~~86~~	101 ~~100~~	116 ~~114~~	130 ~~129~~	145 ~~143~~

Flamborough and Filey Coast SPA – Gannet

~~648.~~718. Gannets were screened in for the O&M phase to assess the potential for an AEoI from displacement from the Project ~~array~~ WTG area in relation to the following conservation objectives for this species, as a feature of the FFC SPA (Document 7.2):

- Maintain the population of each of the qualifying features.

~~649.~~719. Based on the above the conservation objective for the FFC SPA the specific target for the gannet feature is as follows based on Natural England's case-specific advice (Natural England 2021):

- To maintain the size of the breeding population at a level which is above 8,469 breeding pairs (16,938 breeding adults), whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent. The latest count is 30,466 adults based on the 2023 survey (Butcher et al., 2023).

~~650.~~720. The Project ~~array~~ WTG area is located 9~~2.9~~3.5km from the FFC SPA, which is within the mean-maximum plus 1SD foraging distance of 315.2±194.2km (Woodward et al., 2019) and has therefore been screened in for the breeding season. In the non-breeding season, breeding gannets are not constrained by requirements to visit nests to incubate eggs or provision for chicks. It is therefore assumed that individuals will range more widely than during the breeding season, and therefore gannet has also been screened in for the non-breeding season. Gannets recorded during digital aerial surveys are therefore considered to come from a range of breeding colonies in the UK and further afield, as presented in Appendix 7.1.1.

~~651.~~721. The different bio-seasons for consideration of assessing potential risk from displacement on birds from FFC SPA includes the breeding season (March to September), the post-breeding migration bio-season (September to November) and the return migration bio-season (December to March), as defined by Furness (2015) (there is no migration free winter bio-season).

Breeding Bio-season

~~652.~~722. During the breeding bio-season, the number of gannets estimated to occur in the ~~array~~ WTG area and 2km buffer is ~~635~~ 554 (~~634.8~~554.2) individuals. Assuming the proportion adult birds in the array is 90~~3~~% (derived from the percentage of adults among all aged birds from site specific DAS), the total number of breeding adults in the array at risk of displacement is ~~589~~ 499 (~~588~~498.6~~.8~~) during the breeding bio-season.

~~653.~~723. Of these ~~589~~ 499 breeding adults, 100% are predicted to be breeding birds from FFC (Appendix 7.1.1). Therefore, ~~589~~ 499 breeding adults at risk of displacement are attributed to FFC SPA (Table 9.58~~Table 9.30~~). Assuming a displacement rate of 70% and a mortality rate of 1%, the consequent mortality is estimated at less than four (~~4.1~~3.5) breeding adults. However, based on advice from ~~SNCB~~ANCBs (MIG-Birds, 2022), a displacement range of 60% to 80% is also presented in Table 9.58~~Table 9.30~~.

~~654.~~724. Based on a citation population of 16,938 breeding adults and annual background mortality of 1,372 individuals, the addition of less than four predicted breeding adult mortalities would represent a 0.254~~98~~% increase in baseline mortality during the breeding bio-season.

~~655.~~725. As the population of gannets has increased significantly since the citation population count the potential impact on the population is more reasonably assessed against the latest population count undertaken in 2023, consisting of 30,466 individuals and an annual background mortality of 2,468 individuals. On this basis, this would represent a 0.141~~67~~% increase in baseline mortality during the breeding bio-season.

Non-breeding Bio-season

~~656.~~726. The mean-peak number of gannets estimated to occur in the ~~array~~ WTGarea and 2km buffer is estimated at ~~91~~ 69 (~~90~~69.0~~.5~~) and 496 (495.5) individuals during the return migration and the post-breeding migration bio-season, respectively.

~~657.~~727. On the basis that 6.2% of the gannets within the ~~array~~ WTG area are deemed to be breeding adults from FFC SPA during the return migration and 4.8% during the post-breeding migration (Appendix 7.1.1), the total abundance of breeding adults estimated to be displaced from the array plus 2km buffer is four (4.3) ~~5.6~~ during the return migration and 24 (2~~3~~4.0~~.8~~) during the post-breeding migration (Table 9.58~~Table 9.30~~).

~~658.~~728. Based on 70% displacement and 1% mortality, the total predicted consequent mortality from being displaced is estimated at less than one (0.0) individual during the return migration bio-season and less than one (0.2~~1~~) individual during the post-breeding migration bio-season. However, based on advice from ~~SNCB~~ANCBs (MIG-Birds, 2022), a displacement range of 60% to 80% is also presented in Table 9.58~~Table 9.30~~.

~~659.~~729. This consequent estimated mortality equates to an increase in baseline mortality of 0.001% in both the return-migration bio-season and 0.008% in the post-breeding bio-season based on the citation population. Increases to baseline mortality of 0.00~~1~~2 and 0.0~~0~~12~~7~~% relative to the most recent counts are predicted for both non-breeding bio-seasons.

~~660.~~730. This equates to a total consequent mortality from displacement across the entire non-breeding bio-season of less than one (0.2) breeding adult per annum. This represents an increase of 0.014~~08~~% in baseline mortality of the citation population and 0.008~~0~~% increase using the most recent count.

Annual Total

~~661.~~731. Across all bio-seasons, the number of gannets estimated to occur in the ~~array~~ WTG area and a 2km buffer is 1,~~221~~ 119 (1,~~221~~118.7~~.3~~) individuals, with ~~618~~ 527 (~~618~~527.1~~.4~~) being breeding adults from the FFC SPA. The total predicted consequent mortality from being displaced attributed to FFC SPA throughout the operational life of the Project is less than four (~~4.3~~3.7) breeding adult from FFC SPA per annum across all bio-seasons. Displacement consequent mortalities based on the range advocated by ~~SNCB~~ANCBs (60% displacement to 80% displacement, 1% mortality) are displayed in Table 9.58~~Table 9-~~ and Table 9.59~~Table 9-Table 9.30~~.

~~662.~~732. The predicted mortality of less than four breeding adults from FFC SPA per annum across all bio-seasons represents an increase in baseline mortality of 0.~~199~~269% when considering the citation population or an increase of 0.150~~75~~% when considering the recent colony count. This level of impact would be indistinguishable from natural fluctuations in the population.

~~663.~~733. Therefore, the potential for an AEoI to the conservation objectives of the gannet feature of FFC SPA in relation to disturbance and displacement effects in the O&M phase from the Project alone can be ruled out and therefore, subject to natural change, gannet will be maintained as a feature in the long-term.

Table 9-58~~9.589-9.30~~: Range-based displacement mortalities during the O&M phases for gannet at FFC SPA based on the values advocated by ~~S~~ANCBs for both citation population counts and most recent counts (Butcher et al., (2023) Seabird Monitoring Programme). The lower confidence interval (LCI) and the upper confidence interval (UCI) are presented as requested by ~~SNCB~~ANCBs.

Bio-season	Abundance of adults apportioned to SPA (plus 2km buffer)	Estimated increase in mortality (breeding adults per annum)		% increase in baseline mortality (citation count)		% increase in baseline mortality (recent count)	
		70% displacement, 1% mortality	60-80% displacement, 1~~-10~~% mortality	70% displacement, 1% mortality	60-80% displacement, 1~~-10~~% mortality	70% displacement, 1% mortality	60-80% displacement, 1~~-10~~% mortality
Mean							
B~~b~~reeding	498.8~~588.8~~	3.49~~4.1~~	2.99 - 3.99~~3.5 – 46.9~~	0.254~~0.190~~	0.109 - 0.291~~0.114 – 2.660~~	0.141~~0.167~~	0.061 - 0.162~~0.100 – 2.338~~
Post-breeding migration	24.0~~24.0~~	0.17~~0.2~~	0.14 - 0.19~~0.2 - 2.3~~	0.012~~0.008~~	0.005 - 0.014~~0.005 - 0.112~~	0.007~~0.007~~	0.003 - 0.008~~0.042 - 0.098~~
Return migration	4.3~~5.6~~	0.03~~0.0~~	0.03 - 0.03~~0.0 - 0.4~~	0.002~~0.001~~	0.001 - 0.003~~0.001 - 0.014~~	0.001~~0.001~~	0.001 - 0.001~~0.001 - 0.014~~
Annual Total	527.1~~618.5~~	3.69~~4.3~~	3.16 - 4.22~~3.7 – 49.4~~	0.269~~0.199~~	0.115 - 0.307~~0.171 – 2.786~~	0.150~~0.175~~	0.064 - 0.171~~0.105 - 2.450~~
LCI							
Breeding	284.4	1.99	1.71 - 2.28	0.145	0.062 - 0.166	0.081	0.035 - 0.092
Post-breeding migration	13.6	0.10	0.08 - 0.11	0.007	0.003 - 0.008	0.004	0.002 - 0.004

Bio-season	Abundance of adults apportioned to SPA (plus 2km buffer)	Estimated increase in mortality (breeding adults per annum)		% increase in baseline mortality (citation count)		% increase in baseline mortality (recent count)	
		70% displacement, 1% mortality	60-80% displacement, 1~~-10~~% mortality	70% displacement, 1% mortality	60-80% displacement, 1~~-10~~% mortality	70% displacement, 1% mortality	60-80% displacement, 1~~-10~~% mortality
Return migration	2.5	0.02	0.02 - 0.02	0.001	0.001 - 0.001	0.001	0.000 - 0.001
Annual Total	300.5	2.10	1.80 - 2.40	0.153	0.066 - 0.175	0.085	0.037 - 0.097
UCI							
Breeding	746.4	5.22	4.48 - 5.97	0.381	0.163 - 0.435	0.212	0.091 - 0.242
Post-breeding migration	37.2	0.26	0.22 - 0.30	0.019	0.008 - 0.022	0.011	0.005 - 0.012
Return migration	6.4	0.04	0.04 - 0.05	0.003	0.001 - 0.004	0.002	0.001 - 0.002
Annual Total	790.0	5.53	4.74 - 6.32	0.403	0.173 - 0.461	0.224	0.096 - 0.256

Table 9-59~~9.599-9.31~~: Gannet displacement matrix at FFC SPA (array plus 2km buffer), with light blue shading indicating the displacement range advocated by ~~SNCB~~ANCBs, and dark blue indicating the Applicant's approach.

Annual (2km Buffer)	Mortality Rate (%)												
Displaced (%)	1	2	5	10	20	30	40	50	60	70	80	90	100
10	1 ~~1~~	1 ~~1~~	3 ~~3~~	5 ~~6~~	11 ~~12~~	16 ~~19~~	21 ~~25~~	26 ~~31~~	32 ~~37~~	37 ~~43~~	42 ~~49~~	47 ~~56~~	53 ~~62~~
20	1 ~~1~~	2 ~~2~~	5 ~~6~~	11 ~~12~~	21 ~~25~~	32 ~~37~~	42 ~~49~~	53 ~~62~~	63 ~~74~~	74 ~~87~~	84 ~~99~~	95 ~~111~~	105 ~~124~~
30	2 ~~2~~	3 ~~4~~	8 ~~9~~	16 ~~19~~	32 ~~37~~	47 ~~56~~	63 ~~74~~	79 ~~93~~	95 ~~111~~	111 ~~130~~	126 ~~148~~	142 ~~167~~	158 ~~186~~
40	2 ~~2~~	4 ~~5~~	11 ~~12~~	21 ~~25~~	42 ~~49~~	63 ~~74~~	84 ~~99~~	105 ~~124~~	126 ~~148~~	148 ~~173~~	169 ~~198~~	190 ~~223~~	211 ~~247~~
50	3 ~~3~~	5 ~~6~~	13 ~~15~~	26 ~~31~~	53 ~~62~~	79 ~~93~~	105 ~~124~~	132 ~~155~~	158 ~~186~~	184 ~~216~~	211 ~~247~~	237 ~~278~~	264 ~~309~~
60	3 ~~4~~	6 ~~7~~	16 ~~19~~	32 ~~37~~	63 ~~74~~	95 ~~111~~	126 ~~148~~	158 ~~186~~	190 ~~223~~	221 ~~260~~	253 ~~297~~	285 ~~334~~	316 ~~371~~
70	4 ~~4~~	7 ~~9~~	18 ~~22~~	37 ~~43~~	74 ~~87~~	111 ~~130~~	148 ~~173~~	184 ~~216~~	221 ~~260~~	258 ~~303~~	295 ~~346~~	332 ~~390~~	369 ~~433~~
80	4 ~~5~~	8 ~~10~~	21 ~~25~~	42 ~~49~~	84 ~~99~~	126 ~~148~~	169 ~~198~~	211 ~~247~~	253 ~~297~~	295 ~~346~~	337 ~~396~~	379 ~~445~~	422 ~~495~~
90	5 ~~6~~	9 ~~11~~	24 ~~28~~	47 ~~56~~	95 ~~111~~	142 ~~167~~	190 ~~223~~	237 ~~278~~	285 ~~334~~	332 ~~390~~	379 ~~445~~	427 ~~501~~	474 ~~557~~
100	5 ~~6~~	11 ~~12~~	26 ~~31~~	53 ~~62~~	105 ~~124~~	158 ~~186~~	211 ~~247~~	264 ~~309~~	316 ~~371~~	369 ~~433~~	422 ~~495~~	474 ~~557~~	527 ~~618~~

Greater Wash SPA – Common scoter ~~and~~(ECC, Biogenic reef, ORCP and ANS)

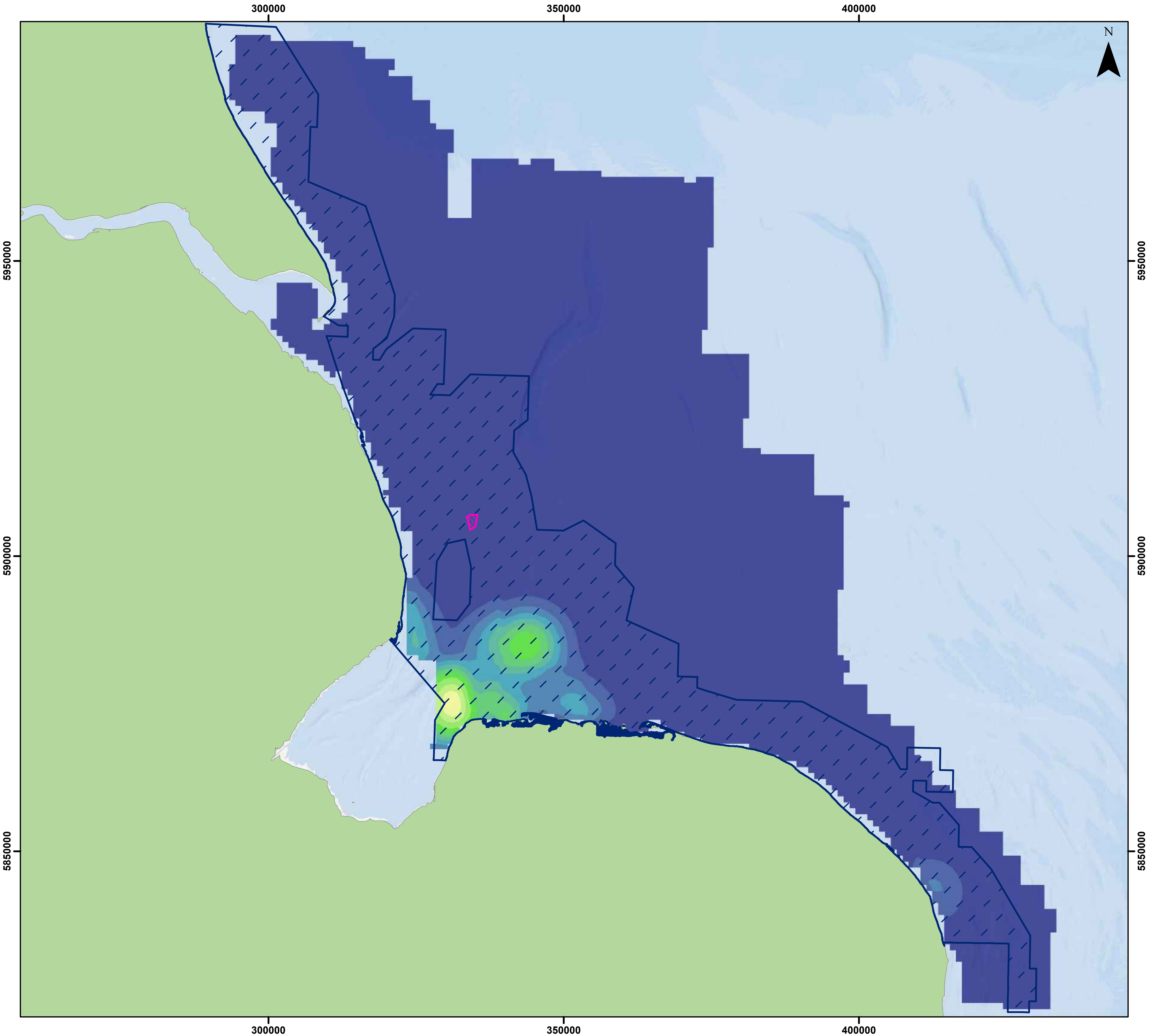
734. The conservation objective for the Greater Wash SPA is to ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the aims of the Wild Birds Directive, by maintaining or restoring:

- The extent and distribution of the habitats of the qualifying features;
- The structure and function of the habitats of the qualifying features;
- The supporting processes on which the habitats of the qualifying features rely;
- The population of each of the qualifying features; and
- The distribution of the qualifying features within the site.

735. The ECC route and ORCP locations directly overlap with the Greater Wash SPA. Common scoter are a designated feature at the Greater Wash SPA, therefore have potential connectivity with both the ECC and ORCP and have been screened in for the impact assessment for the operation and maintenance phase to assess the potential impacts from disturbance and displacement from the Project alone, due to their sensitivity to vessel presence during any maintenance or monitoring works and the presence of the ORCP. The ANS is 24km from the Greater Wash SPA, therefore there is no connectivity with the Greater Wash SPA and the ANS, therefore, has not been considered further.

736. Within their relevant representations, Natural England has requested a more detailed assessment of the impacts of the ORCP on common scoter, specifically during the O&M phase (RR-045 – F6). Therefore, an additional assessment has been undertaken to address these concerns.

737. The location of the ORCP is not identified as a highly utilized location for common scoter (Lawson *et al.,* 2016; Figure 9.4 indicates a hotspot of common scoter on the edge of the Wash (near the coast), not in close proximity to the ORCP. Based on data by Lawson *et al.* (2016), an average density of 0.011 and a maximum density of 0.013 common scoters per km^2 are estimated to be present within the ORCP. Due to the lack of spatial overlap between the common scoter feature and the ORCP, any potential impact from the presence of the ORCP will not adversely affect the integrity of the Greater Wash SPA in relation to its conservation objectives. In particular, the density of common scoter is very low and this species has much higher utilisation in other inshore areas of the SPA. Therefore, the presence of the ORCP will not cause any meaningful impacts to this species within the SPA.

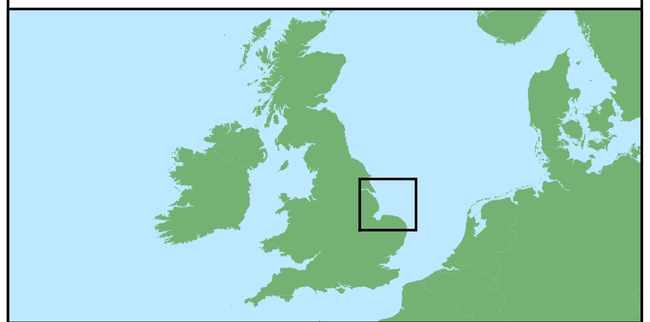


Legend

- ORCP Area
- Greater Wash SPA

Common Scoter Densities within the Greater Wash SPA (Lawson *et al.*, 2016) (birds per km^2)

- 0 - 0.7
- 0.7 - 2.34
- 2.34- 4.51
- 4.51- 7.22
- 7.22 - 10.51
- 10.51 - 14.83
- 14.83 - 21.34
- 21.34 - 31.05
- 31.05 - 40.72
- 40.72 - 56.58



Coordinate System: WGS 1984 UTM Zone 31N

0 20 40 km

Scale: 1:600,000

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Common Scoter Densities within the Greater Wash SPA

Figure 9.7

OUTER DOWSING OFFSHORE WIND

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738. Vessel traffic within the SPA during the operation and maintenance phase of the Project will be considerably lower than during the construction and decommissioning. It can therefore be inferred that there will be no AEoI of common scoter due to displacement effects from vessel traffic. In addition, following guidance from Natural England a best practice protocol to minimise disturbance will be adopted as set out within the Outline Vessel Management Plan (document reference 8.20). For example:

- Where possible, minimise vessel traffic between November and March inclusive.
- Restrict vessel movements where possible to existing navigation routes.
- ~~Avoid areas of higher densities of red-throated divers when using routes outside the established navigation routes is necessary.~~
- Avoid over-revving of engines to minimise noise disturbance.
- Briefing vessel crew on the purposes of the Working in Proximity to Wildlife document.

739. The inclusion of this mitigation will further reduce any potential impacts on on common scoter. Based on the evidence presented above, there is, therefore, no potential for an AEoI to the **population conservation objective of the common scoter feature of Greater Wash SPA in relation to disturbance and displacement effects in the Operation and Maintenance phase from the Project alone and therefore, subject to natural change, common scoter will be maintained as a feature in the long-term.**

740. In addition to maintaining the common scoter population, the conservation objectives also state to maintain the following:

- The extent and distribution of the habitats of the qualifying features;
- The structure and function of the habitats of the qualifying features; and
- The supporting processes on which the habitats of the qualifying features rely.

741. Furthermore, potential effects on prey species namely, ~~sandeels, herring and sprat,~~molluscs that are key prey species for various seabirds, and the habitats that support these species have been covered within Chapter 10: Fish and Shellfish Ecology and Chapter 9: Benthic Subtidal and Intertidal Ecology, respectively, as well as updates provided in the Environmental Report for the Offshore Restricted Build Area and Revision to the Offshore Export Cable Corridor (Document Reference 15.9)[8]. Impacts (including long-term or permanent habitat loss) were found to be non-significant therefore, it is reasonable to assume, regardless of the sensitivity of the receptor, any potential indirect effects on common scoter are extremely low.

[8] https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010130/EN010130-000985-15.9%20Environmental%20Report%20ORBA%20and%20Revision%20ECC.pdf

742. There is, therefore, no potential for AEoI from vessel traffic and presence of the ORCP in the O&M phase from ODOW with regard to the **extent and distribution, the structure and function, and the supporting processes on which the habitats of which the common scoter feature relies on, and therefore, subject to natural change, common scoter will be maintained as a feature in the long-term.**

743. The final conservation objective of the common scoter feature of the Greater Wash SPA is maintaining the distribution of the qualifying feature within the site.

744. As discussed above, the location of the ORCP is not identified as a highly utilized location for common scoter (Lawson *et al.*, 2016; Figure 9.4). Due to the lack of spatial overlap between the common scoter feature and the ORCP, any potential impact from the presence of the ORCP will not adversely affect the integrity of the Greater Wash SPA in relation to the distribution conservation objectives. In particular, the density of common scoter is very low and this species has much higher utilisation in other inshore areas of the SPA. Therefore, the presence of the ORCP will not cause any meaningful changes in distribution to this species within the SPA.

745. There is, therefore, no potential for AEoI from vessel traffic and presence of the ORCP in the O&M phase from ODOW with regard to the **distribution of the common scoter, and therefore, subject to natural change, common scoter will be maintained as a feature in the long-term.**

Greater Wash SPA Red-throated Diver (ECC, Biogenic reef, ORCP and ANS)

746. ~~Gannets~~Red-throated diver were screened in for the O&M phase to assess the potential for an AEoI from displacement from vessel presence during any maintenance or monitoring works and the presence of the ORCP ~~the Project array area~~ in relation to the following conservation objectives for this species, as a feature of the ~~FFC~~Greater Wash SPA (Document 7.2):

- Maintain or restore the population of each of the qualifying features; ~~and~~
- Maintain or restore the extent and distribution of the habitats of the qualifying features; and
- Maintain or restore ~~Maintain~~ the distribution of the qualifying features within the site.

747. Based on the above the conservation objective for the ~~FFC~~Great Wash SPA the specific target for the ~~gannet~~red-throated diver feature is as follows based on Natural England's case-specific advice (Natural England 2021):

- To maintain the size of the non-breeding population at a level which is above ~~8,469 breeding pairs (16,938~~1,407 ~~breeding adults)~~individuals, whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent; and
- To maintain the supporting habitat available for red-throated diver. ~~The latest count is 30,466 adults based on the 2023 survey (Butcher et al., 2023).~~

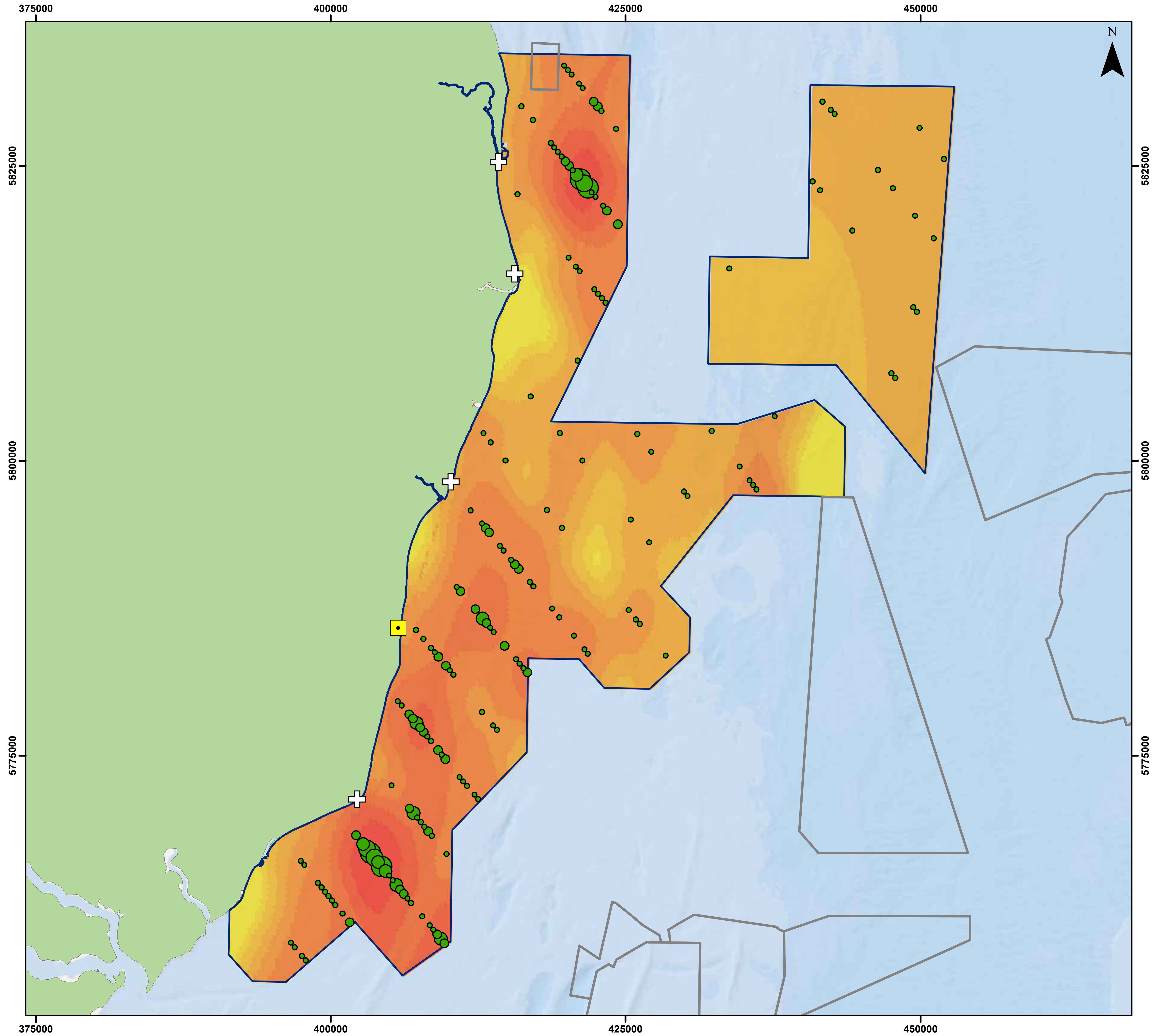
The ECC route and ORCP locations directly overlap with the Greater Wash SPA. Red-throated diver are a designated feature at the Greater Wash SPA, therefore have potential connectivity with both the ECC and ORCP and have been screened in for the impact assessment for the operation and maintenance phase to assess the potential impacts from disturbance and displacement from the Project alone, due to their sensitivity to vessel presence during any maintenance or monitoring works and the presence of the ORCP. The ANS is 24km from the Greater Wash SPA, therefore there is no connectivity with the Greater Wash SPA and the ANS, therefore, has not been considered further.

~~Red-throated diver and common scoter have been screened in for the impact assessment for the O&M phase to assess the impacts from disturbance and displacement from the Project alone. These species may be sensitive to disturbance from vessels required for the maintenance of offshore infrastructure in relation to those parts of the offshore ECC in shallower water, closer to the coast, where these species are most likely to be found, as well as vessel transits associated within maintenance activities within the wider Order Limits.~~

Within their relevant representations, Natural England ~~has~~ requested a more detailed assessment of the impacts of the ORCP on red-throated diver, specifically during the O&M phase (RR-045 – F6). Therefore, ~~an additional~~further detail has been added to the assessment ~~has been undertaken~~ to address these concerns, specifically the uncertainty surrounding the effects of static structures on red-throated diver. Additionally, the Applicant has consulted with Natural England ~~Natural England stated that~~over alternative locations for the ORCP outside the SPA and mitigation in terms of a reduction in size and separation of the ORCPs~~should be considered~~. The ORCPs had initially been located 6km from landfall. Following stakeholder feedback during the pre-application process, specifically in relation to feedback from Natural England, the location of the ORCPs was reviewed and they were moved further offshore, 12km from landfall. The ORCPs could not be moved further east, i.e. beyond the IDRBNR SAC (and also beyond the Greater Wash SPA) without compromising the ability of the project to deliver power to the onshore substation to achieve 1500MW export power.

748. Much evidence has been gathered as to the behaviour of red-throated diver in response to OWFs, with the majority of disturbance/displacement from OWFs attributed to the presence of WTG structures which are rotating. However, there is a relative paucity of peer reviewed studies and analysis of the potential for displacement of red-throated diver from static structures.

749. Based on evidence gathered from the Outer Thames Estuary SPA (also designated for red-throated diver), red-throated divers do not appear to be disturbed or displaced at a consistent distance by anthropogenic structures (Figure 9.6~~Figure XX~~ and Figure 9.7~~Figure XX)~~). Figure 9.6~~Figure XX~~ displays the locations of the Sizewell Nuclear Power Station which is along a transect surveyed during the Outer Thames Estuary SPA surveys (Irwin et al., 2019). A number of offshore structures associated with Sizewell Nuclear Power Station (Sizewell Rigs, assumed to be located at the end of the outfall/ intake pipe) are located in the nearshore environment, in proximity to the power plant. As shown in Figure 9.6~~Figure XX~~, red-throated diver were recorded in proximity to these locations, despite the close proximity to the power plant and associated structures. Further evidence is provided from vantage point surveys undertaken to inform the assessment of disturbance and displacement of red-throated diver from Sizewell C Nuclear Power Station which identified red-throated diver within 500m of the structures. Additionally, the Gunfleet lighthouse is also located within the Outer Thames Estuary SPA (Figure 9.7~~Figure XX~~). Despite this structure being over 20m in height, a medium to high density of red-throated diver was recorded within a 2km buffer of the structure.



Legend

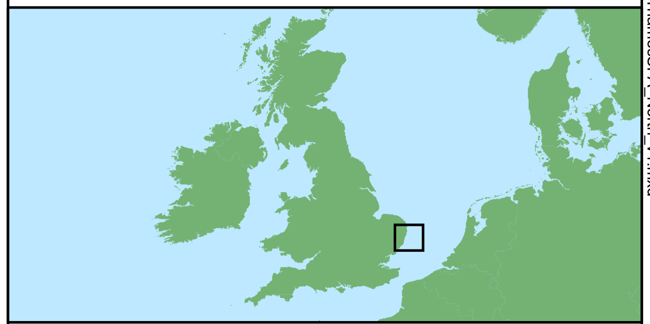
- Outer Thames SPA
- Offshore Wind Farm Boundaries
- Sizewell Nuclear Power Station
- Lighthouse

Red-throated Divers Count (2018) (Jenks) (Irwin *et al.*, 2019)

- 1 - 2
- 3 - 5
- 6 - 10
- 11 - 15
- 16 - 20

Bird Densities (birds per km^2)

- 0.01 - 0.1
- 0.11 - 0.2
- 0.21 - 0.5
- 0.51 - 1
- 1.01 - 2
- 2.01 - 5
- 5.01 - 10
- 10.01 - 20
- 20.01 - 50



Coordinate System: WGS 1984 UTM Zone 31N

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Scale: 1:300,000

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Density of Red-throated Diver in the Northern Section of the Outer Thames Estuary SPA in comparison to Anthropogenic Structures

Figure 9.5

OUTER DOWSING OFFSHORE WIND

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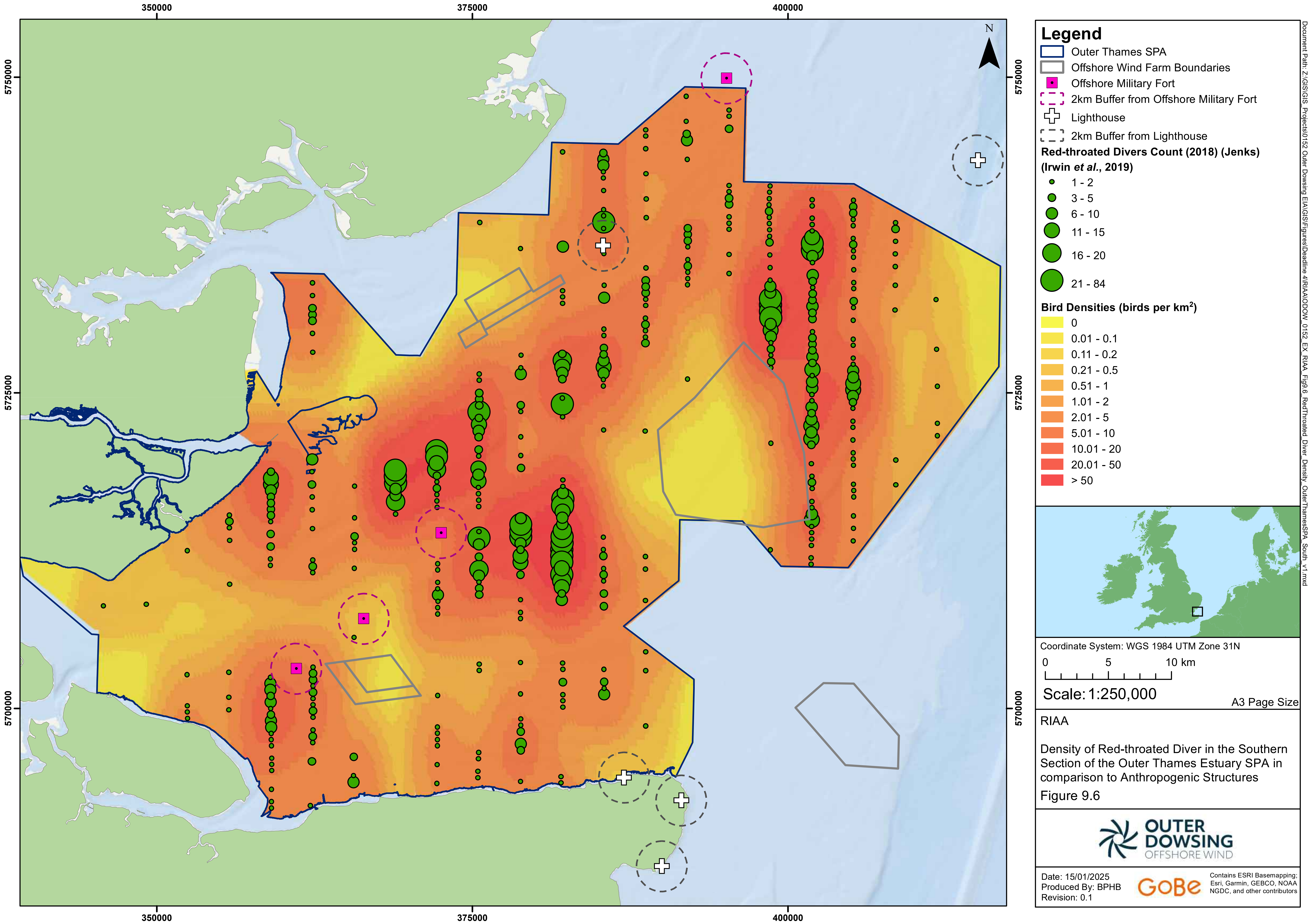
Figure 9-6~~9-69.6~~. Density of red-throated diver in the Northern section of the Outer Thames Estuary SPA in comparison to anthropogenic structures



350000
375000
400000
5750000
5725000
5700000
N
Legend
Outer Thames SPA
Offshore Wind Farm Boundaries
Offshore Military Fort
2km Buffer from Offshore Military Fort
Lighthouse
2km Buffer from Lighthouse
Red-throated Divers Count (2018) (Jenks) (Irwin et al., 2019)
1 - 2
3 - 5
6 - 10
11 - 15
16 - 20
21 - 84
Bird Densities (birds per km²)
0
0.01 - 0.1
0.11 - 0.2
0.21 - 0.5
0.51 - 1
1.01 - 2
2.01 - 5
5.01 - 10
10.01 - 20
20.01 - 50
> 50
Coordinate System: WGS 1984 UTM Zone 31N
0 5 10 km
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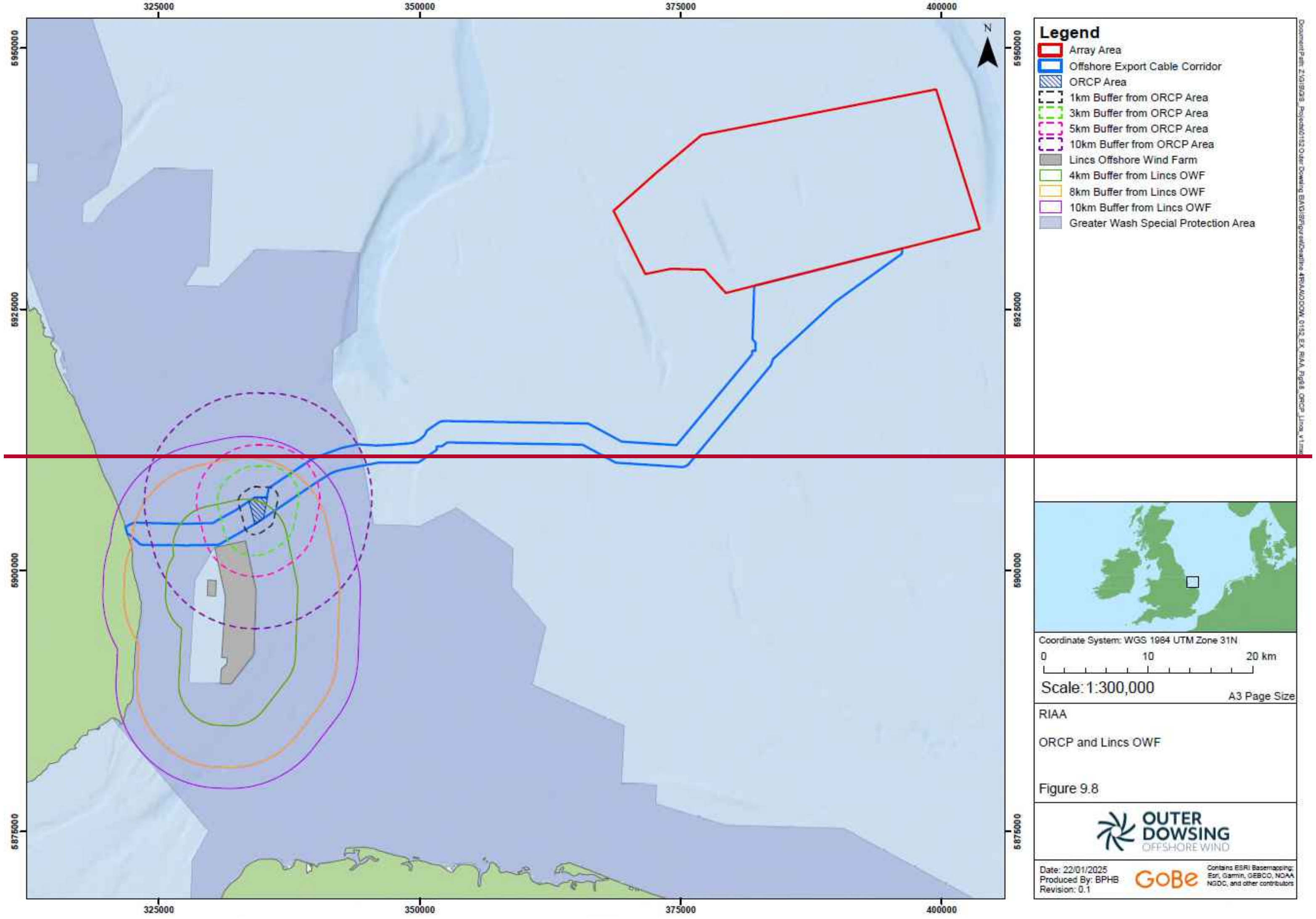
Density of Red-throated Diver in the Southern Section of the Outer Thames Estuary SPA in comparison to Anthropogenic Structures
Figure 9.6
OUTER DOWSING OFFSHORE WIND
Date: 15/01/2025
Produced By: BPHB
Revision: 0.1
GoBe
Contains ESRI Basemapping; Esri, Garmin, GEBCO, NOAA NGDC, and other contributors



~~Figure 9-8 ORCP and Lincs OWF areas including buffers.~~

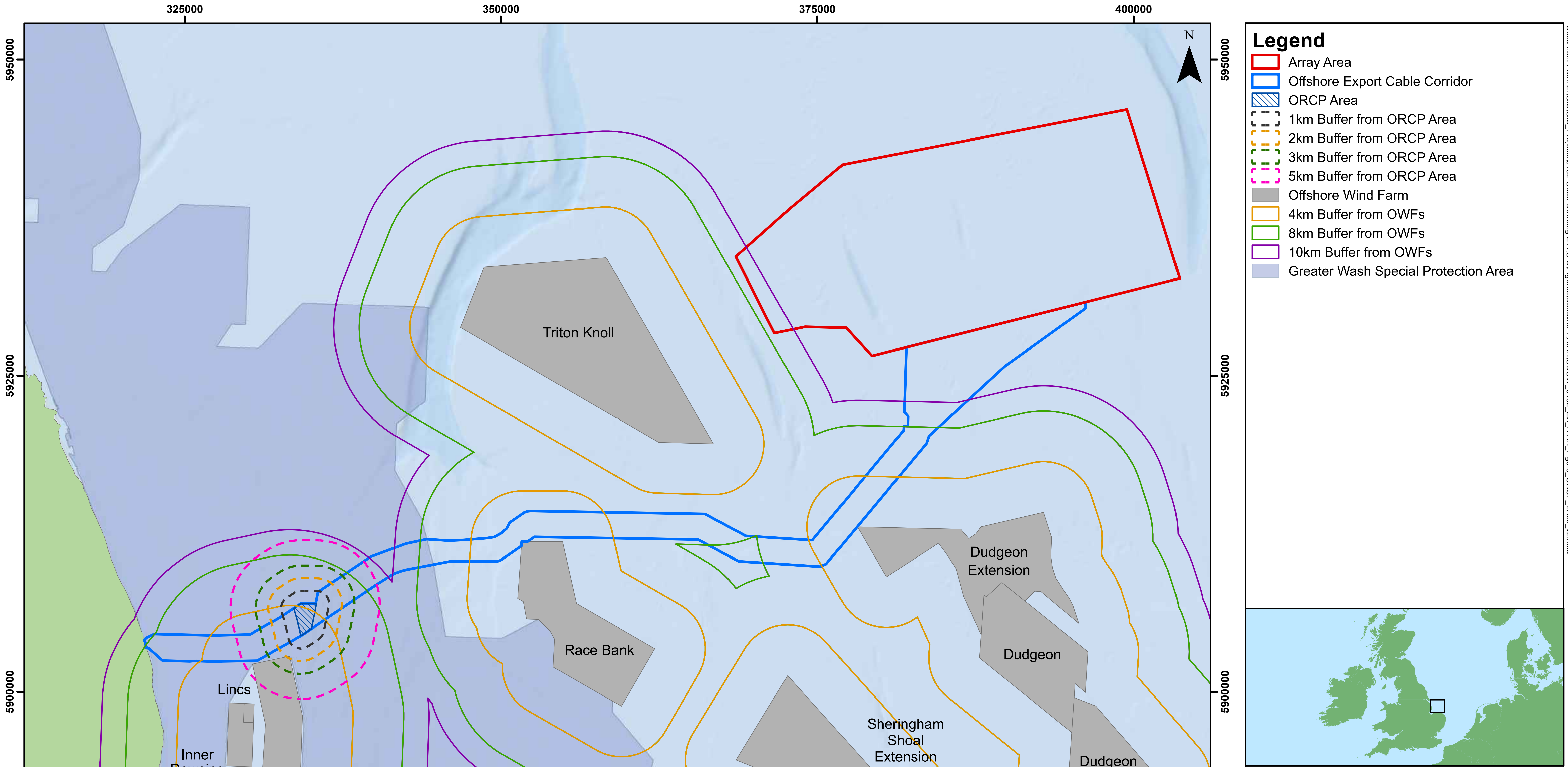
750. Moreover, three offshore military forts (or groups of forts) are located within the Outer Thames Estuary SPA (Figure 9.7~~Figure XX~~). The middle fort is located within the busy Thames shipping lane (marked by buoys and leading out of the Thames Estuary). The low density of red-throated diver in the area is likely to be due to the shipping lane rather than the fort itself. Figure 9.7~~Figure XX~~ shows a reduction of birds around the most westerly fort where it overlaps the shipping corridor in the north. However, to the south of the fort, medium densities of red-throated divers are recorded along the transect line and well within a 2km buffer from the structure. Close to the most easterly fort shown on Figure 9.7~~Figure XX~~ there is a medium density of red-throated diver, despite also being in close proximity to a shipping lane (marked by buoys).

751. Based on the evidence presented above, it is concluded that the presence of the ORCP is unlikely to negatively impact the distribution of red-throated~~ diver during all stages of the Project~~. It is also important to note that, with the removal of the northern ORCP area, the ORCPs will be positioned within the southern ORCP area which is closer to the Lincs ~~offshore wind farm~~OWF.~~ (Figure 9-8).~~ Therefore, there is already a level of baseline disturbance within the area.

752. As such, whilst no measurable displacement effect is predicted from the presence of the ORCPs, were a small-scale effect to occur then it is considered that any displacement from the ORCPs would fall wholly within the existing displacement effects from the Lincs offshore wind farm and would not be additional to ongoing impacts. Moreover, in order to give further comfort to Natural England that there will be no disturbance, the Applicant has proposed reducing the height of the ORCP from 90m to 52m (subject to the acceptance of a change request). ~~with regards to minimising the potential disturbance, the height of the ORCP has been reduced from 90 m to 59.2 m. Nevertheless, b~~Based on Natural England's request for detailed assessment of the impacts of the ORCP on red-throated diver (RR-045 – F6), further consideration is provided below.

753. On a precautionary basis, an assessment has been undertaken on the potential displacement mortalities from the ORCP. Based on a 2 km buffer (deemed artificially precautionary by the Applicant based on the review of evidence presented above). Based on data on red-throated diver densities presented by Lawson *et al.* (2016), an average density of 0.4 birds/km^2 are estimated to be present within the ORCP plus a 2 km buffer. Based on a 2 km buffer around the ORCP, the area of potential disturbance was calculated to be circa 30.0 km^2.

754. Based on the average density of 0.4 birds/km^2, and the total disturbance of area of circa 30.0 km^2, a total of 13 (12.8) red-throated divers are at potential risk of displacement. Based on a displacement rate of 100% and a mortality rate of 1%, this results in a predicted mortality of less than one (0.1) birds per annum. Considering a displacement range of 90% to 100% and a mortality range of 1% to 10%, the consequent range of potential mortality is estimated between 0.1 to 1.3 birds. It is noted that 10% mortality from the operation of the ORCP is extremely unlikely given the size of the structure in comparison to the size of an operational OWF, for which 10% is also deemed highly over-precautionary.



Coordinate System: WGS 1984 UTM Zone 31N

0 10 20 km

Scale: 1:300,000

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ORCP and Lincs OWF

Figure 9.8

OUTER DOWSING OFFSHORE WIND

Date: 22/01/2025
Produced By: BPHB
Revision: 0.1

GoBe

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755. Considering the impact against the citation population of 1,407 individuals, with a background mortality of 330.4 individuals per annum, the addition of less than one (0.1) mortality per annum would represent a 0.039% increase in baseline mortality. Considering the more recent 2016 population count of 1,787 breeding adults (Lawson *et al*., 2016), with a background mortality of 419.7 individuals per annum, the addition of less than one (0.1) mortality would represent a 0.031% increase in baseline mortality. This level of impact is considered to make no material contribution to any changes in populations or baseline mortality.

756. Densities of birds in the ORCP area are anticipated to be lower than the densities described by Lawson *et al.* (2016) as these areas are located within 10 km of other operational OWF projects (e.g. Lincs OWF) where diver densities have been shown to be reduced (HiDef, 2017) (see paragraph 592). As such, a proportion of the birds occupying areas impacted by the existing OWF and associated buffers will already have been displaced, and therefore potential displacement impacts from the O&M of the ECC and ORCP are expected to be lower, and therefore negligible, based on the baseline disturbance from Lincs OWF.

757. Therefore, even when utilising an artificially precautionary approach, the potential mortalities of red-throated diver are negligible, as would be even lower than 0.1 birds.

758. Vessel traffic within the SPA during the O&M phase of the Project will be considerably lower than during the C&D. It can therefore be inferred that there will be no AEoI of red-throated diver due to displacement effects from vessel traffic. In addition, following guidance from Natural England a best practice protocol to minimise disturbance on red-throated divers will be adopted as set out within the Outline Vessel Management Plan (document reference 8.20). For example:

- Where possible, minimising vessel traffic during the most sensitive time in October to March;
- Where possible, restricting vessel movement to existing navigation routes;
- Where possible, maintaining direct transit routes, minimising transit distances through areas used by key species;
- Where possible, avoidance of rafting birds when necessary to go outside of navigational routes, and where possible avoid disturbance to areas with consistently high diver density;
- Avoidance of over-revving engines to minimise noise disturbance; and
- Briefing of vessel crew on the purpose and implications of these vessel management practices.

759. The Applicant recognises that the ORCP is located approximately 4 km from the Lincs OWF. If the presence of the Lincs OWF has a displacement effect on red-throated divers, the Applicant considers that the scope for the ORCP to have a displacement effect is substantially lower~~reduced~~. If there is no displacement or there is evidence of habituation to the Lincs OWF, the Applicant considers that this would also be the case for the ORCP.

760. The inclusion of this mitigation will further reduce any potential impacts on ~~common scoter and r~~red-throated diver. Based on the evidence presented above, ~~T~~there is, therefore, no potential for an AEoI to the **population conservation objective of the red-throated diver feature of Greater Wash SPA in relation to disturbance and displacement effects in the Operation and Maintenance phase from the Project alone and therefore, subject to natural change, red-throated diver will be maintained as a feature in the long-term.**

761. In addition to maintaining the red-throated diver population, the conservation objectives also state to maintain the following:

- The extent and distribution of the habitats of the qualifying features;
- The structure and function of the habitats of the qualifying features; and
- The supporting processes on which the habitats of the qualifying features rely.

762. As discussed within the construction and decommissioning assessment, red-throated diver are opportunistic feeders with a diet composed primarily of fish supplemented with crustaceans, polychaetes molluscs and aquatic insects (Madsen, 1957; Palmer, 1962; Kleinschmidt *et al.,* 2019). As such this species is considered to have a reasonably varied diet. Therefore, the adaptability of red-throated diver foraging behaviours, changes to prey species and abundance and availability is likely to cause minimal impact to foraging habitat use.

763. Furthermore, potential effects on prey species namely, sandeels, herring and sprat, that are key prey species for various seabirds, and the habitats that support these species have been covered within Chapter 10: Fish and Shellfish Ecology and Chapter 9: Benthic Subtidal and Intertidal Ecology, respectively, as well as updates provided in the Environmental Report for the Offshore Restricted Build Area and Revision to the Offshore Export Cable Corridor (Document Reference 15.9)[9]. Impacts (including long-term or permanent habitat loss) were found to be non-significant therefore, it is reasonable to assume, regardless of the sensitivity of the receptor, any potential indirect effects on red-throated diver are extremely low.

764. There is, therefore, no potential for AEoI from vessel traffic and presence of the ORCP in the O&M phase from ODOW with regard to the **extent and distribution, the structure and function, and the supporting processes on which the habitats of which red-throated diver features rely on, and therefore, subject to natural change, red-throated diver will be maintained as a feature in the long-term.**

765. The final conservation objective of the red-throated diver feature of the Greater Wash SPA is maintaining the distribution of the qualifying feature within the site.

766. Based on the review of potential displacement of static structures above, combined with the use of mitigation measures (vessel best practice), which aim to avoid disturbance during peak months of red-throated diver presence, it is concluded that there will be no significant disturbance to red-throated diver during the operation and maintenance of the ORCP.

[9] https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010130/EN010130-000985-15.9%20Environmental%20Report%20ORBA%20and%20Revision%20ECC.pdf

767. Additionally, there is already baseline disturbance from the Lincs OWF. The displacement impacts on red-throated diver that will occur due to the operation and maintenance of the export cable and ORCP within the Greater Wash SPA are low in magnitude, temporary and reversible in nature.

768. There is, therefore, no potential for AEoI from vessel traffic and presence of the ORCP in the O&M phase from ODOW with regard to the distribution of the red-throated divers, and therefore, subject to natural change, red-throated diver will be maintained as a feature in the long-term.

~~664. Considering there are operational windfarms within 10km of the ORCP areas, any disturbance from the physical presence of the unmanned ORCP structure, which is considerably smaller than an operational WTG and has no moving parts, is assumed to be de minimis. Instead, the principal impacts to these species during the O&M phase are anticipated to be from vessels carrying out maintenance activity or transiting back-and-forth to the array area along well established and frequently used routes. Given that vessel numbers during the O&M phase are considerably lower than during construction (Section 9.3.1.4), any predicted impacts are also estimated to be considerably lower.~~

~~665. In addition, as mentioned in the construction and decommissioning section (Paragraphs 545 - 570), the effective areas over which displacement of red-throated diver or common scoter could occur within the Greater Wash SPA due to operational phase displacement impacts from vessel traffic are negligible relative to the overall available habitat.~~

~~**666. There is, therefore, no potential for an AEoI to the conservation objective of the red-throated diver or common scoter as features of Greater Wash SPA in relation to disturbance and displacement effects in the O&M phase from the Project alone and therefore, subject to natural change, these features will be maintained in the long-term.**~~

Non-breeding disturbance and displacement impacts to Scottish SPAs

~~667.~~769. Auks (guillemot, razorbill and puffin) and gannet from Scottish SPAs have been screened in for the assessment of the O&M phase to assess the impacts from disturbance and displacement from the Project alone during the non-breeding bio-season Table 9.60~~Table 9.32~~.

~~668.~~770. For ease of reading, the results of the assessments can be found for all relevant SPAs for each species in the following sections. The full range of impacts have been assessed against the citation and most recent SPA count.

Guillemot

~~669.~~771. Guillemot were assessed during the non-breeding bio-season at the following Scottish SPAs (Table 9.60~~Table 9.32~~). The non-breeding season population size for guillemot in the UK North Sea & Channel waters is predicted to be 1,617,305~~6~~ birds. The predicted displacement consequent mortalities during the non-breeding season for each SPA are laid out in Table 9.60~~Table 9.32~~ on the basis that the Project's estimated impact can be apportioned to each relevant SPA in line with the SPA colony sizes within Furness (2015) (as set out in the apportioning Appendix 7.1.1). The level of impact at all these Scottish SPAs from the Project alone would be indistinguishable from natural fluctuations in the population.

~~670.~~**772. Therefore, the potential for an AEoI to the conservation objectives of the guillemot feature at all of these SPAs in relation to displacement consequent mortality during the O&M phase from the Project alone can be ruled out and therefore, subject to natural change, guillemot will be maintained as a feature in the long-term.**

Table 9-60~~9.609~~ ~~9.32~~: Guillemot displacement impacts apportioned to Scottish SPAs. The ~~full range of~~ displacement mortality is based on 50% displacement and 1% mortality with the Natural England approach presented in brackets ~~with a central value based on 50% displacement and 1% mortality~~ based on ~~(~~70% displacement and 2% mortality~~)~~.

Special Protection Area	Apportioned displacement mortality	Citation population (inds)	Increase to (citation) baseline mortality	Recent population (inds)	Increase to (recent) baseline mortality
Buchan Ness to Collieston Coast SPA	0.6 (0.8)~~0.67 (0.44 – 10.08.3)~~	17,280	0.~~066~~ 056 (0.073~~0.038 - 0.949~~)	29,187	0.~~039~~ 033 (0.043~~0.022 - 0.562~~)
Calf of Eday SPA	0.2 (0.3)~~0.3 (0.2 – 3.54.3)~~	12,645	0.03~~9~~3 (0.042~~0.026 - 0.557~~)	5,504	0.075~~89~~ (0.097~~0.060 - 1.281~~)
Copinsay SPA	0.2 (0.3)~~0.23 (0.12 - 3.18)~~	29,450	0.012~~7~~ (0.016~~0.011 - 0.212~~)	8,151	0.~~060~~ 045 (0.058~~0.040 - 0.764~~)
East Caithness Cliffs SPA	4.2 (5.5)~~45.2 (2.5 - 59.53.1 - 72.3)~~	106,700	0.~~080~~ 065 (0.085~~0.048 - 1.111~~)	149,228	0.~~057~~ 047 (0.061~~0.034 - 0.794~~)
Fair Isle SPA	0.5 (0.7)~~0.56 (0.34 – 8.97.3)~~	32,300	0.~~030~~ 026 (0.034~~0.020 - 0.452~~)	14,906	0.~~066~~ 057 (0.075~~0.044 - 0.979~~)
Forth Islands (UK) SPA	0.7 (1.0)~~0.89 (0.5 – 12.810.5)~~	32,000	0.~~046~~ 039 (0.050~~0.026 - 0.656~~)	25,355	0.~~058~~ 049 (0.063~~0.032 - 0.828~~)
Foula SPA	0.7 (0.9)~~0.7.8 (0.45 - 119.3)~~	37,500	0.~~035~~ 029 (0.038~~0.022 - 0.494~~)	5,763	0.~~228~~ 189 (0.245~~0.142 - 3.214~~)
Fowlsheugh SPA	1.3 (1.8)~~1.74 (0.81.0 – 23.419.2)~~	56,450	0.040~~9~~ (0.052~~0.029 – 0.680~~)	68,837	0.0~~40~~33 (0.042~~0.024 - 0.557~~)
Hermaness, Saxa, Vord and Valla Field SPA	0.2 (0.2)~~0.2 (0.1 – 2.63.1)~~	25,000	0.012~~3~~ (0.016~~0.007 – 0.203~~)	2,293	0.~~143~~ 132 (0.171~~0.071 - 2.216~~)
Hoy SPA	0.2 (0.3)~~0.3 (0.2 – 4.3.5)~~	26,800	0.015~~8~~ (0.020~~0.012 – 0.263~~)	12,634	0.03~~9~~3 (0.042~~0.026 - 0.558~~)
Marwick Head SPA	0.4 (0.6)~~0.45 (0.3 – 7.56.2)~~	37,700	0.~~022~~ 019 (0.025~~0.013 – 0.326~~)	9,552	0.~~086~~ 076 (0.099~~0.051 - 1.287~~)
North Caithness Cliffs SPA	1.8 (2.4)~~2.31.9 (1.1 4 – 31.9 26.2)~~	38,300	0.080~~98~~ (0.104~~0.060 – 1.365~~)	18,018	0.~~209~~ 171 (0.222~~0.127 - 2.902~~)

Special Protection Area	Apportioned displacement mortality	Citation population (inds)	Increase to (citation) baseline mortality	Recent population (inds)	Increase to (recent) baseline mortality
Noss SPA	0.6 (0.8)~~0.67 (0.4 – 108.3)~~	38,970	0.025~~9~~ (0.032~~0.017 – 0.421~~)	23,733	0.041~~8~~ (0.053~~0.028 - 0.691~~)
~~Outer Firth of Forth and St Andrew's Complex SPA~~	0.2 (0.3)~~0.9 (0.5 – 12.3)~~	~~28,123~~	~~0.052 (0.029 – 0.717)~~	~~-~~	~~-~~
Rousay SPA	0.2 (0.3)~~0.32 (0.12 – 3.54.2)~~	10,600	0.~~046~~038 (0.050~~0.031 – 0.650~~)	~~5,911~~6,611	0.061~~74~~ (0.080~~0.050 - 1.041~~)
St Abb's Head SPA	1.1 (1.5)~~1.14 (0.78 – 15.919.3)~~	31,750	0.059~~72~~ (0.076~~0.041 – 0.997~~)	-~~42,905~~	-~~0.053 (0.031 - 0.737)~~
Sumburgh Head SPA	0.2 (0.2)~~0.2 (0.1 – 3.22.7)~~	16,000	0.019~~20~~ (0.025~~0.010 – 0.328~~)	9,368	0.03~~5~~3 (0.043~~0.017 - 0.560~~)
Troup, Pennan and Lion's Heads SPA	0.4 (0.6)~~0.45 (0.3 – 7.46.1)~~	44,600	0.016~~8~~ (0.021~~0.011 – 0.272~~)	23,801	0.030~~4~~ (0.039~~0.021 - 0.510~~)
West Westray	1.3 (1.8)~~1.46 (1.00.8 – 23.18.90))~~	42,150	0.053~~62~~ (0.068~~0.039 - 0.895~~)	24,586	0.090~~107~~ (0.117~~0.067 - 1.534~~)

9.3.3.2 Razorbill

~~671.~~773. Razorbill were assessed during the winter season and the migration season at the Scottish SPAs listed in Table 9.61~~Table 9.33~~. The UK North Sea and English Channel razorbill population is estimated to be 218,621~~2~~ during the winter season and 591,87~~4~~5 during the migration season. The anticipated displacement consequent mortalities for each SPA summed for the full non-breeding bio-season are outlined in Table 9.61~~Table 9.33~~. It has been assumed that the Project's predicted impact can be apportioned to each relevant SPA in line with the SPA colony size within Furness (2015) (Appendix 7.1.1). The level of impact at all these Scottish SPAs would be indistinguishable from natural population fluctuations.

~~672.~~ **Therefore, the potential for an AEoI to the conservation objectives of the razorbill feature at all these SPAs in relation to displacement consequent mortalities during the O&M phase from the project alone can be ruled out and therefore, subject to natural change, razorbill will be maintained as a feature in the long-term.**

~~673.~~774.

Table 9-61~~9.619-9.33~~: Razorbill displacement impacts apportioned to Scottish SPAs. The displacement mortality is based on 50% displacement and 1% mortality with the Natural England approach presented in brackets based on 70% displacement and 2% mortality.

Special Protection Area	Apportioned displacement mortality~~(50:1)~~	Citation population (inds)	Increase to (citation) baseline mortality	Recent population (inds)	Increase to (recent) baseline mortality
St Abb's Head SPA	0.2 (0.5~~0.1 - 2.6~~)	2,180	0.0~~8~~79 (0.221~~0.044 - 1.136~~)	2,683	0.071 (0.179~~0.035 - 0.923~~)
East Caithness Cliffs SPA	~~1.9~~ 1.9 (5.2~~1.2 – 27.0~~)	15,800	0.~~115~~ 028 (0.312~~0.072 - 1.627~~)	30,042	0.~~060~~ 021 (0.164~~0.038 - 0.856~~)
Fair Isle SPA	0.1 (0.4~~0.1 - 1.9~~)	3,400	0.0~~2~~36~~8~~ (0.102~~0.028 - 0.532~~)	1,217	0.~~078~~ 102 (0.284~~0.078 - 1.487~~)
Forth Islands (UK) SPA	0.4~~4~~ (1.1~~0.2 - 5.7~~)	1,400	0.264 ~~272~~ (0.740~~0.136 - 3.878~~)	5,845	0.063~~5~~ (0.177~~0.033 - 0.929~~)
Foula SPA	0.1~~1~~ (0.2~~0.0 - 0.8~~)	6,200	0.0~~1~~08~~5~~ (0.023~~0.000 – 0.123~~)	474	0.~~201~~ 107 (0.299~~0.000 – 1.607~~)
Fowlsheugh SPA	0.5 (1.5~~0.3 – 7.6~~)	5,800	0.08~~2~~6 (0.240~~0.049 – 1.248~~)	12,414	0.0~~38~~40 (0.112~~0.023 – 0.583~~)
North Caithness Cliffs SPA	0.2 (0.7~~0.1 – 3.5~~)	4,000	0.0~~4~~57~~8~~ (0.161~~0.024 – 0.833~~)	3,503	0.066~~54~~ (0.184~~0.027 – 0.952~~)
Troup, Pennan and Lion's Heads SPA	0.3 (0.7~~0.2 – 3.8~~)	4,800	0.0~~6~~51~~0~~ (0.143~~0.040 – 0.754~~)	2,993	0.0~~9~~82~~5~~ (0.230~~0.064 – 1.209~~)

Special Protection Area	Apportioned displacement mortality~~(50:1)~~	Citation population (inds)	Increase to (citation) baseline mortality	Recent population (inds)	Increase to (recent) baseline mortality
West Westray	0.1 (0.2~~0.0 – 1.1~~)	1,946	0.0~~4~~13~~9~~ (0.107~~0.000 - 0.538~~)	955	0.078~~100~~ (0.218~~0.000 - 1.097~~)

9.3.3.3 Puffin

~~674.~~775. Puffin were assessed during the non-breeding bio-seasons at the following Scottish SPAs (Table 9.62~~Table 9.34~~). The puffin population during the non-breeding bio-season in the UK North Sea and English Channel is predicted to be 231,~~975~~958. The displacement consequent mortalities estimated for each SPA during the non-breeding season are presented in Table 9.62~~Table 9.34~~, on the basis that the predicted impact can be apportioned to each relevant SPA in line with the SPA colony count within Furness (2015) (Appendix 7.1.1). The level of impact at all these Scottish SPAs is less than 0.05% increase in baseline mortality, therefore the contribution from the Project is deemed to have no material contribution to the natural mortality rate of the population.~~The level of impact at all these Scottish SPAs would be indistinguishable from the natural fluctuations in populations.~~

~~675.~~776. **Therefore, the potential for an AEoI to the conservation objectives of the puffin feature at all these SPAs in relation to displacement consequent mortalities during the O&M phase from the Project alone can be ruled out and therefore, subject to natural change, puffin will be maintained as a feature in the long-term.**

Table 9-62~~9.629-9.34~~: Puffin displacement impacts apportioned to Scottish SPAs. The displacement mortality is based on 50% displacement and 1% mortality with the Natural England approach presented in brackets base on 70% displacement and 2% mortality.

Special Protection Area	Apportioned displacement mortality~~(50:1)~~	Citation population (inds)	Increase to (citation) baseline mortality	Recent population (inds)	Increase to (recent) baseline mortality
Fair Isle SPA	0.2~~3~~ (0.5~~0.2 – 4.1~~)	23,000	0.009~~14~~ (0.025~~0.009 – 0.190~~)	6,666	0.~~048~~030 (0.085~~0.032 – 0.654~~)
Forth Islands (UK) SPA	1.1~~1.7~~ (3.1)~~1.0 – 23.9)~~	28,000	0.~~065~~042 (0.118~~0.038 – 0.908~~)	124,462	0.~~015~~009 (0.027~~0.009 – 0.204~~)
Foula SPA	0.4~~0.6~~ (1.1~~0.4 – 8.6~~)	48,000	0.~~013~~009 (0.025~~0.009 – 0.191~~)	6,351	0.~~101~~067 (0.188~~0.067 – 1.441~~)
Hermaness, Saxa, Vord and Valla Field SPA	0.4~~6~~ (1.2~~0.4 – 9.1~~)	55,000	0.0~~12~~08 (0.008~~0.008 – 0.176~~)	2,497	0.~~256~~180 (0.504~~0.170 – 3.877~~)
Hoy SPA	0.~~1~~1 (0.2~~0.1 – 1.3~~)	7,000	0.~~015~~009 (0.027~~0.015 – 0.198~~)	-	-
North Caithness Cliffs SPA	0.0 (0.0~~0.0 – 0.4~~)	4,160	0.004~~0~~ (0.012~~0.000 – 0.102~~)	3,053	0.00~~0~~6 (0.017~~0.000 – 0.139~~)
Noss SPA	0.0 (0.0~~0.0 – 0.3~~)	2,348	0.00~~0~~6 (0.018~~0.000 – 0.136~~)	1,174	0.0~~0~~13~~0~~ (0.036~~0.000 – 0.272~~)

9.3.3.4 Gannet

~~676.~~777. Gannet were assessed during the post-breeding migratory season and the return migratory season at the Scottish SPAs listed in Table 9.63~~Table 9.35~~. The UK North Sea and English Channel gannet population during the post-breeding migratory season and the return migratory season are predicted to be 456,299 and 248,385, respectively. These population counts were combined and were used for non-breeding season apportioning of the displacement consequent mortalities estimated for each SPA presented in Table 9.63~~Table 9.35~~. The displacement consequent mortalities estimated for each SPA are presented in Table 9.63~~Table 9.35~~ on the basis that the predicted impact can be apportioned to each relevant SPA in line with the SPA colony counts within Furness (2015) (Appendix 7.1.1). The level of impact at all these Scottish SPAs is less than 0.05% increase in baseline mortality, therefore ~~would be indistinguishable from the natural fluctuations in populations~~the contribution from the Project is deemed to have no material contribution to the natural mortality rate of the population.

~~677.~~778. Therefore, the potential for an AEoI to the conservation objectives of the gannet feature at all these SPAs in relation to displacement consequent mortalities during the O&M phase from the project alone can be ruled out and therefore, subject to natural change, gannet will be maintained as a feature in the long-term.

Table 9-63~~9.639-9.35~~: Gannet displacement impacts apportioned to Scottish SPAs, ~~. The full range of displacement mortality is presented in brackets with a central value~~ based on 7~~5~~0% displacement and 1% mortality.

Special Protection Area	Apportioned displacement mortality~~(70:1)~~	Citation population (inds)	Increase to (citation) baseline mortality	Recent population (inds)	Increase to (recent) baseline mortality
Forth Islands (UK) SPA	~~0.9~~1.0 ~~(0.8 - 1)~~	43,200	0.028~~6~~ ~~(0.023 - 0.029)~~	150,518	0.008~~7~~ ~~(0.007 - 0.008)~~
Fair Isle SPA	0.1 ~~(0 - 0.1)~~	2,332	0.~~053~~ 031~~(0.000 - 0.053)~~	9,942	0.~~012~~ 007 ~~(0.000 - 0.012)~~
Hermaness, Saxa Vord and Valla Field SPA	0.4 ~~(0.3 - 0.4)~~	16,400	0.~~030~~ 027 ~~(0.023 - 0.030)~~	51,160	0.~~010~~ 009~~(0.007 - 0.010)~~
Noss SPA	0.1 ~~(0.1 - 0.2)~~	13,720	0.~~009~~ 013 ~~(0.009 - 0.018)~~	22,944	0.008~~5~~ ~~(0.005 - 0.011)~~

9.3.3.5 Collision Risk

Alde-Ore Estuary SPA & Ramsar – Lesser black-backed gull

~~678.~~779. Lesser black-backed gulls were screened in for the O&M phase to assess the potential for an AEoI from collision from the Project array in relation to the following conservation objectives for this species, as a feature of the Alde-Ore Estuary SPA (Document 7.2):

- Maintain the population of each of the qualifying features.

~~679.~~780. Based on the above the conservation objective for the Alde-Ore Estuary SPA the specific target for the lesser black-backed gull feature is as follows based on Natural England's case-specific advice (Natural England 2021):

- To maintain the size of the breeding population at a level which is above 28,140 breeding adults whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent. The latest count is 3,534 adults based on the 2018/19 SMP survey.

~~680.~~781. The Project ~~array~~ WTG area is located 147.2~~3~~km from the Alde-Ore Estuary SPA, which is within the mean-maximum plus 1SD foraging distance of 236km (Woodward et al., 2019) and has been screened in for the breeding season and the non-breeding season. It is important to note that although the array is within the mean-max foraging (MMF)+1SD it is outside the site-specific foraging range of 124km from Alde-Ore Estuary SPA and therefore there is unlikely to be breeding season connectivity to this site.

782. The different bio-seasons for consideration of assessing potential risk from collision on birds from Alde-Ore Estuary SPA includes the breeding season (Apr – Aug) the post-breeding migration bio-season (August – October) and the return migration bio-season (March – April) and the winter (November – February, as defined by Furness (2015).

~~681.~~783. Predicted collision mortalities for lesser black-backed gull at Alde-Ore Estuary SPA & Ramsar are presented in Table 9.64~~Table 9-40~~.

Breeding Bio-season

~~682.~~784. The predicted collision mortality during the breeding bio-season is ~~less than~~ two (2.0~~1.5~~) individuals. Of these two individuals, the proportion considered to be breeding adults is 66~~0~~%, so the total number of breeding adults in the ~~array~~ WTG area impacted by collision is ~~less than~~ one (1.3~~0.8~~) per annum during the breeding bio-season.

~~683.~~785. Assuming 15.7% of these collisions are predicted to be breeding birds from Alde-Ore Estuary SPA (Appendix 7.1.1), then the consequent mortality during the breeding bio-season is estimated at less than one (0.2~~1~~) breeding adults.

~~684.~~786. Based on a citation population of 28,140 breeding adults and annual background mortality of 3,236~~.1~~ individuals, the addition of less than one predicted breeding adult mortalities would represent a 0.007~~3~~% increase in baseline mortality during the breeding bio-season.

~~685.~~787. As the population of lesser black-backed gulls has changed significantly since the citation population count the potential impact on the population is more reasonably assessed against the latest population count undertaken in 2018/9, consisting of 3,534 individuals and an annual background mortality of 439~~.3~~ individuals. On this basis, this would represent a 0.052~~23~~% increase in baseline mortality during the breeding bio-season.

Non-Breeding Bio-season

~~686.~~788. The predicted collision mortality as a result of the operation of the Project in the return migration bio-season is less than one (0.0) individual, in the post-breeding migration bio-season is less than one (0.0) individual and during the ~~the~~ collision mortality is less than one (0.0) individual. On the basis that ~~0.65~~3.3~~3.3~~% of the lesser black-backed gulls within the ~~array~~ WTG area are deemed to be breeding adults from Alde-Ore Estuary ~~Spa~~ SPA during the return migration, ~~and the~~ 0.61% in the post-breeding migration, and ~~0.61~~55% in the winter bio-season (Appendix 7.1.1), the consequent mortality of adult birds is less than one (0.0) individual during the return migration and post-breeding migration, and less than one (0.0) individual in the winter.

~~687.~~789. This consequent estimated mortality equates to an increase in baseline mortality of 0.000% in the return-migration bio-season, the post-breeding bio-season, and 0.000~~1~~% the winter based on the citation population, and 0.001% relative to the most recent counts for the return-migration bio-season and the post-breeding bio-season, and 0.001% for the winter bio-season.

Annual Total

~~688.~~790. The total predicted consequent mortality from collision attributed to Alde-Ore Estuary SPA throughout the operational life of the Project is less than one (0.2) breeding adult from Alde-Ore Estuary SPA per annum across all bio-seasons.

791. The predicted mortality of less than one breeding adult from Alde-Ore Estuary SPA per annum across all bio-seasons represents an increase of 0.007~~5~~% when considering the citation population or an increase of 0.056~~338~~% when considering the recent colony count. This level of impact is considered to make no material contribution to any changes in the population or its baseline ~~mortality, and~~mortality and would be indistinguishable from natural fluctuations in the population.

~~689.~~792. Although the UCI annual impact value is more than one bird, this results in additions to baseline mortality of 0.262%, which is below the 1% threshold required to undertake further assessment through PVA for this impact, and as such this impact should not be considered as likely to lead to adverse effect. In addition, this is based on a precautionary assessment which uses the UCI value. It is generally accepted that the mean impact value should be used in assessment of impacts.

793. Therefore, the potential for an AEoI to the conservation objectives of the lesser black-backed gull feature of Alde-Ore Estuary SPA & Ramsar in relation to collision risk in the O&M phase from the Project alone can be ruled out and therefore, subject to natural change, lesser black-backed gull will be maintained as a feature in the long-term.

Table 9-64~~9.649~~: Collision mortality for lesser black-backed gull at the Alde-Ore Estuary SPA & Ramsar.

Bio-season	Mortality estimate	% increase citation population	% increase SMP population
Mean			
Breeding	0.2	0.007	0.052
Post-breeding migration	0.0	0.000	0.001~~0~~
Return migration	0.0	0.000	0.001~~0~~
Winter	0.0	0.000	0.002
Annual Total	0.2	0.007	0.057~~3~~
LCI			
Breeding	0.0	0.000	0.000
Post-breeding migration	0.0	0.000	0.000
Return migration	0.0	0.000	0.000
Winter	0.0	0.000	0.000
Annual Total	0.0	0.000	0.000
UCI			
Breeding	1.1	0.033	0.262
Post-breeding migration	0.0	0.001~~0~~	0.005~~1~~
Return migration	0.0	0.001~~0~~	0.006~~1~~
Winter	0.0	0.001	0.006
Annual Total	1.1	0.035~~3~~	0.279~~64~~

Coquet Island SPA – Sandwich Tern

~~690.~~794. Sandwich tern has been screened in for the O&M phase to assess the potential for an AEoI from collision risk from the Project alone in relation to the following conservation objectives for this species, as a feature of the Coquet Islands SPA (Document 7.2):

- Maintain the population of each qualifying feature.

~~691.~~795. Based on the above the conservation objective for the Coquet Islands SPA the specific target for the sandwich tern feature is as follows based on Natural England's case-specific advice (Natural England 2021):

- Maintain the size of the breeding population at a level which is above 2,600 breeding adults, whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent. The latest colony population estimate is 4,428 breeding adults based on the most recent 2022 colony count.

796. The Project ~~array~~ WTG area is located 258.8~~7~~km from Coquet Islands SPA which is beyond the mean max plus 1SD foraging distance of 57.5km (Woodward et al., 2019) and has therefore been screened out for the breeding bio-season. However, there is non-breeding connectivity, including the return-migration bio-season defined as March – May and the post-breeding migration bio-season (July – September) defined by Furness (2015) (Appendix 7.1.1).

~~692.~~797. Predicted collision mortality for sandwich tern at Coquet Island SPA are presented in Table 9.65~~Table 9-37~~.

Non-breeding Bio-season

~~693.~~798. The predicted collision mortality as a result of the operation of the Project in the return migration bio-season is less than one (0.0) individual and in the post-breeding migration bio-season is less than one (0.0) individual. On the basis that 3.52% of the sandwich terns within the ~~array~~ WTG area are deemed to be breeding adults from Coquet Island SPA during the return migration and the post-breeding migration (Appendix 7.1.1), the consequent mortality of adult birds is less than one (0.0) during the return migration and less than one (0.0) during the post-breeding migration.

~~694.~~799. Based on a citation population of 2,600 breeding adults and an annual background mortality of 265~~.2~~ breeding adults per annum, the addition of less than one predicted breeding adult mortality would represent an increase in baseline mortality of <0.001%.

~~695.~~800. As the population of sandwich tern has changed since the citation population count, the potential impact on the population is more reasonably assessed against the latest population count undertaken in 2022, consisting of 4,428 individuals and an annual background mortality of 452~~1.7~~ individuals. On this basis, this level of impact would also represent a <0.001% increase in baseline mortality in the non-breeding bio-season. This level of impact would be indistinguishable from natural fluctuations in the population.

801. Therefore, the potential for an AEoI to the conservation objectives of the sandwich tern feature of Coquet Island SPA in relation to collision risk effects in the O&M phase from the Project alone can be ruled out and therefore, subject to natural change, sandwich tern will be maintained as a feature in the long-term.

Table 9-65~~9.659~~: Collision mortality for sandwich tern at Coquet Island SPA.

Bio-season	Mortality estimate	% increase citation population	% increase SMP population
Mean			
Non-breeding	0.0	0.000	0.000
LCI			
Non-breeding	0.0	0.000	0.000
UCI			
Non-breeding	0.0	0.001	0.001

Farne Islands SPA – Kittiwake

~~696.~~802. Kittiwake has been screened in for the O&M phase to assess the potential for an AEoI from collision risk from the Project alone in relation to the following conservation objectives for this species, as an assemblage feature of the Farne Island SPA (Document 7.2):

- Maintain the population of each qualifying feature.

~~697.~~803. Although kittiwake is only a named feature of the seabird assemblage, for the purpose of this assessment it has been considered in a similar manner to qualifying species, though the conclusion is not whether an AEoI would result from the Project alone on kittiwake as a feature, but more as an important component of the seabird assemblage. The citation count is 8,241 and the latest population estimate is 4,402 AONs (therefore, 8,804 individuals) based on the most recent 2019 colony counts.

~~698.~~804. The Project ~~array~~ WTG area is located 28~~4.2~~6.5km from the Farne Island SPA, which is within the mean-maximum plus 1SD foraging distance of 300.6km (Woodward et al., 2019) and has therefore been screened in for the breeding season and the non-breeding season.

805. The different bio-seasons for consideration of assessing potential risk from collision on birds from Farne Island SPA includes the breeding season (Mar - Aug), the post-breeding migration bio-season (August - December) and the return migration bio-season (January - April), as defined by Furness (2015) (there is no migration free winter bio-season).

~~699.~~806. The collision estimates for kittiwake at Farne Island SPA are presented in Table 9.66~~Table 9-36~~.

Breeding Bio-season

~~700.~~807. The predicted collision mortality during the breeding bio-season is 27~~6~~ (27.2~~5.5~~) individuals. Of these 2~~6~~7 individuals, the proportion considered to be breeding adults is 91% (based on proportions of adults among aged birds from the ~~site-specific~~site-specific DAS data), so the total number of breeding adults in the array impacted by collision is 2~~3~~5 (24.8~~3.2~~) per annum during the breeding bio-season.

~~701.~~808. Assuming 1.3% of these collisions are predicted to be breeding birds from Farne Island SPA (Appendix 7.1.1), then the consequent mortality during the breeding bio-season is estimated at less than one (0.3) breeding adults.

~~702.~~809. Based on a citation population of 8,241 breeding adults and annual background mortality of 1,203~~.2~~ individuals, the addition of less than one predicted breeding adult mortality would represent a 0.027~~8~~% increase in baseline mortality during the breeding bio-season.

~~703.~~810. As the population of kittiwakes has changed significantly since the citation population count the potential impact on the population is more reasonably assessed against the latest population count undertaken in 2019, consisting of 8,804 individuals and an annual background mortality of 1,285~~.4~~ individuals. On this basis, this would represent a 0.025~~6~~% increase in baseline mortality during the breeding bio-season.

Non-breeding Bio-season

~~704.~~811. The predicted collision mortality as a result of the operation of the Project in the return migration bio-season is less than 3 (2.9~~5~~) individuals and in the post-breeding migration bio-season is 3 (3.0~~2.8~~) individuals. On the basis that 0.7% of the kittiwakes within the ~~array~~ WTG area are deemed to be breeding adults Farne Island SPA during the return migration and 0.5% during the post-breeding migration (Appendix 7.1.1), the consequent mortality of adult birds is less than one (0.0) during the return migration and less than one (0.0) during the post-breeding migration.

~~705.~~812. This estimated mortality equates to an increase in baseline mortality of 0.002~~1~~% in the return-migration bio-season and 0.001% in the post-breeding bio-season based on the citation population and 0.001% relative to the most recent counts for the return-migration bio-season and 0.001% for the post-breeding bio-season.

Annual Total

~~706.~~813. The total predicted consequent mortality from collision attributed to Farne Island SPA throughout the operational life of the Project is less than one (0.4) breeding adult from Farne Island SPA per annum across all bio-seasons.

~~707.~~814. The predicted mortality of less than one breeding adult from Farne Island SPA per annum across all bio-seasons represents an increase of 0.030% when considering the citation population or an increase of 0.02~~9~~8% when considering the recent colony count). This level of impact is considered to make no material contribution to any changes in the population or its baseline mortality and would be indistinguishable from natural fluctuations in the population.

815. Therefore, the potential for an AEoI to the conservation objectives of the kittiwake feature of Farne Island SPA in relation to collision risk in the O&M phase from the Project alone can be ruled out and therefore, subject to natural change, kittiwake will be maintained as a feature in the long-term.

Table 9-66~~9.669~~: Collision mortality for kittiwake at the Farne Island SPA.

Bio-season	Mortality estimate	% increase citation population	% increase SMP population
Mean			
Breeding	0.3	0.027	0.025
Post-breeding migration	0.0	0.001	0.001
Return migration	0.0	0.002	0.001
Annual Total	0.4	0.030	0.028
LCI			
Breeding	0.1	0.007	0.006
Post-breeding migration	0.0	0.000	0.000
Return migration	0.0	0.000	0.000
Annual Total	0.1	0.008	0.007
UCI			
Breeding	0.9	0.072	0.067
Post-breeding migration	0.0	0.003	0.003
Return migration	0.0	0.004	0.004
Annual Total	0.9	0.078	0.073

Farne Islands SPA – Sandwich Tern

~~708.~~816. Sandwich tern has been screened in for the O&M phase to assess the potential for an AEoI from collision risk from the Project alone in relation to the following conservation objectives for this species, as a feature of the Farne Islands SPA (Document 7.2):

- Maintain the population of each qualifying feature.

~~709.~~817. Based on the above the conservation objective for the Farne Islands SPA the specific target for the sandwich tern feature is as follows based on Natural England's case-specific advice (Natural England 2021):

- Maintain the size of the breeding population at a level which is above 1,742 breeding adults, whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent. The latest colony population estimate is 417 breeding adults based on the most recent 2019 colony count.

~~710.~~818. The Project ~~array~~ WTG area is located 286.5~~4.2~~km from the Farne Islands SPA which is beyond the mean max plus 1SD foraging distance of 57.5km (Woodward et al., 2019) and has therefore been screened out for the breeding bio-season. However, there is non-breeding connectivity, including the return-migration bio-season defined as March – May and the post-breeding migration bio-season (July – September) defined by Furness (2015) (Appendix 7.1.1).

Non-breeding Bio-season

~~711.~~819. The predicted collision mortality as a result of the operation of the Project in the return migration bio-season is less than one (0.0) individual and in the post-breeding migration bio-season is less than one (0.0) individual. On the basis that 4.3% of the sandwich terns within the ~~array~~ WTG area are deemed to be breeding adults from Farne Island SPA during the return migration and the post-breeding migration (Appendix 7.1.1), the consequent mortality of adult birds is less than one (0.0) during the return migration and less than one (0.0) during the post-breeding migration.

~~712.~~820. Based on a citation population of 1,724 breeding adults and an annual background mortality of 176~~5.8~~ breeding adults per annum, the addition of less than one (0.0~~4~~) predicted breeding adult mortalities would represent an increase in baseline mortality of 0.001~~0~~%.

~~713.~~821. As the population of sandwich tern has changed since the citation population count, the potential impact on the population is more reasonably assessed against the latest population count undertaken in 2019, consisting of 834 individuals and an annual background mortality of 85 individuals per annum. On this basis, this would represent a 0.001~~0~~% increase in baseline mortality in the non-breeding bio-season. This level of impact is considered to make no material contribution to any changes in the population or its baseline mortality and would be indistinguishable from natural fluctuations in the population.

822. Therefore, the potential for an AEoI to the conservation objectives of the Sandwich tern feature of Farne Island SPA in relation to collision risk effects in the O&M phase from the Project alone can be ruled out and therefore, subject to natural change, sandwich tern will be maintained as a feature in the long-term.

Table 9-67~~9.679~~: Collision mortality for sandwich tern at Farne Island SPA.

Bio-season	Mortality estimate	% increase citation population	% increase SMP population
Mean			
Non-breeding	0.0	0.001	0.001
LCI			
Non-breeding	0.0	0.000	0.000
UCI			
Non-breeding	0.0	0.003	0.006

Flamborough and Filey Coast SPA - Kittiwake

~~714.~~823. Kittiwakes were screened in for the O&M phase to assess the potential for an AEoI from collision from the Project array in relation to the following conservation objectives for this species, as a feature of the FFC SPA (Document 7.2):

- Maintain the population of each of the qualifying features.

~~715.~~824. Based on the above conservation objective for the FFC SPA, the specific target for the kittiwake feature is as follows based on Natural England's case-specific advice (Natural England 2021):

- To maintain the size of the breeding population at a level which is above 167,400 breeding adults whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent. The latest count is 89,148 adults based on the 2022 survey (Butcher et al., 2023).

~~716.~~825. The Project ~~array~~ WTG area is located 93.5~~2.9~~km from the FFC SPA, which is within the mean-maximum plus 1SD foraging distance of 300.6km (Woodward et al., 2019) and has therefore been screened in for the breeding season and the non-breeding season.

826. The different bio-seasons for consideration of assessing potential risk from collision on birds from FFC SPA includes the breeding season (Mar-August), the post-breeding migration bio-season (August-December) and the return migration bio-season (January-April), as defined by Furness (2015) (there is no migration free winter bio-season).

~~717.~~827. The predicted collision mortality of kittiwake at FFC SPA are presented in Table 9.68~~Table 9-36~~.

Breeding Bio-season

~~718.~~828. The predicted collision mortality during the breeding bio-season is 27~~6~~ (~~25.5~~26~~6~~7.2) individuals. Of these 26~~7~~ individuals, the proportion considered to be breeding adults based on site specific data is 91%, the total number of breeding adults in the array impacted by collision is 2~~3~~5 (~~23.2~~24.8) per annum during the breeding bio-season.

~~719.~~829. Assuming 61.3% of these collisions are predicted to be breeding birds from FFC SPA (Appendix 7.1.1), then the consequent mortality during the breeding bio-season is estimated at ~~14~~ 15 (15~~4~~.2) breeding adults. The apportioning of 61.3% of collisions to FFC SPA is a result of the inclusion of kittiwakes breeding on offshore structures within a 20km radius of the project (an approach agreed with Natural England, see Table 4.1), based on bespoke surveys carried out by the Applicant in the breeding seasons of 2022 and 2023. This approach is considered to be precautionary as birds breeding on offshore structures beyond the 20km boundary are also likely to use the ~~array~~ WTG area.

~~720.~~830. The FFC SPA was reclassified based on counts from 2008. The original citation population was 167,400 AONs, which has been reduced based on a reclassification citation population to 89,040 breeding adults, with an ~~and~~ annual background mortality of ~~12,999~~13,000 individuals, the addition of 14~~5~~ predicted breeding adult mortalities would represent a 0.117~~0~~% increase in baseline mortality during the breeding bio-season.

~~721.~~831. As the population of kittiwakes has changed since the citation population count the potential impact on the population is more reasonably assessed against the latest population count undertaken in 2022, consisting of 89,148 individuals and an annual background mortality of 13,015 individuals. On this basis, this would represent a 0.117~~09~~% increase in baseline mortality during the breeding bio-season.

Non-breeding Bio-season

~~722.~~832. The predicted collision mortality as a result of the operation of the Project in the return migration bio-season is less than three (2.9~~6~~) individuals and in the post-breeding migration bio-season is three (3.0~~2.8~~) individuals. On the basis that 7.2% of the kittiwakes within the ~~array~~ WTG area are deemed to be breeding adults from FFC SPA during the return migration and 5.4% during the post-breeding migration (Appendix 7.1.1), the consequent mortality of adult birds is less than one (0.2) during the return migration and less than one (0.2) during the post-breeding migration.

~~723.~~833. This estimated mortality equates to an increase in baseline mortality of 0.002~~1~~% in the return-migration bio-season and 0.001 in the post-breeding bio-season based on the citation population and 0.002~~1~~% relative to the most recent counts for the return-migration bio-season and 0.001% for the post-breeding bio-season.

Annual Total

~~724.~~834. The total predicted consequent mortality from collision attributed to FFC SPA throughout the operational life of the Project is 16~~5~~ (~~14.6~~15.5) breeding adult from FFC SPA per annum across all bio-seasons.

~~725.~~835. The predicted mortality of 16~~5~~ breeding adults from FFC SPA per annum across all bio-seasons represents an increase of 0.120~~12~~% when considering the citation population or an increase of 0.119~~2~~% when considering the recent colony count. This level of impact would be indistinguishable from natural fluctuations in the population.

836. **Therefore, the potential for an AEoI to the conservation objectives of the kittiwake feature of FFC SPA in relation to collision risk in the O&M phase from the Project alone can be ruled out and therefore, subject to natural change, kittiwake will be maintained as a feature in the long-term.**

~~726.~~

Table 9-68~~9.689~~: Collision mortality for kittiwake at the FFC SPA.

Bio-season	Mortality estimate	% increase citation population	% increase SMP population
Mean			
Breeding	15.2	0.117	0.117
Post-breeding migration	0.2	0.001	0.001
Return migration	0.2	0.002	0.002
Annual Total	15.5	0.120	0.119
LCI			
Breeding	3.9	0.030	0.030
Post-breeding migration	0.0	0.000	0.000
Return migration	0.0	0.000	0.000
Annual Total	4.0	0.031	0.031
UCI			
Breeding	40.1	0.309	0.308
Post-breeding migration	0.4	0.003	0.003
Return migration	0.5	0.004	0.004
Annual Total	41.0	0.316	0.315

North Norfolk Coast SPA – Sandwich Tern

~~727.~~837. Sandwich tern has been screened in for the O&M phase to assess the potential for an AEoI from collision risk from the Project alone in relation to the following conservation objectives for this species, as a feature of the North Norfolk Coast SPA (Document 7.2):

- Maintain the population of each qualifying feature.

~~728.~~838. Based on the above the conservation objective for the North Norfolk Coast SPA the specific target for the sandwich tern feature is as follows based on Natural England's case-specific advice (Natural England 2021):

- Maintain the size of the breeding population at a level which is above 7,400 breeding adults, whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent. The latest colony population estimate is 14,588 breeding adults based on the most recent 2020-2022 colony count.

839. The Project ~~array~~ WTG area is located 56.4km from the North Norfolk Coast SPA which is within the mean-maximum plus 1SD foraging distance of 57.5km (Woodward et al., 2019) as measured from the boundary of the SPA to the array and has therefore been screened in for the breeding and non-breeding bio-season. However, if measured from the centre of the SPA or from the largest sandwich tern colonies within the SPA, at Scolt Head Island and Blakeney Point, then the Project ~~array~~ WTGarea is ~~77km~~ 60.2km and ~~69.7~~58.2km, respectively, beyond the mean-maximum plus 1SD foraging distance to the ~~array~~ WTG area. The different bio-seasons for consideration of assessing potential risk from collision on birds from North Norfolk Coast SPA includes the breeding season (May - Aug), return-migration bio-season (March – May), and the post-breeding migration bio-season (July – September), as defined by Furness (2015) (Appendix 7.1.1).

~~729.~~840. The predicted collision mortality for sandwich tern at North Norfolk Coast SPA are presented in Table 9.69~~Table 9-39~~.

Breeding Bio-season

~~730.~~841. The predicted collision mortality during the breeding bio-season is less than one (0.4) individual. Based on the proportion considered to be breeding adults is 61%, the total number of breeding adults in the ~~array~~ WTG area impacted by collision is less than one (0.2) per annum during the breeding bio-season.

842. Assuming 100% of these collisions are predicted to be breeding birds from North Norfolk Coast SPA (Appendix 7.1.1), then the consequent mortality during the breeding bio-season is estimated at less than one (0.2) breeding adults.

843. Using Natural England's preferred approach to apportioning, 100% are apportioned to North Norfolk Coast SPA. Therefore, with 100% assumed to be adults and 100% apportioned to North Norfolk Coast SPA, the impact is estimated to be less than one (0.4) breeding adult.

~~731.~~ Under the Applicant approach,

~~732.~~844. ~~B~~based on a citation population of 7,400 breeding adults and annual background mortality of 755~~4.8~~ individuals, the addition of less than one predicted breeding adult mortality would represent a 0.030~~29~~% increase in baseline mortality during the breeding bio-season. Using Natural England's preferred approach, the predicted impact would result~~s~~ in an increase of baseline mortality of 0.050%.

~~733.~~845. As the population of sandwich tern has increased significantly since the citation population count the potential impact on the population is more reasonably assessed against the latest population count undertaken in 2020-22, consisting of 14,588 individuals and an annual background mortality of 1,488~~.0~~ individuals. On this basis, this would represent a 0.002~~15~~% increase in baseline mortality during the breeding bio-season. Using Natural England's preferred approach, the predicted impact would results in an increase of baseline mortality of 0.003%.

Non-breeding Bio-season

~~734.~~846. The predicted collision mortality as a result of the operation of the Project in the return migration bio-season is less than one (0.0) individual and in the post-breeding migration bio-season is less than one (0.0) individual. On the basis that 21.73% of the sandwich terns within the ~~array~~ WTG area are deemed to be breeding adults from North Norfolk Coast SPA during the return migration and the post-breeding migration (Appendix 7.1.1), the consequent mortality of adult birds is less than one (0.0) during the return migration and less than one (0.00) during the post-breeding migration.

~~735.~~847. Based on a citation population of breeding adults the addition of less than one predicted breeding adult mortality would represent an increase in baseline mortality of 0.0010% in the non-breeding season.

~~736.~~848. As the population of sandwich tern has increased since the citation population count, the potential impact on the population is more reasonably assessed against the latest population count. On this basis, this would represent a 0.000% increase in baseline mortality in the non-breeding bio-season.

Annual Total

~~737.~~849. The total predicted consequent mortality from collision attributed to North Norfolk Coast SPA throughout the operational life of the Project is less than one (0.2) breeding adult from North Norfolk Coast SPA per annum across all bio-seasons. When using the Natural England preferred approach, the annual impact is less than one bird (0.4) breeding adult from North Norfolk Coast SPA per annum across all bio-seasons.

~~738.~~850. The predicted mortality of less than one breeding adult from North Norfolk Coast SPA per annum across all bio-seasons represents an increase in baseline mortality of 0.03~~0~~1% when considering the citation population or an increase of 0.016~~5~~% when considering the recent colony count using the Applicant Approach, and 0.051% and 0.026% when considering the Natural England preferred approach. This level of impact is considered to make no material contribution to any changes in the population or its baseline mortality and would be indistinguishable from natural fluctuations in the population.

851. **Therefore, the potential for an AEoI to the conservation objectives of the sandwich tern feature of North Norfolk Coast SPA in relation to collision risk effects in the O&M phase from the Project alone can be ruled out and, subject to natural change, sandwich tern will be maintained as a feature in the long-term.**

Table 9-69~~9.699~~: Collision mortality for sandwich tern at North Norfolk Coast SPA.

Bio-season	Mortality estimate	% increase citation population	% increase SMP population
Mean			
Breeding	0.2	0.030	0.015
Breeding (Natural England)	0.4	0.050	0.003
Non-breeding	0.0	0.001	0.000

Bio-season	Mortality estimate	% increase citation population	% increase SMP population
Annual Total	0.2	0.031	0.016
LCI			
Breeding	0.0	0.002	0.001
Breeding (Natural England)	0.0	0.003	0.000
Non-breeding	0.0	0.000	0.000
Annual Total	0.0	0.002	0.001
UCI			
Breeding	1.3	0.170	0.086
Breeding (Natural England)	2.1	0.283	0.019
Non-breeding	0.0	0.003	0.002
Annual Total	1.3	0.173	0.088

Flamborough and Filey Coast SPA – Herring gull

~~739.~~852. Herring gull has been screened in for the O&M phase to assess the potential for an AEoI from collision risk from the Project alone in relation to the following conservation objectives for this species, as an assemblage feature of the FFC SPA (Document 7.2):

- Maintain the population of each qualifying feature.

~~740.~~853. Although herring gull is only a named feature of the seabird assemblage, for the purpose of this assessment it has been considered in a similar manner to qualifying species, though the conclusion is not whether an AEoI would result from the Project alone on herring gull as a feature, but more as an important component of the seabird assemblage. The latest population estimate is 702 based on the most recent 2017 colony counts.

854. The Project ~~array~~ WTG area is located 93.5~~2.9~~km from the FFC SPA, which is out with the mean-maximum plus 1SD foraging distance of 85.6km (Woodward *et al.,* 2019) and has therefore been screened out for the breeding season. Herring gull has been screened in for the non-breeding bio-season (September – February) as defined by Furness (2015).

855. The prediction collision mortality for herring gull at FFC SPA is presented in Table 9.70~~Table 9-39~~.

Breeding Bio-season

856. The predicted collision mortality during the breeding bio-season is two (2.3) individuals. Based on the proportion considered to be breeding adults is 48%, the total number of breeding adults in the ~~array~~WTG area impacted by collision is one (1.1) per annum during the breeding bio-season.

857. Assuming 8.4% of these collisions are predicted to be breeding birds from FFC SPA (Appendix 7.1.1), then the consequent mortality during the breeding bio-season is estimated at less than one (0.1) breeding adults.

858. Based on a population of 283 breeding adults and annual background mortality of 47 individuals, the addition of less than one predicted breeding adult mortality would represent a 0.193% increase in baseline mortality during the breeding bio-season.

~~741.~~

Non-breeding Bio-season

~~742.~~859. The predicted collision mortality as a result of the operation of the Project in the non-breeding bio-season is less than one (0.7~~7~~) individual. On the basis that ~~0.4~~0.21~~3~~% of the herring gulls within the ~~array~~ WTG area are deemed to be breeding adults from FFC SPA during non-breeding bio-season (Appendix 7.1.1), the mortality of adult birds is less than one (0.0~~1~~). This estimated mortality equates to an increase in baseline mortality of 0.003~~6~~% in the non-breeding bio-season based on the most recent population counts. This level of impact is considered to make no material contribution to any changes in the population or its baseline mortality and would be indistinguishable from natural fluctuations in the population.

860. Therefore, the potential for an AEoI to the conservation objectives of the herring gull assemblage feature of FFC SPA in relation to collision risk in the O&M phase from the Project alone can be ruled out and, subject to natural change, herring gull and the assemblage will be maintained in the long-term.

Table 9-70~~9.709~~: Collision mortality for herring gull at the FFC SPA.

Bio-season	Mortality estimate	% increase SMP population
Mean		
Breeding	0.1	0.193
Non-breeding	0.0	0.003
LCI		
Breeding	0.0	0.000
Non-breeding	0.0	0.000
UCI		
Breeding	0.4	0.764
Non-breeding	0.0	0.013

Flamborough and Filey Coast SPA – Gannet

~~743.~~861. Gannets were screened in for the O&M phase to assess the potential for an AEoI from collision from the Project array in relation to the following conservation objectives for this species, as a feature of the FFC SPA (Document 7.2):

- Maintain the population of each of the qualifying features.

~~744.~~862. Based on the above conservation objective for the FFC SPA the specific target for the gannet feature is as follows based on Natural England's case-specific advice (Natural England 2021):

- To maintain the size of the breeding population at a level which is above 8,469 breeding pairs (16,938 breeding adults), whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent. The latest count is 30,466 adults based on the 2023 survey (Aitken *et al.,* 2017).

~~745.~~863. The Project ~~array~~ WTG area is located 93.5~~2.9~~km from the FFC SPA, which is within the mean-maximum plus 1SD foraging distance of 509.4km (Woodward *et al*., 2019) and has therefore been screened in for the breeding season. In the non-breeding season, breeding gannets are not constrained by requirements to visit nests to incubate eggs or provision for chicks. It is therefore assumed that individuals will range more widely than during the breeding season, and therefore gannet has also been screened in for the non-breeding season. Gannets recorded during DAS are therefore considered to come from a range of breeding colonies in the UK and further afield.

~~746.~~864. The different bio-seasons for consideration of assessing potential risk from collision on birds from FFC SPA includes the breeding season (Mar - September), the post-breeding migration bio-season (September to November) and the return migration bio-season (December to March), as defined by Furness (2015) (there is no migration free winter bio-season).

~~747.~~865. As per Natural England guidance (Parker *et al.,* 2022c), a macro-avoidance rate of 70% has been applied to collision mortality estimates, presented in ~~with a range of 65% to 85% macro-avoidance also presented in~~ Table 9.71~~Table 9.36~~ below.

Breeding Bio-season

~~748.~~866. The predicted collision mortality during the breeding bio-season is one (1.2~~0~~) individual. Of the~~se~~ ~~three~~ one individual~~s~~, the proportion considered to be breeding adults (based on site specific DAS data) is 90~~3~~%, so the total number of breeding adults in the array impacted by collision is one (1.0) per annum during the breeding bio-season. As presented in the apportioning annex (Appendix 7.1.1), 100% of these breeding season impacts are predicted to be breeding birds from the FFC SPA.

~~749.~~867. Based on a citation population of 16,938 breeding adults and annual background mortality of 1,372 individuals, the addition of one (1.0) predicted breeding adult mortalities would represent a 0.076~~0~~% increase in baseline mortality during the breeding bio-season.

~~750.~~868. As the population of gannets has increased significantly since the citation population count the potential impact on the population is more reasonably assessed against the latest population count undertaken in 2023, consisting of 30,466 individuals and an annual background mortality of 2,468~~7.7~~ individuals. On this basis, this would represent a 0.042~~39~~% increase in baseline mortality during the breeding bio-season.

Non-breeding Bio-season

~~751.~~869. The predicted collision mortality as a result of the operation of the Project in the return migration bio-season is less than one (0.~~0~~1) individuals and in the post-breeding migration bio-season is less than one (0.4~~1~~) individuals. On the basis that 6.2% of the gannets within the ~~array~~ WTG area are deemed to be breeding adults from FFC SPA during the return migration and 4.8% during the post-breeding migration (Appendix 7.1.1), the consequent mortality of adult birds is less than one (0.0) during the return migration and less than one (0.0) during the post-breeding migration.

~~752.~~870. This estimated mortality equates to an increase in baseline mortality of 0.000% in the return-migration bio-season~~-~~ based on both the citation counts and the most recent counts. There is an increase in baseline mortality of ~~and~~ 0.001% in the post-breeding bio-season based on both the citation counts 0.000% ~~and~~ using the most recent counts.

Annual Total

~~753.~~871. The total predicted consequent mortality from collision attributed to FFC SPA throughout the operational life of the Project is one (1.~~0~~1) breeding adults from FFC SPA per annum across all bio-seasons.

~~754.~~872. The predicted mortality of one breeding adult from FFC SPA per annum across all bio-seasons represents an increase in baseline mortality of 0.07~~2~~8% when considering the baseline mortality for the citation population and an increase of 0.04~~0~~3% when considering the recent colony count. This level of impact would be indistinguishable from natural fluctuations in the population.

~~755.~~873. Therefore, the potential for an AEoI to the conservation objectives of the gannet feature of FFC SPA in relation to collision risk in the O&M phase from the Project alone can be ruled out and, subject to natural change, gannet will be maintained as a feature in the long-term.

Table 9-71~~9.719~~ ~~9.36~~: Collision mortality ~~based on 65%, 70% and 85% macro-avoidance~~ for gannet~~s~~ at the FFC SPA.

~~Bio-season~~	~~70% macro-avoidance~~		
Bio-season	Mortality estimate	% increase citation population	% increase SMP population
Mean			
Full breeding	1.0~~1.0~~	0.076~~0.039~~	0.042~~0.045~~
Post-breeding migration	0.0~~0.0~~	0.001~~0.002~~	0.001~~0.003~~
Return migration	0.0~~0.0~~	0.000~~0.000~~	0.000~~0.000~~
Annual Total	1.1~~**1.0**~~	0.078~~**0.042**~~	0.043~~**0.048**~~
LCI			
Full breeding	0.0	0.003	0.002

~~Bio-season~~	~~70% macro-avoidance~~		
Post-breeding migration	0.0	0.000	0.000
Return migration	0.0	0.000	0.000
Annual Total	0.0	0.003	0.002
UCI			
Full breeding	4.3	0.310	0.172
Post-breeding migration	0.1	0.006	0.003
Return migration	0.0	0.002	0.001
Annual Total	4.4	0.318	0.177

FFC – Assemblage Features

~~756.~~874. The breeding seabird assemblage feature for FFC SPA has been screened in for the assessment of the O&M phase, comprised of 216,730 individual seabirds at classification, and 298,544 individuals in 2017 (Natural England, 2020). The assemblage comprises the following nine species;

- Gannet;
- Kittiwake;
- Guillemot;
- Razorbill;
- Fulmar;
- Puffin;
- Herring gull;
- Cormorant; and
- Shag.

~~757.~~875. Of these, gannet, kittiwake, guillemot and razorbill are qualifying species of FFC SPA in their own right, and effects on these species have therefore been considered separately. Though they are assemblage features only, puffin and herring gull have also been assessed for impacts alone in the impact section above.

~~758.~~876. Potential impacts on fulmar, cormorant and shag have been screened out of the assessment, owing to their low sensitivity to displacement and collision impacts, alongside low numbers recorded within the Project survey area.

~~759.~~877. As set out in assessments on screened in assemblage species, no significant changes to either their abundance or diversity is expected as a result of the Project. **Therefore, the potential for an AEoI to the conservation objectives of the assemblage features of FFC SPA in relation to collision and displacement risks in the O&M phase from the Project alone can be ruled out and, subject to natural change, both seabird abundance and diversity will be maintained as a feature in the long-term.**

Non-breeding collision impacts to Scottish SPAs

~~760.~~878. Kittiwake and gannet from Scottish SPAs have been screened in for the assessment of the O&M phase to assess the impacts from collision from the Project alone during the non-breeding bio-season.

~~761.~~879. For ease of reading, the results of the assessments can be found for all relevant SPAs for each species in the following sections.

Kittiwake

~~762.~~880. Kittiwake were assessed during the post-breeding migratory season and the return migratory season at the Scottish SPAs listed in Table 9.72~~Table 9.37~~. The kittiwake population in the UK North Sea and English Channel, is estimated to be 829,93~~7~~8 during the post-breeding migratory season and 627,814~~6~~ during the return migratory season. These population counts were combined and were used for non-breeding season apportioning of the displacement consequent mortalities estimated for each SPA presented in Table 9.72~~Table 9.37~~. The displacement consequent mortalities estimated for each SPA are presented in Table 9.72~~Table 9.37~~, on the basis that the predicted impact can be apportioned to each relevant SPA in line with the SPA colony counts within Furness (2015) (Appendix 7.1.1). The level of impact at all these Scottish SPAs is considered to make no material change to populations or mortality rates and would be indistinguishable from the natural population fluctuations.

~~763.~~881. Therefore, the potential for an AEoI to the conservation objectives of the kittiwake feature at all these SPAs in relation to displacement consequent mortalities during the O&M phase from the Project alone can be ruled out and therefore, subject to natural change, kittiwake will be maintained as a feature in the long-term.

Table 9-72~~9.72~~9~~ 9.37~~: Kittiwake collision impacts apportioned to Scottish SPAs.

Special Protection Area	Apportioned collisions	Citation population (inds)	% Increase to (citation) baseline mortality	Recent population (inds)	% Increase to (recent) baseline mortality
Buchan Ness to Collieston Coast SPA	0.1	60,904	0.001	22,5330~~90~~	0.004~~3~~
Calf of Eday SPA	0.0	3,434	0.001~~2~~	284	0.018~~27~~
Copinsay SPA	0.0	19,100	0.000	1,990	0.002
East Caithness Cliffs SPA	0.4	65,000	0.004	48,920	0.006~~5~~
Fair Isle SPA	0.0	36,320	0.000	896	0.006~~5~~
Forth Islands SPA	0.0	16,800	0.001	~~8,322~~2,858	0.007
Foula SPA	0.0	7,680	0.000	1,021~~518~~	0.002
Fowlsheugh SPA	0.1	73,300	0.001	35,380~~28,078~~	0.002
Hermaness, Saxa Vord and Valla Field SPA	0.0	1,844	0.001	144~~530~~	0.019~~7~~
Hoy SPA	0.0	6,000	0.000	550~~608~~	0.005~~4~~
Marwick Head SPA	0.0	15,400	0.000	2,878~~1,812~~	0.001
North Caithness Cliffs SPA	0.1	26,200	0.003~~2~~	11,136	0.006
Noss SPA	0.0	14,040	0.000	236	0.015~~3~~
Rousay SPA	0.0	9,800	0.001	966	0.012~~1~~
St Abb’s Head SPA	0.0	42,340	0.001~~0~~	9,200	0.003~~2~~
Sumburgh Head SPA	0.0	2,732	0.001~~0~~	254	0.006~~5~~
Troup, Pennan and Lion's Heads SPA	0.1	63,200	0.002~~1~~	19,400	0.005
West Westray SPA	0.1	47,800	0.002	1,486	0.055~~0~~

Gannet

~~764.~~882. Gannet were assessed during the post-breeding migratory season and the return migratory season at the Scottish SPAs listed in Table 9.73~~Table 9.38~~. The UK North Sea and English Channel gannet population during the post-breeding migratory season and the return migratory season are predicted to be 456,299 and 248,385, respectively. These population counts were combined and were used for non-breeding season apportioning of the displacement consequent mortalities estimated for each SPA presented in Table 9.73~~Table 9.38~~. The displacement consequent mortalities estimated for each Scottish SPA are presented in Table 9.73~~Table 9.38~~, on the basis that the predicted impact can be apportioned to each relevant SPA in line with the SPA colony counts within Furness (2015) (Appendix 7.1.1). The level of impact at all these Scottish SPAs is considered to make no material contribution to any change in population or mortality rate and would be indistinguishable from the natural fluctuations in populations.

~~765.~~**883. Therefore, the potential for an AEoI to the conservation objectives of the gannet feature at all these SPAs in relation to displacement consequent mortalities during the O&M phase from the project alone can be ruled out, subject to natural change, gannet will be maintained as a feature in the long-term.**

Table 9-73~~9.739 9.38~~: Gannet collision impacts apportioned to Scottish SPAs.

Special Protection Area	Apportioned collisions	Citation population (inds)	% Increase to (citation) baseline mortality	Recent population (inds)	% Increase to (recent) baseline mortality
Forth Islands (UK) SPA	0.1	43,200	0.004~~3~~	150,518	0.000~~1~~
Fair Isle SPA	0.0	2,332	0.004~~3~~	9,942	0.000~~1~~
Noss SPA	0.0	13,720	0.002~~1~~	22,944	0.000~~1~~
Hermaness, Saxa Vord and Valla Field SPA	0.0	16,400	0.004~~3~~	51,160	0.000~~1~~

Migratory Terns and Waterbirds (UK SPAs)

884. Migratory tern, raptor and waterbird species have been screened in for the assessment of O&M phase to assess the potential impact from collision during migration for sites within 100km of the Project. Site specific digital aerial surveys (DAS) were conducted in the ODOW ~~array~~ WTG area plus a 4km buffer. The results of these surveys can provide information on the estimated abundance and density of birds in the area for each bio-season. This however has limitations as the survey methods are not guaranteed to provide reliable estimates of birds in the area during migration periods. This can be due to species moving through the area in poor weather, in short time periods or at night, making the recording of numbers complex using the standard methods. As such, a migratory bird collision assessment was undertaken using the bespoke MigroPath tool, which models likelihood of bird passage through a given area using the locations of relevant SPA's, any staging grounds, and species populations (ES Appendix 12.5~~4~~) (Table 9.74~~Table 9.39~~).

~~766.~~885. MigroPath modelling was used to estimate the numbers of migratory birds passing through the Project for the majority of species. For species, such as migratory seabirds, that do not ~~not~~ follow a point-to-point migration pattern a broad-front modelling approach was undertaken to estimate the number of ~~indivudals~~individuals passing through the Project. Where the numbers of species expected to pass through the Project exceeded 1% of the UK population, migratory Collision Risk Modelling (CRM) was undertaken. Further methodological details are presented in the Environmental Statement Migratory Bird Collision Ri~~l~~sk Modelling Appendix (ES Appendix 12.5).

~~767.~~886. Table 9.74~~Table 9.39~~ shows the collision impact as a percentage of the citation count for each species listed as a feature of six screened in SPA's, and the subsequent increase in baseline mortality. Where a species is listed at more than one SPA, impacts have been apportioned in accordance with the citation populations at each SPA screened in. Although not realistic, this was considered to be an extremely precautionary approach.

Table 9-74~~9.749 9.39~~: Outputs of the migratory ~~MigroPath~~ CRM analysis, apportioned to screened in SPA's. Predicted impacts are calculated using a 98% avoidance rate.

Site	Features	Citation count	Predicted Project ~~i~~impact (individuals)	Apportioned impact to SPA (individuals)	% of citation count	SPA baseline mortality	% increase to Baseline mortality at 98% avoidance
Coquet Island SPA	Arctic tern *(S. paradisaea)*	1,400~~.0~~	0.0	0.0	0.0	224.0	0.000
	Common tern	1,480~~.0~~	~~1.1~~0.0	0.0~~5~~	0.0	177.6	0.009~~3~~
Gibraltar Point SPA	Bar-tailed godwit	719~~.0~~	2.1~~2~~	0.1	0.0	201.3	0.050~~1~~
	Grey plover	2,017~~.0~~	0.0	0.0	0.0	544.6	0.000
	Sanderling	67~~.0~~	0.6	0.0	0.0~~1~~	11.4	0.285~~3~~
Greater Wash SPA	Common scoter	3,449~~.0~~	6.5~~6~~	6.5~~6~~	0.2	758.8	0.858~~9~~
	Common tern	1,020~~.0~~	~~1.1~~0.0	0.0~~3~~	0.0	122.4	0.~~3~~009
	Little gull	1,255~~.0~~	0.0~~1~~	0.0~~1~~	0.0	251.0	0.004
	Red-throated diver	1,407~~.0~~	0.1~~5~~	~~0.5~~0.1	0.0	225.1	0.053~~2~~
Humber Estuary SPA	Avocet	128~~.0~~	0.2	0.1	0.0	28.2	0.203
	Bar-tailed godwit	2,752~~.0~~	2.1~~2~~	0.4	0.0	770.6	0.050~~1~~
	Bittern	4~~.0~~	0.0	0.0	0.2~~5~~	1.2	0.556~~1.7~~
	Black-tailed godwit (icelandica)	1,113~~.0~~	0.4~~5~~	0.2~~3~~	0.0	66.8	0.363~~4~~
	Curlew	3,253~~.0~~	4.5~~7~~	2.1~~2~~	0.1	325.3	0.638~~7~~
	Dark-bellied brent goose;	2,098~~.0~~	0.8~~9~~	0.0	0.0	209.8	0.022
	Dunlin	22,222~~.0~~	9.1~~3~~	3.5~~6~~	0.0	5,777.7	0.060~~1~~
	Golden plover	30,709~~.0~~	16~~7~~.5	16~~7~~.5	0.1	8,291.4	0.199~~2~~
	Goldeneye	467~~.0~~	0.7~~8~~	0.6	0.1	107.4	0.554~~6~~
	Scaup	127~~.0~~	0.2~~3~~	0.2~~3~~	0.2	66.0	0.363~~4~~
	Greenshank *(T. nebularia)*	77~~.0~~	0.0	0.0	0.0	20.0	0.000
	Grey plover	1,704~~.0~~	0.0	0.0	0.0	460.1	0.000
	Hen harrier	8~~.0~~	0.0	0.0	0.5~~5~~	1.5	2.632
	Lapwing	22,765~~.0~~	0.0	0.0	0.0	6,829.5	0.000

Site	Features	Citation count	Predicted Project ~~I~~impact (individuals)	Apportioned impact to SPA (individuals)	% of citation count	SPA baseline mortality	% increase to Baseline mortality at 98% avoidance
	Little tern	102~~.0~~	0.0	0.0	0.0	20.4	0.000
	Mallard	2,456~~.0~~	~~53.8~~35.2	~~53.8~~35.2	~~2.2~~1.4	908.7	~~5.9~~3.876
	Marsh harrier;	10~~.0~~	0.0	0.0	0.0	2.6	0.000
	Oystercatcher	3,503~~.0~~	10.2~~8~~	1.2~~3~~	0.0	420.4	0.291~~3~~
	Pochard	719~~.0~~	0.8	0.8	0.1	251.7	0.302
	Knot	28,165~~.0~~	8.5~~7~~	1.1	0.0	4,506.4	0.023
	Redshank	7,462~~.0~~	1.6~~8~~	1.2~~3~~	0.0	1,940.1	0.060~~1~~
	Ringed plover	1,766~~.0~~	1.3~~4~~	1.3~~4~~	0.1	406.2	0.330
	Ruff	128~~.0~~	0.0	0.0	0.0	61.4	0.033
	Sanderling	818~~.0~~	0.6	0.4	0.0~~1~~	139.1	0.285~~3~~
	Shelduck	4,464~~.0~~	1.4	0.3	0.0	491.0	0.061~~1~~
	Teal *(A. crecca)*	2,322~~.0~~	0.0	0.0	0.0	1,091.3	0.000
	Turnstone	629~~.0~~	0.0	0.0	0.0	88.1	0.000
	Whimbrel *(Numenius phaeopus)*	113~~.0~~	0.0	0.0	0.0	12.4	0.000
	Wigeon	5,044~~.0~~	~~15.3~~14.9	3.4~~5~~	0.1	2,370.7	0.142
North Norfolk Coast SPA	Avocet	252~~.0~~	0.2	0.1	0.0	55.4	0.203
	Bittern	2~~.0~~	0.0	0.0	0.2~~5~~	0.6	~~1.7~~0.556
	Common tern	920~~.0~~	~~1.1~~0.0	~~0.3~~0.0	0.0	110.4	~~0.3~~0.009
	Dark-bellied brent goose;	11,512~~.0~~	0.8~~9~~	0.3	0.0	1,151.2	0.022
	Marsh harrier;	20~~.0~~	0.0	0.0	0.0	5.2	0.000
	Pink-footed goose	23,802~~.0~~	10.8	4.5	0.0	4,046.3	0.112
	Knot	10,801~~.0~~	8.5~~7~~	0.4	0.0	1,728.2	0.023
	Wigeon	14,039~~.0~~	~~15.3~~14.9	9.6~~4~~	0.1	6,598.3	0.142
The Wash SPA	Bar-tailed godwit	11,250~~.0~~	2.1~~2~~	1.6	0.0	3,150.0	0.050~~1~~
	Bewick's swan	68~~.0~~	0.1	0.1	0.1~~2~~	12.2	0.817~~9~~

Site	Features	Citation count	Predicted Project ~~I~~impact (individuals)	Apportioned impact to SPA (individuals)	% of citation count	SPA baseline mortality	% increase to Baseline mortality at 98% avoidance
	Black-tailed godwit	859~~.0~~	0.4~~5~~	0.2	0.0	51.5	0.363~~4~~
	Common scoter	68~~.0~~	6.5~~6~~	~~6.6~~0.1	~~9.7~~0.2	15.0	~~44.1~~0.858
	Common tern	152~~.0~~	~~1.1~~0.0	0.0	0.0	18.2	0.~~3~~009
	Curlew	3,835~~.0~~	4.5~~7~~	2.~~6~~4	0.1	383.5	0.~~7~~638
	Dark-bellied brent goose;	22,248~~.0~~	0.8~~9~~	0.5	0.0	2,224.8	0.022
	Dunlin	35,620~~.0~~	9.1~~3~~	5.6~~7~~	0.0	9,261.2	0.060~~1~~
	Gadwall	71~~.0~~	0.~~4~~2	0.~~4~~2	0.~~6~~3	19.9	~~2.0~~1.107
	Goldeneye	114~~.0~~	0.7~~8~~	0.1	0.1	26.2	0.554~~6~~
	Grey plover	9,708~~.0~~	0.0	0.0	0.0	2,621.2	0.000
	Little tern	33~~.0~~	0.0	0.0	0.0	6.6	0.000
	Oystercatcher	25,651~~.0~~	10.2~~8~~	9.0~~5~~	0.0	3,078.1	0.291~~3~~
	Pink-footed goose	33,265~~.0~~	10.8	6.3	0.0	5,655.1	0.112
	Pintail	923~~.0~~	0.7	0.7	0.1	313.8	0.220
	Knot	186,892~~.0~~	8.5~~7~~	7.0~~2~~	0.0	29,902.7	0.023
	Redshank	2,953~~.0~~	1.6~~8~~	0.5	0.0	767.8	0.060~~1~~
	Sanderling	355~~.0~~	0.6	0.2	0.0~~1~~	60.4	0.285~~3~~
	Shelduck	15,981~~.0~~	1.4	1.1	0.0	1,757.9	0.061~~1~~
	Turnstone	717~~.0~~	0.0	0.0	0.0	100.4	0.000
	Wigeon	3,241~~.0~~	14.9~~15.3~~	2.2	0.1	1,523.3	0.142

~~768.~~887. As can be seen in Table 9.74~~Table 9.39~~, in most cases the impact apportioned to each SPA is less than 0.1% of the citation population, and the increase to baseline mortality at each SPA is below 1%.

~~769.~~888. There ~~are~~ is only ~~two~~ one case~~s~~ where impact is greater than 1% of the citation count (~~common scoter at The Wash SPA and~~ mallard at the Humber Estuary SPA) and ~~five~~ three cases where increases in baseline mortality are above 1% (~~bittern at the North Norfolk Coast and Humber Estuary SPA's,~~ gadwall at The Wash SPA, and hen harrier and mallard at the Humber Estuary SPA).

~~770.~~889. These predicted impacts should be treated with some caution. The avoidance rate used (98% avoidance) is considered to be precautionary. Woodward et al (2023) recommend avoidance rates of 98.5% for ducks, ~~99.3% for bittern,~~ and 99.6% for hen harrier. Using these recommended avoidance rates reduces the increase in baseline mortality ~~to below one for bittern (0.555%) and~~ to 1.315% for hen harrier and decreases impacts for duck species.

~~771.~~890. The apportioned impacts should be considered to be highly precautionary. ~~MigroPath~~ Migratory CRM assigns an impact based upon the UK population, which here has been apportioned among a very small number of SPA's. When apportioning predicted impacts to the population protected by the whole UK SPA network, impacts are reduced substantially, and to a level below 1% of baseline mortality. For ~~bittern~~gadwall, increase to baseline mortality is ~~reduced to 0.105%, gadwall is~~ reduced to 0.028%, mallard to 0.837% and hen harrier to 0.084%.

~~772.~~891. Further caution should be used as ~~MigroPath~~ migratory CRM assumes all individuals within a population migrate. In some species, such as wintering geese, this will be the case, but in many, it is not. In the case of mallard at the Humber Estuary SPA, the impact is greater than 1% of the citation population.

~~773.~~892. As much of the UK mallard population is sedentary, the population estimates used in the ~~Migropath~~ migratory CRM analyses are unlikely to reflect the true scale of mallard migration within and toward the UK. Mallard has a winter population of 675,000 individuals, and a breeding population between 61,000 and 145,000 pairs. Calculating the number of individuals associated with that breeding population from the mid-point of the breeding population estimate (i.e. breeding adults and offspring) gives a population of 368,740 individuals. As the majority of these birds are sedentary (Woodward *et al.,* 2023), it can be assumed that approximately half of the 675,000 birds wintering in the UK have migrated here, and very few UK breeding birds have migrated elsewhere. Therefore, the number of migrating birds within the UK wintering population is approximately half of the number used in the MigroPath ~~calculation~~modelling, and as such, the number of collisions presented here for mallard is likely to be a substantial overestimate.

~~774. Bittern should be treated similarly because male bitterns are largely sedentary and females are only partial migrants. As such, the number of collisions predicted for this species by MigroPath will also be a considerable overestimate.~~

~~775.~~893. Another note of caution regarding the results from ~~MigroPath~~ migratory CRM is that the ~~tool~~ analysis assumes that the majority of species fly at the rotor height 100% of the time. Of the species assessed only dark-bellied brent goose (50%) was assessed at a rate lower than 100% flying at rotor height. Wildfowl and waders especially often fly at low levels when migrating, more often a few metres above the sea, therefore the predicted impacts for mallard, gadwall and common scoter are likely to be overestimated.

~~776.~~894. Considering the highly precautionary nature of the outputs of the ~~MigroPath~~ migratory CRM analyses, and the relatively small number of cases where an increase to baseline mortality is above the 1% threshold, impacts to migrating birds at the six scoped in SPA's can be considered to be minimal and make no material contribution to any changes in population or baseline mortality.

~~777.~~895. Migratory birds may pass windfarms during their migrations; however, the impact is vastly different to species that may come into contact with windfarms daily (e.g., central place foragers during the breeding season). Migratory species are consequently less at risk from adverse impacts caused by the "barrier effect". The costs of one-off avoidances during migration are trivial, accounting for less than 2% of available fat reserves (Masden *et al*., 2009 – common eider; Speakman et al., 2009 – red-throated diver, whooper swan, common scoter).

Combined Collision and Displacement Risk

FFC SPA - Gannet

~~778.~~896. As gannet has been assessed for the impacts of both displacement and collision, consideration is also given to the combined total of these impacts in relation to the conservation objectives of the gannet feature of the FFC SPA (Appendix 7.1.1).

~~779.~~897. Impacts resulting from displacement, collision, and the impacts combined are presented in Table 9.75~~Table 9.40~~ below.

Table 9-75~~9.759-9.40~~:Combined collision and displacement impacts for gannet at the FFC SPA.

Bio-season	Displacement mortality (70% displacement and 1% mortality)	Collision mortality	Combined mortality
Breeding	3.5~~4.1~~	1.0~~1.0~~	4.5~~5.1~~
Post-breeding migration	0.2~~0.2~~	0.0~~0.1~~	0.2~~0.2~~
Return migration	0.0~~0.0~~	0.0~~0.0~~	0.0~~0.0~~
Annual total	**3.7~~4.3~~**	**1.1~~1.0~~**	**4.8~~5.4~~**

~~780.~~898. The annual mortality of breeding adult gannets from the FFC SPA as a result of combined displacement and collision mortality is five (~~5.4~~4.8). Based on a citation population of 16,~~.~~938 breeding adults and an annual background mortality of 1,372 individuals per annum, the addition of five mortalities as a result of the Project would represent a 0.~~391~~347% increase in baseline mortality. Considering the more recent 2023 SMP population count of 30,466 breeding adults and an annual background mortality of 2,468 individuals per annum, the addition of five mortalities would represent a 0.~~217~~193% increase in baseline mortality based on the latest SMP count. This level of increase is considered to make no material contribution to any change in population or mortality levels, and would be indistinguishable from the natural fluctuations in the population.

~~781.~~899. **There is, therefore, no potential for an AEoI to the conservation objectives of the gannet features of the FFC SPA in relation to combined displacement and collision risk effects in the O&M phase from the Project alone and therefore, subject to natural change, this species will be maintained as features in the long-term.**

Scottish SPAs – Gannet

~~782.~~900. Gannet were assessed for both displacement and collision impacts during the post-breeding migration and return migration season at the Scottish SPAs listed in Table 9.8. Impacts resulting from displacement and collision are presented in Table 9.63~~Table 9.35~~ and Table 9.73~~Table 9.38~~ respectively. Impacts resulting from the combination of both these impacts on Scottish SPAs are presented in Table 9.76~~Table 9.41~~ below, on the basis that the predicted impact can be apportioned to each relevant SPA in line with the SPA colony counts within Furness (2015) (Appendix 7.1.1). The level of impact at all these Scottish SPAs is considered to make no material change to populations or mortality rates, and would be indistinguishable from the natural fluctuations in populations.

~~783.~~901. Therefore, the potential for an AEoI to the conservation objectives of the gannet feature at all these SPAs in relation to combined collision and displacement consequent mortalities during the O&M phase from the project alone can be ruled out, subject to natural change, gannet will be maintained as a feature in the long-term.

Table 9-769.769-~~9.41~~: Gannet combined displacement and collision mortalities at Scottish SPAs

Special Protection Area	Apportioned collisions	Displacement mortality (70% displacement and 1% mortality)	Combined mortality	SPA citation population increase in baseline mortality rate (%)	SPA recent population increase in baseline mortality rate (%)
Forth Islands SPA	0.1~~9~~	1.0~~0.3~~	1.1~~2~~	0.032~~5~~	0.009~~10~~
Fair Isle SPA	0.0~~1~~	0.1~~0~~	0.1	0.031~~40~~	0.010~~09~~
Hermaness, Saxa, Vord and Valla Field SPA	0.1~~4~~	0.1~~1~~	0.2~~5~~	0.015~~8~~	0.009~~11~~
Noss SPA	0.0~~1~~	0.1~~0~~	0.1~~2~~	0.035~~17~~	0.008~~10~~

9.4 Migratory Fish

~~784.~~902. The Migratory Fish alone ~~and in-combination~~ assessment~~s~~ has~~ve~~ been updated February 2025 to consider:

- The introduction of an Offshore Restricted Build Area (ORBA) over the northern section of the Project array area;
- The removal of the northern section of the offshore Export Cable Corridor (ECC); and
- ~~a revised in-combination assessment to reflect changes to project status or capture any new plans, projects or activities which have been progressed since the point of the Application; and~~
- M~~m~~inor errata including those previously identified by interested parties.

9.4.1 Assessment criteria

~~785.~~903. The approach taken to the assessment of migratory fish is based upon the following:

- The distance between the array area, WTG area, ORCP area, ANS area, biogenic reef area, and the relevant designated site;
- Sensitivity of the receptors (including consideration of the vulnerability, recoverability, value and importance of the receptors);
- Magnitude of impact (drawing on the spatial extent of any interaction, the likelihood, duration, frequency and reversibility of a potential impact); and
- The effects screened in for LSE.

~~786.~~904. For the RIAA, the assessment of potential for adverse effect draws on the conclusions of Part 6, Volume 1, Chapter 10: Fish and Shellfish Ecology but specifically in the context of the designated fish features (or supporting habitats), in light of the relevant conservation objectives, site-based advice and feature condition.

9.4.2 Maximum Design Scenario

905. Table 9.77~~Table 9.42~~ below provides the Maximum Design Scenario(s) considered for fish and shellfish in relation to underwater noise impacts, as described in Table 4.7 within Part 6, Volume 1, Chapter 10: Fish and Shellfish Ecology. The full project description is provided in Part 6, Volume 1, Chapter 3: Project Description for full reference. Note: as the assessment within the RIAA is only focused on Group 1 fleeing receptors (paragraph 876~~801~~), the MDS presented is tailored as such.

~~787.~~

Table 9-77~~9.77~~9~~-9.42~~: Maximum design scenario for fish and shellfish ecology for the Project alone.

Potential effect	Maximum design scenario assessed	Justification
Construction		
Mortality, injury and behavioural changes resulting from underwater noise arising from construction activity.	~~Array~~ WTG Area – sequential piling of jacket Foundations (temporal MDS) ▪ 100 WTGs on jacket foundations (5m pile diameter, four pin piles per foundation, one foundation per WTG). Sequential piling of six piles in a 24-hour period); ▪ Four small Offshore Substations (OSS) on jacket foundations (5m pile diameter, four piles per foundation and six foundations per OSS), sequential piling of six piles in a 24-hour period); ▪ One offshore accommodation platform (5m diameter jacket foundation, four piles per foundation and six foundations); ▪ Total of 520 piles within the ~~array~~ WTG area; ▪ Maximum hammer energy 3,500kJ; ▪ Six hour piling duration per pin pile for WTGs (2,400 hours piling) ▪ Eight-hour piling duration per pin pile for OSS and accommodation platform) (960 hours pling); ▪ 3,360 hours piling; ▪ Maximum separation distance between piling events will be the maximum extent of the ~~array~~ WTG area. ~~Array~~ WTG Area – sequential piling of monopile foundations (temporal MDS for Group 1 fleeing receptors) ▪ 100 WTGs on monopile foundations (13m pile diameter). Piling of one monopile in a 24-hour period, or sequential piling of two piles in a 24-hour period; ▪ Four small OSS on monopile foundations (14m pile diameter); ▪ One offshore accommodation platform (14m pile diameter); ▪ Total installation of 105 monopiles;	For the ~~array~~ WTG area, the spatial MDS for fleeing receptors from piling in the ~~array~~ WTG area relates to the concurrent piling of two monopile foundations for 100 WTGs, four OSS and one accommodation platform using 6,600kJ hammer energy. This would result in the largest spatial noise impact at any given time when considering impacts to fleeing receptors in the ~~array~~ WTG area. Within the ECC, the spatial MDS for fleeing receptors results from the sequential piling of monopiles for two ORCPs using 6,600kJ hammer energy. For the ANSs, when considering fleeing receptors, the spatial MDS results from the sequential piling of up to four pin piles for jacket foundations within a 24-

Potential effect	Maximum design scenario assessed	Justification
	■ Maximum hammer energy 6,600kJ; ■ Eight-hour piling duration; ■ 840 hours piling duration. ■ Maximum separation distance between piling events will be the maximum extent of the ~~array~~ WTG area. ~~Array~~ WTG area, concurrent piling of monopile foundations (spatial MDS for Group 1 fleeing receptors) ■ Monopile foundations (14m pile diameter). Two monopiles installed concurrently at NE and SW extents of ~~array~~ WTG area (6,600kJ hammer energy). Eight hour-piling duration. ECC (temporal MDS for Group 1 fleeing receptors) ■ Two ORCPs on jacket foundations (5m pile diameter, four piles per foundation and six foundations) total of 24 pin piles per ORCP; ■ Sequential piling of six piles in a 24-hour period); ■ Maximum hammer energy 3,500kJ; ■ 8 hours piling duration per pile. ■ 384 hours total piling duration. ECC (spatial MDS for Group 1 fleeing receptors) ■ Two ORCPs on monopile foundations (14m piles). Piling of one monopile in a 24-hour period, or sequential piling of two piles in a 24-hour period; ■ Maximum hammer energy 6,600kJ; ■ 8 hours piling per pile ■ 16 hours total piling duration . ANS (spatial and temporal MDS for Group 1 fleeing receptors MDS) ■ Two ANS on jacket foundations (5m pile diameter, four piles per foundation). Sequential piling of four piles in a 24-hour period);	hour period, using 3,500kJ hammer energy; or the single piling of one monopile within a 24-hour period using 6,600kJ hammer energy. Note, that the sequential piling of monopiles for the ANSs is not being considered as a piling scenario by the Project. Across the whole project, the temporal MDS results from the sequential piling of pin piles for jacket foundations, using 3,500kJ hammer energy. A total of 3,792 hours of piling within a seven-year construction window would result in the longest duration of piling.

Potential effect	Maximum design scenario assessed	Justification
	▪ Maximum hammer energy 3,500kJ; ▪ 6 Hours piling per pile ▪ 48 hours piling total duration. ANS (spatial MDS for fleeing receptors) ▪ Two ANS on monopile foundations (8m pile diameter). Single piling of one monopile in a 24-hour period. ▪ Maximum hammer energy 6,600kJ; ▪ 8 hours piling per pile ▪ 16 hours piling total duration. UXO Clearance: ▪ Max charge size: 800kg + donor	
O&M		
Underwater noise as a result of operational turbines.	Underwater noise during the operational phase from 100 WTGs and maintenance vessel operations over the lifetime of the project (i.e., up to 35 years). Twenty-four maintenance vessel operations per year, with 840 operations over the lifetime of the project.	Maximum number of operational WTGs and related O&M visits by vessels during the lifetime of the project.
Decommissioning		
Mortality, injury and behavioural changes resulting from underwater noise arising from decommissioning activity.	Maximum levels of underwater noise during decommissioning would be from underwater cutting required to remove structures. This is much less than pile driving and therefore impacts would be less than as assessed during the construction phase/piled foundations would likely be cut approximately 1m below the seabed	This would result in the maximum potential disturbance associated with noise associated with decommissioning activities including foundation decommissioning.

9.4.3 Description of significance

~~788.~~906. A description of the significance of Project level effects upon the receptors grouped under ''migratory fish'', as relevant to the designated site and their associated features screened in for potential LSE, is provided below. Conclusions on AEoI are drawn from the description of significance as relevant to each site and effect.

~~789.~~907. As described in Table 7.1, there is one site which has the potential for LSE for migratory fish features, the Humber Estuary SAC. The site are discussed below in relation to the potential for LSE from underwater noise from construction, operation and maintenance, and decommissioning of the Project.

9.4.4 Construction and decommissioning

9.4.4.1 Underwater noise

~~790.~~908. This section addresses the potential for AEoI from effects associated with underwater noise impacts arising from foundations installation during the construction phase and the decommissioning of foundations within the ~~array~~ WTG area and the ECC.

~~791.~~909. The potential for an AEoI as a result of underwater noise on migratory fish relates to the following designated site and the relevant features (i.e. those features screened in for potential LSE):

- Humber Estuary SAC:
  - Sea lamprey (*Petromyzon marinus*), (qualifying feature but not a primary reason for site selection); and
  - River lamprey (*Lampetra fluviatilis*) (qualifying feature but not a primary reason for site selection).

~~792.~~910. The conservation objectives of the Humber Estuary SAC are:

- To ensure that, subject to natural change, the integrity of the site is maintained or restored as appropriate, and that the site contributes to achieving the Favourable Conservation Status of its qualifying features, by maintaining or restoring:
- the extent and distribution of qualifying natural habitats and habitats of the qualifying species;
- the structure and function (including typical species) of qualifying natural habitats;
- the structure and function of the habitats of the qualifying species;
- the supporting processes on which qualifying natural habitats and the habitats of qualifying species rely;
- the populations of each of the qualifying species; and
- the distribution of qualifying species within the site.

~~793.~~911. The Screening Report (document reference 7.2) determined that the potential for LSE in relation to underwater noise during decommissioning would be similar to, and potentially less than, those outlined in the construction phase. Effectively, the potential for effect during decommissioning would fall within, and be no worse than, the degree of effect during construction, with any such decommissioning being subject to the relevant licensing requirements at that time. Therefore, the main focus of this assessment is in relation to the potential for effects during the construction phase of the Project only.

~~794.~~912. There are a number of sources of underwater noise associated with the Project alone during construction, with these identified within Part 6, Volume 1, Chapter 10: Fish and Shellfish Ecology. General construction noise (including that arising from vessel movements, dredging and seabed preparation works) has been screened out of the assessment, as it will generate low levels of continuous sounds (i.e., from the vessels themselves and/or the sounds from dredging tools) throughout the construction phase. The study area around the Project as defined for the ES is subject to relatively high levels of shipping activity currently, and it is expected that the vessel activity would be no greater than the baseline during construction activities (due to construction exclusion zones reducing current shipping activity and the number of construction vessels expected to be lower than that which currently transit the area). The underwater noise impacts from vessel noise are generally spatially limited to the immediate area around the vessel rather than having impacts over a wide area (e.g., Mitson, 1993). All general construction noise (including that arising from vessel movements, dredging and seabed preparation works) is considered to have a much smaller impact range than that of the piling and UXO noise considered below. Therefore, due to the high baseline activity and tolerance of receptors, these noise sources are screened out. The sources screened in for potential LSE here (in line with Section 8~~8~~ of the current report) being:

- Underwater noise from percussive piling within the ~~array~~ WTG area and the ORCP Area and decommissioning works; and
- Underwater noise during UXO clearance.

~~795.~~913. The approach taken by this RIAA is to assess these effects individually, with a conclusion of the effect from underwater noise drawn based on these effects. The importance of underwater noise for migratory fish is discussed in Part 6, Volume 1, Chapter 10: Fish and Shellfish and Volume 2, Annex 3.2: Underwater noise assessment. That information, together with the underwater noise that may result from the above activities (as discussed within both those reports) and how that may affect migratory fish, is drawn on here in the context of the conservation objectives for the relevant designated site. Each of these effects are discussed in turn below, including the relevance for the features identified.

Project level underwater noise

~~796.~~914. Underwater noise during construction of the Project has been studied specifically through the following, including that of direct relevance to migratory fish:

- Part 6, Volume 1, Chapter 10: Fish and Shellfish; and
- Part 6, Volume 2, Appendix 3.2: Underwater Noise Report.

915. Volume 2, Appendix 3.2: Underwater Noise Report and Underwater Noise Modelling Report for the ORBA (PD1-085) provides the technical evidence base for underwater noise, with Volume 1, Chapter 10: Fish and Shellfish providing the context for migratory fish, in relation to the potential for effects from underwater noise.

~~797.~~916. Underwater noise can potentially have a negative impact on fish species ranging from physical injury/mortality to behavioural impacts to masking of communication. In general, biological damage as a result of underwater noise is either related to a large pressure change (barotrauma) or to the total quantity of sound energy received by a receptor. Barotrauma injury can result from exposure to a high intensity sound even if the sound is of short duration (i.e. UXO clearance or a single strike of a piling hammer). However, when considering injury due to the energy of an exposure, the duration of the exposure and total energy received by the receptor becomes important. Fish are also considered to be sensitive to the particle motion element of underwater noise.

~~798.~~917. Fish receptors can be grouped into the Popper et al., (2014) categories (see Volume 2, Appendix 3.2: Underwater Noise Report.) based on their hearing system:

- Group 1: Fish with no swim bladder or other gas chamber–- which include sea and river lamprey and are sensitive only to particle motion and show sensitivity only to a narrow band of frequencies.
- Group 2: Fish with swim bladders in which hearing does not involve the swim bladder or other gas volume–- which includes salmonids, such as Atlantic salmon, and are more sensitive to particle motion than sound pressure.
- Group 3: Fish in which hearing involves a swim bladder or other gas volume–- e.g. clupeids such as shad species are primarily sensitive to sound pressure, although they also detect particle motion (Hawkins and Popper, 2016).

~~799.~~918. It is worth noting that the only species considered in this assessment (sea and river lamprey) are classed as a Group 1 receptors (Popper et al., 2014). The extent to which intense underwater sound might cause an adverse environmental impact in a particular fish species is dependent upon the level of sound pressure or particle motion, its frequency, duration and/or repetition (Hastings and Popper, 2005). The range of potential effects from intense sound sources, such as pile driving and explosions, includes immediate death, permanent or temporary tissue damage and hearing loss, behavioural changes and masking effects (Popper et al., 2014). Tissue damage can result in eventual death or may make the fish less fit until healing occurs, resulting in lower survival rates. Hearing loss can also lower fitness until hearing recovers. Specifically, when considering migratory fish features such as sea and river lamprey, underwater noise can cause barriers to migration, and therefore due consideration to this impact is given in this assessment.

~~800.~~919. The potential for mortality or mortal injury is likely to occur only in close proximity to the sound source, although for impact piling the risk of this occurring will be reduced by use of soft start techniques at the start of the piling sequence (Table 6.1). This means that fish near to piling operations will likely move outside of the impact range, before noise levels reach a level likely to cause irreversible injury. There is also a potential for mortality or mortal injury from UXO detonations, although it is worth noting that the Applicant is not applying for consent for UXO clearance works as part of the DCO application (as at this stage it is not clear if it will be required, or indeed if required to what extent and location, and a separate Marine Licence will be sought for such works once these factors have been established). With that said, it is anticipated that ADDs would be used prior to a UXO detonation (to be determined in the UXO-specific MMMP as part of the Marine Licence application). The reaction of free-swimming fish to ADDs is unknown, and based on anecdotal evidence from UXO campaigns where records have been made of fish floating at the surface after an explosion, it is possible that some fish will experience mortality and injurious impacts regardless of whether ADDs are used.

~~801.~~920. Recoverable injury is defined as a survivable injury with full recovery occurring after exposure, although decreased fitness during this recovery period may result in increased susceptibility to predation or disease (Popper et al., 2014). The impact ranges for recoverable injury and mortality/potential mortal injury are more or less the same due to the thresholds used. The impact thresholds for Group 1 species (including both sea and river lamprey) are presented in Table 9.78~~Table 9.43~~.

Table 9-78~~9.789-9.43~~: Impact threshold criteria from Popper et al. (2014).

Impact threshold noise level (dB re. 1µPa sound pressure level (SPL)/dB re. 1 µPa^{2}s sound exposure level (SEL))			
	Mortality and potential injury	Recoverable injury	TTS
Group 1	219dB SEL_{cum} 213dB SPL_{peak}	216dB SEL_{cum} 213dB SPL_{peak}	>>186dB SEL_{cum}

~~802.~~921. Temporary threshold shift (TTS) is a temporary reduction in hearing sensitivity caused by exposure to intense sound. TTS results from temporary changes in sensory hair cells of the inner ear and/or damage to auditory nerves. However, sensory hair cells are constantly added to fish and are replaced when damaged and therefore the extent of TTS is of variable duration and magnitude, with no potential for this to lead to permanent effects. Normal hearing ability returns following cessation of the noise causing TTS. When experiencing TTS, fish may have decreased fitness due to a reduced ability to communicate, detect predators or prey, and/or assess their environment. Part 6, Volume 1, Chapter 10: Fish and Shellfish Ecology presents the ranges at which TTS in fish may occur as a result of piling operations during the Project construction phase. There are no available thresholds for TTS effects from other noise sources, however, any impacts are likely to be localised, and for single sound sources such as that from UXO explosions, effects are likely to be within that from cumulative piling exposure.

~~803.~~922. Behavioural effects in response to construction related underwater noise include a wide variety of responses including startle responses (C-turn), strong avoidance behaviour, changes in swimming or schooling behaviour, or changes of position in the water column (e.g. Hawkins et al., 2014). Depending on the strength of the response and the duration of the impact, there is the potential for some of these responses to lead to significant effects at an individual level (e.g. reduced fitness, increased susceptibility to predation) or at a population level (e.g. avoidance or delayed migration to key spawning grounds). There are no quantitative thresholds advised for behavioural impacts assessment, however, Popper et al., (2014) provide qualitative behavioural criteria for fish from a range of sources. These categorise the risks of effects in relative terms as ''high, moderate or low'' at three distances from the source: near (10s of metres), intermediate (100s of metres), and far (1000s of metres), respectively.

~~804.~~923. Table 9.79~~Table 9.44~~, Table 9.80~~Table 9.45~~, and Table 9.81~~Table 9.46~~ summarise the maximum predicted impact ranges for mortality and potential mortal injury, recoverable injury and TTS from piing activities in the ~~array~~ WTG area , ORCP area within the ECC, and ANS areas. The impact ranges from piling within the ~~array~~ WTG area , ORCP area within the ECC, and ANS areas are also presented in Figure 9-9~~Figure 9.8Figure 9.4~~. UXO detonations are considered to have a low likelihood of triggering a population level effect, due to the limited temporal footprint that would arise from UXO operations, therefore effects are likely to be no greater than those from cumulative piling exposure. Behavioural impacts are discussed qualitatively below with respect to each species. It is also considered within Part 6, Volume 1, Chapter 10: Fish and Shellfish Ecology that while the concurrent scenario is identified as the spatial MDS for the ~~array~~ WTG area, due to the low sensitivity for Group 1 receptors (the only group considered in this report as defined within paragraph 876~~801~~), any impacts from piling to individuals are considered to be highly localised. There will be no overlap of impact range contours from the concurrent piling of monopiles or jacket foundations within the ~~array~~ WTG area or ANS area. Therefore, for group 1 fleeing receptors, the sequential installation of monopiles at the NE and SW locations of the ~~array~~ WTG area are considered to represent the spatial MDS.

Table 9-79~~9.79~~9-~~9.44~~: Noise modelling results for injury ranges for fleeing receptors from the sequential piling of WTG foundations in the ~~array~~ WTG area

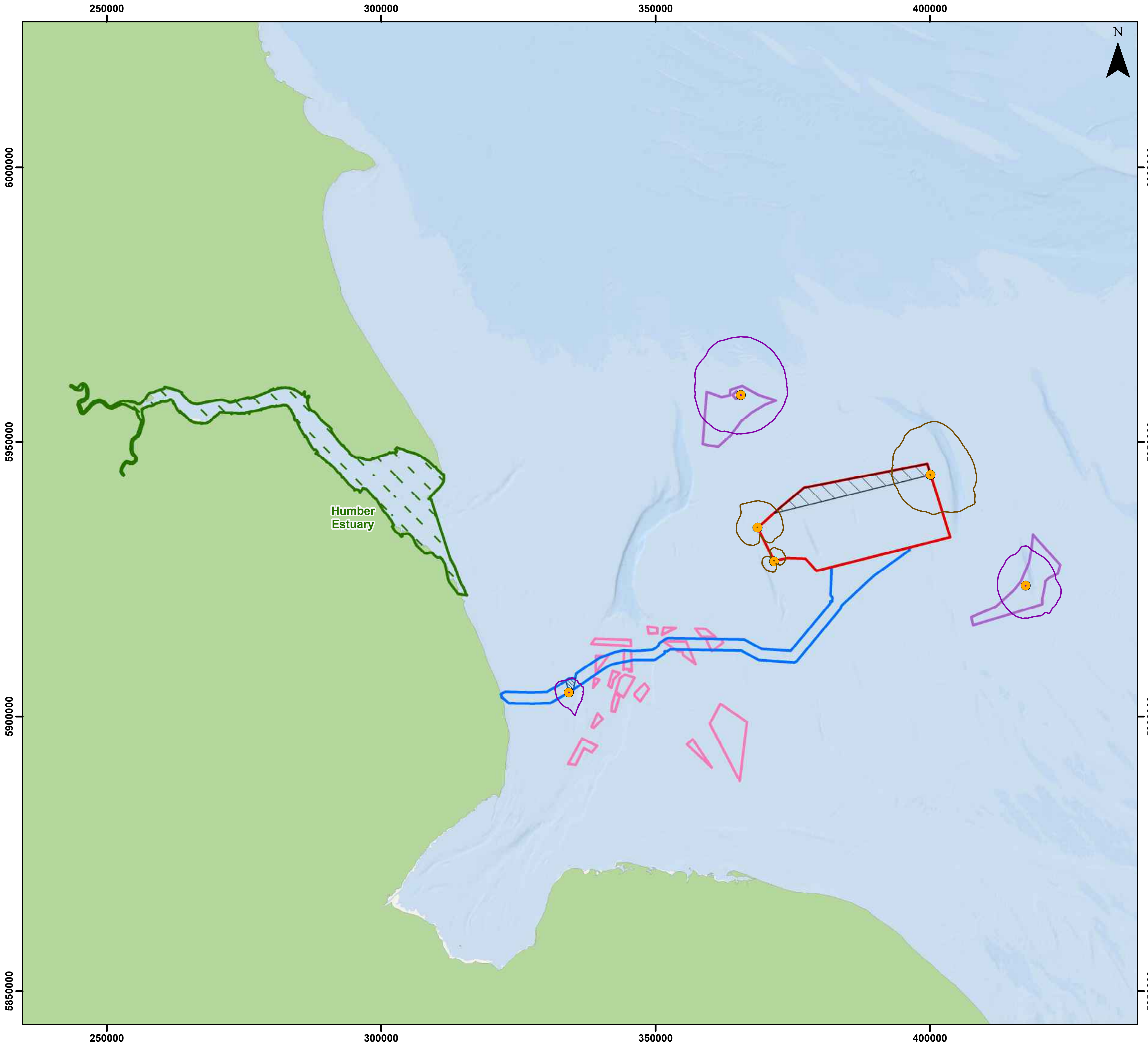
Criteria	Noise Level (dB re 1µPa Sound Exposure Level (SEL)/dB re 1µPa^2 Sound Exposure Level (SEL))	Monopile Foundation Impact Ranges (sequential piling of two monopiles in a 24-hour period)			Jacket Foundation Impact Ranges (sequential piling of six pin-piles in a 24-hour period)		
		Northwest	Northeast	Southwest	Northwest	Northeast	Southwest
Mortality and Potentially Mortal Injury							
SPL_{peak}	213	90m	110m	70m	70m	100m	60m
SEL_{cum} (fleeing)	219	<100m	<100m	<100m	<100m	<100m	<100m
Recoverable Injury							
SPL_{peak}	213	90m	110m	70m	70m	100m	60m
SEL_{cum} (fleeing)	216	<100m	<100m	<100m	<100m	<100m	<100m
TTS							
SEL_{cum} (fleeing)	186	5.2km	~~10km~~9.7km	3.6km	3.8km	8.3km	2.4km

Table 9-809.809 9.45: Noise modelling results for injury ranges for fleeing receptors from the single and sequential piling of ORCP foundations in the ECC

Criteria	Noise Level (dB re 1µPA Sound Exposure Level (SEL)/dB re 1µPA^2 Sound Exposure Level (SEL))	Monopile Foundations		Jacket Foundations	
		N	S	N	S
Mortality and Potentially Mortal Injury					
SPL_{peak}	213	80m	80m	70m	70m
SEL_{cum} (fleeing)	219	<100m	<100m	<100m	<100m
Recoverable Injury					
SPL_{peak}	213	80m	80m	70m	70m
SEL_{cum} (fleeing)	216	<100m	<100m	<100m	<100m
TTS					
SEL_{cum} (fleeing)	186	2.7km	4.4km	1.8km	3.1km

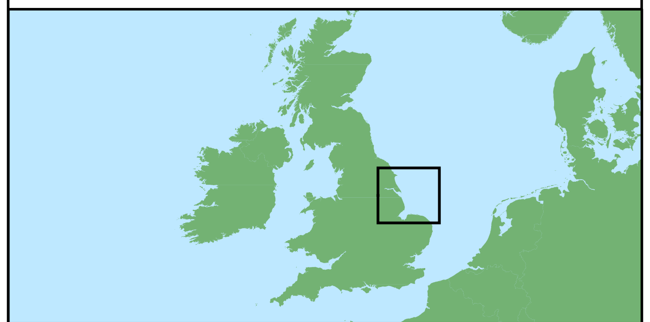
Table 9-81~~9.819-9.46~~: Noise modelling results for injury ranges for fleeing receptors from the single piling of monopile foundations and sequential piling of jacket foundations at the ANS'.

Criteria	Noise Level (dB re 1µPA Sound Exposure Level (SEL)/dB re 1µPA^2 Sound Exposure Level (SEL))	Monopile Foundations		Jacket Foundations	
		N	S	N	S
Mortality and Potentially Mortal Injury					
SPL_{peak}	213	90m	90m	100m	90m
SEL_{cum} (fleeing)	219	<100m	<100m	<100m	<100m
Recoverable Injury					
SPL_{peak}	213	90m	90m	100m	90m
SEL_{cum} (fleeing)	216	<100m	<100m	<100m	<100m
TTS					
SEL_{cum} (fleeing)	186	11km	7.2km	11km	7.1km



Legend

- Array Area
- Offshore Restricted Build Area
- Offshore Export Cable Corridor
- ORCP Area
- Artificial Nesting Structure Area
- Biogenic Reef Restoration Area
- Special Areas of Conservation
- Underwater Noise Modelling Locations
- Monopile Foundations, Single Piling (6,600 kJ)
- Monopile Foundations, Sequential Piling (6,600 kJ)



Coordinate System: WGS 1984 UTM Zone 31N

0 20 40 km

Scale: 1:650,000

A3 Page Size

RIAA

Underwater Noise Impact Ranges from Piling within the Array Area and ECC Relative to the Humber Estuary SAC

Figure 9.9

Date: 22/01/2025
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Underwater noise from piling within the ~~array~~ WTG area, ECC ORCP area, and ANS area.

~~805.~~924. As summarised in Table 9.79~~Table 9.44~~, the maximum design scenario in relation to underwater noise impacts from piling of foundations within the ~~array~~ WTG area, when considering the worst-case impacts on migratory fish species is the following:

- The sequential piling of monopile foundations at the Northeast location of the ~~array~~ WTG area (two piles per 24 hours).

~~806.~~925. As summarised in Table 9.80~~Table 9.45~~ the maximum design scenario in relation to underwater noise impacts from piling of foundations within ORCP area, when considering the worst case impacts on migratory fish species is the following:

- The piling of monopile foundations at the South location of the ORCP area (one pile per 24 hours).

~~807.~~926. As summarised in Table 9.81~~Table 9.46~~, the maximum design scenario in relation to underwater noise impacts from piling of foundations within ANS area, when considering the worst case impacts on migratory fish species is the following:

- The piling of monopile foundations at the North location of the ANS area (one pile per 24 hours).

Consideration of sea lamprey and river lamprey

~~808.~~927. The Humber Estuary, to the north of the study area, is known to host several key diadromous species. Specifically, river lamprey (*Lampetra fluviatilis*) and sea lamprey (*Petromyzon marinus*) are known to migrate through the Humber estuary to freshwater spawning habitats within tributaries that flow into the estuary. The Humber Estuary SAC has both sea and river lamprey present as qualifying features, but not as primary reasons for site selection.

~~809.~~928. Sea lamprey is classed as a Group 1 species (Popper et al., 2014); Group 1 species lack a swim bladder and are therefore considered less sensitive to underwater noise (than other species). Sea lampreys are of mobile nature and are therefore able to flee from noise disturbance. Sea lamprey are also considered transient receptors across the Project during migration. Sea lamprey are widely distributed species when out of the natal rivers and have been found within shallow coastal waters and deep offshore waters (Maitland, 2003). Sea lamprey are not thought to specifically migrate back to their natal rivers (Bergstedt and Seelye, 1995; Waldman et al., 2008); instead, they are thought to return to rivers within the regional area, navigating primarily by detection of larval pheromones to identify suitable rivers (i.e. those with pre-existing larvae) (reviewed in Hansen et al., 2016). This flexibility in homing behaviour of this anadromous fish, combined with the low sensitivity of this species to underwater noise, suggests that noise impacts would only have a very localised effect.

~~810.~~929. Based on their low vulnerability to noise impacts, and their transient nature across the site during migration, sea lamprey are expected to recover quickly, returning to normal behaviours, and recolonising areas shortly after disturbance. Taking this into account, the receptors are deemed to be of low vulnerability, high recoverability and are of national importance. The sensitivity of these receptors to underwater noise impacts is therefore considered to be low.

~~811.~~930. River lamprey is classed as a Group 1 species (Popper et al., 2014), without a swim bladder and are, therefore, considered less sensitive to underwater noise (than other species). River lampreys are of mobile nature and are considered transient across the Project during migration and are therefore able to flee from noise disturbance. River lamprey typically remain within estuarine environments during their adult life stages (Maitland, 2003) and therefore are unlikely to be present close to any noisy activities from the Project, with no potential barrier to migration from noise. Based on their low vulnerability to noise impacts, and their mobile nature, these receptors are expected to recover quickly, returning to normal behaviours, and recolonising areas shortly after disturbance. Taking this into account, the receptors are deemed to be of low vulnerability, high recoverability and are of national importance. The sensitivity of these receptors to underwater noise impacts is therefore considered to be low.

~~812.~~931. Given the nature of noise effects, and the transient nature of sea lamprey and river lamprey across the Project during migration, it is anticipated that sea lamprey and river lamprey would display a fleeing response to noise, and therefore would experience less exposure to underwater noise. In the context of the assessment, fleeing receptors are anticipated to flee from the source at a consistent rate of 1.5 ms-1. Based on the worst case scenarios for underwater noise from piling of foundations within the ~~array~~ WTG area, injurious effects on fleeing fish receptors will only occur in the immediate vicinity (<100m) of the piling activity. TTS effects have the potential to occur up to 11km from foundation piling within the ~~array~~ WTG area (Figure 9-9~~Figure 9.4~~). Taking into consideration the distance of the ~~array~~WTG area from the Humber Estuary SAC (53.1 km), there are no anticipated effects from underwater noise on the sea lamprey and river lamprey features within the designated site.

~~813.~~932. Based on the worst-case piling scenario for underwater noise from the piling of ORCP foundations within the ECC, which results from the piling of monopile foundations, injurious effects on fleeing fish receptors will only occur in the immediate vicinity (<100m) of the piling activity. TTS effects have the potential to occur up to 4.8km from the ORCP area (Figure 9-9~~Figure 9.4~~). Taking into consideration the distance of the ORCP area from the Humber Estuary SAC (14.4km), there are no anticipated effects from underwater noise on the sea lamprey or river lamprey features within the designated site.

~~814.~~933. Based on the worst case scenarios for underwater noise from piling of foundations for the ANS' foundations, injurious effects on fleeing fish receptors will only occur in the immediate vicinity (<100m) of the piling activity. TTS effects have the potential to occur up to 11km from the ANS foundations (Figure 9-9~~Figure 9.4~~). Taking into consideration the distance of the ~~array~~ WTG area from the Humber Estuary SAC (54.4~~47.5~~km), there are no anticipated effects from underwater noise on the sea lamprey and river lamprey features within the designated site.

~~815.~~934. As defined above, there are no quantitative thresholds advised to be used to assess behavioural impacts, however, Popper et al., (2014) provide qualitative behavioural criteria for fish from a range of sources. When considering these criteria, the risk of behavioural effects or auditory masking for sea lamprey and river lamprey is low and within the immediate field (100s of meters). Near field impacts are considered likely to be contained within the TTS effects described above. Therefore, there are not considered to be any significant behavioural impacts on sea or river lamprey.

~~816.~~935. Considering the localised nature of underwater noise from piling within the ~~array~~ WTG area, ORCP area, and ANS area, and the transient nature of the migratory receptors and the low sensitivity of the receptors to underwater noise, there will be no direct impacts from underwater noise from piling activities on migratory fish features within the designated site, and consequently no barriers to migratory behaviours. Any impacts from underwater noise from piling activities on sea and river lamprey within the vicinity of the Project that may be attributed as features of the designated site will be of localised nature, with no population level effects anticipated.

~~817.~~936. As stated in paragraph 9.5.10, the potential for effects during decommissioning will likely fall within, and be no worse than, the degree of effect during construction, with any such decommissioning being subject to the relevant licensing requirements at that time. Therefore, there are no adverse effects on migratory fish features of the Humber Estuary SAC anticipated to occur during the decommissioning phase of the Project.

~~818.~~937. Due to the transient nature of sea lamprey and river lamprey across the site, the low sensitivity of the features, and the localised impact ranges from underwater noise it is considered that there is, **therefore, no AEoI to the sea lamprey and river lamprey features of the Humber Estuary SAC from the Project alone during construction and decommissioning and therefore, subject to natural change, the population of sea lamprey will be maintained in the long-term with respect to underwater noise from construction and decommissioning from the Project.**

Underwater noise from UXO clearance

~~819.~~938. Prior to the start of construction UXO investigation works will be required which may require clearance of UXO through in-situ detonation, resulting in the emission of underwater noise. The Applicant is not applying for consent for UXO clearance works as part of this DCO application (as at this stage it is not clear if it will be required, or indeed if required to what extent and location, and a separate Marine Licence will be sought for such works once these factors have been established). However, it is acknowledged that such UXO clearance could occur and therefore, it is appropriate to consider the potential impacts of this additional source of underwater noise on migratory fish receptors. Should UXO be detected during the pre-construction geophysical survey, clearance (including a detonation option) may be required prior to construction as a safety measure. Any required UXO clearance would take place within the pre-construction phase (broadly 2026), with the proposed date for piling being 2027 - 2029. Therefore, the earliest any such clearance may occur is anticipated to be in 2026.

~~820.~~939. Consideration of impacts from UXO is made on a risk of injury basis and a disturbance element. Part 6, Volume 1, Chapter 10: Fish and Shellfish considers that UXO clearance activities are one of the loudest anthropogenic noise sources that occur underwater, with source levels that can be higher than those from piling (depending on the methodology used). UXO clearance has the potential to result in mortality, potential mortal injury, recoverable injury, TTS and disturbance to fish and shellfish species, depending on the proximity of the individuals to the UXO location and the size of the UXO. Small scale mortality of fish as a result of UXO detonation are evidenced (Dahl et al., 2020), with dead fish recorded floating at the surface following detonation, typically within the immediate vicinity of the detonation and as such this is expected to be a localised impact. However, recoverable injury and disturbance effects will impact a progressively larger area, with TTS and behavioural effects potentially occurring 10's of kilometres from the UXO location.

~~821.~~940. For the purpose of UXO clearance, the current position from the MMO and ~~SNCB~~ANCBs is that low order must be used as the primary clearance method. Where low order is not possible, standard practice for English projects is that bubble curtains are used for high order clearance events.

~~822.~~941. Section 4.7 of Part 6, Volume 1, Chapter 10: Fish and Shellfish concluded that while individual UXO detonations have the potential to result in impact ranges comparable to piling events (as described above) the short-term (seconds) and discrete nature of a UXO detonation is considered to result in a lesser effect. This is because UXO detonation is a discrete event, and while this may result in some temporary disturbance to migratory fish, it is unlikely to result in any significant disturbance compared to more continuous noise sources such as piling that may occur intermittently over a longer period. Furthermore, river lamprey and sea lamprey are considered transient receptors across the site during migration and are able to flee from noise disturbance, and consequently will have less exposure to underwater noise. Taking the above into consideration, there are not anticipated to be any impacts on sea lamprey or river lamprey within the Humber Estuary SAC. Furthermore, there are not anticipated to be any population level effects on sea lamprey or river lamprey outside of the Humber Estuary SAC that may be attributed as features of the designated site.

~~823.~~942. Therefore, based on the transitory nature of sea and river lamprey, short-term and spatially limited nature of the impact, it is concluded that **there is no AEoI to the sea lamprey or river lamprey for the Humber Estuary SAC from the Project alone during construction and decommissioning and therefore, subject to natural change, the populations of sea and river lamprey will be maintained in the long-term with respect to underwater noise associated with UXO clearance.**

9.4.5 Operation & Maintenance

9.4.5.1 Underwater noise from operational WTGs

~~824.~~943. The potential for an AEoI as a result of underwater noise on migratory fish during O&M relates to the following designated site and relevant features (i.e. those features screened in for potential LSE):

- Humber Estuary SAC:
  - Sea lamprey (*Petromyzon marinus*), (qualifying feature but not a primary reason for site selection); and
  - River lamprey (*Lampetra fluviatilis*) (qualifying feature but not a primary reason for site selection).

~~825.~~944. The conservation objectives at the Humber Estuary SAC are listed in paragraph 9.5.8 et seq.

~~826.~~945. Operational WTGs will produce underwater noise as a result of vibration from the rotating machinery in the turbines, which is transmitted through the structure of the pile and foundations. The MMO (2014) review of post-consent monitoring at OWFs found that available data on the operational WTG noise, from the UK and abroad, in general showed that noise levels from operational WTGs are low and the spatial extent of the potential impact of the operational WTG noise on marine receptors is generally estimated to be small. This is supported by several published studies which provide evidence that while detectable, behavioural and/or physiological (stress) responses are restricted to very-close ranges (Thomsen et al., 2006).

~~827.~~946. The potential for operational noise to affect migratory fish is noted in Part 6, Volume 1, Chapter 10: Fish and Shellfish, where it is concluded that there is no significant effect on fish receptors. Specifically, it is considered that the source of noise from an operational turbine mainly originates from the gearbox and the generator, and has tonal characteristics (Madsen et al., 2005; Tougaard et al., 2009). The radiated levels are low and the spatial extent of the potential impact of the operational windfarm noise on marine receptors is generally estimated to be small and thus unlikely to result in any injurious effects on fish. Previous studies show that behavioural responses of fish are only likely to occur at close ranges from the turbine, (i.e., a few metres) (Wahlberg and Westerberg, 2005).

~~828.~~947. There is evidence to suggest that fish species are unlikely to show significant avoidance to the noise levels generated by turbines, with the presence of continuous noise that is not significantly above the hearing threshold of fish not thought to cause any significant movement of fish away from the source (Mitson, 1993). Studies of very low frequency sound have indicated that consistent deterrence from the source is only likely to occur at particle accelerations equivalent to a free-field sound pressure level of 160dB re 1~~?~~ Pa (RMS) (Sand et al., 2001). This is higher than the noise levels reported in the open literature for operational windfarms measured at a number of ranges, all within a few hundred metres of the turbine (Edwards et al., 2007; see also Wahlberg and Westerberg, 2005 and Madsen et al., 2006).

~~829.~~948. The particle acceleration resulting from an operational wind turbine has also been measured by Sigray et al., (2011) with the resultant levels being considered too low to be of concern for behavioural reactions from fish. Furthermore, the particle acceleration levels measured at 10m from the turbine were comparable with hearing thresholds. Whilst limited, the available data provides an indicator that operational wind turbines are unlikely to result in disturbance of fish except within very close proximity of the turbine structure, as postulated by Wahlberg and Westerberg (2005). However, the available measurement data are mostly for smaller turbines (up to 7MW), and it would be expected that larger wind turbines would result in different acoustic characteristics, with foundation type also having an influence on the acoustic characteristics of the noise radiated from the structure.

~~830.~~949. Noise would also result from surface vessels servicing the windfarm. However, noise levels reported by Malme et al. (1989) and Richardson et al. (1995) for large surface vessels indicate that physiological damage to Group 1 fish, such as sea and river lamprey, is unlikely due to their low sensitivity. Considering the operational turbine noise of the windfarm and any associated service vessels, the ambient noise levels within the site would be expected to be lower than those present in the vicinity of nearby shipping lanes.

~~831.~~950. With respect to the potential for disturbance to result in displacement of individuals, and given existing evidence which demonstrates the migratory fish are not displaced from offshore windfarms in general following construction, it is therefore anticipated that, in line with a number of studies conducted to date, any such disturbance response would be in close proximity to turbines only.

~~832.~~951. As regards the conservation objectives for the Humber Estuary SAC, it is considered that whilst the noise generated is long-term and continuous throughout the lifetime of the Project, the potential effects are negligible (especially in comparison to the construction phase effects). Furthermore, considering the distance of the ~~array~~ WTG area from the Humber Estuary SAC and the localised nature of the impact, there will be no direct impacts from operation noise from turbines on migratory fish features within the designated site. Any impacts from underwater noise from operational turbines on sea and river lamprey within the vicinity of the ~~array~~ WTG area that may be attributed as features of the designated site will be of a very small scale nature with negligible population level effects. The risk of effects to sea lamprey and river lamprey at the site is therefore negligible and there is no adverse effect on the extent, distribution, structure and function of the species, structure and function of the supporting habitats and processes, and the population and distribution of the species within the site. **Therefore, it is concluded that there is no AEoI to the sea lamprey or river lamprey for the Humber Estuary SAC from the Project alone and therefore, subject to natural change, the populations of sea and river lamprey will be maintained in the long-term with respect to underwater noise associated with the O&M phase.**

9.5 Onshore Ecology and Ornithology

9.5.1 Assessment criteria

Ornithology Surveys

~~833.~~952. Winter bird surveys were completed during winter 2022/23 (season one) and winter 2023/24 (season two)~~at the end of March 2023~~. The methods and results are presented in ES Volume 3, Appendix 3.22.3.

~~834.~~953. Breeding bird surveys were concluded in July 2023. The methods and results are presented in ES Volume 3, Appendix 3.22.4. The Maximum Design Scenario (MDS) for onshore infrastructure is detailed in Table 9.82~~Table 9.47~~.

Habitat Surveys

~~835.~~954. Records of Annex I habitats and notable plants were requested from Greater Lincolnshire Nature Partnership (GLNP) for all land within the Order Limits, plus a 2 km buffer. The MAGIC website was searched for Annex I habitats within the Order Limits plus 100m. This information was used to provide context for surveys. During the field survey, habitats were mapped using the UK Habitat Classification v1.1 (Butcher, *et al.*, 2020) which includes Annex I habitat types. The presence of notable or invasive non-native plant species was also recorded during the habitat survey.

Invertebrate Surveys

~~836.~~955. In August 2023, a desk study was undertaken for the Order Limits and land within a 2km surrounding radius. The desk study involved a review of the following sources of information for terrestrial invertebrates:

- Information on statutory designated sites for nature conservation and geological interest and priority habitats, for the Order Limits and 2km radius, was obtained from the Multi-Agency Geographical Information System (MAGIC) website managed by Natural England; and,
- Greater Lincolnshire Nature Partnership (GLNP) for information regarding protected and notable species, and locally designated sites with invertebrate interest.

~~837.~~956. The survey of terrestrial invertebrates was undertaken in accordance with the guidelines set out in Surveying Terrestrial and Freshwater Invertebrates for Conservation Evaluation (Drake, et al, 2007). Targeted locations were identified following review of UK Habitat survey data collected in 2023, aerial photography and Ordinance Survey (OS) maps. Areas were identified with the likelihood to contain features of importance to invertebrate species (as outlined in Kirby, P., 2013): Habitat Management for Invertebrates). The study area for terrestrial invertebrates has been determined as 100m from the red line boundary due to the lack of mobility and strong habitat fidelity of the majority of notable and endangered invertebrate species. This was extended to 500m where there are sites of known invertebrate importance to ensure that connectivity between these sites and the project has been accounted for.

~~838.~~957. Habitat information from UK Habitat Surveys, aerial photographs, and maps were reviewed and compared with broad habitat types from Pantheon (Webb, J. et al., 2018) (a database tool developed by Natural England and the Centre for Ecology & Hydrology to analyse invertebrate sample data) to evaluate associated habitats and resources, assemblage types (adapted from the Invertebrate Species-habitat Information System [ISIS]), and habitat fidelity scores. The broad habitat types and habitat information were also assessed to identify the potential Species Assemblage Types (SATs) likely to be associated which are an indicator of Invertebrate Assemblages of Importance.

Otter Surveys

~~839.~~958. Otter records were requested from Greater Lincolnshire Nature Partnership (GLNP) for all land within the Order Limits, plus a 2 km buffer (the Study Area) to provide context for data gathered during the field surveys. The field survey area included all accessible waterbodies (ponds, ditches, streams and rivers) within the Order Limits, and functionally linked waterbodies, both 250m upstream and downstream of a watercourse within the Order Limits. Habitat suitability assessments were initially undertaken to ascertain a waterbodies suitability to support otter. Where habitats presented favourable conditions for otter, further survey visits were carried out to establish presence/ absence of a population.

~~840.~~959. Initially there were 641 waterbodies identified which were going to have surveys undertaken. After the initial surveys, forty-two of these were scoped out due to them being dry or not existing once a site visit was made, therefore a total of 599 waterbodies were surveyed for otter. Where land access was available, two survey visits were undertaken between April 2023 and September 2023 to record presence/ absence. Typically, the two survey visits were at least six weeks apart for any one waterbody. Otter surveys were undertaken in accordance with standard methodologies (Chanin, 2003). Field signs such as holts, couches, slides, spraints and feeding remains were searched for during surveys. The location and details of otter field signs were recorded digitally in Field Maps on a GPS enabled mobile mapping device and geo-referenced photographs were taken, as appropriate. Where evidence of otter presence was recorded, the banks of the waterbody within the immediate vicinity of the recording were searched in greater detail for habitat features suitable for otter. These habitat features include:

- resting sites, or potential resting sites where suitable habitat exists but no evidence of otter presence is found;
- otter holts, or potential otter holts (as above);
- breeding sites, where evidence may include a number of very well-defined otter trails in a small area and/ or cub-sized otter footprints; and,
- commuting opportunities (e.g. dense reedbeds or tall ruderal vegetation) which may allow otter to travel through their home range.

9.5.1.1 MDS for Onshore Ecology & Ornithology

~~841.~~960. The Maximum Design Envelope is outlined in Chapter 3 Project Description (document reference 6.1.3) and the following parameters are supported by the following figure that can be found in ES Volume 2:

- Figure 3.4 Indicative Onshore Infrastructure (document reference 6.2.3.4)
  - *This figure outlines the indicative infrastructure layers as well as associated IDs that have been assigned to each infrastructure element for reference throughout this chapter and the ES. Where an ID is relevant to this figure it is presented in square brackets e.g. [PCC-1].*

Table 9-82~~9.829-9.47~~: Maximum Design Scenario for Onshore Ecology and Ornithology from the Project Alone

Potential effect	Maximum design scenario assessed	Justification
Construction		
Damage to international designated sites	There is potential for the project to negatively impact air quality and some ecological receptors during cable installation, construction of temporary and permanent infrastructure and the final removal of plant form the site. Construction dust can smother species and lead to changes to the chemical composition or the receiving environment. Road traffic emissions generated during the construction phase have potential to negatively impact on sensitive ecological receptors. Decommissioning phase traffic movements and other works could also lead to impacts.	The largest area and duration of potential temporary habitat loss has been considered. Given the sequential nature of the works, it may be that some areas can be reinstated ahead of the 51-month schedule, but they cannot be determined at this stage. It is not expected that there will be any additional permanent onshore habitat loss to that described here.
Permanent habitat loss	Permanent habitat loss associated with onshore Order Limits is limited to the OnSS (including the permanent access), the permanent access (off Roman Bank road) at the Landfall and the Link Box manhole covers located along the onshore ECC and 400kV cable corridor and at the TJB sites. Link boxes are expected to have a permanent footprint of approximately 4m^2 (one manhole type cover) per link box and as they are distributed throughout the Order Limits, will not result in a material loss of habitat for birds. There will be two manhole type covers for each TJB (circuit).	
Temporary habitat loss AND Pollution of waterbodies and	Most of the cable route will be constructed using an open cut method of cable construction. Where open cut trenching is not practicable, for example, due to significant obstructions, or to avoid a significant feature, trenchless techniques will be employed. Vegetation will be cleared from the areas proposed for open cut trenching, temporary construction compounds, cable installation compounds, the OnSS and	

Potential effect	Maximum design scenario assessed	Justification
watercourses, especially via suspended solids	access tracks (Including temporary and permanent access) . The installation of the onshore export cable is a linear construction project with an expected overall construction duration of up to 51-months in total. Enabling access tracks will not require any surface clearance or excavation, however track matting or similar may be laid to protect the ground surface during wet conditions. The potential impacts from the enabling accesses are so minor that they have been excluded from assessment. The trenchless crossing areas (without a haul road) will have no physical impact to above ground habitats. Some sections where trenchless techniques are being employed will have a haul road running through them. The haul road will not cross rivers and main drains. Approximately 30% of the route will be installed by trenchless techniques, which reduces the footprint of land temporarily lost. Haul road would be typically 6.8m wide (and up to 9m at passing places) including verges and drainage channels (where required). It is assumed for the Cable Installation Compounds (CICs) that the whole area will be stripped of vegetation. The area will include the launch/receive pits and plant and machinery will include excavators and drilling rigs. For other temporary construction compounds (SCCs and PCCs), it is also assumed that the whole area will be subject to vegetation clearance. These areas may be used for equipment and materials storage, welfare facilities and staff parking. For all other areas habitats that have been cleared will be reinstated on a like for like basis. Where those habitats have been identified as having important ecological	

Potential effect	Maximum design scenario assessed	Justification
	functionality, they will be enhanced in line with the commitments presented within the Outline Landscape and Ecological Management Strategy (OLEMS) (document reference 8.10). For example, a hedgerow may be replaced with greater species diversity, more standard trees, and an enhanced management regime. In addition, there will be landscape planting at the new OnSS which in addition to providing a visual screen, will also provide enhance habitat for many bird species. Areas where works are not due to take place will be left undisturbed until Year 2, rather than stripping the entire corridor in Year 1. Approximately 1/3 of the ECC will remain unstripped during the winter of construction year 1. Main rivers, IDB and EA maintained assets will be crossed by trenchless techniques where technically practical. It may be preferable for some smaller watercourses and drains to be crossed by open trench crossing. MDS is as described in Chapter 24 Onshore Hydrology, Hydrogeology and Flood Risk.	
Disturbance to birds and otter	The potential exists for bird species to be disturbed by noise and human presence. It is assumed that the construction will take place over up to 51-months and across all seasons. Chapter 6.1.3 states that “The cable duct installation works are continuous, with each work front progressing a section at a time. In any given location, once the cable ducts have been installed, the trench will be backfilled, and the work front will continue moving onto the next section to minimise the amount of land being worked on at any one time”. Onshore construction works and construction-related traffic movements to or from the site shall typically take place between 0700 hours and 1900 hours Monday to Saturday with no activity on Sundays or bank holidays, noting the exceptions as set out in the draft DCO.	

Potential effect	Maximum design scenario assessed	Justification
	Landfall installation will be undertaken from the Transition Joint Bay (TJB) site on the west side of Roman Bank. The trenchless technique that will be adopted at the landfall is HDD. Most of the cable route will be constructed using an open cut method of cable construction. During construction of the cable trenches the topsoil will be stripped and subsoil excavated. The trenches will be excavated using a mechanical excavator, and the export cables will be installed into the open trench from a cable drum delivered to site. The remainder of the trench is then backfilled with the excavated material. The stored topsoil will then be replaced and the surrounding land reinstated back to its previous use. An earth bund will be installed at the perimeter of the open trench sections only, on both sides, approximately 1.5m in height, which will be seeded. Where an open trench approach is not possible, for example, due to significant obstructions (e.g. a major road or watercourse), trenchless techniques may be employed, such as HDD. Plant and machinery at Cable Installation Compounds will include excavators and drilling rigs. There will be six ‘major’ trenchless installation locations, including the landfall and The Haven crossing; the rest are classed as ‘minor’ drills. For the onshore substation, grading, earthworks and drainage will be undertaken initially. Foundations will then be installed which will either be ground-bearing or piled, based on the prevailing ground conditions. The proposed building substructures will be predominantly composed of steel and cladding materials although brick/block-built structures are sometimes employed. The steelwork may	

Potential effect	Maximum design scenario assessed	Justification
	be erected with the use of cranes. A key aspect of the substation installation will be the delivery of the transformers, shunt reactors, dynamic reactive power compensators (e.g. static synchronous compensators), and harmonic filters. Due to their size and weight, these items will be classified as Abnormal Indivisible Loads (AILs) and delivered via specialist means and offloaded with the use of cranes, Self-Propelled Modular Transporters (SPMTs) or skids. The majority of the remaining equipment is anticipated to be erected with the use of small mobile plant and lifting apparatus. No construction works are planned to occur on the beach or inter-tidal zone.. Open trenching works will be focussed on the summer months and no trenching is expected during November to February inclusive. During October and March, soil handling works will be reduced and will only take place where ground conditions are suitable. During the winter period (November to February inclusive), works continue at trenchless installation sites and joint bays that can be accessed by temporary haul roads. Areas of silt lands, closest to the coast will be targeted for construction during the summer months, because of the nature of the soils. These areas are heavily cropped for brassicas and are closest to coastal areas.	
Air quality impacts on all ecological receptors	Effects from air quality are largely associated with airborne pollutants caused by construction traffic and equipment. The assessment will focus on designated sites within and close to the construction zone, temporary site compounds and along access roads and will consider the likely change relative to critical loads. Dust deposition impacts will also be assessed. MDS is as described in Chapter 19 Onshore Air Quality.	

Potential effect	Maximum design scenario assessed	Justification
Operation and Maintenance		
Disturbance of birds and otter during planned and unplanned maintenance works when the proposed development is operational.	There are no SPAs, Ramsars or SACs within the onshore ECC boundary, however, the Greater Wash SPA is located immediately adjacent to the onshore Order Limits at the Landfall and includes the inter-tidal zone. The route may affect areas that are functionally linked to designated sites. Construction activities may also have indirect impacts on the designated sites e.g. alterations in hydrological conditions, pollution or air quality impacts.	It is assumed that impacts could occur as protected and priority species have been recorded within the Order Limits.
Decommissioning		
Impacts during decommissioning are likely to be similar to construction, but more limited in geographical extent and timescale and there would be no permanent habitat loss.	Onshore, it is expected that cable would be left in-situ to avoid adverse effects on the environment and communities. The PD chapter states *The decommissioning process for the ECC has not been made regarding the final decommissioning policy for the onshore cables, considering that industry best practices, rules and legislation change over time.* An onshore decommissioning plan will be developed providing further details on the decommissioning of the onshore elements of the Project in accordance with the onshore decommissioning requirement of the DCO.	It is assumed that impacts could occur as protected and priority species have been recorded within the Order Limits.

~~842.~~961. The onshore Order Limits are shown in Figure 9.5 to Figure 9.11.

~~843.~~962. For the purposes of assessment, the onshore Order Limits have been split into segments from landfall to the Connection Area as shown in Figure 9.5 to Figure 9.11 and listed below:

- ECC 1: Landfall to A52 – Hogsthorpe
- ECC 2: A52 – Hogsthorpe to Marsh Lane
- ECC 3: Marsh Lane to A158 - Skegness Road
- ECC 4: A158 – Skegness Road to Low Road
- ECC 5: Low Road to Steeping River
- ECC 6: Steeping River to Fodder Dike Bank/Fen Bank
- ECC 7: Fodder Dike Bank/Fen Bank to Broadgate
- ECC 8: Broadgate to Ings Drove
- ECC 9: Ings Drove to Church End Lane
- ECC 10: Church End Lane to The Haven
- ECC 11: The Haven to Marsh Road
- ECC 12: Marsh Road to Fosdyke Bridge
- ECC 13: Fosdyke to Surfleet Marsh OnSS/Marsh Drove
- ECC 14: Surfleet Marsh OnSS/Marsh Drove to the Connection Area

9.5.2 Information on European and Ramsar sites

~~844.~~963. Following the Screening exercise, LSE could not be excluded for the following designated sites: Humber Estuary SPA, Ramsar and SAC, The Wash SPA and Ramsar, The Wash and North Norfolk Coast SAC, Gibraltar Point SPA and Ramsar, Satltfeeltby to Theddlethorpe Dunes and Gibraltar Point SAC, Greater Wash SPA and North Norfolk SPA. The relevant European and Ramsar sites along with the Order Limits and the segments are shown on Figure 9.5 to Figure 9.11. The broad conservation objectives for these sites are provided below.

~~845.~~964. The conservation objectives for the Wash and North Norfolk Coast and Humber Estuary SACs are:

- Ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the Favourable Conservation Status of its Qualifying Features, by maintaining or restoring;
    - The extent and distribution of qualifying natural habitats and habitats of qualifying species;
    - The structure and function (including typical species) of qualifying natural habitats;
    - The structure and function of the habitats of qualifying species;

- The supporting processes on which qualifying natural habitats and the habitats of qualifying species rely;
- The populations of qualifying species; and,
- The distribution of qualifying species within the site.

~~846.~~965. The conservation objectives for the Saltfleetby-Theddlethorpe Dunes and Gibraltar Point SAC only include the following three points:

- Ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the Favourable Conservation Status of its Qualifying Features, by maintaining or restoring;
  - The extent and distribution of the qualifying natural habitats;
  - The structure and function (including typical species) of the qualifying natural habitats; and
  - The supporting processes on which the qualifying natural habitats rely.

~~847.~~966. The conservation objectives for the SPAs are generic:

- Ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the aims of the Wild Birds Directive, by maintaining or restoring:
  - The extent and distribution of the habitats of the qualifying features;
  - The structure and function of the habitats of the qualifying features;
  - The supporting processes on which the habitats of the qualifying features rely;
  - The population of each of the qualifying features; and
  - The distribution of the qualifying features within the site.

~~848.~~967. For The Wash, Greater Wash, Humber Estuary, The Gibraltar Point and North Norfolk SPAs, Natural England has published Supplementary Advice on Conservation Objectives (SACO) (Natural England, 2023), which provide a series of 'attributes' and 'targets' for each qualifying feature, which underpin the conservation objectives. These have been used to determine the conservation condition for the relevant features and to inform the assessment of effects.

~~849.~~968. In order to determine the conservation condition of the qualifying features of the relevant Ramsar sites, and therefore whether the objective is to maintain or restore the feature, the citation populations were compared against the most recently available population estimates for the designated sites and are presented for each relevant qualifying feature. Population size is only one of a series of attributes which define conservation condition. The use of population size alone is therefore a proxy. This is considered adequate because populations size is determined by the other attributes and the Project is outside any of the designated sites. Understanding the conservation condition, and the relevant conservation objective, enables an assessment of whether there would be an adverse effect on the integrity of the relevant designated sites, which would occur should any of the conservation objectives be undermined.

9.5.2.1 Feature 1: Avocet

Distribution and Abundance

Project Site

~~850.~~969. ~~The winter bird survey~~In season one (see ES document: 6.~~:~~1.~~:~~22.~~-~~3) the winter bird survey yielded one record of avocet from within the survey area, comprising a group of five birds on 20 March 2023 at Anderby Marsh (ECC 1). It is assumed that these relate to birds prospecting for nest sites. In season two (surveys of which were provided as an additional submission, after the submission of the original RIAA, see Response to Section 51 Advice document: 13.2 and the S 51 Covering Letter (Document AS1-001~~]~~), avocet was recorded in March and April 2024 across four ECC segments, with a peak count of 22 birds recorded in April in ECC 11.

~~851.~~970. ~~854.~~ There were two confirmed and two probable avocet nest sites in 2023 breeding season in the ECC 1 segment (Anderby Marsh). The peak count of the colony was 16 individuals recorded on 20 June, of which some could have been non-breeding birds. No chicks were noted during the surveys. There were some individuals recorded foraging at The Haven (between ECC 10 and 11) on visits 2, 3 and 4 however no breeding behaviour was observed.

~~852.~~971. LWT reported six nests in 2023 and four breeding pairs with seven chicks fledged in 2022 at Anderby Marsh. GLNP data included breeding season records of avocet from Wolla Bank Reedbed, however no details of status were provided and LWT data did not indicate presence of nesting avocet in that reserve. GLNP records include breeding avocet at Middlemarsh Farm, where chicks were recorded in 2013, however this site is located 350m away from the closest access road and >400m from the ECC boundary. There is a large colony of avocet at the RSPB Frampton Marsh reserve. In 2021 and 2022, 117 and 144 pairs were recorded, respectively, categorised as indicating probable breeding. The colony is located approximately 1km from the ECC boundary.

Designated Sites

~~853.~~972. Avocet is a non-breeding and breeding qualifying feature of the Humber Estuary SPA. The non-breeding population was estimated to be 59 individuals at designation (1996/97-2000/01, from Natural England Designated Sites View) and the most recently available five-year average (2017-18/ 2021-22) from British Trust for Ornithology (BTO) Wetland Bird Survey (WeBS) counts for the Humber Estuary is 2,576 individuals (Austin et al., 2023). For the attribute ‘abundance’ the target is to “Maintain the size of the non-breeding population at a level which is above 1,213 individuals, whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent”.

~~854.~~973. The breeding population of the Humber Estuary SPA was estimated to be 64 pairs at the time of designation (1998/2002 data). For the attribute ‘abundance’ the target is to “Maintain the size of the breeding population at a level which is above 233 breeding pairs, whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent”.

~~855.~~974. The Humber Estuary SSSI citation states "…breeding avocets were first recorded here in 1992. The numbers of avocets in particular have increased substantially in recent years". The five-year mean for Great Britain (GB) for the period 2015–2019 reported by the Rare Breeding Birds Panel (RBBP) was 2,138 pairs, an increase of more than 300% in the 25 years to 2019 (Eaton et al., 2021).

Connectivity

~~856.~~975. The attributes that define conservation condition are provided in the Natural England SACO (Natural England webpage, 2023). Winter core commuting distances are unclear. Given the distance between the Humber Estuary and the Project, and the small numbers recorded at the Project site, there would be no pathways for direct impacts on the non-breeding avocet within the designated site. The Humber Estuary non-breeding population is in favourable condition and the maintenance of the supporting habitats listed in the targets would not be directly affected by the Project.

~~857.~~976. Breeding avocet forage between 0.3-5.9km from nest sites mainly during the daytime (Enners et al., 2019). The Humber Estuary is located 12.5km from the application boundary at the closest point. Therefore, the Humber Estuary SPA breeding colonies are too distant from the application boundary to be affected by disturbance or habitat loss when at the colonies and the application boundary is located beyond their foraging range.

[redacted]

9.5.2.2 Feature 2: Lapwing

Distribution and Abundance

Project Site

978. No observations of lapwings were made during the Coastal OP (landfall) surveys in either winter season.

~~859.~~979. In season one, 230 observations were recorded across 12 ECC segments and during a total of ten walkover survey visits with a peak flock count of 400 individuals in ECC 12. In season two, 156 observations were recorded across all 14 ECC segments and during a total of 15 walkover survey visits with a peak flock count of **2,000 individuals in ECC 7.** The most common behaviour observed in both seasons was loafing. -Bare earth/ploughed fields were the most frequently recorded field type utilised by lapwing (81 registrations, a total of 9,505 bird records), followed by cereals (27 registrations, a total of 4,356 bird records) and grassland (42 registrations, a total of 2,727). The latter refers primarily to wetland sites particularly Anderby Marsh.

~~860.~~980. Two lapwing territories (confirmed and probable) were found in the Landfall area (ECC 1) during the breeding bird survey in 2023.

~~861.~~981. The BTO WeBS recorded a peak of 8,501 lapwings within Frampton South 42 (near ECC 11) and 220 birds at the Anderby count sector (ECC 1) (2017-2022).

~~862.~~982. Lapwing is a widespread breeding species in Great Britain.

Designated Sites

~~863.~~983. Lapwing is a non-breeding qualifying feature of The Wash Ramsar. Table 9.83~~Table 9.48~~ details the population estimates for the designated site, their conservation status and objectives.

Table 9-83~~9.83~~9 ~~9.48~~: Population data, conservation status and objectives for lapwing

Designated site	Citation population	BTO WeBS count 16/17-21/22 for the relevant area	Population change	Favourable conservation status (Y/N)	Conservation objective restore or maintain[10]	Survey peak count as a % of citation population	Survey peak count as a % of current WeBS population
The Wash Ramsar	46,422	12,142	-34,280 (-74%)	N	Restore	~~0.86~~4.3%	~~3.29~~16.47%

[10] Where SACO is available and details a target for the abundance attribute, that has been used to determine whether there is a restore or maintain objective. Where that is not available, the target has been inferred from the population change.

Connectivity

~~864.~~984. Lapwing utilises lowland farmland and estuarine habitats in winter and given the proximity of The Wash to the onshore application boundary, it is considered that the non-breeding lapwings occurring within the onshore zone of influence of the Project is likely to be connected with The Wash Ramsar population.

~~865.~~985. Patterns of lapwing movements and occupancy outside of the breeding season can be complex, especially in response to cold weather, as described in Gillings & Fuller 1999. Some GB breeding lapwings are sedentary and stay within the same region following breeding, some migrate to winter elsewhere within GB, however some migrate to Ireland and others to France or Spain. Therefore, breeding birds within the zone of influence of the Project may winter further afield than The Wash, although some are likely to spend at least part of the non-breeding season within The Wash.

9.5.2.3 Feature 3: Golden plover

Distribution and Abundance

Project Site

986. In season one, ~~G~~golden plovers were observed on three occasions with a peak count of 23 individuals (13/09/22) during the Coastal OP (landfall) surveys. There were no observations of this species during the Coastal OP surveys in season two.

~~866.~~987. In season one, 79 observations were recorded across ten ECC segments and during a total of 12 walkover survey visits with a peak flock count of 250 individuals ~~recorded~~ in ECC 6. In season two, 30 observations were recorded across 12 ECC segments and during a total of six visits with a peak count of **2,000 individuals in ECC 12**. The most common behaviour observed in both seasons was loafing. Field types utilised were predominantly bare earth/ ploughed fields (16 registrations, a total of 2,099) and cereal fields (ten registrations, a total of 1,866) with the largest flock recorded in a recently sown crop field.

~~867.~~988. LWT reported up to 175 individuals at Anderby Marsh (ECC 1) in February 2023. BTO WeBS data for 2017-2022 show a peak count of 60 golden plovers at Anderby Marsh. There are up 10,000-15,000 birds gathering at RSPB Frampton Marsh reserve annually (the nearest section is ECC 11).

~~868.~~989. Golden plover breeds in the uplands in Britain (i.e. the Project is located outside of the breeding range).

Designated Sites

~~869.~~990. Golden plover is a non-breeding qualifying feature of Humber Estuary SPA and Ramsar and The Wash Ramsar. Table 9.84~~Table 9.49~~ details the population estimates for the designated sites, their conservation status and objectives.

Table 9-84~~9.84~~9-~~9.49~~: Population data and conservation status for golden plover

Designated site	Citation population	BTO WeBS count 16/17-21/22 for the relevant area	Population change	Favourable conservation status (Y/N)	Conservation objective restore or maintain	Survey peak count as a % of citation population	Survey peak count as a % of current WeBS population
Humber Estuary SPA	30,709	20,812	-9,897 (-32%)	Y	"Maintain the size of the non-breeding population at a level which is above 30,709 wintering individuals, whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent".	~~0.81~~6.51%	~~1.2~~9.61%
Humber Estuary Ramsar	30,709	20,812	-9,897 (-32%)	Y	Maintain	~~0.81~~6.51%	~~1.2~~9.61%
The Wash Ramsar	22,033	15,601	-6,432 (-29%)	N	Restore	~~1.13~~9.08%	~~1.6~~12.82%

Connectivity

~~870.~~991. Patterns of golden plover movements and occupancy outside of the breeding season can be complex, especially in response to cold weather, as described in Gillings & Fuller 1999. Given the close proximity of The Wash to parts of the onshore ECC however, golden plovers recorded utilising farmland habitats within the winter bird survey area are likely to be connected with The Wash non-breeding population. The Humber Estuary is 12.5km away from the onshore ECC at the closest point, and may have connectivity with the golden plover population utilising farmland within the zone of influence of the Project.

9.5.2.4 Feature 4: Curlew

Distribution and Abundance

Project Site

992. In season one, ~~C~~curlew were observed on 17 occasions with a peak count of 18 individuals during the Coastal OP (landfall) surveys. The curlews were observed to be foraging (52.4%) and flying (47.6%). In season two, there was only a single observation of eight curlew during the Coastal OP surveys.

~~871.~~993. In season one, 255 observations were recorded across all 14 ECC segments and during a total of 12 walkover survey visits with a peak flock count of 56 individuals in ECC 8. In season two, 160 observations were recorded across 13 ECC segments and during a total of 14 visits with a peak flock count of **103 individuals in ECC 12**.The most common behaviour observed in both seasons was foraging. In season two, curlew were recorded on grazed and ungrazed grassland (90 registrations, a total of 993 bird records), followed by bare earth/ ploughed fields (39 registrations, a total of 410), cereals (19 registrations, a total of 309) and stubbles (10 registrations, a total of 147).

~~872.~~994. Curlew was not recorded breeding within the Project area.

~~873.~~995. BTO WeBS counts for 2017-22 recorded a peak count of 162 curlew in the Frampton South 44 zone (near ECC 11).

~~874.~~996. Curlew is a widespread breeding species in the uplands and is much rarer in lowland landscapes in GB.

Designated Sites

~~875.~~997. Curlew is a non-breeding qualifying feature of The Wash SPA and Ramsar. Table 9.85~~Table 9.50~~ details the population estimates for the designated sites, their conservation status and objectives.

Table 9-85~~9.85~~9 ~~9.50~~: Population data, conservation status and objectives for curlew

Designated site	Citation population	BTO WeBS count 17/18-21/22 for the relevant area	Population change	Favourable conservation status (Y/N)	Conservation objective restore or maintain	Survey peak count as a % of citation population	Survey peak count as a % of current WeBS population
The Wash SPA	3,700	5,759	2,059 (+56%)	Y	"Maintain the size of the non-breeding population to a level which is above 3,700 individuals, whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent". (SACO)	~~1.51~~2.78%	~~0.97~~1.79%
The Wash Ramsar (passage)	9,438	5,759	-3,679 (-39%)	N	Restore	~~0.59~~1.09%	~~0.97~~1.79%

Connectivity

~~876.~~998. Curlew utilises estuarine habitats and nearby farmland in winter and given the proximity of The Wash to the onshore application boundary, it is considered that the non-breeding curlews occurring within the onshore zone of influence of the Project are likely to be connected with The Wash SPA and Ramsar.

~~877.~~999. Most British breeding curlews migrate south-west and hence any breeding population within the zone of influence of the project is unlikely to be a supporting population for The Wash SPA and Ramsar non-breeding populations.

9.5.2.5 Feature 5: Oystercatcher

Distribution and Abundance

Project Site

1000. In season one, ~~O~~oystercatchers were observed on eight occasions with a peak count of two individuals as part of Coastal OP (landfall) surveys. In season two, only single birds were observed on six visits.

~~878.~~1001. In season one, 22 observations were recorded across eight ECC segments and during a total of nine walkover survey visits with a peak flock count of **23 individuals in ECC 11.** In season two, 18 observations were recorded across eight ECC segments and during a total of eight visits with a peak count of four individuals. The most common behaviour observed was foraging.

~~879.~~1002. Oystercatchers were not recorded at all as part of the breeding bird survey in 2023.

~~880.~~1003. BTO WeBS counts for 2017-22 recorded a peak count of 16 oystercatchers in Burgh Marsh zone (near ECC 4).

~~881.~~1004. Oystercatcher is a widespread breeding species in GB.

Designated Sites

~~882.~~1005. Oystercatcher is a non-breeding qualifying feature of The Wash SPA and Ramsar. Table 9.86~~Table 9.51~~ details the population estimates for the designated sites, their conservation status and objectives.

Table 9-86~~9.86~~9-~~9.51~~: Population data and conservation status and objectives for oystercatcher

Designated site	Citation population	BTO WeBS count 17/18-21/22 for the relevant area	Population change	Favourable conservation status (Y/N)	Conservation objective restore or maintain	Survey peak count as a % of citation population	Survey peak count as a % of current WeBS population
The Wash SPA	24,000	23,097	-903 (-4%)	N	“Restore the size of the non-breeding population at a level which is above 24,000 individuals, whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent”.	0.1%	0.1%
The Wash Ramsar	15,616	23,097	7,481 (+48%	Y	Maintain	0.15%	0.1%

Connectivity

~~883.~~1006. Oystercatchers utilise estuarine habitats and nearby farmland in winter and given the proximity of The Wash to the onshore application boundary, it is considered that the non-breeding oystercatcher occurring within the onshore zone of influence of the Project are likely to be connected with The Wash SPA and Ramsar.

~~884.~~1007. Some breeding oystercatchers are resident whereas others migrate, so any breeding population at the Project site could act as a supporting population for The Wash SPA and Ramsar non-breeding populations.

9.5.2.6 Feature 6: Redshank

Distribution and Abundance

Project Site

1008. In season one, ~~A~~a total of two redshanks were observed on one occasion (24/01/23) during the Coastal OP (landfall) surveys, both foraging. In season two, redshank were recorded foraging on four visits with a peak count of 11 individuals.

~~885.~~1009. In season one, 48 observations were recorded across ten ECC segments and during a total of 11 walkover survey visits with a peak flock count of 35 individuals in ECC 5. The records were clustered at the River Welland, The Haven and Anderby Marsh. In season two, 106 observations were recorded across 11 ECC segments with a peak flock count of **41 individuals in ECC 11**. The most common behaviour observed in both seasons was foraging. ~~The records were clustered at the River Welland, The Haven and Anderby Marsh.~~

~~886.~~1010. Redshanks were not recorded during the breeding bird survey in 2023.

~~887.~~1011. WeBS counts for 2017-22 recorded a peak count of 120 redshank in Frampton North 23 zone (near ECC 11).

~~888.~~1012. The species breeds in saltmarshes, freshwater marsh and wet grasslands in the lowlands.

Designated sites

~~889.~~1013. Redshank is a non-breeding qualifying feature of The Wash SPA and Ramsar, and Humber Estuary SPA and Ramsar and a passage feature of the Humber Estuary Ramsar. Table 9.87~~Table 9.52~~ details the population estimates for the designated sites, their conservation status and objectives.

Table 9-87~~9.87~~9.~~9.52~~: Population data and conservation status and objectives for redshank

Designated site	Citation population	BTO WeBS count 17/18-21/22 for the relevant area	Population change	Favourable conservation status (Y/N)	Conservation objective restore or maintain	Survey peak count as a % of citation population	Survey peak count as a % of current WeBS population
The Wash SPA	4,331	5,329	998 (+23%)	Y	"Maintain the size of the population at a level which is above 4,331 individuals, whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent".	0.~~81~~95%	0.~~66~~77%
The Wash Ramsar	6,373	5,329	-1,044 (-16%)	N	Restore	0.~~55~~64%	0.~~66~~77%
Humber Estuary SPA	4,632	2,659	1,973 (-43%)	N	"Restore the size of the non-breeding population to a level which is at or above 4,632 wintering individuals and 7,462 individuals during passage, whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent".	0.~~76~~88%	1.~~32~~55%
Humber Estuary Ramsar (winter)	4,632	2,659	1,973 (-43%)	N	Restore	0.~~76~~88%	1.~~32~~55%

Designated site	Citation population	BTO WeBS count 17/18-21/22 for the relevant area	Population change	Favourable conservation status (Y/N)	Conservation objective restore or maintain	Survey peak count as a % of citation population	Survey peak count as a % of current WeBS population
Humber Estuary Ramsar (passage)	7,462	No information	-		Assumed restore.	0.~~47~~55%	-

Connectivity

~~890.~~1014. Given the proximity to The Wash and the potential for inter-change between sites during the non-breeding season, there is potential connectivity between the non-breeding redshank recorded within the survey area and the designated sites listed above. Breeding populations in the south of Britain tend to be more sedentary, whereas northerly populations are more migratory. Therefore, any breeding population within the onshore zone of influence of the Project may be a supporting population (but not a qualifying population) of The Wash and Humber Estuaries.

9.5.2.7 Feature 7: Dunlin

Distribution and Abundance

Project Site

1015. In season one, ~~D~~dunlins were observed on three occasions with a peak count of 12 individuals (05/12/22), as part of the Coastal OP (landfall) surveys. In season two, 24 roosting dunlin were observed on 26/03/2024.

~~891.~~1016. In season one, ~~F~~five observations were recorded during a total of four walkover visits mostly in ECC 1 and ECC 11 with a peak flock count of **46 individuals in ECC 11**. In season two, nine observations were recorded during a total of eight visits in four ECC segments with a peak flock count of nine individuals. ~~These birds~~In both seasons, dunlin were observed to be mostly foraging.

~~892.~~1017. WeBS counts for 2017-22 recorded a peak count of 1,260 dunlin in Frampton North 41 zone (near ECC 11).

~~893.~~1018. The species breeds in upland areas in GB (i.e. breeding range does not encompass the Project site).

Designated Sites

~~894.~~1019. Dunlin is a non-breeding qualifying feature of The Wash SPA and Ramsar, and Humber Estuary SPA and Ramsar and a passage feature of the Humber Estuary Ramsar. Table 9.88~~Table 9.53~~ details the population estimates for the designated sites and their conservation status and objectives.

Table 9-88~~9.889-9.53~~: Population data and conservation status and objectives for dunlin

Designated site	Citation population	BTO WeBS count 17/18-21/22 for the relevant area	Population change	Favourable conservation status (Y/N)	Conservation objective restore or maintain	Survey peak count as a % of citation population	Survey peak count as a % of current WeBS population
The Wash SPA	29,000	28,948	-52 (-0.18%)	N	"Restore the size of the non-breeding population at a level which is above 29,000 individuals, whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent".	0.16%	0.16%
The Wash Ramsar	36,600	28,948	-7,652 (-21%)	N	Restore	0.13%	0.16%
Humber Estuary SPA	22,222	17,634	-4,588 (-21%)	N	"Restore the size of the non-breeding population to a level which is above 22,222 wintering individuals and 20,269 individuals during passage, whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent".	0.21%	0.26%
Humber Estuary Ramsar (winter)	22,222	17,634	-6,268	N	Restore	0.21%	0.26%

Designated site	Citation population	BTO WeBS count 17/18-21/22 for the relevant area	Population change	Favourable conservation status (Y/N)	Conservation objective restore or maintain	Survey peak count as a % of citation population	Survey peak count as a % of current WeBS population
Humber Estuary Ramsar (passage)	20,269	No information	-	-	Assumed restore.	0.23%	-

Connectivity

~~895.~~1020. Given the close proximity of The Wash to parts of the onshore application Boundary, dunlins recorded within the winter bird survey area are likely to be connected with The Wash non-breeding population. The Humber Estuary is 12.55km away from the onshore ECC at the closest point, and may also have connectivity with the dunlin population utilising areas within the onshore zone of influence of the Project.

9.5.2.8 Feature 8: Sanderling

Distribution and Abundance

Project Site

1021. In season one, ~~S~~sanderling were observed ~~only~~ during Coastal OP (landfall) surveys on 14 occasions across nine visits with a peak count of 13 individuals (05/12/22). In season two, were observed on 13 visits with a peak count of **57 individuals** (on 09/11/23). In both seasons, ~~T~~the sanderlings were observed to be mostly foraging.

~~896.~~1022. No sanderling were recorded during walkover survey in season one; in season two, a single flock of 19 individuals was recorded foraging in ECC 1.

~~897.~~1023. The species is a non-breeding bird in GB.

Designated Sites

~~898.~~1024. Sanderling is a non-breeding qualifying feature of The Wash SPA and Ramsar, and Gibraltar Point SPA and Ramsar. Table 9.89~~Table 9.54~~ details the population estimates for the designates sites and their conservation status.

Table 9-89~~9.899~~ ~~9.54~~: Population data and conservation status for sanderling

Designated site	Citation population	BTO WeBS count 17/18-21/22 for the relevant area	Population change	Favourable conservation status (Y/N)	Conservation objective restore or maintain	Survey peak count as a % of citation population	Survey peak count as a % of current WeBS population
The Wash SPA	500	10,441	9,941 (+1,988%)	Y	"Maintain the size of the population at a level which is above 500 individuals, whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent".	~~2.6~~11.4%	0.~~12~~55%
The Wash Ramsar	3,505	10,441	6,936 (+198%)	Y	Maintain	~~0.37~~1.63%	0.~~12~~55%
Gibraltar Point Ramsar	971	No information	-26% (from Woodward et al 2019 – medium term change; long term is positive)	N	Restore	~~1.34~~5.87%	-
Gibraltar Point SPA	1,140	No information	-26% (from Woodward et al 2019 – medium term change; long term is positive)	N	Restore	~~1.14~~5.00%	-

Connectivity

~~899.~~1025. The sanderlings recorded within the survey area may be connected with The Wash and Gibraltar Point SPA and Ramsar sites given the proximity.

9.5.2.9 Feature 9: Ruff

Distribution and Abundance

Project Site

~~900.~~1026. In season one, ~~T~~there were no records of ruff utilising land from within the application boundary plus 400m buffer. In season two, ruff were recorded only during walkover survey; five records were made on five visits with a peak count of **16 individuals in ECC 11**. The ruff were recorded predominantly foraging.~~during the extensive winter bird surveys in 2022-23.~~

[redacted]. Ruff is a very rare breeding species in the UK, occurring at a very small number of sites and is not expected to breed within the zone of influence of the Project.

~~902.~~1028. WeBS counts for 2017-22 recorded a peak count of 100 ruff in Frampton South 44 zone (near ECC 11).

Designated sites

~~903.~~1029. Ruff is a non-breeding qualifying feature of the Humber Estuary SPA. The non-breeding population was estimated to be 128 individuals at designation (1996-2000, from Natural England Designated Sites View) and the most recently available five-year average from BTO WeBS counts for the Humber Estuary is 76 individuals (Austin et al., 2023). Natural England SACO states in relation to attribute 'abundance' that the target is to "Restore the size of the non-breeding population to a level which is above 128 individuals during passage, whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent". Table 9.90 details the population estimates for the designated sites, and their conservation status and objectives.

Connectivity

~~904.~~ Based on the low number of observations and low abundance of ruff from within the winter birds survey area during extensive winter bird surveys in 2022-23 and 2023-24, it is concluded that there is negligible current connectivity between the Project site and the Humber Estuary SPA in relation to non-breeding ruff.

1030. ~~Based on the absence of records of ruff from within the winter birds survey area during extensive winter bird surveys in 2022-23, it is concluded that there is no connectivity between the Project site and the Humber Estuary SPA in relation to non-breeding ruff.~~ The important areas for Ruff in and around the Humber Estuary, as detailed within the Natural England Conservation Advice (Natural England webpage, 2023) would not be impacted by the Project. Ruff is a very rare breeding bird in the UK and not considered likely to breed within the zone of influence of the Project. As hydrological links from watercourses are with The Wash rather than the Humber, potential impacts from pollution and hydrological changes are excluded~~.~~

Table 9-90 Population data and conservation status for ruff

Designated site	Citation population	BTO WeBS count 17/18-21/22 for the relevant area	Population change	Favourable conservation status (Y/N)	Conservation objective restore or maintain	Survey peak count as a % of citation population	Survey peak count as a % of current WeBS population
Humber Estuary SPA	128	76	-52 (-40.6%)	N	"Restore the size of the non-breeding population to a level which is above 128 individuals during passage, whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent'	12.5%	21.05%
Humber Estuary Ramsar	128	76	-52 (-40.6%)	N	Restore	12.5%	21.05%

9.5.2.10 Feature 10: Bar-tailed Godwit

Distribution and Abundance

Project Site

1031. No observations of bar-tailed godwit were recorded during the extensive winter bird surveys in ~~2022-23~~either winter season.

~~905.~~1032. It is a non-breeding species in GB.

~~906.~~1033. WeBS counts for 2017-22 recorded a peak count of 80 bar-tailed godwit in Frampton North 41 zone (near ECC 11).

Designated sites

Bar-tailed godwit is a non-breeding qualifying feature of The Wash SPA and Ramsar, Gibraltar Point SPA, and Humber Estuary SPA and Ramsar. Table 9.90~~Table 9.55~~ details the population estimates for the designated sites, and their conservation status and objectives.

Table 9-91~~9.909-9.55~~: Population data, conservation status and objectives for bar-tailed godwit

Designated site	Citation population	BTO WeBS count 17/18-21/22 for the relevant area	Population change	Favourable conservation status (Y/N)	Conservation objective restore or maintain	Survey peak count as a % of citation population	Survey peak count as a % of current WeBS population
The Wash SPA	7,396	16,533	9,137 (+124%)	Y	“Maintain the size of the population at a level which is above 8,200 individuals, whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent”. (SACO)	0	0
The Wash Ramsar	16,546	16,533	-13 (-0.08%)	Y	Maintain	0	0
Gibraltar Point SPA	8,800	6,678 (Natural England SACO)	-2,122 (-24%)	N	“Restore the size of the non-breeding population at a level which is above 8,800 whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent”. (SACO)	0	0
Gibraltar Point Ramsar	3,468	6,678 (Natural England SACO)	3,210 (+93%)	Y	Maintain	0	0
Humber Estuary SPA	2,752	1,876	-876 (-32%)	N	“Restore the size of the non-breeding population to a level	0	0

Designated site	Citation population	BTO WeBS count 17/18-21/22 for the relevant area	Population change	Favourable conservation status (Y/N)	Conservation objective restore or maintain	Survey peak count as a % of citation population	Survey peak count as a % of current WeBS population
					which is above 2,752, whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent". (SACO)		
Humber Estuary Ramsar	2,752	1,876	-876 (-32%)	N	Restore	0	0

Connectivity

~~907.~~1034. Based on the absence of records of bar-tailed godwit from within the winter birds survey area during extensive winter bird surveys in 2022-23 and 2023-24, it is concluded that there is no current connectivity between the Project site and the SPA and Ramsar sites listed above in relation to non-breeding bar-tailed godwit. The important areas for bar-tailed godwit in and around the Humber Estuary (which has a restore objective) as detailed within the Natural England Conservation Advice (Natural England webpage, 2023), would not be impacted by the Project. The Wash and Gibraltar Point populations are in favourable condition and the maintenance of the supporting habitats listed in the targets would not be affected by the Project. This species is a non-breeding bird in the UK. This species is therefore only included for assessment of potential impacts from pollution and hydrological changes.

9.5.2.11 Feature 11: Black-tailed Godwit

Distribution and Abundance

Project Site

1035. In season one, ~~T~~there were only two observations of a total of 27 individuals of black-tailed godwit within the application boundary plus 400m survey area ~~during the winter 2022-23 bird surveys,~~ with a peak count of 16 individuals in ECC 11. Both records were of feeding birds at The Haven, in December and January. In season two, 12 observations were recorded in ECC 1 and 11 and during a total of nine visits with a peak flock count of **18 individuals in ECC 1**.

~~908.~~1036. The species is primarily a non-breeding bird in GB, with a few regular breeding sites in England, mainly in East Anglia, and has not been recorded breeding within the zone of influence of the project.

~~909.~~1037. Large flocks of thousands are reported on passage each autumn at Frampton Marsh RSPB reserve with a peak count of 3,950 recorded in August 2021. Smaller flocks of 10-20 birds are reported to overwinter on the reserve. WeBS counts for 2017-22 recorded a peak count of 3,000 black-tailed godwit in Frampton North 41 zone (near ECC 11).

Designated Sites

~~910.~~1038. Black-tailed godwit is a non-breeding qualifying feature of The Wash SPA and Ramsar and Humber Estuary SPA and Ramsar. Table 9.91~~Table 9.56~~ details the population estimates for the designates sites, their conservation status and objectives.

Table 9-92~~9.919-9.56~~: Population data and conservation status and objectives for black-tailed godwit

Designated site	Citation population	BTO WeBS count 17/18-21/22 for the relevant area	Population change	Favourable conservation status (Y/N)	Conservation objective restore or maintain	Survey peak count as a % of citation population	Survey peak count as a % of current WeBS population
The Wash SPA	260	7,124	6,864 (+2,640%)	Y	"Maintain the size of the non-breeding population at a level which is above 260 individuals whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent". (SACO)	6.~~15~~92%	0.~~22~~25%
The Wash Ramsar	6,849	7,124	275 (+4%)	Y	Maintain	0.~~23~~26%	0.~~22~~25%
Humber Estuary SPA	1,113	5,646	4,533 (+407%)	Y	"Maintain the size of the non-breeding population at a level which is above 2951, whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent". (SACO)	1.~~44~~62%	0.~~28~~32%
Humber Estuary Ramsar (winter)	1,113	5,646	4,533 (+407%)	Y	Maintain	1.462%	0.~~28~~32%

Designated site	Citation population	BTO WeBS count 17/18-21/22 for the relevant area	Population change	Favourable conservation status (Y/N)	Conservation objective restore or maintain	Survey peak count as a % of citation population	Survey peak count as a % of current WeBS population
Humber Estuary Ramsar (passage)	915	Not available	-	-	-	0% (recorded during core winter only)	-

Connectivity

~~911.~~1039. Based on the low number of observations and low abundance of black-tailed godwit from within the winter birds survey area during extensive winter bird surveys in 2022-23 and 2023-24, it is concluded that there is negligible current connectivity between the Project site and the relevant SPA and Ramsar sites in relation to non-breeding black-tailed godwit. The designated sites populations are in favourable condition and the maintenance of the supporting habitats listed in the target would not be affected by the Project. The species is primarily a non-breeding bird in GB and therefore there will not be a potentially supporting breeding population within the ZoI of the Project. This species is therefore only included for assessment of potential impacts from pollution and hydrological changes.

9.5.2.12 Feature 12: Knot

Distribution and Abundance

Project Site

1040. No observations of knot were recorded during the extensive winter bird surveys conducted in either winter season~~winter 2022-23~~.

~~912.~~1041. It is a non-breeding species in GB.

~~913.~~1042. BTO WeBS counts for 2017-22 recorded a peak count of 3,000 knot in Frampton North 41 zone (near ECC 11).

Designated Sites

~~914.~~1043. Knot is a non-breeding qualifying feature of The Wash SPA and Ramsar, and Humber Estuary SPA and Ramsar and a passage feature of the Humber Estuary Ramsar. Table 9.92~~Table 9.57~~ details the population estimates for the designated sites and their conservation status and objectives.

Table 9-93~~9.929-9.57~~: Population data, conservation status and objectives for knot

Designated site	Citation population	BTO WeBS count 15/16-19/20 for the relevant area	Population change	Favourable conservation status (Y/N)	Conservation objective restore or maintain	Survey peak count as a % of citation population	Survey peak count as a % of current WeBS population
The Wash SPA	75,000	209,300	134,400 (+179%)	Y	"Maintain the size of the non-breeding population at a level which is above 75,000 individuals, whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent". (SACO)	0	0
The Wash Ramsar	68,978	209,300	140,322 (+203%)	Y	Maintain	0	0
Humber Estuary SPA	28,165	26,428	-1,737 (-6%)	N	"Maintain the size of the non-breeding population at a level which is above 18,500 individuals on passage and 28,165 wintering individuals, whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent". (SACO)	0	0
Humber Estuary Ramsar	28,165	26,428	-1,737 (-6%)	N	Restore	0	0

Designated site	Citation population	BTO WeBS count 15/16-19/20 for the relevant area	Population change	Favourable conservation status (Y/N)	Conservation objective restore or maintain	Survey peak count as a % of citation population	Survey peak count as a % of current WeBS population
Humber Estuary Ramsar (passage)	18,500	N/A	Unknown	-	-	0	0

Connectivity

~~915.~~1044. Based on the absence of records of knot from within the winter birds survey area during extensive winter bird surveys in 2022-23 and 2023-24, it is concluded that there is no connectivity between the Project site and the relevant SPA and Ramsar sites in relation to non-breeding and passage knot. The maintenance or restoration of the habitats listed in the targets would not be affected by the Project. This species is a non-breeding bird in the UK. This species is therefore only included for assessment of potential impacts from pollution and hydrological changes.

9.5.2.13 Feature 13: Turnstone

Distribution and Abundance

Project Site

1045. There were no turnstone observations during Coastal OP (landfall) surveys in season one. In season two, turnstone were observed on two visits with peak count of seven individuals.

1046. During winter walkover surveys, ~~T~~there was a single observation of turnstone, of two individuals~~, during the extensive winter bird surveys undertaken in winter 2022-23~~in season one. In season two, three observations were recorded in three ECC segments during a total of three visits with a peak count of **18 individuals in ECC 14**.

~~916.~~1047. The species does not normally breed in GB.

~~917.~~1048. WeBS counts for 2017-22 recorded a peak count of 50 turnstone in Frampton North 23 zone (near ECC 11).

Designated Sites

Turnstone is a non-breeding qualifying feature of The Wash SPA. Table 9.93~~Table 9.58~~ details the population estimates for the designated site and conservation status and objectives.

Table 9-94~~9.939-9.58~~: Population data and conservation status for turnstone

Designated site	Citation population	BTO WeBS count 15/16-19/20 for the relevant area	Population change	Favourable conservation status (Y/N)	Conservation objective restore or maintain	Survey peak count as a % of citation population	Survey peak count as a % of current WeBS population
The Wash SPA	980	758	-222 (-23%)	N	"Restore the size of the population at a level which is above 980 individuals, whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent".	~~0.2~~1.84%	~~0.26~~2.37%

Connectivity

~~918.~~1049. Based on the low number of observations and low abundance of ~~a single observation of two~~ turnstones within the winter birds survey area during extensive winter bird surveys in 2022-23 and 2023-24, it is concluded that there is negligible current or past connectivity between the Project site and The Wash SPA in relation to non-breeding turnstone. Potential supporting habitats for The Wash SPA turnstone population are listed as: saltmarsh and other inter-tidal habitats (Natural England webpage, 2023). Such habitats are scarce within the ZoI of the Project (onshore) and therefore past connectivity is also likely to be negligible. This species is a non-breeding bird in the UK. This species is therefore only included for assessment of potential impacts from pollution and hydrological changes.

9.5.2.14 Feature 14: Ringed Plover

Distribution and Abundance

Project Site

1050. In season one, ~~N~~no observations of ringed plovers were recorded during Coastal OP (landfall)~~the extensive winter bird surveys conducted in winter 2022-23~~. In season two, ringed plover was recorded on two visits (in early December with a peak count of two individuals.

1051. During walkover surveys in season one, six observations were recorded in ECC 7 and 11 on four visits with **a peak count of four individuals**. In season two, only a single ringed plover was recorded in ECC 4.~~Two observations of a total of three ringed plovers were made during the breeding bird survey in 2023, early in the season (visit 2) in ECC 1 and 11.~~

~~919.~~1052. The landfall area is considered unsuitable for breeding due to recreational disturbance along the beach.

~~920.~~1053. WeBS counts for 2017-22 recorded a peak count of 170 ringed plovers in Frampton North 41 zone (near ECC 11).

Designated Sites

~~921.~~1054. Ringed plover is a non-breeding qualifying feature of The Wash Ramsar. Table 9.94~~Table 9.59~~ details the population estimates for the designated site and conservation status and objectives.

Table 9-95~~9.94~~9 ~~9.59~~: Population data, conservation status and objectives for ringed plover

Designated site	Citation population	BTO WeBS count 17/18-21/22 for the relevant area	Population change	Favourable conservation status (Y/N)	Conservation objective restore or maintain	Survey peak count as a % of citation population	Survey peak count as a % of current WeBS population
The Wash Ramsar	1,500	1,229	-271 (-18%)	N	Restore	0.27%	0.32%

Connectivity

~~922.~~1055. Based on the low number of observations and low abundance ~~the absence of observations~~ of ringed plover from within the winter birds survey area during extensive winter bird surveys in 2022-23 and 2023-24, it is concluded that there is negligible current connectivity between the Project site and The Wash Ramsar in relation to non-breeding ringed plover. Habitats within the ZoI of the Project are considered to be of low suitability for non-breeding ringed plover and therefore past connectivity is also concluded to be negligible. This species is therefore only included for assessment of potential impacts from pollution and hydrological changes.

9.5.2.15 Feature 15: Grey Plover

Distribution and Abundance

Project Site

1056. In season one, ~~G~~grey plovers were observed on two visits with a single foraging bird being recorded each time as part of the Coastal OP (landfall) surveys. In season two, two grey plovers were observed on a single visit.

~~923.~~1057. During a walkover survey in season one, ~~T~~three observations were recorded at the Haven (ECC 11) with a peak count of **seven individuals** ~~during the walkover survey~~. In season two, nine observations were recorded in ECC 10 and 11 during a total of five visits with a peak count of four individuals. Birds were mostly foraging, followed by ~~on two occasions and~~ loafing ~~on one~~.

~~924.~~1058. WeBS counts for 2017-22 recorded a peak count of 200 grey plovers in Frampton North 23 zone (near ECC 11).

Designated Sites

~~925.~~1059. Grey plover is a non-breeding qualifying feature of The Wash SPA and Ramsar, and Gibraltar Point SPA and Ramsar. Table 9.95~~Table 9.60~~ details the population estimates for the designated sites, their conservation status and objectives.

Table 9-96~~9.959 9.60~~: Population data, conservation status and objectives for grey plover

Designated site	Citation population	BTO WeBS count 17/18-21/22 for the relevant area	Population change	Favourable conservation status (Y/N)	Conservation objective restore or maintain	Survey peak count as a % of citation population	Survey peak count as a % of current WeBS population
The Wash SPA	5,500	11,496	5,996 (+109%)	Y	"Maintain the size of the non-breeding population at a level which is above 5,500 individuals, whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent". (SACO)	0.13%	0.06%
The Wash Ramsar	13,129	11,496	-1,633 (-12%)	N	Restore	0.05%	0.0%
Gibraltar Point Ramsar	2,793	4,810 (Natural England SACO)	2,017 (+72%)	Y	Maintain	0.25%	0.15%
Gibraltar Point SPA	3,980	4,810 (Natural England SACO)	830 (+21%)	Y	Maintain the size of the non-breeding population at a level which is above 3,980 whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent. (SACO)	0.18%	0.15%

Connectivity

~~926.~~1060. Based on the low number of observations and low abundance of grey plover from within the winter birds survey area during extensive winter bird surveys in 2022-23 and 2023-24, it is concluded that there is negligible connectivity between the Project site and the relevant SPA and Ramsar sites in relation to non-breeding grey plover. The Wash SPA population is in favourable condition and the maintenance of the supporting habitats listed in the targets would not be directly affected by the Project. Potential supporting habitats for the other designated sites listed in Table 9.95~~Table 9.60~~ are scarce within the ZoI of the Project and therefore past connectivity is also likely to be negligible. The areas of suitable habitat within the ZoI of the Project are considered not to be important to the maintenance of The Wash SPA population or restoration of the other designated sites populations. It is a non-breeding bird in GB. This species is therefore only included for assessment of potential impacts from pollution and hydrological changes.

9.5.2.16 Feature 16: Bewick's Swan

Distribution and Abundance

Project Site

1061. There were no records of Bewick's swan during the extensive winter bird surveys in ~~winter 2022-23~~either winter season.

~~927.~~1062. It is a non-breeding species in GB.

~~928.~~1063. WeBS counts for 2017-22 recorded a peak count of six Bewick's swans in Frampton North 41 zone (near ECC 11).

Designated Sites

~~929.~~1064. Bewick's swan is a non-breeding qualifying feature of The Wash SPA. Table 9.96~~Table 9.61~~ details the population estimates for the designated site and conservation status and objectives.

Table 9-97~~9.969-9.61~~: Population data, conservation status and objectives for Bewick's swan

Designated site	Citation population	BTO WeBS count 17/18-21/22 for the relevant area	Population change	Favourable conservation status (Y/N)	Conservation objective restore or maintain	Survey peak count as a % of citation population	Survey peak count as a % of current WeBS population
The Wash SPA	130	4	-126 (-97%)	N	"Restore the size of the population to a level which is above 130 individuals, whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent". (SACO)	0	0

Connectivity

~~930.~~1065. Based on the absence of observations of Bewick's swan from within the winter birds survey area during extensive winter bird surveys in 2022-23 and 2023-24, it is concluded that there is negligible connectivity between the Project site and the Wash SPA in relation to non-breeding Bewick's swan. The Natural England Marine Site Details lists potential supporting habitats as: freshwater and coastal grazing marsh and the water column. Those habitats are scarce within the ZoI of the Project (onshore) and therefore past connectivity is also likely to be negligible. It is a non-breeding bird in GB. This species is therefore only included for assessment of potential impacts from pollution and hydrological changes.

9.5.2.17 Feature 17: Dark-bellied Brent Goose

Distribution and Abundance

Project Site

1066. In season one, ~~D~~dark-bellied brent geese were observed on two occasions with a peak count of seven individuals (24/10/22) during the Coastal OP (landfall) surveys. All records were of flying brent geese. There were no observations of this species made in season two.

~~931.~~1067. During walkover surveys in season one, 13 observations were recorded across eight walkover survey visits all in ECC 10 and 11 with a peak flock count of **1,100 individuals**. In season two, 24 observations were recorded across 12 visits predominantly in ECC 10 and 11 with a peak flock count of 650 individuals. The most common behaviour observed was foraging. In season two, dark-bellied brent geese were recorded most frequently on land classed as not farmland (13 registrations, a total of 1,580 bird records); however, most birds were recorded on cereal crops (nine registrations, a total of 1,839 bird records).

~~932.~~1068. BTO WeBS counts for 2017-22 recorded a peak count of 770 dark-bellied brent goose in Frampton South 44 zone (near ECC 11).

~~933.~~1069. Dark-bellied brent goose is a non-breeding bird in GB.

Designated Sites

~~934.~~1070. Dark-bellied brent goose is a non-breeding qualifying feature of The Wash SPA and Ramsar, and Gibraltar Point Ramsar. Table 9.97~~Table 9.62~~ details the population estimates for the designated sites, their conservation status and objectives.

Table 9-98~~9.979-9.62~~: Population data, conservation status and objectives for dark-bellied brent goose

Designated site	Citation population	BTO WeBS count 17/18-21/22 for the relevant area	Population change	Favourable conservation status (Y/N)	Conservation objective restore or maintain	Survey peak count as a % of citation population	Survey peak count as a % of current WeBS population
The Wash SPA	17,000	10,374	-6,626 (-39%)	N	“Restore the size of the non-breeding population at a level which is above 17,000 individuals, whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent”. (SACO)	6.47%	10.6%
The Wash Ramsar	20,861	10,374	-10,487 (-50%)	N	Restore	5.27%	10.6%
Gibraltar Point Ramsar	682	No information	-19% (from Woodward et al 2019, long-term change)	N	Restore	161%	-

Connectivity

~~935.~~1071. Brent geese typically commute up to 5km inland from roost sites to feed (McKay et al., 2001). The Solent Waders and Brent Goose Strategy (SWBGS 2010) report that sites which are closer to the mean high-water mark are more likely to be used. Summers & Critchley (1990) recorded flights between roost and feeding sites of 8 +/- 2km. The study by Rowell & Robinson (2004) documents a general pattern across the SPA suite in England of feeding on intertidal habitats in autumn (Sep-Nov), then moving inland to feed (Dec-Feb), before returning to estuarine areas in spring (Mar-May). The concentration of birds at The Haven are within and adjacent to the Wash SPA and Ramsar and given the close proximity are assumed to be linked to those designated sites.

9.5.2.18 Feature 18: Pink-footed Goose

Distribution and Abundance

Project Site

1072. In season one, ~~P~~pink-footed geese were observed on two occasions with a peak count of two individuals during the Coastal OP (landfall) surveys. All records were of flying pink-footed geese. In season two, there were no observations during the Coastal OP surveys.

~~936.~~1073. During walkover surveys in season one, 27 observations were recorded across nine ECC segments and during a total of 12 walkover survey visits with a peak flock count of 217 individuals in ECC 4. In season two, 23 observations were recorded across nine ECC segments and during a total of seven visits with a peak flock count of **5,000 individuals in ECC 10**. Some large (more than 1,000 individuals) flocks were also recorded in ECC 5 and ECC 7. The most common behaviour observed was foraging. In season two, majority of pink-footed geese were recorded on bare earth/ ploughed fields (five registrations of a total of 8,122 bird records), followed by stubbles (eight registrations, a total of 2,269), grass (four registrations, a total of 2,157) and cereal crops (five registrations, a total of 1,743).

~~937.~~1074. Up to 2,000 individuals were recorded by LWT roosting over winter (2021-2022) following increased water capacity on Anderby ~~marsh~~Marsh. BTO WeBS counts for 2017-22 recorded a peak count of 750 pink-footed goose in Frampton South 41 zone (near ECC 11).

~~938.~~1075. Pink-footed goose is a non-breeding bird in GB.

Designated Sites

~~939.~~1076. Pink-footed goose is a non-breeding qualifying feature of The Wash SPA and Ramsar, and North Norfolk SPA and Ramsar. Table 9.98~~Table 9.63~~ details the population estimates for the designated sites, their conservation status and objectives.

Table 9-99~~9.98~~9 ~~9.63~~: Population data, conservation status and objectives for pink-footed goose

Designated site	Citation population	BTO WeBS count 17/18-21/22 for the relevant area	Population change	Favourable conservation condition (Y/N)	Conservation objective restore or maintain	Survey peak count as a % of citation population	Survey peak count as a % of current WeBS population
The Wash SPA	7,300	30,525	23,225 (+318%)	Y	"Maintain the size of the non-breeding population at a level which is above 7,300 individuals, whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent". (SACO)	~~2.97~~68.49%	~~0.71~~16.38%
The Wash Ramsar	29,099	30,525	1,426 (+5%)	Y	Maintain	~~0.75~~17.18%	~~0.71~~16.38%
North Norfolk Coast SPA	6,000	46,984	40,984 (+683%)	Y	"Maintain the size of the non-breeding population at a level which is above 6,000 individuals, whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent". (SACO)	~~3.62~~83.33%	~~0.46~~10.64%
North Norfolk	9,576	46,984	37,408 (+391%)	Y	Maintain	~~2.27~~52.21%	~~0.46~~10.64%

Designated site	Citation population	BTO WeBS count 17/18-21/22 for the relevant area	Population change	Favourable conservation condition (Y/N)	Conservation objective restore or maintain	Survey peak count as a % of citation population	Survey peak count as a % of current WeBS population
Coast Ramsar							

Potential Connectivity

~~940.~~1077. Scottish Natural Heritage (now NatureScot) (2016) estimates the foraging range of pink-footed goose from night roosts to be a core range of 15-20km. The Wash SPA and Ramsar is located 0.18km from the application boundary at the closest point and hence is within the core foraging range. The North Norfolk Coast SPA and Ramsar is 24km from the application boundary at the closest point and is outwith the core foraging range, however Natural England have advised that there have been observations in recent winters of birds commuting between the North Norfolk sites and Lincolnshire to feed, hence birds recorded within the survey area may also be associated with the North Norfolk SPA and Ramsar.

9.5.2.19 Feature 19: Gadwall

Distribution and Abundance

Project Site

1078. There were no observations of gadwall as part of the Coastal OP (landfall) survey in either winter season.

~~941.~~ During walkover surveys in season one, 13 observations were recorded across three ECC segments and during a total of six walkover survey visits with a peak flock count of 87 individuals in ECC 1. The most common behaviour observed was swimming. In season two, 47 observations were recorded across seven ECC segments and during a total of 14 visits with a peak flock count of **165 individuals in ECC 1**. The most common behaviour observed was foraging, followed by swimming.

~~942.~~1079. The species was not recorded during the breeding bird survey in 2023.

~~943.~~1080. BTO WeBS counts for 2017-22 recorded a peak count of 78 gadwall in Frampton South 01 zone (near ECC 11).

~~944.~~1081. Gadwall is a widespread breeding species in England.

Designated Sites

~~945.~~1082. Gadwall is a non-breeding qualifying feature of The Wash SPA. Table 9.99~~Table 9.64~~ details the population estimates for the designated sites, their conservation status and objectives.

Table 9-100~~9.999-9.64~~: Population data, conservation status and objectives for gadwall

Designated site	Citation population	BTO WeBS count 17/18-21/22 for the relevant area	Population change	Favourable conservation status (Y/N)	Conservation objective restore or maintain	Survey peak count as a % of citation population	Survey peak count as a % of current WeBS population
The Wash SPA	130	156	26 (+20%)	Y	"Maintain the size of the non-breeding population at a level which is above 130 individuals, whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent". (SACO)	~~66.9~~126.92%	~~55,77~~105.76%

Connectivity

~~946.~~1083. Given the proximity of The Wash SPA, non-breeding gadwall recorded within the survey area could be connected to the designated site population. Some British breeding birds appear to be sedentary whereas others migrate to Europe in the autumn. Any breeding population within the zone of influence of the Project may therefore be connected with The Wash SPA non-breeding population.

9.5.2.20 Feature 20: Wigeon

Distribution and Abundance

Project Site

1084. There were no observations of wigeon~~s~~ during Coastal OP (landfall) surveys in season one. In season two, wigeon were observed on two visits with a peak count of 14 individuals.

~~947.~~1085. During walkover surveys in season one, 23 observations were recorded across five ECC segments and during a total of 11 walkover survey visits with a peak flock count of **460 individuals in ECC 1**. Apart from ECC 1, the segments where large flocks of wigeon were recorded were ECC 4, 5 and 11. The most common behaviour observed was foraging. In season two, 66 observations were recorded across six ECC segments and during a total of 14 visits with a peak flock count of 400 individuals in ECC 1. Large flocks (more than 100 individuals) were almost exclusively concentrated in ECC 1. Wigeon was observed foraging and swimming in equal proportions.

~~948.~~1086. BTO WeBS counts for 2017-22 recorded a peak count of 10,656 wigeon in Frampton South 44 zone (near ECC 11).

~~949.~~1087. Wigeon is a rare breeding bird in GB, typically restricted to the uplands and therefore not expected to breed within the zone of influence of the Project.

Designated Sites

~~950.~~1088. Wigeon is a non-breeding qualifying feature of The Wash SPA. Table 9.100~~Table 9.65~~ details the population estimates for the designated sites and their conservation status and objectives.

Table 9-101~~9.1009-9.65~~: Population data, conservation status and objectives for wigeon

Designated site	Citation population	BTO WeBS count 15/16-19/20 for the relevant area	Population change	Favourable conservation status (Y/N)	Conservation objective restore or maintain	Survey peak count as a % of citation population	Survey peak count as a % of current WeBS population
The Wash SPA	3,900	14,452	10,552 (+271%)	Y	"Maintain the size of the population at a level which is above 3,900 individuals, whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent".	11.79%	3.18%

Connectivity

~~951.~~1089. Given the proximity to The Wash SPA, wigeon recorded within the survey area are potentially connected to that designated site.

9.5.2.21 Feature 21: Shelduck

Distribution and Abundance

Project Site

1090. In season one, ~~A~~a single shelduck was observed (14/11/22) loafing during the Coastal OP survey. In season two, two shelduck were observed on 24/04/24.

~~952.~~1091. During walkover surveys in season one, ~~E~~eight observations were recorded across four ECC segments and during a total of five walkover survey visits with a peak flock count of 15 individuals in ECC 1. The most common behaviour observed was loafing. In season two, 38 observations were recorded on 12 visits across three ECC segments with a peak count of **56 individuals in ECC 1**. The most common behaviour observed was foraging, followed by roosting.

~~953.~~1092. Shelducks were not recorded during the breeding bird survey in 2023.

~~954.~~1093. BTO WeBS counts for 2017-22 recorded a peak count of 189 shelduck in Frampton South 44 zone (near ECC 11).

~~955.~~1094. The species breeds around the coast of GB.

Designated Sites

~~956.~~1095. Shelduck is a non-breeding qualifying feature of The Wash SPA and Ramsar and Humber Estuary SPA and Ramsar. Table 9.101~~Table 9.66~~ details the population estimates for the designated sites, their conservation status and objectives.

Table 9-102~~9.1019-9.66~~: Population data, conservation status and objectives for shelduck

Designated site	Citation population	BTO WeBS count 17/18-21/22 for the relevant area	Population change	Favourable conservation status (Y/N)	Conservation objective restore or maintain	Survey peak count as a % of citation population	Survey peak count as a % of current WeBS population
The Wash SPA	16,000	2,170	-13,830 (-86%)	N	"Restore the size of the population to a level which is above 16,000 individuals, whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent". (SACO)	0.~~09~~35%	~~0.69~~2.58%
The Wash Ramsar	9,746	2,170	-7,575 (-78%)	N	Restore	0.~~15~~57%	~~0.6~~2.58%
Humber Estuary SPA	4,464	6,486	2022 (+45%)	Y	"Maintain the size of the non-breeding population at a level which is above 4464, whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent". (SACO)	~~0.34~~1.25%	0.~~23~~86%
Humber Estuary Ramsar	4,464	6,486	2022 (+45%)	Y	Maintain	~~0.34~~1.25%	0.~~23~~86%

Connectivity

~~957.~~1096. Based on the low number of observations and low abundance of shelduck from within the winter birds survey area during extensive winter bird surveys in 2022-23 and 2023-24, it is concluded that there is negligible connectivity between the Project site and the relevant SPA and Ramsar sites in relation to non-breeding shelduck. The Humber Estuary populations are in favourable condition and the maintenance of the supporting habitats listed in the targets would not be directly affected by the Project. Potential supporting habitats for The Wash SPA shelduck population are listed as: saltmarsh, other inter-tidal habitats, coastal lagoons, freshwater and coastal grazing marsh and halophilous scrub (Natural England webpage, 2023). Such habitats are scarce within the ZoI of the Project and therefore past connectivity is also likely to be negligible. This species (non-breeding) is therefore only included for assessment of potential impacts from pollution and hydrological changes. No breeding shelduck was recorded as part of breeding bird surveys in 2023.

9.5.2.22 Feature 22: Pintail

Distribution and Abundance

Project Site

~~958.~~1097. There was only one record of pintail of two birds during Coast OP Surveys ~~during the winter 2022-23 bird surveys~~in season one (no records of pintail were made in season two).

~~959.~~1098. BTO WeBS counts for 2017-22 recorded a peak count of 56 pintail in Frampton South 43 zone (near ECC 11).

~~960.~~1099. The species is a very rare breeding bird in GB.

Designated Sites

~~961.~~1100. Pintail is a non-breeding qualifying feature of The Wash SPA. Table 9.102~~Table 9.67~~ details the population estimates for the designated sites, their conservation status and objectives.

Table 9-103~~9.~~1029 ~~9.67~~: Population data, conservation status and objectives for pintail

Designated site	Citation population	BTO WeBS count 17/18-21/22 for the relevant area	Population change	Favourable conservation status (Y/N)	Conservation objective restore or maintain	Survey peak count as a % of citation population	Survey peak count as a % of current WeBS population
The Wash SPA	1,700	315	-1,385 (-81%)	N	"Restore the size of the non-breeding population to a level which is above 1,700 individuals, whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent". (SACO)	0.12%	0.63%

Connectivity

~~962.~~1101. Based on the absence of records of pintail from within the winter birds survey area during extensive winter bird surveys in 2022-23 and 2023-24, it is concluded that there is negligible connectivity between the Project site and the Wash SPA in relation to pintail. Potential supporting habitats for The Wash SPA pintail population are listed as: saltmarsh, other inter-tidal habitats, coastal lagoons and freshwater and coastal grazing marsh (Natural England webpage, 2023). Such habitats are scarce within the ZoI of the Project and therefore past connectivity is also likely to be negligible. It is a very rare breeding bird in GB. This species is therefore only included for assessment of potential impacts from pollution and hydrological changes.

9.5.2.23 Feature 23: Goldeneye

Distribution and Abundance

Project Site

~~963.~~1102. There were no observations of goldeneye within the application boundary plus 400m survey area during the winter surveys ~~2022-23 bird surveys~~in season one. In season two, one goldeneye was observed on a single winter walkover survey visit in ECC 1.

~~964.~~1103. BTO WeBS counts for 2017-22 recorded a peak count of 16 goldeneye in Frampton North 41 zone (near ECC 11).

~~965.~~1104. The species is a very rare breeding bird in GB, largely restricted to the Scottish Highlands.

Designated Sites

~~966.~~1105. Goldeneye is a non-breeding qualifying feature of The Wash SPA. Table 9.103~~Table 9.68~~ details the population estimates for the designated sites, their conservation status and objectives.

Table 9-104~~9.1039 9.68~~: Population data, conservation status and objectives for goldeneye

Designated site	Citation population	BTO WeBS count 15/16-19/20 for the relevant area	Population change	Favourable conservation status (Y/N)	Conservation objective restore or maintain	Survey peak count as a % of citation population	Survey peak count as a % of current WeBS population
The Wash SPA	220	64	-156 (-71%)	N	"Restore the size of the non-breeding population at a level which is above 220 individuals, whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent". (SACO)	0.45%	1.56%~~0~~

Connectivity

~~967.~~1106. Based on the ~~absence of observations of~~single record of goldeneye from within the winter birds survey area during extensive winter bird surveys in 2022-23 and 2023-24, it is concluded that there is negligible connectivity between the onshore Project site and The Wash SPA in relation to goldeneye. Potential supporting habitats for The Wash SPA goldeneye population are listed as: circalittoral rock, inter-tidal habitats, sub-tidal habitats, coastal lagoons and the water column (Natural England webpage, 2023). Such habitats are scarce within the ZoI of the Project (onshore) and therefore past connectivity is also likely to be negligible. The breeding population in the UK is largely restricted to Scotland. This species is therefore only included for assessment of potential impacts from pollution and hydrological changes.

9.5.2.24 Feature 24: Common scoter

Distribution and Abundance

Project Site

~~968.~~1107. In season one, ~~C~~common scoters were observed on seven occasions during a total of six visits with a peak count of 40 individuals (10/01/23) as part of the Coastal OP (landfall) survey. They were observed to be swimming and foraging. In season two, one common scoter was observed on 11/04/24 as part of the Coastal OP (landfall) survey.

~~969.~~1108. GLNP reported common scoters present throughout the year at Chapel Point, Chapel Six Marshes and Wolla Bank, with larger flocks of up to 500 found at Anderby, Coastal Country Park and Marsh Yard. Occasionally present throughout the year at Frampton Marsh, Moggs Eye and Wrangle. Few records at all other sites. Due to the typical marine habitat of this species, records from inland sites are considered anomalous.

~~970.~~1109. The species is a very rare breeding bird in the UK, restricted to northern Scotland.

Designated Sites

~~971.~~1110. Common scoter is a non-breeding qualifying feature of The Wash SPA and Greater Wash SPA. Table 9.104~~Table 9.69~~ details the population estimates for the designated sites, their conservation status and objectives.

Table 9-105~~9.1049-9.69~~: Population data, and conservation status and objectives for common scoter

Designated site	Citation population	BTO WeBS count 17/18-21/22 for the relevant area	Population change	Favourable conservation status (Y/N)	Conservation objective restore or maintain	Survey peak count as a % of citation population	Survey peak count as a % of current WeBS population
The Wash SPA	830	1,109	279 (+34%)	Y	"Maintain the size of the population at a level which is above 830 individuals, whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent". (SACO)	4.82%	3.61%
Greater Wash SPA	3,449 (Mean of Peak)	No information	-	-	"Maintain the size of the non-breeding population at a level which is above 3,449, whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent". (SACO)	1.16%	-

Connectivity

~~972.~~1111. The landfall survey area overlaps with the Greater Wash SPA and therefore common scoter recorded in the area offshore of the landfall are considered to be part of that designated site.

9.5.2.25 Feature 25: Eider

Distribution and Abundance

Project Site

~~973.~~1112. There was a single record of eider during the Coastal OP (landfall) surveys in ~~winter 2022-23~~season one, of a single individual. No eider were recorded in season two.

~~974.~~1113. BTO WeBS counts for 2017-22 recorded a peak count of 3 eider in Frampton North 60 zone (near ECC 10).

~~975.~~1114. The species was not confirmed breeding during the breeding bird survey in 2023. Habitats within the zone of influence of the Project are considered unsuitable for nesting eider.

Designated Sites

~~976.~~1115. Eider is a non-breeding qualifying feature of The Wash Ramsar. Table 9.105~~Table 9.70~~ details the population estimates for the designated site, conservation status and objectives.

Table 9-106~~9.105~~9-~~9.70~~: Population data, conservation status and objectives for eider

Designated site	Citation population	BTO WeBS count 17/18-21/22 for the relevant area	Population change	Favourable conservation status (Y/N)	Conservation objective restore or maintain	Survey peak count as a % of citation population	Survey peak count as a % of current WeBS population
The Wash Ramsar	1,109	1,609	500 (+45%)	N	Maintain	0.09%	0.06%

Connectivity

~~977.~~1116. Based on the low number of observations and very low abundance of eider from within the winter birds survey area during extensive winter bird surveys in 2022-23 and 2023-24, it is concluded that there is negligible connectivity between the onshore Project site and The Wash Ramsar in relation to non-breeding eider. Potential supporting habitats for The Wash Ramsar eider population are scarce within the ZoI of the Project (onshore) and therefore past connectivity is also likely to be negligible. Habitats within the ZoI of the project are considered unsuitable for nesting eider and the species was not recorded during the breeding bird survey in 2023. This species is therefore only included for assessment of potential impacts from pollution and hydrological changes.

9.5.2.26 Feature 26: Terns

Distribution and Abundance

Project Site

1117. There were no observations of common tern, sandwich tern or little tern during the ~~October 2022 to March 2023~~ winter bird surveys in season one; in season two, two juvenile sandwich terns were observed loafing on 19/09/23.

1118. Common tern, sandwich tern and little tern ~~these~~ are migratory species, which overwinter in Africa. Terns are breeding birds in GB, with a small number of sandwich terns wintering around GB coasts.

~~978.~~1119. 16 common terns were recorded during a single visit (visit 3) as part of the breeding bird survey in 2023, however no breeding was identified.

~~979. 16 common terns were recorded during a single visit (visit 3) as part of the breeding bird survey in 2023, however no breeding was identified.~~

~~980.~~1120. Mitchell et al., 2004 indicates that breeding colonies of these three tern species in the vicinity of the Project are at:

- Little tern – Gibraltar Point.
- Sandwich tern – none in Lincolnshire.
- Common tern – present and breeding at Snettisham, Frieston and Frampton Marshes.

Designated Sites

~~981.~~1121. Table 9.106~~Table 9.71~~ details the population estimates for the designated sites, their conservation status and objectives for sandwich tern, common tern and little tern.

Table 9-107~~9.1069 9.71~~: Population data, conservation status and objectives for breeding terns. Values in () refer to the number of occupied sites

Designated site	Citation population	Best current population estimate (breeding pairs)	Population change	Favourable conservation status (Y/N)	Conservation objective restore or maintain	Survey peak count as a % of citation population	Survey peak count as a % of current WeBS population
Little tern							
Greater Wash SPA	798 pairs (2009-2013)	282 [7] (Combined numbers for Gibraltar Point, North Norfolk Coast and Humber Estuary SPAs for 2015-21 from (Burnell *et al.* 2023).	-516 (-65%)	N	"Maintain the size of the breeding population at a level which is above 798 breeding pairs, whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent". (SACO) -	0	0
Wash SPA	30 pairs	0 (Burnell *et al.* 2023)	-30	N	"Maintain the size of the breeding population at a level which is above 30 breeding pairs, whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent". (SACO)	0	0
Gibraltar Point SPA	40 pairs	21 [1] (Burnell *et al.* 2023)	-19	N	"Restore the size of the breeding population to a level	0	0

Designated site	Citation population	Best current population estimate (breeding pairs)	Population change	Favourable conservation status (Y/N)	Conservation objective restore or maintain	Survey peak count as a % of citation population	Survey peak count as a % of current WeBS population
					which is above 40 pairs, whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent". (SACO)		
Humber Estuary SPA	51 pairs	33 pairs [1] (Burnell *et al.* 2023)	-18 (-35%)	N	"Restore the size of the breeding population to a level which is above 51 breeding pairs, whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent". (SACO)	0	0
Sandwich tern							
Greater Wash SPA	3,852 pairs	4,850 [2] (Numbers for North Norfolk Coast SPAs for 2015-21 from (Burnell *et al.* 2023).	998 (+26%)	Y	"Maintain the size of the breeding population at a level which is above 3,852 breeding pairs, whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent". (SACO)	0	0
Common tern							

Designated site	Citation population	Best current population estimate (breeding pairs)	Population change	Favourable conservation status (Y/N)	Conservation objective restore or maintain	Survey peak count as a % of citation population	Survey peak count as a % of current WeBS population
Greater Wash SPA	510 pairs	357 [5] (Combined numbers for North Norfolk Coast and the Wash SPAs for 2015-21 from (Burnell *et al.* 2023).	-153 (-30%)	N	"Maintain the size of the breeding population at a level which is above 510 breeding pairs, whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent". (SACO)	0	0
Wash SPA	220 pairs	125 pairs [1] (Burnell *et al.* 2023)	-95 (-43%)	N	"Maintain the size of the population at a level which is above 220 pairs whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent". (SACO)	0	0

Connectivity

~~982.~~1122. Little tern and sandwich tern are almost exclusively marine species nesting close to the shore and feeding over the sea. Common tern will utilise marine habitats, but also breed inland at wetland sites and feed on lakes and rivers. All three species may therefore forage offshore of the Landfall area and common tern may utilise wetland habitats elsewhere within the ZoI of the onshore Project.

9.5.2.27 Feature 27: Black-headed Gull

Distribution and Abundance

Project Site

1123. In season one, ~~B~~black-headed gulls were observed on 32 occasions during a total of 13 visits with a peak count of 16 individuals as part of the Coastal OP (landfall) survey. The black-headed gulls were observed exclusively to be loafing. In season two, black-headed gulls were observed during a total of 14 visits with a peak count of 200 individuals on 4/10/24. The most common behaviour observed was foraging, followed by loafing.

~~983.~~1124. During winter walkover surveys in season one, 63 observations were recorded across 12 ECC segments and during a total of 12 walkover survey visits with a peak flock count of 137 individuals in ECC 10. The most common behaviour observed was loafing~~ (53%)~~ followed by foraging~~ (40%)~~. In season two, 640 observations were recorded across all 14 ECC segments with a peak flock count of **600 individuals in ECC 8**. The most common behaviour observed was foraging, followed by loafing. Black-headed gulls were widespread throughout the survey area, utilising agricultural fields, with a concentration of records~~, albeit in low numbers,~~ at the beach and inter-tidal zone.

~~984.~~1125. BTO WeBS counts for 2017-22 recorded a peak count of 900 black-headed gulls in Frampton South 01 zone (near ECC 11).

~~985.~~1126. Black-headed gull is a widespread breeding species in Britain. The species was not confirmed breeding during the breeding bird survey in 2023.

Designated Sites

~~986.~~1127. Black-headed gull is a non-breeding qualifying feature of The Wash Ramsar. Table 9.107~~Table 9.72~~ details the population estimates for the designated sites, their conservation status and objectives.

Table 9-108~~9.107~~9 ~~9.72~~: Population data, conservation status and objectives for black-headed gull

Designated site	Citation population	BTO WeBS count 15/16-19/20 for the relevant area	Population change	Favourable conservation status (Y/N)	Conservation objective restore or maintain	Survey peak count as a % of citation population	Survey peak count as a % of current WeBS population
The Wash Ramsar	31,403	16,348	-15,055 (-48%)	N	Restore	~~0.44~~1.91%	~~0.84~~3.67%

Connectivity

~~987.~~1128. Black-headed gulls recorded within the survey area may be connected with the Wash Ramsar, given the proximity to the designated site. Most black-headed gulls stay in Britain over winter, although may range widely across the country, and therefore it is unlikely that any breeding colony within the ZoI of the Project would be a supporting population for The Wash Ramsar.

9.5.2.28 Feature 28: Bittern

Distribution and Abundance

Project Site

~~988.~~1129. No records of bittern were obtained during the winter bird surveys at the Landfall or onshore ECC in either winter ~~2022-23~~season. Desk study searches identified non-breeding records from Wolla Bank Pit and Wolla Bank Reedbed in late winter-early spring with records increasing.

~~989.~~1130. Bittern was not recorded during the breeding bird survey in 2023. [redacted]

Designated Sites

~~990.~~1131. Bittern is a non-breeding and breeding qualifying feature of the Humber Estuary SPA. The non-breeding population was estimated to be four individuals at designation (1996/97-2000/01, from Natural England Designated Sites View) and the most recently available five-year average from BTO WeBS counts for the Humber Estuary is three individuals (Austin et al., 2023). The Natural England target for attribute “abundance” is to “Maintain the size of the non-breeding population at a level which is above four wintering individuals, whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent”.

~~991.~~1132. The GB breeding population has been rising consistently over the last ten years, with a new record total of 227 pairs counted in 2019 (Eaton et al., 2021). The Natural England target for the Humber Estuary SPA’s attribute ‘abundance’ is to “Maintain the size of the breeding population at a level which is at or above 7 booming males, whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent”.

Connectivity

~~992.~~1133. The average territory size of male bitterns in GB is $0.2km^2$ (RSPB Online [2023]). A radiotracking study found their median home-range sizes were 14.6, 19.3 and 33.1 ha during the booming, moult and winter periods respectively (Gilbert et al., 2005). The Humber Estuary is located 12.5km from the Order Limits at the closest point and therefore the Order Limits is well outwith the core foraging range of bitterns from the Humber SPA. Combined with the absence of records of non-breeding and bittern during the Project surveys, it is considered that connectivity is negligible.

9.5.2.29 Feature 29: Marsh harrier

Distribution and abundance

Project Site

1134. In season one, ~~W~~winter bird surveys recorded nine observations across five ECC segments and during a total of six visits with a peak count of two individuals. In season two, there were 12 observations across five ECC segments and during a total of nine visits with a peak count of two individuals.

[redacted] The desk study search identified records of marsh harrier during the breeding season from multiple locations within the 2km area, indicating that the species will likely be present as a breeding species within the zone of influence of the Project.

~~994.~~113 [redacted] Foraging and passing marsh harriers were also recorded in ECC 6 and 10.

Designated sites

~~995.~~1137. Marsh harrier is a breeding qualifying feature of the Humber Estuary SPA. The breeding population was estimated to be ten females at designation (1998-2002, from Natural England Designated Sites View). The Natural England target for attribute 'abundance' is to "Maintain the size of the non-breeding population at a level which is above 21 breeding females, whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent". The GB marsh harrier breeding population is estimated at 590 pairs and has undergone an 884% expansion in distribution (BTO BirdFacts).

Connectivity

~~996.~~1138. Hardey et al. (2013) states that "In East Anglia, the home range of males varied with the stage of the breeding cycle from 569 ha during courtship to 1,407 ha during the post-fledging period (Underhill-Day, 1990). Males may hunt up to 7km from their nesting territory. Females have smaller home ranges, but these increase in size when they start to feed young (from 100–1,300 ha)". The Humber Estuary is located 12.5km from the application boundary at the closest point and therefore the application boundary is well outside the core foraging range of marsh harriers from the Humber SPA.

~~997.~~1139. Breeding marsh harrier of the Humber Estuary SPA are only considered in relation to potential effects on a possible supporting population of breeding and non-breeding birds at the Project site. This is because the Humber Estuary SPA breeding sites are too distant from the application boundary to be affected by disturbance or habitat loss and the applic~~ci~~ation boundary is located beyond their foraging range.

9.5.2.30 Feature 30: Hen harrier

Distribution and abundance

Project Site

~~998.~~1140. There was only one observation of two hen harriers during the winter bird surveys on 01/02/23 (season one) in ECC 8. The desk study search identified some records of hen harrier from within the 2km search area with limited detail.

~~999.~~1141. Hen harrier primarily breeds in the uplands in Britain, and is therefore not expected to be present as a breeding species within the ZoI of the Project.

Designated sites

~~1000.~~1142. Hen harrier is a non-breeding qualifying feature of the Humber Estuary SPA. The non-breeding population was estimated to be eight individuals at designation (1997/98-2001/02, from Natural England Designated Sites View). The Natural England target for attribute 'abundance' is to "Maintain the size of the non-breeding population at a level which is above eight wintering individuals, whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent".

Connectivity

~~1001.~~1143. Based on the single observation of hen harrier from within the winter birds survey area during extensive winter bird surveys in 2022-23 and 2023-24, it is concluded that there is negligible connectivity between the Project site and the Humber Estuary SPA in relation to non-breeding hen harrier. Potential supporting habitats for The Humber Estuary SPA hen harrier population are listed as: saltmarsh, other inter-tidal habitats, coastal lagoons and reedbeds and freshwater and coastal grazing marsh (Natural England webpage, 2023). Such habitats are scarce within the ZoI of the Project (onshore) and therefore past connectivity is also likely to be negligible. Hen harrier is very unlikely to occur as a breeding species within the zone of influence of the Project.

9.5.2.31 Feature 31: Waterbird assemblage

Designated sites

~~1002.~~1144. Waterbird assemblage is a feature of Humber SPA and Ramsar, The Wash SPA and Ramsar and Gibraltar Point Ramsar. Table 9.108~~Table 9.73~~ details the population estimates for the waterbird assemblages for the designated sites, their conservation status and objectives.

Table 9-109~~9.1089-9.73~~: Population data, conservation status and objectives for waterbird assemblage

Designated site	Citation population	BTO WeBS alerts for waterbird assesmblages (Woodward et al., 2019)	BTO WeBS alerts for waterbird assemblages % change since baseline	Favourable conservation status (Y/N)	Conservation objective restore or maintain
Humber Estuary SPA	153,934	No alerts	-24%	N	"Restore the overall abundance of the assemblage to a level which is above 153,934 whilst avoiding deterioration from its current level as indicated by the latest peak mean count or equivalent". (SACO)
Humber Estuary Ramsar	153,934			N	Restore
The Wash SPA	203,829	No alerts	+359%	Y	"Maintain the overall abundance of the assemblage at a level which is above 214,000 whilst avoiding deterioration from its current level as indicated by the latest peak mean count or equivalent". (SACO)
The Wash Ramsar	292,541			Y	Maintain
Gibraltar Point Ramsar	53,072	No alerts	+92% (long term change)	Y	Maintain

9.5.2.32 Feature 32: Habitat features of SACs and Ramsar sites

Distribution

Project Site

~~1003.~~1145. Small areas of Annex 1 habitat associated with the coast were recorded during the habitat survey. These were:

- 2110 Embryonic shifting dunes, at the coast in ECC 1.
- 2160 Dunes with Hippophae rhamnoides, at the coast in ECC 1, although much is planted and may not match the Annex I type.
- 1130 Estuaries, in the tidal sections of The Haven (Boston) and the River Welland (Fosdyke Bridge), which both flow into The Wash, and are located within ECC 10 to ECC 12 and ECC 14
- 1330 Atlantic salt meadows (Glauco-Puccinellietalia maritimae), same locations as 1130; and
- 1140 Mudflats and sandflats not covered by seawater at low tide, same locations as 1130.

Designated Sites

~~1004.~~1146. The habitat 2110 Embryonic shifting dunes is the Qualifying Interest of Saltfleetby-Theddlethorpe Dunes & Gibraltar Point SAC, while the 1130 Estuaries, 1330 Atlantic salt meadows and 1140 Mudflats and sandflats are the qualifying interest of The Wash & North Norfolk Coast SAC.

~~1005.~~1147. Table 9.109~~Table 9.74~~ lists the habitat features of the relevant European and Ramsar Sites, their recorded condition, and their overall conservation objectives. Note that LSE for Humber Estuary SAC and estuarine features of the Humber Estuary Ramsar were excluded at Stage 1 Screening. The LSE for the Humber Estuary Ramsar could not be excluded for the sand dunes only, as these are within the Saltfleetby-Theddlethorpe Dunes & Gibraltar Point SAC.

Table 9-110~~9.109~~9-~~9.74~~: European and Ramsar Sites, Qualifying Interest Habitats, Conservation status and Objectives

Designated site	Habitat Type	Favourable conservation status Y/N (from NE SSSI Condition of Features)	Conservation Objective Restore or Maintain
Humber Estuary Ramsar	Dune systems and humid dune slacks	N	Restore
Saltfleetby-Theddlethorpe Dunes & Gibraltar Point SAC	2120 Shifting dunes along the shoreline with *Ammophila arenaria* (white dunes)	Y	Maintain
	2130 Fixed coastal dunes with herbaceous vegetation (grey dunes)	Y	Maintain
	2160 Dunes with *Hippophae rhamnoides*	Y	Maintain
	2190 Humid dune slacks	Y	Maintain
	2110 Embryonic shifting dunes	Y	Maintain
Gibraltar Point Ramsar	Dune, saltmarsh, and freshwater marsh	Dunes – N Saltmarsh – Y Freshwater marsh – no data	Dunes – Restore Saltmarsh – Maintain Freshwater marsh – no data
The Wash & North Norfolk Coast SAC	1140 Mudflats and sandflats not covered by seawater at low tide	N	Restore
	1310 Salicornia and other annuals colonizing mud and sand	Y	Maintain
	1330 Atlantic salt meadows (Glauco-Puccinellietalia maritimae)	Y	Maintain
	1420 Mediterranean and thermo-Atlantic halophilous scrubs (*Sarcocornetea fruticosi*)	Y	Maintain

Designated site	Habitat Type	Favourable conservation status Y/N (from NE SSSI Condition of Features)	Conservation Objective Restore or Maintain
The Wash & North Norfolk Coast SAC	1150 Coastal lagoons * Priority feature	Y	Maintain
The Wash Ramsar	Saltmarshes, major intertidal banks of sand and mud, shallow water, and deep channels; inter-relationship between saltmarshes, intertidal sand, mudflats, and estuarine waters;	Y	Maintain

Connectivity

~~1006.~~1148. The 2110 and 2160 habitats in the Order Limits are not within an SAC but may provide supporting habitat for the same and similar habitat types within Saltfleetby-Theddlethorpe Dunes & Gibraltar Point SAC where 2110 and 2160 habitats, and other types of dune habitat, are qualifying interest features. The 2110 and (created) 2160 habitat in the Order Limits is connected by a continuous stretch of coastline, with sand dunes occurring in several discrete sections, to both Saltfleetby-Theddlethorpe Dunes (12.4km to the north) and Gibraltar Point (c. 2.4km to the south). Therefore the 2110 habitat in the Order Limits may provide a 'stepping stone' link between the two parts of the SAC. Saltfleetby-Theddlethorpe Dunes are included in the Humber Estuary Ramsar and therefore have the same potential connectivity as described for the SAC.

~~1007.~~1149. Similarly, the 1130, 1330 and 1140 habitats within the ECC are outside an SAC but directly connected to the same habitats within the Wash and North Norfolk Coast SAC and the Wash Ramsar, at both the Haven and Fosdyke. The habitats within the Order Limits may therefore be supporting habitat to the same habitats within the SAC and Ramsar. Moreover, there is a direct hydrological link between the Order Limits and the Wash and North Norfolk Coast SAC, the Wash Ramsar SAC, (Saltfleetby-Theddlethorpe Dunes &) Gibraltar Point SAC, and Gibraltar Point Ramsar via watercourses and ditches.

9.5.2.33 Feature 33: Red Data Book Invertebrates

Distribution

Project Site

~~1008.~~1150. Two qualifying interest aquatic invertebrate populations were screened in for assessment in the RIAA. These are Hairy Dragonfly *Brachytron pratense* and a water beetle *Haliplus mucronatus*. These species are both aquatic invertebrates which are found in or around the freshwater habitats.

~~1009.~~1151. There are no records of either *Brachytron pratense* or *Haliplus mucronatus* from within the ECC. However, Brachytron pratense has known populations at Hutoft Bank Pit Nature Reserve/Sea Bank Clay Pits SSSI (near Sandilands), Wolla Bank Pit, Gibraltar Point and Frampton Marsh RSPB Reserve, which are c. 3970m, c. 285m, c. 2400m and c. 520m from the ECC, respectively. The closest population is therefore at Wolla Bank Pit. *Haliplus mucronatus* also has a population at Gibraltar Point; other known populations are more than 15km distant from the ECC.

Designated Sites

~~1010.~~1152. Both of these red data book invertebrates are a qualifying feature of the Gibraltar Point Ramsar site.

~~1011.~~1153. No information on the conservation condition, and therefore conservation objectives (restore or maintain), was identified.

Connectivity

~~1012.~~1154. The possible connection between the Order Limits and the populations of these two invertebrate species is through surface water flows.

- Hutoft Bank Pit Nature Reserve/Sea Bank Clay Pits SSSI is in the same surface water catchment as the Order Limits (Anderby Main Drain) but is not hydraulically connected;
- Wolla Bank Pit is in the same surface water catchment as the Order Limits (Willoughby High Drain) and therefore potentially hydraulically connected;
- Gibraltar Point is connected to the Order Limits via the Steeping River; however this may not supply water to the habitat of the two species; and
- Frampton Marsh RSPB Reserve is in the same surface water catchment as the Order Limits (Black Sluice) and therefore potentially hydraulically connected.

~~1013.~~1155. Whilst only Gibraltar Point has these species as a qualifying feature of a European or Ramsar site, it is possible that the populations in the other locations are supporting populations (e.g. through exchange of individuals).

9.5.2.34 Feature 34: Otter

Distribution

Project Site

~~1014.~~1156. Habitats within the ECC which have potential to support otter include the surface water ditch network, some of which has moderate suitability for otter, and the six main rivers within the Order Limits.

~~1015.~~1157. There is one existing record of Otter from within the Order Limits and 92 records from within the Study Area. The Otter record from within the Order Limits, dates from 2015 and was located at ECC 13. Outside the Order Limits, the largest number of existing otter records were located near to ECC 6, with a total of 20 records.

~~1016.~~1158. During surveys for ODOW, evidence of Otter included:

- a couch was recorded within ECC 3;
- a slide was recorded within ECC 5;
- holts within ECC 10 and ECC 14;
- Footprints within ECC 13 and ECC 14; and
- Feeding evidence constituting bivalve remains at ECC 2, ECC 5 and ECC 10

Designated Sites

~~1017.~~1159. Otter is a qualifying feature of The Wash and North Norfolk SAC but is not a primary reason for selection. No population is given in the site citation and the feature is not included in the marine condition assessment. No recent population estimate was identified. The Standard Data Form indicates that the 'degree of conservation' is 'average or reduced' indicating that it may be in unfavourable condition and therefore the conservation objective may be to restore the population. However, the date of this assessment is unclear and the otter population in the Anglian Region appears to be in favourable condition, as there were lots of new positive records in the 2009-10 survey and fewer sites which were positive in 2000-02 and negative in 2009-10 (Environment Agency, 2010). Therefore, The Wash and North Norfolk SAC should be in favourable condition with an overall objective of maintaining the population.

Connectivity

~~1018.~~1160. The Otter has a large home range, with one study indicating that the home range encompasses an average of 7.5km of river for females and between 10 - 20km for males. The records of Otter within the Order Limits are mostly 8km or less via main rivers from the coastline and boundary of The Wash and North Norfolk SAC. There are numerous connecting watercourses in the form of the ditch networks and main rivers (the Steeping River, the Haven, and the Welland) between the Order Limits and the SAC. The otter population which ranges into the Order Limits is therefore the SAC population or very closely linked to the SAC population. The Otter habitat within the SAC is also linked to the Order Limits by surface water flows.

9.5.3 Construction and Decommissioning

9.5.3.1 Pathway 1 - Habitat Loss

~~1019.~~1161. There will be no habitat loss from the Humber Estuary SPA, or any other SPA, SAC or Ramsar site within the onshore Order Limits (i.e. above MHWS). The majority of the habitat loss within the Order Limits will be temporary, occurring only during construction, with permanent habitat loss largely limited to the footprint of the OnSS (indicative permanent site area of 18 ha). Construction will occur for up to 51 months, and habitats not permanently impacted will be reinstated on completion of works. The TJBs and JBs will largely be restored, with some manhole cover type access to the LBs retained. The working corridor will be contained within the typically 80m wide Order Limits and is expected to be 60m wide. At the decommissioning stage it is currently planned to leave the onshore cables in the ground. However, should the onshore infrastructure be removed, for the purposes of a worst-case scenario, it is considered that impacts associated with the decommissioning phase would be no greater than those identified for the construction phase.

Feature 1: Avocet

Implication for Conservation Objectives Unmitigated

[redacted] he UK avocet breeding population is estimated to be 2,228 pairs (RBBP five-year mean) with the most recent estimate from 2021 being 2,349 confirmed pairs (RBBP, 2023). The six pairs present represent approximately 0.27% of the UK breeding population.

~~1021.~~1163. Habitats within the vicinity of the OnSS location appear unsuitable for use by breeding avocet and no breeding records were identified through the desk study and breeding bird survey from those areas. [redacted]. Elsewhere along the onshore ECC, habitats are unsuitable for breeding avocet and there have been no further desk study records of breeding avocet potentially within the Order Limits.

~~1022.~~1164. For breeding avocet of the Humber Estuary SPA, the SACO targets relevant to habitat loss are:

- “Maintain the size of the breeding population at a level which is above 233 breeding pairs, whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent”.
- “Maintain the structure, function and supporting processes associated with the feature and its supporting habitat through management or other measures (whether within and/or outside the site boundary as appropriate) and ensure these measures are not being undermined or compromised”.
- "Restore the extent, distribution and availability of suitable habitat (either within or outside the site boundary) which supports the feature for all necessary stages of its breeding cycle (courtship, nesting, feeding) to: an unspecified extent, based on restoring natural estuarine functioning". The following habitats support this feature during the breeding season: Coastal lagoons, Intertidal sand and mudflats.

~~1023.~~1165. The relevant SACO targets for non-breeding avocet of Humber Estuary SPA are:

- “Maintain the size of the non-breeding population at a level which is above 1213 individuals, whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent”.
- “Restore the extent, distribution and availability of suitable habitat (either within or outside the site boundary) which supports the feature for all necessary stages of the non-breeding/wintering period (moulting, roosting, loafing, feeding) at [unspecified extent]. The following habitats support this feature: Intertidal sand and mudflats, Coastal lagoons, Saltmarsh”.

Integrity Test (Alone) – Unmitigated

~~1024.~~1166. The national avocet breeding population has increased by approximately 300% in the 25 years to 2021 (RBBP, 2023). Given the relatively small area of permanent habitat loss (ca. 38 ha), the largely arable habitats present, the avoidance of areas where breeding avocets have been identified, and the favourable condition of the avocet population, temporary and permanent habitat loss would:

- not reduce the breeding population below its current level;
- not affect the restoration of intertidal sand and mudflats, coastal lagoons and saltmarsh habitats.

~~1025.~~1167. Habitat loss would therefore not undermine the conservation objectives for the Humber Estuary SPA. **It is concluded that there will be no adverse effect on integrity (AEoI) of the Humber Estuary SPA in relation to habitat loss and avocet (breeding and non-breeding), in the absence of mitigation, for the project alone.**

Feature 2: Lapwing

Implication for Conservation Objectives Unmitigated

~~1026.~~1168. No observations of lapwings were made during the Coastal OP (landfall) surveys in either winter season. In season one, 230 observations were recorded across 12 ECC segments and during a total of ten walkover survey visits with a peak flock count of 400 individuals in ECC 12. In season two, 156 observations were recorded across all 14 ECC segments and during a total of 15 walkover survey visits with a peak flock count of **2,000 individuals in ECC 7**. ~~230 observations were recorded across 12 ECC segments and during a total of ten walkover survey visits with a peak flock count of 400 individuals in ECC 12.~~ The most common behaviour observed was loafing.

~~1027.~~1169. There were no records of lapwing from ~~the 2022-23~~ winter bird surveys in the vicinity of the OnSS and therefore no potential for permanent habitat loss.

~~1028.~~1170. In season one, ~~L~~lapwing (>10 individuals) was recorded from within the onshore Order Limits, specifically areas which will be subject to temporary habitat loss, from the following locations:

- Peak flock count of 11 in arable field in ECC 1. The area of temporary habitat loss comprises approximately 10% of the field area.
- Peak flock count of 29 in arable field in ECC 3 (c. 10% temporary loss).
- Peak flock count of 130 in arable field in ECC 3 (c. 40% temporary loss).
- Peak flock count of 43 in arable field in ECC 5 (c. 10% temporary loss).
- Peak flock count of 35 in arable field in ECC 6. The area of temporary habitat loss comprises an access track only along one edge of the field.
- Peak flock count of 27 in arable field in ECC 6 (c. 30% temporary loss).
- Peak flock count of 60 in arable field in ECC 6 (c. 10% loss, from the corner of the field). A flock of 2,500 was recorded just outside the 400m buffer in this locality.

- Peak flock count of 34 in arable field in ECC 6 (c. 30% temporary loss).
- Peak flock count of 121 in arable field in ECC 7(c. 20% temporary loss).
- Peak flock count of 34 in arable field in ECC 7 (c. 10% temporary loss).
- Peak flock count of 32 in arable field in ECC 7 (c. 30% temporary loss).
- Peak flock count of 55 in arable field in ECC 8 (c. 10% temporary loss, from the edge of the field).
- Peak flock count of 50 in arable field in ECC 8 (c. 30% temporary loss).
- Peak flock count of 42 in arable field in ECC 8 (c. 20% temporary loss, from the edge of the field).
- Peak flock count of 40 in arable field in ECC 9 (c. 20% temporary loss).
- Peak flock count of 232 in arable field in ECC 9 (c. 30% temporary loss).
- Peak flock count of 36 in arable field in ECC 9 (c. 50% temporary loss).
- Peak flock count of 13 in arable field in ECC 9 (c. 10% temporary loss).
- Peak flock count of 48 in arable field in ECC 10 (c. 20% temporary loss).
- Peak flock count of 16 in arable field in ECC 11 (c. 20% temporary loss).
- Peak flock count of 41 in arable field in ECC 12 (c. 30% temporary loss).
- Peak flock count of 13 in arable field in ECC 12 (c. 40% temporary loss).
- Peak flock count of 26 in arable field in ECC 13. The proposal is for an access track only, however, it will follow an existing well defined track so habitat loss will be negligible.

1171. In season two, lapwing (>10 individuals) was recorded from within the onshore Order Limits, specifically areas which will be subject to temporary habitat loss, from the following locations:

- Peak flock count of 41 in arable field in ECC 2. The area of temporary habitat loss comprises approximately 20% of the field area.
- Peak flock count of 400 in arable field in ECC 2 (c. 10% temporary loss).
- Peak flock count of 250 in arable field in ECC 2 (c. 20% temporary loss).
- Peak flock count of 150 in arable field in ECC 2 (c. 15% temporary loss)
- Peak flock count of 40 in arable field in ECC 3 (c. 20% temporary loss).
- Peak flock count of 1,500 in arable field in ECC 3 (c. 30% temporary loss).
- Peak flock count of 200 in arable field in ECC 3 (c. 10% temporary loss).
- Peak flock count of 300 in arable field in ECC 3 (c. 25% temporary loss).
- Peak flock count of 24 in arable field in ECC 4 (c. 25% temporary loss).
- Peak flock count of 126 in arable field in ECC 5 (c. 25% temporary loss).

- Peak flock count of 300 in arable field in ECC 5 (c. 40% temporary loss).
- Peak flock count of 80 in arable field in ECC 5 (c. 40% temporary loss).
- Peak flock count of 26 in arable field in ECC 5 (c. 10% temporary loss).
- Peak flock count of 23 in arable field in ECC 6 (c. 25% temporary loss).
- Peak flock count of 64 in arable field in ECC 7 (c. 15% temporary loss).
- Peak flock count of 2,000 in arable field in ECC 7 (c. 40% temporary loss).
- Peak flock count of 62 in arable field in ECC 7 (c. 40% temporary loss).
- Peak flock count of 1,200 in arable field in ECC 7 (c. 10% temporary loss).
- Peak flock count of 164 in arable field in ECC 8 (c. 25% temporary loss).
- Peak flock count of 85 in arable field in ECC 8 (c. 10% temporary loss).
- Peak flock count of 24 in arable field in ECC 8 (c. 5% temporary loss).
- Peak flock count of 40 in arable field in ECC 8 (c. 10% temporary loss).
- Peak flock count of 54 in arable field in ECC 9 (c. 10% temporary loss).
- Peak flock count of 45 in arable field in ECC 9 (c. 30% temporary loss).
- Peak flock count of 80 in arable field in ECC 9 (c. 25% temporary loss).
- Peak flock count of 100 in arable field in ECC 10 (c. 15% temporary loss).
- Peak flock count of 77 in arable field in ECC 10 (c. 10% temporary loss).
- Peak flock count of 200 in arable field in ECC 11 (c. 10% temporary loss).
- Peak flock count of 400 in arable field in ECC 11 (c. 15% temporary loss).
- Peak flock count of 68 in arable field in ECC 12 (c. 20% temporary loss).
- Peak flock count of 29 in arable field in ECC 12 (c. 20% temporary loss).
- Peak flock count of 31 in arable field in ECC 13 (c. 30% temporary loss).
- Peak flock count of 53 in arable field in ECC 13 (c. 10% temporary loss).
- Peak flock count of 11 in arable field in ECC 13 (c. 30% temporary loss).
- Peak flock count of 60 in arable field in ECC 14 (c. 10% temporary loss).
- Peak flock count of 37 in arable field in ECC 14 within the National Grid Substation Search Area (the area of temporary habitat loss will depend on the final location of the substation).
- Peak flock count of 153 in arable field in ECC 14(within the National Grid Substation Search Area (the area of temporary habitat loss will depend on the final location of the substation).

~~1029.~~1172. Lapwing is a non-breeding qualifying feature of The Wash Ramsar with a "restore" target because of the 74% population decline from 46,422 at citation to 12,142 at the recent BTO WeBS count (2017-18/21-22).

~~1030.~~1173. The GB lapwing winter population has declined by 47% between 1995/96 to 2020/21 although distribution has not changed significantly (Austin et al., 2023, from BTO BirdFacts). The GB breeding population has declined by 59% between 1967 and 2020 and undergone an 18.6% contraction in distribution (BTO BirdFacts). The ~~UK~~ GB winter population is estimated to be ~~635~~620,000 (2006-07) and the breeding population 98,000 pairs (2016) (Woodward et al., 2020 from BTO BirdFacts). In season one, ~~T~~the peak flock count of 232 from a land parcel which will be subject to habitat loss represents approximately 0.04% of the ~~UK~~ GB winter population, however, the majority of the peak flock counts were substantially lower than 232. In season two, the peak flock count of 2,000 from a land parcel which will be subject to habitat loss represents approximately 0.32% of the GB winter population, however, there were only three instances of lapwing flocks exceeding 1,000 individuals within a land parcel which will be a subject to habitat loss. The majority of the peak flock counts were substantially lower than 2,000.

1174. A review of the winter ecology of lapwings and golden plover (Gillings & Fuller, 1999) identified the following aspects of their feeding ecology and habitat preferences. Both lapwing and golden plover consume invertebrate prey at and below the soil surface, utilising grassland and arable fields. On cultivated land, the species are known to use bare till, particularly shortly after ploughing, as well as winter cereals and stubbles. Some studies have indicated a preference for grassland over arable, particularly permanent pastures with higher earthworm density, and particularly in mid to late winter perhaps as the soil may be more protected from frost (Gillings & Fuller, 1999). In arable dominated regions, they have been found to persist feeding on cropland throughout the winter. Structural aspects of fields are also important, with a general preference for larger fields, those without tall boundary features and with well-drained soils. They will, therefore, utilise a range of arable field habitats, which aligns with their recorded widespread distribution during ECC walkover surveys.

~~1031.~~1175. Gillings & Fuller (1999) state that "*The switch to grassland does not occur in all areas. In Norfolk, where grassland occurs at low density, Golden Plovers and Lapwings did not switch to grassland even during cold weather. They persisted feeding on sugar beet stubbles, short autumn cereals, and bare till throughout the winter until departing for breeding grounds in March (S. Gillings unpubl.)*".

~~1032. Gillings & Fuller (1999) state that "*The switch to grassland does not occur in all areas. In Norfolk, where grassland occurs at low density, Golden Plovers and Lapwings did not switch to grassland even during cold weather. They persisted feeding on sugar beet stubbles, short autumn cereals, and bare till throughout the winter until departing for breeding grounds in March (S. Gillings unpubl.)*".~~

~~1033.~~1176. Lapwing is widespread across the survey area and as is shown from the bullet point list all aggregations were from arable fields. It is also clear from the list that even for those fields affected, generally <40% of the field area will be temporarily lost, due to the narrow width of the ECC (potential disturbance displacement is assessed separately). The area to be temporarily lost is small relative to the non-breeding foraging range of the species.

~~1034.~~1177. Arable farming is the dominant land use in the region and arable field habitat is common in the area surrounding the ECC. BTO state that "there is good evidence that declines have resulted from habitat loss and degradation due to changes in agricultural practice, in particular change from spring to autumn sowing, drainage of grasslands and loss of mixed farmland, which have led to breeding productivity dropping below a sustainable level. Chick mortality is thought to be the main determinant of poor Lapwing productivity, and therefore of population decline" (BTO BirdFacts, 2023). One study shows that the population size has been limited by breeding success and not the availability of over-winter arable farmland habitat (Sheldon et al., 2004). Therefore, temporary loss of arable habitat to the Project would not have an appreciable impact on the lapwing non-breeding population because alternative wintering and breeding habitat is available in the wider landscape.

Integrity Test (Alone) – Unmitigated

~~1035.~~1178. Habitat loss will be temporary, short-term, impacting generally <40% of the field area where the ECC overlaps with land utilised by lapwing and loss for this species will be limited to arable land only which is common in the local area and not a limiting factor for the wintering population. Taking account of the embedded mitigation in Section 6~~6~~, habitat loss would not hinder the restoration of the population of the Ramsar and **therefore would not have an AEoI on The Wash Ramsar in relation to non-breeding lapwing.**

~~1036.~~1179. Two breeding lapwing pairs were identified, both from Anderby Marsh. The requirement for surveys for breeding lapwing from agricultural fields along the route of the ECC, with the exception of areas of permanent infrastructure, was not necessary on the basis of the temporary nature of impact and low quality of the habitat, with the survey scope agreed with Natural England. Given that Anderby Marsh will be avoided through the use of trenchless crossing, the absence of breeding records from the OnSS, and the temporary nature of the impact, **there will be no AEoI on the Wash Ramsar in relation to a potentially supporting breeding lapwing population.**

Feature 3: Golden plover

Implication for Conservation Objectives Unmitigated

~~1037.~~1180. Golden plovers were observed on three occasions with a peak count 23 individuals (13/09/22) during the Coastal OP (landfall) surveys. In season one, 79 observations were recorded across ten ECC segments and during a total of 12 walkover survey visits with a peak flock count of 250 individuals in ECC 6. In season two, 30 observations were recorded across 12 ECC segments and during a total of six visits with a peak count of **2,000 individuals in ECC 12**. The most common behaviour observed in both seasons was loafing~~79 observations were recorded across ten ECC segments and during a total of 12 walkover survey visits with a peak flock count of 250 individuals. The most common behaviour observed was loafing.~~

~~1038.~~1181. There were no records of golden plover from the ~~2022-23~~ winter bird surveys in the vicinity of the OnSS and, therefore, no potential for permanent habitat loss.

~~1039.~~1182. In season one, ~~G~~golden plover (>10 individuals) was recorded from within the onshore Order Limits, specifically areas which will be subject to temporary habitat loss, from the following locations:

~~Peak flock count of 23 in arable field in ECC 1 (c.20% temporary loss).~~

- Peak flock count of 23 in arable field in ECC 1 (c.20% temporary loss).
- Peak flock count of 31 in arable field in ECC 1 – Landfall compound (c. 70% temporary loss).
- Peak flock count of 11 in arable field in ECC 2. (c. 50% temporary loss).
- Peak flock count of 64 in arable field in ECC 3 (c.50% temporary loss).
- Peak flock count of 35 in arable field in ECC 6 (c.30% temporary loss).
- Peak flock count of 250 in arable field in ECC 6 (c. 10% temporary loss, from the corner of the field). A flock of 950 was recorded just beyond the 400m buffer in this locality.
- Peak flock count of 36 in arable field in ECC 7 (c. 20% temporary loss).
- Peak flock count of 26 in arable field in ECC 7 (c. 10% temporary loss).
- Peak flock count of 11 in arable field in ECC 9 (c. 50% temporary loss).
- Peak flock count of 73 in arable field in ECC 9 (c. 30% temporary loss).
- Peak flock count of 87 in arable field in ECC 9 (c. 60% temporary loss).
- Peak flock count of 19 in arable field in ECC 12 (c. 40% temporary loss).

1183. In season two, golden plover (>10 individuals) was recorded from within the onshore Order Limits, specifically areas which will be subject to temporary habitat loss, from the following locations:

- Peak flock count of 52 in arable field in ECC 1 (c. 10% temporary loss).
- Peak flock count of 105 in arable field in ECC 3 (c. 20% temporary loss).
- Peak flock count of 120 in arable field in ECC 5 (c. 40% temporary loss).
- Peak flock count of 17 in arable field in ECC 6 (c. 15% temporary loss).
- Peak flock count of 57 in arable field in ECC 6 (c. 35% temporary loss).
- Peak flock count of 1,000 in arable field in ECC 6 (c. 15% temporary loss).
- Peak flock count of 14 in arable field in ECC 8 (c. 40% temporary loss).
- Peak flock count of 72 in arable field in ECC 8 (c. 25% temporary loss).
- Peak flock count of 102 in arable field in ECC 9 (c. 20% temporary loss).
- Peak flock count of 150 in arable field in ECC 10 (c. 10% temporary loss).
- Peak flock count of 114 in arable field in ECC 10 (c. 10% temporary loss).
- Peak flock count of 27 in arable field in ECC 13 (c. 40% temporary loss).

~~1040.~~1184. Golden plover is a non-breeding qualifying feature of Humber Estuary SPA and Ramsar and The Wash Ramsar.

~~1041.~~1185. For non-breeding golden plover of the Humber Estuary SPA, the SACO targets relevant to habitat loss are:

- "Restore the size of the non-breeding population to a level which is above 30,709 wintering individuals, whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent"; and
- "Restore the extent, distribution and availability of suitable habitat (either within or outside the site boundary) which supports the feature for all necessary stages of the non-breeding/wintering period (moulting, roosting, loafing, feeding) [to] [an unspecified extent, based on restoring natural estuarine functioning]".

~~1042.~~1186. The following habitats support this feature:

- Intertidal sand and mudflats;
- Coastal lagoons;
- Saltmarsh; and
- Inland areas of wet grassland and agricultural land (both arable land and permanent pasture). Grassland is the most important feeding habitat, with earthworm-rich permanent pastures preferred over leys and arable.

~~1043.~~1187. The Wash Ramsar population has a restore objective and the population has declined from 22,033 at citation to 15,601 at the latest BTO WeBS count (2017/18-21/22). The Humber SPA population have a "maintain" SACO objective, however the population decreased from 30,709 at citation to 20,812 at the latest BTO WeBS count (2017/18-21/22). For this reason, the Humber Ramsar objective is assessed as "restore".

~~1044.~~1188. The GB golden plover winter population has declined by 14% between 1995/96 to 2020/21 although distribution has expanded by 18.5% (Austin et al., 2023, from BTO BirdFacts). The GB breeding population is stable but undergone a 20.9% contraction in distribution (BTO BirdFacts). The ~~UK~~ GB winter population is estimated to be ~~410~~400,000 (2006-07) and the breeding population 33,000 pairs (2016) (Woodward et al., 2020 from BTO BirdFacts). The peak flock count in season one of 250 represents approximately 0.06% of the ~~UK~~ GB winter population, however, the majority of the peak flock counts were substantially lower than 250. The peak flock count in season two of 2,000 (recorded outwith the ECC but within the 400m buffer) represents approximately 0.50% of the GB winter population, however, the majority of the peak flock counts were substantially lower than 1,000.

~~1045.~~1189. BTO states that the causes of population changes are unclear (BTO BirdFacts, 2023). The winter population is, however, increasing in Europe and undergoing an eastwards range shift, potentially due to climate change (Birdlife International, 2024), indicating that otherwise suitable habitat has been vacated in GB and, therefore, winter habitat availability would not be a factor which limits the size of the wintering population in GB.

Integrity Test (Alone) – Unmitigated

~~1046.~~1190. Habitat loss will be temporary, short-term, impacting generally 50% or less of the field area where the ECC overlaps with land utilised by golden plover and that loss for this species will be limited to arable land only which is common in the local area and not a causal factor for declines in the wintering population. Therefore, temporary and permanent habitat loss would:

- not affect the restoration of the non-breeding populations to 30,709 individuals; and
- not affect the restoration of the extent, distribution and availability of priority habitats.

~~1047.~~1191. Habitat loss would therefore not undermine the restoration of the Wash Ramsar or Humber Estuary SPA/Ramsar populations. **It is concluded that there will be no adverse effect on integrity (AEoI) of these designated sites in relation to habitat loss and golden plover (non-breeding), in the absence of mitigation, for the project alone.**

Features 4, 5 and 6: Curlew, Oystercatcher and Redshank

Implication for Conservation Objectives Unmitigated

~~1048.~~1192. No breeding curlew, oystercatcher nor redshank was confirmed during the breeding bird survey in 2023.

~~1049.~~1193. In season one, **curlew** were observed on 17 occasions with a peak count of 18 individuals during the Coastal OP (landfall) surveys. In season two, there was only a single observation of eight curlew during the Coastal OP surveys. In season one, 255 observations were recorded across all 14 ECC segments and during a total of 12 walkover survey visits with a peak flock count of 56 individuals in ECC 8. In season two, 160 observations were recorded across 13 ECC segments and during a total of 14 visits with a peak flock count of **103 individuals in ECC 12**.~~**Curlew** were observed on 17 occasions with a peak count of 18 individuals (13/02/23) during Coastal OP (landfall) surveys. The curlews were observed to be foraging (52.4%) and flying (47.6%). 255 observations were recorded across all 14 ECC segments and during a total of 12 walkover survey visits with a peak flock count of 56 individuals. The most common behaviour observed was foraging.~~

~~1050.~~1194. There were no records of curlew from ~~the 2022-23~~ winter bird surveys in the vicinity of the OnSS and, therefore, no potential for permanent habitat loss.

~~1051.~~1195. In season one, ~~C~~curlew (>10 individuals) was recorded from within the onshore Order Limits, specifically areas which will be subject to temporary habitat loss, from the following locations:

- Peak flock count of 13 in pasture field in ECC 5. Trenchless techniques are planned in this area so habitat loss would be limited to the haul road only across one corner of the field.
- Peak flock count of 11 in arable field in ECC 5 (c. 40% temporary loss).
- Peak flock count of 28 in a small arable field in ECC 7 (c. 80% temporary loss).
- Peak flock count of 25 arable field in ECC 7 (c. 20% temporary loss).
- Peak flock count of 28 in arable field in ECC 8 (c. 30% temporary loss).

- Peak flock count of 29 in arable field in ECC 10 (c. 30% temporary loss).
- Peak flock count of 17 in arable field in ECC 10 (c. 40% temporary loss).
- Peak flock count of 17 in arable field in ECC 13. The field is planned for an access track only, to follow an existing tractor access along one edge of the field.

1196. In season two, curlew (>10 individuals) was recorded from within the onshore Order Limits, specifically areas which will be subject to temporary habitat loss, from the following locations:

- Peak flock count of 74 in arable field in ECC 5 (c. 25% temporary loss).
- Peak flock count of 52 in arable field in ECC 5 (c. 40% temporary loss).
- Peak flock count of 29 in arable field in ECC 6 (c. 25% temporary loss).
- Peak flock count of 12 in arable field in ECC 10 (c. 40% temporary loss).
- Peak flock count of 20 in arable field in ECC 13 (c. 40% temporary loss).

~~1052.~~1197. Curlew is a non-breeding qualifying feature of The Wash SPA and Ramsar. The relevant SACO targets for non-breeding curlew of the Wash SPA are:

- "Maintain the size of the non-breeding population to a level which is above 3,700 individuals, whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent".
- "Maintain the extent, distribution and availability of suitable habitat (either within or outside the site boundary) which supports the feature for all necessary stages of the non-breeding/wintering period (moulting, roosting, loafing, feeding). Intertidal coarse sediment (unknown), Intertidal rock (6.5 ha), Intertidal sand and muddy sand (23069 ha), Intertidal mud (5921 ha), Intertidal mixed sediments (unknown), Coastal lagoons (19 ha), Intertidal biogenic reef: mussel beds (500 ha), Freshwater and coastal grazing marsh (0.25 ha), Saltmarsh (5704 ha), which is not feature specific but is an aggregation of the following saltmarsh features: - *Salicornia* and other annuals colonising mud and sand - Atlantic salt meadows (*Glauco-puccinellietalia maritimae*) - Mediterranean and thermo-Atlantic halophilous scrubs (*Sarcocornetea fruticosi*) - Spartina Swards".

~~1053.~~1198. The Wash SPA population has a maintain objective and the population has increased from 3,700 at citation to 5,759 at the latest BTO WeBS count (2017/18-21/22).

~~1054.~~1199. The GB curlew winter population is estimated at 125,000 and has declined by 30% between 1995/96 to 2020/21 (in UK) although distribution has expanded by 11.6% (Woodward et al. 2020 and Austin et al., 2023, from BTO BirdFacts). The GB breeding population is estimated at 59,000 pairs and has declined by 48% between 1995-2020 (in UK) and undergone a 19.2% contraction in distribution (BTO BirdFacts). The peak flock count of ~~29~~ 56 recorded in season one, represents approximately 0.~~02~~04% of the GB winter population. The peak flock count of 103 recorded in season two, represents approximately 0.08% of the GB winter population, respectively.

~~1055.~~1200. Research indicates that the main cause of the national population decline relates to habitat changes at breeding sites (BTO BirdFacts, 2023) and, therefore, availability of winter habitat is not a major limiting factor. The same sources states "a study of colour-ringed birds wintering in south-west England suggested that apparent survival was highest during winter, and hence the main threats to this wintering population appeared to be during the breeding season or on migration (Robinson et al. 2020)". Whilst the European breeding population overall has declined, there have been apparent increases in the wintering populations along the East Atlantic flyway (Birdlife International, 2024).

~~1056.~~1201. Curlew is omnivorous, eating a variety of invertebrate prey and plant material and feeds in coastal habitats, such as mudflats, as well as grassland and arable fields (eg. Brown, 2015).

~~1057.~~1202. The impact assessment is the same as described for lapwing, on the basis of their similar distribution and broad habitat preferences, and no evidence for lack of availability of winter farmland impacting on the population. On the same basis, temporary and permanent habitat loss would:

- not reduce the non-breeding populations below their current levels; and
- not affect the extent, distribution and availability of priority habitats.

~~1058.~~1203. In season one, **oystercatchers** were observed on eight occasions with a peak count of two individuals as part of Coastal OP (landfall) surveys. In season two, only single birds were observed on six visits. In season one, 22 observations were recorded across eight ECC segments and during a total of nine walkover survey visits with a peak flock count of **23 individuals in ECC 11.** In season two, 18 observations were recorded across eight ECC segments and during a total of eight visits with a peak count of four individuals. ~~**Oystercatchers** were observed on eight occasions with a peak count of two individuals as part of the Coastal OP (landfall) surveys. 22 observations were recorded across eight ECC segments and during a total of nine walkover survey visits with a peak flock count of 23 individuals. The most common behaviour observed was foraging.~~ The birds were recorded utilising farmland habitat within the winter bird survey area, with concentrations of records at The Haven (inter-tidal habitats) and the Landfall (low numbers using Anderby Marsh and inter-tidal habitats).

~~1059.~~1204. There were no records of oystercatcher from the ~~2022-23~~ winter bird surveys in the vicinity of the OnSS and, therefore, no potential for permanent habitat loss.

~~1060.~~1205. Oystercatcher is a non-breeding qualifying feature of The Wash SPA and Ramsar. The relevant SACO targets for non-breeding oystercatcher of the Wash SPA are:

- "Restore the size of the non-breeding population to a level which is above 24,000 individuals, whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent".

- “Maintain the extent, distribution and availability of suitable habitat (either within or outside the site boundary) which supports the feature for all necessary stages of the non-breeding/wintering period (moulting, roosting, loafing, feeding). Intertidal coarse sediment (unknown) Intertidal rock (6.5 ha), Intertidal sand and muddy sand (23069 ha), Intertidal mud (5921 ha), Intertidal mixed sediments (unknown), Coastal lagoons (19 ha), Intertidal stony reef (unknown), Intertidal biogenic reef: mussel beds (500 ha), Freshwater and coastal grazing marsh (0.25 ha), Saltmarsh (5704 ha), which is not feature specific but is an aggregation of the following saltmarsh features: - *Salicornia* and other annuals colonising mud and sand, - Atlantic salt meadows (*Glauco-puccinellietalia maritimae*), - Mediterranean and thermo-Atlantic halophilous scrubs -Spartina swards”.

~~1061.~~1206. The Wash SPA population has a “restore” SACO objective, however the population has declined only slightly from 24,000 at citation to 23,097 at the latest BTO WeBS count (2017/18-21/22). The Wash Ramsar population has increased 48% since 15,616 at citation and thus has a “maintain” objective.

~~1062.~~1207. The GB oystercatcher winter population is estimated at 305,000 and has declined by 21% between 1995/96 to 2020/21 (in UK) although distribution has expanded by 37.6% (Woodward et al. 2020 and Austin et al., 2023, from BTO BirdFacts). The GB breeding population is estimated at 96,000 pairs and has declined by 22% between 1995-2020 (in UK) but the distribution has expanded by 22.7% (BTO BirdFacts). The species is described as a “very common coastal passage migrant/ winter visitor and fairly common resident. Less common inland, but now breeds in small numbers.” in Lincolnshire (Lincs Bird Club). The peak flock count of ~~29~~ 23 represents approximately 0.01% of the GB winter population and likely <1% of the Lincolnshire population.

~~1063.~~1208. During construction, temporary habitat loss within the onshore Order Limits would result in the temporary loss of some agricultural foraging, loafing and roosting habitat, however there will be other similar habitat available nearby. Wetland habitats at the landfall and The Haven will be protected from loss of habitat using trenchless cable placing techniques.

~~1064.~~1209. Given the small area of temporal loss of the largely available arable habitats, the small number of oystercatchers recorded within the Order Limits plus 400m, and the favourable condition of the oystercatcher population, temporary habitat loss would:

- not prevent restoration of the non-breeding populations; and
- not affect the extent, distribution and availability of suitable habitats.

~~1065.~~1210. In season one, a total of two **redshank** were observed on one occasion (24/01/23) during the Coastal OP (landfall) surveys, both foraging. In season two, redshank were recorded foraging on four visits with a peak count of 11 individuals. In season one, 48 observations were recorded across ten ECC segments and during a total of 11 walkover survey visits with a peak flock count of 35 individuals in ECC 5. In season two, 106 observations were recorded across 11 ECC segments with a peak flock count of **41 individuals in ECC 11**. ~~A total of two **redshanks** were observed on one occasion (24/01/23) during landfall surveys, both foraging. Forty-eight observations were recorded across ten ECC segments and during a total of 11 walkover survey visits with a peak flock count of 35 individuals. The most common behaviour observed was foraging.~~ The records were clustered at the River Welland, The Haven and Anderby Marsh, utilising farmland habitat within the winter bird survey area, with concentrations of records at The Haven (inter-tidal habitats) and the Landfall (low numbers using Anderby Marsh).

~~1066.~~1211. There were no records of redshank from the ~~2022-23~~ winter bird surveys in the vicinity of the OnSS and, therefore, no potential for permanent habitat loss.

~~1067.~~1212. In season one, ~~R~~redshank was recorded from within the onshore Order Limits, specifically areas which will be subject to temporary habitat loss, from the following locations:

- Peak flock count of two in arable field in ECC 5. Less than 50% of the field will be subject to temporary habitat loss. Likely associated with the drain at the field edge, outside of the Order Limits;
- Peak flock count of four in ECC 8 in arable field (likely associated with the drain at the field edge). Approximately 50% of the field will be subject to temporary habitat loss, although only a very small section of drain will be affected, with a culvert to support the haul road crossing (the cable will cross the drain via trenchless crossing).
- Peak flock count of eight in ECC 8 (c. 20% temporary loss).
- Peak flock count of two from an arable field from ECC 9. Cable Installation Compound and haul road will occupy approximately 30% of the field.
- Peak flock count of three from an arable field from EC C9. Open trench will result in approximately 30% temporary habitat loss from that field.
- Peak flock count of 11 in ECC 13 from the bank of the river Welland and adjacent field, however, an access track only is planned for that location, to follow an existing track, so will not be subject to habitat loss.

1213. In season two, redshank was recorded from within the onshore Order Limits, specifically areas which will be subject to temporary habitat loss, from the following locations:

- Peak flock count of three in arable field in ECC 1. Less than 40% of the field will be subject to temporary habitat loss.
- Peak flock count of two from an arable field from ECC 3 (c. 15% temporary loss).
- Peak flock count of three from an arable field from ECC 3 (c. 20% temporary loss).
- Peak flock count of six from an arable field from ECC 5 (c. 40% temporary loss).
- Peak flock count of three from an arable field from ECC 8 (c. 30% temporary loss).

- Peak flock count of 39 in ECC 13 from the bank of the river Welland adjacent to a field, of which c. 30% be subject to habitat loss.

~~1068.~~1214. Redshank is a non-breeding qualifying feature of The Wash SPA and Ramsar, and Humber Estuary SPA and Ramsar and a passage feature of the Humber Estuary Ramsar. For non-breeding redshank of the Wash SPA and Humber SPA, the SACO targets relevant to habitat loss are presented in Table 9.110~~Table 9.75~~.

Table 9-111~~9.1109-9.75~~: Abundance and habitat SACO targets for redshank of the Wash SPA and Humber Estuary SPA

SPA	Non-breeding population: abundance	Supporting habitat: extent, distribution and availability of supporting habitat for the non-breeding season
The Wash	Maintain the size of the population at a level which is above 4,331 individuals, whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent.	Maintain the extent, distribution and availability of suitable habitat (either within or outside the site boundary) which supports the feature for all necessary stages of the non-breeding/wintering period (moulting, roosting, loafing, feeding). Intertidal coarse sediment (unknown), Intertidal rock (6.5 ha), Intertidal sand and muddy sand (23069 ha), Intertidal mud (5921 ha), Intertidal mixed sediments (unknown), Coastal lagoons (19 ha), Intertidal biogenic reef: mussel beds (500 ha), Freshwater and coastal grazing marsh (0.25 ha), Saltmarsh (5704 ha), which is not feature specific but is an aggregation of the following saltmarsh features: - *Salicornia* and other annuals colonising mud and sand - Atlantic salt meadows (*Glauco-puccinellietalia maritimae*) - Mediterranean and thermo-Atlantic halophilous scrubs (*Sarcocornetea fruticosi*) - Spartina Swards
Humber Estuary	Restore the size of the non-breeding population to a level which is at or above 4,632 wintering individuals and 7,462 individuals during passage, whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent.	Restore the extent, distribution and availability of suitable habitat (either within or outside the site boundary) which supports the feature for all necessary stages of the non-breeding/wintering period (moulting, roosting, loafing, feeding) to an unspecified extent, based on restoring natural estuarine functioning. The following habitats support this feature: Intertidal sand and mudflats, Coastal lagoons, Saltmarsh, Inland areas of wet grassland and agricultural land (both arable land and permanent pasture), Supralittoral sand and shingle, Artificial structures such as derelict pier/jetty structures, flood defences.

~~1069.~~1215. The Wash SPA population is in favourable condition with "maintain" SACO objective (23% increase since 4,331 at citation), while the Humber Estuary SPA population has a "restore" SACO target due to a 43% decline from 4,632 at citation compared to the latest BTO WeBS count (2017-19/ 21-22). Both The Wash and Humber Estuary (winter) Ramsar sites have "restore" objectives because of 16% and 43% population declines respectively.

~~1070.~~1216. The GB redshank winter population is estimated at 100,000 and has declined by 20% between 1995/96 to 2020/21 (in UK) although distribution has expanded by 2.9% (Woodward et al. 2020 and Austin et al., 2023, from BTO BirdFacts). The GB breeding population is estimated at 22,000 pairs and has declined by 49% between 1995-2020 (in UK) and undergone a 43.1% contraction in distribution (BTO BirdFacts). The peak flock count of ~~11~~ 41 recorded in the Order Limits represents approximately 0.~~01~~04% of the GB winter population.

~~1071.~~1217. BTO state (assumed in relation to the breeding population) that "There is good evidence to suggest that Redshank decline is related to changes in habitat management, in particular drainage and agricultural intensification. Where birds still nest in wet meadows, a suggested solution includes manipulating water levels, reducing grazing and suspending agricultural operations during the nesting period" (BTO BirdFacts, 2023). The same source states "Wintering populations (augmented by many Icelandic and some other northern European breeders) have shown some increase since the 1970s but have been in decline since about 2001, although the most recent counts suggest this decline may now have slowed and wintering numbers since 2011/12 have remained relatively stable (WeBS: Frost et al. 2020)". The species population in Europe has undergone a moderate decline between 1980 and 2013 (Birdlife International, 2024).

~~1072.~~1218. Of the areas to be subject to temporary habitat loss, only a small number of locations (arable fields and field drains) were recorded in use by low numbers of redshank, and it is, therefore, concluded that temporary habitat loss would:

- not affect the restoration or maintenance (as relevant) of the non-breeding populations;
- not affect the extent, distribution and availability of suitable habitats.

Integrity test (alone) – Unmitigated

~~1073.~~1219. Given the availability of alternative farmland foraging habitat, the small scale and temporary nature of habitat loss relative to the foraging range and the small number of recorded individuals, it is expected that the conservation objectives of the relevant European sites would not be undermined as a result of habitat loss impacting non-breeding curlew, oystercatcher and redshank from the project alone.

~~1074.~~1220. It is concluded that **there will be no adverse effect on integrity (AEoI) of these designated sites in relation to habitat loss and non-breeding curlew, oystercatcher and redshank, in the absence of mitigation, for the project alone.**

Features 7 and 8: Dunlin and Sanderling

Implication for Conservation Objectives Unmitigated

~~1075.~~1221. In season one, **dunlin** were observed on three occasions with a peak count of 12 individuals (05/12/22), as part of the Coastal OP (landfall) surveys. In season two, 24 roosting dunlin were observed on 26/03/2024. In season one, five observations were recorded during a total of four walkover visits mostly in ECC 1 and ECC 11 with a peak flock count of **46 individuals in ECC 11**. In season two, nine observations were recorded during a total of eight visits in four ECC segments with a peak flock count of nine individuals.~~Dunlin were observed on three occasions with a peak count of 12 individuals (05/12/22), as part of the Coastal OP (landfall) surveys. Five observations were recorded during a total of four walkover visits mostly in ECC 1 with a peak flock count of 46 individuals. These birds were observed to be mostly foraging~~.

~~1076.~~1222. In season one, **sanderling** were observed during Coastal OP (landfall) surveys on 14 occasions across nine visits with a peak count of 13 individuals (05/12/22). In season two, were observed on 13 visits with a peak count of **57 individuals** (on 09/11/23). In both seasons, the sanderlings were observed to be mostly foraging. No sanderling were recorded during walkover survey in season one; in season two, a single flock of 19 individuals was recorded foraging in ECC 1.~~Sanderling were observed only during Coastal OP (landfall) surveys on 14 occasions across nine visits with a peak count of 13 individuals (05/12/22). The sanderlings were observed to be mostly foraging.~~

~~1077.~~1223. There were no records of dunlin or sanderling from the ~~2022-23~~ winter bird surveys in the vicinity of the OnSS and, therefore, no potential for permanent habitat loss.

~~1078.~~1224. Dunlin is a non-breeding qualifying feature of The Wash SPA and Ramsar, and Humber Estuary SPA and Ramsar and a passage feature of the Humber Estuary Ramsar. Sanderling is a non-breeding qualifying feature of The Wash SPA and Ramsar, and Gibraltar Point SPA and Ramsar. For non-breeding dunlin and sanderling of the Wash, Humber Estuary and Gibraltar Point SPAs, the SACO targets relevant to habitat loss are presented in Table 9.111~~Table 9.76~~.

Table 9-112~~9.1119-9.76~~: Abundance and habitat SACO targets for non-breeding dunlin and sanderling of the Wash, Humber Estuary and Gibraltar Point SPAs

Site	Non-breeding population: abundance	Supporting habitat: extent, distribution and availability of supporting habitat for the non-breeding season
Dunlin		
The Wash SPA	Restore the size of the non-breeding population at a level which is above 29,000 individuals, whilst avoiding deterioration from	Maintain the extent, distribution and availability of suitable habitat (either within or outside the site boundary) which supports the feature for all necessary stages of the non-breeding/wintering period (moulting, roosting, loafing, feeding). Intertidal coarse sediment (unknown), Intertidal rock (6.5 ha), Intertidal sand and muddy sand (23069 ha), Intertidal mud (5921 ha), Intertidal mixed sediment (unknown), Coastal lagoons (19 ha), Intertidal biogenic reef:

Site	Non-breeding population: abundance	Supporting habitat: extent, distribution and availability of supporting habitat for the non-breeding season
	its current level as indicated by the latest mean peak count or equivalent.	mussel beds (500 ha), Freshwater and coastal grazing marsh (0.25 ha), Saltmarsh (5704 ha), which is not feature specific but is an aggregation of the following saltmarsh features: - *Salicornia* and other annuals colonising mud and sand - Atlantic salt meadows (*Glauco-puccinellietalia maritimae*) - Mediterranean and thermo-Atlantic halophilous scrubs (*Sarcocornetea fruticosi*) - Spartina Swards
Humber Estuary SPA	Restore the size of the non-breeding population to a level which is above 22,222 wintering individuals and 20,269 individuals during passage, whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent.	Restore the extent, distribution and availability of suitable habitat (either within or outside the site boundary) which supports the feature for all necessary stages of the non-breeding/wintering period (moulting, roosting, loafing, feeding) to an unspecified extent, based on restoring natural estuarine functioning. The following habitats support this feature: Intertidal sand and mudflats, Coastal lagoons, Saltmarsh, Inland areas of wet grassland and agricultural land (both arable land and permanent pasture), *Salicornia* and other annuals colonising mud and sand.
Sanderling		
The Wash SPA	Maintain the size of the population at a level which is above 500 individuals, whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent.	Maintain the extent, distribution and availability of suitable habitat (either within or outside the site boundary) which supports the feature for all necessary stages of the non-breeding/wintering period (moulting, roosting, loafing, feeding). Intertidal coarse sediment(unknown) , Intertidal rock (6.5 ha), Intertidal sand and muddy sand (23069 ha), Intertidal mud (5921 ha), Intertidal mixed sediments (unknown), Coastal lagoons (19 ha), Saltmarsh (5704 ha), which is not feature specific but is an aggregation of the following saltmarsh features: *Salicornia* and other annuals colonising mud and sand, - Atlantic salt meadows (*Glauco-puccinellietalia maritimae*) - Mediterranean and thermo-Atlantic halophilous scrubs (*Sarcocornetea fruticosi*) - Spartina Swards
Gibraltar Point SPA	Maintain the size of the non-breeding population at a level which is	Maintain the extent, distribution and availability of suitable habitat (either within or outside the site boundary) which supports the feature for all necessary stages of the non-breeding/wintering period (moulting, roosting, loafing, feeding). Coastal lagoons (1.7 ha), Intertidal coarse sediment

Site	Non-breeding population: abundance	Supporting habitat: extent, distribution and availability of supporting habitat for the non-breeding season
	above 1,140, whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent.	(unknown), Intertidal mixed sediment (unknown), Intertidal mud (6 ha), Intertidal sand and muddy sand (68 ha), Saltmarsh (138 ha), which is not feature specific but is an aggregation of the following saltmarsh features: *Salicornia* and other annuals colonising mud and sand, Atlantic salt meadows and Mediterranean & thermo-Atlantic haphilous scrubs.

~~1079.~~1225. Dunlin populations for both the Wash and Humber Estuary SPAs and Ramsar are in unfavourable condition with "restore" SACO targets, although the latest BTO WeBS count (2017-18/21-22) for The Wash SPA was only 52 individuals short of the citation target of 29,000. The Humber Estuary SPA population declined by 21% from the citation target of 22,222. Both The Wash and Humber Estuary Ramsar populations of dunlin declined 21% of the citation target of 36,600 and 22,000, respectively.

~~1080.~~1226. Sanderling population of the Wash SPA and Ramsar are in favourable condition (maintain objectives) with 1,988% and 198% increases compared to citation targets of 500 and 3,505, respectively. The Gibraltar Point SPA and Ramsar populations are in unfavourable condition with a medium-term decline of 26% albeit set in the long-term positive trend.

~~1081.~~1227. The ~~UK~~ GB winter population of dunlin is estimated at ~~350~~345,000 and it decreased 45% between 1995/96 to 2020/21, while the winter population of sanderling is estimated at ~~21~~20,000 and increased by 27% in the same period (Austin et al. 2023, BTO BirdFacts).

~~1082.~~1228. At the Landfall, and at The Haven, the cable will be installed using trenchless techniques and therefore there would be no habitat loss at Anderby Marsh or of intertidal areas, where dunlin and sanderling were recorded. Elsewhere within the onshore Order Limits, habitats are unsuitable for dunlin and sanderling.

Integrity test (alone) – Unmitigated

~~1083.~~1229. Given the lack of priority habitat loss, small number of individuals recorded and low suitability of the remaining habitats within the ZoI of the Project, it is concluded that temporary habitat loss would:

- not affect the restoration or maintenance (as relevant) of the non-breeding populations;
- not affect the extent, distribution and availability of suitable habitats.

~~1084.~~1230. It is concluded that **there will be no AEoI of these designated sites in relation to habitat loss and non-breeding dunlin and sanderling in the absence of additional mitigation, for the project alone.**

Features 9 to 16

~~1085.~~1231. As set out in Section~~s~~ 9.5.2~~9.5.2~~, connectivity to SPA and Ramsar site populations has been discounted for Features 9 to 16 in respect of habitat loss and are therefore not discussed here. It is concluded that **there will be no AEoI of these designated sites in relation to habitat loss and non-breeding Features 9 to 16 in the absence of mitigation, for the project alone.**

Feature 17: Dark-bellied brent goose

Implication for Conservation Objectives Unmitigated

~~1086.~~1232. In season one, dark-bellied brent geese were observed on two occasions with a peak count of seven individuals (24/10/22) during the Coastal OP (landfall) surveys. All records were of flying brent geese. There were no observations of this species made in season two during the Coastal OP surveys. During walkover surveys in season one, 13 observations were recorded across eight walkover survey visits all in ECC 10 and 11 with a peak flock count of **1,100 individuals**. In season two, 24 observations were recorded across 12 visits predominantly in ECC 10 and 11 with a peak flock count of 650 individuals.~~Dark-bellied brent geese were observed on two occasions with a peak count of seven individuals (24/10/22) during the Coastal OP (landfall) surveys. All records were of flying brent geese. 13 observations were recorded across eight walkover survey visits in ECC 10 and 11 with a peak flock count of 1,100 individuals~~. The most common behaviour observed was foraging.

~~1087.~~1233. There were no records of dark-bellied brent goose from the ~~2022-23~~ winter bird surveys in the vicinity of the OnSS and, therefore, no potential for permanent habitat loss.

1234. In season one, ~~T~~the only observations of this species from within the onshore Order Limits were from The Haven and nearby fields. The peak flock count for the survey area of 1,100 was from a field close to The Haven but outwith the onshore Order Limits.

~~1088. The Haven itself will be avoided through the use of trenchless techniques and, therefore, there will be no loss of riparian, saltmarsh or other intertidal habitats. The peak flock count from those riparian habitats was 650 birds.~~

1235. Flocks were recorded using the two arable fields immediately adjacent to the east and west sides of the river crossing, with a peak of 109 and 67 birds respectively. These were the only two locations which will be subject to temporary habitat loss which were recorded as utilised by this species within the onshore Order Limits. Records of this species from within the winter walkover survey area were clustered at The Haven and adjacent fields, likely because this is the closest point of the ECC to the SPA boundary.

1236. In season two, only two records were made within in ECC 11 (peak count of 180 and peak count of 250) within the trenchless technic section crossing ~~t~~The Haven.

1237. The Haven itself will be avoided through the use of trenchless techniques and, therefore, there will be no loss of riparian, saltmarsh or other intertidal habitats. The peak flock count from those riparian habitats was 650 birds in both winter seasons.

1238. In season two, dark-bellied brent goose was recorded most frequently on land classed as not farmland (13 registrations, a total of 1,580 birds); however, most birds were recorded on cereal crops (nine registrations, a total of 1,839 birds) (PD1-093).

~~1089.~~

~~1090.~~1239. Dark-bellied brent goose is a non-breeding qualifying feature of The Wash SPA and Ramsar and Gibraltar Point Ramsar.

~~1091.~~1240. For non-breeding dark-bellied brent goose of the Wash SPA, the SACO targets relevant to habitat loss are:

- "Restore the size of the non-breeding population at a level which is above 17,000 individuals, whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent".
- "Maintain the extent, distribution and availability of suitable habitat (either within or outside the site boundary) which supports the feature for all necessary stages of the non-breeding/wintering period (moulting, roosting, loafing, feeding). Intertidal coarse sediment (unknown), Intertidal mixed sediment (unknown), Intertidal sand and muddy sand (23069 ha), Intertidal mud (5921 ha), Freshwater and coastal grazing marsh (0.25 ha), Water column, Saltmarsh (5704 ha), which is not feature specific but is an aggregation of the following saltmarsh features: - *Salicornia* and other annuals colonising mud and sand - Atlantic salt meadows (*Glauco-puccinellietalia maritimae*) - Mediterranean and thermo-Atlantic halophilous scrubs (*Sarcocornetea fruticosi*) - Spartina Swards".

~~1092.~~1241. The recent BTO WeBS count data (2017/18-21/22) suggest that the Wash SPA population declined 39% and the Wash Ramsar declined 50% in relation to the citation targets of 17,000 and 20,861 respectively. Gibraltar Point Ramsar population experienced a 19% long-term decline (Woodward et al., 2019)

~~1093.~~1242. The GB dark-bellied brent goose winter population is estimated at 135,000 and has declined by 4% between 1995/96 to 2020/21 (in UK) although distribution has expanded by 69.3% (Woodward et al. 2020 and Austin et al., 2023, from BTO BirdFacts). The peak flock count of 109 from a land parcel which will be subject to temporal habitat loss (the peak count from the wider survey area was 1,100) represents approximately 0.08% of the GB winter population.

~~1094.~~1243. During the construction phase, there will be loss of farmland within an 80m wide route corridor, which will result in the loss of some foraging habitat for dark-bellied brent goose, however there will be other alternative habitat available nearby. Potential displacement of brent geese from land adjacent to the corridor is discussed in the 'Pathway 2 – Disturbance' section.

1244. Contrary to the rest of the assessed species, dark-bellied brent geese records concentrate around a specific area around the River Haven crossing. This area consists of predominately arable fields with grasslands and riparian habitat associated with The Haven, within the Order Limits plus 400m. Wheat and grass are the first and the third most common crop types within the Order Limits plus 400m with an estimated coverage of 2,915 ha and 700 ha respectively. These crops are evenly distributed along the Order Limits plus 400m. These crops were also most common within sample crop polygons with an average coverage of 14,141 ha and 12,251 ha respectively for 2019, 2020, and 2021 (PD1-093).

~~1095.~~1245. The cable installation compounds will be set back from the river edge by approximately 100m, and the width of the ECC corridor is such that only part of each field will be occupied. The area of temporary habitat loss for this species is, therefore, very small (0.05km^2 from arable recorded as utilised by this species from within 1km of The Wash).

Integrity Test (Alone) – Unmitigated

~~1096.~~1246. Given the small area of temporary habitat loss within the utilised land parcels and availability of alternative foraging habitats, it is concluded that temporary habitat loss would:

- not affect the restoration of the non-breeding populations; and
- not affect the extent, distribution and availability of suitable habitats.

~~1097.~~1247. The impact of habitat loss alone (including embedded mitigation) would not undermine any of the conservation objectives and restoration efforts and **therefore would not have AEoI of the Wash SPA and Ramsar or Gibraltar Point Ramsar in relation to non-breeding dark-bellied brent goose.**

Feature 18: Pink-footed goose

Implication for Conservation Objectives Unmitigated

~~1098.~~1248. In season one, pink-footed geese were observed on two occasions with a peak count of two individuals during the Coastal OP (landfall) surveys. All records were of flying pink-footed geese. In season two, there were no observations during the Coastal OP surveys. During walkover surveys in season one, 27 observations were recorded across nine ECC segments and during a total of 12 walkover survey visits with a peak flock count of 217 individuals in ECC 4. In season two, 23 observations were recorded across nine ECC segments and during a total of seven visits with a peak flock count of **5,000 individuals in ECC 10**. Some large (more than 1,000 individuals) flocks were also recorded in ECC 5 and ECC 7~~Pink-footed geese were observed on two occasions with a peak count of two individuals (24/10/22) during Coastal OP (landfall) surveys. All records were of flying pink-footed geese. 27 observations were recorded across nine ECC segments and during a total of 12 walkover survey visits with a peak flock count of 217 individuals~~.

~~1099.~~1249. There were no records of pink-footed goose from the ~~2022-23~~ winter bird surveys in the vicinity of the OnSS and, therefore, no potential for permanent habitat loss.

~~1100.~~1250. In season one, ~~P~~pink-footed goose was recorded from within the Order Limits, specifically areas which will be subject to temporary habitat loss, from the following locations:

- Peak flock count of 21 in arable field in ECC 3. The area of temporary habitat loss comprises approximately 20% of the field area.
- Peak flock count of 34 in arable field in ECC 4. The area of temporary habitat loss comprises approximately 20% of the field area.
- Peak flock count of 4 from ECC 5. The area of temporary habitat loss comprises approximately 10% of the field area.
- Peak flock count of 6 from ECC 7. The area of temporary habitat loss comprises approximately 40% of the field area.
- Peak flock count of 12 from ECC 7. The area of temporary habitat loss comprises approximately 30% of the field area.
- Peak flock count of 43 from ECC 9. The area of temporary habitat loss comprises approximately 20% of the field area.
- Peak flock count of 67 from ECC 11. The area of temporary habitat loss comprises approximately 30% of the field area.

1251. In season two, pink-footed goose was recorded from within the Order Limits, specifically areas which will be subject to temporary habitat loss, from the following locations:

- Peak flock count of 12 in arable field in ECC 1. The area of temporary habitat loss comprises approximately 20% of the field area.
- Peak flock count of 450 in arable field in ECC 2. The area of temporary habitat loss comprises approximately 5% of the field area.
- Peak flock count of 23 in arable field from ECC 4. The area of temporary habitat loss comprises approximately 5% of the field area.
- Peak flock count of 93 from ECC 5. The area of temporary habitat loss comprises approximately 25% of the field area.
- Peak flock count of 1,100 from ECC 7. The area of temporary habitat loss comprises approximately 10% of the field area.
- Peak flock count of 6 from ECC 7. The area of temporary habitat loss comprises approximately 20% of the field area.
- Peak flock count of 900 from ECC 8. The area of temporary habitat loss comprises approximately 15% of the field area.
- Peak flock count of 800 from ECC 8. The area of temporary habitat loss comprises approximately 25% of the field area.
- Peak flock count of 5,000 from ECC 10. The area of temporary habitat loss comprises approximately 40% of the field area.

1252. Majority of pink-footed geese were recorded on bare earth/ ploughed fields (five registrations of a total of 8,122 bird records), followed by stubbles (eight registrations, a total of 2,269), grass (four registrations, a total of 2,157) and cereal crops (five registrations, a total of 1,743) (PD1-093).

~~1101.~~1253. For non-breeding pink-footed goose of the Wash SPA, the SACO targets relevant to habitat loss are:

- "Maintain the size of the non-breeding population at a level which is above 7,300 individuals, whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent".
- "Maintain the extent, distribution and availability of suitable habitat (either within or outside the site boundary) which supports the feature for all necessary stages of the non-breeding/wintering period. Intertidal sand and muddy sand (23069 ha), Intertidal mud (5921 ha), Intertidal mixed sediments (unknown), Freshwater and coastal grazing marsh (0.25 ha), Water column, Saltmarsh (5704 ha), which is not feature specific but is an aggregation of the following saltmarsh features: - *Salicornia* and other annuals colonising mud and sand, - Atlantic salt meadows (*Glauco-puccinellietalia maritimae*), - Mediterranean and thermo-Atlantic halophilous scrubs".

~~1102.~~1254. For non-breeding pink-footed goose of North Norfolk SPA, the SACO targets relevant to habitat loss are:

- "Maintain the size of the non-breeding population at a level which is above 6,000 individuals, whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent".
- "Maintain the extent, distribution and availability of suitable habitat (either within or outside the site boundary) which supports the feature for all necessary stages of the non-breeding/wintering period (moulting, roosting, loafing, feeding) at levels described in site specific supporting notes. Area of the supporting habitat is currently understood to be: Freshwater and coastal grazing marsh (839 ha), Intertidal mixed sediments (unknown), Intertidal mud (236 ha), Intertidal sand and muddy sand (2486 ha), Water column (unknown), Saltmarsh (2959 ha), which is not feature specific but is an aggregation of the following saltmarsh features: *Salicornia* and other annuals colonising mud and sand, Atlantic salt meadows (*Glauco-puccinellietalia maritimae*), Mediterranean and thermo-Atlantic halophilous scrubs".

~~1103.~~1255. For non-breeding pink-footed goose of the Wash Ramsar and North Norfolk Ramsar sites the conservation objective is understood to "maintain" the populations.

~~1104.~~1256. Both The Wash and North Norfolk SPAs and Ramsar site populations are in favourable conditions with large recent increases compared to the citation targets (BTO WeBS count data).

~~1105.~~1257. The GB pink-footed goose winter population is estimated at 510,000 and has increased by 104% between 1995/96 to 2020/21 (in UK) and distribution has expanded by 94.6% (Woodward et al. 2020 and Austin et al., 2023, from BTO BirdFacts). The peak flock count from a land parcel which will be subject to habitat loss of ~~67~~ 5,000 represents approximately ~~0.01~~1% of the GB winter population, Between zero and three flock records were recorded per visit, which demonstrates that the species is typically utilising very few fields across the survey area at any one time, in the context of the very long length of the route corridor (~70km). Field types utilised were predominantly bare earth, cereal and stubble, which are common field types within the survey area during the winter season. Pink-footed geese were widely distributed across the survey area, with most of the locations having been recorded in use on a single occasion, indicating that flocks utilise specific fields for short periods only. Between zero and three flock records were recorded per visit, which demonstrates that the species is typically utilising very few fields across the survey area at any one time.

Integrity Test (Alone) – Unmitigated

1258. In total, pink-footed geese were recorded from seven of the fields within the onshore Order Limits which will be subject to temporary habitat loss in season one and nine fields in season two. These were all arable fields. Pink-footed geese feed on a range of agricultural crops and grassland, and will commute large distances to foraging grounds, typically up to 20km.

~~1106.~~1259. Sample crop survey within the Order Limits plus 400m shows that fallow land, which includes bare ground/ ploughed and stubble fields is the second most common land use type (after wheat) covering an estimated 926 ha. Wheat and grass are the first and the third most common crop types within the Order Limits plus 400m with an estimated coverage of 2,915 ha and 700 ha respectively. All these crops were evenly distributed along Order Limits plus 400m (Annex 2: Figure 1.1-1.26: Sample Distribution of Crop Types within the Order Limits plus 400m Buffer – Spring 2023). Wheat and grass were also most common within sample crop polygons with an average coverage of 14,141 ha and 12,251 ha respectively for 2019, 2020 and 2021. On average, fallow and non-vegetated or sparsely vegetated land represented a total of 8,149 ha (PD1-093).

~~1107.~~1260. Given the increasing population, the availability of alternative foraging habitat, the small scale of habitat loss relative to the foraging range and the temporary nature of the loss, the permanent/ temporary habitat loss would:

- not reduce the non-breeding populations below their current levels; and
- not affect the extent, distribution and availability of suitable SACO habitats.

~~1108.~~1261. The impact of habitat loss alone (including embedded mitigation) would not undermine any of the conservation objectives and **therefore there would be no AEoI of the Wash SPA and Ramsar and North Norfolk Coast SPA and Ramsar in relation to non-breeding pink-footed goose.**

Feature 19: Gadwall

Implication for Conservation Objectives Unmitigated

~~1109.~~1262. In season one, there were 13 observations of gadwall were recorded across three ECC segments and during a total of six walkover survey visits with a peak flock count of 87 individuals in ECC 1. The most common behaviour observed was swimming. In season two, 47 observations were recorded across seven ECC segments and during a total of 14 visits with a peak flock count of **165 individuals in ECC 1**.~~There were 13 observations of gadwall recorded across three ECC segments and during a total of six walkover survey visits with a peak flock count of 87 individuals.~~

~~1110.~~1263. There ~~were~~ was only one~~no~~ record~~s~~ of gadwall from the season two ~~2022-23~~ winter bird surveys from a farm track ~~(and no suitable habitat)~~ in the vicinity of the OnSS (of three individuals), however due to this record being in unsuitable habitat, there is~~and, therefore,~~ no potential for permanent habitat loss.

~~1111.~~1264. Gadwall is a non-breeding qualifying feature of The Wash SPA.

~~1112.~~1265. For non-breeding gadwall of the Wash SPA, the SACO targets relevant to habitat loss are:

- "Maintain the size of the non-breeding population at a level which is above 130 individuals, whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent".
- "Maintain the extent, distribution and availability of suitable habitat (either within or outside the site boundary) which supports the feature for all necessary stages of the non-breeding/wintering period (moulting, roosting, loafing, feeding). Coastal lagoons (19 ha), Coastal Reedbeds (unknown), Freshwater and coastal grazing marsh (0.25 ha), Water Column".

~~1113.~~1266. The non-breeding gadwall population of The Wash SPA is in a favourable condition with a "maintain" SACO target, based on the recent 20% increase from 130 at citation (BTO WeBS count 2017/18-21/22).

~~1114.~~1267. The GB gadwall winter population is estimated at 31,000 and has increased by 73% between 1995/96 to 2020/21 with a 90.3% expansion of distribution (Woodward et al. 2020 and Austin et al., 2023, from BTO BirdFacts).

Integrity Test (Alone) – Unmitigated

~~1115.~~1268. The peak flock count of ~~87~~ 165 was recorded at Anderby Marsh and that location will be avoided through the use of trenchless techniques. Otherwise, records of this species from within the onshore Order Limits were limited to a peak flock count of ~~two~~ seven on the Steeping River, and that location will also be avoided through trenchless techniques.

~~1116.~~1269. Given that none of the areas to be subject to temporary habitat loss were recorded in use by gadwall the permanent/ temporary habitat loss would:

- not reduce the non-breeding populations below their current levels; and
- not affect the extent, distribution and availability of suitable habitats.

~~1117.~~1270. It is **therefore concluded that there would be no AEoI of the Wash SPA in relation to non-breeding gadwall in the absence of mitigation, for the project alone.**

Feature 20: Wigeon

Implication for Conservation Objectives Unmitigated

~~1118.~~1271. There were no observations of wigeon during Coastal OP (landfall) surveys in season one. In season two, wigeon were observed on two visits with a peak count of 14 individuals. During walkover surveys in season one, 23 observations were recorded across five ECC segments and during a total of 11 walkover survey visits with a peak flock count of **460 individuals in ECC 1**~~Twenty-three observations were recorded across five ECC segments and during a total of 11 walkover survey visits with a peak flock count of **460 individuals**. Apart from ECC 1, the segments where large flocks of wigeon were recorded were ECC 4, 5 and 11~~. The most common behaviour observed was foraging.

~~1119.~~1272. There were no records of wigeon (and no suitable habitats) in the vicinity of the OnSS and, therefore, there is no potential for permanent habitat loss.

~~1120.~~1273. Wigeon is a non-breeding qualifying feature of The Wash SPA.

~~1121.~~1274. For non-breeding wigeon of the Wash SPA, the SACO targets relevant to habitat loss are:

- "Maintain the size of the population at a level which is above 3,900 individuals, whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent".
- "Maintain the extent, distribution and availability of suitable habitat (either within or outside the site boundary) which supports the feature for all necessary stages of the non-breeding/wintering period (moulting, roosting, loafing, feeding). Coastal lagoons (19 ha), Freshwater and coastal grazing marsh (0.25 ha) Intertidal coarse sediment (unknown), Intertidal mixed sediment (unknown), Intertidal mud (5921 ha), Intertidal rock (6.5 ha) Intertidal sand and muddy sand (23069 ha), Water column (unknown), Saltmarsh (5704 ha), which is not feature specific but is an aggregation of the following saltmarsh features: - *Salicornia* and other annuals colonising mud and sand, - Atlantic salt meadows (*Glauco-puccinellietalia maritimae*), - Mediterranean and thermo-Atlantic halophilous scrubs, - Spartina Swards".

~~1122.~~1275. The winter population of The Wash SPA wigeon is in a favourable condition with a "maintain" SACO target based on a 271% increase from the citation target of 3,900 to 10,552 at the recent BTO WeBS count for 2017/18-21/22.

~~1123.~~1276. The GB wigeon winter population is estimated at 450,000 and has declined by 11% between 1995/96 to 2020/21 although distribution has expanded by 25.4% (Woodward et al. 2020 and Austin et al., 2023, from BTO BirdFacts).

Integrity Test (Alone) – Unmitigated

~~1124.~~1277. The peak flock count of 460 was recorded at Anderby Marsh and that location will be avoided through the use of trenchless techniques. Otherwise, records of flocks exceeding hundred individuals of this species from within the onshore Order Limits were limited to a peak flock count of 117 (~~a single observation during the survey period, in February~~in season one) in an arable field in segment ECC 5 ~~(there were a small number of additional records from fields overlapping with the 400m buffer zone)~~and a peak flock count of 110 (in season two) from a pond 300m west of the ECC in segment ECC 4. The species is common in coastal areas in the county, so will utilise numerous arable fields in the wider area. Wigeon is a dabbling duck species, feeding on plant material at wetlands as well as feeding inland on grassland and arable land. The cable will be open trenched through that field, however, less than 50% of the field will be subject to habitat loss.

~~1125.~~1278. Given that only a single arable field of the areas to be subject to temporary habitat loss was recorded in use by wigeon, the permanent/ temporary habitat loss would:

- not reduce the non-breeding populations below their current levels; and
- not affect the extent, distribution and availability of suitable SACO habitats.

~~1126.~~1279. It is **therefore concluded that there would be no AEoI of the Wash SPA in relation to non-breeding wigeon in the absence of mitigation, for the project alone.**

Features 21, 22 and 23

~~1127.~~1280. As set out in Section 9.5.2~~9.5.2~~, connectivity to SPA and Ramsar site populations has been discounted for Features 21, 22 and 23 in respect of habitat loss and are therefore not discussed here. It is concluded that **there will be no AEoI of these designated sites in relation to habitat loss and non-breeding Features 21 to 23 in the absence of mitigation, for the project alone.**

Feature 24: Common Scoter

Implication for Conservation Objectives Unmitigated

~~1128.~~1281. In season one, common scoters were observed on seven occasions during a total of six visits with a peak count of 40 individuals (10/01/23) as part of the Coastal OP (landfall) survey. They were observed to be swimming and foraging. In season two, one common scoter was observed on 11/04/24 as part of the Coastal OP (landfall) survey. ~~There were 12 observations of common scoter from the Landfall surveys and ten from the ECC surveys, during the winter 2022/23 bird surveys, with a peak count of 40 individuals. All records were offshore of the Landfall area, with five flocks feeding, four swimming and one loafing.~~ All records were >350m offshore from MHWS, ranging to 590m offshore.

~~1129.~~1282. Common scoter is a non-breeding qualifying feature of The Wash SPA and Greater Wash SPA.

~~1130.~~1283. For non-breeding common scoter of the Wash SPA, the SACO targets relevant to habitat loss are:

- "Maintain the size of the population at a level which is above 830 individuals, whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent".
- "Maintain the extent, distribution and availability of suitable habitat (either within or outside the site boundary) which supports the feature for all necessary stages of the non-breeding/wintering period (moulting, roosting, loafing, and feeding). Intertidal rock (6.5 ha), Intertidal coarse sediment (unknown), Intertidal sand and muddy sand (23069 ha), Intertidal mud (5921 ha), Intertidal mixed sediments (unknown), Circalittoral rock (126 ha), Subtidal coarse sediment (unknown), Subtidal sand (unknown), Subtidal mud (unknown), Subtidal mixed sediments (unknown), Subtidal biogenic reefs: Sabellaria spp. (unknown), Intertidal stony reef (unknown), Subtidal stony reef (unknown), Intertidal biogenic reefs: mussel beds (500 ha), Subtidal biogenic reefs: mussel beds (unknown), Water column (unknown)".

~~1131.~~1284. For non-breeding common scoter of the Greater Wash SPA, the SACO targets relevant to habitat loss are:

- "Maintain the size of the non-breeding population at a level which is above 3,449, whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent".
- "Maintain the extent, distribution and availability of suitable habitat (either within or outside the site boundary) which supports the feature for all necessary stages of the non-breeding/wintering period (moulting, roosting, loafing, feeding) at the following levels: Water column (N/A); Intertidal rock (2.8343031 Ha); Intertidal coarse sediment (176.39153 Ha); Intertidal sand and muddy sand (3,541.5793 Ha); Intertidal mud (219.82485 Ha); Intertidal mixed sediments (416.62415 Ha); Infralittoral rock (72.233598 Ha); Circalittoral rock (3,672.3027 Ha); Subtidal coarse sediment (145,111.06 Ha); Subtidal sand (85,047.984 Ha); Subtidal mud (6,088.083 Ha); Subtidal mixed sediments (98,084.014 Ha); Subtidal biogenic reefs: Sabellaria spp. (8,111.0345 Ha); Intertidal biogenic reef: mussel beds (148.48664 Ha)".

~~1132.~~1285. The non-breeding population of The Wash SPA is in a favourable condition with a "maintain" SACO objective based on the recent 34% increase from 830 at citation (BTO WeBS count 2017/18-21/22).

~~1133.~~1286. The GB winter population is estimated at 135,000 (2011-15), which increased 95% in the period 1995/96 to 2020/21 and expanded 40.5% between 1981-84 and 2007-11 (BTO BirdFacts).

Integrity Test (Alone) – Unmitigated

~~1134.~~1287. This section assesses the impacts on common scoter from onshore works only (i.e. above MHWS). As non-breeding common scoters have only been recorded offshore, the permanent/ temporary habitat loss would:

- not reduce the non-breeding populations below their current levels; and
- not affect the extent, distribution and availability of suitable habitats.

~~1135.~~1288. It is concluded that **no AEoI of the Wash SPA and Greater Wash SPA in relation to non-breeding common scoter in the absence of mitigation, for the project alone.**

Feature 25 Eider

~~1136.~~1289. As set out in Section~~s~~ 9.5.2.25~~9.5.2.25~~, connectivity to SPA and Ramsar site populations has been discounted for Feature 25 in respect of habitat loss and is therefore not discussed here.

Feature Group 26: Terns

Implication for Conservation Objectives Unmitigated

~~1137.~~1290. Sixteen common terns were recorded during a single visit (visit 3) as part of the breeding bird survey in 2023, however no breeding was confirmed. There were no observations of common tern, sandwich tern or little tern during the winter bird surveys in season one; in season two, two juvenile sandwich terns were observed loafing on 19/09/23.~~There were no observations of common tern, Sandwich tern or little tern during the October 2022 to March 2023 winter bird surveys.~~

~~1138.~~1291. Relevant SACO targets for the breeding tern species in SPAs are presented in Table 9.112~~Table 9.77~~.

Table 9-113~~9.1129-9.77~~: Abundance and habitat SACO targets for little tern, Sandwich tern and common tern

Site	Breeding population: abundance	Supporting habitat: extent, distribution and availability of supporting habitat for the non-breeding season
Little Tern		
Greater Wash SPA	"Maintain the size of the breeding population at a level which is above 798 breeding pairs, whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent".	Maintain the extent, distribution and availability of suitable habitat (either within or outside the site boundary) which supports the feature for all necessary stages of its breeding cycle (courtship, nesting, feeding) at the following levels: Water column (N/A); Intertidal coarse sediment (176.39153 Ha); Intertidal sand and muddy sand (3,541.5793 Ha); Intertidal mixed sediments (416.62415 Ha).
The Wash SPA	"Maintain the size of the breeding population at a level which is above 30 breeding pairs, whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent".	Maintain the extent, distribution and availability of suitable habitat (either within or outside the site boundary) which supports the feature for all necessary stages of its breeding cycle (courtship, nesting, feeding): Coastal lagoons (1.7 ha), Intertidal coarse sediment (unknown), Intertidal mixed sediment (unknown), Intertidal sand and muddy sand (68 ha), Water column (unknown). This target may apply to supporting habitat which lies outside the site boundary. Generally, birds will not be nesting on habitat regularly flooded by the tide but they will be found in intertidal habitats above the Mean High Water Mark (which may not have been mapped).

Site	Breeding population: abundance	Supporting habitat: extent, distribution and availability of supporting habitat for the non-breeding season
Gibraltar Point SPA	"Restore the size of the breeding population to a level which is above 40 pairs, whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent".	Maintain the extent, distribution and availability of suitable habitat (either within or outside the site boundary) which supports the feature for all necessary stages of its breeding cycle (courtship, nesting, feeding): Coastal lagoons (1.7 ha), Intertidal coarse sediment (unknown), Intertidal mixed sediment (unknown), Intertidal sand and muddy sand (68 ha), Water column (unknown). This target may apply to supporting habitat which lies outside the site boundary. Generally, birds will not be nesting on habitat regularly flooded by the tide but they will be found in intertidal habitats above the Mean High Water Mark (which may not have been mapped).
Humber Estuary SPA	"Restore the size of the breeding population to a level which is above 51 breeding pairs, whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent".	Restore the extent, distribution and availability of suitable habitat (either within or outside the site boundary) which supports the feature for all necessary stages of its breeding cycle (courtship, nesting, feeding) to: an unspecified extent, based on restoring natural estuarine functioning. The following habitats support this feature during the breeding season: Sand dunes, Intertidal mixed sediments, Intertidal sand and muddy sand, Coastal lagoons, Water column.
Sandwich Tern		
Greater Wash SPA	"Maintain the size of the breeding population at a level which is above 3,852 breeding pairs, whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent".	Maintain the extent, distribution and availability of suitable habitat (either within or outside the site boundary) which supports the feature for all necessary stages of its breeding cycle (courtship, nesting, feeding) at the following levels: Water column (N/A); Intertidal coarse sediment (176.39153 Ha); Intertidal sand and muddy sand (3,541.5793 Ha); Intertidal mixed sediments (416.62415 Ha); Atlantic salt meadows (*Glauco-puccinellietalia maritimae*) (732.08374 Ha); Mediterranean and thermo-Atlantic halophilous scrubs (*Sarcocornetea fruticosi*) (732.08374 Ha).
Common Tern		
Greater Wash SPA	"Maintain the size of the breeding population at a level which is above 510 breeding pairs, whilst avoiding deterioration from its current level as	Maintain the extent, distribution and availability of suitable habitat (either within or outside the site boundary) which supports the feature for all necessary stages of its breeding cycle (courtship, nesting, feeding) the following levels: Water column (N/A); Intertidal coarse sediment (176.39153 Ha); Intertidal sand and muddy sand (3,541.5793 Ha); Intertidal mixed sediments (416.62415 Ha); Mediterranean and thermo-Atlantic halophilous scrubs (*Sarcocornetea*

Site	Breeding population: abundance	Supporting habitat: extent, distribution and availability of supporting habitat for the non-breeding season
	indicated by the latest mean peak count or equivalent".	*fruticosi*) (732.08374 Ha); Atlantic salt meadows (*Glauco-puccinellietalia maritimae*) (732.08374 Ha).
The Wash SPA	"Maintain the size of the population at a level which is above 220 pairs whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent".	"Maintain the extent, distribution and availability of suitable habitat (either within or outside the site boundary) which supports the feature for all necessary stages of its breeding cycle (courtship, nesting, feeding). Coastal lagoons (19 ha), Freshwater and coastal grazing marsh (0.25 ha), Intertidal coarse sediment (unknown), Intertidal mixed sediment (unknown), Intertidal sand and muddy sand (23069 ha) Water column, Saltmarsh (5704 ha), which is not feature specific but is an aggregation of the following saltmarsh features: - *Salicornia* and other annuals colonising mud and sand, - Atlantic salt meadows (*Glauco-puccinellietalia maritimae*), - Mediterranean and thermo-Atlantic halophilous scrubs - Spartina Swards. This target may apply to supporting habitat which lies outside the site boundary. Birds will not be nesting on habitat regularly flooded by the tide but they will be found in intertidal habitats above the Mean High Water Mark (which may not have been mapped)."

~~1139.~~1292. Little tern and Sandwich tern are almost exclusively marine species nesting close to the shore and feeding over the sea. Common tern will utilise marine habitats, but also breed inland at wetland sites and feed on lakes and rivers.

~~1140.~~1293. Cable installation at the Landfall area and crossings of other significant wetland features, such as The Haven, will be undertaken by trenchless techniques and will not be subject to habitat loss.

Integrity Test (Alone) – Unmitigated

~~1141.~~1294. Given that there will be no loss of suitable habitat for tern species and therefore no possibility to undermine the conservation objectives of the relevant designated sites, the permanent/ temporary habitat loss would:

- not affect the restoration or maintenance (as relevant) of the breeding populations below their current levels; and
- not affect the extent, distribution and availability of suitable habitats.

~~1142.~~1295. It is concluded that **there will be no AEoI of those sites in relation to breeding terns from the onshore elements of the project alone.**

Feature 27: Black-headed Gull

Implication for Conservation Objectives Unmitigated

~~1143.~~1296. In season one, black-headed gulls were observed on 32 occasions during a total of 13 visits with a peak count of 16 individuals as part of the Coastal OP (landfall) survey. The black-headed gulls were observed exclusively to be loafing. In season two, black-headed gulls were observed during a total of 14 visits with a peak count of 200 individuals on 4/10/24. The most common behaviour observed was foraging, followed by loafing. During winter walkover surveys in season one, 63 observations were recorded across 12 ECC segments and during a total of 12 walkover survey visits with a peak flock count of 137 individuals in ECC 10. The most common behaviour observed was loafing followed by foraging. In season two, 640 observations were recorded across all 14 ECC segments with a peak flock count of **600 individuals in ECC 8**. The most common behaviour observed was foraging, followed by loafing. ~~Black-headed gulls were observed on 32 occasions during a total of 13 visits with a peak count of 16 individuals (01/02/23) as part of the Coastal OP (landfall) surveys. The black-headed gulls were observed exclusively to be loafing. 63 observations were recorded across 12 ECC segments and during a total of 12 walkover survey visits with a peak flock count of 137 individuals. The most common behaviour observed was loafing (53%) followed by foraging (40%).~~ Black-headed gulls were widespread throughout the survey area, utilising agricultural fields, with a concentration of records~~, albeit in low numbers,~~ at the beach and inter-tidal zone.

~~1144.~~1297. Black-headed gulls were not confirmed breeding within the Project area during the breeding bird survey in 2023.

~~1145.~~1298. Black-headed gull is a non-breeding qualifying feature of The Wash Ramsar, and the population has declined 31,403 at citation to 15,055 at the most recent WeBS count (2017/18-21/22). The GB black-headed gull winter population is estimated at 2.2 million and has declined by 31% between 1995/96 to 2020/21 (in UK) and distribution has contracted by 5% (Woodward et al. 2020 and Austin et al., 2023, from BTO BirdFacts). The GB breeding population is estimated at 140,000 pairs and has undergone a 12.5% contraction in distribution (BTO BirdFacts). The peak flock count of ~~137~~ 600 represents approximately 0.~~006~~03% of the GB winter population.

Integrity Test (Alone) – Unmitigated

~~1146.~~1299. Project design has ensured no habitat loss from the beach, where the species was recorded on most visits. The main watercourses and wetlands have also been avoided through the use of trenchless techniques. The temporary loss of arable field habitats, which are common in the local area, and from a small area relative to the non-breeding foraging range for this species, is such that the impact would be of negligible magnitude for this species.

~~1147.~~1300. For the reasons outlined above, the permanent and temporary habitat loss arising from the Project (taking account of embedded mitigation) would:

- not affect the restoration of the non-breeding population below their current levels; and
- not affect the extent, distribution and availability of suitable habitats.

~~1148.~~1301. It is concluded that **there will be no AEoI of The Wash Ramsar in relation to non-breeding black-headed gulls from the onshore elements of the project alone**.

Feature 28: Bittern

Implication for Conservation Objectives Unmitigated

~~1149.~~1302. There were no records of bittern from within the survey area during the winter walkover and coastal OP surveys and no breeding bittern were identified during the 2023 breeding bird surveys. [redacted]

~~1150.~~1303. Bittern is a non-breeding and breeding qualifying feature of the Humber Estuary SPA.

~~1151.~~1304. For non-breeding bittern of the Humber SPA, the SACO targets relevant to habitat loss are:

- "Maintain the size of the non-breeding population at a level which is above 4 wintering individuals, whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent".
- "Maintain the extent, distribution and availability of suitable habitat (either within or outside the site boundary) which supports the feature for all necessary stages of the non-breeding/wintering period (moulting, roosting, loafing, feeding) to an unspecified extent, based on restoring natural estuarine functioning. The following habitats support this feature: freshwater and tidal reedbeds, Freshwater wetlands".

~~1152.~~1305. The most recently available five-year average from BTO WeBS counts for the Humber Estuary is three individuals (Austin et al., 2023).

Integrity Test (Alone) – Unmitigated

~~1153.~~1306. Bittern would not be impacted by temporary or permanent habitat loss resulting from the Project, as they utilise reedbed habitat and notable wetland features, such as Anderby Marsh, which will be avoided using trenchless techniques.

~~1154.~~1307. For the reasons outlined above, the permanent and temporary habitat loss arising from the Project would:

- not reduce the non-breeding or breeding populations below their current levels; and
- not affect the extent, distribution and availability of suitable SACO habitats.

~~1155.~~1308. It is therefore concluded that **there will be no AEoI of Humber Estuary SPA in relation to non-breeding or breeding bittern from the onshore elements of the project alone.**

Feature 29: Marsh Harrier

Implication for Conservation Objectives Unmitigated

~~1156.~~1309. Three breeding pairs of marsh harrier were recorded during the 2023 breeding bird surveys. [redacted]

~~1157.~~1310. Marsh harrier is a breeding qualifying feature of the Humber Estuary SPA.

~~1158.~~1311. For breeding marsh harrier of Humber Estuary SPA, the SACO targets relevant to habitat loss are:

- "Maintain the size of the non-breeding population at a level which is above 21 breeding females, whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent".
- "Maintain the extent, distribution and availability of suitable habitat (either within or outside the site boundary) which supports the feature for all necessary stages of its breeding cycle (courtship, nesting, feeding) at: current level. Exact ha not known at this time. The following habitats support this feature during the breeding season: Tidal reedbeds, Intertidal mixed sediments, Intertidal sand and muddy sand, Freshwater wetlands, Inland areas of wet grassland, rough grassland and agricultural land (both arable land and permanent pasture)".

~~1159.~~1312. The GB marsh harrier breeding population is estimated at 590 pairs and has undergone an 884% expansion in distribution (BTO BirdFacts). A national winter population estimate is unavailable. The three breeding pairs recorded during 2023 surveys represent approximately 0.7% of the UK breeding population.

~~1160.~~1313. Throughout the year, marsh harriers hunt over arable fields, reedbed, freshwater marsh and salt marsh (Underhill-Day, 2002). A study in East Anglia found the home range of males to be 569ha during courtship to 1,407ha post-fledging, with birds hunting up to 7km from the nesting area (Underhill-Day, 1990). Females home ranges vary from 100 to 1,300ha (Hardey et al. 2013). There was a total of nine records of marsh harrier during the winter 2022-23 ECC surveys. The ECC route is an approximately 80m wide linear corridor and habitat loss will primarily be of arable farmland, which is common in the local area.

Integrity Test (Alone) – Unmitigated

[redacted]

~~1162.~~1315. For the reasons outlined above, the permanent and temporary habitat loss arising from the Project would:

- not reduce the breeding populations below their current levels; and
- not affect the extent, distribution and availability of suitable SACO habitats.

~~1163.~~1316. It is **therefore concluded that there will be no AEoI of Humber Estuary SPA in relation to breeding marsh harrier from the onshore elements of the project alone**.

Feature 30: Hen harrier

~~1164.~~1317. As set out in Section 9.5.2 ~~9.5.2~~, connectivity to SPA and Ramsar site populations has been discounted for Feature 30 in respect of habitat loss and are therefore not discussed here. It is concluded that **there will be no AEoI of these designated sites in relation to habitat loss and non-breeding ~~Feature 30~~hen harrier in the absence of mitigation, for the project alone.**

Feature Group 31: Waterbird Assemblage

Implication for Conservation Objectives Unmitigated

~~1165.~~1318. Waterbird assemblage is a feature of Humber SPA and Ramsar, The Wash SPA and Ramsar and Gibraltar Point Ramsar.

~~1166.~~1319. For non-breeding waterbird assemblage of Humber Estuary SPA, the SACO targets relevant to habitat loss are:

- "Restore the overall abundance of the assemblage to a level which is above 153,934 whilst avoiding deterioration from its current level as indicated by the latest peak mean count or equivalent".
- "Restore the extent, distribution and availability of suitable habitat (either within or outside the site boundary) which supports the feature for all necessary stages of the non-breeding/wintering period (moulting, roosting, loafing, feeding) to an unknown extent, based on restoring natural estuarine functioning. The principal habitats known or likely to support the assemblage feature at this SPA are: Intertidal sand and mudflats, Coastal lagoons, Saltmarsh, Tidal reedbeds, Freshwater wetlands, Inland areas of wet grassland, rough grassland and agricultural land (both arable land and permanent pasture), Annual vegetation of driftlines (sand and shingle), Artificial structures such as derelict pier/jetty structures, flood defences".

~~1167.~~1320. For non-breeding waterbird assemblage of The Wash SPA, the SACO targets relevant to habitat loss are:

- "Maintain the overall abundance of the assemblage at a level which is above 214,000 whilst avoiding deterioration from its current level as indicated by the latest peak mean count or equivalent".
- "Maintain the structure, function and availability of the following habitats which support the assemblage feature for all stages (moulting, roosting, loafing, feeding) of the non-breeding period; Atlantic salt meadows, Intertidal coarse sediment, Intertidal mixed sediments, Intertidal mud, Intertidal sand and muddy sand, Mediterranean and thermo-Atlantic halophilous scrubs, *Salicornia* and other annuals colonising mud and sand, Spartina swards, Subtidal seagrass beds".

~~1168.~~1321. The assemblages of the Humber Estuary SPA and Ramsar are in unfavourable condition with -24% recorded declines since baseline by the BTO WeBS alerts, resulting in a "restore" target. The assemblage of The Wash SPA/ Ramsar and Gibraltar Point Ramsar are in favourable conditions with 359% and 92% increases respectively and "maintain" targets.

~~1169.~~1322. Relevant species of the waterbird assemblage feature have been screened out or assessed individually. Given that the assessment of the features already undertaken concluded no significant effects on the integrity of the relevant designated sites, the permanent and temporary habitat loss arising from the Project would:

- not affect the restoration or maintenance (as relevant) of the non-breeding populations; and
- not affect the extent, distribution and availability of suitable SACO habitats.

~~1170.~~1323. It is **therefore concluded that there will be no AEoI of Humber Estuary SPA/Ramsar, Wash SPA/Ramsar or Gibraltar Point Ramsar in relation to the waterbird assemblage from the onshore elements of the project alone.**

Feature Group 32 Habitat Features of SACs and Ramsar sites

~~1171.~~1324. The Order Limits lie entirely outwith European and Ramsar Sites and therefore there will be no habitat loss within such Sites. For the Annex I habitat within the Order Limits, which may provide supporting habitat to the same or similar Annex I habitats within the European or Ramsar sites, habitat loss will be avoided by using trenchless techniques. This applies to all the following:

- 2110 Embryonic shifting dunes, at the coast in ECC 1.
- Potential 2160 Dunes with *Hippophae rhamnoides*, at the coast in ECC 1.
- 1130 Estuaries, in the tidal sections of The Haven (Boston) and the River Welland (Fosdyke Bridge), which both flow into The Wash, and are located within ECC 10 to ECC 12 and ECC 14
- 1330 Atlantic salt meadows (Glauco-Puccinellietalia maritimae), same locations as 1130; and
- 1140 Mudflats and sandflats not covered by seawater at low tide, same locations as 1130.

~~1172.~~1325. There is therefore no means by which habitat loss from the Project could undermine the conservation objectives of the screened in SACs and Ramsar sites relation to the qualifying habitat features. **There would therefore not be an AEoI for the Humber Estuary SAC and Ramsar, Satltfleetby-Theddlethorpe Dunes and Gibraltar Point SAC, Gibraltar Point Ramsar, The Wash and North Norfolk SAC and The Wash Ramsar through habitat loss.**

Feature Group 33: Red Data Book Invertebrates

~~1173.~~1326. There would no loss of habitat which to supports the two red data book invertebrate species Hairy Dragonfly Brachytron pratense and a water beetle Haliplus mucronatus and therefore no possibility of undermining the conservation objectives for these species through loss of habitat. **There would therefore not be an AEoI for the Gibraltar Point Ramsar**.

Feature 34: Otter

~~1174.~~1327. There will be no loss of Otter habitat from within The Wash and North Norfolk SAC and, within the Order Limits, l all sizeable waterbodies and those with significant flow will be crossed if necessary using trenchless techniques. Therefore, there will be no loss of foraging habitat for Otter. The known Otter holts will also not be affected by the construction works meaning that no breeding sites will be lost.

~~1175.~~1328. Therefore, the conservation objectives of The Wash and North Norfolk SAC would not be undermined by habitat loss and **there would be no AEoI of The Wash and North Norfolk SAC in relation to habitat loss and otter**.

9.5.3.2 Pathway 2 – Disturbance of Birds and Mammals Outside The SPA

~~1176.~~1329. Section 7 of the Project Description chapter (ES Part 6 Chapter 3) states that trenchless techniques will be used to install the cables beneath the intertidal and near shore area. It states that *"The Landfall HDD and cable installation operations will be undertaken from the Landfall Compound on the west side of Roman Bank. The Project has committed to undertaking no construction works on the beach"*.

~~1177.~~1330. It describes that the TJB will be located a minimum of 80m to the west of Roman Bank. A landfall logistics compound will be located within the Landfall area. The trenchless techniques exit pits will be located below mean low water springs (MLWS). The Landfall works are anticipated to take up to a maximum of 42 months to complete. For decommissioning, it is expected that the onshore cable would be left in situ to avoid adverse effects on the environment and communities. However, should the onshore infrastructure be removed, for the purposes of a worst-case scenario, it is considered that impacts associated with the decommissioning phase would be no greater than those identified for the construction phase.

~~1178.~~1331. A report by The Institute of Estuarine and Coastal Studies (IECS) (Cutts et al., 2009) provides a review of the evidence relating to construction disturbance impacts on non-breeding waterfowl and was used to develop a Waterbird Disturbance Mitigation Toolkit (Cutts et al., 2013). The Toolkit summarises the following general waterbird disturbance levels from visual stimuli:

- High level disturbance stimuli: close proximity of works (<100m); works or 3rd parties on foreshore; workers on foot; large/fast moving machinery.
- Moderate level disturbance stimuli: high level activities for which birds are habituated; and small/slow moving plant.
- Low level disturbance stimuli: moderate level activities for which birds are habituated; works out of sight; high level works >500m away from birds (or 300m with habituation); moderate level works >300m away (or 250m with habituation).

~~1179.~~1332. The study summarises the waterbird responses to construction noise disturbance as:

- High noise level effects – sudden noise of > 60 dB (at the bird) or prolonged noise of > 72 dB.
- Moderate noise level effects – occasional noise > 55 dB, regular noise 60-72 dB and long-term regular noise >72 dB.
- Low noise level effects – noise < 55 dB and noise between 55-72 dB in some highly disturbed areas.

~~1180.~~1333. The Toolkit provides a table presenting standard distance decay rates for noise and states Above the acceptable 70 dB dose threshold *"yellow to orange shading is where a response is likely but mitigation may be effective in reducing disturbance risk; pale red where mitigation is necessary and might be of value, but with remaining risk of effect; dark red where a flight response is almost certain to occur and would be increasingly difficult to mitigate through simple screening etc and may require the cessation of works during high sensitivity periods".*

~~1181.~~1334. The ECC and 400kV cable corridor comprises two distinct types of activity which occur in discrete sections along the route, as illustrated in Volume 2, Figure 3.4 (document reference 6.2.3.4). Open trenched sections will include perimeter earth bunds of approximately 1.5m height, which will screen ground level works activities from the surrounding habitats. Trenches will be dug by mechanical excavator and cables laid from a cable drum. Cable Installation Compounds will not include perimeter earth bunds and plant and machinery will include excavators and drilling rigs. There will be six 'major' trenchless Cable Installation Compounds, including the landfall and The Haven crossing; the rest are classed as 'minor' drills. Construction works at the OnSS will include foundations, erection of steel framework and delivery of abnormal indivisible loads and installation by cranes.

~~1182.~~1335. The noise assessment for the Project is detailed in Volume 1, Chapter 26: Noise and Vibration. This has assessed noise disturbance impacts to SPAs, Ramsar sites and SSSIs, as well as to Anderby Marsh LWT Reserve. A threshold level of 55dB LAeq has been adopted for that assessment, derived from the Air Quality Technical Advisory Group 09 (AQTAG09) document, which provides guidance on the effects of industrial noise on wildlife. From this it has been determined that this threshold level will not be met within the boundary of any such designated site as a result of the construction activity, excluding a very small amount of overlap with The Wash SPA at The Haven. This is addressed through additional mitigation, comprising a seasonal restriction to construction activity, to avoid works during the period of October to March inclusive within 400m of The Wash SPA and Ramsar.

~~1183.~~1336. Year 1 surveys have identified the following qualifying features occurring within the small section of The Wash SPA/Ramsar which falls within 400m of the onshore Order Limits:

- dark-bellied brent goose, peak of 250 (frequency of 4 in Oct, Nov, Feb and Mar) and peak of 81 (frequency of 1, in Oct, over-flying);
- pink-footed goose, peak of 67 (frequency of 2, in Nov and Dec); and
- black headed gull, peak of 25 (frequency of 1, in Mar).

~~1184.~~1337. It is recognised that sudden, impulsive type noise tends to have a greater disturbance impact to birds than regular, consistent noise. The Toolkit suggests a threshold of 70dB LAmax for non-breeding waterbirds; however, evidence for breeding waterbirds and other species is more limited. Therefore, a more precautionary 65dB LAmax threshold may be appropriate when also considering impacts to breeding birds. LAmax is the metric which gives an indication of peak levels, so would encompass the impulsive type noise which may be most impactful. It is, however, more reliable given the nature of the planned works to model LAeq (average) construction noise levels, as there is limited published data regarding maximum noise levels from plant. This is particularly true for the Project, which has committed to use silent piling technology (at landfall) and vibratory sheet piling, rather than impact piling along the onshore ECC and 400kV cable corridor, with impact piling limited to the OnSS Construction. The remaining construction activities are non-drilling related activities, such as the use of excavators and dumpers, where the average and peak noise levels are unlikely to be significantly different.

~~1185.~~1338. Coincidentally, the noise assessment for human receptors also adopts the 65dB (LAeq) threshold and that indicates that along the ECC route and 400kV cable corridor, the distance from the working area at which the 65dB threshold level is met or exceeded is 80m. The average noise level generated from the open trenched and Cable Installation Compound sections, as well as site establishment and restoration, is similar.

~~1186.~~1339. During the project's landfall works, a Landfall Compound will be required to accommodate the drill rig, TJBs, cable storage, installation activities and welfare facilities. Each drill would start from the Landfall Compound [PCC-1] to the west of Roman Bank, to drill eastward below Roman Bank, Anderby Marsh LNR, the sea defence, and beach, exiting in the subtidal zone at a suitable depth seaward of MLWS.

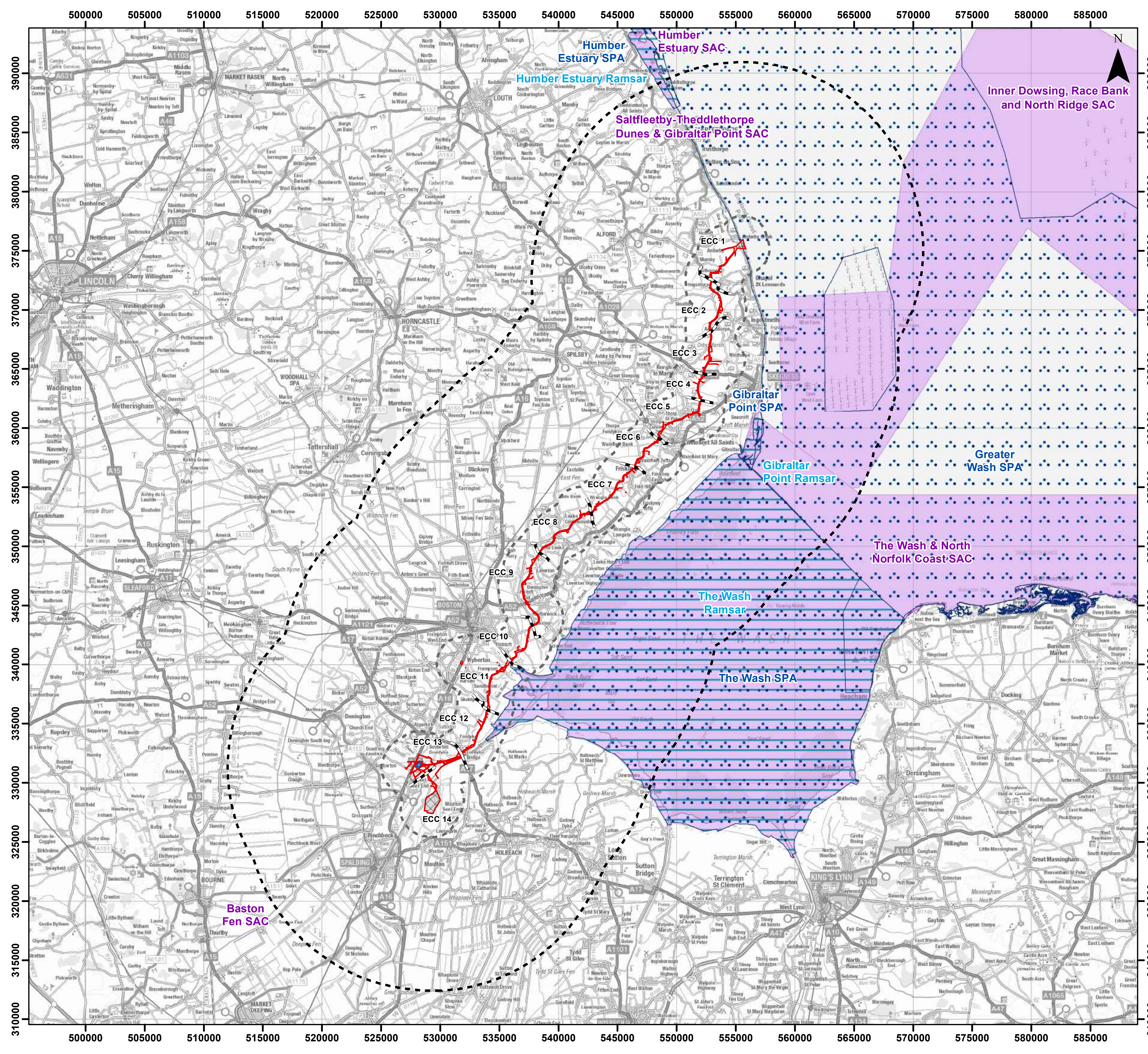
~~1187.~~1340. Given the close proximity of the Landfall compound to Anderby Marsh LWT Reserve, which is utilised by a range of sensitive non-breeding waterbirds and breeding Schedule 1 species, more detailed noise modelling was undertaken to assess the potential noise impacts from the planned construction works at the landfall.

~~1188.~~1341. The modelling results for the landfall incorporate the embedded mitigation (See Section 6) of a 4m high earth bund to shield the construction area from the nature reserve, as well as the existing landscape feature of Roman Bank. The model shows that this results in predicted noise levels within Anderby Marsh Reserve to be below the 55dB LAeq contour (see Appendix 26.4, Figure 26.4 (document reference 6.3.26.4)) and below the 65dB LAmax contour. It is, therefore, concluded that with the embedded mitigation in place, the noise levels would be below the threshold at which adverse behavioural bird responses would be initiated.

~~1189.~~1342. Additional mitigation to further reduce the potential noise disturbance at the landfall includes the commitment to use silent piling technology, to locate noisier plant at the western end of the compound as far as practicable, and to construct the mitigation bund in March, August and/or September, outside of the core breeding bird season and prior to the winter season/early in the passage period.

~~1190.~~1343. The construction work for the installation of export cables involves a number of discrete activities undertaken along the length of the cable route, the duration of each activity at any location being dependent on the nature of construction activity being undertaken. The works at any location would therefore be intermittent and not continuous for the 51-month construction period.

~~1191.~~1344. Other than birds occurring within a section of The Haven which is part The Wash SPA and Ramsar, the assessment that follows relates to disturbance of birds outside the SPA and Ramsar sites but which are or may be associated with such a site or sites, as assessed in Section 9.5.2 ~~section 9.5.2~~ onwards. Disturbance of birds when outside the relevant SPA or Ramsar site may still have implications for the conservation objectives. For reference, the locations of European and Ramsar sites are shown on Figure 9.5 to Figure 9.11 and the distances between the Order Limits and each site is given in Table 7.1. Similarly, the assessment considers disturbance to otters when outside SACs but which are likely to form part of an SAC population, as described in Section 9.5.2.~~section 9.5.2.~~



Legend

- Order Limits
- Onshore Segment Break
- Onshore Order Limits 2 km Buffer
- Onshore Order Limits 15 km Buffer
- Special Protection Area (SPA)
- Ramsar
- Special Area of Conservation (SAC)

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Coordinate System: British National Grid

0 3.75 7.5 15 km

Scale: 1:300,000

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European and Ramsar Sites

Figure 9.5

OUTER DOWSING OFFSHORE WIND

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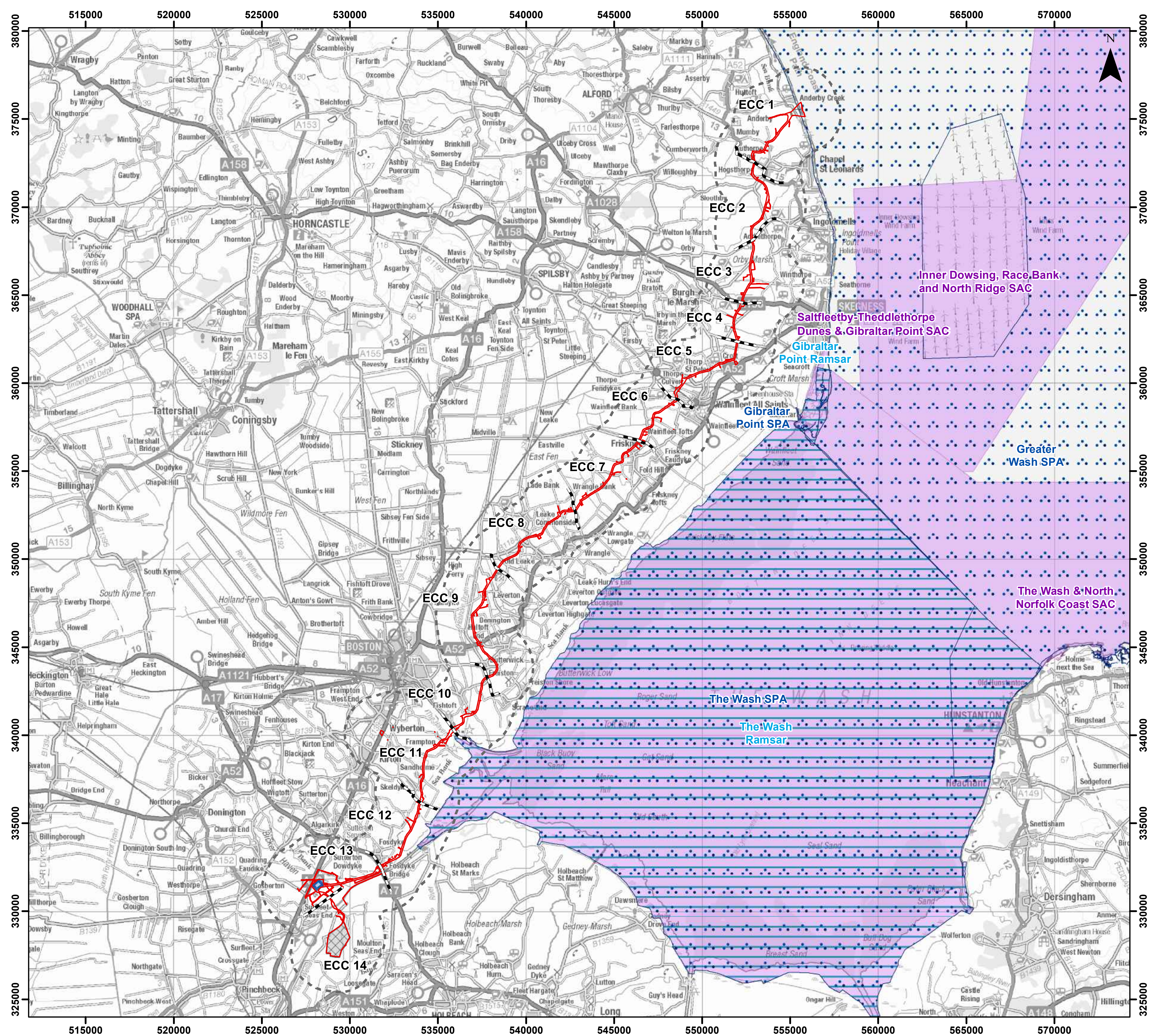

Legend

- Order Limits
- Onshore Segment Break
- Onshore Order Limits 2 km Buffer
- Special Protection Area (SPA)
- Ramsar
- Special Area of Conservation (SAC)

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Coordinate System: British National Grid

0 2.5 5 10 km

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European and Ramsar Sites

Figure 9.6

OUTER DOWSING OFFSHORE WIND

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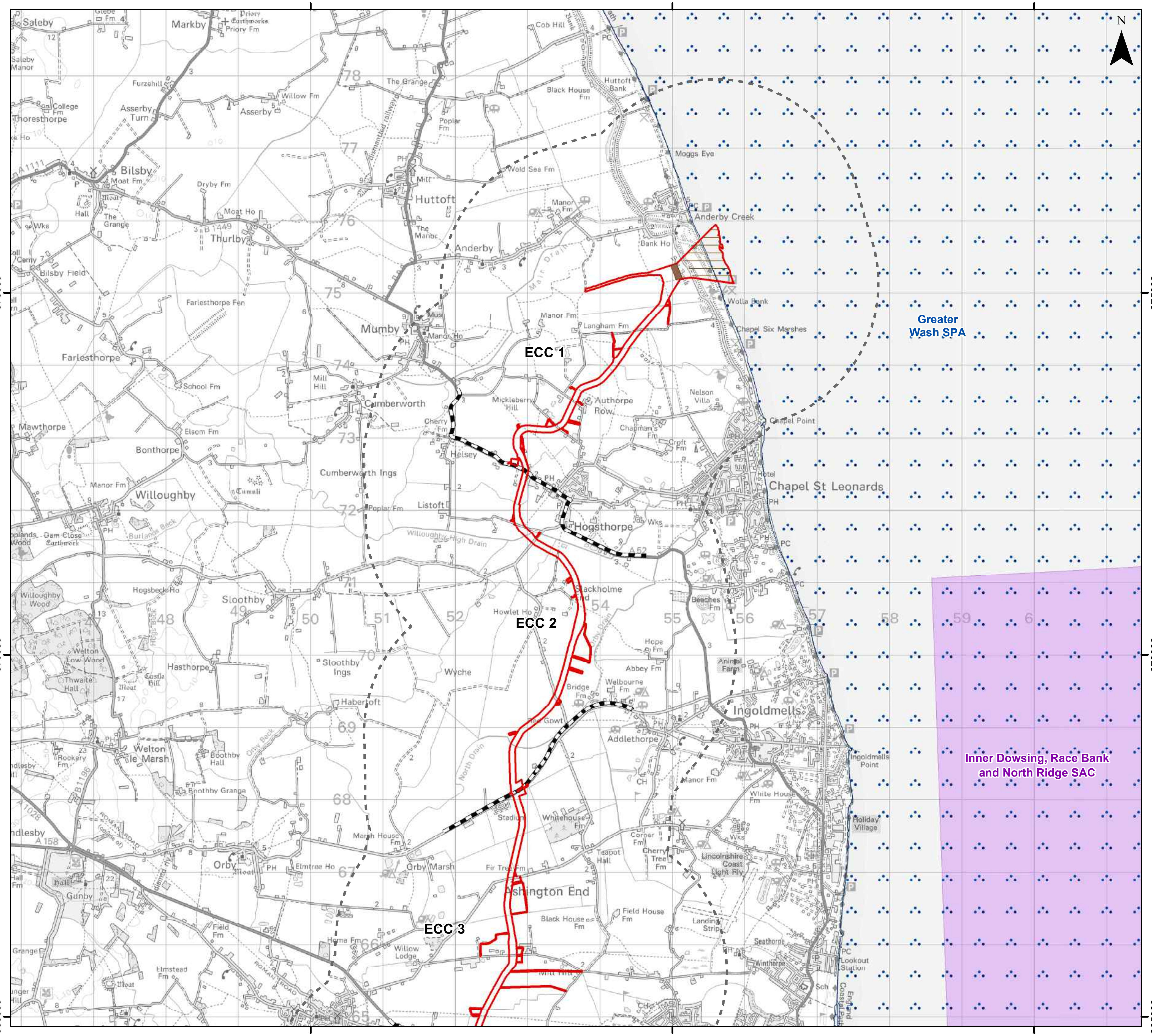

Legend

- Order Limits
- Onshore Segment Break
- Landfall Trenchless Works Area
- Transition Joint Bay Area
- Onshore Order Limits 2 km Buffer
- Special Protection Area (SPA)
- Special Area of Conservation (SAC)

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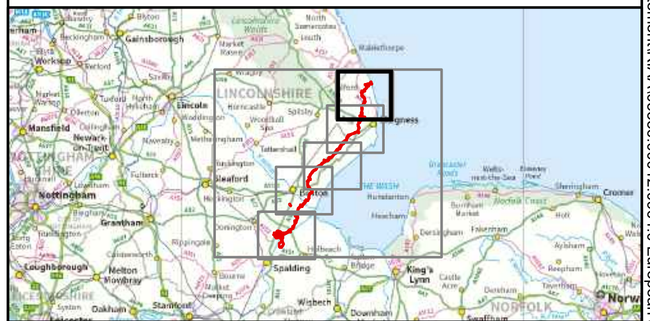

Coordinate System: British National Grid

0 0.5 1 2 km

Scale: 1:50,000

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European and Ramsar Sites

Figure 9.7

OUTER DOWSING OFFSHORE WIND

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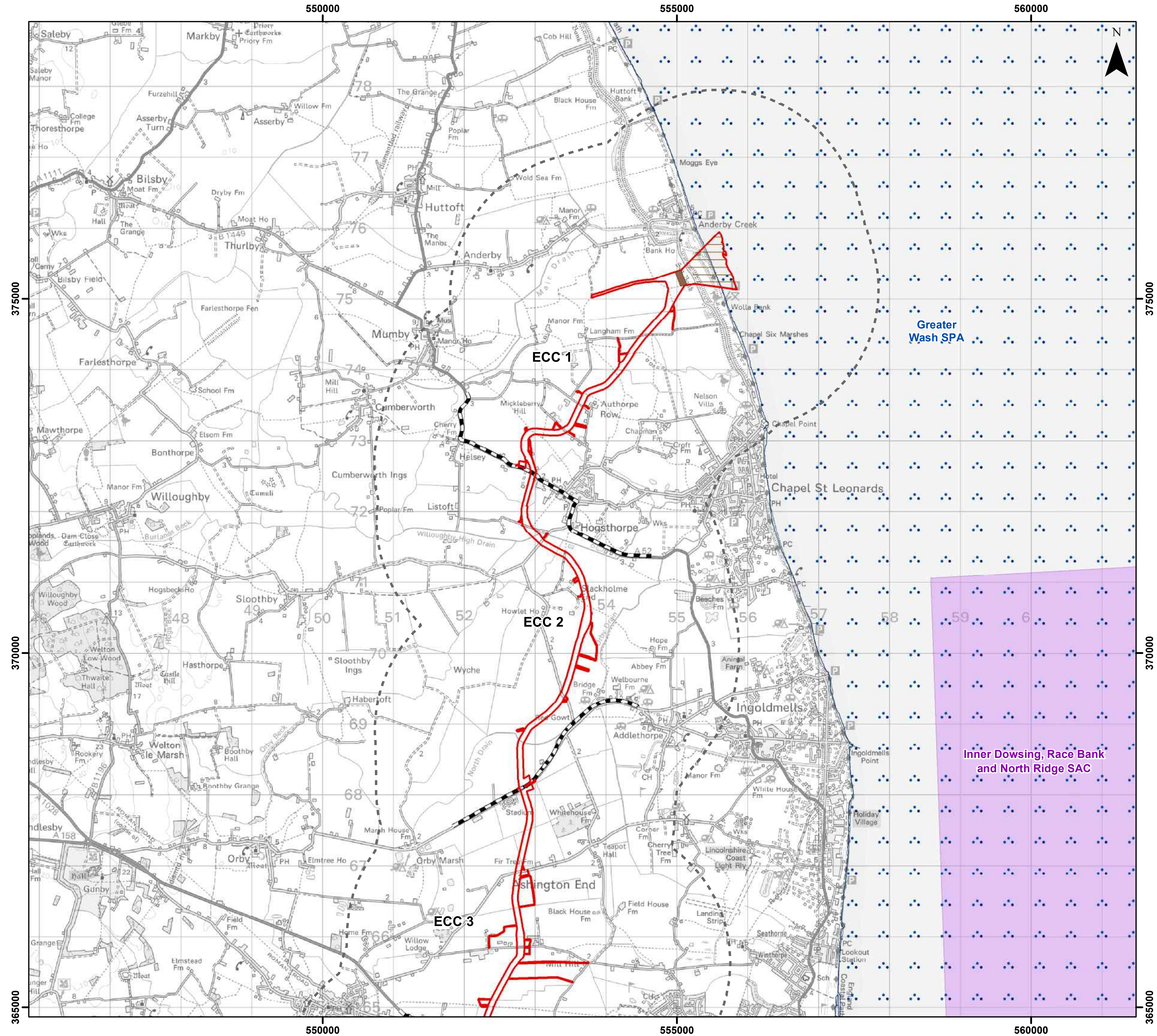

Legend

- Order Limits
- Onshore Segment Break
- Landfall Trenchless Works Area
- Transition Joint Bay Area
- Onshore Order Limits 2 km Buffer
- Special Protection Area (SPA)
- Special Area of Conservation (SAC)

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Coordinate System: British National Grid

0 0.5 1 2 km

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European and Ramsar Sites

Figure 9.7

OUTER DOWSING OFFSHORE WIND

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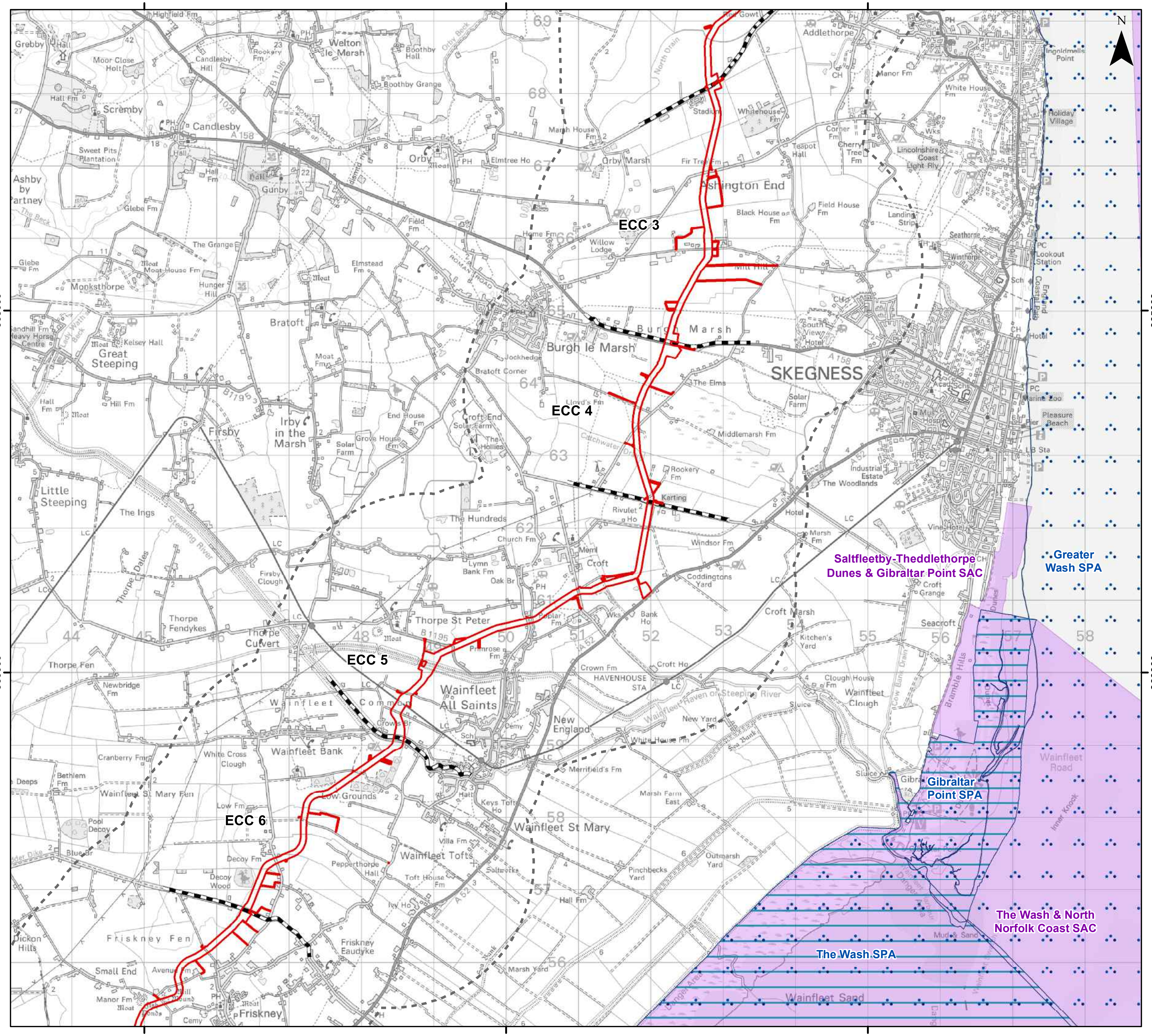

Legend

- Order Limits
- Onshore Segment Break
- Onshore Order Limits 2 km Buffer
- Special Protection Area (SPA)
- Ramsar
- Special Area of Conservation (SAC)

Sources:
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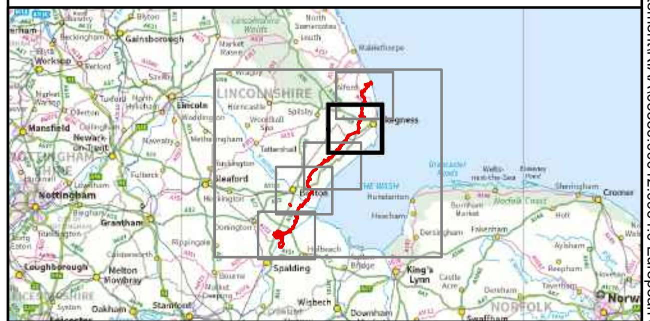

Coordinate System: British National Grid

0 0.5 1 2 km

Scale: 1:50,000

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European and Ramsar Sites

Figure 9.8

OUTER DOWSING OFFSHORE WIND

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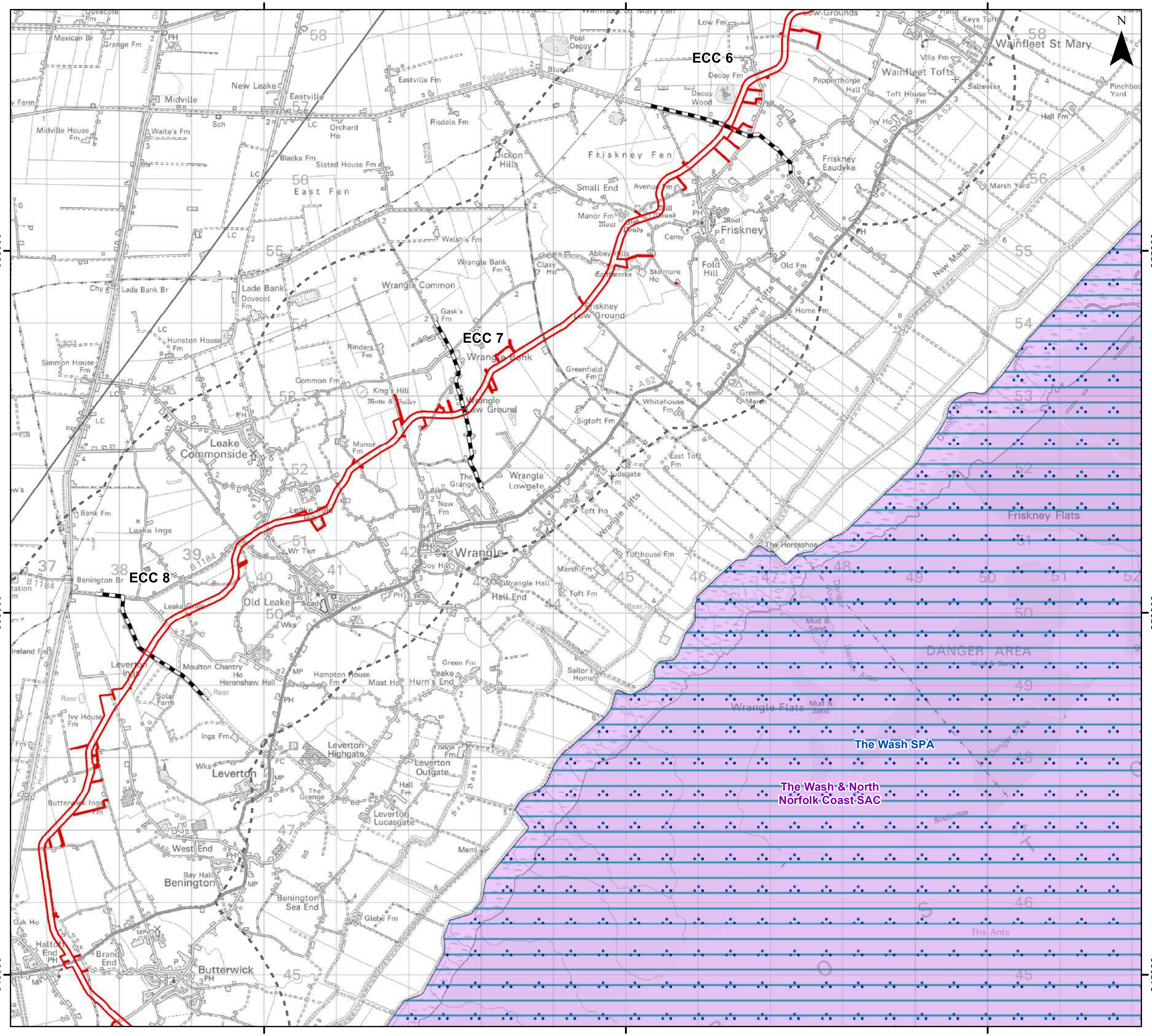

Legend

- Order Limits
- Onshore Segment Break
- Onshore Order Limits 2 km Buffer
- Special Protection Area (SPA)
- Ramsar
- Special Area of Conservation (SAC)

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0 0.5 1 2 km

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European and Ramsar Sites

Figure 9.9

OUTER DOWSING OFFSHORE WIND

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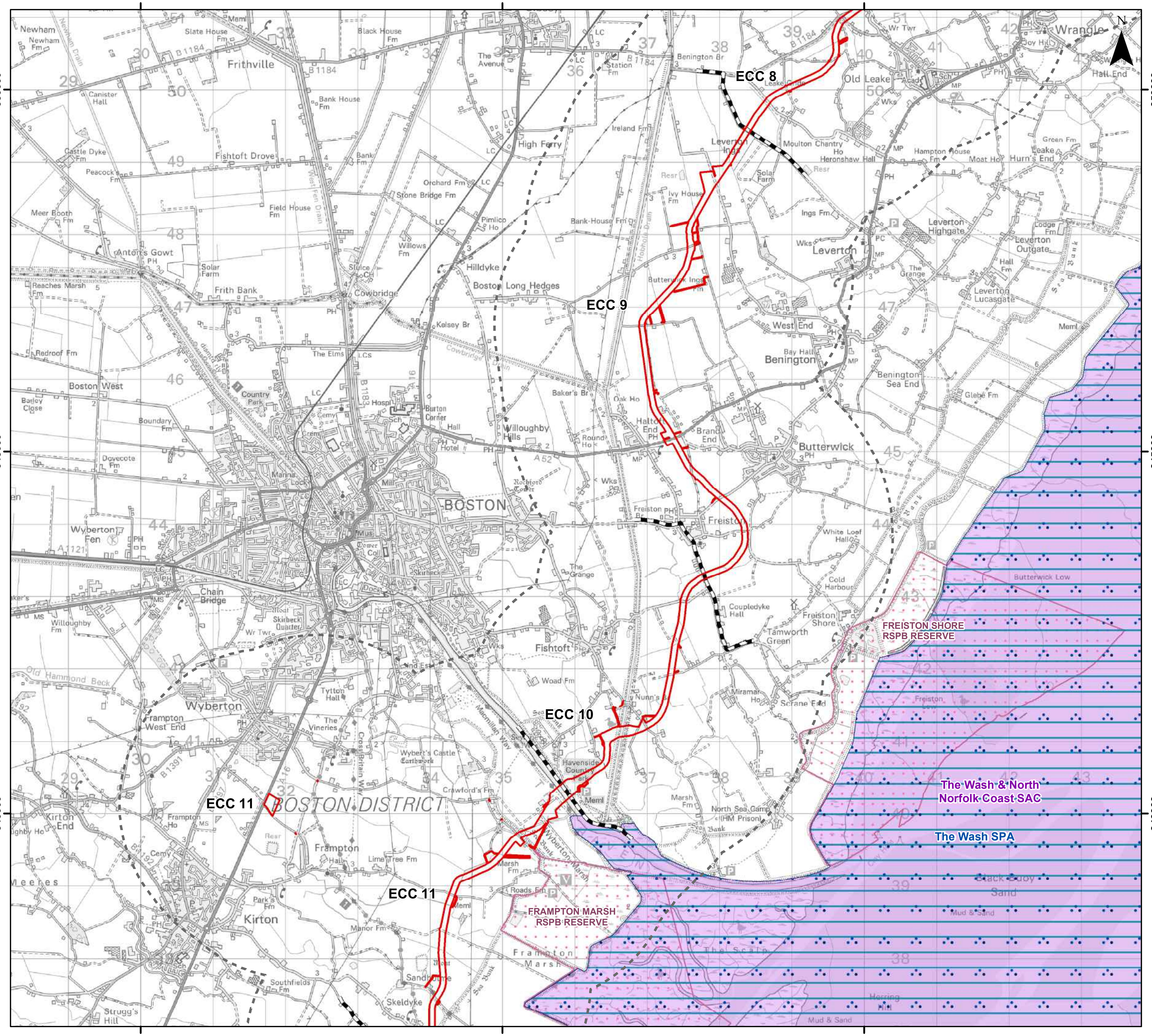

Legend

- Order Limits
- Onshore Segment Break
- Onshore Order Limits 2 km Buffer
- Special Protection Area (SPA)
- Ramsar
- Special Area of Conservation (SAC)
- RSPB Reserve

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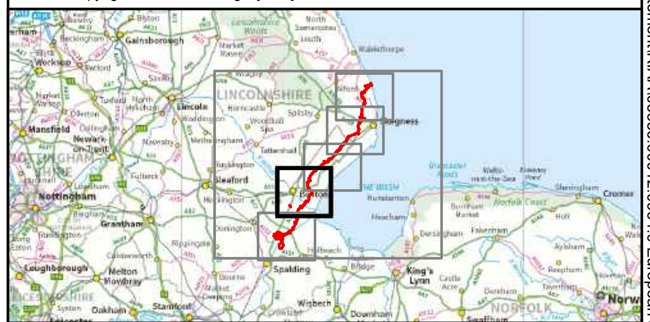

Coordinate System: British National Grid

0 0.5 1 2 km

Scale: 1:50,000

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European and Ramsar Sites

Figure 9.10

OUTER DOWSING OFFSHORE WIND

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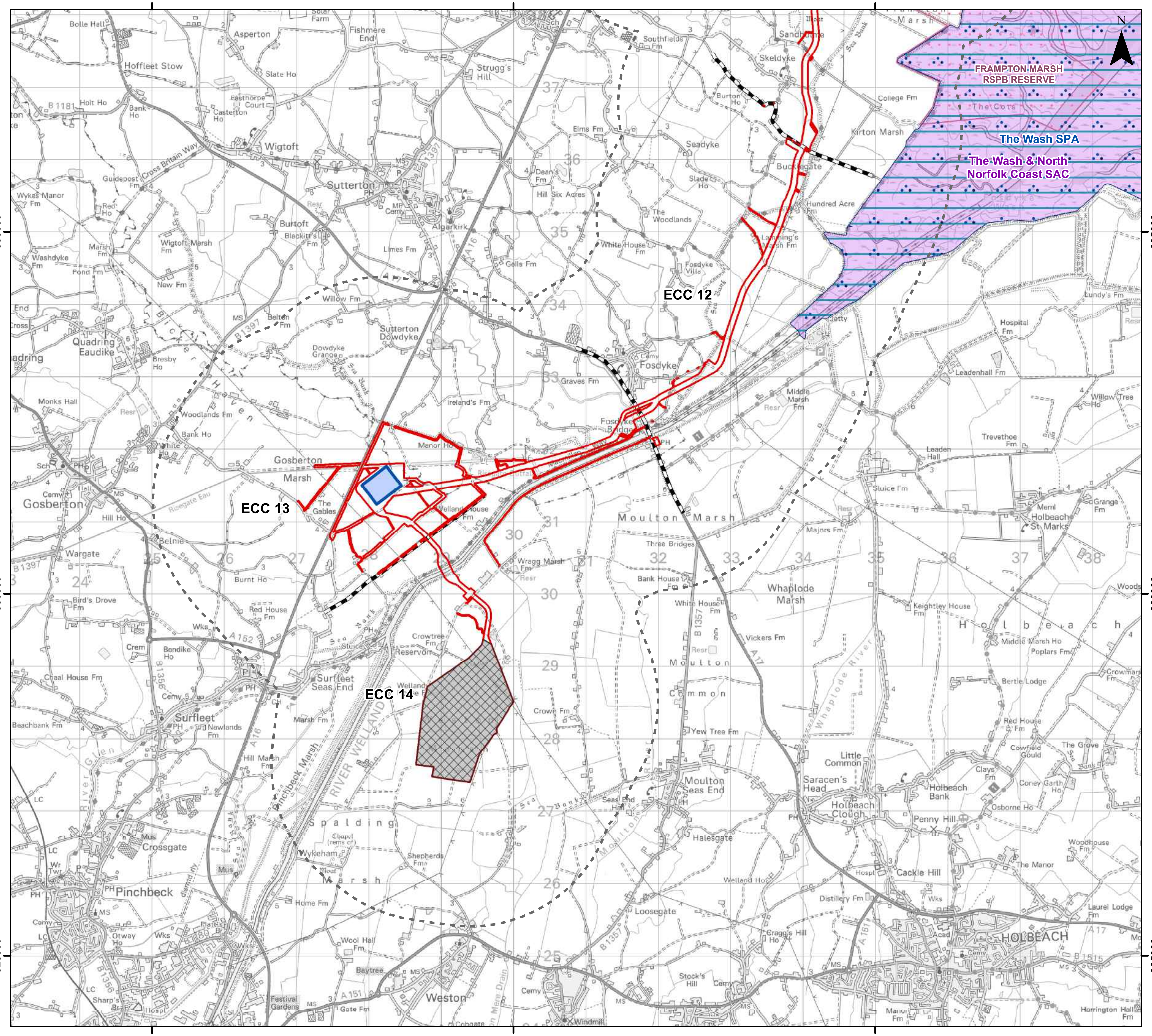

Legend

- Order Limits
- Onshore Segment Break
- Onshore Substation (OnSS) Footprint
- Connection Area
- Onshore Order Limits 2 km Buffer
- Special Protection Area (SPA)
- Ramsar
- Special Area of Conservation (SAC)
- RSPB Reserve

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Coordinate System: British National Grid

0 0.5 1 2 km

Scale: 1:50,000

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Report to Inform Appropriate Assessment

European and Ramsar Sites

Figure 9.11

OUTER DOWSING OFFSHORE WIND

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Feature 1: Avocet

Implication for [redacted]

~~1192.~~1345. [redacted] There was only a single record during non-breeding bird surveys, in March 2023, and 13 records during non-breeding bird surveys in March and April 2024, all assumed to be birds prospecting to breed.~~There was only a single record during non-breeding bird surveys, in March, and assumed to be birds prospecting to breed.~~

~~1193.~~1346. The relevant SACO targets for breeding avocet of Humber Estuary SPA are:

- "Maintain the size of the breeding population at a level which is above 233 breeding pairs, whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent".
- "Reduce the frequency, duration and / or intensity of disturbance affecting roosting, foraging, feeding, moulting and/or loafing birds so that they are not significantly disturbed".

~~1194.~~1347. The relevant SACO targets for non-breeding avocet of Humber Estuary SPA are:

- "Maintain the size of the non-breeding population at a level which is above 1,213 individuals, whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent".
- "Reduce the frequency, duration and / or intensity of disturbance affecting roosting, foraging, feeding, moulting and/or loafing birds so that they are not significantly disturbed".

~~1195.~~1348. Natural England have previously recommended a 300m safe working distance (for non-construction operations such as human presence and shooting) around avocet nest sites

[redacted]

~~1197.~~1350. In the absence of additional mitigation, there is a residual risk of disturbance of the breeding population at Anderby Marsh, as the works will occur within 300m of the Marsh and there is some uncertainty about the effectiveness of Roman Bank as a screen. This could reduce nesting success, and therefore the potential immigration into the breeding population of the Humber Estuary SPA, potentially undermining the conservation objectives of the SPA.

Mitigation

~~1198.~~1351. Refer to the onshore ecology mitigation detailed in Section [redacted]

~~1199.~~1352. As an additional measure, a specific survey and monitoring protocol will be developed to ensure adherence with the legal protection for nesting avocet as a Schedule 1 nesting species.

Integrity test (alone) – Mitigated

~~1200.~~1353. Breeding avocet is a qualifying feature of the Humber Estuary SPA and the population is at favourable conservation status. The breeding population nationally has increased more than 300% in the 25 years to 2009 (Easton et al. 2021).

~~1201.~~1354. With the embedded design and mitigation measures and additional mitigation in place, the potential for disturbance will be reduced and disturbance would:

- Not reduce the size of the breeding and non-breeding populations; and
- Not inhibit reduction in disturbance such that the populations are not significantly disturbed.

~~1202.~~1355. Therefore, **there will be no AEoI of Humber Estuary SPA in relation to breeding and non-breeding avocet for the Project alone during construction and decommissioning.**

Feature 2: Lapwing

Implication for Conservation Objectives Unmitigated

~~1203.~~1356. No observations of lapwings were made during Coastal OP (landfall) surveys in either winter season. In season one, 230 observations were recorded across 12 ECC segments and during a total of ten walkover survey visits with a peak flock count of 400 individuals in ECC 12. In season two, 156 observations were recorded across all 14 ECC segments and during a total of 15 walkover survey visits with a peak flock count of **2,000 individuals in ECC 7**. ~~230 observations were recorded across 12 ECC segments and during a total of ten walkover survey visits with a peak flock count of 400 individuals, which represents 3.29% of the recent population estimated for the Wash Ramsar.~~ The most common behaviour observed was loafing.

~~1204.~~1357. Two breeding territories were also identified, both from Anderby Marsh.

~~1205.~~1358. In season one, ~~N~~notable flocks (of >100 birds) within the potential disturbance area (excluding habitat loss areas which have been assessed separately) were:

- Peak flock count of 258 from Anderby Marsh and 125 from an arable field adjacent and to the north of the landfall construction compound.
- Peak flock count of 110 from ECC 3, from an arable field adjacent to a TCC and 100m to the east of the ECC (mainly open trenched section) at the closest point.
- Peak flock count of 220 (frequency of 1) from ECC 4, >400m from the ECC but at the edge of the 400m buffer from an enabling access track.
- Peak flock count of 160 from ECC 5, from an arable field to the south of a TCC (separated by the A52 road) and 250m to the south of the ECC (Cable Installation Compound sections) at the closest point.
- Peak flock count of 138 from ECC 5, from an arable field 200m to the north of the ECC (open trenched and Cable Installation Compound sections) at the closest point and separated from it by multiple field boundaries with hedges/~~tress~~trees.

- Peak flock count of 110 from ECC 5, from a grassland field 350m to the north of the ECC at the closest point (apparently used for recreation).
- Peak flock count of 324 (frequency of 1) from the edge of the 400m buffer in ECC 5.
- Peak flock count of 148 (frequency of 1) from the edge of the 400m buffer in ECC 6.
- Peak flock count of 250 from ECC 8, from an arable field 200m south of the ECC at the closest point (open trenched section).
- Peak flock count of 208 from ECC 9, from an arable field adjacent to the ECC at the closest point.
- Peak flock count of 284 from ECC 9, from an arable field 200m to the west of the ECC at the closest point, separated from it by a minor road.
- Peak flock count of 157 from ECC 9, from an arable field 150m to the east of the ECC at the closest point, separated from it by a minor road and a treeline.
- Peak flock count of 232 from ECC 9, from an arable field which the ECC partly runs through.
- Peak flock count of 210 from ECC 11, from an arable field adjacent to the ECC at the closest point (the field itself being 1km in length).
- Peak flock counts of 400 and 100 from ECC 12, from two adjacent arable fields, adjacent to the ECC at the closest point and 500m at the furthest point.

1359. In season two, notable flocks (of >100 birds) within the potential disturbance area (excluding habitat loss areas which have been assessed separately) were:

- Peak flock count of 1,000 from ECC 3, from an arable field 350m to the east of the ECC at the closest point, separated by a farm track.
- Peak flock count of 500 from ECC 3, from an arable field 350m to the west of the ECC at the closest point, separated by a farm track.
- Peak flock count of 110 from ECC 4, from a wetland area 350m to the west of the ECC at the closest point, separated by a farm track.
- Peak flock count of 120 from ECC 5, from an arable field 300m from the enabling access track to the north of the ECC.
- Peak flock count of 700 from ECC 5, from an arable field adjacent to the ECC 150m at the closest point.
- Peak flock count of 143 from ECC 5, from an arable field 250m to the east of the ECC.
- Peak flock count of 108 from ECC 6, from an arable field 250m from the enabling access track and 650m to the east of the ECC.
- Peak flock count of 110 from ECC 9, from an arable field 250m to the west of the ECC at the closest point, separated by a minor road.
- Peak flock count of 300 from ECC 11, from an arable field 300m to the west of the ECC at the closest point, separated by a field boundary.

- Peak flock count of 107 from ECC 11, from an arable field 350m to the east of the ECC at the closest point, separated by multiple farm tracks.
- Peak flock count of 200 from ECC 12, from an arable field 350m to the east of the ECC at the closest point, separated by multiple farm tracks.
- Peak flock count of 165 from ECC 13, from an arable field 550m to the northwest of the OnSS at the closest point, separated by the A16 road (within the 400m buffer).

~~1206.~~1360. In addition, in season one, a peak flock count of 2,500 was recorded just outside of the 400m buffer in ECC 6. The population of non-breeding lapwing of The Wash Ramsar is in unfavourable condition and the numbers have significantly declined from a citation population of 46,422 to the most recent WeBS estimate of 12,976. One study found that the population size has been limited by breeding success and not the availability of over-winter arable farmland habitat (Sheldon et al., 2004). BTO BirdFacts (2023) states that the population decline is due to breeding productivity dropping below a sustainable level. The peak flock count in season one of 400 represents approximately 0.06% of the GB~~UK~~ wintering population. The peak flock count in season two of 2,000 represents approximately 0.32% of the GB wintering population.

~~1207.~~1361. The identified breeding lapwing at Anderby Marsh will be protected from disturbance by the existing bund at Roman Bank as well as the extra mitigation bund to be installed on three sides of the landfall construction compound.

~~1208.~~1362. Lapwing is classified as a species of moderate sensitivity to disturbance in the Disturbance Toolkit, although it is noted that research into disturbance to wintering birds is limited. In relation to visual disturbance, a distance of 300m is cited at which 'high level' disturbance stimuli could elicit a disturbance response. The Toolkit considers that noise levels of up to 72dB at the feature would be acceptable, with caution above 55dB. It states that lapwing will roost to within 200m of plant and, therefore, a source noise generation of 115-120dB at 200m from lapwing may be acceptable, with caution above 87-92dB at 200m range.

~~1209.~~1363. Disturbance, in the absence of mitigation, has the potential to limit foraging and displace birds to potentially sub-optimal foraging and roosting locations and, therefore, has the potential to impact survival of lapwing within the vicinity. Lapwing primarily utilise arable fields within the survey area, and similar agricultural land is common in the surrounding area.

~~1210.~~1364. Embedded design and mitigation measures would also apply to non-breeding lapwing, including avoiding onshore impact piling other than at the OnSS; a 4m high earth bund at the landfall construction compound; and perimeter earth bunds along the open trenched sections.

~~1211.~~1365. The disturbance impact would be of temporary duration, of up to 51 months, and would not be uniform across the ECC during that time, with works occurring in discrete areas at any one time. The impact would be localised in relation to certain work activities, notably site establishment and restoration and Cable Installation Compound works (works within open trenched areas being partially screened by perimeter earth bunds). The impact would largely relate to arable field habitat, which is common in the surrounding area. Whilst the population has declined recently, this is due to declines relating to breeding success (rather than wintering habitat availability) and there is likely to be available alternative suitable wintering habitat for the remaining birds to use when displaced from areas around construction activity. Given the frequency of records and on a precautionary basis, temporary construction disturbance combined with temporary habitat loss may hinder the restoration of the population (and therefore, distribution) within the The Wash Ramsar (should the populations be linked), and, therefore **AEoI cannot be excluded** in the absence of additional mitigation.

Mitigation

~~1212.~~1366. Refer to the onshore ecology mitigation detailed in Section 6.~~6.~~

~~1213.~~1367. In order to minimise the potential for disturbance, and provide greater certainty to the conclusions, additional mitigation has been included in the form of a commitment to localised working. As detailed in Section 6~~6~~, works between November to February inclusive will be carried out by several small teams at discrete locations along the route, such as joint bay or link box installation, trenchless crossings, cable installation (pulling of cables through pre-installed ducts) and other non-intrusive earth works (e.g. cable testing). Assuming a works area of 100m at these sites and 10 active sites, this would account for approximately 1,000m of works or (1km / 70km) or 1.4% of the cable corridor at any one time. Activity on the remaining 98.6% of the corridor will be confined to the operatives taking daily access to the work site where this involves the use of a haul road and moving the drilling plant to the next site once the work at any location is complete.

~~1214.~~1368. Between April to September inclusive (weather dependent), the works area would account for approximately 5% of the cable corridor. During October and March, summer works will progressively be completed/started and transitioned between summer and winter working levels.

~~1215.~~1369. This commitment to localised working will ensure that disturbance is minimised, particularly during the period of November to February inclusive, with the level of works reducing in October and increasing in March, from/to maximum extents between April to September of approximately 5% of the route corridor at any one time.

~~1216.~~1370. The temporal spread of records of this species are presented in Table 9.113~~Table 9.78~~ and Table 9.114~~Table 9.79~~.

Table 9-114~~9.1139-9.78~~: Temporal spread of lapwing records from ~~Year 1~~season one and season two non-breeding bird surveys (Order Limits plus 400m buffer)

Metric (Survey Type)	Month							
	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr

Metric (Survey Type)	Month							
Season one:								
Peak Count (Coastal OP Surveys)	0	0	0	0	0	0	0	--
Peak Flock Count (ECC Surveys)	0	0	324	138	230	400	250	-
Total Number of Flocks	0	0	20	78	48	55	29	-
Season two:								
Peak Count (Coastal OP Surveys)	0	0	0	0	0	0	0	0
Peak Flock Count (ECC Surveys)	3	2000	1500	700	1200	1000	88	6
Total Number of Flocks	1	7	16	44	47	21	12	8

Table 9-115~~9.1149~~ ~~9.79~~: Temporal spread of lapwing records from nearby BTO WeBS Sector Counts

5 Year Average - BTO WeBS Counts								
Sector	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr
Frampton North 41	62	32	167	169	56	65	0	5
Frampton North 23	0	3	94	536	13	103	1	1
Frampton North 60	0	0	0	0	0	0	0	0
Anderby	0	0	5	30	130	25	0	1
Burgh Marsh Zone 1	5	1	57	40	300	150	50	37

~~1217.~~1371. These data suggest that lapwing occur in larger numbers from ~~**November**~~ October **to March inclusive.**

~~1218.~~1372. The additional mitigation of suspending works during periods of freezing weather will also reduce the potential disturbance impact on this species.

~~1219.~~1373. Further specific mitigation options included at PEIR stage included the use of temporary screening during potentially disturbing construction works within and adjacent to areas used by significant numbers of waterbirds. Those fields listed above are the locations where the greatest aggregations of non-breeding lapwing have been recorded. Whilst the inherent characteristics of some arable fields make them more suitable for lapwing, such as their size and sightlines, usage will also vary with crop rotation. Given their widespread distribution, the localised working commitment will mitigate the potential for construction disturbance, and it is considered that screening is not appropriate.

Integrity Test (Alone) – Mitigated

~~1220.~~1374. With the embedded and additional mitigation measures in place, the potential for disturbance will be reduced and disturbance would:

- Not affect the restoration of the non-breeding population.

~~1221.~~1375. Therefore, **there will be no AEoI of the Wash Ramsar in relation to non-breeding lapwing for the Project alone during construction and decommissioning.**

Feature 3: Golden Plover

Implication for Conservation Objectives Unmitigated

~~1222.~~1376. Golden plovers were observed on three occasions with a peak count of 23 individuals during a single Coastal OP (landfall) survey. In season one, 79 observations were recorded across ten ECC segments and during a total of 12 walkover survey visits with a peak flock count of 250 individuals. Observations were of birds feeding and loafing within fields across the survey area. LWT advised that 175 golden plovers were recorded at Anderby Marsh in February 2023. In season two, 30 observations were recorded across 12 ECC segments and during a total of six visits with a peak count of **2,000 individuals in ECC 12**.

~~1223.~~1377. In season one, ~~N~~notable flocks (of >100 birds) within the potential disturbance area (excluding habitat loss areas which have been assessed separately) were:

- Peak flock count of 110 from Anderby Marsh.
- Peak flock count of 250 from ECC 6 (same field as peak flock count of 2,500 lapwing) from an arable field which the ECC will run through. The centre of the field is 250m, and the furthest point of the field is 600m, from the ECC. The ECC runs through a corner of the field only. A peak flock count of 950 golden plover were recorded close to but outside of the 400m buffer.
- Peak flock count of 145 from ECC 8, from an arable field adjacent to the ECC (300m from it at the furthest point).

1378. In season two, notable flocks (of >100 birds) within the potential disturbance area (excluding habitat loss areas which have been assessed separately) were:

- Peak flock count of 300 from ECC 3, from an arable field adjacent to the ECC and 150m to the north of it.
- Peak flock count of 100 from ECC 5, from an arable field 350m to the east of the ECC and 200m from the enabling access track.
- Peak flock count of 2,000 from ECC 12, from an arable field 350m to the east of the ECC and separated by a farm track.

~~1224.~~1379. Whilst the species has a widespread distribution across the survey area, the numbers and frequency are lower than for lapwing, with ~~only three~~ eight fields identified supporting groups of >100 birds. Golden plover population status at various spatial scales is detailed within the Habitat Loss section for this species.

~~1225.~~1380. Golden plover is a non-breeding qualifying feature of Humber Estuary SPA and Ramsar and The Wash Ramsar.

~~1226.~~1381. The relevant SACO targets for non-breeding golden plover of Humber Estuary SPA are:

- “Restore the size of the non-breeding population to a level which is above 30,709 wintering individuals, whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent”.

- "Reduce the frequency, duration and/or intensity of disturbance affecting roosting, foraging, feeding, moulting and/or loafing birds so that they are not significantly disturbed".

~~1227.~~1382. It clarifies that "Disturbance should be judged as significant if an action (alone or in combination with other effects) impacts on (water)birds in such a way as to be likely to cause impacts on populations of a species through either:

- changed local distribution on a continuing basis; and/or
- changed local abundance on a sustained basis; and/or
- the reduction of ability of any significant group of birds to survive, breed, or rear their young."

~~1228.~~ The Wash Ramsar population has a "restore" objective and the population has declined from 22,033 at citation to 15,601 at the latest BTO WeBS count (2017/18-2021/22). The Humber SPA and Ramsar populations have "restore" objectives, with a population of 30,709 at citation and 20,812 at the latest BTO WeBS count (2017/18-2021/22). ~~The peak flock count of 250 represents approximately 0.23% of the GB winter population.~~ The peak flock count in season two of 2,000 (recorded outwith the ECC but within the 400m buffer) represents approximately 0.49% of the UK winter population, however, the majority of the peak flock counts were substantially lower than 1,000.

~~1229.~~1383. A Natural England and RSPB report (2019) indicates that the breeding population is facing high level threats from climate change and non-climatic threats, whereas the wintering populations may benefit from climate change and face low level non-climatic threats, although it is also declining in GB. The winter population is, however, increasing in Europe and undergoing an eastwards range shift, potentially due to climate change (Birdlife International, 2024), indicating that otherwise suitable habitat has been vacated in GB. Therefore, winter habitat availability would not be a limited resource in GB.

~~1230.~~1384. Golden plover is classified as a species of moderate sensitivity to disturbance in the Disturbance Toolkit (Cutts et al., 2013), although it is noted that research into disturbance to wintering birds is limited. In relation to visual disturbance, a distance of 200m is cited at which 'high level' stimuli could cause disturbance. The Toolkit considers that noise levels up to 72dB at the receptor would be acceptable, with caution above 55dB. It states that golden plover will roost to within 300m of plant and considers a source noise generation of 120-115dB at 300m from golden plover may be acceptable, with caution above 107-112dB. In the absence of specific mitigation and on a precautionary basis, the onshore Project works may cause disturbance to golden plover utilising farmland habitats at a distance of up to 300m.

~~1231.~~1385. The disturbance impact assessment and relevant embedded mitigation measures are the same as described for lapwing, on the basis of their similar distribution, habitat preferences, sensitivity to disturbance and that winter habitat availability is not a limiting factor for the population. Given the much lower abundance and frequency of records compared to lapwing, as well as the ~~availibilty~~availability of large areas of alternative foraging ~~habiat~~habitat, temporary construction disturbance combined with temporary habitat would not hinder the restoration of the populations of Humber Estuary SPA, Ramsar or Wash Ramsar, and, **therefore there is no potential for AEoI**.

Additional mitigation

Refer to the onshore ecology mitigation detailed in Section ~~-~~ 6~~6~~. The proposed additional mitigation measures described for lapwing will also be applied, and be equally applicable, for this species. The available data, as presented in Table 9.115~~Table 9.80~~ and Table 9.116~~Table 9.81~~, suggest that golden plover occur in larger numbers from ~~**November**~~ **October to March inclusive**, as is the case for lapwing.

Table 9-116~~9.115~~~~9-9.80~~: Temporal spread of golden plover records from ~~Year 1~~season one and season two non-breeding bird surveys (Order Limits plus 400m buffer)

Metric (Survey Type)	Month							
	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr
Season one:								
Peak Count (Coastal OP Surveys)	23	0	~~0~~34	0	0	0	0	-
Peak Flock Count (ECC Surveys)	23	31	250	87	70	128	145	-
Total Number of Flocks	1	1	12	35	12	6	12	-
Season two:								
Peak Count (Coastal OP Surveys)	0	0	0	0	0	0	0	0
Peak Flock Count (ECC Surveys)	0	2000	102	500	1000	0	47	0
Total Number of Flocks	0	1	3	18	7	0	1	0

Table 9-117~~9.116~~~~9-9.81~~: Temporal spread of golden plover records from nearby BTO WeBS Sector Counts

5 Year Average - BTO WeBS Counts								
Sector	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr
Frampton North 41	1	0	150	1	0	0	0	0
Frampton North 23	0	0	0	0	0	0	0	10
Frampton North 60	0	0	0	0	0	0	0	0
Anderby	0	0	0	0	15	0	0	0
Burgh Marsh Zone 1	0	0	80	0	0	15	0	0

Integrity Test (Alone) – Mitigated

~~1232.~~1386. With the embedded design and mitigation measures in place, the potential for disturbance will be reduced, and given the lower frequency and abundance than lapwing, and greater confidence in the availability of winter habitat, disturbance would:

- Not affect the restoration of the non-breeding populations; and
- Not inhibit reduction in disturbance such that the populations are not significantly disturbed.

~~1233.~~1387. **Therefore, there will be no AEoI of Humber SPA, Ramsar or Wash Ramsar in relation to non-breeding golden plover for the Project alone during construction and decommissioning.**

Features 4, 5 and 6: Curlew, Oystercatcher and Redshank

Implication for Conservation Objectives Unmitigated

~~1234.~~ In season one, **curlew** were observed on 17 occasions with a peak count of 18 individuals during the Coastal OP (landfall) surveys. In season two, there was only a single observation of eight curlew during the Coastal OP surveys. In season one, 255 observations were recorded across all 14 ECC segments and during a total of 12 walkover survey visits with a peak flock count of 56 individuals in ECC 8. In season two, 160 observations were recorded across 13 ECC segments and during a total of 14 visits with a peak flock count of **103 individuals in ECC 12**~~**Curlew** were observed on 17 occasions with a peak count of 18 individuals during the Coastal OP (landfall) surveys. The curlews were observed to be foraging (52.4%) and flying (47.6%). 255 observations were recorded across all 14 ECC segments and during a total of 12 walkover survey visits with a peak flock count of 56 individuals. The most common behaviour observed was foraging~~.

~~1235.~~1388. Curlew were widespread throughout the survey area, utilising arable and pasture fields, as well as Anderby Marsh (ECC 1) and The Haven (ECC 10 and 11). There were no records of breeding curlew from the 2023 breeding bird surveys.

~~1236.~~1389. In season one, ~~N~~notable flocks (of >50 birds) within the potential disturbance area (excluding habitat loss areas which have been assessed separately) were:

- Peak flock count of 54 curlew from an arable field 250m west of the ECC (an open trenched section) at the closest point in ECC 5.
- Peak flock count of 56 from an arable field 150m from the ECC at the closest point (450m at the further point) and separated by a minor road in ECC 8.

1390. In season two, notable flocks (of >50 birds) within the potential disturbance area (excluding habitat loss areas which have been assessed separately) were:

- Peak flock count of 89 curlew from an arable field in ECC 5, 350m north of the ECC (and 300m from the enabling access track).
- Peak flock count of 74 curlew from an arable field in ECC 5, 350m north of the ECC.
- Peak flock count of 100 curlew from an arable field in ECC 5, adjacent to the ECC.
- Peak flock count of 52 curlew from an arable field in ECC 11, adjacent to the ECC.

~~1237.~~1391. Whilst the species has a widespread distribution across the survey area, the numbers are lower than for lapwing and golden plover, with only two fields identified supporting groups of >50 birds.

~~1238.~~1392. Curlew is a non-breeding qualifying feature of The Wash SPA and Ramsar.

~~1239.~~1393. The relevant SACO targets for non-breeding curlew of The Wash SPA are:

- "Maintain the size of the non-breeding population to a level which is above 3,700 individuals, whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent".

- "Reduce the frequency, duration and/or intensity of disturbance affecting roosting and/or foraging birds so that they are not significantly disturbed".

~~1240.~~1394. The Wash SPA population has a "maintain" SACO objective and the population has increased from 3,700 at citation to 5,759 at the latest BTO WeBS count (2017/18-21/22). The peak flock count of 103 recorded in season two, represents approximately 0.08% of the GB winter population.~~The peak flock count of 56 represents approximately 0.09% of the GB winter population.~~

~~1241.~~1395. Research indicates that the main cause of the population decline relates to habitat changes at breeding sites (BTO BirdFacts, 2023) and, therefore, availability of winter habitat is not a major limiting factor. The same sources states "a study of colour-ringed birds wintering in south-west England suggested that apparent survival was highest during winter, and hence the main threats to this wintering population appeared to be during the breeding season or on migration (Robinson et al. 2020)".

~~1242.~~1396. Curlew is classified as a species of moderate sensitivity to disturbance in the Disturbance Toolkit. In relation to visual disturbance, a distance of 300m is cited at which 'moderate' and 'high level' disturbance stimuli could cause disturbance. The Toolkit considers that noise levels up to 117-122dB at source would be acceptable when birds are at 300m range.

~~1243.~~1397. The disturbance impact assessment and relevant embedded mitigation measures are the same as described for lapwing, on the basis of their similar distribution, broad habitat preferences, sensitivity to disturbance and that winter habitat availability is not a limiting factor for the population. With the embedded design and mitigation measures in place, disturbance will be minimised, and there would be no appreciable negative change in population size or distribution and, therefore, **no potential for AEoI** due to construction disturbance.

~~1244.~~1398. The additional mitigation measures described for lapwing will also be applied, and equally reduce the risk of disturbance effects on the population, for this species. The available data, as presented in Table 9.117~~Table 9.82~~ and Table 9.118~~Table 9.83~~, suggest that curlew occur in larger numbers from **November to March inclusive**, similarly as is the case for lapwing.

Table 9-118~~9.1179-9.82~~: Temporal spread of curlew records from ~~Year 1~~season one and season two non-breeding bird surveys (Order Limits plus 400m buffer)

Metric (Survey Type)	Month							
	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr
Season one:								
Peak Count (Coastal OP Surveys)	0	2	0	0	0	18	6	-
Peak Flock Count (ECC Surveys)	0	6	35	56	28	44	54	-
Total Number of Flocks	~~-~~0	6	21	58	58	56	56	-
Season two:								
Peak Count (Coastal OP Surveys)	0	8	0	0	0	0	0	0
Peak Flock Count (ECC Surveys)	0	6	103	52	74	100	49	4
Total Number of Flocks	0	6	25	53	17	30	18	12

Table 9-119~~9.118~~9-~~9.83~~: Temporal spread of curlew records from nearby BTO WeBS Sector Counts

5 Year Average - BTO WeBS Counts								
Sector	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr
Frampton North 41	0	0	0	0	0	0	0	0
Frampton North 23	28	7	5	11	10	9	3	4
Frampton North 60	0	0	0	1	0	0	0	0
Anderby	1	6	5	22	17	61	25	2
Burgh Marsh Zone 1	0	19	19	5	32	5	67	8

~~1245.~~ In season one, oystercatchers were observed on eight occasions with a peak count of two individuals as part of Coastal OP (landfall) surveys. In season two, only single birds were observed on six visits. In season one, 22 observations were recorded across eight ECC segments and during a total of nine walkover survey visits with a peak flock count of **23 individuals in ECC 11.** In season two, 18 observations were recorded across eight ECC segments and during a total of eight visits with a peak count of four individuals. ~~**Oystercatchers** were observed on eight occasions with a peak count of two individuals as part of the Coastal OP (landfall) surveys. 22 observations were recorded across eight ECC segments and during a total of nine walkover survey visits with a peak flock count of 23 individuals. The most common behaviour observed was foraging.~~

~~1246.~~1399. The relevant SACO targets for non-breeding oystercatcher of The Wash SPA are:

- "Maintain the size of the non-breeding population to a level which is above 24,000 individuals, whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent".
- "Reduce the frequency, duration and/or intensity of disturbance affecting roosting and/or foraging birds so that they are not significantly disturbed".

~~1247.~~1400. Oystercatcher is classified as a species of moderate sensitivity to disturbance in the Disturbance Toolkit. In relation to visual disturbance, a distance of 200m is cited at which 'moderate' and 'high level' disturbance stimuli could be elicit a disturbance response. The Toolkit considers that noise levels up to 72dB at the receptor, with caution applied at levels above 55dB. In the absence of specific mitigation and on a precautionary basis, the onshore Project works may cause disturbance to non-breeding oystercatcher utilising farmland habitats at a distance of up to 300m.

~~1248.~~1401. The disturbance impact assessment and relevant embedded mitigation measures are the same as described for lapwing, on the basis of their similar distribution, sensitivity to disturbance and that winter habitat availability is not a limiting factor for the population. With the embedded design and mitigation measures in place, disturbance will be minimised, and there would be no appreciable negative change in population size or distribution and, therefore, **no potential of AEoI** due to construction disturbance.

~~1249.~~1402. The additional mitigation measures described for lapwing will also be applied, and equally reduce the risk of disturbance effects on the population, for this species.

~~1250.~~1403. In season one, a total of two **redshanks** were observed on one occasion (24/01/23) during the Coastal OP (landfall) surveys, both foraging. In season two, redshank were recorded foraging on four visits with a peak count of 11 individuals. In season one, 48 observations were recorded across ten ECC segments and during a total of 11 walkover survey visits with a peak flock count of 35 individuals in ECC 5. In season two, 106 observations were recorded across 11 ECC segments with a peak flock count of **41 individuals in ECC 11**. ~~A total of two **redshanks** were observed on one occasion (24/01/23) during landfall surveys, both foraging. 48 observations were recorded across ten ECC segments and during a total of 11 walkover survey visits with a peak flock count of 35 individuals.~~ The were some aggregations of records from the River Welland, The Haven and Anderby Marsh. Otherwise, the species was typically associated with main drains and field drains. The peak count from the landfall through the tide surveys was ~~one~~ five and the species was only present on ~~1~~5% of counts.

~~1251.~~1404. There were no notable flocks (of >50 birds) within the potential disturbance area (excluding habitat loss areas which have been assessed separately). There were no records of breeding redshank from the 2023 breeding bird surveys.

~~1252.~~1405. The relevant SACO targets for non-breeding redshank of Humber Estuary SPA are:

- "Restore the size of the non-breeding population to a level which is at or above 4,632 wintering individuals and 7,462 individuals during passage, whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent".
- "Reduce the frequency, duration and / or intensity of disturbance affecting roosting, foraging, feeding, moulting and/or loafing birds so that they are not significantly disturbed".

~~1253.~~1406. The relevant SACO targets for non-breeding redshank of the Wash SPA are:

- "Maintain the size of the population at a level which is above 4,331 individuals, whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent".
- "Reduce the frequency, duration and / or intensity of disturbance affecting roosting, foraging, feeding, moulting and/or loafing birds so that they are not significantly disturbed".

~~1254.~~1407. Redshank is a non-breeding qualifying feature of The Wash SPA and Ramsar, and Humber Estuary SPA and Ramsar and a passage feature of the Humber Estuary Ramsar. The most recent BTO WeBS count for The Wash is 5,329, whereas the citation population for The Wash SPA was 4,331 and the objective is to maintain the population. The Wash Ramsar citation population was, however, higher at 6,373. The most recent WeBS count for The Humber Estuary is 2,659, whereas the citation population for The Humber Estuary SPA and Ramsar was 4,632 and the conservation objective is to restore.

~~1255.~~1408. A study of non-breeding waders at Cardiff Bay (Burton et al., 2002) found that densities of curlew, oystercatcher and redshank were significantly reduced adjacent to construction work. Disturbance, in the absence of mitigation, has the potential to limit foraging and displace birds to potentially sub-optimal roosting locations and therefore has the potential to impact survival of these waders within the vicinity. This could undermine the population/abundance conservation objective for the designated sites, and the SACO target of the SPAs to reduce disturbance, leading to an AEoI of those designated sites.

~~1256.~~1409. With the use of trenchless techniques to cross the main watercourses and avoid Anderby Marsh, The Haven and Welland, as well as the embedded mitigation measures, potential disturbance will be minimised. Combined with the low numbers of redshank recorded within the survey area, there would be no appreciable negative change in population size or distribution and, therefore, **no potential for AEoI** due to construction disturbance.

~~1257.~~1410. The additional mitigation, particularly the seasonal restriction to works around The Haven area, will further reduce the potential for disturbance to this species.

Additional mitigation

~~1258.~~1411. Refer to the onshore ecology mitigation detailed in Section 6~~6~~.

Integrity Test (Alone) – Mitigated

~~1259.~~1412. With the embedded and additional mitigation (as described for lapwing) in place, disturbance will be minimised, localised and temporary, not enough to change the local distribution or abundance for any more than a short period or reduce the ability of a significant group to survive.

~~1260.~~1413. It is concluded that disturbance would:

- Not inhibit restoration or maintenance (as relevant) of the non-breeding populations; and
- Not inhibit reduction in disturbance such that the populations are not significantly disturbed.

~~**1261.**~~**1414.** Therefore, there will be **no AEoI of The Wash SPA and Ramsar and Humber SPA and Ramsar in relation to non-breeding curlew, oystercatcher and redshank for the Project alone during construction and decommissioning.**

Features 7 and 8: Dunlin and Sanderling

Implication for Conservation Objectives Unmitigated

~~1262.~~ In season one, **dunlin** were observed on three occasions with a peak count of 12 individuals (05/12/22), as part of the Coastal OP (landfall) surveys. In season two, 24 roosting dunlin were observed on 26/03/2024. In season one, five observations were recorded during a total of four walkover visits mostly in ECC 1 and ECC 11 with a peak flock count of **46 individuals in ECC 11**. In season two, nine observations were recorded during a total of eight visits in four ECC segments with a peak flock count of nine individuals. ~~**Dunlin** were observed on three occasions with a peak count of 12 individuals (05/12/22), as part of the Coastal OP (landfall) surveys. Five observations were recorded during a total of four walkover visits mostly in ECC 1 with a peak flock count of **46 individuals**. These birds were observed to be mostly foraging.~~

~~1263.~~1415. For non-breeding dunlin of the Humber Estuary SPA, the SACO targets relevant to habitat loss are:

- "Restore the size of the non-breeding population to a level which is above 22,222 wintering individuals and 20,269 individuals during passage, whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent".
- "Reduce the frequency, duration and / or intensity of disturbance affecting roosting, foraging, feeding, moulting and/or loafing birds so that they are not significantly disturbed".

~~1264.~~1416. For non-breeding dunlin of The Wash SPA, the SACO targets relevant to disturbance are:

- "Restore the size of the non-breeding population at a level which is above 29,000 individuals, whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent".
- "Reduce the frequency, duration and / or intensity of disturbance affecting roosting, foraging, feeding, moulting and/or loafing birds so that they are not significantly disturbed".

~~1265.~~1417. Dunlin is classified as a species of low sensitivity to disturbance in the Disturbance Toolkit. In relation to visual disturbance, a distance of 75m is cited at which 'high level' stimuli could cause disturbance. The Toolkit considers that noise levels up to 72dB at the receptor are acceptable, with caution applied at levels above 60dB. In the absence of specific mitigation and on a precautionary basis, the onshore Project works may cause disturbance to non-breeding dunlin at a distance of up to 200m.

~~1266.~~1418. In season one, **sanderling** were observed during Coastal OP (landfall) surveys on 14 occasions across nine visits with a peak count of 13 individuals (05/12/22). In season two, were observed on 13 visits with a peak count of **57 individuals** (on 09/11/23). In both seasons, the sanderlings were observed to be mostly foraging. No sanderling were recorded during walkover survey in season one; in season two, a single flock of 19 individuals was recorded foraging in ECC 1.~~**Sanderling** were observed only during Coastal OP (landfall) surveys on 14 occasions across nine visits with a peak count of 13 individuals, which represents 0.12% of the most recent population estimation for the Wash SPA and Ramsar. There is no recent population estimation for Gibraltar Point Ramsar. The sanderlings were observed to be mostly foraging.~~

~~1267.~~1419. For non-breeding sanderling of the Humber Estuary SPA, the SACO targets relevant to habitat loss are:

- "Maintain the size of the population at a level which is above 500 individuals, whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent".
- "Reduce the frequency, duration and / or intensity of disturbance affecting roosting, foraging, feeding, moulting and/or loafing birds so that they are not significantly disturbed".

~~1268.~~1420. For non-breeding sanderling of the Gibraltar Point SPA, the SACO targets relevant disturbance are:

- "Maintain the size of the non-breeding population at a level which is above 1,140, whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent".

- "Reduce the frequency, duration and / or intensity of disturbance affecting roosting, foraging, feeding, moulting and/or loafing birds so that they are not significantly disturbed".

~~1269.~~1421. Sanderling is classified as a species of low sensitivity to disturbance in the Disturbance Toolkit. In relation to visual disturbance, a distance of 50m is cited at which 'high level' stimuli could cause disturbance. The Toolkit considers that noise levels up to 75B at the receptor are acceptable, with caution applied at levels above 60dB. In the absence of specific mitigation and on a precautionary basis, the onshore Project works may cause disturbance to non-breeding sanderling at a distance of up to 200m.

~~1270.~~1422. Disturbance, in the absence of mitigation, has the potential to limit foraging and displace birds to potential sub-optimal roosting locations and therefore has the potential to impact survival of dunlin and sanderling within the vicinity. As would be expected based on habitat requirements, sanderling were recorded from the beach at the landfall ~~only during winter 2022-23 bird surveys~~.

~~1271.~~1423. Both species were recorded at low abundances and frequency during the winter bird surveys. The peak count of 46 dunlin (frequency 1) was recorded on the River Haven, 350 m from the Order Limits (ECC 11). The second largest peak count of 36 dunlin (frequency 4) was recorded within the landfall trenchless work area. There are embedded mitigation strategies for both areas detailed in Section 6 ~~6~~. It is, therefore, concluded that any potential disturbance to these species arising from onshore construction activity would be of negligible magnitude and there is **no potential for AEoI**.

Additional mitigation

~~1272.~~1424. Refer to the onshore ecology mitigation detailed in Section 6~~6~~.

Integrity Test (Alone) –Mitigated

~~1273.~~1425. With the mitigation in place, disturbance will be minimised, localised and temporary, not enough to change the local distribution or abundance for any more than a short period or reduce the ability of a significant group to survive.

~~1274.~~1426. It is concluded that disturbance would:

- Not affect the restoration or maintenance (as relevant) of the non-breeding populations; and
- Not inhibit reduction in disturbance such that the populations are not significantly disturbed.

~~**1275.**~~**1427.** Therefore, there will be **no AEoI of The Wash and Humber SPAs and Ramsar and Gibraltar Point Ramsar in relation to non-breeding dunlin and sanderling for the Project alone during construction and decommissioning.**

Features 17 and 18: Dark-bellied brent goose and pink-footed goose

~~1276.~~1428. In season one, **dark-bellied brent geese** were observed on two occasions with a peak count of seven individuals (24/10/22) during the Coastal OP (landfall) surveys. All records were of flying brent geese. There were no observations of this species during the Coastal OP surveys made in season two. During walkover surveys in season one, 13 observations were recorded across eight walkover survey visits all in ECC 10 and 11 with a peak flock count of **1,100 individuals**. In season two, 24 observations were recorded across 12 visits predominantly in ECC 10 and 11 with a peak flock count of 650 individuals.~~Dark-bellied brent geese were observed on two occasions with a peak count of seven individuals (24/10/22) during the Coastal OP (landfall) surveys. All records were of flying brent geese. 13 observations were recorded across eight walkover survey visits mostly in ECC 10 and 11 with a peak flock count of 1,100 individuals.~~ The most common behaviour observed was foraging.

~~1277.~~1429. In season one, ~~A~~all except one of the brent goose records within the onshore Order Limits plus 400m buffer were recorded at The Haven during the 2022-23 ECC winter surveys, both in fields and saltmarsh. Brent geese were recorded from the following locations within the potential disturbance area (excluding habitat loss areas which have been assessed separately):

- The highest peak flock count of 1,100 was from an arable field east of the river and 200m to the south of the ECC (Cable Installation Compound section) at the closest point.
- A peak flock count of 48 from an arable field located 130m to the north of the ECC (Cable Installation Compound) at the closest point in ECC 11.
- Peak flock counts of 370, 148 and 81 from the River Haven and associated inter-tidal banks, within the HDD section (no haul road). The HDD compound areas are set back from the riverbank approximately 100m on either side. The river channel is contained within two bunds, which provide screening between the adjacent fields and the river/inter-tidal habitats, with an intervening line of trees also present parallel with the west bank.
- A peak flock count of 250 from the saltmarsh west of the river (within The Wash SPA boundary) and approximately 200m to the south of the ECC (Cable Installation Compound section) at the closest point. A bund is present between the saltmarsh and the ECC area, providing screening.

1430. In season two, brent geese were recorded from the following locations within the potential disturbance area (excluding habitat loss areas which have been assessed separately):

- A flock of 600 in ECC 10 from an arable field 250m to the west from of the ECC (Cable Installation Compound section).
- A flock of 21 in ECC 10 from an arable field 300m to the east of the ECC (Cable Installation Compound section).
- A peak count of 180 in ECC 11 from an arable field 350m to the east from the ECC (Cable Installation Compound section), set back from the approximately 400m from the Haven.
- A flock of 450 in ECC 11 from an arable field 100m to the east from the ECC (Temporary Access Track) set back approximately 600m from the Haven.

- A peak count of 300 in ECC 11 from an arable field 250m to the east from the ECC (Secondary Construction Compound), set back 300m from ~~t~~The Haven.
- A peak count of 650 from ECC 11 from a grassland in a riparian zone 350m to the east from the ECC (Cable Installation Compound section), set back 100m from the Haven.
- A flock of 88 in ECC 12 from an arable field 380m from the ECC (Cable Installation Compound section).
- A flock of 14 in ECC 12 from an arable field 350m from the ECC Cable Installation Compound section~~)~~.

~~1278.~~1431. For non-breeding dark-bellied brent goose of the Wash SPA, the SACO targets relevant to disturbance are:

- "Restore the size of the non-breeding population at a level which is above 17,000 individuals, whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent".
- "Reduce the frequency, duration and / or intensity of disturbance affecting roosting, foraging, feeding, moulting and/or loafing birds so that they are not significantly disturbed".

~~1279.~~1432. For non-breeding dark-bellied brent goose of Gibraltar Point Ramsar site, the conservation objective is set to "restore" the population.

~~1280.~~1433. The peak flock count of 1,100 recorded in season one represents approximately 0.81% of the GB winter population. The Disturbance Toolkit classifies brent goose as a species of high sensitivity to visual and noise disturbance and advises that for any visible construction works planned within 400m of brent geese consideration should be given to mitigation options. Owens (1977) however states: "Brent geese quickly become habituated to most sounds. Unexpected ones, such as nearby gun shots from wildfowlers, usually put the geese to flight. Similarly, the first shots of the day at the Colne Army ranges caused geese to leave the saltings for the mudflats. They quickly returned however and ignored all subsequent firing that day. At Foulness, the extremely loud but regular bangs made during weapon testing caused little reaction after the first weeks. Brent Geese fed undisturbed 50m from passing trains at Leigh Marsh."

~~1281.~~1434. There may be line of sight between geese in the two arable field locations listed above and the Cable Installation Compound construction works and, therefore, a risk of displacement of geese from those locations. For the flocks observed on the river and saltmarsh habitats, the intervening bunds will provide a visual screen between birds on the ground and the construction area (other than potentially for tall machinery) and a noise attenuation barrier. Given the proximity, there remains a risk of displacement as a result of birds in flight choosing not to settle in those areas and/or from noise disturbance. The impact would be adverse, affecting a small section of The Haven and two adjacent fields, temporary (for a period of up to 42 months) and affecting up to 1,100 geese **(there is a potential for AEoI without additional mitigation).**

~~1282.~~1435. The additional mitigation for The Wash SPA and Ramsar, comprising a seasonal restriction to construction activity, to avoid works during the period of October to March inclusive within 400m of The Wash SPA, will reduce the potential disturbance impact to this species. Additionally, the seasonal restriction will be extended to cover the identified brent goose foraging areas adjacent to The Haven, as shown in Volume 2, Figure 22.4 (document reference 6.2.22.4).

~~1283.~~1436. The temporal spread of records of this species are presented in Table 9.119~~Table 9.84~~ and Table 9.120~~Table 9.85~~.

Table 9-120~~9.1199-9.84~~: Temporal spread of dark-bellied brent goose records from ~~Year 1~~season one and season ~~2~~two non-breeding bird surveys (Order Limits plus 400m buffer)

Metric (Survey Type)	Month							
~~Season one:~~	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr
Season one:								
Peak Count (Coastal OP Surveys)	0	7	0	4	0	0	0	-
Peak Flock Count (ECC Surveys)	0	81	250	487	48	1,100	370	-
Total Number of Flocks (ECC Surveys)	0	2	3	1	1	4	2	-
Season two:								
Peak Count (Coastal OP Surveys)	0	0	0	0	0	0	0	0
Peak Flock Count (ECC Surveys)	0	14	38	600	650	450	250	180
Total Number of Flocks (ECC Surveys)	0	1	3	3	4	6	3	4

Table 9-121~~9.1209-9.85~~: Temporal spread of dark-bellied brent goose records from nearby BTO WeBS Sector Counts

	5 Year Average - BTO WeBS Counts							
Sector	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr
Frampton North 41	0	0	0	5	1	1	1	0
Frampton North 23	0	0	31	36	103	35	37	4
Frampton North 60	0	40	6	31	140	5	0	0
Anderby	0	0	0	0	0	0	0	0
Burgh Marsh Zone 1	0	0	0	0	0	0	0	0

~~1284.~~1437. These data indicate that an appropriate seasonal restriction for dark-bellied brent geese at the Haven would apply from October to March inclusive.

~~1285.~~1438. This will ensure that disturbance impacts are minimised to the three functionally linked areas listed above because no works will occur within 400m of them during the core non-breeding period when the geese are present. This excludes the field in ECC 11 with a peak flock count of 48 in season one, two records from ECC 10 (600 and 21) and two records from ECC 12 (88 and 14) in season two, which ~~is~~ are located further away from the cluster around the Haven but is within 400m of the Order Limits. ~~This is excluded as it is a single~~ These records ~~of a relatively small~~are at least 250m ~~flock~~ away from the ~~area of clustered activity~~ECC. With this additional mitigation in place, there would be no appreciable negative change in population size or distribution and, therefore, no significant effect on dark-bellied brent geese due to construction disturbance.

~~1286.~~1439. In season one, **pink-footed geese** were observed on two occasions with a peak count of two individuals during the Coastal OP (landfall) surveys. All records were of flying pink-footed geese. In season two, there were no observations during the Coastal OP surveys. During walkover surveys in season one, 27 observations were recorded across nine ECC segments and during a total of 12 walkover survey visits with a peak flock count of 217 individuals in ECC 4. In season two, 23 observations were recorded across nine ECC segments and during a total of seven visits with a peak flock count of **5,000 individuals in ECC 10**. Some large (more than 1,000 individuals) flocks were also recorded in ECC 5 and ECC 7. ~~**Pink-footed geese** were observed on two occasions with a peak count of two individuals (24/10/22) during the Coastal OP (landfall) surveys. All records were of flying pink-footed geese. 27 observations were recorded across nine ECC segments and during a total of 12 walkover survey visits with a peak flock count of 217 individuals.~~

1440. Pink-footed goose is not included in the Disturbance Toolkit but is likely to have a similar sensitivity to construction disturbance to that described for brent goose and may be impacted by visual and noise disturbance at a distance of up to 400m from the source. Pink-footed geese were recorded during season one winter bird surveys utilising various fields along the onshore ECC, at relatively low frequency and mainly in low numbers but occasionally in larger flocks, including some which constitute a significant proportion of the designated site populations.

~~1287.~~1441. In season two, majority of pink-footed geese were recorded on bare earth/ ploughed fields (five registrations of a total of 8,122 bird records), followed by stubbles (eight registrations, a total of 2,269), grass (four registrations, a total of 2,157) and cereal crops (five registrations, a total of 1,743) (PD1-093).

~~1288.~~1442. In season one, ~~N~~notable flocks (of >50 birds) within the potential 400m disturbance buffer were:

- Peak flock count of 217 in ECC 4 in an arable field immediately adjacent to the ECC with various Cable Installation Compounds sections.
- Peak flock count of 107 from the edge of the 400m buffer in ECC 4.
- Peak flock count of 138 from ECC 5 in an arable field, 200m to the east of the ECC (a long open trenched section) at the closest point.

- Peak flock count of 67 from ECC 11 (TCC and trenchless works section), from saltmarsh by The Haven, 250m to the south of the ECC at the closest point, with an intervening bund.
- Peak flock count of 67 from ECC 11 from an arable field through which the ECC (open trench and Cable Installation Compounds) will run.

1443. In season two, notable flocks (of >50 birds) within the potential 400m disturbance buffer were:

- Peak flock count of 500 from ECC 1 (Open Cut or Trenchless) from an arable field 380m east of the ECC.
- Peak flock count of 750 from ECC 2 (various Cable Installation Compounds) from a grassland field 380m southwest from the ECC.
- Peak flock count of 450 from ECC 2 (Cable Installation Compounds) from an arable field 50m east from the ECC.
- Peak flock count 250 from ECC 3 (Cable Installation Compounds) from an arable field 350m east from the ECC.
- Peak flock count of 300 from ECC 3 (Enabling Access Track) from a grassland field 300m north from the ECC.
- Peak flock count of 93 from ECC 5 (Open Cut or Trenchless) from an arable field within the cable corridor.
- Peak count of 450 from ECC 5 (Open Cut or Trenchless) from an arable field 300m east from the ECC.
- Peak count of 1,400 from ECC 5 (Primary Construction Compound) from an arable field 200m from the compound.
- Peak count of 1,100 from ECC 7 (Open Cut or Trenchless) from an arable field 50m east from the ECC.
- Peak count of 310 from ECC 8 (Cable Installation Compounds) from an arable field 150m north from the ECC.
- Peak count of 900 from ECC 8 (Cable Installation Compounds) from an arable field 200m southeast of the ECC.
- Peak count of 800 from ECC 8 (Open Cut or Trenchless) from an arable field 100m from the ECC.
- Peak count of 5,000 from ECC 10 (Open Cut or Trenchless) from an arable field within the cable corridor.
- Peak count of 120 from ECC 11 (minor installations near Wyberton Road) from an arable field 150m from the nearest installation.
- Peak count of 75 from ECC 11 ((minor installations near Wyberton Road) from an arable field 380m from the nearest installation.

~~1289.~~1444. For non-breeding pink-footed goose of the Wash SPA, the SACO targets relevant to habitat loss are:

- "Maintain the size of the non-breeding population at a level which is above 7,300 individuals, whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent".
- "Reduce the frequency, duration and / or intensity of disturbance affecting roosting, foraging, feeding, moulting and/or loafing birds so that they are not significantly disturbed".

~~1290.~~1445. For non-breeding pink-footed goose of North Norfolk SPA, the SACO targets relevant to disturbance are:

- "Maintain the size of the non-breeding population at a level which is above 6,000 individuals, whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent".
- "Reduce the frequency, duration and / or intensity of disturbance affecting roosting, foraging, feeding, moulting and/or loafing birds so that they are not significantly disturbed".

~~1291.~~1446. For non-breeding pink-footed goose of the Wash Ramsar and North Norfolk Ramsar sites the conservation objective is set to "maintain" the populations.

1447. The peak flock count of ~~217~~ 5,000 represents approximately ~~0.04~~0.98% of the GB winter population (510,000 birds – BTO BirdFacts). All of the pink-footed geese were recorded within farmland habitats in season two winter bird surveys. The only location with a peak flock count of >50 birds recorded utilising non-farmland habitat was the peak count of 67 recorded by The Haven in season one, and as described for brent goose, birds may be displaced from that area in the absence of additional mitigation. The remaining notable groups were each from arable fields and there were only three identified from the whole survey area in season one. Whilst the inherent characteristics of some arable fields make them more suitable for geese, such as their size and sightlines, usage will vary with crop rotation.

~~1292.~~

~~1293.~~1448. The temporal spread of records of this species are presented in Table 9.121~~Table 9.86~~ and Table 9.122~~Table 9.87~~.

Table 9-122~~9.1219 9.86~~ Temporal spread of pink-footed goose records from ~~Year 1~~season one and season two non-breeding bird surveys (Order Limits plus 400m buffer)

Metric (Survey Type)	Month							
	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr
Season one:								
Peak Count (Coastal OP Surveys)	0	2	0	0	0	0	0	-
Peak Flock Count (ECC Surveys)	0	12	217	67	12	7	138	-
Total Number of Flocks (ECC surveys)	0	2	6	12	3	2	2	-
Season two:								
Peak Count (Coastal OP Surveys)	0	0	0	0	0	0	0	0
Peak Flock Count (ECC Surveys)	0	1100	0	5000	900	310	0	0
Total Number of Flocks (ECC surveys)	0	7	0	3	8	5	0	0

Table 9-123~~9.1229 9.87~~: Temporal spread of pink-footed goose records from nearby BTO WeBS Sector Counts

	5 Year Average - BTO WeBS Counts							
Sector	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr
Frampton North 41	0	0	0	0	0	0	0	0
Frampton North 23	0	0	0	0	0	0	0	0
Frampton North 60	0	0	0	0	0	0	0	0
Anderby	0	0	0	0	0	0	0	0
Burgh Marsh Zone 1	0	55	250	0	0	0	0	0

~~1294.~~1449. These data suggest that pink-footed goose occur in larger numbers in **from October and ~~early~~ throughout winter (November ~~and December~~to February) and early spring (March).**

~~1295.~~1450. Pink-footed geese feed on a range of agricultural crops and grassland, and will commute large distances to foraging grounds, typically up to 20km. BirdLife International (accessed 2023) states that “in its wintering areas the species is more reliant on grass, grain, vegetables (e.g. carrots, sugar beet (Kear 2005a)) and potatoes grown on agricultural land (del Hoyo et al. 1992)”. It also states “an investigation carried out in one of the species's wintering areas (UK) found that it was most likely to forage on grasslands a minimum of 6 ha in area, managed by livestock grazing or mechanical cutting, with an optimum sward height of 13-20 cm (although the species was also found to use heavily grazed land down to a sward height to 1.5 cm), at a distance of less than 10km away from roosting sites (the optimum distance was 2-5km away) (Vickery and Gill 1999)”. The species will, therefore, feed on a variety of crop types and typically utilises fields within 10km of roosting sites (most likely to be within the SPA/estuary).

~~1296.~~1451. It is noted that the Sheringham Shoal and Dudgeon Offshore Windfarm Extension DCO Application includes outline mitigation for FLL (Sheringham Shoal, 2023, Doc Ref 9.19). The Sheringham and Dudgeon Extension project has proposed the following mitigation (included here as an example only). They will survey all fields which are: >6ha in size; within a 200m buffer of the Order Limits; fall within 10.4km of the SPA boundary; and where works are due to commence between November and January inclusive. Where sugar beet is identified, the Nov-Jan seasonal restriction for construction activity would be enacted (regardless of identified goose presence). Where geese are identified, the seasonal restriction would be extended, unless and until they have exhausted the foraging resource. This approach, however, is not appropriate for the Project as there are a wide variety of crop types present, with sugar beet forming only a small proportion[11], and geese have a widespread distribution across the survey area.

[11] Cropping data for 1,000ha of the onshore Order Limits was undertaken in 2023 and of this only 20ha were sugar beet crop which was localised within ECC-9 Segment (representing 2% of the area that was surveyed)

~~1297.~~1452. Given the favourable conservation status of the population, the availability of alternative foraging habitat, the small scale of potential displacement relative to the foraging range, the temporary nature of the loss, and the peak flock count of 67 from non-arable habitat, it is concluded that there would be no appreciable negative change in population size or distribution and, therefore, **no AEoI due to temporary disturbance**.

~~1298.~~1453. Nevertheless, the additional mitigation to enact a seasonal restriction around The Haven, and in particular the localised working commitment as detailed for lapwing (in a previous section), would reduce the potential for disturbance of pink-footed geese, including avoiding disturbance to those using non-arable habitat within the designated site boundary (as a result of the seasonal restriction at The Haven).

Mitigation

~~1299.~~1454. Refer to the onshore ecology mitigation detailed in Section 6~~6~~.

Integrity Test (Alone) – Mitigated

~~1300.~~1455. With the mitigation in place, disturbance will be minimised, localised and temporary, not enough to change the local distribution or abundance for any more than a short period or reduce the ability of a significant group to survive.

~~1301.~~1456. It is concluded that disturbance would:

- Not affect the restoration or maintenance (as relevant) of the non-breeding populations; and
- Not inhibit reduction in disturbance such that the populations are not significantly disturbed.

~~1302.~~1457. Therefore, there will be **no AEoI of The Wash and North Norfolk SPAs and Ramsar sites in relation to non-breeding dark-bellied brent goose and pink-footed goose for the Project alone during construction and decommissioning.**

Features 19 and 20: Gadwall and Wigeon

Implication for Conservation Objectives Unmitigated

~~1303.~~1458. ~~9.6.442~~ There were no observations of **gadwall** as part of the Coastal OP (landfall) survey. During walkover surveys in season one, 13 observations were recorded across three ECC segments and during a total of six walkover survey visits with a peak flock count of 87 individuals in ECC 1. The most common behaviour observed was swimming. In season two, 47 observations were recorded across seven ECC segments and during a total of 14 visits with a peak flock count of **165 individuals in ECC 1**~~13 observations were recorded across three ECC segments and during a total of six walkover survey visits with a peak flock count of 87 individuals. The most common behaviour observed was swimming~~.

~~1304.~~1459. ~~9.6.443~~ In season one, ~~G~~gadwall was recorded within the 400m potential disturbance buffer ~~during winter 2022-23 bird surveys~~ in the following locations:

- The peak flock count of 87 was recorded from Anderby Marsh, which is located approximately 80m at the closest point from the landfall construction compound.
- There was also a peak flock count of five from Wolla Bank Pit Reserve.

- Peak flock count of two from a pond 140m from the ECC (Cable Installation Compound) and 60m from an access track in ECC 1.
- Three peak flock counts of one, two and two birds on the Wainfleet Relief Channel, approximately 200m from the ECC (temporary access track or Cable Installation Compound) in ECC 5.
- Two peak flock counts of two from the Steeping River.

1460. In season two, gadwall was recorded within the 400m potential disturbance buffer in the following locations:

- Peak flock count of 12 from ECC 4, from a wetland area 350m to the west of the ECC at the closest point, separated by a farm track.
- Peak flock count of two on the Wainfleet Relief Channel in ECC 5, approximately 250m from the ECC.
- Three peak flock counts of two, two and five birds in The Haven and adjacent relief channel in ECC 10 (trenchless work sections).
- Two peak flock counts of four and seven birds in the River Welland in ECC 13 (trenchless work sections).

~~1305.~~1461. For non-breeding gadwall of the Wash SPA, the SACO targets relevant to disturbance are:

- "Maintain the size of the non-breeding population at a level which is above 130 individuals, whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent".
- "Reduce the frequency, duration and / or intensity of disturbance affecting roosting, foraging, feeding, moulting and/or loafing birds so that they are not significantly disturbed".

~~1306.~~1462. The peak flock count of ~~87~~ 165 represents approximately 0.~~28~~53% of the GB wintering population. The recommended buffer for gadwall from construction activity is 200m (Wallis et al., 2019). There is a road and an existing earth mound (Roman Bank) separating the landfall construction compound from Anderby Marsh. In addition, as described in the introductory text for Impact 3, specific mitigation has been embedded in the design to further reduce potential disturbance to birds utilising Anderby Marsh, including a 4m high earth bund to be installed on the north, east and south sides of the landfall construction compound. As described in that section, this will reduce noise disturbance to the Marsh to below the threshold levels for significant disturbance to non-breeding waterbirds. The bund will also provide a screen between the compound and the other coastal nature reserves. The other flocks recorded were occasional records ~~each of one or two~~comprising of several birds only. With the specific landfall disturbance reduction mitigation in place, potential disturbance would be minimised and there would be **no potential for AEoI** on non-breeding gadwall.

~~1307.~~1463. There were no observations of **wigeon** during Coastal OP (landfall) surveys in season one. In season two, wigeon were observed on two visits with a peak count of 14 individuals. During walkover surveys in season one, 23 observations were recorded across five ECC segments and during a total of 11 walkover survey visits with a peak flock count of **460 individuals in ECC 1.** ~~There were no observations of **wigeons** during the Coastal OP (landfall) surveys. 23 observations were recorded across five ECC segments and during a total of 11 walkover survey visits with a peak flock count of 460 individuals. Apart from ECC 1, the segments where large flocks of wigeon were recorded were ECC 4, 5 and 11.~~ The most common behaviour observed was foraging.

~~1308.~~1464. In season one, ~~W~~wigeon was recorded within the 400m potential disturbance buffer ~~during winter 2022-23 bird surveys~~ in the following locations:

- The peak flock count of 460 was recorded from Anderby Marsh, which is located within the onshore Order Limits and approximately 80m at the closest point from the landfall construction compound.
- Peak flock counts of 130 and 78 from a pond 300m west of the ECC (Cable Installation Compound) and in ECC 4.
- Peak flock counts from arable fields of 35 (250m to west of ECC at closest point) and 80 (20m west of ECC at closest point) from a Cable Installation Compound section in ECC 5.
- Peak flock count of two from a pond 250m south of the ECC, open trenched section, and peak flock count of 12 from ponds 300m south of the ECC, Cable Installation Compound, in ECC 7.
- Peak flock count of 350 (frequency of 1) from within RSPB Frampton Marsh Reserve. This was at the very edge of the 400m buffer from the ECC corridor, and closer to two enabling access tracks, which will be used during mobilisation and demobilisation only.

1465. In season two, wigeon was recorded within the 400m potential disturbance buffer in the following locations:

- The peak flock count of 400 was recorded from Anderby Marsh, which is located within the onshore Order Limits and approximately 150m at the closest point from the landfall construction compound.
- Peak flock counts of 110 and 66 from a pond 300m west of the ECC (Cable Installation Compound) and in ECC 4.
- Peak flock count of seven from a pond 250m south of the ECC and peak flock count of two from ponds 300m south of the ECC, open trenched section, in ECC 7.
- Peak flock count of seven from a relief channel 500m north of the ECC (trenchless work section) in ECC 10.
- Peak flock counts of two and seven in the River Welland 250m south of the ECC (Cable Installation Compound) in ECC 12.
- Peak flock counts of nine and 14 in the River Welland 200m south of the ECC and 400m northeast of the ECC respectively (Cable Installation Compound and trenchless work section), in ECC 13 and 14.

~~1309.~~1466. For non-breeding widgeon of the Wash SPA, the SACO targets relevant to disturbance are:

- "Maintain the size of the population at a level which is above 3,900 individuals, whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent".
- "Reduce the frequency, duration and / or intensity of disturbance affecting roosting, foraging, feeding, moulting and/or loafing birds so that they are not significantly disturbed".

~~1310.~~1467. The peak flock count of 460 represents approximately 0.1% of the GB wintering population. The recommended buffer for wigeon from construction activity is 200m (Wallis et al., 2019). As described in the assessment of impacts to non-breeding gadwall at Anderby Marsh, with the existing landscape features and the embedded mitigation measures, disturbance will be minimised to non-breeding waterbirds utilising Anderby Marsh. The single additional area within 200m of the ECC, which was recorded in use during the winter ~~2022-23~~ bird surveys in season one, was a peak flock count of 80 in ECC 5. The field itself will have an access track along one edge and is 20m from the ECC at the closest point, however, only part of the field is within the 200m potential disturbance buffer, and half of it is closest to an open trenched section, as well as having an intervening ditch which is partially lined with trees. It's, therefore, likely that up to half of the field may be subject to disturbance displacement. The field itself is arable. Wigeon were also recorded from the adjacent arable field, which is beyond the potential disturbance distance from the ECC. The potential disturbance impact would be adverse, temporary and affecting a single land parcel recorded in use by wigeon, an arable field which is common in the local area.

~~1311.~~1468. The wigeon population of The Wash SPA is at favourable conservation status. The most recent WeBS count (2017/18-2021/22) is 14,452. With the specific landfall disturbance reduction mitigation in place, and seasonal restriction around The Haven, potential disturbance would be minimised and there would be no appreciable negative change in population size or distribution and, therefore, **no potential for AEoI.**

Additional mitigation

~~1312.~~1469. Refer to the onshore ecology mitigation detailed in Section 6.~~6.~~

Integrity Test (Alone) –Mitigated

~~1313.~~1470. With the mitigation in place, disturbance will be minimised, localised and temporary, not enough to change the local distribution or abundance for any more than a short period or reduce the ability of a significant group to survive.

~~1314.~~1471. It is concluded that disturbance would:

- Not reduce the size of the non-breeding populations; and
- Not inhibit reduction in disturbance such that the populations are not significantly disturbed.

~~1315.~~1472. Therefore, **there will be no AEoI of The Wash SPAs in relation to non-breeding gadwall and wigeon for the Project alone during construction and decommissioning.**

Feature 24: Common Scoter

Implication for Conservation Objectives Unmitigated

~~1316.~~1473. In season one, common scoters were observed on seven occasions during a total of six visits with a peak count of 40 individuals (10/01/23) as part of the Coastal OP (landfall) survey. They were observed to be swimming and foraging. In season two, one common scoter was observed on 11/04/24 as part of the Coastal OP (landfall) survey. ~~There were 12 observations of common scoter from the Landfall surveys and ten from the ECC surveys, during the winter 2022/23 bird surveys, with a peak count of 40 individuals. All records were offshore of the Landfall area, with five flocks feeding, four swimming and one loafing.~~ All records were >350m offshore from MHWS, ranging to 590m offshore.

~~1317.~~1474. For non-breeding common scoter of the Wash SPA, the SACO targets relevant to disturbance are:

- "Maintain the size of the population at a level which is above 830 individuals, whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent".
- "Reduce the frequency, duration and / or intensity of disturbance affecting roosting, foraging, feeding, moulting and/or loafing birds so that they are not significantly disturbed".

~~1318.~~1475. As would be expected based on habitat requirements, common scoter was only recorded on the sea, offshore from the landfall ~~during the 2022-23~~ as part of the Coastal OP (landfall) surveys~~winter bird surveys~~. This section assesses impacts arising from works in the onshore environment only, landward of MHWS. It is, therefore, concluded that any potential disturbance to this species arising from onshore construction activity would be of negligible magnitude and **no potential for AEoI**.

~~1319.~~1476. It is concluded that disturbance would:

- Not reduce the size of the non-breeding population; and
- Not inhibit reduction in disturbance such that the population is not significantly disturbed.

~~1320.~~1477. Therefore, there will be **no AEoI of The Wash SPA in relation to non-breeding common scoter for the Project alone during construction and decommissioning**.

Feature Group 26: Terns

~~1321.~~1478. There were no observations of common tern, sandwich tern or little tern during the winter bird surveys in season one; in season two, two juvenile sandwich terns were observed loafing on 19/09/23. ~~There were no observations of common tern, Sandwich tern or little tern during the October 2022 to March 2023 winter bird surveys as these are migratory species wintering in Africa.~~ 16 common terns were recorded during a single visit (visit 3) as part of the breeding bird survey in 2023, however no breeding was confirmed.

~~1322.~~1479. Relevant SACO targets for the breeding tern species in SPAs are presented in Table 9.123~~Table 9.88~~.

Table 9-124~~9.1239 9.88~~: Abundance and disturbance SACO targets for little tern, Sandwich tern and common tern

The site	Non-breeding population: abundance	Supporting habitat: extent, distribution and availability of supporting habitat for the non-breeding season
Little tern		
Greater Wash SPA	"Maintain the size of the breeding population at a level which is above 798 breeding pairs, whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent".	Reduce the frequency, duration and / or intensity of disturbance affecting roosting, foraging, feeding, moulting and/or loafing birds so that they are not significantly disturbed
The Wash SPA	"Maintain the size of the breeding population at a level which is above 30 breeding pairs, whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent".	Reduce the frequency, duration and / or intensity of disturbance affecting roosting, foraging, feeding, moulting and/or loafing birds so that they are not significantly disturbed
Gibraltar Point SPA	"Restore the size of the breeding population to a level which is above 40 pairs, whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent".	Reduce the frequency, duration and / or intensity of disturbance affecting roosting, foraging, feeding, moulting and/or loafing birds so that they are not significantly disturbed
Humber Estuary SPA	"Restore the size of the breeding population to a level which is above 51 breeding pairs, whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent".	Reduce the frequency, duration and / or intensity of disturbance affecting roosting, foraging, feeding, moulting and/or loafing birds so that they are not significantly disturbed
Sandwich tern		
Greater Wash SPA	"Maintain the size of the breeding population at a level which is above 3,852 breeding pairs, whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent".	Reduce the frequency, duration and / or intensity of disturbance affecting roosting, foraging, feeding, moulting and/or loafing birds so that they are not significantly disturbed
Common tern		
Greater Wash SPA	"Maintain the size of the breeding population at a level which is above 510 breeding pairs, whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent".	Reduce the frequency, duration and / or intensity of disturbance affecting roosting, foraging, feeding, moulting and/or loafing birds so that they are not significantly disturbed

The site	Non-breeding population: abundance	Supporting habitat: extent, distribution and availability of supporting habitat for the non-breeding season
The Wash SPA	"Maintain the size of the population at a level which is above 220 pairs whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent".	Reduce the frequency, duration and / or intensity of disturbance affecting roosting, foraging, feeding, moulting and/or loafing birds so that they are not significantly disturbed

~~1323.~~1480. Little tern and Sandwich tern are marine species and the beach area within and adjacent to the Landfall is considered unsuitable for nesting terns due to human recreational disturbance. The only pathway by which disturbance may be caused to little tern and Sandwich tern would be in relation to birds foraging inshore adjacent to the onshore Order Limits.

~~1324.~~1481. A study by Parsons et al., 2015 estimated a mean maximum little tern foraging range of 2.4km (for seaward extent) and 3.9km (for along-shore extent). Eglington (2013) reviewed several studies and concluded that most reported a foraging range of <4km from the colony. The Landfall is approximately 13km from Gibraltar Point at the closest point and 11km from the Humber Estuary and therefore beyond the typical foraging range for this species. Therefore, there is no risk that construction disturbance would undermine the conservation objectives of The Wash or Greater Wash SPA, Gibraltar Point or Humber Estuary SPA little tern populations and there would be **no AEoI of those sites.**

~~1325.~~1482. Eglington & Perrow (2014) state that Sandwich terns often fly >30km between their colony and foraging areas. Thaxter et al., 2012 state a mean maximum foraging range of 49km and a mean range of 11.5km. The nearest colonies are at the North Norfolk Coast SPA (screened out for this species) and the tracking and modelling presented by Wilson et al., 2014 indicates that the Landfall area is outwith the core range but within the maximum range. Given the large foraging range of this species and the relatively small area of sea falling within the zone of influence of the Landfall area (above MHWS), and the avoidance of construction works on the beach above MHWS, it is concluded that such works would not undermine the conservation objectives of the Greater Wash SPA for Sandwich tern. **There would therefore be no AEoI of the Greater Wash SPA (the only relevant site screened in for this species) in relation to Sandwich tern as a result of construction disturbance.**

~~1326.~~1483. The only regular breeding common tern colony within The Wash SPA was identified in the Snettisham/ Wolferton area (Natural England, 2013). In 2005, a new breeding colony established on islands within a saline lagoon at Freiston Nature Reserve directly adjacent to The Wash SPA and small numbers have bred at Frampton Marsh since 2010. These birds would forage along the coast utilising intertidal habitats, marshes and rivers. Given the relatively small area of sea falling within the zone of influence of the Landfall area (above MHWS), and the avoidance of construction works on the beach above MHWS, it is concluded that such works would not undermine the conservation objectives of the Greater Wash SPA for common tern. **There would therefore be no AEoI of the Greater Wash SPA in relation to common terns as a result of construction disturbance.**

Additional mitigation

~~1327.~~1484. Refer to the onshore ecology mitigation detailed in Section 6~~6~~.

Integrity Test (Alone) –Mitigated

~~1328.~~1485. It is concluded that disturbance would:

- Not affect the restoration or maintenance (as relevant) of the breeding populations; and
- Not inhibit reduction in disturbance such that the populations are not significantly disturbed.

~~1329.~~1486. Therefore, there will be **no AEoI of those designated sites in relation to breeding little, Sandwich and common terns for the Project alone during construction and decommissioning.**

Feature 27: Black-headed gull

Implication for Conservation Objectives Unmitigated

~~1330.~~1487. In season one, black-headed gulls were observed on 32 occasions during a total of 13 visits with a peak count of 16 individuals as part of the Coastal OP (landfall) survey. The black-headed gulls were observed exclusively to be loafing. In season two, black-headed gulls were observed during a total of 14 visits with a peak count of 200 individuals on 4/10/24. The most common behaviour observed was foraging, followed by loafing. During winter walkover surveys in season one, 63 observations were recorded across 12 ECC segments and during a total of 12 walkover survey visits with a peak flock count of 137 individuals in ECC 10. The most common behaviour observed was loafing followed by foraging. In season two, 640 observations were recorded across all 14 ECC segments with a peak flock count of **600 individuals in ECC 8**. The most common behaviour observed was foraging, followed by loafing. ~~Black-headed gulls were observed on 32 occasions during a total of 13 visits with a peak count of 16 individuals as part of the Coastal OP (landfall) survey. The black-headed gulls were observed exclusively to be loafing. 63 observations were recorded across 12 ECC segments and during a total of 12 walkover survey visits with a peak flock count of 137 individuals. The most common behaviour observed was loafing (53%) followed by foraging (40%).~~ Black-headed gulls were widespread throughout the survey area, utilising agricultural fields, with a concentration of records~~, albeit in low numbers,~~ at the beach and inter-tidal zone. No breeding black-headed gull colonies were identified within the survey area.

~~1331.~~1488. The black-headed gull population of The Wash Ramsar almost halved from the citation target of 31,403 to 16,348 (BTO WeBS) and therefore it is in unfavourable condition with a "restore" target.

~~1332.~~1489. Black-headed gull is a species of low sensitivity to human disturbance and is likely to be tolerant of construction activities in proximity to foraging areas. The embedded design and mitigation measures would also apply to non-breeding black-headed gull, including avoiding impact piling other than at the OnSS. Therefore, there is **no potential for AEoI**.

Mitigation

~~1333.~~1490. Refer to the onshore ecology mitigation detailed in Section 6~~6~~. Additional mitigation, notably the restriction to works during freezing weather conditions, will further reduce the potential for disturbance to this species.

Integrity Test (Alone) – Mitigated

~~1334.~~1491. It is concluded that disturbance would:

- Not affect the restoration of the non-breeding population; and
- Not inhibit reduction in disturbance such that the populations are not significantly disturbed.

~~1335.~~1492. Therefore, there will be **no AEoI of The Wash Ramsar in relation to non-breeding black-headed gull for the Project alone during construction and decommissioning**.

Feature 28: Bittern

~~1336.~~1493. Bittern was not confirmed as breeding during the breeding bird survey in 2023. Non-breeding bittern may utilise reedbed habitats at Wolla Bank, although no records were obtained from extensive winter bird surveys in 2022/23 and 2023-24, indicating that this may be occasional use only.

~~1337.~~1494. For non-breeding bittern of Humber Estuary SPA, the SACO targets relevant to disturbance are:

- "Maintain the size of the non-breeding population at a level which is above 4 wintering individuals, whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent".
- "Restrict the frequency, duration and / or intensity of disturbance affecting roosting, foraging, feeding, moulting and/or loafing birds so that they are not significantly disturbed".

~~1338.~~1495. Wolla Bank reedbeds are located adjacent to the agricultural fields at the Landfall, with the TJB and associated construction compound to be located somewhere within the 300m wide Order Limits, set back at least 80m from Roman Bank. Disturbance, in the absence of mitigation, has the potential to limit foraging and displace birds to potentially sub-optimal foraging and roosting locations and therefore has the potential to impact survival of bittern within the vicinity. Bittern will be screened from disturbance at least partially by the reed vegetation of the marsh habitat that they occupy.

~~1339.~~1496. The Landfall TJB area is located approximately 250m from Wolla Bank Reedbed at the closest point and the construction compound will be set back 80m from Anderby Marsh, and therefore approximately 200m from Wolla Bank Reedbed at the closest point. Given the separation distance, and screening from existing habitats and features, it is considered that the potential for disturbance to bittern is negligible (no AEoI).

Mitigation

~~1340.~~1497. Refer to the onshore ecology mitigation detailed in Section 6~~6~~. This includes a 4m high earth bund to screen the landfall compound from the coastal reserves.

Integrity Test (Alone) – Mitigated

~~1341.~~1498. With the mitigation in place, disturbance will be minimised, localised and temporary, not enough to change the local distribution or abundance for any more than a short period.

~~1342.~~1499. It is concluded that disturbance would:

- Not reduce the size of the non-breeding populations; and
- Not inhibit reduction in disturbance such that the populations are not significantly disturbed.

~~1343.~~1500. Therefore, there will be **no AEoI of Humber Estuary SPA in relation to non-breeding bittern for the Project alone during construction and decommissioning.**

Feature 29: Marsh Harrier

Implication for Conservation Objectives Unmitigated

~~1344.~~1501. In season one, winter bird surveys recorded nine observations across five ECC segments and during a total of six visits with a peak count of **two individuals** [redacted]

~~1346.~~1503. The three pairs recorded during breeding bird surveys represent approximately 0.7% of the UK breeding population. There were a total of nine records of marsh harrier during the winter 2022-23 ECC surveys and no evidence of the presence of a communal winter roost.

~~1347.~~1504. For breeding marsh harrier of the Humber Estuary SPA, the SACO targets relevant to disturbance are:

- "Maintain the size of the non-breeding population at a level which is above 21 breeding females, whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent".
- "Reduce the frequency, duration and/ or intensity of disturbance affecting roosting, nesting, foraging, feeding, moulting and/or loafing birds so that they are not significantly disturbed".

~~1348.~~1505. Goodship & Furness (2022) classify marsh harrier as of medium sensitivity to human disturbance and suggest a buffer zone of 300-500m during the breeding and non-breeding seasons. Disturbance, in the absence of mitigation, has the potential to limit foraging and displace birds to potentially sub-optimal foraging locations and therefore has the potential to impact survival of marsh harrier within the vicinity. However, there is similar agricultural habitat available in the wider area and no concentrated foraging activity was recorded during the non-breeding season. The conservation status of the Humber Estuary breeding marsh harrier population is favourable.

~~1349.~~1506. Throughout the year, marsh harriers hunt over arable fields, reedbed, freshwater marsh and salt marsh (Underhill-Day, 2002). A study in East Anglia found the home range of males to be 569ha during courtship to 1,407ha post-fledging, with birds hunting up to 7km from the nesting area (Underhill-Day, 1990). Females home ranges vary from 100 to 1,300ha (Hardey et al. 2013).

~~1350.~~1507. The ECC route is an approximately 80m wide linear corridor and potential disturbance displacement of foraging birds will be from arable farmland, which is common in the local area. Given the temporary loss of common foraging habitat from a small proportion of the home (breeding) and winter ranges, there would be no appreciable negative change in population size or distribution and there would be **no potential for AEoI.**

Additional mitigation

[redacted]

With this mitigation secured, and given the distances of estimated nesting sites from the construction works, it is concluded that disturbance to nesting marsh harriers will be avoided (not significant).

~~1352.~~1509. A specific survey and monitoring protocol will be developed to ensure adherence with the legal protection for nesting marsh harrier as a Schedule 1 nesting species, to provide further assurance that disturbance to nesting birds will be avoided.

Integrity Test (Alone) – Mitigated

~~1353.~~1510. **For the reasons outlined above, disturbance would not undermine the conservation objective (population/abundance objective and target to reduce disturbance) of the designated site and therefore there would be no AEoI of the site.**

Feature Group 31: Waterbird Assemblage

Implication for Conservation Objectives Unmitigated

~~1354.~~1511. For those designated sites in favourable condition, from the assessment of features already undertaken, the Project would not undermine the conservation objective to maintain the populations of waterfowl for The Wash SPA or Ramsar and Gibraltar Point Ramsar. The Project could however affect the SACO target to reduce disturbance. For The Humber Estuary SPA and Ramsar site, due to the conservation status being unfavourable and the conservation objective being to restore, the Project could undermine the conservation objectives.

~~1355.~~1512. For waterbird assemblage feature of the Humber Estuary SPA, the SACO targets relevant to disturbance are:

- "Restore the overall abundance of the assemblage to a level which is above 153,934 whilst avoiding deterioration from its current level as indicated by the latest peak mean count or equivalent".
- "Reduce the frequency, duration and / or intensity of disturbance affecting roosting, foraging, feeding, moulting and/or loafing birds so that they are not significantly disturbed".

~~1356.~~1513. For waterbird assemblage feature of The Wash SPA, the SACO targets relevant to disturbance are:

- "Maintain the overall abundance of the assemblage at a level which is above 214,000 whilst avoiding deterioration from its current level as indicated by the latest peak mean count or equivalent".
- "Reduce the frequency, duration and / or intensity of disturbance affecting roosting, foraging, feeding, moulting and/or loafing birds so that they are not significantly disturbed".

Mitigation

~~1357.~~1514. Refer to the onshore ecology mitigation detailed in Section 6~~6~~.

Integrity Test (Alone) –Mitigated

~~1358.~~1515. With mitigation in place the conservation objective for the waterfowl assemblage would not be undermined for the identified designated sites.

~~1359.~~1516. It is concluded that disturbance would:

- Not affect the restoration or maintenance (as relevant) of the non-breeding population; and
- Not inhibit reduction in disturbance such that the populations are not significantly disturbed.

~~1360.~~1517. Therefore, there will be **no AEoI of Humber Estuary/Ramsar, Wash SPA/Ramsar and Greater Wash SPAs in relation to waterbird assemblage for the Project alone during construction and decommissioning**.

Feature Group 32 and 33: Habitat Features of SACs and Ramsar Sites Red Data Book Invertebrates

~~1361.~~1518. LSE for these features from this impact pathway has been screened out.

Feature 34: Otter

~~1362.~~1519. There is the potential for construction activity to superficially disturb Otters by temporarily disrupting foraging or breeding activity. However, this species is not especially sensitive to disturbance (Chanin, 2003) and therefore disturbance associated with construction, which is temporary, would not affect the maintenance of Otter population within the SAC. Nevertheless, the potential locations of Otter breeding activity within the Order limits have been identified through surveys and these will be monitored during the construction methods, with other methods also employed to screen the works from places where Otters occur.

9.5.3.3 Pathway 3 – Decrease in Water Quality and Quantity

Features 1-34: All Features

Implications for Conservation Objectives Unmitigated

~~1363.~~1520. The water quality targets for The Wash and Humber Estuary SPAs are:

- "Restrict aqueous contaminants to levels equating to High Status according to Annex VIII and Good Status according to Annex X of the Water Framework Directive, avoiding deterioration from existing levels".
- "Maintain the dissolved oxygen (DO) concentration at levels equating to Good Ecological Status (specifically ≥ 5.7 mg per litre (at 35 salinity) for 95 % of the year)], avoiding deterioration from existing levels".
- "Maintain water quality and specifically mean winter dissolved inorganic nitrogen (DIN) at a concentration equating to High Ecological Status (specifically mean winter DIN is < 12 µM for coastal waters), avoiding deterioration from existing levels".
- "Maintain natural levels of turbidity (e.g. concentrations of suspended sediment, plankton and other material) across the habitat".

~~1364.~~1521. The water quality targets for The Wash and North Norfolk SAC are:

- "Where the feature is dependent on estuarine water, ensure water quality and quantity is maintained to a standard that provides the necessary conditions to support the feature: maintain dissolved oxygen (DO) at ≥ 5.7mg l-1 standardised to a salinity of 35".
- "Restrict aqueous contaminants to levels equating to High Status according to Annex VIII and Good Status according to Annex X of the Water Framework Directive, avoiding deterioration from existing levels".
- "Restrict surface sediment contaminants (<1cm from the surface) to below the OSPAR Environment Assessment Criteria (EAC) or Effects Range Low (ERL) threshold. For example, mean cadmium levels should be maintained below the ERL of 1.2 mg per kg".
- "Maintain the natural nutrient status, dissolved oxygen (DO), phytoplankton levels and opportunistic algae, so that they do not have an adverse impact on the species and communities of the lagoon, which are subject to natural fluctuation".

- "Maintain natural levels of turbidity (e.g. suspended concentrations of sediment, plankton and other material) across the habitat".

~~1365.~~1522. The water quality targets for Gibraltar Point SPA are:

- Reduce aqueous contaminants to levels equating to High Status according to Annex VIII and Good Status according to Annex X of the Water Framework Directive, avoiding deterioration from existing levels.
- Maintain the dissolved oxygen (DO) concentration at levels equating to High Ecological Status (specifically ≥ 5.7 mg L-1 (at 35 salinity) for 95 % of year) avoiding deterioration from existing levels.
- Maintain water quality at mean winter dissolved inorganic nitrogen levels where biological indicators of eutrophication (opportunistic macroalgal and phytoplankton blooms) do not affect the integrity of the site and features, avoiding deterioration from existing levels.
- Maintain natural levels of turbidity (e.g. concentrations of suspended sediment, plankton and other material) across the habitat.

~~1366.~~1523. A detailed assessment of this impact is provided within Volume 1, Chapter 24: Hydrology, Hydrogeology and Flood Risk. To summarise, it concludes that with embedded mitigation measures in place, the impact to water quality as a result of direct spills would be negligible to minor adverse and not significant.

~~1367.~~1524. Chapter 24 considers the hydrological impacts of sediment runoff and spills/pollution on the following features: watercourses; near-shore coastal waters; transitional waterbodies (Witham and Welland); groundwater quality; and flood risk. These impacts are considered separately for the following elements of the Project: onshore ECC; OnSS; trenchless drilling; and landfall compound. The greatest potential for impacts to occur is during the construction phase, and all impacts that may occur during the operation and decommissioning phases are assessed as being of negligible magnitude and of minor adverse or negligible significance.

~~1368.~~1525. A range of hydrological mitigation measures have been provided, including:

- The outline CoCP will include:
  - Requirement for a flood response plan; and
  - Measures to control runoff, for example sediment fences, containment of storage areas and treatment of any runoff. Such measures would prevent the potential reduction in water quality associated with increased sediment loading affecting nearby tidal waters, fluvial watercourses or drainage ditches during construction works, especially during excavations or earthwork activities.
  - Measures to manage soil and stockpiling of materials which are contained within the Outline Soil Management Plan (SMP), within the CoCP (Document Ref 8.1.3). Measures include requirement for stockpiling to only be permitted in designated stockpile areas and all designated stockpile areas to be located be a minimum of 10 m from any open watercourse features.

- Measures to minimise the risk of a pollution event, which are contained within the outline Pollution Prevention and Emergency Incident Response Plan (PPEIRP) within the CoCP (Document Ref 8.1.4). Measures include spill procedures and use of spill kits. These measures together with appropriate drainage systems and containment will minimise the potential for any reduction in water quality associated with spills or leaks of stored oils/fuels/chemicals or other polluting substances migrating into nearby water bodies.

~~1369.~~1526. The mechanism for hydrological impacts to coastal waters, which would include The Wash SPA and Ramsar and The Greater Wash SPA, from onshore works is indirect via watercourses discharging to the coast. Hydrological connections are with The Wash rather than The Humber. This mechanism will serve to reduce impacts from sediment entrainment and spills through settlement and dilution respectively and the assessed impacts on coastal waters from inland works, accounting for the embedded mitigation, are each of minor adverse or negligible magnitude.

~~1370.~~1527. Assessed impacts on transitional waterbodies and groundwater quality are each of minor adverse or negligible magnitude. The OnSS is located in an area at high risk of flooding from the tidal reach of the River Welland. However, construction activities would not impede floodplain flows (refer to Chapter 24 Hydrology and Flood Risk (document reference 6.1.24)).

~~1371.~~1528. Each assessed construction phase impact on watercourses is assessed as low magnitude, given the embedded mitigation and that any direct pollution from spills would be small. The impact would be of an intermittent nature and of short duration. A range of embedded mitigation measures are included to minimise potential impacts to water quality within watercourses.

~~1372.~~1529. The only pathway for hydrological impacts to bird populations which has not been assessed as of negligible magnitude, is water quality impacts on watercourses, assessed as being of low magnitude. This could result in minor degradation of watercourse habitats for birds, for example, through impacts to prey resources. However, a range of embedded mitigation measures have been included to minimise the potential for sediment and pollution impacts to watercourses. The potential impact would also be intermittent and short-term only during the construction phase.

~~1373.~~1530. An assessment of potential impacts of the Project against the Water Framework Directive (WFD) has been undertaken in ES Appendix 8.1 (document reference 6.3.8.1). This demonstrates that the proposed activities associated with the Project will not result in a deterioration of designated sites and do not jeopardise the attainment of good status (or the potential to achieve good ecological and chemical status), including The Wash and Humber Estuary SAC and the Wash and North Norfolk SAC.

~~1374.~~1531. Water quality impacts on watercourses are assessed as being of low magnitude. This could result in minor degradation of watercourse habitats for birds, for example, through impacts to prey resources. However, a range of embedded mitigation measures have been included to minimise the potential for sediment and pollution impacts to watercourses. The potential impact would also be intermittent and short-term only during the construction phase.

~~1375.~~1532. As previously described, Gibraltar Point Ramsar is connected to the ECC via the Steeping River, and Wolla Bank Pit and Frampton Marsh RSPB Reserve is in the same surface water catchments as the Order Limits (Black Sluice) and may be connected via surface water flows. These sites support the hairy dragonfly *Brachytron pratense* and the Ramsar supports the water beetle *Haliplus mucronatus* which are both qualifying interest species of Gibraltar Point Ramsar. Their populations are sensitive to water quality and, without mitigation, there is a risk that pollution arising from construction activity would have a negative effect on the freshwater marsh habitat and the populations of these invertebrates, and undermine the (implied) conservation objectives for the Ramsar. However, the mitigation measures outlined above would ensure water quality within the Ramsar, Wolla Bank Pit and RSPB Reserve is maintained.

Integrity Test (Alone) – Unmitigated

~~1376.~~1533. It is concluded that with the embedded mitigation measures as outlined in Section 6~~6~~, **there would be no AEoI on any of the identified designated sites in relation to hydrological impacts from the Project alone.**

9.5.3.4 Pathway 4 – Decrease in Air Quality

Implications for Conservation Objectives Unmitigated

Features 1-34: All Features

~~1377.~~1534. The air quality targets for The Wash and Humber Estuary SPA's and The Wash and North Norfolk SAC are:

- "Maintain concentrations and deposition of air pollutants at below the site-relevant Critical Load or Level values given for this feature of the site on the Air Pollution Information System (www.apis.ac.uk)".

~~1378.~~1535. Background nitrogen levels within the SAC are approximately 11 N/ha/year (APIS). There are defined Nitrogen deposition targets for individual bird species, which vary in their sensitivity.

~~1379.~~1536. Impacts in relation to air quality, including on designated ornithological sites, have been assessed in Volume 1, Chapter 19 Onshore Air Quality and are summarised below in respect of ecological features:

- Construction Impact 1, Dust/PM10 emissions:
  - The ZoI is 20m from the onshore construction area.
  - The potential impact pathway is damage to supporting habitats via dust deposition.
  - The only SPA within 20m of the onshore Order Limits is the Greater Wash SPA, however, construction activities will be located >20m from the SPA. Several ornithological LWS and LWT Reserves (which may have functional linkage) are within or adjacent to the Order Limits.
  - The risk in relation to impacts to designated ecological sites has been deemed to be Medium, in the absence of mitigation, given the proximity of the Greater Wash SPA. On a precautionary basis, and in the absence of mitigation, **AEoI of the Greater Wash SPA cannot be excluded.**

- Construction Impact 2, Road traffic emissions:
  - The ZoI is 200m from a main public road link expected to witness a change in vehicular flows as a result of Project construction activities.
  - The potential impact pathway is damage to supporting habitats via airborne pollutants.
  - There is a single European site, the Greater Wash SPA, within the ZoI. However, the road traffic flows generated by the Project are below the IAQM prescribed screening thresholds (IAQM, 2020) both alone and in-combination with other relevant plans/projects. Effects on international ecological designations are insignificant.
  - Potential air pollution effects during the construction phase will be temporary and short-term (up to 42-months). The habitats within the ZoI are predominantly agricultural and of low sensitivity to air pollution. For these reasons, road traffic impacts on supporting habitats for birds outside of designated areas are negligible.
- Construction Impact 3, Emissions from Non-Road Mobile Machinery (NRMM).
  - The ZoI is 50m from potential NRMM activity.
  - The potential impact pathway is damage to supporting habitats via airborne pollutants.
  - The only SPA within 50m of the onshore Order Limits is the Greater Wash SPA, however emergency vehicle access only is planned at the beach and all other construction activities will be located >50m from the SPA. Whilst several ornithological LWS and LWT Reserves (which may have functional linkage) are within or adjacent to the Order Limits, NRMM works will be set back >50m from them.
  - The maximum annual mean background pollutant concentrations across the study area are well below the respective Critical Levels. Concentrations across the full extent of the onshore Order Limits are expected to vary and be lower relative to the maximum reported.
  - On a precautionary basis, and in the absence of mitigation, A**EoI of the Greater Wash SPA cannot be excluded.**
- Decommissioning Impacts:
  - Onshore decommissioning activities are expected to be restricted to the OnSS only, with other infrastructure left in situ. At the end of the operational life of the windfarm (approximately 35 years) it is expected that potential emissions contributions will be lower relative to the construction period, due to tighter regulation and new technologies. For the same reasons, it is expected that air quality will have improved by the time of decommissioning. These elements (alone and/or in combination) would result in a reduction in the level of significance in comparison to the assessment of construction effects and ther**e would be no AEoI.**

Mitigation

- Construction Impact 1, Dust/PM10 emissions:

- Commensurate with the identified level of risk, mitigation measures are identified by Institute of Air Quality Management (IAQM) guidance (IAQM, 2023) to ensure that any potential impacts arising from any onshore construction works are minimised and, where possible, completely removed. These measures represent embedded mitigation for the Project and are included within the Outline Air Quality Management Plan (AQMP) and provided as part of the outline Code of Construction Practice (CoCP).

- Construction Impact 3, Emissions from Non-Road Mobile Machinery (NRMM).
  - Embedded mitigation measures as outlined for Construction Impact 1.

Integrity Test (Alone) – Mitigated

- Construction Impact 1, Dust/PM10 emissions:
  - Given the set back distances of construction works from key sensitive supporting habitats for birds, including Anderby Marsh and The Haven, combined with the embedded mitigation and predominantly agricultural land across the remainder of the ECC route, dust impacts to other supporting habitats for birds are of negligible magnitude (**no AEoI**).
- Construction Impact 3, Emissions from Non-Road Mobile Machinery (NRMM).
  - Whilst taking into account the embedded mitigation as well as the short-term, transient, phased nature of the construction works, the background pollutant concentrations and the potential areas of the designations affected, the likelihood of NRMM causing an exceedance is low. Potential impacts from NRMM emissions on ecological receptors are, therefore, negligible (**no AEoI**).

9.5.4 Operations and Maintenance

9.5.4.1 Pathway 1 – Habitat Loss

Features 1-34: All Features

~~1380.~~1537. During operation of the project no further land take is anticipated, therefore, habitat loss during operation does not require assessment within the RIAA.

9.5.4.2 Pathway 2 – Disturbance of Birds and Mammals During Operation and Maintenance

Implications for Conservation Objectives Unmitigated

~~1381.~~1538. During the operational period (anticipated to be approximately 35 years), scheduled and unscheduled monitoring and maintenance activities will be required. Preventive maintenance will be undertaken according to a service schedule, whereas corrective maintenance will be needed to cover unexpected repairs.

~~1382.~~1539. Onshore, the O&M requirements will be largely corrective, accompanied by infrequent on-site inspections of the onshore ECC. Periodic access to TJBs may be required for inspection.

~~1383.~~1540. There may be O&M staff visiting the OnSS to undertake works when necessary (currently expected to be once per week). The OnSS will not be manned. This would be highly localised within the OnSS with a minimal likelihood of disturbance expected to the adjacent habitats and species.

~~**1384.**~~**1541.** In the absence of mitigation, and on a precautionary basis, **an AEoI cannot be excluded in relation to disturbance to bird features utilising FLL.**

Mitigation

~~1385.~~1542. Maintenance activities will be subject to an Environmental Management System (EnMS) which will include specific measures to avoid potential impacts to protected/notable species. The EnMS would also include measures to minimise the risk of a pollution event.

Integrity Test (Alone) - Mitigated

~~1386.~~1543. Following the implementation of an agreed EnMS, **no AEoI would occur for any important ornithological features as a result of operation and maintenance activities**.

9.5.4.3 Pathway 3 – Decrease in Water Quality and Quantity

Features 1-34: All Features

~~1387.~~1544. As described in Section 9.3 of the Project Description chapter (ES Volume 1 Chapter 3), most operational maintenance activity will be undertaken at the OnSS, with infrequent on-site inspections, including inspection of assets at designated access points such as TJBs. Given the nature and frequency of the operational maintenance works, they **could not undermine the conservation objectives for any of the designated sites as a result of hydrological impacts and would not have an AEoI of those sites from the project alone**. This pathway is therefore excluded from further assessment for all features.

9.5.4.4 Pathway 4 – Decrease in Air Quality

Features 1-34: All features

~~1388.~~1545. The potential impact pathway is damage to supporting habitats via airborne pollutants from road traffic emissions. As detailed in the Chapter 19 assessment, operational phase vehicle movements are expected to be of a low frequency, below the relevant IAQM screening thresholds. **Therefore, potential impacts to ecological receptors are negligible (no AEoI).**

10 Stage 2: Assessment of Adverse Effect In-Combination

~~1389.~~1546. Screening for designated sites and features in-combination is presented in S~~s~~ection 7.2 identifying the plans and projects to be considered for assessment. The assessment presented here draws on that presented within relevant topic specific chapters of the ES, tailored for the requirements of this RIAA, to inform the assessment of AEoI in-combination to the features and effects screened in.

~~1390.~~1547. In assessing the potential for in-combination effects associated with the Project, it is important to bear in mind that some projects, predominantly those 'proposed' or identified in development plans etc. may or may not actually be taken forward, or they may be taken forward but not in the same form as currently presented. There is thus a need to build in some consideration of certainty (or uncertainty) with respect to the potential impacts which might arise from such proposals. For example, relevant projects/plans with consent and (if required) CfD (or similar) are more likely to contribute to in-combination impact with the Project (providing temporal and spatial pathways exist), whereas projects/plans not yet approved or not yet submitted are less certain to contribute to such an impact, as some may not achieve approval or may not ultimately be built due to other factors.

~~1391.~~1548. For this reason, all relevant projects/plans considered in-combination alongside the Project have been allocated into 'Tiers', reflecting their current stage within the planning and development process. Where the tiering approach differs between receptor groups, this is noted in the relevant section. The tiering approach allows the in-combination impact assessment to present several future development scenarios, each with a differing potential for being ultimately built out. The definition of each tier is described in Section 7.2, with the plans and projects screened in for further consideration here defined within Table 7.5.

~~1392.~~1549. For each plan/project screened in (Section 7.2), the in-combination MDS draws on the information presented in topic specific chapters of the ES. The aim is to identify, for each receptor group, the aspects of the plans, projects and programmes screened in to be assessed. Consideration is given to the following points:

- Level of detail available for project/plans;
- Potential for an effect-pathway-receptor link;
- Potential for a physical interaction; and
- Potential for temporal interaction.

~~1393.~~1550. Following the identification of the plans and projects with the potential to result in an AEoI in-combination with the Project, the assessment has been made below. The information is presented according to the following receptor groupings:

- Benthic Subtidal and Intertidal Ecology;
- Marine Mammals;
- Offshore Ornithology;

- Migratory Fish; and
- Onshore Ecology.

10.1 Benthic Subtidal and Intertidal Ecology

1551. The Benthic Subtidal and Intertidal Ecology in-combination assessment has been updated February 2025 to consider:

- The introduction of an Offshore Restricted Build Area (ORBA) over the northern section of the Project array area;
- The removal of the northern section of the offshore Export Cable Corridor (ECC);
- A revised in-combination assessment to reflect changes to project status or capture any new plans, projects or activities which have been progressed since the point of the Application; and
- Minor errata including those previously identified by interested parties.

~~1394.~~1552. The potential for LSE in-combination from the Project with regard to benthic subtidal and intertidal ecology is summarised in Section 7.2, with the in-combination assessment presented below.

~~1395.~~1553. Information to inform the AA alone for subtidal and benthic intertidal ecology is provided in Section 9 ~~9~~ which assesses seven impacts, across seven sites (North Norfolk Sandbanks and Saturn Reef SAC, Inner Dowsing, Race Bank, and North Ridge SAC, The Wash and North Norfolk Coast SAC, Humber Estuary Ramsar, Humber Estuary SAC, Gibraltar Point Ramsar, and The Wash Ramsar) during the construction, decommissioning, and operation and maintenance phases.

~~1396.~~1554. Part 6, Volume 1, Chapter 9: Benthic Subtidal and Intertidal Ecology considers that several of the impacts assessed for the Project alone are not considered relevant in the cumulative assessment due to:

- the highly localised nature of the impacts;
- management and mitigation measures in place at the Project and on other projects that will reduce the risk occurring; and
- where the potential significance of the impact from the Project alone has been assessed as negligible and there is no overall significance

~~1397.~~1555. Therefore, based on these conclusions, the in-combination assessment presented below excludes several impacts assessed for the Project alone. Table 10.1 summarises the impacts that are assessed in the benthic subtidal and intertidal ecology in-combination assessment presented here.

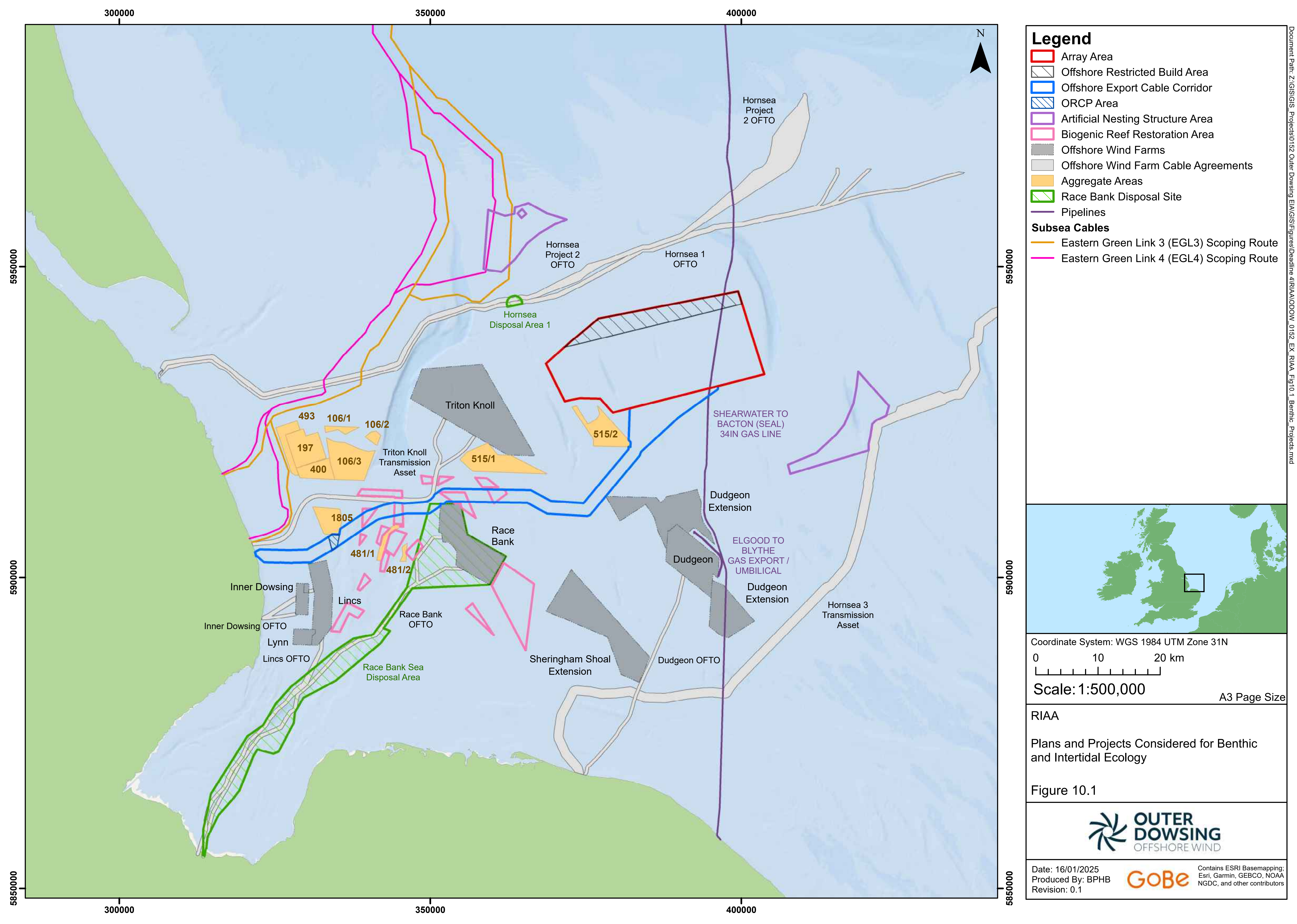
~~1398.~~1556. Figure 10.1 shows the location of the Projects considered in-combination for the Benthic Subtidal and Intertidal Ecology assessments.

Table 10-1~~10.110 110.1~~: Screening of impacts for inclusion in AA in-combination, following AA alone conclusions (taken from ES Part 6, Volume 1, Chapter 9: Benthic Subtidal and Intertidal Ecology)

AA alone impact pathway	Screened in for AA in-combination	Reason for exclusion
Physical habitat loss/disturbance	Yes, all phases	N/A
Suspended sediment/deposition	Yes, all phases	N/A
Accidental and Indirect Pollution	No	The impact is highly localised and of negligible significance according to ES Part 6, Volume 1, Chapter 9: Benthic Subtidal and Intertidal Ecology. Through existing standard operating and pollution prevention guidelines which are required for all marine vessels and installations (including through MARPOL), the potential for an effect from any marine project is inherently addressed through these standard requirements. Therefore, on this basis it is reasonable to conclude that there is no LSE in-combination and following the approach considered for this RIAA (and on other OWF projects), this impact is screened out of the in-combination assessment.
INNS	No	The impact is highly localised and of negligible significance according to ES Part 6, Volume 1, Chapter 9: Benthic Subtidal and Intertidal Ecology. Through existing standard operating guidance, industry legislation, codes of conduct, and best practice guidelines which are required for all marine vessels and installations (including the Invasive Alien Species [Enforcement and Permitting] Order 2019[12] and Marine Strategy Framework Directive[13]), the potential for an effect from any marine project is inherently addressed through these standard requirements. Therefore, on this basis it is reasonable to conclude that there is no LSE in-combination and following the approach considered for this RIAA (and on other

[12] https://www.legislation.gov.uk/uksi/2019/527/contents/made
[13]https://research-and-innovation.ec.europa.eu/research-area/environment/oceans-and-seas/eu-marine-strategy-framework-directive_en#:~:text=funded%20research%20contribution-,What%20the%20EU%20Marine%20Strategy%20Framework%20Directive%20(MSFD)%20is,economic%20and%20social%20activities%20depend.

AA alone impact pathway	Screened in for AA in-combination	Reason for exclusion
		OWF projects), this impact is screened out of the in-combination assessment.
Changes to physical processes	No	The impact is considered to be negligible within the ES Part 6, Volume 1, Chapter 9: Benthic Subtidal and Intertidal Ecology. The assessment for the impact alone concluded a negligible impact with no residual impacts from the Project, as it is generally considered that the patterns of processes governing the overall evolution of the systems are at a much larger scale than the proposed works, and any changes to seabed morphology are not considered likely to influence the overall form and function of the system. Additionally, the range of effects are considered to be limited. Therefore, it is considered that there is no pathway for effect in-combination and following the approach considered for this RIAA (and on other OWF projects), this impact is screened out of the in-combination assessment.



Legend
Array Area
Offshore Restricted Build Area
Offshore Export Cable Corridor
ORCP Area
Artificial Nesting Structure Area
Biogenic Reef Restoration Area
Offshore Wind Farms
Offshore Wind Farm Cable Agreements
Aggregate Areas
Race Bank Disposal Site
Pipelines
Subsea Cables
Eastern Green Link 3 (EGL3) Scoping Route
Eastern Green Link 4 (EGL4) Scoping Route
Hornsea Project 2 OFTO
Hornsea 1 OFTO
Hornsea Disposal Area 1
Triton Knoll
Triton Knoll Transmission Asset
493
106/1
106/2
197
106/3
400
515/1
515/2
1805
481/1
481/2
SHEARWATER TO BACTON (SEAL) 34IN GAS LINE
Dudgeon Extension
Race Bank
Dudgeon
ELGOOD TO BLYTHE GAS EXPORT / UMBILICAL
Inner Dowsing
Lincs
Race Bank OFTO
Inner Dowsing OFTO
Lynn
Lincs OFTO
Race Bank Sea Disposal Area
Sheringham Shoal Extension
Dudgeon OFTO
Hornsea 3 Transmission Asset
Coordinate System: WGS 1984 UTM Zone 31N
0 10 20 km
Scale: 1:500,000
A3 Page Size
RIAA
Plans and Projects Considered for Benthic and Intertidal Ecology
Figure 10.1
OUTER DOWSING OFFSHORE WIND
Date: 16/01/2025
Produced By: BPHB
Revision: 0.1
GoBe
Contains ESRI Basemapping; Esri, Garmin, GEBCO, NOAA NGDC, and other contributors
Document Path: Z:\GIS\GIS_Projects\0152 Outer Dowsing EIA\GIS\Figures\Deadline 4\RIAA\ODOW_0152_EX_RIAA_Fig10.1_Benthic_Projects.mxd

~~1399.~~1557. As outlined in Part 6, Volume 1, Chapter 9: Benthic Subtidal and Intertidal Ecology, for potential effects on Benthic Subtidal and Intertidal Ecology, planned projects were screened into the assessment based on a screening range that encapsulates the Project's benthic and intertidal study area as defined by the secondary ZoI, which has been defined based on the expected maximum distance that water from within the Order Limits might be transported on a single mean spring tide, in the flood and/or ebb direction. This screening area therefore encompasses the extent of impacts to Benthic Subtidal and Intertidal Ecology associated with the Project.

~~1400.~~1558. Figure 10.2 above highlights the Projects which have been screened in for the in-combination assessment for benthic and subtidal ecology, these can be summarised into the following project types:

- OWFs – both planned and consented;
- OWF cables;
- Aggregate and disposal areas;
- Subsea cables and pipelines;
- Oil and gas pipelines;
- Oil and gas subsurface;
- Oil and gas surface; and
- Carbon capture and storage.

~~1401.~~1559. With regard to the potential impacts considered in-combination, the potential for a LSE in-combination was identified for the benthic habitats of the following sites (noting that not all effects apply to all sites):

- Inner Dowsing, Race Bank and North Ridge SAC;
- North Norfolk Sandbanks and Saturn Reef SAC;
- ~~Inner Dowsing, Race Bank and North Ridge SAC;~~
- The Wash and North Norfolk Coast SAC;
- Humber Estuary Ramsar;
- Humber Estuary SAC;
- Gibraltar Point Ramsar; and
- The Wash Ramsar.

10.1.1 Construction and decommissioning

~~1402.~~1560. The potential for an AEoI in-combination as a result of effects on Benthic Subtidal and Intertidal Ecology during construction and decommissioning phases relates to the sites listed above. As for the Project alone assessment, the potential for LSE during decommissioning would be no greater than, and potentially less than, those outlined for the construction phase.

10.1.1.1 Physical habitat loss/disturbance

~~1403.~~1561. There is the potential for in-combination physical habitat loss/disturbance as a result of both the construction and decommissioning activities associated with the Project and the Tier 1, 2 and 3 projects identified in Table 7.5. For the purposes of this assessment, this additive impact has been assessed from projects that fall within the benthic subtidal ecology study area (as defined within Section 7.2).

~~1404.~~1562. The plans or projects identified as potentially contributing to an in-combination effect on the sites listed above as a result of physical habitat loss/disturbance are as follows:

- Tier 1;
  - Inner Dowsing OWF;
  - Lincs OWF;
  - Triton Knoll OWF;
  - Race Bank OWF;
  - Dudgeon OWF;
  - Lynn OWF;
  - Sheringham Shoal Extension OWF;
  - Dudgeon Extension OWF;
  - Westminster Gravels Ltd (515/2);
  - Westminster Gravels Ltd (515/1);
  - Hanson Aggregates Marine Ltd (106/2);
  - Hanson Aggregates Marine Ltd (106/3);
  - Hanson Aggregates Marine Ltd (106/1);
  - Hanson Aggregates Marine Ltd (400);
  - Tarmac Marine Ltd (197);
  - Tarmac Marine Ltd (481/1);
  - Tarmac Marine Ltd (493);
  - Van Oord Ltd (481/2);
  - Race Bank Sea Disposal Site;
  - Hornsea Disposal Area 1;

- Hornsea 1 OFTO;
- Hornsea 2 OFTO;
- Triton Knoll Transmission Asset;
- Dudgeon OFTO;
- Race Bank OFTO;
- Lincs Transmission Asset;
- Inner Dowsing Transmission Asset;
- Gas Shearwater to Bacton Seal Line (Shell);
- Elgood to Blythe Gas Export Pipeline; and
- Elgood to Blythe Umbilical Pipeline;
- ~~Durango 48/21A-4 Oil and Gas Works; and~~
- ~~48/9A Mimas Oil and Gas Works.~~

- Tier 2;
  - Eastern Greenlink 3; and
  - Eastern Greenlink 4.
  - ~~No Tier 2 projects identified.~~
- Tier 3;
  - No Tier 3 projects identified.

Tier 1 Projects

~~1405.~~1563. Of the Tier 1 projects identified above, for a project to have an in-combination effect on a designated site with the Project with respect to physical habitat loss/disturbance, it is considered that there must be a direct overlap with an SAC that is also impacted by the Project. Therefore, several of the projects listed above do not require consideration, with only the following projects identified as having any overlap with the Inner Dowsing, Race Bank and North Ridge SAC (the only SAC considered to have a potential impact on physical habitat loss and disturbance from the Project):

- Inner Dowsing OWF;
- Lincs OWF;
- Race Bank OWF;
- Lynn OWF;
- Westminster Gravels Ltd (515/1);
- Tarmac Marine Ltd (481/1);
- Van Oord Ltd (481/2);

- Race Bank Sea Disposal Site
- Triton Knoll Transmission Asset;
- Race Bank OFTO;
- Lincs Transmission Asset; and
- Inner Dowsing Transmission Asset.

~~1406.~~1564. The Inner Dowsing OWF, Lincs OWF, Race Bank OWF, Lynn OWF, Westminster Gravels Ltd (515/1), Tarmac Marine Ltd (481/1), Van Oord Ltd (481/2), Race Bank Sea Disposal Site, Triton Knoll Transmission Asset, Race Bank OFTO, Lincs Transmission Asset, and Inner Dowsing Transmission Asset all have direct overlap with the Inner Dowsing, Race Bank and North Ridge SAC. The Project also overlaps with this SAC and therefore there is a potential for an in-combination effect to arise.

~~1407.~~1565. *S. Spinulosa* is a feature of the Inner Dowsing, Race Bank and North Ridge SAC and as outlined within the project alone assessment, a pre-construction Annex I habitat survey will be implemented where the project crosses with the SAC to determine the location of any potential *S. Spinulosa* reef features (Table 6.1). The Project has committed to a Biogenic Reef Mitigation Plan, (Document reference 7.6.3) which includes a commitment to micrositing around any areas of identified *S. Spinulosa* reef within the SAC. It is therefore anticipated that all habitat loss to *S. Spinulosa* reef features within the SAC will be avoided, and therefore there will be no physical habitat loss/disturbance with the designated biogenic reef features. As there will be no interaction between the Project and the designated biogenic reef feature, it is considered that there is no pathway for the Project to act in-combination with the identified projects on this feature. There is, **therefore, no potential for AEoI on *S. Spinulosa* reef features, having regard to the conservation objectives of the Inner Dowsing, Race Bank and North Ridge SAC in relation to physical habitat loss/disturbance from the Project in-combination with other Tier 1 plans and projects during construction and decommissioning and therefore, subject to natural change, the designated features will be maintained in the long-term.**

~~1408.~~1566. The SAC contains a variety of dynamic sandbanks, with an influx of sediments from the north, thus the inhabiting fauna are likely to be relatively tolerant to habitat disturbances and there is a good chance of renewing the physical structure of the banks and associated benthic communities (JNCC and Natural England, 2010). The likely biotopes present within the Annex I habitat 'Sandbanks which are slightly covered by seawater all the time' are deemed to be of low vulnerability and medium to high recoverability to habitat disturbance. Of the identified plans, projects and activities, only O&M activities from the Race Bank OWF have the potential to impact on the sandbank features of the SAC in-combination with the Project. Any activities from the Race Bank project are expected to small scale temporary impacts. Considering the medium to high recoverability of the communities of the sandbank features, and the embedded mitigation for the Project to redistribute any removed sediment back within the SAC (to support the recovery of the physical sandbanks) and the ongoing sediment transport to the SAC, it is expected that the sandbank features will recover within a short (1 – 2 years) timeframe. There is, **therefore, no potential for AEoI on sandbank features, having regard to the conservation objectives of the Inner Dowsing, Race Bank and North Ridge SAC in relation to physical habitat loss/disturbance from the Project in-combination with other Tier 1 plans and projects and therefore, subject to natural change, the designated features will be maintained in the long-term.**

~~1409.~~1567. It is worth noting that the Race Bank Sea Disposal Site does have overlap with the Inner Dowsing, Race Bank and North Ridge SAC, however the Race Bank Sea Disposal Site is not operational and therefore there is no pathway to result in an in-combination effect on the Inner Dowsing, Race Bank and North Ridge SAC.

Tier 2 Projects

~~1410. Eastern Greenlink 3;~~

1568. As stated above for Tier 1 projects, for a project to have an in-combination effect on a designated site with the Project with respect to physical habitat loss/disturbance, it is considered that there must be a direct overlap with an SAC that is also impacted by the Project (in this instance the Inner Dowsing, Race Bank and North Ridge SAC). Therefore, as neither of the identified Tier 2 projects (Eastern Green Link 3 and 4) have direct overlap with this site, there is no potential for an effect in-combination. Therefore, **there is no potential for AEoI, having regard to the conservation objectives of the Inner Dowsing, Race Bank and North Ridge SAC, The Wash and North Norfolk Coast SAC, and The Wash Ramsar in relation to physical habitat loss/disturbance from the Project in-combination with both Tier 1 and Tier 2 plans and projects during construction and decommissioning. Therefore, subject to natural change, the designated features will be maintained in the long-term.**

~~Eastern Greenlink 4;~~

- ~~No Tier 2 projects identified.~~

Tier 3 Projects

- No Tier 3 projects identified.

10.1.1.2 Suspended sediment/deposition

~~1411.~~1569. There is the potential for in-combination suspended sediment/deposition as a result of both the construction and decommissioning activities associated with the Project and the Tier 1, 2 and 3 projects identified in Table 7.5. For the purposes of this assessment, this additive impact has been assessed from projects that fall within the screening range defined within Section 7.2.

~~1412.~~1570. The plans or projects identified to contribute to an in-combination effect on the sites listed above (paragraph 1478~~1403~~), as a result of suspended sediment/deposition are as follows:

- Tier 1;
  - Inner Dowsing OWF;
  - Lincs OWF;
  - Triton Knoll OWF;
  - Race Bank OWF;
  - Dudgeon OWF;
  - Lynn OWF;
  - Sheringham Shoal Extension OWF;
  - Dudgeon Extension OWF;
  - Hornsea Three Transmission Asset;
  - Westminster Gravels Ltd (515/2);
  - Westminster Gravels Ltd (515/1);
  - Hanson Aggregates Marine Ltd (106/2);
  - Hanson Aggregates Marine Ltd (106/3);
  - Hanson Aggregates Marine Ltd (106/1);
  - Hanson Aggregates Marine Ltd (400);
  - Tarmac Marine Ltd (197);
  - Tarmac Marine Ltd (481/1);
  - Tarmac Marine Ltd (493);
  - Van Oord Ltd (481/2);
  - Race Bank Sea Disposal Site;
  - Hornsea Disposal Area 1;
  - Hornsea 1 OFTO;
  - Hornsea 2 OFTO;

- Triton Knoll Transmission Asset;
- Dudgeon OFTO;
- Race Bank OFTO;
- Lincs Transmission Asset;
- Inner Dowsing Transmission Asset;
- Gas Shearwater to Bacton Seal Line (Shell);
- Elgood to Blythe Gas Export Pipeline and~~;~~
- Elgood to Blythe Umbilical Pipeline.~~;~~
- ~~Durango 48/21A-4 Oil and Gas Works; and~~
- ~~48/9A Mimas Oil and Gas Works.~~

- Tier 2;
  - Eastern Greenlink 3; and
  - Eastern Greenlink 4.
  - ~~No Tier 2 projects identified.~~
- Tier 3;
  - Hanson Aggregates Marine Ltd (1805);

Tier 1

~~1413.~~1571. Of the Tier 1 projects identified above, for a project to have an in-combination effect on a designated site with the Project with respect to suspended sediment/deposition, it is considered that there must be an overlap of the ZoI for suspended sediment/deposition to reach. It is considered within Part 6, Volume 1, Chapter 9: Benthic Subtidal and Intertidal Ecology that up to 600m from the release point is considered to be the zone of lesser but measurable SSC increase and no measurable thickness of deposition. Therefore, projects and sites that fall within the 600m zone of measurable SSC increases have been assessed for a potential in-combination impact. The only sites considered to be within this ZoI for in-combination effects are the Inner Dowsing, Race Bank and North Ridge SAC, The Wash and North Norfolk Coast SAC, and The Wash Ramsar. Additionally, several of the projects listed above do not require consideration, with only the following projects identified as having any overlap with any potential SAC:

- Inner Dowsing OWF;
- Lincs OWF;
- Race Bank OWF;
- Lynn OWF;
- Westminster Gravels Ltd (515/1);

- Hanson Aggregates Marine Ltd (106/3);
- Tarmac Marine Ltd (481/1);
- Van Oord Ltd (481/2);
- Race Bank Sea Disposal Site;
- Hornsea Three Transmission Asset;
- Triton Knoll Transmission Asset;
- Dudgeon OFTO;
- Race Bank OFTO;
- Lincs Transmission Asset; and
- Inner Dowsing Transmission Asset.

~~1414.~~1572. The Inner Dowsing OWF, Lincs OWF, Race Bank OWF, Lynn OWF, Westminster Gravels Ltd (515/1), Hanson Aggregates Marine Ltd (106/3), Tarmac Marine Ltd (481/1), Van Oord Ltd (481/2), Race Bank Sea Disposal Site, Triton Knoll Transmission Asset, Race Bank OFTO, Lincs Transmission Asset and Inner Dowsing Transmission Asset all have direct overlap with the Inner Dowsing, Race Bank and North Ridge SAC. The Hornsea Three Transmission Asset, Dudgeon OFTO and Race Bank OFTO all have direct overlap with The Wash and North Norfolk Coast SAC. The Race Bank OFTO has direct overlap with The Wash Ramsar site, and as the Project also overlaps with this SAC, there is a potential for an in-combination effect to arise.

~~1415.~~1573. Part 6, Volume 1, Chapter 9: Benthic Subtidal and Intertidal Ecology details that the highest increase in SSC and greatest likely thickness of deposition will occur in the 0-50 m zone, where all gravel sized sediment and also a large proportion of sands that are not resuspended high into the water column will settle. As distance increases the thickness of deposition and levels of SSC is likely to decrease with mainly fines remaining in suspension. For the three designated sites, the two features that are considered to be potentially impacted the most by suspended sediment/deposition are *S. Spinulosa* reef and sandbanks which are slightly covered by sea water all the time.

~~1416.~~1574. *S. Spinulosa* are often found in areas of high-water movement with some degree of sediment transport essential for tube-building and feeding (Jackson and Hiscock, 2008). Given their preference for turbid waters their tolerance to the suspension and/or settlement of fine material during adjacent construction activity may be high (Jackson and Hiscock 2008; Tyler-Walters 2008). *S. Spinulosa* reefs adjacent to for example aggregate dredging areas appear unimpacted by dredging operations (Pearce et al. 2007; Pearce et al. 2011). Evidence suggests that given the dynamic sedimentary environments in which sabellariids live, their populations can certainly persevere in turbid conditions in spite of 'typical' natural levels of burial (Last et al. 2011) and that recovery from burial events is high. It is considered that *S. Spinulosa* reef have some level of tolerance, resilience and recoverability to SSC and deposition effects. In addition, the short-term and intermittent nature of the effects associated with the construction and decommissioning works, mean that it is considered that there will be limited impacts on *S. Spinulosa* reef within the site.

~~1417.~~1575. For the designated sandbank feature at the site, the re-settlement of the deposited sediments will mean that all sediment is immediately available for transport at the naturally occurring rate and direction, controlled entirely by natural processes. As such, the sediment will have immediately re-joined the natural sedimentary environment within the local area and so by definition is not 'lost from the system' due to the dredging/spoil disposal process. Due to the dynamic nature of the sandwaves, these morphological features are considered to have moderate levels of recoverability (Part 6, Volume 1, Chapter 7: Marine Physical Processes). There is, **therefore, no potential for AEoI, having regard to the conservation objectives of the Inner Dowsing, Race Bank and North Ridge SAC, The Wash and North Norfolk Coast SAC, and The Wash Ramsar in relation to suspended sediment/deposition from the Project in-combination with other Tier 1 plans and projects during construction and decommissioning and therefore, subject to natural change, the designated features will be maintained in the long-term.**

Tier 2 Projects

~~1418.~~1576. As stated above for Tier 1 projects, projects and sites that fall within the 600m zone of measurable SSC increases have been assessed for a potential in-combination impact. Therefore, projects and sites that fall within the 600m zone of measurable SSC increases have been assessed for a potential in-combination impact. As stated above, the only sites considered to be within this ZoI for in-combination effects are the Inner Dowsing, Race Bank and North Ridge SAC, The Wash and North Norfolk Coast SAC, and The Wash Ramsar. Both of the identified Tier 2 projects (Eastern Green Link 3 and 4) are beyond 600m from any of these sites, and therefore there is no potential for an effect in-combination. Therefore, **there is no potential for AEoI, having regard to the conservation objectives of the Inner Dowsing, Race Bank and North Ridge SAC, The Wash and North Norfolk Coast SAC, and The Wash Ramsar in relation to suspended sediment/deposition from the Project in-combination with both Tier 1 and Tier 2 plans and projects during construction and decommissioning. Therefore, subject to natural change, the designated features will be maintained in the long-term.**~~No Tier 2 projects identified.~~

Tier 3 Projects

~~1419.~~1577. As stated above for Tier 1 and 2 projects, projects and sites that fall within the 600m zone of measurable SSC increases have been assessed for a potential in-combination impact. However, despite overlap with the site with Hanson Aggregates 1805, given the resilience of *sabellariids* to burial effects, the short-term and intermittent nature of effects, and lack of a pathway for in-combination effects on sandbanks, **there is no potential for AEoI, having regard to the conservation objectives of the Inner Dowsing, Race Bank and North Ridge SAC, The Wash and North Norfolk Coast SAC, and The Wash Ramsar in relation to suspended sediment/deposition from the Project in-combination with ~~both~~ Tier 1, 2 and Tier 3 plans and projects during construction and decommissioning. Therefore, subject to natural change, the designated features will be maintained in the long-term.**

10.1.2 O&M

~~1420.~~1578. The potential for an AEoI in-combination as a result of effects on Benthic Subtidal and Intertidal Ecology during O&M relates to the sites identified in paragraph 1478~~1403~~.

10.1.2.1 Physical habitat loss/disturbance

~~1421.~~1579. There is the potential for in-combination physical habitat loss/disturbance as a result of both the O&M activities associated with the Project and the Tier 1, 2 and 3 projects identified in Table 7.5. For the purposes of this assessment, this additive impact has been assessed from projects that fall within the benthic ecology study area.

~~1422.~~1580. The plans or projects identified to contribute to an in-combination effect on the sites listed above (paragraph 1478~~1403~~), as a result of physical habitat loss/disturbance are as follows:

- Tier 1;
  - Inner Dowsing OWF;
  - Lincs OWF;
  - Triton Knoll OWF;
  - Race Bank OWF;
  - Dudgeon OWF;
  - Lynn OWF;
  - Sheringham Shoal Extension OWF;
  - Dudgeon Extension OWF;
  - Hornsea Three Transmission Asset;
  - Westminster Gravels Ltd (515/2);
  - Westminster Gravels Ltd (515/1);
  - Hanson Aggregates Marine Ltd (106/2);
  - Hanson Aggregates Marine Ltd (106/3);

- Hanson Aggregates Marine Ltd (106/1);
- Hanson Aggregates Marine Ltd (400);
- Tarmac Marine Ltd (197);
- Tarmac Marine Ltd (481/1);
- Tarmac Marine Ltd (493);
- Van Oord Ltd (481/2);
- Race Bank Sea Disposal Site;
- Hornsea Disposal Area 1;
- Hornsea 1 OFTO;
- Hornsea 2 OFTO;
- Triton Knoll Transmission Asset;
- Dudgeon OFTO;
- Race Bank OFTO;
- Lincs Transmission Asset;
- Inner Dowsing Transmission Asset;
- Gas Shearwater to Bacton Seal Line (Shell);
- Elgood to Blythe Gas Export Pipeline; and
- Elgood to Blythe Umbilical Pipeline.~~;~~
- ~~Durango 48/21A-4 Oil and Gas Works; and~~
- ~~48/9A Mimas Oil and Gas Works.~~

- Tier 2;
  - Eastern Greenlink 3; and
  - Eastern Greenlink 4.
  - ~~No Tier 2 projects identified.~~
- Tier 3;
  - No Tier 3 projects identified.

Tier 1 Projects

~~1423.~~1581. Of the Tier 1 projects identified above, for a project to have an in-combination effect on a designated site with the Project with respect to physical habitat loss/disturbance, it is considered that there must be a direct overlap with an SAC that is also impacted by the Project. Therefore, several of the projects listed above do not require consideration, with only the following projects identified as having any overlap with the Inner Dowsing, Race Bank and North Ridge SAC (the only SAC considered to have a potential impact on physical habitat loss and disturbance from the Project):

- Inner Dowsing OWF;
- Lincs OWF;
- Race Bank OWF;
- Lynn OWF;
- Westminster Gravels Ltd (515/1);
- Tarmac Marine Ltd (481/1);
- Van Oord Ltd (481/2);
- Race Bank Sea Disposal Site
- Triton Knoll Transmission Asset;
- Race Bank OFTO;
- Lincs Transmission Asset; and
- Inner Dowsing Transmission Asset.

~~1424.~~1582. The Inner Dowsing OWF, Lincs OWF, Race Bank OWF, Lynn OWF, Westminster Gravels Ltd (515/1), Tarmac Marine Ltd (481/1), Van Oord Ltd (481/2), Race Bank Sea Disposal Site, Triton Knoll Transmission Asset, Race Bank OFTO, Lincs Transmission Asset, and Inner Dowsing Transmission Asset all have direct overlap with the Inner Dowsing, Race Bank and North Ridge SAC. The Project also overlaps with this SAC and therefore there is a potential for an in-combination effect to arise. However, when factoring the pre-construction Annex I habitat surveys implemented during construction as discussed within Section 6, it is considered that there will be no biogenic reef features affected by the physical presence of the cable. Additionally, any O&M works undertaken for the project will be informed by these pre-construction surveys, ensuring that the locations of designated reef features are known and can be avoided. Therefore, it is anticipated that habitat loss of *S. Spinulosa* reef features within the SAC will be avoided by any O&M effects, and therefore there will be no physical habitat loss with the designated reef features. As there will be no interaction between the Project and the designated biogenic reef feature, it is considered that there is no pathway for the Project to act in-combination with the identified projects on this feature. There is, **therefore, no potential for AEoI on *S. Spinulosa* reef features, having regard to the conservation objectives of the Inner Dowsing, Race Bank and North Ridge SAC in relation to physical habitat loss/disturbance from the Project in-combination with other Tier 1 plans and projects during O&M and therefore, subject to natural change, the designated features will be maintained in the long term.**

~~1425.~~1583. A preliminary CBRA has been undertaken by the Project for the section of the cable route which passes through the Inner Dowsing, Race Bank and North Ridge SAC. The results of this CBRA have been used to update the project design, with the Project able to commit to a maximum of 5% of the cable length over the sandbanks within the Inner Dowsing, Race Bank and North Ridge SAC requiring cable protection in a worst-case, and a commitment that all cable protection used on the sandbanks will be removable, and only either rock bags or concrete mattresses will be used. It is worth noting that the impact from Race Bank OWF is on the Race Bank sandbank itself, and whilst the Race Bank sandbank has been assessed as in unfavourable condition, the status of the Inner Dowsing and North Ridge sandbank features is currently largely unassessed. Additionally, the removable nature of the rock protection to be used ensures that while there may be an impact to the features, after decommissioning they are anticipated to recover in a short amount of time and there is therefore no contribution to an in-combination interaction with Race Bank.

~~1426.~~1584. Given the potential impacts from the Project are on the Inner Dowsing and North Ridge sandbank features, and there is a small overlap from removable rock protection on those sandbanks of the site (5,760m^2, approximately 1.59% of the designated sandbank features), the removability of the rock protection, and the lack of any significant interaction from the project alone with the designated sandbanks, it is considered that there is no potential for a significant interaction in-combination. **Therefore, there is no potential for AEoI on sandbank features, having regard to the conservation objectives of the Inner Dowsing, Race Bank and North Ridge SAC in relation to physical habitat loss/disturbance from the Project in-combination with other Tier 1 plans and projects during O&M and therefore, subject to natural change, the designated features will be maintained in the long-term.**

Tier 2 Projects

1585. As stated above for Tier 1 projects, for a project to have an in-combination effect on a designated site with the Project with respect to physical habitat loss/disturbance, it is considered that there must be a direct overlap with an SAC that is also impacted by the Project (in this instance the Inner Dowsing, Race Bank and North Ridge SAC). Therefore, as neither of the identified Tier 2 projects (Eastern Green Link 3 and 4) have direct overlap with this site, there is no potential for an effect in-combination. Therefore, **there is no potential for AEoI, having regard to the conservation objectives of the Inner Dowsing, Race Bank and North Ridge SAC, The Wash and North Norfolk Coast SAC, and The Wash Ramsar in relation to physical habitat loss/disturbance from the Project in-combination with both Tier 1 and Tier 2 plans and projects during operation and maintenance. Therefore, subject to natural change, the designated features will be maintained in the long-term.**

~~1427. No Tier 2 projects identified.~~

Tier 3 Projects

~~1428.~~1586. No Tier 3 projects identified.

10.1.2.2 Suspended sediment/deposition

~~1429.~~1587. There is the potential for in-combination suspended sediment/deposition as a result of the O&M activities associated with the Project and the Tier 1, 2 and 3 projects identified in Table 7.5. For the purposes of this assessment, this additive impact has been assessed from projects that fall within the benthic ecology study area.

~~1430.~~1588. The plans or projects identified to contribute to an in-combination effect on the sites listed above (paragraph 1478~~1403~~), as a result of suspended sediment/deposition are as follows:

- Tier 1;
  - Inner Dowsing OWF;
  - Lincs OWF;
  - Triton Knoll OWF;
  - Race Bank OWF;

- Dudgeon OWF;
- Lynn OWF;
- Sheringham Shoal Extension OWF;
- Dudgeon Extension OWF;
- Hornsea Three Transmission Asset;
- Westminster Gravels Ltd (515/2);
- Westminster Gravels Ltd (515/1);
- Hanson Aggregates Marine Ltd (106/2);
- Hanson Aggregates Marine Ltd (106/3);
- Hanson Aggregates Marine Ltd (106/1);
- Hanson Aggregates Marine Ltd (400);
- Tarmac Marine Ltd (197);
- Tarmac Marine Ltd (481/1);
- Tarmac Marine Ltd (493);
- Van Oord Ltd (481/2);
- Race Bank Sea Disposal Site;
- Hornsea Disposal Area 1;
- Hornsea 1 OFTO;
- Hornsea 2 OFTO;
- Triton Knoll Transmission Asset;
- Dudgeon OFTO;
- Race Bank OFTO;
- Lincs Transmission Asset;
- Inner Dowsing Transmission Asset;
- Gas Shearwater to Bacton Seal Line (Shell);
- Elgood to Blythe Gas Export Pipeline; and
- Elgood to Blythe Umbilical Pipeline.~~;~~
- ~~Durango 48/21A-4 Oil and Gas Works; and~~
- ~~48/9A Mimas Oil and Gas Works.~~

- Tier 2;
  - Eastern Greenlink 3; and

- Eastern Greenlink 4.
- ~~No Tier 2 projects identified.~~

- Tier 3;
    - Hanson Aggregates Marine Ltd (1805).~~;~~

Tier 1

~~1431.~~1589. Of the Tier 1 projects identified above, for a project to have an in-combination effect on a designated site with the Project with respect to suspended sediment/deposition, it is considered that there must be an overlap of the ZoI for suspended sediment/deposition to reach. It is considered within Part 6, Volume 1, Chapter 9: Benthic Subtidal and Intertidal Ecology that up to 600m from the release point is considered to be the zone of lesser but measurable SSC increase and no measurable thickness of deposition. Therefore, projects and sites that fall within the 600m zone of measurable SSC increases have been assessed for a potential in-combination impact. The only sites considered to be within this ZoI for in-combination effects are the Inner Dowsing, Race Bank and North Ridge SAC, The Wash and North Norfolk Coast SAC, and The Wash Ramsar. Additionally, several of the projects listed above do not require consideration, with only the following projects identified as having any overlap with any potential SAC:

- Inner Dowsing OWF;
- Lincs OWF;
- Race Bank OWF;
- Lynn OWF;
- Westminster Gravels Ltd (515/1);
- Hanson Aggregates Marine Ltd (106/3);
- Tarmac Marine Ltd (481/1);
- Van Oord Ltd (481/2);
- Race Bank Sea Disposal Site;
- Hornsea Three Transmission Asset;
- Triton Knoll Transmission Asset;
- Dudgeon OFTO;
- Race Bank OFTO;
- Lincs Transmission Asset; and
- Inner Dowsing Transmission Asset.

~~1432.~~1590. The Inner Dowsing OWF, Lincs OWF, Race Bank OWF, Lynn OWF, Westminster Gravels Ltd (515/1), Hanson Aggregates Marine Ltd (106/3), Tarmac Marine Ltd (481/1), Van Oord Ltd (481/2), Race Bank Sea Disposal Site, Triton Knoll Transmission Asset, Race Bank OFTO, Lincs Transmission Asset and Inner Dowsing Transmission Asset all have direct overlap with the Inner Dowsing, Race Bank and North Ridge SAC. The Hornsea Three Transmission Asset, Dudgeon OFTO and Race Bank OFTO all have direct overlap with The Wash and North Norfolk Coast SAC. The Race Bank OFTO has direct overlap with The Wash Ramsar site, and as the Project also overlaps with this SAC there is a potential for an in-combination effect to arise.

~~1433.~~1591. Part 6, Volume 1, Chapter 9: Benthic Subtidal and Intertidal Ecology details that the highest increase in SSC and greatest likely thickness of deposition will occur in the 0-50 m zone, where all gravel sized sediment and also a large proportion of sands that are not resuspended high into the water column will settle. As distance increases the thickness of deposition and levels of SSC is likely to decrease with mainly fines remaining in suspension. For the three designated sites, the two features that are considered to be potentially impacted the most by suspended sediment/deposition are *S. Spinulosa* reef and which are slightly covered by sea water all the time. *S. Spinulosa* reef are considered to have some level of tolerance, resilience and recoverability to SSC effects. In addition, the short-term and intermittent nature of the effects associated with the O&M works, mean that it is considered that there will be no significant impact to *S. Spinulosa* reef within the sites.

~~1434.~~1592. For the designated sandbank feature at the site, the re-settlement of the deposited sediments will mean that all sediment is immediately available for transport at the naturally occurring rate and direction, controlled entirely by natural processes. As such, the sediment will have immediately re-joined the natural sedimentary environment within the local area and so by definition is not 'lost from the system' due to the dredging/spoil disposal process. Due to the dynamic nature of the sandwaves, these morphological features are considered to have moderate levels of recoverability (Part 6, Volume 1, Chapter 7: Marine Physical Processes). It is therefore considered that as the project will have no impact on the features at this site from the project alone (Section 9.2), it is considered that there is no pathway for effect in-combination between the project and any of the identified projects. There is, **therefore, no potential for AEoI, having regard to the conservation objectives of the Inner Dowsing, Race Bank and North Ridge SAC, The Wash and North Norfolk Coast SAC, and The Wash Ramsar in relation to suspended sediment/deposition from the Project in-combination with other Tier 1 plans and projects during O&M and therefore, subject to natural change, the designated features will be maintained in the long-term.**

Tier 2 Projects

1593. As stated above for Tier 1 projects, projects and sites that fall within the 600m zone of measurable SSC increases have been assessed for a potential in-combination impact. Therefore, projects and sites that fall within the 600m zone of measurable SSC increases have been assessed for a potential in-combination impact. As stated above, the only sites considered to be within this ZoI for in-combination effects are the Inner Dowsing, Race Bank and North Ridge SAC, The Wash and North Norfolk Coast SAC, and The Wash Ramsar. Both of the identified Tier 2 projects (Eastern Green Link 3 and 4) are beyond 600m from any of these sites, and therefore there is no potential for an effect in-combination. Therefore, **there is no potential for AEoI, having regard to the conservation objectives of the Inner Dowsing, Race Bank and North Ridge SAC, The Wash and North Norfolk Coast SAC, and The Wash Ramsar in relation to suspended sediment/deposition from the Project in-combination with both Tier 1 and Tier 2 plans and projects during operation and maintenance. Therefore, subject to natural change, the designated features will be maintained in the long-term.**

1594.

- ~~Eastern Greenlink 3;~~
- ~~Eastern Greenlink 4;~~

~~1435. No Tier 2 projects identified.~~

Tier 3 Projects

~~1436.~~1595. As stated in Tier 1, it is considered that there is no significant impact from the Project in-combination with other projects on any designated features of the identified designated sites. The same approach applies for the Tier 3 projects identified. There is, **therefore, no potential for AEoI, having regard to the conservation objectives of the Inner Dowsing, Race Bank and North Ridge SAC, The Wash and North Norfolk Coast SAC, and The Wash Ramsar in relation to suspended sediment/deposition from the Project in-combination with both Tier 1 and Tier 3 plans and projects during O&M and therefore, subject to natural change, the designated features will be maintained in the long-term.**

10.2 Marine Mammals

1596. The Marine Mammals in-combination assessment has been updated February 2025 to consider:

- The introduction of an Offshore Restricted Build Area (ORBA) over the northern section of the Project array area;
- The removal of the northern section of the offshore Export Cable Corridor (ECC);
- A revised in-combination assessment to reflect changes to project status or capture any new plans, projects or activities which have been progressed since the point of the Application; and
- Minor errata including those previously identified by interested parties.

~~1437.~~1597. The potential for LSE in-combination from the Project with regard to marine mammals is summarised in Section 7.2, with the in-combination assessment presented below.

~~1438.~~1598. Information to inform the Project alone assessment for marine mammals is provided in Section 0~~9.2~~ which assesses impacts on the three marine mammal features (harbour porpoise, harbour seal and grey seal) associated with three UK sites and 12 transboundary sites during construction, operation, maintenance and decommissioning (Table 7.1).

~~1439.~~1599. Part 6, Volume 1, Chapter 11: Marine Mammals considers that several of the impacts assessed for the Project alone are not considered relevant in the cumulative assessment due to:

- the highly localised nature of the impacts;
- management and mitigation measures in place at the Project and on other projects that will reduce the risk occurring; and
- where the potential significance of the impact from the Project alone has been assessed as negligible.

~~1440.~~1600. Therefore, based on these conclusions, the in-combination assessment excludes several impacts assessed for the Project alone. Table 10.2 summarises the impacts that are assessed in the marine mammal in-combination assessment presented here.

Table 10-2~~10.2~~10-~~210.2~~: Screening of impacts for inclusion in AA in-combination, following AA alone conclusions (taken from ES Part 6, Volume 1, Chapter 11: Marine Mammals)

AA alone impact pathway	Screened in for AA in-combination	Reason for exclusion
Underwater noise	Yes, but for disturbance in construction and decommissioning only	Auditory injury (PTS): where PTS may result from activities such as pile driving and UXO clearance, suitable mitigation will be put in place to reduce injury risk to marine mammals (as a requirement of European Protected Species legislation). Barrier effects are considered to be highly localised and negligible significance within ES Part 6, Volume 1, Chapter 11: Marine Mammals.
Vessel disturbance	Yes, all phases	N/A
Vessel collision risk	No	It is expected that all offshore wind projects will follow the Codes of Conduct provided by the WiSe Scheme[14], Scottish Marine Wildlife Watching Code[15] or Guide to Best Practice for Watching Marine Wildlife[16] to reduce the already low risk of collisions with marine mammals.

[14] https://www.wisescheme.org/
[15] https://www.nature.scot/scottish-marine-wildlife-watching-code-smwwc-part-1
[16] https://www.nature.scot/guide-best-practice-watching-marine-wildlife-smwwc-part-2

AA alone impact pathway	Screened in for AA in-combination	Reason for exclusion
Indirect pollution	No	Impact is highly localised and of negligible significance according to ES Part 6, Volume 1, Chapter 11: Marine Mammals.
Accidental pollution	No	Impact is highly localised and of negligible significance according to ES Part 6, Volume 1, Chapter 11: Marine Mammals.
Changes to prey	No	Impact is highly localised and of negligible significance according to ES Part 6, Volume 1, Chapter 11: Marine Mammals.

~~1441.~~1601. As with the Project alone assessments presented in Section 0~~9.2~~, the in-combination assessment for marine mammals assesses whether the impacts listed above have the potential to prevent the conservation objectives of the relevant designated sites being met. The same approach is taken here; however, the conservation objectives are not repeated.

~~1442.~~1602. The in-combination assessment for marine mammals has been determined based on the plans and projects described within Table 7.6 where there is potential for any phase of such projects to have temporal or spatial overlap with that of the Project, and there is a potential for the effects screened in within Table 10.2 to occur from the project. No information is currently available regarding oil and gas seismic surveys so they have not been included further within this assessment. Similarly, CCS projects are not considered for underwater noise given the nature of the projects.

~~1443.~~1603. For clarity, a Zone of Influence (ZOI) has been applied to screen in relevant offshore projects. The ZOI for marine mammals is the species-specific MU (North Sea MU for porpoise, Southeast MU for harbour seals, combined Southeast and Northeast MUs for grey seals).

~~1444.~~1604. The assessment presented here draws on the cumulative assessments presented in ES Part 6, Volume 1, Chapter 11: Marine Mammals.

~~1445.~~1605. Effectively for a project to be screened in for in-combination assessment, there needs to be potential for relevant works to occur within the same timeframe as relevant works at the Project, with these identified in Table 10.2. The sites/features included in-combination are then those that are located within the species-specific screening distance from one or more of the Projects identified for in-combination assessment.

~~1446.~~1606. Each project has been considered on the basis of effect–receptor pathway, data confidence and the temporal and spatial scales involved. This screened in only some of the Projects presented in Table 7.6.

~~1447.~~1607. The time period considered for marine mammals is 2022-2032 inclusive and the potential piling window for the Project is expected to be sometime between 2026-2029 inclusive. The tiering structure discussed in Section 7.2 was used for the assessment, noting that the tiering structure for marine mammals is different to that of the other receptors and aligns with the tiers proposed by Natural England in 2022 as presented within Table 7.3 and ES Part 6, Volume 1, Chapter 11: Marine Mammals.

~~1448.~~1608. Where possible for each project, information on the expected impacts on marine mammal features of the relevant designated sites have been collated and used to inform the in-combination assessment presented below.

10.2.1 Construction and decommissioning

10.2.1.1 Underwater noise

~~1449.~~1609. The potential for an AEoI in-combination as a result of underwater noise on marine mammals during construction and decommissioning relates to the following designated sites and the relevant features (i.e. the features screened in for potential LSE). The potential for LSE during decommissioning would be similar to, and potentially less than, that outlined in the construction phase.

- Southern North Sea SAC (harbour porpoise);
- Wash and North Norfolk Coast SAC (harbour seal);
- Humber Estuary SAC (grey seal);
- Humber Estuary Ramsar (grey seal);
- Berwickshire and North Northumberland Coast SAC (grey seal);
- Moray Firth SAC (bottlenose dolphin);
- Transboundary sites (for harbour seal, specifically Doggersbank (Netherlands) SAC and Klaverbank SCI); and
- Transboundary sites (twelve sites for grey seal, specifically Doggersbank (Netherlands) SAC, Klaverbank SCI, Bancs des Flandres, Vlaamse Banken, SBZ 1, SBZ 2, SBZ 3, Vlakte van de Raan, Westerschelde & Saeftinghe, Voordelta, Noordzeekustzone and Waddenzee).

~~1450.~~1610. Of the Projects identified in Table 7.6 above, those with the potential for an in-combination effect with the Project with respect to underwater noise are limited to those with potential for a temporal overlap of the construction phases (specifically piling or, if known, UXO or seismic survey).

~~1451.~~1611. Timeframes for decommissioning are highly uncertain for all projects and therefore an assessment of the potential for an in-combination effect during decommissioning cannot be made at this time. However, it is likely that the potential for effect during decommissioning would be less than that during construction and would in any case be assessed in line with the regulatory requirements at the time.

~~1452.~~1612. As highlighted in the assessment of AEoI for the Project alone, there are a number of potential sources of underwater noise associated with construction of an OWF. Comment on these for the purposes of the in-combination assessment is provided below:

- Percussive piling–- to be carried through to the assessment for projects screened in in-combination;
- UXO clearance–- planned and licensed UXO activity associated with projects screened in is included (where that information is in the public domain); and

- Geophysical and seismic survey -planned geophysical/seismic survey included within the screening range (where that information is in the public domain).

~~1453.~~1613. Vessel disturbance is considered separately.

~~1454.~~1614. The potential for underwater noise to result during construction of the Project, together with the sensitivity of harbour porpoise, harbour seal and grey seal to such noise, has been discussed in Section 9.2~~09.29.3~~ as part of the assessment of AEoI alone, with that information not repeated here.

~~1455.~~1615. The assessment in-combination is made below, initially for harbour porpoise and then for harbour seal and grey seal.

Potential for an In-combination Effect on Harbour Porpoise from Underwater Noise

~~1456.~~1616. Of the projects presented in Table 7.6, it is considered that only nine projects have the potential to have an in-combination effect with the Project. For a project to be considered for underwater noise, they must overlap temporally with the anticipated noise generating stages of construction (2026-2029 inclusive, Part 6, Volume 1, Chapter 11: Marine Mammals) and spatially with the SNS SAC. Based on the latest guidance, a 26km EDR is considered appropriate for underwater noise effects and therefore for a project to be considered to act in combination with the Project spatially it must have an overlap with the summer area of the SNS SAC when factoring in a 26km buffer. Following this, the considered projects are:

- Dudgeon Extension OWF;
- East Anglia 1N OWF;
- East Anglia 2 OWF;
- Hornsea 3 OWF;
- Hornsea 4 OWF;
- Norfolk Boreas OWF;
- Dogger Bank C;
- Dogger Bank South (East); and
- Dogger Bank South (West).

~~1457.~~1617. Table 10.3 and Table 10.4 below provide further information on the potential for spatial and temporal in-combination effects (respectively) on the SNS SAC.

~~1458.~~1618. For the Tier 3 and 4 projects assessed, it is considered that the degree of certainty in terms of project programme timeframe and project scale decreases with the increasing tier allocation. Whilst it is recognised that the planned construction windows of these windfarm projects, where publicly available, may overlap with (and may extend beyond) the construction window of the Project, it is acknowledged, in common with all such projects with such a large construction window during the planning process and prior to securing a CfD, that actual construction may last for a proportion of the total construction window and that in reality the actual construction window may shift further. In addition, it is common for the scale of a project to change following consent or achieving CfD, for example a reduced number of WTGs (potentially with an increased capacity per WTG) may be progressed to final scheme design.

~~1459.~~1619. Therefore, the quantitative assessment is presented in stages–- essentially increasing the potential for impact as each tier is added (while increasing the uncertainty that such a scenario would ever occur). The purpose is to provide a comprehensive assessment while enabling the areas of ‘'risk’' in-combination to be identified. The areas of risk are effectively seasons where there is a risk of an in-combination exceedance of thresholds, the certainty of that exceedance being driven by the tier within which the relevant project(s) sit. All such risk is highlighted here for the In-principle SNS SAC SIP (to be submitted as part of the DCO Application). The main purpose of the SIP is to manage the risk posed by such uncertainty going forward, and to provide certainty in planning terms that where a risk of threshold exceedance has been identified, measures are in place to address that risk and ensure the thresholds are not breached. Such an approach was first used on East Anglia Three, a project which achieved consent in August 2017.

~~1460.~~1620. The assessment of the potential for AEoI with respect to underwater noise for plans and projects in-combination with the Project in relation to harbour porpoise and with regard to the conservation objectives of the site is determined below,.

Potential for significant disturbance to the species within the site

~~1461.~~1621. For the purposes of the assessment of AEoI in-combination for harbour porpoise, the methodology applied to the assessment alone for the conservation objectives concerned with disturbance in harbour porpoise has been extended to consider the potential for effect from the above projects in-combination.

~~1462.~~1622. The overall aim of the assessment of disturbance within the SNS SAC is to identify the percentage of the relevant part of the SAC within which harbour porpoise may exhibit avoidance behaviour (displacement) together with an understanding of the total duration of such disturbance, within the overall construction window. The approach takes account of both spatial and temporal elements, as required by the definition of significance. As much of the ~~array~~ WTG area construction activities will fall within the SNS SAC summer area (although in total the construction timeline will extend across a number of seasons), the assessment is presented on a seasonal basis – to enable the potential for effect to be fully understood for which works may occur from the Project.

~~1463.~~1623. The following assessment includes a number of assumptions, with these summarised as follows:

- Only relevant works at the Project that may result in underwater noise planned during the summer season (April – September) within the period 2026 – 2029 (i.e. the months during the expected construction timeframe that the summer area of the SNS SAC supports higher densities of harbour porpoise plus one year either side) are considered. This is in line with the cumulative assessment for marine mammals presented in ES Part 6, Volume 1, Chapter 11: Marine Mammals. It is expected that site preparation works prior to foundation installation will take place intermittently between Q1 2026 – Q4 2026;
- An assumption that all UXO clearance, geophysical survey and foundation piles at the Project will be installed within the 2026-2029 timeframe, but UXO/geophysical survey will precede piling (in any case adding totals would be inaccurate given the high degree of EDR overlap that would result);
- All construction activities associated with the Project are relevant to the summer season only;
- Piling may be consecutive (single piling event per 24-hours) or concurrent (up to two piling rigs per 24-hours);
- Piling may be monopiles (26km EDR) or pinpiles (15km EDR);
- Should geophysical survey occur, a 5km buffer has been applied (as the 12km EDR applies to air gun surveys not typical of an offshore windfarm); and
- The maximum spatial overlap that may occur from an individual UXO clearance or piling location within each project has been assumed (based on a 26km EDR).

~~1464.~~1624. Table 10.3 summarises the potential for effect from a single event (assumed worst case, whether that be monopiles or UXO clearance) per day for the Project and the Projects assessed in combination with the Project. Only those projects whose impact areas overlap with the summer part of the SNS SAC have been considered. The potential effect from two activities (whichever would result in the worst footprint) to occur per 24-hours is summarised in Table 10.4. Figure values are presented as minimum and maximum (where relevant) as the location of noise relevant to the SNS SAC will affect the degree of spatial overlap. It is also particularly relevant to note that the calculations assume that all projects will progress in the timeframes specified, that activities will occur at the worst possible locations for each project simultaneously, do not take account of overlap between projects and do not include the possibility of noise mitigation at source. It is therefore clear that the values in-combination represent a highly unlikely scenario – with considerable precaution built into the assessment.

~~1465.~~1625. Figure 10.3 shows the location of the Projects considered in-combination for underwater noise disturbance impacts.

Table 10-3~~10.310-310.3~~: Spatial Effect In-Combination from a Single Event in a Single Day in Summer Season (cells highlighted in red are at risk of exceeding the threshold if unmitigated through the SIP process)

Project		Season Summer 25 (km²)	Summer 26 (km²)	Summer 27 (km²)	Summer 28 (km²)	Summer 29 (km²)	Relevant activity
The Project	Max (km²)	-	1922.79	~~1726~~1631.2~~.31~~	~~1726.31~~1631.2	~~1726.~~1631.2~~31~~	UXO/geophysical surveys Q2 2026-Q2 2027
	Min (km²)	-	496.65	149.23	149.23	149.23	ANS area piling 2026 (ANS South having the largest impact) ~~Array~~ WTG area piling Q2 2027-Q2 2029
Total for the Project	Max (km²)	-	1922.79	~~1726.31~~1631.2	~~1726.31~~1631.2	~~1726.31~~1631.2	Daily unmitigated area (EDR of 26km)
	Min (km²)	-	496~~69~~.65	149.23	149.23	149.23	
	Max (%)	-	7.12~~1~~%	6.04~~39~~%	6.04~~39~~%	6.04~~39~~%	Daily unmitigated % (EDR of 26km)
	Min (%)	-	1.84%	0.55%	0.55%	0.55%	
Tier 2							
Dogger Bank C	Max (km²)	25.32	25.32	25.32	-	-	UXO 2024 Piling Q1 2025 – Q4 2027
	Min (km²)	-	-	-	-	-	
Total for the Project and Tier 2	Max (km²)	25.32	1948.11	~~1751.63~~1656.52	~~1726.31~~1631.2	~~1726.31~~1631.2	Daily unmitigated % (EDR of 26km)
	Min (km²)	-	496.65	149.23	149.23	149.23	
	Max (%)	0.09%	7.21%	6.14~~48~~%	6.04~~39~~%	6.04~~39~~%	Daily unmitigated % (EDR of 26km)
	Min (%)	-	1.84%	0.55%	0.55%	0.55%	
Tier 3							
	Max (km²)	2109.09	2109.09	-	-	-	Piling Q2 2025 – Q4 2026

Project		Season Summer 25 (km²)	Summer 26 (km²)	Summer 27 (km²)	Summer 28 (km²)	Summer 29 (km²)	Relevant activity
Norfolk Boreas	Min (km²)	383.39	383.39	-	-	-	
East Anglia 1N	Max (km²)	1181.16	1181.16	-	-	-	UXO Q1 2025-Q4 2025 Piling Q1 2026 – Q3 2028
	Min (km²)	304.83	304.83	-	-	-	
East Anglia 2	Max (km²)	179.28	179.28	-	-	-	UXO Q1 2024 – Q4 2024 Piling Q1 2025 – Q4 2027
	Min (km²)	-	-	-	-	-	
Hornsea Four	Max (km²)	2123.71~~2123.71~~	2123.71	2123.71	2123.71	2123.71	UXO Q1 – Q4 2025
	Min (km²)	1929.12	1929.12	1929.12	1929.12	1929.12	Piling Q6 – Q4 2030
Hornsea Three	Max (km²)	431.54	431.54	431.54	431.54	431.54	UXO Q1 – Q4 2025 Piling Q1 2026 – Q4 2032
	Min (km²)	-	-	-	-	-	
Dudgeon Extension	Max (km²)	-	-	356.00	356.00	356.00	UXO 2027 (assumed)~~5~~ Piling 2028-2031
	Min (km²)	-	-	-	-	-	
Total for the Project + Tier 2 + Tier 3	Max (km²)	~~6050.09~~6050.1	~~7972.88~~10096.59	~~4306.884211.77~~4567.77	~~4281.564186.45~~4542.45	~~4281.56~~4542.45~~4186.45~~	Daily unmitigated area (EDR of 26km)
	Min (km²)	2617.34~~5~~	~~3114.00~~5237.69	2078.35	2078.35	2078.35	
	Max (%)	[redacted]		16.92%~~15.6093%~~	16.82%~~15.5184%~~	16.82%~~15.5184%~~	Daily unmitigated % (EDR of 26km)
	Min (%)			7.70~~69~~%	7.70~~69~~%	7.70~~69~~%	

Project		Season Summer 25 (km^2)	Summer 26 (km^2)	Summer 27 (km^2)	Summer 28 (km^2)	Summer 29 (km^2)	Relevant activity
~~Tier 4~~							
~~Dudgeon Extension~~	~~Max (km^2)~~	~~-~~	~~313.09~~	~~313.09~~	~~313.09~~	~~-~~	~~UXO 2025~~ ~~Piling 2026~~
	~~Min (km^2)~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	
~~Total for the Project + Tier 2 + Tier 3 + Tier 4~~	~~Max (km^2)~~	~~6050.09~~	~~8285.97~~	~~4619.97~~	~~4594.64~~	~~4281.56~~	~~Daily unmitigated area (EDR of 26km)~~
	~~Min (km^2)~~	~~2617.35~~	~~3114.00~~	~~2078.35~~	~~2078.35~~	~~2078.35~~	
	~~Max (%)~~	~~22.38%~~	~~30.66%~~	~~17.09%~~	~~17.00%~~	~~15.84%~~	~~Daily unmitigated % (EDR of 26km)~~
	~~Min (km^2)~~	~~9.68%~~	~~11.52%~~	~~7.69%~~	~~7.69%~~	~~7.69%~~	
Tier 4~~5~~							
Dogger Banks South (West)	Max (km^2)	-	-~~2123.71~~	2123.7~~1~~	2123.7~~1~~	2123.7~~1~~	UXO Q1 – Q4 2026 Piling Q1 2027 – Q4 2029
	Min (km^2)	-	-~~2123.71~~	2123.7~~1~~	2123.7~~1~~	2123.7~~1~~	
Dogger Bank South (East)	Max (km^2)	-	-~~2123.71~~	2123.7~~1~~	2123.7~~1~~	2123.7~~1~~	UXO Q1 – Q4 2026 Piling Q1 2027 – Q4 2029
	Min (km^2)	-	-~~1974.86~~	1974.86	1974.86	1974.86	
Total for the Project + Tier 2 + Tier 3 + [redacted]	Max (km^2)	6050.1~~6050.09~~	10096.59~~12533.39~~	8815.19~~8867.39~~	8789.87~~8842.06~~	8789.87~~8528.98~~	Daily unmitigated area (EDR of 26km)
	Min (km^2)	2617.34~~2617.~~	~~7212.57~~9336.	6176.92	6176.92	6176.92	
	Max (%)	[redacted]					Daily unmitigated % (EDR of 26km)

Project		Season					Relevant activity
		Summer 25 (km^2)	Summer 26 (km^2)	Summer 27 (km^2)	Summer 28 (km^2)	Summer 29 (km^2)	
Tier 4 ~~+ Tier 5~~	Min (km^2)	9.69%~~9.68%~~	[redacted]				

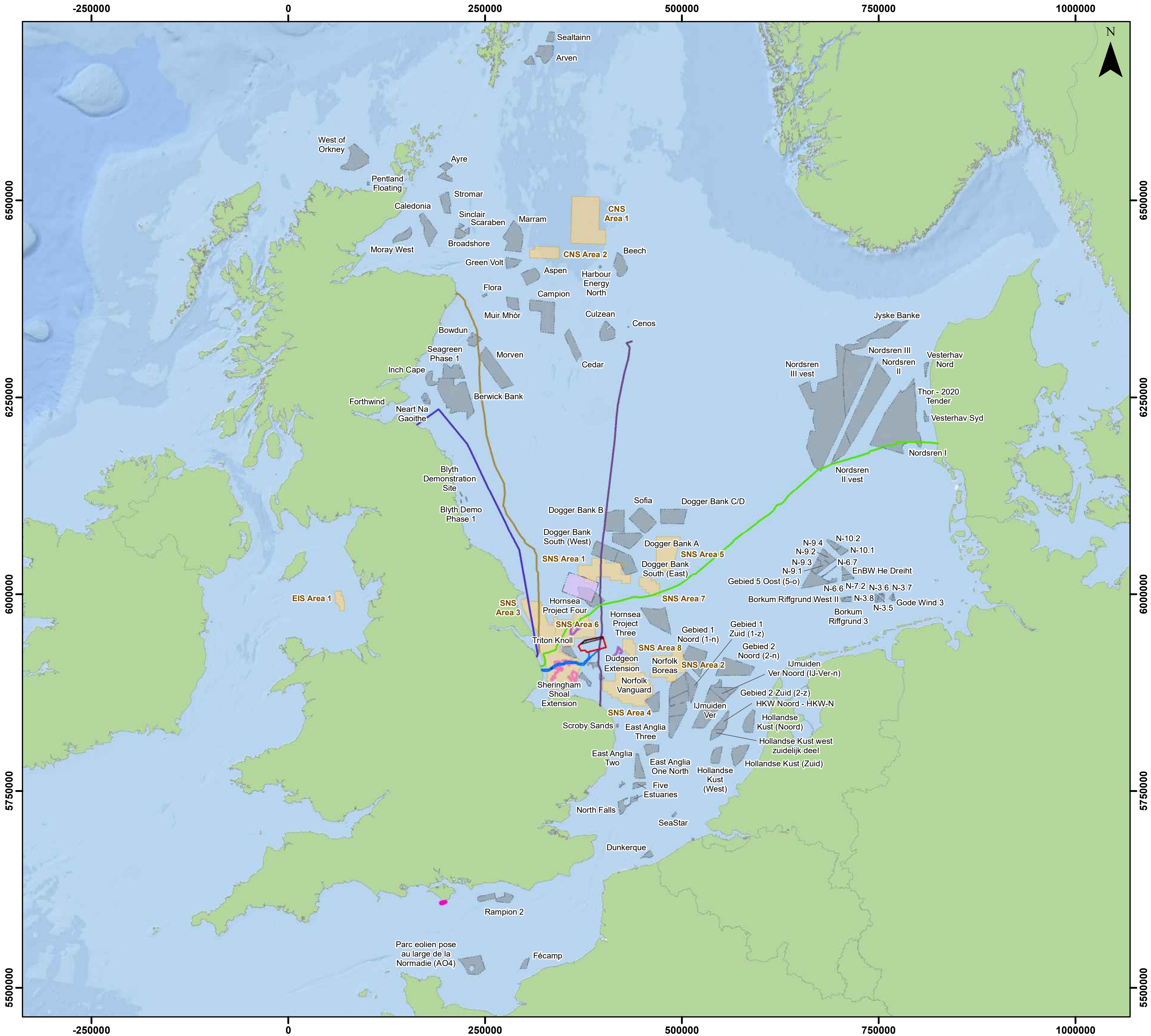
Table 10-4~~10.4~~10.4~~10.4~~: Spatial Effect In-Combination from two Events in a Single Day per Season (cells highlighted in red are at risk of exceeding the threshold if unmitigated through the SIP process).

Project		Season Summer 25 (km²)	Summer 26 (km²)	Summer 27 (km²)	Summer 28 (km²)	Summer 29 (km²)	Relevant activity
The Project	Max (km^2)	-	2177.70	~~2084~~1641.20~~.60~~	~~2084.60~~1641.20	~~2084.60~~1641.20	UXO/geophysical surveys Q2 2026-Q2 2027 ANS area piling 2026 (ANS South having the largest impact) ~~Array~~ WTG area piling Q2 2027-Q2 2029
	Min (km^2)	-	496.65	149.23	149.23	149.23	
Total for the Project	Max (km^2)	-	2177.70	~~2084.60~~1641.20	~~2084.60~~1641.20	~~2084.60~~1641.20	Daily unmitigated area (EDR of 26km)
	Min (km^2)	-	496.65	149.23	149.23	149.23	
	Max (%)	-	8.07~~6~~%	~~7.71~~6.08~~7~~%	~~7.71~~6.08~~7~~%	~~7.71~~6.08~~7~~%	Daily unmitigated % (EDR of 26km)
	Min (%)	-	1.84%	0.55%	0.55%	0.55%	
Tier 2							
Dogger Bank C	Max (km^2)	25.32~~0~~	25.32~~0~~	25.32~~0~~	-	-	UXO 2024 Piling Q1 2025 – Q4 2027
	Min (km^2)	-	-	-	-	-	
Total for the Project and Tier 2	Max (km^2)	25.32~~0~~	2203.02~~0~~	~~2109.90~~1666.52	~~2084.60~~1666.52	~~2084.60~~1641.2	Daily unmitigated % (EDR of 26km)
	Min (km^2)	-	496.65	149.23	149.23	149.23	
	Max (%)	0.09%	8.16~~5~~%	6.17~~7.81~~%	6.08~~7.71~~%	6.08~~7.71~~%	Daily unmitigated % (EDR of 26km)
	Min (%)	-	1.84%	0.55%	0.55%	0.55%	
Tier 3							

Project		Season Summer 25 (km^2)	Summer 26 (km^2)	Summer 27 (km^2)	Summer 28 (km^2)	Summer 29 (km^2)	Relevant activity
Norfolk Boreas	Max (km^2)	2448.60	2448.60	-	-	-	Piling Q2 2025 – Q4 2026
	Min (km^2)	383.39	383.39	-	-	-	
East Anglia 1N	Max (km^2)	1366.10	1366.10	-	-	-	UXO Q1 2025-Q4 2025
	Min (km^2)	304.83	304.83	-	-	-	Piling Q1 2026 – Q3 2028
East Anglia 2	Max (km^2)	179.30	179.30	-	-	-	UXO Q1 2024 – Q4 2024
	Min (km^2)	-	-	-	-	-	Piling Q1 2025 – Q4 2027
Hornsea Four	Max (km^2)	~~3682.80~~3682.80	3682.80	3682.80	3682.80	3682.80	UXO Q1 – Q4 2025
	Min (km^2)	1929.12	1929.12	1929.12	1929.12	1929.12	Piling Q6 – Q4 2030
Hornsea Three	Max (km^2)	502.10	502.10	502.10	502.10	502.10	UXO Q1 – Q4 2025 Piling Q1 2026 – Q4 2032
	Min (km^2)	-	-	-	-	-	
Dudgeon Extension	Max (km^2)	-	2123.7	627.59	637.59	~~-~~627.59	UXO 2025 Piling 2026
	Min (km^2)	-	-	-	-	-	
Total for the Project + Tier 2 + Tier 3	Max (km^2)	8204.22~~8204.20~~	12505.62~~10381.90~~	6479.01~~6294.80~~	6463.69~~6269.50~~	6453.69~~6269.50~~	Daily unmitigated area (EDR of 26km)
	Min (km^2)	2617.34~~2617.35~~	2078.35~~3114.00~~	2078.35~~2078.35~~	2078.35~~2078.35~~	2078.35~~2078.35~~	
	Max (%)	[redacted]					Daily unmitigated % (EDR of 26km)
	Min (%)	9.69%~~9.68%~~	7.70%~~11.52%~~	7.70%~~7.69%~~	7.70%~~7.69%~~	7.70%~~7.69%~~	

Project		Season Summer 25 (km^2)	Summer 26 (km^2)	Summer 27 (km^2)	Summer 28 (km^2)	Summer 29 (km^2)	Relevant activity
~~Tier 4~~							
~~Dudgeon Extension~~	~~Max (km^2)~~	~~-~~	~~651.00~~	~~651.00~~	~~651.00~~	~~-~~	~~UXO 2025~~ ~~Piling 2026~~
	~~Min (km^2)~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	
~~Total for the Project + Tier 2 + Tier 3 + Tier 4~~	~~Max (km^2)~~	~~8204.20~~	~~11032.90~~	~~6945.80~~	~~6920.50~~	~~6269.50~~	~~Daily unmitigated area (EDR of 26km)~~
	~~Min (km^2)~~	~~2617.35~~	~~3114.00~~	~~2078.35~~	~~2078.35~~	~~2078.35~~	
	~~Max (%)~~	~~30.35%~~	~~40.82%~~	~~25.70%~~	~~25.60%~~	~~23.20%~~	~~Daily unmitigated % (EDR of 26km)~~
Tier 4~~5~~							
Dogger Banks South (West)	Max (km^2)	-	3773.10	3773.10	3773.10	3773.10	UXO Q1 – Q4 2026 Piling Q1 2027 – Q4 2029
	Min (km^2)	-	-~~2123.71~~	2123.71	2123.71	2123.71	
Dogger Bank South (East)	Max (km^2)	-	-~~3671.40~~	3671.40	3671.40	3671.40	UXO Q1 – Q4 2026 Piling Q1 2027 – Q4 2029
	Min (km^2)	-	-~~1974.86~~	1974.86	1974.86	1974.86	
Total for the Project + Tier 2 + Tier 3 +	Max (km^2)	8204.22~~8204.20~~	16278.72~~18477.40~~	13923.51~~14390.30~~	13908.19~~14365.00~~	13898.19~~13714.00~~	Daily unmitigated area (EDR of 26km)
	Min (km^2)	2617.34~~2617.35~~	2078.35~~7212.57~~	6176.92~~6176.92~~	6176.92~~6176.92~~	6176.92~~6176.92~~	
	Max (%)	[redacted]					Daily unmitigated % (EDR of 26km)

Project		Season					Relevant activity
		Summer 25 (km^2)	Summer 26 (km^2)	Summer 27 (km^2)	Summer 28 (km^2)	Summer 29 (km^2)	
Tier 4 ~~+ Tier 5~~	Min (km^2)	9.69%~~9.68%~~	7.70%~~26.69%~~	[redacted]			

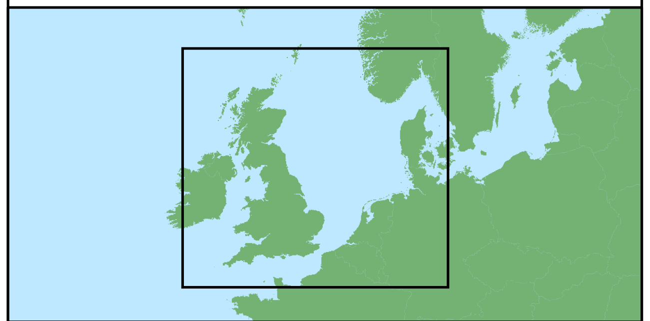


Legend

- Array Area
- Offshore Restricted Build Area
- Offshore Export Cable Corridor
- ORCP Area
- Artificial Nesting Structure Area
- Biogenic Reef Restoration Area
- Offshore Wind Farm
- Carbon Storage License Areas
- Endurance (Carbon Capture)
- Perpetuus Tidal Energy Centre (PTEC)
- Gas Shearwater to Bacton Seal Line

Subsea Power Cable

- Peterhead to South Humber (E4L5)
- South East Scotland to South Humber
- Viking Link Interconnector



Coordinate System: WGS 1984 UTM Zone 31N

0 100 200 km

Scale: 1:4,500,000

A3 Page Size

RIAA

Plans and Projects Considered for Marine Mammals

Figure 10.2

OUTER DOWSING OFFSHORE WIND

Date: 15/01/2025
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Document Path: Z:\GIS\GIS_Projects\0152 Outer Dowsing EIA\GIS\Figures\Deadline 4\RIAA\ODOW_0152_EX_RIAA_Fig10.2_Marine_Mammal_Projects.mxd

~~1466.~~1626. It should be noted that the above tables are very much intended to represent an unmitigated and precautionary worst case scenario and do not take account of any overlap between individual activities associated with individual projects – which would occur in the unlikely event that all such activity occurred in the same day. Once such double counting is taken into account, the remaining potential for overlap (based on each project piling at the worst possible location for each project and assuming an unrealistic build out) is reduced.

~~1467.~~1627. Furthermore, the timeframe of projects means that such a risk on a day-by-day basis would not actually materialise, with the maximum values even less likely to occur (as this requires simultaneous works at all projects at the worst location). With uncertainty in pile schedule and build out of projects, it is hard to assess this, with a typical reduction in the order of approximately 15-25% based on previous examples. The removal of double counting that occurs from project overlap reinforces the relevance of the primary mitigation approach noted above – effectively adding certainty to the case that primary mitigation, the application of spatial and/or temporal mitigation on activity, would be able to provide sufficient and appropriate mitigation to avoid the risk of threshold exceedance (as applied through the SIP). The exact scenario or suite of measures that would be required can only be determined when there is certainty on construction timeframes for the in-combination projects.

How the SIP will manage adherence to the thresholds

~~1468.~~1628. The In-principle SNS SAC SIP (Part 8, Report 7) will manage adherence to the thresholds by addressing the risks with respect to the SNS SAC identified above. In particular, it will include confirmation of the relevant project design for the Project alone and include measures for mitigation that would fully address that risk, drawing on the range of mitigation options available.

~~1469.~~1629. It is important to note that the understanding of underwater noise, the potential for impact and how best to mitigate it is constantly evolving. For example, there is a DESNZ workstream that is providing much greater clarity on the risk posed by UXO clearance. Further, the recent paper by Hastie et al. (2019) provided evidence, for the first time, which demonstrated the change in impulsive noise to non-impulsive noise characteristics over distance, and which, when developed further, is expected to considerably affect predicted impact ranges for impulsive noise sources (such as piling and UXO). The In-principle SNS SAC SIP includes a requirement for a review on a specified timeframe and will therefore enable the process to draw on such advances and ensure that, in the context of the risks posed by the Project alone, the daily 20% and seasonal 10% thresholds with respect to the SNS SAC are not exceeded.

~~1470.~~1630. As concluded in Section 9.2~~09.2~~, it is clear that the Project alone would not trigger the 20% threshold under any circumstance. However, there are apparent risks to the 20% threshold when other projects are screened in for assessment in-combination – on the assumption that all projects would in fact undertake piling activity on the same day. Such risks need to be placed in context to determine where risk may actually exist and what measures are available to help mitigate that risk. Key to the process is the requirement on all projects assessed here in-combination to be subject to a SIP, which will ensure on a case-by-case basis that the thresholds will not be exceeded (alone and in-combination).

~~1471.~~1631. Table 10.3 determines the risk from the Project together with all in-combination projects, assuming a single event per day (on a minimum and maximum basis). For the Project, together with the identified Tier 3 and 4 projects, the potential for the daily 20% threshold exceedance is during the summers of 2025-2029 under the maximum scenarios. Table 10.5 determines the risk of concurrent piling; as expected, the risk of the 20% threshold being exceeded increases if all projects simultaneously choose to undertake concurrent piling.

~~1472.~~1632. It is therefore clear that there is potential for a threshold exceedance to occur if all activity is unmitigated. However, the In-principle SNS SAC SIP that will be produced will contain the process to be followed to determine the need for any mitigation as well as the type of mitigation required. Should mitigation be required to remain within the threshold, the In-principle SNS SAC SIP will include as a primary mitigation measure the potential to vary schedules or location of works. Such mitigation could be applied here and would manage the risk from a worst case scenario (e.g. multiple projects all working at their worst case location simultaneously) and ensure that the thresholds are not exceeded. Given the number of variables involved, it is not possible to be clear on the exact scenario that will eventually be chosen or what primary mitigation measure will actually be required (if any). However, there are several routes that can be taken to avoid an exceedance of the daily 20% threshold and the In-principle SNS SAC SIP will provide for these to be applied (as appropriate).

~~1473.~~1633. In addition to the primary mitigation referred to above, the In-principle SNS SAC SIP will also include provision for secondary mitigation. A number of potential solutions will be identified, including noise mitigation at source, with the caveat that these are options that could be applied should the SIP require it. The application of certain mitigation measures has been acknowledged by JNCC as resulting in a reduction in the EDR of mitigated (15km EDR) and unmitigated (26km EDR) monopile installation.

~~1474.~~1634. It would be disproportionate to identify the required mitigation at this point, since the need for any mitigation is not certain and depends on the final construction timeframe of individual projects. It is the purpose of the SIP to acknowledge these risks, and to identify the appropriate measures should they be required (including the timeframe attached to the SIP process) to ensure that the Project, alone and/or in-combination, would not exceed the 20% or 10% threshold. Such a SIP is understood to be a requirement on all OWF within 26 km of the SNS SAC going forward.

In-combination effects on disturbance across a season

~~1475.~~1635. As regards the consideration of the potential for an in-combination effect across a season (the 10% value), there is a risk of the seasonal threshold being exceeded, regardless of whether or not the Project is included. However, as mentioned, it is clear that the risk is highly precautionary and an overestimate, for a number of reasons:

- For a number of the Projects, no total piling days exist and a precautionary assumption has been made;
- A number of the Projects have a very large construction window, are highly likely to progress to construction well before 2027 and it is therefore extremely unlikely that all projects will be in a position to construct within the same summer season (and for individual projects to the extent assumed);
- The assessment does not take temporal overlap between projects into account, which is likely to account for approximately 15-25% of the total threshold exceedance on a daily basis;
- As noted above, the Tiering structure reflects project certainty, with significant uncertainty for most of the Projects as regards final scheme design and for all projects final construction window; and
- All projects within the in-combination assessment are similarly constrained by the SNS SAC and the requirement for a SIP (As a result of the Review of Consents process or individual project DCO) – which will prevent any project exceeding the thresholds alone and/or in-combination.

~~1476.~~1636. Given the requirement for a SIP on all projects, together with the need for all projects to seek licensing for UXO clearance, it is considered that sufficient controls exist to ensure that no seasonal threshold exceedance occurs, thus providing certainty of no AEoI with respect to the SNS SAC. It is clear that the key risks in-combination will depend on which project builds out within the same timeframe as the Project, with the level of certainty attached to these varying depending on their allocated tier.

Table 10-5~~10.5~~10.5~~10.5~~: Summary of risk to the 10% threshold in-combination from piling within the summer season

Tier	Project	Activities per summer season	Average area (km^2) overlap per day	Average % overlap per summer season	Threshold risk
N/A	The Project	100~~47~~ days of piling[17]	~~1,093.21~~890.22 km^2	1.80~~04~~%	Small contribution to the total. Will require consideration of the SNS SAC (requirement of the project level SIP).
2	Dogger Bank C	183 days of piling	12.66 km^2	0.05 %	Very small contribution to the total. Will require consideration of the SNS SAC (requirement of the project level SIP).
3	East Anglia 1 N	183 days of piling	742.99 km^2	2.75%	Small contribution to the total. Will require consideration of the SNS SAC (requirement of the project level SIP).
3	East Anglia 2	183 days of piling	89.64 km^2	0.33%	Very small contribution to the total. Will require consideration of the SNS SAC (requirement of the project level SIP).
3	Hornsea 3	111 days of piling	215.77 km^2	0.48~~05~~%	Very small contribution to the total. Will require consideration of the SNS SAC (requirement of the project level SIP).
3	Hornsea 4	183 days of piling	2026.42km^2	7.51~~0~~%	Represents a considerable proportion. However, it is it is likely that piling would occur concurrently, reducing the amount of piling days. Will require consideration of the SNS SAC (requirement of the project level SIP).

[17] The value of 47 days was an errata in the original submitted version of the RIAA (the MDS has not been changed).

Tier	Project	Activities per summer season	Average area (km^2) overlap per day	Average % overlap per summer season	Threshold risk
4	Norfolk Boreas	54 days of piling	1,246.24 km^2	1.36%	Represents a considerable proportion. However, it is it is likely that piling would occur concurrently, reducing the amount of piling days. Will require consideration of the SNS SAC (requirement of the project level SIP).
4	Dudgeon Extension	32 days of piling	~~156.54~~178.00 km^2[18]	0.12~~0~~%	Very small contribution to the total. Will require consideration of the SNS SAC (requirement of the project level SIP).
5	Dogger Bank South (West)	183 days of piling	2123.71 km^2	7.87~~6~~ km^2	Represents a considerable proportion. However, it is it is likely that piling would occur concurrently, reducing the amount of piling days. Will require consideration of the SNS SAC (requirement of the project level SIP).
5	Dogger Bank South (East)	183 days of piling	2049.28~~5~~ km^2	7.59~~8~~ km^2	Represents a considerable proportion. However, it is it is likely that piling would occur concurrently, reducing the amount of piling days. Will require consideration of the SNS SAC (requirement of the project level SIP).

[18] The values for Dudgeon Extension have been changed based on updated project information.

~~1477.~~1637. Table 10.5 presents the risks to the 10% seasonal thresholds, based on available project information and certainty. It bases the maximum number of piling days per season on maximum WTG locations but does not take account of project overlap given current uncertainty; these risks will be managed through the SIP process. However, it does show that where a project applies a more realistic number of piling days in a season, the proportional contribution of that project to the overall totals reduces considerably.

~~1478.~~1638. It can be concluded that, with the mitigation that will be afforded by the SIP, the MMMP and the anticipated requirement for a UXO-specific MMMP (which will be a condition of the UXO ML if UXO clearance is required and the ML applied for), **there will be no AEoI will as a result of disturbance to harbour porpoise (as defined by the daily 20% and seasonal 10% thresholds) for the Project alone and/or in-combination during construction and decommissioning as a result of piling.**

Seismic and Geophysical Survey

~~1479.~~1639. No specific information on the requirement for seismic and geophysical survey for the Project alone is identified at this point; although any surveys that are required will occur prior to the main construction phase in 2027 to 2030. In any case, the potential for effect from such surveys will be less than that considered here for UXO clearance (and occurring within that timeframe) and is therefore incorporated within the current assessment (as the footprint of effect from any such survey would be incorporated into the footprint of effect from the UXO clearance; the footprints are not additive). Further, the requirement for a Project level SIP provides certainty that the conclusions drawn for the Project alone will remain valid and that no adverse effect would result in-combination, including a suite of measures that can be drawn on if required to ensure that conclusion holds true. No specific information on planned or proposed surveys in-combination has been identified within the relevant timeframe for inclusion in the assessment here.

Key points for the Project In-Combination with Respect to the SNS SAC

~~1480.~~1640. A summary of the key points for the Project in relation to the SNS SAC are provided in Table 10.6 below.

~~1481.~~1641. In the context of the MMMP, the In-principle SNS SAC SIP and the anticipated requirement for a UXO-MMMP (if/when a UXO licence applied for), there is, **therefore, no AEoI resulting from disturbance of harbour porpoise within the SNS SAC from the Project in-combination during construction and decommissioning and therefore, subject to natural change, the feature will be maintained in the long-term.**

Table 10-6~~10.610-610.6~~: Summary of the in-combination risk for the Project and the SNS SAC

Project element	Summer season	Risk Management
Piling within the Project ~~array~~ WTG area	Risk of exceedance of the daily 20% threshold for the Project in-combination with Tier 3 and 4 projects on maximum design scenario's only (both single and concurrent piling). As projects are added, risk rises on a minimum scenario basis (excluding double counting between projects). Risk of exceedance of the seasonal 10% threshold in-combination depending on the number of piling days committed to in a season by individual projects, location of any such piling and which projects are in a position to proceed.	Requirement for a SIP is understood to apply to all OWF within 26 km of the SNS SAC. The SIPs are provided for within individual project DCOs or the Review of Consents (as relevant) and provide management and mitigation measures that ensure compliance with the thresholds in all cases, alone and/or in-combination. The SIPs will include detail on management for all types of underwater noise generated by the project.
UXO clearance within the Project array area	Risk of exceedance of the daily 20% threshold for the Project in-combination with Tier 3 and 4 projects on maximum design scenario's only (both single and concurrent UXO clearances). As projects are added, risk rises (excluding double counting between projects). Risk of exceedance of the seasonal 10% threshold in-combination depending on the number of piling/UXO clearance days committed to in a season by individual projects, location of any such activities and which projects are in a position to proceed.	
UXO clearance within the Order Limits	Some locations are outside consideration of the SNS SAC. Potential for daily 20% threshold exceedance in-combination depending on UXO location and which project is added. Risk of exceedance of the seasonal 10% threshold in-combination depending on the number of piling/UXO clearance days committed to in a season by individual projects, location of any such activities and which projects are in a position to proceed.	

Project element	Summer season	Risk Management
Geophysical and seismic survey	Contribution not calculated given lack of information on planned survey type, location and duration from all projects considered. Any contribution to thresholds expected to be within the footprint of effect from UXO clearance and controlled through the SIP. Given the location of the summer extents relative to the Project, any contribution would be limited to survey within a short section of the ECC in any case.	

Potential for an In-combination Effect on Harbour and Grey Seal from Underwater Noise

~~1482.~~1642. Table 10.7 below draws on the information presented in the Screening Report and Section 7.2 which summarises the relevant projects to be assessed in-combination for potential temporal and spatial effects in relation to construction of the Project. It should be noted that the location of the Projects screened in is such that each project is relevant to a different suite of sites. Further, the Projects included are limited to those with the potential for construction phase overlap – projects with O&M phase overlap are considered under vessel disturbance.

Table 10-7~~10.710 710.7~~: Projects considered for the harbour and grey seal assessments.

Designated site	Relevant species	Project	Tier
▪ The Wash and North Norfolk Coast SAC; ▪ Doggersbank (Netherlands) SAC; ▪ Klaverbank SCI	Harbour seal	Dogger Bank C	2
		Dudgeon Extension	3~~4~~
		East Anglia 1N	3
		East Anglia 2	3
		East Anglia 3	3
		Endurance	6
		Five Estuaries	4~~5~~
		Hornsea 3	3
		Hornsea 4	3~~4~~
		Norfolk Boreas	3
		Norfolk Vanguard East	3
		Norfolk Vanguard West	3
		North Falls	4~~6~~
		Rampion 2	4~~5~~
		Sheringham Shoal Extension	3~~4~~
		Sofia	2
▪ Humber Estuary SAC; ▪ Humber Estuary Ramsar; ▪ Berwickshire and North Northumberland Coast SAC ▪ Bancs des Flandres SAC; ▪ Doggersbank (Netherlands) SAC; ▪ Klaverbank SCI; ▪ SBZ 1 SCI; ▪ SBZ 2 SCI;	Grey Seal	Blyth Demonstration Phases 2&3	3
		Dogger Bank C	2
		Dudgeon Extension	3~~4~~
		East Anglia 1N	3
		East Anglia 2	3
		East Anglia 3	3
		Endurance	6
		Five Estuaries	4~~5~~
		Hollandse Kust (West)	6
		Hornsea 3	3
		Hornsea 4	3~~4~~
		Norfolk Boreas	3
		Norfolk Vanguard East	3
		Norfolk Vanguard West	3

Designated site	Relevant species	Project	Tier
▪ SBZ 3 SCI; ▪ Vlaamse Banked SCI; ▪ Vlakte van de Raan SCI; ▪ Voordelta SCI; ▪ Waddenzee SCI; ▪ Westerschelde & Saeftinghe SCI.		North Falls	4~~6~~
		Rampion 2	4~~5~~
		Sheringham Shoal Extension	3~~4~~
		Sofia	2

~~1483.~~1643. Consideration of the potential for an in-combination effect on harbour seal and grey seal, on a site-by-site basis, applies the same conservation objectives as the assessment alone. For harbour seal and grey seal, the relevant points effectively relate to the habitat (its structure and function, extent and distribution and the supporting processes on which the habitats depend) together with the population and distribution of each species.

~~1484.~~1644. For both species, there is no potential for underwater noise alone or in-combination to affect the habitats and supporting processes used by seals. The primary pathway for potential effect on the habitat and supporting processes for harbour and grey seals, is through impacts on prey species. Part 6, Volume 1, Chapter 10: Fish and Shellfish Ecology found the potential for effect on fish species to be minor at most, and therefore not significant in EIA terms. Impacts from underwater noise to fish are spatially limited and broadly restricted to the period of ensonification. Fish are not necessarily fully displaced from an ensonified area and consequently will remain within the ensonified area during noisy events and so will still be present upon return of the seals (should any seals be displaced). Whilst noise can result in behavioural changes in fish, these are short lived and so will also not lead to any potential implications for hunting behaviour in seals following cessation of the noise. Given the relative spatial and temporal scale and extent of the potential effects on fish species, combined with the spatial and temporal scale and location of the relevant designated sites and the wide ranging nature of seals, there is, **therefore, no AEoI to the supporting habitats relevant to harbour seal and grey seal and their prey for any of the sites under consideration as a result of the Project alone and/or in-combination and therefore, subject to natural change, the supporting habitat for grey seal and harbour seal prey will be maintained in the long-term.**

~~1485.~~1645. The potential for the Project to contribute to any in-combination risk of injury (defined as risk of onset of PTS) with respect to harbour seal and grey seal is considered to be negligible. That conclusion is reinforced by the number of individual animals potentially at risk from unmitigated piling, which for the Project alone is 35 individuals as a worst case (0.72% of the reference population). For UXO clearance, the number of harbour seal and grey seal potentially affected is two individuals for both species (0.03% and 0.02% of the MU population) respectively, therefore only likely to occur for a fraction of the total UXO clearances anticipated. Such an effect is fully provided for within the MMMP and the anticipated requirement for a UXO-MMMP, with the mitigation area exceeding the range of effect. There is, **therefore, no potential for AEoI with respect to injury (PTS) for harbour seal or grey seal for any of the sites under consideration as a result of the Project alone and/or in-combination and therefore, subject to natural change, the population and distribution of grey seal and harbour seal will be maintained in the long-term.**

~~1486.~~1646. In addition to the site-by site basis presented above, the potential for an in-combination effect on the population and distribution of harbour seal and grey seal applies to harbour seal and grey seal at sea regardless of the site within which they are associated and therefore is also considered here on a species-by-species basis (not withstanding seals from some sites having a greater potential for connectivity with the region around the Project than others).

Harbour Seal

~~1487.~~1647. Part 6, Volume 1, Chapter 11: Marine Mammals in Section 1.8 identifies the potential for the highest level of predicted disturbance to harbour seals across the MU is in 2026, when several central/southern North Sea projects are constructing. The impact from construction phase underwater noise at this time from all identified projects (Table 10.7, assuming all projects are constructing at the same time and that disturbance is additive across projects) results in a potential for a temporary disturbance of up to 313 individuals (6.5% of the harbour seal MU population) per day. By comparison, the total impact is expected to be lower throughout the remainder of the Project construction window (2026-2029). A maximum of 43 harbour seals (0.9% of the MU) may be disturbed per day in 2027 (assuming all considered projects are constructing at the same time, and that disturbance is additive across projects), reducing to 36 harbour seals (0.7% of the MU) in 2028, and 25 seals (0.5% of the MU) in 2029. The effect was considered to be of medium magnitude, with reproductive rates of individuals potentially impacted in the short term (over a limited number of breeding cycles but not enough to affect the population trajectory over a generational scale), and a sensitivity of low, resulting in a significance of minor, which is not significant in EIA terms.

Grey Seal

~~1488.~~1648. Part 6, Volume 1, Chapter 11: Marine Mammals in Section 1.8 identifies the potential for the highest level of predicted disturbance to harbour seals across the MU is in 2025, when several central/southern North Sea projects are constructing. The impact from construction phase underwater noise at this time from all identified projects (Table 10.7, assuming all projects are constructing at the same time and that disturbance is additive across projects) results in a potential for a temporary disturbance of up to 7,951 individuals (15 % of the grey seal MU population) per day. By comparison, the total impact is expected to be lower throughout the remainder Project construction window (2026-2029). At this time, a maximum of 7538 grey seals (14.2% of the MU) may be disturbed per day in 2026 (assuming all considered projects are constructing at the same time, and that disturbance is additive across projects), reducing to 5,338 grey seals (10.1 % of the MU) in 2027, 5,246 seals (9.9% of the MU) in 2028, and 3,508 (6.6% of the MU) in 2029. The effect was considered to be of medium magnitude, with reproductive rates of individuals potentially impacted in the short term (over a limited number of breeding cycles but not enough to affect the population trajectory over a generational scale), and a sensitivity of negligible, resulting in a significance of minor, which is not significant in EIA terms.

Conclusion for the In-Combination Assessment of Disturbance from Underwater Noise on Harbour Seal and Grey Seal

~~1489.~~1649. As regards risk of in-combination underwater noise during construction for harbour seal and grey seal, in line with the conclusions for disturbance from piling activity it can therefore be concluded that no AEoI will result to the habitat (its structure and function, extent and distribution and the supporting processes on which the habitats depend) together with the population and distribution of the species of harbour seal and grey seal for any of the sites under consideration as a result of the Project alone and/or in-combination during construction and decommissioning and therefore, subject to natural change, the population and distribution of grey seal and harbour seal will be maintained in the long-term.

Potential for an In-combination Effect on Bottlenose dolphin from Underwater Noise

~~1490.~~1650. Table 10.8 below, drawing on the information presented in the screening report and section 7.2 summarises the relevant projects to be assessed in-combination for potential temporal and spatial effects in relation to construction of the Project. It should be noted that the location of the Projects screened is such that each project is relevant to a different suite of sites. Further, the Projects included are limited to those with potential for construction phase overlap – projects with O&M phase overlap are considered under vessel disturbance.

Table 10-8~~10.810-810.8~~: Projects considered for the bottlenose dolphins assessment

Designated site	Relevant species	Project	Tier
Moray Firth SAC	Bottlenose dolphin	Berwick Bank	1
		Moray West	3
		Inch Cape Offshore Windfarm	2

Designated site	Relevant species	Project	Tier
		SeaGreen Offshore Windfarm	2
		Blyth Demonstration Phases 2 & 3	3

~~1491.~~1651. Consideration of the potential for an in-combination effect on bottlenose dolphin, on a site-by-site basis, applies the same conservation objectives as the assessment alone. For bottlenose dolphin the relevant points effectively relate to the population and distribution of the species.

~~1492.~~1652. In the assessment alone (Section 9.2 ~~09.2~~) it was concluded that there was no potential for LSE via any pathway on the bottlenose dolphins associated with Moray Firth. The primary reason for this conclusion was that the locations where works were being carried out where there was a risk of bottlenose dolphins being present, the works are being carried out in a separate MU to what Moray Firth SAC is within, and all works and impacts are located >1000km from the designated site. Furthermore, there were no residual impacts predicted which would contribute to a potential in-combination impact.

~~1493.~~1653. With this in consideration, it can therefore be concluded that no AEoI will result to the population and distribution of the species of bottlenose dolphin associated with the Moray Firth SAC as a result of the Project alone and/or in-combination during construction and decommissioning and therefore, subject to natural change, the population and distribution of bottlenose dolphin will be maintained in the long-term.

Vessel Presence Disturbance

~~1494.~~1654. The potential for an AEoI in-combination as a result of vessel disturbance on marine mammals during construction and decommissioning relates to the following designated sites and the relevant feature (i.e. those features screened in for potential LSE):

- Southern North Sea SAC (harbour porpoise);
- Wash and North Norfolk Coast SAC (harbour seal);
- Humber Estuary SAC (grey seal);
- Humber Estuary Ramsar (grey seal);
- Berwickshire and North Northumberland Coast SAC (grey seal);
- Moray Firth SAC (bottlenose dolphin)
- Transboundary sites (for harbour seal), specifically Doggersbank (Netherlands) SAC and Klaverbank SCI); and
- Transboundary sites (twelve sites for grey seal), specifically Doggersbank (Netherlands) SAC, Klaverbank SCI, Bancs des Flandres SCI, Vlaamse Banken SAC, SBZ 1 SCI, SBZ 2 SCI, SBZ 3 SCI, Vlakte van de Raan SCI, Westerschelde & Saeftinghe SCI, Voordelta SCI, Noordzeekustzone SCI and Waddenzee SCI.

~~1495.~~1655. The potential for LSE during decommissioning would be similar to, and potentially less than, those outlined in the construction phase.

~~1496.~~1656. The cumulative assessment presented in Part 6, Volume 1, Chapter 11: Marine Mammals considers the potential for disturbance to marine mammals from vessels as part of the overall risk of disturbance from projects resulting from underwater noise. Effectively, it is difficult to separate the two out, with the potential for disturbance from vessels tending to sit inside (and being less in terms of extent) the potential for disturbance from activities such as piling. Furthermore, the localised nature of vessel disturbance to individual projects, and the widespread nature of those projects, within the context of the overall habitat availability for harbour porpoise, harbour seal and grey seal means that the potential for an in-combination effect is minimal. It should also be noted that for many of the Projects identified in Table 7.6, the risk of an in-combination effect resulting from vessel related disturbance is essentially an ongoing issue as many are licensed activities that have been in operation for some time (and some would therefore be included to some degree within the baseline level of shipping activity assessed for the Project). For example, Volume 2, Appendix 15.1: Navigational Risk Assessment reports on shipping and navigation baseline data collected through the period 2019-2021. The shipping and navigation data collected (and therefore the existing vessel movements applied as baseline) will therefore include vessel movements associated with offshore windfarms operational prior to 2019 (for example both East Anglia ONE and Hornsea Project One were completed in 2019 and therefore the later navigation surveys would cover the operational phases only).

~~1497.~~1657. The area surrounding the Project already experiences a reasonable amount of vessel traffic throughout the year. In the summer there is an average of 64-65 unique vessels per day passing through the study area, and 10 unique vessels per day through the array area with less in the winter (see Part 6, Volume 1, Chapter 15: Shipping and Navigation). Therefore, it is considered that the introduction of vessels during operation and maintenance is not a novel impact for marine mammals present in the area.

~~1498.~~1658. Disturbance from vessel noise is only likely where noise from vessel movements is greater than the background ambient noise. The busiest period during construction in terms of vessel traffic would be when up to ten vessels are present in a given $5km^2$ construction area. This level of activity is unlikely to occur across the entire array area at any one time, rather this intensity is expected across approximately three or four $5km^2$ blocks. During the operational period of the Project, it is considered unlikely that vessel noise will impact marine mammal receptors at levels additional to the background vessel presence.

~~1499.~~1659. The magnitude and characteristics of vessel noise varies depending on ship type, ship size, mode of propulsion, operational factors and speed. Vessels of varying size produce different frequencies, generally becoming lower frequency with increasing size. The distance at which animals may react is difficult to predict and behavioural responses can vary a great deal depending on context.

~~1500.~~1660. It is not expected that the level of vessel activity during the O&M phase of the Project would cause a significant increase in the risk of disturbance by vessels or collision risk with vessels. The adoption of a vessel management plan (Table 6.1) that includes preferred transit routes and guidance for vessel operations in the vicinity of marine mammals and around seal haul-outs will minimise the potential for any impact. The impact is predicted to be local, of short-term duration and intermittent. It is expected that any marine mammals that are disturbed as a result of vessel presence will return to the area once the vessel disturbance has ended.

Potential for an In-combination Effect on Harbour Porpoise from Vessel Disturbance

~~1501.~~1661. For harbour porpoise, the 2019 advice on operations within the SNS SAC (JNCC, 2019) found that although it is expected that overall shipping levels are expected to increase as a result of increased windfarm activity in the North Sea, given the existing levels of shipping in the area it is unlikely that additional management measures will be required. Further, it identified that significant increases in vessel traffic associated with windfarm activity would require assessment – with that assessment for the Project alone presented above.

~~1502.~~1662. There are very few studies that indicate a critical level of activity in relation to harbour porpoise density, but an analysis presented in Heinänen and Skov (2015) suggested that harbour porpoise density was significantly lower in areas with vessel transit rates of greater than 80 per day. Vessel traffic in the array area from other plans and projects, even considering the addition of construction and decommissioning phase traffic (a maximum of ten at any one time per 5km^2 area), will still be below this figure. It is therefore not expected that the level of vessel activity during construction and decommissioning of the Project would cause a significant increase in the risk of disturbance by vessels or collision risk with vessels.

~~1503.~~1663. The relevant conservation objectives for harbour porpoise are cited in The Screening Report (document reference 7.2).

~~1504.~~1664. The first two conservation objectives address risk of injury and disturbance. Part 6, Volume 1, Chapter 11: Marine Mammals found (in the context of existing shipping levels, the increase in those levels proposed during construction and decommissioning at the Project and the relevant project mitigation at both the Project and those considered in-combination) the increased vessel traffic associated with the construction and decommissioning phases of the Project and other projects in-combination is insufficient to result in mortality, injury or significant disturbance in marine mammals. That conclusion is supported at a site-based level by Heinänen and Skov (2015) as above.

~~1505.~~1665. The third conservation objective is focused on maintaining the supporting habitats and processes, together with availability of harbour porpoise prey, within the SNS SAC. The Advice on Activities refers to supporting habitats as 'the characteristics of the seabed and water column' in the context of 'ensuring prey is maintained within the site'. Vessels and shipping will not lead to a direct impact on the habitats and processes.

~~1506.~~1666. There is, **therefore, no AEoI relevant to harbour porpoise for the SNS SAC from vessel disturbance from the Project alone and/or in-combination during construction and decommissioning and therefore, subject to natural change, the harbour porpoise will be maintained in the long-term.**

Potential for an In-combination Effect on Harbour and Grey Seals from Vessel Disturbance

~~1507.~~1667. Jones et al., (2017) presents an analysis of the predicted co-occurrence of ships and seals at sea which demonstrates that UK wide there is a large degree of predicted cooccurrence, particularly within 50km of the coast close to seal haul-outs. There is no evidence relating decreasing seal populations with high levels of co-occurrence between ships and animals. In fact, in areas where seal populations are showing high levels of growth (e.g. southeast England) ship co-occurrences are highest (Jones et al., 2017). Thomsen et al. (2006) estimated that both harbour and grey seals will respond to both small (~2 kHz) and large (~0.25 kHz) vessels at approximately 400 m. The potential for underwater noise from vessels during construction to disturb seal and grey seals will therefore be significantly less than that resulting from piling disturbance and highly localised to the vessel. Any disturbance associated with vessel movements would be contained within the footprint of wider construction level disturbance and would not significantly add to that.

~~1508.~~1668. As regards risk of in-combination vessel disturbance during construction for harbour seal and grey seal, in line with the conclusions for disturbance from piling activity it can **therefore be concluded that no AEoI will result to the habitat (its structure and function, extent and distribution and the supporting processes on which the habitats depend) together with the population and distribution of the species of harbour seal and grey seal for any of the sites under consideration as a result of the Project alone and/or in-combination during construction and decommissioning and therefore, subject to natural change, the population and distribution of grey seal and harbour seal will be maintained in the long-term.**

Potential for an In-combination Effect on bottlenose dolphin from Vessel Disturbance

~~1509.~~1669. In the assessment alone (Section 0~~9.2~~) it was concluded that there was no potential for LSE via any pathway on the bottlenose dolphins associated with Moray Firth. The primary reason for this conclusion was that the locations where works were being carried out where there was a risk of bottlenose dolphins being present, the works are being carried out in a separate MU to what Moray Firth SAC is within, and all works and impacts are located >1000km from the designated site. With regards to vessel disturbance this was also reinforced within Lusseau et al., 2011, which concluded that vessel disturbance does not have an impact on this SAC feature.

~~1510.~~1670. With this in consideration, it can **therefore be concluded that no AEoI will result to the population and distribution of the species of bottlenose dolphin associated with the Moray Firth SAC as a result of the Project alone and/or in-combination during construction and decommissioning and therefore, subject to natural change, the population and distribution of bottlenose dolphin will be maintained in the long-term.**

10.2.2 O&M

Vessel Presence Disturbance

~~1511.~~1671. The potential for an AEoI in-combination as a result of vessel disturbance on marine mammals during O&M relates to the following designated sites and the relevant features (i.e. the features screened in for potential LSE):

- Southern North Sea SAC (harbour porpoise);
- Wash and North Norfolk Coast SAC (harbour seal);
- Humber Estuary SAC (grey seal);
- Humber Estuary Ramsar (grey seal);
- Berwickshire and North Northumberland Coast SAC (grey seal);
- Moray Firth SAC (bottlenose dolphin)
- Transboundary sites (for harbour seal), specifically Doggersbank (Netherlands) SAC and Klaverbank SCI); and
- Transboundary sites (twelve sites for grey seal), specifically Doggersbank (Netherlands) SAC, Klaverbank SCI, Bancs des Flandres SCI, Vlaamse Banken SAC, SBZ 1 SCI, SBZ 2 SCI, SBZ 3 SCI, Vlakte van de Raan SCI, Westerschelde & Saeftinghe SCI, Voordelta SCI, Noordzeekustzone SCI and Waddenzee SCI.

~~1512.~~1672. Part 6, Volume 1, Chapter 11: Marine Mammals considers the potential for disturbance to marine mammals from vessels as part of the overall risk of disturbance from projects resulting from underwater noise. Effectively, it is extremely difficult to reliably quantify the level of increased noise related disturbance to marine mammals resulting from increased vessel activity on a cumulative basis, given the large degree of temporal and spatial variation in vessel movements between projects and regions, coupled with the spatial and temporal variation in marine mammal movements across the region.

~~1513.~~1673. Vessel routes to and from offshore windfarms and other projects will predominantly use existing vessel routes where marine mammals will be accustomed to regular vessel movements and therefore vessel activity will already be an existing feature of the baseline. Vessel activity within array area are likely to be limited and relatively slow. Increases in vessels during the operational phases of projects are likely to be small in relation to current and ongoing levels of shipping. The potential for effect is predicted to be highly localised, intermittent and reversible for the duration of all projects. Such a low-level additional contribution to existing levels of shipping disturbance is not predicted to have a significant effect on any marine mammal population, with no anticipated changes to range or distribution of any species (Part 6, Volume 1, Chapter 11: Marine Mammals).

~~1514.~~1674. There is **therefore no potential for the Project to contribute in any meaningful way to any in-combination effect. It can therefore be concluded that therefore no AEoI will result from vessel related disturbance for any of the sites under consideration as a result of the Project alone and/or in-combination during O&M and therefore, subject to natural change, the features will be maintained in the long-term.**

10.3 Offshore and Intertidal Ornithology

1675. The Offshore and Intertidal Ornithology in-combination assessment has been updated February 2025 to consider:

- The introduction of an Offshore Restricted Build Area (ORBA) over the northern section of the Project array area;
- The removal of the northern section of the offshore Export Cable Corridor (ECC);
- minor errata including those previously identified by interested parties;
- A revised in-combination assessment to reflect changes to project status or capture any new plans, projects or activities which have been progressed since the point of the Application;
- Updates to "Natural England's" approach for certain assessment values where further information has been provided by that organisation post-Application; and
- Additional detail which has been requested by Natural England to facilitate their appraisal of the potential for an AEoI for red-throated diver within the Greater Wash SPA.

1676. The potential impacts on ornithological receptors arising from collision and displacement from the Project in-combination with other projects is determined based on impacts reported by relevant projects screened in as per Table 7.7. Impact numbers from the recent submissions of Muir Mhor OWF and Caledonia OWF ~~impacts~~ have not been included in the in-combination assessment due to limitation in retrieving accurate apportioned results for the project alone.

1677. The Applicant has reviewed the recently submitted Application for Caledonia OWF, which has proposed a phased design for consent. On review of the publicly available information, it is unclear on what would be the most appropriate impact value to include for the two design stages combined. Therefore, to avoid including uncertainty within assessment these project values were excluded from assessment at this stage. As Caledonia OWF and Muir Mhor OWF are located a significant distance beyond the MMFR of gannet feature from the Flamborough and Filey Coast SPA, it is not expected that the inclusion of Caledonia OWF and Muir Mhor predicted impacts would materially change the in-combination assessment conclusions drawn due to expected limited connectivity.

1678. Similarly, the appropriate apportioned impacts for Muir Mhor OWF

1679. The in-combination impacts have been calculated using a 'tiered' approach as presented in Table 7.4.

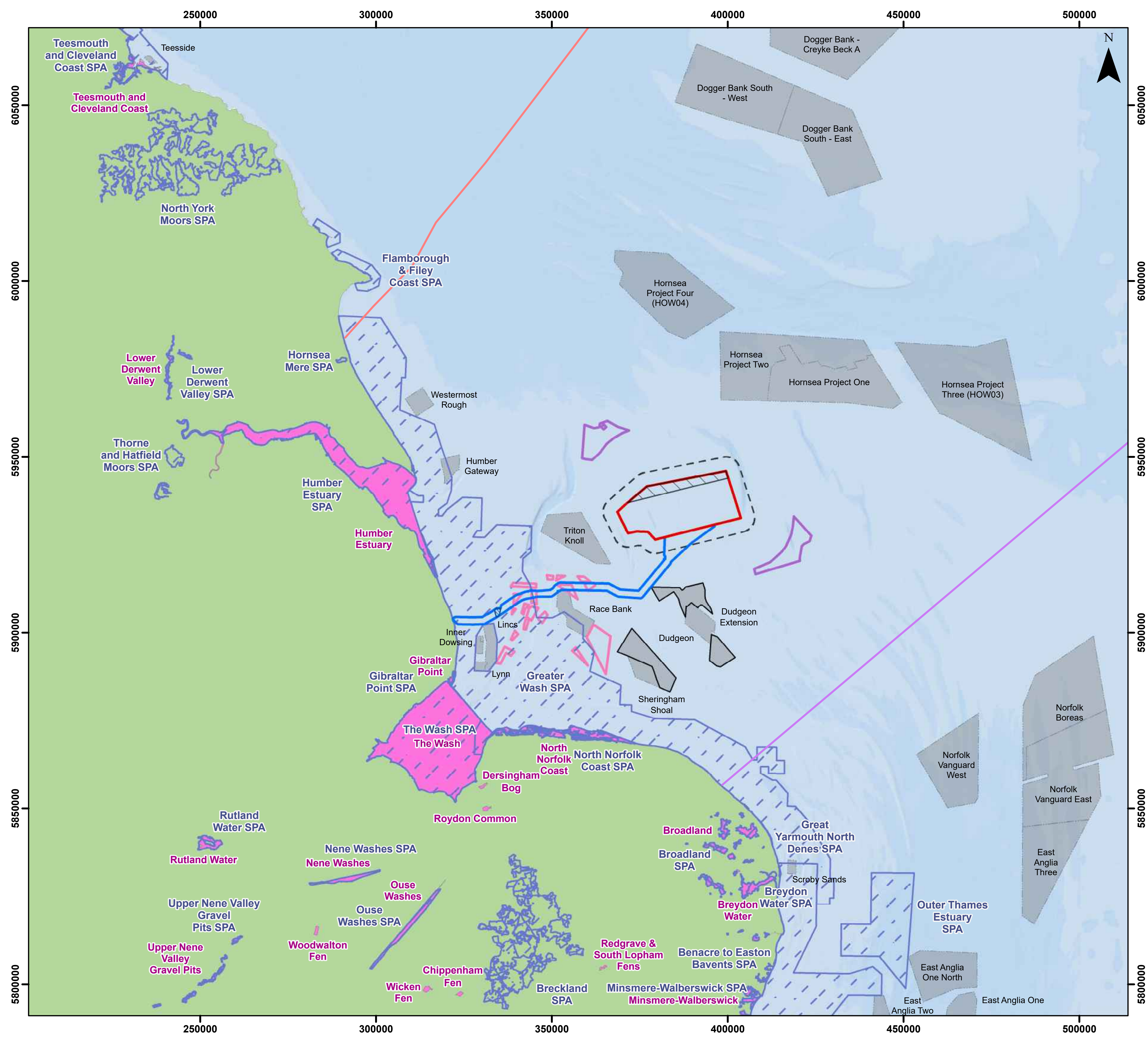
1680. The sources for all the in-combination impacts from the projects have been included within each results table. The references are as follows:

- Sheringham Shoal Extension and Dudgeon Extension Offshore Wind Farms, Natural England's Offshore Ornithology Position (referred to as Natural England's offshore ornithology position for SEP&DEP Deadline 8) (Natural England, 2023);
- Hornsea Four Ornithology EIA & HRA Annex (referred to as Hornsea Four Annex~~-~~) (APEM and GoBe Consultants, 2022);

- Rampion 2 Wind Farm, In-combination Assessment Update for Guillemot and Razorbill (referred to as Rampion 2 in-combination update) (APEM, 2024)
- Pentland Floating OWF Environmental Impact Assessment Report (referred to as Pentland Floating EIAR) (HiDef Aerial Surveying Limited, 2022);
- Forthwind OWF Environmental Impact Assessment Report (referred to as Forthwind EIAR) (Forthwind, 2022)-
- Greenvolt OWF Report to Inform Appropriate Assessment (referred to as Greenvolt RIAA) (RoyalHaskoningsDHV., 2023);
- Berwick Bank OWF Report to Inform Appropriate Assessment (referred to as Berwick Bank RIAA) (RPS and Royal HaskoningDHV., 2022);
- West of Orkney OWF Report to Inform Appropriate Assessment (referred to as West of Orkney RIAA) (Xodus and MacArthur Green, 2023);
- North Falls OWF Report to Inform Appropriate Assessment (referred to as North Falls RIAA) (SSE Renewables and RWE, 2024);
- Dogger Bank South OWF Report to Inform Appropriate Assessment (referred to as Dogger Bank South RIAA) (RWE, 2024);
- Ossian OWF Report to Inform Appropriate Assessment (referred to as Ossian RIAA) (NIRAS and RPS, 2024);
- Five Estuaries OWF Report to Inform Appropriate Assessment (referred to as Five Estuaries RIAA) (GoBe Consultants, 2024);
- Salamander OWF Report to Inform Appropriate Assessment (referred to as Salamander RIAA) (NIRAS, 2024).

~~1515.~~1681. Dogger Bank South have two approaches for their impact assessment, using a realistic approach and a worst-case approach where the adult proportions vary. This is captured along with the Project Applicant's approach and the NE preferred approach within the in-combination scenarios presented.

~~1516.~~1682. The location of the Project in relation to the SPAs and projects within closest proximity is presented in Figure 10.3 below.

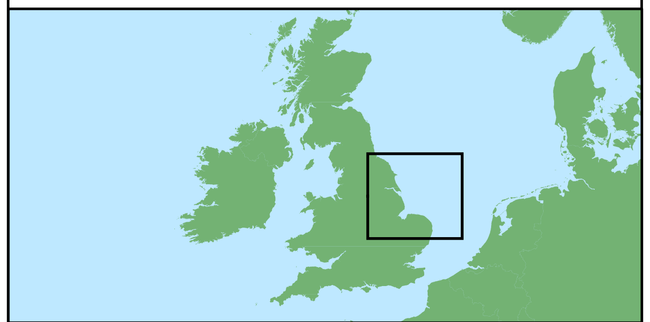


Legend

- Array Area
- 4km Buffer from Array Area
- Offshore Restricted Build Area
- Offshore Export Cable Corridor
- ORCP Area
- Artificial Nesting Structure Area
- Biogenic Reef Restoration Area
- Offshore Wind Farms
- Future Wind Farm Extensions
- Special Protection Area
- Ramsar Site

Subsea Power Cable

- Aminth Interconnector
- Continental Link (MPI)



Coordinate System: WGS 1984 UTM Zone 31N

0 25 50 km

Scale: 1:1,000,000

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RIAA

Location of the Project in relation to Protected Sites and Projects within Closest Proximity

Figure 10.3

OUTER DOWSING OFFSHORE WIND

Date: 15/01/2025
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Figure 10-3~~10-310.310.3~~: Location of the Project in relation to protected sites and projects within closest proximity.

10.3.1 Construction and Decommissioning

~~1517.~~1683. During the construction & decommissioning phase, the assessment of displacement impacts from the Project alone (Section 9.3~~9.4~~) concluded no impacts of note for any of the species assessed. It is therefore considered that the Project will not make any material contribution to existing in-combination mortalities during the construction & decommissioning phases.

~~1518.~~1684. An overview of the screening process for disturbance and displacement in the construction & decommissioning phases is provided in Table 10.9 below. The sites that have been screened out are due to the assessment alone concluding an inconsequential level of effect that would be well within the error margins of the assessment, and therefore no potential for any contribution to an in-combination impact.

~~1519.~~1685. A summary of sites and features considered for a disturbance and displacement assessment during construction and decommissioning phases for the Project in-combination are provided in Table 10.9 below.

10.3.1.1 Red-throated diver and common scoter

~~1520.~~1686. The magnitude and duration of the predicted impacts indicate that the likelihood of an in-combination disturbance effect is extremely small. The assessment for the Project alone concluded potential for a trivial and inconsequential level of effect for both red-throated diver and common scoter (mean of <0.1 birds per annum), equating to an increase in baseline mortality of <0.05% for both species (red-throated diver = 0.026%, and common scoter = 0.000). Impacts below a 1% increase in baseline mortality are generally considered to be indistinguishable from natural fluctuations in the population. Therefore, it would take roughly 40 projects with an equivalent level of impact to reach this threshold.

~~1521.~~1687. It should also be noted that, whilst the ECC route will partially overlap with the Greater Wash SPA, cable laying is only likely to be undertaken alongside a maximum of one other project (Sheringham and Dudgeon Extension Projects; SEP and DEP) with connectivity to the red-throated diver and common scoter features at the Greater Wash SPA. In addition, whilst some displacement of red throated diver and common scoter in the ECC crossing the Greater Wash SPA will occur during the construction phase, with mitigation in place in relation to vessel management (Outline Vessel Management Plan (document 8.20), even if the location of the Project's construction base is in the Humber Estuary (leading to the greatest transit of traffic through the SPA) there would not be a considerable increase in the baseline level of vessel traffic transiting through the SPA. **Therefore, there is no potential for an in-combination effect to adversely affect the red-throated diver or common scoter features of the Greater Wash SPA.**

10.3.1.2 Auks

~~1522.~~1688. The impacts from disturbance and displacement on large auk species are predicted to be greatest during the O&M phase. This is due to the low number of other projects with overlapping construction schedules and the project having its largest footprint during the O&M phase (i.e. when all turbines are in place). Therefore, auks have only been assessed for disturbance and displacement in-combination during the O&M phase.

10.3.1.3 Scottish SPAs

~~1523.~~1689. All Scottish SPAs have not been assessed in-combination for the construction and decommissioning phase because the impacts from the project alone for guillemot, razorbill, puffin and gannet features at these sites amounts to an increase in baseline mortality of approximately 0.1% or less. **Therefore, there is considered to be no material contribution from the Project alone to the in-combination total for these sites. As explained in paragraph 435~~435431~~, the impacts from disturbance and displacement in-combination on all these species is predicted to be greatest during the O&M phase, for which an in-combination assessment is carried out in Section 10.3.2.**

Table 10-9~~10.910-10.9~~: Summary of the sites and features considered for a disturbance and displacement assessment during construction and decommissioning phases for the Project in-combination.

Site	Feature	Bio-season	Screened In/Out
The Greater Wash SPA	Red-throated diver	Non-breeding	Out
	Common scoter	Non-breeding	Out
FFC SPA	Guillemot	Breeding and non-breeding	Out
	Razorbill	Breeding and non-breeding	Out
	Puffin*	Breeding and non-breeding	Out
	Gannet	Breeding and non-breeding	Out
Farne Islands SPA	Guillemot	Non-breeding	Out
	Puffin	Non-breeding	Out
Coquet Island SPA	Puffin*	Breeding and non-breeding	Out
Scottish SPAs			
Buchan Ness to Collieston Coast SPA	Guillemot*	Non-breeding	Out
Calf of Eday SPA	Guillemot*	Non-breeding	Out
Copinsay SPA	Guillemot*	Non-breeding	Out
East Caithness Cliffs SPA	Guillemot*; Razorbill*	Non-breeding	Out
Fair Isle SPA	Guillemot*; Razorbill*; Puffin*; Gannet*	Non-breeding	Out

Site	Feature	Bio-season	Screened In/Out
Forth Islands (UK) SPA	Guillemot; Razorbill; Puffin; Gannet	Non-breeding	Out
Foula SPA	Guillemot; Razorbill*; Puffin	Non-breeding	Out
Fowlsheugh SPA	Guillemot; Razorbill*	Non-breeding	Out
Hermaness, Saxa, Vord and Valla Field SPA	Guillemot*; Puffin; Gannet	Non-breeding	Out
Hoy SPA	Guillemot*; Puffin*	Non-breeding	Out
Marwick Head SPA	Guillemot*	Non-breeding	Out
North Caithness Cliffs SPA	Guillemot; Razorbill*; Puffin*	Non-breeding	Out
Noss SPA	Guillemot; Puffin*, Gannet	Non-breeding	Out
Rousay SPA	Guillemot*	Non-breeding	Out
St Abb's Head SPA	Guillemot*; Razorbill*	Non-breeding	Out
Sumburgh Head SPA	Guillemot*	Non-breeding	Out
Troup, Pennan and Lion's Heads SPA	Guillemot; Razorbill*	Non-breeding	Out
West Westray	Guillemot*	Non-breeding	Out

* Species listed as Assemblage features

10.3.2 O&M

10.3.2.1 Disturbance and Displacement

~~1524.~~1690. The potential for direct disturbance and displacement from offshore windfarms to result in an AEoI in-combination with the Project relates to the following designated sites and the relevant features:

- Coquet Island SPA; puffin;
- ~~East Caithness Cliffs SPA; guillemot and razorbill;~~
- Farne Islands SPA; guillemot and puffin; and
- Flamborough and Filey Coast SPA; gannet, guillemot and razorbill.

~~1525.~~1691. An overview of the screening process for disturbance and displacement in the O&M phase is provided in Table 10.10 below. Sites have been screened out due to the assessment for the Project alone concluding a level of effect considered to make no material contribution to any change in population or mortality rates, and that would be well within the error margins of the assessment and therefore provide no potential for any material contribution for an in-combination impact. The alone impacts using the Applicant and Natural England preferred approaches are presented to justify the screening outcome (Table 10.10).

Scottish SPAs

~~1526.~~1692. Justifications for screening out English SPAs are provided in Table 10.10 below. All Scottish SPAs have not been assessed in-combination for the operation & maintenance phase because the impacts from the project alone for guillemot and razorbill features at these sites amount to an increase in baseline mortality at these sites of approximately 0.1% or less. Therefore, there is considered to be no material contribution from the Project alone to the in-combination total for these sites.

Red-throated diver and common scoter

~~1527.~~1693. Even if the location of the Projects O&M base is confirmed as the Humber Estuary, this scenario is not predicted to considerably increase the baseline level of vessel traffic transiting through the Greater Wash SPA beyond the existing level, particularly given the implementation of a Vessel Management Plan (VMP)~~-~~. As the magnitude and duration of displacement impacts from O&M vessel traffic is predicted to be considerably lower than during the construction phase, for which the assessment alone concluded potential for a trivial and inconsequential level of effect on both red-throated diver and common scoter, there is **therefore no potential for any contribution for an in-combination effect on these features of the Greater Wash SPA during O&M.**

Migratory waterbirds

~~1528.~~1694. The assessment of the Project alone impacts on migratory waterbirds from the Greater Wash SPA, North Norfolk Coast SPA, the Wash SPA, Gibraltar Point SPA and the Humber Estuary SPA concluded potential for a trivial and inconsequential level of effect for all features. **Therefore, there is no potential for any contribution for an in-combination effect on migratory features of these SPAs.**

Table 10-10~~10.1010-1010.10~~: Summary of the sites and features considered for a disturbance and displacement assessment during O&M phases for the Project in-combination.

Site	Feature	Bio-season	Alone Impact Applicant (Natural England)	Screened In/Out
The Greater Wash SPA	Red-throated diver	Non-breeding	0.1 (0.9)	Out
	Common Scoter	Non-breeding	0.0	Out
FFC SPA	Guillemot	Breeding and non-breeding	18.2 (248.7)	In
	Razorbill	Breeding and non-breeding	10.5 (68.9)	In
	Puffin*	Breeding and non-breeding	0.4 (2.0)	In
	Gannet	Breeding and non-breeding	3.7	In
Farne Islands SPA	Guillemot	Non-breeding	1.7 (~~0.8)~~2.2)	In

Site	Feature	Bio-season	Alone Impact Applicant (Natural England)	Screened In/Out
	Puffin	Non-breeding	0.7~~4~~ (~~1~~2.0)	In
Coquet Island SPA	Puffin*	Breeding and non-breeding	1.7~~4~~ (8.0~~7.3~~)	In
Scottish SPAs				
Buchan Ness to Collieston Coast SPA	Guillemot*	Non-breeding	0.6 (0.8)	Out
Calf of Eday SPA	Guillemot*	Non-breeding	0.2 (0.3)	Out
Copinsay SPA	Guillemot*	Non-breeding	0.2 (0.3)	Out
East Caithness Cliffs SPA	Guillemot*; Razorbill*	Non-breeding	4.2 (5.5); 1.9 (5.2)	Out
Fair Isle SPA	Guillemot*; Razorbill*; Puffin*; Gannet*	Non-breeding	0.5 (0.7); 0.1 (0.4); 0.0 (0.1); 0.1	Out
Forth Islands (UK) SPA	Guillemot; Razorbill; Puffin; Gannet	Non-breeding	0.7 (1.0); 0.4 (1.1); 0.6 (1.6); 1.0	Out
Foula SPA	Guillemot; Razorbill*; Puffin	Non-breeding	0.7 (0.9); 0.1 (0.2); 0.1 (0.2)	Out
Fowlsheugh SPA	Guillemot; Razorbill*	Non-breeding	1.3 (1.8); 0.5 (1.5)	Out
Hermaness, Saxa, Vord and Valla Field SPA	Guillemot*; Puffin; Gannet	Non-breeding	0.2 (0.2); 0.6 (0.2); 0.4	Out
Hoy SPA	Guillemot*; Puffin*	Non-breeding	0.2 (0.3); 0.0 (0.0)	Out
Marwick Head SPA	Guillemot*	Non-breeding	0.4 (0.6)	Out
North Caithness Cliffs SPA	Guillemot; Razorbill*; Puffin*	Non-breeding	1.8 (2.4); 0.2 (0.7); 0.0 (0.0)	Out
Noss SPA	Guillemot; Puffin*; Gannet	Non-breeding	0.6 (0.8); 0.0 (0.0); 0.1	Out
Rousay SPA	Guillemot*	Non-breeding	0.2 (0.3)	Out
St Abb’s Head SPA	Guillemot*; Razorbill*	Non-breeding	1.1 (1.5); 0.2 (0.5)	Out
Sumburgh Head SPA	Guillemot*	Non-breeding	0.2 (0.2)	Out
Troup, Pennan and Lion’s Heads SPA	Guillemot; Razorbill*	Non-breeding	0.4 (0.6); 0.3 (0.7)	Out
West Westray	Guillemot*; Razorbill *	Non-breeding	1.3 (1.8); 0.1 (0.2)	Out
~~Buchan Ness to Collieston Coast SPA~~	~~Guillemot*~~	~~Non-breeding~~		~~Out~~

* Species listed as Assemblage features

~~1529.~~1695. The assessments provided within this RIAA include a number of assumptions that contribute to the predicted impacts and potential effects being considered precautionary, including:

- The population within each bio-season for all of the offshore windfarms being the mean of the peaks from each survey year. This makes the assumption that such a high population is maintained for each of the months within each bio-season, whilst the actual abundance is likely to be less than this throughout the months making up each bio-season (see 19.9 Consideration of bio-seasons in the assessment of guillemot [REP2-058]);
- The population within offshore windfarm ~~array~~ WTG area and/or buffers to the south of the Project is likely to include non-breeding and migratory auks moving north and south during the months considered as being included in the breeding bio-season for this assessment;
- All sites being considered within the maximum foraging range is very precautionary, considering that many of the offshore windfarm array area and their buffers are beyond a reasonable distance to assume they would be regularly used (if at all) by species during the breeding bio-season from relevant SPAs. Species specific evidence is provided throughout;
- The maximum extent of displacement considered for each species is likely to be greater than actually experienced within the ~~array~~ WTG area and buffer (see 19.10 Rates of displacement in guillemot and razorbill [REP2-059]);
- The maximum of 10% mortality of auks displaced during the non-migratory breeding bio-season is highly unlikely within all the offshore windfarms included within this assessment, as the species assessed in this RIAA are not solely dependent upon these area for all their foraging needs;
- Not accounting for additional non-breeding adults within the North Sea that contribute to the population within the offshore windfarms considered within this in-combination assessment throughout the year; and
- That the layers of precaution that are provided within the most precautionary assessments within this RIAA are highly unlikely to occur (see 19.8 Levels of precaution in the assessment and compensation calculations for offshore ornithology [REP2-057]).

~~1530.~~1696. In addition, due to uncertainties in the way density dependence acts on seabird populations (Horswill and Robinson, 2015) the PVA analysis (Appendix 7.1.2) was carried out for density independent scenarios.

~~1531.~~1697. Density dependence regulates population size by adjusting demographic rates to maintain a population around a carrying capacity. If impacts from OWFs decrease survival rates, the resulting decrease in competition for resources might lead to increased survival and/or productivity in the remaining population, consequently boosting population growth. The importance of density dependence is evident in natural ecosystems, where without it, populations would exhibit exponential growth. However, the mechanisms as to how this operates in seabird are largely uncertain. Misinterpretation of density dependence in population assessments can result in unreliable predictions. As such, PVA models used in this assessment were density independent, despite ecological evidence suggesting the presence of density dependence in large populations (Horswill et al., 2017). While density-independent models lack the capacity for population recovery once it falls below a certain threshold, they are preferred for impact assessments due to their precautionary nature (Ridge et al. 2019). Please see the Appendix 7.1.2 for further justification.

Coquet Island SPA – Puffin

~~1532.~~1698. Puffin has been screened in for the assessment of the O&M phase to assess the impacts from disturbance and displacement from the Project in-combination with other OWFs in relation to the conservation objectives for this species as a feature of the Coquet SPA (presented in Section 9.3 and Document 7.2).

~~1533.~~1699. A range of proposed, consented, under-construction, and operational OWFs in UK waters in the North Sea and English Channel were screened in for the in-combination assessment, based on the potential for adverse effects from activities taking place at these sites in combination with the O&M of the Project. During the breeding season projects were screened in if they were within the mean-maximum foraging range (137.1km) plus 1SD (128.3km) of puffin from the Coquet Island SPA based on data from Woodward et al. (2019). Since puffins range further outside of the breeding season, consideration was also given to other project within the wider UK North Sea and English Channel Biologically Defined Minimum Population Scales (BDMPS) area during the non-breeding bio-season.

~~1534.~~1700. During the breeding bio-season it is considered that potential displacement impacts on puffin from the Project may be attributed more highly to offshore windfarms within areas of sea within foraging distance from this breeding colony. In order to assess the potential in-combination impacts on puffin from multiple offshore windfarms, information was compiled on the seasonal abundance of puffins measured at each offshore windfarm site (plus 2km buffer). During this, only Berwick Bank was found to have apportioned impacts to puffins at Coquet Island SPA. The breeding season assessment therefore considers impacts resulting from this project, in-combination with the Project. The breeding season abundance reported in the Berwick Bank draft RIAA (RPS and Royal HaskoningDHV, 2022) was subjected to a process of attribution to Coquet Islands (Appendix 7.1.1).

~~1535.~~1701. To determine the number of puffins from the Coquet Islands SPA associated with other OWFs for the relevant non-breeding seasons, the cumulative totals were extracted from the Hornsea Four EIA and HRA Assessment Annex (APEM and GoBe Consultants, 2022), with numbers also added from ~~-~~Pentland Floating Windfarm, Berwick Bank~~,~~ and Green Volt.

~~1536.~~1702. Cumulative totals were then apportioned to the Coquet Island SPA based on the proportion of breeding adults from the UK North Sea and English Channel BDMPS population that can be attributed to the Coquet Islands SPA as defined by Furness (2015). Following this approach to apportionment, the proportion of the BDMPS populations from the Coquet Island SPA during the non-breeding bio-season of 10.6% was applied, as previously agreed as being appropriate by Natural England during the Norfolk Boreas examination (Natural England, 2020) and for this Project through the EPP (Table 4.2~~Table 4-2Table 4.2~~).

~~1537.~~1703. As per evidence presented in Section 9.3, a displacement rate of 50% and a mortality rate of 1% are presented as the Applicant's approach for the assessment of in-combination impacts on puffin. However, based on advice from ~~SNCB~~ANCBs (MIG-Birds, 2022), a displacement range of 30% to 70% and a mortality range of 1% to 10% are also presented in Table 10.12. Results for annual displacement consequent mortalities are also presented in a matrix in Table 10.16~~Table 10.16~~.

~~1538.~~1704. Table 10.11~~Table 10.11~~ below presents the abundance of puffins as attributed to the Coquet Islands SPA within all other offshore windfarms and their 2km buffers for consideration in this in-combination assessment. It should be noted that these values are highly likely to be overly precautionary, as they are based on seasonal mean peaks added into an annual total. The Tier 1 and 2 projects numbers are an accumulation of impacts from all Tier 1 and 2 projects in the North Sea and English Channel. Counts are taken from the Hornsea Project Four Ornithology EIA and HRA Annex.

~~Table 10.11: Mean peak abundances apportioned to the Coquet Island SPA for puffin from relevant tier one and two projects.~~

~~Project~~	~~Breeding season~~	~~Non-breeding season~~		~~Annual total~~
		~~Total~~	~~Apportioned~~	
~~Tier 1 and 2 projects~~	~~-~~	~~23,662.0~~	~~2,508.2~~	~~2,508.2~~
~~Pentland Floating~~	~~-~~	~~2.0~~	~~0.2~~	~~0.2~~
~~Berwick Bank~~	~~197.1~~	~~0.0~~	~~0.0~~	~~197.1~~
~~Green Volt~~	~~-~~	~~41.0~~	~~4.3~~	~~4.3~~
~~The Project~~	~~293.5~~		~~67.7~~	~~361.2~~
~~Total~~	**~~490.6~~**		**~~2,580.4~~**	**~~3,071.0~~**

Table 10-11~~10.1110-11~~: Mean peak abundances apportioned to the Coquet Island SPA for puffin from relevant tier one and two projects.

Project	Annual Total Abundance subject to displacement impact	Tier	Source
Consented Projects	2,508	1a – 1c	Hornsea Four Annex
Greenvolt	-	1c	Green Volt RIAA
Berwick Bank	197	1d	Berwick Bank RIAA
West of Orkney	-	1d	West of Orkney RIAA
Dogger Bank South (54.3%)	43	1d	Dogger Bank South RIAA
Dogger Bank South (100%)	63	1d	Dogger Bank South RIAA
Ossian	167	1d	Ossian RIAA
Five Estuaries	-	1d	Five Estuaries RIAA
Salamander	37	1d	Salamander RIAA
The Project (Applicant's Approach)	333	1d	-
The Project (NE Approach)	569	1d	-
Total projects (realistic-case)	3,285		
Total projects (worst-case)	3,540		

Breeding Bio-season

1705. During the breeding season, an estimated 197 (197.1) individuals are apportioned to the Coquet Island SPA from the Berwick Bank OWF. In combination with the 288.5~~294 (293.5)~~ individuals apportioned to Coquet Island SPA from the Project, the total number of individuals in-combination is 485.6~~490.6~~. The predicted displacement mortality, based on 50% displacement and 1% mortality, is two~~hree~~ (2.4~~5~~) breeding adults.

~~1539.~~1706. Using Natural England's preferred approach, 525 (524.8) breeding adults are apportioned to ODOW. In combination with the 197.1 breeding adults from Berwick Bank this gives a total of 721.9 breeding adults. The predicted displacement mortality, based upon 70% displacement and 2% mortality is 10 (10.1) breeding adults.

~~1540.~~1707. Based on a citation population of 31,686 breeding adult puffins at the Coquet Island SPA and an annual background mortality of 2,978~~1,933~~ breeding adults per annum, the addition of two~~hree~~ displacement consequent mortalities would represent a 0.080~~127~~% increase in baseline mortality, of which the Project contributes one (1.45) individuals~~l~~, representing a 0.04~~7~~8% increase in baseline mortality.

1708. As the population of puffins has changed since the citation population count the potential impact on the population is more reasonably assessed against the latest population count undertaken in 2019, which was 50,058 breeding adults, with an annual baseline mortality of 4,705.5 breeding adults per annum. The addition of two~~hree~~ mortalities would represent a 0.051~~2~~% increase in baseline mortality, the Project contributes one (1.4~~5~~) individual representing a 0.029~~31~~% increase in baseline mortality.

1709. Using Natural England's preferred approach, based on a citation population of 31,686 breeding adult puffins at the Coquet Island SPA and an annual background mortality of 2,978 breeding adults per annum, the addition of 10 displacement consequent mortalities would represent a 0.339% increase in baseline mortality, of which the Project contributes seven (7.4) individuals, representing a 0.248% increase in baseline mortality.

1710. As the population of puffins has changed since the citation population count the potential impact on the population is more reasonably assessed against the latest population count undertaken in 2019, which was 50,058 breeding adults, with an annual baseline mortality of 4,705.5 breeding adults per annum. The addition of 10 mortalities would represent a 0.214% increase in baseline mortality, the Project contributes seven (7.4) individuals representing a 0.157% increase in baseline mortality.

Non-breeding Bio-season

~~1541.~~1711. The in-combination number of individuals at risk of displacement from OWFs, including the Project that have been apportioned to the Coquet Island SPA is 2,557~~80 (2,580.4)~~ individuals in the non-breeding bio-season. The displacement consequent mortality, based on 50% displacement and 1% mortality is 13 (12.9~~89~~) individuals.

~~1542.~~1712. Considering the potential impact to the Coquet Island SPA citation population, the addition of 13 mortalities would represent a 0.430~~668~~% increase in baseline mortality, of which the Project contributes less than one (0.1~~3~~) mortality, representing a 0.004~~11~~% increase in baseline mortality.

~~1543.~~1713. Assessing the potential impact to the more recent Coquet Island SPA SMP population during the non-breeding bio-season, the addition of 13 mortalities would represent a 0.~~272~~4324% increase in baseline mortality, of which the Project contributes less than one (0.2~~13~~) mortality, representing a 0.007~~27~~% increase in baseline mortality.

Annual Total

~~1544.~~1714. The in-combination number of puffins predicted to be displaced from all OWFs, including the Project, is 3,285~~63071 (3,071.0)~~ individuals per annum. The predicted displacement consequent mortality, based on 50% displacement and 1% mortality, is 16~~5~~ (16.4~~315.4~~) individuals.

~~1545.~~1715. Considering the potential impact to the Coquet Island citation population, the addition of 16~~5~~ mortalities would represent a 0.~~547~~551~~794~~% increase in baseline mortality, of which the Project contributes less than two (1.7~~68~~) mortalities, representing a 0.056~~261~~% increase in baseline mortality.

1716. Assessing the potential impact to the more recent Coquet Island SPA SMP population, the addition of 16~~5~~ mortalities would represent a 0.34~~2~~9~~6~~% increase in baseline mortality, of which the Project contributes less than two (1.6~~8~~) mortalities, representing a 0.035~~38~~% increase in baseline mortality. ~~At a displacement rate of 70% and a mortality rate of 10%, the increase to baseline mortality of the citation population is 11.122%, and to the most recent count is 4.569%.~~

1717. Under Natural England’s preferred approach, the in-combination number of puffins predicted to be displaced from all OWFs, including the Project, is 3,5~~19~~40 individuals per annum. The predicted displacement consequent mortality, based on 70% displacement and 2% mortality, is ~~49~~50 (49.6~~3~~) individuals.

~~1546.~~ Considering the potential impact to the Coquet Island citation population, the addition of ~~49~~50 mortalities would represent a 1.6~~55~~64% increase in baseline mortality, of which the Project contributes less than two (1.6) mortalities, representing a 0.056~~2~~% increase in baseline mortality.

1718.

~~1547.~~ Assessing the potential impact to the more recent Coquet Island SPA SMP population, the addition of ~~49~~50 mortalities would represent a 1.0~~48~~53% increase in baseline mortality, of which the Project contributes less than two (1.6) mortalities, representing a 0.03~~3~~5% increase in baseline mortality.

Table 10-12~~10.12~~10-12~~10.12~~: In-combination displacement consequent mortalities for puffin at the Coquet Island SPA.

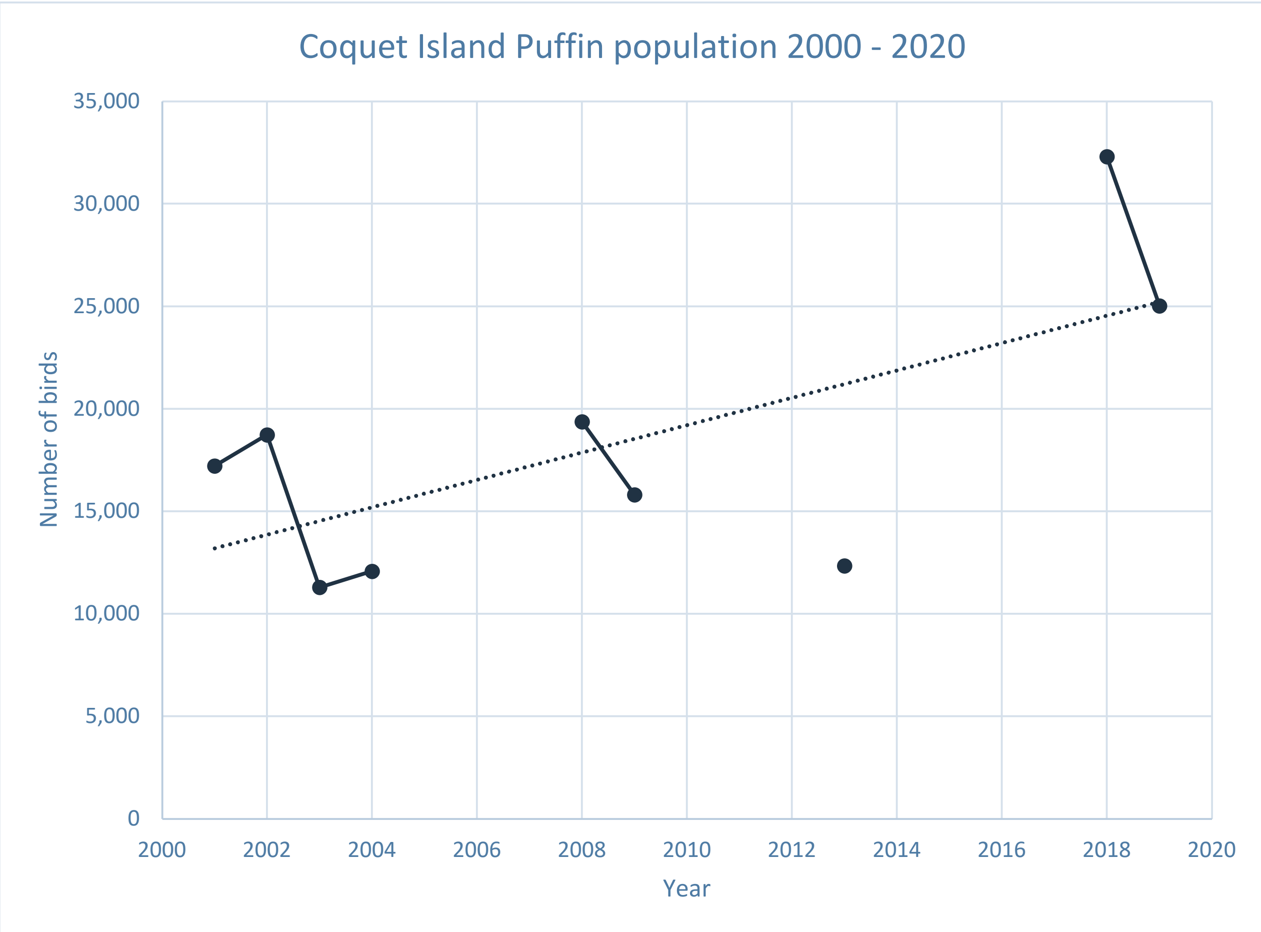
~~Bio-season~~Scenario	Annual Total Abundance of adults apportioned to the Coquet Island SPA (array/ WTG area plus 2km buffer)	Estimated mortality (breeding adults per annum)			% increase in baseline mortality (citation count)			% increase in baseline mortality (recent count)		
		50% displacement, 1% mortality	70% displacement, 2% mortality~~30-70% displacement, 1-10% mortality~~	30-70% displacement, 1-10% mortality	50% displacement, 1% mortality	70% displacement, 2% mortality~~30-70% displacement, 1-10% mortality~~	30-70% displacement, 1-10% mortality	50% displacement, 1% mortality	70% displacement, 2% mortality~~30-70% displacement, 1-10% mortality~~	30-70% displacement, 1-10% mortality
~~Breeding~~"realistic-case" all projects	3,285 ~~490.6~~	16.4~~2.5~~	46.0~~1.5 – 34.3~~	9.9 – 229.9	0.551~~0.127~~	1.544~~0.076 – 1.777~~	0.331 - 7.719	0.349~~0.052~~	0.977~~0.031 – 0.730~~	0.209 - 4.886
"worst-case" all projects~~Non-breeding~~	3,540~~2,580.4~~	17.7~~12.9~~	49.6~~7.7 – 180.6~~	10.6 – 247.8	0.594~~0.668~~	1.664~~0.401 – 9.354~~	0.357 - 8.321	0.376~~0.274~~	1.053~~0.165 – 3.839~~	0.226 - 5.267
~~**Annual total**~~	~~**3,071.0**~~	~~**15.4**~~	~~**9.2 – 215.0**~~		~~**0.794**~~	~~**0.447 – 11.122**~~		~~**0.326**~~	~~**0.196 – 4.569**~~	

~~1548.~~1719. As the increase in baseline mortality exceeds 1% for the citation and SMP population, further consideration is given in the form of PVA (Appendix 7.1.2).

~~1549.~~1720. PVA was undertaken on a range of scenarios for both the Project alone and in-combination with other projects (as presented in Appendix 7.1.2 and Table 10.14~~Table 10.11~~). For each scenario, counterfactual of population growth (CGR) and counterfactual of population size (CPS) have been presented from the model outputs, measuring the changes in annual growth rate and population size respectively at the end of the impacted period of 35 years relative to a baseline scenario. The impact on adult survival is also presented, calculated as the number of mortalities divided by the relevant population size used in the PVA analysis (in this case, the 2019 Coquet Island SPA count).

~~1550.~~1721. Table 10.13 below provides an overview of population changes in puffin at the Coquet Island SPA, with population trends fluctuating between 2002 and 2013, and then showing much larger fluctuations between 2013 and 2019. However, overall, the population has increased over the last 18 years of available data.

Table 10-13~~10.13~~10-13~~10.13~~: Population trends of puffin at the Coquet Island SPA from the SMP database (BTO, 2023)



~~1551.~~1722. The worst-case in-combination scenario of 70% displacement and 2~~10~~% mortality would represent a 0.1~~5~~% annual reduction in population growth rate which would be considered indistinguishable from natural fluctuations in the population. Considering the Applicant's approach of 50% displacement and 1% mortality which is more ecologically likely, the predicted in-combination impact represents a <0.1% annual reduction in population growth rate. When assessed alongside the population trends presented in Table 10.14, a 0.1~~5~~% reduction in annual population growth rate would maintain a positive growth trajectory in the population and be undiscernible from natural fluctuations in the population.

Table 10-14~~10.14~~10-14~~10.14~~: PVA outputs for breeding adult puffin at the Coquet Island SPA resulting from displacement impacts.

PVA Scenario	Annual mortality	Impact on adult survival	Median CGR	Median CPS
Project alone				
Applicant's Approach				
~~30% displacement, 1% mortality~~	~~1.1~~	~~<0.001~~	~~1.000~~	~~0.999~~
50% displacement, 1% mortality	1.7~~8~~	<0.001	1.000	0.999
70% displacement, 2% mortality	4.7~~5.9~~	<0.001	1.000	0.997~~6~~
NE Approach				
50% displacement, 1% mortality	2.8	<0.001	1.000	0.998
70% displacement, 2% mortality	8.0	<0.001	1.000	0.994
~~70% displacement, 10% mortality~~	~~25.3~~	~~0.001~~	~~0.999~~	~~0.979~~
In-combination				
50% displacement, 1% mortality (low)~~30% displacement, 1% mortality~~	16.4~~9.2~~	<0.001~~<0.001~~	1.000~~1.000~~	0.987~~0.992~~
70% displacement, 2% mortality (low)	46.0	0.001	0.999	0.963
50% displacement, 1% mortality (high)	17.7~~15.4~~	<0.001~~<0.001~~	1.000~~1.000~~	0.986~~0.988~~
70% displacement, 2% mortality (high)~~70% displacement, 2% mortality~~	49.6~~43.0~~	0.001~~0.001~~	0.999~~0.999~~	0.960~~0.964~~
~~70% displacement, 10% mortality~~	~~215.0~~	~~0.004~~	~~0.995~~	~~0.834~~

~~1552.~~1723. It is therefore concluded that the in-combination predicted puffin mortality due to displacement in the O&M phase would not adversely affect the integrity of the Coquet Island SPA.

Table 10-15~~10.15~~10-15~~10.15~~: ~~i~~In-combination displacement matrix for puffin attributed to the Coquet Island SPA, with light blue shading representing the displacement and mortality range advocated for by ~~SNCB~~ANCBs, and dark blue representing the Applicant's approach.

Annual (2km Buffer)	Mortality Rate (%)												
Displaced (%)	1	2	5	10	20	30	40	50	60	70	80	90	100
10	3 ~~3~~	7 ~~6~~	16 ~~15~~	33 ~~31~~	66 ~~61~~	99 ~~92~~	131 ~~123~~	164 ~~154~~	197 ~~184~~	230 ~~215~~	263 ~~246~~	296 ~~276~~	328 ~~307~~
20	7 ~~6~~	13 ~~12~~	33 ~~31~~	66 ~~61~~	131 ~~123~~	197 ~~184~~	263 ~~246~~	328 ~~307~~	394 ~~369~~	460 ~~430~~	526 ~~491~~	591 ~~553~~	657 ~~614~~
30	10 ~~9~~	20 ~~18~~	49 ~~46~~	99 ~~92~~	197 ~~184~~	296 ~~276~~	394 ~~369~~	493 ~~461~~	591 ~~553~~	690 ~~645~~	788 ~~737~~	887 ~~829~~	985 ~~921~~
40	13 ~~12~~	26 ~~25~~	66 ~~61~~	131 ~~123~~	263 ~~246~~	394 ~~369~~	526 ~~491~~	657 ~~614~~	788 ~~737~~	920 ~~860~~	1,051 ~~983~~	1,182 ~~1,106~~	1,314 ~~1,228~~
50	16 ~~15~~	33 ~~31~~	82 ~~77~~	164 ~~154~~	328 ~~307~~	493 ~~461~~	657 ~~614~~	821 ~~768~~	985 ~~921~~	1,150 ~~1,075~~	1,314 ~~1,228~~	1,478 ~~1,382~~	1,642 ~~1,536~~
60	20 ~~18~~	39 ~~37~~	99 ~~92~~	197 ~~184~~	394 ~~369~~	591 ~~553~~	788 ~~737~~	985 ~~921~~	1,182 ~~1,106~~	1,380 ~~1,290~~	1,577 ~~1,474~~	1,774 ~~1,658~~	1,971 ~~1,843~~
70	23 ~~21~~	46 ~~43~~	115 ~~107~~	230 ~~215~~	460 ~~430~~	690 ~~645~~	920 ~~860~~	1,150 ~~1,075~~	1,380 ~~1,290~~	1,609 ~~1,505~~	1,839 ~~1,720~~	2,069 ~~1,935~~	2,299 ~~2,150~~
80	26 ~~25~~	53 ~~49~~	131 ~~123~~	263 ~~246~~	526 ~~491~~	788 ~~737~~	1,051 ~~983~~	1,314 ~~1,228~~	1,577 ~~1,474~~	1,839 ~~1,720~~	2,102 ~~1,965~~	2,365 ~~2,211~~	2,628 ~~2,457~~
90	30 ~~28~~	59 ~~55~~	148 ~~138~~	296 ~~276~~	591 ~~553~~	887 ~~829~~	1,182 ~~1,106~~	1,478 ~~1,382~~	1,774 ~~1,658~~	2,069 ~~1,935~~	2,365 ~~2,211~~	2,661 ~~2,488~~	2,956 ~~2,764~~
100	33 ~~31~~	66 ~~61~~	164 ~~154~~	328 ~~307~~	657 ~~614~~	985 ~~921~~	1,314 ~~1,228~~	1,642 ~~1,536~~	1,971 ~~1,843~~	2,299 ~~2,150~~	2,628 ~~2,457~~	2,956 ~~2,764~~	3,285 ~~3,071~~

Table 10-16~~10.1610-16~~: In-combination displacement matrix for puffin attributed to the Coquet Island SPA, with light blue shading representing the displacement and mortality range advocated for by ~~SNCB~~ANCBs, and dark blue representing Natural England's preferred approach.

Annual (2km Buffer)	Mortality Rate (%)												
Displaced (%)	1	2	5	10	20	30	40	50	60	70	80	90	100
10	4	7	18	35	71	106	142	177	212	248	283	319	354
20	7	14	35	71	142	212	283	354	425	496	566	637	708
30	11	21	53	106	212	319	425	531	637	743	850	956	1,062
40	14	28	71	142	283	425	566	708	850	991	1,133	1,275	1,416
50	18	35	89	177	354	531	708	885	1,062	1,239	1,416	1,593	1,770
60	21	42	106	212	425	637	850	1,062	1,275	1,487	1,699	1,912	2,124
70	25	50	124	248	496	743	991	1,239	1,487	1,735	1,983	2,230	2,478
80	28	57	142	283	566	850	1,133	1,416	1,699	1,983	2,266	2,549	2,832
90	32	64	159	319	637	956	1,275	1,593	1,912	2,230	2,549	2,868	3,186
100	35	71	177	354	708	1,062	1,416	1,770	2,124	2,478	2,832	3,186	3,540

Farne Islands SPA – Guillemot (Non-breeding Bio-season)

~~1553.~~1724. Guillemot has been screened in for the assessment of the O&M phase during the non-breeding season to assess the impacts from disturbance and displacement from the Project in-combination with other OWFs in relation to the conservation objectives for this species as a feature of the Farne Islands SPA (presented in Document 7.2).

~~1554.~~1725. A range of proposed, consented, under-construction, and operational OWFs in UK waters in the North Sea and English Channel were screened in for the in-combination assessment, based on the potential for adverse effects from activities taking place at these sites in combination with the O&M of the Project. To determine the number of guillemots from the Farne Islands SPA associated with other OWFs for the relevant non-breeding seasons, the cumulative totals were extracted from the Natural England Offshore Ornithology Position for Sheringham Shoal and Dudgeon Offshore Windfarm Extension Projects Deadline 8 Submission ~~Dudgeon and Sheringham Shoal extension projects cumulative updates technical note~~ (~~Royal HaskoningDHV~~Natural England, 2024~~3~~), with total numbers of tier 1 and 2 projects presented in Table 10.18~~Table 10.17~~, in addition to numbers presented for ~~-~~Pentland Floating Windfarm, Berwick Bank and Green Volt.

~~1555.~~1726. Cumulative totals were then apportioned to the Farne Islands SPA based on the proportion of breeding adults from the UK North Sea and English Channel BDMPS population that can be attributed to the Farne Islands SPA as defined by Furness (2015). Following this approach to apportionment, the proportion of the BDMPS populations from the Farne Islands SPA during the non-breeding bio-season of 3.7% was agreed as appropriate by Natural England during the Norfolk Boreas examination (Natural England 2020) and for this project through the EPP (Table 4.2).

~~1556.~~1727. During the breeding season, only impacts from Berwick Bank have been apportioned to the Farne Islands SPA, and are included in the annual total below.

1728. As per evidence presented in Section 9.3~~9.4~~, a displacement rate of 50% and a mortality rate of 1% are presented as the Applicant's approach for the assessment of in-combination impacts on guillemot. However, based on ~~SNCB~~ANCB advice (MIG-Birds, 2022), a displacement range of 30% to 70% and a mortality range of 1% to 10~~210~~% is also presented in Table 10.19~~Table 10.18~~. Results for annual displacement consequent mortalities are also presented in a matrix in Table 10.19~~Table 10.18~~. ~~Table 10.16~~ below presents the total abundance of guillemots from relevant projects (array area plus 2km buffer), alongside numbers apportioned to the Farne Islands SPA. It should be noted that these values are highly likely to be overly precautionary as they are based on seasonal mean peaks added into an annual total.

~~1557.~~

~~Table 10.16: Mean peak abundances and abundances apportioned to the Farne Islands SPA for guillemot from relevant tier one and two projects.~~

~~Project~~	~~Breeding season~~		~~Annual total~~
		~~Apportioned~~	
~~Tier 1 and 2 projects~~	~~-~~	~~9,066.3~~	~~9,066.3~~
~~ForthWind~~	~~-~~	~~14.8~~	~~14.8~~
~~Pentland Floating~~	~~-~~	~~24.1~~	~~24.1~~
~~Berwick Bank~~	~~2,948.0~~	~~1,634.3~~	~~4,582.3~~
~~Green Volt~~	~~-~~	~~595.9~~	~~595.9~~
~~The Project~~	~~-~~	~~418.3~~	~~418.3~~
~~**Total**~~	~~**2,948.0**~~	~~**11,753.7**~~	~~**14,701.7**~~

Table 10-17~~10.1710-17~~: Mean peak abundances and abundances apportioned to the Farne Islands SPA for guillemot from relevant tier one and two projects.

Project	Annual Total Abundance subject to displacement impact	Tier	Source
Consented Projects	8,601	1a – 1c	Rampion 2 in-combination update
ForthWind	15	1c	Forthwind EIAR
Pentland Floating	24	1c	Pentland Floating EIAR
Greenvolt	600	1c	Green Volt RIAA
Berwick Bank	4,597	1d	Berwick Bank RIAA
West of Orkney	160	1d	Rampion 2 in-combination update
North Falls	200	1d	North Falls RIAA
Dogger Bank South	745	1d	Dogger Bank South RIAA
Ossian	-	1d	Ossian RIAA
Five Estuaries	138	1d	Five Estuaries RIAA
Salamander	-	1d	Salamander RIAA
The Project (Applicant's Approach)	338	1d	
The Project (NE Approach)	160	1d	-
Total projects (realistic-case)	15,418		
Total projects (worst-case)	15,240		

~~*Non-breeding season*~~

~~1558. The in-combination number of individuals at risk of displacement from OWFs, including the Project, that have been apportioned to the Farne Islands SPA is 15,8411,754 (11,753.7) individuals in the non-breeding bio-season. The displacement consequent mortality, based on 50% displacement and 1% mortality, is 79 (79.2)59 (58.8) individuals.~~

~~1559. Considering the potential impact to the Farne Islands citation population of 65,751 breeding adults with a baseline mortality of 4,011 individuals per annum, the addition of 7959 mortalities would represent a 1.9741.465% increase in baseline mortality, of which the Project contributes less than two (1.72.1) mortalities, representing a 0.03452% increase in baseline mortality.~~

~~Assessing the potential impact to the more recent 2023 Farne Islands SMP population of 46,332 breeding adults with a baseline mortality of 2,826.3 individuals per annum, the addition of 759 mortalities would represent a 2.7982.079% increase in baseline mortality, of which the Project contributes less than two (1.72.1) mortalities, representing a 0.06072% increase in baseline mortality. The full range of potential impacts are presented in Table 10.17 below.~~

~~Under Natural England's preferred approach, the in-combination number of individuals at risk of displacement from OWFs, including the Project, that have been apportioned to the Farne Islands SPA is 15,636 individuals in the non-breeding bio-season. The displacement consequent mortality, based on 70% displacement and 2% mortality, is 221 (221.4) individuals.~~

~~Considering the potential impact to the Farne Islands citation population of 65,751 breeding adults with a baseline mortality of 4,011 individuals per annum, the addition of 221 mortalities would represent a 5.520% increase in baseline mortality.~~

~~Assessing the potential impact to the more recent 2023 Farne Islands SMP population of 46,332 breeding adults with a baseline mortality of 2,826.3 individuals per annum, the addition of 221 mortalities would represent a 7.834% increase in baseline mortality. The full range of potential impacts are presented in Table 10.17 below.~~

~~1560.~~

Annual total

~~1561.~~1729. Across all bio-seasons, the in-combination number of individuals at risk of displacement from OWFs, including the Project, that have been apportioned to the Farne Islands SPA is ~~21,75114,702 (14,701.7)~~15,418.3 individuals. The displacement consequent mortality based on 50% displacement and 1% mortality is ~~109~~77 (~~108~~77.1~~.8~~)~~74 (73.5)~~ individuals.

~~1562.~~1730. Considering the potential impact to the Farne Islands citation population of 65,751 breeding adults with a baseline mortality of 4,011 individuals per annum, the addition of ~~109~~ ~~74~~77 mortalities would represent a 1.922 ~~2.7121.833~~% increase in baseline mortality, of which the Project of which the Project contributes less than two (1.7~~2.1~~) mortalities, representing a 0.034~~52~~% increase in baseline mortality.

1731. Assessing the potential impact to the more recent 2023 Farne Islands SMP population of 46,332 breeding adults with a baseline mortality of 2,826 individuals per annum, the addition of ~~10959~~77 mortalities would represent a 2.728~~3. 8482.601~~% increase in baseline mortality.~~, of which the Project contributes two (2.1) mortalities, representing a 0.052% increase in baseline mortality.~~

~~1563.~~1732. Under Natural England's preferred approach, the displacement mortality, based upon 70% displacement and 2% mortality is 213 (213.4)~~302.0~~ birds. This would represent an increase on baseline mortality of 5.319~~7. 530~~% on the citation population and 7.549~~10. 686~~% on the most recent population.

Table 10-18~~10.18~~10-18~~10.17~~: In-combination displacement consequent mortalities for guillemot at the Farne Islands SPA.

~~Bio-season~~Scenario	Abundance of adults apportioned to the Farne Islands SPA (~~array~~ WTG area plus 2km buffer)	Estimated increase in mortality (breeding adults per annum)			% increase in baseline mortality (citation count)			% increase in baseline mortality (recent count)		
		50% displacement, 1% mortality	70% displacement, 2% mortality~~50% displacement, 1% mortality~~	30-70% displacement, 1-10% mortality	50% displacement, 1% mortality	70% displacement, 2% mortality	30-70% displacement, 1-10% mortality	50% displacement, 1% mortality	70% displacement, 2% mortality	30-70% displacement, 1-10% mortality
Total projects (realistic-case)~~Non-breeding~~	15,418.3~~11,753.7~~	77.1	215.9~~58.8~~	46.3~~35.3 – 822.8~~ - 1,079.3	1.922~~1.465~~	5.382	1.153~~0.879 – 20.514~~ - 26.909	2.728~~2.079~~	7.638	1.637~~1.248 – 29.111~~ - 38.188
Total projects (worst-case)~~Annual total~~	15,239.6~~14,701.7~~	76.2	213.4~~73.5~~	45.7~~44.1 – 1,029.1~~ - 1,066.8	1.900~~1.833~~	5.319	1.140~~1.100 – 25.659~~ - 26.597	~~2.601~~2.696	7.549	1.618~~1.561 – 36.413~~ - 37.745

Table 10-19~~10.19~~10-19~~10.18~~: In-combination displacement matrix for guillemot attributed to the Farne Island SPA across all bio-seasons, with light blue shading representing the displacement and mortality range advocated for by ~~SNCB~~ANCBs, and dark blue representing t~~T~~he Applicant's approach.

Annual	Mortality Rate (%)												
Displaced (%)	1	2	5	10	20	30	40	50	60	70	80	90	100
10	15 ~~15~~	31 ~~29~~	77 ~~74~~	154 ~~147~~	308 ~~294~~	463 ~~441~~	617 ~~588~~	771 ~~735~~	925 ~~882~~	1,079 ~~1,029~~	1,233 ~~1,176~~	1,388 ~~1,323~~	1,542 ~~1,470~~
20	31 ~~29~~	62 ~~59~~	154 ~~147~~	308 ~~294~~	617 ~~588~~	925 ~~882~~	1,233 ~~1,176~~	1,542 ~~1,470~~	1,850 ~~1,764~~	2,159 ~~2,058~~	2,467 ~~2,352~~	2,775 ~~2,646~~	3,084 ~~2,940~~
30	46 ~~44~~	93 ~~88~~	231 ~~221~~	463 ~~441~~	925 ~~882~~	1,388 ~~1,323~~	1,850 ~~1,764~~	2,313 ~~2,205~~	2,775 ~~2,646~~	3,238 ~~3,087~~	3,700 ~~3,528~~	4,163 ~~3,969~~	4,625 ~~4,411~~
40	62 ~~59~~	123 ~~118~~	308 ~~294~~	617 ~~588~~	1,233 ~~1,176~~	1,850 ~~1,764~~	2,467 ~~2,352~~	3,084 ~~2,940~~	3,700 ~~3,528~~	4,317 ~~4,116~~	4,934 ~~4,705~~	5,551 ~~5,293~~	6,167 ~~5,881~~
50	77 ~~74~~	154 ~~147~~	385 ~~368~~	771 ~~735~~	1,542 ~~1,470~~	2,313 ~~2,205~~	3,084 ~~2,940~~	3,855 ~~3,675~~	4,625 ~~4,411~~	5,396 ~~5,146~~	6,167 ~~5,881~~	6,938 ~~6,616~~	7,709 ~~7,351~~
60	93 ~~88~~	185 ~~176~~	463 ~~441~~	925 ~~882~~	1,850 ~~1,764~~	2,775 ~~2,646~~	3,700 ~~3,528~~	4,625 ~~4,411~~	5,551 ~~5,293~~	6,476 ~~6,175~~	7,401 ~~7,057~~	8,326 ~~7,939~~	9,251 ~~8,821~~
70	108 ~~103~~	216 ~~206~~	540 ~~515~~	1,079 ~~1,029~~	2,159 ~~2,058~~	3,238 ~~3,087~~	4,317 ~~4,116~~	5,396 ~~5,146~~	6,476 ~~6,175~~	7,555 ~~7,204~~	8,634 ~~8,233~~	9,713 ~~9,262~~	10,793 ~~10,291~~
80	123 ~~118~~	247 ~~235~~	617 ~~588~~	1,233 ~~1,176~~	2,467 ~~2,352~~	3,700 ~~3,528~~	4,934 ~~4,705~~	6,167 ~~5,881~~	7,401 ~~7,057~~	8,634 ~~8,233~~	9,868 ~~9,409~~	11,101 ~~10,585~~	12,335 ~~11,761~~
90	139 ~~132~~	278 ~~265~~	694 ~~662~~	1,388 ~~1,323~~	2,775 ~~2,646~~	4,163 ~~3,969~~	5,551 ~~5,293~~	6,938 ~~6,616~~	8,326 ~~7,939~~	9,713 ~~9,262~~	11,101 ~~10,585~~	12,489 ~~11,908~~	13,876 ~~13,232~~
100	154 ~~147~~	308 ~~294~~	771 ~~735~~	1,542 ~~1,470~~	3,084 ~~2,940~~	4,625 ~~4,411~~	6,167 ~~5,881~~	7,709 ~~7,351~~	9,251 ~~8,821~~	10,793 ~~10,291~~	12,335 ~~11,761~~	13,876 ~~13,232~~	15,418 ~~14,702~~

Table 10-20~~10.2010-20~~: In-combination displacement matrix for guillemot attributed to the Farne Island SPA across all bio-seasons, with light blue shading representing the displacement and mortality range advocated for by ~~SNCB~~ANCBs, and dark blue representing Natural England's preferred approach.

Annual	Mortality Rate (%)												
Displaced (%)	1	2	5	10	20	30	40	50	60	70	80	90	100
10	15	30	76	152	305	457	610	762	914	1,067	1,219	1,372	1,524
20	30	61	152	305	610	914	1,219	1,524	1,829	2,134	2,438	2,743	3,048
30	46	91	229	457	914	1,372	1,829	2,286	2,743	3,200	3,657	4,115	4,572
40	61	122	305	610	1,219	1,829	2,438	3,048	3,657	4,267	4,877	5,486	6,096
50	76	152	381	762	1,524	2,286	3,048	3,810	4,572	5,334	6,096	6,858	7,620
60	91	183	457	914	1,829	2,743	3,657	4,572	5,486	6,401	7,315	8,229	9,144
70	107	213	533	1,067	2,134	3,200	4,267	5,334	6,401	7,467	8,534	9,601	10,668
80	122	244	610	1,219	2,438	3,657	4,877	6,096	7,315	8,534	9,753	10,972	12,192
90	137	274	686	1,372	2,743	4,115	5,486	6,858	8,229	9,601	10,972	12,344	13,716
100	152	305	762	1,524	3,048	4,572	6,096	7,620	9,144	10,668	12,192	13,716	15,240

~~1564.~~1733. Given that the percentage increase in baseline mortality is over 1% for both the citation and SMP population sizes, further consideration is given in the form of PVA (Appendix 7.1.2).

~~1565.~~1734. PVA was undertaken on a range of scenarios for both the Project alone and in-combination with other projects (as presented in Appendix 7.1.2 and Table 10.22~~Table 10.16~~). For each scenario, CGR and CPS values have been presented from the model outputs, measuring the changes in annual growth rate and population size respectively at the end of the impacted period of 35 years relative to a baseline scenario. The impact on adult survival is also presented, calculated as the number of mortalities divided by the relevant population size used in the PVA analysis (in this case, the 2019 Farne Islands SPA count). PVA outputs are presented in Table 10.23~~Table 10.21~~.

~~1566.~~ Over the last 20 years, the Farne Islands SPA has shown an overall slight increase in population numbers. Though a decrease in the last five years is evident, the population has shown fluctuations in numbers over the presented time period.

1735.

Table 10-21~~10.21~~~~10-21~~~~10.19~~: Population trends in guillemot at the Farne Islands SPA based on the SMP database (BTO, 2023).

Year	Population count (Ind)	Percentage change since last count (%)
2023	46,332	-21.7
2022	59,168	-6.0
2021	62,936	-0.8
2020	63,413	-1.0
2019	64,042	+28.2
2018	49,972	+3.6
2017	48,234	-1.6
2016	49,037	-8.3
2015	53,461	+3.0
2014	51,883	+3.7
2013	50,048	+2.0
2012	49,076	+5.9
2010	46,355	-3.7
2009	48,126	+9.7
2008	43,865	-9.8
2007	48,650	+3.7
2005	46,915	+7.4
2004	43,694	+3.2
2003	42,338	

~~1567.~~ The worst-case in-combination scenario of 70% displacement and 2~~10~~% mortality would represent a 0.5~~72.5~~% annual reduction in population growth rate. Notably, the worst case scenario is considered highly precautionary, and not representative of actual impacts expected as a result of the Project in-combination with other projects. ~~This was also supported in advice given by Natural England to Norfolk Boreas at Deadline 4 (Natural England 2020):~~

~~*'However, while there is some empirical evidence to support the displacement levels for auks we do not know what the likely mortality impacts of displacement are. We therefore consider it appropriate to consider a range of mortalities from 1-10%. However, on the basis that the projects that have been scoped into the assessment lie in areas of the North Sea that represent low to medium levels of guillemot density during both the breeding (where relevant) and non-breeding seasons (Seabird Sensitivity Mapping Tool), it is assumed that areas of low/medium density will be less important/desirable feeding areas and therefore mortality impacts of displacement from lower quality areas would be lower than displacement from optimal/important areas. Therefore, we do not anticipate that mortality rates to be at the top of the range considered...'*~~

~~1568. This is also supported by more recent available data which suggests 70% displacement and 10% mortality is a large overestimation of actual impacts (APEM, 2021; MacArthur Green, 2023).~~

~~1569. An alternative worst-case scenario based on alignment with the SoS's decision on Hornsea Project Four is therefore the use of 70% displacement and 2% mortality, which would represent a 0.5% reduction in population growth rate.~~ This is ~~further~~ reduced to a 0.2~~3~~2% reduction when considering the Applicant's approach of 50% displacement and 1% mortality. Based on both the previous precedent from Hornsea Project Four and the Applicant's approach values, the predicted impact is expected to be indistinguishable from natural fluctuations in the population when considering the changes in population numbers presented in Table 10.22~~Table 10.20~~. ~~Compared to the magnitude of natural fluctuations within this population, even the potential changes predicted by PVA for the 70:10 displacement and mortality ratio are small, with, for example, an increase of 28.2% between 2018 and 2019, and a decrease of 8.3% between 2015 and 2016.~~

~~1570.~~1736. In spite of the PVA results showing a reduction in colony growth exceeding 0.5%, It is not anticipated that this level of reduction is realistic. This reduction is based upon a displacement rate of 70% and a mortality rate of 2%, both of which are considered to be highly precautionary (REP2-0~~95~~59 – 19.10 Rates of displacement in guillemot and razorbill). In addition, the assessments are based upon means of peak populations per bio-season, which is also a precautionary approach (REP2-057 – 19.8 Levels of precaution in the assessment and compensation calculations for offshore ornithology). For guillemot this is particularly precautionary as the breeding bio-season populations are derived from April peaks, before breeding commences, when colony attendance is low and birds are not under the same constraints as they are when incubating or feeding young (REP3-049 – 20.17 Guillemot and razorbill compensation quanta). Tracking of guillemots from the Farne Islands in the non-breeding season suggests that the level of apportionment used may overestimate the number of Farne Islands breeders using the Project. Although sample sizes were small, data presented in Buckingham et al (2022) suggest that the project is at best on the periphery of the 50% density kernel for birds tracked from the Farnes, with the vast majority of data points to the north of the project. An appropriately reduced level of apportionment to the Farne Islands SPA would reduce the level of impact predicted, thus reducing any changes to colony size or growth rate attributable to the project. Apportioning of impacts to the Farne Islands SPA is also based upon an extremely unlikely adult proportion of 100% (compared to the adult proportion of 57% derived from a stable age distribution in Furness 2015), does not apply a sabbatical rate (i.e. assumes that all birds will be breeding, when in reality a small percentage of adults do not breed each year). As such, the impacts derived from the 70% displacement and 2% mortality (and therefore the PVA carried out that uses these results) is considered to be highly precautionary. The Applicant considers the impacts derived from the 50% displacement and 1% mortality to be precautionary but present a more realistic assessment of impacts.

Table 10-22~~10.22~~10-22~~10.20~~: PVA outputs for breeding adult guillemot at the Farne Islands SPA resulting from displacement impacts.

PVA Scenario	Annual mortality	Impact on adult survival	Median CGR	Median CPS
Project alone				
Applicant's Approach				
50% displacement, 1% mortality~~30% displacement, 1% mortality~~	1.7~~1.3~~	<0.001	1.000~~1.000~~	0.999~~0.999~~
70% displacement, 2% mortality~~50% displacement, 1% mortality~~	4.7~~2.1~~	<0.001	1.000~~1.000~~	0.996~~0.998~~
NE Approach				
50% displacement, 1% mortality ~~70%~~	0.8~~5.9~~	<0.001	1.000~~1.000~~	0.999~~0.996~~

PVA Scenario	Annual mortality	Impact on adult survival	Median CGR	Median CPS
~~displacement, 2% mortality~~				
70% displacement, 2% mortality~~70% displacement, 10% mortality~~	2.2~~29.3~~	<0.001	1.000~~0.999~~	0.998~~0.975~~
In-combination				
50% displacement, 1% mortality (low)~~30% displacement, 1% mortality~~	77.1~~44.1~~	0.002~~0.001~~	0.998~~0.999~~	0.935~~0.962~~
70% displacement, 2% mortality (low)~~50% displacement, 1% mortality~~	215.9~~73.5~~	0.005~~0.001~~	0.995~~0.998~~	0.828~~0.938~~
50% displacement, 1% mortality (high)~~70% displacement, 2% mortality~~	76.2~~205.8~~	0.002~~0.003~~	0.998~~0.995~~	0.936~~0.835~~
70% displacement, 2% mortality (high)~~70% displacement, 10% mortality~~	213.4~~1029.1~~	0.005~~0.016~~	0.995~~0.975~~	0.830~~0.403~~

~~1571.~~1737. In addition to this conclusion, it should also be noted that the assessment is already considered precautionary in nature, because it does not account~~is based on mean peak abundance, which is likely to overestimate the abundance of individuals present in the area throughout the whole season, while also not accounting~~ for the fact that individuals are possibly double counted across multiple projects within similar areas, thus further over-inflating predicted impacts.

1738. It is therefore concluded that the in-combination predicted guillemot mortality due to displacement in the O&M phase would not adversely affect the integrity of the Farne Islands SPA.

Farne Islands SPA – Puffin (Non-breeding Bio-season)

~~1572.~~1739. Puffin has been screened in for the assessment of the O&M phase during the non-breeding season to assess the impacts from disturbance and displacement from the Project in-combination with other OWFs in relation to the conservation objectives for this species as a feature of the Farne Islands SPA (presented in Section 9.3 and Document 7.2).

~~1573.~~1740. A range of proposed, consented, under-construction, and operational OWFs in UK waters in the North Sea and English Channel were screened in for the in-combination assessment, based on the potential for adverse effects from activities taking place at these sites in combination with the O&M of the Project. To determine the number of puffins from the Farne Islands SPA associated with other OWFs for the relevant non-breeding seasons, the cumulative totals were extracted from the Hornsea Four EIA and HRA Assessment Annex (APEM and GoBe Consultants, 2022), with numbers also added from Pentland Floating Windfarm, Berwick Bank, Green Volt, West of Orkney, Ossian, Dogger Bank South, Salamander, Five Estuaries, and Outer Dowsing.

~~1574.~~1741. Cumulative totals were then apportioned to the Farne Islands SPA based on the proportion of breeding adults from the UK North Sea and English Channel BDMPS population that can be attributed to the Farne Islands SPA as defined by Furness (2015). Following this approach to apportionment the proportion of the BDMPS populations from the Farne Islands SPA during non-breeding bio-season of 34.5% was applied, as agreed as appropriate by Natural England during the Norfolk Boreas examination (Natural England, 2020) and for this Project through the EPP (Table 4.2).

~~1575.~~1742. During the breeding season, only Berwick Bank has apportioned impacts to the Puffin feature of the Farne Islands SPA. This impact has been added to the annual total below.

~~1576.~~1743. As per evidence presented in Section 9.3, a displacement rate of 50% and a mortality rate of 1% are presented as the Applicant's approach for the assessment of in-combination impacts on puffin. However, based on advice from ~~SNCB~~ANCBs (MIG-Birds, 2022), a displacement range of 30% to 70% and a mortality range of 1% to 10% are also ~~a displacement range of 30% to 70% and a mortality range of 1% to 210% is also~~ presented in Table 10.25~~Table 10.22~~. Results for annual displacement consequent mortalities are also presented in a matrix in Table 10.26~~Table 10.23~~. Table 10.23~~Table 10.21~~ below presents the total abundance of puffins from relevant projects (array area plus 2km buffer), alongside numbers apportioned to the Farne Islands SPA. It should be noted that these values are highly likely to be overly precautionary, as they are based on seasonal mean peaks added into an annual total.

Table 10-23~~10.2310-2310.21~~: Mean peak abundances and abundances apportioned to the Farne Islands SPA for puffin from relevant tier one and two projects.

Project	~~Breeding season~~Annual Total	Tier	Source
~~Tier 1 and 2 projects~~ Total consented projects	8,163~~-~~	1a – 1c	Hornsea Four
~~Pentland Floating~~	~~-~~		
Pentland Floating	14	1c	Pentland Floating EIAR
Berwick Bank	710 ~~710.3~~	1d	Berwick Bank RIAA

Project	~~Breeding season~~Annual Total	Tier	Source
West of Orkney	-	1d	West of Orkney RIAA
Green Volt	14~~-~~	1c	Green Volt RIAA
Ossian	406	1d	Ossian RIAA
Dogger Bank South (54.3%)	99	1d	Dogger Bank South RIAA
Dogger Bank South (100%)	128	1d	Dogger Bank South RIAA
Salamander	82	1d	Salamander RIAA
Five Estuaries	-	1d	Five Estuaries RIAA
Outer Dowsing	143 ~~-~~	1d	
Total projects (realistic-case)	9,~~561~~632 ~~**710.3**~~		
Total projects (worst-case)	9,~~590~~661		

~~*Non-breeding season*~~

~~1577. The in-combination number of individuals at risk of displacement from OWFs, including the Project that have been apportioned to the Farne Islands SPA is 8,313938 (8,937.9) individuals in the non-breeding bio-season. The displacement consequent mortality, based on 50% displacement and 1% mortality is 4212 (41.922.0) individuals.~~

~~1578. Considering the potential impact to the Farne Islands citation population of 76,798 breeding adults, with a background mortality of 7,219 individuals per annum, the addition of 4212 mortalities would represent a 0.57666782% increase in baseline mortality, of which the Project contributes one (0.71.01) mortality, representing a 0.001510% increase in baseline mortality.~~

~~Assessing the potential impact to the more recent 2019 Farne Islands SMP population of 87,054 breeding adults, with a background mortality of 8,225 individuals per annum, the addition of 4212 mortalities would represent a 0.5850510% increase in baseline mortality, of which the Project contributes one (1.01)0.7) mortality, representing a 0.009413% increase in baseline mortality.~~

~~Under Natural England's preferred approach, the displacement consequent mortality, based on 70% displacement and 2% mortality is 1176 (1176.4) individuals. Considering the potential impact to the Farne Islands citation population of 76,798 breeding adults, with a background mortality of 7,219 individuals per annum, the addition of 11167 mortalities would represent a 1.62612% increase in baseline mortality, of which the Project contributes one (0.71.0) mortality, representing a 0.01005% increase in baseline mortality.~~

~~Assessing the potential impact to the more recent 2019 Farne Islands SMP population of 87,054 breeding adults, with a background mortality of 8,225 individuals per annum, the addition of 116 mortalities would represent a 1.415427% increase in baseline mortality, of which the Project contributes one (0.71.0) mortality, representing a 0.0049% increase in baseline mortality.~~

Annual total

~~1579.~~1744. Across all bio-seasons, the in-combination number of individuals at risk of displacement from OWFs, including the Project that have been apportioned to the Farne Islands SPA is 9,632~~590108 (9,108.1)~~ individuals. The displacement consequent mortality, based on 50% displacement and 1% mortality is 48~~6~~ (48.2~~7.95.5~~) individuals.

~~1580.~~1745. Considering the potential impact to the Farne Islands citation population of 76,798 breeding adults, with a background mortality of 7,219 individuals per annum, the addition of 48~~6~~ mortalities would represent a 0.667~~431~~% increase in baseline mortality, of which the Project contributes one (0.7~~1.1~~) mortalities, representing a 0.01~~5~~0% increase in baseline mortality.

1746. Assessing the potential impact to the more recent 2019 Farne Islands SMP population of 87,054 breeding adults, with a background mortality of 8,225 individuals per annum, the addition of 48~~6~~ mortalities would represent a 0.585~~354~~% increase in baseline mortality, of which the Project contributes one (0.7~~1.0~~1) mortality, representing a 0.0~~13~~09% increase in baseline mortality. The full range of impacts are presented in Table 10.25~~Table 10.22~~ and in a displacement matrix in Table 10.26~~Table 10.23~~.

Under Natural England's preferred approach, the displacement consequent mortality, based on 70% displacement and 2% mortality is 1345~~4~~ (13~~3~~54~~.3~~83) individuals. This would represent an increase on baseline mortality of 1.8~~68~~74~~0~~% for the citation population and 1.644~~392~~% for the most recent count.

~~1581.~~1747.

~~1582.~~ Although the impacts based on the Applicant's approach are below the 1% threshold, ~~Though the increase in baseline mortality for both the citation and SMP population is greater than 1% based on the upper range (70% displacement, 210% mortality), the impacts based on the Applicant's approach are far below the 1% threshold, with these results deemed more ecologically relevant. Additionally, the project alone contribution represents a <0.1% increase in baseline mortality for both populations. Therefore, the impact from the Project is considered make no material change to populations or mortality rates.~~

~~**1583. It is therefore concluded that the in-combination predicted puffin mortality due to displacement in the O&M phase would not adversely affect the integrity of the Farne Islands SPA.**~~

1748. the increase in baseline mortality for both the citation and SMP population is greater than 1% based on the upper range (70% displacement, 2% mortality). Therefore the impact has been assessed further using PVA, the results of which are in Table 10.24 below.

Table 10-24~~10.24~~: PVA outputs for annual impacts to breeding adult puffin at the Farne Islands SPA resulting from displacement.

PVA Scenario	Annual mortality	Impact on adult survival	Median CGR	Median CPS
Project alone				
50% displacement, 1% mortality	0.7~~0.4~~	<0.00~~0~~1	1.000~~1.000~~	1.000~~1.000~~
70% displacement, 2% mortality	2.0~~1.0~~	<0.0~~0~~01	1.000~~1.000~~	0.999~~1.000~~
In-combination				
50% displacement, 1% mortality (low)	48.2~~47.8~~	0.001~~0.0006~~	0.999~~0.999~~	0.978~~0.978~~
70% displacement, 2% mortality (low)	134.8~~133.8~~	0.002~~0.0015~~	0.998~~0.998~~	0.939~~0.939~~
50% displacement, 1% mortality (high)	48.3~~47.9~~	0.001~~0.0006~~	0.999~~0.999~~	0.978~~0.978~~
70% displacement, 2% mortality (high)	135.3~~134.3~~	0.002~~0.0015~~	0.998~~0.998~~	0.939~~0.939~~

1749. At the highest predicted in-combination impact the CGR shows an average reduction in growth rate of less than 0.2% compared to an unimpacted population. This level of impact is well within the natural fluctuations in the population growth rate and would be undetectable. This conclusion has also been formed based on density independent models, which do not account for any resilient in the population to recover from the loss of individuals, when in reality there will be a non-breeding proportion of the population that could replace the small number of individuals that may be lost through in-combination impacts from offshore windfarms.

1750. In addition to this conclusion, it should also be noted that the assessment is already considered precautionary in nature, because it does not account for the fact that individuals are possibly double counted across multiple projects within similar areas, thus further over-inflating predicted impacts.

1751. It is therefore concluded that the in-combination predicted puffin mortality due to displacement in the O&M phase would not adversely affect the integrity of the Farne Islands SPA.

Table 10-25~~10.25~~10-24~~10.22~~: In-combination displacement consequent mortalities for puffin at the Farne Islands SPA.

~~Bio-season~~Scenario	Annual total ~~A~~abundance of adults apportioned to the Farne Islands SPA (array/WTG area plus 2km buffer)	Estimated increase in mortality (breeding adults per annum)			% increase in baseline mortality (citation count)			% increase in baseline mortality (recent count)		
		50% displacement, 1% mortality	70% displacement, 2% mortality	30-70% displacement, 1-10% mortality	50% displacement, 1% mortality	70% displacement, 2% mortality	30-70% displacement, 1-10% mortality	50% displacement, 1% mortality	70% displacement, 2% mortality	30-70% displacement, 1-10% mortality
Total “realistic-case”~~Non-breeding~~	9,631.9~~9,560.68,397.8~~	4~~7.8~~8.2~~42.0~~	134~~3~~.8	28.9~~7~~ - 6~~69.2~~74.2~~25.2 – 587.8~~	0.667~~20.582~~	1.868~~54~~	0.397 - 9.271~~0.349 – 8.143~~	0.585~~10.631~~	1.639~~27~~	0.3~~49~~51 - 8.197~~360.379 – 8.832~~
Total “worst-case”~~Annual total~~	9,661.2~~9,589.99,108.1~~	~~47.9~~48.3~~45.5~~	13~~4~~5.3	~~28.8~~29.0 - 67~~1.3~~6.3~~27.3 – 637.6~~	0.669~~40.631~~	1.874~~60~~	0.399 - 9.299~~0.379 – 8.832~~	0.587~~30.554~~	1.644~~32~~	0.352~~0~~ - 8.~~161~~222~~0.332 – 7.751~~

Table 10-26~~10.26~~10-25~~10.23~~: In-combination displacement matrix for puffin attributed to the Farne Islands SPA across all bio-seasons, with light blue shading representing the displacement and mortality range advocated for by ~~SNCB~~ANCBs, and dark blue representing the Applicant's approach.

Annual	Mortality Rate (%)												
Displaced (%)	1	2	5	10	20	30	40	50	60	70	80	90	100
10	10 ~~10~~ ~~9~~	19 ~~19~~ ~~18~~	48 ~~48~~ ~~46~~	96 ~~96~~ ~~91~~	193 ~~191~~ ~~182~~	289 ~~287~~ ~~273~~	385 ~~382~~ ~~364~~	482 ~~478~~ ~~455~~	578 ~~574~~ ~~546~~	674 ~~669~~ ~~638~~	771 ~~765~~ ~~729~~	867 ~~860~~ ~~820~~	963 ~~956~~ ~~911~~
20	19 ~~19~~ ~~18~~	39 ~~38~~ ~~36~~	96 ~~96~~ ~~91~~	193 ~~191~~ ~~182~~	385 ~~382~~ ~~364~~	578 ~~574~~ ~~546~~	771 ~~765~~ ~~729~~	963 ~~956~~ ~~911~~	1,156 ~~1,147~~ ~~1,093~~	1,348 ~~1,338~~ ~~1,275~~	1,541 ~~1,530~~ ~~1,457~~	1,734 ~~1,721~~ ~~1,639~~	1,926 ~~1,912~~ ~~1,822~~
30	29 ~~29~~ ~~27~~	58 ~~57~~ ~~55~~	144 ~~143~~ ~~137~~	289 ~~287~~ ~~273~~	578 ~~574~~ ~~546~~	867 ~~860~~ ~~820~~	1,156 ~~1,147~~ ~~1,093~~	1,445 ~~1,434~~ ~~1,366~~	1,734 ~~1,721~~ ~~1,639~~	2,023 ~~2,008~~ ~~1,913~~	2,312 ~~2,295~~ ~~2,186~~	2,601 ~~2,581~~ ~~2,459~~	2,890 ~~2,868~~ ~~2,732~~
40	39 ~~38~~ ~~36~~	77 ~~76~~ ~~73~~	193 ~~191~~ ~~182~~	385 ~~382~~ ~~364~~	771 ~~765~~ ~~729~~	1,156 ~~1,147~~ ~~1,093~~	1,541 ~~1,530~~ ~~1,457~~	1,926 ~~1,912~~ ~~1,822~~	2,312 ~~2,295~~ ~~2,186~~	2,697 ~~2,677~~ ~~2,550~~	3,082 ~~3,059~~ ~~2,915~~	3,467 ~~3,442~~ ~~3,279~~	3,853 ~~3,824~~ ~~3,643~~
50	48 ~~48~~ ~~46~~	96 ~~96~~ ~~91~~	241 ~~239~~ ~~228~~	482 ~~478~~ ~~455~~	963 ~~956~~ ~~911~~	1,445 ~~1,434~~ ~~1,366~~	1,926 ~~1,912~~ ~~1,822~~	2,408 ~~2,390~~ ~~2,277~~	2,890 ~~2,868~~ ~~2,732~~	3,371 ~~3,346~~ ~~3,188~~	3,853 ~~3,824~~ ~~3,643~~	4,334 ~~4,302~~ ~~4,099~~	4,816 ~~4,780~~ ~~4,554~~
60	58 ~~57~~ ~~55~~	116 ~~115~~ ~~109~~	289 ~~287~~ ~~273~~	578 ~~574~~ ~~546~~	1,156 ~~1,147~~ ~~1,093~~	1,734 ~~1,721~~ ~~1,639~~	2,312 ~~2,295~~ ~~2,186~~	2,890 ~~2,868~~ ~~2,732~~	3,467 ~~3,442~~ ~~3,279~~	4,045 ~~4,015~~ ~~3,825~~	4,623 ~~4,589~~ ~~4,372~~	5,201 ~~5,163~~ ~~4,918~~	5,779 ~~5,736~~ ~~5,465~~
70	67 ~~67~~ ~~64~~	135 ~~134~~ ~~128~~	337 ~~335~~ ~~319~~	674 ~~669~~ ~~638~~	1,348 ~~1,338~~ ~~1,275~~	2,023 ~~2,008~~ ~~1,913~~	2,697 ~~2,677~~ ~~2,550~~	3,371 ~~3,346~~ ~~3,188~~	4,045 ~~4,015~~ ~~3,825~~	4,720 ~~4,685~~ ~~4,463~~	5,394 ~~5,354~~ ~~5,101~~	6,068 ~~6,023~~ ~~5,738~~	6,742 ~~6,692~~ ~~6,376~~

Annual	Mortality Rate (%)												
80	77 ~~76~~ ~~73~~	154 ~~153~~ ~~146~~	385 ~~382~~ ~~364~~	771 ~~765~~ ~~729~~	1,541 ~~1,530~~ ~~1,457~~	2,312 ~~2,295~~ ~~2,186~~	3,082 ~~3,059~~ ~~2,915~~	3,853 ~~3,824~~ ~~3,643~~	4,623 ~~4,589~~ ~~4,372~~	5,394 ~~5,354~~ ~~5,101~~	6,164 ~~6,119~~ ~~5,829~~	6,935 ~~6,884~~ ~~6,558~~	7,706 ~~7,648~~ ~~7,286~~
90	87 ~~86~~ ~~112~~	173 ~~172~~ ~~224~~	433 ~~430~~ ~~410~~	867 ~~860~~ ~~820~~	1,734 ~~1,721~~ ~~1,639~~	2,601 ~~2,581~~ ~~2,459~~	3,467 ~~3,442~~ ~~3,279~~	4,334 ~~4,302~~ ~~4,099~~	5,201 ~~5,163~~ ~~4,918~~	6,068 ~~6,023~~ ~~5,738~~	6,935 ~~6,884~~ ~~6,558~~	7,802 ~~7,744~~ ~~7,378~~	8,669 ~~8,605~~ ~~8,197~~
100	96 ~~96~~ ~~124~~	193 ~~191~~ ~~249~~	482 ~~478~~ ~~455~~	963 ~~956~~ ~~911~~	1,926 ~~1,912~~ ~~1,822~~	2,890 ~~2,868~~ ~~2,732~~	3,853 ~~3,824~~ ~~3,643~~	4,816 ~~4,780~~ ~~4,554~~	5,779 ~~5,736~~ ~~5,465~~	6,742 ~~6,692~~ ~~6,376~~	7,706 ~~7,648~~ ~~7,286~~	8,669 ~~8,605~~ ~~8,197~~	9,632 ~~9,561~~ ~~9,108~~

Table 10-27~~10.27~~~~10-26~~: In-combination displacement matrix for puffin attributed to the Farne Islands SPA across all bio-seasons, with light blue shading representing the displacement and mortality range advocated for by ~~SNCB~~ANCBs, and dark blue representing Natural England's preferred approach.

Annual	Mortality Rate (%)												
Displaced (%)	1	2	5	10	20	30	40	50	60	70	80	90	100
10	10 ~~10~~	19 ~~19~~	48 ~~48~~	97 ~~96~~	193 ~~192~~	290 ~~288~~	386 ~~384~~	483 ~~479~~	580 ~~575~~	676 ~~671~~	773 ~~767~~	870 ~~863~~	966 ~~959~~
20	19 ~~19~~	39 ~~38~~	97 ~~96~~	193 ~~192~~	386 ~~384~~	580 ~~575~~	773 ~~767~~	966 ~~959~~	1,159 ~~1,151~~	1,353 ~~1,343~~	1,546 ~~1,534~~	1,739 ~~1,726~~	1,932 ~~1,918~~
30	29 ~~29~~	58 ~~58~~	145 ~~144~~	290 ~~288~~	580 ~~575~~	870 ~~863~~	1,159 ~~1,151~~	1,449 ~~1,438~~	1,739 ~~1,726~~	2,029 ~~2,014~~	2,319 ~~2,302~~	2,609 ~~2,589~~	2,898 ~~2,877~~
40	39 ~~38~~	77 ~~77~~	193 ~~192~~	386 ~~384~~	773 ~~767~~	1,159 ~~1,151~~	1,546 ~~1,534~~	1,932 ~~1,918~~	2,319 ~~2,302~~	2,705 ~~2,685~~	3,092 ~~3,069~~	3,478 ~~3,452~~	3,864 ~~3,836~~
50	48 ~~48~~	97 ~~96~~	242 ~~240~~	483 ~~479~~	966 ~~959~~	1,449 ~~1,438~~	1,932 ~~1,918~~	2,415 ~~2,397~~	2,898 ~~2,877~~	3,381 ~~3,356~~	3,864 ~~3,836~~	4,348 ~~4,315~~	4,831 ~~4,795~~
60	58 ~~58~~	116 ~~115~~	290 ~~288~~	580 ~~575~~	1,159 ~~1,151~~	1,739 ~~1,726~~	2,319 ~~2,302~~	2,898 ~~2,877~~	3,478 ~~3,452~~	4,058 ~~4,028~~	4,637 ~~4,603~~	5,217 ~~5,179~~	5,797 ~~5,754~~
70	68 ~~67~~	135 ~~134~~	338 ~~336~~	676 ~~671~~	1,353 ~~1,343~~	2,029 ~~2,014~~	2,705 ~~2,685~~	3,381 ~~3,356~~	4,058 ~~4,028~~	4,734 ~~4,699~~	5,410 ~~5,370~~	6,087 ~~6,042~~	6,763 ~~6,713~~
80	77 ~~77~~	155 ~~153~~	386 ~~384~~	773 ~~767~~	1,546 ~~1,534~~	2,319 ~~2,302~~	3,092 ~~3,069~~	3,864 ~~3,836~~	4,637 ~~4,603~~	5,410 ~~5,370~~	6,183 ~~6,138~~	6,956 ~~6,905~~	7,729 ~~7,672~~
90	87 ~~86~~	174 ~~173~~	435 ~~432~~	870 ~~863~~	1,739 ~~1,726~~	2,609 ~~2,589~~	3,478 ~~3,452~~	4,348 ~~4,315~~	5,217 ~~5,179~~	6,087 ~~6,042~~	6,956 ~~6,905~~	7,826 ~~7,768~~	8,695 ~~8,631~~
100	97 ~~96~~	193 ~~192~~	483 ~~479~~	966 ~~959~~	1,932 ~~1,918~~	2,898 ~~2,877~~	3,864 ~~3,836~~	4,831 ~~4,795~~	5,797 ~~5,754~~	6,763 ~~6,713~~	7,729 ~~7,672~~	8,695 ~~8,631~~	9,661 ~~9,590~~

Flamborough and Filey Coast SPA – Guillemot

~~1584.~~1752. Guillemot has been screened in for the assessment of the O&M phase to assess the impacts from disturbance and displacement from the Project in-combination with other OWFs in relation to the conservation objectives for this species as a feature of the FFC SPA (presented in Section~~-~~ 9.3~~9.4~~).

~~1585.~~1753. A range of proposed, consented, under-construction, and operational OWFs in UK waters in the North Sea and English Channel were screened in to the in-combination assessment, based on the potential for adverse effects from activities taking place at these sites in combination with the Project. During the breeding season, projects were screened in if they were within the mean-maximum foraging range (73.2km) plus 1SD (80.5) of guillemot from the FFC SPA based on data from Woodward et al. (2019). Since guillemots range further outside of the breeding season, consideration was also given to other project within the wider UK North Sea and English Channel BDMPS area during the non-breeding bio-season. Projects included within the in-combination assessment are presented in Table 10.29~~Table 10.25~~ below.

~~1586.~~1754. During the breeding bio-season, it is considered that potential displacement impacts on guillemot from FFC SPA may be attributed more highly to offshore windfarms within areas of sea within foraging distance from this breeding colony. In order to assess the potential in-combination impacts on guillemot from multiple offshore windfarms, information was compiled on the seasonal abundance of guillemots measured at each offshore windfarm site (plus 2km buffer). The seasonal guillemot abundances were then subjected to a process of attribution to FFC SPA (Appendix 7.1.1).

~~1587.~~1755. Outside of the breeding bio-season, when the population contains a mix of birds from UK breeding colonies and breeding colonies from further away, then a much lower percentage of birds can be attributed to any particular breeding colony SPA population. This apportionment is based on calculating the proportion of the breeding adults within the UK North Sea and English Channel BDMPS population that can be attributed to the FFC SPA as defined by Furness (2015), based on the data within that report. Following this approach to apportionment, the proportion of the BDMPS populations from FFC SPA during non-breeding bio-season of 4.4% was agreed as appropriate by Natural England during the Norfolk Boreas examination (Natural England, 2020) and for this Project through the EPP (Table 4.1).

~~1588.~~1756. The total numbers presented in ~~Table 10.24~~ are derived from in-combination tables presented for the Natural England Offshore Ornithology Position for Sheringham Shoal and Dudgeon Offshore Windfarm Extension Projects Deadline 8 ~~Apportioning and HRA Updates Technical Note~~Submission (~~Royal HaskoningDHV~~Natural England, 2023~~a~~). The following amendments were made to the values presented:

- Inclusion of values from the Green Volt RIAA (Royal HaskoningDHV, 2023b), West of Orkney RIAA (Xodus & MacArthur Green 2023), Berwick Bank RIAA (RPS and Royal HaskoningDHV, 2022), Five Estuaries ~~draft~~ RIAA (GoBe Consultants, 202~~3~~4), North Falls RIAA (SSE Renewables and RWE, 202~~3~~4), Ossian Wind Farm (NIRAS and RPS, 2024), and Dogger Bank South ~~PEIR~~ (MacArthur Green, 202~~3~~4);

- Removal of Beatrice Demonstrator as the Project will be decommissioned by the time the Project is predicted to be operation; and
- Inclusion of values from the Project.

~~1589.~~1757. As per evidence presented in Section 9.3, a displacement rate of 50% and a mortality rate of 1% are presented as the Applicant's approach for the assessment of in-combination impacts on guillemot. However, based on SNCB advice (SNCBs, 2022), a displacement range of 30 to ~~30% to~~ 70% and a mortality ~~range of 1% to~~of ~~10~~21-10% is presented in Table 10.31~~Table 10-30Table 10.27~~. Results for annual displacement consequent mortalities are also presented in Table 10.31~~Table 10-30Table 10.27~~. ~~Table 10.24~~ presents the abundance of guillemots as attributed to FFC SPA within all other offshore windfarms and their 2km buffers for consideration in this in-combination assessment. It should be noted that these values are highly likely to be overly precautionary as they are based on seasonal mean peaks ~~added~~ summed into an annual total.

~~Table 10.24: In-combination displacement total for guillemot attributed to the FFC SPA~~

~~Project~~	~~Seasonal population at risk of displacement~~			~~Tier~~
	~~Breeding~~	~~Non-breeding~~	~~Annual Total~~	
~~Beatrice~~	~~0~~	~~121~~	~~121~~	~~1a~~
~~Blyth Demonstration Site~~	~~0~~	~~58~~	~~58~~	~~1a~~
~~Dudgeon~~	~~0~~	~~24~~	~~24~~	~~1a~~
~~East Anglia One~~	~~0~~	~~28~~	~~28~~	~~1a~~
~~EOWDC~~	~~0~~	~~10~~	~~10~~	~~1a~~
~~Galloper~~	~~0~~	~~26~~	~~26~~	~~1a~~
~~Greater Gabbard~~	~~0~~	~~24~~	~~24~~	~~1a~~
~~Gunfleet Sands~~	~~0~~	~~16~~	~~16~~	~~1a~~
~~Hornsea Project One~~	~~4,554~~	~~356~~	~~4,910~~	~~1a~~
~~Humber Gateway~~	~~99~~	~~6~~	~~105~~	~~1a~~
~~Hywind~~	~~0~~	~~94~~	~~94~~	~~1a~~
~~Kentish Flats~~	~~0~~	~~0~~	~~0~~	~~1a~~
~~Kentish Flats Extension~~	~~0~~	~~0~~	~~0~~	~~1a~~
~~Kincardine~~	~~0~~	~~0~~	~~0~~	~~1a~~
~~Lincs, Lynn & Inner Dowsing~~	~~0~~	~~36~~	~~36~~	~~1a~~
~~London Array~~	~~0~~	~~17~~	~~17~~	~~1a~~
~~Methil~~	~~0~~	~~0~~	~~0~~	~~1a~~
~~Race Bank~~	~~0~~	~~31~~	~~31~~	~~1a~~
~~Rampion~~	~~0~~	~~684~~	~~684~~	~~1a~~
~~Scroby Sands~~	~~-~~	~~-~~	~~0~~	~~1a~~
~~Sheringham Shoal~~	~~0~~	~~32~~	~~32~~	~~1a~~
~~Teesside~~	~~267~~	~~40~~	~~307~~	~~1a~~
~~Thanet~~	~~0~~	~~6~~	~~6~~	~~1a~~
~~Westermost Rough~~	~~347~~	~~21~~	~~368~~	~~1a~~
~~Hornsea Project Two~~	~~3,581~~	~~579~~	~~4,161~~	~~1a~~

~~Project~~	~~Seasonal population at risk of displacement~~			~~Tier~~
	~~Breeding~~	~~Non-breeding~~	~~Annual Total~~	
~~Moray East~~	~~0~~	~~24~~	~~24~~	~~1b~~
~~Neart na Gaoithe~~	~~0~~	~~166~~	~~166~~	~~1b~~
~~Triton Knoll~~	~~425~~	~~33~~	~~458~~	~~1b~~
~~Firth of Forth Alpha~~	~~0~~	~~206~~	~~206~~	~~1b~~
~~Firth of Forth Bravo~~	~~0~~	~~181~~	~~181~~	~~1b~~
~~East Anglia Three~~	~~0~~	~~126~~	~~126~~	~~1b~~
~~Dogger Bank A~~	~~1,893~~	~~270~~	~~2,163~~	~~1c~~
~~Dogger Bank B~~	~~3,318~~	~~467~~	~~3,785~~	~~1c~~
~~Dogger Bank C~~	~~1,149~~	~~100~~	~~1,249~~	~~1c~~
~~Hornsea Three~~	~~0~~	~~782~~	~~782~~	~~1c~~
~~Inch Cape~~	~~0~~	~~140~~	~~140~~	~~1c~~
~~Moray West~~	~~0~~	~~1,680~~	~~1,680~~	~~1c~~
~~Sofia~~	~~1,824~~	~~163~~	~~1,987~~	~~1c~~
~~Norfolk Boreas~~	~~0~~	~~606~~	~~606~~	~~1c~~
~~Norfolk Vanguard~~	~~0~~	~~210~~	~~210~~	~~1c~~
~~East Anglia ONE North~~	~~0~~	~~83~~	~~83~~	~~1c~~
~~East Anglia TWO~~	~~0~~	~~74~~	~~74~~	~~1c~~
~~DEP and SEP~~	~~0~~	~~703~~	~~703~~	~~1d~~
~~Hornsea Four~~	~~9,382~~	~~22,927~~	~~32,309~~	~~1c~~
~~Greenvolt~~	~~-~~	~~711~~	~~711~~	~~1d~~
~~Pentland~~	~~-~~	~~-~~	~~0~~	~~1d~~
~~West of Orkney~~	~~-~~	~~189~~	~~189~~	~~1d~~
~~Berwick Bank~~	~~-~~	~~711~~	~~711~~	~~2~~
~~Rampion 2~~		~~573~~	~~573~~	~~2~~
~~North Falls~~	~~-~~	~~198~~	~~198~~	~~2~~
~~Dogger Bank South (East and West)~~	~~18,004~~	~~1,118~~	~~19,122~~	~~2~~
~~Five Estuaries~~	~~-~~	~~152~~	~~152~~	~~2~~

~~Project~~	~~Seasonal population at risk of displacement~~			~~Tier~~
	~~Breeding~~	~~Non-breeding~~	~~Annual Total~~	
~~Total (without ODOW)~~	~~44,843~~	~~34,798~~	~~79,643~~	
~~Outer Dowsing~~	**~~4,687~~**	**~~495~~**	**~~5,181~~**	
~~All projects total~~	~~49,530~~	~~35,293~~	~~84,824~~	

Table 10-28~~10.2810-27~~: In-combination displacement total for guillemot attributed to the FFC SPA.

Project	Annual Total	Tier	Source
Total consented projects (standard apportioning)	37,333	1a - 1c	Natural England SEP&DEP Position Paper
Total consented projects (bespoke apportioning)	58,667	1a - 1c	Natural England SEP&DEP Position Paper
Green Volt	720	1c	Green Volt RIAA
Berwick Bank	711	1d	Berwick Bank RIAA
West of Orkney	-	1d	West of Orkney RIAA
North Falls	236	1d	North Falls RIAA
Dogger Bank South (54.3%)	9,126	1d	Dogger Bank South RIAA
Dogger Bank South (100%)	15,814	1d	Dogger Bank South RIAA
Ossian	2,133	1d	Ossian RIAA
Five Estuaries	163	1d	Five Estuaries RIAA
Salamander	-	1d	Salamander RIAA
Outer Dowsing (Applicant's Approach)	3,639	1d	
Outer Dowsing (NE Approach)	17,763	1d	
Total projects (realistic-case)	**54,061**		
Total projects (worst-case)	**96,206**		

~~*Breeding Bio-season*~~

~~The in-combination number of breeding adults attributed to FFC SPA at risk of displacement from OWFs, including the Project, during the breeding bio-season is 49,530. The predicted consequent mortality, based on 50% displacement and 1% mortality, is 248 (247.7) breeding adults.~~

~~Based on a citation population of 83,214 breeding adult guillemots at FFC SPA and an annual background mortality of 5,076 breeding adults per annum, the addition of 248 displacement consequent mortalities would represent a 4.879% increase in baseline mortality, of which the Project contributes 23 (23.4) individuals, representing a 0.426% increase in baseline mortality.~~

~~As the population of guillemot has increased since the citation population count the potential impact on the population is more reasonably assessed against the latest population count undertaken in 2022, which was 149,980 breeding adults, with an annual baseline mortality of 9,149 breeding adults per annum. The addition of 248 mortalities would represent a 2.711% increase in baseline mortality, the Project contributes 23 (23.4) individuals representing a 0.251% increase in baseline mortality.~~

~~*Non-breeding Bio-season*~~

~~The in-combination number of individuals at risk of displacement from OWFs, including the Project, that have been apportioned to FFC SPA is 35,293 (35,293.1) individuals in the non-breeding bio-season. The displacement consequent mortality, based on 50% displacement and 1% mortality is 177 (176.5) individuals.~~

~~Considering the potential impact to the FFC citation population, the addition of 176 individuals would represent a 3.476% increase in baseline mortality, of which the Project contributes three (2.4) mortalities, representing a 0.049% increase in baseline mortality.~~

~~Assessing the potential impact to the more recent FFC SMP population during the non-breeding bio-season, the addition of 176 individuals would represent a 1.923% increase in baseline mortality, of which the Project contributes three (2.5) mortality, representing a 0.027% increase in baseline mortality.~~

Annual Total

~~1590.~~1758. As bio-season specific impacts could not be traced for certain projects, the in-combination assessment for guillemot at FFC SPA is based on annual impacts. The in-combination number of guillemots predicted to be displaced from all OWFs, including the Project, is 54,061~~84,824 (84,823.9)~~ individuals per annum across all bi-seasons. The predicted displacement consequent mortality, based on 50% displacement and 1% mortality, is 270 (270.3) ~~424 (424.1)~~ individuals.

~~1591.~~1759. Considering the potential impact to the FFC citation population, the addition of 270~~424~~ mortalities would represent an 5.352~~8.335~~% increase in baseline mortality, of which the Project contributes 18 (18.2)~~26 (25.9)~~ mortalities, representing a 0.358~~.510~~% increase in baseline mortality.

1760. Assessing the potential impact to the more recent FFC SMP population, the addition of 270~~424~~ mortalities would represent a 2.955~~4.634~~% increase in baseline mortality, of which the Project contributes 18 (18.2)~~26 (25.9)~~ mortalities, representing a 0.199~~283~~% increase in baseline mortality. Due to the percentage increase in baseline mortality exceeding 1%, further consideration to these impacts is given in the form of PVA (Appendix 7.1.2).

1761. Under Natural England's preferred approach, the in-combination number of guillemots predicted to be displaced from all OWFs, including the Project, is 96,206 individuals per annum. The predicted displacement consequent mortality, based on 70% displacement and 2% mortality, is ~~481~~1,347 (1,346.9~~481.0~~)~~-~~ individuals.

1762. Considering the potential impact to the FFC citation population, the addition of 1,347 ~~481~~ mortalities would represent an 26.534% increase in baseline mortality.

1763. Assessing the potential impact to the more recent FFC SMP population, the addition of 1,347 ~~481~~ mortalities would represent a 14.772% increase in baseline mortality. Due to the percentage increase in baseline mortality exceeding 1%, further consideration to these impacts is given in the form of PVA (Appendix 7.1.2).

~~1592.~~

~~1593.~~1764. The in-combination impacts are not expected to impact the integrity of the guillemot population at FFC SPA~~, based on a PVA undertaken by the Dudgeon and Sheringham Shoal Extension project (Royal Haskoning DHV 2022)~~. Between 1986 and 2017, the guillemot population at FFC SPA had an average annual growth rate of 3.8%. This rises to 4.6% when considering the period 2008 – 2017 alone.

~~1594.~~1765. PVA was undertaken on a range of scenarios for both the Project alone and in-combination with other projects (Appendix 7.1.2). For each scenario, CGR and CPS values have been presented from the model outputs, measuring the changes in annual growth rate and population size respectively at the end of the impacted period of 35 years relative to a baseline scenario. The impact on adult survival is also presented, calculated as the number of mortalities divided by the relevant population size used in the PVA analysis (in this case, the ~~2019~~ 2022 ~~Farne Islands~~FFC ~~-~~SPA count). PVA outputs are presented in Table 10.22~~Table 10.22Table 10.20~~.

~~1595.~~1766. At the FFC SPA, the mean annual population growth rate between 1969 and 2022 is approximately 4%, with growth in more recent years (between 2008 and 2017) at 4.6%. Though it is not possible to predict how this growth rate will change over the 35-year lifetime of the Project, the current population growth rate suggests that the colony is expected to continue increasing in size.

1767. The worst-case in-combination scenario of 70% displacement and 2~~10~~% mortality (70:2%, NE approach) would represent a ~~0.7~~1.0~~9~~% annual reduction in population growth rate compared to an unimpacted population. Notably, the worst case scenario is considered highly precautionary, and not representative of actual impacts expected as a result of the Project in-combination with other projects. This was also supported in advice given by Natural England to Norfolk Boreas at Deadline 4 (Natural England 2020).

~~1596.~~ ~~:~~

~~*'However, while there is some empirical evidence to support the displacement levels for auks we do not know what the likely mortality impacts of displacement are. We therefore consider it appropriate to consider a range of mortalities from 1-10%. However, on the basis that the projects that have been scoped into the assessment lie in areas of the North Sea that represent low to medium levels of guillemot density during both the breeding (where relevant) and non-breeding seasons (Seabird Sensitivity Mapping Tool), it is assumed that areas of low/medium density will be less important/desirable feeding areas and therefore mortality impacts of displacement from lower quality areas would be lower than displacement from optimal/important areas. Therefore, we do not anticipate that mortality rates to be at the top of the range considered..'*~~

~~1597. This is also supported by more recent available data which suggests 70% displacement and 10% mortality is a large overestimation of actual impacts (APEM, 2021; MacArthur Green, 2023), and as outlined in Section 9.3.~~

1768. ~~An alternative worst-case scenario based on alignment with the SoS's decision on Hornsea Project Four is therefore the use of 70% displacement and 2% mortality, which would represent a 1.0% reduction in population growth rate when considering the NE approach, and 0.9% when considering the Project approach.~~ This is ~~further~~ reduced to a ~~0.4% and~~ 0.~~3~~2% reduction ~~respectively~~ when considering the Applicant's approach of 50% displacement and 1% mortality which is considered more ecologically relevant (as outlined in Section 9.3). Based on this, an annual reduction of approximately 0.~~3~~2% resulting from this scenario would be indistinguishable from natural fluctuations in the population. Natural England have previously stated that a maximum reduction in the growth rate of 0.4% would not cause an AEoI of the guillemot feature of the FFC SPA (Natural England, 2021b). This threshold is only triggered by impacts predicted at 70:2~~10~~%, for the project alone using the Natural England approach to apportioning (a displacement and mortality rate considered unlikely by Natural England), and 70:2% when considering realistic worst-case in-combination impacts.

1769. In spite of some ~~the~~ PVA scenarios results~~s~~ing in ~~showing~~ a reduction in colony growth exceeding 0.5%, It is not anticipated that this level of reduction is realistic. This reduction is based upon a displacement rate of 70% and a mortality rate of 2%, both of which are considered to be highly precautionary (REP2-0~~95~~58 – 19.10 Rates of displacement in guillemot and razorbill). In addition, the assessments are based upon means of peak populations per bio-season, which is a precautionary approach (REP2-057 - 19.8 Levels of precaution in the assessment and compensation calculations for offshore ornithology). For guillemot this is particularly precautionary for the Project's contribution as the breeding bio-season populations are derived from April peaks, before breeding commences, when colony attendance is low and birds are not under the same constraints as they are when incubating or feeding young (REP2-058 – 19.9 Consideration of bio-season in the assessment of guillemot) REP3-049 – 20.17 Guillemot and razorbill compensation quanta)~~)~~. Apportioning of impacts to the ~~Farne Islands~~FFC SPA is also based upon an extremely unlikely adult proportion of 100% (compared to the adult proportion of 57% recommended in Furness 2015), does not apply a sabbatical rate (i.e. assumes that all birds will be breeding, when in reality a small percentage of adults do not breed each year) (REP2-057). As such, the impacts ~~drived~~derived from the 70% displacement and 2% mortality (and therefore the PVA carried out that uses these results) is considered to be highly precautionary. The Applicant considers the impacts derived from the 50% displacement and 1% mortality to be precautionary but present a more realistic assessment of impacts.

~~1598.~~

Table 10-29~~10.2910-2810.25~~: PVA outputs for breeding adult guillemot at the FFC SPA resulting from displacement impacts.

PVA Scenario	Annual mortality	Impact on adult survival	Median CGR	Median CPS
Project alone				
Project approach				
~~30% displacement, 1% mortality~~	~~15.5~~	~~<0.001~~	~~1.000~~	~~0.996~~
50% displacement, 1% mortality	18.2~~25.9~~	<0.001	1.000~~1.000~~	0.994~~0.993~~
70% displacement, 2% mortality	50.9~~72.5~~	<0.001	1.000~~0.999~~	0.984~~0.981~~
~~70% displacement, 10% mortality~~	~~362.7~~	~~0.002~~	~~0.997~~	~~0.907~~
NE approach				
~~30% displacement, 1% mortality~~	~~50.8~~	~~<0.001~~	~~1.000~~	~~0.986~~
50% displacement, 1% mortality	88.8~~84.7~~	<0.001~~0.001~~	1.000~~0.999~~	0.990~~0.977~~
70% displacement, 2% mortality	248.7~~237.2~~	0.001~~2~~	0.999~~0.998~~	0.972~~0.938~~

PVA Scenario	Annual mortality	Impact on adult survival	Median CGR	Median CPS
~~70% displacement, 10% mortality~~	~~1,185.8~~	~~0.008~~	~~0.991~~	~~0.726~~
In-combination				
~~Project approach~~				
~~30% displacement, 1% mortality~~	~~254.5~~	~~0.002~~	~~0.998~~	~~0.934~~
50% displacement, 1% mortality (low)~~50% displacement, 1% mortality~~	270.3~~270.3424.1~~	0.0020~~0.0020.003~~	0.998~~0.9980.997~~	0.916~~0.9300.892~~
70% displacement, 2% mortality (low)~~70% displacement, 2% mortality~~	756.9~~756.91187.5~~	0.0065~~0.0070.008~~	0.993~~0.9940.991~~	0.783~~0.8150.726~~
50% displacement, 1% mortality (high)	481.0~~481.0~~	0.0023~~0.002~~	0.997~~0.996~~	0.911~~0.878~~
70% displacement, 2% mortality (high)	1346.9~~1,346.9~~	0.0069~~0.007~~	0.993~~0.990~~	0.771~~0.695~~
~~70% displacement, 10% mortality~~	~~5937.7~~	~~0.040~~	~~0.956~~	~~0.195~~
~~NE approach~~				
~~30% displacement, 1% mortality~~	~~289.7~~	~~0.002~~	~~0.998~~	~~0.925~~
~~50% displacement, 1% mortality~~	~~482.9~~	~~0.003~~	~~0.996~~	~~0.878~~
~~70% displacement, 2% mortality~~	~~1,352.2~~	~~0.009~~	~~0.990~~	~~0.694~~
~~70% displacement, 10% mortality~~	~~6,760.8~~	~~0.045~~	~~0.950~~	~~0.155~~

~~1599.~~1770. With the FFC SPA colony growing at a rate of approximately 4%, the FFC SPA population is still expected to show positive growth under all scenarios presented. At 50% displacement and 1% mortality, the CGR is 0.998~~76~~ representing a 0.20~~34~~% reduction in the colony growth rate with the predicted in-combination impacts acting on the colony in comparison to an unimpacted scenario.

~~1600.~~ At the less likely but more precautionary 70% displacement and 2% mortality, the predicted reduction in growth rate compared to an unimpacted scenario is 0.~~7~~57~~1~~%. With the FFC SPA colony thriving (for example, annual growth of 4.6% between 2008 and 2017), the predicted reduction in growth rate is not anticipated to prevent the conservation objectives of maintaining the colony above 149,980 ~~41,607 pairs~~breeding adults and avoiding deterioration below the level of the latest mean peak count or equivalent. A reduction in growth rate from, for example, 4.6% per year to 3.6% per year would slow growth but not reverse it and cause the colony to go into decline.

1771.

~~1601. The scale of impact related growth rate reduction at a 70:10 displacement and mortality rate (1%) suggests that existing growth rates at the colony would need to decline substantially before displacement impacts start to create a negative trend in colony numbers.~~

~~1602.~~ Density dependence regulates population size by adjusting demographic rates to maintain a population around a carrying capacity. If impacts from OWFs decrease survival rates, the resulting decrease in competition for resources might lead to increased survival and/or productivity in the remaining population, consequently boosting population growth. The importance of density dependence is evident in natural ecosystems, where without it, populations would exhibit exponential growth. However, the mechanisms as to how this operates in seabird colonies are largely uncertain. Misinterpretation of density dependence in population assessments can result in unreliable predictions. As such, PVA models used in this assessment were density independent, despite ecological evidence suggesting the presence of density dependence in large populations (Horswill et al., 2017). While density-independent models lack the capacity for population recovery once it falls below a certain threshold, they are preferred for impact assessments due to their precautionary nature (Ridge et al. 2019). Please see Appendix 7.1.2 for further justification.

~~1603.~~1772.

~~1604.~~1773. Although the in-combination impacts resulting from displacement exceed a 1% increase in baseline mortality, based on the evidence provided above, it is considered that the level of additional impact would be indistinguishable from natural fluctuations in the population and the SPA population would maintain its current size over the long term.

~~1605.~~ **It is therefore concluded that the in-combination predicted guillemot mortality due to displacement in the O&M phase would not adversely affect the integrity of the FFC SPA.**

~~1606.~~1774.

~~1607.~~1775. In case the SoS draws a conclusion of AEoI, the Project has developed a without prejudice Guillemot Compensation Plan (GCP) (document reference 7.7.2; APP-252). Alongside this, a number of options for compensation measures have been developed and are presented alongside the GCP.

~~Table 10.26: In-combination displacement consequent mortalities for guillemot at the FFC SPA.~~

~~Bio-season~~	~~Abundance of adults apportioned to the FFC SPA (array area plus 2km buffer)~~	~~Estimated increase in mortality (breeding adults per annum)~~		~~% increase in baseline mortality (citation count)~~		~~% increase in baseline mortality (recent count)~~	
		~~50% displacement, 1% mortality~~	~~30-70% displacement, 1-10% mortality~~	~~50% displacement, 1% mortality~~	~~30-70% displacement, 1-10% mortality~~	~~50% displacement, 1% mortality~~	~~30-70% displacement, 1-10% mortality~~
~~Applicants approach~~							
~~Breeding~~	~~49,530~~	~~247.7~~	~~148.6 – 3467.8~~	~~4.879~~	~~2.927 – 68.306~~	~~2.711~~	~~1.626 – 37.954~~
~~Non-breeding~~	~~35,293~~	~~176.5~~	~~105.9 – 2471.0~~	~~3.476~~	~~2.085 – 48.664~~	~~1.923~~	~~1.153 – 26.922~~
~~Annual Total~~	~~84,824~~	~~424.1~~	~~254.5 – 5937.4~~	~~8.355~~	~~5.013 – 116.97~~	~~4.634~~	~~2.780 – 64.876~~
~~NE Approach~~							
~~Breeding~~	~~61,226~~	~~306.1~~	~~183.6 – 4,285.4~~	~~6.030~~	~~3.618 – 84.420~~	~~4.121~~	~~2.473 – 57.694~~
~~Non-breeding~~	~~35,293~~	~~176.5~~	~~105.9 – 2,471.0~~	~~3.476~~	~~2.085 – 48.664~~	~~2.376~~	~~1.426 – 33.264~~
~~Annual Total~~	~~96,582~~	~~482.9~~	~~257.3 – 6004.6~~	~~9.513~~	~~5.708 – 133.182~~	~~6.502~~	~~3.901 – 91.028~~

Table 10-30~~10.30~~~~10-29~~: In-combination displacement consequent mortalities for guillemot at the FFC SPA.

Scenario	Annual total abundance of adults apportioned to the ~~Farne Islands~~FFC SPA (array/WTG area plus 2km buffer)	Estimated increase in mortality (breeding adults per annum)			% increase in baseline mortality (citation count)			% increase in baseline mortality (recent count)		
		50% displacement, 1% mortality	70% displacement, 2% mortality	30-70% displacement, 1-10% mortality	50% displacement, 1% mortality	70% displacement, -2% mortality	30-70% displacement, 1-10% mortality	50% displacement, 1% mortality	70% displacement, 2% mortality	30-70% displacement, 1-10% mortality
Total "realistic-case"	54,061~~.0~~	270.3	756.9	162.2 – 3,784.3	5.325	14.910	3.195 - 74.551	2.955	8.273	1.773 - 41.364
Total "worst-case"	96,206~~6.5~~	481.0	1,3~~,~~46.9	288.6 – 6,734.5	9.477	26.534	5.686 - 132.671	5.258	14.722	3.155 - 73.610

Table 10-31~~10.31~~10-30~~10.27~~: In-combination displacement matrix for guillemot at the FFC SPA, with light blue shading representing the displacement and mortality range advocated for by ~~SNCB~~ANCBs, and dark blue representing the Applicant's approach.

Annual (2km Buffer)	Mortality Rate (%)												
Displaced (%)	1	2	5	10	20	30	40	50	60	70	80	90	100
10	54 ~~84~~	108 ~~169~~	270 ~~421~~	541 ~~843~~	1,081 ~~1,686~~	1,622 ~~2,529~~	2,162 ~~3,371~~	2,703 ~~4,214~~	3,244 ~~5,057~~	3,784 ~~5,900~~	4,325 ~~6,743~~	4,865 ~~7,586~~	5,406 ~~8,428~~
20	108 ~~169~~	216 ~~337~~	541 ~~843~~	1,081 ~~1,686~~	2,162 ~~3,371~~	3,244 ~~5,057~~	4,325 ~~6,743~~	5,406 ~~8,428~~	6,487 ~~10,114~~	7,569 ~~11,800~~	8,650 ~~13,485~~	9,731 ~~15,171~~	10,812 ~~16,857~~
30	162 ~~253~~	324 ~~506~~	811 ~~1,264~~	1,622 ~~2,529~~	3,244 ~~5,057~~	4,865 ~~7,586~~	6,487 ~~10,114~~	8,109 ~~12,643~~	9,731 ~~15,171~~	11,353 ~~17,700~~	12,975 ~~20,228~~	14,596 ~~22,757~~	16,218 ~~25,285~~
40	216 ~~337~~	432 ~~674~~	1,081 ~~1,686~~	2,162 ~~3,371~~	4,325 ~~6,743~~	6,487 ~~10,114~~	8,650 ~~13,485~~	10,812 ~~16,857~~	12,975 ~~20,228~~	15,137 ~~23,600~~	17,300 ~~26,971~~	19,462 ~~30,342~~	21,624 ~~33,714~~
50	270 ~~421~~	541 ~~843~~	1,352 ~~2,107~~	2,703 ~~4,214~~	5,406 ~~8,428~~	8,109 ~~12,643~~	10,812 ~~16,857~~	13,515 ~~21,071~~	16,218 ~~25,285~~	18,921 ~~29,499~~	21,624 ~~33,714~~	24,327 ~~37,928~~	27,031 ~~42,142~~
60	324 ~~506~~	649 ~~1,011~~	1,622 ~~2,529~~	3,244 ~~5,057~~	6,487 ~~10,114~~	9,731 ~~15,171~~	12,975 ~~20,228~~	16,218 ~~25,285~~	19,462 ~~30,342~~	22,706 ~~35,399~~	25,949 ~~40,456~~	29,193 ~~45,513~~	32,437 ~~50,570~~
70	378 ~~590~~	757 ~~1,180~~	1,892 ~~2,950~~	3,784 ~~5,900~~	7,569 ~~11,800~~	11,353 ~~17,700~~	15,137 ~~23,600~~	18,921 ~~29,499~~	22,706 ~~35,399~~	26,490 ~~41,299~~	30,274 ~~47,199~~	34,058 ~~53,099~~	37,843 ~~58,999~~
80	432 ~~674~~	865 ~~1,349~~	2,162 ~~3,371~~	4,325 ~~6,743~~	8,650 ~~13,485~~	12,975 ~~20,228~~	17,300 ~~26,971~~	21,624 ~~33,714~~	25,949 ~~40,456~~	30,274 ~~47,199~~	34,599 ~~53,942~~	38,924 ~~60,684~~	43,249 ~~67,427~~
90	487 ~~759~~	973 ~~1,517~~	2,433 ~~3,793~~	4,865 ~~7,586~~	9,731 ~~15,171~~	14,596 ~~22,757~~	19,462 ~~30,342~~	24,327 ~~37,928~~	29,193 ~~45,513~~	34,058 ~~53,099~~	38,924 ~~60,684~~	43,789 ~~68,270~~	48,655 ~~75,856~~
100	541 ~~843~~	1,081 ~~1,686~~	2,703 ~~4,214~~	5,406 ~~8,428~~	10,812 ~~16,857~~	16,218 ~~25,285~~	21,624 ~~33,714~~	27,031 ~~42,142~~	32,437 ~~50,570~~	37,843 ~~58,999~~	43,249 ~~67,427~~	48,655 ~~75,856~~	54,061 ~~84,284~~

Table 10-32~~10.32~~~~10-31~~: In-combination displacement matrix for guillemot at the FFC SPA, with light blue shading representing the displacement and mortality range advocated for by ~~SNCB~~ANCBs, and dark blue representing Natural England's preferred approach.

Annual (2km Buffer)	Mortality Rate (%)												
Displaced (%)	1	2	5	10	20	30	40	50	60	70	80	90	100
10	96	192	481	962	1,924	2,886	3,848	4,810	5,772	6,734	7,697	8,659	9,621
20	192	385	962	1,924	3,848	5,772	7,697	9,621	11,545	13,469	15,393	17,317	19,241
30	289	577	1,443	2,886	5,772	8,659	11,545	14,431	17,317	20,203	23,090	25,976	28,862
40	385	770	1,924	3,848	7,697	11,545	15,393	19,241	23,090	26,938	30,786	34,634	38,483
50	481	962	2,405	4,810	9,621	14,431	19,241	24,052	28,862	33,672	38,483	43,293	48,103
60	577	1,154	2,886	5,772	11,545	17,317	23,090	28,862	34,634	40,407	46,179	51,951	57,724
70	673	1,347	3,367	6,734	13,469	20,203	26,938	33,672	40,407	47,141	53,876	60,610	67,345
80	770	1,539	3,848	7,697	15,393	23,090	30,786	38,483	46,179	53,876	61,572	69,269	76,965
90	866	1,732	4,329	8,659	17,317	25,976	34,634	43,293	51,951	60,610	69,269	77,927	86,586
100	962	1,924	4,810	9,621	19,241	28,862	38,483	48,103	57,724	67,345	76,965	86,586	96,206

Flamborough and Filey Coast SPA – Razorbill

~~1608.~~1776. Razorbill has been screened in to the assessment of the O&M phase to assess the impacts from disturbance and displacement from the Project in-combination with other OWFs in relation to the conservation objectives for this species as a feature of the FFC SPA (presented in Section 9.3 and Document 7.2).

~~1609.~~1777. A range of proposed, consented, under-construction, and operational OWFs in UK waters in the North Sea and English Channel were screened in to the in-combination assessment, based on the potential for adverse effects from activities taking place at these sites in combination with the Project. During the breeding season, projects were screened in if they were within the mean-maximum foraging range (88.7km) plus 1SD (75.9km) of razorbill from the FFC SPA based on data from Woodward et al. (2019). Since razorbills range further outside of the breeding season, consideration was also given to other projects within the wider UK North Sea and English Channel BDMPS area during the non-breeding bio-season. Projects included within the in-combination assessment are presented in Table 10.33 below.

~~1610.~~1778. During the breeding bio-season, it is considered that potential displacement impacts on razorbills from FFC SPA may be attributed more highly to offshore windfarms within areas of sea within foraging distance from this breeding colony. In order to assess the potential in-combination impacts on razorbill from multiple offshore windfarms, information was compiled on the seasonal abundance of razorbills measured at each offshore windfarm site (plus 2km buffer). The seasonal razorbill abundances were then subjected to a process of attribution to FFC SPA (Appendix 7.1.1).

~~1611.~~1779. Outside of the breeding bio-season, when the population contains a mix of birds from UK breeding colonies and breeding colonies from further away, then a much lower percentage of birds can be attributed to any particular breeding colony SPA population. This apportionment is based on calculating the proportion of the breeding adults within the UK North Sea and English Channel BDMPS population that can be attributed to the FFC SPA as defined by Furness (2015), based on the data within that report. Following this approach to apportionment the proportion of the BDMPS populations from FFC SPA during the migration bio-seasons of 3.4%, and during the winter bio-season of 0.9% was agreed as appropriate by Natural England during the Norfolk Boreas examination (Natural England 2020) and for this project through the EPP (Table 4.2). However Natural England have advised use of a bespoke apportioning of 70.8% in the post-breeding bio-season.

~~1612.~~1780. The total numbers presented in Table 10.33are derived from in-combination tables presented for the Natural England Offshore Ornithology Position for Sheringham Shoal and Dudgeon Offshore Windfarm Extension Projects Deadline 8 Submission ~~Sheringham Shoal and Dudgeon Offshore Windfarm Extension Projects Deadline 8 Apportioning and HRA Updates Technical Note~~ (~~Royal HaskoningDHV~~Natural England, 2023~~a~~). The following amendments were made to the values presented:

- Inclusion of values from the Green Volt RIAA (Royal HaskoningDHV, 2023b), West of Orkney RIAA (Xodus & MacArthur Green 2023), Berwick Bank RIAA (RPS and Royal HaskoningDHV, 2022), Five Estuaries ~~draft~~ RIAA (GoBe Consultants, ~~2023~~2024), North Falls RIAA (SSE Renewables and RWE, ~~2023~~2024), and Dogger Bank South ~~PEIR~~ (MacArthur Green, ~~2023~~2024);
- Removal of Beatrice Demonstrator as the Project will be decommissioned by the time the Project is predicted to be operation; and
- Inclusion of values from the Project.

~~1613.~~1781. As per evidence presented in Section 9.3, a displacement rate of 50% and a mortality rate of 1% are presented as the Applicant's approach for the assessment of in-combination impacts on razorbill. However, based on advice from ~~SNCBs (MIG-Birds, 2022)~~Natural England, a displacement range of 30% to 70% and a mortality range of 1% to 10% are also presented ~~a displacement range rate of 3070% to 70% and a mortality range rate of 1% to 210% is also presented~~ in Table 10.34~~Table 10.29~~. Results for annual displacement consequent mortalities are also presented in a matrix in Table 10.35~~Table 10.35Table 10.30~~.

~~1614.~~1782. Table 10.33 ~~Table 10.28~~ below presents the abundance of razorbills as attributed to FFC SPA within all other offshore windfarms and their 2km buffers for consideration in this in-combination assessment. It should be noted that these values are highly likely to be overly precautionary, as they are based on seasonal mean peaks ~~added~~ summed into an annual total. For more information on levels of precaution please see 19.8 Levels of precaution in the assessment and compensation calculations for offshore ornithology (REP2-057).

~~Table 10.28: in-combination displacement total for razorbill attributed to the FFC SPA.~~

~~Project~~	~~Seasonal population at risk of displacement~~					~~Tier~~
	~~breeding~~	~~Post-breeding migration~~	~~winter~~	~~Return migration~~	~~Annual total~~	
~~Beatrice~~	~~0~~	~~28~~	~~15~~	~~28~~	~~72~~	~~1a~~
~~Blyth Demonstration Site~~	~~0~~	~~3~~	~~2~~	~~3~~	~~8~~	~~1a~~
~~Dudgeon~~	~~0~~	~~12~~	~~20~~	~~12~~	~~44~~	~~1a~~
~~East Anglia One~~	~~0~~	~~1~~	~~4~~	~~11~~	~~17~~	~~1a~~
~~EOWDC~~	~~0~~	~~2~~	~~0~~	~~1~~	~~3~~	~~1a~~
~~Galloper~~	~~0~~	~~2~~	~~3~~	~~13~~	~~18~~	~~1a~~
~~Greater Gabbard~~	~~0~~	~~0~~	~~11~~	~~3~~	~~13~~	~~1a~~
~~Gunfleet Sands~~	~~0~~	~~0~~	~~1~~	~~0~~	~~1~~	~~1a~~
~~Hornsea Project One~~	~~535~~	~~164~~	~~41~~	~~61~~	~~800~~	~~1a~~
~~Humber Gateway~~	~~0~~	~~1~~	~~0~~	~~1~~	~~2~~	~~1a~~
~~Hywind~~	~~0~~	~~24~~	~~0~~	~~-~~	~~25~~	~~1a~~
~~Kentish Flats Extension~~	~~-~~	~~-~~	~~-~~	~~-~~	~~0~~	~~1a~~
~~Kentish Flats I~~	~~-~~	~~-~~	~~-~~	~~-~~	~~0~~	~~1a~~
~~Kincardine~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~1a~~
~~Lincs, Lynn & Inner Dowsing~~	~~0~~	~~1~~	~~1~~	~~1~~	~~3~~	~~1a~~
~~London Array~~	~~0~~	~~1~~	~~0~~	~~1~~	~~2~~	~~1a~~
~~Methil~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~1a~~
~~Race Bank~~	~~0~~	~~1~~	~~1~~	~~1~~	~~4~~	~~1a~~
~~Rampion~~	~~0~~	~~2~~	~~34~~	~~113~~	~~149~~	~~1a~~
~~Scroby Sands~~	~~-~~	~~-~~	~~-~~	~~-~~	~~0~~	~~1a~~
~~Sheringham Shoal~~	~~0~~	~~46~~	~~6~~	~~1~~	~~52~~	~~1a~~
~~Teesside~~	~~0~~	~~2~~	~~0~~	~~1~~	~~3~~	~~1a~~
~~Thanet~~	~~0~~	~~0~~	~~0~~	~~1~~	~~1~~	~~1a~~
~~Westermost Rough~~	~~91~~	~~4~~	~~4~~	~~3~~	~~102~~	~~1a~~
~~Hornsea Project Two~~	~~1,210~~	~~144~~	~~19~~	~~57~~	~~1,430~~	~~1b~~

~~Project~~	~~Seasonal population at risk of displacement~~					~~Tier~~
	~~breeding~~	~~Post-breeding migration~~	~~winter~~	~~Return migration~~	~~Annual total~~	
~~Moray East~~	~~0~~	~~38~~	~~1~~	~~6~~	~~44~~	~~1b~~
~~Neart na Gaoithe~~	~~0~~	~~187~~	~~14~~	~~-~~	~~200~~	~~1b~~
~~Triton Knoll~~	~~0~~	~~9~~	~~23~~	~~4~~	~~36~~	~~1b~~
~~East Anglia Three~~	~~0~~	~~38~~	~~41~~	~~52~~	~~130~~	~~1b~~
~~Firth of Forth Alpha~~	~~0~~	~~-~~	~~30~~	~~-~~	~~30~~	~~1b~~
~~Firth of Forth Bravo~~	~~0~~	~~-~~	~~34~~	~~-~~	~~34~~	~~1b~~
~~Dogger Bank A~~	~~375~~	~~54~~	~~47~~	~~141~~	~~616~~	~~1b~~
~~Dogger Bank B~~	~~461~~	~~71~~	~~58~~	~~174~~	~~765~~	~~1b~~
~~Dogger Bank C~~	~~250~~	~~11~~	~~26~~	~~65~~	~~352~~	~~1c~~
~~Hornsea Three~~	~~0~~	~~69~~	~~99~~	~~72~~	~~240~~	~~1c~~
~~Inch Cape~~	~~0~~	~~98~~	~~18~~	~~-~~	~~115~~	~~1c~~
~~Moray West~~	~~0~~	~~121~~	~~5~~	~~122~~	~~247~~	~~1c~~
~~Sofia~~	~~346~~	~~20~~	~~39~~	~~100~~	~~505~~	~~1c~~
~~East Anglia ONE North~~	~~0~~	~~3~~	~~2~~	~~7~~	~~11~~	~~1c~~
~~East Anglia TWO~~	~~0~~	~~2~~	~~4~~	~~8~~	~~13~~	~~1c~~
~~Norfolk Boreas~~	~~0~~	~~9~~	~~29~~	~~12~~	~~49~~	~~1c~~
~~Norfolk Vanguard~~	~~0~~	~~30~~	~~23~~	~~31~~	~~84~~	~~1c~~
~~DEP and SEP~~	~~86~~	~~153~~	~~41~~	~~16~~	~~296~~	~~1c~~
~~Rampion 2~~	~~-~~	~~1~~	~~33~~	~~213~~	~~247~~	~~1c~~
~~Hornsea Four~~	~~386~~	~~2,845~~	~~13~~	~~15~~	~~3,259~~	~~1c~~
~~Greenvolt~~		~~2~~	~~2~~	~~2~~	~~6~~	~~1d~~
~~Pentland~~	~~-~~	~~-~~	~~-~~	~~-~~	~~0~~	~~1d~~
~~West of Orkney~~	~~-~~	~~5~~	~~5~~	~~5~~	~~15~~	~~2~~
~~Berwick Bank~~	~~-~~	~~299~~	~~38~~	~~253~~	~~590~~	~~2~~
~~North Falls~~	~~-~~	~~9~~	~~69~~	~~63~~	~~141~~	~~2~~
~~Dogger bank south~~	~~3,029~~	~~42~~	~~37~~	~~292~~	~~3,400~~	~~2~~

~~Project~~	~~Seasonal population at risk of displacement~~					~~Tier~~
	~~breeding~~	~~Post-breeding migration~~	~~winter~~	~~Return migration~~	~~Annual total~~	
~~Five Estuaries (PEIR)~~	~~-~~	~~10~~	~~10~~	~~26~~	~~45~~	
~~Total (without ODOW)~~	~~6,768~~	~~4,559~~	~~898~~	~~1,990~~	~~14,216~~	
~~Outer Dowsing~~	~~**2,050**~~	~~**81**~~	~~**18**~~	~~**210**~~	~~**2,358**~~	~~2~~
~~All projects total~~	~~**8,818**~~	~~**4,640**~~	~~**916**~~	~~**2,200**~~	~~**16,575**~~	

Table 10-33~~10.33~~~~10-32~~: in-combination displacement total for razorbill attributed to the FFC SPA.

Project	Annual Total	Tier	Source
Consented projects (standard apportioning)	7,143	1a – 1c	Natural England SEP&DEP Position Paper
Consented projects bespoke apportioning)	10,000	1a – 1c	Natural England SEP&DEP Position Paper
Greenvolt	-	1c	Green Volt RIAA
Berwick Bank	590	1d	Berwick Bank RIAA
WoO	-	1d	West of Orkney RIAA
North Falls	116	1d	North Falls RIAA
Dogger Bank South (61.3%)	2,221	1d	Dogger Bank South RIAA
Dogger Bank South (100%)	3,315	1d	Dogger Bank South RIAA
Ossian	-	1d	Ossian RIAA
Five Estuaries	70	1d	Five Estuaries RIAA
Salamander	-	1d	Salamander RIAA
Outer Dowsing (Applicant's Approach)	2,097	1d	
Outer Dowsing (NE Approach)	4,924	1d	
Total projects (realistic-case)	12,236		
Total projects (worst-case)	19,014		

~~*Breeding Bio-season*~~

~~1615. The in-combination number of breeding adults attributed to FFC SPA at risk of displacement from OWFs, including the Project, during the breeding bio-season is 8,818 (8,818.0). The predicted consequent mortality, based on 50% displacement and 1% mortality, is 44 (44.1) breeding adults.~~

~~1616. Based on a citation population of 21,140 breeding adult razorbills at FFC SPA and an annual background mortality of 2,220 breeding adults per annum, the addition of 44 displacement consequent mortalities would represent a 1.986% increase in baseline mortality, of which the Project contributes 10 (10.2) individuals, representing a 0.462% increase in baseline mortality.~~

~~1617. As the population of razorbills has increased since the citation population count, the potential impact on the population is more reasonably assessed against the latest population count undertaken in 2022, which was 61,346 breeding adults, with an annual baseline mortality of 6441 (6441.3) breeding adults per annum. The addition of 44 mortalities would represent a 0.684% increase in baseline mortality, of which the Project contributes 10 (10.2) individuals representing a 0.159% increase in baseline mortality.~~

~~*Non-breeding Bio-season*~~

~~1618. The in-combination number of individuals at risk of displacement from OWFs, including the Project, that have been apportioned to FFC SPA is 4,640 individuals in the post-breeding migration bio-season, 916 in the winter bio-season and 2,200 individuals in the return migration bio-season.~~

~~1619. The predicted displacement consequent mortality, based on 50% displacement and 1% mortality, is 23 (23.2) individuals in the post-breeding migration bio-season, 11 (11.0) individuals in the winter bio-season, and five (4.6) individuals in the return migration bio-season.~~

~~1620. Considering the potential impact to the FFC citation population during the post-breeding migration bio-season, the addition of 23 individuals would represent a 1.045% increase in baseline mortality, of which the Project contributes less than one (0.4) mortality, representing a 0.018% increase in baseline mortality. During the winter bio-season, the addition of 11 individuals would represent a 0.495% increase in baseline mortality, of which the Project contributes less than one (0.1) mortality, representing a 0.005% increase in baseline mortality. During the return migration bio-season, the addition of five mortalities would represent a 0.206% increase in baseline mortality, of which the Project contributes less than one (0.9) mortality, representing a 0.040% increase in baseline mortality.~~

~~1621. Assessing the potential impact to the more recent FFC SMP population during the post-breeding migration bio-season, the addition of 23 individuals would represent a 0.360% increase in baseline mortality, of which the Project contributes less than one (0.4) mortality, representing a 0.006% increase in baseline mortality. During the winter bio-season, the addition of 11 individuals would represent a 0.171% increase in baseline mortality, of which the Project contributes less than one (0.1) mortality, representing a 0.001% increase in baseline mortality. During the return migration bio-season, the addition of eight mortalities would represent a 0.071% increase in baseline mortality, of which the Project contributes less than one (0.9) mortality, representing a 0.016% increase in baseline mortality.~~

Annual Total

~~1622.~~1783. As bio-season specific impacts could not be traced for certain projects, the in-combination assessment for razorbill at FFC SPA is based on annual impacts. The in-combination number of razorbills predicted to be displaced from all OWFs, including the Project, is 12,236~~16,575 (16,574.8)~~ individuals per annum. The predicted displacement consequent mortality, based on 50% displacement and 1% mortality, is 61 (61.2)~~83 (82.9)~~ individuals.

~~1623.~~1784. Considering the potential impact to the FFC citation population, the addition of 61~~83~~ mortalities would represent a 2.756~~3.733~~% increase in baseline mortality, of which the Project contributes 10~~2~~ (10.5~~11.8~~) mortalities, representing a 0.472~~531~~% increase in baseline mortality. Assessing the potential impact to the more recent FFC SMP population, the addition of 61 mortalities would represent a 0.950% increase in baseline mortality, of which the Project contributes 10 (10.5) mortalities, representing a 0.163% increase in baseline mortality.

1785. When following the Natural England approach and the higher project approaches, 19,014 individuals are at risk of displacement across all projects. At a displacement rate of 70% and a mortality rate of 2% this would lead to a potential impact of 266.2 breeding adults. This level of impact results in an increase in baseline mortality of 11.992% relative to the citation population and 4.133% relative to the more appropriate recent population count.

~~1624.~~1786. ~~Assessing the potential impact to the more recent FFC SMP population, the addition of 6183 mortalities would represent a 0.9501.287% increase in baseline mortality, of which the Project contributes 102 (10.51.8) mortalities, representing a 0.16383% increase in baseline mortality.~~ Due to the percentage increase in baseline mortality for the Natural England approach exceeding 1%, further consideration of this impact is given below in the form of PVA analysis.

~~Table 10.29: In-combination displacement consequent mortalities for Razorbill at the FFC SPA.~~

~~Bio-season~~	~~Abundance of adults apportioned to the FFC SPA (array area plus 2km buffer)~~	~~Estimated increase in mortality (breeding adults per annum)~~		~~% increase in baseline mortality (citation count)~~		~~% increase in baseline mortality (recent count)~~	
		~~50% displacement, 1% mortality~~	~~30-70% displacement, 1-10% mortality~~	~~50% displacement, 1% mortality~~	~~30-70% displacement, 1-10% mortality~~	~~50% displacement, 1% mortality~~	~~30-70% displacement, 1-10% mortality~~
~~Breeding~~	~~8,817.9~~	~~44.1~~	~~26.5 – 617.4~~	~~1.986~~	~~1.192 – 27.804~~	~~0.684~~	~~0.411 - 9.583~~
~~Post-breeding migration~~	~~4,640.1~~	~~23.2~~	~~13.9 – 324.8~~	~~1.045~~	~~0.624 – 14.560~~	~~0.360~~	~~0.216 - 5.043~~
~~Return migration~~	~~2199.7~~	~~11.0~~	~~6.6 – 154.0~~	~~0.495~~	~~0.297 – 6.930~~	~~0.171~~	~~0.102 - 2.391~~
~~Winter~~	~~916.3~~	~~4.6~~	~~2.76 – 64.4~~	~~0.206~~	~~0.124 – 2.884~~	~~0.071~~	~~0.043 - 0.996~~
~~Annual Total~~	**~~16,574.8~~**	**~~82.9~~**	**~~49.7 – 1160.6~~**	**~~3.733~~**	**~~2.240 – 52.276~~**	**~~1.287~~**	**~~0.772 - 18.011~~**

Table ~~10.34~~~~10-33~~10-34: In-combination displacement consequent mortalities for Razorbill at the FFC SPA.

Scenario	Annual total abundance of adults apportioned to the ~~Farne Islands~~FFC SPA (array/WTG area plus 2km buffer)	Estimated increase in mortality (breeding adults per annum)			% increase in baseline mortality (citation count)			% increase in baseline mortality (recent count)		
		50% displacement, 1% mortality	70% displacement, 2% mortality	30-70% displacement, 1-10% mortality	50% displacement, 1% mortality	70% displacement, 2% mortality	30-70% displacement, 1-10% mortality	50% displacement, 1% mortality	70% displacement, 2% mortality	30-70% displacement, 1-10% mortality
Total “realistic-case”	12,236.1	61.2	171.3	36.7 - 856.5	2.756	7.717	1.654 - 38.587	0.950	2.659	0.570 - 13.297
Total “worst-case”	19,014.1	95.1	266.2	57.0 – 1,331.0	4.283	11.992	2.570 - 59.962	1.476	4.133	0.886 - 20.663

Table 10-35~~10.3510-3410.30~~: In-combination displacement matrix for razorbill at the FFC SPA, with light blue shading representing the displacement and mortality range advocated for by ~~SNCB~~ANCBs, and dark blue representing the Applicant's approach.

Annual (2km Buffer)	Mortality Rate (%)												
Displaced (%)	1	2	5	10	20	30	40	50	60	70	80	90	100
10	12 ~~17~~	24 ~~33~~	61 ~~83~~	122 ~~166~~	245 ~~332~~	367 ~~497~~	489 ~~663~~	612 ~~829~~	734 ~~995~~	857 ~~1,160~~	979 ~~1,326~~	1,101 ~~1,492~~	1,224 ~~1,658~~
20	24 ~~33~~	49 ~~66~~	122 ~~166~~	245 ~~332~~	489 ~~663~~	734 ~~995~~	979 ~~1,326~~	1,224 ~~1,658~~	1,468 ~~1,989~~	1,713 ~~2,321~~	1,958 ~~2,652~~	2,202 ~~2,984~~	2,447 ~~3,315~~
30	37 ~~50~~	73 ~~99~~	184 ~~249~~	367 ~~497~~	734 ~~995~~	1,101 ~~1,492~~	1,468 ~~1,989~~	1,835 ~~2,486~~	2,202 ~~2,984~~	2,570 ~~3,481~~	2,937 ~~3,978~~	3,304 ~~4,475~~	3,671 ~~4,973~~
40	49 ~~66~~	98 ~~133~~	245 ~~332~~	489 ~~663~~	979 ~~1,326~~	1,468 ~~1,989~~	1,958 ~~2,652~~	2,447 ~~3,315~~	2,937 ~~3,978~~	3,426 ~~4,641~~	3,916 ~~5,304~~	4,405 ~~5,967~~	4,894 ~~6,630~~
50	61 ~~83~~	122 ~~166~~	306 ~~414~~	612 ~~829~~	1,224 ~~1,658~~	1,835 ~~2,486~~	2,447 ~~3,315~~	3,059 ~~4,144~~	3,671 ~~4,973~~	4,283 ~~5,801~~	4,894 ~~6,630~~	5,506 ~~7,459~~	6,118 ~~8,288~~
60	73 ~~99~~	147 ~~199~~	367 ~~497~~	734 ~~995~~	1,468 ~~1,989~~	2,202 ~~2,984~~	2,937 ~~3,978~~	3,671 ~~4,973~~	4,405 ~~5,967~~	5,139 ~~6,962~~	5,873 ~~7,956~~	6,607 ~~8,951~~	7,342 ~~9,945~~
70	86 ~~116~~	171 ~~232~~	428 ~~580~~	857 ~~1,160~~	1,713 ~~2,321~~	2,570 ~~3,481~~	3,426 ~~4,641~~	4,283 ~~5,801~~	5,139 ~~6,962~~	5,996 ~~8,122~~	6,852 ~~9,282~~	7,709 ~~10,442~~	8,565 ~~11,603~~
80	98 ~~133~~	196 ~~265~~	489 ~~663~~	979 ~~1,326~~	1,958 ~~2,652~~	2,937 ~~3,978~~	3,916 ~~5,304~~	4,894 ~~6,630~~	5,873 ~~7,956~~	6,852 ~~9,282~~	7,831 ~~10,608~~	8,810 ~~11,934~~	9,789 ~~13,260~~
90	110 ~~149~~	220 ~~298~~	551 ~~746~~	1,101 ~~1,492~~	2,202 ~~2,984~~	3,304 ~~4,475~~	4,405 ~~5,967~~	5,506 ~~7,459~~	6,607 ~~8,951~~	7,709 ~~10,442~~	8,810 ~~11,934~~	9,911 ~~13,426~~	11,012 ~~14,918~~
100	122 ~~166~~	245 ~~332~~	612 ~~829~~	1,224 ~~1,658~~	2,447 ~~3,315~~	3,671 ~~4,973~~	4,894 ~~6,630~~	6,118 ~~8,288~~	7,342 ~~9,945~~	8,565 ~~11,603~~	9,789 ~~13,260~~	11,012 ~~14,918~~	12,236 ~~16,575~~

Table 10-36~~10.3610-35~~: In-combination displacement matrix for razorbill at the FFC SPA, with light blue shading representing the displacement and mortality range advocated for by ~~SNCB~~ANCBs, and dark blue representing Natural England's preferred approach.

Annual (2km Buffer)	Mortality Rate (%)												
Displaced (%)	1	2	5	10	20	30	40	50	60	70	80	90	100
10	19	38	95	190	380	570	761	951	1,141	1,331	1,521	1,711	1,901
20	38	76	190	380	761	1,141	1,521	1,901	2,282	2,662	3,042	3,423	3,803
30	57	114	285	570	1,141	1,711	2,282	2,852	3,423	3,993	4,563	5,134	5,704
40	76	152	380	761	1,521	2,282	3,042	3,803	4,563	5,324	6,084	6,845	7,606
50	95	190	475	951	1,901	2,852	3,803	4,754	5,704	6,655	7,606	8,556	9,507
60	114	228	570	1,141	2,282	3,423	4,563	5,704	6,845	7,986	9,127	10,268	11,408
70	133	266	665	1,331	2,662	3,993	5,324	6,655	7,986	9,317	10,648	11,979	13,310
80	152	304	761	1,521	3,042	4,563	6,084	7,606	9,127	10,648	12,169	13,690	15,211
90	171	342	856	1,711	3,423	5,134	6,845	8,556	10,268	11,979	13,690	15,401	17,113
100	190	380	951	1,901	3,803	5,704	7,606	9,507	11,408	13,310	15,211	17,113	19,014

~~1625.~~1787. PVA was undertaken on a range of scenarios of displacement and mortality rates for both the Project alone and in-combination with other projects. For each scenario, CGR and CPS values have been presented from the model outputs, measuring the changes in annual growth rate and population size respectively at the end of the impacted period of 35 years relative to a baseline scenario. The impact on adult survival is also presented, calculated as the number of mortalities divided by the relevant population size used in the PVA analysis (Appendix 7.1.2) (in this case, the 2022 FFC count).

~~1626.~~1788. At the FFC SPA, the mean annual population growth rate between 1969 and 2022 is approximately 6%. Though it is not possible to predict how this growth rate will change over the 35-year lifetime of the Project, the current population growth rate suggests that the colony is expected to continue increasing in size.

~~1627. The worst-case scenario of 70% displacement and 10% mortality (NE approach) would result in an annual reduction in population growth rate of 5.1%. Notably, this scenario is considered highly precautionary, and not representative of actual impacts expected as a result of the Project in-combination with other projects. This was also supported in advice given by Natural England to Norfolk Boreas at Deadline 4 (Natural England 2020):~~

~~*'While there is some empirical evidence to support the displacement levels for auks we do not know what the likely mortality impacts of displacement are. We therefore consider it appropriate to consider a range of mortalities from 1-10%. However, on the basis that the projects that have been scoped into the assessment lie in areas of the North Sea that represent low to medium levels of razorbill density during both the breeding (where relevant) and non-breeding seasons (Seabird Sensitivity Mapping Tool), it is assumed that areas of low/medium density will be less important/desirable feeding areas and therefore mortality impacts of displacement from less good areas would be lower than displacement from optimal/important areas. Therefore, we do not expect mortality rates to be at the top of the range considered.'*~~

~~1628. Since many of the same sites are screened in for both projects, and the individuals present in the Project array are expected to have similar habitat preferences, this advice is also considered relevant for the Project. Therefore, results based on 70% displacement and 10% mortality are not considered ecologically justified, with the Applicant's approach of 50% displacement and 1% mortality forming the main basis of the Project assessment. This is also supported by more recent available data which suggests 70% displacement and 10% mortality is a large overestimation of actual impacts (APEM, 2021; MacArthur Green, 2023), as outlined in Section 9.3.~~

~~1629.~~1789. A~~n alternative~~ worst-case scenario based on alignment with the SoS's decision on Hornsea Project Four is~~ therefore~~ the use of 70% displacement and 2% mortality (Natural England preferred approach). This approach predicts a reduction in growth rate of 0.5~~4~~% between the impacted and baseline scenarios. This is reduced to 0.~~2~~1% reduction in growth rate when considering the Applicant's approach of 50% displacement and 1% mortality. It is therefore predicted that, even with multiple levels of precaution ~~build~~ built into the assessment (19.8 Levels of precaution in the assessment and compensation calculations for offshore ornithology [REP2-057]~~Paragraph 1530~~), both the anticipated Natural England scenario and Applicant's approach would not cause any reversal of the current population trend.

~~1630.~~1790. With the FFC SPA colony thriving (for example, annual growth of 9.7% between 2008 and 2017, with growth over a longer period (1987 to 2017) of 5.8%), the predicted reduction in growth rate is not anticipated to prevent the conservation objectives of maintaining the colony above 10,570 pairs and avoiding deterioration below the level of the latest mean peak count or equivalent. A reduction in growth rate from, for example, 5.8% per year to ~~4.8~~5.3% per year (as is predicted at 70% displacement and 2% mortality) would slow growth slightly but not reverse it and cause the colony to go into decline. Therefore, existing growth rates at the colony would need to decline substantially before displacement impacts start to create a negative trend in colony numbers. Even so, the population would maintain a level far higher than the citation count for the SPA.

~~1631.~~1791. In addition to this conclusion, it should also be noted that the assessment is already considered precautionary in nature~~ as laid out in Paragraph 1530~~. The main assumptions leading to precaution in the assessment of potential displacement impacts on razorbill are, firstly the impacts are applied to the mean peak abundance of individuals within the ~~array~~ WTG area and 2km buffer, which overestimate the abundance of individuals present in the area throughout the whole season, while also not accounting for the fact that individuals are likely to have been double counted across multiple projects within similar areas, thus further over-inflating predicted impacts. Secondly, there is growing evidence that the displacement rates for razorbill are substantially lower than even the Applicant's approach of 50% (REP2-059 - 19.10 Rates of displacement in guillemot and razorbill) (APEM, 2022; Trinder *et al.*, 2024; Lamb *et al* ., 2024). Additionally, the PVA analysis does not incorporate density dependence, which results in over-precautionary modelled outputs, and because the FFC SPA razorbill population is also modelled as a closed population with no emigration or immigration, the model assumes that the population is more constrained than it is in reality.

~~1632.~~1792. It is therefore concluded that the in-combination predicted razorbill mortality due to displacement in the O&M phase would not adversely affect the integrity of the razorbill feature of the FFC SPA.

~~1633.~~1793. In case the SoS draws a conclusion of AEoI, the Project has developed a without prejudice derogation case for razorbill at FFC SPA (document reference 7.7.3 Razorbill Compensation Strategy [APP-255]). Alongside this, a number of options for Project alone and collaborative compensation measures have been developed and are presented within document 7.7.3 Razorbill Compensation Strategy.

Table 10-37~~10.3710-3610.31~~: PVA outputs for breeding adult razorbill at the FFC SPA resulting from displacement impacts.

PVA Scenario	Annual mortality	Impact on survival	Median CGR	Median CPS
~~Project alone~~Applicant's Approach				
~~30% displacement, 1% mortality~~	~~6.1~~	~~<0.001~~	~~1.000~~	~~0.996~~
50% displacement, 1% mortality	10.5~~10.2~~	<0.001	1.000~~1.000~~	0.993~~0.993~~
70% displacement, 2% mortality	29.4~~28.7~~	<0.001	0.999~~0.999~~	0.980~~0.980~~
NE Approach				
50% displacement, 1% mortality	24.6	<0.001	1.000	0.983
70% displacement, 2% mortality	68.9	0.001	0.999	0.953
~~70% displacement, 10% mortality~~	~~143.5~~	~~0.002~~	~~0.997~~	~~0.905~~
In-combination				
50% displacement, 1% mortality (low)~~30% displacement, 1% mortality~~	61.2~~49.7~~	0.001~~0.001~~	0.999~~0.999~~	0.958~~0.966~~
70% displacement, 2% mortality (low)~~50% displacement, 1% mortality~~	171.3~~82.9~~	0.003~~0.001~~	0.997~~0.998~~	0.888~~0.944~~
50% displacement, 1% mortality (high)~~70% displacement, 2% mortality~~	95.1~~232.0~~	0.002~~0.004~~	0.998~~0.996~~	0.937~~0.851~~
70% displacement, 2% mortality (high)~~70% displacement, 10% mortality~~	266.2~~1160.2~~	0.004~~0.019~~	0.995~~0.978~~	0.831~~0.444~~

Flamborough and Filey Coast SPA - Puffin

~~1634.~~1794. Puffin has been screened in for the assessment of the O&M phase to assess the impacts from disturbance and displacement from the Project in-combination with other OWFs in relation to the conservation objectives for this species as a feature of the FFC SPA (presented in Section 9.3~~9.4~~).

~~1635.~~1795. A range of proposed, consented, under-construction, and operational OWFs in UK waters in the North Sea and English Channel were screened in for the in-combination assessment, based on the potential for adverse effects from activities taking place at these sites in combination with the O&M of the Project. During the breeding season, projects were screened in if they were within the mean-maximum foraging range (137.1km) plus 1SD (128.3km) of puffin from the FFC SPA based on data from Woodward *et al.* (2019). Since puffins range further outside of the breeding season, consideration was also given to other project within the wider UK North Sea and English Channel BDMPS area during the non-breeding bio-season. Projects included within the in-combination assessment are presented in Table 10.38~~Table 10.33~~ below.

~~1636.~~1796. During the breeding bio-season it is considered that potential displacement impacts on puffin from FFC SPA may be attributed more highly to offshore windfarms within areas of sea within foraging distance from this breeding colony. In order to assess the potential in-combination impacts on puffin from multiple offshore windfarms, information was compiled on the seasonal abundance of puffins measured at each offshore windfarm site (plus 2km buffer). The seasonal puffin abundances were then subjected to a process of attribution to FFC SPA ~~(Appendix 4)~~.

~~1637.~~1797. Outside of the breeding bio-season, when the population contains a mix of birds from UK breeding colonies and breeding colonies from further away, then a much lower percentage of birds can be attributed to any particular breeding colony SPA population. This apportionment is based on calculating the proportion of the breeding adults within the UK North Sea and English Channel BDMPS population that can be attributed to the FFC SPA as defined by Furness (2015), based on the data within that report. Following this approach to apportionment the proportion of the BDMPS populations from FFC SPA during non-breeding bio-season of 0.8% was agreed as appropriate by Natural England during the Norfolk Boreas examination (Natural England 2020) and for this project through the EPP (Table 4.2).

~~1638.~~1798. The total numbers presented in Table 10.38 are derived from in-combination tables presented for the Natural England Offshore Ornithology Position for Sheringham Shoal and Dudgeon Offshore Windfarm Extension Projects Deadline 8 Submission ~~Hornsea Project Four Ornithology EIA & HRA Annex~~ (~~APEM Ltd and GoBe Consultants 2022~~Natural England, 2023). The following amendments were made to the values presented:

- Inclusion of values from the Green Volt RIAA (Royal HaskoningDHV, 2023b), West of Orkney RIAA (Xodus & MacArthur Green 2023), Berwick Bank RIAA (RPS and Royal HaskoningDHV, 2022), Five Estuaries ~~draft~~ RIAA (GoBe Consultants, 202~~3~~4), North Falls RIAA (SSE Renewables and RWE, 202~~3~~4), and Dogger Bank South ~~PEIR~~ (MacArthur Green 2023);
- Removal of Beatrice Demonstrator as the Project will be decommissioned by the time the Project is predicted to be operation; and
- Inclusion of values from the Project.

~~1639.~~1799. As per evidence presented in Section 9.3, a displacement rate of 50% and a mortality rate of 1% are presented as the Applicant's approach for the assessment of in-combination impacts on puffin. However, ~~based on advice from SNCBs (MIG-Birds, 2022),~~the Natural England approach ~~using a displacement range~~, ~~-~~a displacement range of 30% to 70% and a mortality range of 1% to 10% are also presented~~rate of 70% and a mortality rate of 2% of 30% to 70% and a mortality range of 1% to 10% is also~~ presented in~~-~~ Table 10.39~~Table 10.33~~. Results for annual displacement consequent mortalities are also presented in a matrix in Table 10.40~~Table 10.40Table 10.34~~.

~~1640.~~1800. Table 10.38 ~~STYLEREF 1 \s SEQ Table * ARABIC \s 1 Table 10.32~~ below presents the abundance of puffins as attributed to FFC SPA within all other offshore windfarms and their 2km buffers for consideration in this in-combination assessment. It should be noted that these values are highly likely to be overly precautionary, as they are based on seasonal mean peaks ~~added~~ summed to make an~~into an~~ annual total.

~~Table 10.32: in-combination displacement total for puffin attributed to the FFC SPA.~~

~~Project~~	~~Seasonal population at risk of displacement~~			~~Tier~~
	~~Breeding~~	~~Non-breeding~~	~~Annual Total~~	
~~Beatrice~~	~~0~~	~~10~~	~~10~~	~~1a~~
~~Blyth Demonstration Site~~	~~0~~	~~1~~	~~1~~	~~1a~~
~~Dudgeon~~	~~0~~	~~0~~	~~0~~	~~1a~~
~~East Anglia One~~	~~0~~	~~0~~	~~0~~	~~1a~~
~~EOWDC~~	~~0~~	~~0~~	~~0~~	~~1a~~
~~Galloper~~	~~0~~	~~0~~	~~0~~	~~1a~~
~~Greater Gabbard~~	~~0~~	~~0~~	~~0~~	~~1a~~
~~Gunfleet Sands~~	~~-~~	~~-~~	~~0~~	~~1a~~
~~Hornsea Project One~~	~~407~~	~~5~~	~~412~~	~~1a~~
~~Humber Gateway~~	~~15~~	~~0~~	~~15~~	~~1a~~
~~Hywind 2 Demonstration~~	~~0~~	~~0~~	~~0~~	~~1a~~
~~Kentish Flats~~	~~-~~	~~-~~	~~0~~	~~1a~~
~~Kentish Flats Extension~~	~~0~~	~~0~~	~~0~~	~~1a~~
~~Kincardine~~	~~0~~	~~0~~	~~0~~	~~1a~~
~~Lincs, Lynn and Inner Dowsing~~	~~0~~	~~0~~	~~0~~	~~1a~~
~~London Array~~	~~0~~	~~0~~	~~0~~	~~1a~~
~~Methil~~	~~0~~	~~0~~	~~0~~	~~1a~~
~~Race Bank~~	~~0~~	~~0~~	~~0~~	~~1a~~
~~Rampion~~	~~0~~	~~0~~	~~0~~	~~1a~~
~~Scroby Sands~~	~~-~~	~~-~~	~~0~~	~~1a~~
~~Sheringham Shoal~~	~~0~~	~~0~~	~~0~~	~~1a~~
~~Teesside~~	~~35~~	~~0~~	~~35~~	~~1a~~
~~Thanet~~	~~0~~	~~0~~	~~0~~	~~1a~~
~~Westermost Rough~~	~~61~~	~~0~~	~~61~~	~~1a~~
~~Hornsea Project Two~~	~~178~~	~~8~~	~~186~~	~~1b~~

~~Project~~	~~Seasonal population at risk of displacement~~			~~Tier~~
	~~Breeding~~	~~Non-breeding~~	~~Annual Total~~	
~~Moray East~~	~~0~~	~~3~~	~~3~~	~~1b~~
~~Neart na Gaoithe~~	~~0~~	~~9~~	~~9~~	~~1b~~
~~Seagreen Alpha~~	~~0~~	~~6~~	~~6~~	~~1b~~
~~Seagreen Bravo~~	~~0~~	~~16~~	~~16~~	~~1b~~
~~Triton Knoll~~	~~23~~	~~0~~	~~23~~	~~1b~~
~~Dogger Bank Creyke Beck A~~	~~11~~	~~1~~	~~12~~	~~1c~~
~~Dogger Bank Creyke Beck B~~	~~31~~	~~3~~	~~34~~	~~1c~~
~~Dogger Bank Teessde A~~	~~10~~	~~1~~	~~11~~	~~1c~~
~~East Anglia Three~~	~~0~~	~~1~~	~~1~~	~~1c~~
~~Hornsea Three (NE approach)~~	~~127~~	~~0~~	~~127~~	~~1c~~
~~Inch Cape~~	~~0~~	~~11~~	~~11~~	~~1c~~
~~Moray West~~	~~0~~	~~16~~	~~16~~	~~1c~~
~~Sofia~~	~~11~~	~~1~~	~~12~~	~~1c~~
~~East Anglia One North~~	~~-~~	~~-~~	~~0~~	~~1d~~
~~East Anglia Two~~	~~0~~	~~0~~	~~0~~	~~1d~~
~~Norfolk Boreas~~	~~0~~	~~1~~	~~1~~	~~1d~~
~~Norfolk Vanguard~~	~~0~~	~~0~~	~~0~~	~~1d~~
~~Hornsea Four~~	~~203~~	~~2~~	~~205~~	~~1e~~
~~Dudgeon Extension Project~~	~~0~~	~~0~~	~~0~~	~~2~~
~~Sheringham Shoal Extension Project~~	~~0~~	~~0~~	~~0~~	~~2~~
~~Rampion 2~~	~~0~~	~~0~~	~~0~~	~~2~~
~~Berwick Bank~~	~~0~~	~~0~~	~~0~~	~~2~~
~~Greenvolt~~	~~-~~	~~-~~	~~-~~	~~2~~
~~Pentland~~	~~-~~	~~-~~	~~-~~	~~2~~
~~West of Orkney~~	~~-~~	~~11~~	~~11~~	~~2~~
~~Berwick Bank~~	~~2~~	~~-~~	~~2~~	~~2~~
~~North Falls~~	~~-~~	~~-~~	~~-~~	~~2~~

~~Project~~	~~Seasonal population at risk of displacement~~			~~Tier~~
	~~Breeding~~	~~Non-breeding~~	~~Annual Total~~	
~~Dogger bank south~~	~~345~~	~~6~~		~~2~~
~~Five Estuaries (PEIR)~~	~~-~~	~~-~~	~~-~~	~~2~~
~~Total (without ODOW)~~	~~1,459~~	~~112~~	~~1,220~~	
~~Outer Dowsing~~	**~~79~~**	**~~5~~**	**~~84~~**	
~~All Projects Total~~	~~1,538~~	~~118~~	~~1,304~~	

Table 10-38~~10.3810-37~~: in-combination displacement total for puffin attributed to the FFC SPA.

Project	Annual Total	Tier	Source
Consented projects total	1,207	1a – 1c	Natural England SEP&DEP Position Paper
Greenvolt	-	1c	Green Volt RIAA
Berwick Bank	-	1d	Berwick Bank RIAA
WoO	-	1d	West of Orkney RIAA
Dogger Bank South (54.3%)	23	1d	Dogger Bank South RIAA
Dogger Bank South (100%)	41	1d	Dogger Bank South RIAA
Five Estuaries	-	1d	Five Estuaries RIAA
Ossian	-	1d	Ossian RIAA
Salamander	-	1d	Salamander RIAA
Outer Dowsing (Applicant's Approach)	81~~79~~	1d	
Outer Dowsing (NE Approach)	145~~143~~	1d	
Total projects (realistic-case)	1,311~~1,309~~		
Total projects (worst-case)	1,392~~1,391~~		

~~*Breeding Bio-season*~~

~~1641. The in-combination number of breeding adults attributed to FFC SPA at risk of displacement from OWFs, including the Project, during the breeding bio-season is 1,538 (1,538.0). The predicted consequent mortality, based on 50% displacement and 1% mortality, is eight (7.7) breeding adults.~~

~~1642. Based on the latest FFC SMP population count undertaken in 2022, which was 3,080 breeding adults with an annual baseline mortality of 289.5 breeding adults per annum, the addition of eight mortalities would represent a 2.946% increase in baseline mortality and the Project would contribute less than one (0.4) individual representing a 0.136% increase in baseline mortality.~~

~~*Non-breeding Bio-season*~~

~~1643. The in-combination number of individuals at risk of displacement from OWFs, including Outer Dowsing, that have been apportioned to FFC SPA is 118 (1176) individuals in the non-breeding bio-season. The displacement consequent mortality, based on 50% displacement and 1% mortality is less than one (0.6) individual.~~

~~1644. Assessing the potential impact to the FFC SMP population during the non-breeding bio-season, the addition of less than one individual would represent a 0.335% increase in baseline mortality, of which the Project contributes less than one (0.03) mortality, representing a 0.009% increase in baseline mortality.~~

Annual Total

~~1645.~~1801. As bio-season specific impacts could not be traced for certain projects, the in-combination assessment for puffin at FFC SPA is based on annual impacts. The in-combination number of puffins predicted to be displaced from all OWFs, including the Project, is 1,3~~09~~11~~656~~ ~~(1655.6))~~ individuals per annum. The predicted displacement consequent mortality, based on 50% displacement and 1% mortality, is seven~~eight~~ (6.~~5~~6~~8.3~~) individuals.

1802. Assessing the potential impact to the FFC SMP population, the addition of seven~~eight~~ (6.5) mortalities would represent a 2.264~~3.727~~~~2.859~~% increase in baseline mortality, of which the Project contributes less than one (0.4) mortality, representing a 0.1~~37~~40~~45~~% increase in baseline mortality.

Under Natural England's preferred approach, the in-combination number of puffins predicted to be displaced from all OWFs, including the Project, is 1,39~~1~~2 ~~-~~individuals per annum. The predicted displacement consequent mortality, based on 70% displacement and 2% mortality, is ~~seven~~19 (~~7.0~~19.5) individuals.

~~1646.~~ Assessing the potential impact to the FFC SMP population, the addition of ~~seven~~19.5 mortalities would represent a 6.733~~3.959~~% increase in baseline mortality.

1803.

~~1647.~~1804. Considering the in-combination impact exceeds a 1% increase in baseline mortality the effects have been investigated further through a PVA.

~~1648. Though the impact exceeds a 1% increase in baseline mortality, it is considered highly unlikely that impacts will result in an AEOI of the puffin feature at the FFC SPA. Based on SMP population counts, the population has increased by 63.6% between 2000 and 2018, with a 48.6% increase between 2017 and 2018 alone, rising from 2,878 to 4,279. Considering the impacts from the Project in-combination with other projects, the loss of seveneight individuals would represent a loss of less than 0.5% (0.164%) of the current population.~~

~~1649. In addition to this, the contribution of less than one mortality from the Project alone is not considered to be a material contribution to existing mortalities, with the mortality representing <0.1% of the most recent population count.~~

~~1650. Although the in-combination impacts resulting from displacement exceed a 1% increase in baseline mortality, based on the evidence provided above and the current increasing population, it is considered that the level of additional impact would be indistinguishable from natural fluctuations in the population, with the Project alone also making no material contribution to the existing in-combination mortalities. As such, the contribution that puffin makes to the seabird breeding assemblage will be maintained.~~

~~1651. It is therefore concluded that the in-combination predicted puffin mortality due to displacement in the O&M phase would not adversely affect the integrity of the seabird breeding assemblage at the FFC SPA.~~

~~Table 10.33: in-combination displacement consequent mortalities for puffin at the FFC SPA.~~

~~Bio-season~~	~~Abundance of adults apportioned to the FFC SPA (array area plus 2km buffer)~~	~~Estimated increase in mortality (breeding adults per annum)~~		~~% increase in baseline mortality (citation count)~~		~~% increase in baseline mortality (recent count)~~	
		~~50% displacement, 1% mortality~~	~~30-70% displacement, 1-10% mortality~~	~~50% displacement, 1% mortality~~	~~30-70% displacement, 1-10% mortality~~	~~50% displacement, 1% mortality~~	~~30-70% displacement, 1-10% mortality~~
~~Breeding~~	~~1538.0~~	~~7.7~~	~~4.62 – 107.8~~	~~4.397~~	~~2.638 – 61.558~~	~~2.656~~	~~1.593 – 37.184~~
~~Non-breeding~~	~~117.6~~	~~0.6~~	~~0.4 – 8.4~~	~~0.335~~	~~0.201 – 4.690~~	~~0.203~~	~~0.122 – 2.842~~
~~Annual Total~~	**~~1655.6~~**	**~~8.3~~**	**~~4.9 – 116.2~~**	**~~4.714~~**	**~~2.826 – 65.940~~**	**~~2.859~~**	**~~1.715 – 40.026~~**

Table 10-39~~10.3910-38~~: in-combination displacement consequent mortalities for puffin at the FFC SPA.

Scenario	Annual total abundance of adults apportioned to the ~~Farne~~FFC SPA ~~Islands SPA~~ (array/WTG area plus 2km buffer)	Estimated increase in mortality (breeding adults per annum)			% increase in baseline mortality (citation count)			% increase in baseline mortality (recent count)		
		50% displacement, 1% mortality	70% displacement, 2% mortality	30-70% displacement, 1-10% mortality	50% displacement, 1% mortality	70% displacement, 2% mortality	30-70% displacement, 1-10% mortality	50% displacement, 1% mortality	70% displacement, 2% mortality	30-70% displacement, 1-10% mortality
Total "realistic-case"	1,3~~09.2~~10.9	6.~~5~~6	18.~~3~~4	3.9 - 91.~~6~~8	3.7~~27~~32	10.4~~36~~50	2.23~~6~~9 - 52.~~182~~250	2.261	6.331	1.35~~7~~8 - 31.6~~55~~96
Total "worst-case"	1,39~~0.5~~2.2	7.0	19.5	4.2 - 97.3	3.9~~59~~64	11.0~~85~~98	2.37~~5~~8 - 55.4~~24~~92	2.405~~2~~	6.7~~24~~33	1.44~~1~~3 - 33.6~~22~~63

Table 10-40~~10.4010-3910.34~~: ~~i~~In-combination displacement matrix for adult puffin attributed to the FFC SPA across all bio-seasons, with light blue shading representing the displacement and mortality range advocated for by ~~SNCB~~ANCBs, and dark blue representing the Applicant's approach.

Annual (2km Buffer)	Mortality Rate (%)												
Displaced (%)	1	2	5	10	20	30	40	50	60	70	80	90	100
10	1 ~~1 2~~	3 ~~3 3~~	7 ~~7 8~~	13 ~~13 17~~	26 ~~26 33~~	39 ~~39 50~~	52 ~~52 66~~	66 ~~65 83~~	79 ~~79 99~~	92 ~~92 116~~	105 ~~105 132~~	118 ~~118 149~~	131 ~~131 166~~
20	3 ~~3 3~~	5 ~~5 7~~	13 ~~13 17~~	26 ~~26 33~~	52 ~~52 66~~	79 ~~79 99~~	105 ~~105 132~~	131 ~~131 166~~	157 ~~157 199~~	184 ~~183 232~~	210 ~~209 265~~	236 ~~236 298~~	262 ~~262 331~~
30	4 ~~4 5~~	8 ~~8 10~~	20 ~~20 25~~	39 ~~39 50~~	79 ~~79 99~~	118 ~~118 149~~	157 ~~157 199~~	197 ~~196 248~~	236 ~~236 298~~	275 ~~275 348~~	315 ~~314 397~~	354 ~~353 447~~	393 ~~393 497~~
40	5 ~~5 7~~	10 ~~10 13~~	26 ~~26 33~~	52 ~~52 66~~	105 ~~105 132~~	157 ~~157 199~~	210 ~~209 265~~	262 ~~262 331~~	315 ~~314 397~~	367 ~~367 464~~	419 ~~419 530~~	472 ~~471 596~~	524 ~~524 662~~
50	7 ~~7 8~~	13 ~~13 17~~	33 ~~33 41~~	66 ~~65 83~~	131 ~~131 166~~	197 ~~196 248~~	262 ~~262 331~~	328 ~~327 414~~	393 ~~393 497~~	459 ~~458 580~~	524 ~~524 662~~	590 ~~589 745~~	655 ~~655 828~~
60	8 ~~8 10~~	16 ~~16 20~~	39 ~~39 50~~	79 ~~79 99~~	157 ~~157 199~~	236 ~~236 298~~	315 ~~314 397~~	393 ~~393 497~~	472 ~~471 596~~	551 ~~550 696~~	629 ~~628 795~~	708 ~~707 894~~	787 ~~785 994~~
70	9 ~~9 12~~	18 ~~18 23~~	46 ~~46 58~~	92 ~~92 116~~	184 ~~183 232~~	275 ~~275 348~~	367 ~~367 464~~	459 ~~458 580~~	551 ~~550 696~~	642 ~~641 811~~	734 ~~733 927~~	826 ~~825 1,043~~	918 ~~916 1,159~~

Annual (2km Buffer)	Mortality Rate (%)												
80	10 ~~10~~ ~~13~~	21 ~~21~~ ~~26~~	52 ~~52~~ ~~66~~	105 ~~105~~ ~~132~~	210 ~~209~~ ~~265~~	315 ~~314~~ ~~397~~	419 ~~419~~ ~~530~~	524 ~~524~~ ~~662~~	629 ~~628~~ ~~795~~	734 ~~733~~ ~~927~~	839 ~~838~~ ~~1,060~~	944 ~~943~~ ~~1,192~~	1,049 ~~1,047~~ ~~1,325~~
90	12 ~~12~~ ~~15~~	24 ~~24~~ ~~30~~	59 ~~59~~ ~~75~~	118 ~~118~~ ~~149~~	236 ~~236~~ ~~298~~	354 ~~353~~ ~~447~~	472 ~~471~~ ~~596~~	590 ~~589~~ ~~745~~	708 ~~707~~ ~~894~~	826 ~~825~~ ~~1,043~~	944 ~~943~~ ~~1,192~~	1,062 ~~1,060~~ ~~1,341~~	1,180 ~~1,178~~ ~~1,490~~
100	13 ~~13~~ ~~17~~	26 ~~26~~ ~~33~~	66 ~~65~~ ~~83~~	131 ~~131~~ ~~166~~	262 ~~262~~ ~~331~~	393 ~~393~~ ~~497~~	524 ~~524~~ ~~662~~	655 ~~655~~ ~~828~~	787 ~~785~~ ~~994~~	918 ~~916~~ ~~1,159~~	1,049 ~~1,047~~ ~~1,325~~	1,180 ~~1,178~~ ~~1,490~~	1311 ~~1,309~~ ~~1,656~~

Table 10-41~~10.4110-40~~: In-combination displacement matrix for adult puffin attributed to the FFC SPA across all bio-seasons, with light blue shading representing the displacement and mortality range advocated for by ~~SNCB~~ANCBs, and dark blue representing Natural England's preferred approach.

Annual (2km Buffer)	Mortality Rate (%)												
Displaced (%)	1	2	5	10	20	30	40	50	60	70	80	90	100
10	1 ~~1~~	3 ~~3~~	7 ~~7~~	14 ~~14~~	28 ~~28~~	42 ~~42~~	56 ~~56~~	70 ~~70~~	84 ~~83~~	97 ~~97~~	111 ~~111~~	125 ~~125~~	139 ~~139~~
20	3 ~~3~~	6 ~~6~~	14 ~~14~~	28 ~~28~~	56 ~~56~~	84 ~~83~~	111 ~~111~~	139 ~~139~~	167 ~~167~~	195 ~~195~~	223 ~~222~~	251 ~~250~~	278 ~~278~~
30	4 ~~4~~	8 ~~8~~	21 ~~21~~	42 ~~42~~	84 ~~83~~	125 ~~125~~	167 ~~167~~	209 ~~209~~	251 ~~250~~	292 ~~292~~	334 ~~334~~	376 ~~375~~	418 ~~417~~
40	6 ~~6~~	11 ~~11~~	28 ~~28~~	56 ~~56~~	111 ~~111~~	167 ~~167~~	223 ~~222~~	278 ~~278~~	334 ~~334~~	390 ~~389~~	446 ~~445~~	501 ~~501~~	557 ~~556~~
50	7 ~~7~~	14 ~~14~~	35 ~~35~~	70 ~~70~~	139 ~~139~~	209 ~~209~~	278 ~~278~~	348 ~~348~~	418 ~~417~~	487 ~~487~~	557 ~~556~~	626 ~~626~~	696 ~~695~~
60	8 ~~8~~	17 ~~17~~	42 ~~42~~	84 ~~83~~	167 ~~167~~	251 ~~250~~	334 ~~334~~	418 ~~417~~	501 ~~501~~	585 ~~584~~	668 ~~667~~	752 ~~751~~	835 ~~834~~
70	10 ~~10~~	19 ~~19~~	49 ~~49~~	97 ~~97~~	195 ~~195~~	292 ~~292~~	390 ~~389~~	487 ~~487~~	585 ~~584~~	682 ~~681~~	780 ~~779~~	877 ~~876~~	975 ~~973~~
80	11 ~~11~~	22 ~~22~~	56 ~~56~~	111 ~~111~~	223 ~~222~~	334 ~~334~~	446 ~~445~~	557 ~~556~~	668 ~~667~~	780 ~~779~~	891 ~~890~~	1,002 ~~1,001~~	1,114 ~~1,112~~
90	13 ~~13~~	25 ~~25~~	63 ~~63~~	125 ~~125~~	251 ~~250~~	376 ~~375~~	501 ~~501~~	626 ~~626~~	752 ~~751~~	877 ~~876~~	1,002 ~~1,001~~	1,128 ~~1,126~~	1,253 ~~1,251~~
100	14 ~~14~~	28 ~~28~~	70 ~~70~~	139 ~~139~~	278 ~~278~~	418 ~~417~~	557 ~~556~~	696 ~~695~~	835 ~~834~~	975 ~~973~~	1,114 ~~1,112~~	1,253 ~~1,251~~	1392~~1,391~~

1805. PVA was undertaken on a range of scenarios of displacement and mortality rates for both the Project alone and in-combination with other projects. For each scenario, CGR and CPS values have been presented from the model outputs, measuring the changes in annual growth rate and population size respectively at the end of the impacted period of 35 years relative to a baseline scenario.

1806. Based on SMP population counts, the population has increased by 63.6% between 2000 and 2018, with a 48.6% increase between 2017 and 2018 alone, rising from 2,878 to 4,279. This equates to an average annual population increase of roughly 2.90% over the 18-year period. Though it is not possible to predict how this growth rate will change over the 35-year lifetime of the Project, the current population growth rate suggests that the colony is healthy and expected to continue increasing in size.

1807. A worst-case scenario based on the Natural England position is 70% displacement and 2% mortality. This approach predicts a reduction in growth rate of 0.72% between the impacted and baseline scenarios Table 10.42. This is reduced to 0.25% reduction in growth rate when considering the Applicant's approach of 50% displacement and 1% mortality. It is therefore predicted that, even with multiple levels of precaution built into the assessment (see 19.8 Levels of precaution in the assessment and compensation calculations for offshore ornithology [REP2-057]), both the anticipated Natural England scenario and Applicant's approach would not cause any reversal of the current population trend. As such, the contribution that puffin makes to the seabird breeding assemblage will be maintained.

1808. It should also be noted that the assessment is already considered precautionary in nature. The main assumptions leading to precaution in the assessment of potential displacement impacts on puffin are, firstly the impacts are applied to the mean peak abundance of individuals within the ~~array~~WTG area and 2km buffer, which overestimate the abundance of individuals present in the area throughout the whole season, while also not accounting for the fact that individuals are likely to have been double counted across multiple projects within similar areas, thus further over-inflating predicted impacts. Secondly, there is growing evidence that the displacement rates for puffin are substantially lower than even the Applicant's approach of 50% (REP2-059). Additionally, the PVA analysis does not incorporate density dependence, which results in over-precautionary modelled outputs, and because the FFC SPA razorbill population is also modelled as a closed population with no emigration or immigration, the model assumes that the population is more constrained than it is in reality.

1809. In addition to this, the contribution of less than one mortality from the Project alone is not considered to be a material contribution to existing mortalities, with the mortality representing just 0.4 birds, less than a 0.2% increase in baseline mortality of the most recent population count.

1810. It is therefore concluded that the in-combination predicted puffin mortality due to displacement in the O&M phase would not adversely affect the integrity of the seabird breeding assemblage at the FFC SPA.

Table 10-42~~10.42~~: PVA outputs for breeding adult puffin at the FFC SPA resulting from displacement impacts.

PVA Scenario	Annual mortality	Impact on survival	Median CGR	Median CPS
Applicant's Approach				
50% displacement, 1% mortality	0.4	0.00013	1.000	0.994
70% displacement, 2% mortality	1.1	0.00036	1.000	0.984
NE Approach				
50% displacement, 1% mortality	0.7	0.00023	1.000	0.990
70% displacement, 2% mortality	2.0	0.00065	0.999	0.972
In-combination				
50% displacement, 1% mortality (low)	6.6	0.00213	0.998	0.916
70% displacement, 2% mortality (low)	18.4	0.00595	0.993	0.784
50% displacement, 1% mortality (high)	7.0	0.00226	0.997	0.911
70% displacement, 2% mortality (high)	19.5	0.00632	0.993	0.771

Flamborough and Filey Coast SPA – Gannet

~~1652.~~1811. Gannet has been screened in for the assessment of the O&M phase to assess the impacts from disturbance and displacement from the Project in-combination with other OWFs in relation to the conservation objectives for this species as a feature of the FFC SPA (presented in Section 9.3).

~~1653.~~1812. A range of proposed, consented, under-construction, and operational OWFs in UK waters in the North Sea and English Channel were screened in for the in-combination assessment, based on the potential for adverse effects from activities taking place at these sites in combination with the O&M of the Project. During the breeding season projects were screened in if they were within the mean-maximum foraging range (315.2km) plus 1SD (194.2km) of gannet from the FFC SPA based on data from Woodward et al. (2019). Since gannets range further outside of the breeding season, consideration was also given to other project within the wider UK North Sea and English Channel BDMPS area during the return migration and post-breeding migration bio-seasons. Projects included within the in-combination assessment are presented in Table 10.44~~Table 10.43Table 10.36~~ below.

~~1654.~~1813. During the breeding bio-season it is considered that potential displacement impacts on gannets from the FFC SPA may be attributed more highly to offshore windfarms within areas of sea within foraging distance from this breeding colony. In order to assess the potential in-combination impacts on gannet from multiple offshore windfarms, information was compiled on the seasonal abundance of gannets measured at each offshore windfarm site (plus 2km buffer). The seasonal gannet abundances were then subjected to a process of attribution to FFC SPA (Appendix 4).

~~1655.~~1814. Outside of the breeding bio-season, when the population contains a mix of birds from UK breeding colonies and breeding colonies from further away, then a much lower percentage of birds can be attributed to any particular breeding colony SPA population. This apportionment is based on calculating the proportion of the breeding adults within the UK North Sea and English Channel BDMPS population that can be attributed to the FFC SPA as defined by Furness (2015), based on the data within that report (Appendix 4). Following this approach to apportionment the proportions of the BDMPS populations from FFC SPA during return migration and post-breeding migration bio-seasons were estimated to be 6.23% and 4.84% respectively, which has been agreed as appropriate by Natural England during the Norfolk Boreas examination (Natural England 2020) and for this project through the evidence plan process (Table 4.2).

~~1656.~~1815. The total numbers presented in Table 10.44~~Table 10.43 Table 10.35~~ are derived from in-combination tables presented for the Natural England Offshore Ornithology Position for Sheringham Shoal and Dudgeon Offshore Windfarm Extension Projects Deadline 8 Submission ~~Sheringham Shoal and Dudgeon Offshore Windfarm Extension Projects Deadline 8 Apportioning and HRA Updates Technical Note~~ (~~Royal HaskoningDHV~~Natural England, 2023~~a~~). The following amendments were made to the values presented:

- Inclusion of values from the Green Volt RIAA (Royal HaskoningDHV, 2023b), West of Orkney RIAA (Xodus & MacArthur Green 2023), Berwick Bank RIAA (RPS and Royal HaskoningDHV, 2022), Ossian Windfarm RIAA (NIRAS and RPS, 2024), Five Estuaries ~~draft~~ RIAA (GoBe Consultants, 2024~~3~~), North Falls RIAA (SSE Renewables and RWE, ~~2023~~2024), and Dogger Bank South ~~PEIR~~ (MacArthur Green 2024~~3~~);
- Removal of Beatrice Demonstrator as the Project will be decommissioned by the time the Project is predicted to be operation; and
- Inclusion of values from the Project.

~~1657.~~1816. As per evidence presented in Section 9.3, a displacement rate of 70% and a mortality rate of 1% are presented as the Applicant's and Natural England approaches for the assessment of in-combination impacts on gannet. ~~However, based on SNCB advice (MIG-Birds, 2022), a displacement range of 60% to 80% is also presented in Table 10.36.~~ Results for annual displacement consequent mortalities are also presented in a matrix in Table 10.45~~Table 10.44Table 10.37~~.

~~1658.~~1817. Table 10.44~~Table 10.43Table 10.36~~ below presents the abundance of gannets as attributed to FFC SPA within all other offshore windfarms and their 2km buffers for consideration in this in-combination displacement assessment. It should be noted that these values are highly likely to be overly precautionary, as they are based on seasonal mean peaks added into an annual total.

~~Table 10.35: Seasonal mean peak abundances of gannets attributed to the FFC SPA from OWFs used to determine in-combination displacement impacts.~~

~~Project~~	~~Seasonal population at risk of displacement~~				~~Tier~~
	~~breeding~~	~~Post-breeding migration (Autumn)~~	~~Return migration (Spring)~~	~~Annual total~~	
~~Beatrice~~	~~0~~	~~0~~	~~0~~	~~0~~	~~1a~~
~~Blyth Demonstration Site~~	~~-~~	~~-~~	~~-~~	~~0~~	~~1a~~
~~Dudgeon~~	~~53~~	~~1~~	~~1~~	~~55~~	~~1a~~
~~East Anglia One~~	~~161~~	~~175~~	~~5~~	~~340~~	~~1a~~
~~EOWDC~~	~~0~~	~~0~~	~~0~~	~~0~~	~~1a~~
~~Galloper~~	~~0~~	~~44~~	~~17~~	~~61~~	~~1a~~
~~Greater Gabbard~~	~~0~~	~~3~~	~~7~~	~~10~~	~~1a~~
~~Gunfleet Sands~~	~~0~~	~~1~~	~~1~~	~~1~~	~~1a~~
~~Hornsea Project One~~	~~671~~	~~33~~	~~16~~	~~720~~	~~1a~~
~~Humber Gateway~~	~~-~~	~~-~~	~~-~~	~~0~~	~~1a~~
~~Hywind~~	~~0~~	~~0~~	~~0~~	~~0~~	~~1a~~
~~Kentish Flats~~	~~-~~	~~-~~	~~-~~	~~0~~	~~1a~~
~~Kentish Flats Extension~~	~~0~~	~~1~~	~~0~~	~~1~~	~~1a~~
~~Lincs~~	~~-~~	~~-~~	~~-~~	~~0~~	~~1a~~
~~London Array~~	~~-~~	~~-~~	~~-~~	~~0~~	~~1a~~
~~Methil~~	~~0~~	~~0~~	~~0~~	~~0~~	~~1a~~
~~Race Bank~~	~~92~~	~~2~~	~~2~~	~~95~~	~~1a~~
~~Rampion~~	~~0~~	~~28~~	~~0~~	~~28~~	~~1a~~
~~Scroby Sands~~	~~-~~	~~-~~	~~-~~	~~0~~	~~1a~~
~~Sheringham Shoal~~	~~47~~	~~2~~	~~0~~	~~49~~	~~1a~~
~~Teesside~~	~~1~~	~~0~~	~~0~~	~~1~~	~~1a~~
~~Thanet~~	~~-~~	~~-~~	~~-~~	~~0~~	~~1a~~
~~Westermost Rough~~	~~-~~	~~-~~	~~-~~	~~0~~	~~1a~~

~~Project~~	~~Seasonal population at risk of displacement~~				~~Tier~~
	~~breeding~~	~~Post-breeding migration (Autumn)~~	~~Return migration (Spring)~~	~~Annual total~~	
~~Kincardine~~	~~0~~	~~0~~	~~0~~	~~0~~	~~1a~~
~~Hornsea Project Two~~	~~457~~	~~55~~	~~8~~	~~519~~	~~1b~~
~~Moray East~~	~~0~~	~~14~~	~~2~~	~~16~~	~~1b~~
~~Neart na Gaoithe~~	~~0~~	~~27~~	~~17~~	~~44~~	~~1b~~
~~Triton Knoll~~	~~211~~	~~1~~	~~2~~	~~213~~	~~1b~~
~~Firth of Forth Alpha and Bravo~~	~~0~~	~~32~~	~~21~~	~~53~~	~~1b~~
~~East Anglia Three~~	~~412~~	~~61~~	~~33~~	~~505~~	~~1b~~
~~Dogger Bank Creyke Beck Projects A and B~~	~~578~~	~~98~~	~~24~~	~~700~~	~~1c~~
~~Dogger Bank Teesside Projects A and B~~	~~1,125~~	~~43~~	~~29~~	~~1,196~~	~~1c~~
~~Hornsea Three~~	~~844~~	~~47~~	~~33~~	~~924~~	~~1c~~
~~Inch Cape~~	~~0~~	~~34~~	~~13~~	~~47~~	~~1c~~
~~Moray West~~	~~0~~	~~21~~	~~9~~	~~30~~	~~1c~~
~~Hornsea Four~~	~~883~~	~~38~~	~~25~~	~~946~~	~~1c~~
~~East Anglia ONE North~~	~~149~~	~~23~~	~~3~~	~~174~~	~~1c~~
~~East Anglia TWO~~	~~192~~	~~43~~	~~12~~	~~247~~	~~1c~~
~~Norfolk Boreas~~	~~1,229~~	~~83~~	~~33~~	~~1,344~~	~~1d~~
~~Norfolk Vanguard~~	~~271~~	~~118~~	~~27~~	~~416~~	~~1d~~
~~DEP and SEP~~	~~337~~	~~31~~	~~4~~	~~372~~	~~1d~~
~~Rampion 2~~	~~0~~	~~4~~	~~3~~	~~7~~	~~1d~~
~~Greenvolt~~	~~3~~	~~1~~	~~4~~	~~8~~	~~1d~~
~~Pentland~~	~~-~~	~~-~~	~~0~~	~~0~~	~~2~~
~~Berwick Bank~~	~~55~~	~~30~~	~~11~~	~~96~~	~~2~~
~~West of Orkney~~	~~-~~	~~44~~	~~56~~	~~99~~	~~2~~
~~North Falls RIAA~~	~~37~~	~~22~~	~~15~~	~~75~~	~~2~~

~~Project~~	~~Seasonal population at risk of displacement~~				~~Tier~~
	~~breeding~~	~~Post-breeding migration (Autumn)~~	~~Return migration (Spring)~~	~~Annual total~~	
~~Dogger Bank South~~	~~203~~	~~50~~	~~1~~	~~253~~	~~2~~
~~Five Estaries (PEIR)~~	~~78~~	~~31~~	~~4~~		~~2~~
~~Total (without ODOW)~~	~~8,088~~	~~1,235~~	~~433~~	~~9,756~~	
~~Outer Dowsing~~	~~584~~	~~30~~	~~4~~	~~619~~	
~~**All Projects Total**~~	~~**8,672**~~	~~**1,265**~~	~~**437**~~	~~**10,374**~~	

Table 10-43~~10.4310-41~~: Annual mean peak abundances of gannets attributed to the FFC SPA from OWFs used to determine in-combination displacement impacts.

Project	Annual Total	Tier	
Consented project total	9,167	1a – 1c	Natural England SEP&DEP Position Paper
Greenvolt	8	1c	Green Volt RIAA
Berwick Bank	96	1d	Berwick Bank RIAA
West of Orkney	99	1d	West of Orkney RIAA
North Falls	78	1d	North Falls RIAA
Dogger Bank South (60%)	1,022	1d	Dogger Bank South RIAA
Dogger Bank South (100%)	1,646	1d	Dogger Bank South RIAA
Five Estuaries	40	1d	Five Estuaries RIAA
Ossian	110	1d	Ossian RIAA
The Project	527	1d	
All Projects Total (realistic-case)	11,146		
All Projects Total (worst-case)	11,770		

~~*Breeding Bio-season*~~

~~1659. The in-combination number of breeding adults attributed to FFC SPA at risk of displacement from OWFs, including Outer Dowsing, during the breeding bio-season is 8,672 (8671.8). The predicted consequent mortality, based on 70% displacement and 1% mortality, is 61 (60.7) breeding adults.~~

~~1660. Based on a citation population of 16,938 breeding adult gannets at FFC SPA and an annual background mortality of 1,372 breeding adults per annum, the addition of 61 displacement related mortalities would represent a 4.424% increase in baseline mortality, of which the Project contributes three (4.1) individuals, representing a 0.298% increase in baseline mortality.~~

~~1661. As the population of gannets has increased since the citation population count the potential impact on the population is more reasonably assessed against the latest population count undertaken in 2023, which was 30,466 breeding adults, with an annual baseline mortality of 2,468 breeding adults per annum. The addition of 61 mortalities would represent a 2.461% increase in baseline mortality, of which the Project contributes four (4.1) individuals, representing a 0.167% increase in baseline mortality.~~

~~*Non-breeding Bio-season*~~

~~1662. The in-combination number of individuals at risk of displacement from OWFs, including the Project, that have been apportioned to FFC SPA is 1,259 (1,259.1) individuals in the post-breeding migration bio-season, and 439 (438.9) individuals in the return migration bio-season.~~

~~1663. The predicted displacement consequent mortality, based on 70% displacement and 1% mortality, is nine (8.8) individuals in the post-breeding migration bio-season, and three (3.1) individuals in the return migration bio-season.~~

~~1664. Considering the potential impact to the FFC citation population during the post-breeding migration bio-season, the addition of nine individuals would represent a 0.642% increase in baseline mortality, of which the Project contributes less than one (0.2) mortality, representing a 0.007% increase in baseline mortality. During the return migration bio-season, the addition of three mortalities would represent a 0.224% increase in baseline mortality, of which the Project contributes less than one (0.1) mortality, representing a 0.001% increase in baseline mortality.~~

~~1665. Assessing the potential impact to the more recent FFC SMP population during the post-breeding migration bio-season, the addition of nine individuals would represent a 0.357% increase in baseline mortality, of which the Project contributes less than one (0.1) mortality, representing a 0.007% increase in baseline mortality. During the return migration bio-season, the addition of three mortalities would represent a 0.125% increase in baseline mortality, of which the Project contributes less than one (0.1) mortality, representing a 0.001% increase in baseline mortality.~~

Annual Total

~~1666.~~1818. As bio-season specific impacts could not be traced for certain projects, the in-combination displacement assessment for gannet at FFC SPA is based on annual impacts. The in-combination number of gannets predicted to be displaced from all OWFs, including the Project, is 11,145~~0,375~~ ~~(10,374.8)~~ individuals per annum. The predicted displacement consequent mortality, based on 70% displacement and 1% mortality, is 78~~73~~ (~~82.4~~78.0~~72.6~~) individuals.

~~1667.~~1819. Considering the potential impact to the FFC citation population, the addition of 78~~73~~ mortalities would represent a 5.687~~5.293~~% increase in baseline mortality~~, of which the Project contributes four (4.3) mortalities, representing a 0.008% increase in baseline mortality~~.

~~1668.~~ Assessing the potential impact to the more recent FFC SMP population, the addition of 78~~73~~ mortalities would represent a 3.162~~2.943~~% increase in baseline mortality. ~~, of which the Project only contributes four (4.3) mortalities, representing a 0.007% increase in baseline mortality.~~

1820. Though the in-combination impacts exceed a 1% increase in baseline mortality, the expected impacts are not expected to impact the integrity of the gannet feature at the FFC SPA. A full PVA analysis for the combined impacts of displacement and collision on the gannet feature of FFC SPA is provided in the combined collision and displacement assessment (Paragraph 1767~~1765~~).

~~1669. As presented in the PVA analysis for the Dudgeon and Sheringham Shoal extension project RIAA (Royal HaskoningDHV, 2022), a worst case scenario of 400 mortalities per annum (based on combined displacement and collision mortalities, and not incorporating macro-avoidance into collision estimates) would reduce population growth rate by up to 1.9% compared with the unimpacted scenario. Considering the FFC SPA, the gannet population is considered to be robust, with a population growth rate of 12% between 1985 and 2017. In comparison, the average annual growth rate of gannet colonies is 1.8% (based on over 90 years of data). The FFC gannet population is therefore considered robust enough to allow the conservation objective to sustain this level of mortality. Considering the impacts from displacement only resulting from the Project in-combination with other projects, the predicted annual mortality of 7873 individuals represents just 17.616.5% of the total number of individuals upon which this PVA analysis was based on. Based on this, the impacts resulting from displacement from the Project in-combination with other projects will not impact the integrity of the gannet feature of the FFC SPA.~~

~~1670. In addition to this conclusion, it should also be noted that the assessment is already considered precautionary in nature, based on mean peaks which overestimate the abundance of individuals present in the area throughout the whole season, while also not accounting for the fact that individuals are likely to have been double counted across multiple projects within similar areas, thus further over-inflating predicted impacts.~~

~~1671. Although the in-combination impacts resulting from displacement exceed a 1% increase in baseline mortality, given the evidence provided above, it is considered that the gannet population at FFC SPA will not decline as a result of impacts of displacement.~~

~~**1672. It is therefore concluded that the in-combination predicted gannet mortality due to displacement in the O&M phase would not adversely affect the integrity of the FFC SPA.**~~

Table 10-44~~10.43~~10-42~~10.36~~: In-combination displacement consequent mortalities for gannet at the FFC SPA.

~~Bio-season~~Scenario	Abundance of adults apportioned to the FFC SPA (array/WTG area plus 2km buffer)	Estimated increase in mortality (breeding adults per annum)		% increase in baseline mortality (citation count)		% increase in baseline mortality (recent count)	
		70% displacement, 1% mortality	60-80% displacement, 1% mortality	70% displacement, 1% mortality	60-80% displacement, 1% mortality	70% displacement, 1% mortality	60-80% displacement, 1% mortality
~~breeding~~Total projects (realistic-case)	11,145.6 ~~8676.6~~	78.0~~60.7~~	66.9 - 89.2~~52.0 – 69.4~~	5.687~~4.424~~	4.874 - 6.499~~3.795 – 5.059~~	3.162~~2.461~~	2.710 - 3.613~~2.109 – 2.812~~
Total projects (worst-case)	11,769.6	82.4	70.6 - 94.2	6.005	5.147 - 6.863	3.339	2.862 - 3.816
~~Post-breeding migration~~	~~1,259.1~~	~~8.8~~	~~7.5 – 10.1 – 9.0~~	~~0.642~~	~~0.550 – 0.733~~	~~0.357~~	~~0.306 – 0.408~~
~~Return migration~~	~~438.9~~	~~3.1~~	~~2.7 – 3.5~~	~~0.224~~	~~0.192 – 0.256~~	~~0.125~~	~~0.107 – 0.143~~
~~**Annual Total**~~	~~**10,374.8**~~	~~**72.6**~~	~~**62.2 – 82.9**~~	~~**5.293**~~	~~**4.536 – 6.049**~~	~~**2.934**~~	~~**2.514 – 3.353**~~

Table 10-45~~10.4410-4310.37~~: In-combination displacement matrix for gannet at the FFC SPA, with light blue shading representing the displacement and mortality range advocated for by ~~SNCB~~ANCBs, and dark blue representing the Applicant's approach.

Annual (2km Buffer)	Mortality Rate (%)												
Displaced (%)	1	2	5	10	20	30	40	50	60	70	80	90	100
10	11 ~~10~~	22 ~~21~~	56 ~~52~~	111 ~~104~~	223 ~~208~~	334 ~~311~~	446 ~~415~~	557 ~~519~~	669 ~~623~~	780 ~~726~~	892 ~~830~~	1,003 ~~934~~	1,115 ~~1,038~~
20	22 ~~21~~	45 ~~42~~	111 ~~104~~	223 ~~208~~	446 ~~415~~	669 ~~623~~	892 ~~830~~	1,115 ~~1,038~~	1,337 ~~1,245~~	1,560 ~~1,453~~	1,783 ~~1,660~~	2,006 ~~1,868~~	2,229 ~~2,075~~
30	33 ~~31~~	67 ~~62~~	167 ~~156~~	334 ~~311~~	669 ~~623~~	1,003 ~~934~~	1,337 ~~1,245~~	1,672 ~~1,556~~	2,006 ~~1,868~~	2,341 ~~2,179~~	2,675 ~~2,490~~	3,009 ~~2,801~~	3,344 ~~3,113~~
40	45 ~~42~~	89 ~~83~~	223 ~~208~~	446 ~~415~~	892 ~~830~~	1,337 ~~1,245~~	1,783 ~~1,660~~	2,229 ~~2,075~~	2,675 ~~2,490~~	3,121 ~~2,905~~	3,567 ~~3,320~~	4,012 ~~3,735~~	4,458 ~~4,150~~
50	56 ~~52~~	111 ~~104~~	279 ~~259~~	557 ~~519~~	1,115 ~~1,038~~	1,672 ~~1,556~~	2,229 ~~2,075~~	2,786 ~~2,594~~	3,344 ~~3,113~~	3,901 ~~3,631~~	4,458 ~~4,150~~	5,016 ~~4,669~~	5,573 ~~5,188~~
60	67 ~~62~~	134 ~~125~~	334 ~~311~~	669 ~~623~~	1,337 ~~1,245~~	2,006 ~~1,868~~	2,675 ~~2,490~~	3,344 ~~3,113~~	4,012 ~~3,735~~	4,681 ~~4,358~~	5,350 ~~4,980~~	6,019 ~~5,603~~	6,687 ~~6,225~~
70	78 ~~73~~	156 ~~145~~	390 ~~363~~	780 ~~726~~	1,560 ~~1,453~~	2,341 ~~2,179~~	3,121 ~~2,905~~	3,901 ~~3,631~~	4,681 ~~4,358~~	5,461 ~~5,084~~	6,242 ~~5,810~~	7,022 ~~6,536~~	7,802 ~~7,263~~
80	89 ~~83~~	178 ~~166~~	446 ~~415~~	892 ~~830~~	1,783 ~~1,660~~	2,675 ~~2,490~~	3,567 ~~3,320~~	4,458 ~~4,150~~	5,350 ~~4,980~~	6,242 ~~5,810~~	7,133 ~~6,640~~	8,025 ~~7,470~~	8,916 ~~8,300~~
90	100 ~~93~~	201 ~~187~~	502 ~~467~~	1,003 ~~934~~	2,006 ~~1,868~~	3,009 ~~2,801~~	4,012 ~~3,735~~	5,016 ~~4,669~~	6,019 ~~5,603~~	7,022 ~~6,536~~	8,025 ~~7,470~~	9,028 ~~8,404~~	10,031 ~~9,338~~
100	111 ~~104~~	223 ~~208~~	557 ~~519~~	1,115 ~~1,038~~	2,229 ~~2,075~~	3,344 ~~3,113~~	4,458 ~~4,150~~	5,573 ~~5,188~~	6,687 ~~6,225~~	7,802 ~~7,263~~	8,916 ~~8,300~~	10,031 ~~9,338~~	11,146 ~~10,375~~

Table 10-46~~10.4510-44~~: In-combination displacement matrix for gannet at the FFC SPA, with light blue shading representing the displacement and mortality range advocated for by ~~SNCB~~ANCBs, and dark blue representing Natural England's preferred approach.

Annual (2km Buffer)	Mortality Rate (%)												
Displaced (%)	1	2	5	10	20	30	40	50	60	70	80	90	100
10	12	24	59	118	235	353	471	588	706	824	942	1,059	1,177
20	24	47	118	235	471	706	942	1,177	1,412	1,648	1,883	2,119	2,354
30	35	71	177	353	706	1,059	1,412	1,765	2,119	2,472	2,825	3,178	3,531
40	47	94	235	471	942	1,412	1,883	2,354	2,825	3,295	3,766	4,237	4,708
50	59	118	294	588	1,177	1,765	2,354	2,942	3,531	4,119	4,708	5,296	5,885
60	71	141	353	706	1,412	2,119	2,825	3,531	4,237	4,943	5,649	6,356	7,062
70	82	165	412	824	1,648	2,472	3,295	4,119	4,943	5,767	6,591	7,415	8,239
80	94	188	471	942	1,883	2,825	3,766	4,708	5,649	6,591	7,533	8,474	9,416
90	106	212	530	1,059	2,119	3,178	4,237	5,296	6,356	7,415	8,474	9,533	10,593
100	118	235	588	1,177	2,354	3,531	4,708	5,885	7,062	8,239	9,416	10,593	11,770

10.3.2.2 Collision Risk

~~1673.~~1821. The potential for the Project in-combination with other projects to result in an AEoI resulting from collision impacts has been considered in relation to the following designated sites and the relevant features:

- Flamborough and Filey Coast SPA; gannet and kittiwake~~; and~~
- ~~North Norfolk Coast SPA; Sandwich tern.~~

~~1674.~~1822. An in-combination assessment for sandwich tern at the North Norfolk Coast SPA has not been carried out due to the low project impacts (0.23-0.38 individuals), and the fact that ~~Is this change to the~~ there is ~~only~~limited connectivity between the SPA and the Project (i.e. there is no connectivity, based upon MMFR, between the Project and the actual colonies, meaning that birds from the SPA are ~~highly~~ unlikely to occur ~~there~~within the ~~array~~ WTG area in large numbers). The Applicant notes that Natural England advices that the Project alone impact for lesser black-backed gull at Alde-ore Estuary SPA and Sandwich tern at NNC SPA are sufficiently low and therefore are screened out of in-combination assessment.

~~1675.~~1823. An overview of the screening process for collision impacts in the O&M phase is presented in Table 10.47~~Table 10.47Table 10.38~~ below. The sites that have been screened out are due to the assessment alone concluding a trivial and inconsequential level of effect that would be well within the error margins of the assessment, and therefore no potential for any contribution to an in-combination impact.

Table 10-47~~10.4710-4510.38~~: Summary of the sites and features considered for collision risk assessment during the O&M phase for the Project in-combination.

Site	Feature	Bio-season	Alone Impact Applicant (Natural England)	Screened In/Out
North Norfolk Coast SPA	Sandwich tern	Breeding and ~~-~~non-breeding	0.2 (0.4)	Out~~In~~
FFC SPA	Kittiwake	Breeding and ~~-~~non-breeding	15.6	In
	Gannet	Breeding and ~~-~~non-breeding	1.1	In
	Herring gull (assemblage feature)	Breeding and ~~-~~non-breedin~~g~~g	0.1 (0.2)	Out
Alde-Ore Estuary SPA	Lesser Black-backed Gull	Breeding and non-breeding	0.2	Out
Coquet Island	Sandwich tern	Non-breeding	0.0	Out
	Common tern	Non-breeding	0.0	Out
Farne Island SPA	Kittiwake	Breeding and non-breeding	0.4	Out
	Sandwich tern	Non-breeding	0.0	Out

Site	Feature	Bio-season	Alone Impact Applicant (Natural England)	Screened In/Out
Scottish sites				
Buchan Ness to Collieston Coast SPA	Kittiwake	Non-breeding	0.1	Out
Calf of Eday SPA	Kittiwake	Non-breeding	0.0	Out
Copinsay SPA	Kittiwake	Non-breeding	0.0	Out
East Caithness Cliffs SPA	Kittiwake	Non-breeding	0.4	Out
Fair Isle SPA	Kittiwake	Non-breeding	0.0	Out
Forth Islands (UK) SPA	Kittiwake; Gannet	Non-breeding	0.0	Out
Foula SPA	Kittiwake	Non-breeding	0.0	Out
Fowlsheugh SPA	Kittiwake	Non-breeding	0.1	Out
Hermaness, Saxa, Vord and Valla Field SPA	Kittiwake	Non-breeding	0.0	Out
Hoy SPA	Kittiwake	Non-breeding	0.0	Out
Marwick Head SPA	Kittiwake	Non-breeding	0.0	Out
North Caithness Cliffs SPA	Kittiwake	Non-breeding	0.1	Out
Noss SPA	Kittiwake	Non-breeding	0.0	Out
Rousay SPA	Kittiwake	Non-breeding	0.0	Out
St Abb's Head SPA	Kittiwake	Non-breeding	0.0	Out
Sumburgh Head SPA	Kittiwake	Non-breeding	0.0	Out
Troup, Pennan and Lion's Heads SPA	Kittiwake	Non-breeding	0.1	Out
West Westray	Kittiwake	Non-breeding	0.1	Out

~~1676.~~1824. The assessments provided within this RIAA for the remaining site and features to be assessed for collision risk in-combination include a number of assumptions that contribute to the predicted impacts and potential effects being considered overly precautionary, including:

- The population within other offshore windfarm array areas and/or buffers are likely to include non-breeding and migratory birds moving north and south during the months considered as being included in the breeding bio-season for this assessment;
- All sites being considered within the mean maximum foraging range is very precautionary, considering that many of offshore windfarm array areas and their buffers are beyond a reasonable distance to assume to be regularly used by screened gannet and kittiwake from the FFC SPA, and Sandwich tern from the North Norfolk Coast SPA; and
- Not accounting for additional non-breeding adults within the North Sea that contribute to the population within the offshore windfarms considered within this in-combination assessment throughout the year.

Flamborough and Filey Coast SPA - Kittiwake

~~1677.~~1825. Kittiwake has been screened in for the assessment of the O&M phase to assess the impacts from collision from the Project in-combination with other OWFs in relation to the conservation objectives for this species as a feature of the FFC SPA (presented in Section 9.3 and Document 7.2).

~~1678.~~1826. A range of proposed, consented, under-construction, and operational OWFs in UK waters in the North Sea and English Channel were screened in for the in-combination assessment, based on the potential for adverse effects from activities taking place at these sites in combination with the O&M of the Project. During the breeding season projects were screened in if they were within the mean-maximum foraging range (156.1km) plus 1SD (144.5km) of kittiwake from the FFC SPA based on data from Woodward et al. (2019). Since kittiwakes range further outside of the breeding season, consideration was also given to other project within the wider UK North Sea and English Channel BDMPS area during the return migration and post-breeding migration bio-seasons. Projects included within the in-combination assessment are presented in Table 10.48~~Table 10.39~~ below.

~~1679.~~1827. Collision numbers are derived from in-combination tables presented for the Natural England Offshore Ornithology Position for Sheringham Shoal and Dudgeon Offshore Windfarm Extension Projects Deadline 8 Submission ~~Sheringham Shoal and Dudgeon Offshore Windfarm Extension Projects Deadline 8 Apportioning and HRA Updates Technical Note~~ (~~Royal HaskoningDHV~~Natural England, 2023~~a~~). The majority of these values have been updated to reflect the updated (deterministic) avoidance rate of 99.2%, with the exception of Kentish Flats Extension and Methil where the avoidance rate used was not known, and therefore no adjustment was made.

~~1680.~~1828. The Round-Four Plan-level HRA concluded that an AEoI could not be ruled out for the kittiwake feature of FFC SPA. In addition, several projects have now compensated for kittiwake impacts at the FFC SPA; these projects have therefore been excluded by the Sheringham Shoal and Dudgeon Extension Projects as they are no longer considered relevant to the in-combination assessment. This approach is also adopted by the Project, although compensated impacts are presented as a separate scenario. Projects where impacts have been compensated for include Hornsea Three, Norfolk Boreas, Norfolk Vanguard, East Anglia One North, East Anglia Two and Hornsea Four, and Sheringham Shoal and Dudgeon Offshore Windfarm Extension Projects. ~~Numbers for Hornsea Four are already provided by the Sheringham Shoal and Dudgeon Extension Projects although for the other projects, numbers were taken from the East Anglia TWO and East Anglia ONE North Windfarms Deadline 13 Cumulative and In-combination Collision Risk and Displacement Update RIAA (MacArthur Green and Royal HaskoningDHV, 2021).~~ The following amendments were made to the values presented:

- Inclusion of values from the Green Volt RIAA (Royal HaskoningDHV, 2023b), West of Orkney RIAA (Xodus & MacArthur Green 2023), Berwick Bank RIAA (RPS and Royal HaskoningDHV, 2022), Five Estuaries ~~draft~~ RIAA (GoBe Consultants, 2023), North Falls RIAA (SSE Renewables and RWE, 2023), and Dogger Bank South ~~PEIR~~ RIAA (MacArthur Green 2023);

- The removal of collisions from Hornsea Three, Norfolk Boreas, Norfolk Vanguard, East Anglia One North, East Anglia Two and Hornsea Four following acceptance of compensation for kittiwake;
- Removal of Beatrice Demonstrator as the Project will be decommissioned by the time the Project is predicted to be operation; and
- Inclusion of values from the Project.

1829. Collision mortalities taken from Green Volt, West of Orkney and Berwick Bank are based on old avoidance rates (98.9%). Therefore, these values were adjusted to update to the 99.2% avoidance rate advocated for in the most recent Natural England guidance (Natural England, 2022) ~~accordingly~~ using the following equation:

$$\left[{}^{existing\ CRM\ values}/_{(1-0.989)}\right] \times (1-0.992)$$

~~1681.~~1830. ~~by dividing the existing CRM values by (1-0.989) and multiplying by (1-0.992) to update to the 99.2% avoidance rate advocated for in the most recent Natural England guidance (Natural England, 2022).~~ The~~is~~ adjustment was ~~also~~ made to the values for the 'Consented projects (compensation set to zero)' scenario, however the adjustment was not applied for the 'Consented projects' scenario, therefore presents a precautionary impact ~~from Hornsea Three, East Anglia ONE North, East Anglia Two, Norfolk Boreas and Norfolk Vanguard (i.e., compensated impacts for the separate scenario), as this adjustment is not presented in the East Anglia TWO and East Anglia ONE North Windfarms Deadline 13 Cumulative and In-combination Collision Risk and Displacement Update RIAA (MacArthur Green and Royal HaskoningDHV, 2021)~~.

~~Table 10.39: in-combination collision mortalities for kittiwake attributed to the FFC SPA.~~

~~Project~~	~~Seasonal population at risk of collision~~				~~Tier~~
	~~breeding~~	~~Post-breeding migration~~	~~Return Migration~~	~~Annual Total~~	
~~Beatrice~~	~~0.0~~	~~0.4~~	~~2.1~~	~~2.5~~	~~1a~~
~~Blyth Demonstration Site~~	~~0.0~~	~~0.1~~	~~0.1~~	~~0.1~~	~~1a~~
~~Dudgeon~~	~~-~~	~~-~~	~~-~~	~~0.0~~	~~1a~~
~~East Anglia One~~	~~0.0~~	~~6.3~~	~~2.5~~	~~8.7~~	~~1a~~
~~EOWDC~~	~~0.0~~	~~0.2~~	~~0.1~~	~~0.3~~	~~1a~~
~~Galloper~~	~~0.0~~	~~1.1~~	~~1.7~~	~~2.8~~	~~1a~~
~~Greater Gabbard~~	~~0.0~~	~~0.6~~	~~0.6~~	~~1.2~~	~~1a~~
~~Gunfleet Sands~~	~~-~~	~~-~~	~~-~~	~~0.0~~	~~1a~~
~~Hornsea Project One~~	~~26.5~~	~~2.2~~	~~1.1~~	~~29.8~~	~~1a~~
~~Humber Gateway~~	~~1.4~~	~~0.1~~	~~0.1~~	~~1.6~~	~~1a~~
~~Hywind~~	~~0.0~~	~~0.1~~	~~0.1~~	~~0.2~~	~~1a~~
~~Kentish Flats~~	~~0.0~~	~~0.1~~	~~0.1~~	~~0.1~~	~~1a~~
~~Kentish Flats Extension~~	~~0.0~~	~~0.0~~	~~0.2~~	~~0.2~~	~~1a~~
~~Kincardine~~	~~0.0~~	~~0.4~~	~~0.1~~	~~0.4~~	~~1a~~
~~Lincs~~	~~0.5~~	~~0.1~~	~~0.1~~	~~0.6~~	~~1a~~
~~Lynn & Inner Dowsing~~	~~-~~	~~-~~	~~-~~	~~0.0~~	~~1a~~
~~London Array~~	~~0.0~~	~~0.1~~	~~0.1~~	~~0.2~~	~~1a~~
~~Methil~~	~~0.0~~	~~0.0~~	~~0.0~~	~~0.0~~	~~1a~~
~~Race Bank~~	~~1.4~~	~~0.9~~	~~0.3~~	~~2.6~~	~~1a~~
~~Rampion~~	~~0.0~~	~~1.5~~	~~1.5~~	~~3.1~~	~~1a~~
~~Scroby Sands~~	~~-~~	~~-~~	~~-~~	~~0.0~~	~~1a~~
~~Sheringham Shoal~~	~~-~~	~~-~~	~~-~~	~~0.0~~	~~1a~~
~~Teesside~~	~~0.0~~	~~0.9~~	~~0.1~~	~~1.1~~	~~1a~~
~~Thanet~~	~~0.0~~	~~0.0~~	~~0.0~~	~~0.1~~	~~1a~~
~~Westermost Rough~~	~~0.1~~	~~0.0~~	~~0.0~~	~~0.1~~	~~1b~~

~~Project~~	~~Seasonal population at risk of collision~~				~~Tier~~
	~~breeding~~	~~Post-breeding migration~~	~~Return Migration~~	~~Annual Total~~	
~~Hornsea Project Two~~	~~9.7~~	~~0.4~~	~~0.1~~	~~10.2~~	~~1b~~
~~Moray East~~	~~0.0~~	~~0.1~~	~~1.0~~	~~1.1~~	~~1b~~
~~Neart na Gaoithe~~	~~0.0~~	~~2.2~~	~~0.2~~	~~2.5~~	~~1b~~
~~Triton Knoll~~	~~17.9~~	~~5.5~~	~~2.4~~	~~25.7~~	~~1b~~
~~Firth of Forth Alpha and Bravo~~	~~0.0~~	~~12.3~~	~~12.9~~	~~25.2~~	~~1c~~
~~East Anglia Three~~	~~0.0~~	~~2.7~~	~~2.0~~	~~4.7~~	~~1c~~
~~Dogger Bank A & B~~	~~40.6~~	~~5.3~~	~~15.5~~	~~61.3~~	~~1c~~
~~Dogger Bank C & Sofia~~	~~19.2~~	~~3.6~~	~~11.3~~	~~34.1~~	~~1c~~
~~Hornsea Three~~	~~72.0~~	~~2.0~~	~~1.0~~	~~0.0~~	~~1c~~
~~Inch Cape~~	~~0.0~~	~~8.8~~	~~3.3~~	~~12.1~~	~~1c~~
~~Moray West~~	~~0.0~~	~~0.9~~	~~0.4~~	~~1.3~~	~~1c~~
~~East Anglia ONE North~~	~~0.0~~	~~0.4~~	~~0.3~~	~~0.7~~	~~1c~~
~~East Anglia TWO~~	~~0.0~~	~~0.3~~	~~0.5~~	~~0.8~~	~~1d~~
~~Norfolk Boreas~~	~~11.4~~	~~1.7~~	~~0.9~~	~~14.0~~	~~1d~~
~~Norfolk Vanguard~~	~~18.7~~	~~0.9~~	~~1.4~~	~~21.0~~	~~1c~~
~~Hornsea Four~~	~~51.2~~	~~0.5~~	~~0.2~~	~~52.0~~	~~1c~~
~~DEP and SEP~~	~~6.1~~	~~0.2~~	~~0.1~~	~~6.4~~	~~1d~~
~~Berwick Bank~~	~~0.4~~	~~7.1~~	~~10.0~~	~~17.4~~	~~1d~~
~~Pentland floating~~	~~-~~	~~-~~	~~-~~	~~0.0~~	~~1d~~
~~Greenvolt~~	~~-~~	~~0.2~~	~~0.1~~	~~0.4~~	~~1d~~
~~West of Orkney~~	~~-~~	~~2.0~~	~~2.5~~	~~4.5~~	~~1d~~
~~Rampion 2~~	~~0.0~~	~~0.1~~	~~0.4~~	~~0.4~~	~~1d~~
~~Five Estaries (PEIR)~~	~~-~~	~~0.6~~	~~0.5~~	~~1.1~~	~~2~~
~~North Falls~~	~~6.3~~	~~0.5~~	~~1.0~~	~~7.8~~	~~2~~
~~Dogger Bank South~~	~~91.7~~	~~2.7~~	~~2.2~~	~~96.7~~	~~2~~
~~Total (without ODOW)~~	~~375.0~~	~~76.1~~	~~81.1~~	~~531.9~~	~~2~~

~~Project~~	~~Seasonal population at risk of collision~~				~~Tier~~
	~~breeding~~	~~Post-breeding migration~~	~~Return Migration~~	~~Annual Total~~	
~~Outer Dowsing~~	~~14.2~~	~~0.2~~	~~0.2~~	~~14.5~~	
~~All Projects Total~~	**~~389.2~~**	**~~76.2~~**	**~~81.3~~**	**~~546.5~~**	
~~All projects total without H3, H4 EA1N, EA2, NB & NV~~	**~~235.9~~**	**~~60.7~~**	**~~73.4~~**	**~~383.0~~**	

Table 10-48~~10.48~~~~10-46~~: in-combination collision mortalities for kittiwake attributed to the FFC SPA.

Project	Annual Total	Tier	Source
Consented projects (compensation set to zero)	292.0	1a – 1c	Natural England SEP&DEP Position Paper
Consented projects	394.0	1a – 1c	Natural England SEP&DEP Position Paper
Greenvolt	0.4	1c	Green Volt RIAA
Berwick Bank	17.4	1d	Berwick Bank RIAA
West of Orkney	4.5	1d	West of Orkney RIAA
North Falls	0.8	1d	North Falls RIAA
Dogger Bank South (53%)	99.6	1d	Dogger Bank South RIAA
Dogger Bank South (100%)	182.2	1d	Dogger Bank South RIAA
Ossian	3.4	1d	Ossian RIAA
Five Estuaries	0.8	1d	Five Estuaries RIAA
The Project	15.5	1d	
All Projects Total (realistic-case)	434.3		
All projects total (worst-case)	618.9		

~~*Breeding Bio-season*~~

~~1682. The number of kittiwakes from FFC SPA predicted to be subject to collision resultant mortality from the Project in-combination with all other projects in the breeding bio-season is 236 (235.9) breeding adults.~~

~~1683. When considering the potential impact of this loss to the FFC SPA citation population, this prediction of 236 breeding adults suffering collision consequent mortality would represent a 1.815% increase in baseline mortality, of which the Project alone contributes an increase of 14 (14.2) predicted breeding adult mortalities equating to an increase of 0.110% in baseline mortality.~~

~~1684. Considering the impact on the more recent FFC SMP count, the loss of 236 breeding adults would represent a 1.813% increase in baseline mortality, of which the Project alone contributes an increase of 14 (14.2) predicted breeding adult mortalities equating to an increase of 0.109% in baseline mortality.~~

~~*Non-Breeding Bio-season*~~

~~1685. The number of kittiwakes from FFC SPA predicted to be subject to collision resultant mortality from the Project and all other projects in the return migration bio-season is 73 (73.4) adults, and in the post-breeding migration bio-season is 61 (60.7) adults.~~

~~1686. When considering the potential impact of this loss to the FFC SPA citation population, the addition of 73.4 adult mortalities would represent a 0.564% in baseline mortality in the return migration bio-season, of which the Project alone contributes an increase of less than one (0.2) predicted breeding adult mortality equating to an increase of 0.001% in baseline mortality. During the post-breeding migration bio-season, the addition of 61 adult mortalities would represent a 0.467% increase in baseline mortality, of which the Project alone contributes an increase of less than one (0.2) predicted adult mortality equating to an increase of 0.001% in baseline mortality.~~

~~1687. When considering the potential impact of this loss to the more recent 2017 colony count for kittiwake, then the addition of 73 breeding adult mortalities in the return migration bio-season would represent a 0.564% increase in baseline mortality, of which the Project alone contributes an increase of less than one (0.2) predicted breeding adult mortality equating to an increase of 0.001% in baseline mortality. During the post-breeding migration bio-season the addition of 61 adult mortalities would represent a 0.467% increase in baseline mortality, of which the Project alone contributes an increase of less than one (0.2) predicted breeding adult mortality equating to an increase of 0.001% in baseline mortality.~~

Annual Total

1831. As bio-season specific impacts could not be traced for certain projects, the in-combination assessment for kittiwake at FFC SPA is based on annual impacts. The total number of kittiwakes from FFC SPA predicted to be subject to collision mortality per annum from the Project in-combination with other projects is 434 (434.3)~~383 (383.0)~~. The predicted baseline mortality increase of the citation population is estimated at 3.341~~2.946~~% across all bio-seasons per annum, of which the Project alone contributes an increase of 16~~5~~ (15~~4~~.5) predicted breeding adult mortalities equating to an increase of 0.120~~69~~% in baseline mortality per annum. The predicted consequent baseline mortality increase ~~of~~ in relation to the more recent 2017 colony count is estimated as 3.337~~2.942~~% across all bio-seasons per annum, of which the Project alone contributes an increase of 16~~5~~ (15~~4~~.5) predicted breeding adult mortalities, equating to a 0.119~~112~~% increase in baseline mortality per annum across all bio-seasons. Given the in-combination increase in baseline mortality exceeds 1%, further consideration to these impacts is provided below.

Under ~~Natural England's preferred approach~~the worst case approach, including all compensated projects and assuming the Natural England scenario for the Dogger Bank South Project, the total number of kittiwakes from FFC SPA predicted to be subject to collision mortality per annum from the Project in-combination with other projects is 619 (618.9). The predicted baseline mortality increase of the citation population is estimated at 4.761% across all bio-seasons per annum. The predicted consequent baseline mortality increase of the more recent 2017 colony count is estimated as 4.755% across all bio-seasons per annum.

~~1688.~~1832.

~~1689.~~1833. PVA has been undertaken on a range of scenarios for kittiwake at the FFC SPA (Appendix 7.1.2). For each scenario, CGR and CPS have been presented from the model outputs, measuring the changes in annual growth rate and population size respectively at the end of the impacted period relative to a baseline scenario. The impact on adult survival is also presented, calculated as the number of mortalities divided by the relevant population size used in the PVA analysis (in this case, the 2022 FFC count).

~~1690.~~1834. The kittiwake population trend at the FFC SPA has varied considerably over the last ~70 years, increasing from 17,600 pairs in 1952 to 85,395 pairs in 1979, with the population then declining to the current level of 44,574 pairs in 2022. However, it should be noted that the peak count of 85,395 pairs in 1979 is widely disputed (e.g., Coulson 2011 and 2017; McArthur Green 2015), with recorders at the time considered to have recorded the number of individuals birds present as opposed to breeding birds, inflating the recorded population count to double what it should be. Taking this into consideration, the population decrease would be significantly less than recorded between 1979 and current counts. Considering more recent trends, an annual increase of ~2% is seen between 2000 and 2017 despite multiple OWFs being operational in the North Sea, though it is also acknowledged the population has shown a decline of 13% between 2017 and 2022.

~~1691.~~1835. The worst-case scenario assessed includes predicted collisions from all projects, including those which have compensated for (or will provide compensation for) their impacts on kittiwake at the FFC SPA. Based on this scenario, the predicted impact is a 0.8~~7~~% reduction in annual population growth rate. However, as these compensated impacts are no longer considered ecologically relevant, the realistic worst-case scenario is the in-combination total excluding these projects, which represents a 0.6~~5~~% reduction in annual population growth rate. This level of impact is considered to be indistinguishable from natural fluctuations in the population; impacts from OWFs are also expected to be minimal compared to other current pressures (e.g., sandeel availability).

Table 10-49~~10.48~~~~10-47~~~~10.40~~: PVA outputs for breeding adult kittiwakes at the Flamborough and Filey Coast SPA from collision impacts.

PVA Scenario	Annual mortality	Impact on survival	Medan CGR	Median CPS
Project alone	15.5~~14.5~~	<0.001	1.000~~1.000~~	0.993~~0.993~~
Project in-combination (excluding compensated projects)	434.3~~383.0~~	0.005~~0.004~~	0.994~~0.995~~	0.812~~0.832~~
Project in-combination (including compensated projects)	618.9~~531.9~~	0.007~~0.006~~	0.992~~0.993~~	0.743~~0.775~~

~~1692.~~**1836. Based on PVA results, the Project cannot rule out a conclusion of adverse effect on integrity in-combination to the kittiwake feature at FFC SPA during the O&M phase when including compensated projects (increasing the total impacts to 619 ~~532~~ birds per annum under the worst-case scenario). However, it should be noted that the in-combination impacts are estimated at 434~~383~~ birds per annum, reduced from previous totals following incorporation of kittiwake compensation for multiple projects. Under this scenario the difference in growth rate between the impacted and baseline scenarios is 0.6~~5~~%, which is unlikely to adversely affect the FFC SPA kittiwake population, particularly when viewed alongside the precaution in the assessment. For example, if published species-specific avoidance rates were used rather then those of the species group, or a reasonably precautionary level of density dependence incorporated into the PVA assessment then a conclusion of no AEoI is highly probable.**

~~1693.~~1837. In the case that the SoS draws a conclusion of AEoI, the Project has developed a derogation case for kittiwake at FFC SPA (document reference 7.5). Alongside this, a number of options for Project alone and strategic level compensation measures have been developed and are presented within document 7.7.1 Kittiwake Compensation Plan.

Table 10-50~~10.50~~~~10-48~~: Summary of impacts on the kittiwake population at FFC SPA.

Scenario	Annual Mortality	% increase in baseline mortality (citation count)	% increase in baseline mortality (recent count)
Total realistic case	434.3	3.341	3.337
Total worst case	618.9	4.761	4.755

Flamborough and Filey Coast SPA - gannets

~~1694.~~1838. Gannet has been screened in for the assessment of the O&M phase to assess the impacts from collision risk from the Project in-combination with other OWFs in relation to the conservation objectives for this species as a feature of the FFC SPA (presented in Section 9.3).

~~1695.~~1839. A range of proposed, consented, under-construction, and operational OWFs in UK waters in the North Sea and English Channel were screened in for the in-combination assessment, based on the potential for adverse effects from activities taking place at these sites in combination with the O&M of the Project. During the breeding season projects were screened in if they were within the mean-maximum foraging range (315.2km) plus 1SD (194.2km) of gannet from the FFC SPA based on data from Woodward et al. (2019). Since gannets range further outside of the breeding season, consideration was also given to other project within the wider UK North Sea and English Channel BDMPS area during the return migration and post-breeding migration bio-seasons. Projects included within the in-combination assessment are presented in Table 10.51 ~~STYLEREF 1 \s SEQ Table * ARABIC \s 1 Table 10.41~~ below.

~~1696.~~1840. Collision numbers were derived from in-combination tables presented for the Natural England Offshore Ornithology Position for Sheringham Shoal and Dudgeon Offshore Windfarm Extension Projects Deadline 8 Submission ~~Sheringham Shoal and Dudgeon Offshore Windfarm Extension Projects Deadline 8 Apportioning and HRA Updates Technical Note~~ (~~Royal HaskoningDHV~~Natural England, 2023~~a~~). The majority of these values have been updated to reflect the updated avoidance rate of 99.2% and 70% macro-avoidance , with the exception of Lynn and Inner Dowsing and Methil where the avoidance rate used was now known, and therefore no adjustment was made. The following amendments were made to the values presented:

- Inclusion of values from the Green Volt RIAA (Royal HaskoningDHV, 2023b), West of Orkney RIAA (Xodus & MacArthur Green 2023), Berwick Bank RIAA (RPS and Royal HaskoningDHV, 2022), Five Estuaries ~~draft~~ RIAA (GoBe Consultants, 202~~3~~4), North Falls RIAA (SSE Renewables and RWE, 2024~~3~~), and Dogger Bank South ~~PEIR~~ (MacArthur Green 2024~~3~~); Inclusion of values from the Berwick Bank draft RIAA (RPS and Royal HaskoningDHV, 2022);
- Removal of Beatrice Demonstrator as the Project will be decommissioned by the time Outer Dowsing is predicted to be operation; and
- Inclusion of values from the Project, corrected for 70% macro-avoidance as per Natural England guidance (Parker et al., 2022c).

~~Table 10.41: in-combination collision mortalities for gannet attributed to the FFC SPA.~~

~~Project~~	~~Seasonal population at risk of collision~~				~~Tier~~
	~~Breeding~~	~~Post-breeding migration~~	~~Return migration~~	~~Annual total~~	
~~Beatrice demo~~	~~0.0~~	~~0.0~~	~~0.0~~	~~0.0~~	~~1a~~
~~Beatrice~~	~~0.0~~	~~0.5~~	~~0.1~~	~~0.6~~	~~1a~~
~~Blyth Demonstration Site~~	~~0.0~~	~~0.0~~	~~0.0~~	~~0.1~~	~~1a~~
~~Dudgeon~~	~~4.9~~	~~0.4~~	~~0.3~~	~~5.5~~	~~1a~~
~~East Anglia One~~	~~0.7~~	~~1.4~~	~~0.1~~	~~2.2~~	~~1a~~
~~EOWDC~~	~~0.0~~	~~0.1~~	~~0.0~~	~~0.1~~	~~1a~~
~~Galloper~~	~~0.0~~	~~0.3~~	~~0.2~~	~~0.5~~	~~1a~~
~~Greater Gabbard~~	~~0.0~~	~~0.1~~	~~0.1~~	~~0.2~~	~~1a~~
~~Gunfleet Sands~~	~~-~~	~~-~~	~~-~~	~~0.0~~	~~1a~~
~~Hornsea Project One~~	~~2.5~~	~~0.3~~	~~0.3~~	~~3.1~~	~~1a~~
~~Humber Gateway~~	~~0.4~~	~~0.0~~	~~0.0~~	~~0.4~~	~~1a~~
~~Hywind 2 Demonstration~~	~~0.0~~	~~0.0~~	~~0.0~~	~~0.0~~	~~1a~~
~~Kentish Flats~~	~~0.0~~	~~0.0~~	~~0.0~~	~~0.0~~	~~1a~~
~~Kentish Flats Extension~~	~~-~~	~~-~~	~~-~~	~~0.0~~	~~1a~~
~~Kincardine~~	~~0.0~~	~~0.0~~	~~0.0~~	~~0.0~~	~~1a~~
~~Lincs~~	~~0.5~~	~~0.0~~	~~0.0~~	~~0.5~~	~~1a~~
~~Lynn & Inner Dowsing~~	~~0.1~~	~~0.0~~	~~0.0~~	~~0.1~~	~~1a~~
~~London Array~~	~~0.0~~	~~0.0~~	~~0.0~~	~~0.0~~	~~1a~~
~~Methil~~	~~0.0~~	~~0.0~~	~~0.0~~	~~0.0~~	~~1a~~
~~Race Bank~~	~~7.4~~	~~0.1~~	~~0.1~~	~~7.5~~	~~1a~~
~~Rampion~~	~~0.0~~	~~0.7~~	~~0.0~~	~~0.7~~	~~1a~~
~~Scroby Sands~~	~~-~~	~~-~~	~~-~~	~~0.0~~	~~1a~~
~~Sheringham Shoal~~	~~3.1~~	~~0.0~~	~~0.0~~	~~3.1~~	~~1a~~
~~Teesside~~	~~0.5~~	~~0.0~~	~~0.0~~	~~0.5~~	~~1a~~
~~Thanet~~	~~0.0~~	~~0.0~~	~~0.0~~	~~0.0~~	~~1b~~
~~Westermost Rough~~	~~0.0~~	~~0.0~~	~~0.0~~	~~0.0~~	~~1b~~

~~Project~~	~~Seasonal population at risk of collision~~				~~Tier~~
	~~Breeding~~	~~Post-breeding migration~~	~~Return migration~~	~~Annual total~~	
~~Hornsea Project Two~~	~~1.5~~	~~0.1~~	~~0.1~~	~~1.7~~	~~1b~~
~~Moray East~~	~~0.0~~	~~0.4~~	~~0.1~~	~~0.5~~	~~1b~~
~~Neart na Gaoithe~~	~~0.0~~	~~0.5~~	~~0.3~~	~~0.8~~	~~1b~~
~~Triton Knoll~~	~~5.8~~	~~0.7~~	~~0.4~~	~~6.9~~	~~1b~~
~~Firth of Forth Alpha and Bravo~~	~~0.0~~	~~0.5~~	~~0.9~~	~~1.4~~	~~1b~~
~~Dogger Bank A & B~~	~~8.9~~	~~0.9~~	~~0.7~~	~~10.5~~	~~1c~~
~~Dogger Bank C & Sofia~~	~~1.6~~	~~0.1~~	~~0.1~~	~~1.9~~	~~1c~~
~~East Anglia Three~~	~~1.3~~	~~0.3~~	~~0.1~~	~~1.8~~	~~1c~~
~~Hornsea Three~~	~~1.3~~	~~0.0~~	~~0.0~~	~~1.5~~	~~1c~~
~~Inch Cape~~	~~0.0~~	~~0.3~~	~~0.1~~	~~0.4~~	~~1c~~
~~Moray West~~	~~0.0~~	~~0.0~~	~~0.0~~	~~0.0~~	~~1c~~
~~East Anglia ONE North~~	~~2.7~~	~~0.1~~	~~0.0~~	~~2.8~~	~~1c~~
~~East Anglia TWO~~	~~2.7~~	~~0.2~~	~~0.0~~	~~3.0~~	~~1c~~
~~Hornsea Four~~	~~3.1~~	~~0.1~~	~~0.0~~	~~3.2~~	~~1c~~
~~Norfolk Boreas~~	~~3.1~~	~~0.1~~	~~0.1~~	~~3.3~~	~~1c~~
~~Norfolk Vanguard~~	~~1.8~~	~~0.2~~	~~0.1~~	~~2.1~~	~~1c~~
~~DEP and SEP~~	~~0.3~~	~~0.0~~	~~0.0~~	~~0.3~~	~~1d~~
~~Rampion 2~~	~~0.0~~	~~0.0~~	~~0.0~~	~~0.1~~	~~1d~~
~~Greenvolt~~	~~0.1~~	~~0.0~~	~~0.0~~	~~0.1~~	~~2~~
~~Pentland~~	~~-~~	~~-~~	~~-~~	~~0.0~~	~~2~~
~~West of Orkney~~	~~-~~	~~0.1~~	~~0.1~~	~~0.2~~	~~2~~
~~Berwick Bank~~	~~0.4~~	~~0.1~~	~~0.0~~	~~0.5~~	~~2~~
~~North Falls~~	~~0.7~~	~~0.1~~	~~0.1~~	~~0.9~~	~~2~~
~~Dogger Bank South~~	~~1.6~~	~~0.2~~	~~0.0~~	~~1.7~~	~~2~~
~~Five Estaries (PEIR)~~	~~1.3~~	~~0.1~~	~~0.0~~	~~1.4~~	~~2~~
~~Total (without ODOW)~~	~~58.3~~	~~9.0~~	~~4.5~~	~~72.2~~	
~~Outer Dowsing~~	~~1.0~~	~~0.1~~	~~0.0~~	~~1.0~~	

~~Project~~	~~Seasonal population at risk of collision~~				~~Tier~~
	~~Breeding~~	~~Post-breeding migration~~	~~Return migration~~	~~Annual total~~	
~~All Projects Total~~	~~59.3~~	~~9.0~~	~~4.5~~	~~73.2~~	

Table 10-51~~10.50~~~~10-49~~: in-combination collision mortalities for gannet attributed to the FFC SPA.

Project	Annual total	Tier	Source
Consented projects	67.5	1a – 1c	Natural England SEP&DEP Position Paper
Greenvolt	0.1	1c	Green Volt RIAA
Berwick Bank	0.5	1d	Berwick Bank RIAA
West of Orkney	0.2	1d	West of Orkney RIAA
North Falls	0.5	1d	North Falls RIAA
Dogger Bank South (60%)	5.1	1d	Dogger Bank South RIAA
Dogger Bank South (100%)	8.2	1d	Dogger Bank South RIAA
Five Estuaries	0.1	1d	Five Estuaries RIAA
Ossian	1.4	1d	Ossian RIAA
The Project	1.1	1d	
Total projects (realistic-case)	76.6		
Total projects (worst-case)	79.7		

~~*Breeding Bio-season*~~

~~1697. The number of gannets from FFC SPA predicted to be subject to collision resultant mortality from the Project in-combination with all other projects in the breeding bio-season is 59 (59.3) breeding adults.~~

~~1698. When considering the potential impact of this loss to the FFC SPA citation population, this prediction of 59 breeding adults suffering collision mortality would represent a 4.320% increase in baseline mortality, of which the Project alone contributes an increase of one (1.0) predicted breeding adult mortality equating to an increase of 0.045% in baseline mortality.~~

~~1699. Considering the impact on the more recent FFC SMP count, the loss of 59 breeding adults would represent a 2.732% increase in baseline mortality, of which the Project alone contributes an increase of one (1.0) predicted breeding adult mortality equating to an increase of 0.039% in baseline mortality.~~

~~*Non-Breeding Bio-season*~~

~~1700. The number of gannets from FFC SPA predicted to be subject to collision resultant mortality, from the Project and all other projects, in the return migration bio-season is four (4.4) adults and in the post-breeding migration bio-season is nine (9.0) adults.~~

~~1701. When considering the potential impact of this loss to the FFC SPA citation population, the addition of four adult mortalities would represent a 0.327% in baseline mortality in the return migration bio-season, of which the Project alone contributes an increase of less than one (0.02) predicted breeding adult mortality equating to an increase of 0.001% in baseline mortality. During the post-breeding migration bio-season, the addition of nine adult mortalities would represent a 0.657% increase in baseline mortality, of which the Project alone contributes an increase of less than one (0.1) predicted breeding adult mortality equating to an increase of 0.001% in baseline mortality.~~

~~1702. When considering the potential impact of this loss to the more recent 2023 colony count for gannet, then the addition of four breeding adult mortalities in the return migration bio-season would represent a 0.206% increase in baseline mortality, of which the Project alone contributes an increase of less than one (0.02) predicted breeding adult mortality equating to an increase of 0.001%% in baseline mortality. During the post-breeding migration bio-season the addition of nine adult mortalities would represent a 0.415% increase in baseline mortality, of which the Project alone contributes an increase of less than one (0.01) predicted breeding adult mortality equating to an increase of 0.001% in baseline mortality.~~

Annual Total

1841. As bio-season specific impacts could not be traced for certain projects, the in-combination assessment for gannet at FFC SPA is based on annual impacts. The total number of gannets from FFC SPA predicted to be subject to collision mortality per annum from the Project in-combination with other projects is 77 (76.6~~3 (73.2~~). The predicted consequent baseline mortality increase of the citation population is estimated at 5.583~~335~~% across all bio-seasons per annum, of which the Project alone contributes an increase of one (1.0~~1~~) predicted breeding adult mortalities equating to an increase of 0.078~~23~~% in baseline mortality per annum. The predicted consequent baseline mortality increase of the more recent 2023 colony count is estimated at 3.104~~374~~% across all bio-seasons per annum, of which the Project alone contributes an increase of one (1.0~~1~~) predicted breeding adult mortalities equating to an increase of 0.043~~20~~% in baseline mortality per annum across all bio-seasons.

Under Natural England's preferred approach, the total number of gannets from FFC SPA predicted to be subject to collision mortality per annum from the Project in-combination with other projects is 80 (79.7). The predicted consequent baseline mortality increase of the citation population is estimated at 5.810% across all bio-seasons per annum, of which the Project alone contributes an increase of one (1.0) predicted breeding adult mortalities equating to an increase of 0.078% in baseline mortality per annum. The predicted consequent baseline mortality increase of the more recent 2023 colony count is estimated at 3.230% across all bio-seasons per annum, of which the Project alone contributes an increase of one (1.0) predicted breeding adult mortalities equating to an increase of 0.043% in baseline mortality per annum across all bio-seasons.

~~1703.~~ Although the percentage increase in baseline mortality exceeds 1%, this conclusion is considered ~~highly over-~~precautionary. ~~Recent advice from Natural England has advocated the application of macro-avoidance correction factors to CRM outputs of 0.65 to 0.85. Applying macro-avoidance to in-combination impacts for all projects presented in Table 10.41 would reduce the total estimated collision mortality to between 50 (49.5) and 116 (115.5) mortalities per annum. This would represent a 3.609% - 8.421% increase in baseline mortality for the citation population, and a 2.282% - 5.325% increase in baseline mortality for the more recent SMP count.~~

1842. ~~Additionally, t~~The contribution from the Project alone is considered to make no material contribution to changes in population or mortality representing less than two gannet mortalities and less than a <0.1% increase in baseline mortality for both the citation and FFC SMP populations. Therefore, this Project is not considered to have a measurable impact from collision impact on the gannet feature of the FFC SPA.

~~1704.~~

1843. Taking into consideration the now accepted macro-avoidance behaviour, the increasing population trend at the colony and UK scale and the no material contribution from the Project, it is therefore concluded that the in-combination impact predicted gannet mortality due to collision in the O&M phase would not adversely impact the conservation objectives of the gannet feature of the FFC SPA.

Scenario	Total mortality	% increase in baseline mortality (citation count)	% increase in baseline mortality (recent count)
~~Realistic-case~~Realistic-case	76.6	5.580	3.102
Worst-case	79.7	5.807	3.228

10.3.2.3 Combined displacement and collision

Flamborough and Filey Coast SPA – Gannet

~~1705.~~1844. As gannet has been assessed for the impacts of both displacement and collision, consideration is also given to the combined total of these impacts in relation to the conservation objectives of the gannet feature of the FFC SPA (Document 7.2).

~~1706.~~1845. The predicted annual in-combination impacts are collated from information presented in the displacement in-combination analysis (Table 10.43) ~~Table 10.35)~~ and collision in-combination analysis (Table 10.51~~Table 10.50Table 10.41~~). Total mortalities resulting from these impacts are presented in Table 10.52~~Table 10.52Table 10.42~~ below.

Table 10-52~~10.5210-5010.42~~: Annual in-combination combined collision and displacement mortality of gannet at the FFC SPA, incorporating ~~0%, 65%, 70% and 85%~~ macro-avoidance. The Applicant's preferred approach aligns with the Natural England approach in using 70% displacement and 1% mortality.

Scenario	Displacement mortality	Collision mortality	Combined mortality
~~Raslistic~~Realistic-case			
~~Annual total (60% displacement, 1% morality)~~	~~62.2~~	~~76.673.2~~	~~143.4135.5~~
Annual total (70% displacement, 1% morality)	78.0~~72.6~~	76.6~~73.2~~	154.6~~145.8~~
~~Annual total (80% displacement, 1% morality)~~	~~83.0~~	~~76.673.2~~	~~165.7156.2~~
~~w~~Worst-case			
~~Annual total (60% displacement, 1% morality)~~		~~79.7~~	~~150.3~~
Annual total (70% displacement, 1% morality)	82.4	79.7	162.1
~~Annual total (80% displacement, 1% morality)~~		~~79.7~~	~~162.1~~

~~1707.~~1846. The total number of predicted gannet mortalities as a result of both collision and displacement is 155 (154.6)~~46 (145.8)~~ individuals per annum. Based on a citation population of 16,938 breeding adults and a baseline mortality of 1,372 individuals per annum, the addition of 155~~146~~ mortalities would represent a 0.113~~10.629~~% increase in baseline mortality. Considering the more recent 2023 population count of 30,466 breeding adults and a baseline mortality of 2,468 individuals per annum, the addition of 155~~146~~ mortalities would represent a 0.063~~5.910~~% increase in baseline mortality. Of this, the Project contributes a total of 4.8~~5.4~~ gannets representing an increase in baseline mortality of 0.347~~294~~% and 0.193%~~09~~ at the citation and 2023 populations respectively which is deemed to make no material contribution to any change in population or mortality rates. However, as the predicted impacts exceed a 1% increase in baseline mortality, further consideration is given to this impact in the form of PVA analysis.

~~1708.~~1847. PVA (Appendix 7.1.2) was undertaken on a range of scenarios for both the Project alone and in-combination with other projects. For each scenario, CGR and CPS have been presented from the model outputs, measuring the changes in annual growth rate and population size respectively at the end of the impacted period of 35 years relative to a baseline scenario. The impact on adult survival is also presented, calculated as the number of mortalities divided by the relevant population size used in the PVA analysis (in this case, the 2023 FFC count).

~~1709.~~1848. ~~10.4.217~~ The gannet population at the FFC SPA has shown considerable growth, rising from 9 pairs in 1960 to 15,233 in 2023. An overview of annual growth rates from available count data is presented in below.

Table 10-53~~10.5310-5110.43~~: Mean annual percentage population growth rates for gannets at the FFC SPA

Year	FFC SPA colony count (AON)	Mean annual percentage population growth rate since previous count
1960	9	-
1969	21	8.7%
1987	780	22.2%
1999	2,552	11.2%
2008	6,386	11.0%
2017	13,392	8.6%
2022	13,125	0.5%
2023	15,233	16.1%

~~1710.~~1849. Considering the worst-case scenario ~~(80% displacement, 1% mortality)~~ the annual reduction in population growth rate is predicted as 0.6%. Based on the annual population growth rates presented in this reduction is not expected to result in a reversal of population trends, especially considering the most recent population count showed a 16.1% increase in population compared with 2022. This is particularly notable considering that multiple OWFs are operational within the North Sea, yet the FFC population has still shown one of the largest annual percentage increases since colony creation.

~~1711.~~1850. Natural England responses to the Norfolk Boreas Project stated that they believe the annual growth rate of the FFC SPA is “likely to do better than a 1.3% annual growth rate in the foreseeable future” (Natural England, 2020), and based on trends presented above it is expected that trends may greatly exceed this. Considering this and the population trends presented in Table 10.53~~Table 10.43~~, predicted cumulative impacts are expected to be indistinguishable from natural fluctuations in the population.

Table 10-54~~10.5310-5210.44~~: PVA outputs for gannet at the FFC SPA incorporating combined collision and displacement impacts.

PVA Scenario	Annual mortality	Impact on survival	Medan CGR	Median CPS
Project alone				
~~60% displacement, 1% mortality~~	~~4.7~~	~~<0.001~~	~~1.000~~	~~0.993~~
70% displacement, 1% mortality	4.8~~5.4~~	<0.001	1.000~~1.000~~	0.993~~0.993~~
~~80% displacement, 1% mortality~~	~~5.9~~	~~<0.001~~	~~1.000~~	~~0.992~~
Project in-combination				
~~60% displacement, 1% mortality~~	~~135.5~~	~~0.004~~	~~0.995~~	~~0.827~~
70% displacement, 1% mortality (low)	154.6~~145.8~~	0.005	0.994	0.806~~0.815~~
~~8~~70% displacement, 1% mortality (high)	162.1~~156.2~~	0.005	0.994	0.806~~0.804~~

~~1712.~~1851. **It is therefore concluded that the in-combination predicted gannet mortality due to combined displacement and collision in the O&M phase would not adversely affect the integrity of the gannet feature of the FFC SPA.**

10.3.3 Other factors contributing towards changing bird populations

~~1713.~~1852. Seabird populations fluctuate in response to a variety of factors, such as changes in prey availability, predation, or reduction of breeding habitat. Stochastic events such as winter storms can also impact numbers of birds.

~~1714.~~1853. The closure of the North Sea industrial sandeel fishery in 2024 is likely to have positive impacts on breeding seabirds, in particular those for which sandeels form a significant part of the diet, such as kittiwake, Sandwich tern, guillemot, razorbill, and puffin. Productivity in North Sea colonies in kittiwake and auks is linked to sandeel abundance (Régnier et al., 2024) and sandeels can be the most abundant prey when local abundance allows (e.g. Anderson *et al*., 2014). Even in scenarios where sandeel abundance is reduced through other means (e.g. suboptimal winter sea temperatures), the impact this has on birds is reduced when sandeel abundance is modelled without the impact of commercial fisheries (Daunt *et al*., 2008).

~~1715.~~1854. Assuming survival rates are unchanged, increased productivity is likely to lead to recovering, or increasing populations at many North Sea colonies. Increased productivity may also help to grow colonies through increased recruitment from other colonies, as seabirds use public information (i.e., information gleaned on breeding success, among other factors) to inform recruitment.

~~1716.~~1855. The likelihood of increases associated with the closure of the North Sea sandeel fishery gives context to the populations used in the assessments and the conclusions regarding the potential impacts of the Project. Increasing colony sizes will mean relatively reduced impacts at the colony level. Likewise, increased growth rates will mean that impact related reductions in growth are less likely to translate into decreases in population.

10.4 Migratory Fish

1856. The Migratory Fish in-combination assessment has been updated February 2025 to consider:

- The introduction of an Offshore Restricted Build Area (ORBA) over the northern section of the Project array area;
- The removal of the northern section of the offshore Export Cable Corridor (ECC);
- A revised in-combination assessment to reflect changes to project status or capture any new plans, projects or activities which have been progressed since the point of the Application; and
- Minor errata including those previously identified by interested parties.

~~1717.~~1857. The potential for LSE in-combination from the Project with regard to migratory fish is summarised in Section 7.2, with the in-combination assessment presented below.

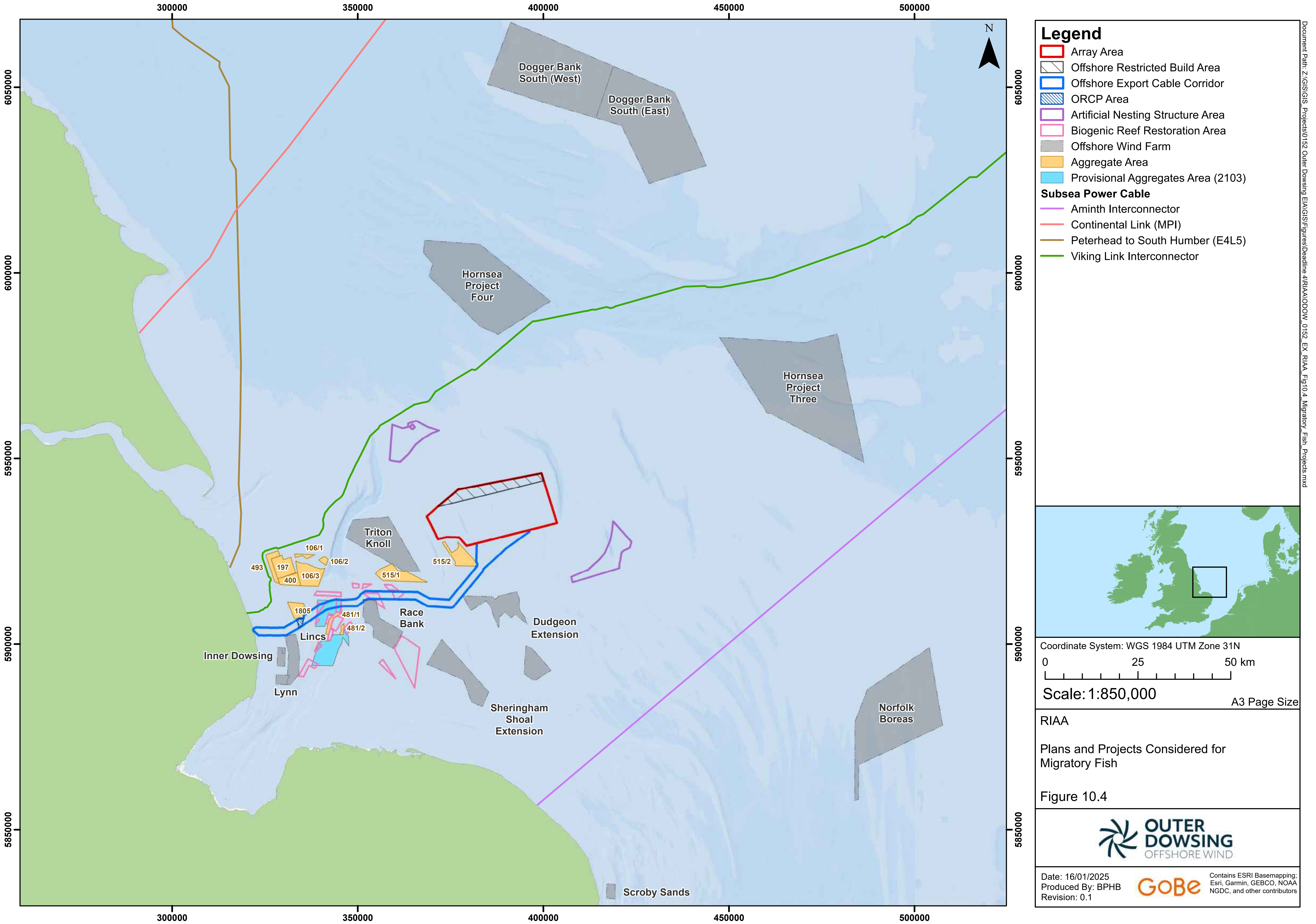
~~1718.~~1858. Information to inform the Project alone assessment for migratory fish is provided in Section 9.4 which assesses the effects of underwater noise on the identified site (Humber Estuary SAC) during construction, decommissioning, operation, and maintenance.

~~1719.~~1859. Table 7.8 highlights the Projects which have been screened in for the in-combination assessment for migratory fish, these can be summarised into four main types of projects:

- Offshore windfarms - both planned and consented;
- Aggregate and disposal areas;
- Oil and gas platforms; and
- Cable projects.

~~1720.~~1860. Figure 10.4 shows the location of the Projects considered in-combination for the fish and shellfish assessments.

~~1721.~~1861. Underwater noise is the only impact that has been screened in for the Project alone assessment (and concluded no AEoI); however several other effects were identified at screening which were not considered to have any effect from the Project alone. Based on the distance from the Project to the Humber Estuary SAC (~~53.1km~~54.4km to the array and WTG area, 18.9~~5~~km to the offshore ECC, and 17.1km to the onshore ECC), it is considered that there is no pathway for effect for any of the effects considered aside from underwater noise. **Therefore, these effects are not assessed in-combination, with no in-combination AEoI assumed for these effects.**



RIAA

Plans and Projects Considered for Migratory Fish

Figure 10.4

10.4.1 Construction and decommissioning

~~1722.~~1862. The potential for an AEoI in-combination as a result of effects on migratory fish during construction and decommissioning relates to the site and effects listed above. As for the AA alone, the potential for LSE during decommissioning would be similar to, and potentially less than, those outlined in the construction phase.

10.4.1.1 Underwater Noise

~~1723.~~1863. The potential for an AEoI in-combination as a result of underwater noise on migratory fish during construction and decommissioning relates to the following designated site and the relevant features. The potential for LSE during decommissioning would be similar to, and potentially less than, those outlined in the construction phase:

- Humber Estuary SAC (sea lamprey and river lamprey).

~~1724.~~1864. Of the Projects identified in Table 7.8 above, those with the potential for an in-combination effect with the Project with respect to underwater noise are limited to those with potential for a temporal overlap of the construction phases (specifically piling or, if known, UXO or seismic surveys).

~~1725.~~1865. Timeframes for decommissioning are not certain for most projects and therefore an assessment of the potential for an in-combination effect during decommissioning cannot be made at this time. However, it can be concluded that the potential for an effect during the decommissioning phase would be less than that during construction and would in any case be assessed in line with the regulatory requirements at the time.

~~1726.~~1866. As highlighted in the assessment of AEoI for the Project alone, there are a number of potential sources of underwater noise associated with the construction of an OWF. Comment on these for the purposes of the in-combination assessment is provided below:

- Percussive piling - to be carried through to the assessment for projects screened in in-combination;
- UXO clearance - planned and licensed UXO activity associated with projects screened in is included (where that information is in the public domain); and
- Geophysical and seismic survey -planned geophysical/seismic survey included within the screening range (where that information is in the public domain).

~~1727.~~1867. It is of note that vessel disturbance is considered separately, as is operational noise.

~~1728.~~1868. The potential for underwater noise to result during construction of the Project, together with the sensitivity of sea and river lamprey to such noise, has been discussed in Section 9.4 as part of the Project alone assessment, with that information not repeated here.

~~1729.~~1869. The assessment of the in-combination effects is made for both sea lamprey and river lamprey together as they are the same sensitivity group (Group 1), and both the effects and conclusions are the same for both species at the site.

Potential for an in-combination effect on sea lamprey and river lamprey from underwater noise

~~1730.~~1870. It is considered that assessing underwater noise in-combination impacts on sea lamprey within 100km of the Project is considered a highly precautionary buffer upon which to include projects within the area. However, if in-combination effects on sea and river lamprey were to occur, the activities presenting the highest risk are pile driving activities during the construction phase of OWFs. Specifically, based on the screening range and the timeline of projects this would include the following projects:

- Norfolk Boreas;
- Hornsea Project Three;
- Hornsea Project Four;
- Sheringham Shoal Extension;
- Dudgeon Extension;
- Dogger Bank South (East); and
- Dogger Bank South (West).

~~1731.~~1871. It is considered that in-combination risks of mortality or potential mortal injury or recoverable injury of sea lamprey and river lamprey from piling noise would not be expected to occur as a result of the Project and the Projects listed above due to the small range within which potential injury effects would be expected (i.e., predicted to occur within < 100m of piling activity). Given that the distances between the OWF projects are larger than the mortality and injurious impact ranges from piling (the closest project, Dudgeon Extension, is approximately 13km away), there is no overlap of injurious impacts considered. Due to the small impact ranges for mortality or injurious impacts, it is reasonable to conclude that very low numbers of sea and river lamprey that would be associated with the site will be exposed to the impact even when at sea, including as a result of in-combination effects. Therefore, in-combination risks of injurious impacts are not expected to manifest at levels that could compromise the extent, distribution, structure, and function of the habitats, structure and function of the species, supporting processes, or the population and distribution of the species.

~~1732.~~ With respect to TTS impacts, it is considered that in-combination risks from piling noise would not be expected to occur as a result of the Project and the Projects listed above due to the range within which potential injury effects would be expected (i.e., predicted to occur within 10km of piling activity). Given that the distances between the OWF projects are larger than the injury impact ranges from piling (the closest project, Dudgeon Extension, is approximately 13km away), there is no overlap of TTS impacts considered. Due to the small impact ranges for TTS, it is reasonable to conclude that very low numbers of sea and river lamprey that would be associated with the site will be exposed to the impact even when at sea, including as a result of in-combination effects. Therefore, in-combination risks of TTS impacts are not expected to manifest at levels that could compromise the extent, distribution, structure, and function of the habitats, structure and function of the species, supporting processes, or the population and distribution of the species.

~~1733.~~1872. With regard to the in-combination behavioural effects associated with underwater noise as a result of Norfolk Boreas, Hornsea Project Three, Hornsea Project Four, Sheringham Shoal Extension, Dudgeon Extension and the Project, the assessment considers all phases of the Projects that overlap either temporally or spatially with the proposed works. As with the alone assessment for sea lamprey and river lamprey presented in Section 9.4, the in-combination assessment of whether behavioural changes could cause an AEoI on the Humber Estuary SAC focuses on whether in-combination impacts could compromise the maintenance of the size of the site-specific lamprey populations.

~~1734.~~1873. Norfolk Boreas OWF (Vattenfall, 2019), Hornsea Project Three OWF (Ørsted, 2018), Hornsea Project Four OWF (Ørsted, 2021), and Sheringham Shoal and Dudgeon OWF Extensions (Equinor, 2022) all concluded within their HRAs that they would have no effects alone or in-combination with the Humber Estuary SAC based on the distances the Project(s) and the site.

~~1735.~~1874. Behavioural effects on sea lamprey and river lamprey as a result of piling noise are predicted to be dependent on the nature of the receptors, with larger impact ranges predicted for fish with a swim bladder compared to those without. Lamprey do not have a swim bladder, so therefore are not considered to have high sensitivity to underwater noise and therefore behavioural effects are anticipated to be limited. Between piling events, fish may resume normal behaviour and distribution, as evidenced by work of McCauley et al. (2000) which showed that fish returned to normal behavioural patterns within 14 to 30 minutes after the cessation of seismic airgun firing. Therefore, due to the long distances between projects, and between projects and the site, alongside the reduced sensitivity of the species, the noted behavioural response, and recovery from noise impacts, it is considered that in-combination behavioural impacts are not expected to manifest at levels that could compromise the extent, distribution, structure, and function of the habitats, structure and function of the species, supporting processes, or the population and distribution of the species.

~~1736.~~1875. **Therefore, it is concluded that there is no AEoI to the conservation objectives for the Humber Estuary SAC from the Project in-combination with identified plans and projects and therefore, subject to natural change, the populations of sea and river lamprey will be maintained in the long-term with respect to underwater noise associated with the O&M phase.**

10.4.2 O&M

10.4.2.1 Underwater Noise

~~1737.~~1876. The potential for an AEoI in-combination as a result of underwater noise on migratory fish during O&M relates to the following designated site and the relevant features:

- Humber Estuary SAC (sea lamprey and river lamprey).

~~1738.~~1877. Underwater noise levels during the operational phase are predicted to be considerably lower than those of the construction phase, being limited to noise from operational turbines and maintenance vessel traffic. The sources for operation noise are described within Section 9.4.

~~1739.~~1878. The assessment in-combination is made for both sea lamprey and river lamprey together as the effects and conclusions are the same for both species and at the site.

Potential for an in-combination effect on sea lamprey and river lamprey from underwater noise

~~1740.~~1879. It is considered that assessing underwater noise in-combination impacts on sea and river lamprey within 100km of the Project is considered a highly precautionary buffer upon which to include projects within the area. Specifically, based on the screening range and the timeline of projects this would include the following projects:

- Norfolk Boreas;
- Hornsea Project Three;
- Hornsea Project Four;
- Sheringham Shoal Extension;
- Dudgeon Extension;
- Dogger Bank South (East); and
- Dogger Bank South (West).

~~1741.~~1880. It is considered that in-combination risks of mortality or potential mortal injury or recoverable injury of mortality of sea lamprey and river lamprey from piling noise would not be expected to occur as a result of the Project and the Projects listed above due to the small range within which potential injury effects would be expected (i.e., predicted to occur within a few meters of each turbine). Given that the distances between the OWF projects are larger than the injury impact ranges from operation (the closest project of those considered, Dungeon Extension, is approximately 13km away), there is no overlap of injurious impacts considered. Due to the small impact ranges for injurious impacts, it is reasonable to conclude that very low numbers of sea and river lamprey that would be associated with the site will be exposed to the impact even what at sea, including as a result of in-combination effects. Therefore, in-combination risks of injurious impacts are not expected to manifest at levels that could compromise the extent, distribution, structure, and function of the habitats, structure and function of the species, supporting processes, or the population and distribution of the species.

~~1742.~~1881. With respect to TTS impacts, it is considered that in-combination risks from operational noise would not be expected to occur as a result of the Project and the Projects listed above due to the range within which potential injury effects would be expected (i.e., predicted to occur within a few meters of each turbine). Given that the distances between the OWF projects are larger than the injury impact ranges from operation (the closest project, Dungeon Extension, is approximately 13km away), there is no overlap of TTS impacts considered. Due to the small impact ranges for TTS, it is reasonable to conclude that very low numbers of sea and river lamprey that would be associated with the site will be exposed to the impact even when at sea, including as a result of in-combination effects. Therefore, in-combination risks of TTS impacts are not expected to manifest at levels that could compromise the extent, distribution, structure, and function of the habitats, structure and function of the species, supporting processes, or the population and distribution of the species.

~~1743.~~1882. With regard to the in-combination behavioural effects associated with underwater noise as a result of Norfolk Boreas, Hornsea Project Three, Hornsea Project Four, Sheringham Shoal Extension, Dudgeon Extension and the Project, the assessment considers all phases of the Projects that overlap either temporally or spatially with the proposed works. As with the alone assessment for sea lamprey and river lamprey presented in Section 9.4, the in-combination assessment of whether and behavioural changes could cause an AEoI on the Humber Estuary SAC focuses on whether in-combination impacts could compromise the maintenance of the size of the site-specific lamprey populations.

~~1744.~~1883. Norfolk Boreas OWF (Vattenfall, 2019), Hornsea Project Three OWF (Ørsted, 2018), Hornsea Project Four OWF (Ørsted, 2021), and Sheringham Shoal and Dudgeon OWF Extensions (Equinor, 2022) all concluded within their HRAs that they would have no effects alone or in-combination with the Humber Estuary SAC based on the distances the Project(s) and the site.

~~1745.~~1884. Additionally, studies of very low frequency sound (similar to that produced by the operation of turbines) have indicated that consistent deterrence from the source is only likely to occur at particle accelerations equivalent to a free-field sound pressure level of 160dB re 1µPa (RMS) (Sand et al., 2001). This is higher than the noise levels reported in the open literature for operational windfarms measured at a number of ranges, all within a few hundred metres of the turbine (Nedwell et al., 2007a; Edwards et al., 2007; Betke et al., 2004, see also Wahlberg and Westerberg, 2005 and Madsen et al., 2006). The particle acceleration resulting from an operational wind turbine has also been measured by Sigray et al., (2011) with the resultant levels being considered too low to be of concern for behavioural reactions from fish. Furthermore, the particle acceleration levels measured at 10m from the turbine were comparable with hearing thresholds. Whilst limited, the available data provides an indicator that operational wind turbines are unlikely to result in disturbance of fish except within very close proximity of the turbine structure, as postulated by Wahlberg and Westerberg (2005). Considering the operational turbine noise of the windfarm and any associated service vessels, the ambient noise levels within the site would be expected to be lower than those present in the vicinity of nearby shipping lanes.

~~1746.~~1885. Therefore, due to the conclusions from other projects, the distances between projects, and between projects and the site, alongside the noted noise levels generated by turbines and the lack of response from fish, it is considered that in-combination behavioural impacts are not expected to manifest at levels that could compromise the extent, distribution, structure, and function of the habitats, structure and function of the species, supporting processes, or the population and distribution of the species.

~~1747.~~1886. Therefore, **it is concluded that there is no AEoI to the conservation objectives for the Humber Estuary SAC from the Project in-combination with identified plans and projects and therefore, subject to natural change, the populations of sea and river lamprey will be maintained in the long-term with respect to underwater noise associated with the O&M phase.**

10.5 Onshore Ecology and Ornithology

~~1748.~~1887. The HRA Screening report identified relevant NSIP and major development projects (as defined by the Town and Country Planning (Development Management Procedure) Order 2015) to be included within the in-combination assessment as detailed within Table 10.55~~Table 10.45~~. Smaller developments do not need consideration as they are too small to exert an effect on the qualifying interest features of the identified designated sites. Major development projects included in the assessment are:

- The winning and working of minerals or the use of land for mineral-working deposits;
- Waste development;
- The provision of dwellinghouses, where:
  - The number of dwellinghouses to be provided is ten or more; or

- The development is to be carried out on a site having an area of 0.5 hectares or more.

- The provision of a building or buildings where the floor space to be created by the development is 1,000 m^2 or more; or Development carried out on a site having an area of 1 hectare or more.

~~1749.~~1888. ~~Two~~Five additional major projects have been identified~~-~~, the proposed National Grid Substation at Weston Marsh, ~~and~~ Plant-based Protein Facility at Surfleet Bank,~~-~~ Viking CCS Pipeline, and Eastern Green Link 3 and 4, which have been included in Table 10.55~~Table 10.45~~.

Table 10-55~~10.5410-5310.45~~: Major development applications considered within the onshore in-combination assessment

Code	Development type	Project	Status (at Feb 2024)	Details
Lincolnshire County Council				
1	Minerals 9km W of Humber Estuary SPA and Ramsar	EIA/36/22 (Lincolnshire)	EIA required	Manby Airfield, Manby. **Proposal** - For an anaerobic digestor and fertiliser production plant.
North Lincolnshire District Council				
2	Housing 8km S of Humber Estuary SPA and Ramsar	PA/2020/554	Appeal allowed	Land between 57-71 Brigg Road, Messingham, DN17 3QX. Application for approval of reserved matters, appearance, landscaping, layout & scale, pursuant to outline application PA/2020/554 for 99 dwellings
3	Housing 5km SE of Humber Estuary SPA and Ramsar	PA/2022/1628	Approved with Conditions	Land south of Moorwell Road, Yaddlethorpe, Bottesford. Application for approval of reserved matters (appearance, landscaping, layout and scale) pursuant to outline application PA/2019/1782 dated 03/04/2020 for a residential development of up to 200 dwellings.
4	Housing 15km SE of Humber Estuary	PA/2022/1408	Appeal allowed	Land rear of Southdown House, Grayingham Road, Kirton in Lindsey, DN21 4EL.

Code	Development type	Project	Status (at Feb 2024)	Details
				Outline planning permission for a residential development of up to 28 dwellings.
5	Housing 13km S of Humber Estuary	PA/2022/1307	Approval of reserved matters – not yet determined	Land off Applefields, Wrawby. Application for approval of reserved matters (appearance, landscaping, layout and scale) pursuant to outline application PA/2017/674 dated 13/09/2019 for 22 dwellings.
6	Housing 8km W of Humber Estuary	PA/2022/628	Split Decision	Hybrid application comprising full planning permission to erect 32 dwellings and outline planning permission for 85 dwellings.
7	Housing 3km SE of Humber Estuary	PA/SCR/2022/1	EIA not required	Land off Burringham Road. EIA screening request relating to the erection of 599 dwellings.
8	100m from Humber Estuary	PA/2022/77	Not yet determined	Planning permission to erect 28 dwellings
9	2.5km S of Humber Estuary	PA/2021/2151	Appeal allowed	Outline planning permission for a residential development of up to 390 dwellings. Land west of Brigg Road and south of Horkstow Road, Barton upon Humber.
NE Lincolnshire District Council				
10	3.5km W of Humber Estuary	DM/1028/20/NMA	Non-Material Amendment - Accepted	Non Material Amendment following application DM/0651/19/REM (Reserved matters application for the erection of 50 dwellings.

Code	Development type	Project	Status (at Feb 2024)	Details
				Land At Larkspur Avenue Larkspur Avenue Healing North East Lincolnshire.
East Lindsey District Council				
11	500m W of Greater Wash	S/153/01314/22	EIA not required	Residential development of up to 522 dwellings. Land on the north side of Church Lane, Skegness.
12	13km NW of Wash	S/169/02610/21	EIA not required	Braybrook House, Main Road, Stickney, Boston, Lincolnshire, PE22 8AY. Outline erection of a foodhall/shop, 4 no. industrial units and 50 no. residential dwellings.
Boston Borough Council				
13	2km N of Wash	B/22/0370	Not Yet Determined	41, Church Green Road, Fishtoft. Proposed residential development of 41 affordable dwellings.
14	2km N of Wash	B/22/0366	Not Yet Determined	Erection of 74 dwellings. Land North of Slippery Gowt Lane, Boston.
15	3km NW of Wash	B/21/0413	Not Yet Determined	Re-plan and re-design of the housing layout within phases 2 & 3 (154 dwellings) on parts of the site previously approved under B/18/0039 (for the erection of up to 195 dwellings); including provision of 13 additional units (to create a combined total of 208 dwellings). Land at Middlegate Road West, Frampton.

Code	Development type	Project	Status (at Feb 2024)	Details
16	3.5km N of Wash	B/21/0475	Favourable with conditions	Outline application for the erection of 35 no. dwellings. Land north of Old Main Road, Old Leake, Boston, PE22 9HR.
17	3.5km N of Wash	B/21/0349	Favourable with conditions	Development of up to 135 dwellings of affordable housing. Land at Toot Lane, Boston.
South Holland District Council				
18	1km W of Wash	PE-00049-22	EIA Screening - confirmed	Request for EIA scoping opinion in respect of proposed wind turbine and solar development. Land north and south of Main Road and east of Dawsmere Road, Gedney Drove End.
Kings Lynn and West Norfolk Council				
19	1km E of Wash	22/00929/FM	Awaiting decision	Development of 61 housing with care apartments, 39 care ready bungalows and 60 residential dwellings together with community facilities and services and associated landscaping, highway works and associated infrastructure. Land S of Hunstanton Commercial Park and E of Kings Lynn Road, Hunstanton, Norfolk.
20	11km SW of Wash	22/00768/OM	Application Permitted	Outline Application: Proposed Residential Development of up to 40 Dwellings.

Code	Development type	Project	Status (at Feb 2024)	Details
				KGB Transport 44 St Johns Road, Tilney St Lawrence, Norfolk, PE34 4QJ.
21	3.5km S of Wash	22/00111/F	Application Permitted	Variation of Condition 1 attached to Planning Permission 17/01632/RMM: Residential development for 40 dwellings. Fosters Sports Ground, Clenchwarton, Kings Lynn, Norfolk, PE34 4BP.
North Norfolk Council				
22	13km S of Greater Wash	PF/21/1990	Pending consideration (July 2021)	Construction of 38 residential dwellings with associated infrastructure and landscaping. Land Off Norwich Road, Corpusty, Norfolk.
23	1km S of Greater Wash	PF/19/1028	Pending Consideration (June 2019)	Erection of 30 residential dwellings. Land At Back Lane, Roughton.
East Riding of Yorkshire Council				
34	1.2km N of Humber Estuary	22/04002/STPLF	Pending decision	Erection of 54 dwellings. Land south and east Of Dovecote Tranby Park, Jenny Brough Lane, Hessle.
35	2km N of Humber Estuary	22/03861/STPLF	Pending consideration	Erection of 166 dwellings. Land north east Of 6 Broadacre Park, Brough.
36	300m N of Humber Estuary	21/03132/STPLF	Pending decision	Erection of 119 dwellings

Code	Development type	Project	Status (at Feb 2024)	Details
				Land west of Blasket Road, Ferriby High Road, North Ferriby.
37	1.6km N of Humber Estuary	22/03465/STOUT	Application refused	Outline - Erection of up to 120 dwellings. Land and premises at Common Lane, Welton.
38	10km N of Humber Estuary	22/01208/STPLF	Application approved	Construction of solar photovoltaic development. Land north, east And west Of Carr Plantation, Ferry Road, Wawne.
39	2.5km N of Humber Estuary	23/00760/STPLFE	Pending consideration	Installation and operation of a Solar Farm. Land south and west Of Froghall Farm, Wyton Road, Preston.
40	8 km N of Humber Estuary	22/02775/STPLF	Pending consideration	Construction of a 49.99MW Solar Farm. Land West Of Benningholme Grange Farm, Kidhill Lane, Benningholme.
Additional major projects identified				
41	6 km SW of The Wash	N/A	Pre-scoping	National Grid Substation at Weston Marsh
42	6 km W of The Wash	H17-1097-23	Undecided	Naylor Farms, Land East of Surfleet Bank
43	Overlapping with Humber Estuary SPA and Ramsar	EN070008	Pre-examination (Jul'24)	Viking CCS Pipeline
44	Eastern Green Link 3		Scoping	A high voltage subsea cable between Peterhead in Aberdeenshire and the Lincolnshire in England (a part of The Great Grid Upgrade).
45	Eastern Green Link 4		Scoping	A high voltage subsea cable between Westfield in Aberdeenshire and the

Code	Development type	Project	Status (at Feb 2024)	Details
				Lincolnshire in England (a part of The Great Grid Upgrade).

~~1750.~~1889. Local plans of the following nearby locations which have been screened in were reviewed to assess the potential of allocations being 'major developments' for the in-combination assessment:

- East Lindsey District Council;
- South-East Lincolnshire; and
- Kings Lynn and West Norfolk.

~~1751.~~1890. Details of the allocations identified are provided in Table 10.56~~Table 10.46~~.

Table 10-56~~10.55~~~~10-54~~~~10.46~~: Review of local plans and allocations of ‘major development’ size for inclusion in in-combination assessment

Reference	Local plan	Allocation type	Approximate distance and direction from the nearest designated site	Approximate distance and direction from the onshore Order Limits
24 - Holbeach Food Enterprise Zone	SE Lincs	Employment	11km W	6km SE
25 - Kirton Distribution Park	SE Lincs	Employment	4km NW	3km NW
26 - Lincs Gateway, Spalding	SE Lincs	Employment	13km SW	5km SW
27 - Clay Lake, Splading	SE Lincs	Employment	13km SW	5km SW
28 - Boston Sou006	SE Lincs	Sustainable Urban Extension	4km N	3.5km N
29 - Boston Wes002	SE Lincs	Sustainable Urban Extension	5km N	4.5km N
30 - Spalding Vernatts	SE Lincs	Sustainable Urban Extension	13km SW	5km SW
31 - Holbeach West	SE Lincs	Sustainable Urban Extension	8km S	6km S
32 - Boston Distributor Road	SE Lincs	Highways	5km N	4.5km N
33 - Spalding Western Relief Road	SE Lincs	Highways	13km SW	5km SW

10.5.1 Construction and decommissioning

~~1752.~~1891. The potential for undermining conservation objectives from the project alone during decommissioning is *de minimus*, as the habitats that have been identified as most sensitive (those in use by SAC, SPA and Ramsar site features) are located away from the OnSS, where the majority of decommissioning activity will take place. Moreover, none of the identified projects are expected to be undertaking decommissioning at a similar time to the Project. Based primarily on the location of the OnSS, there will be no AEoI of the designated sites identified due to decommissioning.

~~1753.~~1892. An assessment of the potential for AEoI was undertaken, considering whether construction of the Project was likely to occur at the same time as, or in succession with, the identified projects and based on the location of those projects (refer to Table 10.57~~Table 10.47~~).

Table 10-57~~10.5610-5510.47~~: Major development applications considered within the onshore in-combination assessment

Project	Potential for in-combination effect Y/N	Project Details
BAEF	Y	South of Boston, by The Haven. The application involves the construction of a 102MWe gross (80MWe exportable) energy from waste facility with light weight aggregates facility, wharf, waste reception and storage facility and grid connection. DCO granted on 6 July 2023.
Heckington Fen Solar Park	N	DCO application submitted in 2023 DCO granted on 6 July 2023. Located 17km north-west of the Project, to the west of Boston.
Transition to Integrated Gas and Renewable Energy (TIGRE) Project 1	N	Located entirely offshore, more than 12nm. Gas fired power station connecting into an offshore substation.
Triton Knoll Electrical System	N	The works, which commenced in September 2018, involved laying 57km of 220kV underground cable from the project's landfall location near Anderby Creek to the newly constructed Triton Knoll Onshore Substation near Bicker Fen. Completed October 2021.
TKOWF	N	Offshore construction commenced in January 2020, 20 miles off the coast of Lincolnshire. Turbine commissioning was successfully completed in January 2022.
Hornsea Project Four	Y – Humber Estuary only	DCO granted in July 2023. Onshore cable route in East Yorks.
Hornsea Project Three	N	Offshore windfarm. Has received DCO.
Hornsea Project Two	N	Operational offshore windfarm.
Hornsea Project One	N	Operational offshore windfarm.
Able Marine Energy Park	N	320 ha of developable land and 1300m of new deep water quays, specifically designed for the offshore wind sector. On the south bank of the Humber Estuary. DCO issued in 2013 and site is operational.
Able Marine Energy Park – Material Change 1	N	To move an area (referred to as "Mitigation Area A" in the 2014 Order) proposed for ecological mitigation to a new site. Change granted.

Project	Potential for in-combination effect Y/N	Project Details
Able Marine Energy Park – Material Change 2	N	To alter the alignment of the quay, removing the specialist berth at the southern end of the quay and setting back the quay line at the northern end, creating a barge berth. The Application also seeks changes to the 2014 Order to allow amendments to dredging and sediment disposal patterns arising from the new quay alignment, and the option of a more efficient construction methodology, identified during the design process. Proposed changes have been authorised.
South Humber Bank Energy Centre	N	The construction and operation of an energy from waste plant of up to 95 megawatts gross capacity. DCO granted in 2021. The project website advises that construction of SHBEC will commence as early as 2022. The construction phase is expected to last for approximately 36 months, with the EfW power station entering operation in 2025.
A160-A180 Port of Immingham Improvement	N	The project would widen the existing single carriageway section of the A160 to dual carriageway. Granted in 2015.
Dogger Bank South Offshore Windfarms (East and West)	Y – Humber Estuary only	Offshore of East Yorkshire. Onshore study area north of Hull. The application is expected in April – June 2024.
Humber Low Carbon Pipelines	N	New onshore pipeline infrastructure to transport the captured carbon emissions from the region's industrial emitters for safe storage in the North Sea, and enable industries to fuel-switch from fossil fuels to low-carbon hydrogen. The application was withdrawn in January 2024.
North Killingholme Power Project	N	The proposal is for a new thermal generating station that will operate either as a Combined Cycle Gas Turbine (CCGT) plant or as an Integrated Gasification Combined Cycle (IGCC) plant, with a total electrical output of up to 470Mwe. Granted in 2014.

Project	Potential for in-combination effect Y/N	Project Details
River Humber Gas Pipeline Replacement Project	N	The replacement of a natural gas transmission pipeline, housed within a tunnel beneath the Humber Estuary commencing approximately 2 miles north east of Goxhill, North Lincolnshire, terminating approximately 1 mile south east of Paull, East Riding of Yorkshire. Decided 2016.
A63 Castle Street Improvement Hull	N	The Scheme comprises improvements to approximately 1.5km of the A63 and connecting side roads in Hull between Ropery Street and the Market Place/Queen Street junction. Granted in 2020.
Medworth Energy from Waste Combined Heat and Power (CHP) Facility	N	An Energy from Waste combined heat and power facility with a maximum gross capacity of 58MW. Examination in 2024. Located ~24km from the Project and 16km from the Wash SPA and Ramsar.
1 – Planning application	N	Minerals site at EIA stage. Located 9km west of Humber Estuary SPA and Ramsar.
2 – Planning application	N	Housing scheme at consented – appeal allowed. Located 8km south of the Humber Estuary SPA and Ramsar.
3 – Planning application	N	Housing scheme at application stage. Located 5km south-east of the Humber Estuary.
4 – Planning application	N	Housing scheme consented – appeal allowed. Located 15km south-east of Humber Estuary.
5 – Planning application	N	Housing scheme at determination of reserved matters stage. Located 13km south of the Humber Estuary SPA and Ramsar.
6 – Planning application	N	Housing scheme – approved Located 8km south of the Humber Estuary SPA and Ramsar.
7 – Planning application	Y	Housing scheme of up to 599 dwellings at EIA screening stage. Located 3km south-east of Humber Estuary.

Project	Potential for in-combination effect Y/N	Project Details
8 – Planning application	Y	Housing scheme (28 dwellings) at determination stage. Located 100m from Humber Estuary.
9 – Planning application	Y	Housing scheme (390 dwellings) consented – appeal allowed. Located 2.5km south of Humber Estuary.
10 – Planning application	N	Housing scheme – approved. 3.5km west of Humber Estuary.
11 – Planning application	Y	Housing scheme - EIA not required (522 dwellings). Located 500 m from the Greater Wash.
12 – Planning application	N	Housing scheme - EIA not required (50 dwellings). 13km west of The Wash.
13 – Planning application	N	Housing scheme at determination stage (50 dwellings). 13km west of The Wash.
14 – Planning application	Y	Housing scheme at determination stage (74 dwellings). 2km north of The Wash (at Boston).
15 – Planning application	Y	Housing scheme at determination stage (208 dwellings). 3km north-west of The Wash.
16 – Planning application	Y	Housing scheme at outline application stage (35 dwellings). 3.5km north of The Wash.
17 – Planning application	Y	Housing scheme (135 dwellings) – favourable with conditions. 3.5km north of The Wash.
18 – Planning application	Y	Wind and solar project – EIA stage. Located 1km west of The Wash.
19 – Planning application	Y	Housing scheme at determination stage (160 dwellings). 1km east of The Wash.
20 – Planning application	N	Housing scheme permitted (40 dwellings). 11km south-west of The Wash.

Project	Potential for in-combination effect Y/N	Project Details
21 – Planning application	N	Housing scheme permitted (40 dwellings). 3.5km south of The Wash.
22 – Planning application	N	Housing scheme at determination stage (38 dwellings). 13km south of Greater Wash.
23 – Planning application	N	Housing scheme at determination stage (30 dwellings). 1km south of Greater Wash.
24 – Allocation	N	Food enterprise zone. 11km west of the nearest designated site.
25 – Allocation	Y	Distribution Park. 4km from nearest designated site and 3km from the Project PEIR Boundary.
26 – Allocation	N	Employment zone, Spalding. 13km west of the nearest designated site.
27 – Allocation	N	Employment zone, Spalding. 13km west of the nearest designated site.
28 – Allocation	Y	Sustainable Urban Extension (SUE), Boston South.
29 – Allocation	Y	SUE, Boston West.
30 – Allocation	N	SUE, Spalding. 13km west of the nearest designated site.
31 – Allocation	N	SUE, Holbeach. 8km west of the nearest designated site.
32 - Allocation	Y	Distributor road, Boston.
33 - Allocation	N	Relief road, Spalding. 13km west of the nearest designated site.
34 – Planning Application	N	Housing scheme at determination stage (52 dwellings). 1.2 km north of Humber Estuary
35 – Planning application	Y	Housing scheme at determination stage. 2 km north of Humber Estuary.
36 – Planning application	Y	Housing scheme at determination stage. 300 m north of Humber Estuary,
37 – Planning application	N	Housing scheme refused. 1.6 km north of Humber Estuary.
38 – Planning application	N	Solar farm development - approved 10 km N of Humber Estuary.

Project	Potential for in-combination effect Y/N	Project Details
39 – Planning application	Y	Solar farm development at determination stage. 2.5km N of Humber Estuary.
40 – Planning application	Y	Solar farm development at determination stage. 8km N of Humber Estuary.
41 – Pre-Scoping	Y	Proposed National Grid Substation at Weston Marsh.
42 – Planning Application	Y	Protein Plant at Surfleet Marsh.
43 - Viking Carbon Capture and Storage (CCS) Pipeline	Y	The Viking CCS Pipeline comprises a new onshore underground pipeline of approximately 55.5km in length, which will transport carbon dioxide from the Immingham industrial area to the Theddlethorpe area on the Lincolnshire coast, where it will connect into the existing offshore pipeline. The project is in the examination stage expected to close on 26 September 2024. DCO and the beginning of the construction period is expected in 2025.
44 – Eastern Green Link 3	N	In early development (scoping stage). There is not enough information on exact routing of the HVDC cables, the final landfall and converter stations for a meaningful assessment, but it is located further away from the Wash SPA than the Project itself.
44 – Eastern Green Link 4	N	In early development (scoping stage). There is not enough information on exact routing of the HVDC cables, the final landfall and converter stations for a meaningful assessment, but it is located further away from the Wash SPA than the Project itself.

~~1754.~~1893. The projects and plans were then reviewed for their likelihood to have an effect on the relevant designated site, based on Table 10.58~~Table 10.48~~ and proximity to the relevant designated sites.

Table 10-58~~10.5710-5610.48~~: In-combination effects for identified designated sites for projects and plans onshore.

Project	The Wash SPA and Ramsar and The Wash and North Norfolk SAC	Greater Wash SPA	Gibraltar Point SPA and Ramsar	Humber Estuary SPA, Ramsar and SAC	North Norfolk SPA and Ramsar
BAEF	Y	N	N	N	N
Hornsea Project Four	N	N	N	Y	N
Dogger Bank South Offshore Windfarms	N	N	N	Y	N
7 – Planning application	N	N	N	Y	N
8 – Planning application	N	N	N	Y	N
9 – Planning application	N	N	N	Y	N
11 – Planning application	N	Y	N	Y	N
14 – Planning application	Y	N	N	N	N
15 – Planning application	Y	N	N	N	N
16 – Planning application	Y	N	N	N	N
17 – Planning application	Y	N	N	N	N
18 – Planning application	Y	N	N	N	N
19 – Planning application	Y	N	N	N	Y
25 – Allocation	Y	N	N	N	N
28 – Allocation	Y	N	N	N	N
29 – Allocation	Y	N	N	N	N
32 - Allocation	Y	N	N	N	N
35 – Planning application	N	N	N	Y	N
36 – Planning application	N	N	N	Y	N
39 – Planning application	N	N	N	Y	N
40 – Planning application	N	N	N	Y	N
41 – Pre-Scoping	Y	N	N	N	N

Project	The Wash SPA and Ramsar and The Wash and North Norfolk SAC	Greater Wash SPA	Gibraltar Point SPA and Ramsar	Humber Estuary SPA, Ramsar and SAC	North Norfolk SPA and Ramsar
42 – Planning application	Y	N	N	N	N
43 – Viking Carbon Capture and Storage Pipeline	N	N	N	Y	N

Avian qualifying features of identified SPAs and Ramsar sites

~~1755.~~1894. For the onshore in-combination assessment, individual avian features are not assessed. Instead, the key pathway – disturbance, identified during the alone assessment is discussed based on the different habitats used by the different species, this is due to the effects being similar across avian species.

~~1756.~~1895. Boston Alternative Energy Facility is an energy from waste project, generating up to 102 MW of energy, with fuel arriving by ship through The Haven. It will be located within Riverside Industrial Estate on the outskirts of Boston. The DCO application was submitted in March 2021 and the SoS granted the development consent in July 2023. The applicant's HRA concluded no AEoI in relation to The Wash SPA and Ramsar, however subsequently information has been submitted regarding compensatory measures for disturbance to roosting waterbirds at the mouth of The Haven, arising from vessel transits associated with the project. One of the four compensatory option areas partially overlaps with the Project Order Limits, whereas the other three are located >500m from the Order Limits. Those four sites are within agricultural fields, which would be subject to hydrological change to provide alternative roosting habitat for waterbirds. Should the BAEF Wyberton Roads (South) compensation site be completed in advance of, or during, the construction phase for the Project, there will be a seasonal restriction to construction works within 400m of that compensation site. In that scenario, no works within that area will be undertaken during the period of November to March inclusive. The Project will use trenchless techniques to cross The Haven, thereby avoiding habitat loss and minimising disturbance. Mitigation will be implemented for the Project to further reduce and where possible avoid temporary disturbance at The Haven, including localised working, seasonal restrictions, and avoiding works during periods of freezing weather.

~~1757.~~1896. Planning applications 14-19 are six developments within 3.5km of The Wash, two have been approved, one is awaiting determination, two outline applications with 'favourable with conditions' outcomes and one at EIA Screening stage.

- Application 14 is a non-EIA proposal for 74 dwellings, 2km north of The Wash and no HRA has been undertaken.
- Application 15 is the re-design of an approved plan for 208 dwellings, 3km north of The Wash and no HRA has been undertaken. Natural England advised that the application is not likely to result in significant impacts on statutory designated nature conservation sites.
- Application 16 is a non-EIA outline application for 35 dwellings, 3.5km north of The Wash, and no HRA has been undertaken.
- Application 17 is a proposal for 135 dwellings, 3.5km north of The Wash and no HRA was undertaken. The biodiversity report concluded there would be no risk of significant effects on statutory designated sites. The applicant is in the process of discharging planning conditions.
- Application 18 is a wind and solar project 1km west of The Wash, at EIA Screening stage. Four wind turbines and 16MW solar array are proposed. The planning authority anticipate LSE on The Wash, subject to outcomes of bird surveys, due to risk of collision and/or disturbance particularly from the wind turbines element of the project.

- Application 19 is a proposal for 160 dwellings, 0.8km west of The Wash. Natural England advise that with mitigation secured, impacts on The Wash SPA and Ramsar and The Wash and North Norfolk SAC can be avoided. Mitigation comprised of a payment to the Norfolk Green Infrastructure and Recreational Impact Avoidance Strategy and provision of on-site green infrastructure. The identified impact pathway within the HRA is recreational disturbance. It has been recommended for approval at planning committee.

~~1758.~~1897. Of these six developments, the first four are unlikely to result in LSE on designated sites and are not expected to contribute to in-combination effects with the Project. Application 19 has been approved and has secured mitigation to avoid AEoI from recreational disturbance to The Wash SPA and Ramsar. Whilst this would be an operational phase impact, Application 19 would be expected to be completed by the time of construction for the Project, and therefore have a temporal overlap, however with the mitigation that has been secured it is not expected to contribute to adverse effects on The Wash SPA or Ramsar. Application 18 is at an early stage of development and limited ecological information is available. There is a possibility of temporal overlap in construction of Application 18 with the Project, and therefore there would be potential for an in-combination construction phase disturbance effect on FLL of The Wash SPA and Ramsar.

~~1759.~~1898. Allocations 25, 28, 29 & 32 are four projects identified in Local Plans, three of which relate to housing provision and highways work around Boston and one is a distribution park at Kirton. If these projects are taken forwards, potential impact pathways to The Wash SPA and Ramsar include recreational disturbance (housing) and construction phase disturbance (all schemes) to any waterbirds utilising functionally linked farmland habitats. Given that no planning applications have been submitted, no details of potential impacts or functional linkage are available at this stage.

~~1760.~~1899. Hornsea Four Offshore Windfarm was granted development consent in July 2023. The landfall is north of Skipsea, with an onshore ECC to an OnSS north of Hull. All potential effects relating to onshore ecology were screened out and therefore it can be excluded from the Project onshore in-combination assessment.

~~1761.~~1900. Dogger Bank South Offshore Windfarms (East and West) are in the pre-application stage with the application expected to be submitted between April and June 2024. The proposed landfall is near Skipsea with an onshore ECC to an OnSS north of Hull. Scoping information only is available at this stage. Given that Hornsea Four was able to screen out all potential effects relating to onshore ecology and was in a similar locality, that may also be the case for Dogger Bank South, however HRA Screening is unavailable at this stage.

~~1762.~~1901. The Humber Low Carbon Pipelines project proposed new onshore pipeline infrastructure between Drax and Easington, including a tunnel beneath the Humber Estuary. The application was withdrawn in January 2024.

~~1763.~~1902. Planning applications 7-9, 11, 35 and 36 are housing schemes located within 3km of the Humber Estuary:

- Application 7 is a proposal for up to 599 dwellings, at EIA screening stage, located 3km south-east of Humber Estuary. It was determined that EIA is not required. No HRA has been provided.
- Application 8 is a proposal for 28 dwellings, at determination stage, located 100m from the Humber Estuary. No impacts on European sites were identified in the PEA or Ecology Officer's letter.
- Application 9 is a proposal for 390 dwellings, at appeal stage, located 2.5km south of the Humber Estuary. One of the reasons for refusal was that insufficient information had been submitted to demonstrate that the proposed development would not have an AEoI of the Humber Estuary SPA and Ramsar site. The shadow HRA identified LSE in relation to recreational disturbance only. Mitigation is proposed in the form of on-site greenspace and access to walking routes away from the designated sites.
- Application 11 is a proposal for 522 dwellings, at EIA screening stage, located 500m from the Greater Wash. EIA is not required, as no significant environmental effects are anticipated. No HRA is available.
- Application 35 is a proposed housing scheme of 166 dwellings located approximately 2km to the north of the Humber Estuary. Natural England has requested information for an HRA for the project but that information is not currently available.
- Application 36 is a proposed housing scheme of 119 dwellings located approximately 300 m north of the Humber Estuary. Natural England has requested that the competent authority undertake an HRA for the project and that further information is provided from the applicant regarding potential recreational disturbance and proposed mitigation for loss of FLL.

~~1764.~~1903. From those housing applications, Applications 9, 35 and 36 have potential to contribute to an in-combination effect with the Project, on the Humber Estuary SPA. The only impact pathway identified for Application 9 was recreational disturbance (i.e. an operational phase impact) and mitigation measures have been put forward to address that potential impact. Further information is required before HRAs for Application 35 can be completed. A Report to Inform Habitat Regulations Assessment was developed in October 2023 following two rounds of comments from Natural England for Application 36. The report concluded that "Subject to the proposal being undertaken in accordance with the recommended mitigation measures; this assessment determines that the proposal will not adversely affect the integrity of the Humber Estuary SAC/SPA/Ramsar either alone or in combination with other plans or projects and the project may be authorised subject to securing the recommended measures". Wetland Bird Management and Enhancement Plan was developed in January 2024 to offer compensation and mitigation for the loss of functionally linked land for curlew.

~~1765.~~1904. A further two solar farm developments were identified with potential impacts on the Humber Estuary SPA:

- Application 39 is a proposed solar farm located approximately 2.5km north of the Humber Estuary. Natural England has requested further information to inform an HRA, including wintering and passage bird surveys. The winter bird survey was undertaken in 2022-23, but the full results are not available.

- Application 40 is a proposed solar farm located approximately 8km north of the Humber Estuary. Shadow Habitat Regulations Assessment (Stage 1 Significance Test and Stage 2 Appropriate Assessment was produced in December 2023. The assessment concluded that "the baseline wintering bird surveys indicate that golden plover and lapwing were observed in high enough numbers to suggest a linked functionality between the Turf Carr Solar Farm Site, and the Humber Estuary SPA. Potential disturbance of golden plover and lapwing during construction, arising from both noise and visual impacts, will be effectively mitigated for by scheduling all construction activity in the summer months, between April – September. Thus, occurring outside of the time of year where the Site is primarily used by birds such as lapwing and golden plover". Wader Management and Monitoring Plan was developed in December 2023, and it is proposed that approximately 26ha of permanent grassland, comprising four fields located to the south of the Site, shall be maintained as habitat that is suitable for lapwing, golden plover, and other species associated with the SPA, for the lifetime of the solar farm. Additional habitat management and monitoring was proposed for the 40-year lifetime of the development. The scheme has been agreed in principle by the East Riding of Yorkshire Council Nature Conservation Officer, however it awaits comments from Natural England.

~~1766.~~1905. Project 41 is the National Grid Substation (NGSS) which will be located within the onshore Order Limits at Weston Marsh (the western terminus of the 400kV cable corridor). Design details are not available at this stage, but the assumptions include a footprint of approximately 800m by 200m plus temporary working area. Non-breeding and breeding bird survey data have been collected from the area in which the substation will be located, as part of the Project's surveys to establish the baseline in the area where the Project will connect to the NGSS, and presented in ES Appendices 3.22.3 and 3.22.4. No SPA or Ramsar qualifying features were identified as breeding within the potential disturbance zone. For non-breeding birds from within the 400m buffer of the option area, records were limited to a peak of 56 lapwing, seven herring gulls and four mute swans. Construction of the National Grid OnSS is expected to occur concurrently with the Project construction period, however, survey data indicates that the National Grid OnSS area is of low importance for birds. Project 42 is the Naylor Farms Protein Plant which will be located at Surfleet Marsh and is a 14.3ha site currently managed as a cabbage field.

1906. Project 43 is the Viking CCS Pipeline which comprises a new onshore underground pipeline of approximately 55.5km in length, which will transport Carbon Dioxide from the Immingham industrial area to the Theddlethorpe area on the Lincolnshire coast, where it will connect into the existing Lincolnshire Offshore Gas Gathering System pipeline. The connection site with Lincolnshire Offshore Gas Gathering at Theddlethorpe is located approx. 14km north of ODOW Onshore Order Limits. Subject to the granting of a DCO, it is currently anticipated that site preparation would commence in late 2025, with main construction taking place in 2026 and the Proposed Development becoming operational in 2027. The main construction activities are expected to take around 12 months. Since ODOW works are expected to start in 2027, there is a potential for a simultaneous or, more likely, sequential in-combination effect. Main pipe laying works are predominantly planned during late spring, summer and early autumn months with a rate of approx. 500m per day. The Viking CCS Pipeline DCO site boundary overlaps with Humber Estuary SPA and Ramsar, however according to applicant's HRA (version 3 – July 2024), there will be no direct habitat loss within those designated sites.

~~1767.~~1907. Projects 44 and 45 (Eastern Green Link 3 and 4) are part of The Great Grid Upgrade, comprising subsea cables between Scotland (Peterhead and Westfield) and England (Lincolnshire and Norfolk) and associated onshore infrastructure. In England, the proposed onshore elements of EGL 3 and EGL 4 would be in the districts of East Lindsey, Boston and South Holland, in Lincolnshire; and the district of King's Lynn and West Norfolk, in Norfolk, however the exact routing of the HVDC cables, the final landfall and converter stations are not known at this stage. As these projects are in early phase of development, there are not sufficient information for a meaningful assessment, therefore they can be excluded from the Project onshore in-combination assessment.

~~1768.~~1908. Mitigation for the Project, as detailed in Section 6~~6~~, includes avoidance of designated ornithological sites, either through route selection or trenchless techniques. The onshore Order Limits is set back from Anderby Marsh and The Wash SPA and Ramsar at The Haven. Further mitigation to reduce disturbance to birds includes the use of seasonal restrictions and localised working. With the inclusion of these mitigation measures for the Project, there would be no AEoI on any of the designated sites as a result of the Project during the construction phase in-combination with other identified projects and plans. O&M

~~1769.~~1909. After construction, habitats along the cable route will be reinstated and during routine scheduled operation and maintenance there will be little activity along the onshore ECC. Scheduled monitoring visits to above ground infrastructure will typically occur on an annual basis. These will be comparable to pedestrian/single vehicle access and will not be undertaken in periods of extreme cold weather in accordance with the alone assessment mitigation. Scheduled maintenance and operation, when undertaken with the mitigation recommended in the alone assessment have no pathway to undermine the conservation objectives in-combination with other identified projects, and will have no AEoI of the identified designated sites.

~~1770.~~1910. Corrective maintenance has the potential to cause disturbance to avian features when at the Landfall or in proximity to The Haven, as discussed in the alone assessment section. The instances of unscheduled maintenance are expected to be infrequent and affecting discrete areas at any one time, and no further habitat loss is anticipated. With the mitigation incorporated for the Project, as detailed in the alone assessment section, there would be no AEoI on any of the designated sites as a result of the Project during the operational phase in-combination with other identified projects and plans.

Feature Group 32: Habitat Features of SACs and Ramsars

~~1771.~~1911. None of the projects and plans identified would result direct effects on habitats within SACs and Ramsars, and the Project would not contribute to any in combination effects arising from recreational activity. In combination effects on these habitats arising from changes in water quality and air quality are most likely for projects occurring at the same, for example, the National Grid substation, and the Boston Alternative Energy facility may happen at the same time as the Project.

~~1772.~~1912. Other than freshwater marsh at Gibraltar Point Ramsar, the habitats within the designated sites are either terrestrial habitats independent of surface water from rivers (sand dunes etc) or marine habitats, which receive freshwater flows but are more influenced by sea water quality. The risk that freshwater marsh at Gibraltar Point Ramsar and seawater quality are affected by construction activity on land is increased slightly when the project is considered in combination with other projects however, with the mitigation incorporated for the Project, as detailed in the alone assessment section, there would be no AEoI on any of the designated sites as a result of the Project during the construction phase in-combination with other identified projects and plans.

~~1773.~~1913. The air quality effects arising from the construction phase are *de minimis* and would not make a meaningful contribution to any air quality effects on the habitats within the SACs and Ramsar Sites.

Feature Group 33: Red Data Book Invertebrates

~~1774.~~1914. The two red data book invertebrates are both freshwater species, present in the freshwater marsh at Gibraltar Point Ramsar and for one of them, in other designated sites. As set above for the freshwater marsh, the risk of these species being affected by aquatic pollution may be elevated when projects are considered in combination, however the mitigation to maintain water quality across all projects would ensure there would be no AEoI on any of the designated sites as a result of the Project during the construction phase in-combination with other identified projects and plans.

Feature 34: Otter

~~1775.~~1915. Otter is a species which is also dependent on water quality and again the mitigation to maintain water quality would prevent adverse effects on this species during the construction phase in-combination with other identified projects and plans. As site for the Project alone, this species is not vulnerable to disturbance and therefore in-combination AEoI on the otter population arising from disturbance can be excluded.

11 Transboundary Statement

~~1776.~~1916. The Screening process has identified 26 transboundary sites for assessment, with these sites being as follows (including the relevant designated species screened in):

- Doggersbank (Netherlands) SAC (grey seal and harbour seal);
- Klaverbank (Netherlands) SAC (grey seal and harbour seal);
- Bancs des Flandres (France) SCI (grey seal);
- Vlaamse Banken SCI (Belgium) (grey seal);
- SBZ 1 SCI (Belgium) (grey seal);
- SBZ 2 SCI (Belgium) (grey seal);
- SBZ 3 SCI (Belgium) (grey seal);
- Vlakte van de Raan (Netherlands) SCI (grey seal);
- Westerschelde & Saeftinghe (Netherlands) SCI (grey seal);
- Voordelta (Netherlands) SCI (grey seal);
- Noordzeekustzone SCI (Netherlands) (grey seal);
- Waddenzee SCI (Netherlands) (grey seal);
- Duinen en Lage Land Texel SCI (Netherlands) (lesser black-backed gull);
- Waddenzee SPA (Netherlands) (lesser black-backed gull);
- Duinen Vlieland SCI (Netherlands) (lesser black-backed gull);
- Littoral seino-marin SPA (France) (fulmar);
- Cap Sizun SPA (France) (fulmar);
- Cote de Granit Rose-Sept Iles SPA (France) (fulmar, Manx shearwater);
- Tregor Goelo SPA (France) (fulmar);
- Cap d'Erquy – Cap Fréhel SPA (France) (fulmar);
- Camaret SPA (France) (fulmar);
- Falaise du Bessin Occidental SPA (France) (fulmar);
- Ouessant – Molène SPA (France) (fulmar, Manx shearwater);
- Seevogelschutzgebiet Helgoland SPA (Germany) (fulmar);
- Iles Houat Hoedic SPA (France) (Manx shearwater); and
- Baie de Morlaix SPA (France) (Manx shearwater).

~~1777.~~1917. A transboundary screening assessment was submitted alongside the scoping report. The Inspectorate consulted with any relevant consultees on the information provided within that document. No concerns were raised by any relevant consultees, with the exception of a few watching briefs for the final assessments presented within the final RIAA. It is considered that the Inspectorate may undertake further consultation on the information presented within this RIAA on behalf of the SoS following the submission of the DCO Application.

~~1778.~~1918. Consideration of the potential for an AEoI alone has been addressed in Section 0~~9.2~~ for marine mammals and 9.3 for offshore and intertidal ornithology, including in relation to the above sites, with all conclusions being that there will be no AEoI. The assessment in-combination with other plans or projects (including transboundary projects) has been addressed in Section 10.2 for marine mammals and 10.3 for offshore and intertidal ornithology, with all conclusions similarly being that no AEoI will occur.

~~1779.~~1919. It can therefore be concluded that no AEoI exists for an effect from the Project alone and/or in-combination on any transboundary sites identified in other EEA states.

12 Conclusions of the Assessment

~~1780.~~1920. A summary of the assessment is presented below, identifying in Table 12.1 and Table 12.2 the designated sites (together with the relevant feature(s)) screened in for effect in relation to the Project alone and in-combination, including the conclusion on AEoI.

Table 12-1~~12.112-112.1~~: Conclusions of the assessment for AEoI for all offshore receptor groups

Designated Site	Relevant Features	Potential for Effect	Conclusion on Adverse Effect Alone			Conclusion on Adverse Effect In-combination		
			Construction	O&M	Decommissioning	Construction	O&M	Decommissioning
Subtidal and Intertidal Benthic Ecology								
North Norfolk Sandbanks and Saturn Reef SAC	▪ Reefs; and ▪ Sandbanks which are slightly covered by sea water all of the time	▪ Suspended sediment/deposition; ▪ Indirect Pollution; ▪ Accidental Pollution; ▪ INNS; and ▪ Changes to physical processes.	No potential for AEoI			No potential for AEoI		
Inner Dowsing, Race Bank, and North Ridge SAC	▪ Reefs; and ▪ Sandbanks which are slightly covered by sea water all of the time	▪ Physical habitat loss/disturbance	No potential for AEoI			No potential for AEoI		
		▪ Suspended sediment/deposition	No potential for AEoI			No potential for AEoI		
		▪ Indirect Pollution; ▪ Accidental Pollution; ▪ INNS; and ▪ Changes to physical processes	No potential for AEoI			No potential for AEoI		
The Wash and North Norfolk Coast SAC	▪ Sandbanks which are slightly covered by sea water all of the time; ▪ Mudflats and sandflats not covered by seawater at low tide; ▪ Large shallow inlets and bays; ▪ Reefs; ▪ *Salicornia* and other annuals colonizing mud and sand; and ▪ Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)	▪ Suspended sediment/deposition; ▪ Indirect Pollution; ▪ Accidental Pollution; ▪ INNS; and ▪ Changes to physical processes	No potential for AEoI			No potential for AEoI		
Humber Estuary Ramsar	▪ Dune systems with humid dune slacks, ▪ Estuarine waters; ▪ Intertidal mud and sand flats; ▪ Saltmarshes; and ▪ Coastal brackish/saline lagoons	▪ Suspended sediment/deposition; ▪ Indirect Pollution; ▪ Accidental Pollution; ▪ INNS; and ▪ Changes to physical processes	No potential for AEoI			No potential for AEoI		
Humber Estuary SAC	▪ Estuaries; ▪ Mudflats and sandflats not covered by seawater at low tide;	▪ Suspended sediment/deposition; ▪ Indirect Pollution;	No potential for AEoI			No potential for AEoI		

Designated Site	Relevant Features	Potential for Effect	Conclusion on Adverse Effect Alone			Conclusion on Adverse Effect In-combination		
			Construction	O&M	Decommissioning	Construction	O&M	Decommissioning
	▪ Sandbanks which are slightly covered by sea water all the time; ▪ Salicornia and other annuals colonizing mud and sand; and ▪ Atlantic salt meadows.	▪ Accidental Pollution; ▪ INNS; and ▪ Changes to physical processes						
Gibraltar Point Ramsar	▪ Estuarine mudflats; ▪ Sandbanks; ▪ Saltmarsh; and ▪ Dunes	▪ Suspended sediment/deposition; ▪ Indirect Pollution; ▪ Accidental Pollution; ▪ INNS; and ▪ Changes to physical processes	No potential for AEoI			No potential for AEoI		
The Wash Ramsar	▪ Saltmarshes; ▪ Estuaries; ▪ Major intertidal banks of sand and mud; ▪ Shallow water; and ▪ Deep channels	▪ Suspended sediment/deposition; ▪ Indirect Pollution; ▪ Accidental Pollution; ▪ INNS; and ▪ Changes to physical processes	No potential for AEoI			No potential for AEoI		
Marine Mammals								
Southern North Sea SAC	▪ Harbour porpoise	▪ Underwater noise; ▪ Vessel disturbance; ▪ Collision risk; ▪ Indirect pollution; ▪ Accidental pollution; and ▪ Changes to prey.	No potential for AEoI			No potential for AEoI		
Humber Estuary SAC	▪ Grey seal (*Halichoerus grypus*)	▪ Underwater noise; ▪ Vessel disturbance; and ▪ Collision risk	No potential for AEoI			No potential for AEoI		
Humber Estuary Ramsar	▪ Grey seal (*H. grypus*)	▪ Underwater noise; ▪ Vessel disturbance; and ▪ Collision risk	No potential for AEoI			No potential for AEoI		
The Wash and North Norfolk Coast SAC	▪ Harbour seal (*Phoca vitulina*)	▪ Underwater noise; ▪ Vessel disturbance; and ▪ Collision risk	No potential for AEoI			No potential for AEoI		
Bancs des Flandres SAC	▪ Grey seal (*H. grypus*)	▪ Underwater noise; ▪ Vessel disturbance; and ▪ Collision risk	No potential for AEoI			No potential for AEoI		
Doggersbank (Netherlands) SAC	▪ Harbour seal (*Phoca vitulina*); and ▪ Grey seal (*H. grypus*)	▪ Underwater noise; ▪ Vessel disturbance; and ▪ Collision risk	No potential for AEoI			No potential for AEoI		

Designated Site	Relevant Features	Potential for Effect	Conclusion on Adverse Effect Alone: Construction	O&M	Decommissioning	Conclusion on Adverse Effect In-combination: Construction	O&M	Decommissioning
Klaverbank SCI	▪ Harbour seal (*Phoca vitulina*); and ▪ Grey seal (*Halichoerus grypus*)	▪ Underwater noise; ▪ Vessel disturbance; and ▪ Collision risk	No potential for AEoI			No potential for AEoI		
Noordzeekustone SCI	▪ Grey seal (*H. grypus*)	▪ Underwater noise; ▪ Vessel disturbance; and ▪ Collision risk	No potential for AEoI			No potential for AEoI		
SBZ 1 SCI	▪ Grey seal (*H. grypus*)	▪ Underwater noise; ▪ Vessel disturbance; and ▪ Collision risk	No potential for AEoI			No potential for AEoI		
SBZ 2 SCI	▪ Grey seal (*H. grypus*)	▪ Underwater noise; ▪ Vessel disturbance; and ▪ Collision risk	No potential for AEoI			No potential for AEoI		
SBZ 3 SCI	▪ Grey seal (*H. grypus*)	▪ Underwater noise; ▪ Vessel disturbance; and ▪ Collision risk	No potential for AEoI			No potential for AEoI		
Vlaamse Banked SCI	▪ Grey seal (*H. grypus*)	▪ Underwater noise; ▪ Vessel disturbance; and ▪ Collision risk	No potential for AEoI			No potential for AEoI		
Vlakte van de Raan SCI	▪ Grey seal (*H. grypus*)	▪ Underwater noise; ▪ Vessel disturbance; and ▪ Collision risk	No potential for AEoI			No potential for AEoI		
Voordelta SCI	▪ Grey seal (*H. grypus*)	▪ Underwater noise; ▪ Vessel disturbance; and ▪ Collision risk	No potential for AEoI			No potential for AEoI		
Waddenzee SCI	▪ Grey seal (*H. grypus*)	▪ Underwater noise; ▪ Vessel disturbance; and ▪ Collision risk	No potential for AEoI			No potential for AEoI		
Westerschelde & Saeftinghe SCI	▪ Grey seal (*H. grypus*)	▪ Underwater noise; ▪ Vessel disturbance; and ▪ Collision risk	No potential for AEoI			No potential for AEoI		
Offshore and Intertidal Ornithology								
Greater Wash SPA	▪ Common scoter; and ▪ Red-throated diver	▪ Disturbance and displacement	No potential for AEoI			No potential for AEoI		
North Norfolk Coast SPA	▪ Sandwich term	▪ Collision risk	No potential for AEoI			No potential for AEoI		
Flamborough and Filey Coast SPA	▪ Herring gull ▪ Kittiwake; and ▪ Gannet	▪ Collision risk	No potential for AEoI			▪ No potential for AEoI	▪ No potential for AEoI (gannet) ▪ Potential for AEoI (Kittiwake)	▪ No potential for AEoI
	▪ Guillemot; ▪ Razorbill; ▪ Gannet; and	▪ Disturbance and displacement	No potential for AEoI			No potential for AEoI		

Designated Site	Relevant Features	Potential for Effect	Conclusion on Adverse Effect Alone Construction O&M Decommissioning	Conclusion on Adverse Effect In-combination Construction O&M Decommissioning
	▪ Puffin			
Coquet Island SPA	▪ Sandwich tern ▪ -	▪ Collision risk	No potential for AEoI	No potential for AEoI
	▪ Puffin	▪ Disturbance and displacement	No potential for AEoI	No potential for AEoI
Farne Islands SPA	▪ Kittiwake	▪ Collision risk	No potential for AEoI	No potential for AEoI
Alde-Ore Estuary SPA	▪ Lesser black backed gull	▪ Collision	No potential for AEoI	No potential for AEoI-
Scottish SPAs	▪ Gannet; and ▪ Kittiwake	▪ Collision risk	No potential for AEoI	No potential for AEoI
	▪ Gannet; ▪ Guillemot; ▪ Razorbill; and ▪ Puffin	▪ Disturbance and displacement	No potential for AEoI	No potential for AEoI
Migratory Fish				
Humber Estuary Sea SAC	▪ Sea lamprey *Petromyzon marinus*; and ▪ River lamprey *Lampetra fluviatilis*	▪ Underwater Noise	No potential for AEoI	No potential for AEoI

Table 12-2~~12.2~~~~12.2~~~~12.2~~: Conclusions of the assessment for AEoI for all onshore receptor groups

~~BDesignated~~Designated Site	Relevant Features	Potential for Effect	Conclusion on Adverse Effect Alone			Conclusion on Adverse Effect In-combination		
			Construction	Operation	Decommissioning	Construction	Operation	Decommissioning
Onshore Ecology								
Greater Wash SPA	Non-breeding common scoter. Breeding bird species: Sandwich tern; Common tern; and Little tern.	Habitat loss; Disturbance of birds within the SPA; Pollution.	No potential for AEoI for little tern, Sandwich tern or common tern. No AEoI for common scoter from onshore elements of the Project.			No potential for AEoI for little tern, Sandwich tern or common tern. No AEoI for common scoter from onshore elements of the Project.		
The Wash SPA	Bewick's swan (non-breeding); Pink-footed goose (non-breeding); Dark-bellied brent goose (non-breeding); Shelduck (non-breeding) Wigeon (non-breeding); Gadwall (non-breeding); Pintail (non-breeding); Common scoter (non-breeding); Goldeneye (non-breeding); Oystercatcher (non-breeding); Grey plover (non-breeding); Knot (non-breeding); Sanderling (non-breeding); Dunlin (non-breeding); Black-tailed godwit (non-breeding); Bar-tailed godwit (Non-breeding); Curlew (Non-breeding); Redshank (Non-breeding); Turnstone (Non-breeding); Common tern (Breeding); Little tern (Breeding); and Waterbird assemblage	Habitat loss; Disturbance of birds within and outside the SPA; Pollution; Air quality impacts.	No potential for AEoI.	No potential for AEoI.	No potential for AEoI.	No potential for AEoI.	No potential for AEoI.	No potential for AEoI.
The Wash Ramsar	Criterion 1 – Saltmarshes, major intertidal banks of sand and mud, shallow water, and deep channels; Criterion 3 – inter-relationship between saltmarshes, intertidal sand, mudflats, and estuarine waters;	Habitat loss; Disturbance of birds within and outside the SPA; Pollution; Air quality impacts.	No potential for AEoI.	No potential for AEoI.	No potential for AEoI.	No potential for AEoI.	No potential for AEoI.	No potential for AEoI.

~~BDesignated~~Designated Site	Relevant Features	Potential for Effect	Conclusion on Adverse Effect Alone			Conclusion on Adverse Effect In-combination		
			Construction	Operation	Decommissioning	Construction	Operation	Decommissioning
	Criterion 5 – Bird assemblages of international importance; Criterion 6 – Bird species/ populations occurring at levels of international importance: Species with peak counts in spring/autumn: Redshank; Curlew; Oystercatcher (wintering); Grey plover *(*wintering); Knot; and Sanderling. Species with peak counts in winter: Black-headed gull*;* Eider*;* Bar-tailed godwit*;* Shelduck; Dark-bellied brent goose*;* Dunlin*;* Pink-footed goose*;* Golden plover; and Lapwing. Species with peak counts in spring/autumn: Black-tailed godwit*;* and ringed plover.							
The Wash and North Norfolk Coast SAC	1330 Atlantic salt meadows (Glauco-Puccinellietalia maritimae); 1420 Mediterranean and thermo-Atlantic halophilous scrubs (Sarcocornetea fruticosi); 1150 Coastal lagoons *Priority feature; and Otter.	Loss of habitats present within the SAC; Disturbance to otter. Habitat loss for otter.	No potential for AEoI.	No potential for AEoI.	No potential for AEoI.	No potential for AEoI.	No potential for AEoI.	No potential for AEoI.
Gibraltar Point SPA	Grey plover (Non-breeding); Sanderling (Non-breeding); Bar-tailed godwit (Non-breeding); and Little tern (Breeding).	Habitat loss; Disturbance of birds outside the SPA; Pollution; Air quality impacts.	No potential for AEoI.	No potential for AEoI.	No potential for AEoI.	No potential for AEoI.	No potential for AEoI.	No potential for AEoI.

~~BDesignated~~Designated Site	Relevant Features	Potential for Effect	Conclusion on Adverse Effect Alone			Conclusion on Adverse Effect In-combination		
			Construction	Operation	Decommissioning	Construction	Operation	Decommissioning
Gibraltar Point Ramsar	Onshore Ramsar Features: Ramsar Criterion 1: Coastal habitats – estuarine mudflats, sandbanks, and saltmarsh; Ramsar Criterion 2: Red Data book invertebrates – including: *Haliplus mucronatus* (a water beetle, aquatic) *Brachytron pratense* (hairy dragonfly, aquatic) Ramsar criterion 5: Waterfowl. Ramsar criterion 6: Grey plover, sanderling, bar-tailed godwit, dark-bellied brent goose.	Habitat loss; Disturbance of birds outside the SPA; Pollution; Air quality impacts.	No potential for AEoI.	No potential for AEoI.	No potential for AEoI.	No potential for AEoI.	No potential for AEoI.	No potential for AEoI.
Saltfleetby-Theddlethorpe Dunes and Gibraltar Point SAC	Annex I habitats: 2110 Embryonic shifting dunes; 2120 "Shifting dunes along the shoreline with *Ammophila arenaria* ('white dunes'")"; 2130 "Fixed coastal dunes with herbaceous vegetation ('grey dunes')" Priority feature; 2160 Dunes with *Hippophae rhamnoides*; and 2190 Humid dune slacks.	Loss of habitats within the SAC, or reduction of habitat quality.	No potential for AEoI.	No potential for AEoI.	No potential for AEoI.	No potential for AEoI.	No potential for AEoI.	No potential for AEoI.
Humber Estuary SPA	Great Bittern (non-breeding and breeding); Shelduck (non-breeding); Marsh harrier; (breeding); Hen harrier (non-breeding); Avocet (non-breeding and breeding); Golden plover (non-breeding); Knot (non-breeding); Dunlin (non-breeding); Ruff (non-breeding); Black-tailed godwit *(L. limosa)* (non-breeding); Bar-tailed godwit (non-breeding); Redshank (non-breeding); Little tern (breeding); and	Habitat loss; Disturbance of birds outside the SPA; Pollution; Air quality impacts.	No potential for AEoI.	No potential for AEoI.	No potential for AEoI.	No potential for AEoI.	No potential for AEoI.	No potential for AEoI.

~~BDesignated~~Designated Site	Relevant Features	Potential for Effect	Conclusion on Adverse Effect Alone			Conclusion on Adverse Effect In-combination		
			Construction	Operation	Decommissioning	Construction	Operation	Decommissioning
	Waterbird assemblage							
Humber Estuary Ramsar	Onshore Ramsar Features: Criterion 1- dune systems and humid dune slacks; Criterion 5 – assemblages of international importance (waterfowl, non-breeding season); Criterion 6 – species/populations occurring at levels of international importance: Shelduck; Golden plover*;* Knot; Dunlin*;* Black-tailed godwit *(L. limosa);* Bar-tailed godwit*;* and Redshank.	Habitat loss; Disturbance of birds outside the SPA; Pollution; Air quality impacts.	No potential for AEoI.	No potential for AEoI.	No potential for AEoI.	No potential for AEoI.	No potential for AEoI.	No potential for AEoI.
North Norfolk SPA	Pink-footed goose	Habitat loss; Disturbance of birds outside the SPA;	No potential for AEoI.	No potential for AEoI.	No potential for AEoI.	No potential for AEoI.	No potential for AEoI.	No potential for AEoI.
North Norfolk Ramsar	Pink-footed goose	Habitat loss; Disturbance of birds outside the SPA;	No potential for AEoI.	No potential for AEoI.	No potential for AEoI.	No potential for AEoI.	No potential for AEoI.	No potential for AEoI.

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