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Application Document 13

Part 1: Caledonia North Report to Inform Appropriate Assessment

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Reports to Inform Appropriate Assessment (RIAAs) have been drafted to inform the Caledonia North and Caledonia South applications. Due to the interlinkages between both applications, the contents within each (Parts 1 to 4 of the RIAAs) are identical, with Caledonia North and Caledonia South, as well as the Proposed Development (Offshore), considered within both documents.

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Acronyms and Abbreviations

AA	Appropriate Assessment
AEoSI	Adverse Effect on Site Integrity
BDMPS	Biologically Defined Minimum Population Scales
BERR	Business, Enterprise and Regulatory Reform
CaP	Cable Plan
CLV	Cable Laying Vessel
CRM	Collision Risk Modelling
cSAC	Candidate SAC
CTV	Crew Transfer Vessels
DAS	Digital Aerial Survey
DEA	Drag Embedded Anchors
DECC	Department of Energy and Climate Change
DESNZ	Department for Energy Security and Net Zero
DE	Design Envelope
DP	Decommissioning Programme
ECJ	European Court of Justice
EDPR	EDP Renewables
EIAR	Environmental Impact Assessment Report
EMODnet	European Marine Observation and Data Network
EMP	Environmental Management Plan
EOWDC	European Offshore Wind Development Centre
EPS	European Protected Species

FCS	Favourable Conservation Status
FHG	Functional Hearing Groups
FWPM	Freshwater Pearl Mussel
FWTG	Floating Wind Turbine Generator
HF	High Frequency
HRA	Habitats Regulations Appraisal
IROPI	Imperative Reasons of Overriding Public Interest
JNCC	Joint Nature Conservation Committee
JUV	Jack-up Vessel
LAT	Lowest Astronomical Tide
LMP	Lighting and Marking Plan
LSE	Likely Significant Effect
MD-LOT	Marine Directorate - Licensing Operations Team
MHWS	Mean High Water Springs
MMMP	Marine Mammal Mitigation Plan
MoM	Minutes of Meeting
MPA	Marine Protected Area
MPCP	Marine Pollution Contingency Plan
MSL	Mean Sea Level
NAF	Nocturnal Activity Factor
NETS	National Electricity Transmission System
NSN	National Site Network
O&M	Operation and Maintenance
OECC	Offshore Export Cable Corridor

OfTI	Offshore Transmission Infrastructure
OnTI	Onshore Transmission Infrastructure
ORJIP	Offshore Renewables Joint Industry Programme
OSP	Offshore Substation Platform
OWF	Offshore Wind Farm
PEMP	Project Environmental Monitoring Programme
PS	Piling Strategy
pSPA	Potential SPA
PTS	Permanent Threshold Shift
RIAA	Report to Inform Appropriate Assessment
RSPB	Royal Society for the Protection of Birds
SAC	Special Area of Conservation
SCI	Site of Community Importance
SEL	Sound Exposure Level
SNCB	Statutory Nature Conservation Body
SNH	Scottish Natural Heritage
SPA	Special Protected Area
SPL_{peak}	Peak Sound Pressure Level
SOV	Service Operation Vessel
SoS	Secretary of State
TTS	Temporary Threshold Shift
UK	United Kingdom
UXO	Unexploded Ordnance
VMP	Vessel Management Plan

WTG	Wind Turbine Generator
ZoI	Zone of Influence

Executive Summary

Caledonia Offshore Wind Farm Limited (hereafter referred to as the 'Applicant') intends to build an Offshore Wind Farm (OWF), named the Caledonia OWF, situated within the outer Moray Firth, off the north-east coast of Scotland. To support with deliverability and potential phased construction of the Proposed Development (Offshore), the Applicant is submitting two consent applications, referred to as Caledonia North and Caledonia South. Details of the design and sequencing of phasing is discussed in more detail within the Environmental Impact Assessment Report Volume 1, Chapter 5: Proposed Development Phasing.

This Report to Inform Appropriate Assessment (RIAA) has been drafted to provide the Scottish Ministers with the information necessary to undertake a Habitats Regulations Appraisal (HRA) as part of the determination process for the Section 36 applications for Caledonia North and Caledonia South. The Proposed Development comprises onshore and offshore components. The subject of this RIAA is the offshore infrastructure only, referred to as the Proposed Development (Offshore).

Two RIAAs have been created: one for Caledonia North (Application Document 13) and one for Caledonia South (Application Document 14). Both documents are identical; however, they have been submitted for Caledonia North and Caledonia South separately to inform the individual consent applications.

For ease of navigation and to allow for assessment and review of each application area independently, the RIAA has been split into four parts with the assessment of Caledonia North, Caledonia South and the Proposed Development (Offshore) located in Parts 2, 3 and 4 respectively.

The RIAA builds upon the conclusions of the Stage One HRA Screening Report (Application Document 12) which determines whether the Proposed Development (Offshore) alone or in-combination with other plans and projects could result in Likely Significant Effects (LSE) on European sites in relation to their Conservation Objectives. In instances where LSE cannot be ruled out, a Stage Two Appropriate Assessment (AA) must be conducted.

Accordingly, this RIAA (and associated appendices) provides information to inform the Stage Two AA which assesses whether sites (including transboundary) with the potential for LSE also have the potential for an Adverse Effect on Site Integrity (AEoSI) alone or in-combination with other plans and projects. The three receptor groups assessed within this RIAA include: marine mammals, offshore and intertidal ornithology and migratory fish. Benthic and intertidal habitats are not included within this assessment as they were screened out.

Following an extensive assessment, it has been concluded that there is no potential for AEoSI resulting from Caledonia North, Caledonia South or the Proposed Development (Offshore) alone or in-combination with other plans and projects for any sites designated for marine mammal and migratory fish receptor groups. For sites designated for offshore and intertidal ornithology, it has been concluded that there would be no AEoSI resulting from Caledonia North or Caledonia South alone; however, for the Proposed Development (Offshore) in-combination with other plans and projects a conclusion of AEoSI has been drawn for five designated sites.

1 Introduction

This document is Part 1 of the Caledonia North Report to Inform Appropriate Assessment (RIAA) and contains the introduction, consultation and overview of impacts considered within the assessment (Sections 1-7). For the assessment of Caledonia North see Part 2 (Section 8), for the assessment of Caledonia South see Part 3 (Section 9) and for the assessment of the Proposed Development (Offshore) see Part 4 (Sections 10 to 12).

1.1 Background to the Proposed Development (Offshore)

1.1.1.1 This Report to Inform Appropriate Assessment (RIAA) has been produced to inform the Habitat Regulations Appraisal (HRA) process for the Caledonia Offshore Wind Farm (OWF). It provides information to enable the competent authority (in this case the Scottish Ministers) to undertake an Appropriate Assessment (AA) of the Caledonia OWF with respect to its potential to have an Adverse Effect on Site Integrity (AEoSI) of European and Ramsar sites of nature conservation importance, (also referred to as Natura 2000 sites) alone or in-combination.

1.1.1.2 Ocean Winds is progressing the proposal for an OWF, which has been named the Caledonia OWF, with this assessment comprising the offshore elements (hereafter referred to as the Proposed Development (Offshore)); see Figure 1-1, via the newly incorporated limited company of Caledonia Offshore Wind Farm Ltd (the Applicant). The terms of the Option Agreement are dependent upon Ocean Winds being awarded all key consents and permissions to construct and operate the OWF from the relevant regulatory authorities.

1.1.1.3 The Proposed Development (Offshore) will be developed in two phases. The sequencing of how the phases can be brought forward is discussed in more detail within the Environmental Impact Assessment Report (EIAR) Volume 1, Chapter 5: Proposed Development Phasing. For the Proposed Development (Offshore) there are separate consent applications for each phase, referred to as Caledonia North and Caledonia South (Figure 1-1). Therefore, to support each application, Caledonia North and Caledonia South have been assessed separately within Sections 8 and 9, respectively. Sections 8 and 9 can be found in Parts 2 and 3 respectively.

1.1.1.4 Caledonia North will be comprised of the following:

- Up to 77 Wind Turbine Generators (WTGs);
- Up to 77 inter-array cables;
- Up to one interconnector cable;
- Up to two Offshore Substation Platform(s) (OSPs); and
- Up to two offshore export cables.

1.1.1.5 Caledonia South will be comprised of the following:

- Up to 78 WTGs;
- Up to 78 inter-array cables;
- Up to one interconnector cable;
- Up to two OSPs; and
- Up to two offshore export cables.

1.1.1.6 The Proposed Development (Offshore), which encompasses Caledonia North and Caledonia South, will be comprised of the following:

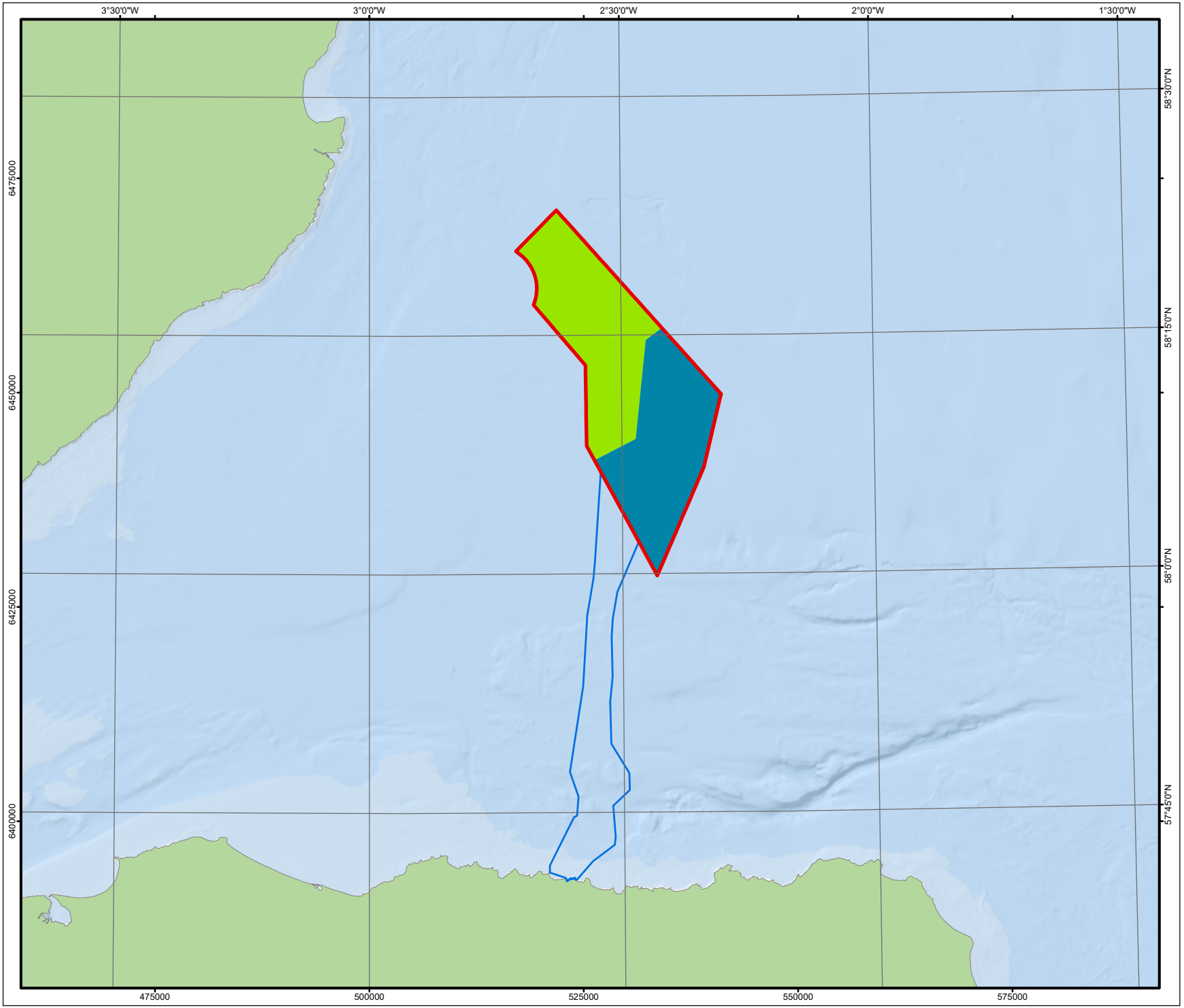
- Up to 140 WTGs;
- Up to 140 inter-array cables;
- Up to two interconnector cables;
- Up to four OSPs; and
- Up to four offshore export cables.

1.1.1.7 It is highlighted that the number of WTGs as part of the Proposed Development (Offshore), and thus assuming the development of both Caledonia North and Caledonia South, will not exceed 140 (noting this is less than the sum of maximum number of WTGs per application).

1.1.1.8 With respect to in-combination impacts the worst-case scenario is for Caledonia North and Caledonia South to be built concurrently. Caledonia North and Caledonia South individually, are not considered in-combination with other OWF schemes. Therefore, the in-combination assessment has only been considered for the Proposed Development (Offshore) within Section 10, which can be found in Part 4 of this RIAA.

1.1.1.9 Caledonia North and Caledonia South are assessed independently, however Caledonia North and Caledonia South along with the Offshore Transmission Infrastructure (OfTI) that will carry the power generated by the Proposed Development (Offshore) ashore at the Landfall Site on the Aberdeenshire coast (up to Mean High Water Springs (MHWS) and the Onshore Transmission Infrastructure (OnTI) are collectively referred to as the 'Proposed Development'. Both Caledonia North and Caledonia South have been assessed together with one another as the Proposed Development (Offshore) in a separate assessment in Section 10. The onshore aspects of the Proposed Development are being considered separately within the Application Document 11: The Proposed Development (Onshore) Report to Inform Appropriate Assessment.

1.1.1.10 For ease of navigation and to allow for assessment and review of each application area independently, the RIAA has been split into four parts with the assessment of Caledonia North, Caledonia South and the Proposed Development (Offshore) located in Parts 2, 3 and 4 respectively. A full roadmap of the structure of the RIAA is provided in Section 3.



Caledonia OWF
Caledonia North Site
Caledonia South Site
Offshore Export Cable Corridor

0 5 10 15 20 km

REV	DATE	DOC STATUS	ORIGIN	REVIEW	APP
01	09/09/2024	Approved	EV	BB	DH

CALEDONIA Offshore Wind Farm

GoBe APEMGroup

CONTRACTOR DRAWING NO: UKCAL1_GO_WNF_HRA_MAP_00102	CONTRACTOR REV: 01
GEODETIC PARAMETERS: WGS 84 / UTM zone 30N (EPSG: 32630)	

DRAWING TITLE

Figure 1-1: The Proposed Development Boundary including Caledonia OWF, Caledonia North Site, Caledonia South Site and OECC

STATUS: Approved	SCALE: 1:600,000	
DRAWING NUMBER: N/A	SHEET NO: 01 of 01	REV: N/A

1.2 Purpose of the RIAA

1.2.1.1 The United Kingdom (UK) has a legally designated network of designated sites for the protection of important flora and fauna, as originally legislated under international legislation (for a full breakdown of the historic and current legislative history please see Section 4). The Scottish Government has a responsibility to consider the potential effects of plans and projects on designated sites through an AA process.

1.2.1.2 The Habitats Regulations[i] guidance on the assessment of plans and projects significantly affecting Natura 2000 sites (Natura 2000 sites now being a part of the UK Site Network), identifies a 4 stage process to the assessment. Together, these stages are referred to as the HRA. The second stage, known as the AA, is part of this process.

1.2.1.3 This RIAA, together with the Offshore HRA Screening Report (Application Document 12) (hereafter referred to as the 'Screening Report'), provides information relevant to the consultation process for the Proposed Development (Offshore), by providing the information required for an HRA to be carried out for the Proposed Development (Offshore). Screening was originally undertaken in 2022 and issued to consultees in September 2022. Consultation has been undertaken since, with a summary of the consultation process to date with detail on comments received and how/where these are addressed is provided in Section 5 of this report. Any updates to screening have been summarised within Sections 2.

1.2.1.4 This document summarises the conclusions relating to evidencing no Likely Significant Effect (LSE), as concluded in the Screening Report (Application Document 12) with respect to the conservation objectives of the screened in European and Ramsar sites. Where potential for LSE cannot be ruled out this report determines the potential for an AEoSI alone and/or in-combination to occur as a result of the Proposed Development (Offshore).

1.2.1.5 This RIAA is part of a suite of documents prepared for the application for the consent of the Proposed Development (Offshore). 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 for the EIAR chapters.

[i] Habitats Directive (92/43/EEC) on the conservation of natural habitats and of wild fauna and flora (the 'Habitats Directive')

1.2.1.6 For ease of reference, and to minimise repetition, the main sources of information within the EIAR for the RIAA are as follows:

- Volume 1, Chapter 1: Introduction;
- Volume 1, Chapter 2: Legislation and Policy;
- Volume 1, Chapter 3: Proposed Development Description (Offshore);
- Volume 1, Chapter 5: Proposed Development Phasing;
- Volume 1, Chapter 6: Site Selection and Alternatives;
- Volumes 2, 3 and 4, Chapter 2: Marine and Coastal Processes;
- Volumes 2, 3 and 4, Chapter 5: Fish and Shellfish Ecology;
- Volumes 2, 3 and 4, Chapter 6: Offshore Ornithology; and
- Volumes 2, 3 and 4, Chapter 7: Marine Mammals.

1.3 Implications of Previous Decisions

1.3.1.1 Several OWF projects have been granted consent within Scottish waters, the most recent being the Green Volt OWF, Pentland Floating OWF and Moray West OWF. Other OWF projects have had applications submitted, including Ossian OWF, West of Orkney OWF and Berwick Bank OWF, which are currently pending determination by Scottish Ministers

1.3.1.2 To date, Green Volt is the only Scottish OWF to be granted consent with a conclusion of AEoSI. The Scottish Ministers concluded that the most up to date and best scientific advice available has been used in reaching the conclusion that the Green Volt OWF will not adversely affect the integrity of the relevant sites and is satisfied that no reasonable scientific doubt remains.

1.3.1.3 However, the AA concluded there would be an AEoSI from Green Volt OWF in combination with other plans or projects for the following features and SPAs:

- Kittiwake *Rissa tridactyla* at Buchan Ness to Collieston Coast SPA;
- Kittiwake, razorbill *Alca torda* and guillemot *Uria aalge* at East Caithness Cliffs SPA;
- Gannet *Morus bassanus* at Forth Islands SPA;
- Kittiwake at Fowlsheugh SPA; and
- Kittiwake at Troup, Pennan and Lion's Head SPA.

1.3.1.4 Further, the AA was unable to conclude beyond reasonable scientific doubt that there will be no AEoSI from Green Volt OWF in combination with other plans or projects for the following features and SPAs:

- Guillemot at Fowlsheugh SPA; and
- Puffin *Fratercula arctica at* Forth Islands SPA.

1.3.1.5 In addition to the above, for the features and sites listed below, no AEoSI could not be concluded in-combination with other projects. However, it was considered that the project-alone contribution to the in-combination impacts was small and as such does not make a tangible contribution to the impacts on:

- Kittiwake and puffin at Forth Islands SPA (both with and without Berwick Bank OWF);
- Razorbill at Fowlsheugh SPA (both with and without Berwick Bank OWF);
- Kittiwake at North Caithness Cliffs SPA (both with and without Berwick Bank OWF);
- Kittiwake at St Abbs Head to Fast Castle SPA (both with and without Berwick Bank OWF); and
- Kittiwake at West Westray SPA (both with and without Berwick Bank OWF).

1.3.1.6 However, despite the conclusions of AEoSI, the Scottish Ministers granted consent to Green Volt on the basis of a HRA derogation, whereby a case for no alternative solutions, imperative reasons of overriding public interest (IROPI) and ability to provide adequate compensation measures was accepted. This is stated within the Green Volt decision letter:

"Given that the AA for the Development identified adverse effects at the sites listed above, the Scottish Ministers proceeded to consider the derogations provisions in the Habitats Regulations. The Scottish Ministers are satisfied that there are no alternative solutions to the Development in order to meet its objectives and that the Development must be carried out for imperative reasons of overriding public interest, notwithstanding a negative assessment of the implications for a European site. Further, the Scottish Ministers consider that the compensatory measures proposed by the Company, which comprise drainage management, disturbance reduction and tree mallow removal measures, can be secured by the inclusion of a suitable condition in the consent requiring the delivery of measures in advance of commencing the Development. The Scottish Ministers further consider that the compensatory measures are sufficient to ensure that the overall coherence of the UK site network is protected.

The Scottish Ministers consider that, having taken into account the information provided by the Company and the responses of the consultative bodies, there are no concerns (other than those addressed through the Derogation Case included at Annex E) in relation to the impact of the Development alone or in combination with other plans and projects on marine mammals and European sites which would require consent to be withheld".

1.3.1.7 Several OWF projects within the UK have also been consented with AEoSI concluded, by the determining authority, on ornithological and intertidal and subtidal habitat receptors. Within the UK, the first OWF project in the UK which was granted consent despite a conclusion of AEoSI was Hornsea Three,

which was granted consent on the 31 December 2020. The AEoSI identified from Hornsea Three was on kittiwake at the Flamborough and Filey Coast 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 AEoSI, as stated in paragraph 6.60 of the Secretary of State (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".

1.3.1.8 Since then, Norfolk Boreas, Norfolk Vanguard, East Anglia ONE North, East Anglia Two, Hornsea Four, and the Sheringham Shoal and Dudgeon Extension projects were all consented (on 10 December 2021, 11 February 2022, 31 March 2022 (both East Anglia projects), 12 July 2023, and 17 April 2024 respectively), despite similar AEoSI identified for benthic and/or ornithology receptors (with the conclusion relating to ornithological receptors being of note).

1.3.1.9 For all of these projects, the SoS concluded an AEoSI on kittiwake at the Flamborough and Filey Coast SPA (in-combination only for Hornsea Four), with Hornsea Four and Sheringham Shoal and Dudgeon Extension also concluding AEoSI on guillemot at the same site. Norfolk Vanguard, Norfolk Boreas, and East Anglia ONE North and TWO all concluded AEoSI on lesser black backed gull at the Alde-Ore Estuary SPA and Ramsar site, and red throated diver at the Outer Thames Estuary SPA, while Sheringham Shoal and Dudgeon Extensions concluded AEoSI on Sandwich tern of the North Norfolk Coast SPA and Greater Wash SPA.

1.3.1.10 All the projects mentioned were all granted consent based on their ability to provide compensation for the identified AEoSI, as stated in:

- The Norfolk Boreas 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".

- The Norfolk Vanguard 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".

- The East Anglia ONE North decision letter:

  "The Secretary of State is satisfied that the necessary compensatory measures to ensure that the overall coherence of the National Site Network can be secured with regards to The Flamborough and Filey Coast SPA kittiwake feature; and the Alde-Ore Estuary SPA lesser black-backed gull feature.

  The Secretary of State notes the advice of Natural England that the updated package of compensation measures provides a reasonable prospect of coherence of the national site network being maintained. The Secretary of State notes that this advice is provided in the specific scenario of a reduction in the impacts of the Proposed Development via a 8km buffer and an avoidance of the impacts of East Anglia TWO Offshore Wind Farm via a 10km buffer and should not be taken as Natural England's advice on other permutations. However, the Secretary of State considers that, given the compensation ratio of 9:1 the shared package of compensatory measures would adequately compensate for the residual adverse effects on the red-throated diver feature of the SPA with a buffer distance of 8km between the Proposed Development and the Outer Thames Estuary SPA as well as the full adverse effects of East Anglia TWO Offshore Wind Farm at 8.3km. The Secretary of State acknowledges that whilst such a project layout does not constitute an alternative solution (given the loss in generating capacity), it is nevertheless the only project layout where he can have confidence that the package of compensatory measures will be effective".

- The East Anglia TWO decision letter:

  "The Secretary of State is satisfied that the necessary compensatory measures to ensure that the overall coherence of the National Site Network can be secured with regards to The Flamborough and Filey Coast SPA kittiwake feature; and the Alde-Ore Estuary SPA lesser black-backed gull feature.

  The Secretary of State notes the advice of Natural England that the updated package of compensation measures provides a reasonable prospect of coherence of the national site network being maintained. The Secretary of State notes that this advice is provided in the specific scenario of a reduction in the impacts of the Proposed Development to 10km, i.e. an avoidance of impacts, and a reduction in the impacts of the East Anglia ONE North Offshore I via an 8km buffer and should not be taken as Natural England's advice on other permutations.

However, he considers that, given the compensation ratio of 9:1 the shared package of compensatory measures would adequately compensate for adverse effects on the red-throated diver feature of the SPA at a distance of 8.3km between the Proposed Development and the Outer Thames Estuary SPA".

- 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 (Offshore) and to ensure the overall coherence of the UK NSN, the Secretary of State concludes that the significant benefits associated with the Proposed Development (Offshore) 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 (Offshore)".

- The Sheringham Shoal and Dudgeon Extensions decision letter:

  "The Secretary of State has 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 (see section 5 above and the HRA that has been published alongside this letter). For the reasons given in this letter, the Secretary of State concludes that the benefits of the Proposed Development outweigh its adverse impacts and that the requirements of the Habitats Regulations are met".

1.3.1.11 In summary, the above projects were all consented after the SoS was satisfied that the projects each met the derogations tests under Regulation 64 of the Habitats Regulations.

2 Updates Since Completion of the Screening Report

2.1.1.1 As stated within paragraph 1.2.1.3, HRA screening was originally undertaken in 2022, and issued to consultees in September of that year. However, since that time the design of the Proposed Development (Offshore) has changed from a single array area, into the Caledonia North and Caledonia South Sites (Array Areas). Between these design changes and the consultation undertaken on the Screening Report (Application Document 12), the screening exercise has been updated with several changes to the screening outcomes identified.

2.1.1.2 The introduction of the Caledonia North and Caledonia South areas has split the screening exercise into three distinct assessments: one for Caledonia North (including the Caledonia North Offshore Export Cable Corridor (OECC), one for Caledonia South (including the Caledonia South OECC), and one for the Proposed Development (Offshore) (including the Caledonia OECC) (i.e., both Caledonia North and Caledonia South). Sites that were screened in and remain screened in following the split, have been assessed for each section discretely in full, including re-doing the screening assessments where necessary.

2.1.1.3 With respect to benthic subtidal and intertidal ecology, consideration of the three scenarios separately did not result in any changes from the initial screening as the screening range applied (20km based on maximum tidal excursion) does not reach any sites designated for benthic features.

2.1.1.4 With respect to marine mammals, following consultation with NatureScot, the screening range considered for harbour and grey seals (*Phoca vitulina* and *Halichoerus grypus*) was updated to 50km and 20km respectively, based on the at sea distribution during the breeding season. This has led to a reduction in the sites screened in for marine mammals, with the following sites designated for seals that were initially screened in within the Screening Report (Application Document 12), now screened out:

- Dornoch Firth and Loch Fleet Ramsar (harbour seal);
- Dornoch Firth and Morrich More SAC (harbour seal);
- Faray and Holm of Faray SAC (grey seal);
- Sanday SAC (harbour seal);
- Bancs des Flandres SAC (grey seal);
- Doggersbank (Netherlands) SAC (harbour and grey seal);
- Klaverbak Site of Community Importance (SCI) (harbour and grey seal);
- Noordzeekustone SCI (grey seal);
- SBZ 1 SCI (grey seal);

- SBZ 2 SCI (grey seal);
- SBZ 3 SCI (grey seal);
- Vlaamse Banken SCI (harbour and grey seal);
- Vlakte van de Raan SCI (grey seal);
- Voordelta SCI (grey seal);
- Waddenzee SCI (grey seal); and
- Westerschelde and Saeftinghe SCI (grey seal).

2.1.1.5 Additionally, the 2022 Screening Report considered several effects for the operational phase of floating turbines only (entanglement and barrier effects), which within the updated context of this RIAA relate only to Caledonia South and the Proposed Development (Offshore), not Caledonia North. Since the publication of that 2022 report, additional consideration has been given to these effects and the potential significance on bottlenose dolphins associated with the Moray Firth SAC which has resulted in the screening out of these effects from assessment.

2.1.1.6 It is considered that each mooring line for floating turbines will have a maximum length of 1km in the water column (Table 10-6). Of the potential options for mooring configurations, catenary configurations present the greatest entanglement risk to marine mammals as they have the least taut lines (Benjamins *et al*., 2014[1]; Harnois *et al*., 2015[2]), however even catenary configurations are considered to have too much tension on these lines to generate any loops big enough that could entangle marine mammals (Benjamins *et al*., 2014[1]; Harnois *et al*., 2015[2]; Copping *et al*., 2020[3]; Garavelli, 2020[4]). The same applies to dynamic cables in the water column, as these cables prevent the creation of loops within the system (Young *et al*., 2018[5]).

2.1.1.7 It is considered that given the size of the mooring lines compared to the size of bottlenose dolphins, in addition to the ability of bottlenose dolphins to detect such large-diameter lines through echolocation (Maxwell *et al*., 2022[6]; Benjamins *et al*., 2014[1]; Nielsen *et al*., 2012[7]), there is negligible risk of bottlenose dolphins becoming entangled with the moorings directly (primary entanglement). Furthermore, secondary and tertiary entanglement are only considered a risk to marine mammals if they are in an area of high fishing presence. There is considered to be a moderate to low relative density of fishing-related items among seabed litter in the waters off north-east Scotland compared to elsewhere in European waters (EMODnet[8]), and animals associated with the SAC are not considered to move beyond 2km from the coast of Scotland (Quick *et al*., 2014[9]). Therefore, bottlenose dolphins associated with the SAC are not anticipated to have a presence within the array areas for either Caledonia South or the Proposed Development (Offshore). Consequently, it is considered that there is no pathway for effect

and thus no LSE for entanglement effects on the bottlenose dolphin feature of the Moray Firth SAC. This impact is screened out from further assessment.

2.1.1.8 As established, bottlenose dolphins associated with the Moray Firth SAC are not anticipated to enter the array area boundaries and therefore cannot have any interaction with the physical presence of floating turbines and associated mooring cables. Furthermore, as bottlenose dolphins would be able to detect and therefore navigate around the cables and turbines (Maxwell *et al*., 2022[6]; Benjamins *et al*., 2014[1]; Nielsen *et al*., 2012[7]), it is considered that any physical presence in the water column would it is not result in any potential risk of barrier effects from floating turbines. Consequently, it is considered that there is no pathway for effect and thus no LSE for barrier effects on the bottlenose dolphin feature of the Moray Firth SAC. This impact is screened out from further assessment.

2.1.1.9 With respect to offshore and intertidal ornithology, the Screening Report (Application Document 12) identified all European sites (SPAs and Ramsar sites) with designated ornithology features (both breeding/non-breeding seabirds and waterbirds) located within a mean of the maximum foraging range +1 Standard Deviation, (Woodward *et al*. 2019[32]); hereafter referred to as MMF+1SD, of the Proposed Development (Offshore) using straight line distances. Throughout consultation with NatureScot and in line with the interim guidance from NatureScot (2018[10]), it was advised that foraging ranges used should take into account species that are known to avoid commuting over land. As such, the distance of each colony from the Proposed Development (Offshore) was measured as the distance from the geometric centre of the Caledonia OWF (i.e., the Array Area) to the geometric centre of the colony, taking the shortest at sea distance route possible (in line with NatureScot 2018 Interim Guidance[10]).

2.1.1.10 In order to calculate at sea distance the centre of the Caledonia OWF was also used. This has led to a reduction in sites screened in for offshore and intertidal ornithology during both the breeding season due to lack of connectivity. The following sites and features, initially screened in within the Screening Report (Application Document 12), are now screened out for the breeding season:

- Copinsay SPA (great black-backed gull *Larus marinus*);
- Hoy SPA (great black-backed gull);
- Buchan Ness to Collieston Coast SPA (guillemot and herring gull *Larus argentatus*);
- Fowlsheugh SPA (guillemot, razorbill and herring gull);
- Cape Wrath SPA (guillemot and razorbill);
- Sule Skerry and Sule Stack SPA (guillemot);
- Fair Isle SPA (guillemot);
- Forth Islands SPA (puffin, razorbill and lesser black-backed gull);

- Farne Islands SPA (kittiwake); and
- Hermaness, Saxa Vord and Valla Field SPA (kittiwake).

2.1.1.11 Additionally, when considering the recent advice provided by NatureScot regarding screening conclusions to Salamander OWF (NIRAS, 2024[11]) the following sites and features have also been screened out:

- Herring gull feature of Fowlsheugh SPA and Buchan Ness SPA during the non-breeding season. This is due to NatureScot recommending a regional approach during the non-breeding season for herring gulls, for which the site is outwith herring gulls MMF+1SD from the Proposed Development (Offshore). Therefore, no connectivity during the non-breeding season was concluded;
- Puffin feature of Forth Islands SPA during the non-breeding season. This is due to NatureScot suggesting assessment of puffin is not required during the non-breeding season;
- Lesser black-backed gull feature of Forth Islands SPA during the non-breeding season. This is due to NatureScot recommending a regional approach during the non-breeding season for razorbill, for which all sites are outwith lesser black-backed gulls MMF+1SD from the Proposed Development (Offshore). Therefore, no connectivity during the non-breeding season was concluded;
- Razorbill feature of Cape Wrath SPA during the non-breeding season. This is due to NatureScot recommending a regional approach during the non-breeding season for razorbill, for which all sites are outwith razorbills MMF+1SD from the Proposed Development (Offshore). Therefore, no connectivity during the non-breeding season was concluded; and
- Guillemot feature of Fowlsheugh SPA, Cape Wrath SPA, Sule Skerry and Sule Stack SPA, Buchan Ness SPA and Fair Isle SPA during the non-breeding season. This is due to NatureScot recommending a regional approach during the non-breeding season for guillemot, for which all sites are outwith guillemots MMF+1SD from the Proposed Development (Offshore). Therefore, no connectivity during the non-breeding season was concluded.

2.1.1.12 For the Gannet feature of St Kilda SPA (breeding and non-breeding season) and Flamborough and Filey Coast SPA (breeding season) the potential for LSE has now been excluded. No LSE has been concluded for both SPAs during the breeding season due to lack of expected connectivity, as gannets are known to show 'space partitioning' during the breeding season (Wakefield *et al.*, 2013[17]). As clearly presented within Wakefield *et al.* (2013[17]) gannets from St Kilda and Flamborough and Filey Coast SPA show no overlap with the Proposed Development (Offshore). Additionally, for the gannet feature of St Kilda the potential for an LSE during the non-breeding season can be excluded based on the limited proportion of gannets from the colony are expected to winter in the North Sea post-breeding (Appendix A of Furness, 2015[12]).

2.1.1.13 Fulmars *Fulmarus glacialis* are classified as having a low vulnerability to distributional response effects (Furness and Wade, 2012[86]; Furness *et al*., 2012[13]; Bradbury *et al*., 2014[87]; Wade *et al*., 2016[14]; SNCBs, 2022[79]) and as such are not considered susceptible to distributional response effects (see Volume 7B, Appendix 6-2, Annex 4: Offshore Ornithology Review of Relevant Evidence). Within consultation, species to be included within assessments for collision and distributional response assessments were discussed with NatureScot. It was advised during consultation (meeting 09/05/2024) that rather than screening out fulmar a qualitative assessment should be undertaken for potential barrier effects. This assessment has been included within Section 7.3.7.

2.1.1.14 With regards to Sandwich tern *Thalasseus sandvicensis*, the Loch of Strathbeg SPA was initially screened in within the Screening Report (Application Document 12). However, within site specific digital aerial surveys no individuals were recorded during the entire non-breeding season within the array area of the Proposed Development (Offshore). As such, LSE can confidently be ruled out during the non-breeding season due to lack of connectivity. During post breeding migration, given that migration occurs from breeding colonies to Africa it is unlikely that individuals would travel south (bisecting the Caledonia OWF) (Alerstam *et al*., 2019[15]). Site-specific DAS data conforms with this as no Sandwich terns were recorded during post breeding migration. As such, LSE can confidently be ruled out during post breeding migration due to lack of connectivity. Therefore, the Loch of Strathbeg SPA is now screened out for Sandwich tern. The Applicant notes NatureScot's request to consider potential impacts on Sandwich tern at the Ythan Estuary, Sands of Forvie and Meikle Loch SPA during the construction phase within the export cable corridor. As such, Ythan Estuary, Sands of Forvie and Meikle Loch SPA has now been screened in for Sandwich tern.

2.1.1.15 With regards to Arctic skua *Stercorarius parasiticus*, the Hoy SPA was initially screened in for collision during the operation and maintenance (O&M) phase within the Screening Report (Application Document 12). However, only one individual was recorded within the 24 months of site specific digital aerial surveys of the Project. Based on the limited number recorded, the potential for LSE can confidently be excluded for the Arctic Skua feature of Hoy SPA. This conclusion was consulted on with NatureScot in May 2024, with NatureScot providing written confirmation of the species to be included within collision risk assessments for the Caledonia OWF, for which Arctic Skua was excluded. Therefore, the Hoy SPA is now screened out for Arctic skua.

2.1.1.16 The Screening Report (Application Document 12) for the Proposed Development (Offshore) screened lesser black-backed gull (*Larus fuscus*), Arctic skua (*Stercocarius parasiticus*) and terns (common (*Sterna hirundo*) and Arctic (*Sterna paradisaea*)) into the assessment of collision risk. Due to the low numbers recorded within the DAS (Table 2-1), these species have been excluded from the CRM assessment. The 24 baseline surveys recorded

two flying lesser black-backed gulls and one flying Arctic skua within the Array Area. Tern numbers were notably low, with eight terns recorded in May and August, with a maximum of three birds per species/species group (Common tern, Arctic tern, and "Commic" tern) observed at the end and beginning of the migration seasons.

Table 2-1: Raw count and densities of unapportioned species counts of flying birds in the Caledonia OWF, Caledonia North and Caledonia South.

Species	Caledonia OWF		Caledonia North		Caledonia South	
	Raw count	Density	Raw count	Density	Raw count	Density
Lesser black-backed gull	2	0.03 (Jun 2022)	2	0.05 (Jun 2022)	-	-
Arctic skua	1	0.01 (Aug 2022)	1	0.03 (Aug 2022)	-	-
Common tern	3	0.04 (Aug 2021)	3	0.08 (Aug 2021)	-	-
Arctic tern	-	-	-	-	-	-
"Commic" tern	5	0.03, 0.03, 0.02 (Aug 2021; May 2022; Aug 2022)	5	0.05, 0.05, 0.03 (Aug 2021; May 2022; Aug 2022)	-	-

2.1.1.17 Within the Offshore Scoping Opinion (Volume 7, Appendix 3) published in January 2023, NatureScot requested the addition of several sites for consideration in the AA. This has led to the following sites that were initially screened out within the Screening Report (Application Document 12), to now be screened in:

- Moray Firth SPA (shag *Gulosus aristotelis*);
- Handa SPA (kittiwake and great skua *Stercorarius skua*);
- Shiant Isles SPA (kittiwake);
- St Kilda SPA (great skua); and
- Ythan Estuary, Sands of Forvie and Meikle Loch SPA (sandwich tern).

2.1.1.18 In addition to those sites outlined above, NatureScot requested consideration of additional sites and features in the HRA. Table 2-2: lists the requested sites and features and provides the Applicants reasons for including or excluding them.

Table 2-2: Additional qualifying features and sites requested by NatureScot for inclusion in HRA within Scoping Opinion (January 2023).

Site	Distance to Proposed Development (Offshore) (km)	Species	Reasoning
Canna and Sanday SPA	398.4	Kittiwake	The Array Area is outwith the MMF±1SD foraging ranges (Woodward *et al*., 2019[32]) for designated seabird species (156.1±144.5km kittiwake, 137.1±128.3km puffin). Project experience to date strongly suggests all other potential effects result in no LSE for this species-site in-combination. Therefore, LSE can confidently be ruled out and discounted in relation to all other effects alone or in-combination.
		Puffin	
Flannan Isles SPA	337.5	Kittiwake	The Array Area is outwith the MMF+1SD foraging ranges (Woodward *et al*., 2019[32]) for designated seabird species (156.1±144.5km). Project experience to date strongly suggests all other potential effects result in no LSE for this species-site in-combination. Therefore, LSE can confidently be ruled out and discounted in relation to all other effects alone or in-combination.
		Leach's petrel *Hydrobates leucorhous*	Further consideration of the potential for an AEoSI with regard to Leach's petrel species is presented in Section 7.3.5.
Handa SPA	207.5	Guillemot	The Array Area is outwith the MMF+1SD foraging ranges (Woodward *et al*., 2019[32]) for designated seabird species (73.2±80.5km guillemot, 88.7±75.9km razorbill). Project experience to date strongly suggests all other potential effects result in no LSE for this species-site in-combination. Therefore, LSE can confidently be ruled out and discounted in relation to all other effects alone or in-combination.
		Razorbill	
Shiant Isles SPA	293.5	Puffin	The Array Area is outwith the MMF+1SD foraging ranges (Woodward *et al*., 2019[32]) for designated seabird species (137.1±128.3km). Project experience to date strongly suggests all other potential effects result in no LSE for this species-site in-combination. Therefore, LSE can confidently be ruled out and discounted in relation to all other effects alone or in-combination.

Site	Distance to Proposed Development (Offshore) (km)	Species	Reasoning
St Kilda SPA	408.8	Leach's petrel	Further consideration of the potential for an AEoSI with regard to Leach's petrel species is presented in Section 7.3.5.
		Manx; shearwater *Puffinus puffinus*	This species was recorded infrequently and in low abundances within site specific DAS. Manx shearwaters also have low vulnerability to displacement and are not considered at risk of collision due to flight height distribution and behaviours (Deakin *et al*., 2022[16]; Bradbury *et al*., 2014[87]) Project experience to date strongly suggests all other potential effects result in no LSE for this species-site in-combination. Therefore, LSE can confidently be ruled out and discounted in relation to all other effects alone or in-combination.
		Gannet	For gannet, St Kilda SPA is within MMF+1SD of the Array Area. However, as gannets are known to show 'space partitioning' between adjacent colonies (Wakefield *et al.*, 2013[17]) there is no overlap between the foraging areas of gannet from St Kilda SPA and the Array Area. Therefore, LSE can confidently be ruled out and discounted in relation to all other effects alone or in-combination.
North Rona and Sula Sgeir SPA	242.6	Leach's petrel	Further consideration of the potential for an AEoSI with regard to Leach's and Storm petrel species is presented in Section 7.3.5.
Foula SPA	222.5	Leach's petrel	
Sule Skerry and Sule Stack SPA	154.8	Leach's petrel	
Ramna Stacks and Gruney SPA	445.9	Leach's petrel	
Priest Island (Summer Isles)	259.1	Storm petrel	
Treshnish Isles SPA	449.0	Storm petrel	

Site	Distance to Proposed Development (Offshore) (km)	Species	Reasoning
Rum SPA	410.5	Manx; and shearwater	This species was recorded infrequently and in low abundances within site specific digital aerial surveys (DAS) undertaken to provide an up-to-date survey of species (undertaken monthly between May 2021 and April 2023 inclusive) occurring within the array area of the Proposed Development (Offshore). Manx shearwaters also have low vulnerability to displacement and are not considered at risk of collision due to flight height distribution and behaviours (Deakin *et al.*, 2022[16]; Bradbury *et al*., 2014[87]) Project experience to date strongly suggests all other potential effects result in no LSE for this species-site in-combination. Therefore, LSE can confidently be ruled out and discounted in relation to all other effects alone or in-combination.

2.1.1.19 With regards to offshore and intertidal ornithology assessments for Outer Firth of Forth and St Andrews Bay Complex SPA and Northumberland Marine SPA assessments have been undertaken within sections for associated breeding SPAs that have been screened into the assessment. These are the Forth Islands SPA (Section 8.2.2, Section 9.2.2 and Section 10.2.2) and Farne Islands SPA respectively (Section 8.2.2, Section 9.2.2 and Section 10.2.2).

2.1.1.20 With respect to migratory fish, the Screening Report (Application Document 12) considered a precautionary range of 100km following the precedent on other OWF projects in the UK. Through consultation with NatureScot, it was advised that given the lack of understanding around fish migrations in Scotland, fish should not be considered within the HRA for the Proposed Development (Offshore), and instead left to be considered exclusively through EIA process. It is the Applicant's position however that not considering migratory fish within the HRA would not fulfil the legal obligations prescribed within the Habitat Regulations and associated guidance (see Section 4), as all designated sites for Annex II species should be considered. Therefore, the previously used 100km screening range is still considered to be appropriate. However, three sites (River Borgie SAC, River Naver SAC and River See SAC) that were initially screened in for migratory fish were screened out as measurements to Caledonia North, Caledonia South and the Proposed Development (Offshore) were retaken which meant that three of the original sites are no longer within the 100km Zone of Influence (ZoI).

2.1.1.21 Additionally, for migratory fish the Screening Report (Application Document 12) considered accidental pollution and water quality resulting from accidental spills from construction, O&M and decommissioning vessels and contaminants being released during piling activities along with increases in suspended sediment concentrations from construction and decommissioning. Accidental pollution has been screened out on the basis that the magnitude of any accidental spill will be limited by the size of chemical or oil inventory on construction vessels, additionally, released hydrocarbons would be subject to rapid dilution, weathering and dispersion and would be unlikely to persist in the marine environment. The ZoI defined within the Volume 2: Chapter 5 – Fish and Shellfish Ecology chapter of the EIAR for suspended sediment concentrations is 10km, the nearest site designated for migratory fish is 27km away and, therefore, well beyond the ZoI. Suspended sediment concentrations has since been screened out given the distance from the Proposed Development (Offshore) and the sites designated for migratory fish. In addition, rivers are often extremely turbid environments which migratory fish travel through and, therefore, suspended sediment arising from construction of an OWF would be isolated and non-comparable with an estuarine environment.

3 Structure of the RIAA

3.1.1.1 This document is set out in a number of stages that follow the prescribed HRA process, with the overall structure of the document summarised below:

- **Part 1**
  - Executive Summary - Summarises the Project, need for an Appropriate Assessment and the outcome of the RIAA in regards to AEoSI;
  - Section 1: Introduction - Provides a background to the Proposed Development (Offshore), including its purpose, and where related information can be found (including the baseline environment and the full project description);
  - Section 2: Updates Since Completion of the Screening Report – Summarises the changes to the Proposed Development (Offshore) and HRA screening since the Screening Report (Application Document 12) was prepared;
  - Section 3: Structure of the RIAA - Details the structure of the document for the ease of reference, and defines the process to be followed;
  - Section 4: Legislation, Policy and Guidance – Identifies the legislation driving the need for the report, together with the policy and guidance defining the structure;
  - Section 5: Consultation - Summarises all consultation undertaken on the HRA process to date, including details around how issues have been addressed;
  - Section 6: Proposed Development (Offshore) Description - Draws on the information presented in relevant chapters of the EIAR to provide detail to the relevant aspects of Caledonia North and Caledonia South to the assessments, including temporal and spatial aspects as well as information on site selection and alternatives;
  - Section 7: Overview of Potential Impacts Considered – Provides the methodology used for the assessment of AEoSI and provides any appropriate information to inform the assessment process followed below;
- **Part 2**
  - Section 8: Assessment of Caledonia North – Assesses the potential for impacts from Caledonia North, alone. This section includes a summary of screening and the full assessment of AEoSI (the assessment for AEoSI in-combination with other plans and projects is located in Section 10, only one in-combination assessment has been completed to make the assessment more concise);

- **Part 3**
  - Section 9: Assessment of Caledonia South – Assesses the potential for impacts from Caledonia South, alone. This section includes a summary of screening and the full assessment of AEoSI (the assessment for AEoSI in-combination with other plans and projects is located in Section 10, only one in-combination assessment has been completed to make the assessment more concise);
- **Part 4**
  - Section 10: Assessment of the Proposed Development (Offshore) – Assesses the potential for impacts from the Proposed Development (Offshore), both alone and in-combination with other plans and projects. This section includes a summary of screening and the full assessment of AEoSI;
  - Section 11: Transboundary Statement for Caledonia North and Caledonia South – Provides a summary statement on the Applicant's position on transboundary effects from the Proposed Development (Offshore); and
  - Section 12: Conclusions of the Assessment – Summarises the assessment undertaken for the Proposed Development (Offshore).

4 Legislation and Policy Guidance

4.1 Habitats Directive and Habitats Regulations

4.1.1.1 The legislation surrounding designated sites in Scotland comes from both Scottish and wider UK legislation.

4.1.1.2 The Habitats Directive (92/43/EEC) on the conservation of natural habitats and of wild fauna and flora (the 'Habitats Directive'), protected habitats and species of European nature conservation importance. Together with the Council Directive (2009/147/EC) on the conservation of wild birds (the 'Birds Directive'), the Habitats Directive established a network of internationally important sites, designated for their ecological status: SACs, under the Habitats Directive promote the protection of flora, fauna and habitats; and SPAs, under the Birds Directive in order to protect rare, vulnerable and migratory birds. These sites combined to create a Europe wide 'Natura 2000' network of designated sites, which were referred to as 'European sites'.

4.1.1.3 The above Directives were transposed into UK legislation through a series of Regulations. Terrestrial areas of the UK, and territorial waters out to 12 nautical miles (nm), are covered under both the Conservation (Natural Habitats, &c.) Regulations 1994 and the Conservation of Habitats and Species Regulations 2017 (the Habitats Regulations), with waters beyond 12 nm, to the extent of the British Fishery Limits and UK Continental Shelf Designated Area, covered under The Conservation of Offshore Marine Habitats and Species Regulations 2017. These Regulations are collectively referred to here as the Habitats Regulations.

4.1.1.4 Scottish Government policy 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 candidate SACs (cSACs).

4.2 EU Exit Regulations

4.2.1.1 The UK left the European Union on Exit Day, 31 January 2020, following Completion Day on 31 December 2020. The EU Exit Regulations (2019[18]) 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 Proposed Development (Offshore).

4.2.1.2 Although the UK is no longer bound by EU laws, specific EU-Exit legislation passed by both the Scottish Parliament and the UK aims to safeguard Scotland's nature, striving to match or exceed the environmental standards set by the EU in the long-term. Consequently, certain adjustments were made

to Scotland's Habitats Regulations, but only to the extent where they were necessary. This was to maintain their functionality and to ensure that the requirements of the preceding legislation continued governing the designation and protection of European sites.

4.2.1.3 The amendments to the Habitats Regulations are set out within 'EU Exit: The Habitats Regulations in Scotland' (Scottish Government, 2020[19]) and include:

- European sites, European marine sites and European offshore marine sites within the UK as defined by the Habitats regulations, are now excluded from the EU's Natura 2000 network. Instead, they constitute a nationwide network of protected areas known as the National Site Network (NSN) and continue to benefit from equivalent levels of protection. (As this assessment includes transboundary sites, the term adopted within this report is hereafter European sites);
- Management objectives are set for the NSN. In Scotland, including its inshore and offshore areas, Scottish Ministers are required to collaborate with other UK administrations to manage and, if necessary, adjust the NSN to meet these objectives;
- The European Commission is no longer involved in the designation process or providing opinions on IROPI regarding granting consent for plans or projects when a competent authority cannot ascertain no adverse effects on site integrity following completion of an HRA. These responsibilities now fall under the jurisdiction of the Scottish Ministers, with guidance from NatureScot and the Joint Nature Conservation Committee (JNCC).
- The Habitats Regulations now grant authority to modify the annexes and schedules associated with the Habitats and Birds Directives, to the extent that they pertain to the Habitats Regulations. These powers are vested in the Scottish Ministers; and

4.2.1.4 New powers have been conferred upon the Scottish Ministers concerning the 1994 Habitats Regulations, and the Secretary of State now possesses authority regarding the Habitats Regulations. These powers enable them to issue guidance for interpreting the mandates outlined in the preceding legislation.

4.3 Energy Act 2023

4.3.1.1 Part 13 Chapter 1 (Sections 290 to 295) of the UK Government's Energy Act, 2023, provides legislative provisions which include for the potential for strategic compensation delivered by public authorities and marine recovery funds which may fund compensation.

4.3.1.2 The statutory provisions also extend to potentially altering the requirements of assessment and how the compensation is dealt with. This may in the future be relevant to both European sites and Marine protection areas. The Applicant will continue to monitor the implementation of these provisions.

4.4 Further Guidance

4.4.1.1 Further key guidance of relevance that has been used to inform this RIAA comprise:

- NatureScot (2022[20]). European Site Casework Guidance: How to consider plans and projects affecting Special Areas of Conservation (SACs) and Special Protection Areas (SPAs);
- Scottish Natural Heritage (SNH) (2018[21]). HRA on the Moray Firth: A Guide for developers and regulators;
- SNH (2019[22]). The handling of mitigation in Habitats Regulations Appraisal – the People Over Wind CJEU judgement;
- Department of Energy and Climate Change (DECC) (2016[23]). Guidance on when new marine Natura 2000 sites should be taken into account in offshore renewable energy consents and licenses. May 2016;
- European Commission (2001[24]). Assessment of Plans and Projects Significantly Affecting Natura 2000 Sites: Methodological Guidance on the provisions of Article 6(3) and 6(4) of the 'Habitats' Directive 92/43/EEC. November 2001;
- European Commission (2019[25]). Managing Natura 2000 sites. The Provisions of Article 6 of the 'Habitats' Directive 92/43/EEC;
- European Commission (2020[26]). EU Guidance on wind energy on wind energy development in accordance with EU nature directives;
- David Tyldesley and Associates (2015[27]). HRA of Plans. Guidance for Plan-making Bodies in Scotland. A NatureScot (formerly) HRA guidance document;
- David Tyldesley and Associates (2021a[28]). The Habitat Regulations Assessment Handbook;
- Department of Environment, Food and Rural Affairs (DEFRA), Natural England, Welsh Government and Natural Resources Wales (NRW) (2021) (Updated 2023[29]);
- Department of Communities and Local Government (2006[30]). Guidance on 'Planning for the Protection of European Sites: Appropriate Assessment'; and
- Scottish Government (2018[31]). Marine Directorate (formerly Marine Scotland) Consenting and Licensing Guidance: For Offshore Wind, Wave and Tidal Energy Applications.

4.6 Case Law and Recent Examples

4.6.1.1 Specific case law of note includes recent rulings by the European Court of Justice (ECJ), referred to here as Sweetman II or 'People over Wind', and Holohan. The People over Wind ruling relates to how screening to prove no 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).

4.6.1.2 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 or supporting habitat for a designated species). Both these rulings have been taken into consideration during preparation of the Screening Report (Application Document 12) and this RIAA.

4.6.1.3 Additionally, as discussed in Section 1.3, recent consents awarded to a number of offshore wind projects have including decisions of relevance to the Proposed Development (Offshore).

4.7 The HRA Process

4.7.1.1 In Scotland, the HRA process is considered to be a three-stage process, with each stage determining the requirement for the next in a sequential manner. The stages considered are as follows:

- Stage 1 - Screening: This involves identifying if the plan or project is necessary for the management of a designated site and then determining if a potential LSE can be ruled out, either alone or in-combination with other plans and projects;
- Stage 2 – AA: Here, the sites for which LSE could not be discounted in Stage 1 are evaluated to determine if the proposal could adversely affect the integrity of it, in consideration of the sites' conservation objectives; and
- Stage 3 - Assessment of Alternative Solutions/IROPI: Where it cannot be concluded that there is no adverse effect on site integrity, the competent authority must test that there are no feasible alternative solutions to the plan or project with a reduced impact on designated sites, and that there are IROPI for the plan or project. Compensatory measures must also be developed to ensure that the overall coherence of the NSN is maintained.

4.7.1.2 Each stage, except the final one, establishes the prerequisites and boundaries for the subsequent stage. This report builds on the Stage 1 Screening exercise that has already been undertaken and presents the assessment for Stage 2 of the HRA process.

5 Consultation

5.1.1.1 Consultation has been ongoing for the Proposed Development (Offshore), with the Screening Report (Application Document 12) published in September 2022 and the subsequent Scoping Opinion (Volume 7, Appendix 3) published in January 2023. Consultation from various stakeholders was undertaken in relation to the HRA for the Proposed Development (Offshore), with comments received from Marine Directorate - Licensing Operations Team (MD-LOT[ii]), NatureScot and RSPB.

5.1.1.2 In addition to more formal consultation, the Applicant has engaged with NatureScot and RSPB throughout the pre-application stage via bilateral meetings to discuss Offshore and Intertidal Ornithology (see Volume 1, Chapter 8: Consultation Summary).

5.1.1.3 Consultation on the Screening Report (Application Document 12), any comments of relevance from the Offshore Scoping Report (Volume 7, Appendix 2) and additional consultation activities are summarised in Table 5-1.

[ii] In 2023, Marine Scotland was renamed Marine Directorate, and thus the marine licensing and consents team is now referred to as Marine Directorate - Licensing Operations Team (MD-LOT).

Table 5-1: Consultation with respect to HRA.

Consultee	Date and Document	Comment	Where Addressed in the RIAA
MD-LOT	January 2023, Scoping Opinion	The Applicant submitted a Habitats Regulations Appraisal ("HRA") Screening Report ("HRA Screening Report") separate from the Scoping Report on 3 October 2022 in relation to the Proposed Development (Offshore). The Scottish Ministers response to the HRA Screening Report is however contained within the relevant receptor chapters of this Scoping Opinion. In addition, the Scottish Ministers advise that the representations from NatureScot and Royal Society for the Protection of Birds ("RSPB") on the HRA Screening Report must be fully reviewed and addressed by the Applicant.	All consultation received from relevant bodies (including the Scottish Ministers, NatureScot and the RSBP) are presented within this table and addressed throughout the RIAA.
MD-LOT	January 2023, Scoping Opinion	The Scottish Ministers highlight that the HRA report should take into account the representations provided by consultees and submitted alongside the EIAR.	All consultation received from relevant bodies (including the Scottish Ministers, NatureScot and the RSBP) are presented within this table and addressed throughout the RIAA.
MD-LOT	January 2023, Scoping Opinion	With regards to the HRA Screening Report, the Scottish Ministers agree with the conclusions specific to benthic subtidal and intertidal ecology which is supported by the NatureScot representation.	Multilateral agreement to not include benthic subtidal and intertidal ecology receptors is reflected in the RIAA.
MD-LOT	January 2023, Scoping Opinion	With regards to the HRA Screening Report, the Scottish Ministers advise that all SACs designated for Atlantic salmon (*Salmo salar*) in Scotland are screened in at this stage for further assessment, in line with the NatureScot representation. The Scottish Ministers also agree with the NatureScot representation that all SACs with Fresh Water Pearl Mussels ("FWPM") as a qualifying feature should also be screened in for further assessment as Atlantic salmon are a host	Following the scoping opinion, and further discussions, Nature Scot provided advice on 01 June 2023 that diadromous fish should not be considered within the HRA for the Proposed Development (Offshore) given a lack of information regarding migratory fish populations and migration routes. However, the Applicant considers that excluding fish is not legally appropriate and in order to satisfy the Habitats Regulations, diadromous/migratory fish have been

Consultee	Date and Document	Comment	Where Addressed in the RIAA
		species for FWPM during a critical parasitic phase of the FWPM life cycle and therefore indirect impacts require consideration to ensure populations are not adversely affected. Following further discussions with the Scottish Minister and NatureScot, the Scottish Minister decided that no SACs designated for Atlantic salmon in Scotland should be screened in at this stage for further assessment. However, given the nature of the works, the Applicant would rather take a precautionary approach and use the industry standard of 100km from the Proposed Development (Offshore) to scope in SACs designated for migratory fish receptors. Therefore, further discussions with the Scottish Minister and NatureScot are underway.	considered and assessed. Following the justification within the Screening Report (Application Document 12) and the precedent set on other offshore wind farms, a 100km screening distance was used for identifying sites designated for migratory fish receptors. Sites screened in for migratory fish receptors can be seen in Section 8.2.3 and 9.2.3.
MD-LOT	January 2023, Scoping Opinion	The Applicant should also note that further consideration is required for in-combination impacts in relation to the HRA Screening given the 100km approach is not appropriate for migratory fish. The Applicant must fully address the NatureScot representation with regards to HRA.	As stated above, the Applicant is confident that the 100km screening range for fish is appropriate and is more precautionary than the recommendations from NatureScot; therefore, no change to the screening for in-combination impacts is required.
MD-LOT	January 2023, Scoping Opinion	With regards to the HRA Screening Report, in addition to the impact pathways identified, impacts of wet storage have not been sufficiently addressed. The Scottish Ministers advise further assessment of potential impacts is required in the HRA, in line with the NatureScot representation.	The Applicant notes the potential impact pathways from wet storage. Since the Scoping Opinion (Volume 7, Appendix 3), further consultation has been undertaken, with recommendations from the Marine Directorate and NatureScot that wet storage will be licenced separately outwith the Proposed Development (Offshore).
MD-LOT	January 2023, Scoping Opinion	The Scottish Ministers broadly agree with the use of Woodward *et al*. (2019[32]) in regard to foraging ranges, with the exception of gannets, guillemots and razorbills. NatureScot advise contained in Annex 1 of	The Applicant has noted this request and can confirm that this was the approach taken as presented in the EIAR.

Consultee	Date and Document	Comment	Where Addressed in the RIAA
		its representation must be fully addressed by the Applicant in the EIAR. Additionally, the Scottish Ministers advise that shag must be scoped in for further assessment for the Moray Firth SPA. Impacts on Sandwich tern at Ythan Estuary SPA must also be scoped in for assessment during the construction phase within the export cable corridor.	Consideration of the potential impacts on shag at the Moray Firth SPA and Sandwich tern at Ythan Estuary SPA (during the construction phase within the export cable corridor) are considered within Section 7.3.9 for Caledonia North, Caledonia South and the Caledonia OWF.
MD-LOT	January 2023, Scoping Opinion	In line with the NatureScot representation, The Scottish Ministers advise that the mean foraging ranges for Leach's petrel should be in line with Woodward *et al.* (2019[32]). Therefore, in addition to those identified North Rona and Sula Sgeir SPA, Foula SPA, Flannan Isles SPA, Sule Skerry and Sule Stack SPA, St Kilda SPA and Ramna stacks and Gruney SPA must be scoped in the HRA for further assessment.	Further consideration of the potential for an AEoSI with regard to storm petrel species is presented in Section 7.3.5.
MD-LOT	January 2023, Scoping Opinion	Additionally in line with the NatureScot representation, The Scottish Ministers disagree that SPAs should be scoped out on the basis that they are located on the west coast of the UK. The screening process for HRA requires that all species with theoretical connectivity are screened in for further consideration – taking into account at sea connectivity distances. Therefore, the following species and sites must be considered to have Likely Significant Effect ("LSE"); Handa SPA for Great skua, Fulmar and Kittiwake, Guillemot and Razorbill; Priest Island (Summer Isles) SPA for Storm Petrel; Shiant Isles SPA for Kittiwake, Fulmar and Puffin; Rum SPA for Manx shearwater; Canna and Sanday SPA for Kittiwake and Puffin; Flannan Isles SPA for Kittiwake, Fulmar and Leach's Petrel; Treshnish Isles SPA for Storm petrel; Mingulay and Berneray SPA for Fulmar and St Kilda SPA for Gannet, Fulmar, Manx	Within the Scoping Opinion (Volume 7, Appendix 3) published in January 2023, NatureScot requested the addition of several sites for consideration in relation to the HRA. This has led to these sites that were initially screened out within the Screening Report (Application Document 12), to now be screened in. With regards to the additional sites outlined, these sites have not been included within assessments due to the reasons provided in Table 2-2.

Consultee	Date and Document	Comment	Where Addressed in the RIAA
		shearwater, Great skua, and Leach's petrel. The Applicant should refer to Annex 1 of the NatureScot representation for guidance on establishing connectivity.	
MD-LOT	January 2023, Scoping Opinion	In regard to connectivity and identification of key sites for migratory birds (non-seabirds), the Scottish Ministers highlight the NatureScot representation and advise that this is considered by the Applicant in the HRA.	Connectivity and identification of key sites for migratory birds was undertaken as part of HRA Screening. These sites and species have been considered within Section 7.3.11.
MD-LOT	January 2023, Scoping Opinion	In regards to transboundary impacts, in addition to those identified, in line with the NatureScot representation, the Scottish Ministers advise that the following SPAs should be considered to have LSE and be screened in for assessment in the HRA: Rathlin Island SPA for Fulmar; Copelin Islands SPA for Manx shearwater; Glannau Aberdaron ac Ynys Enlli/Aberdaron Coast SPA and Bardsey Island SPA for Manx shearwater; Skomer, Skokholm and the Seas off Pembrokeshire/Sgomer, Sgogwm a Moroedd Penfro SPA for Manx shearwater; Isles of Scilly SPA for Fulmar and Manx shearwater.	The proposed sites and species have been considered and have been screened out due to lack of potential for connectivity.
MD-LOT	January 2023, Scoping Opinion	The Applicant should also note the RSPB HRA representation in regard to the exclusion of Sooty shearwater, Manx shearwater, European storm petrel and Leach's storm petrel. This must be addressed in full by the Applicant in the HRA.	Further consideration of the potential for an AEoSI with regard to storm petrel and shearwater species is presented in Section 7.3.5 and 0 respectively.
MD-LOT	January 2023,	Finally, the Applicant should consider the RSPB HRA representation, in regard to the request for matrix	RSPB consultation has been considered within the RIAA and addressed within this table. Screening Matrices have been provided in Appendix I of the Screening Report (Application Document 12) and

Consultee	Date and Document	Comment	Where Addressed in the RIAA
	Scoping Opinion	tables to be provided showing evidence supporting conclusions for HRA screening assessments.	Integrity Matrices have been provided in Application Document 13, Appendix 13-1 and Application Document 14, Appendix 14-1.
MD-LOT	January 2023, Scoping Opinion	In regard to the HRA Screening, in line with the NatureScot representation, the Scottish Ministers are content with the protected sites scoped in and out for bottlenose dolphins (*Tursiops truncatus*) (and harbour porpoise (*Phocoena phocoena*). The Scottish Ministers do not agree with the sites scoped in for grey seals (*Halichoerus grypus*) and harbour seals (*Phoca vitulina*). The NatureScot representation in regard to grey seals and harbour seals must be implemented in full by the Applicant in the HRA.	The Applicant notes this conclusion from NatureScot and has since updated the screening exercise to reflect the proposed changes for grey and harbour seals. Sites screened in using the updated screening distances can be found in Section 8.1, 9.1 and 10.1.
NatureScot	January 2023, Scoping Opinion	There is a list of key sites provided in section 10.3.2.11. There is no description for the methods for defining these sites, or justification for their inclusion, so interpretation of this list is difficult. Several of these sites are also listed in the HRA screening report, but the list here is shorter, missing several of the sites scoped into the HRA. We advise that key sites to take forward will be those sites that have theoretical connectivity and an impact pathway, so we would expect this list to include several additional sites as per the HRA and our advice on HRA screening below.	Sites have been screening in based on the screening criteria laid out in the Screening Report (Application Document 12) based on potential connectivity to the Proposed Development (Offshore). Sites screened in for further assessment can be seen in Sections 8.1, 9.1 and 10.1.
NatureScot	January 2023, Scoping Opinion	Additionally, several SPAs have been scoped out on the sole basis that the SPA is located on the west coast of the UK. For example, see Appendix A – Rum SPA, p. 69 - which states "This SPA is located on the west coast of the UK. It is unlikely to resolve in meaningful connectivity with the array due to the distance required to travel around land. LSE can therefore be	Within the Scoping Opinion (Volume 7, Appendix 3) published in January 2023, NatureScot requested the addition of several sites for consideration in relation to the HRA. This has led to the following sites that were initially screened out within the Screening Report (Application Document 12), to now be screened in:

Consultee	Date and Document	Comment	Where Addressed in the RIAA
		discounted". We disagree with this statement. The scoping process for HRA requires that all species within theoretical connectivity are scoped in for further consideration – taking into account at sea connectivity distances. "As a result the following species and sites must be considered to have LSE: ▪ Handa SPA for Great skua, Fulmar and Kittiwake, Guillemot and Razorbill; ▪ Preist Island (Summer Isles) SPA for Storm Petrel; ▪ Shiant Isles SPA for Kittiwake, Fulmar and Puffin; ▪ Rum SPA for Manx shearwater; ▪ Canna and Sanday SPA for Kittiwake and Puffin; ▪ Flannan Isles SPA for Kittiwake, Fulmar and Leach's Petrel; ▪ Treshnish Isles SPA for Storm petrel; ▪ Mingulay and Berneray SPA for Fulmar; and ▪ St Kilda SPA for Gannet, Fulmar, Manx shearwater, Great skua, and Leach's petrel.	With regards to the additional sites outlined, these sites have not been included within assessments due to the reasons provided in Table 2-2.
NatureScot	January 2023, Scoping Opinion	The HRA screening takes into consideration key impact pathways. However, impacts arising from wet storage have not been sufficiently addressed in the HRA Screening Report and requires further assessment of the potential impacts.	The Applicant notes the potential impact pathways from wet storage. Since the Scoping Opinion (Volume 7, Appendix 3), further consultation has been undertaken, with recommendations from the Marine Directorate and NatureScot that wet storage will be licenced separately out with the Proposed Development (Offshore).

Consultee	Date and Document	Comment	Where Addressed in the RIAA
NatureScot	January 2023, Scoping Opinion	We agree with the protected sites scoped in/out for bottlenose dolphins and harbour porpoise. We do not agree with the protected sites which are scoped in for grey seals and harbour seals. All of these sites are outside the 20km (grey seal) and 50km (harbour seal) connectivity distances we advise for screening (as justified below). The Applicant needs to consider if there is tagging data that might support connectivity. We also do not advise that transboundary sites are screened in for grey seals, for the same reason.	The Applicant notes the agreement on sites screened out of assessment. The rationale behind screening conclusions is stated within the Screening Report (Application Document 12) and further clarity has been provided following consultation.
NatureScot	January 2023, Scoping Opinion	We advise screening sites in for assessment if the project site/impact radius is within 20km of the SAC. Although grey seals can and do forage considerable distances, the Conservation Objectives for grey seal SACs are related to the protection of the breeding colony. During this sensitive time, grey seals do not travel in general further than the 20km and, therefore, we use this distance as a connectivity buffer. Outside the breeding season the number of grey seals present at a protected site can dramatically decrease. There is evidence to show that grey seals do not forage close to the SAC outside the breeding season and instead can travel to different management units when foraging (Carter *et al.*, 2022[33]).	The Applicant has implemented the recommended screening ranges as reflected within Section 8.1 of the Screening Report (Application Document 12).
NatureScot	January 2023, Scoping Opinion	We advise screening sites in for assessment if the project site/impact radius is within 50km of the SAC. Harbour seals show greater site fidelity throughout the year and, unlike grey seals, there is no seasonal difference. We would consider ranges further than this if there is tagging information to suggest SAC animals were travelling to the project site area.	The Applicant has implemented the recommended screening ranges as reflected within Section 8.1 of the Screening Report (Application Document 12).

Consultee	Date and Document	Comment	Where Addressed in the RIAA
NatureScot	January 2023, Scoping Opinion	The site selection takes a very precautionary approach of including an initial selection range of 50km, then a range of 20km for determining likely significant effect. This seems suitably precautionary, and it is unlikely that impacts would extend beyond this range. There are no SACs within this range, and we agree with their conclusion that there are no designated sites for benthic 23 features close enough to the Proposed Development (Offshore) for any of the activities to result in a likely significant effect.	The Applicant notes the agreement on site selection.
NatureScot	January 2023, Scoping Opinion	There is the potential for European sites that have Atlantic salmon as a qualifying feature to have connectivity with the Proposed Development (Offshore), despite being located a large distance away. This is due to the mobile nature of migrating Atlantic salmon, either as smolts travelling from rivers to offshore feeding grounds, or as adults returning to natal rivers to spawn. Although limited information is currently available on migratory routes, available tracking data indicates that tagged smolts migrate along the southern coast of Moray Firth (see Moray Firth Tracking Project; https://atlanticsalmontrust.org/our-work/morayfirthtrackingproject). However, it is unclear where they migrate to after this as is the migration routes of returning adult salmon. We acknowledge there is a lack of data on diadromous fish movements in and around the north and eastern coasts of Scotland. However, a lack of data is not sufficient evidence to conclude no LSE. Therefore, rather than using the 100km approach as mentioned in the HRA screening report, we advise that all SACs	Following the Scoping Opinion (Volume 7, Appendix 3), and discussions NatureScot provided advice on 01 June 2023 that diadromous fish should not be considered within the HRA for the Proposed Development (Offshore) given a lack of information regarding migratory fish populations and migration routes. However, the Applicant considers that excluding fish is not legally appropriate and in order to satisfy the Habitats Regulations, diadromous/ migratory fish have been considered and assessed. Following the justification within the Screening Report (Application Document 12) and the precedent set on other offshore wind farms, a 100km screening distance was used for identifying sites designated for migratory fish receptors. Sites screened in for migratory fish receptors can be seen in Section 8.2.3 and 9.2.3.

Consultee	Date and Document	Comment	Where Addressed in the RIAA
		designated for Atlantic salmon in Scotland are screened in at this stage for further assessment.	
NatureScot	January 2023, Scoping Opinion	There is limited information on the distribution and behaviour of sea and river lamprey in marine waters and it is possible that migration routes may overlap with the Proposed Development (Offshore). We agree that the River Spey SAC is screened in for HRA assessment.	The Applicant notes the agreement on site selection.
NatureScot	January 2023, Scoping Opinion	Atlantic salmon are a host species for FWPM (*Margaritifera margaritifera*) during a critical parasitic phase of the mussels lifecycle and so there is a need to consider indirect impacts upon this species to ensure populations are not adversely affected. Therefore, we advise that SACs with FWPM as a qualifying feature are also screened in for further assessment.	The screening exercise has been updated to include FWPM for all sites within the established screening range (Sections 8.1, 9.1 and 10.1 for Caledonia North, Caledonia South and the Proposed Development (Offshore) respectively).
NatureScot	January 2023, Scoping Opinion	Despite advising that all Atlantic salmon and FWPM sites are included as having LSE, as we cannot currently apportion impacts correctly to individual SACs, further discussion will be required to agree how this will be assessed in the next stage of the HRA process.	Following the Scoping Opinion (Volume 7, Appendix 3), and further discussions, NatureScot provided advice on 01 June 2023 that diadromous fish should not be considered within the HRA for the Proposed Development (Offshore) given a lack of information regarding migratory fish populations and migration routes. However, the Applicant considers that excluding fish is not legally appropriate and in order to satisfy the Habitats Regulations, diadromous/ migratory fish have been considered and assessed.
NatureScot	January 2023, Scoping Opinion	Further consideration is required for in-combination impacts as the 100km approach in not appropriate for migratory fish.	As stated above, the Applicant is confident that the 100km screening range for fish is appropriate and therefore no change to the screening for in-combination impacts is required.

Consultee	Date and Document	Comment	Where Addressed in the RIAA
RSPB	January 2023, Scoping Opinion	We would welcome the use of matrix tables with evidence supporting conclusions within HRA screening assessments. This would make it clear for each protected site, exactly which species is being screening in or out (and whether they are breeding wintering), for what phase of development (e.g., construction, O&M, and decommissioning) that is, and what the impact mechanism being considered is (e.g., disturbance, displacement, collision, barrier to movement, habitat loss, prey availability). The evidence supporting conclusions should provide species- and site-specific narrative to adequately justify the decisions made.	Screening Matrices have been provided in Appendix I of the Screening Report (Application Document 12) and Integrity Matrices have been provided in Application Document 13, Appendix 13-1 and Application Document 14, Appendix 14-1.
NatureScot	June/July 2024, Consultation Note	The Applicant consulted with NatureScot on the plans and projects selected as relevant to the in-combination assessment for marine mammals, impacts to be considered in the assessment as well as projects to be considered in the cumulative iPCoD modelling. In a meeting held on 11th July 2024, NatureScot advised that only Scottish projects should be considered in the in-combination assessment for marine mammals (rather than projects within species-specific MUs as specified in the consultation note). Subsequently, in the email from 24th July 2024, NatureScot confirmed they are content with using species-specific Management Units (MUs) to screen in projects for the in-combination longlist, but to remove projects where information is not available in the public domain and those which are already operational. NatureScot also confirmed they are content with including only Scottish projects in the marine mammal in-combination assessment.	The in-combination assessment for marine mammals (Sections 10.3.1) has included the advice from NatureScot in the screening for other plans and project to be included in the in-combination assessment.

Consultee	Date and Document	Comment	Where Addressed in the RIAA
		NatureScot advice also included recommendation to: ▪ Include projects up to a year on either side of Caledonia plans; ▪ Use iPCoD to assess cumulative effects. The updated iPCoD including DEB was not available in time for the Proposed Development (Offshore) submission and therefore iPCoD version based on parameters in Sinclair *et al*. (2020[34]) was used.	
NatureScot	Consultation Workshop, 25/05/2023	NatureScot provided written comments by email regarding the defined seasons. Provided confirmation of seasons to use for kittiwake, great black-backed gull, herring gull, great skua, guillemot, razorbill, puffin and gannet (dated 04/07/2023).	The Applicant has used the confirmed seasons outlined within the email dated 04/07/2023 (Section 7.3.3).
NatureScot	January 2023, Scoping Opinion	Displacement rates - For displacement assessments we advocate adoption of a range of mortality figures, including consideration of potential seasonal differences. We advise the following values for auks (guillemots, razorbills and puffins), gannet and kittiwake as per Table 1 [see Appendix I of Scoping response from NatureScot].	Displacement and mortality ranges have been presented using both the Guidance Approach and Applicant Approach throughout the RIAA (see Volume 7B, Appendix 6-2: Offshore Ornithology Distributional Responses Technical Report). Further evidence on auk displacement rates have been submitted since the Scoping Opinion (Volume 7, Appendix 3), and therefore have been taken into account within the Applicant Approach (Volume 7B, Appendix 6-2: Offshore Ornithology Distributional Responses Technical Report).
NatureScot	Consultation Workshop 25/05/2023	Collision risk - We note and support the intention to use the stochastic Collision Risk Model (sCRM) App developed by Masden (2015) to assess collision risk. The report also states that it will be run deterministically. We accept the use of deterministic	The collision risk assessment has been carried out using the stochastic and deterministic version of the sCRM tool, as agreed in consultation. The results are presented from the stochastic model within this RIAA, with all results presented within the CRM technical report and the Annexes (Volume 7B, Appendix 6-3:

Consultee	Date and Document	Comment	Where Addressed in the RIAA
		CRM but advise that the stochastic models should also be presented.	Offshore Ornithology Collision Risk Modelling Technical Report).
Nature Scot and RSPB	Consultation Workshop 01/07/2024	East Caithness Cliffs SPA colony counts – The Applicant queried how assessments should be undertaken based on the age of the colony count data not conforming to NatureScot advice. NatureScot confirmed that this year's (2024) data would be preferred as trend information may not be a true representation of what has happened at colony (i.e. Avian flu, marine heatwaves) and this would need to be included in any updates that incorporate the trend information. NatureScot also noted that it would also be beneficial to look at a way to incorporate productivity data due to reports of guillemots being present on cliffs but not laying eggs. NatureScot suggested that Bob Swann would be a good person to contact due to his extensive knowledge of the site. The Applicant confirmed that NEEOG is undertaking guillemot counts for this year but queried what to use in the absence of that data due to project timelines. RSPB recommended a qualitative approach in addition to older count data. NatureScot agreed to this approach and suggested interpreting outputs of PVA models with older published data in context of the recent population changes, qualitatively.	The Applicant has used East Caithness Cliff colony counts from Swann (2016) for the assessments due to discrepancies noted between this report and the SMP, this is in line with consultation responses received for Green Volt OWF (Royal HaskoningDHV, 2023[35]). The assessment for East Caithness Cliffs can be found in Volume 7, Appendix 4: Habitat Regulations Assessment (from Section 8.2.3.3). Assessments have been undertaken taking into account recent population trends in a qualitative manner.
NatureScot and RSPB	Consultation Workshop 01/07/2024	Gannet colony count at Bass Rock – The Applicant queried how assessments should be undertaken based on the age of the colony count data not conforming to NatureScot advice As counts were last made in 2014 and 2023, the Applicant queried which population	The Applicant would like to thank NatureScot and RSPB for this useful discussion regarding the gannet Bass Rock colony count. In line with advice received from NatureScot that "the survey data needs to be comparable to colony data for assessments", both the 2014 count and 2021 count (Harris *et al*., 2023[36])

Consultee	Date and Document	Comment	Where Addressed in the RIAA
		count would NatureScot advise should be used in light of the Bass Rock 2024 colony. NatureScot recommended that both 2023 and 2014 count data are displayed and contextualised and to use most recent drone count for the assessments. They also recommended to note in the application that newer drone counts are to follow later. NatureScot highlighted survey data needs to be comparable to colony data for assessments and that currently available count needs to be used in assessment. They also noted that it helps to show the colony's resilience which is likely to be different in light of the HPAI outbreak, and may influence compensation options. Newer counts coming later can be used for context on what has happened in population, and to inform compensation discussions. RSPB agreed with NatureScot, and added that the other aspect is understanding additional mortality, and the ability of the population to respond to outbreaks is an ongoing question and, in terms of compensation, there will be no point in time where a clear answer will be available.	have been displayed due to the reasons outlined in Section 7.3.12. The assessment for Forth Islands SPA can be found in Volume 7, Appendix 4: Habitat Regulations Assessment (from Section 8.2.3.281)

6 Proposed Development (Offshore) Description

6.1 Overview

6.1.1.1 The Proposed Development (Offshore) is located in the Moray Firth in the North Sea. The northern limit of the site is approximately 22km off the coast of Wick, Highland and the southern limit of the site is approximately 38km off the coast of Banff, Aberdeenshire. The lifespan of the Proposed Development (Offshore) is anticipated to be 35 years. The depth range of the Array Area is approximately 39-88m relative to Lowest Astronomical Tide (LAT).

6.1.1.2 The Proposed Development (Offshore) will incorporate various offshore infrastructure within the Array Area and OECC between the Array Area and preferred Landfall Site. The boundary of the Proposed Development (Offshore) is presented within Figure 1-1, which include the Caledonia North and Caledonia South Array Areas and OECCs.

6.1.1.3 The Proposed Development (Offshore)has been divided into two development sites: Caledonia North and Caledonia South. These sites will be the location for the Caledonia North and Caledonia South developments. The shallower Caledonia North is proposed to contain bottom-fixed WTG technology only, while the relatively deeper Caledonia South is proposed to contain either bottom-fixed WTG technology only, or a combination of bottom-fixed and floating WTG technology. The total Caledonia OWF (Array Area) footprint is approximately 423km^2, which comprises Caledonia North Site with a footprint of approximately 218.5km^2 and Caledonia South Site with a footprint of approximately 204.5km^2. It is noted that this reflects a slight reduction in total size of the Array Area compared to the original NE4 Plan Option; refer to EIAR Volume 1, Chapter 6: Site Selection and Alternatives for further information.

6.1.1.4 The Caledonia North OECC covers the area within which the Caledonia North offshore export cables are installed, extending southward from the Caledonia North Site, through the Caledonia Site and to the Landfall Site at Stake Ness, with a total footprint of approximately of 390.8km^2. The Caledonia South OECC covers the area within which the Caledonia South offshore export cables are installed, extending southward from the Caledonia South Site to the Landfall Site at Stake Ness, with a total footprint of approximately 221.3km^2. The exact route of the offshore export cables within the OECCs will be determined at a later stage through a route optioneering appraisal once a full post-consent site investigation campaign has been completed. This will determine the preferred route in terms of environmental and technical considerations, alongside consideration of consultation feedback.

6.1.1.5 A full description of the Proposed Development (Offshore) is provided in Volume 1, Chapter 3: Proposed Development Description (Offshore).

6.2 Mitigation

6.2.1.1 The information on the mitigation being proposed for each receptor group and in relation to individual potential impacts arising from the Proposed Development (Offshore) is set out in the individual topic chapters of the EIAR. The mitigation relevant to the RIAA is summarised below in Table 6-1. Mitigation was not taken into account during the evidencing of no LSE within the Screening Report (Application Document 12); however, it is a consideration during the determination of the potential for AEoSI within the design scenario assessed. The approach ensures the RIAA is compliant with the People over Wind ruling referenced in Section 4.5.

6.2.1.2 It is worth noting that as discussed within Section 8.1.1, 9.1.1 and 10.1.1, potential for LSE was ruled out both alone and in-combination for any designated sites with Benthic Subtidal and Intertidal ecology receptors, and therefore no mitigation has been considered for this group.

Table 6-1: Mitigation measures considered for the Proposed Development (Offshore).

Measure	Receptor Group of Relevance for Assessment	Details of Measure
M-1	▪ Migratory fish	Development of and adherence to a Cable Plan (CaP). The CaP will confirm planned cable routing, burial and any additional protection and will set out methods for post-installation cable monitoring.
M-3	▪ Offshore and intertidal ornithology	Development of and adherence to a Construction Method Statement (CMS). The CMS will confirm construction methods and the roles and responsibilities of parties engaged in construction. It will detail any construction-related mitigation measures.
M-5	▪ Migratory fish	Where practicable, cable burial will be the preferred means of cable protection. Cable burial will be informed by the cable burial risk assessment and detailed within the CaP.
M-7	▪ Migratory fish	Suitable implementation and monitoring of cable protection (via burial, or external protection where adequate burial depth as identified via risk assessment is not feasible), as detailed within the CaP.
M-8	▪ Marine mammals; ▪ Offshore and intertidal ornithology; and ▪ Migratory fish.	Development of and adherence to an Environmental Management Plan (EMP). The EMP will set out mitigation measures and procedures relevant to environmental management, including but not limited to the following topics: Chemical usage, invasive non-native marine species, dropped objects, pollution prevention and contingency planning, and waste management.
M-9	▪ Marine mammals; and ▪ Migratory fish.	Development of and adherence to a Marine Pollution Contingency Plan (MPCP). The MPCP will identify potential sources of pollution and associated spill response and reporting procedures.
M-10	▪ Migratory fish	Development of and adherence to a Decommissioning Programme (DP). The DP will outline measures for the decommissioning of Caledonia North and Caledonia South.
M-11	▪ Marine mammals; and	Development of and adherence to a Piling Strategy (PS) (applicable where piling is undertaken). The PS will detail the method of pile installation and

Measure	Receptor Group of Relevance for Assessment	Details of Measure
	▪ Migratory fish.	associated noise levels. It will describe any mitigation measures to be put in place (e.g., soft starts and ramp ups, use of Acoustic Deterrent Devices) during piling to manage the effects of underwater noise on sensitive receptors.
M-12	▪ Marine mammals; ▪ Offshore and intertidal ornithology; and ▪ Migratory fish.	Development of and adherence to a Project Environmental Monitoring Programme (PEMP). The PEMP will set out commitments to environmental monitoring in pre-, during and post-construction phases of Caledonia North and Caledonia South.
M-13	▪ Marine mammals; and ▪ Offshore and intertidal ornithology.	Development of and adherence to a Vessel Management Plan (VMP). The VMP will confirm the types and numbers of vessels that will be engaged on Caledonia North and Caledonia South and consider vessel coordination including indicative transit route planning.
M-14	▪ Offshore and intertidal ornithology.	Development of and adherence to a Lighting and Marking Plan (LMP). The LMP will confirm compliance with legal requirements with regards to shipping, navigation and aviation marking and lighting.
M-15	▪ Offshore and intertidal ornithology.	Blade clearance of at least 35m above Mean Sea Level (MSL) (minimum blade clearance of 35m will be maintained for floating WTGs due to tidal movements; noting floating WTGs are only included within the design envelope for Caledonia South).
M-16	▪ Marine mammals	Development of and adherence to Marine Mammal Mitigation Plan (MMMP). This will identify appropriate mitigation measures during offshore activities that are likely to produce underwater noise and vibration levels capable of potentially causing injury or disturbance to marine mammals. This will be developed alongside the PS and referred to in European Protected Species (EPS) licence applications.
M-96	▪ Marine mammals	Unexploded ordnance (UXO) hazards will be avoided where practicable and appropriate. If avoidance is not possible, decision making will relate to removal, with disposal in-situ considered if avoidance or removal is not possible. If disposal is required, and where practicable and appropriate, low-order deflagration will be the preferred method. The indicative mitigation measures

Measure	Receptor Group of Relevance for Assessment	Details of Measure
		for UXO clearance are provided in the draft MMMP (M-16), however, Licensing of UXO clearance works will be subject to a standalone Marine Licence and EPS licence application. At the post-consent stage, these applications will provide details of measures to minimising impacts on marine mammals where appropriate.
M-106	▪ Offshore and intertidal ornithology.	Trenchless techniques (Horizontal Directional Drilling) will be used as installation methodology at landfall to avoid direct impacts to the intertidal area.

7 Overview of Potential Impacts Considered within Appropriate Assessment

7.1 Introduction

7.1.1.1 This section sets out the methodology used for the assessment of AEoSI including the types of impacts considered and any required understanding that applies to multiple sites.

7.1.1.2 To reiterate, following the completion of Stage 1 Screening (Application Document 12), the Benthic Subtidal and Intertidal Ecology receptor group was screened out, with no sites taken forward for consideration within this RIAA. This is due to the screening ranges considered and no designated sites with benthic features being identified.

7.1.1.3 However, marine mammals, offshore and intertidal ornithology, and migratory fish were all screened in for consideration and are considered further within this RIAA.

7.1.1.4 The ZoI used to screen in designated sites within each receptor group can be seen in Table 7-1.

Table 7-1: ZoI used to identify designated sites to be included within the screening.

Receptor Group	ZoI applied
Marine Mammals	Coastal East Scotland MU and Greater North Sea MU
Offshore and Intertidal Ornithology	Mean Max Foraging range (MMFR) +1SD (Woodward *et al*., 2019[32])
Migratory Fish	100km

7.2 Marine Mammals

7.2.1 Overview

7.2.1.1 All cetaceans are listed under Annex IV of the Habitats Directive, which means that they are protected wherever they occur within a Member State's territory. In addition, some species of cetacean and pinniped are also listed under Annex II of the Directive which requires that the core areas of their habitat are designated as European Sites. Annex II marine mammal species that occur in UK waters are bottlenose dolphin (*Tursiops truncatus*), harbour porpoise (*Phocoena phocoena*), grey seal (*Halichoerus grypus*) and harbour seal (*Phoca vitulina*).

7.2.1.2 This section explains the approach taken to assessing the potential impacts of the Proposed Development (Offshore) on European Sites designated for Annex II marine mammal features. European Sites designated for marine mammals have been screened in given their potential connectivity with impacts associated with the offshore infrastructure and the O&M base. Due to the mobile nature of the species considered, the extent of the ZoI has been classified by the appropriate MU and typical foraging ranges.

7.2.1.3 The Screening exercise identified LSEs on the following European site designated for Annex II marine mammal features:

- Moray Firth SAC (bottlenose dolphin).

7.2.1.4 This section presents the potential impacts to the marine mammal feature of this site across the various phases of development.

7.2.2 Construction and Decommissioning

7.2.2.1 During construction and decommissioning phases, the following impacts have been screened in for potential impacts to designated marine mammal features:

- Underwater noise (resulting from piling, unexploded ordnance (UXO) clearance and pre-construction surveys);
- Vessel collision risk and disturbance; and
- Changes to prey availability.

7.2.2.2 Given the complexity of underwater noise, additional information is presented here relating to the assessment of this effect. All relevant information to vessel collision risk, vessel disturbance and changes to prey effects are included within the relevant assessments.

Underwater Noise

7.2.2.3 Anthropogenic activities can have direct and indirect impacts on marine mammals, with underwater noise being one of the more commonly cited impact pathways. The greatest effects on marine mammals are likely to occur from impulsive underwater noise within the construction phase resulting from pile driving, UXO clearance or geophysical surveys. However, there is also potential for underwater noise impacts from non-impulsive noise and noise emitted from activities during the O&M and decommissioning phases.

7.2.2.4 Marine mammals are widely documented to be sensitive to underwater noise considering their reliance on sound for communication, navigation and foraging (OSPAR, 2009[37]; Southall *et al.*, 2019[38]; 2021[38]). Potential impacts have varying degrees of observed and/or predicted severity, ranging from changes in behaviour and masking (Basran *et al.*, 2020[39]), displacement and disturbance (Graham *et al.*, 2019[40]), to injury and even mortality (Schaffeld

et al., 2019[41]). Indirect impacts may also occur through direct impacts to prey species (Sivle *et al*., 2021[42]).

7.2.2.5 Following the criteria set out in Southall *et al*. (2019[38]) a Permanent Threshold Shift (PTS) in hearing is used in this assessment as the threshold for onset of auditory injury. In addition, the temporary threshold shift (TTS) in hearing criteria is considered in the assessment of impacts from UXO clearance as a proxy for disturbance (as recommended in Southall *et al*., 2007[52]).

7.2.2.6 To assess impacts of underwater noise, sound sources are typically divided into two categories, 'impulsive' and 'non-impulsive', based on attributes of the sound source:

- Impulsive sound sources (e.g., impact pile driving, UXO clearance): These are transient and brief (less than a second), broadband, and typically consist of high peak pressure with rapid rise and decay times; and
- Non-impulsive sound sources (e.g., dredging, trenching, vessel movements): These may be broadband, narrowband, or tonal, and can be continuous or intermittent, but typically lack high peak pressure with rapid rise time.

7.2.2.7 Exposure to loud sounds can reduce hearing sensitivity, generally affecting specific frequencies. This threshold shift may be temporary or permanent, resulting from physical damage to the auditory system. PTS refers to a lasting change in hearing sensitivity due to ear structure damage, while TTS is a temporary reduction in sensitivity. Sound propagates in water as alternating pressure waves (compressions and rarefactions), measured in Pascals (Pa), with underwater sound referenced to 1 micro-Pascal (µPa). The decibel (dB) is a relative unit used to express the ratio of two values of acoustic power and is typically expressed as ten times the logarithm in base 10. There are different metrics which can be used as measures of underwater sound pressure. Key metrics used in this report are as follows:

- Sound pressure level (SPL): The maximum sound pressure during a stated time interval. A peak sound pressure may arise from a positive or negative sound pressure. This quantity is typically useful as a metric for a pulsed waveform;
- Root mean square SPL (SPL_{rms}): The square root of the mean square pressure, where the mean square pressure is the time integral of squared sound pressure over a specified time interval divided by the duration of the time interval;
- Peak SPL (SPL_{peak}): The highest (zero-peak) positive or negative sound pressure, in decibels;
- Sound exposure level (SEL): a measure of the sound pressure squared over a stated period of time or noise event and is normalised to one second; and

- Cumulative SEL (SEL_{cum}): representative of the total acoustic energy of a noise source taking place across 24-hours.

7.2.2.8 Noise exposure criteria are typically represented by dual exposure metrics including the frequency weighted SEL (expressed in dB re. μPa^{2-s} or $\mu Pa^2{}_s$) and the unweighted SPL (expressed in units relative to 1 µPa in water; ISO 18406, 2017[43]; Juretzek *et al*., 2021[44]). The terms 'weighted' and 'unweighted' relate to hearing sensitivities (e.g., frequencies of sound detectable to an individual) of marine mammals and are traditionally based on species audiograms. SPL_{peak} thresholds are considered unweighted as the high peak sound pressures that are associated with direct mechanical damage to the auditory system are not frequency dependent. SEL_{cum} thresholds are considered frequency-weighted to marine mammal functional hearing groups. This is because the physiological damage that sound energy can cause is mainly restricted to energy occurring in the frequency range of a species' hearing range (Southall *et al*., 2019[38]).

7.2.2.9 Bottlenose dolphins are within the 'High Frequency (HF)' functional hearing group, as highlighted in Southall *et al*. (2019[38]), and have a generalised hearing range between 150Hz and 160kHz. They have a peak hearing sensitivity at frequencies between 0.8 - 24kHz for social communication and 10 – 150kHz for broadband echolocation clicks (Accomando *et al*., 2020[45]). The impact thresholds of bottlenose dolphins are presented within Table 7-2. The SPL_{peak} reflects the 'instantaneous' PTS onset, which is the maximum absolute value used to assess the potential risk of instantaneous PTS in hearing. These are based on the animal being close to the sound source (within 1 m), which is unlikely and, therefore, extremely precautionary. SEL_{cum} is used to assess the potential risk of PTS onset through exposure to noise accumulated over 24-hours.

Table 7-2: Bottlenose dolphin PTS onset impact thresholds for impulsive and non-impulsive noise (Southall *et al*., 2019[38]).

Impact	Impulsive		Non-Impulsive
PTS	185 dB SEL_{cum} dB re $1\mu Pa^2{}_s$ weighted	230 dB SPL_{peak} dB re 1µPa unweighted	198 dB SEL_{cum} dB re $1\mu Pa^2{}_s$ weighted

7.2.2.10 Underwater noise modelling has been conducted to estimate the underwater noise levels likely to arise during the construction of the offshore infrastructure. Further details on the methodology can be found in Volume 7B, Appendix 7-2: Marine Mammals Underwater Noise Assessment Methodology.

7.2.2.11 Impact ranges presented in the assessment represent the minimum starting distances from the piling location for fleeing animals to escape and prevent them from receiving a dose higher than the threshold which would result in injury. In calculating the received noise level that animals are likely to receive during various sources of underwater noise associated with the Proposed

Development (Offshore), bottlenose dolphins were assumed to start moving away at a swim speed of 1.52 m/s once the activity (e.g., piling, geophysical surveys, dredging) has started (based on the mean swimming speed recorded during foraging presented in Bailey and Thompson (2006[46]).

Site Investigation Surveys

7.2.2.12 Underwater noise generated from geophysical survey sources has the potential to cause injury (e.g., auditory damage) to marine mammals. Geophysical surveys typically use high resolution equipment (e.g., sub-bottom profiler (SBP; 210–220 dB re 1µPa (SPL_{peak}); 2–15kHz with a peak frequency of 3.5kHz), multibeam echosounder (MBES; 210–240 dB re 1µPa (SPL_{peak}) for multiple beams and 197dB re 1µPa (SPL_{peak}) for a single beam; 200–400kHz), side scan sonar (SSS; 210 dB re 1µPa (SPL_{peak}); 300 and 900kHz)) which is towed near the ocean surface behind the survey vessel. This equipment emits high-energy sound sources with a downwards projection through the water column to the seabed with the aim of mapping the geology of the topography. Although highly directional in nature, the impulsive, high-energy sound emitted from SBPs have been shown to elicit behavioural and physiological responses in many species of marine mammal (Blackwell *et al*., 2015[47]; Erbe *et al*., 2018[48]; Gordon *et al*., 2003[49]; Richardson *et al*., 2013[50]; Romano *et al*., 2004[51]; Southall *et al*., 2007[52]; 2019[38]).

7.2.2.13 Ultra-short baseline (USBL; 187 – 206 dB re 1 µPa; 19 – 34kHz) systems can impact marine mammals if their operating frequencies overlap with the hearing sensitivities of receptors. The assessed USBL does overlap with the peak hearing sensitivity for bottlenose dolphin social vocalisations. USBLs involve an acoustic pulse which is transmitted from the transceiver (located on the hull of the vessel or extended on a pole below the sea surface) and received by the subsea transponder (mounted on tracked equipment), and a return pulse is released in response. USBL systems can also range between having a highly directional or omni-directional nature.

Pile Driving

7.2.2.14 Whether there are ecological consequences of PTS for marine mammals from piling noise is a subject of active study. At an expert elicitation workshop for the interim Population Consequences of Disturbance framework (iPCoD framework), experts in marine mammal hearing discussed the nature, extent and potential consequence of PTS to UK marine mammal species arising from exposure to repeated low-frequency impulsive noise such as pile driving (Booth *et al*., 2019[53]). This workshop outlined and collated the best and most recent empirical data available on the effects of PTS on marine mammals. Of particular relevance for this RIAA, the findings of the elicitation included that PTS did not mean animals were deaf, that the limitations of the ambient noise environment should be considered and that the magnitude and frequency band in which PTS occurs are critical to assessing the effect on vital rates.

7.2.2.15 For piling noise, most acoustic energy is between 30–500Hz, with a peak usually between 100–300Hz and energy extending above 2kHz (Kastelein *et al.*, 2015[54]; 2016[55]). Studies have shown that exposure to impulsive pile driving noise induces TTS (and consequently PTS) in a relatively narrow frequency band in harbour porpoise and harbour seals (reviewed in Finneran, 2015[56]), with statistically significant TTS occurring at 4 and 8kHz (Kastelein *et al*., 2016[55]) and centred at 4kHz (Kastelein *et al*., 2012a[57]; 2012b[58]; 2013[59]; 2017[60]). Therefore, during the expert elicitation workshop, the experts agreed that any threshold shifts (temporary or permanent) as a result of pile driving would manifest themselves in the 2–10kHz range (Kastelein *et al*., 2017[60]) and that a PTS 'notch' of 6–18dB in a narrow frequency band in the 2–10kHz region is unlikely to significantly affect the fitness of individuals (i.e., its ability to survive and reproduce).

UXO Clearance

7.2.2.16 Explosives have the potential to cause injury or mortality in the immediate vicinity (e.g., <50m; Danil and Leger, 2011[61]) from either blast induced trauma (i.e., shock wave) or auditory impacts (i.e., sound wave). Most of the acoustic energy produced by a high-order detonation is below a few hundred Hz, and there is a pronounced decline in energy levels above 5 to 10kHz (von Benda-Beckmann *et al*., 2015[62]; Salomons *et al*., 2021[63]). Recent acoustic characterisation of UXO clearance noise has shown that there is more energy at lower frequencies (<100Hz) then previously assumed (Robinson *et al*., 2022[64]). If PTS or TTS were to occur within this low frequency range, it would be unlikely to result in any significant impact to the vital rates of a bottlenose dolphin.

7.2.2.17 Low-order deflagration of UXO is the preferred method of UXO clearance as it reduces the underwater noise impacts by rapidly burning the explosive material within UXO away rather than detonation. A study based in the Moray Firth investigated the impact of low-order deflagration techniques of 82 UXO with net explosive quantities (NEQ) varying from 6kg to 700kg (Ocean Winds, 2024[153]). This paper concluded that auditory injury impact ranges were all <1.5km which is a much smaller impact range compared to the estimated impact ranges for equivalent high-order detonations of these UXOs (e.g., up to 15km).

Non-impulsive Noise Sources

7.2.2.18 Non-impulsive sounds are broadly regarded as a lower risk to marine mammals as compared to impulsive noise sources. Non-impulsive noise sources result from works including vessel movement, cable lying, dredging (backhoe and suction), drilling, rock placement, trenching and pre-construction surveys.

7.2.2.19 Continuous noise from cable installation is generally considered to be unlikely to impact marine mammals due to its non-impulsive nature, and the fact that it is likely to be dominated by vessels from which installation takes place

(Genesis, 2011[65]). For noise from cable trenching activities, its sound levels at the North Hoyle OWF were generally low (10 to 15dB above background levels) with frequencies ranging from 100Hz to 1kHz (Nedwell *et al*., 2003[66]). Noise generated by rock placement works is largely unknown. The study of rock placement activities in the Yell Sound in Shetland found that relevant noise produced low frequency tonal noise from the machinery, and that the measured noise levels were within background levels (Nedwell and Howell 2004[67]).

7.2.2.20 The energy of continuous and broadband noise from dredging activities is mainly below 1kHz, although its frequency and sound pressure level can vary considerably depending on the equipment used, activity carried out, and the environmental characteristics (Todd *et al*., 2015[68]). Dredging will potentially be required for seabed preparation works for foundations, and the installations of export cable and inter-array cable for the Proposed Development (Offshore). The frequency range of dredging has been described to vary between 45Hz and 7kHz (Evans, 1990[69]; Thompson *et al*., 2009[70]; Verboom, 2014[71]). A study analysing the impacts of dredging on bottlenose dolphins, found that higher intensities of dredging caused bottlenose dolphin to spend less time in the area; however, this effect was only temporary (Pirotta *et al*., 2013[72]). Another study determined that response varied depending on the site, with dolphins either remaining or being absent (Marley *et al*., 2017[73]), which suggests that the response may be context specific (i.e., some sites being ecologically more important than others).

7.2.2.21 Vessel noise from medium to large-sized construction vessels (travelling at a speed of 10 knots) will result in an increase in the level of non-impulsive and continuous sound within and around the Proposed Development (Offshore). Vessels and associated equipment generally emit low frequency noise, such as large vessels (up to 10kHz), small vessels (up to 40kHz), low-frequency active sonar (<1kHz) and mid-frequency active sonar (1-10kHz; Duarte *et al*., 2021[74]). The general characteristics of commercial vessel noise is dominated by sounds from propellers, thrusters and various rotating machinery. In general, noise from support and supply vessels (50 to 100m in length) are expected to have broadband root mean square (rms) SPL source levels ranging 165 to 180 dB re 1µPa @1m, with the majority of energy below 1kHz (OSPAR, 2009[75]), whereas large commercial vessels (>100m in length) produce relatively loud (180-190 SPL_{rms} dB re 1µPa @1m or greater) and predominately low frequency sounds, with the strongest energy concentrated below several hundred Hz (OSPAR, 2009[75]; Erbe *et al*., 2019[76]). Small vessels are reported to emit source levels of 130-175 SPL_{rms} dB 1µPa@1m with higher frequency bands (above 1kHz) compared to large ships (Erbe *et al*., 2019[76]). These frequencies overlap across the hearing sensitivity range of delphinids (i.e., 150Hz – 160kHz; Southall *et al*., 2019[38]); however, impacts from vessel noise are only likely to occur where increased noise from vessel movements is greater than the background ambient noise.

7.2.2.22 There is limited information on the response of bottlenose dolphin to non-impulsive noise sources, with most studies focusing on impulsive noise sources such as pile driving and seismic surveys utilising airguns.

7.2.2.23 There is potential for behavioural disturbance due to underwater noise, which could result in disruption to foraging and resting activities and/or an increase in travel and energetic costs (Marley *et al*., 2017[73]; Pirotta *et al*., 2015[77]), although evidence suggests that this will occur on a small spatial and temporal scale. Furthermore, New *et al*. (2013[78]) modelling data from the Moray Firth population, showed that while there is potential for disturbance events to affect bottlenose dolphin behaviour and health (which could then impact vital rates and population dynamics), individuals are able to compensate for immediate behavioural responses to disturbances caused by vessel activity. This suggests that bottlenose dolphins have some capability to adapt their behaviour and tolerate certain levels of temporary disturbance.

7.2.3 O&M

7.2.3.1 During O&M phases, the following impacts have been screened in for potential impacts to designated marine mammal features:

- Underwater noise;
- Collision risk; and
- Changes to prey availability.

7.2.3.2 All relevant information to underwater noise, vessel collision risk, vessel disturbance and changes to prey effects is presented in the relevant assessments.

7.3 Offshore and Intertidal Ornithology

7.3.1 Overview

7.3.1.1 This section provides information to determine whether the potential impact of the Proposed Development (Offshore) will have an AEoSI with respect to offshore ornithology qualifying features or provide further justification regarding the potential for an LSE of designated sites (in this case SPAs or Ramsar Sites) screened into the Appropriate Assessment outlined within the Screening Report (Application Document 12) and Section 2.

7.3.1.2 In order to reduce repetition of assessments, consideration of qualitative assessments are provided for all designated sites and qualifying features screened in for assessment combined where appropriate for potential impact pathways and project phases. For example, for more distant sites, where the level of connectivity can be considered relatively weak, as evidenced through the level of predicted impact apportioned to the designated site (Volume 7B Appendix 6-6: Offshore Ornithology: Apportioning Technical Report),

assessments have been presented for all relevant designated sites together for each receptor.

7.3.2 Construction and Decommissioning

7.3.2.1 During construction and decommissioning phases, the following impacts have been screened in for potential effects to designated ornithological features:

- Distributional Responses:
  - Construction, and associated vessel traffic, within the OECC;
  - Construction, and associated vessel traffic, associated with the Array Area; and
  - Vessel transit routes (through the Moray Firth SPA).

7.3.2.2 Given the complexity of distributional responses, information is presented here relevant to the assessment.

Distributional Responses

7.3.2.3 During the construction phase of the Proposed Development (Offshore), the installation of offshore infrastructure and associated movement of vessels and helicopters, could lead to potential disturbance of seabirds. This disturbance may result in displacement of birds from the Proposed Development (Offshore), driving a temporary habitat loss and reduced area available for foraging, loafing, and moulting.

7.3.2.4 The effect of distributional responses from construction are likely to be limited spatially and temporally, primarily affecting birds utilising habitats within the construction area (consisting of parts of the array area, OECC and intertidal zone only), with the extent of effects depending on the activities taking place. The effects are also likely reversable in nature, with birds returning to the area following the end of construction phase. It is noted that there is the potential for vessels to transit through the Moray Firth SPA, which is designated for red-throated diver (*Gavia stellata*). As red-throated diver is particularly vulnerable to disturbance from vessel traffic (Statutory Nature Conservation Body (SNCB), 2022[79]), the potential effects from these transit routes have also been considered.

7.3.2.5 There is evidence to suggest the susceptibility of seabirds to disturbance from OWF construction activities varies between species. Dierschke *et al*. (2016[84]) noted both avoidance and attraction to varying degrees to operational wind farms (which may also apply to the construction phase of OWFs), depending upon the species in question. This observation has also been made by a number of other studies (Fliessbach *et al*., 2019[80]; Furness *et al*., 2013[81]; Furness and Wade, 2012[86]; Garthe and Hüppop, 2004[85]; MMO, 2018[82]).

7.3.2.6 The screening process has identified the features and sites to have potential impacts from distributional responses during the construction and decommissioning phases (LSE cannot be ruled out) as those presented in Table 7-3.

Table 7-3: Sites and associated designated features identified for potential AEoSI from distributional responses in the construction and decommissioning phases.

Site	Feature
East Caithness Cliffs SPA	▪ Kittiwake; ▪ Guillemot; and ▪ Razorbill.
Moray Firth SPA (vessel disturbance)	▪ Common scoter; ▪ Eider; ▪ Goldeneye; ▪ Great northern diver; ▪ Long-tailed duck; ▪ Red-breasted merganser; ▪ Red-throated diver; ▪ Shag; ▪ Scaup; ▪ Slavonian grebe; and ▪ Velvet scoter.
North Caithness Cliffs SPA	▪ Kittiwake*; ▪ Guillemot; ▪ Razorbill*; and ▪ Puffin*.
Troup, Pennan and Lion's Heads SPA	▪ Kittiwake*; ▪ Guillemot; and ▪ Razorbill*.
Copinsay SPA	▪ Kittiwake*; and ▪ Guillemot*.
Hoy SPA	▪ Kittiwake; ▪ Guillemot*; and ▪ Puffin*.
Buchan Ness to Collieston Coast SPA	▪ Kittiwake*
Auskerry SPA	▪ Storm petrel (Section 7.3.5)
Rousay SPA	▪ Kittiwake*; and ▪ Guillemot*.
Marwick Head SPA	▪ Kittiwake*; and ▪ Guillemot.
Calf of Eday SPA	▪ Kittiwake*; and

Site	Feature
	▪ Guillemot*.
West Westray SPA	▪ Kittiwake*; ▪ Guillemot; and ▪ Razorbill*.
Fowlsheugh SPA	▪ Kittiwake; and ▪ Razorbill (non-breeding only).
Cape Wrath SPA	▪ Kittiwake*; ▪ Puffin*.
Sule Skerry and Sule Stack SPA	▪ Puffin; ▪ Gannet; and ▪ Storm petrel (Section 7.3.5).
Fair Isle SPA	▪ Kittiwake*; ▪ Razorbill*; ▪ Puffin*; and ▪ Gannet*.
Sumburgh Head SPA	▪ Kittiwake*
Foula SPA	▪ Kittiwake*; and ▪ Puffin.
North Rona and Sula Sgeir SPA	▪ Kittiwake*; ▪ Puffin*; ▪ Gannet; and ▪ Storm petrel (Section 7.3.5).
Mousa SPA	▪ Storm petrel (Section 7.3.5)
Forth Islands SPA	▪ Kittiwake*; ▪ Razorbill (non-breeding only); and ▪ Gannet.
Noss SPA	▪ Kittiwake*; ▪ Puffin*; and ▪ Gannet.
St Abb's Head to Fast Castle SPA	▪ Kittiwake*
Hermaness, Saxa Vord and Valla Field SPA	▪ Kittiwake (non-breeding only); and ▪ Gannet.
Flamborough and Filey Coast SPA	▪ Gannet (non-breeding only)
Handa SPA	▪ Kittiwake
Shiant Isles SPA	▪ Kittiwake

Site	Feature
Ythan Estuary, Sands of Forvie and Meikle Loch SPA	▪ Sandwich tern (Section 7.3.9)
Farne Islands SPA	▪ Kittiwake (non-breeding only)
* Identifies species which are part of an assemblage feature only.	

7.3.2.7 The impacts of distributional responses during the construction phase of the Proposed Development (Offshore) are unlikely to equal those estimated during the O&M phase of the Proposed Development (Offshore).

7.3.2.8 Construction phase impacts are temporally and spatially limited. As such, any potential effect would be limited to construction areas and their surroundings, be short term, reversible, and the level of impact limited. For the Proposed Development alone assessment for the O&M phase, it was concluded that there is no potential for an AEoSI with respect to distributional responses. Therefore, since the equivalent impacts during the construction phase are predicted to be of a considerably smaller duration, spatial scale and magnitude, as well as being fully reversible, the same conclusion can confidently be made for construction and decommissioning for all sites and receptors.

7.3.3 Operation and Maintenance

7.3.3.1 During O&M phases, the following effects have been screened in for potential impact to designated ornithological features:

- Distributional responses; and
- Collision risk.

7.3.3.2 Given the complexity of distributional responses and collision risk, information is presented here relevant to the assessment.

Distributional Responses

7.3.3.3 During the operational phase, WTGs may directly disturb and displace vulnerable seabirds that would be found within and around the Array Area of the Proposed Development (Offshore). Displacement may lead to temporary or permanent indirect habitat loss for sensitive seabirds, and, therefore, reduce the area available to forage, loaf and/or moult. Birds that do not intend to utilise the operational OWF but would have previously flown through it on the way to a feeding, resting or nesting area, and which either stop short or detour around it, are potentially subject to barrier effects. Both impact pathways can cause reductions in either individual survival and/or breeding success.

7.3.3.4 While barrier effects are considered a separate impact to displacement, any impacts as a result of barrier effects are incorporated within the displacement assessment as per the NatureScot Guidance Note 8 (NatureScot, 2023a[83]). The distributional responses assessment presented here considered both flying and sitting birds, therefore any potential impacts on resident birds are already accounted for. By including sitting birds within the analysis those potentially displaced from an area of sea they reside are assessed, meanwhile the inclusion of flying birds provides for an assessment of potential barrier effects to birds moving through the area of interest.

7.3.3.5 While barrier effects are considered a separate impact to displacement, any impacts as a result of barrier effects are incorporated within the displacement assessment as per the NatureScot Guidance Note 8 (NatureScot, 2023a[83]). The distributional responses assessment presented here considered both flying and sitting birds, therefore any potential impacts on resident birds are already accounted for. By including sitting birds within the analysis those potentially displaced from an area of sea they reside are assessed, meanwhile the inclusion of flying birds provides for an assessment of potential barrier effects to birds moving through the area of interest.

7.3.3.6 The susceptibility of seabirds to displacement from operational infrastructure associated with OWFs, such as WTGs and shipping activity related to maintenance activities varies between species. As per Dierschke *et al*. (2016[84]) some species exhibit both displacement and avoidance to varying degrees while others were attracted to OWFs. Notably, guillemot, razorbill, puffin, and red-throated diver have all been shown to exhibit behavioural responses to OWFs and may be displaced as a consequence.

7.3.3.7 Garthe and Hüppop (2004[85]) developed a scoring system for such disturbance factors, which is used widely in OWF EIAs. Similarly, Furness and Wade (2012[86]) developed disturbance ratings for particular species based on Garthe and Hüppop (2004[85]), alongside scores for habitat flexibility and conservation importance in a Scottish context. These factors were used to define an index value that highlights the sensitivity of a species to disturbance and displacement. Bradbury *et al*. (2014[87]) provided an update to the Furness and Wade (2012[86]) paper to consider seabirds in English waters, which subsequently was used to inform the Joint SNCB advice on assessment of displacement effects (SNCBs, 2022[79]).

7.3.3.8 Species were included based on their abundance in the Caledonia North Site and Caledonia South Site, highlighted by the 24 months of baseline data (Volume 7B, Appendix 6-1: Offshore Ornithology Baseline Characterisation Report), and on evidence regarding their sensitivity to displacement and barrier effects (Furness *et al.,* 2013[81]; Bradbury *et al.,* 2014[87]; SNCB, 2022[79]).

7.3.3.9 The distributional assessment presented here is primarily based on the NatureScot Guidance Note 8 (NatureScot, 2023a[83]) regarding a Matrix-based method to assessment presented in the Joint Statutory Nature Conservation Body (SNCB) Interim Advice Note (SNCB, 2022[79]).

7.3.3.10 Assessments for distributional responses are presented as two approaches. The Guidance Approach is based on the NatureScot Guidance Note 8 (NatureScot, 2023a[83]) and the Applicant Approach is based upon the consideration of the most appropriate parameters with consideration of other projects in the Moray Firth zone (further detail is provided within the Volume 7B, Appendix 6-2, Annex 4: Offshore Ornithology Review of Relevant Evidence).

7.3.3.11 Table 7-4 presents the displacement and mortality rates used in the Guidance Approach and the Applicant Approach during the operational phase of the Proposed Development (Offshore).

Table 7-4: Displacement and mortality rates used for the NatureScot Guidance Approach and the Applicant Approach, for the assessment during the operational phase of the Proposed Development (Offshore).

Species	Displacement Rate	Mortality Rate – Breeding Season	Mortality Rate – Non-breeding Season
Guidance Approach			
Guillemot, Razorbill and Puffin	60%	3% and 5%	1% and 3%
Kittiwake	30%	1% and 3%	1% and 3%
Gannet	70%	1% and 3%	1% and 3%
Applicant Approach			
Guillemot, Razorbill and Puffin	50%*	1%	1%
Kittiwake	Not Assessed	Not Assessed	Not Assessed
Gannet	70%	1%	1%
* The displacement rate presented for auks as the Applicant Approach is considered to be a maximum displacement rate as detailed and evidenced within Volume 7B, Appendix 6-2, Annex 4: Offshore Ornithology Review of Relevant Evidence.			

7.3.3.12 The screening process has identified the features and sites that are likely to have potential impacts from distributional responses during the O&M phase (LSE cannot be ruled out) as those presented in Table 7-5.

Table 7-5: Sites and associated designated features identified for potential AEoSI from distributional responses in the operational phase.

Site	Feature
East Caithness Cliffs SPA	▪ Kittiwake; ▪ Guillemot; and ▪ Razorbill.
Moray Firth SPA (vessel disturbance)	▪ Common scoter; ▪ Eider; ▪ Goldeneye; ▪ Great northern diver; ▪ Long-tailed duck; ▪ Red-breasted merganser; ▪ Red-throated diver; ▪ Shag; ▪ Scaup; ▪ Slavonian grebe; and ▪ Velvet scoter.
North Caithness Cliffs SPA	▪ Kittiwake*; ▪ Guillemot; ▪ Razorbill*; and ▪ Puffin*.
Troup, Pennan and Lion's Heads SPA	▪ Kittiwake*; ▪ Guillemot; and ▪ Razorbill*.
Copinsay SPA	▪ Kittiwake*; and ▪ Guillemot*.
Hoy SPA	▪ Kittiwake; ▪ Guillemot*; and ▪ Puffin*.
Buchan Ness to Collieston Coast SPA	▪ Kittiwake*
Auskerry SPA	▪ Storm petrel (Section 7.3.5)
Rousay SPA	▪ Kittiwake*; and ▪ Guillemot*.
Marwick Head SPA	▪ Kittiwake*; and ▪ Guillemot.
Calf of Eday SPA	▪ Kittiwake*: and ▪ Guillemot*.
West Westray SPA	▪ Kittiwake*; ▪ Guillemot; and ▪ Razorbill*.

Site	Feature
Fowlsheugh SPA	▪ Kittiwake; and ▪ Razorbill (non-breeding only).
Cape Wrath SPA	▪ Kittiwake*; ▪ Razorbill (non-breeding only); and ▪ Puffin*.
Sule Skerry and Sule Stack SPA	▪ Puffin; ▪ Gannet; and ▪ Storm petrel (Section 7.3.5).
Fair Isle SPA	▪ Kittiwake*; ▪ Razorbill*; ▪ Puffin*; and ▪ Gannet*.
Sumburgh Head SPA	▪ Kittiwake*
Foula SPA	▪ Kittiwake*; and ▪ Puffin.
North Rona and Sula Sgeir SPA	▪ Kittiwake*; ▪ Puffin*; ▪ Gannet; and ▪ Storm petrel (Section 7.3.5).
Mousa SPA	▪ Storm petrel (Section 7.3.5)
Forth Islands SPA	▪ Kittiwake*; ▪ Razorbill (non-breeding only); ▪ Puffin (non-breeding only); and ▪ Gannet.
Noss SPA	▪ Kittiwake*; ▪ Puffin*; and ▪ Gannet.
St Abb's Head to Fast Castle SPA	▪ Kittiwake*
Hermaness, Saxa Vord and Valla Field SPA	▪ Kittiwake (non-breeding only); and ▪ Gannet.
Flamborough and Filey Coast SPA	▪ Gannet (non-breeding only)
Handa SPA	▪ Kittiwake
Shiant Isles SPA	▪ Kittiwake
Farne Islands SPA	▪ Kittiwake (non-breeding only)
*Identifies species which are part of an assemblage feature only.	

Collision Risk

7.3.3.13 During the operational phase of an OWF, there is a risk that birds flying through the array could collide with the rotor blades of WTGs. The potential risk to collide with WTG blades increases where there are increased levels of flight activity. This can be associated with important foraging areas for seabirds where food supply is concentrated or there is a high passage rate of birds (potentially due to daily commuting from nesting and feeding areas or passing through on seasonal migrations). Therefore, Collision Risk Modelling (CRM) is used to estimate the collision risk with the OWF.

7.3.3.14 The seabird species that have been screened in for collision risk assessment have been identified as being potentially sensitive to collision with OWFs due to published information considering traits such as flight manoeuvrability, proportion of time in flight, and proportion of birds expected to occur at rotor swept heights (e.g., Garthe and Hüppop, 2004[85]; Furness and Wade, 2012[86]; Bradbury *et al.,* 2014[87]; Johnston *et al.,* 2014a[88]; 2014b[89]). The screening process has identified the features and sites to have potential collision risk during the O&M phase (LSE cannot be ruled out) as those presented in Table 7-6.

Table 7-6: Sites and associated designated features identified for potential AEoSI from collision risk.

Site	Feature
East Caithness Cliffs SPA	▪ Kittiwake; ▪ Great black-backed gull*; and ▪ Herring gull.
Moray Firth SPA (Migratory collision risk; Section 7.3.11)	▪ Common scoter; ▪ Eider; ▪ Goldeneye; ▪ Great northern diver; ▪ Long-tailed duck; ▪ Red-breasted merganser; ▪ Red-throated diver; ▪ Scaup; ▪ Slavonian grebe; and ▪ Velvet scoter.
North Caithness Cliffs SPA	▪ Kittiwake*
Troup, Pennan and Lion's Heads SPA	▪ Herring gull*; and ▪ Kittiwake*.
Pentland Firth Islands SPA (Migratory collision risk; Section 7.3.11)	▪ Arctic tern
Moray and Nairn Coast SPA (Migratory collision risk)	▪ Bar-tailed godwit; ▪ Greylag goose; ▪ Pink footed goose;

Site	Feature
	▪ Redshank; ▪ Dunlin; ▪ Oystercatcher; ▪ Red-breasted merganser; and ▪ Wigeon.
Moray and Nairn Coast Ramsar (Migratory collision risk; Section 7.3.11)	▪ Greylag goose; ▪ Pink footed goose; and ▪ Redshank.
Copinsay SPA	▪ Kittiwake*; and ▪ Great black-backed gull (non-breeding only).
Hoy SPA	▪ Great skua; ▪ Kittiwake; and ▪ Great black-backed gull (non-breeding only).
Buchan Ness to Collieston Coast SPA	▪ Kittiwake*
Dornoch Firth and Loch SPA (Migratory collision risk; Section 7.3.11)	▪ Bar-tailed godwit; ▪ Greylag goose; ▪ Osprey; and ▪ Wigeon.
Dornoch Firth and Loch Fleet Ramsar (Migratory collision risk; Section 7.3.11)	▪ Bar-tailed godwit; ▪ Greylag goose; and ▪ Wigeon.
Rousay SPA	▪ Kittiwake*
Marwick Head SPA	▪ Kittiwake*
Calf of Eday SPA	▪ Kittiwake*
Cromarty Firth SPA (Migratory collision risk; Section 7.3.11)	▪ Bar-tailed godwit; ▪ Greylag goose; and ▪ Whooper swan.
Cromarty Firth Ramsar (Migratory collision risk; Section 7.3.11)	▪ Bar-tailed godwit; ▪ Greylag goose; ▪ Common tern; ▪ Dunlin; ▪ Knot; ▪ Oystercatcher; ▪ Red-breasted merganser; ▪ Redshank; ▪ Scaup; and ▪ Wigeon.

Site	Feature
West Westray SPA	▪ Kittiwake*
Inner Moray Firth SPA (Migratory collision risk; Section 7.3.11)	▪ Bar-tailed godwit; ▪ Greylag goose; ▪ Red-breasted merganser; ▪ Redshank; ▪ Curlew; ▪ Goldeneye; ▪ Oystercatcher; ▪ Scaup; ▪ Teal; and ▪ Wigeon.
Inner Moray Firth Ramsar (Migratory collision risk; Section 7.3.11)	▪ Bar-tailed godwit; ▪ Greylag goose; ▪ Red-breasted merganser; and ▪ Redshank.
Fowlsheugh SPA	▪ Kittiwake
Cape Wrath SPA	▪ Kittiwake*
Sule Skerry and Sule Stack SPA	▪ Gannet
Fair Isle SPA	▪ Kittiwake*; ▪ Great skua*; and ▪ Gannet*.
Sumburgh Head SPA	▪ Kittiwake*
Foula SPA	▪ Kittiwake* ▪ Great skua
North Rona and Sula Sgeir SPA	▪ Kittiwake*; and ▪ Gannet.
Forth Islands SPA	▪ Kittiwake*; and ▪ Gannet.
Noss SPA	▪ Kittiwake*; ▪ Great skua; and ▪ Gannet.
St Abb's Head to Fast Castle SPA	▪ Kittiwake*
Ronas–Hill - North Roe and Tingon SPA	▪ Great skua
Fetlar SPA	▪ Great skua
Hermaness, Saxa Vord and Valla Field SPA	▪ Gannet; ▪ Great skua; and

Site	Feature
	▪ Kittiwake (non-breeding only).
Flamborough and Filey Coast SPA	▪ Gannet (non-breeding only)
Handa SPA	▪ Kittiwake; and ▪ Great skua.
Shiant Isles SPA	▪ Kittiwake
St Kilda SPA	▪ Great skua
Farne Islands SPA	▪ Kittiwake
*Species which are part of an assemblage feature only.	

7.3.3.15 CRM was undertaken using the web-browser version of the Marine Science Scotland Stochastic Collision Risk Model Shiny Application ("sCRM App"; Caneco, 2022[90]), as recommended by NatureScot (2023b[91]). CRM was run stochastically and deterministically as recommended by NatureScot (2023b[91]), with stochastic outputs used to inform assessments within the RIAA. Detailed methods employed for CRM and results are presented within Volume 7B, Appendix 6-3: Offshore Ornithology Collision Risk Modelling Technical Report.

7.3.3.16 Band Option 2 only has been used to inform RIAA assessments, which assumes flight height distribution is uniform across the rotor swept height. The NatureScot (2023b[91]) guidance also requests the use of Band Option 3, which accounts for the skewed vertical distribution of bird flight heights between the lowest and the highest levels of the rotors. However, the use of the Option 3 is no longer required, as highlighted within the Morven OWF Scoping Opinion (Marine Directorate, 2023[92]), which stated that the guidance will subsequently be updated in due course (Volume 7B, Appendix 6-3: Offshore Ornithology Collision Risk Modelling Technical Report).

Model Parameters

7.3.3.17 The physical and biological parameters used to inform CRM modelling follow NatureScot (2023b[91]) guidance and were discussed and agreed in consultation with NatureScot in May 2023. The most recent published avoidance rates (NatureScot, 2023b[91]), based on Ozsanlev-Harris *et al*. (2023[93]), were used for each CRM scenario. Further detail in relation to input parameter selection for CRM is provided in Volume 7B, Appendix 6-3: Offshore Ornithology Collision Risk Modelling Technical Report.

Precautionary Nature of CRM

7.3.3.18 The species parameters used within the CRM assessment (see 7.3.3.17 and 7.3.3.17) are based on the NatureScot (2023b[91]) Guidance Note 7. For all Collision sensitive species, avoidance rates are based on species groupings rather than species specific avoidance rates due to the low sample size of available evidence currently available to inform parameterisation. However, it is important to note the level of potential precaution which may be included within assessment based on emerging evidence from post-construction monitoring studies and emerging research relating to species behavioural interactions with OWFs. The Offshore Renewables Joint Industry Programme (ORJIP) funded an OWF avoidance study at Thanet OWF, which recorded over 12,000 bird movements between 2014 and 2016. The results from two years of monitoring found that only six birds (all gull species) were reported to have collided with WTGs during this two-year period (Skov *et al*., 2018[94]). Further analysis by Bowgen and Cook (2018[95]) recommended higher avoidance rates for gannet and kittiwake than was recommended for CRM at the time, suggesting rates of 99.5% and 99.0%, respectively.

7.3.3.19 Additionally, a recent report from Aberdeen Offshore Windfarm Limited (AOWFL, 2023[96]) at the European Offshore Wind Development Centre (EOWDC), found that collision rates of birds are likely to be lower than predicted, as no collisions or narrow escapes were recorded in over 10,000 bird videos recorded in 2020 and 2021. This implies that collision rates are very low and suggests that a high level of precaution is incorporated into the current methodology.

7.3.3.20 Current recommended flight speeds are derived from Pennycuick (1997[97]) for gannet or Alerstam *et al*. (2007[98]) for all other species. In relation to gannet, the flight speed presented in Pennycuick (1997[97]) is based on 32 cliff-based observations using an ornithodolite (Pennycuick, 1982[99]) over a period of 12 days on the island of Foula. The instrument used is for flight speed estimates at short ranges of up to 295m (Pennycuick, 1983[100]) and with a position error of about 2.6m at 100m and 8m at maximum range. The precision of the instrument was described, in the words of the author, as 'not very high' (Pennycuick, 1982[99]). A more recent study (Skov *et al*., 2018[94]) used laser rangefinder tracking data to estimate flight speed both inside and outside the Thanet OWF for gannet from 706 tracks over a period of approximately two years, the results of which suggested on average a slower flight speed for gannet (13.3 vs 14.9m/s).

7.3.3.21 In relation to kittiwake, as noted within the recent Crown Estate Round Four strategic assessment (Niras, 2022[101]) the flight speed presented in Alerstam *et al*. (2007[98]) is based off a total of two birds observed in either southern Sweden or the Arctic Circle, with no association to OWF or consideration provided to their flight behaviour (migratory or foraging). A review of flight speeds undertaken by Royal Haskoning DHV (2020[102]) for Norfolk Boreas OWF estimated that the current flight speed used for kittiwake (13.1m/s; Alerstam

et al., 2007[98]) is likely an overestimation whereas a value of 10.8m/s would be more realistic. The average flight speed recorded from Thanet OWF (Skov *et al*., 2018[94]) again suggest a lower estimate of flight speed of 8.7m/s for kittiwake. The flight speed used within the CRM assessment can directly impact the predicted potential mortality due to collision risk and therefore the risks could be lowered using more recent evidence.

7.3.3.22 Finally, Nocturnal activity factors (NAF) currently advocated by NatureScot are derived from the scoring index for nocturnal activity presented in Garthe and Hüppop (2004[85]) based on literature review and personal observations. These index values were then converted into a nocturnal activity factor as follows; 1 = 0%, 2 = 25%, 3 = 50%, 4 = 75%, 5 = 100%. NAF values from more recent evidence by Furness *et al*. (2018[103]), MacArthur Green, APEM and Royal HaskoningDHV (2015[104]), Masden (2015[105]) and Skov *et al*. (2018[94]) have all found significantly lower nocturnal activity than those presented in Garthe and Hüppop (2004[85]), especially during the breeding season.

7.3.3.23 Overall, these findings suggest that the collision risk modelling input parameters for this assessment and other developments incorporate a high degree of precaution, and this should be carefully considered when interpreting the model outputs.

7.3.4 Additional Assessment Information

Seasonal Considerations

7.3.4.1 Seabird seasonal definitions have been defined by NatureScot (2020[106]) as:

- *"Breeding season: birds are strongly associated with nest site – nesting, egg laying, provisioning young"; and*
- *"Non-breeding season: birds are more widely dispersed and not strongly associated with nest site".*

7.3.4.2 The seasonal definitions used within the assessment are based on those presented in NatureScot (2020[106]). The use of these defined seasons within the EIA and HRA were agreed with NatureScot during consultation (May 2023), and are presented in Table 7-7 for seabird species included in the assessment.

Table 7-7: Defined seasons in the Scottish Marine Environment for seabird species (NatureScot, 2020106).

Species	Breeding Season	Non-breeding Season
Kittiwake	Mid-April to August	September to Early April
Great black-backed gull	April to August	September to March
Herring gull	April to August	September to March
Common tern	May to Mid-September	-
Arctic tern	May to August	-
Great skua	Mid-April to Mid-September	Mid-September to Mid-April
Arctic skua	May to August	-
Common guillemot	April to mid-August	Late August to March
Razorbill	April to mid-August	Late August to March
Puffin	April to Mid- August	Late August to March
Gannet	Mid-March to September	October to Early-March

Combined Impacts

7.3.4.3 Gannet and kittiwake have both been assessed for both distributional responses and collision risk. The suggestion within the NatureScot guidance is to use an additive approach (i.e., total predicted impact = total predicted collision rate + total predicted distributional responses mortality). However, this approach does not consider that birds that have been displaced from the OWF are not at risk from collision. Such an approach could therefore lead to the overestimation of the combined impact of collision and distributional responses.

7.3.4.4 For kittiwake, there is limited evidence for consistent changes in distribution as a result of OWF operation, and therefore it is not considered appropriate to attempt to correct for this effect in CRM. However, to avoid the potential for overestimation of impacts for gannet, the Applicant Approach has also been presented (see Volume 7B, Appendix 6-3: Offshore Ornithology Collision Risk Modelling Technical Report). A macro-avoidance rate has been applied to the gannet densities used within the CRM, by adding a "correction" step (Pavat *et al.,* 2023[107]) as agreed with NatureScot in consultation. NatureScot advise the use of macro-avoidance rate in the non-breeding season (update to guidance note imminent). As per the interim advice on updated CRM parameters (Joint SNCB, 2022[79]) it is recommended that the density of gannets in flight is reduced by 70% when conducting CRM. Alongside the recommended

methodology (NatureScot, 2023b[91]), this method has been presented as part of the Applicant Approach to estimate the impact of the Proposed Development (Offshore) on gannet when accounting for the double counting issue.

Population Viability Analysis

7.3.4.5 In accordance with advice provided within NatureScot Guidance note 11 (NatureScot, 2023b[91]), where a survival rate change of 0.02% is exceeded, further consideration of population level consequences will be analysed via Population Viability Analysis (PVA). Details relating to the methodology employed for PVA required within this report is provided within Appendix 13-2: HRA PVA Technical Note and Cumulative Assessment.

7.3.4.6 As presented, two outputs from PVA analysis are presented, the Counterfactual of Population Size (CPS) and Counterfactual of Population Growth Rates (CPGR). The focus of assessment conclusions is based on the CPGR, as the outputs can be readily cross examined against known recent and historic population growth rates of differing populations to provide an informed decision on the likely impact such an effect may have on the colony long term. In contrast the CFPS is a subjective output, with no way to validate what such predicted reductions in population size (as a consequence of predicted impacts) are likely to have on a specified population. The CFPS output might appear to show a significant reduction in population size comparatively to the baseline population to a non-specialist, but this could be easily misconstrued to assume the population is therefore in population decline, which might not necessarily be the case.

7.3.4.7 CFGR has been examined where feasible against known historic and recent colony population trends, information relating to the condition status of the SPA and inclusion of expert judgement to inform AEoSI conclusions where the change in survival rate exceeded 0.02%.

7.3.5 Consideration of Storm Petrel Species for HRA

7.3.5.1 To ensure appropriate baseline characterisation of offshore ornithology receptors including storm petrel species (i.e., European storm petrel and Leach's petrel), site-specific DAS for the Caledonia OWF were undertaken monthly between May 2021 and April 2023 (inclusive). DAS were undertaken using a ground sampling distance (GSD) of 1.5cm. This GSD leads to higher resolution imagery and subsequent increased detectability of cryptic species such as storm petrel species, in contrast to the standard best practice of 2cm GSD.

7.3.5.2 Within site-specific DAS, no storm petrel species were recorded within the array area of the Caledonia OWF. However, the Applicant is cognisant of NatureScot's request to consider certain designated sites for both European storm and Leach's petrel (outlined in Section 5) and the limitations of DAS

given the nocturnal behaviour of the species, and the potential for baseline DAS to sometimes not record birds present in low abundance due to them not being captured by the grid-based sampling methodology. As such the Applicant has further considered the potential impacts of the Proposed Development (Offshore) on storm petrel species within this section. Further to this, as requested in consultation, the Applicant has also considered the potential impact of artificial lighting on European and Leach's storm petrel as detailed within Volumes 2, 3 and 4, Chapter 6: Offshore Ornithology.

7.3.5.1 Although storm petrels are well known to be active at night, tagging data of European storm petrels from Mousa SPA (the closest SPA to the Proposed Development (Offshore)) showed that during three sampled parts of the breeding season (incubation, brooding and post brooding) over four breeding seasons, tagged individuals tended to forage within daylight hours and return to the colony during the hours of darkness (Bolton, 2021[108]). During daylight hours, the distribution of tagged individuals was more pelagic and widespread than at night. Furthermore, storm petrels have been recorded to forage close to colonies in the intertidal zone during the night (Albores-Barajas *et al*., 2011[109]; Thomas *et al*., 2006[110]; D'Elbee and Hemery, 1998[111]), while longer foraging trips occurred in daylight during the breeding season (Albores-Barajas *et al*., 2011[109]).

7.3.5.2 Nocturnal and diurnal Utilisation Distribution bands (Bolton, 2021[108] Figure 7-1) for European storm petrels from Mousa SPA clearly depict no overlap with the Proposed Development (Offshore), which supports the conclusions of the site-specific baseline DAS. The distance of the nearest European storm/Leach's petrel colonies, the consideration their foraging ranges (Woodward *et al*., 2019[32]; Bolton, 2021[108]), and predicted densities around the area (<0.1 birds/km^2 for both species) from Waggitt *et al*. (2019[112];Table 7-6) suggest minimal to no overlap between their distribution and the Proposed Development (Offshore). Calculation of maximum foraging ranges by Bolton (2021[108]) indicated that birds tagged at Mousa would only theoretically reach the location of the Proposed Development (Offshore) during the incubation phase of the breeding season; the maximum recorded foraging ranges during the brooding and post-brooding periods were less than the distance between the Mousa SPA and the Proposed Development (Offshore).

7.3.5.3 This conclusion is bolstered by the ebird relative density range maps (Fink *et al*., 2022[113]). These sources suggest very low occurrence of both European storm and Leach's storm petrel over the Proposed Development (Offshore) and only on passage, which would be in agreement with the lack of records within site specific DAS. It is important to note that although DAS surveys are limited in terms of the length of time surveyed and spatial extent of surveys, no instances of storm petrel were recorded, indicating along with the additional sources presented that the Caledonia OWF is not an area of importance for these species.

7.3.5.4 For both Leach's and European storm petrels, evidence around exact migration routes of birds breeding in the North Atlantic has until recently been relatively unknown due to difficulties in recapturing storm petrels on migration and limitations in bio-logger technology (Wernham *et al*., 2002[138]; Militão *et al*., 2022[114]; Thomas, 2024[115]). More generally, European storm petrels are known to migrate out of the North Sea in Autumn (August onwards over a protracted period) to wintering grounds off the coast of Southern Africa (Wernham *et al*., 2002[138]; Thomas, 2024[115]; Deakin *et al*., 2022[16]), before then migrating back to colonies in Spring (end of April). Though evidence is limited, a minimum spring migration rate of 116km a day is suggested based on based on recapture efforts (Wernham *et al*., 2002[138]). Leach's storm petrels undergo Autumn migration from September to November, to winter within the South Atlantic before migrating back to breeding colonies in Spring (late April) (Wernham *et al*., 2002[138]; Pollet *et al*., 2019[116]). Migratory movements usually occur significantly offshore with land-based observations usually limited to storm events (particularly in Autumn) where birds are blown inshore, especially off the west coast of the UK and Ireland, potentially suggesting a greater tendency to migrate via Western waters, rather than the North Sea (Wernham *et al*., 2002[138]). Despite the limited amount of evidence currently available, potential for a tangible impact to occur non-breeding is considered limited based on knows migratory patterns and limited temporal overlap.

7.3.5.5 The evidence presented suggest minimal to no overlap between storm petrel species distribution and the Proposed Development (Offshore). As such, it can be confidently concluded that the Caledonia OWF is not an area of importance to either storm petrel species. Connectivity is considered low for both storm petrel species when considering the results of the site-specific DAS and above additional evidence. Therefore, the Applicant remains of the position that an LSE can be confidently dismissed for Leach's and/or European storm petrel qualifying features identified within the Screening Report (Application Document 12).

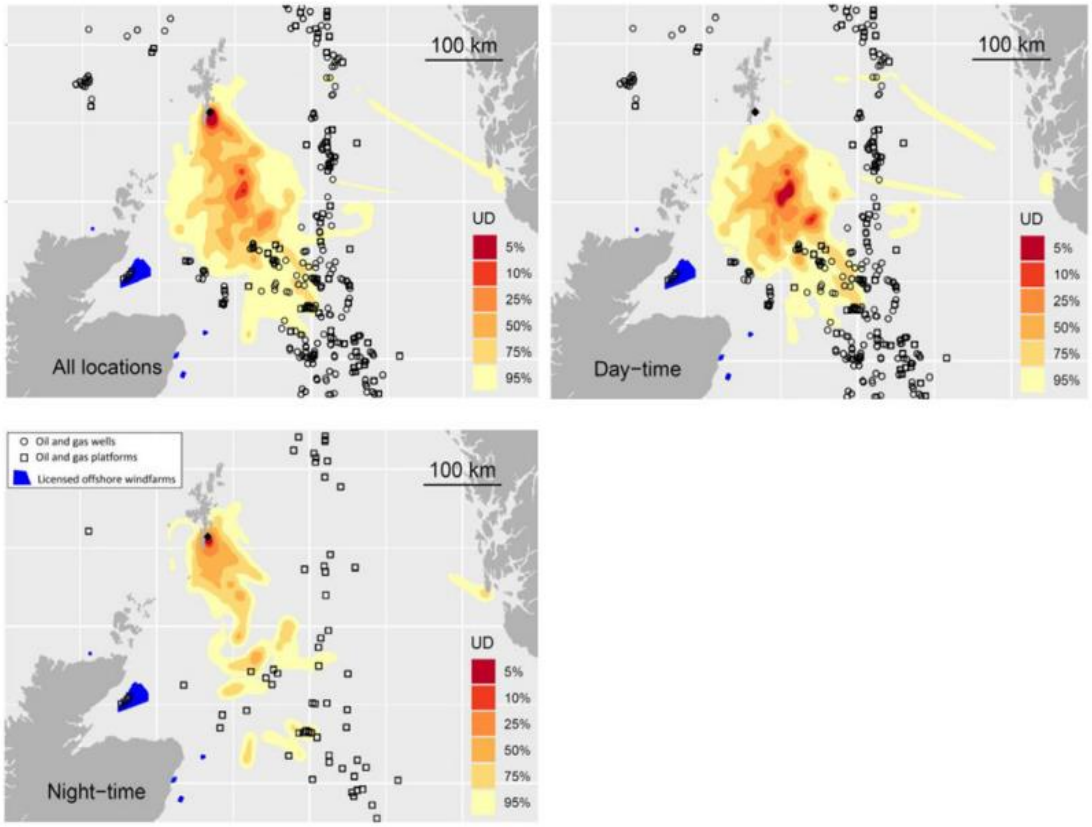


Figure 7-1: Distribution of storm petrels during the 24-hour cycle, during the daylight and during the hours of darkness. Breeding colony is located by black diamond, active oil and gas wells are indicated by circles and platforms by squares (Bolton, 2021[108]).

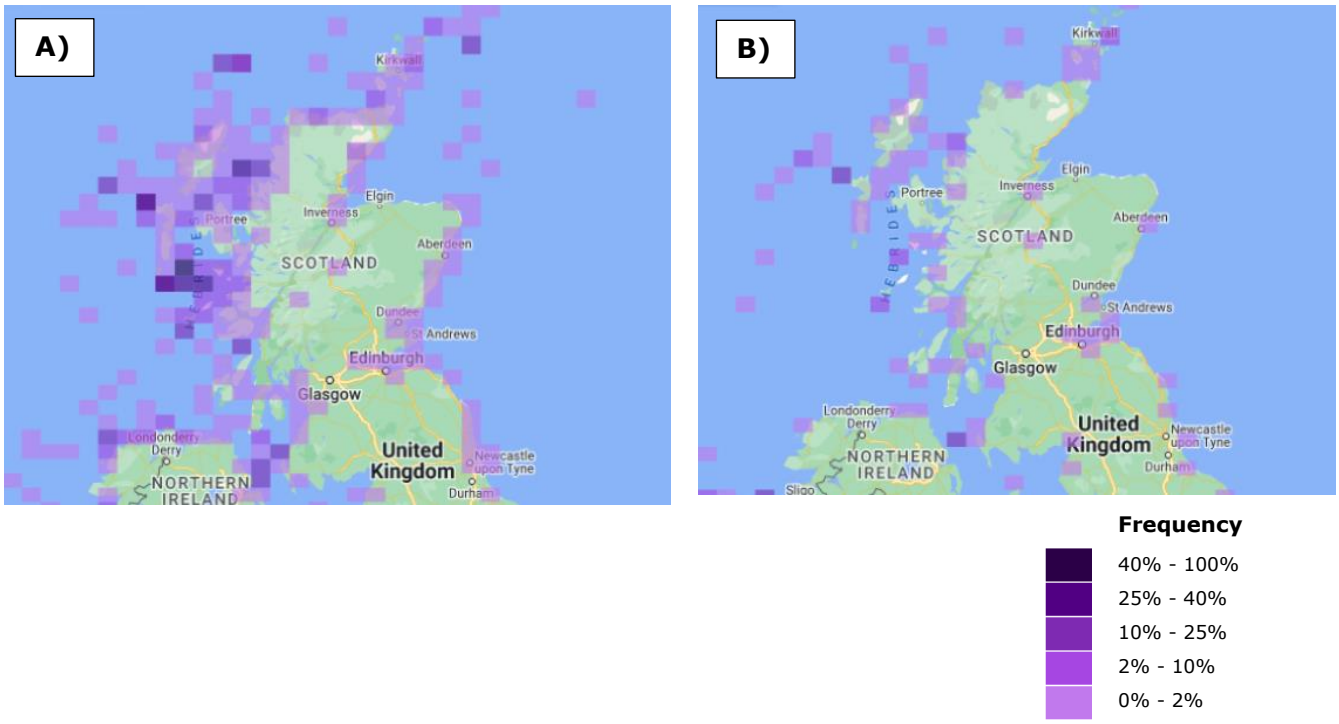


Figure 7-2: eBird relative density range maps (Fink *et al*., 2022[113]), A; European storm petrel and B; Leach's storm petrel.

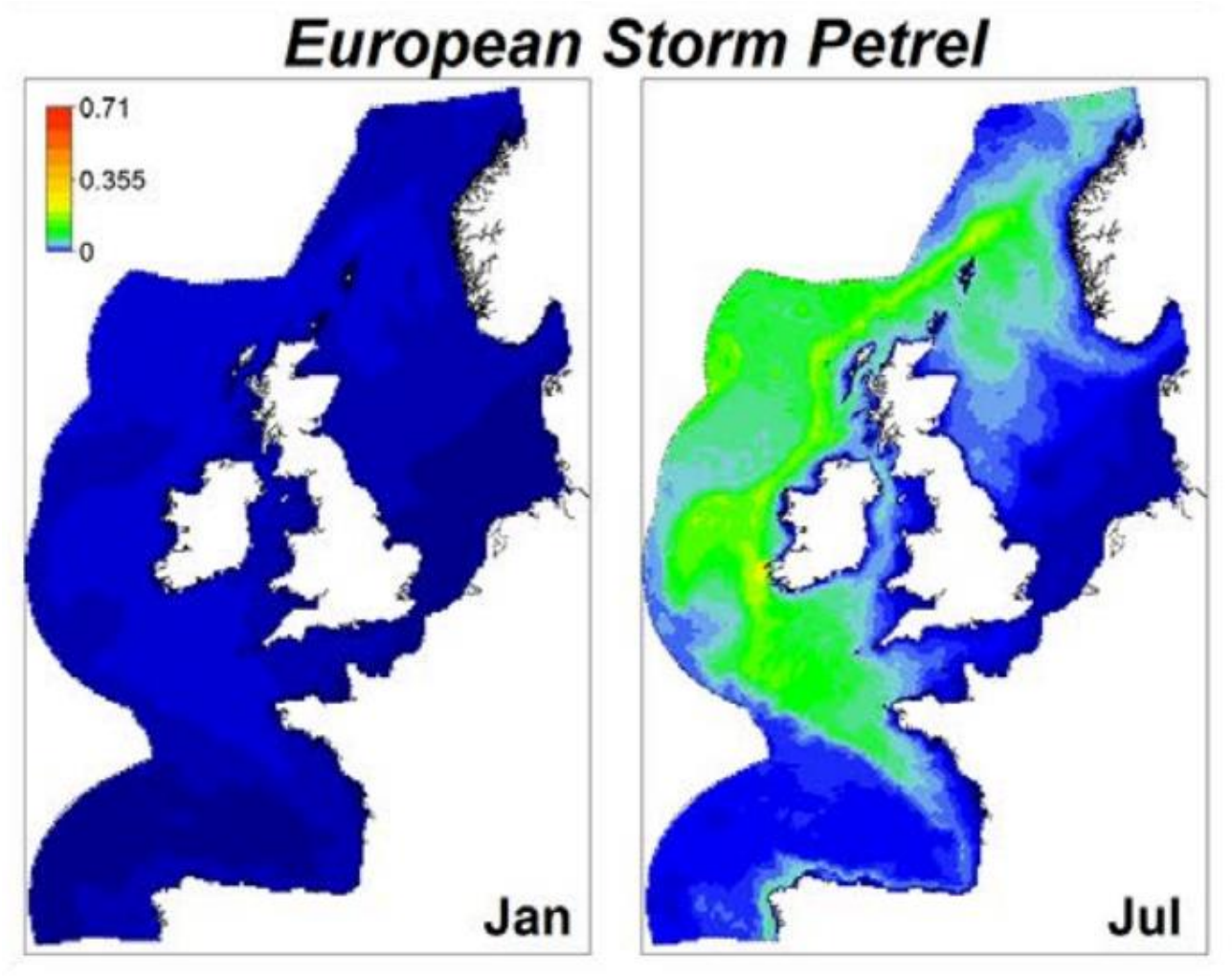


Figure 7-3: Spatial variation in predicted densities (animals per km^2) of European storm-petrel in January and July derived from Waggitt *et al*. (2019[112]).

7.3.6 Consideration of Shearwater Species for HRA

7.3.6.1 As requested within consultation, the Applicant has considered the potential impact of artificial lighting on Manx shearwater and sooty shearwater as detailed within Volumes 2, 3 and 4, Chapter 6: Offshore Ornithology. For clarity sooty shearwater is a scarce migrant within UK waters and therefore is not cited as a feature of any UK SPA, therefore no further consideration is required for this species within the RIAA.

7.3.6.2 The EIA concluded a negligible magnitude of impact due to the lack of a potential effect pathway when considering the lighting employed by OWFs, combined with the lack of connectivity to the Caledonia OWF due to the low numbers of Manx shearwater recorded within site specific DAS (a total of 28 Manx shearwater within the 24 months of DAS for the Caledonia OWF). Therefore, the potential for an LSE with respect to any Manx shearwater qualifying features can confidently be excluded for lighting effects.

7.3.6.3 This conclusion of limited connectivity, is bolstered by both the Waggitt *et al*., (2019[112]; Figure 7-4) and eBird relative density range maps (Fink *et al*., 2022[113]; Figure 7-5). This source suggests very low occurrence of both Manx shearwater over the Caledonia OWF and only on passage, which would be in agreement with the lack of records within site specific DAS.

7.3.6.4 The evidence presented suggest minimal to no overlap between Manx shearwater distribution and the Proposed Development (Offshore). As such, it can be confidently concluded that the Caledonia OWF is not an area of importance for Manx shearwater. Connectivity between the Caledonia OWF and key breeding SPA populations of this species is concluded as limited when considering the results of the site-specific DAS and above additional evidence. Therefore, the Applicant remains of the position that an LSE can be confidently excluded for all remaining impact pathways for Manx shearwater, as concluded at screening stage.

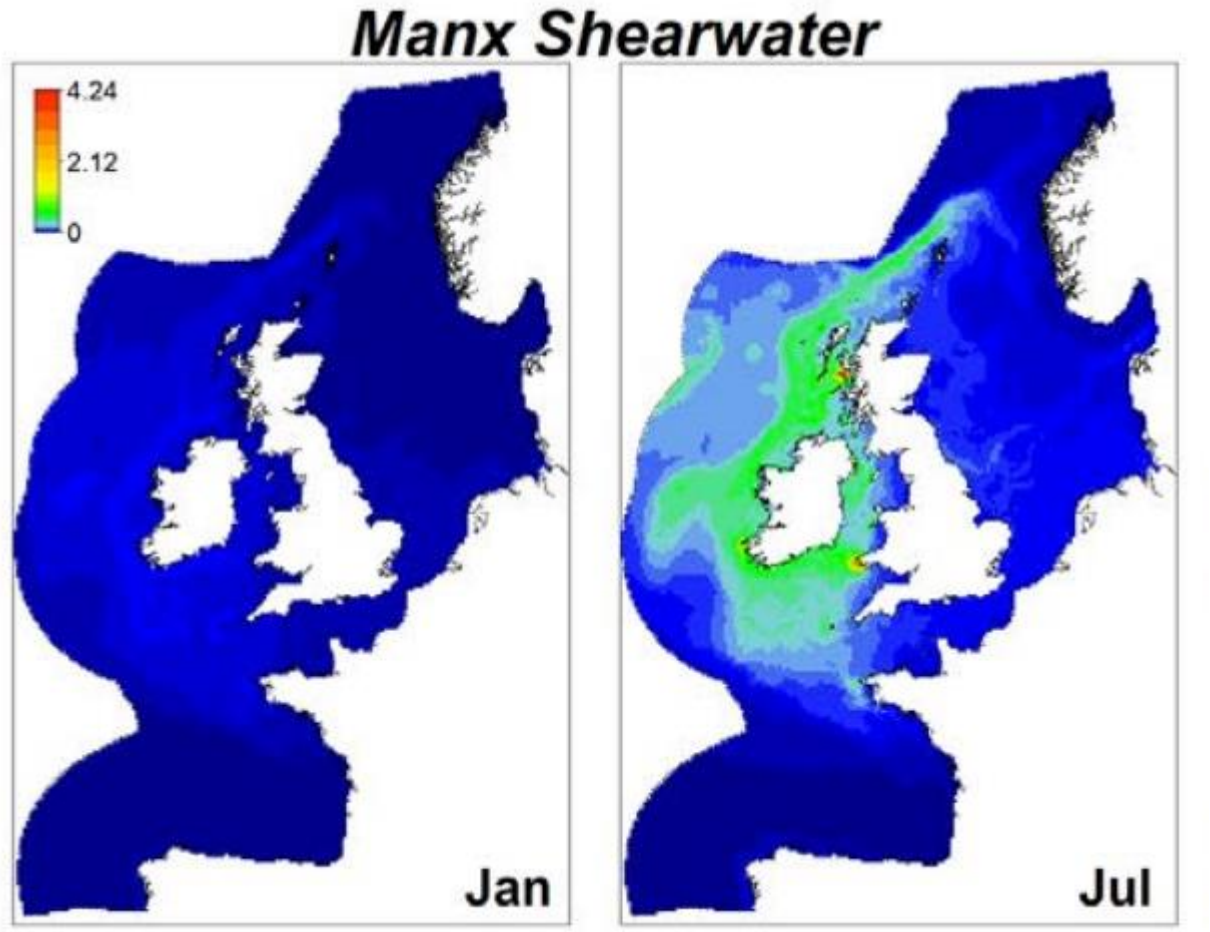


Figure 7-4: Spatial variation in predicted densities (animals per km^2) of Manx shearwater in January and July derived from Waggitt *et al*. (2019[112]).

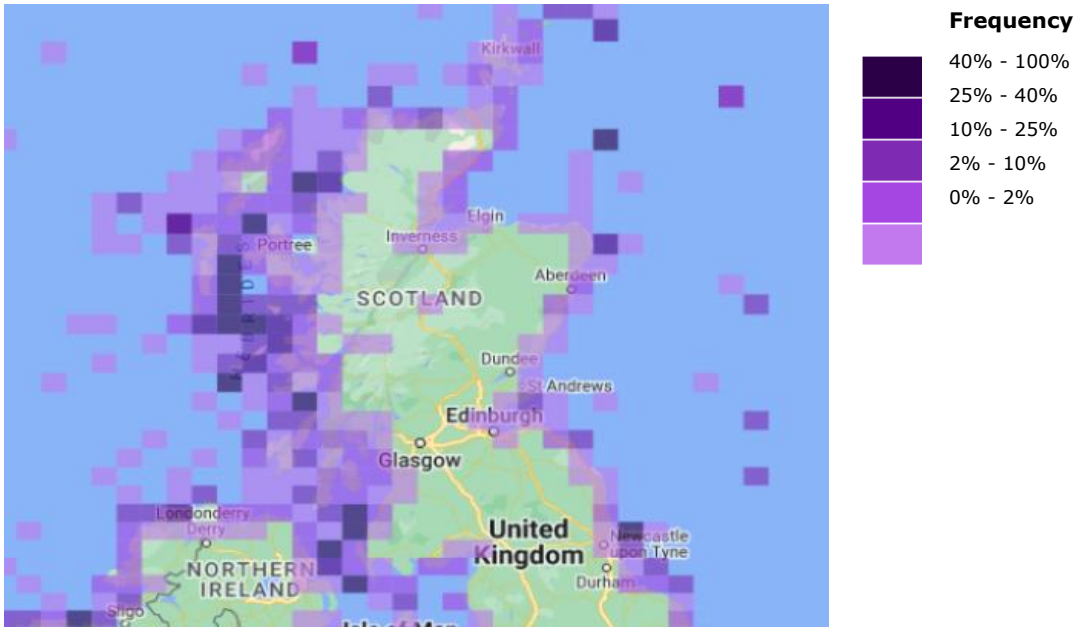


Figure 7-5: eBird relative density range maps (Fink *et al*., 2022[113]) for Manx shearwater.

7.3.7 Consideration of Fulmar for Potential Barrier Effects

7.3.7.1 When an OWF is in operational phase, the presence of WTGs has the potential to create a barrier movement of birds in flight. This could potentially alter the flight routes to foraging sites for birds and increase energetic expenditure associated with these movements. The overall impact may result in a reduced rate in breeding success or survival for birds affected. Barrier effects of OWFs can affect those species which may forage regularly in the array area or further than the Caledonia OWF.

7.3.7.2 As requested through consultation, the potential for barrier effects associated with the Proposed Development (Offshore) in relation to fulmar qualifying features has been considered below. The following SPAs were screened in due to potential for an LSE of barrier effect on fulmar when considering the species MMFR (Woodward *et al*., 2019[32]):

- East Caithness Cliffs SPA;
- North Caithness Cliffs SPA;
- Troup, Pennan and Lion's Heads SPA;
- Copinsay SPA;
- Hoy SPA;
- Buchan Ness to Collieston Coast SPA;
- Rousay SPA;
- Calf of Eday SPA;
- West Westray SPA;
- Fowlsheugh SPA;
- Cape Wrath SPA;
- Sumburgh Head SPA;
- Foula SPA;
- North Rona and Sula Sgeir;
- Noss SPA;
- Fetlar SPA;
- Hermaness, Saxa Vord and Valla Field SPA;
- Coquet Island SPA;
- Flamborough and Filey Coast SPA;
- Handa SPA;
- Shiant Isles SPA; and
- St Kilda SPA.

7.3.7.3 Fulmar are generalist feeders, taking a wide range of prey as well as scavenging for fish offal at fishing vessels (Camphuysen and Garthe, 1997[117]). Naturally, their diet consists of fish (*Ammodytidae*, *Clupeidae*, *Gadidae*), squid, and crustaceans (Ojowski *et al*., 2001[118]). They are a central place forager in the breeding season with predominant breeding sites in the Northern Isles, Western Isles and the north coast of Scotland (Burnell *et al*., 2023[142]; Hamer *et al*., 1997[119]), though breeding birds are also widely distributed along UK coastlines. Due to their varied diet consisting of prey from both inshore and pelagic waters, fulmar are not thought be restricted to specific areas and forage widely across the marine environment. Fulmar undertake large foraging trips during the breeding season, with a MMFR + SD of 1,182km (Woodward *et al*., 2019[32]). For example, fulmar from Enyhallow, Orkney, travelled as far as the Charlie-Gibbs Fracture Zone in the Mid-Atlantic Ridge in the breeding season (Edwards *et al*., 2013[120]).

7.3.7.4 During the non-breeding season, birds feed within the pelagic zone around shelf edges (Fauchald *et al*., 2021[121]; Lack, 1986[122]; Stone *et al*., 1995[123]).

7.3.7.5 Fulmar are considered to have a very low susceptibility to displacement as well as exhibiting weak avoidance behaviour to OWFs (SNCB, 2022[79]; Bradbury *et al*., 2014[87]; Furness *et al*., 2013[81]). Post construction monitoring At the BARD OWF, located within German waters, suggested fulmars showed avoidance behaviour in response to the OWF (Neumann *et al*., 2013[124]; Braasch *et al*., 2015[125]). The authors considered that the reduced presence of fulmar within the OWF could be due to the lack of fishing vessels within the OWF area, rather than the avoidance behaviour due to the presence of the OWF. A review of fulmar avoidance and attraction in European waters completed by Dierschke *et al*. (2016[84]). Overall the review concluded fulmar showed weak avoidance behaviour, though due to lack of available quantitative studies and low densities of fulmars recorded within OWFs, behavioural responses could only be inferred rather than proven to be statistically significant from natural variability in habitat usage (Dierschke *et al*. 2016[84]). Additionally, the author suggests fulmars may show stronger avoidance than concluded, though uncertainty remains around such a conclusion given the lack of avoidable evidence (Dierschke *et al*. 2016[84]). The latest review of post-construction monitoring of OWFs in the North Sea and Baltic Seas was completed Lamb *et al*. (2024[126]). In relation to fulmar, a total of four studies from five OWFs were reviewed. Lamb *et al*. (2024[127]) found that the magnitude for displacement was large for fulmar relative to other species when such an impact was detected, but there was a low chance of detecting significant effects relative to other species due to few studies reporting fulmar presence, and those that did often reported the species at low densities.

7.3.7.6 Overall, it appears that fulmar generalised behavioural response to OWFs is that of avoidance, though to what degree and influential factors remains uncertain. It may be the case that responses to the presence of OWFs also vary at the individual level, though this cannot be considered in further detail due to a lack of evidence. Despite this, it is currently considered that the consequences of this avoidance is likely to limited at the population level, for several reasons. A study which modelled the energetic costs of OWF avoidance by a range of seabird species indicated that the predicted increase in energy requirements for fulmar was at the lower end of predictions, due to the gliding flight adaptations and relatively low number of foraging trips undertaken during the breeding season (Masden *et al*., 2010[128]). Their generalist diet suggests that in the event of exclusion from an OWF occurring, the majority of birds within the affected populations are likely to be able to utilise a range of food sources beyond the boundaries of OWFs should this be required.

7.3.7.7 It is therefore considered that whilst OWF avoidance may occur by fulmar, the net impact at the population level is anticipated to be low. It is concluded there is no potential for an AEoSI with respect to barrier effect on fulmar features of all designated sites screened in for assessment.

7.3.8 Consideration of Entanglement with Mooring Lines

7.3.8.1 The following SPA's and qualifying features were screened in due to potential for an LSE from entanglement with mooring lines:

- East Caithness Cliffs SPA (guillemot and razorbill);
- North Caithness Cliffs SPA (guillemot, razorbill and puffin);
- Troup, Pennan and Lion's Head SPA (guillemot and razorbill);
- Copinsay SPA (guillemot);
- Hoy SPA (guillemot and puffin);
- Rousay SPA (guillemot);
- Marwick Head SPA (guillemot);
- West Westray SPA (guillemot and razorbill);
- Cape Wrath SPA (puffin and razorbill (razorbill during the non-breeding season);
- Sule Skerry and Sule Stack SPA (gannet and puffin);
- Fair Isle SPA (razorbill, gannet and puffin);
- Foula SPA (puffin);
- North Rona and Sula Sgeir SPA (gannet and puffin);
- Forth Islands SPA (gannet, puffin and razorbill (puffin and razorbill during the non-breeding season only);

- Noss SPA (gannet and puffin);
- Hermaness, Saxa Vord and Valla Field SPA (gannet);
- Flamborough and Filey Coast SPA (gannet during the non-breeding season); and
- Fowlsheugh SPA (razorbill during the non-breeding season).

7.3.8.2 There is no clear guidance currently available regarding the approach to the assessment and monitoring required for floating WTG designs for potential bird entanglement. Additionally, following a brief review of published reports for similar floating OWF projects and other moored infrastructures, there are no examples where seabird entanglement has been scoped in for assessment. This is likely because such incidents are anticipated to be extremely rare. Furthermore, floating structures associated with the oil and gas industry have been present in this region of the North Sea for several decades with no significant impacts reported. As such, the likelihood of a significant impact is considered low.

7.3.8.3 The risk of entanglement is considered to be unlikely due to design parameters, as the mooring lines are kept under tension and the chain's dimensions significantly reduce the chances of full or partial entanglement.

7.3.8.4 The risk of indirect entanglement by diving birds may increase should fishing gear become entangled on the mooring lines due to the increased likelihood of the infrastructure acting as a fish aggregation device (FAD). The embedded maintenance and monitoring practices of the deployed infrastructure will mitigate this risk, namely via maintenance inspections to collect and remove debris (such as abandoned fishing nets, pots and other marine rubbish) amongst the mooring lines. This embedded mitigation will help decrease the potential risk of any entanglement, as such it is concluded that there is no potential for a AEoSI with respect to entanglement in mooring lines for any designated sites and ornithology features screened in for assessment.

7.3.9 Consideration of Distributional Responses

OECC and Landfall

7.3.9.1 The Applicant notes NatureScot's request to consider potential impacts on Sandwich tern at the Ythan Estuary, Sands of Forvie and Meikle Loch SPA during the construction and decommissioning phase within the OECC. As such, potential for LSE alone has been considered here for the Sandwich tern qualifying feature of the Ythan Estuary, Sands of Forvie and Meikle Loch SPA for distributional response (construction and decommissioning; OECC).

Ythan Estuary, Sands of Forvie and Meikle Loch SPA

7.3.9.2 Ythan Estuary, Sands of Forvie and Meikle Loch SPA is 82.2km (around land) from Caledonia OWF, within the MMFR +1SD of Sandwich tern (34.3±23.2km) (Woodward *et al.*, 2019[32]).

7.3.9.3 Relevant surveys were utilised for assessment of the OECCs and Horizontal Directional Drilling (HDD) offshore exit point to assess receptor baselines of species identified as utilising the Proposed Development (Offshore) and surrounding areas. As such, intertidal surveys were conducted for the assessment of effects on birds in the intertidal zone encompasses the intertidal area between Mean High Water Spring (MHWS) tides extending out to 1.5km seaward from MHWS, covering the proposed route of the OECC from the Offshore Ornithology Study Area to the proposed landfall location.

7.3.9.4 With regards to Sandwich tern, no individuals were recorded during intertidal surveys. As such, the potential for LSE can confidently be ruled out for Sandwich tern at the Ythan Estuary, Sands of Forvie and Meikle Loch SPA due to lack of connectivity with the OECC and landfall study area.

Vessel Disturbance

Moray Firth SPA

7.3.9.5 During consultation (May 2023), the Applicant requested NatureScot's confirmation on whether it was suitable to scope out operational disturbance and displacement associated with the OECC as a result of the area being refined since scoping (i.e., the OECC no longer directly overlaps with the Moray Firth SPA).

7.3.9.6 NatureScot confirmed that due to the refinement of the OECC, this impact pathway can be scoped out in the RIAA with respect to the corridor and the qualifying interests of the Moray Firth SPA. However, it was noted that, depending on the shore bases used for all phases of the development (construction, O&M and decommissioning) and associated vessel routes, types and frequency, the potential impact of vessel disturbance may be required.

7.3.9.7 As such, this section considers the following qualifying features of the Moray Firth SPA due to the potential for an LSE from vessel traffic:

- Common scoter;
- Eider;
- Goldeneye;
- Great northern diver;
- Long-tailed duck;
- Red-breasted merganser;
- Red-throated diver;
- Scaup;
- Slavonian grebe;
- Velvet scoter; and
- Shag.

7.3.9.8 During the construction, O&M and decommissioning phase of the Proposed Development (Offshore), there will be an increase in vessel traffic which could lead to the potential disturbance of Moray Firth SPA qualifying features. This disturbance may result in displacement of birds, driving a temporary habitat loss and reduced area available for foraging, loafing, and moulting.

7.3.9.9 The effect of distributional responses from the presence of vessels will be limited spatially and temporally, and effects are also likely reversible in nature, with birds returning to impacted areas area following the passage of vessels.

7.3.9.10 The temporary nature of impacts is particularly relevant to vessel activity during the construction and decommissioning phases, given the relatively short duration of these phases. Therefore, when considering the limited spatial and temporal effect of vessel traffic and the intent to use established vessel routes where this is possible, it can be concluded there is no potential for an AEoSI with respect to vessel traffic on the considered features of the Moray Firth SPA during the construction and decommissioning phase.

7.3.9.11 The location of the O&M base (from which vessels servicing the OWF will operate during the operational phase), and therefore the specific vessel transit routes, are yet to be determined. Based on the location of possible O&M bases relative to the Moray Firth SPA and the Caledonia OWF, a transit distance of a minimum of 0km (Fraserburgh) up to a maximum of around 20km (Buckie) through the Moray Firth SPA is considered to be a realistic worst case scenario on which to base this assessment.

7.3.9.12 In the event that a transit route through the Moray Firth SPA is required for Caledonia OWF O&M traffic, the area of SPA habitat subject to disturbance as a result of vessel activities will be relatively small. A 1km disturbance distance around the transit corridor (considered to be a precautionary disturbance distance even for highly sensitive species such as red-throated diver based on reviewed literature on this subject (Bellebaum *et al*., 2006[129]; Jarrett *et al*., 2018[130]; Topping and Petersen, 2011[131]; Fliessbach *et al*., 2019[132]) would result in a disturbance effect occurring on 2.3% of the total habitat within the Moray Firth SPA, should the maximum 20km long transit route through the Moray Firth SPA be required. This indicates that should displacement occur from this area, there is an abundance of alternative habitat within the SPA that can be utilised by displaced birds.

7.3.9.13 For all transits through the Moray Firth SPA, the use of established vessel routes will be prioritised. Therefore, it is likely that disturbance effects due to Caledonia OWF O&M vessel traffic will frequently be occurring within habitat which is already disturbed by other vessels. The impact of the Caledonia OWF O&M vessel traffic will likely be lower than that described below as in many cases, the impacted habitat will be impacted by other vessel activity.

7.3.9.14 Furthermore, vessels will follow best practice procedures and will adhere to a Vessel Management Plan, which will further minimise the risk of disturbance and displacement of the qualifying features of the Moray Firth SPA.

7.3.9.15 Information on the repopulation of areas by red-throated diver (which is considered to be the most sensitive qualifying feature of the Moray Firth SPA to this impact pathway) following displacement by vessels was identified from a single source (Burger *et al*., 2019[133]). This suggested that birds may partially return into areas a vessel has passed through after around seven hours, though the duration of the displacement effect may be greater where faster vessels are concerned, and less where vessels move slowly. Increasing the number of vessel transits through the transit corridor may result in birds being more frequently displaced, which potentially could have energetic consequences for displaced birds. Since red-throated diver are understood to possess the capacity to adapt their foraging behaviour to reflect changing conditions (Thompson *et al*., 2023[134]), individuals may be likely to be able to accommodate any additional energetic costs due to displacement by O&M vessel traffic. No evidence has been identified that indicates that red-throated diver mortality will be impacted as a result of displacement, therefore an assumed mortality rate of 1% is considered to be appropriately precautionary for the purposes of this assessment.

7.3.9.16 As the qualifying feature of the Moray Firth SPA with the greatest sensitivity to disturbance by vessel traffic, and with the largest range overlap with areas where this could occur, red-throated diver was selected for additional assessment to attempt to quantify the potential impacts. This has been estimated from data presented in Scott *et al*. (2023[135]). This study undertook two DAS of the Moray Firth SPA in January 2020 and March 2020, the data from which was used to produce density maps for the Moray Firth SPA. The data generated by this study was used in a GIS exercise to estimate potential displacement impacts.

7.3.9.17 An area of search for this potential impact was defined by drawing a polygon from potential O&M base locations that would require vessels to cross the Moray Firth SPA, to the extents of the Proposed Development (Offshore). The polygon was buffered by 1km to account for a potential disturbance distance from a given vessel. The red-throated diver densities inside this polygon (which were generated on a 1km x 1km grid) were extracted and compared with densities across the wider Moray Firth SPA, to estimate the relative importance of the area of search to red-throated diver (Table 7-8).

Table 7-8: Maximum and mean red-throated diver densities with 95% confidence intervals within the O&M vessel disturbance area of search and the whole Moray Firth SPA calculated from DAS in January 2020 and March 2020.

Density Parameter (birds/km^2)	January 2020		March 2020	
	Moray Firth SPA	Area of Search	Moray Firth SPA	Area of Search
Maximum	1.09	0.58	7.81	0.73
Mean	0.14	0.35	0.50	0.27
95% UCI	0.80	0.57	2.62	0.65
95% LCI	0.00	0.11	0.00	0.01

7.3.9.18 In the January 2020 and March 2020 surveys there was considerable variation in the total number of red-throated divers predicted to be within the Moray Firth SPA boundary (254 versus 918, based on Table 11 of Scott *et al.*, 2023[135]). This compares with the cited population of 324 individuals. Despite the differences in overall abundance between the two surveys, the mean density of birds within the area of search remained stable across the two surveys (0.35 birds/km^2 versus 0.27 birds/km^2), as did the 95% confidence intervals. In January 2020, the mean density within the area of search was higher than the corresponding value for the entire Moray Firth SPA, though there was considerable overlap between the 95% confidence intervals within the two regions, and the maximum recorded density in the Moray Firth SPA was substantially greater than within the area of search (1.09 birds/km^2 versus 0.58 birds/km^2). During the March 2020 survey, maximum and mean densities were considerably higher across the entire Moray Firth SPA than the area of search. From these data, it is concluded that the area of search does not appear to be of elevated importance to red-throated diver relative to other areas of the Moray Firth SPA.

7.3.9.19 Based on a 100% displacement rate, and a 1% mortality of displaced birds within a 20km long transit corridor within the area of search (considered in all respects to be a worst case scenario), the potential mortality level of red-throated diver due to O&M vessel displacement has been estimated using the mean densities and 95% confidence intervals presented in Table 7-8. These are 0.22 (95% CI 0.07 to 0.36) using the January 2020 data, and 0.17 (95% CI 0.01 to 0.41) using the March 2020 data. This could result in an increase in existing mortality within the Moray Firth SPA population of 0.54% (0.17% to 0.88%) using the January 2020 data, and 0.12% (95% CI 0.00% to 0.28%) using the March 2020 data. If the highly precautionary maximum densities are used, the predicted mortality increases based on the January 2020 and March 2020 data are 0.90% and 0.31% respectively.

7.3.9.20 Increases in the existing mortality rate of less than 1% are likely to be undetectable against natural variation. For the reasons discussed in the paragraphs above (i.e. the presence of existing disturbance sources within the transit corridor, and the likelihood of red-throated diver energy budgets being able to absorb the energetic cost of any additional displacement) , it is likely that these numbers are overestimates of both the numbers of displaced birds, and the mortality that is likely to occur, as a result of this impact.

7.3.9.21 It is concluded that the O&M vessel traffic associated with the Caledonia OWF will not result in an AEoSI on the qualifying features of the Moray Firth SPA.

7.3.10 Consideration of Indirect Impacts Through Effects on Habitats and Prey Species

7.3.10.1 During the construction, O&M and decommissioning phase of Caledonia OWF, potential impacts on prey species may indirectly affect ornithological features. Long-term habitat loss will occur throughout the lifetime of the Proposed Development (Offshore) due to the presence of turbine foundations, scour protection and cable protection. Additionally, suspended sediments from maintenance activity may result in fish and mobile invertebrates avoiding the area and may smother and hide immobile benthic prey. The resulting increase in turbidity of the water column may also make it harder for seabirds to see their prey. These impacts could therefore result in a reduction in prey available to foraging seabirds within the construction area. Any form of indirect effect (including reductions in prey and habitat availability) may cause reduced survival or reproductive fitness of at-risk species. The maximum impact on ornithological receptors will result from the maximum impact on fish and benthic organisms. Such potential effects on benthic invertebrates and fish have been assessed at an EIA level within Volumes 2, 3 and 4, Chapter 4: Benthic Subtidal and Intertidal Ecology and Volumes 2, 3 and 4, Chapter 5: Fish and Shellfish Ecology, and with respect to HRA in Section 7.3.12 for migratory fish. The conclusions of those assessments inform this assessment of indirect effects on ornithology receptors.

7.3.10.2 With regard to habitat loss, Volumes 2, 3 and 4, Chapter 5: Fish and Shellfish Ecology discusses the potential impacts upon fish relevant to ornithology as prey species of Caledonia OWF. For species such as herring, sprat and sandeels, which are the main prey items of seabirds species, potential impacts during operation are considered to be minor, and not significant in EIA terms (see Volumes 2, 3 and 4, Chapter 5: Fish and Shellfish Ecology) and no potential for an AEoSI with respect to fish species from designated sites assessed (see Sections 8.2.3, 9.2.3 and 10.2.3). With a conclusion of minor adverse impact on fish prey species, which is considered not significant in EIA terms, it is concluded that the there is no potential for an AEoSI with respect to changes in prey availability for any designated sites and ornithology features screened in for assessment.

7.3.11 Consideration of Migratory Collision Risk

7.3.11.1 The following SPA's/Ramsar's and their qualifying features were screened in due to potential for an LSE from collision risk, based on the potential for interaction between these species and the Caledonia OWF when undertaking annual migratory movements:

- Moray Firth SPA: common scoter, eider, goldeneye, great northern diver, long-tailed duck, red-breasted merganser, red-throated diver, scaup, Slavonian grebe and velvet scoter;
- Pentland Firth Islands SPA: Arctic tern;
- Moray and Nairn Coast SPA: bar-tailed godwit, greylag goose, pink footed goose, redshank, dunlin, oystercatcher, red-breasted merganser and wigeon;
- Moray and Nairn Coast Ramsar: greylag goose, pink footed goose and redshank;
- Dornoch Firth and Loch Fleet SPA: bar-tailed godwit, graylag goose, osprey and wigeon;
- Dornoch Firth and Loch Fleet Ramsar: bar-tailed godwit, graylag goose and wigeon;
- Cromarty Firth SPA: bar-tailed godwit, graylag goose and whooper swan;
- Cromarty Firth Ramsar: bar-tailed godwit, graylag goose, common tern, dunlin, knot, oystercatcher, red-breasted merganser, redshank, scaup and wigeon;
- Inner Moray Firth SPA; bar-tailed godwit, graylag goose, red-breasted merganser, redshank, curlew, goldeneye, oystercatcher, scaup, teal and wigeon; and
- Inner Moray Firth and Ramsar; bar-tailed godwit, graylag goose, red-breasted merganser and redshank.

7.3.11.2 It is possible that both seabirds and non-seabird species may interact with the Caledonia OWF when undertaking annual migratory movements between their breeding and wintering grounds.

7.3.11.3 Migratory collision risk modelling was undertaken using the recently developed stochastic collision risk modelling tool and accompanying recommended parameters within Woodward *et al.* (2023[136]). Further details on the approach is presented in Volume 7B, Appendix 6-7: Offshore Ornithology Migratory Collision Risk Modelling Technical Report.

7.3.11.4 For most migratory wildfowl and wader species considered, the level of predicted impact is less than a single individual per annum at the EIA level (Volume 7B, Appendix 6-7: Offshore Ornithology Migratory Collision Risk Modelling Technical Report), such a level of effect can be concluded as intangible and would therefore not lead to an AEoSI for the Proposed Development (Offshore) alone or in-combination.

7.3.11.5 For species, where the level of impact at an EIA level was predicted to be greater than a single individual per annum, impacts have been apportioned to UK SPAs screened in for assessment (Table 7-9). This was only the case for dunlin and wigeon.

7.3.11.6 The apportionment of impacts to SPAs/Ramsar's screened in for assessment was undertaken by proportionally allocating annual total collisions to each site based on the SPA/Ramsar Site Population (Table 7-9).

7.3.11.7 The resulting level of apportioned impact to SPAs/Ramsar's screened in for assessment for dunlin and wigeon would result in a <0.001 and 0.001 survival rate percentage point change respectively (Table 7-9), such level of effects would almost certainly be indistinguishable from natural fluctuations in the population and therefore would not lead to an AEoSI for the Proposed Development (Offshore) alone.

7.3.11.8 When considering the potential for migratory CRM in-combination, WWT and MacArthur Green Ltd (2014[87]) undertook a strategic assessment of 27 different seabird and 38 non-seabird migratory species in relation to migratory collision risk.

7.3.11.9 For wildfowl and wader species, WWT and MacArthur Green (2014[87]) indicate that collision estimates are very small. Populations passing through Scottish waters are considered not at risk of significant levels of additional mortality due to collisions with Scottish OWFs. Waterfowl and wader species migratory flights are at a high altitude and so collisions with turbines are highly unlikely. Only when unfavourable weather occurs will these species lower their flight altitude and follow coastal pointers to navigate (van de Kam *et al.*, 2004). Given the age of this assessment, an update was undertaken by Berwick Bank OWF (RPS and Royal Haskoning DVH, 2022[137]) which updated the number of turbines considered cumulatively based on the as-built design scenarios for Scottish OWFs. The results of this update found a reduction of over 300 turbines, further reducing the potential for any collisions to occur, and thus further reinforcing the conclusions of the original strategic assessment (WWT and MacArthur Green, 2014[87]). When considering the minimal impact contribution the Proposed Development (Offshore) would add to any in-combination effect, combined with the conclusions of the strategic assessment (WWT and MacArthur Green, 2014[87]) it can be confidently concluded there is no potential for an AEoSI for the Proposed Development (Offshore) in-combination with other plans and projects for the qualifying features and sites assessed within Table 7-9.

7.3.11.10 For seabird species, the strategic assessment of collision risk for birds on migration undertaken by Woodward *et al.* (2023[136]) noted that density estimates entered into the sCRM tool would capture seabird exposure to offshore wind farms. As such, the assessment of collision risk of seabirds should be undertaken using the existing model as distinguishing between migrant and resident seabirds is not possible. The seabird species considered for migratory collision (Arctic tern and common tern) were recorded in low numbers; therefore, collision risk modelling could not be undertaken for these species. However, the low numbers recorded (three maximum raw counts of common tern were recorded in August 2021 within Caledonia North and 15 maximum raw counts of Arctic tern were recorded between May and August, three in Caledonia North and 12 individuals within Caledonia South) indicates that the Caledonia OWF is not an area of importance for these tern species.

7.3.11.11 During post breeding migration, it is noted that the location of the project means that it is possible that terns could short-stop within the Caledonia OWF. Despite this, given that migration occurs from breeding colonies to Africa it is more likely that terns would short-stop to the south of the Caledonia OWF (Alerstam *et al.,* 2019[15]).

7.3.11.12 In addition, when undertaking migration through Scottish waters common and Arctic terns are known to follow the coast and have a tendency to migrate within narrow coastal bands from 0 to 10km and 0 to 20km from shore, respectively (Wernham *et al*., 2002[138]). The tendency for these tern species to travel up to a maximum of 20km from the coast correlates with the site specific Caledonia OWF DAS, as a very limited number of terns were recorded within the Caledonia OWF during migratory months. The shortest distance to shore from the Offshore Project is 23.4km, which suggests limited intersection of potential migratory corridors. As such, it can be confidently concluded there is no potential for an AEoSI for the Proposed Development (Offshore) in relation to migratory collision in-combination with other plans and projects for common and Arctic tern.

Table 7-9: Summary of estimated EIA level migratory collisions apportioned to SPA/Ramsar sites screened in for assessment for Caledonia North, Caledonia South and the Caledonia OWF (presenting the WCS) and resultant change in survival rate percentage point change compared to SPA/Ramsar site population.

Species	Annual Total Collision (EIA)			Site	SPA/Ramsar Site Population (Citation/ Standard Data Form)	Apportioned Impact			Change in Average Survival Rate (% Point Change)		
	Caledonia North	Caledonia South	Caledonia OWF			Caledonia North	Caledonia South	Caledonia OWF	Caledonia North	Caledonia South	Caledonia OWF
Dunlin	-	-	1.592 ± 0.209	Moray and Nairn Coast SPA	2,689	-	-	0.7	-	-	<0.001
				Cromarty Firth Ramsar	3,384	-	-	0.9	-	-	<0.001
Wigeon	3.892 ± 0.639	4.091 ± 0.582	7.108 ± 0.932	Moray and Nairn Coast SPA	2,600	0.3	0.3	0.5	<0.001	<0.001	<0.001
				Dornoch Firth and Loch Fleet SPA and Ramsar	15,304	1.7	1.8	3.2	<0.001	<0.001	0.001
				Cromarty Firth Ramsar	9,204	1.0	1.1	1.9	<0.001	<0.001	<0.001
				Inner Moray Firth SPA	7,310	0.8	0.9	1.5	<0.001	<0.001	<0.001
Note, '-' represents potential impacts which do not exceed a single individual per annum at an EIA level.											

7.3.12 Consideration of Highly Pathogenic Avian Influenza

7.3.12.1 In relation to addressing impacts of Highly Pathogenic Avian Influenza ("HPAI"), the Applicant, in undertaking the RIAA, has considered the impact of HPAI on colonies as detailed in the NatureScot and RSPB representations for other recent OWF Projects.

7.3.12.2 The first instance of the recent outbreak of the HPAI (H5NI strain) was recorded in the UK in April 2022 in great skuas (Lean *et al*., 2024[139]). In the UK, a total of 23 seabird species have tested positive for HPAI (Defra, 2023[140]). Across Scotland, 20,500 seabirds were reported dead within five months of 2022 (NatureScot, 2023c[141]). Gannet, great skua and guillemot were considered to have been the most impacted by HPAI in 2022, on account of the minimum loss, recovery rate and the number of positive cases (NatureScot, 2023c[141]).

7.3.12.3 The RSPB established a HPAI Seabird Surveys Project which provided a comparison of pre-HPAI colony counts from Burnell *et al*. (2023[142]) and post-HPAI counts, following surveys undertaken in summer 2023 (Tremlett *et al*., 2024[143]). Gannet AONs at UK breeding colonies surveyed in 2023 declined by 25% compared to pre-HPAI baseline, with changes at Scottish colonies (of which six were surveyed) ranging between declines of 3% (Fair Isle) to 37% (Hermaness, Saxa Vord and Valla Field). However, the declines at most sites are likely to be worse than indicated, owing to the previously increasing population and the length of time since the baseline counts were made.

7.3.12.4 Kittiwake AONs at the 21 UK colonies surveyed increased by 8% relative to the baseline counts (Tremlett *et al*., 2024[143]). Across the 19 Scottish breeding colonies surveyed, the average change in population between the baseline and 2023 counts was a 16% increase and a 21% increase in the Scottish breeding population overall, with most larger colonies recording population increases. However, trends were highly variable between colonies.

7.3.12.5 Guillemot counts at the national level remained relatively stable when compared with the pre-HPAI baseline, contrasting with a period of declining populations prior to the baseline count. Different trends were recorded by colony, with both increases (e.g., Cape Wrath, Fowlsheugh, North Caithness Cliffs and St Kilda) and decreases (e.g., Copinsay, Forth Islands, St. Abb's Head to Fast Castle) of up to around a third reported (Tremlett *et al*., 2024[143]).

7.3.12.6 The baseline DAS occurred between April 2021 and April 2023 and therefore the mean seasonal peaks in abundance occur for some species and seasons during the HPAI outbreak. Consideration of when the mean peak abundances are observed within a season and the timing of HPAI at colonies has been taken into account for gannet.

7.3.12.7 The gannet mean peak count calculated for the breeding season is derived from the June 2021 and June (4th) 2022 surveys. The first clinical symptoms of HPAI were observed in gannets on the Bass Rock on 4th June 2022 (Lane *et al*., 2023[144]) and short-term behavioural changes in gannet foraging distribution and distance travelled as a consequence of colony infection was recorded in tagged birds from the third week of June (Jeglinski *et al*., 2024[145]). Although the breeding season peak abundance between years is approximately two-fold higher in 2022 this is not unexpected considering the annual variations in peak counts which are often observed. Furthermore, when accounting for the size of the confidence intervals the breeding peak abundance between years is not significantly different (see Volume 7B, Appendix 6-1: Offshore Ornithology Baseline Characterisation Report). Therefore, the most appropriate population to assess impacts on the Bass Rock colony (Forth Islands SPA) would be prior to colony decline due to HPAIV. As the mean peak count over the Project area represents gannet abundance in relation to the colony population prior to the mass infection mortality event. The last count at Bass Rock was undertaken ten years ago in 2014 of 75,259 AOS. NatureScot guidance note 5 (NatureScot, 2023[91]) advises that the most up to date counts are used. Although a drone survey of Bass Rock was undertaken in 2023 which estimated the population to be 51,844 AOS (Harris *et al*., 2023[146]) this post HPAI outbreak colony population would not be appropriate for assessment. However, Wanless *et al*. (2023[147]) estimated that there would have been in the region of 81,000 AOS in 2021 prior to the outbreak of HPAI in 2022 and confirmed as a reliable estimate in Harris *et al*. (2023[146]).

7.3.12.8 Therefore, the Applicant would consider the Bass Rock gannet population estimate of 81,000 AOS to be the most appropriate and up-to-date to be used in assessments for Project as it represents the population associated with the derived mean peak abundance over the Project area during the breeding season.

7.3.12.9 The seasonal peak count for the non-breeding season occurred in October 2021 in year one and October 2022 in year two. The peak counts therefore occur prior to the outbreak of HPAI in year one and during the outbreak in year two. These peak counts differ significantly between years; 386 vs 58, a 6-7-fold difference. This may suggest that the year two peak count does not represent normal inter annual variation and is a reflection of population decline due to HPAI.

7.3.12.10 Therefore, the Applicant would not consider it appropriate to mean the yearly non-breeding peak counts as the year two counts are highly likely to be unrepresentative of normal inter annual variation and Project site usage. The peak count from the year one non-breeding season rather than an ambiguous mean peak from the two years would be a more robust estimate.

7.4 Migratory Fish

7.4.1 Construction and Decommissioning

7.4.1.1 During construction and decommissioning the following effect have been screened in for potential impacts to designated migratory fish features:

- Underwater noise.

7.4.1.2 Given the complexity of underwater noise, information is presented here relating to the assessment of these effects.

Underwater Noise

7.4.1.3 There are a number of sources of underwater noise associated with the Proposed Development (Offshore) alone during construction, with these identified within Volumes 2, 3 and 4, Chapter 5: 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 Proposed Development (Offshore) as defined for the EIAR (Volumes 2, 3 and 4, Chapter 9: Shipping and Navigation) is subject to relatively high levels of shipping activity currently, and it is expected that the vessel activity would not be significantly greater than the baseline during construction activities (an estimated increase of 25 vessels per day). 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[148]). 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 are:

- Underwater noise from percussive piling within the array area and decommissioning works; and
- Underwater noise during UXO clearance.

7.4.1.4 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.

7.4.1.5 The screening process has identified the features and sites to have potential impacts from underwater noise during the construction and decommissioning phases (LSE cannot be ruled out) as those presented in Table 7-10.

Table 7-10: Sites and associated designated features identified for potential AEoSI from underwater noise in the construction and decommissioning phases.

Site	Feature
River Spey SAC	▪ Atlantic salmon; and ▪ Freshwater pearl mussel.
Berriedale and Langwell Waters SAC	▪ Atlantic salmon; ▪ Sea lamprey; and ▪ Freshwater pearl mussel.
River Thurso SAC	▪ Atlantic salmon

Project Level Underwater Noise

7.4.1.6 Underwater noise with relation to migratory fish during construction of the Proposed Development (Offshore) has been detailed in the following documents:

- Volumes 2, 3 and 4, Chapter 5: Fish and Shellfish Ecology; and
- Volume 7, Appendix 12: Underwater Noise Technical Note.

7.4.1.7 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.

7.4.1.8 Fish receptors can be grouped into the Popper *et al*. (2014[149]) categories 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, 2017[150]).

7.4.1.9 The extent to which intense underwater sound might cause an adverse environmental impact in migratory fish species is dependent upon the level of sound pressure or particle motion, its frequency, duration and/or repetition (Hastings and Popper, 2005[151]). 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[149]). 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, underwater noise can cause barriers to migration, and therefore due consideration to this impact is given in this assessment.

7.4.1.10 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. 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.

7.4.1.11 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[149]). 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 the three groups are presented in Table 7-11.

Table 7-11: Impact threshold criteria from Popper *et al*. (2014[149]).

Impact Threshold Noise Level (dB re. 1µPa Sound Pressure Level (SPL)/dB re. 1 µPa2s Sound Exposure Level)			
Group	Mortality and Potential Injury	Recoverable Injury	TTS
Group 1	219dB SEl_{cum} 213dB SPL_{peak}	216dB SEl_{cum} 213db SPL_{peak}	>>186dB SEl_{cum}
Group 2	210dB SEl_{cum} >207dB SPL_{peak}	203dB SEl_{cum} or >207dB SPL_{peak}	>186dB SEl_{cum}
Group 3	207dB SEl_{cum} >207dB SPL_{peak}	203dB SEl_{cum} or >207dB SPL_{peak}	186dB SEl_{cum}

7.4.1.12 Similar to marine mammals (Section 7.2) TTS is a temporary reduction in hearing sensitivity caused by exposure to intense sound resulting in temporary changes in sensory hair cells of the inner ear and/or damage to auditory nerves. However, unlike marine mammals, in fish sensory hair cells are constantly added 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. Volumes 2, 3 and 4, Chapter 5: Fish and Shellfish Ecology presents the ranges at which TTS in fish may occur as a result of piling operations during the Proposed Development (Offshore) 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 clearance, effects are likely to be within that from cumulative piling exposure.

7.4.1.13 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[152]). 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[149]) 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.

Underwater Noise from UXO Clearance

7.4.1.14 There is also a potential for mortality or mortal injury from UXO clearance. Prior to the start of construction, UXO investigation works will be required which may require clearance of UXO through in-situ clearance, resulting in the emission of underwater noise. However, due to the lack of clarity around the requirement for this, the volume required, and the location where it may take place, the Applicant is not applying for consent for UXO clearance works within this consent application. A separate licence may be applied for as and when the need for UXO clearance is established.

7.4.1.15 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 and marine mammal receptors. Should UXO be detected during the pre-construction geophysical survey, clearance may be required prior to construction as a safety measure. The in-construction Moray West OWF has successfully used low order deflagration methods across the whole project (Ocean Winds, 2024[153]). Monitoring data from this has confirmed use of this clearance technique resulted in significantly reduced underwater noise effects. The Applicant would endeavour to use best available techniques such as low-order deflagration should any UXO be identified. Dependant on clearance method, ADDs may be used as mitigation. 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.

7.4.2 Operation and Maintenance

7.4.2.1 During O&M phases, the following effects have been screened in for potential impacts to designated migratory fish features:

- Electromagnetic frequencies (EMF).

7.4.2.2 Given the complexity of EMF effects, information is presented here relating to the assessment of these effects. All relevant information to accidental pollution and water quality effects are included within the relevant assessments.

Electromagnetic Frequencies (EMF)

7.4.2.3 EMFs are produced as a result of the electricity passing through the cables (inter-array and export cables). Three different EMF types can be generated by offshore wind cables: electric fields (E fields); magnetic fields (B fields); and induced electric fields (iE fields). The presence of EMF-generating infrastructure such as underwater cables associated with the OWF may lead to displacement for migratory fish species.

7.4.2.4 Industry standard offshore wind cables all contain shielding which prevents E fields from passing into the marine environment and as such, these are not considered any further.

7.4.2.5 Cable shielding does not however significantly alter or prevent the emission of B fields. It is the movement of the B fields within a medium (i.e., seawater) which generates iE fields. These iE fields can be produced by the movement of the alternating B field (in the case of alternating current (AC) transmission) through the seawater. transmission). It should be noted that offshore wind AC cables emit weak fields which are mostly undetectable by fish and shellfish communities (Tricas and Gill, 2011[154]).

7.4.2.6 The screening process has identified the features and sites to have potential impacts from underwater noise during the O&M phases (LSE cannot be ruled out) as those presented in Table 7-12.

Table 7-12: Sites and associated designated features identified for potential AEoSI from EMF in the O&M phases.

Site	Feature
River Spey SAC	▪ Atlantic salmon; and ▪ Freshwater pearl mussel.
Berriedale and Langwell Waters SAC	▪ Atlantic salmon; ▪ Sea lamprey; and ▪ Freshwater pearl mussel.
River Thurso SAC	▪ Atlantic salmon

7.5 Conclusion

7.5.1.1 As previously stated in Section 3, the assessment for Caledonia North can be found in Part 1 (Section 8), Caledonia South in Part 3 (Section 9) and the Proposed Development (Offshore) in Part 4 (Section 10).

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