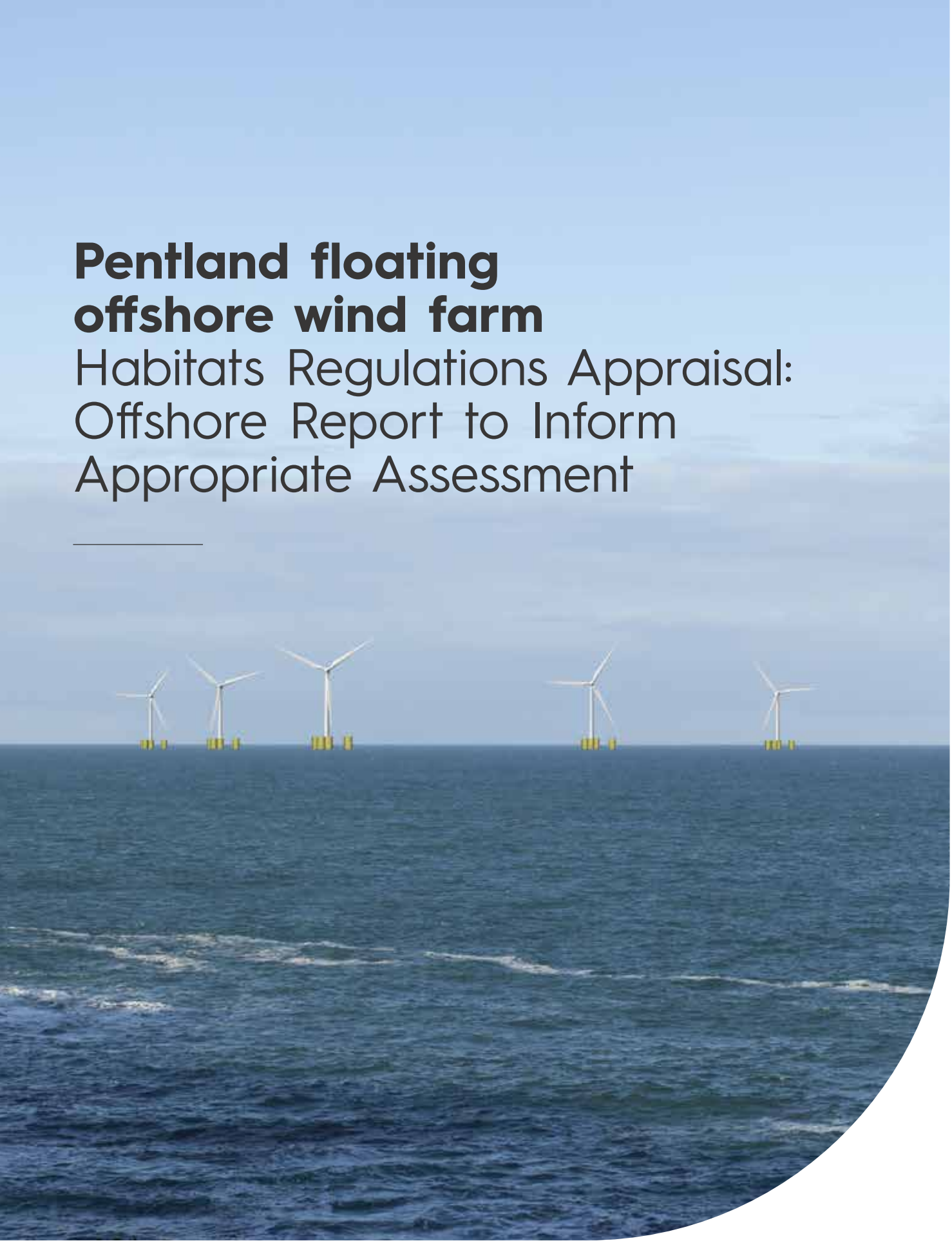
Pentland floating offshore wind farm

Habitats Regulations Appraisal: Offshore Report to Inform Appropriate Assessment



PENTLAND FLOATING OFFSHORE WIND FARM

PENTLAND FLOATING OFFSHORE WIND FARM

HABITATS REGULATIONS APPRAISAL:

OFFSHORE REPORT TO INFORM APPROPRIATE ASSESSMENT

Document Title:	Pentland Floating Offshore Wind Farm Offshore RIAA
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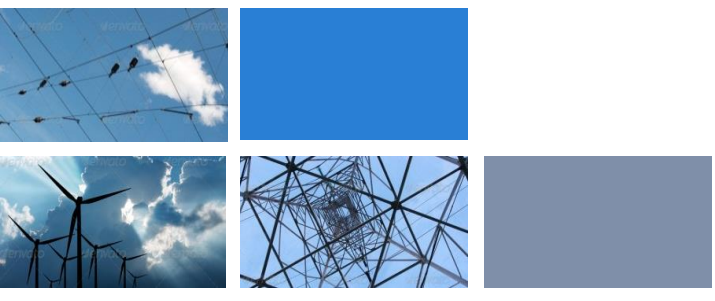
		Company	Xodus Group Ltd	Copenhagen Offshore Partners	Copenhagen Offshore Partners



CONTENTS

GLOSSARY OF PROJECT TERMS

Key Terms	Definition
Dounreay Trì Floating Wind Demonstration Project (the 'Dounreay Trì Project')	The 2017 consented project that was previously owned by Dounreay Trì Limited (in administration) and acquired by Highland Wind Limited (HWL) in 2020. The Dounreay Trì Project consent was for two demonstrator floating Wind Turbine Generators (WTGs) with a marine licence that overlaps with the Offshore Development, as defined. The offshore components of the Dounreay Trì Project consent are no longer being implemented.
Highland Wind Limited	The Developer of the Project (defined below) and the Applicant for the associated consents and licences.
Landfall	The point where the Offshore Export Cable(s) from the PFOWF Array Area, as defined, will be brought ashore.
Offshore Export Cable(s)	The cable(s) that transmits electricity produced by the WTGs to landfall.
Offshore Export Cable Corridor (OECC)	The area within which the Offshore Export Cable(s) will be located.
Offshore Site	The area encompassing the PFOWF Array Area and OECC, as defined.
Onshore Site	The area encompassing the PFOWF Onshore Transmission Infrastructure, as defined.
Pentland Floating Offshore Wind Farm (PFOWF) Array and Offshore Export Cable(s) (the 'Offshore Development')	All offshore components of the Project (WTGs, inter-array and Offshore Export Cable(s), floating substructures, and all other associated offshore infrastructure) required during operation of the Project, for which HWL are seeking consent. The Offshore Development is the focus of this Environmental Impact Assessment Report.
PFOWF Array	All WTGs, inter-array cables, mooring lines, floating sub-structures and supporting subsea infrastructure within the PFOWF Array Area, as defined, excluding the Offshore Export Cable(s).
PFOWF Array Area	The area where the WTGs will be located within the Offshore Site, as defined.
PFOWF Onshore Transmission Infrastructure (the 'Onshore Development')	All onshore components of the Project, including horizontal directional drilling, onshore cables (i.e. those above mean low water springs), transition joint bay, cable joint bays, substation, construction compound, and access (and all other associated infrastructure) across all project phases from development to decommissioning, for which HWL are seeking consent from The Highland Council.
PFOWF Project (the 'Project')	The combined Offshore Development and Onshore Development, as defined.

ACRONYMS AND ABBREVIATIONS

AA	Appropriate Assessment
AIS	Automatic Information Systems
AON	Apparently Occupied Nest
AOS	Apparently Occupied Site
AOT	Apparently Occupied Territory
BAT	Best Available Technology
BATNEEC	Best Available Technique Not Entailing Excessive Cost
BDMPS	Biologically Defined Minimum Population Scales
BT	British Telecom
BTO	British Trust for Ornithology
CAA	Civil Aviation Authority
CBRA	Cable Burial Risk Assessment
CCS	Carbon Capture and Storage
CEMP	Construction Environmental Management Plan
CES	Coastal East Scotland
CMS	Construction Method Statement
CRM	Collision Risk Modelling
CWSH	Coastal West Scotland and the Hebrides
DAERA	Department of Agriculture, Environment and Rural Affairs
DECC	Department of Energy and Climate Change
DEFRA	Department of Environment, Food and Rural Affairs
DSFB	District Salmon Fishery Board
ECC	Export Cable Corridor
ECOMMAS	East Coast Marine Mammal Acoustic Study
EDR	Effective Deterrent Range
EIA	Environmental Impact Assessment
EIAR	Environmental Impact Assessment Report
EMEC	European Marine Energy Centre
EMF	Electromagnetic Fields
EOWDC	European Offshore Wind Deployment Centre
EPS	European Protected Species
ES	Environmental Statement
EU	European Union
FAB	French-Alderney-Britain

FLO	Fisheries Liaison Officer
FMS	Fisheries Management Scotland
FWPM	Freshwater Pearl Mussel
HDD	Horizontal Directional Drilling
HIE	Highlands and Islands Enterprise
HPAI	Highly Pathogenic Avian Influenza
HRA	Habitats Regulations Appraisal
HVAC	High Voltage Alternating Current
HVDC	High Voltage Direct Current
HWL	Highland Wind Limited
IALA	International Association Of Marine Aids To Navigation And Lighthouse Authorities
IAMMWG	Inter Agency Marine Mammal Working Group
ID	Identification
IMO	International Maritime Organisation
INNS	Invasive Non-native Species
IROPI	Imperative Reasons of Overriding Public Interest
JNCC	Joint Nature Conservation Committee
LMP	Lighting and Marking Plan
LSE	Likely Significant Effects
MARPOL	International Convention for the Prevention of Pollution from Ships
MBES	Multibeam Echosounder
MHWS	Mean High Water Springs
MLWS	Mean Low Water Springs
MMMP	Marine Mammal Mitigation Plan
MOWWL	Moray Offshore Windfarm (West) Limited
MPA	Marine Protected Area
MPCP	Marine Pollution Contingency Plan
MS-LOT	Marine Scotland Licensing Operations Team
MSS	Marine Scotland Science
MU	Management Unit
MW	Megawatts
NCA	Nature Conservation Appraisal
NCMPA	Nature Conservation Marine Protected Area
NCO	North Coast and Orkney
NDSFB	Northern District Salmon Fishery Board
NOAA	National Oceanic and Atmospheric Administration

NPWS	National Parks of Wildlife Service
NRTE	Naval Reactor Test Establishment
NS	North Sea
NSP	Navigational Safety Plan
OECC	Offshore Export Cable Corridor
OEM	Original Equipment Manufacturer
OEMP	Operational Environmental Management Plan
OFLO	Offshore Fisheries Liaison Officers
OREI	Offshore Renewable Energy Installations
OSPAR	Oslo-Paris Convention
OWSMRF	Offshore Wind Strategic Monitoring and Research Forum
PDE	Project Design Envelope
PEMP	Project Environmental Monitoring Programme
PFOWF	Pentland Floating Offshore Wind Farm
PTS	Permanent Threshold Shift
PVA	Population Viability Analysis
RIAA	Report to Inform Appropriate Assessment
RSPB	Royal Society for the Protection of Birds
SAC	Special Area of Conservation
SCOS	Special Committee on Seals
SD	Standard Deviation
SG	Scottish Government
SHE	Scottish Hydro Electric
SHEPD	Scottish Hydro Electric Power Distribution
SMP	Sectoral Marine Plan
SMRU	Sea Mammal Research Unit
SMU	Seal Management Unit
SMWWC	Scottish Marine Wildlife Watching Code
SNCB	Statutory Nature Conservation Bodies
SNH	Scottish Natural Heritage
SOSS	Strategic Ornithological Support Service
SPA	Special Protection Area
SPL	Source pressure level
SPP	Scottish Planning Policy
SSE	Scottish and Southern Energy
SSEN	Scottish and Southern Electricity Networks

SSS	Side Scan Sonar
SSSI	Sites of Special Scientific Interest
TLP	Tension Leg Platform
TTS	Temporary Threshold Shift
UK	United Kingdom
USBL	Ultra-short Baseline
UXO	Unexploded Ordnance
VMP	Vessel Management Plan
WCS	Worst Case Scenario
WS	West Scotland
WTG	Wind Turbine Generators
WWT	Wildfowl and Wetlands Trust
ZOI	Zones of Influence

1 INTRODUCTION

1.1 Report Overview

Xodus Group (Xodus) has prepared this Habitats Regulation Appraisal (HRA) Report to Inform Appropriate Assessment (RIAA) on behalf of Highland Wind Limited (HWL), with support from industry experts. SMRU has authored the marine mammal appraisal and HiDef have authored the ornithology section. Natural Power Consultants (NPC) have provided third party review of the Ornithology section. This report has been prepared to support the Section 36 Consent and Marine Licence applications for Pentland Floating Offshore Wind Farm (PFOWF) Array and Offshore Export Cable(s), herein referred to collectively as the Offshore Development.

The need for a Phase 2 HRA RIAA was identified through Phase 1 Screening and through subsequent stakeholder engagement with Marine Scotland Licensing Operations Team (MS-LOT) and other statutory consultees. A Nature Conservation Appraisal (NCA) Screening Report (HWL, 2022) was submitted to Marine Scotland in February 2022, which outlined the details of the Offshore Development and an assessment of whether, in view of best scientific knowledge, there is potential for the Offshore Development, individually or in combination with another plan or project, to have a Likely Significant Effect (LSE) on a European site. For those sites where LSE could not be excluded, they have been carried forward for assessment in this RIAA. The Screening Opinion (MS-LOT, 2022) for the NCA Screening Report was received from Marine Scotland in June 2022 (details of the responses received are provided in Section 4 of this report).

This HRA RIAA provides the Competent Authority with the information required to assist them in undertaking an Appropriate Assessment (AA) for the Offshore Development as required under The Conservation (Natural Habitats & c.) Regulations 1994, as amended and the Conservation of Marine Habitats and Species Regulations 2017 (hereafter referred to as the 'Habitats Regulations'), to ensure compliance with the Habitats Directive (92/43/EEC).

This RIAA considers whether there is any potential for adverse effects from the Offshore Development on the conservation objectives and integrity of the relevant European sites (Special Areas of Conservation [SACs], Special Protection Areas [SPAs] [including candidate and proposed sites] and Ramsar Sites) where LSE could not be ruled out at Phase 1 Screening, as detailed in Section 2 of this report.

This report considers the LSE of the Offshore Development on qualifying interests through all phases of the development, including construction, operation and maintenance, and decommissioning.

1.2 Background to the Project

HWL is proposing to develop, construct and demonstrate a floating offshore wind farm with an installed capacity of around 100 megawatts (MW), known as the PFOWF Project or 'the Project'. The PFOWF Array Area, where the Wind Turbine Generators (WTGs) will be located, is situated approximately 7.5 km off the coast of Dounreay, Caithness. The Offshore Export Cable Corridor (OECC) extends south from the PFOWF Array to landfall at the Dounreay coast. The location of the Offshore Development (the Offshore Site) is shown in Figure 1.1.

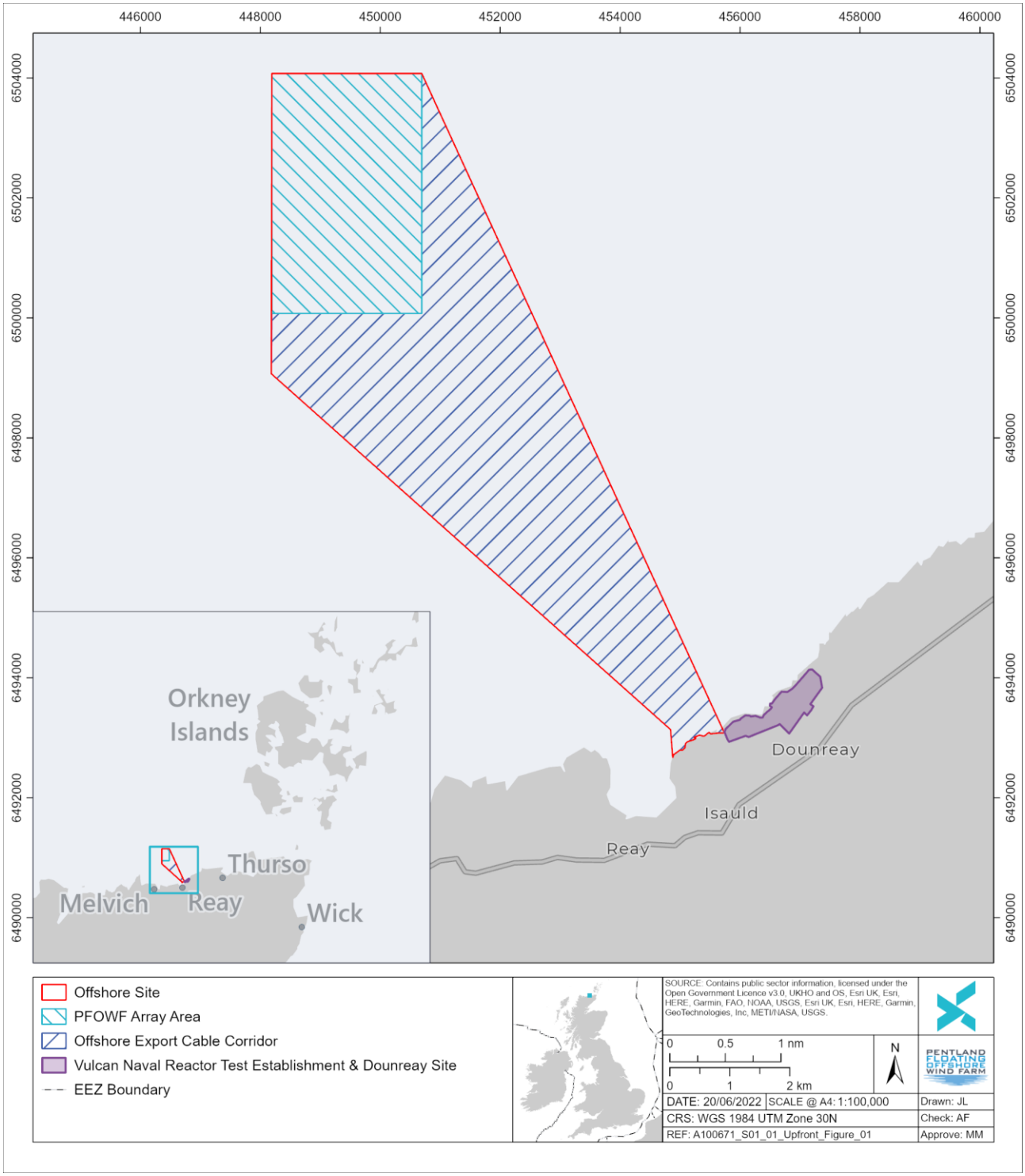


Figure 1.1 Location of the Offshore Development

The PFOWF Project will comprise:

- **The PFOWF Array and Offshore Export Cable(s) (the Offshore Development):** An offshore array of up to seven floating WTGs connected to one another by subsea inter-array cables, supported by floating structures, mooring lines and anchors. Offshore Export Cable(s) will carry the power generated by the PFOWF to a landfall location at the Dounreay coast, as shown in Figure 1.1; the Offshore Development is the focus of this HRA RIAA; and
- **The PFOWF Onshore Transmission Infrastructure (the Onshore Development**): All transmission infrastructure associated with the PFOWF Project landward of Mean Low Water Springs (MLWS). Buried onshore cables will transmit the power inland to a new substation, where it will connect to the transmission network. HWL have received agreement from Scottish and Southern Electricity Networks (SSEN) Transmission for connection into the Scottish and Southern Energy (SSE) Dounreay Substation. The Onshore Development will be subject to a separate consent application from The Highland Council, which will include a separate HRA RIAA for the Onshore Development components.

The key components of the Offshore Development are outlined below, further details are provided in Section 5: Project Description.

- Up to seven floating offshore WTGs;
- Up to seven associated floating substructures;
- Up to nine mooring lines for each floating substructure (63 in total);
- Up to nine anchors or piles for each floating substructure (63 in total);
- Up to seven inter-array cables (dynamic and static);
- Up to two offshore export cables (continuation of inter-array cables to bring power ashore), with landfall achieved via horizontal directional drilling (HDD); and
- Associated scour protection and cable protection (if required);

1.3 Assessment Process and Supporting Information

HRA is an iterative process, and this RIAA has not been prepared in isolation, but instead forms part of a suite of documents being submitted as part of the application.

The RIAA builds upon the conclusions of the Screening exercise undertaken to date, which is summarised in Section 3.

The RIAA has been developed alongside the PFOWF Offshore Environmental Impact Assessment Report (EIAR) produced as part of the Environmental Impact Assessment (EIA) process (under the EIA Regulations). Where information was not previously available, the Screening exercise adopted a highly precautionary stance. In some cases, the availability of assessments supporting the EIA process, together with an updated maximum Design Envelope (see Section 5.2), has provided the evidence to refine the conclusions regarding impacts to European sites. Where design or supporting information is common to both assessments (EIAR and the HRA) this information has been referenced throughout the RIAA where appropriate.

It should be noted that although the supporting assessments (such as modelling) have been used to assess the effects on European Site integrity, the conclusions of the EIA have not been used to ascertain the assessment outcomes of the RIAA, as these two distinct assessments must be separate and stand-alone.

Other key documents include technical reports (both for site-specific survey but also modelling and desk-based studies). A summary list of key project chapters and documents with information relevant to the HRA and this RIAA includes:

- Offshore EIAR (Volume 2): Main Report:
  - Chapter 1: Introduction, provides a detailed account of the background to the Offshore Development, location of the Offshore Development and an overview of the main components of the Offshore Development for which HWL are seeking consent.
  - Chapter 2: Legislation and Policy, outlines the consents framework, key legislation and policies that have been considered for the development of the Offshore Development throughout the Environmental Impact Assessment (EIA) process.
  - Chapter 3: Site Selection and Alternatives, provides details of the process followed to determine the location for the Offshore Development and any alternative sites considered.
  - Chapter 5: Project Description, the Project Description provides a detailed description of the Proposed Offshore Development, including the design parameters described in accordance with the Design Envelope approach.
  - Chapter 10: Fish and Shellfish Ecology, provides the assessment methodology, detail on potential receptors, impact sources and consideration of sensitivity to impacts as a basis for the EIA presented in the Offshore EIAR. This Chapter also provides a detailed description of the baseline environment with respect to fish and shellfish.
  - Chapter 11: Marine Mammals and Other Megafauna; an assessment at the EIA level of potential effects from the Offshore Development's impacts to marine mammals and other megafauna receptors. This Chapter also provides a detailed description of the baseline environment with respects to marine mammals and other megafauna.
  - Chapter 12: Marine Ornithology; an assessment at the EIA level of potential effects from the Offshore Development's impacts to ornithological receptors. This Chapter provides a detailed baseline environment with respect to Marine Ornithology receptors relevant to the Offshore Development.
  - Chapter 21: Summary of Residual Effects and Mitigation summarises the residual effects on the receptors assessed within the EIAR and the committed mitigation measures within the chapters of the EIAR.

- Offshore EIAR (Volume 3): Technical Appendices:
  - Appendix 6.1: Cumulative Effects Assessment Short-listed developments sets out a short list of 'other developments' that may interact with the Offshore Development and respective Zones of Influence (ZOIs) during construction, operation and maintenance, or decommissioning.
  - Appendix 10.1: Pentland Floating Offshore Wind Farm (PFOWF): Underwater noise modelling Environmental Report – prepared by Subacoustech, provides results of the underwater noise propagation modelling undertaken for the Offshore Development in respect of fish and marine mammal receptors.
  - Appendix 11.1: Underwater Noise Impact Assessment Report – prepared by SMRU Consulting, provides a detailed quantitative Underwater Noise Impact Assessment to understand the likelihood and magnitude of potential impacts on marine mammal species and their populations.
  - Appendix 12.1: Baseline Data – prepared by HiDef, informs both the marine ornithology baseline characterisation for the Offshore Development and the EIA/HRA assessments.

- Appendix 12.2: Connectivity and Apportioning - prepared by HiDef, determines the long-list of SPA breeding seabird colonies screened in for connectivity, and provides the methodologies for undertaking both breeding and non-breeding season SPA apportioning.
- Appendix 12.3: Collision Risk Modelling – prepared by HiDef, provides the methodology for collision risk modelling (CRM) and presents the total estimated mortalities for each species, broken down by season. These mortalities are then apportioned across SPAs (using the apportioning weightings calculated in Appendix 12.2) and the population consequences modelled, where required, using Population Viability Analysis (PVA) as presented in Appendix 12.5.
- Appendix 12.4: Displacement Analysis – prepared by HiDef, provides the methodologies for displacement assessment and reports the estimated displacement mortalities potentially arising due to the Offshore Development. The population consequences of these displacement impacts are modelled, where required, using PVA (Appendix 12.5).
- Appendix 12.5: Population Modelling – prepared by HiDef, presents the PVAs undertaken for kittiwake, guillemot and puffin at North Caithness Cliffs SPA.
- Appendix 12.6: Consultation Advice – prepared by HiDef, presents the full record of all pre-application advice on marine ornithology, relevant to both EIA and HRA.

1.4 Structure of the HRA

The structure of this document is summarised below:

> **Section 1**: Introduction. Provides the background of the Offshore Development, including the assessment process and supporting information.

> **Section 2**: Legislation, Policy, and Guidance. Identifies the legislation, policy, and guidance driving the need for the RIAA and defining the structure and content of the report.

> **Section 3**: Overview of the HRA Screening Process. Summarises the screening process and identifies relevant European Sites to be considered within this HRA assessment.

> **Section 4**: HRA Consultation. Summarises the consultation that has taken place to date, with whom the consultation was undertaken and the date the consultation was conducted.

> **Section 5**: Project Description. Outlines the Offshore Development parameters including the construction, operation and maintenance, and decommissioning programmes.

> **Section 6**: Embedded Mitigation. Outlines the embedded mitigation measures that have been incorporated into the Project Design Envelope (PDE) to prevent / reduce any potentially adverse effects on qualifying interests.

> **Section 7**: Annex II Migratory Fish Assessment. Provides an assessment of potential effects on Annex II migratory fish qualifying interests.

> **Section 8**: Annex II Marine Mammals Assessment. Provides an assessment of potential effects on Annex II migratory marine mammal qualifying interests.

> **Section 9**: Special Protected Areas with Ornithology Interests. Provides an assessment of potential effects on SPAs with ornithology qualifying interests.

> **Section 10**: Conclusions of the Assessment. Summarises the conclusions of the potential adverse effects of the Offshore Development on qualifying interests, either alone or in-combination.

> **Section 11**: References.

2 LEGISLATION, POLICY, AND GUIDANCE

2.1 Legislative Context

Under Article 6(3) of the Habitats Directive (92/43/EEC), a HRA is required where a plan or project is likely to have a significant effect on a protected European site or European Marine Site (a Natura 2000 site) either directly or in combination with any other plan or project.

Within Scotland, the legislative drivers governing the need for HRA are:

- The Conservation (Natural Habitats & c.) Regulations 1994, as amended and the Conservation of Marine Habitats and Species Regulations 2017 (hereafter referred to as the 'Habitats Regulations')[1];
- The Conservation on Wetlands of International Importance especially as Waterfowl Habitat (the 'Ramsar Convention') (implemented through the Habitats Regulations); and
- The Wildlife and Countryside Act 1981.

It is through the Habitats Regulations that the Habitats Directive [Council Directive 92/43/EEC] and the Birds Directive [Directive 2009/147/EC] have been transposed into Scottish Law.

The Habitats Regulations outline how development control decisions which could directly, indirectly or in-combination with, affect a European Site. It is through Scottish Government (SG) policy (as outlined in the Scottish Planning Policy [SPP]) that the regulations should apply. Article 6(3) of the Habitats Directive [92/43/EEC] states that:

"*Any plan or project not directly connected with or necessary to the management of the site but likely to have a significant effect thereon, either individually or in combination with other plans or projects, shall be subject to appropriate assessment of its implications for the site in view of the site's conservation objectives*."

It is necessary in the first instance to determine whether it is possible to conclude that a proposed development will not give rise to LSE on a European Site. If it is not possible to conclude that the proposed development will not have a significant effect on the European Site (based on objective information) an Appropriate Assessment will be required to be undertaken.

The Habitats Regulations require that an AA must be undertaken by a Competent Authority before any decision for consent should be granted for any project that could have adverse effects on the integrity of a European Site or European Marine Site. The AA should be carried out in view of the conservation objectives of these sites.

2.1.1 Habitats Regulations

Key legislation that should be considered in relation to the potential effects of the Offshore Development on ecologically designated sites has been summarised in Table 2.1 below.

Table 2.1 Legislation and policy relevant to ecologically designated sites

Designated site	Legalisation
SPA / SAC (United Kingdom [UK] National Site Network)	> The European Union (EU) Habitats Directive implemented through the Conservation (Natural Habitats & c.) Regulations 1994 (as amended in Scotland) (the Habitats Regulations) > Conservation of Habitats and Species Regulations 2017

[1] The Conservation (Natural Habitats & c.) Regulations 1994 apply to territorial waters out to 12 nautical miles (nm), and the Conservation of Marine Habitats and Species Regulations 2017 applies to Section 36 Consent applications out to 12 nm.

Designated site	Legalisation
Ramsar Sites	> The Convention on Wetlands of International Importance especially as Waterfowl Habitat (the 'Ramsar Convention') (implemented through the Habitats Regulations

2.1.2 European Sites (post Brexit)

Following the UK's exit from the EU, SACs and SPAs designated under the UK and the Convention of Habitats and Species regulations 2017 no longer form part of the EU's Natura 2000 Network. These sites and new SPAs and SACs now form the UK National Site Network (as defined in Regulation 1994). This includes both inshore and offshore sites in the UK.

Despite the UK's exit from the EU, the HRA process remains unchanged (Scottish Government, 2020). The term 'European marine site' is interchangeable with 'European site' and refers to SACs and SPAs covered by tidal water that protect marine and coastal habitats and species. UK planning policy also extended the definition to include proposed and designated Ramsar wetland sites of international importance designated under the Ramsar Convention 1971. The Scottish Government policy on protecting Ramsar sites notes that where Ramsar Site interests coincide with Natura qualifying interests protected under an SPA or an SAC, as the case may be, the interests are given the same level of (legal) protection as Natura sites. The policy also notes that where Ramsar interests are not the same as Natura qualifying interests but instead match Sites of Special Scientific Interest (SSSI) features, these receive protection under the SSSI regime (Scottish Government, 2019).

2.2 The HRA Process

The Habitats Regulations are in place to protect European Sites and contain the procedural requirements for the HRA process to assess the potential effects of a development on the qualifying interests of these European sites (Scottish Government, 2020). As mentioned above, in the UK, the Habitats Regulations are extended to consider the potential impacts of a development on Ramsar sites where interests coincide with Natura qualifying interests protected under an SPA or an SAC.

The objectives of the Habitats Regulations in relation to the UK Site Network include:

> To maintain and restore qualifying habitats and species listed under the Habitats Directive to a favourable conservation status; and

> To ensure the survival and reproduction of qualifying species of wild bird within their area of distribution and to maintain populations at levels that correspond to ecological, scientific and cultural requirements, whilst taking account of economic and recreational requirements of the site.

NatureScot (formerly Scottish Natural Heritage [SNH]) guidance 'Natura sites and the Habitats Regulations. How to consider proposals affecting SACs and SPAs in Scotland. The essential quick guide' (SNH, 2018), discusses a staged process for the assessment of a project on European Sites. These key stages can be summarised as follows:

> Stage One: Screening – to determine whether a proposal is likely to have a significant effect on a European Site, this stage does not take into account any embedded mitigation measures (other than the intrinsic project design) as detailed in Section 2.4;

> Stage Two: Report to Inform Appropriate Assessment – to provide information to allow the Competent Authority to ascertain whether the proposal will or will not adversely affect the integrity of a European Site, this stage considers the embedded mitigation measures implemented for the Offshore Development (as detailed in Section 6);

> Stage Three: Assessment of Alternative Solutions – if it cannot be ascertained that a European Site's integrity will not be adversely affected, alternative solutions will need to be considered; and

- Stage Four: Assessment of 'Imperative Reasons of Overriding Public Interest' – if there are no alternative solutions which can be implemented to ensure no adverse effects on a European Site's integrity then an assessment of whether there are imperative reasons of over-riding public interest for the proposal will be undertaken.

Cumulatively, these stages are referred to as a HRA. This document has been prepared in support of Stage Two, Report to Inform Appropriate Assessment (RIAA). This HRA RIAA provides the Competent Authority with the information required to assist them in undertaking an AA and determine whether there is any 'adverse effect on site integrity' from the Offshore Development.

The latter stages become relevant if the RIAA cannot exclude the risk of an adverse effect on site integrity. These stages will be addressed in the event there is a negative outcome to the second stage (AA). The current report therefore presents the conclusions of Stage One and the findings of Stage Two. The findings do not identify any requirement to progress beyond Stage Two for the Offshore Development.

2.3 Guidance Documents

Within Scotland, the HRA process draws on guidance and advice provided by NatureScot (formerly Scottish Natural Heritage [SNH]), primarily through the HRA guidance document 'Habitats Regulations Appraisal of Plans. Guidance for Plan-making Bodies in Scotland' (Tyldesley and Associates, 2015). This guidance document outlines a 13-stage process of statutory procedures which are used to assess the LSE of a development on European Sites, these stages fall within the key stages of HRA as described above. This guidance is referred to under 'Planning Circular 6, 2013. Development Planning' (Scottish Government, 2013).

Other guidance documents that should be used to inform the HRA process include:

- European Commission (2000). Article 6 - Managing and protecting Natura 2000 sites;
- Department of Energy and Climate Change (DECC) (2016). Guidance on when new marine Natura 2000 sites should be taken into account in offshore renewable energy consents and licences. May 2016;
- SNH (2000). Natura Casework Guidance: Consideration of Proposals affecting SPA and SAC. Guidance Note Series; and
- Oxford Brookes (2001). 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.

2.4 Case Law

Where the RIAA indicates that there is the potential for significant effects on European Site qualifying interests, the project proposal will be reviewed in accordance with regulatory guidance and against current case law, following which Marine Scotland would seek expert advice to identify and categorise the actual impacts of the development on European sites and qualifying interests, and identify what mitigation measures may be required (Scottish Government, 2018).

2.4.1 The People Over Wind Court of Justice of the European Union Judgement

In April 2018 the European Court of Justice issued a judgement that clarifies the stage in the HRA process when mitigation measures can be taken into account in the assessment of LSE on a European site.

The judgement is in relation to how screening for potential LSE is carried out. The ruling specifically states that mitigation cannot be considered at screening (but remains applicable for the determination of adverse effect). This ruling was taken into consideration during the preparation of the NCA Screening Report (HWL, 2022), submitted to Marine Scotland in February 2022. At that stage, no mitigation measures, other than those intrinsic to the project design, were used to assess whether the Offshore Development could have potential LSE on any European Sites.

3 OVERVIEW OF THE HRA SCREENING PROCESS

3.1 Screening Process Undertaken for the Project

As required under Stage 1 of the HRA process, HWL undertook an NCA Screening exercise to inform the scope of this RIAA. Subsequently, an NCA Screening Report for the Offshore Development (HWL, 2022) was issued to Marine Scotland and other relevant statutory stakeholders for comment which outlined the proposed scope of the RIAA for the Offshore Development in line with requirements made under Article 6 of the Habitats Directive (European Parliament, Council 1992), HRA Case Law and best practice guidance.

The NCA Screening Report considered sites to be assessed for LSE under the Habitats Regulations, as well as other designated sites, including Nature Conservation Marine Protected Areas (NCMPAs) under the Marine (Scotland) Act 2010. For clarity, only the screening exercise for European sites considered under the Habitats Regulations (SACs, SPAs and Ramsars) are stated here and assessed within this RIAA. All other designated sites have been fully assessed within the Offshore EIAR.

As per 'The People Over Wind' Case Law (see Section 2.4.1), no mitigation measures, other than those intrinsic to the project design were used to assess the potential for LSE on a European Site's integrity at screening stage.

During the screening exercise, the criteria outlined in Table 3.1 were used to identify connectivity between the Offshore Development and European Sites or Ramsar Sites.

Table 3.1 Criteria used for Identification of European Sites and Ramsar sites

Criteria
> There is direct spatial overlap between the Offshore Development and a European Sites or Ramsar Sites
> There is spatial overlap between the secondary effect footprint2 of the Offshore Development and European Sites or Ramsar Sites
> The European Sites or Ramsar Sites host a mobile population of qualifying interests (e.g. Annex II Migratory Fish, Annex II Marine Mammals and/or Ornithology interests) or support a habitat for the qualifying feature that may directly interact with the Offshore Development
> The European Sites or Ramsar Sites host a mobile population of qualifying interests (e.g. Annex II Migratory Fish, Annex II Marine Mammals and/or Ornithology interests) or support a habitat for the qualifying feature that may directly interact with the secondary effect footprint of the Offshore Development

3.1.1 Designated Site Identification

The identification of designated sites to be considered for potential LSE was undertaken with reference to the qualifying species / interests of the European Sites or Ramsar designated sites in line with the following process:

> Identifying the range of potential impacts that the Offshore Development could have on European Sites or Ramsar sites qualifying interests (impact pathways); and

> Determining connectivity between the Offshore Development and the European Sites or Ramsar sites.

[2] This is considered to occur where indirect effects from the Offshore Development (e.g. sediment plume) overlaps with a European Site or Ramsar site qualifying species or habitat.

Table 3.2 summarises the criteria used to identify the designated sites that would require further assessment within the RIAA based on the above criteria.

Table 3.2 Designated Sites Requiring Further Consideration

Designated Site	Criteria
Seabird SPAs	SPA breeding seabird colonies that have potential connectivity with the Offshore Development based on foraging range (Woodward *et al*., 2019).
Marine SPAs	Marine SPAs protected for at sea concentrations of seabirds will require further consideration where they directly overlap or are in close proximity to the Offshore Site. Determination of connectivity for marine SPAs is based on whether or not the Offshore Development would directly impact the seabird species whilst they are within the SPA site boundary.
Wildfowl and wader SPAs / Ramsar sites	Designated to protect the UK wintering grounds of migratory wildfowl and wader species.
SACs (including candidate sites) with breeding harbour seal and grey seal interests	Harbour seals qualifying interests within the relevant species Management Units (MU) overlapping with the Offshore Development.
SACs (including proposed and candidate sites) with otter interests	SACs with otter interests that overlap with or are located within 500 m of the Offshore Development.
SACs (including proposed and candidate sites) with cetaceans as qualifying interests	SACs with cetaceans as qualifying interests within the relevant species MUs overlapping with the Offshore Development.
SACs with Atlantic salmon and sandeels	SACs with Atlantic salmon and sandeels (which are prey for salmonids) who's migrating smolts or adult salmon are likely to interact with the Offshore Development.
SACs (including proposed and candidate sites) designated for seabed/benthic protected interests	SACs designated for seabed / benthic protected interests that overlap with or are located within 10 km of the Offshore Development.

3.2 Receptors

The following sections provide an overview of the receptors screened into the RIAA based on the European Sites which have been identified as necessary to be screened into the RIAA in line with the criteria listed in Table 3.2. Receptors screened out of the RIAA and justification for these omissions are also provided (this is often on the basis that there are no European sites where that receptor is a qualifying interest with connectivity with the Offshore Development).

A full list of the European Sites screened into the RIAA is provided in Section 3.3 and Section 3.4 below.

3.2.1 Receptors Screened In

The receptors that have been screened in for further assessment within this RIAA are:

- Annex II migratory fish species
    - Section 10.4.4 of the Offshore EIAR (Volume 2): Chapter 10: Fish and Shellfish Ecology provides a comprehensive baseline for fish and shellfish species using the waters in and around the Offshore Site. In the EIA Scoping Opinion Marine Scotland Science and NatureScot advised that all river SACs in Scotland with salmonids should be screened into the HRA. As there is a direct relationship between salmonids and freshwater pearl mussels this species requires to be considered in parallel on designated sties with Atlantic salmon listed as a qualifying interest. All other fish and shellfish species were considered not to have

any connectivity with the Offshore Development and so were screened out for further assessment. This screening process was presented in the NCA Screening Report for consultation (HWL, 2022), and the Screening Opinion (MS-LOT, 2022) did not advise to include any further species for the HRA. Therefore, the two fish and shellfish species screened in for assessment in this RIAA are:

- Atlantic salmon (*Salmo salar*); and
- Freshwater pearl mussel (*Margaritifera margaritifera*) (indirect effects).

> Annex II marine mammals

Section 11.4.4 of the Offshore EIAR (Volume 2): Chapter 11: Marine Mammals and other Megafauna provides a comprehensive baseline for marine mammal and other megafauna species using the waters in and around the Offshore Site; this has been developed by using published abundance and distribution data (Evans *et al*., 2011; Hague *et al*., 2020) and from data collected during the aerial surveys of the Offshore Array Area (HiDef, 2021) and the MMO observations during the PFOWF geophysical surveys in 2021 (MMT, 2021). In the NCA Screening Report (HWL, 2022), species to be screened in for further assessment were identified by using the relevant species Management Unit (MU) that overlaps with the Offshore Site. Whilst eight species were included in the NCA Screening Report (HWL, 2022), further review of the qualifying interests of the European Sites screened into the HRA resulted in the four species below being taken forward for further assessment in this RIAA; the species screened out are discussed in Section 3.2.2.2:

- Bottlenose dolphin (*Tursiops truncatus*);
- Harbour porpoise (*Phocoena phocoena*);
- Harbour seal (*Phoca vitulina*); and
- Grey seal (*Halichoerus grypus*).

> Ornithology interests

Section 12.4.4 of the Offshore EIAR (Volume 2): Chapter 12: Marine Ornithology sets out the Baseline Description of the Offshore Development in respect of marine ornithological interests. Two years of digital video aerial survey work (in 2015 and 2020 / 2021) have been carried out to inform this baseline, recording the ornithological (primarily seabird) activity occurring on-site. These will be birds using the area for foraging, resting or other activities (such as preening) and/or birds that are transiting the area enroute to other locations. Detailed information on the numbers of birds recorded, and the resulting density and site population estimates is provided in the Offshore EIAR (Volume 3): Technical Appendix 12.1: Baseline Data.

Based on this survey work and the baseline characterisation presented in Section 12.4 of the Offshore EIAR (Volume 2): Chapter 12: Marine Ornithology, the following SPA seabird species were identified as needing further consideration in the RIAA:

- Black-legged kittiwake (*Rissa tridactyla*), hereafter ‘kittiwake’;
- Guillemot (*Uria aalge*);
- Razorbill (*Alca torda*);
- Atlantic puffin (*Fratercula arctica*), hereafter ‘puffin’;
- Northern fulmar (*Fulmarus glacialis*), hereafter ‘fulmar’;
- Northern gannet (*Morus bassanus*), hereafter ‘gannet’; and
- Great skua (*Stercorarius skua*).

These SPA seabird species were included in the NCA Screening Report for consultation (HWL, 2022). The Screening Opinion (MS-LOT, 2022) did not advise any further species be screened in under HRA for the Offshore Development, except red-throated diver (*Gavia stellata*) specifically at Caithness and Sutherland Peatlands SPA and Ramsar site (see Section 9.12). Petrel and shearwater species were also raised for consideration by RSPB Scotland and have been assessed collectively and qualitatively (as requested) in

Section 9.6.3. The assessment here includes European storm petrel (*Hydrobates pelagicus*) hereafter 'storm petrel', Leach's storm petrel (*Hydrobates leucorhous*) hereafter 'Leach's petrel', and Manx shearwater (*Puffinus puffinus*).

Peregrine falcon (*Falco peregrinus*), hereafter 'peregrine', are also included for assessment, specifically as a qualifying interest of North Caithness Cliffs SPA (see Section 9.10).

As confirmed in the Screening Opinion (MS-LOT, 2022), collision risk impacts to SPA wildfowl and wader species have been considered strategically and qualitatively making reference to the available report from the Wildfowl and Wetlands Trust (WWT) (2014), commissioned by Marine Scotland. This assessment is provided in Section 9.6.4 In this regard, Ramsar sites (also designated for migratory wildfowl and waders) are included for consideration in Section 9.6.4.

Terrestrial SPAs flagged in the Screening Opinion in respect of the Onshore Development: Caithness Lochs, Caithness and Sutherland Peatlands will be covered in the Onshore HRA.

3.2.2 Receptors Screened Out

3.2.2.1 Fish Species

Brook lamprey (*Lampetra planeri*) undergo limited spawning migrations and stay within the freshwater of the rivers (NatureScot, 2020). As the rivers designated for brook lamprey do not overlap with the Offshore Development, connectivity is not anticipated. River lamprey (*Lampetra fluviatilis*) migrate from their coastal feeding grounds into freshwater to spawn during the autumn and spring (NatureScot, 2020). Similarly, the rivers (and river mouths) designated for river lamprey do not overlap with the Offshore Site and as such no connectivity is anticipated. Sea lamprey is the largest of the three British lamprey species. Although sea lamprey migrate from the sea to rivers, the river mouths of the river SACs designated for sea lamprey do not overlap with the Offshore Site, with the closest located 107 km from the Offshore Site. Therefore, connectivity with these species is not anticipated and they have been screened out of the RIAA. This has been agreed through consultation (see Section 4).

Sandeels (*Ammodytes americanus*) were considered at Screening. However, no European Sites under the Habitats Regulations were identified for this qualifying interest, and thus have been screened out of the RIAA. This has been agreed through consultation (see Section 4).

3.2.2.2 Marine Mammals

There are no European Sites under the Habitats Regulations for the following qualifying interests: Minke whale (*Balaenoptera acutorostrata*), Risso's Dolphin (Grampus griseus), white-beaked dolphin (*Lagenorhynchus albirostris*), common dolphin (*Delphinus Delphis*), and basking sharks (*Cetorhinus maximus*); these species have therefore been screened out of the RIAA. This has been agreed through consultation (see Section 4).

Whilst orca are observed off the coast of Orkney and within the Moray Firth, often on a seasonal basis, this species is not listed in Annex II of the Habitats Directive and there are no sites designated for the protection of orca in the UK or internationally within European waters of the North-east Atlantic or North Sea. This species is, therefore, not considered within this RIAA.

3.2.2.3 Ornithology

The following three species are qualifying interests of SPA breeding seabird colonies, however, they are screened out of the RIAA for the under-noted reasons:

- Arctic tern (*Sterna paradisaea*);
- Great black-backed gull (*Larus marinus*); and
- Herring gull (*Larus argentatus*).

Arctic terns have a small foraging range, as recorded in Woodward *et al.* (2019) (mean max 25.7 km ±14.8 SD); Offshore EIAR (Volume 3): Technical Appendix 12.2: Connectivity and Apportioning. There are no SPAs for Arctic tern within foraging range of the PFOWF Array Area, but RSPB have identified four non-designated breeding colonies (Melvich Bay, Caol Loch, Dounreay and Georgemas). Therefore, the species has been

included for assessment under EIA in relation to these local colonies (Offshore EIAR [Volume 2]: Chapter 12: Marine Ornithology). This species is screened out of the RIAA.

Great black-backed gulls were only recorded in the PFOWF Array Area during the non-breeding season (September to March), and in very low numbers. The peak population estimate was of 10 birds (95% CI 9 – 10) in October 2020; Tables 43 and 44, Offshore EIAR (Volume 3): Technical Appendix 12.1: Baseline Data. Therefore, there is no breeding season connectivity with any SPA colony (Offshore EIAR [Volume 3] Technical Appendix 12.2: Connectivity and Apportioning) and only an EIA non-breeding season assessment is required as presented in Offshore EIAR (Volume 2): Chapter 12: Marine Ornithology. The species is screened out of the RIAA.

Herring gulls were only recorded in the PFOWF Array Area once over the two years of digital aerial survey work with an abundance estimate of just five birds (95% CI 2 – 7) in October 2015; Tables 52 and 53, Offshore EIAR (Volume 3): Technical Appendix 12.1: Baseline Data. Therefore, there is no breeding season connectivity with any SPA colony (Offshore EIAR [Volume 3] Technical Appendix 12.2: Connectivity and Apportioning) and only an EIA non-breeding season assessment is required as presented in Offshore EIAR (Volume 2): Chapter 12: Marine Ornithology. This species is screened out of the RIAA.

Marine SPAs and marine SPA extensions are designated for at sea concentrations of seabirds and protect those seabirds whilst they are within the SPA. Connectivity based on foraging range does not apply to at sea concentrations of seabirds, only to SPA breeding colonies. The intention of marine SPAs and marine SPA extensions is to afford site-based protection to seabirds from the breeding colonies whilst they are at sea. The only instance where a marine SPA or marine SPA extension would be screened into HRA is where proposed development directly overlaps the SPA site, or where it is in such proximity that it may cause disturbance or changes in distribution to the seabirds whilst they are in the SPA. In this regard, for the Offshore Development, it is only North Caithness Cliffs SPA (where the designation includes a marine extension from each of the SPA colony sub-sites) that needs included for assessment. This is because the nearshore section of the OECC directly overlaps with the Melvich SPA sub-site marine extension (Section 9.10.2.1).

For the avoidance of doubt the following marine SPAs are not screened in under HRA in respect of the Offshore Development: Scapa Flow SPA, Moray Firth SPA, the Outer Firth of Forth and St Andrews Bay Complex SPA, Seas off Foula SPA and Seas off St Kilda SPA.

3.2.2.4 Benthic Receptors

All SACs designated for the conservation of seabed and/or benthic interests are located outside of the 10 km radius from the Offshore Site. This radius has been determined based on the maximum tidal excursions predicted at the Offshore Site and, therefore, the maximum sediment transport distance which could cause a LSE on benthic receptors. For this reason, benthic receptors have not been considered further within this RIAA.

3.2.2.5 Otters

SACs with otters (*Lutra lutra*) listed as a qualifying feature are not considered to have connectivity to the Offshore Development as no SACs were identified within 500 m of the Offshore Site. This exclusion radius has been determined based on the small home ranges of coastal otters and the limited Offshore Development activities within the inter-tidal area, which consists only of HDD operations under the seabed. Therefore, this species was screened out of the NCA Screening Report and are not considered further within this RIAA[3].

3.3 Special Areas of Conservation and Interests Screened In

The following sections present the SACs screened into the RIAA for Annex II Migratory Fish and Marine Mammal interests.

3.3.1 Annex II Migratory Fish

Table 3.3 the SACs and corresponding Annex II Migratory Fish qualifying interests screened into the assessment, and justification for the screening decision. These SACs are also shown in Figure 3.1.

[3] Terrestrial SACs designated for otter features will be assessed within the RIAA submitted as part of the consent application for the Onshore Development to The Highland Council.

Table 3.3 SACs Screened in for Annex II Migratory Fish Qualifying Interests

Site name	Qualifying interest(s) screened in	Distance to the PFOWF Array Area (km)[4]	Distance to Offshore Export Cable Corridor (km)[5]	Requirement for further assessment
UK SACs				
River Thurso	Atlantic Salmon	21	17	The Offshore Development is located less than 20 km from the SAC. Based on the typical migration route extent and pathway for Atlantic salmon, potential connectivity cannot be ruled out. Therefore, **LSE cannot be ruled out.**
River Naver	Atlantic Salmon	22	22	The Offshore Development is located less than 30 km from the SAC. Based on the typical migration route extent and pathway for Atlantic salmon, potential connectivity cannot be ruled out. Therefore, **LSE cannot be ruled out.**
River Borgie	Atlantic Salmon	24	24	The Offshore Development is located less than 30 km from the SAC. Based on the typical migration route extent and pathway for Atlantic salmon, potential connectivity cannot be ruled out. Therefore, **LSE cannot be ruled out.**
Berridale and Langwell Waters	Atlantic Salmon	114	113	Although the Offshore Development is located a significant distance from the SAC, based on the typical migration route extent and pathway for Atlantic salmon, potential connectivity cannot be ruled out. Therefore, **LSE cannot be ruled out.**
River Spey	Atlantic salmon	159	158	Although the Offshore Development is located a significant distance from the SAC, based on the typical migration route extent and pathway for Atlantic salmon, potential connectivity cannot be ruled out. Therefore, **LSE cannot be ruled out.**
Little Gruinard River	Atlantic Salmon.	161	161	Although the Offshore Development is located a significant distance from the SAC, based on the typical migration route extent and pathway for Atlantic salmon, potential connectivity cannot be ruled out. Therefore, **LSE cannot be ruled out.**
River Oykel	Atlantic salmon.	182	181	Although the Offshore Development is located a significant distance from the SAC, based on the typical migration route extent

[4] Distances provided within this table have been measured using least cost path analysis to identify the minimum distance between the site and Offshore Development by sea. They are not straight-line distances which may include over-land travel (i.e. 'as the crow flies').
[5] Distances provided within this table have been measured using least cost path analysis to identify the minimum distance between the site and Offshore Development by sea. They are not straight-line distances which may include over-land travel (i.e. 'as the crow flies').

Site name	Qualifying interest(s) screened in	Distance to the PFOWF Array Area (km)[4]	Distance to Offshore Export Cable Corridor (km)[5]	Requirement for further assessment
				and pathway for Atlantic salmon, potential connectivity cannot be ruled out. Therefore, **LSE cannot be ruled out.**
Langavat	Atlantic Salmon	198	198	Although the Offshore Development is located a significant distance from the SAC, based on the typical migration route extent and pathway for Atlantic salmon, potential connectivity cannot be ruled out. Therefore, **LSE cannot be ruled out.**
North Harris	Atlantic Salmon	228	228	Although the Offshore Development is located a significant distance from the SAC, based on the typical migration route extent and pathway for Atlantic salmon, potential connectivity cannot be ruled out. Therefore, **LSE cannot be ruled out.**
River Dee	Atlantic salmon	254	252	Although the Offshore Development is located a significant distance from the SAC, based on the typical migration route extent and pathway for Atlantic salmon, potential connectivity cannot be ruled out. Therefore, **LSE cannot be ruled out.**
River Moriston	Atlantic salmon	271	271	Although the Offshore Development is located a significant distance from the SAC, based on the typical migration route extent and pathway for Atlantic salmon, potential connectivity cannot be ruled out. Therefore, **LSE cannot be ruled out.**
River South Esk	Atlantic salmon	312	311	Although the Offshore Development is located a significant distance from the SAC, based on the typical migration route extent and pathway for Atlantic salmon, potential connectivity cannot be ruled out. Therefore, **LSE cannot be ruled out.**
River Tay	Atlantic salmon	385	383	Although the Offshore Development is located a significant distance from the SAC, based on the typical migration route extent and pathway for Atlantic salmon, potential connectivity cannot be ruled out. Therefore, **LSE cannot be ruled out.**
River Tweed	Atlantic Salmon.	404	403	Although the Offshore Development is located a significant distance from the SAC, based on the typical migration route extent and pathway for Atlantic salmon, potential connectivity cannot be ruled out. Therefore, **LSE cannot be ruled out.**
River Teith	Atlantic salmon.	450	448	Although the Offshore Development is located a significant distance from the SAC, based on the typical migration route extent and pathway for Atlantic salmon, potential

Site name	Qualifying interest(s) screened in	Distance to the PFOWF Array Area (km)[4]	Distance to Offshore Export Cable Corridor (km)[5]	Requirement for further assessment
				connectivity cannot be ruled out. Therefore, **LSE cannot be ruled out.**
Endrick Water	Atlantic Salmon	621	620	Although the Offshore Development is located a significant distance from the SAC, based on the typical migration route extent and pathway for Atlantic salmon, potential connectivity cannot be ruled out. Therefore, **LSE cannot be ruled out.**
River Bladnoch	Atlantic Salmon	653	653	Although the Offshore Development is located a significant distance from the SA, based on the typical migration route extent (and pathway for Atlantic salmon, potential connectivity cannot be ruled out. Therefore, **LSE cannot be ruled out.**

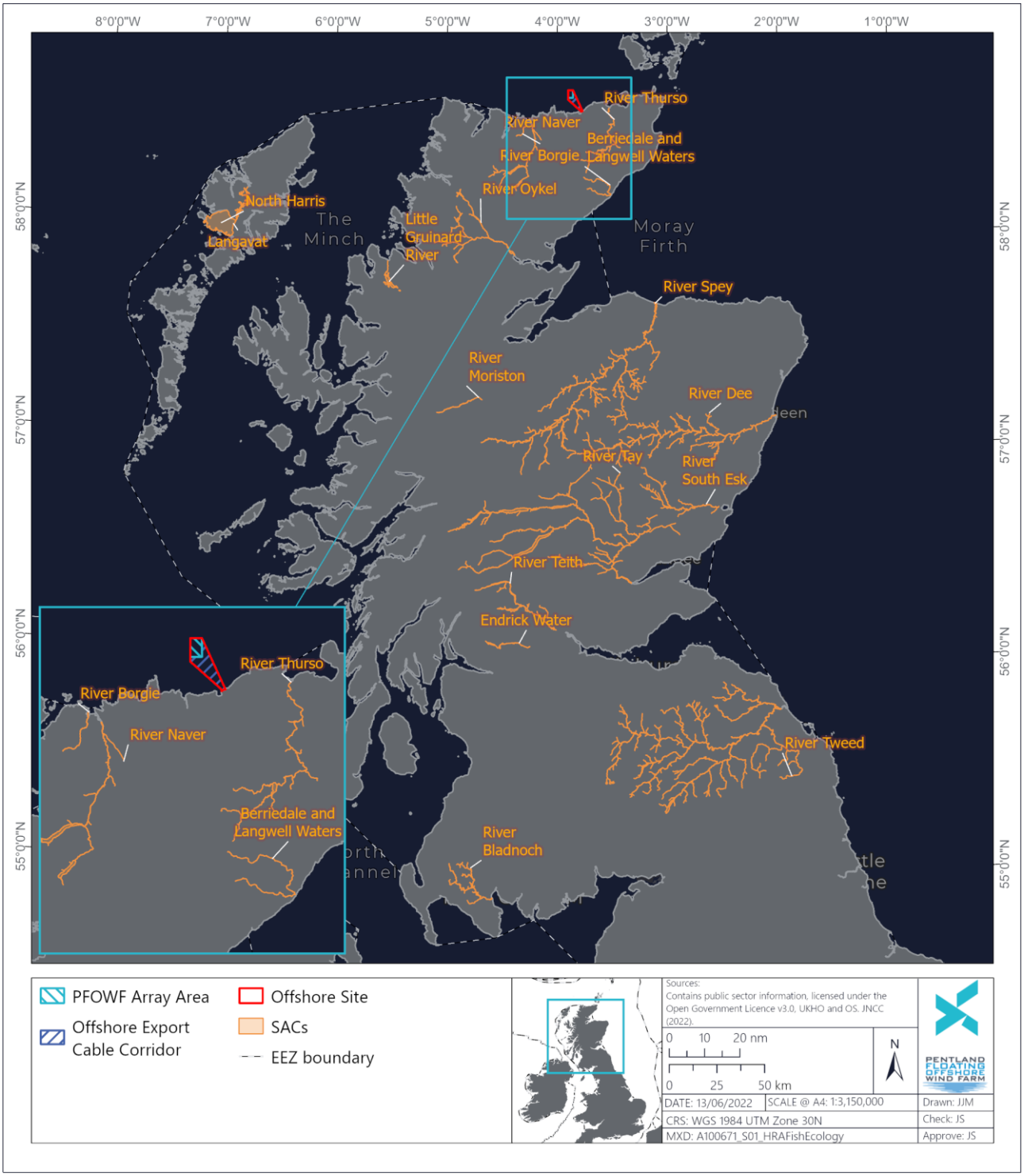


Figure 3.1 SACs Designated for Annex II Migratory Fish Screened into the RIAA

3.3.2 Annex II Marine Mammals

The SACs screened into the assessment for marine mammals includes all SACs within the relevant cetacean and seal MUs which overlap or are immediately proximal to the Offshore Site, as defined in the screening criteria set out in Table 3.1. This method of screening has been advised through consultation with the competent authorities. A larger number of SACs were originally submitted to Marine Scotland in the NCA Screening Report (HWL, 2022) and this list has been further refined following receipt of the Screening Opinion in June 2022; this consultation has been captured in Table 4.1 below.

Table 3.4 provides for the refined list of SACs screened into the assessment, and their corresponding Annex II Marine Mammal qualifying interests and justification for the screening decision.

Figure 3.2 and Figure 3.3 depict all of the UK and European SACs with cetacean and seal qualifying interests, respectively, which are considered relevant to the Offshore Development. The least-cost path distance (i.e. the minimum distance at sea which avoids land) between the Offshore Site and the nearest SAC for each of the four qualifying species has been provided on these figures for illustrative purposes.

Table 3.4 SACs screened in for Annex II Marine Mammal Qualifying Interests based on the cetacean and seal MUs relevant to the Offshore Development

Site name	Qualifying interest(s) screened in	Distance to Offshore Site (km)[1]	Requirement for further assessment
UK SACs			
Faray and Holm of Faray	Grey seal	94	SAC overlaps with North Coast and Orkney (NCO) MU for grey seals, which contains approximately 35,979 animals [2]. Therefore, **LSE cannot be ruled out**.
Inner Hebrides and the Minches	Harbour porpoise	115	SAC overlaps with West Scotland (WS) MU for harbour porpoise, which contains approximately 28,936 animals (IAMMWG, 2021). Therefore, **LSE cannot be ruled out**.
Sanday	Harbour seal	107	SAC overlaps with NCO MU for harbour seals, which contains approximately 1,951 animals [3]. Therefore, **LSE cannot be ruled out**.
Moray Firth	Bottlenose dolphin	126	SAC overlaps with Coastal East Scotland (CES) MU for bottlenose dolphins, which contains approximately 224 animals (Arso-Civil *et al.*, 2021). Therefore, **LSE cannot be ruled out**.
Skerries and Causeway	Harbour porpoise.	478	SAC overlaps with WS MU for harbour porpoise. Therefore, **LSE cannot be ruled out**.
Southern North Sea	Harbour porpoise	493	SAC overlaps with North Sea (NS) MU for harbour porpoise, which contains approximately 346,601 animals (IAMMWG, 2021). Therefore, **LSE cannot be ruled out**.

Site name	Qualifying interest(s) screened in	Distance to Offshore Site (km)[1]	Requirement for further assessment
European SACs			
Doggersbank	Harbour porpoise	582	Each of the European SACs overlap with the southernmost extent of the NS MU for harbour porpoise. Although these sites are a considerable distance from the Offshore Site, **LSE cannot be ruled out.**
Klaverbank	Harbour porpoise	624	
Gule Rev	Harbour porpoise	705	
Sydlige Nordsø	Harbour porpoise	721	
Sylter Außenriff	Harbour porpoise	737	
Store Rev	Harbour porpoise	766	
Vadehavet med Ribe Å, Tved Å og Varde Å vest for Varde	Harbour porpoise	788	
Borkum-Riffgrund	Harbour porpoise	793	
Skagens Gren og Skagerak	Harbour porpoise	797	
Waddenzee	Harbour porpoise	803	
NTP S-H Wattenmeer und angrenzende Küstengebiete	Harbour porpoise	818	
Nationalpark NiedersÃ¤chsisches Wattenmeer	Harbour porpoise	837	
Helgoland mit Helgoländer Felssockel	Harbour porpoise	863	
Steingrund	Harbour porpoise	868	
Vlaamse Banken	Harbour porpoise	879	
Voordelta	Harbour porpoise	880	
Bancs des Flandres	Harbour porpoise	889	
Vlakte van de Raan	Harbour porpoise	899	
Hamburgisches Wattenmeer	Harbour porpoise	900	
Oosterschelde	Harbour porpoise	903	
Westerschelde & Saeftinghe	Harbour porpoise	909	
Ridens et dunes hydrauliques du détroit du Pas-de-Calais	Harbour porpoise	909	

Site name	Qualifying interest(s) screened in	Distance to Offshore Site (km)[1]	Requirement for further assessment
Récifs Gris-Nez Blanc-Nez	Harbour porpoise	910	
Baie de Canche et couloir des trois estuaires	Harbour porpoise	951	
Baie de Seine occidentale	Harbour porpoise	1012	
Baie de Seine orientale	Harbour porpoise	1039	

[1] Distances provided within this table have been measured using least cost path analysis to identify the minimum distance between the site and Offshore Development by sea. They are not straight-line distances which may include over-land travel (i.e. 'as the crow flies').

[2] Assumes that 23.9% of the total grey seal population is hauled-out during the August surveys (Russell *et al.*, 2016). To account for the portion of the population at-sea, the data is thus scaled as: 8,599 / 23.9*100 = 35,979.

[3] Assumes that 72% of the total harbour seal population is hauled-out during the August surveys (Lonergan *et al.*, 2013). To account for the portion of the population at-sea, the data is thus scaled as: 1,405 / 72*100 = 1,951.

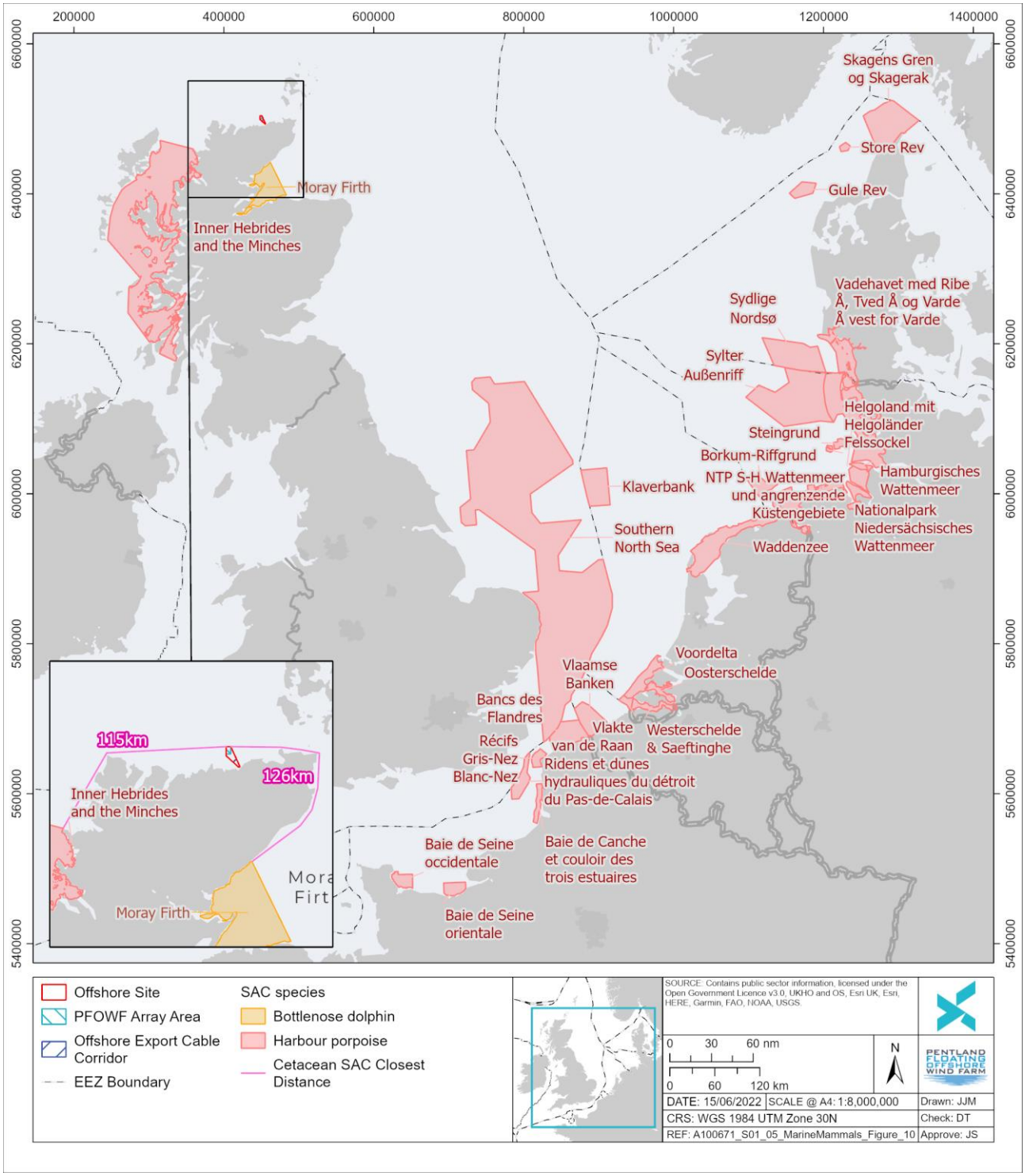


Figure 3.2 SACs with Cetacean Qualifying Interests which overlap the relevant Management Units for the Offshore Development

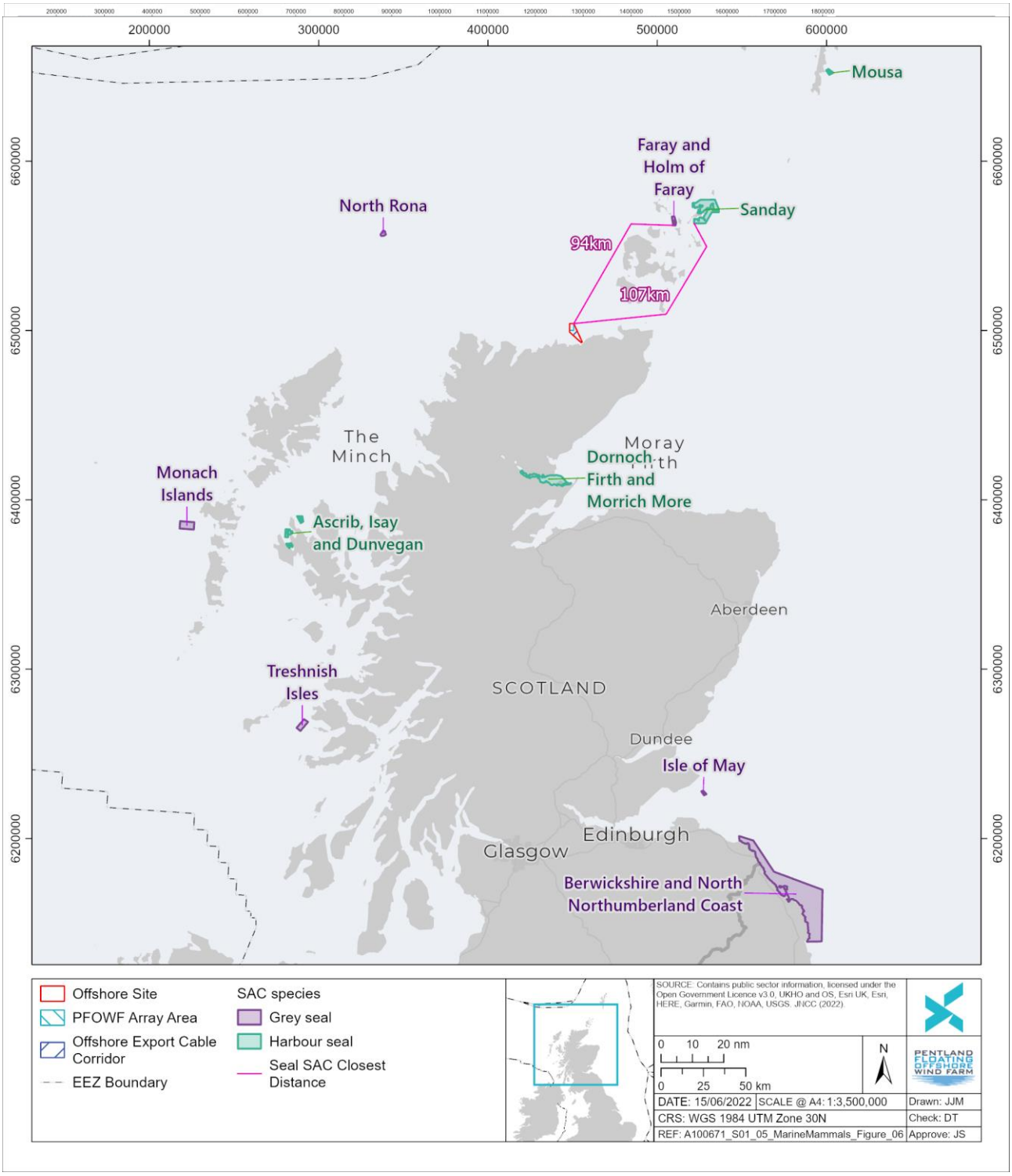


Figure 3.3 SACs with Seal Qualifying Interests in Scottish Waters

3.4 Special Protected Areas and Interests Screened In

For the seabirds listed in Section 3.2.1, connectivity between the Offshore Site and their SPA breeding colonies is defined based on their foraging range. For most of the species this is the mean-max distance plus one standard deviation as presented in Woodward *et al*. (2019). However, for gannet, razorbill and guillemot NatureScot has provided specific advice. In respect of gannet, NatureScot advise consideration of site-specific maximum foraging ranges for Forth Islands SPA (590 km), St Kilda SPA (709 km) and Grassholm SPA (517 km). For guillemot and razorbill, NatureScot advise use of mean max +1 SD, including data from Fair Isle for all Northern Isles designated sites. For all designated sites south of the Pentland Firth (i.e. excluding the Northern Isles), they advised use of mean max +1 SD discounting Fair Isle values and noted they consider North Caithness Cliffs SPA to lie south of the Pentland Firth.

These foraging distances used to determine connectivity for the relevant SPA seabirds are presented in Table 3.5 and 3.6. This connectivity screening determined the SPA long lists submitted for consultation in the NCA Screening Report (HWL, 2022).

Table 3.5 Species and foraging ranges as per Woodward *et al.* (2019)

Species	Mean Max (km)	SD (km)	Total (km)
Kittiwake	156.1	144.5	300.6
Puffin	137.1	128.3	265.4
Fulmar	542.3	657.9	1200.2
Gannet	315.2	194.2	509.4
Great skua	443.3	487.9	931.2

Table 3.6 Guillemot and razorbill foraging ranges following NatureScot scoping advice

Species	Mean max plus 1 SD (km) North of Pentland Firth	Mean max plus 1 SD (km) South of Pentland Firth
Guillemot	153.7	95.2
Razorbill	164.6	122.2

Further to the Screening Opinion (MS-LOT, 2022) an additional connectivity screening exercise has been undertaken to identify SPAs relevant to consider in respect of petrel and shearwater species, based on the following foraging ranges from Woodward *et al*. (2019):

- Storm petrel; 336 km (mean max only, no SD given);
- Leach's petrel; 567 km (mean max only, no SD given); and
- Manx shearwater; 2365.5 km (mean max plus 1 SD).

A full SPA connectivity screening has not been undertaken for Manx shearwater due to its very large foraging range, which would therefore consider all SPAs in the UK and northern Europe where they are a qualifying species. In this regard, as can be seen from Section 9.6.3 the direct or indirect impact of the Offshore Development on this species is highly unlikely. Therefore, there would be **no adverse effect on site integrity** on any of the SPAs where it qualifies.

Table 3.7 presents the specific SPAs and ornithological qualifying interests screened into the assessment and Figure 3.4 depicts all of these SPAs. SPA seabird assemblages have not been screened in as an individual unit, but instead the screening includes each of their named component species.

As noted in Section 3.2, red-throated diver are screened in specifically in relation to Caithness and Sutherland Peatlands SPA and peregrine are screened in specifically in relation to North Caithness Cliffs SPA, both included in Table 3.7.

Table 3.7 SPAs screened in for Ornithology Qualifying Interests

SPA	Qualifying interest(s) screened in	Distance to PFOWF Array Area (km)[6]
North Caithness Cliffs and marine extension	Breeding: > Fulmar; > Guillemot; > Kittiwake; > Puffin; > Razorbill); and > Peregrine.	7.5 (Note that the OECC will pass through the seaward extension of the SPA)
Caithness and Sutherland Peatlands	Breeding: > Red-throated diver.	10.5 (Note that the nearshore section of the OECC is 3.5 km from the SPA)
Hoy	Breeding: > Fulmar; > Great skua; > Guillemot; > Kittiwake; > Puffin; and > Red-throated diver. Arctic skua and great black-backed gull are also listed, and the Offshore Development is within their foraging distances, but they are not screened in as no individuals of either species were recorded within the PFOWF Array Area during breeding season surveys.	30
Cape Wrath	Breeding: > Fulmar; > Guillemot; > Kittiwake; > Puffin; and > Razorbill.	51
Sule Skerry and Sule Stack	Breeding:	52

[6] The distances presented within this table have been measured by sea and are not straight-line distances.

SPA	Qualifying interest(s) screened in	Distance to PFOWF Array Area (km)[6]
	> Gannet; > Guillemot; > Leach's petrel; > Puffin; and > Storm petrel.	
Marwick Head	Breeding: > Guillemot; and > Kittiwake.	58
East Caithness Cliffs	Breeding: > Fulmar; > Guillemot; > Herring gull; > Kittiwake; and > Razorbill. Great black-backed gull is also listed, and the Offshore Development is within the species' foraging range but is not screened in as no individuals of this species were recorded within the PFOWF Array Area during breeding season surveys.	73
Copinsay	Breeding: > Fulmar: > Guillemot; and > Kittiwake. Great black-backed gull is also listed, and the Offshore Development is within the species' foraging range but is not screened in as no individuals of this species were recorded within the PFOWF Array Area during breeding season surveys.	73
Rousay	Breeding: > Fulmar; > Guillemot; and > Kittiwake.	76
West Westray	Breeding: > Fulmar; > Guillemot; > Kittiwake; and	85

SPA	Qualifying interest(s) screened in	Distance to PFOWF Array Area (km)[6]
	> Razorbill.	
Auskerry	Breeding: > Storm petrel	89
Handa	Breeding: > Fulmar; > Great skua; > Guillemot; > Kittiwake; and > Razorbill.	98
Calf of Eday	Breeding: > Fulmar; > Guillemot; and > Kittiwake.	99
Priest Island	Breeding: > Storm petrel	141
North Rona and Sula Sgeir	Breeding: > Fulmar; > Gannet; > Kittiwake > Leach's petrel; > Puffin; > Razorbill; and > Storm petrel.	157
Fair Isle	Breeding: > Fulmar; > Gannet; > Great skua; > Kittiwake; and > Puffin.	167
Troup, Pennan and Lion's Heads	Breeding: > Fulmar:	169

SPA	Qualifying interest(s) screened in	Distance to PFOWF Array Area (km)[6]
	> Gannet; and > Kittiwake.	
Foula	Breeding: > Fulmar; > Great skua; > Kittiwake; > Leach's petrel; and > Puffin.	191
Buchan Ness to Collieston Coast	Breeding: > Fulmar; and > Kittiwake.	204
Sumburgh Head	Breeding: > Fulmar; and > Kittiwake.	206
Mousa	Breeding: > Storm petrel	218
Flannan Isles	Breeding: > Fulmar; > Kittiwake; > Leach's petrel; and > Puffin.	229
Noss	Breeding: > Fulmar; > Gannet; > Great skua; > Kittiwake; and > Puffin.	243
Ramna Stacks and Gruney	Breeding: > Leach's petrel.	267
Fowlsheugh	Breeding: > Fulmar; and	275

SPA	Qualifying interest(s) screened in	Distance to PFOWF Array Area (km)[6]
	> Kittiwake.	
Canna and Sanday	Breeding: > Kittiwake.	289
Rum	Breeding: > Manx shearwater	301
Fetlar	Breeding: > Fulmar; and > Great skua.	297
Hermaness, Saxa Vord and Valla Field	Breeding: > Fulmar: > Gannet; and > Great skua.	301
St Kilda	Breeding: > Fulmar; > Gannet; > Great skua; > Leach's petrel; > Manx shearwater; and > Storm petrel.	307
Mingulay and Berneray	Breeding: > Fulmar.	326
Forth Islands	Breeding: > Gannet.	365
Rathlin Island	Breeding: > Fulmar.	491
Horn Head to Fanad Head	Breeding: > Fulmar.	499
Tory Island	Breeding: > Fulmar.	511
West Donegal Coast	Breeding: > Fulmar.	531

SPA	Qualifying interest(s) screened in	Distance to PFOWF Array Area (km)[6]
Ailsa Craig	Breeding: > Gannet.	546
Copeland Islands	Breeding: > Manx shearwater.	558
Duvillaun Islands	Breeding: > Fulmar.	681
Clare Island	Breeding: > Fulmar.	714
Lambay Island	Breeding: > Fulmar.	721
High Island, Inishshark, Davillaun	Breeding: > Fulmar.	733
Cliffs of Moher	Breeding: > Fulmar.	829
Kerry Head	Breeding: > Fulmar.	870
Dingle Peninsula	Breeding: > Fulmar.	880
Saltee Islands	Breeding: > Fulmar.	897
Puffin Island	Breeding: > Fulmar.	943
Skelligs	Breeding: > Fulmar.	951
Iveragh Peninsula	Breeding: > Fulmar.	954
Deenish Island and Scariff Island	Breeding: > Fulmar.	963

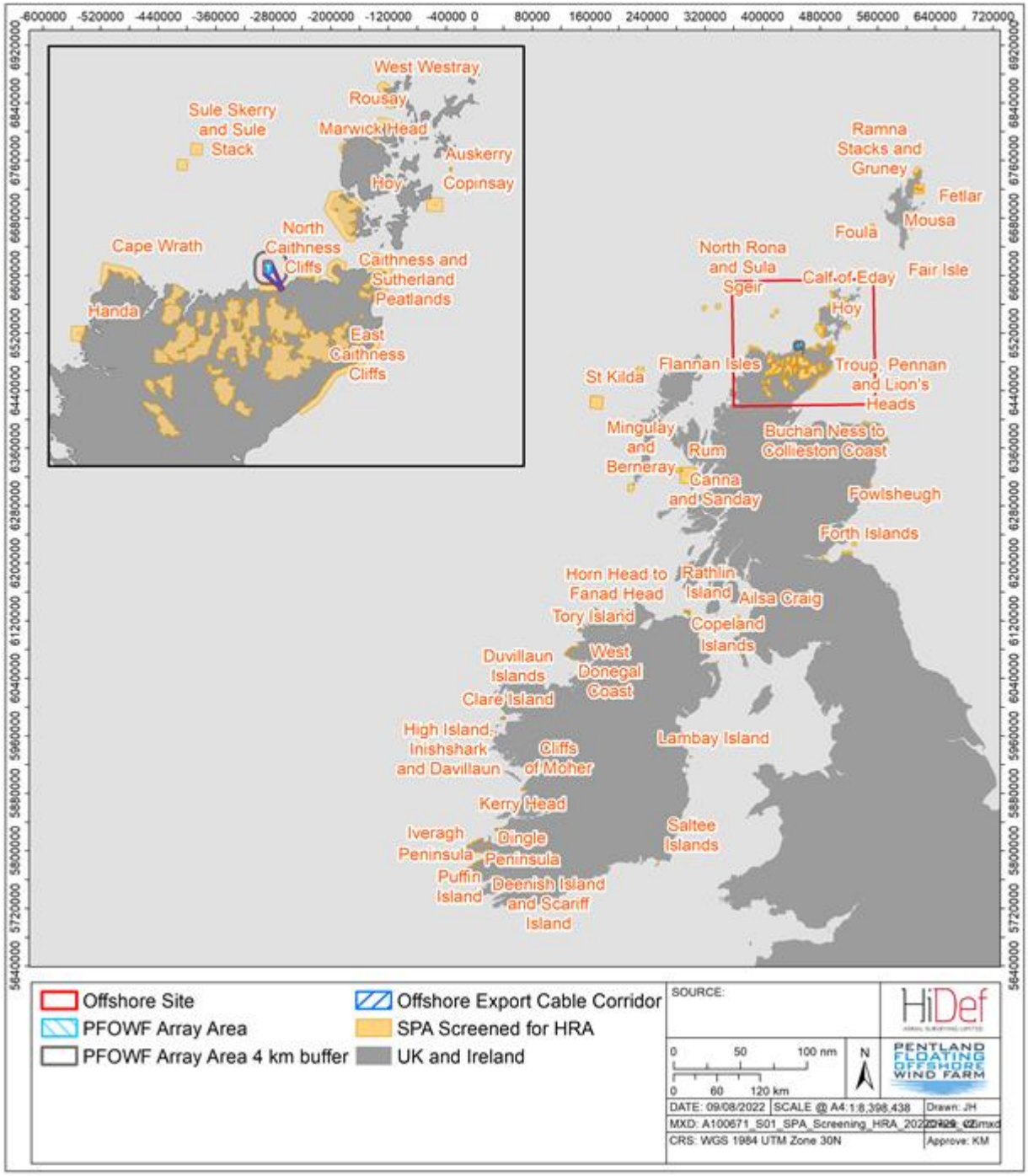


Figure 3.4 SPAs screened in for Ornithology Qualifying Interests

3.5 Potential Impacts Considered at Screening

Table 3.8 summarises the potential impact pathways that were identified during screening for each qualifying interest considered during the screening process, and agreed upon with stakeholders during consultation.

It should be noted that as the NCA Screening Report considered both European Sites and designated sites assessed under the Marine (Scotland) Act 2010, this table was also used for the identification of impact pathways in relation to qualifying interests of NCMPA's and SSSIs which are not covered under the HRA process. Instead impacts in relation to these sites and their qualifying interests are considered within the Offshore EIAR.

The impact pathways screened into the RIAA based on the qualifying interests of the European Sites screened into the receptor specific assessments are discussed further in each of the assessment sections within this report.

Whilst Table 3.8 below presents all the impact pathways that were considered during screening, some are not considered further in the RIAA due to there being no connectivity between the project activity and the specific qualifying interest(s) of the screened in European Site; justification for this is also provided in each of the receptor specific assessments within this RIAA, along with reference to specific feedback from consultees where applicable.

Table 3.8 High-level Overview of Potential Broad Pressures on Marine Qualifying Interests

Receptor	Impact	Project phase		
		Installation	Operation	Decommissioning
Fish and Shellfish Ecology	Disturbance or damage to sensitive species due to underwater noise generated from construction activities	Yes	No	Yes
	Direct habitat loss due to disturbance of spawning and nursery grounds during the installation of export cables and placement of anchors on seabed	Yes	No	Yes
	Effects of increased sedimentation / smothering on fish and shellfish during construction activities	No	No	No
	Habitat loss of spawning and nursery grounds due to presence of anchors and export cable on the seabed	No	Yes	No
	Effects of electromagnetic fields (EMFs) from subsea and dynamic cables on sensitive species	No	Yes	No
	Barrier effects on migratory fish from the presence of the floating platform and associated infrastructure	No	No	No
	Effects of operational noise on sensitive species	No	No	No

Receptor	Impact	Project phase		
		Installation	Operation	Decommissioning
	Fish and/or predator aggregation around the floating structure and associated infrastructure	No	Yes	No
	Ghost fishing due to lost fishing gear becoming entangled in installed infrastructure	No	Yes	No
Ornithology	Disturbance and/or displacement of seabirds due to vessel presence (including noise and lighting)	Yes	Yes	Yes
	Collision risk with turbine blades	No	Yes	No
	Disturbance and/or displacement of seabirds	Yes	Yes	Yes
	Barrier effect due to physical presence of WTGs	No	Yes	No
	Indirect effects on seabirds due to changes in distribution of prey items	Yes	Yes	Yes
	Accidental pollution events	Yes	Yes	Yes
	Entanglement with debris caught on mooring lines	No	Yes	No
	Impacts arising from the Offshore Export Cable(s) where it passes through the marine section of North Caithness Cliffs SPA	Yes	Yes	Yes
Marine Mammals and Other Megafauna	Injury and/or disturbance from underwater noise	Yes	Yes	Yes
	Indirect impacts of construction noise on the prey species of marine mammals	Yes	No	No
	Risk of injury resulting from entanglement of marine mammals or basking sharks with mooring lines or cables, including secondary interactions with derelict fishing gears, or entrapment with mooring systems *	No	Yes	No
	Risk of injury resulting from collision of marine mammals or basking sharks with WTG foundations and other subsea structures*	No	Yes	No

Receptor	Impact	Project phase		
		Installation	Operation	Decommissioning
	Displacement or barrier effects resulting from the physical presence of devices and infrastructure	No	Yes	No
	Collision risk with vessels	Yes	Yes	Yes
	Disturbance from vessels	Yes	Yes	Yes
	Impacts associated with effects upon marine water quality, particularly due to any disturbed sediments affecting turbidity	Yes	Yes	Yes
	Accidental pollution events	No	No	No
	Long term habitat change, including the potential for change in foraging opportunities	No	Yes	No
	Risk associated with EMFs associated with subsea and dynamic cables	No	No	No
* It should be noted that basking sharks are not considered within this RIAA as these are not a qualifying feature of any European Site.				

4 HRA CONSULTATION

4.1 Consultation and HRA Screening

As part of stage one of the HRA process, consultation with key stakeholders was undertaken by HWL. A NCA Screening Report (HWL, 2022) was submitted to Marine Scotland which outlined the details of the Offshore Development and an assessment of whether, in view of best scientific knowledge, there is potential for the Offshore Development, individually or in combination with another plan or project, to have a LSE on a European site. Where LSE could not be excluded, these have been carried forward for assessment in this RIAA. A Screening Opinion was received from Marine Scotland in June 2022 and responses are presented in this RIAA. These comments, together with HWL responses have been summarised in Table 4.1.

HWL will maintain communication with key statutory and non-statutory stakeholders throughout the HRA process to capture and address comments regarding the Offshore Development.

Table 4.1 Consultee Responses to Pentland Floating offshore Wind Farm NCA Screening Report

Consultee	Topic	Consultee Comment	Response
Migratory Fish			
MS-LOT on behalf of Scottish Ministers	Diadromous fish	*With respect to the qualifying features to be considered, we advise that the Special Areas of Conservation ("SACs") with Atlantic salmon listed as a qualifying interest included in tables 4.5 and 4.7 of the NCA Screening Report are correct. However, we also highlight to the Developer the MSS advice that a further four SACs should be screened in: Berriedale and Langwell Waters, Langavat, Endrick Water and North Harris. We also advise the SACs with fresh water pearl mussels must be screened in, per the NatureScot representation and MSS advice. SACs designated for sea and river lamprey can be screened out for the lamprey qualifying interest.*	The SACs listed here have been screened into the assessment as detailed within . These have been assessed within Section 7. Freshwater pearl mussels have been screened in for indirect effects as detailed in Section 3.2.1 and Section 7.1.1.
		As regards potential impacts, "fish aggregation" around the floating structure and associated infrastructure should be expanded to "fish and/or predator aggregation", as supported by MSS advice.	Fish and/or predator aggregation around the floating structures and associated infrastructure has not been screened into the RIAA. The surfaces provided by the floating substructures, anchors and mooring lines will provide minimal surface area for colonisation, when compared with the larger area over which the substructures / infrastructure will be deployed. Hence, the artificial reef effect of the PFOWF Array Area is likely to be small and is unlikely to significantly increase the productivity of the area. As a result, fish production in the area is unlikely to increase significantly. As the effect will be very localised, it is unlikely to have a LSE on migratory fish such as Atlantic salmon, and so this impact pathway has been screened out and is not considered further in the RIAA. See Section 7.1.2 for further explanation. Nonetheless, this impact is considered within Offshore EIAR (Volume 2): Chapter 10: Fish and Shellfish.

Consultee	Topic	Consultee Comment	Response
District Salmon Fishery Board – Northern	General Project	*The NDSFB is reassured to note that the Scoping Report now includes consideration of the development's connectivity with salmon rivers in the Board's area and the potential for adverse effects on salmon (juveniles and adults) moving to and from these rivers to their ocean feeding grounds.*	Noted.
	General Project	*More generally, the proposed area of development straddles a major throughway for salmon originating from, or returning to, rivers across a much larger geographical area both to east and west. This is particularly the case due to the proposed development's proximity to the western edge of the Pentland Firth which is a notable pinch point on the salmon's migratory route. The Board is encouraged to note that the revised document now recognises that the potential effects of the proposed development on migratory salmonids, both juveniles and adults, extend far beyond the windfarm's immediate vicinity.*	All river SAC protected for Atlantic Salmon and freshwater pearl mussels in the north of Scotland have been screened into the assessment. See Section 7.
	In-combination Assessment	*The Board also notes that the revised document now scopes-in in-combination effects with marine developments of other kinds – extant or planned.*	In-combination project list for Annex II migratory species are list in Section 7.7.4.
		Section 5.2 gives a wide-ranging list of marine project types that will be assessed for in-combination effects with the proposed development. However, tidal turbines and wave energy devices are notably absent from the list. The Meygen site in the Inner Sound, and the planned tidal turbine arrays at Brims Ness, Ness of Duncansby and Brough Ness should be included. They are all located within the Pentland Firth pinch point. They are all located in relatively close proximity to the Pentland Offshore Floating Wind Farm site. The arrays are therefore obvious candidates for in-combination effects, and they should be assessed as such.	Only Projects within 50 km of the Offshore Site are considered to have the potential to result in in-combination effects for Annex II Migratory Fish species. Although the maximum mean disturbance range for underwear noise to Atlantic Salmon (and other migratory species) may only extend to 19 km, a precautionary 50 km ZoI was agreed upon with consultees prior to the underwater noise modelling results (see Offshore EIAR (Volume 3): Appendix 10.1: Pentland Floating Offshore Wind Farm (PFOWF): Underwater noise modelling Environmental Report, for further information). Whilst the MeyGen project is within the 50 km ZoI, in-combination assessment of future construction phases have not been considered within the underwater

Consultee	Topic	Consultee Comment	Response
			noise assessment, and consequently is not included in this RIAA.[7] The list of projects screened into the in-combination assessment does not include operational projects as these form part of the baseline, with the exception of dredging projects. As the sites are already constructed no in-combination underwater noise effects from impact piling need to be considered (they also lie outside the 19 km potential impact radius identified), with regards to EMF effects on migratory species, the sites are too far away to have in-combination EMF effects on migratory species. The projects mentioned within this comment (Brims Ness, Ness of Duncansby and Brough Ness) fall outwith the in-combination scope. In addition, these projects are historic (the seabed leases were awarded in approximately 2010). The companies are no longer in existence and there are no future plans for the projects to be built out. Therefore, these projects have not been considered within the in-combination assessment.

[7] The MeyGen tidal project has currently four 1.5 MW turbines deployed, as well as a subsea hub for the existing turbines which was installed in 2020. In 2017, MeyGen Limited were granted permission to deploy a further four turbines (Phase 1b) however no construction activity for this phase has taken place to date, and there is very limited publicly available information on their construction timelines for this phase. The project has restrictions on the consent for phased development (under the deploy and monitor approach) and cannot proceed to subsequent phases without application and further consultation. On 7th July 2022, MeyGen Limited was successful in the Contracts for Difference (CfD) Allocation Round 4, for Phase 1c (28MW). Whilst the results announcement Department for Business, Energy and Industrial Strategy indicates that MeyGen aim to install this phase in 2026/27, a new separate application will need to be made to Marine Scotland for this phase under their phased consent condition. As the CfD announcement was made <1 month prior to submission of the application for the Offshore Development (i.e. beyond the 6 month cut-off agreed upon with MS-LOT), and there is no further information available on MeyGen's plans or construction timelines for any of these works, only the existing operational project has been considered in the cumulative assessment for PFOWF.

Consultee	Topic	Consultee Comment	Response
	Barrier Effects	*Item 5 under Fish and Shellfish Ecology considers the barrier effects on migratory fish from the presence of the floating platform and the associated infrastructure, suggesting that there will be no effects in any of the installation, operation or decommissioning phases. This position is not tenable and should be updated to consider the visual impact of moving turbine blades and the related, but separate, effect of turbine flicker, on epipelagic fishes such as salmon during the operational phase of development. The arguments proposed in the Tormsdale Windfarm (currently being considered by the SG Energy Consents Unit) should be taken onboard and the associated risks should be assessed.*	Barrier effects on migratory fish from the presence of the floating platform and the associated infrastructure has not been screened into the RIAA. Barrier effects will be very localised. If Atlantic salmon do avoid the Offshore Development, there will be minimal changes to their migration route. This impact was screened out following advice from MSS and so is not considered further in the RIAA or EIA. See Section 7.1.2 for further information.
District Salmon Fishery Board – Caithness	General Project	*The Caithness District Salmon Fishery Board notes the recent response of the neighbouring Northern District Salmon Fishery Board and Fully endorses their comments*	Noted. Responses to NDSFB are provided above.
Marine Scotland Science	Marine fish ecology	*For marine fish ecology, the NCA Screening Report identified the North-West Orkney Nature Conservation Marine Protected Area (NCMPA), designated for sandeels, as requiring further assessment as it is located less than 35 km from the offshore development. MSS note that the developer has correctly identified potential impacts to sandeel, however we agree with NS where they advise that the proposed development is not capable of affecting sandeels as the protected feature of the North-West Orkney NCMPA.*	Noted. The North-West Orkney NCMPA has not been included within this assessment as it is not a European Site considered under HRA. This site is also not included within the assessment presented within Offshore EIAR (Volume 2): Chapter 10: Fish and Shellfish, due to the lack of connectivity to the Offshore Development.
	Diadromous fish	*MSS agree with the developer and with NS that SACs designated for sea and river lamprey can be screened out for the lamprey Qualifying Interest.*	Noted. Sea and river lamprey have been screened out of the assessment as detailed within Section 3.2.2.

Consultee	Topic	Consultee Comment	Response
		There is an error in Table 4.1: "SACs with Atlantic salmon and sandeels (which prey on salmonids)", should read "SACs with Atlantic salmon and sandeels (which are prey for salmonids)"	Noted and amended in Table 3.2 of this report.
		There are 4 SACs for which salmon are listed as a Qualifying Interest missing from Table 4.5 and Table 4.7: these are Berriedale and Langwell Waters, Langavat, Endrick Water and North Harris.	The SACs listed here have been screened into the assessment as detailed within . These have been assessed within Section 7.
		MSS agree with NatureScot's advice that SACs with fresh water pearl mussel as a Qualifying Interest should be screened in.	Noted. Freshwater pearl mussels have been screened in for indirect effects as detailed in Section 3.2.1 and Section 7.1.1.
		In Table 4.6, "Fish aggregation around the floating structure and associated infrastructure" is correctly included as a potential impact. MSS suggest this should be expanded to "Fish and / or predator aggregation around the floating structure and associated infrastructure".	Fish and/or predator aggregation around the floating structures and associated infrastructure has not been screened into the RIAA. See Section 7.1.2 for further explanation.
		The Northern District Salmon Fishery Board (DSFB) response refers to the potential for visual effects from an array of wind turbines with rotating blades (direct visual impact of moving turbine blades and the related shadow flicker cast by moving blades) to be a spatial barrier to the migration of salmon. Fisheries Management Scotland (FMS) do not specifically mention visual effects in their response, but say that they are disappointed that possible barrier effects have not been scoped in. *The topic of shadow flicker insofar as it applies in fresh waters has recently been reviewed by Dodd and Briers (2021). Most of what they say is also likely to apply to the potential for direct visual impact. Dodd and Briers (2021) concluded that, 'While there is some information available about the response of Atlantic salmon to changes in light intensity (e.g. responses to strobe light or artificial light at night), there is no published information about*	Barrier effects on migratory fish from the presence of the floating platform and the associated infrastructure has not been screened into the RIAA. Barrier effects will be very localised. If Atlantic salmon do avoid the Offshore Development, there will be minimal changes to their migration route. In addition, this impact was screened out following advice from MSS and so is not considered further in the RIAA or EIA. See Section 7.1.2 for further information.

Consultee	Topic	Consultee Comment	Response
		the responses (biological or behavioural) of Atlantic salmon, or any fish species, to artificial light patterns of the characteristics associated with shadow flicker'; and that, 'shadow flicker is unlikely to result in a change at the population level'. They also recommended further research into the effects of shadow flicker/changes in light pattern/intensity on Atlantic salmon. *MSS would largely accept these conclusions as also applying to the salmon life-stages in the marine context and endorse that information from further research would also be useful in a marine context.* *However, based on present information, MSS would not consider it to be a high priority need for marine renewables assessments, and the MSS position remains that barrier effects do not require assessment in the EIA Report for Pentland Floating Offshore Wind Farm.*	
	In-combination Assessment	*MSS agree with the approach to in-combination assessment*	Noted.
	Consultation	*MSS understand that there are responses from the Northern and Caithness DSFBs which we may be asked to comment on.*	Noted.
NatureScot	Diadromous fish	*The NCA screening report states that the rivers and river mouths designated for sea and river lamprey do not overlap with the PFOWF and are therefore screened out due to no connectivity. Although there is very limited information on the distribution and behaviour of river and sea lamprey in marine waters, it is possible that migration routes for both species may overlap with the proposed development. However, considering the distance to the nearest SAC (107 km), it is unlikely that the proposal will have a significant effect and we agree they are screened out.*	Noted. Sea and river lamprey have been screened out of the assessment as detailed within Section 3.2.2.

Consultee	Topic	Consultee Comment	Response
	In-direct Impacts	*Atlantic salmon are a host species for freshwater pearl mussel (FWPM) during a critical parasitic phase of the mussels lifecycle, and so there is a need to consider indirect impacts upon this species to ensure population is not adversely affected. Therefore, we advise that SACs with FWPM as a qualifying feature are screened in. We agree with the Atlantic salmon SACs that are screened in.*	Noted. Freshwater pearl mussels have been screened in for indirect effects as detailed in Section 3.2.1 and Section 7.1.1.
Marine Mammals			
MS-LOT on behalf of Scottish Ministers	Species Identification	*With regards to the list of marine mammal species considered in Table 4.3, we are content with those included with the exception of the white-beaked dolphin. This does not require consideration as there are no protected sites for this species in Scottish waters, per MSS advice. For the avoidance of doubt, common dolphin can be similarly screened out. We note that Table 4.3 uses numbers for bottlenose dolphin which are out of date. We refer the Developer to estimates provided in NatureScot's response in Appendix 1.*	This comment has been noted and aligns with the marine mammals considered in the assessment of Annex II marine mammal species in Section 8 below. Bottlenose dolphin management unit sizes have been updated to reflect the most recent data, as recommended.
	SACs Identified for Assessment	*As regards designated sites to be taken forward for assessment in Table 4.4, we advise that only SACs with seal qualifying interests within the Orkney & North Coast Management Unit are screened in, in line with MSS advice and the NatureScot representation.*	This comment has been noted and the RIAA aligns with the suggested method for screening of pinniped SACs.
	Impacts Assessed	*We largely agree with the impact pathways in Table 4.6 of the NCA Screening Report but consider that effects on water quality (e.g. turbidity) can be screened out in line with MSS advice. We note that all North Sea SACs designated for harbour porpoises are included in the NCA Screening Report and advise that impact pathways and distance are used to focus on the qualifying features and SACs which are likely to experience significant effects, as supported by the NatureScot representation and MSS advice.*	All sites have been screened in for the relevant Marine Mammal MUs in the first instance. However, the assessment of LSE has taken a step-wise approach to the identification of relevant SACs based on whether a potential impact pathway between the qualifying features/interests of the site and the Offshore Development exists. This considers distance between the planned activities and the protected site, as advised.

Consultee	Topic	Consultee Comment	Response
	NC MPAs	*As regards potential impacts on nature conservation Marine Protected Areas ("NC MPAs"), we advise that only those which affect features within the boundary of the site need to be considered, per the NatureScot representation. As such, North-west Orkney NC MPA (for sandeel), Southern Trench NC MPA (for minke whale), North-east Lewis NC MPA (for Risso's dolphin) and the Sea of the Hebrides NC MPA (for basking shark and minke whale) can be screened out of the NCA.*	This comment has been noted. Impacts to these NCMPAs are covered in the Offshore EIAR (Volume 2): Chapter 11: Marine Mammals and other Megafauna, which aligns with the conclusion of no impacts on NCMPAs with marine mammal features/interests, based on the definition of connectivity (direct overlap) provided.
	In Combination Assessment	*We advise that all operational and consented developments (including tidal and wave energy projects such as MeyGen and EMEC's Fall of Warness and Billia Croo sites) with impacts on the same protected sites as the Pentland Floating Offshore project should be screened in to the in-combination assessment. This view takes into consideration the NatureScot, RSPB and Northern DSFB representations. Cut off dates for the cumulative assessment have been previously agreed between Marine Scotland – Licensing Operations Team and Highland Wind Limited via email correspondence on 06 December 2021.*	Tidal stream and wave energy developments, including those mentioned, have been included in the in-combination assessment for Marine Mammals, per the in-combination project information provided in Section 8.1.1 of this RIAA.
Marine Scotland Science	SACs Identified for Assessment	*MSS agree with the list of marine mammal species to be considered (as presented in Table 4.3) with the exception of white-beaked dolphin, as there are no protected sites for this species. MSS note NatureScot's (NS) advice that common dolphin should also be considered, though as with white-beaked dolphin there are no protected sites for this species in Scottish waters.*	This comment has been noted and aligns with the marine mammals considered in the assessment of Annex II marine mammal species in Section 8 of this RIAA.
		MSS are content with the exclusion of all seal SACs except the three sites within the Orkney and North Coast seal management area, as advised by NS.	There are only two SACs designated for the protection of seals within the boundaries of the North Coast and Orkney (NCO) Seal Management Unit (SMU): Sanday SAC and Faray and Holm of Faray SAC. The North Rona SAC, which we believe to be the third site mentioned here, falls within the boundaries of the Western Isles Management Unit. whilst this site is a similar distance to the Offshore Site as the

Consultee	Topic	Consultee Comment	Response
			Sanday SAC, an examination of telemetry data and estimated at-sea distribution of animals hauling-out at North Rona SAC (see Section 8.4.2) indicates very limited connectivity with the Offshore Development and its impact footprint. Due to this lack of connectivity and its location within a seal MU which is not considered spatially relevant to the Offshore Site, an appropriate assessment of the North Rona SAC is not included.
		MSS are content with the approach to screening in designated sites for harbour porpoise, recommended by NS. Some SACs have been screened in for further assessment that are over 1000 km away from the project site, and MSS support the focussing of this list to include only sites where there is potential connectivity, based on distance and impact pathway.	All sites have been screened in for the relevant Marine Mammal MUs in the first instance. However, the assessment of LSE within this RIAA has taken a step-wise approach to the identification of relevant SACs based on whether a potential impact pathway between the qualifying features/interests of the site and the Offshore Development exists, and which considers distance between the planned activities and the protected site.
	Impacts Assessed	*MSS broadly agree with the list of impact pathways presented in Table 4.6, however we consider that effects on water quality (i.e. turbidity) can be excluded, as this impact is primarily to the prey species of marine mammals, which is covered under its own impact pathway.*	The assessment of LSE no longer screens in turbidity or water quality as a relevant impact pathway for marine mammals as qualifying features/interests of any protected sites. Rather, indirect impacts to marine mammals via changes in prey distributions resulting from changes to water quality have been covered instead in Section 8 of the RIAA.
NatureScot	Species Identification	*We advise that common dolphin are included in the list of marine mammal species requiring further consideration in the NCA screening report (see section 4.5.2). This species is recorded in the baseline surveys and regularly recorded on the west coast of Orkney.* *From follow up NCA Screening Report consultation received 26th April 2022:*	In reference to the follow up consultation received 26th April 2022: This comment has been noted and aligns with the marine mammals considered in the assessment of Annex II marine mammal species in Section 8 of the RIAA.

Consultee	Topic	Consultee Comment	Response
		We are happy for common dolphin, and white-beaked dolphin which are also included in the list in section 4.4.2 of the NCA screening report, to be screened out.	
	Management Units	*Note in table 4.3, which refers to management units, that the numbers for bottlenose dolphin are out of date (the correct population estimate for the east coast management unit is 224 bottlenose dolphins, please see https://www.nature.scot/doc/east-coast-scotland-bottlenose-dolphins-estimate-population-size-2015-2019*	The amended management units have been incorporated into the assessment of LSE against the bottlenose dolphin population affiliated with the Coastal East Scotland Management Unit, which overlaps the Moray Firth SAC
	SACs identified for Assessment	*In table 4.4, the maximum recorded distances for seals have been used as a screening buffer. Based on telemetry data, we generally advise a screening buffer of 50 km for harbour seals and 20 km for grey seals. However, for this proposal, we advise that all seal SACs within the Orkney & north coast management unit are screened in, as there is evidence that harbour seals are foraging further away from haul outs. Therefore, Faray and Holm of Faray SAC, Sanday SAC and North Rona SAC should be screened in. Other seals SACs can be screened out.*	There are only two SACs designated for the protection of seals within the boundaries of the NCO SMU: Sanday SAC and Faray and Holm of Faray SAC. The North Rona SAC falls within the boundaries of the Western Isles Management Unit. Whilst this site is a similar distance to the Offshore Site as the Sanday SAC, an examination of telemetry data and estimated at-sea distribution of animals hauling-out at North Rona SAC (see Section 8.4.2) indicates very limited connectivity with the Offshore Site and its impact footprint. Due to this lack of connectivity and its location within an SMU which is not considered spatially relevant to the Offshore Development, we have not included an appropriate assessment of the North Rona SAC.
		Please be aware that the conservation objectives for the seal SACs are currently being revised in line with a programme for all European sites to have their conservation objectives updated.	This comment has been noted and will be addressed as further information is made available.

Consultee	Topic	Consultee Comment	Response
		We are unable to advise when these maybe published but will keep you updated as far as we can.	
		For harbour porpoise, all of the North Sea SACs are included in the NCA screening report. Due to problems identifying a population or individuals using these SACs, it will be difficult to prove connectivity or percentage of animals likely to be affected. We recommend that impact pathways (e.g. underwater noise), as well as distance, are used to focus on the qualifying features and SACs with a likely significant effect. The list in table 4.7 with 'further assessment required' identified, could be narrowed down to focus on qualifying features and SACs which have connectivity and there is an impact pathway.	All sites have been screened in for the relevant Marine Mammal MUs in the first instance. However, the assessment of LSE has taken a step-wise approach to the identification of relevant SACs based on whether a potential impact pathway between the qualifying features/interests of the site and the Offshore Development exists, and which considers distance between the planned activities and the protected site, as advised.
NatureScot	NC MPAs	*For NC MPAs, only potential impacts that affect interests within the boundary of the site need to be considered. Due to the large distances between the proposal and NC MPAs, and consideration of the potential impact pathways, we advise that proposed development is not capable of affecting the protected features on the following sites: North-west Orkney NC MPA (sandeel), Southern Trench NC MPA (minke whale), North-east Lewis NC MPA (Risso's dolphin) and the Sea of the Hebrides NC MPA (basking shark and minke whale).*	This comment has been noted. Impacts to these NCMPAs are covered in the EIA, which aligns with the conclusion of no impacts on NCMPAs with marine mammal features/interests, based on the definition of connectivity (direct overlap) provided.
	In-combination Assessment	*We agree with the approach to in-combination assessment. The assessment should also include other marine renewable projects such as tidal developments (e.g. MeyGen, EMEC (Fall of Warness) and wave (EMEC Billia Croo).*	Tidal stream and wave energy developments, including those mentioned, have been included in the in-combination assessment for Marine Mammals, per the in-combination project information provided in Section 8.1.1 of this RIAA.
Royal Society for the Protection	Species Identification	*Section 4.5.2 Sites Designated for Marine Mammal and Other Megafauna Features should include orca as they are regularly observed off the coast in this area*	Whilst orca are observed off the coast of Orkney and within the Moray Firth, often on a seasonal basis, this species is not an Annex II species in the Habitats Directive and there are no sites designated for the protection of Orca in the UK or internationally within European waters of the North-east

Consultee	Topic	Consultee Comment	Response
of Birds (RSPB)			Atlantic or North Sea; this species is therefore not considered within this RIAA.
Ornithology			
MS-LOT on behalf of Scottish Ministers	Collision Risk Modelling	*We agree with the use of a qualitative narrative in assessing migratory collision risk due to the MS commissioned project assessing migratory collision risks not yet being published, as set out in the NatureScot representation and MSS advice.*	Migratory collision risk (wildfowl and waders) is addressed in Section 9.6.4 of this RIAA.
	Impact Pathways	*As regards impact pathways, we request that the Developer screen in the potential pathway of entanglement in secondary interactions diving birds may have with discarded fishing gear, as supported by MSS advice.*	Potential for entanglement with debris caught on mooring lines is addressed in Section 9.6.8 of this RIAA.
	HRA screening	*The approach of using apportioning to assess likely significant effects at screening stage is not acceptable. We support the approach recommended by NatureScot advice provided by NatureScot and MSS to define the 'long-list' of Special Protected Areas ("SPAs") and features that have connectivity which can then be revised by consideration of 'at-sea' distances as a biological sense-check for species that are known to fly around land. The MSS apportioning tool should be used where applicable.*	All the required SPA long lists following NS advice on determining connectivity (as above) were presented in the NCA Screening Report (HWL, 2022), submitted for consultation on 2 February 2022. As stated in the report, these SPA long lists had been biologically 'sense-checked' prior to submission and were determined based on 'at sea' distances. In the Screening Opinion (MS-LOT, 2022b) received on 17 June 2022, no advice was provided by either MSS or NS on how to screen for LSE (if they did not accept the use of apportioning weightings) therefore the RIAA is based on the original SPA long lists. The MS Apportioning Tool (Wakefield option) has been used for kittiwake, guillemot and razorbill as requested
	Connectivity and Apportioning	*When undertaking apportioning, the most up-to-date data available on the Seabird Monitoring Database highlighted by RSPB and MSS should be included if relevant to the species and sites being examined. We also advise that the Caithness and*	Latest figures were obtained from the SMP database and a spreadsheet of these counts was provided to MSS, NS and RSPB on 7 October 2021.

Consultee	Topic	Consultee Comment	Response
		Sutherland Peatlands SPA for red-throated diver detailed by RSPB should be included in the HRA.	Red-throated diver as a qualifying interest of Caithness and Sutherland Peatlands SPA are addressed in Section 9.12.2.1 of this RIAA.
		With respect to the qualifying features to be considered in Table 4.7, impacts to storm petrels and shearwaters should be assessed qualitatively within the HRA, including a discussion of these species biology and ecology in relation to detection and impact pathways, as outlined in the RSPB representation and MSS advice. We also draw your attention to the incorrect listing of several species as SPA qualifying features in Table 4.7 – these species should be considered in apportioning as non-SPAs per the NatureScot representation and MSS advice.	Impacts on nocturnally active species including shearwaters and petrels are addressed Section 9.6.4 of this RIAA. Noted, on the SPA listings.
		With regards to wader and wildfowl species (and other migratory species/taxa) such as red-throated divers, these should be considered in a migration assessment alone and in combination in line with the RSPB representation and MSS advice.	Consideration of collision risk to migratory species (wildfowl and wader species, including red-throated diver) is given in Section 9.6.4 of this RIAA. This considers potential collision risk arising from the Offshore Development alone and in combination with other offshore wind farms, making reference to available literature (Wright et al., 2012 and WWT, 2014).
	Migratory Species Assessment	*We agree with the use of a qualitative narrative in assessing migratory collision risk due to the MS commissioned project assessing migratory collision risks not yet being published, as set out in the NatureScot representation and MSS advice.*	SPA/Ramsar wildfowl and wader species addressed collectively and qualitatively in Section 9.6.4 of this RIAA.
Marine Scotland Science	Migratory Species Assessment	*MSS note that it is unlikely the MS-commissioned strategic assessment of migratory species will be available to inform on this application and as such MSS support NS's conclusions of a qualitative assessment, highlighting the previous report (20141) as guidance.*	Noted.

Consultee	Topic	Consultee Comment	Response
	Impact Pathways	With respect to impact pathways, *MSS seek to highlight the potential pathway of entanglement in secondary interactions with discarded fishing gear to diving birds for consideration in assessment.*	Noted. Potential for entanglement with debris caught on mooring lines is addressed in Section 9.6.8 of this RIAA.
	Connectivity and Apportioning	*MSS, together with NatureScot, support the application of the Likely Significant Effect (LSE) test to be undertaken in advance of apportioning approaches. NatureScot articulate the main reasons for this in their response. MSS support the revision of the long-list by at-sea distances, where appropriate*	Noted. The SPA long lists provided in the NCA Screening Report (HWL, 2022) were based on 'at sea' distances. The RIAA is now based the original long lists as no advice from MSS was received on how to screen for LSE.
		RSPB provide further comment on apportioning methodology and together with RSPB, MSS support the use of the MSS apportioning tool, where applicable. However, please note an email was received from Catriona Gall of HiDef on the 2 March 2022, regarding outstanding questions on approaches for assessment methodology. This email was circulated to individuals from LOT, RSPB, NS and MSS. The apportioning approach was documented as an outstanding issue (amongst other headings/ queries). A response to this email, following consultation with NatureScot was sought in a request on the 18 March 2022. MSS therefore do not comment here on further specifics of the apportioning raised by RSPB in this response, but provide comment in the 18 March request response here: 2022-18-03- Pentland Floating Offshore Wind Farm – Follow up queries from HiDef – REEA Response Letter to MS-LOT details – Objective ECM (scotland.gov.uk)	The MS apportioning tool (Wakefield option) has been used for kittiwake, guillemot and razorbill as advised, and the NS (2018) guidance for all other species
	SPA Identification	*MSS, with NS, also note the errors in Table 4.7 regarding species not named as SPA features. MSS agree with RSPB comments that, where available, updated counts for seabirds, available on the Seabird Monitoring Database should be used. RSPB highlight that an SPA for red-throated diver, 'Caithness and Sutherland peatlands SPA' has not been included in the long list but does have connectivity to the proposed cable corridor*	Noted. Red-throated diver from Caithness and Sutherland Peatlands SPA are considered in Section 9.12.2.1 of this RIAA.. Latest counts were obtained from the SMP database as advised at scoping and noted in the Offshore EIAR (Volume 3) Technical Appendix 12.6: Consultation Advice. A

Consultee	Topic	Consultee Comment	Response
			spreadsheet of these counts was provided to MSS, NS and RSPB Scotland on 7 October 2021. In this regard, note that the MS Apportioning Tool (Wakefield option), references Seabird 2000
	SPA Features / Interests – Petrels and shearwaters	*MSS agree with RSPB that impacts to storm petrels and shearwaters should be considered qualitatively within the assessment, including discussion of their biology and ecology, for example as it may relate to detection and impact pathways.*	Baseline characterisation for these species is presented in Section 12.4.4.12 of the EIAR Chapter with potential impacts are assessed in Section 9.6.3 of this RIAA.
	HRA Screening Opinion	*With respect to the first query: 'In MSS' response from 01 April 2022, it is noted that "RSPB highlight that an SPA for red-throated diver, 'Caithness and Sutherland peatlands SPA' has not been included in the long list but does have connectivity to the proposed cable corridor". For the avoidance of doubt, could MSS please confirm whether or not it believes this should be addressed in the HRA Screening Opinion, per RSPB's request?'* *MSS confirm that this should be addressed in the HRA screening opinion.*	Red-throated diver as a qualifying interest of Caithness and Sutherland Peatlands SPA' are addressed in Section 9.12.2.1 of this RIAA.
	Collision Risk Modelling	*With respect to the second request: 'RSPB have also noted that, in its opinion, both in-combination and individual assessments should be carried out for wader and wildfowl species such as red-throated divers due to nearby terrestrial SPAs. Does MSS concur with this?'* *MSS consider that it is appropriate for species such as red-throated diver to be assessed both alone and in-combination. Waders and wildfowl (and other migratory species/taxa) should be considered in a migration assessment alone and in-combination. Red-throated divers breed terrestrially but forage offshore in the breeding season and overwinter coastally (although their distribution can change from breeding season). The Caithness and Sutherland Peatlands SPA, with designated red-throated diver*	MSS provided their advice on consideration of collision risk to migratory species (wildfowl and waders) in the Scoping Opinion, as further discussed at the meeting held on 16 December 2021. This matter is addressed in Section 12.6.2.1.9 of the EIAR Chapter and in Section 9.6.4 of this RIAA This considers potential collision risk arising from the Offshore Development alone and in-combination with other offshore wind farms, referring to available literature (Wright et al., 2012 and WWT, 2014). Impacts on red-throated diver as a qualifying interest of Caithness and Sutherland Peatlands SPA' are addressed in Section 9.12.2.1 of this RIAA.

Consultee	Topic	Consultee Comment	Response
		breeding population, has foraging distance connectivity with the proposed project, therefore it should be assessed alone and in-combination.	
	Advice on Further Assessment	*Advice on further assessment of terrestrial SPA species that could have connectivity with the project below Mean High Water Springs should be consulted upon with statutory nature conservation colleagues from NatureScot.*	Noted. NatureScot have been consulted.
NatureScot	Migratory Collision Risk	*We are aware that the MS commissioned project for migratory collision risk has not yet been completed. We therefore agree with using a qualitative narrative for this part of the assessment.*	Noted. Migratory collision risk (wildfowl and waders) is addressed in Section 12.6.2.1.9 of the EIAR Chapter and in Section 9.6.4 of this RIAA.
	LSE Assessment Methodology	*We have raised concerns with the approach adopted in the NCA screening report for screening ornithological features, which we have previously raised (meeting on the 16th December 2021). Our main concern is the introduction of apportioning as part of screening for LSE. We consider this introduces an assessment of magnitude to this test. The purpose of screening is to identify those European sites for which an Appropriate Assessment is required. The HRA process requires that this comprises those sites and features where an LSE is expected to arise from the project. The approach taken within Scotland and elsewhere in the UK is that this is a coarse filter; LSE will be assumed to arise where there is the potential presence of an impact pathway. The screening process, therefore, examines potential connectivity between the activities assumed to occur through the development and the qualifying features of European site(s). We acknowledge this approach to screening is highly precautionary as no judgement is made about the likely magnitude of any impact arising from the project, just that a pathway for an impact to occur is assumed to exist. However, this is being applied UK-wide and follows European case law. The extent to which that connectivity will lead to an adverse effect on each site is then considered in more detail*	Noted. All the required SPA long lists were presented in the NCA Screening Report (HWL, 2022) following the NS advice on determining connectivity (as above). As stated in the report, these SPA long lists were biologically 'sense-checked' prior to submission and were determined based on 'at sea' distances. In the Screening Opinion (MS-LOT, 2022b) no advice was provided by either MSS or NS on how to screen for LSE (if they did not accept the use of apportioning weightings) therefore the RIAA is based on the original SPA long lists.

Consultee	Topic	Consultee Comment	Response
		at a later stage of the HRA process. Our recommended approach to screening is that of defining the 'long-list' of SPAs and features that have connectivity (as defined by mean-max foraging range plus on standard deviation presented in Woodward et al. 2019; with exceptions for gannet, razorbill and guillemot). This long list can be revised by consideration of 'at-sea' distances as a biological sense-check for species that are known to fly around land.	
		Consistency in screening and provision of the long list is an important part of providing transparency in the assessment process. As we move forward with ScotWind this is increasingly important.	As above.
	Connectivity and Apportioning	*We also noticed that in the apportioning approach used there were several species that were incorrectly listed as SPA qualifying features but would need to be considered in apportioning as non-SPAs (e.g. puffin at East Caithness Cliffs and gannet at Troup Head).*	Noted. Gannet were identified in Table 4.7 as an SSSI interest rather than an SPA qualifier. They had been included for apportioning based on advice previously provided by NS for other wind farms.
Royal Society for the Protection of Birds (RSPB)	Connectivity and Apportioning	*We are content with the apportioning work undertaken, based on NatureScot guidance, for all species except guillemot, razorbill, shag, and kittiwake. This because a new tool is now available for these species. In our scoping response, we recommended that this tool is used, which builds on the NS guidance methods.* *We understand that an attempt was made to use the Marine Scotland apportioning tool, but it raised a number of queries which need to be resolved and this was recently discussed at a meeting between Marine Scotland, NatureScot, RSPB and HiDef on 22nd February 2022. Once these issues have been addressed, we would strongly recommend that this tool is used for guillemot, razorbill, shag and kittiwake*	The MS Apportioning Tool (Wakefield option) has been utilised for kittiwake, guillemot and razorbill apportioning (shag were not recorded on-site) Technical Appendix 12.2: Connectivity and Apportioning.

Consultee	Topic	Consultee Comment	Response
		We note that the Report states that "the 'most recent counts' obtained during the Seabirds Count census, 2015-2019" were used for apportioning. We welcome this but note that surveys for the census were completed in 2021, and 2020 and 2021 data is now available on the Seabird Monitoring Database. This data should be included if relevant to the species and sites being examined.	This is a typo from the JNCC website where the census title had not been updated at the time it was referred to for use in the report. 2020 and 2021 counts have been obtained where relevant from the SMP database.
		Tables for Arctic tern and red-throated diver are not presented in the SPA long-list nor the apportioning calculations "as there are no SPAs within respective foraging range for each species". We would like to highlight that the subsea cable of the development within the 9 km foraging range for red-throated diver from the Caithness and Sutherland Peatlands SPA. This should be addressed within the HRA.	There are no Arctic tern SPAs located within foraging range of the Offshore Development, so this species is screened out of HRA (as reported in the RIAA). Potential impacts on local colonies of Arctic tern (as identified by RSPB Scotland) are addressed in the EIAR Chapter. Impacts on red-throated diver as a qualifying interest of Caithness and Sutherland Peatlands SPA are assessed in Section 9.12.2.1 of this RIAA.
		Lastly, it would have been useful to include a column showing the number of birds from each SPA on the development site in the apportioning calculation tables as per the NS interim guidance note. We request this is included in subsequent documents as appropriate.	In terms of process, impacts have been apportioned for assessment rather than SPA numbers.
	Collision Risk Modelling	*We note that petrels and shearwaters did not make the long list of SPAs, "as they are either not within foraging range or not recorded in significant numbers during survey work". However we are concerned about collision risk to crepuscular and nocturnal Procellariiformes. There is strong evidence to suggest that storm petrels would be missed during aerial surveys due to this behaviour (Dr Aly McCluskie, pers. Comms.). The Offshore Wind Strategic Monitoring and Research Forum (OWSMRF) have also identified the potential risk to this species from collision with wind turbines due to lack of research.*	Noted. SPA petrel and shearwater species addressed collectively and qualitatively in Section 9.6.3.

		The proposed development site is within foraging range (within 330km as per Woodward et al 2019) of the nearest protected breeding colonies (Auskerry SPA and the Sule Skerry and Sule Stack SPA). However, the site also lies close to the coast. Although storm petrels will tend to avoid coastal areas during daylight, there is evidence of inshore foraging at night, and movement close to the coast at night in locations that are distant from colonies. Birds are regularly trapped in mist nets at night, far away from known breeding areas (Dr Mark Bolton, pers. Comms). Research also suggests that lights on structures may attract juveniles and displace adults. *Nocturnal migrants are known to be more susceptible to attraction to artificial light (e.g. lighthouses) during foggy conditions. Between July and Sept immature birds will prospect breeding colonies across the whole of west and north Scotland. Ringing data shows that individuals travel very widely on a nightly basis – birds may be caught in locations several hundreds of km apart on successive nights, in locations far from any colony.* *There is also unpublished evidence from the Mousa tracking work undertaken by Dr Mark Bolton that, during foggy conditions, birds become disorientated and are unable to follow a direct route to the colony from the offshore feeding areas. The tracks indicate that birds become disorientated, and when they reach a coastline, they follow the coast for tens of kilometres, to locate the colony (Mark Bolton, pers. Comms). Under these conditions, there is potential for breeding adults to occur close to the coast, away from their colony, and to be susceptible to light attraction to a wind farm.* *These individuals may be susceptible to collision with turbines at the site, especially if attracted to artificial light during foggy conditions.* *Therefore, contextual data should be presented to inform a qualitative assessment of the potential impacts on these species. The HRA document should acknowledge this.*	Impacts on nocturnally active species including shearwaters and petrels are addressed in Section 12.6.2.1.10 of the EIAR Chapter. SPA petrel and shearwater species are addressed collectively and qualitatively in Section 9.6.3 of this RIAA.

Consultee	Topic	Consultee Comment	Response
	Cumulative Assessment	*The cumulative impact assessment needs to consider all operational and consented developments (including tidal and wave energy projects) with impacts on the same SPAs as the Pentland Floating Offshore project and a quantitative assessment produced. In addition, sites within the planning system and Scotwind will need to be taken into account and require qualitative analysis.*	Assessment of cumulative / in-combination impacts is presented in Section 12.7 of the EIAR Chapter and in Section 9.9 and Sections 9.10 to 9.43 of this RIAA. Table 12.27 of the EIAR presents the development long list including ScotWind projects.
		In addition, we note that wader and wildfowl species such as red-throated divers will receive a qualitative in-isolation assessment. We believe this should be both an individual and an in-combination assessment. The species are associated with nearby terrestrial SPAs (such as the Caithness and Sutherland Peatlands SPA) and were encountered by surveys during the breeding season as they are known to forage at sea whilst breeding. Onshore wind farm developments have the potential to cause cumulative collision and/or displacement and their effects should be considered.	Red-throated diver were recorded during the digital aerial surveys but only in minimal numbers (Technical Appendix 12.1: Baseline Data). SPA / Ramsar wildfowl and wader species are addressed collectively and qualitatively in Section 9.6.4 of this RIAA. They are also addressed within the EIAR Chapter.
	Terrestrial Birds	*We welcome the intention to undertake a qualitative assessment of potential risk to wildfowl and waders on migration. However, the HRA Report states that a screening exercise for wildfowl and wader SPAs will not be undertaken as "the matter cannot be dealt with at an individual project level, or by individual SPA." It is unclear why this is the case. For example, the Caithness Lochs SPA, located to the south of the proposed development is designated for its wintering populations of Greenland white-fronted geese, whooper swan and greylag goose. Since there are no other Greenland white-fronted goose populations in the north of Scotland, any individuals or flocks of this species overflying the site on migration will very likely belong to this SPA population.*	SPA / Ramsar wildfowl and wader species addressed collectively and qualitatively in Section 11.26.4. This approach was agreed between all parties (MSS, NatureScot and RSPB Scotland) at the meeting on 16th December 2021, prior to submission of the HRA screening report (Technical Appendix 12.6: Consultation Advice.

Consultee	Topic	Consultee Comment	Response
Other Screening Comments			
Marine Scotland Science	Benthic Ecology	*MSS have no further comments to add but are supportive of those submitted by NS.*	Noted. No comments on benthic ecology were received by NatureScot.
NatureScot	NCMPA Identification EIA	*For NC MPAs, only potential impacts that affect features within the boundary of the site need to be considered. Due to the large distances between the proposal and NC MPAs, and consideration of the potential impact pathways, we advise that proposed development is not capable of affecting the protected features on the following sites: North-west Orkney NC MPA (sandeel), Southern Trench NC MPA (minke whale), North-east Lewis NC MPA (Risso's dolphin) and the Sea of the Hebrides NC MPA (basking shark and minke whale).*	Noted. The listed NCMPAs have not been included within this assessment as these are not European Sites considered under HRA. These sites are also not included within the assessment presented within Offshore EIAR (Volume 2): Main Report as the Offshore Development is not capable of affecting these protected features/interests.
	In-combination assessment	*We agree with the approach to in-combination assessment. The assessment should also include other marine renewable projects such as tidal developments (e.g. MeyGen, EMEC Fall of Warness) and wave (EMEC Billia Croo).*	Noted

5 PROJECT DESCRIPTION

5.1 Introduction

As set out in Section 1.3, a full description of the Offshore Development is provided in Offshore EIAR (Volume 2): Chapter 5: Project Description. The following information within this section provides a summary of the key maximum Design Envelope parameters for the Offshore Development infrastructure that are relevant to the assessment provided in this RIAA.

5.2 Design Envelope Approach

This Offshore Development has adopted a Design Envelope approach to the assessment and application. This is because at this early stage in the development process for the Offshore Development it is not possible to finalise the specifics of the project design, due to:

> Procurement and supply chain considerations associated with emerging technologies;

> The timing of investment decisions; and

> Further site investigations which will inform the final project design.

Throughout the RIAA (and EIAR) the parameters comprising the Offshore Development follow this Design Envelope approach which assesses the potential impacts of the Offshore Development based on the worst case parameters. The worst case parameters identified and assessed are the most realistic scenario that would give rise to the greatest potential impact for the topic assessed, therefore they are considered to provide a cautious worst case assessment. This approach ensures that the scenario that would have the greatest impact (e.g. largest footprint, longest exposure, or tallest dimensions, depending on the topic) is assessed for each relevant receptor; it can then be assumed that any other (lesser) scenarios will have an impact that is no greater than that assessed.

The final Design Envelope of the Offshore Development, as presented within Offshore EIAR (Volume 2): Chapter 5: Project Description, has been refined during the EIA process from that presented in the Scoping Report (HWL, 2020) and Scoping Report Addendum (HWL, 2022). Stakeholder comments received in the Scoping Opinion, the Scoping Opinion Addendum, during consultation meetings and at public events have also been considered. The Design Envelope presented represents the different technology solutions still under consideration and will be further refined as the development of the Offshore Development progresses. Further details of the Design Envelope refinement are provided within Section 5.4 below.

For brevity, as the full Offshore Development Design Envelope (set out in Offshore EIAR (Volume 2): Chapter 5: Project Description) does not apply to each receptor group, it has not been repeated here in its entirety. A summary of the key maximum Design Envelope parameters for the Offshore Development infrastructure is provided below in 5.5.

The specific parameters within the Design Envelope that are relevant to the receptor assessments in this RIAA are presented within the relevant assessment sections of this report.

5.3 Embedded Mitigation

As part of the Offshore Development design process, a number of designed-in measures and management plans have been proposed to reduce the potential for impacts on receptors. As there is a commitment to implementing these measures which will likely be secured through consent conditions, they are considered inherently part of the design of the Offshore Development and have therefore been considered in the assessment presented below (i.e. the determination of significance of effect assumes implementation of these embedded mitigation measures). These measures are considered standard industry practice for this type of development. These embedded measures and any additional measures which have been identified for the receptors assessed are further discussed in Section 6 below.

As detailed in Section 2.4.1, in line with case law, these embedded mitigation measures, other than those intrinsic to the project design, were not used during the screening stage of the HRA. That is, they were not used to assess the potential for LSE on a European Site's integrity.

5.4 Offshore Development Alternatives

As set out in Section 1.3, the process to develop alternatives for the Offshore Development Design Envelope is detailed within Offshore EIAR (Volume 2): Chapter 3: Site Selection and Alternatives. This Chapter of the EIAR explains how the Design Envelope has been refined since Screening and the design parameters that have been taken forward for the assessments as summarised below in Section 5.5.

The key refinement to the Design Envelope is that the PFOWF Array Area has been reduced by 50% with the primary aim of reducing the horizontal spread associated with the WTGs when viewed from the north coast. By reducing the area, the minimum distance from the coastline to the WTGs has also been increased from approximately 6 km to 7.5 km.

The reduction in the PFOWF Array Area reduces the footprint available to locate the WTGs and associated offshore infrastructure and benefits a number of receptors including ornithology, marine mammals and migratory fish species.

In addition to the reduction in the PFOWF Array Area, the total maximum number of WTGs that may be installed has been reduced from ten down to seven. This change also reduces the number of associated supporting structures and sub-structure infrastructure required, thus reducing impacts from the Offshore Development on marine ecology receptors, including those assessed within this RIAA.

A full description of the Offshore Development Design Envelope refinements is provided in the Offshore EIAR (Volume 2): Chapter 3: Site Selection and Alternatives.

5.5 Key Parameters of the Offshore Development

HWL is proposing to develop, construct and demonstrate a floating offshore wind farm with an installed capacity of around 100 MW. The Offshore Development components encompasses:

> The PFOWF Array Area: The area where the WTGs and associate supporting infrastructure (floating substructures, moorings, anchors and inter-array cables) will be located within the Offshore Site; and

> The Offshore Export Cable Corridor: The area within which the Offshore Export Cable(s) will be located.

The key maximum parameters for the Offshore Development of relevance to the assessments within this RIAA are summarised below in Table 5.1. In defining maximum parameters and worst case scenarios for WTG assessment, it should be noted that the Offshore Development will install a maximum of seven WTGs, up to a maximum rotor diameter of 260 m and 300 m maximum tip height. Should HWL proceed with the largest WTG (e.g. 300 m height and rotor diameter of 260 m) this would result in fewer than seven WTGs being required to meet the anticipated generating capacity of the Offshore Development.

Within the assessments undertaken in this report, a worst case scenario (WCS) has been defined for each of the receptors, based on the parameters that would give rise to the greatest level of impact. These receptor worst case scenarios are defined within each of the specific receptor assessment within this document.

As described above the full details of the Offshore Development are provided in in Offshore EIAR (Volume 2): Chapter 5: Project Description.

Table 5.1 Key Offshore Development Parameters

Offshore Development aspect	Options considered	Maximum (or Minimum) parameters
Wind Turbine Generators (WTG) specifications	n/a	Maximum Number of WTGs: **7** Minimum Blade Clearance from sea-level: **35 m** Maximum Hub height: **190 m** Maximum Rotor diameter: **260 m** Maximum tip height: **300 m** Total rotor swept area (Maximum 7 WTGs): **371,650 m^2** Minimum Spacing between WTGs: **800 m**
Floating substructure options	Two types of floating substructures: semi-submersible and tension leg platform (TLP)	Maximum Length: **125 m** Maximum Breadth: **125 m** Maximum Height: **70 m (TLP) / 50 m (semi-submersible)** Maximum structure height above sea level**: 30 m** Maximum structure depth below sea level: **20 m (TLP) / 20 m (semi-submersible)** Maximum Footprint: **15,625 m^2**
Moorings	Taut spread mooring / catenary mooring / semi-taut mooring	Maximum Moorings per WTG: **9** Maximum Length per line: **1,650 m (catenary)** Maximum Spread radius: **up to 1,500 m (catenary)**
Anchor Piles	Two types of anchor piles are proposed: impact piles or drilled/screw piles (drilled piles are not considered worst case from an underwater noise perspective so parameters are not included in this table)	Maximum Anchor Piles per WTG: **9** Maximum Anchor Pile burial depth: **20 m (impact piles)** Maximum Diameter: **5 m (impact piles)** **Impact Piling Installation Scenario:** Maximum Blow Energy: **2,500 kJ** Maximum Number of Piles per Day: **3** Minimum Number of piles per Day: **1**
Inter-array cable characteristics	n/a	Maximum no. of inter-array cables: **7** Maximum voltage: **110 kV** Maximum External cable diameter: **300 mm** Maximum footprint on seabed per cable: **500 m** Maximum cumulative length of inter-array cables on seabed: **20 km** Maximum cumulative length of inter-array cable system: **25 km** Minimum Target depth of lowering: **0.6 m (wherever possible)** Maximum length of cable requiring additional cable protection: **50% of seabed laid cable.**

Offshore Development aspect	Options considered	Maximum (or Minimum) parameters
Export cable characteristics	n/a	Maximum no. of Offshore Export Cable(s) / trenches: **Two cables in separate trenches** Maximum cable voltage: **110 kV** Maximum External cable diameter: **300 mm** Maximum footprint of the dynamic/floating portion of the Offshore Export Cable(s) to touchdown point on seabed: **500 m** Maximum cable length on seabed (per Offshore Export Cable[s]): **12.5 km (25 km in total for 2 cables)** Minimum Target depth of lowering: **0.6 m (wherever possible)** Maximum length of Offshore Export Cable(s) requiring additional cable protection: **50% of the cable length.**

5.6 Construction Programme

A detailed construction programme will be developed as design and procurement activities progress.

The offshore construction activities are anticipated to commence in 2024 with the commencement of the HDD works at landfall. The installation of the offshore components is then likely to be completed across two seven-month construction stages, anticipated to commence in spring 2025 (Stage 1), pausing over the winter months and then continuing in spring and summer 2026 (Stage 2).

It is proposed that anchor installation and Offshore Export Cable(s) installation would take place in Stage 1 of the construction phase with the remaining offshore components installed in Stage 2. Should there be any delays in the installation programme for HDD works or anchor installation, due to weather or other unforeseen circumstances, offshore export cable installation may be delayed to Stage 2. It should be noted that installation of the Offshore Export Cable(s) will take place over one season only, in either Stage 1 or Stage 2, but not both.

In terms of construction sequencing, it is proposed that a single WTG and associated floating foundation will be installed in Stage 1 ahead of the remaining WTGs which will be installed in Stage 2. Whilst this approach will be confirmed during detailed design, the installation of a single WTG will provide a valuable opportunity to trial the technology required for the array.

Should consent be granted, full details of the construction programme, construction sequencing and installation methodologies for the Offshore Development will be confirmed within the Construction Programme consent plan and CMS for the Offshore Development, and this will be submitted to MS-LOT for approval on behalf of Scottish Ministers.

The full array is anticipated to be commissioned and operational by the end of Q4 2026.

The nature of offshore work requires operations to be planned on a 24-hour, seven days a week basis; however, work will not be continuous over the whole construction period. The durations presented are indicative only and are subject to change which may arise, for example, from weather downtime, site conditions, equipment lead times and supply programmes, sequential work requirements, and logistical issues. The key construction activities and anticipated high-level durations are outlined in Figure 5.1

It should be noted that these are anticipated construction years only and the construction programme may change. The final construction programme for the Offshore Development will be confirmed in the Construction Programme which will be required as a condition of the consent.

Task	2024												2025												2026											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Intertidal / HDD operations																																				
Export cable installation																																				
Anchor installation																																				
Mooring installation																																				
WTG and substructure installation																																				
Inter-array cables installation																																				
Offshore commissioning																																				
Single Turbine Mooring, WTG Installation and Commissioning																																				

Key:

Likely Construction Period

Possible Construction Period

Either 2025 or 2026

Unfavourable months for in-field operations

Figure 5.1 Indicative High-Level Programme for the Offshore Development

5.6.1 Construction Vessels

Construction of the Offshore Development will require a variety of different vessel options dependent on the final project design and anchor, mooring and substructure solutions selected. Full details of the vessels which may be required to facilitate the construction of the Offshore Development are provided in Offshore EIAR (Volume 2): Chapter 5: Project Description.

As a number of project designs are being considered, there are multiple scenarios for the number and type of construction vessels that will be required. Conservative assumptions have been made on the vessel activity involved in the offshore installation campaign; these are presented in Table 5.2.

Table 5.2 Estimated Vessel Requirements during Offshore Construction Campaign

Vessel Requirement	Maximum total number
Number of vessels used throughout campaign	30
Number of vessels on site simultaneously	10
Number of vessel movements (defined as a return entry exit from the Development Area) that may be required	660

5.7 Operation and Maintenance and Decommissioning Programme

The proposed operational phase for the development is 30 years. As described above, it is anticipated that, if granted consent, then construction of the offshore components is anticipated to commence in 2024 with HDD works at landfall and the PFOWF Array will be fully operational by 2026. During the operational period, scheduled and unscheduled monitoring and maintenance activities will be required.

Under Section 105 of the Energy Act 2004 (as amended) (UK Parliament, 2004), developers of offshore renewable energy projects are required to prepare a Decommissioning Programme for approval by Scottish Ministers. A Section 105 notice is issued to developers by the regulator after consent has been issued for the given development. Developers are then required to submit a detailed plan for the decommissioning works, including anticipated costs and financial securities; this is then consulted on by MS-LOT prior to seeking ministerial approval.

In developing a Decommissioning Programme, HWL will seek to maximise the re-use of materials and will pay full regard to the 'waste-hierarchy'. In order to ensure that commercial viability is maintained, the BATNEEC (Best Available Technique Not Entailing Excessive Cost) decommissioning solutions will be sought. In achieving the above objectives, the Offshore Development will ensure practical integrity. When decommissioning the wind farm, the Offshore Development will seek to minimise influence on land transportation and where practicable, will plan transportation between the coast and respective waste management facilities in order to reduce safety issues and disturbance to traffic.

In line with the Scottish Government's default position for the decommissioning of Offshore Renewable Energy Installations (OREI), the starting presumption is that at the end of the operational life-cycle of the Offshore Development, there will be a requirement for all offshore components (above and below seabed) to be completely removed to shore for re-use, recycling, incineration with energy recovery, or disposal at a licensed site. As the Offshore Development's anticipated life-cycle is up to 30 years from full commissioning, there may have been advances in technological capabilities for decommissioning and/or changes to legislation by this time, therefore decommissioning best practice and legislation will be applied at that time of the Offshore Development's decommissioning. Under international standards such as those published by the International Maritime Organisation (IMO), there is the potential to consider leaving components *in situ*, for example, scour protection, which may not be practical or desirable to recover, or piles which may be cut off 1 m below the seabed. However it is understood that this would require a robust and compelling justification to be presented to Marine Scotland in order to be granted approval for partial removal of the Offshore Development. In this instance, a comparative assessment would be undertaken to provide a recommendation, based on the performance against five main criteria: Safety, Environmental, Societal, Technical Feasibility and Economic.

Throughout the Offshore Development's life-cycle the Decommissioning Programme will be reviewed and updated every five years. Consultee bodies listed in the S105 Notices, and any additional consultees identified by MS-LOT or HWL, will be provided with the opportunity to comment on the final decommissioning strategy prior to it being finalised. It is anticipated that the final revision process will commence two years prior to the initiation of decommissioning activities.

Full details of the operation, maintenance and decommissioning activities is available in Offshore EIAR (Volume 2): Chapter 5: Project Description.

6 MITIGATION AND MANAGEMENT PLANS

As described in Section 5.3 a number of embedded mitigation measures and management plans have been incorporated into the Project Design Envelope to prevent/reduce any potential adverse effects on receptors where possible. These embedded mitigation measures and management plans have been accounted for in this RIAA when assessing the potential magnitude of effect from the identified impacts.

As detailed in Section 2.4.1, in line with case law, these embedded mitigation measures, other than those intrinsic to the project design, were not used during the screening stage of the HRA, that is, they were not used to assess the potential for LSE on a European Site's integrity.

In addition to embedded mitigation and management plans, in some cases additional mitigation may be required, where measures are required to prevent or reduce any remaining potential adverse effects. These are considered and detailed in any integrity test where they may be required.

6.1 Embedded Mitigation and Management Plans

Embedded mitigation measures and management plans considered relevant to the receptors assessed within this RIAA are provided below in Table 6.1. These embedded mitigation measures and management plans will be secured intrinsically through the project design or through conditions attached to the S.36 Consent and/or Marine Licences.

Table 6.1 Embedded Mitigation Measures and Management Plans for the Offshore Development

Embedded Mitigation Measures and Management Plans	Justification	Receptor Applicable to in this RIAA
Management Plans		
Project Environmental Monitoring Programme (PEMP)	Through the EIA process, conclusions have been drawn on the potential environmental impact of developing the Offshore Development. Where required, a monitoring plan will be put in place to provide further evidence to support these conclusions and provide information for future offshore wind farm developments.	All
Construction Environmental Management Plan (CEMP)	The CEMP will set out procedures to ensure all activities with potential to affect the environment are appropriately managed and will include: a description of works and construction processes, roles and responsibilities, description of vessel routes and safety procedures, pollution control and spillage response plans, incident reporting, chemical usage requirements, waste management plans, plant service procedures, communication and reporting structures and timeline of work. It will detail the final design selected and take into account Marine Licence Conditions and commitments.	All
Offshore Construction Method Statement (CMS)	A CMS will be developed in accordance with the CEMP detailing how the Offshore Development activities and plans identified within the CEMP will be carried out, and also highlighting any possible dangers/risks associated with particular Offshore Development activities.	All
Environmental Clerk of Works (ECoW)	An independent ECoW will be appointed to audit site activities and will advise on implementation of mitigation.	All
Operational Environmental Management Plan (OEMP)	The developer will collate an OEMP to guide on-going operations and maintenance activities during the life-cycle of the Offshore Development. The OEMP will also set out the procedures for managing and delivering the specific environmental	All

Embedded Mitigation Measures and Management Plans	Justification	Receptor Applicable to in this RIAA
	commitments including a Marine Pollution Contingency Plan and invasive non-native species (INNS) Management Plan.	
Cable Plan	The Cable Plan will be provided post- consent and detail the location/ route and cable laying techniques of the inter-array and Offshore Export Cable(s)and detail the methods for cable surveys during the operational life of the cables for the Offshore Development. This will be supported by survey results from the geotechnical, geophysical and benthic surveys. The cable plan will also detail EMF of the cables deployed. A Cable Burial Risk Assessment (CBRA) will also be undertaken and included within the Cable Plan which will detail cable specifications, cable installation, cable protection, target burial depths / depth of lowering and any hazards the cable will present during the life-cycle of the cable.	Migratory Fish / Marine Mammals
Piling Strategy	A Piling Strategy will be written for the Offshore Development if impact piling is selected as the installation mechanism for the WTG foundations. The strategy will provide full details of the piling activities and parameters, including expected noise levels, duration of activities and any required mitigations associated with this installation technique.	Migratory Fish / Marine Mammals
Marine Mammal Mitigation Plan (MMMP)	A MMMP will be developed and implemented throughout all phases of the Offshore Development to ensure the risk of injury to marine mammals is negligible and all possible disturbance effects are reduced. Best Available Technology (BAT) will be employed along with due consideration of the local environment (e.g. protected sites or other important habitats) in line with the JNCC (2010) guidance: "The protection of marine European Protected Species from injury and disturbance" and the Marine Scotland (2020) guidance: The protection of Marine European Protected Species from injury and disturbance, Guidance for Scottish Inshore Waters". The MMMP will: > Follow the guidance from "Statutory nature conservation agency protocol for minimising the risk of injury to marine mammals from piling noise" (JNCC, 2010), in relation to piling activities; and > Consider the guidance from "JNCC guidelines for minimising the risk of injury to marine mammals from geophysical surveys" (JNCC, 2017) in relation to geophysical surveys where appropriated, based on the risk of injury associated with the equipment being employed.	Marine Mammals
Vessel Management Plan (VMP)	A VMP will be developed and implemented throughout all Offshore Development phases. The VMP will follow the guidance from The Scottish Marine Wildlife Watching Code (SMWWC) (NatureScot, 2017) in relation to protecting the marine wildlife from encounters. > Relevant vessel crew will be trained in the SMWWC to ensure the risk of injury to marine wildlife is negligible and all possible disturbance effects are reduced; and	Marine Mammals / Ornithology

Embedded Mitigation Measures and Management Plans	Justification	Receptor Applicable to in this RIAA
	> A traffic management scheme will be included to reduce vessel overlaps reducing further disturbances to marine mammals and ornithology interests;	
Navigational Safety Plan (NSP)	A NSP will be developed for the Offshore Development which will detail all navigational safety measures, construction exclusion zones if required, notices to mariners and radio navigation warnings, anchoring areas, lighting and marking requirements and emergency response procedures during all phases of the project. The NSP sets out the WTG lighting requirements for shipping and navigational safety, and will adopt good practice in respect of seabird attraction to lighting.	Ornithology
Lighting and Marking Plan (LMP)	The LMP will provide that the Offshore Development be lit and marked in accordance with the current Civil Aviation Authority (CAA) and MoD aviation lighting policy and guidance. The LMP will also detail the navigational lighting requirements detailed in IALA Recommendation O-139.	Ornithology
Decommissioning Programme	A Decommissioning Programme will be provided pre-construction to address the principal decommissioning measures for the Offshore Development, this will be written in accordance with applicable guidance and detail the management, environmental management and schedule for decommissioning. The Decommissioning Programme will help to mitigate the decommissioning impacts on receptors.	All
Embedded mitigations		
Minimum Air Gap	Minimum air gap increased to 35 m which is a key measure to minimise collision risk to seabird species.	Ornithology
Reduced PFOWF Array Area	Final PFOWF Array Area is 10 km^2 much less than what was originally proposed. This significantly reduces the potential effects on receptors.	All
Target depth of lowering	Static cables will be trenched and buried to a target depth of 0.6 m. Where this cannot be achieved, remedial cable protection will be applied. This will provide some separation between the cables and migratory fish, therefore reducing the effect of EMF	Migratory Fish / Marine Mammals
Removal of debris from floating lines and cables	The accumulation of marine debris on floating lines and cables has the potential to generate adverse interactions between mobile marine species and PFOWF infrastructure. Derelict fishing gears are of particular concern due to the entanglement risk they introduce to marine megafauna, including marine mammals. Mooring lines and floating inter-array cables will be inspected with a risk-based frequency during the operational life-cycle of the Offshore Development, starting at a higher frequency and likely declining after a number of years, based on evidence gathered during inspections. Additionally, one to three of the floating substructures will be equipped with sensors monitoring tension and inclination on mooring lines. This will detect any larger debris and anomalies. Any inspected or detected debris on the floating lines and cables will be recovered based on a risk assessment which considers	Migratory Fish / Marine Mammals

Embedded Mitigation Measures and Management Plans	Justification	Receptor Applicable to in this RIAA
	impact on environment, risk to asset integrity and cost of intervention.	
Removal of marine growth	The substructures will be designed to accommodate marine growth; however, in order to manage weight/ drag induced fatigue, growth levels will be inspected regularly, and subsequent removal of this growth will be undertaken using water jetting tools if substantial accumulation is in evidence.	Migratory Fish / Marine Mammals
Minimum Spacing between WTGs	The minimum spacing between each WTG (from the center of each WTG structure) will be 800 m. This will reduce the likelihood of collision and entanglement to marine mammals.	Marine Mammals
Nacelle, Tower and Rotor Design	The nacelle, tower and rotor are designed and constructed in order to contain leaks thereby reducing the risk of spillage into the marine environment.	All
Adherence with the International Convention for the Prevention of Pollution from Ships (MARPOL)	All vessels will operate in adherence with Marine Pollution (MARPOL) requirements. Accordance with this will help to ensure that the potential for release of pollutants is minimised during operations.	All

7 ANNEX II MIGRATORY FISH ASSESSMENT

7.1 Introduction

This section provides an assessment of the adverse effects from the Offshore Development on SACs designated for the conservation of Annex II migratory fish which have been screened into the assessment. The only qualifying migratory fish species screened into this assessment are Atlantic salmon and freshwater pearl mussels. Atlantic salmon are a host species for freshwater pearl mussels during a critical parasitic phase of the mussel's lifecycle, and therefore freshwater pearl mussels have the potential to be indirectly affected. All other migratory species have been screened out (see Section 3.2.2).

This section provides information that should be used to determine the potential effects of the Offshore Development on the conservation objectives of the SACs screened in for assessment.

7.1.1 Summary of Screening

Screening was conducted in order to identify potential exposure pathways for Atlantic salmon and freshwater pearl mussels (see Section 3). The fish species screened in for further assessment are:

- Atlantic salmon; and
- Freshwater pearl mussel (indirect effects).

7.1.1.1 SACs screened in for assessment

The SACs screened in for assessment are shown in Section 3.2.1; **Error! Reference source not found.**.

7.1.1.2 In-combination assessment

Projects within 50 km of the Offshore Site are considered to have the potential to result in in-combination effects for Annex II Migratory Fish Species. Although the maximum mean disturbance range for underwater noise to Atlantic Salmon (and other migratory species) may only extend to 19 km, a precautionary 50 km ZoI was agreed upon with consultees prior to the underwater noise modelling results (see Offshore EIAR (Volume 3): Appendix 10.1). The projects that have been considered for the in-combination assessment are listed in Table 7.1 and shown on Figure 7.1.

The approach to the assessment of projects includes:

- Quantitative assessment of projects submitted to Scoping up to six months prior to PFOWF application submission;
- Qualitative assessment of projects submitted to Scoping up to five months prior to PFOWF application submission; and
- Acknowledgement of projects submitted to Scoping between five and two months prior to PFOWF application submission.

This approach was shared with MS-LOT and agreement was confirmed via email on 6 December 2021. The list of cumulative projects screened into assessment was provided to MS-LOT and consultees and comments were received on 16 May 2022. These comments have been taken into account within this assessment.

It is noted that the West of Orkney Windfarm submitted a Scoping Report outside of the above timeframe and is therefore not included in the assessment of in-combination effects below. However, it is envisaged that there will be no overlap with the PFOWF Offshore Development activities due to differing project schedules.

The MeyGen tidal project is 40 km from the Offshore Site and is therefore beyond the area of search for in-combination effects other than underwater noise. However, due to lack of publicly available information on MeyGen's construction timelines it has not been considered within the in-combination impact assessment (as set out in the footnote to Table 4.1 in Section 4.1).

It is not anticipated that there will be any additional in-combination impacts from the Onshore Development on Atlantic salmon as there are no river SACs designated for Atlantic salmon that overlap with the Onshore

Development. Additionally, all onshore activities are fully terrestrial (above MHWS), with the exception of HDD. Atlantic salmon migrate wholly offshore, and as HDD operations will bypass the inter-tidal region with the exit point between 400 – 700 m offshore, there are not anticipated to be any significant in-combination effects from the Onshore Development on Atlantic salmon. In addition, there will not be any discharge of pollutants to the marine environment at this location as this will be managed through conditions of the Onshore Development consent such as a Drainage Strategy, CEMP and Pollution Prevention Plan.

Table 7.1 List of projects considered for the Fish and Shellfish Ecology Cumulative Impact Assessment

Development Type	Project Name	Status	Phase	Data Confidence	Relevant Receptors	Distance from Offshore Development (km)[viii]
Cable	Scottish Hydro Electric (SHE) Transmission Orkney – Caithness project	Consented	Consented (construction timelines unknown)	Medium	All	0
Dredge disposal site	Scrabster Extension dredge disposal site	Open	Active	High	All	18
Dredge disposal site	Stromness C dredge disposal site	Open	Active	High	All	41
Dredge disposal site	Scapa dredge disposal site	Open	Active	High	All	46
Cable	Scottish Hydro Electric Power Distribution (SHEPD) Orkney to Hoy North Cable	Operational (awaiting replacement)	Cable replacement expected 2021/2022	High	All	47
Cable	British Telecom (BT) telecommunications cables across Orkney	Pre-consent (application stage)	2022	Medium	All	51
Dredge disposal site	Stromness B dredge disposal site	Open	Active	High	All	51
Cable	SHE Transmission Shetland HVDC Link	Under construction	Construction period:	High	All	69

[viii] Distances for projects within this table have been re-measured (since submission of the NCA Screening Report) by sea and are not straight-line distances (i.e. over land). Therefore, a small number of the projects appear outwith the 50 km study area but have been retained for consistency with previously consulted upon in-combination project list.

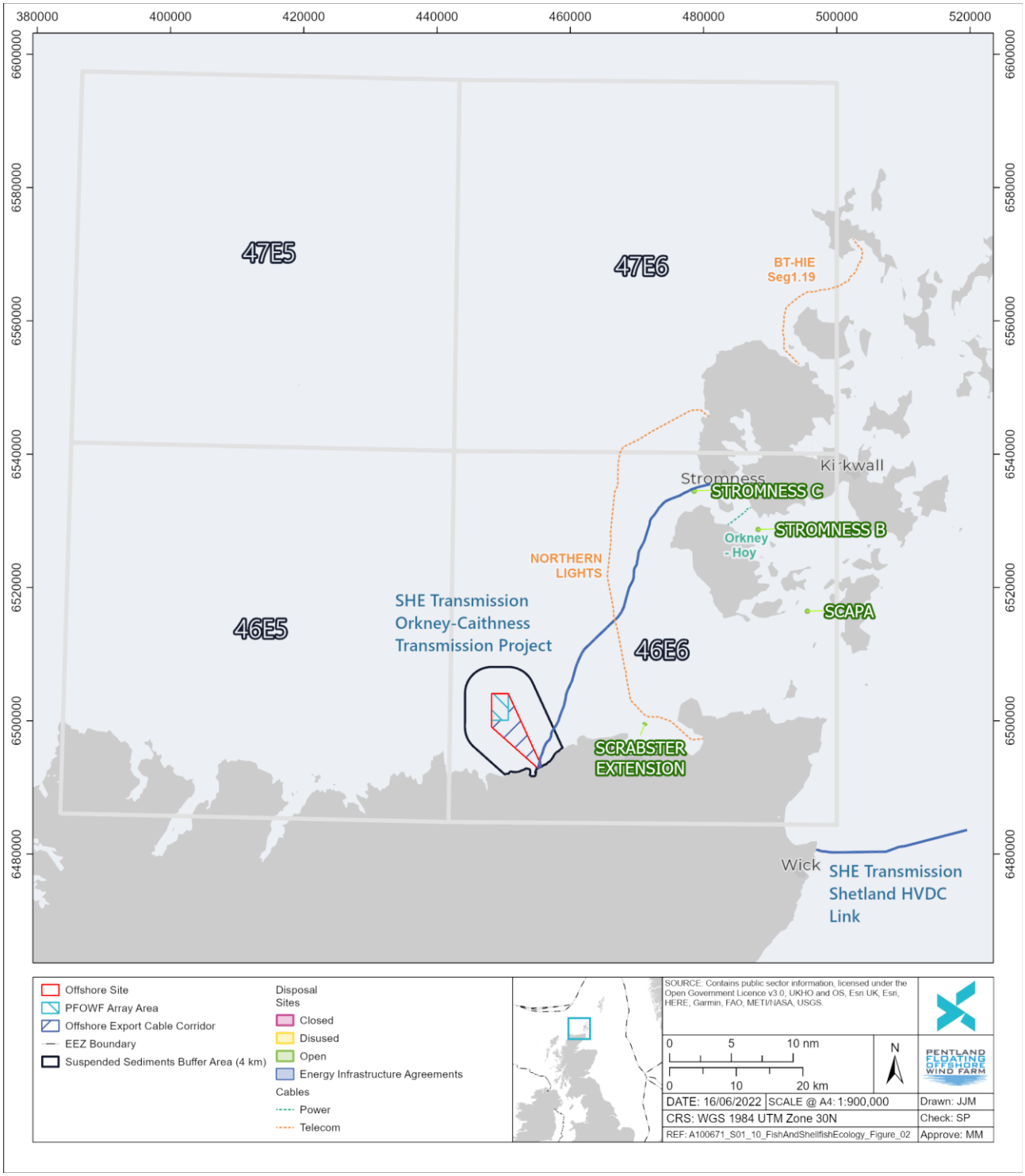


Figure 7.1 In-combination projects identified for Annex II migratory species within 50 km of the Offshore Development

7.1.2 Impacts Screened Out

Following the assessment during screening, and in line with the position that embedded mitigation is not to be included for the purposes of determining the potential of LSE, the following potential impact pathways have been screened out for further assessment within this RIAA:

Table 7.2 Impact pathways screened out of RIAA

Receptor	Pathway Screened Out
Annex II Migratory Fish	**Direct habitat loss due to disturbance of spawning and nursery grounds during the installation of export cables and placement of anchors on seabed:** > Spawning grounds for diadromous fish, including Atlantic salmon, are located within rivers (NatureScot, 2020a; MarLIN, 2022a). Deposited eggs tend to hatch the following spring, and the hatched salmon remain in the riverbed feeding on the attached yolk sac. Within the Scottish river systems, salmon tend to remain in the rivers for two to three years whilst they grow and transform, to allow them to adapt to salt water. > As the Offshore Development does not overlap with any of the identified river SACs, there is no potential for connectivity or LSE, and so this impact pathway has been screened out and is not considered further in the RIAA.
	Effects of increased sedimentation / smothering on fish and shellfish during construction activities: > This potential effect was included within the NCA screening report as sandeels (a demersal spawner) were previously screened in. However, North-West Orkney NCMPA, designated for sandeels, is not a European site and so does not require assessment under HRA (see section 3.2.2.1). Additionally, MSS and NatureScot also advised that the Offshore Development is not capable of affecting sandeels as the protected feature of the North-West Orkney NCMPA (see related comments in Section 4.1). > The effect on spawning grounds is considered to be greater than nursery grounds as larvae and eggs are only mobile via currents, whereas juvenile fish are able to flee away from disturbance. > Spawning grounds for diadromous fish, including Atlantic salmon, are located within rivers (NatureScot, 2020a; MarLin, 2022a). Deposited eggs tend to hatch the following spring, and the hatched salmon remain in the riverbed feeding on the attached yolk sac. Within the Scottish river systems, salmon tend to remain in the rivers for two to three years whilst they grow and transform, to allow them to adapt to salt water. Therefore, only adult migrating Atlantic salmon are anticipated to be within the vicinity of the Offshore Development. > Sedimentation effects will be localised. Atlantic salmon are generally not sensitive to an increase in sedimentation or smothering and can avoid this if necessary, with minimum impact on migration routes. Therefore, there is no potential for connectivity or LSE and so this impact pathway has been screened out and is not considered further in the RIAA.
	Habitat loss of spawning and nursery grounds due to presence of anchors and export cable on the seabed: > This potential effect was included within the NCA screening report as sandeels (a demersal spawner) were previously screened in. However, North-West Orkney NCMPA, designated for sandeels, is not a European site and so does not require assessment under HRA (see section 3.2.2.1). Additionally, MSS and NatureScot also advised that the Offshore Development is not capable of affecting sandeels as the protected feature of the North-West Orkney NCMPA (see related comments in Section 4.1). > Spawning grounds for diadromous fish, including Atlantic salmon, are located within rivers (NatureScot, 2020a; MarLin, 2022a). Deposited eggs tend to hatch the following spring, and the hatched salmon remain in the riverbed feeding on the attached yolk sac. Within the Scottish river systems, salmon tend to remain in the rivers for two to three years whilst they grow and transform, to allow them to adapt to salt water.

Receptor	Pathway Screened Out
	> As the Offshore Development does not overlap with any of the identified river SACs, there is no potential for connectivity or LSE and so this impact pathway has been screened out and is not considered further in the RIAA
	Barrier effects on migratory fish from the presence of the floating platform and associated infrastructure: > The small scale and offshore location of the Offshore Development, enables passage either side, and therefore is unlikely to present a significant barrier to movement for migratory fish. Furthermore, the PFOWF Array Area is located at least 21 km from the nearest SAC for migratory salmonids. Dodd and Briers (2021) concluded that there is no published information regarding the biological or behavioural responses of Atlantic salmon, or any fish species, to artificial light patterns of the characteristics associated with shadow flicker, and shadow flicker is unlikely to result in a change at the population level to Atlantic salmon. Information from operational wind farms also notes the potential for wind farms to act as artificial reef systems whereby fish are attracted to the area, rather than deterred. Whilst the research on the subject on fish behaviour associated with visual disturbance is limited (i.e. visual disturbance from shadow flicker), based on present information, it is very unlikely that there would be LSE as a result of shadow flicker on migratory fish species or the integrity of a European site. > Barrier effects will be very localised. If Atlantic salmon do avoid the Offshore Development, there will be minimal changes to their migration route. In addition, this impact was screened out following advice from MSS (see related comments in Section 4.1) and so is not considered further in the RIAA.
	Effects of operational noise on sensitive species: > Disturbance to migratory fish populations, particularly salmon and sea trout, caused by underwater noise produced from the operation of up to seven WTGs is anticipated to be minimal. > Based on studies for fixed WTGs, the main source of underwater noise from operational WTGs will be mechanically generated vibration from the rotating machinery in the WTGs, which is transmitted into the sea through the structure of the WTG tower and foundations (Nedwell *et al*., 2003, Tougaard *et al*, 2020). Noise levels generated above the water surface are low enough that no significant airborne sound will pass from the air to the water. > The Offshore Development is also a floating design (floating designs by nature are expected to have a lower noise output) and sufficiently small that underwater noise which is generated during operations and maintenance is not expected to create a barrier effect to migration pathways of fish species through the Pentland Firth. > Results from noise modelling undertaken for the Offshore Development indicate there will be negligible risk of injury with both recoverable injury and Temporary Threshold Shift (TTS) occurring at < 50 m from the source. Based on these results, and supported by comments from consultees (see related comments in Section 4.1), no LSE on Atlantic Salmon are anticipated and as such effects from operational noise have not been considered further in this RIAA.

Receptor	Pathway Screened Out
	Fish and/or predator aggregation around the floating structures and associated infrastructure: > The surfaces provided by the floating substructures, anchors and mooring lines will provide minimal surface area for colonisation, hence the artificial reef effect within the PFOWF Array Area is likely to be small and is unlikely to significantly increase the productivity of the area. As a result, fish production in the area is unlikely to increase significantly. > The surfaces provided by the floating substructures, anchors and mooring lines will provide minimal surface area for colonisation, when compared with the larger area over which substructures will be deployed. Hence, the artificial reef effect of the PFOWF Array Area is likely to be small and is unlikely to significantly increase the productivity of the area. As a result, fish production in the area is unlikely to increase significantly. As the effect will be very localised, it is unlikely to have a LSE on migratory fish such as Atlantic salmon, and so this impact pathway has been screened out and is not considered further in the RIAA.
	Ghost fishing due to lost fishing gear becoming entangled in installed infrastructure: > Structures on or near the seabed present a potential snagging risk to fishing gear which is towed along the seabed. During the construction phase, within the PFOWF Array Area, this includes pre-installed infrastructure, such as the anchors installed in advance of the mooring lines and WTGs, any mooring lines installed ahead of hook-up to WTGs, any areas of cable awaiting burial or protection and any dropped objects. > There is potential for lost gear to become entangled with Offshore Development infrastructure (both pre-installed during Construction phase and during the Operational phase) leading to ghost fishing, and consequently impacting fish and shellfish species. The potential for this to occur and the significance of the impact to fish and shellfish species is assessed within Chapter 13: Commercial Fisheries of the EIAR. > There is no potential for ghost fishing to cause LSE on an SAC integrity given the size of the Offshore Development and the availability of space to manoeuvre around the development, and given there is no direct overlap with any of the SACs.

7.1.3 Summary of Potential Pathways

Several potential impact pathways were identified during the HRA screening stage. Since submission of the NCA Screening Report (HWL, 2022), several of these pathways have been screened out following further research, refinement of the Offshore Development Design Envelope (see Section 5) and advice received from consultees (see Sections 4.1 and 7.1.2). The remaining pressures (impact pathways) for which potential LSE could not be ruled out for the European Sites screened into the RIAA include:

> Underwater noise from unexploded ordnance, drilling and/or piling/particle motion disturbance; and

> Electromagnetic fields (EMF).

7.2 Project Design Envelope Parameters Relevant to Atlantic Salmon and Freshwater pearl mussel

The realistic WCS for the assessment of adverse effects on SAC integrity is based on the design option (or combination of options) that represents the greatest potential for change, confidence can be held that development of any alternative options within the design parameters will give rise to no effects greater or worse than those assessed in this impact assessment.

Table 7.3 presents the realistic WCS for potential impacts on Atlantic salmon during construction, operational and maintenance and decommissioning phases of the Offshore Development.

In terms of Atlantic salmon, the realistic WCS has been derived by ensuring that the maximum parameters of components for the Offshore Development with potential to interact with Annex II Migratory Fish are considered to enable, for example, the maximum underwater noise disturbance area from the installation of anchors, to be assessed. For example, impact piles have been considered as the worst case anchor installation method for disturbance or injury to Atlantic salmon from underwater noise.

Table 7.3 Design parameters specific to the Atlantic salmon assessment

Potential Impact	Design Envelope Scenario Assessed
Construction Phase	
Disturbance of Atlantic salmon and possible alteration of migration routes due to underwater noise generated form construction activities	**Anchors: Impact piles** > Up to nine impact piles per WTG (63 piles total), each pile being up to a maximum of 5 m in diameter. The following scenario is considered as the worst case for the impact assessment: o 5-m diameter tubular pile, 20 m length. Installed using a hammer with maximum blow energy of 2,500 kJ over a total period of eight hours per pile. A maximum of three piles installed in 24 hours; o A minimum of one pile installed in 24 hours; o A maximum of 63 days of piling; and > Soft-start procedures assume 5% of maximum hammer energy for the first five minutes, doubling every five minutes for up to 20 minutes before full hammer energy is employed. **Unexploded Ordnance (UXO) Clearance** UXO clearance is not planned nor anticipated to be required for the Offshore Development, based on the Risk Assessment carried out by Ordtek (2021). Any UXO clearance activities which are identified as being required during the UXO and geophysical survey campaign will be considered in consultation with the relevant stakeholders and will be covered under a separate license application. Should clearance be required during the pre-construction phase, it would generate temporary underwater noise emissions with the potential to injure or disturb migratory fish. > High-order detonation charge size: 525 kg (plus donor charge).
Operational and Maintenance Phase	
Effects of EMFs on migratory fish	**Offshore Export Cable(s)** > A maximum of two (High Voltage Alternating Current [HVAC]) Offshore Export Cable(s) which will run from the Offshore Development to landfall; and > Maximum voltage of voltage of 110 kV. However, for the purpose of EMF impacts 66 kV is the worst case and is the basis for the assessment[ix]. **Inter-array Cables** Maximum of 7 inter-array with a maximum voltage of with a maximum voltage of 110 kV. However, for the purpose of EMF impacts 66 kV is the worst case and is the basis for the assessment, as explained in Table 5.1: > Maximum proportion of cable on the seabed is 20 km; and

[ix] Whilst export cables and inter array cables may be rated up to 110 kV, the worst case cable voltage for potential EMF effects is 66 kV. Potential magnetic fields generated are proportional to cable current and higher cable voltages results in smaller cable currents, whilst a lower cable voltage results in a larger current and therefore higher levels of EMF and thermal loads.

Potential Impact	Design Envelope Scenario Assessed
	> A maximum of 500 m per inter-array cable could be in the water column.
Decommissioning	
Potential impacts arising during the decommissioning phase are expected to be similar to, but not exceeding, those arising during the construction phase.	In the absence of detailed information regarding decommissioning works, the implications for migratory fish are likely less than those of the construction phase. This is due to impact piling not taking place during decommissioning, and all cables are likely to be removed removing all EMF effects. Therefore, the worst case parameters defined for the construction phase are significantly greater than the parameters anticipated for the decommissioning phase. The decommissioning approach is set out in Chapter 5: Project Description of Offshore EIAR (Volume 2). It is expected that all offshore components will be completely removed to shore for re-use, recycling and disposal during decommissioning, unless there is compelling evidence to leave certain components, *in situ,* for example, scour protection, which may not be practical to recover, or piles which may be cut off 1 m below the seabed. It may be preferable to leave the scour protection *in situ* to preserve the marine habitat that may have developed over the life of the Offshore Development; this is particularly the case for remedial protection placement / boulders as these are generally quite small in grade size and thousands in quantity so not practical to recover. A Decommissioning Programme will be developed pre-construction to address the principal decommissioning measures for the Offshore Development, this will be written in accordance with applicable guidance and detail the management, environmental management and schedule for decommissioning. The Decommissioning Programme will be reviewed and updated throughout the life-cycle of the Offshore Development to account for changing best practice. Relevant stakeholders and regulators will be consulted to establish the approach. The seabed will be restored, as far as reasonably practicable, to the condition it was prior to the construction of the Offshore Development.

7.3 Approach to Assessment

The potential adverse effects on the identified designated site include disturbance to and possible alteration of migration routes due to underwater noise generated form construction activities, and effects of EMF affecting Atlantic salmon migration routes.

The largest impact range for underwater noise will be due to impact piling activities. This will not be a direct effect as the impact range does not overlap with any of the SACs identified during screening. Therefore, this assessment looks at the indirect effects on the qualifying interests of the SACs, for example the prevention of Atlantic salmon migrating to and from rivers and foraging grounds and adverse effects on the integrity of the conservation objectives of the SACs screened into the assessment.

7.4 Underwater Noise

7.4.1 Modelling

To estimate the underwater noise levels likely to be generated by the proposed construction activities, predictive noise modelling has been undertaken, based on best practice techniques described in Robinson *et al.* (2014). Impact piling forms the most important noise source, due to both the sound pressure levels generated and the duration of the activity; as such, it is the primary focus of the Underwater Noise impact Assessment.

The modelling of impact piling sound was undertaken using the INSPIRE semi-empirical underwater noise propagation model (Version 5.1) which uses numerical modelling and measured source level data as inputs. This model is designed to calculate the propagation of noise in shallow, mixed water, typical of the conditions around the UK and as such is very well suited to the region of the Pentland Firth. The model has been trained

on 80 datasets of underwater noise propagation from monitoring during offshore piling activities. The modelling shows the range at which different fish species are affected by underwater sounds from, in this case, impact piling by calculating the noise contour radii (Offshore EIAR [Volume 3]: Technical Appendix 10.1 Underwater Noise Modelling).

This section focuses on the underwater noise impacts from impact piling activities on Atlantic salmon as, if utilised, it will provide for the greatest noise source during construction. Other installation activities such as cable laying, dredging, trenching, rock placement (as an example method of cable protection) and vessels also result in underwater noise and were included in underwater noise modelling for the Offshore Development.

Underwater noise modelling undertaken, predicted the potential effects of underwater noise produced from all noise sources with the exception of impact piling would be negligible and not significant, as presented in Offshore EIAR (Volume 3): Technical Appendix 10.1: Underwater Noise Modelling. The noise emissions from these sources fall below the appropriate injury or disturbance criteria for fish and shellfish species within 50 m of the source of the noise. Therefore they are not considered further in this assessment.

The potential underwater noise propagation from UXO clearance was also modelled and assessed, based on Popper *et al*. (2014) unweighted SPLpeak impact criteria for explosions (Offshore EIAR [Volume 3]: Technical Appendix 10.1: Underwater Noise Modelling). The assessment is highly precautionary and estimated that mortality and potential mortal injury to all fish species (including Atlantic salmon) may range between < 50 to 810 m from the source, depending upon the charge weight of the UXO encountered. This assessment did not assume any embedded mitigations.

It is worth noting that the desk-based UXO risk assessment undertaken by Ordtek (2021) has indicated that it will be possible to avoid any UXO encountered during the UXO survey and, should further mitigation be required (i.e. clearance or detonation), this would be subject to separate assessment and licence applications. However, to provide a comprehensive assessment of potential worst case impacts associated with the Offshore Development activities, an initial assessment of noise-related impacts from UXO clearance has been undertaken for the Construction phase of the Offshore Development.

The worst case scenario for impact piling was modelled in the noise assessment Offshore EIAR (Volume 3): Technical Appendix 10.1. Underwater Noise Modelling, and is presented in Table 7.4. The worst case for impact piling is considered highly precautionary due to hammer capacity, pile fatigue, the likelihood of three piles all being installed within 24 hours with the worst case parameters, or other on-site practicalities (see Offshore EIAR (Volume 3): Technical Appendix 10.1 Underwater Noise Modelling for further detail). However, this is considered to represent a ‘cautious worst case’ scenario for the assessment.

Fish species can be split into four groups when it comes to sound sensitivity. Atlantic Salmon fall under group 2: Salmonids are fish with swim bladders; however, swim bladders do not appear to play a role in hearing. Therefore, they are only sensitive to particle motion and only show sensitivity to a narrow band of frequencies. According to Popper *et al.* (2014) criteria, Atlantic salmon fall under the category “*Fish: swim bladder is not involved in hearing (particle motion detection e.g. Atlantic salmon*”.

Popper *et al.,* 2014 criteria for the potential impact on Atlantic salmon from impact piling activities and the modelling results are summarised in Table 7.4.

Table 7.4 Popper *et al.* (2014) thresholds for Group 2 fish species and the worst case scenario modelling results (Offshore EIAR [Volume 3]: Technical Appendix 10.1 Underwater Noise Modelling Report).

Type of Animal	Parameter	Mortality and potential mortal injury		Impairment					Behaviour
		Threshold	Worst case Scenario (mean range)	Recoverable Injury		Temporary Threshold Shift (TTS)		Masking	
				Threshold	Worst case Scenario (mean range)	Threshold	Worst case Scenario (mean range)		
Fish: swim bladder is not involved in hearing (particle motion detection) e.g. Atlantic salmon	SELcum dB re 1 µPa 2 ·s	210	Fleeing <100 m	203	Fleeing <100 m	>186	Fleeing 19 km	(N) Moderate (I) Low (F) Low	(N) High (I) Moderate (F) Low
			Stationary 6.6 km		Stationary 14 km		Stationary 34 km		
	SPLpeak dB re 1 µPa	>207	250 m	>207	250 m	-	-		
	SPLpeak dB re 1 µPa	>207	250 m	>207	250 m	-	-		

7.4.2 Assessment of Potential Effects on Migratory Atlantic Salmon

Given the mobile nature of Atlantic salmon, potential impacts associated with construction/installation, operation and maintenance, and decommissioning are expected to be minimal on the basis that Atlantic salmon can readily move out of or avoid the main area of potential impact.

The Sectoral Marine Plan (SMP) (2020) identified Atlantic salmon are likely to be present in the region of the Northern Plan Option areas. This is due to the multiple rivers with known salmon populations with connectivity to the northern region of Scotland. In addition, the Pentland Firth is a major throughway for Atlantic salmon returning from ocean feeding grounds to rivers within north and east Scotland (FCRT, 2017).

Adult Atlantic salmon which are in the immediate vicinity of the sound generating activity are generally able to vacate the area and avoid the likelihood of physical injury. However, larvae are not highly mobile and are therefore more likely to incur injuries from the sound energy, including damage to their hearing, kidneys, hearts and swim bladders. As Atlantic salmon spawn only in rivers, larvae will only be present in rivers and therefore will not be in the vicinity of the Offshore Development. By the time they are smolts and reach the sea, they are highly mobile and therefore, they will not be affected by underwater noise from piling activity. Migratory salmon have therefore been assessed as mobile (fleeing species).

7.4.2.1.1 Mortality, potential mortal injury and recoverable injury

Mortality and potential mortal injury are severe injuries resulting from a noise source that may result in death to an individual animal. The threshold will differ per species. A recoverable injury is a survivable injury where the receptor will fully recover after the exposure to noise has ended. However, the effect may result in a temporary decrease in fitness and increase the individual's susceptibility to predation.

The noise modelling results suggest mortality, potential mortal injury and recoverable injury for Atlantic salmon (>207 SPLpeak dB re 1 µPa) may occur up to 250 m. The River Thurso SAC is the closest SAC located 21 km from the PFOWF Array Area (where the impact piling activities will take place). Therefore, Atlantic salmon within the SAC, or SACs located at a greater distance from the Offshore Development, will not be directly affected by the underwater noise with the potential to cause injury. It is anticipated that migratory salmon located in the vicinity of the Offshore Development are likely to flee the area when construction activity commences and are therefore unlikely to be within 250 m of the source.

Impact piling activities are expected to take place over a relatively short period (63 days), therefore underwater noise emissions will only occur within a singular location for a brief period. Given the large expanse of comparable marine habitat surrounding the Offshore Development, it is highly unlikely that Offshore Development activities would compromise regional movements. Given the short duration and temporary nature of piling activities, the potential for adverse effects on Atlantic salmon is considered to be minimal.

Taking into account the points above, no adverse effects on Atlantic salmon are anticipated.

7.4.2.1.2 Temporary Threshold Shift (TTS), masking and behavioural disturbance

TTS is a temporary reduction in hearing sensitivity that is caused when a receptor is exposed to intense sound. Normally hearing ability returns shortly after the emitted noise ends. Whilst the receptor is experiencing TTS, this may cause a temporary decrease in fitness and ability to detect prey.

Fish and shellfish species will have varying reactions and sensitivities to impact piling noise. This is dependent on how these species perceive sound in the environment. There is potential for these responses to lead to adverse effects at an individual level (e.g. reduced fitness, susceptibility to predation) or potentially at a population level (e.g. avoidance or delayed migration to key spawning grounds), depending on the duration and strength of the impact. Atlantic salmon are a group two species and are not considered to be hearing specialists, therefore, they are less sensitive to underwater noise (Popper *et al.,* 2014).

As the spatial extent of the Offshore Development is small, and there is a large surrounding area of similar habitat, it is reasonable to assume that if these vocalisations were being masked, Atlantic salmon would move out of the zone of effect to an area that is less affected.

As detailed above, Atlantic salmon are considered to be mobile species as salmon larvae and eggs are not expected to be in the vicinity of the Offshore Development. The potential for TTS of Atlantic salmon (>186 SELcum dB re 1 µPa 2 ·s) may occur up to 19 km from the noise source. However, the closest SAC (River Thurso SAC) is located 21 km from the PFOWF Array Area (where the impact piling activities will take place). Therefore, Atlantic salmon within the SAC, or SACs located at a greater distance from the Offshore Development, will not be directly affected by the underwater noise with the potential to cause temporary injury or disturbance. It is anticipated that migratory salmon located in the vicinity of the Offshore Development are likely to flee the area when piling activity commences. Impact piling activity taking place will be in a small proportion of this wider available habitat. Therefore, according to the qualitive data provide by Popper *et al* (2014), auditory masking in Atlantic salmon from piling are expected to be Low except in the immediate vicinity of the source and behavioural effects are Low to Moderate, except in the immediate vicinity of the source, resulting in a localised effect.

Impact piling activities are expected to take place over a relatively short period (63 days), therefore underwater noise emissions will only occur within a singular location for a brief period. Given the large expanse of comparable marine habitat surrounding the Offshore Development, it is highly unlikely that Offshore Development activities would compromise regional movements. Given the short duration and temporary nature of piling activities, the potential for adverse effects on Atlantic salmon is considered to be minimal.

Taking into account the points above, no adverse effects on Atlantic salmon are anticipated.

7.4.2.1.3 UXO Clearance

UXO clearance has been identified as a possible noise source with the potential to effect Atlantic salmon through the generation of underwater noise. The detonation of UXO would be a short term (seconds) increase in underwater noise (i.e. sound pressure levels and particle motion). Underwater noise levels will be temporarily elevated, and this may result in injury or behavioural effects to Atlantic salmon.

An initial desk-based UXO assessment undertaken by Ordtek (2021) has indicated a low likelihood of UXO being encountered in the Offshore Site and it is anticipated that it will be possible to avoid any UXO encountered during the survey. Should further mitigation be required, such as clearance or detonation, this would be subject to separate assessment and Marine Licence applications. Nonetheless, for the purpose of providing a comprehensive assessment of potential worst case impacts associated with Offshore Development activities, an initial assessment of noise-related impacts from UXO clearance has been undertaken at this stage. If UXO clearance is identified as being required in order to proceed with the Offshore Development, it will be located within either the PFOWF Array Area or the Offshore Export Cable Corridor.

In order to assess the potential impacts of UXO clearance, two scenarios of potential UXO clearance have been modelled by Subacoustech Environmental (Offshore EIAR [Volume 3]: Technical Appendix 10.1), in line with Popper *et al.* (2014) criteria for explosions. The two scenarios are detailed below:

1) The worst case high-order detonation of a large 525 kg UXO plus donor charge, whereby the detonation of the donor charge causes a complete detonation of all explosive material in the 525 kg UXO; and
2) The low-order detonation of any size of UXO using a small specialist donor charge (up to 500 g) to vaporise the explosive material in the UXO in the absence of an explosion (deflagration) and therefore noise levels are proportional to the donor charge only.

It is expected that if any UXO clearance is required, that it would be undertaken using low-order clearance, however, the potential impact radii associated with a high-order detonation have been taken forward into the following assessment to provide a cautious worst case. The impact radii modelled for the high-order detonation scenario (Offshore EIAR [Volume 3]: Technical Appendix 10.1) are shown in Table 7.5.

Within the Popper *et al.* (2014) criteria for explosions, mortality and potential mortal injury is expected to occur between 229 – 234 dB. Popper *et al.* (2014) for explosions use the lowest amplitude in the literature available that have caused consistent mortality. Due to this, for all hearing groups there is the potential that UXO clearance could result in mortality and potential mortal injury impacts at a radius of between 490 to 810 m from

the source. Therefore, as a cautious worst case for this assessment, although highly conservative, the 810 m radius has been assumed for Atlantic salmon.

No particle motion modelling for mortality and potential mortal injury has been modelled for eggs and larvae. Popper *et al.* (2014) states that risk of mortality and potential mortality could occur at a peak particle motion velocity greater than 13 mm/s $^{-1}$ in a spawning bed during the period of egg incubation. However, as detailed above, Atlantic salmon are considered to be mobile species and salmon larvae and eggs are not expected to be in the vicinity of the Offshore Development.

Table 7.5 Summary of the impact ranges for UXO detonation using the unweighted SPLpeak explosion noise criteria from Popper *et al.* (2014) for Atlantic salmon

Popper *et al.* (2014) Unweighted SPLpeak	525 kg + donor
234 dB (Mortality and potential mortality)	490 m
229 dB (Mortality and potential mortality)	810 m

Full details of the underwater noise modelling and ranges for both scenarios are provided in the Underwater Noise Modelling Subacoustech Environmental Report (Offshore EIAR [Volume 3]: Technical Appendix 10.1: Underwater Noise Modelling).

As discussed above, for Atlantic salmon the maximum mortality and potential mortality impact radius for UXO clearance (based on a 525 kg UXO plus donor charge) is 810 m from the source. This effect will be an isolated explosion, instantaneous and occur over a matter of seconds.

For recoverable injury and TTS, only qualitative risk levels are available from Popper *et al.* (2014) due to lack of data available on these effects from explosions. For Atlantic salmon, in hearing Group 2 (e.g. those with a swim bladder), the risk of recoverable injury and TTS impacts are expected to be High in the near field (tens of metres) and intermediate field (hundreds of metres) and Low in the far field (thousands of metres).

For mortality, potential mortality, TTS and recoverable injury, all impacts will be localised within the near and intermediate fields. The impact will be a single explosion, highly localised and extremely short lived (a matter of seconds) and will not affect long term functioning on Atlantic salmon populations. Therefore, Atlantic salmon within the SACs assessed will not be directly impacted by the underwater noise with the potential to cause mortality, potential mortality, temporary injury or disturbance due to the intervening distances of the SACs screened in. It is anticipated that migratory salmon located in the vicinity of the Offshore Development are likely to flee the area when UXO clearance activity commences.

Taking into account the points above, no adverse effects on Atlantic salmon are anticipated.

As detailed above, it is worth noting that the desk-based UXO risk assessment undertaken by Ordtek (2021) has indicated that it will be possible to avoid any UXO encountered during the UXO survey and, should further mitigation be required (i.e. clearance or detonation), this would be subject to separate assessment once further details of any UXO were established and a separate Marine Licence application will be provided. However, this assessment for fish and shellfish has been provided to give an indicative assessment of potential worst case impacts associated with project construction activities.

7.4.3 Assessment of Potential Effects on Freshwater Pearl Mussels

Atlantic salmon are a host species for freshwater pearl mussels during a critical parasitic phase of the mussels lifecycle. As no adverse effects are anticipated for migratory Atlantic salmon, indirect effects on freshwater pearl mussels are also not anticipated.

7.5 Electromagnetic fields (EMF)

7.5.1 Modelling

EMF emissions are generated from the transmission of electricity through cables. The cables produce EMF which have both electric (E) measured in volts per metre (V m-1) and magnetic components (B) measured in micro tesla (μT). Whilst the E field is entirely contained within the cable sheathing, the B fields penetrate most materials and therefore will therefore be present in the marine environment.

Up to two 110 kV Offshore Export Cable(s) (HVAC) will be installed as part of the Offshore Development, each with a maximum length of 12.5 km. Although a maximum voltage of 110 kV is proposed, the worst case in terms of EMF is the lower 66 kV option (as set out in Table 7.3). Where seabed conditions allow, the Offshore Export Cable(s) will be buried to a target depth of a minimum of 0.6 m, with the aim of burying up to 100% of the cable to this minimum target depth. Remedial protection will be used where burial is not achieved to a height of 1 m, and it is expected that remedial protection will account for up to 50% of the cable length as a worst case scenario.

Up to seven 110 kV inter-array cables will be installed as part of the Offshore Development. Although a maximum voltage of 110 kV is proposed, the worst case in terms of EMF is the lower 66 kV option (as set out in Table 7.3). The inter-array cables and sections of the Offshore Export Cable(s) will be dynamic and these sections will be suspended in the water column, therefore they will only be buried from the point of touch down on the seabed. A maximum of 5 km of dynamic inter-array cable will be present in the water column and 500 m of dynamic Offshore Export Cable(s) across the PFOWF Array Area. A maximum of 20 km of inter-array cables will be situated on the seabed and either buried, wherever possible, to a minimum depth of 0.6 m or covered by remedial rock placement to a height of 1 m.

Although the burial of cables and other protective measures such as rock protection are not considered to be effective ways to mitigate the extent of magnetic fields in the marine environment, it does separate the most sensitive species from the source of the emissions, therefore reducing the maximum field strength likely to be encountered (e.g. at the seabed) (Copping *et al*., 2020). In addition, design parameters and installation methods are expected to conform to industry standard specifications which includes shielding technology to reduce the direct emission of EMFs.

HWL has commissioned an initial modelling exercise of the predicted EMF from both the inter-array and Offshore Export Cable(s) to determine the realistic worst case EMF potential based on the worst case EMF potential, i.e. the 66 kV option. The modelling demonstrates that EMF effects will be below the natural variation of the earth's magnetic field for both seabed laid and in-water dynamic cables. Should two Offshore Export Cable(s) be installed, the anticipated separation distance between cables (20 m) means there will be no potential interaction between EMF effects (Prysmian, 2022).

7.5.1.1 Buried/protected cable sections

It is recognised that the burial of cables and other protective measures, such as placement of remedial protection, are not considered to be effective ways to mitigate magnetic emissions into the marine environment entirely. However, burial separates the most sensitive species from the source of the emissions (Copping *et al*., 2020). In addition, design parameters and installation methods are expected to conform to industry standard specifications which includes shielding technology to reduce the direct emission of EMFs.

The results of the Prysmian (2022) study are shown in Table 7.6 for the various protection heights or burial depths assessed. From the modelling undertaken, an EMF strength of approximately 17.7 μT would be produced by the buried Offshore Export Cable(s) at the seabed, assuming 0.6 m burial is achieved (Prysmian, 2022). This rapidly dissipates when assuming 1 m burial or protection, and no EMFs are experienced at a distance of 5 m from the source.

The earth's magnetic field intensity is known to vary between 25 -to 65 μT (National Oceanic and Atmospheric Administration (NOAA), 2021a). For context, a reference magnitude of the earth's magnetic field at a particular location can be estimated from models publicly available (NOAA, 2021b), and for the Offshore Site, from sea level to maximum water depth, the geomagnetic total field is estimated as 50.7±0.14μT. As such, the magnetic

field produced by 66 kV cables would be less than the value associated with the earth's magnetic field at the Offshore Site. As such Atlantic salmon are unlikely to detect any notable change from EMFs produced by 66 kV cable(s), particularly if burial of 0.6 m is achieved, or remedial cable protection measures are applied for the static sections of the inter-array cables and the Offshore Export Cable(s).

Table 7.6 EMF levels at various distance from buried cable (Prysmian, 2022)

Component	5 m	1 m	Seabed (cable buried by a minimum of 0.6 m)
Offshore Export Cable(s) and buried inter- array cables	≈ 0 µT	0.73 µT	17.1

7.5.1.2 Dynamic cables in the water column

Up to 5 km of the 110 kV dynamic inter-array cables and 500 m of the 110 kV Offshore Export Cable(s) will be present within the water column. Migratory fish are more likely to encounter EMFs produced by these cables, as they will not be buried or have a physical barrier between the fish and the EMF source.

As detailed above, modelling has been conducted on the worst case of a 66 kV inter-array cable given the increased EMF potential, as set out in Chapter 5: Project Description of the Offshore EIAR. The results of the Prysmian (2022) study are shown in Table 7.7 for the various distances from the source assessed. From the modelling undertaken, an EMF strength of approximately 3.21 µT would be produced by the dynamic portions of the inter-array cables at 1 m from the source (Prysmian, 2022). This rapidly attenuates, as shown, with no detectable EMFs modelled at 5 m from the source.

Table 7.7 EMF levels at various distances from the dynamic cables in the water column (Prysmian, 2022)

Component	10 m	5 m	1 m
Inter- array cables and Offshore Export Cable(s)[x]	≈0 µT	≈0 µT	3.21 µT

7.5.2 Assessment of Potential Effects on Migratory Salmon

Atlantic salmon are electromagnetically sensitive due to the presence of magnetic receptors (Gillson *et al.,* 2022). Within their skeletal structure they contain magnetically sensitive material and may use naturally occurring magnetic fields as a navigational tool for migration (Putman *et al.,* 2013; Scanlan *et al*., 2018; Minkoff *et al*., 2020). Therefore, if the migration route between an Atlantic salmon natal river and the corresponding offshore habitats crosses the Offshore Export Cable Corridor and the PFOWF Array Area, there is a potential for EMFs resulting from the Offshore Development to impact the behaviour of migrating individuals, particularly in shallower waters of 20 m or less (Gill *et al.,* 2012) and within the PFOWF Array Area where the inter-array cable will be throughout the water column. Such an effect could result in changes to navigation, avoidance behaviour, or the delay/interruption of Atlantic salmon migrating to or from their natal rivers. However, studies have shown widely variable results, and therefore the extent of the effect of EMFs on Atlantic salmon is currently unclear (Gill & Bartlett, 2010). In particular, electro-magnetic-sensitive species may be receptive to anthropogenic EMFs that fall within the range of natural EMFs. The global geomagnetic field ranges from approximately 25 µT to 65 µT (Hutchison *et al.*, 2020). Where the Offshore Export Cable(s) begin at the HDD exit point, water depths are expected to be a minimum of 20 m.

[x] As the Offshore Export Cable(s) will connect directly to the first WTG in the array configuration, the first section will also be in the water column and dynamic. Consequently, it will share many of the key components of the dynamic inter-array cable. See Offshore EIAR (Volume 2): Chapter 5 Project Description, Section 5.5.2.

Most migratory salmonids swim within the top 5 m of the water (Godfrey *et al*., 2014); therefore, they would not be affected by EMF emitted from the Offshore Export Cable(s) and inter-array cables on the seabed, and are more likely to encounter the dynamic cables in the water column. Armstrong *et al.* (2015) concluded that there was no identifiable behavioural response of Atlantic salmon to magnetic fields at intensities of 95 µT and below.

The modelling results highlight only low levels of EMF are anticipated to be emitted by inter-array and Offshore Export Cable(s). This is particularly apparent if target burial depths are achieved for the Offshore Export Cable(s) and static sections of the inter-array cables as secured through the implementation of embedded mitigations such as the Cable Plan, Design Specification and Layout Plan, which will reduce the maximum exposure to EMF. Additionally, only localised effects of EMF are predicted for the inter-array cables in the water column. Moreover, even when assuming complete avoidance of the PFOWF Array Area, the effect is still highly localised in the context of Atlantic salmon migration routes. Any effects upon fish orientation or migratory behaviour are likely to be small and temporary (due to species mobility).

Taking into account the points above, no adverse effects on Atlantic salmon are anticipated.

7.5.3 Assessment of Potential Effects on Freshwater Pearl Mussels

Atlantic salmon are a host species for freshwater pearl mussels during a critical parasitic phase of the mussels lifecycle. As no adverse effects are anticipated for migratory Atlantic salmon, indirect effects on freshwater pearl mussels are not anticipated.

7.6 Assessment of Potential In-combination Effects

The approach to the in-combination assessment and projects screened into the RIAA are presented in Section 7.1.1.2 and Table 7.1.

As described in Section 7.5, no adverse effects are anticipated on migratory salmon for the Offshore Development alone.

The underwater noise impact assessment focused on piling activities. Other anthropogenic underwater noise generating activities from the Offshore Development such as cable laying, suction dredging, trenching, remedial cable protection and installation vessels do not have the potential to cause injury. The projects considered within the in-combination assessment are cable and dredging projects where piling activity will not occur (see list of projects considered in Table 7.1.

Therefore, no adverse in-combination effects are anticipated on Atlantic Salmon or freshwater pearl mussel.

7.6.1 Effects of EMFs Affecting Migration

As described above, no adverse effects are anticipated for the Offshore Development alone.

The range of EMF from subsea cables is very localised, therefore, only the SHE Transmission Orkney – Caithness Cable Project has been considered as having the potential to act in-combination with the Offshore Development. Under the Orkney – Caithness Cable Project's Marine Licence and installation approval plans SHE Transmission will be required to bury the cables to a sufficient burial depth where possible or, where not possible, place remedial protection over these sections to reduce the impact of EMF. If the SHE Transmission Orkney – Caithness project is already installed by the time the Offshore Development is constructed, the Offshore Export Cable(s) required for the Offshore Development may have to cross this asset. The crossing will be installed in line with industry best practice to reduce any potential damage and will be in accordance with a crossing agreement sought between SHE Transmission and HWL. Proximity agreements will also be developed, if required, and these will seek agreement on how close construction activities can occur to existing infrastructure. HWL has been in regular contact with SHE Transmission and this engagement will continue to occur throughout the construction, operation and maintenance, and decommissioning phases of the Offshore Development.

As proximity agreements will be in place, the cables will not be close enough to cause in-combination EMF effects, with the exception of the point of crossing. However, cables will need to be further protected at the crossing and therefore, given the EMF levels anticipated with the application of 1 m of cable protection (0.73 µT), even in-combination, it is highly unlikely that these levels will surpass those of the Earth's own magnetic field at the Offshore Site (50.7±0.14µT [NOAA, 2021b]).

Therefore, no adverse in-combination effects are anticipated on Atlantic Salmon or freshwater pearl mussel.

7.7 River Thurso SAC

The River Thurso SAC, designated in 2005, covers an area of 348.25 ha (3.48 km^2) along the River Thurso on the north coast of Scotland. The site is characterised by inland water bodies, bogs, marshes, dry grassland, deciduous woodland and inland rocks (JNCC, 2022a). The River Thurso SAC is designated for the conservation of the Annex II species Atlantic salmon. The River Thurso SAC is located 17 km from the Offshore Export Cable Corridor and 19 km from the PFOWF Array Area.

7.7.1 Site Details and Qualifying Interests

The NCA Screening Report (HWL, 2022) identified the River Thurso SAC as a site where migratory fish are a qualifying feature where there was potential for LSE. The feature condition and broader conservation status of the qualifying interests have been summarised in Table 7.8 (NatureScot, 2021a).

Table 7.8 Qualifying Interests and Condition for the River Thurso SAC

Qualifying Interests	Feature Condition	Assessment Date	Broader Conservation Status
Atlantic salmon *(Salmo salar)*	Unfavourable – recovering	2011	UK: Unfavourable European Region: Unfavourable

The River Thurso SAC supports a higher portion of Atlantic salmon in the winter months than rivers further south of the species migratory range. This is attributed to the location of the river and the general trend towards cooler water temperatures within the river, which results in slower-growing juveniles and a later smolt. There is also evidence to suggest that of the Atlantic salmon that spawn within the River Thurso SAC, grilse return meaning that the River Thurso supports the full-range of Atlantic salmon life-cycle (JNCC, 2022a).

Atlantic salmon present a number of sensitivities relating to offshore developments within the marine environment (Scottish Government, 2019). Sensitivities relevant to underwater noise and EMFs include:

- Non-Physical Disturbance (Noise Disturbance causing Barrier or Exclusion Effects); and
- Non-Physical Disturbance (EMF).

7.7.2 Site Objectives

The objectives of the River Thurso SAC are to avoid the deterioration of the qualifying species and ensure that the integrity of the site is maintained to a Favourable Conservation Status. Table 7.9 provides the high-level conservation objective statements for the River Thurso SAC.

Table 7.9 River Thurso SAC Conservation Objectives

River Thurso SAC
> To ensure that the qualifying interests of the River Thurso SAC are in favourable condition and make an appropriate contribution to achieving a Favourable Conservation Status; and > To ensure that the integrity of the River Thurso SAC is maintained or restored in the context of environmental changes by meeting the objectives of the qualifying feature.
For Atlantic Salmon
> To restore the population of Atlantic salmon, including range of genetic types, as a viable component of the site; > Restore the distribution of Atlantic salmon throughout the site; and > Restore the habitats supporting Atlantic salmon within the site and the availability of food.

7.7.3 Assessment of Adverse Effects Alone

7.7.3.1 Underwater noise

For the reasons identified in Section 7.4.2, there is expected to be **no adverse effects** on migratory Atlantic salmon, as a qualifying interest of the River Thurso SAC, or the overall site integrity or conservation objectives as a result of mortality or disturbance from underwater noise associated with construction activities at the Offshore Development.

7.7.3.2 Effects of EMFs affecting migration

For the reasons identified in Section 7.5.2, there is expected to be **no adverse effect**s on migratory Atlantic salmon, as a qualifying interest of the River Thurso SAC, or the overall site integrity or conservation objectives as a result of EMF from the Offshore Export Cable(s) or the inter-array cables at the Offshore Development.

7.7.4 Assessment of Adverse Effects In-combination

For the reason identified in Section 7.6, **no adverse in-combination effects** are anticipated on the River Thurso SAC site integrity or conservation objectives.

7.7.5 Summary

The assessment indicates that no adverse effects are anticipated on site integrity or conservation objectives of the River Thurso SAC as outlined in Table 7.8.

Table 7.10 Summary of results

Protected Site	Qualifying Feature	Potential Effect	Conclusion
River Thurso	Atlantic Salmon	Disturbance to and possible alteration of migration routes due to underwater noise generated from construction activities	No adverse effects on site integrity or conservation objectives are anticipated.
		Effects of EMFs affecting migration	No adverse effects on site integrity or conservation objectives are anticipated.

7.8 River Naver SAC

The River Naver, designated in 2005, covers an area of 1044.15 ha (10.44 km^2) in the highlands of Scotland. The site is characterised by inland water bodies, bogs, marshes, heath, dry grassland, deciduous woodland and inland rocks. The site is designated for the conservation of Annex II species including Atlantic salmon and freshwater pearl mussel. The River Naver SAC is located 22 km from the Offshore Site.

7.8.1 Site Details and Qualifying Interests

The NCA Screening Report (HWL, 2022) identified the River Naver SAC as a site where migratory salmon are a qualifying feature where there was potential for LSE. The feature condition and broader conservation status of the qualifying interests have been summarised in Table 7.11 (NatureScot, 2021b).

Table 7.11 Qualifying Interests and Condition for the River Naver SAC

Qualifying Interests	Feature Condition	Assessment Date	Broader Conservation Status
Atlantic salmon	Favourable - recovered	2011	UK: Unfavourable European Region: Unfavourable
Freshwater pearl mussel	Unfavourable	2015	UK: Unfavourable European Region: Unfavourable

The River Naver SAC supports a large population of Atlantic Salmon that represents one of the most northerly populations of the species in the UK. The cooler ambient water temperature characteristic of the River Naver supports slow-growing parr which smolt at a later age. The site allows for relatively unhindered migration for Atlantic salmon which results in the return of multi sea-winter salmon (JNCC, 2022b).

Atlantic salmon present a number of sensitivities relating to offshore developments within the marine environment (Scottish Government, 2019). These include:

- Non-Physical Disturbance (Noise Disturbance causing Barrier or Exclusion Effects); and
- Non-Physical Disturbance (EMF).

7.8.2 Site Objectives

The objectives of the River Naver SAC are to avoid the deterioration of the qualifying species and ensure that the integrity of the site is maintained to a Favourable Conservation Status. Table 7.12 provides the high-level conservation objective statements for the River Naver SAC.

Table 7.12 River Naver SAC Conservation Objectives

River Naver SAC
- To ensure that the qualifying interests of the River Naver SAC are in favourable condition and make an appropriate contribution to achieving a Favourable Conservation Status; and - To ensure that the integrity of the River Naver SAC is maintained or restored in the context of environmental changes by meeting the objectives of the qualifying feature.
For Atlantic Salmon
- To maintain the population of Atlantic salmon, including range of genetic types, as a viable component of the site;

River Naver SAC
> Maintain the distribution of Atlantic salmon throughout the site; and
> Maintain the habitats supporting Atlantic salmon within the site and the availability of food.

7.8.3 Assessment of Adverse Effects Alone

7.8.3.1 Underwater noise

For the reasons identified in Section 7.4.2, there is expected to be **no adverse effect** on migratory Atlantic salmon as a qualifying interest of the River Naver SAC, or the overall site integrity or conservation objectives as a result of mortality or disturbance from underwater noise associated with construction activities at the Offshore Development.

For the reasons identified in Section 7.4.3, there is expected to be **no adverse effects** on freshwater pearl mussels, as a qualifying interest of the River Naver SAC, or the overall site integrity or conservation objectives as result of indirect effects on Atlantic salmon.

7.8.3.2 Effects of EMFs affecting migration

For the reasons identified in Section 7.5.2, there is expected to be **no adverse effects** on migratory Atlantic salmon, as a qualifying interest of the River Naver SAC, or the overall site integrity or conservation objectives as a result of EMF from the Offshore Export Cable(s) or the inter-array cables at the Offshore Development

For the reasons identified in Section 7.5.3, there is expected to be **no adverse effects** on freshwater pearl mussels, as a qualifying interest of the River Naver SAC, or the overall site integrity or conservation objectives as result of indirect effects on Atlantic salmon.

7.8.4 Assessment of Adverse Effects In-combination

For the reasons identified in Section 7.6, **no adverse in-combination effects** are anticipated on the River Naver SAC site integrity or conservation objectives.

7.8.5 Summary

The assessment indicates that no adverse effects are anticipated on the integrity or conservation objectives of the River Naver SAC as outlined in Table 7.13.

Table 7.13 Summary of results

Protected Site	Qualifying Feature	Potential Effect	Conclusion
River Naver	Atlantic Salmon	Disturbance to and possible alteration of migration routes due to underwater noise generated from construction activities	No adverse effects on site integrity or conservation objectives are anticipated.
		Effects of EMFs affecting migration	No adverse effects on site integrity or conservation objectives are anticipated.
	Freshwater pearl mussel	Disturbance to and possible alteration of migration routes due to underwater noise generated from construction activities resulting in an indirect effect on freshwater pearl mussels	No adverse effects on site integrity or conservation objectives are anticipated.

Protected Site	Qualifying Feature	Potential Effect	Conclusion
		Effects of EMFs affecting migration of Atlantic salmon resulting in an indirect effect on freshwater pearl mussels	No adverse effects on site integrity or conservation objectives are anticipated.

7.9 River Borgie SAC

The River Borgie, designated in 2005, covers an area of 33.92 (1.33 km^2) ha in the Highlands of Scotland. The site is characterised by tidal rivers, mud flats, sand flats, shingle, sea cliffs, heath, scrub and deciduous woodland. The site is designated for the conservation of Annex II species including freshwater pearl mussel and Atlantic salmon. The River Borgie SAC is located 24 km from the Offshore Site.

7.9.1 Site Details and Qualifying Interests

The NCA Screening Report (HWL, 2022) identified the River Borgie SAC as a site where migratory fish are a qualifying feature where there was potential for LSE. The feature condition and broader conservation status of the relevant qualifying interests have been summarised in Table 7.14 (NatureScot, 2021c).

Table 7.14 Relevant Qualifying Interests and Condition for the River Borgie SAC

Qualifying Interests	Feature Condition	Assessment Date	Broader Conservation Status
Atlantic salmon	Favourable - recovered	2011	UK: Unfavourable European Region: Unfavourable
Freshwater pearl mussel	Unfavourable	2014	UK: Unfavourable European Region: Unfavourable

Whilst listed as a qualifying species for the River Borgie SAC, Atlantic salmon are not considered to be a primary reason for site selection as a SAC.

Atlantic salmon present a number of sensitivities relating to offshore developments within the marine environment (Scottish Government, 2019). These include:

- Non-Physical Disturbance (Noise Disturbance causing Barrier or Exclusion Effects); and
- Non-Physical Disturbance (EMF).

7.9.2 Site Objectives

The objectives of the River Borgie SAC are to avoid the deterioration of the qualifying species and ensure that the integrity of the site is maintained to a Favourable Conservation Status. Table 7.15 provides the high-level conservation objective statements for the River Borgie SAC.

Table 7.15 River Borgie SAC Conservation Objectives

River Borgie SAC
> To ensure that the qualifying interests of the River Borgie SAC are in favourable condition and make an appropriate contribution to achieving a Favourable Conservation Status; and > To ensure that the integrity of the River Borgie SAC is maintained or restored in the context of environmental changes by meeting the objectives of the qualifying feature.

River Borgie SAC
For Atlantic Salmon
> To maintain the population of Atlantic salmon, including range of genetic types, as a viable component of the site; > Maintain the distribution of Atlantic salmon throughout the site; and > Maintain the habitats supporting Atlantic salmon within the site and the availability of food.

7.9.3 Assessment of Adverse Effects Alone

7.9.3.1 Underwater noise

For the reasons identified in Section 7.4.2, there is expected to be **no adverse effects** on migratory Atlantic salmon as a qualifying feature of the River Borgie SAC, or the overall site integrity or conservation objectives as a result of mortality or disturbance from underwater noise associated with construction activities at the Offshore Development.

For the reasons identified in Section 7.4.3, there is expected to be **no adverse effects** on freshwater pearl mussels, as a qualifying feature of the River Borgie SAC, or the overall site integrity or conservation objectives as result of indirect effects on Atlantic salmon.

7.9.3.2 Effects of EMFs affecting migration

For the reasons identified in Section 7.5.2, there is expected to be **no adverse effects** on migratory Atlantic salmon, as a qualifying feature of the River Naver SAC, or the overall site integrity or conservation objectives as a result of EMF from the Offshore Export Cable(s) or the inter-array cables at the Offshore Development.

For the reasons identified in Section 7.5.3, there is expected to be **no adverse effects** on freshwater pearl mussels, as a qualifying feature of the River Naver SAC, or the overall site integrity or conservation objectives as result of indirect effects on Atlantic salmon.

7.9.4 Assessment of Adverse Effects In-combination

For the reasons identified in Section 7.6, **no adverse in-combination effects** are anticipated on migratory Atlantic salmon or freshwater pearl mussels is predicted for the River Borgie SAC site integrity or conservation objectives.

7.9.5 Summary

The assessment indicates that no adverse effects are anticipated on the integrity or conservation objectives of the River Borgie as outlined in Table 7.16.

Table 7.16 Summary of results

Protected Site	Qualifying Feature	Potential Effect	Conclusion
River Borgie	Atlantic Salmon	Disturbance to and possible alteration of migration routes due to underwater noise generated from construction activities	No adverse effects on site integrity or conservation objectives are anticipated.
		Effects of EMFs affecting migration	No adverse effects on site integrity or conservation objectives are anticipated.

Protected Site	Qualifying Feature	Potential Effect	Conclusion
	Freshwater pearl mussel	Disturbance to and possible alteration of migration routes due to underwater noise generated from construction activities resulting in an indirect effect on freshwater pearl mussels	No adverse effects on site integrity or conservation objectives are anticipated.
		Effects of EMFs affecting migration of Atlantic salmon resulting in an indirect effect on freshwater pearl mussels	No adverse effects on site integrity or conservation objectives are anticipated.

7.10 Berriedale and Langwell Waters SAC

The Berriedale and Langwell Waters SAC, designated in 2005, covers an area of 58.25 ha (0.58 km^2) in the Northern Isles and North Highlands. The site is characterised by inland water bodies, bogs, marshes, deciduous woodland, inland rocks and permanent snow and ice. The site is designated for the conservation of the Annex II species Atlantic salmon. The Berriedale and Langwell SAC is located 113 km from the Offshore Site.

7.10.1 Site Details and Qualifying Interests

The NCA Screening Report (HWL, 2022) identified the River Berriedale and Langwell Waters SAC as a site where migratory fish are a qualifying feature where there was potential for LSE. The feature condition and broader conservation status of the qualifying interests have been summarised in Table 7.17 (NatureScot, 2021d).

Table 7.17 Qualifying Interests and Condition for the Berriedal and Langwell Waters SAC

Qualifying Interests	Feature Condition	Assessment Date	Broader Conservation Status
Atlantic salmon	Favourable	2011	UK: Unfavourable European Region: Unfavourable

The Berriedale and Langwell Waters SAC supports a small but high-quality salmon population. The river is formed of two separate catchments that are oligotrophic and drain to the southern edge of the Caithness and Sutherland peatlands. Whilst the population of salmon supported by this SAC is small, the long history of low management and intervention with the river means that the site scores highly for naturalness. This river supports the full range of Atlantic salmon life-cycles, with individuals returning to the site throughout the spring and summer (JNCC, 2022c).

Atlantic salmon present a number of sensitivities relating to offshore developments within the marine environment (Scottish Government, 2019). These include:

> Non-Physical Disturbance (Noise Disturbance causing Barrier or Exclusion Effects); and

> Non-Physical Disturbance (EMF).

7.10.2 Site Objectives

The objectives of the Berriedale and Langwell Waters SAC are to avoid the deterioration of the qualifying species and ensuring that the integrity of the site is maintained to a Favourable Conservation Status. Table 7.18 provides the high-level conservation objective statements for the Berriedale and Langwell Waters SAC.

Table 7.18 Berriedale and Langwell Waters SAC Conservation Objectives

Berriedale and Langwell Waters SAC
> To ensure that the qualifying feature of the Berriedale and Langwell Waters SAC is in favourable condition and make an appropriate contribution to achieving a Favourable Conservation Status; and > To ensure that the integrity of the Berriedale and Langwell SAC is maintained by meeting the objectives of the qualifying feature.
For Atlantic Salmon
> To maintain the population of Atlantic salmon, including range of genetic types, as a viable component of the site; > Maintain the distribution of Atlantic salmon throughout the site; and > Maintain the habitats supporting Atlantic salmon within the site and the availability of food.

7.10.3 Assessment of Adverse Effect Alone

7.10.3.1 Underwater noise

For the reasons identified in Section 7.4.2, there is expected to be **no adverse effects** on migratory Atlantic salmon as a qualifying feature of the Berriedale and Langwell Waters SAC, or the overall site integrity as a result of mortality or disturbance from underwater noise associated with construction activities at the Offshore Development.

7.10.3.2 Effects of EMFs affecting migration

For the reasons identified in Section 7.5.2, there is expected to be **no adverse effects** on migratory Atlantic salmon, as a qualifying feature of the Berriedale and Langwell Waters SAC, or the overall site integrity as a result of EMF from the Offshore Export Cable(s) or the inter-array cables at the Offshore Development

7.10.4 Assessment of Adverse Effects In-combination

For the reason identified in Section 7.6, **no adverse in-combination effects** are anticipated on the Berriedale and Langwell Waters SAC site integrity.

7.10.5 Summary

The assessment indicates that no adverse effects are anticipated on the integrity or conservation objectives of the River Berriedale and Langwell Waters SAC outlined in Table 7.19.

Table 7.19 Summary of results

Protected Site	Qualifying Feature	Potential Effect	Conclusion
River Berriedale and Langwell Waters	Atlantic Salmon	Disturbance to and possible alteration of migration routes due to underwater noise generated form construction activities	No adverse effects on site integrity or conservation objectives are anticipated.
		Effects of EMFs affecting migration	No adverse effects on site integrity or conservation objectives are anticipated.

7.11 River Spey SAC

The River Spey SAC, designated in 2005, covers an area of 5759.72 ha (57.59 km^2) within the Highlands of Scotland. The site is characterised by inland water bodies, bogs, marshes, heath, humid grassland, improved grassland, arable land, deciduous woodland, coniferous woodland, mixed woodland and settlements. The site is designated for the conservation of Annex II species including freshwater pear mussel and Atlantic salmon. The River Spey SAC is located 159 km from the Offshore Site.

7.11.1 Site Details and Qualifying Interests

The NCA Screening Report (HWL, 2022) identified the River Spey SAC as a site where migratory fish are a qualifying feature where there was potential for LSE. The feature condition and broader conservation status of the qualifying interests have been summarised in Table 7.20 (NatureScot, 2021e).

Table 7.20 Qualifying Interests and Condition for the River Spey SAC

Qualifying Interests	Feature Condition	Assessment Date	Broader Conservation Status
Atlantic salmon	Unfavourable - recovering	2011	UK: Unfavourable European Region: Unfavourable
Freshwater pearl mussel	Unfavourable – declining	2015	UK: Unfavourable European Region: Unfavourable

The River Spey supports on of the largest Atlantic Salmon populations in Scotland. Adult Atlantic salmon spawn throughout the length of the river, with good quality nursery grounds found throughout the river and its tributaries. There are few anthropogenic barriers to Atlantic salmon migration within the River Spey and the waters remain largely unpolluted. Atlantic salmon of all ages have been recorded within the River Spey, including migrating smolts and returning adult fish (JNCC, 2022d).

Atlantic salmon present a number of sensitivities relating to offshore developments within the marine environment (Scottish Government, 2019). These include:

- Non-Physical Disturbance (Noise Disturbance causing Barrier or Exclusion Effects); and
- Non-Physical Disturbance (EMF).

7.11.2 Site Objectives

The objectives of the River Spey SAC are to avoid the deterioration of the qualifying species and ensure that the integrity of the site is maintained to a Favourable Conservation Status. Table 7.21 provides the high-level conservation objective statements for the River Spey SAC.

Table 7.21 River Spey SAC Conservation Objectives

River Spey SAC
> To ensure that the qualifying interests of the River Spey SAC are in favourable condition and make an appropriate contribution to achieving a Favourable Conservation Status; and > To ensure that the integrity of the River Spey SAC is maintained or restored in the context of environmental changes by meeting the objectives of the qualifying feature.

River Spey SAC
For Atlantic Salmon
> To restore the population of Atlantic salmon, including range of genetic types, as a viable component of the site; > Restore the distribution of Atlantic salmon throughout the site; and > Restore the habitats supporting Atlantic salmon within the site and the availability of food.

7.11.3 Assessment of Adverse Effects Alone

7.11.3.1 Underwater noise

For the reasons identified in Section 7.4.2, there is expected to be **no adverse effects** on migratory Atlantic salmon as a qualifying feature of the River Spey SAC, or the overall site integrity as a result of mortality or disturbance from underwater noise associated with construction activities at the Offshore Development.

For the reasons identified in Section 7.4.3, there is expected to be **no adverse effects** on freshwater pearl mussels, as a qualifying feature of the River Spey SAC, or the overall site integrity as result of indirect effects on Atlantic salmon.

7.11.3.2 Effects of EMFs affecting migration

For the reasons identified in Section 7.5.2, there is expected to be **no adverse effects** on migratory Atlantic salmon, as a qualifying feature of the River Spey SAC, or the overall site integrity as a result of EMF from the Offshore Export Cable(s) or the inter-array cables at the Offshore Development

For the reasons identified in Section 7.5.3, there is expected to be **no adverse effects** on freshwater pearl mussels, as a qualifying feature of the River Spey SAC, or the overall site integrity as result of indirect effects on Atlantic salmon.

7.11.4 Assessment of Adverse Effects In-combination

For the reasons identified in Section 7.6, **no adverse in-combination effects** are anticipated on the River Spey SAC site integrity.

7.11.5 Summary

The assessment indicates that no adverse effects are anticipated on the integrity or conservation objectives of the River Spey SAC outlined in Table 7.22.

Table 7.22 Summary of results

Protected Site	Qualifying Feature	Potential Effect	Conclusion
River Spey	Atlantic Salmon	Disturbance to and possible alteration of migration routes due to underwater noise generated from construction activities	No adverse effects on site integrity or conservation objectives are anticipated.
		Effects of EMFs affecting migration	No adverse effects on site integrity or conservation objectives are anticipated.
	Freshwater pearl mussel	Disturbance to and possible alteration of migration routes due to underwater noise generated from	No adverse effects on site integrity or conservation objectives are anticipated.

Protected Site	Qualifying Feature	Potential Effect	Conclusion
		construction activities resulting in an indirect effect on freshwater pearl mussels	
		Effects of EMFs affecting migration of Atlantic salmon resulting in an indirect effect on freshwater pearl mussels	No adverse effects on site integrity or conservation objectives are anticipated.

7.12 River Little Gruinard SAC

The Little Gruinard River SAC, designated in 2005, covers an area of 1167.28 ha (11.67 km^2) in the Highlands of Scotland. The site is characterised by inland water bodies and heath. The site is designated for the conservation of the Annex II species Atlantic Salmon. The Little Gruinard River SAC is located 161 km from the Offshore Site

7.12.1 Site Details and Qualifying Interests

The NCA Screening Report (HWL, 2022) identified the River Little Gruinard SAC as a site where migratory fish are a qualifying feature where there was potential for LSE. The feature condition and broader conservation status of the qualifying interests have been summarised in Table 7.23 (NatureScot, 2021f).

Table 7.23 Qualifying Interests and Condition for the River Little Gruinard SAC

Qualifying Interests	Feature Condition	Assessment Date	Broader Conservation Status
Atlantic salmon	Favourable – recovered	2011	UK: Unfavourable European Region: Unfavourable

The River Little Gruinard SAC supports a high-quality Atlantic salmon population. The population is oligotrophic, with relatively low levels of species diversity and productivity. The stock of adult Atlantic Salmon within the River Little Gruinard SAC is dominated by grilse, which return to the river in winter having spent the summer at sea.

Atlantic salmon present a number of sensitivities relating to offshore developments within the marine environment (Scottish Government, 2019). These include:

> Non-Physical Disturbance (Noise Disturbance causing Barrier or Exclusion Effects); and

> Non-Physical Disturbance (EMF).

7.12.2 Site Objectives

The objectives of the River Little Gruinard SAC are to avoid the deterioration of the qualifying species and ensure that the integrity of the site is maintained to a Favourable Conservation Status. Table 7.24 provides the high-level conservation objective statements for the River Little Gruinard SAC.

Table 7.24 Little Gruinard River SAC Conservation Objectives

River Little Gruinard SAC
> To ensure that the qualifying interests of the River Little Gruinard SAC are in favourable condition and make an appropriate contribution to achieving a Favourable Conservation Status; and > To ensure that the integrity of the River Little Gruinard SAC is maintained or restored in the context of environmental changes by meeting the objectives of the qualifying feature.
For Atlantic Salmon
> To maintain the population of Atlantic salmon, including range of genetic types, as a viable component of the site; > Maintain the distribution of Atlantic salmon throughout the site; and > Maintain the habitats supporting Atlantic salmon within the site and the availability of food.

7.12.3 Assessment of Adverse Effects Alone

7.12.3.1 Underwater noise

For the reasons identified in Section 7.4.2, there is expected to be **no adverse effects** on migratory Atlantic salmon as a qualifying feature of the River Little Gruinard SAC, or the overall site integrity as a result of mortality or disturbance from underwater noise associated with construction activities at the Offshore Development.

7.12.3.2 Effects of EMFs affecting migration

For the reasons identified in Section 7.5.2, there is expected to be **no adverse effects** on migratory Atlantic salmon, as a qualifying feature of the River Little Gruinard SAC, or the overall site integrity as a result of EMF from the Offshore Export Cable(s) or the inter-array cables at the Offshore Development.

7.12.4 Assessment of Adverse Effects In-combination

For the reason identified in Section 7.6, **no adverse in-combination effects** are anticipated on the River Little Gruinard SAC site integrity.

7.12.5 Summary

The assessment indicates that no adverse effects are anticipated on the integrity or conservation objectives of the River Little Gruinard SAC outlined in Table 7.25.

Table 7.25 Summary of results

Protected Site	Qualifying Feature	Potential Effect	Conclusion
River Little Gruinard	Atlantic Salmon	Disturbance to and possible alteration of migration routes due to underwater noise generated form construction activities	No adverse effects on site integrity or conservation objectives are anticipated.
		Effects of EMFs affecting migration	No adverse effects on site integrity or conservation objectives are anticipated.

7.13 River Oykel SAC

The River Oykel SAC, designated in 2005, covers an area of 921.46 ha (9.21 km^2) in the Highlands of Scotland. The site is characterised by inland water bodies, bogs, marshes, dry grassland, deciduous woodland and inland rocks. The site is designated for the conservation of the Annex II species Atlantic salmon and freshwater pearl mussel. The River Oykel SAC is located 181 km from the Offshore Site.

7.13.1 Site Details and Qualifying Interests

The NCA Screening Report (HWL, 2022) identified the River Oykel SAC as a site where migratory fish are a qualifying feature where there was potential for LSE. The feature condition and broader conservation status of the qualifying interests have been summarised in Table 7.26 (NatureScot, 2021g).

Table 7.26 Qualifying Interests and Condition for the River Oykel SAC

Qualifying Interests	Feature Condition	Assessment Date	Broader Conservation Status
Atlantic salmon	Favourable - recovered	2011	UK: Unfavourable European Region: Unfavourable
Freshwater pearl mussel	Unfavourable	2015	UK: Unfavourable European Region: Unfavourable

Whilst listed as a qualifying species for the River Oykel SAC, Atlantic salmon are not considered to be a primary reason for site selection as a SAC.

Atlantic salmon present a number of sensitivities relating to offshore developments within the marine environment (Scottish Government, 2019). These include:

- Non-Physical Disturbance (Noise Disturbance causing Barrier or Exclusion Effects); and
- Non-Physical Disturbance (EMF).

7.13.2 Site Objectives

The objectives of the River Oykel SAC are to avoid the deterioration of the qualifying species and ensure that the integrity of the site is maintained to a Favourable Conservation Status. Table 7.27 provides the high-level conservation objective statements for the River Oykel SAC.

Table 7.27 River Oykel SAC Conservation Objectives

River Oykel SAC
> To ensure that the qualifying interests of the River Oykel SAC are in favourable condition and make an appropriate contribution to achieving a Favourable Conservation Status; and > To ensure that the integrity of the River Oykel SAC is maintained or restored in the context of environmental changes by meeting the objectives of the qualifying feature.
For Atlantic Salmon
> To maintain the population of Atlantic salmon, including range of genetic types, as a viable component of the site; > Maintain the distribution of Atlantic salmon throughout the site; and > Maintain the habitats supporting Atlantic salmon within the site and the availability of food.

7.13.3 Assessment of Adverse Effects Alone

7.13.3.1 Underwater noise

For the reasons identified in Section 7.4.2, there is expected to be **no adverse effects** on migratory Atlantic salmon as a qualifying feature of the River Oykel SAC, or the overall site integrity as a result of mortality or disturbance from underwater noise associated with construction activities at the Offshore Development.

For the reasons identified in Section 7.4.3, there is expected to be **no adverse effects** on freshwater pearl mussels, as a qualifying feature of the River Oykel SAC, or the overall site integrity as result of indirect effects on Atlantic salmon.

7.13.3.2 Effects of EMFs affecting migration

For the reasons identified in Section 7.5.2, there is expected to be **no adverse effects** on migratory Atlantic salmon, as a qualifying feature of the River Oykel SAC, or the overall site integrity as a result of EMF from the Offshore Export Cable(s) or the inter-array cables at the Offshore Development.

For the reasons identified in Section 7.5.3, there is expected to be **no adverse effects** on freshwater pearl mussels, as a qualifying feature of the River Oykel SAC, or the overall site integrity as result of indirect effects on Atlantic salmon.

7.13.4 Assessment of Adverse Effects In-combination

For the reasons identified in Section 7.6, **no adverse in-combination effects** are anticipated on the River Oykel SAC site integrity

7.13.5 Summary

The assessment indicates that no adverse effects are anticipated on the integrity or conservation objectives of the River Oykel SAC outlined in Table 7.28.

Table 7.28 Summary of results

Protected Site	Qualifying Feature	Potential Effect	Conclusion
River Oykel	Atlantic Salmon	Disturbance to and possible alteration of migration routes due to underwater noise generated from construction activities	No adverse effects on site integrity or conservation objectives are anticipated.
		Effects of EMFs affecting migration	No adverse effects on site integrity or conservation objectives are anticipated.
	Freshwater pearl mussel	Disturbance to and possible alteration of migration routes due to underwater noise generated from construction activities resulting in an indirect effect on freshwater pearl mussels	No adverse effects on site integrity or conservation objectives are anticipated.
		Effects of EMFs affecting migration of Atlantic salmon resulting in an indirect effect on freshwater pearl mussels	No adverse effects on site integrity or conservation objectives are anticipated.

7.14 Langavat SAC

The Langavat SAC, designated in 2005, covers an area of 1471.42 ha (14.71 km^2) in Argyll and the Outer Hebrides. The site is characterised by inland water bodies. The site is designated for the conservation of the Annex II species Atlantic salmon. The Langavat SAC is located 198 km from the Offshore Site.

7.14.1 Site Details and Qualifying Interests

The NCA Screening Report (HWL, 2022) identified the Langavat SAC as a site where migratory fish are a qualifying feature where there was potential for LSE. The feature condition and broader conservation status of the qualifying interests have been summarised in Table 7.29 (NatureScot, 2021h).

Table 7.29 Qualifying Interests and Condition for the Langavat SAC

Qualifying Interests	Feature Condition	Assessment Date	Broader Conservation Status
Atlantic salmon	Unfavourable - recovering	2011	UK: Unfavourable European Region: Unfavourable

The Langavat SAC represents a high-quality salmon population in the Western Isles. This area supports a high proportion of lacustrine rearing areas for salmon, a contrast to the riverine systems usually preferred by salmon populations. The overall productivity of the population at this site is limited by the oligotrophic conditions of the system. The site supports a small proportion of the Scottish salmon population, however, it is the best salmon system in the Western Isles of Scotland (JNCC, 2022e).

Atlantic salmon present a number of sensitivities relating to offshore developments within the marine environment (Scottish Government, 2019). These include:

- Non-Physical Disturbance (Noise Disturbance causing Barrier or Exclusion Effects); and
- Non-Physical Disturbance (EMF).

7.14.2 Site Objectives

The objectives of the Langavat SAC are to avoid the deterioration of the qualifying species and ensure that the integrity of the site is maintained to a Favourable Conservation Status. Table 7.30 provides the high-level conservation objective statements for the Langavat SAC.

Table 7.30 Langavat SAC Conservation Objectives

Langavat SAC
> To ensure that the qualifying feature of the Langavat SAC is in favourable condition and make an appropriate contribution to achieving a Favourable Conservation Status; and > To ensure that the integrity of the Langavat SAC is maintained by meeting the objectives of the qualifying feature.
For Atlantic Salmon
> To restore the population of Atlantic salmon, including range of genetic types, as a viable component of the site; > Restore the distribution of Atlantic salmon throughout the site; and > Restore the habitats supporting Atlantic salmon within the site and the availability of food.

7.14.3 Assessment of Adverse Effect Alone

7.14.3.1 Underwater noise

For the reasons identified in Section 7.4.2, there is expected to be **no adverse effects** on migratory Atlantic salmon as a qualifying feature of the Langavat SAC, or the overall site integrity as a result of mortality or disturbance from underwater noise associated with construction activities at the Offshore Development.

7.14.3.2 Effects of EMFs affecting migration

For the reasons identified in Section 7.5.2, there is expected to be **no adverse effects** on migratory Atlantic salmon, as a qualifying feature of the Langavat SAC, or the overall site integrity as a result of EMF from the Offshore Export Cable(s) or the inter-array cables at the Offshore Development.

7.14.4 Assessment of Adverse Effects In-combination

For the reason identified in Section 7.6, **no adverse in-combination effects** are anticipated on the Langavat SAC site integrity.

7.14.5 Summary

The assessment indicates that no adverse effects are anticipated on the integrity or conservation objectives of the Langwell SAC outlined in Table 7.31.

Table 7.31 Summary of results

Protected Site	Qualifying Feature	Potential Effect	Conclusion
Langavat	Atlantic Salmon	Disturbance to and possible alteration of migration routes due to underwater noise generated from construction activities	No adverse effects on site integrity or conservation objectives are anticipated.
		Effects of EMFs affecting migration	No adverse effects on site integrity or conservation objectives are anticipated.

7.15 North Harris SAC

The North Harris SAC, designated in 2005, covers an area of 13,119.9 ha (131.19 km^2) in Argyll and the Outer Hebrides. The site is characterised by inland water bodies, bogs, marshes, heath, grassland, coniferous woodland, inland rocks and permanent snow and ice. The site is designated for the conservation Annex II species Atlantic salmon and freshwater pearl mussels. The North Harris SAC is located 228 km from the Offshore Site.

7.15.1 Site Details and Qualifying Interests

The NCA Screening Report (HWL, 2022) identified the North Harris SAC as a site where migratory fish are a qualifying feature where there was potential for LSE. The feature condition and broader conservation status of the qualifying interests have been summarised in Table 7.32 (NatureScot, 2021i).

Table 7.32 Qualifying Interests and Condition for the North Harris SAC

Qualifying Interests	Feature Condition	Assessment Date	Broader Conservation Status
Atlantic salmon	Unfavourable – recovering	2011	UK: Unfavourable European Region: Unfavourable
Freshwater pearl mussel	Unfavourable	2014	UK: Unfavourable European Region: Unfavourable

Whilst listed as a qualifying species for the North Harris SAC, Atlantic salmon are not considered to be a primary reason for site selection as an SAC.

Atlantic salmon present a number of sensitivities relating to offshore developments within the marine environment (Scottish Government, 2019). These include:

- Non-Physical Disturbance (Noise Disturbance causing Barrier or Exclusion Effects); and
- Non-Physical Disturbance (EMF).

7.15.2 Site Objectives

The objectives of the North Harris SAC are to avoid the deterioration of the qualifying species and ensure that the integrity of the site is maintained to a Favourable Conservation Status. Table 7.33 provides the high-level conservation objective statements for the North Harris SAC.

Table 7.33 North Harris SAC Conservation Objectives

North Harris SAC
- To avoid deterioration of the habitats of the qualifying species or significant disturbance to the qualifying species, thus ensuring that the integrity of the site is maintained, and the site makes an appropriate contribution to achieving favourable conservation status for each of the qualifying interests.
For Atlantic Salmon
To ensure for the qualifying species that the following are maintained in the long term: - Population of the species, including range of genetic types for salmon, as a viable component of the site; - Distribution of the species within site; - Distribution an extent of habitats supporting the species; - Structure, function and supporting processes of habitats supporting the species; and - No significant disturbance of the species.

7.15.3 Assessment of Adverse Effect Alone

7.15.3.1 Underwater noise

For the reasons identified in Section 7.4.2, there is expected to be **no adverse effects** on migratory Atlantic salmon as a qualifying feature of the North Harris SAC, or the overall site integrity as a result of mortality or disturbance from underwater noise associated with construction activities at the Offshore Development.

For the reasons identified in Section 7.4.3, there is expected to be **no adverse effects** on freshwater pearl mussels, as a qualifying feature of the North Harris SAC, or the overall site integrity as result of indirect effects on Atlantic salmon.

7.15.3.2 Effects of EMFs affecting migration

For the reasons identified in Section 7.5.2, there is expected to be **no adverse effects** on migratory Atlantic salmon, as a qualifying feature of the North Harris SAC, or the overall site integrity as a result of EMF from the Offshore Export Cable(s) or the inter-array cables at the Offshore Development.

For the reasons identified in Section 7.5.3, there is expected to be **no adverse effects** on freshwater pearl mussels, as a qualifying feature of the North Harris SAC, or the overall site integrity as result of indirect effects on Atlantic salmon.

7.15.4 Assessment of Adverse Effects In-combination

For the reasons identified in Section 7.6, **no adverse in-combination effects** are anticipated on the North Harris SAC site integrity.

7.15.5 Summary

The assessment indicates that no adverse effects are anticipated on the integrity or conservation objectives of the North Harris SAC outlined in Table 7.34.

Table 7.34 Summary of results

Protected Site	Qualifying Feature	Potential Effect	Conclusion
North Harris	Atlantic Salmon	Disturbance to and possible alteration of migration routes due to underwater noise generated from construction activities	No adverse effects on site integrity or conservation objectives are anticipated.
		Effects of EMFs affecting migration	No adverse effects on site integrity or conservation objectives are anticipated.
	Freshwater pearl mussel	Disturbance to and possible alteration of migration routes due to underwater noise generated from construction activities resulting in an indirect effect on freshwater pearl mussels	No adverse effects on site integrity or conservation objectives are anticipated.
		Effects of EMFs affecting migration of Atlantic salmon resulting in an indirect effect on freshwater pearl mussels	No adverse effects on site integrity or conservation objectives are anticipated.

7.16 River Dee SAC

The River Dee SAC, designated in 2005, covers an area of 2334.48 ha (23.34 km^2) in the county of Aberdeenshire on the east coast of Scotland. The site is characterised by tidal rivers, estuaries, inland water bodies, bogs, heath, dry grassland, humid grassland, woodland and inland rocks. The River Dee SAC is designated for the conservation of the Annex II species freshwater pearl mussel and Atlantic salmon. The River Dee SAC is located 252 km from the Offshore Site.

7.16.1 Site Details and Qualifying Interests

The NCA Screening Report (HWL, 2022) identified the River Dee SAC as a site where migratory fish are a qualifying feature where there was potential for LSE. The condition and broader conservation status of the qualifying interests have been summarised in Table 7.35 (NatureScot, 2021j).

Table 7.35 Qualifying Interests and Condition for the River Dee SAC

Qualifying Interests	Feature Condition	Assessment Date	Broader Conservation Status
Atlantic salmon	Favourable – recovered	2011	UK: Unfavourable European Region: Unfavourable
Freshwater pearl mussel	Unfavourable	2018	UK: Unfavourable European Region: Unfavourable

The River Dee SAC supports a high-quality Atlantic salmon population on the east coast of Scotland. The River Dee is accessible to Atlantic salmon at a number of locations, resulting in the site supporting the full range of life-history for Atlantic salmon. The River Dee headwaters, which drain into the Cairngorm and Grampian mountains have seen a significant decline in the number of Atlantic salmon abundance in recent years. The River Dee SAC supports a significant proportion of the Scottish Atlantic salmon population, contributing approximately 4 to 5% of all salmon caught in Scotland annually (JNCC, 2022f).

Atlantic salmon present a number of sensitivities relating to offshore developments within the marine environment (Scottish Government, 2019). These include:

- Non-Physical Disturbance (Noise Disturbance causing Barrier or Exclusion Effects); and
- Non-Physical Disturbance (EMF).

7.16.2 Site Objectives

The objectives of the River Dee SAC are to avoid the deterioration of the qualifying species and ensure that the integrity of the site is maintained to a Favourable Conservation Status. Table 7.36 provides the high-level conservation objective statements for the River Dee SAC.

Table 7.36 River Dee SAC Conservation Objectives

River Dee SAC
> To ensure that the qualifying interests of the River Dee SAC are in favourable condition and make an appropriate contribution to achieving a Favourable Conservation Status; and > To ensure that the integrity of the River Dee SAC is maintained or restored in the context of environmental changes by meeting the objectives of the qualifying feature.
For Atlantic Salmon
> To maintain the population of Atlantic salmon, including range of genetic types, as a viable component of the site; > Maintain the distribution of Atlantic salmon throughout the site; and > Maintain the habitats supporting Atlantic salmon within the site and the availability of food.

7.16.3 Assessment of Adverse Effects Alone

7.16.3.1 Underwater noise

For the reasons identified in Section 7.4.2, there is expected to be **no adverse effects** on migratory Atlantic salmon as a qualifying feature of the River Dee SAC, or the overall site integrity as a result of mortality or disturbance from underwater noise associated with construction activities at the Offshore Development.

For the reasons identified in Section 7.4.3, there is expected to be **no adverse effect effects** on freshwater pearl mussels, as a qualifying feature of the River Dee SAC, or the overall site integrity as result of indirect effects on Atlantic salmon.

7.16.3.2 Effects of EMFs affecting migration

For the reasons identified in Section 7.5.2,there is expected to be **no adverse effects** on migratory Atlantic salmon, as a qualifying feature of the River Dee SAC, or the overall site integrity as a result of EMF from the Offshore Export Cable(s) or the inter-array cables at the Offshore Development.

For the reasons identified in Section 7.5.3, there is expected to be **no adverse effects** on freshwater pearl mussels, as a qualifying feature of the River Dee SAC, or the overall site integrity as result of indirect effects on Atlantic salmon.

7.16.4 Assessment of Adverse Effects In-combination

For the reasons identified in Section 7.6, **no adverse in-combination effects** are anticipated on the River Dee site integrity.

7.16.5 Summary

The assessment indicates that no adverse effects are anticipated on the integrity or conservation objectives of the River Dee SAC outlined in Table 7.37.

Table 7.37 Summary of results

Protected Site	Qualifying Feature	Potential Effect	Conclusion
River Dee	Atlantic Salmon	Disturbance to and possible alteration of migration routes due to underwater noise generated from construction activities	No adverse effects on site integrity or conservation objectives are anticipated.
		Effects of EMFs affecting migration	No adverse effects on site integrity or conservation objectives are anticipated.
	Freshwater pearl mussel	Disturbance to and possible alteration of migration routes due to underwater noise generated from construction activities resulting in an indirect effect on freshwater pearl mussels	No adverse effects on site integrity or conservation objectives are anticipated.
		Effects of EMFs affecting migration of Atlantic salmon resulting in an indirect effect on freshwater pearl mussels	No adverse effects on site integrity or conservation objectives are anticipated.

7.17 River Moriston SAC

The River Moriston SAC, designated in 2005, covers an area of 194.38 ha (1.94 km^2) in the Highlands of Scotland. The site is characterised by inland water bodies, bogs, marshes, heath, deciduous woodland and coniferous woodland. The site is designated for the conservation of the Annex II species freshwater pearl mussel and Atlantic salmon. The River Moriston SAC is located 271 km from the Offshore Site.

7.17.1 Site Details and Qualifying Interests

The NCA Screening Report (HWL, 2022) identified the River Moriston SAC as a site where migratory fish are a qualifying feature where there was potential for LSE. The condition and broader conservation status of the qualifying interests have been summarised in Table 7.38 (NatureScot, 2021k).

Table 7.38 Qualifying Interests and Condition for the River Moriston SAC

Qualifying Interests	Feature Condition	Assessment Date	Broader Conservation Status
Atlantic salmon	Favourable – recovered	2011	UK: Unfavourable European Region: Unfavourable
Freshwater pearl mussel	Unfavourable	2018	UK: Unfavourable European Region: Unfavourable

Whilst listed as a qualifying species for the River Moriston SAC, Atlantic salmon are not considered to be a primary reason for site selection as an SAC.

Atlantic salmon present a number of sensitivities relating to offshore developments within the marine environment (Scottish Government, 2019). These include:

- Non-Physical Disturbance (Noise Disturbance causing Barrier or Exclusion Effects); and
- Non-Physical Disturbance (EMF).

7.17.2 Site Objectives

The objectives of the River Moriston SAC are to avoid the deterioration of the qualifying species and ensure that the integrity of the site is maintained to a Favourable Conservation Status. Table 7.39 provides the high-level conservation objective statements for the River Moriston SAC.

Table 7.39 River Moriston SAC Conservation Objectives

River Moriston SAC
> To ensure that the qualifying interests of the River Moriston SAC are in favourable condition and make an appropriate contribution to achieving a Favourable Conservation Status; and > To ensure that the integrity of the River Moriston SAC is maintained or restored in the context of environmental changes by meeting the objectives of the qualifying feature.
For Atlantic Salmon
> To restore the population of Atlantic salmon, including range of genetic types, as a viable component of the site; > Restore the distribution of Atlantic salmon throughout the site; and > Restore the habitats supporting Atlantic salmon within the site and the availability of food.

7.17.3 Assessment of Adverse Effects Alone

7.17.3.1 Underwater noise

For the reasons identified in Section 7.4.2, there is expected to be **no adverse effects** on migratory Atlantic salmon as a qualifying feature of the River Moriston SAC, or the overall site integrity as a result of mortality or disturbance from underwater noise associated with construction activities at the Offshore Development.

For the reasons identified in Section 7.4.3, there is expected to be **no adverse effects** on freshwater pearl mussels, as a qualifying feature of the River Moriston SAC, or the overall site integrity as result of indirect effects on Atlantic salmon.

7.17.3.2 Effects of EMFs affecting migration

For the reasons identified in Section 7.5.2, there is expected to be **no adverse effects** on migratory Atlantic salmon, as a qualifying feature of the River Moriston SAC, or the overall site integrity as a result of EMF from the Offshore Export Cable(s) or the inter-array cables at the Offshore Development.

For the reasons identified in Section 7.5.3, there is expected to be **no adverse effects** on freshwater pearl mussels, as a qualifying feature of the River Moriston SAC, or the overall site integrity as result of indirect effects on Atlantic salmon.

7.17.4 Assessment of Adverse Effects In-combination

For the reasons identified in Section 7.6, **no adverse in-combination effects** are anticipated on the River Moriston SAC.

7.17.5 Summary

The assessment indicates that no adverse effects are anticipated on the integrity or conservation objectives of the River Moriston SAC outlined in Table 7.40.

Table 7.40 Summary of results

Protected Site	Qualifying Feature	Potential Effect	Conclusion
River Moriston	Atlantic Salmon	Disturbance to and possible alteration of migration routes due to underwater noise generated from construction activities	No adverse effects on site integrity or conservation objectives are anticipated.
		Effects of EMFs affecting migration	No adverse effects on site integrity or conservation objectives are anticipated.
	Freshwater pearl mussel	Disturbance to and possible alteration of migration routes due to underwater noise generated from construction activities resulting in an indirect effect on freshwater pearl mussels	No adverse effects on site integrity or conservation objectives are anticipated.
		Effects of EMFs affecting migration of Atlantic salmon resulting in an indirect effect on freshwater pearl mussels	No adverse effects on site integrity or conservation objectives are anticipated.

7.18 River South Esk SAC

The River South Esk SAC, designated in 2005, covers an area of 471.85 ha (4.71 km^2) on the east coast of Scotland. The site is characterised by tidal rivers, inland water bodies, bog, heath, humid grassland, arable land, woodland and settlements. The site is designated for the conservation of the Annex II species freshwater pearl mussel and Atlantic salmon. The River South Esk SAC is located 311 km from the Offshore Site.

7.18.1 Site Details and Qualifying Interests

The NCA Screening Report (HWL, 2022) identified the River South Esk SAC as a site where migratory fish are a qualifying feature where there was potential for LSE. The condition and broader conservation status of the qualifying interests have been summarised in Table 7.41 (NatureScot, 2021l).

Table 7.41 Qualifying Interests and Condition for the River South Esk SAC

Qualifying Interests	Feature Condition	Assessment Date	Broader Conservation Status
Atlantic salmon	Favourable – recovered	2011	UK: Unfavourable European Region: Unfavourable
Freshwater pearl mussel	Unfavourable	2009	UK: Unfavourable European Region: Unfavourable

The River South Esk SAC supports a large, high-quality Atlantic salmon population on the east coast of Scotland. The River South Esk is accessible to salmon throughout the year and supports the full range of Atlantic salmon life cycle, with spring and summer salmon and grilse all present.

Atlantic salmon present a number of sensitivities relating to offshore developments within the marine environment (Scottish Government, 2019). These include:

- Non-Physical Disturbance (Noise Disturbance causing Barrier or Exclusion Effects); and
- Non-Physical Disturbance (EMF).

7.18.2 Site Objectives

The objectives of the River South Esk SAC are to avoid the deterioration of the qualifying species and ensure that the integrity of the site is maintained to a Favourable Conservation Status. Table 7.42 provides the high-level conservation objective statements for the River South Esk SAC.

Table 7.42 River South Esk SAC Conservation Objectives

River South Esk SAC
> To ensure that the qualifying interests of the River South Esk SAC are in favourable condition and make an appropriate contribution to achieving a Favourable Conservation Status; and > To ensure that the integrity of the River South Esk SAC is maintained or restored in the context of environmental changes by meeting the objectives of the qualifying feature.
For Atlantic Salmon
> To restore the population of Atlantic salmon, including range of genetic types, as a viable component of the site;

River South Esk SAC
> Restore the distribution of Atlantic salmon throughout the site; and > Restore the habitats supporting Atlantic salmon within the site and the availability of food.

7.18.3 Assessment of Adverse Effects Alone

7.18.3.1 Underwater noise

For the reasons identified in Section 7.4.2, there is expected to be **no adverse effects** on migratory Atlantic salmon as a qualifying feature of the River South Esk SAC, or the overall site integrity as a result of mortality or disturbance from underwater noise associated with construction activities at the Offshore Development.

For the reasons identified in Section 7.4.3, there is expected to be **no adverse effects** on freshwater pearl mussels, as a qualifying feature of the River South Esk SAC, or the overall site integrity as result of indirect effects on Atlantic salmon.

7.18.3.2 Effects of EMFs affecting migration

For the reasons identified in Section 7.5.2, there is expected to be **no adverse effects** on migratory Atlantic salmon, as a qualifying feature of the River South Esk SAC, or the overall site integrity as a result of EMF from the Offshore Export Cable(s) or the inter-array cables at the Offshore Development.

For the reasons identified in Section 7.5.3, there is expected to be **no adverse effects** on freshwater pearl mussels, as a qualifying feature of the River South Esk SAC, or the overall site integrity as result of indirect effects on Atlantic salmon.

7.18.4 Assessment of Adverse Effects In-combination

For the reasons identified in Section 7.6, **no adverse in-combination effects** are anticipated on the River South Esk SAC site integrity.

7.18.5 Summary

The assessment indicates that no adverse effects are anticipated on the integrity or conservation objectives of the River South Esk SAC outlined in Table 7.43.

Table 7.43 Summary of results

Protected Site	Qualifying Feature	Potential Effect	Conclusion
River South Esk	Atlantic Salmon	Disturbance to and possible alteration of migration routes due to underwater noise generated from construction activities	No adverse effects on site integrity or conservation objectives are anticipated.
		Effects of EMFs affecting migration	No adverse effects on site integrity or conservation objectives are anticipated.
	Freshwater pearl mussel	Disturbance to and possible alteration of migration routes due to underwater noise generated from construction activities resulting in an indirect effect on freshwater pearl mussels	No adverse effects on site integrity or conservation objectives are anticipated.

Protected Site	Qualifying Feature	Potential Effect	Conclusion
		Effects of EMFs affecting migration of Atlantic salmon resulting in an indirect effect on freshwater pearl mussels	No adverse effects on site integrity or conservation objectives are anticipated.

7.19 River Tay SAC

The River Tay SAC, designated in 2005, covers an area of 9461.63 ha (94.61 km^2) within the Highlands of Scotland. The site is characterised by shingle, sea cliffs, inland water bodies, bogs and marshes. The River Dee SAC is designated for the conservation of the Annex II species Atlantic salmon. The River Tay SAC is located 383 km from the Offshore Site.

7.19.1 Site Details and Qualifying Interests

The NCA Screening Report (HWL, 2022) identified the River Tay SAC as a site where migratory fish are a qualifying feature where there was potential for LSE. The feature condition and broader conservation status of the qualifying interests have been summarised in Table 7.44 (NatureScot, 2021m).

Table 7.44 Qualifying Interests and Condition for the River Tay SAC

Qualifying Interests	Feature Condition	Assessment Date	Broader Conservation Status
Atlantic salmon	Favourable – recovered	2011	UK: Unfavourable European Region: Unfavourable

The River Tay Sac supports a high-quality Atlantic salmon population which, in 1999, supported 10% of the total Scottish catch for the species. There is considerable ecological diversity within the River Tay, with adult Atlantic salmon entering the river throughout the year to spawn in one of the numerous catchment areas (JNCC, 2022g).

Atlantic salmon present a number of sensitivities relating to offshore developments within the marine environment (Scottish Government, 2019). These include:

> Non-Physical Disturbance (Noise Disturbance causing Barrier or Exclusion Effects); and

> Non-Physical Disturbance (EMF).

7.19.2 Site Objectives

The objectives of the River Tay SAC are to avoid the deterioration of the qualifying species and ensure that the integrity of the site is maintained to a Favourable Conservation Status. Table 7.45 provides the high-level conservation objective statements for the River Tay SAC.

Table 7.45 River Tay SAC Conservation Objectives

River Tay SAC
> To ensure that the qualifying interests of the River Tay SAC are in favourable condition and make an appropriate contribution to achieving a Favourable Conservation Status; and > To ensure that the integrity of the River Tay SAC is maintained or restored in the context of environmental changes by meeting the objectives of the qualifying feature.

River Tay SAC
For Atlantic Salmon
> To maintain the population of Atlantic salmon, including range of genetic types, as a viable component of the site; > Maintain the distribution of Atlantic salmon throughout the site; and > Maintain the habitats supporting Atlantic salmon within the site and the availability of food.

7.19.3 Assessment of Adverse Effects Alone

7.19.3.1 Underwater noise

For the reasons identified in Section 7.4.2, there is expected to be **no adverse effects** on migratory Atlantic salmon as a qualifying feature of the River Tay SAC, or the overall site integrity as a result of mortality or disturbance from underwater noise associated with construction activities at the Offshore Development.

7.19.3.2 Effects of EMFs affecting migration

For the reasons identified in Section 7.5.2, there is expected to be **no adverse effects** on migratory Atlantic salmon, as a qualifying feature of the River Tay SAC, or the overall site integrity as a result of EMF from the Offshore Export Cable(s) or the inter-array cables at the Offshore Development.

7.19.4 Assessment of Adverse Effects In-combination

For the reason identified in Section 7.6, **no adverse in-combination effects** are anticipated on the River Tay SAC site integrity.

7.19.5 Summary

The assessment indicates that no adverse effects are anticipated on the integrity or conservation objectives of the River Tay SAC outlined in Table 7.46.

Table 7.46 Summary of results

Protected Site	Qualifying Feature	Potential Effect	Conclusion
River Tay	Atlantic Salmon	Disturbance to and possible alteration of migration routes due to underwater noise generated from construction activities	No adverse effects on site integrity or conservation objectives are anticipated.
		Effects of EMFs affecting migration	No adverse effects on site integrity or conservation objectives are anticipated.

7.20 River Tweed SAC

The River Tweed SAC, designated in 2005, covers an area of 3742.65 ha (37.42 km^2) in the Scottish Borders and Northumberland. The site is characterised by tidal rivers, estuaries, inland water bodies, bogs, marshes and deciduous woodland. The site is designated for the conservation of the Annex I habitat water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation. The site is also designated for the conservation of Annex II species Atlantic salmon. The River Tweed SAC is located 403 km from the Offshore Site.

7.20.1 Site Details and Qualifying Interests

The NCA Screening Report (HWL, 2022) identified the River Tweed SAC as a site where migratory fish are a qualifying feature where there was potential for LSE. The condition and broader conservation status of the qualifying interests have been summarised in Table 7.47 (NatureScot, 2021n).

Table 7.47 Qualifying Interests and Condition for the River Tweed SAC

Qualifying Interests	Feature Condition	Assessment Date	Broader Conservation Status
Atlantic salmon	Favourable	2011	UK: Unfavourable European Region: Unfavourable

The River Tweed support a very large population of Atlantic salmon, with sub-catchments in Scotland and England. A high proportion of the River Tweed is accessible to Atlantic salmon, supporting a significant portion of the Scottish salmon resource. Estimates suggest that the River Tweed supports the highest Atlantic salmon catch in Scotland, with approximately 15% of all Scottish salmon caught in the River Tweed (JNCC, 2022h).

Atlantic salmon present a number of sensitivities relating to offshore developments within the marine environment (Scottish Government, 2019). These include:

- Non-Physical Disturbance (Noise Disturbance causing Barrier or Exclusion Effects); and
- Non-Physical Disturbance (EMF).

7.20.2 Site Objectives

The objectives of the River Tweed SAC are to avoid the deterioration of the qualifying species and ensure that the integrity of the site is maintained to a Favourable Conservation Status. Table 7.48 provides the high-level conservation objective statements for the River Tweed SAC.

Table 7.48 River Tweed SAC Conservation Objectives

River Tweed SAC
> To ensure that the qualifying interests of the River Tweed SAC are in favourable condition and make an appropriate contribution to achieving a Favourable Conservation Status; and > To ensure that the integrity of the River Tweed SAC is maintained or restored in the context of environmental changes by meeting the objectives of the qualifying feature.
For Atlantic Salmon
> To maintain the population of Atlantic salmon, including range of genetic types, as a viable component of the site; > Maintain the distribution of Atlantic salmon throughout the site; and > Maintain the habitats supporting Atlantic salmon within the site and the availability of food.

7.20.3 Assessment of Adverse Effects Alone

For the reasons identified in Section 7.4.2, there is expected to be **no adverse effects** on migratory Atlantic salmon as a qualifying feature of the River Tweed SAC, or the overall site integrity as a result of mortality or disturbance from underwater noise associated with construction activities at the Offshore Development.

7.20.3.1 Underwater noise

For the reasons identified in Section 7.4.2, there is expected to be no adverse effects on migratory Atlantic salmon as a qualifying feature of the River Tweed SAC, or the overall site integrity as a result of mortality or disturbance from underwater noise associated with construction activities at the Offshore Development.

7.20.3.2 Effects of EMFs affecting migration

For the reasons identified in Section 7.5.2, there is expected to be **no adverse effects** on migratory Atlantic salmon, as a qualifying feature of the River Tweed SAC, or the overall site integrity as a result of EMF from the Offshore Export Cable(s) or the inter-array cables at the Offshore Development.

7.20.4 Assessment of Adverse Effects In-combination

For the reason identified in Section 7.6, **no adverse in-combination effects** are anticipated on the River Tweed SAC site integrity.

7.20.5 Summary

The assessment indicates that no adverse effects are anticipated on the integrity or conservation objectives of the River Tweed SAC outlined in Table 7.49.

Table 7.49 Summary of results

Protected Site	Qualifying Feature	Potential Effect	Conclusion
River Tweed	Atlantic Salmon	Disturbance to and possible alteration of migration routes due to underwater noise generated from construction activities	No adverse effects on site integrity or conservation objectives are anticipated.
		Effects of EMFs affecting migration	No adverse effects on site integrity or conservation objectives are anticipated.

7.21 River Teith SAC

The River Teith SAC, designated in 2005, covers an area of 1289.33 ha (12.89 km^2) in Stirlingshire. The site is characterised by tidal rivers, estuaries, mud flats, inland water bodies, bogs, marshes and deciduous woodland. The site is designated for the conservation of the Annex II species Atlantic salmon (JNCC, 2022i). The River Teith SAC is located 448 km from the Offshore Site.

7.21.1 Site Details and Qualifying Interests

The NCA Screening Report (HWL, 2022) identified the River Teith SAC as a site where migratory fish are a qualifying feature where there was potential for LSE. The condition and broader conservation status of the qualifying interests have been summarised in Table 7.50 (NatureScot, 2021o).

Table 7.50 Qualifying Interests and Condition for the River Teith SAC

Qualifying Interests	Feature Condition	Assessment Date	Broader Conservation Status
Atlantic salmon	Favourable – recovered	2011	UK: Unfavourable European Region: Unfavourable

Whilst listed as a qualifying species for the River Teith SAC, Atlantic salmon are not considered to be a primary reason for site selection as an SAC.

Atlantic salmon present a number of sensitivities relating to offshore developments within the marine environment (Scottish Government, 2019). These include:

> Non-Physical Disturbance (Noise Disturbance causing Barrier or Exclusion Effects); and

> Non-Physical Disturbance (EMF).

7.21.2 Site Objectives

The objectives of the River Teith SAC are to avoid the deterioration of the qualifying species and ensure that the integrity of the site is maintained to a Favourable Conservation Status. Table 7.51 provides the high-level conservation objective statements for the River Teith SAC.

Table 7.51 River Teith SAC Conservation Objectives

River Teith SAC
> To ensure that the qualifying interests of the River Teith SAC are in favourable condition and make an appropriate contribution to achieving a Favourable Conservation Status; and > To ensure that the integrity of the River Teith SAC is maintained or restored in the context of environmental changes by meeting the objectives of the qualifying feature.
For Atlantic Salmon
> To maintain the population of Atlantic salmon, including range of genetic types, as a viable component of the site; > Maintain the distribution of Atlantic salmon throughout the site; and > Maintain the habitats supporting Atlantic salmon within the site and the availability of food.

7.21.3 Assessment of Adverse Effects Alone

7.21.3.1 Underwater noise

For the reasons identified in Section 7.4.2, there is expected to be **no adverse effects** on migratory Atlantic salmon as a qualifying feature of the River Teith SAC, or the overall site integrity as a result of mortality or disturbance from underwater noise associated with construction activities at the Offshore Development.

7.21.3.2 Effects of EMFs affecting migration

For the reasons identified in Section 7.5.2, there is expected to be **no adverse effects** on migratory Atlantic salmon, as a qualifying feature of the River Teith SAC, or the overall site integrity as a result of EMF from the Offshore Export Cable(s) or the inter-array cables at the Offshore Development.

7.21.4 Assessment of Adverse Effects In-combination

For the reason identified in Section 7.6, **no adverse in-combination effects** are anticipated on **the River Teith SAC** site integrity.

7.21.5 Summary

The assessment indicates that no adverse effects are anticipated on the integrity or conservation objectives of the River Teith SAC outlined in Table 7.52.

Table 7.52 Summary of results

Protected Site	Qualifying Feature	Potential Effect	Conclusion
River Teith	Atlantic Salmon	Disturbance to and possible alteration of migration routes due to underwater noise generated from construction activities	No adverse effects on site integrity or conservation objectives are anticipated.
		Effects of EMFs affecting migration	No adverse effects on site integrity or conservation objectives are anticipated.

7.22 Endrick Water SAC

The Endrick Water SAC, designated in 2005, covers an area of 235.45 ha (2.35 km^2) in the Forth. The site is characterised by inland water bodies, bogs, marshes, arable land, deciduous woodland, inland rocks and permanent snow and ice. The site is designated for the conservation of the Annex II species Atlantic salmon, Brook lamprey and River lamprey. The Endrick Water SAC is located 620 km from the Offshore Site.

7.22.1 Site Details and Qualifying Interests

The NCA Screening Report (HWL, 2022) identified the Endrick Water SAC as a site where migratory fish are a qualifying feature where there was potential for LSE. The condition and broader conservation status of the qualifying interests have been summarised in Table 7.31 (NatureScot, 2021p).

Table 7.53 Qualifying Interests and Condition for the Endrick Water SAC

Qualifying Interests	Interest Condition	Assessment Date	Broader Conservation Status
Atlantic salmon	Unfavourable - recovering	2011	UK: Unfavourable European Region: Unfavourable

Whilst listed as a qualifying species for the Endrick Water SAC, Atlantic salmon are not considered to be a primary reason for site selection as an SAC.

Atlantic salmon present a number of sensitivities relating to offshore developments within the marine environment (Scottish Government, 2019). These include:

> Non-Physical Disturbance (Noise Disturbance causing Barrier or Exclusion Effects); and

> Non-Physical Disturbance (EMF).

7.22.2 Site Objectives

The objectives of the Endrick Water SAC are to avoid the deterioration of the qualifying species and ensure that the integrity of the site is maintained to a Favourable Conservation Status. Table 7.32 provides the high-level conservation objective statements for the Endrick Water SAC.

Table 7.54 Endrick Water SAC Conservation Objectives

Endrick Water SAC
> To avoid deterioration of the habitats of the qualifying species or significant disturbance to the qualifying species, thus ensuring that the integrity of the site is maintained, and the site makes an appropriate contribution to achieving favourable conservation status for each of the qualifying interests.
For Atlantic Salmon
To ensure for the qualifying species that the following are maintained in the long term: > Population of the species, including range of genetic types for salmon, as a viable component of the site; > Distribution of the species within site; > Distribution an extent of habitats supporting the species; > Structure, function and supporting processes of habitats supporting the species; and > No significant disturbance of the species.

7.22.3 Assessment of Adverse Effect Alone

7.22.3.1 Underwater noise

For the reasons identified in Section 7.4.2, there is expected to be **no adverse effects** on migratory Atlantic salmon as a qualifying feature of the Endrick Water SAC, or the overall site integrity as a result of mortality or disturbance from underwater noise associated with construction activities at the Offshore Development.

7.22.3.2 Effects of EMFs affecting migration

For the reasons identified in Section 7.5.2, there is expected to be **no adverse effects** on migratory Atlantic salmon, as a qualifying feature of the Endrick Water SAC, or the overall site integrity as a result of EMF from the Offshore Export Cable(s) or the inter-array cables at the Offshore Development.

7.22.4 Assessment of Adverse Effects In-combination

For the reason identified in Section 7.6, **no adverse in-combination effects** are anticipated on the Endrick Water SAC site integrity.

7.22.5 Summary

The assessment indicates that no adverse effects are anticipated on the integrity or conservation objectives of the Endrick Water SAC outlined in Table 7.55.

Table 7.55 Summary of results

Protected Site	Qualifying Feature	Potential Effect	Conclusion
Endrick Water	Atlantic Salmon	Disturbance to and possible alteration of migration routes due to underwater noise generated from construction activities	No adverse effects on site integrity or conservation objectives are anticipated.
		Effects of EMFs affecting migration	No adverse effects on site integrity or conservation objectives are anticipated.

7.23 River Bladnoch SAC

The River Bladnoch SAC, designated in 2005, covers an area of 272.6 ha (2.72 km^2) in Dumfries and Galloway. The site is characterised by tidal rivers, inland water bodies, bogs, marshes and deciduous woodland. The site is designated for the conservation of the Annex II species Atlantic salmon. The River Bladnoch SAC is located 653 km from the Offshore Site.

7.23.1 Site Details and Qualifying Interests

The NCA Screening Report (HWL, 2022) identified the River Bladnoch SAC as a site where migratory fish are a qualifying feature where there was potential for LSE. The condition and broader conservation status of the qualifying interests have been summarised in Table 7.56 (NatureScot, 2021q).

Table 7.56 Qualifying Interests and Condition for the River Bladnoch SAC

Qualifying Interests	Feature Condition	Assessment Date	Broader Conservation Status
Atlantic salmon	Unfavourable – recovering	2011	UK: Unfavourable European Region: Unfavourable

The River Bladnoch SAC supports a high-quality Atlantic salmon population in south-west Scotland. The rivers in this area are usually used as spring runs for Atlantic salmon. The river reflects a diverse range of ecological and water quality characteristics; however, the Atlantic salmon population of the site has seen declines in recent decades resulting from acidification. Local and national initiatives are in place to restore the river by reducing and improving the effects of population (JNCC, 2022j).

Atlantic salmon present a number of sensitivities relating to offshore developments within the marine environment (Scottish Government, 2019). These include:

- Non-Physical Disturbance (Noise Disturbance causing Barrier or Exclusion Effects); and
- Non-Physical Disturbance (EMF).

7.23.2 Site Objectives

The objectives of the River Bladnoch SAC are to avoid the deterioration of the qualifying species and ensure that the integrity of the site is maintained to a Favourable Conservation Status. Table 7.57 provides the high-level conservation objective statements for the River Bladnoch SAC.

Table 7.57 River Bladnoch SAC Conservation Objectives

River Bladnoch SAC
> To ensure that the qualifying interests of the River Baldnoch SAC are in favourable condition and make an appropriate contribution to achieving a Favourable Conservation Status; and > To ensure that the integrity of the River Bladnoch SAC is maintained or restored in the context of environmental changes by meeting the objectives of the qualifying feature.
For Atlantic Salmon
> To restore the population of Atlantic salmon, including range of genetic types, as a viable component of the site; > Restore the distribution of Atlantic salmon throughout the site; and > Restore the habitats supporting Atlantic salmon within the site and the availability of food.

7.23.3 Assessment of Adverse Effects Alone

7.23.3.1 Underwater noise

For the reasons identified in Section 7.4.2, there is expected to be **no adverse effects** on migratory Atlantic salmon as a qualifying feature of the River Baldnoch SAC, or the overall site integrity as a result of mortality or disturbance from underwater noise associated with construction activities at the Offshore Development.

7.23.3.2 Effects of EMFs affecting migration

For the reasons identified in Section 7.5.2, there is expected to be **no adverse effects** on migratory Atlantic salmon, as a qualifying feature of the River Baldnoch SAC, or the overall site integrity as a result of EMF from the Offshore Export Cable(s) or the inter-array cables at the Offshore Development.

7.23.4 Assessment of Adverse Effects In-combination

For the reason identified in Section 7.6, **no adverse in-combination effects** are anticipated on the River Baldnoch SAC site integrity.

7.23.5 Summary

The assessment indicates that no adverse effects are anticipated on the integrity or conservation objectives of the River Bladnoch SAC outlined in Table 7.58.

Table 7.58 Summary of results

Protected Site	Qualifying Feature	Potential Effect	Conclusion
River Bladnoch	Atlantic Salmon	Disturbance to and possible alteration of migration routes due to underwater noise generated from construction activities	No adverse effects on site integrity or conservation objectives are anticipated.
		Effects of EMFs affecting migration	No adverse effects on site integrity or conservation objectives are anticipated.

7.24 Conclusion

A summary of the Offshore Development's assessment on protected sites with Atlantic salmon and freshwater pearl mussels as listed interests is shown in Table 7.59.

Table 7.59 Summary of results

Protected Site	Qualifying Feature	Potential Effect	Conclusion
River Thurso	Atlantic Salmon	Disturbance to and possible alteration of migration routes due to underwater noise generated from construction activities	No adverse effects on site integrity or conservation objectives are anticipated.
		Effects of EMFs affecting migration	No adverse effects on site integrity or conservation objectives are anticipated.
River Naver	Atlantic Salmon	Disturbance to and possible alteration of migration routes due to	No adverse effects on site integrity or conservation objectives are anticipated.

Protected Site	Qualifying Feature	Potential Effect	Conclusion
		underwater noise generated from construction activities	
		Effects of EMFs affecting migration	No adverse effects on site integrity or conservation objectives are anticipated.
	Freshwater pearl mussel	Disturbance to and possible alteration of migration routes due to underwater noise generated from construction activities resulting in an indirect effect on freshwater pearl mussels	No adverse effects on site integrity or conservation objectives are anticipated.
		Effects of EMFs affecting migration of Atlantic salmon resulting in an indirect effect on freshwater pearl mussels	No adverse effects on site integrity or conservation objectives are anticipated.
River Borgie	Atlantic Salmon	Disturbance to and possible alteration of migration routes due to underwater noise generated from construction activities	No adverse effects on site integrity or conservation objectives are anticipated.
		Effects of EMFs affecting migration	No adverse effects on site integrity or conservation objectives are anticipated.
	Freshwater pearl mussel	Disturbance to and possible alteration of migration routes due to underwater noise generated from construction activities resulting in an indirect effect on freshwater pearl mussels	No adverse effects on site integrity or conservation objectives are anticipated.
		Effects of EMFs affecting migration of Atlantic salmon resulting in an indirect effect on freshwater pearl mussels	No adverse effects on site integrity or conservation objectives are anticipated.
River Oykel	Atlantic Salmon	Disturbance to and possible alteration of migration routes due to underwater noise generated from construction activities	No adverse effects on site integrity or conservation objectives are anticipated.
		Effects of EMFs affecting migration	No adverse effects on site integrity or conservation objectives are anticipated.
	Freshwater pearl mussel	Disturbance to and possible alteration of migration routes due to underwater noise generated from construction activities resulting in an indirect effect on freshwater pearl mussels	No adverse effects on site integrity or conservation objectives are anticipated.
		Effects of EMFs affecting migration of Atlantic salmon resulting in an	No adverse effects on site integrity or conservation objectives are anticipated.

Protected Site	Qualifying Feature	Potential Effect	Conclusion
		indirect effect on freshwater pearl mussels	
River Spey	Atlantic Salmon	Disturbance to and possible alteration of migration routes due to underwater noise generated from construction activities	No adverse effects on site integrity or conservation objectives are anticipated.
		Effects of EMFs affecting migration	No adverse effects on site integrity or conservation objectives are anticipated.
	Freshwater pearl mussel	Disturbance to and possible alteration of migration routes due to underwater noise generated from construction activities resulting in an indirect effect on freshwater pearl mussels	No adverse effects on site integrity or conservation objectives are anticipated.
		Effects of EMFs affecting migration of Atlantic salmon resulting in an indirect effect on freshwater pearl mussels	No adverse effects on site integrity or conservation objectives are anticipated.
River Little Gruinard	Atlantic Salmon	Disturbance to and possible alteration of migration routes due to underwater noise generated from construction activities	No adverse effects on site integrity or conservation objectives are anticipated.
		Effects of EMFs affecting migration	No adverse effects on site integrity or conservation objectives are anticipated.
River Moriston	Atlantic Salmon	Disturbance to and possible alteration of migration routes due to underwater noise generated from construction activities	No adverse effects on site integrity or conservation objectives are anticipated.
		Effects of EMFs affecting migration	No adverse effects on site integrity or conservation objectives are anticipated.
	Freshwater pearl mussel	Disturbance to and possible alteration of migration routes due to underwater noise generated from construction activities resulting in an indirect effect on freshwater pearl mussels	No adverse effects on site integrity or conservation objectives are anticipated.
		Effects of EMFs affecting migration of Atlantic salmon resulting in an indirect effect on freshwater pearl mussels	No adverse effects on site integrity or conservation objectives are anticipated.
River Dee	Atlantic Salmon	Disturbance to and possible alteration of migration routes due to underwater noise generated from construction activities	No adverse effects on site integrity or conservation objectives are anticipated.

Protected Site	Qualifying Feature	Potential Effect	Conclusion
		Effects of EMFs affecting migration	No adverse effects on site integrity or conservation objectives are anticipated.
	Freshwater pearl mussel	Disturbance to and possible alteration of migration routes due to underwater noise generated from construction activities resulting in an indirect effect on freshwater pearl mussels	No adverse effects on site integrity or conservation objectives are anticipated.
		Effects of EMFs affecting migration of Atlantic salmon resulting in an indirect effect on freshwater pearl mussels	No adverse effects on site integrity or conservation objectives are anticipated.
River Tay	Atlantic Salmon	Disturbance to and possible alteration of migration routes due to underwater noise generated from construction activities	No adverse effects on site integrity or conservation objectives are anticipated.
		Effects of EMFs affecting migration	No adverse effects on site integrity or conservation objectives are anticipated.
River South Esk	Atlantic Salmon	Disturbance to and possible alteration of migration routes due to underwater noise generated from construction activities	No adverse effects on site integrity or conservation objectives are anticipated.
		Effects of EMFs affecting migration	No adverse effects on site integrity or conservation objectives are anticipated.
	Freshwater pearl mussel	Disturbance to and possible alteration of migration routes due to underwater noise generated from construction activities resulting in an indirect effect on freshwater pearl mussels	No adverse effects on site integrity or conservation objectives are anticipated.
		Effects of EMFs affecting migration of Atlantic salmon resulting in an indirect effect on freshwater pearl mussels	No adverse effects on site integrity or conservation objectives are anticipated.
River Teith	Atlantic Salmon	Disturbance to and possible alteration of migration routes due to underwater noise generated from construction activities	No adverse effects on site integrity or conservation objectives are anticipated.
		Effects of EMFs affecting migration	No adverse effects on site integrity or conservation objectives are anticipated.
River Tweed	Atlantic Salmon	Disturbance to and possible alteration of migration routes due to	No adverse effects on site integrity or conservation objectives are anticipated.

Protected Site	Qualifying Feature	Potential Effect	Conclusion
		underwater noise generated from construction activities	
		Effects of EMFs affecting migration	No adverse effects on site integrity or conservation objectives are anticipated.
River Bladnoch	Atlantic Salmon	Disturbance to and possible alteration of migration routes due to underwater noise generated from construction activities	No adverse effects on site integrity or conservation objectives are anticipated.
		Effects of EMFs affecting migration	No adverse effects on site integrity or conservation objectives are anticipated.
River Berriedale and Langwell Waters	Atlantic Salmon	Disturbance to and possible alteration of migration routes due to underwater noise generated from construction activities	No adverse effects on site integrity or conservation objectives are anticipated.
		Effects of EMFs affecting migration	No adverse effects on site integrity or conservation objectives are anticipated.
Langavat	Atlantic Salmon	Disturbance to and possible alteration of migration routes due to underwater noise generated from construction activities	No adverse effects on site integrity or conservation objectives are anticipated.
		Effects of EMFs affecting migration	No adverse effects on site integrity or conservation objectives are anticipated.
Endrick Water	Atlantic Salmon	Disturbance to and possible alteration of migration routes due to underwater noise generated from construction activities	No adverse effects on site integrity or conservation objectives are anticipated.
		Effects of EMFs affecting migration	No adverse effects on site integrity or conservation objectives are anticipated.
North Harris	Atlantic Salmon	Disturbance to and possible alteration of migration routes due to underwater noise generated from construction activities	No adverse effects on site integrity or conservation objectives are anticipated.
		Effects of EMFs affecting migration	No adverse effects on site integrity or conservation objectives are anticipated.
	Freshwater pearl mussel	Disturbance to and possible alteration of migration routes due to underwater noise generated from construction activities resulting in an indirect effect on freshwater pearl mussels	No adverse effects on site integrity or conservation objectives are anticipated.

Protected Site	Qualifying Feature	Potential Effect	Conclusion
		Effects of EMFs affecting migration of Atlantic salmon resulting in an indirect effect on freshwater pearl mussels	No adverse effects on site integrity or conservation objectives are anticipated.

7.24.1 Additional Mitigation and Monitoring

Having given consideration to embedded mitigation measures for the Offshore Development, the RIAA concluded no adverse effects to the integrity of the European Sites assessed, and therefore there is no requirement for additional mitigation over and above the embedded mitigation measures proposed in Section 6.

8 ANNEX II MARINE MAMMALS ASSESSMENT

8.1 Introduction

This section provides an assessment of the adverse effects from the Offshore Development on SACs designated for the conservation of Annex II marine mammals which have been screened into the assessment. This section also provides information that should be used to determine the potential effects of the Offshore Development on the conservation objectives of the SACs screened in for assessment.

8.1.1 Summary of Screening

8.1.1.1 Screening process for Annex II marine mammals

Screening was conducted in order to identify potential exposure pathways between Annex II marine mammals and the Offshore Development (as detailed in Section 3). The Annex II marine mammal qualifying interests screened in for Stage 2 assessment are:

- Bottlenose dolphin (*Tursiops truncatus*);
- Harbour porpoise (*Phocoena phocoena*);
- Harbour seal (*Phoca vitulina*); and
- Grey seal (*Halichoerus grypus*).

These species are managed individually, over their biogeographic ranges, through defined MUs. Figure 8.1 and 8.2 below illustrate the extents of the relevant MUs and SMUs to the Offshore Development.

The following MUs have been considered in the screening process, based on overlap or proximity to the Offshore Development:

- Bottlenose dolphin:
    - Coastal East Scotland (CES) MU (overlapping); and
    - Coastal West Scotland and the Hebrides (CWSH) MU (has a boundary within 6.2 km of the study area).
- Harbour porpoise:
    - North Sea (NS) MU (overlapping); and
    - West Scotland (WS) MU (has a boundary within 6.2 km of the study area).
- Harbour seal and grey seal:
    - North Coast and Orkney (NCO) SMU, for both species (overlapping).

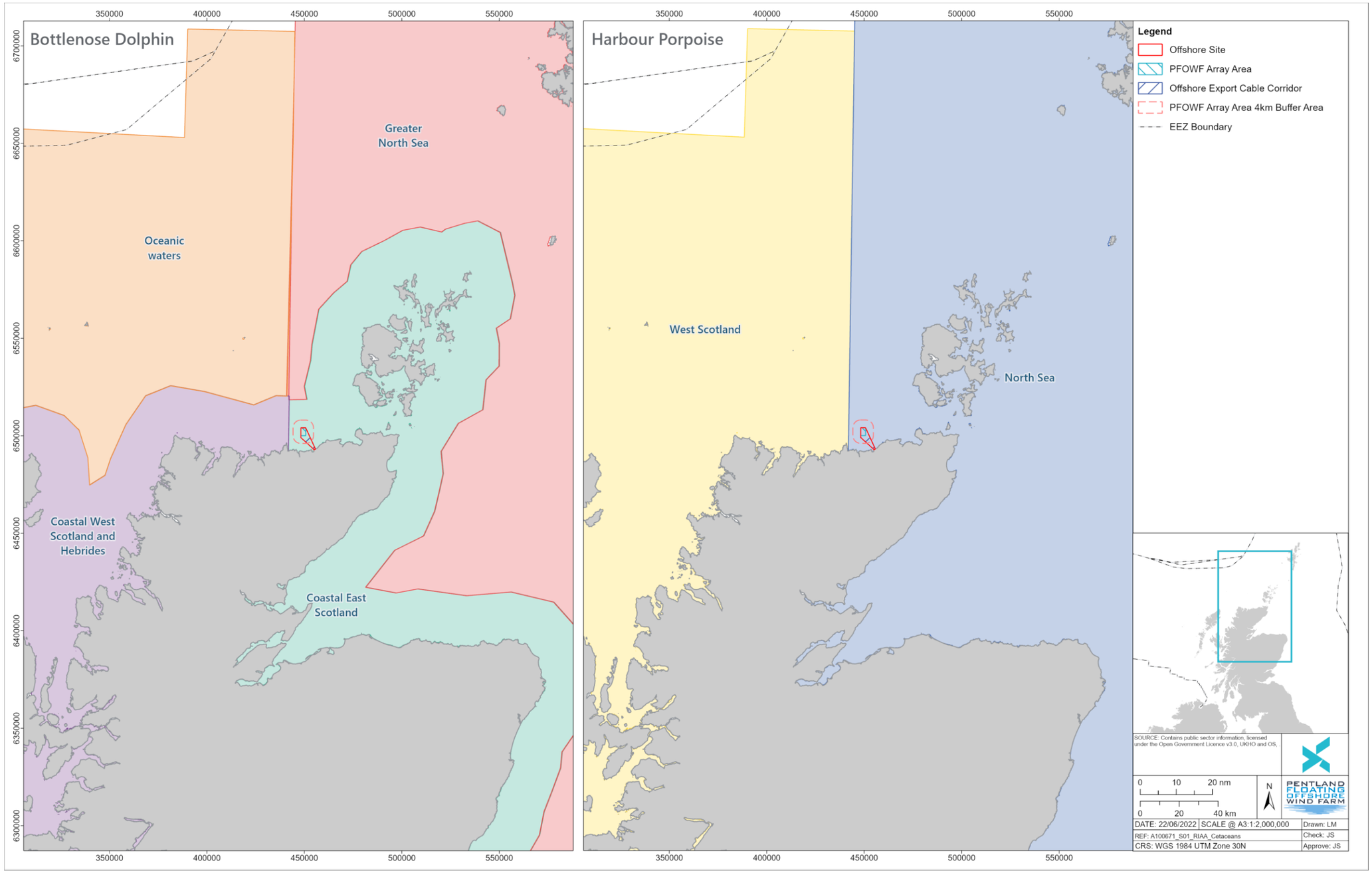


Figure 8.1 Cetacean Management Units relevant to the Offshore Development

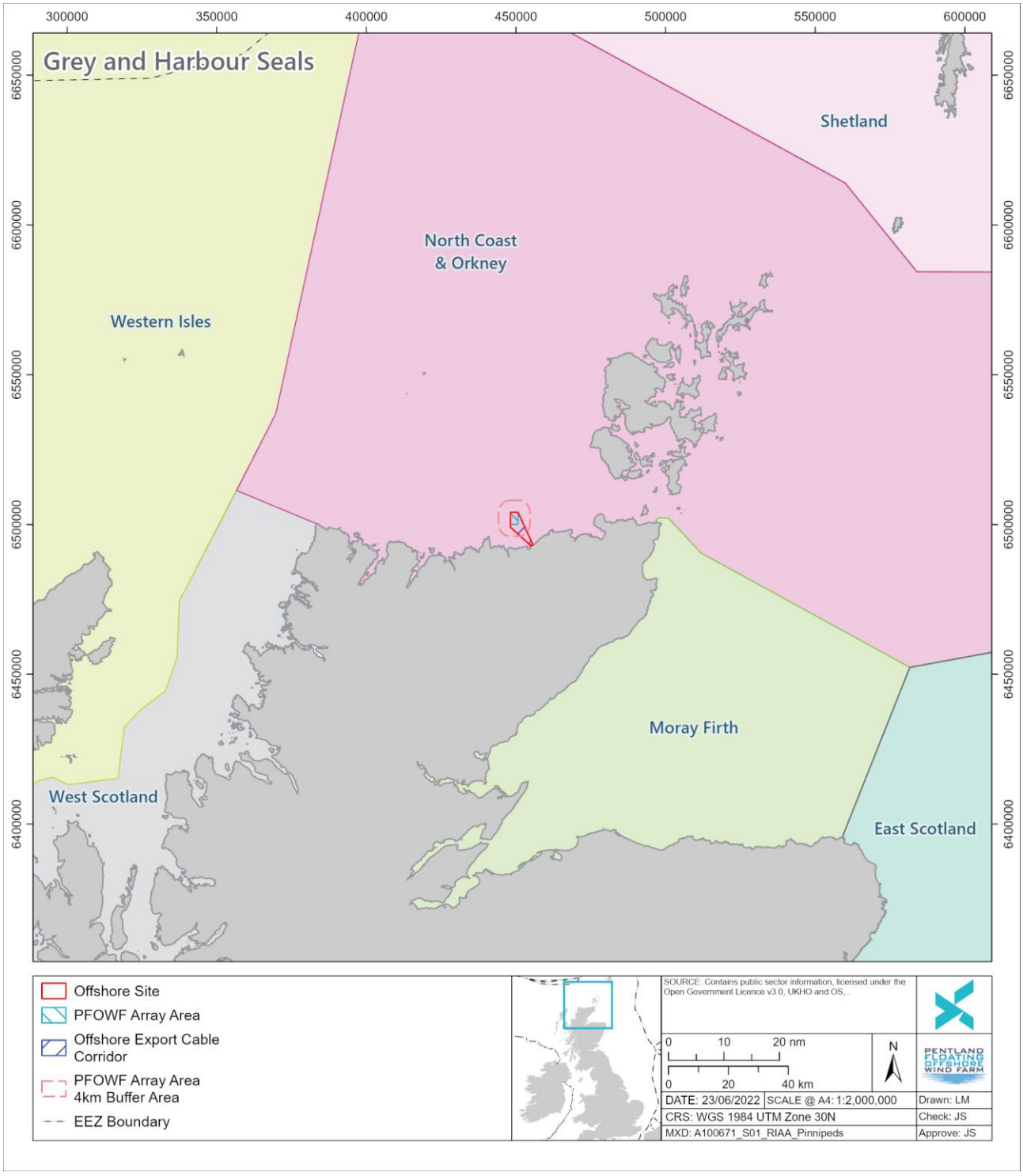


Figure 8.2 Seal Management Units relevant to the Offshore Development

8.1.1.2 SACs screened in for assessment

The SACs screened in for assessment are shown in Section 3.3.2; Table 3.4.

8.1.1.3 In-combination assessment

Various projects have been considered for in-combination impacts with the proposed Offshore Development activities in the assessment of adverse effects to marine mammals as qualifying interests of protected sites. Table 8.1 provides the project details and justification for each project's in-combination consideration, based on which of the relevant marine mammal MUs overlap, and therefore may have connectivity, with that project.

Table 8.1 Projects which are relevant to the in-combination impact assessment for sites with marine mammal qualifying interests based on the marine mammal MUs relevant to the Offshore Site

Project	Type	MU Used in Project Screening			
		CES & CWSH[1]	NS	WS	NCO
Green Volt	Offshore wind farm	Y	Y	N	N
Rampion 2	Offshore wind farm	N	Y	N	N
Erebus	Offshore wind farm	N	N	N	N
Blyth Offshore Demonstrator – Phase 2	Offshore wind farm	N	Y	N	N
Dogger Bank C	Offshore wind farm	N	Y	N	N
Sofia	Offshore wind farm	N	Y	N	N
Hornsea Three	Offshore wind farm	N	Y	N	N
Hornsea Four	Offshore wind farm	N	Y	N	N
Norfolk Vanguard	Offshore wind farm	N	Y	N	N
Norfolk Boreas	Offshore wind farm	N	Y	N	N
Dudgeon & Sheringham Shoal Extensions	Offshore wind farm	N	Y	N	N
East Anglia ONE North	Offshore wind farm	N	Y	N	N
East Anglia Two	Offshore wind farm	N	Y	N	N
East Anglia Three	Offshore wind farm	N	Y	N	N
Awel y Môr	Offshore wind farm	N	N	N	N
Offshore wind farms in EU waters	Offshore wind farm	N	Y	N	N
European Marine Energy Centre (EMEC) Billia Croo	Wave energy testing site	Y	Y	N	Y
EMEC Fall of Wareness	Tidal stream energy testing site	Y	Y	N	Y
EMEC Scapa Flow	Wave energy testing site	Y	Y	N	Y
MeyGen	Tidal stream energy development	Y	Y	N	Y

Project	Type	MU Used in Project Screening			
		CES & CWSH[1]	NS	WS	NCO
Scapa Deep Water Quay	Ports and Harbours	Y	Y	N	Y
Hatston Pier Expansion Project	Ports and Harbours	Y	Y	N	Y
Scotland England Green Link 1	Interconnector	Y	Y	N	N
Scotland England Green Link 2	Interconnector	Y	Y	N	N
NorthConnect	Interconnector	Y	Y	N	N
Celtic Interconnector	Interconnector	N	N	N	N
French-Alderney-Britain (FAB) Link	Interconnector	N	N	N	N
Acorn	Carbon capture and storage (CCS)	N	Y	N	N
Faray slipway extension and landing jetty	Jetty	Y	Y	Y	Y
North Sea oil and gas assets	Field developments & decommissioning	N	Y	N	N
Seismic airgun surveys for oil and gas and CCS developments	Seismic Surveys	N	Y	N	N

[1] The Offshore Development lies within the CES MU for bottlenose dolphin. Whilst the boundaries of three other bottlenose dolphin MUs lie within 20 km of the Offshore Development, only projects within (or with the potential to result in impacts to) the CES MU, for which there is a single site - the Moray Firth SAC, are considered within the in-combination assessment. This is because there are no SACs with bottlenose dolphin as a qualifying feature in the WS or Oceanic Waters MU. Within the Greater North Sea MU, all SACs with bottlenose dolphin as a qualifying feature are located on the coast of continental Europe, over 1,000 km distant; as such, any impacts from the Offshore Development on bottlenose dolphin within the Greater North Sea MU are not likely to have an adverse effect on such distant sites.

8.1.2 Impacts Screened Out

Following the initial screening, as presented in Table 3.8, the following potential impact pathways have been screened out for further assessment within this RIAA. Table 8.2 below provides justification for any additional impact pathways which have been screened out from further assessment.

Table 8.2 Pathways screened out of RIAA

Receptor	Pathway Screened Out
Annex II Marine Mammals	**Corkscrew injury to seals from vessel activities:** Research by Brownlow *et al.* (2016) presents irrefutable evidence that corkscrew injuries can be caused by grey seal predation on weaned grey seal pups. There are additional observations of adult grey seals killing and eating young harbour seals in Germany (van Neer *et al*, 2016). Regulators and Statutory Nature Conservation Bodies (SNCBs) now consider that the use of vessels with ducted propellers may not pose any increased risk to seals above those of normal shipping activities. As a result, the risk of corkscrew injury to seals has been screened out as it is not anticipated to result in LSE from any proposed activities relating to the Offshore Development and has, therefore, not been considered further in the RIAA.

Receptor	Pathway Screened Out
	Disturbance from EMF emissions: Although there is limited research into the effects of EMF on marine mammals, there is also very little indication that the emission of EMFs generate acute or severe adverse effects on those taxa. Marine mammals are considered less sensitive to EMFs than other marine species, such as diadromous fish and elasmobranchs, which utilise EMFs to aid in migration, orientation and hunting (Copping *et al.*, 2020). Based on the EMF study undertaken for the Offshore Development, EMF emissions from the Offshore Export Cable(s) will be well below those from the Earth's magnetic field. It is therefore highly unlikely that the Offshore Development has potential to bring about perceptible physiological or behavioural changes to widely distributed and free ranging marine mammal receptors. Therefore, there is no potential for adverse effects on marine mammals, including as qualifying interests of protected sites, and this impact has not been considered further within the RIAA.
	Disturbance or displacement from temporary increases in suspended sediments: All marine mammals found in UK waters have some level of adaptation to deal with short-term reductions in visibility, such as those experienced when foraging at depth or outwith daylight hours. Habitat use by cetaceans predominantly takes place within the water column, so these animals are less likely to interact with temporary increases in turbidity occurring near the seabed. Seals, which are more likely to forage at depth and on the sea floor, regularly experience elevated levels of localised sediment suspension (e.g. due to a reduction in water column volume, or as a result of their foraging techniques). As such, this taxa has adapted to utilise their vibrissae (whiskers) and other tactile information as the primary sense during times of reduced visibility (Murphy *et al.*, 2015). For these reasons, no significant disturbance or displacement impacts to any marine mammals are anticipated from the proposed Offshore Development activities and this impact has not been considered further within the RIAA.
	Disturbance in the very nearshore environment due to underwater noise generated by Horizontal Directional Drilling (HDD): HDD is planned for landfall (the first 400 - 700 m from Mean High Water Springs (MHWS) of the Offshore Export Cable(s) as it leaves the Onshore Site and enters the marine environment. However, as the noise source itself comes from machinery on land and underground and the noise source will be radiated into the seabed within the highly energetic coastal environment. A study by Nedwell et al., (2012) indicates that noise generated by the HDD activities are anticipated to be <130 dB re. 1µPa at the seabed, will not exceed the ambient noise of the nearshore environment. Therefore, there is no potential for adverse effects on marine mammals, and this impact has not been considered further within the RIAA.
	Disturbance due to the physical presence of vessels: In agreement with consultation received through the Scoping Opinion and the Scoping Opinion Addendum (provided in Offshore EIAR [Volume 2] Chapter 11: Marine Mammals and Other Megafauna, Section 11.3), it is difficult to separate disturbance caused by vessel presence from that generated by vessel noise. The consultees have agreed that they are content that disturbance due to the physical presence of vessels is scoped out, providing that disturbance-related impacts to marine mammals are fully considered in an underwater noise assessment. The RIAA includes a full assessment of vessel noise and any potential disturbance effects it may have on Annex II marine mammal receptors. In line with the advice received, disturbance from the physical presence of vessels has not been considered further in the RIAA.
	Collision risk with vessels: All vessel movements associated with the Offshore Development will be managed under a VMP which will include safety measures to protect and reduce the risk of collision with marine mammals using protocols supplied in the SMWWC (NatureScot, 2017) and be secured under condition. This type of mitigation is considered to be standard and best practice and thus intrinsically part of the Offshore Development Design. As such, the risk of injury or mortality resulting from collision of marine mammals with vessels has not been considered further in the RIAA.

8.1.3 Summary of Potential Pathways

Several potential impact pathways were identified during the HRA screening stage and through the EIA process; these are:

- Injury and disturbance from underwater noise associated with:
    - Pre-construction geophysical surveys, noting that a separate European Protected Species (EPS) Licence will be required for these activities, which will be supported by an EPS risk assessment;
    - Potential pre-construction UXO clearance - UXO clearance is not anticipated to be required for the Offshore Development and is not included within the consent application supported by this RIAA. However, should UXO clearance be required during the pre-construction phase, it would generate underwater noise emissions with the potential to injure or disturb marine megafauna, and is assessed here for completeness. If UXO clearance was required, a separate assessment would be undertaken and separate application submitted in the future.
    - Pile installation using impact piling;
    - Other construction activities;
    - Operations and maintenance vessels;
    - Operational noise from mooring infrastructure; and
    - Decommissioning activities.
- Displacement and/or barrier effects resulting from the physical presence of devices and infrastructure;
- Risk of injury or mortality resulting from entanglement of marine mammals with mooring lines or cables, including secondary interactions with derelict fishing gears, or entrapment with mooring systems; and
- Collision risk with floating infrastructure.

8.2 Project Design Envelope Parameters Relevant to Annex II Marine Mammals

As outlined in the Project Description (Section 5), this assessment considers the Offshore Development parameters which are likely to result in the greatest environmental impact on the receptor, known as the 'realistic worst case scenario'. The realistic worst case scenario represents, for any given receptor and potential impact on the receptor, various options in the Design Envelope that would result in the greatest potential for change to receptor in question (see Offshore EIAR [Volume 2]: Chapter 5: Project Description and Chapter 11: Marine Mammals and Other Megafauna, Section 11.5.4). In this way, use of the realistic worst case scenario provides for a cautious assessment of the potential impacts of the Offshore Development on the environment in line with Marine Scotland's (2022) *Guidance for applicants on using the design envelope for applications under section 36 of the Electricity Act 1989*.

Table 8.3 details the realistic worst case scenario design parameters which are associated with activities which may impact marine mammals during the construction, operation and maintenance, and decommissioning phases of the Offshore Development. For marine mammals, the realistic worst case scenario has been derived by applying the contemporary understanding of key species sensitivities to the proposed activity and identifying which aspects of the Design Envelope would most likely result in the largest impact on marine mammal receptors.

Table 8.3 Design Envelope parameters specific to the assessment of impacts to marine mammal receptors

Potential Impact	Design Envelope Scenario Assessed
Construction Phase	
Noise-related impacts to marine mammals associated with construction noise, including the risk of physiological impacts, barrier effects and displacement	**Anchors: Impact piles:** > Up to nine impact piles per WTG (63 piles total), each pile being up to a maximum of 5 m in diameter. The following scenario is considered as the worst case for the impact assessment: o 5-m diameter tubular pile, 20 m length. Installed using a hammer with maximum blow energy of 2,500 kJ over a total period of eight hours per pile. A maximum of three piles installed in 24 hours; o A minimum of one pile installed in 24 hours; o A maximum of 63 days of piling; and > Soft-start procedures assume 5% of maximum hammer energy for the first five minutes, doubling every five minutes for up to 20 minutes before full hammer energy is employed. **Geophysical surveys**: includes pre- and post-installation surveys and surveys to confirm the presence of any UXOs: > Multibeam Echosounder (MBES): o Frequency: 200-400 kHz; o Source pressure level (SPL): 218 (peak), 213 (rms) $dB_{re\ 1\ \mu Pa\ @\ 1m}$ > Side Scan Sonar (SSS): o Frequency: 300 & 900 kHz; o (SPL: 210 (peak), 242 (rms) $dB_{re\ 1\ \mu Pa\ @\ 1m}$ > Ultra-short Baseline (USBL): o Frequency: 20-35 kHz; o SPL: 194 (peak), 188 (rms) $dB_{re\ 1\ \mu Pa\ @\ 1m}$ **UXO Clearance:** UXO clearance is not planned nor anticipated to be required for the Offshore Development, based on the Risk Assessment carried out by Ordtek (2021). Any UXO clearance activities which are identified as being required during the UXO and geophysical survey campaign will be considered in consultation with the relevant stakeholders and will be covered under a separate licence. Should clearance be required during the pre-construction phase, it would generate temporary underwater noise emissions with the potential to injure or disturb marine megafauna. > High-order detonation charge size: 525 kg (plus donor charge) **Other Construction Activities:** > Suction dredging forms the worst case intermittent, non-impulsive noise source during construction: o SPL: 186 (rms) $dB_{re\ 1\ \mu Pa\ @\ 1m}$ > Vessel noise – from various survey vessels, cable installation, crew transfer, and support vessels: o A maximum of ten vessels will be in the Offshore Site simultaneously.

Potential Impact	Design Envelope Scenario Assessed
	○ Large vessels (>100 m) produce the loudest continuous noise source. ○ SPL: 168 (rms) dBre 1 µPa @ 1m ○ 1,630 concurrent vessel days from 10 different vessels.
Operation and Maintenance Phase	
Noise-related impacts to marine mammals associated with operational noise, including the risk of physiological impacts, barrier effects and displacement as a result of operational monitoring surveys and vessel activities	**Mooring line 'pinging':** The sudden re-tension in a mooring cable following a period of slackness, resulting in a short 'pinging' or 'snapping' noise. Scenario based on modelling of noise data analysed at the Hywind Project (the only project to date where this phenomenon has been reported) (Midforth *et al.*, 2022): > Up to 23 pings per day (average rate of less than once per hour) > Ten WTGs = predicted potential SELcum (unweighted) of 160 dB re 1 µPa2s > Therefore, seven WTGs (as proposed for the Offshore Development) = SELcum (unweighted) of < 160 dB re 1 μPa^2s **Vessel Noise** – from crew transfer, and support vessels: > Large vessels (>100 m) produce the loudest continuous noise source. > SPL: 168 (rms) $dB_{re\ 1\ \mu Pa\ @\ 1m}$
Risk of injury resulting from entanglement of marine mammals with mooring lines or cables, including secondary interactions with derelict fishing gears Displacement or barrier effects resulting from the physical presence of devices and infrastructure, including substructures, mooring lines and cables	**WTGs:** > WTGs have the potential to influence prey and subsequent predator distributions (e.g. by acting as fish aggregates) through the introduction of novel structures in the marine environment. > Total number of WTGs: 7 > Minimum WTG spacing: 800 m > Total array area: 10 km^2 **Substructures:** > The semi-submersible substructure option will have the greatest surface area and potential for movement within the water column, based on design. ○ Maximum footprint: 15,625 m^2 ○ Maximum length and breadth of 125 x 125 m, height 50 m (30 m in air, 20 m below sea) ○ Below-sea surface area: 25,625 m2 per WTG **Cables:** > Dynamic components of inter-array cables may introduce barriers to movement within the water column and/or displacement from the study area, as well as increase entanglement risk. > Cabling within the water column: 5,000 m of cable within the water as a worst case scenario. > Up to 300 mm diameter. **Moorings:** > Total moorings: 63 (9 per WTG)

Potential Impact	Design Envelope Scenario Assessed
	> Changes in water quality, due to sedimentation, which may affect prey distributions may result from the repeated movement of mooring lines and chains along the seabed. > Moorings may also introduce lines in the water column which can entangle other floating manmade objects (e.g. derelict fishing lines and gears). > Catenary mooring systems o Of the mooring systems under consideration, the catenary mooring system is expected to have the largest seabed footprint (based on a 1,650 m mooring line length): up to 1,485 m per line on the seabed; and o The largest spread radius: 1,500 m per line > Semi-taut mooring systems o Expected to have the largest pelagic footprint (based on a 1,050 m mooring line length): up to 525 m per line within the water column. > Mooring systems may use single or combined materials, including synthetic ropes, steel wire ropes and cables, and steel chains: o Chains / cables will be 175 mm thick o Synthetic ropes will be 350 mm thick
Decommissioning Phase	
Potential impacts arising during the decommissioning phase are expected to be similar to, but not exceeding, those arising during the construction phase.	In the absence of detailed information regarding decommissioning works, the implications for marine mammals and other megafauna are considered analogous with or likely less than those of the construction phase. Therefore, the worst case parameters defined for the construction phase also apply to decommissioning. The decommissioning approach is set out in Chapter 5: Project Description of Offshore EIAR (Volume 2). It is expected that all offshore components will be completely removed to shore for re-use, recycling and disposal during decommissioning, unless there is compelling evidence to leave certain components, *in situ*, for example, scour protection, which may not be practical to recover, or piles which may be cut off 1 m below the seabed. It may be preferable to leave the scour protection *in situ* to preserve the marine habitat that may have developed over the life of the Offshore Development; this is particularly the case for remedial protection placement / boulders as these are generally quite small in grade size and thousands in quantity so not practical to recover. A Decommissioning Programme will be developed pre-construction to address the principal decommissioning measures for the Offshore Development, this will be written in accordance with applicable guidance and detail the management, environmental management and schedule for decommissioning. The Decommissioning Programme will be reviewed and updated throughout the life-cycle of the Offshore Development to account for changing best practice. Relevant stakeholders and regulators will be consulted to establish the approach. The seabed will be restored, as far as reasonably practicable, to the condition it was prior to the construction of the Offshore Development.

8.3 Approach to Assessment

When considering the potential effects of a project on the marine mammal interests of a SAC, the high mobility of marine mammal species results in the potential for individuals to be affected outside the boundary of the SAC for which they are a qualifying feature. In this assessment, an initial approach is adopted which considers all SACs for marine mammal qualifying species which occur within the species-specific Management Unit in which the Offshore Development is located, or which it is directly proximal to, and then progressing to those sites where a potential impact pathway between the qualifying interests and the Offshore Development exists to a full assessment.

The following Annex II marine mammal assessment is provided to determine whether activities associated with the Offshore Development can reasonably be expected to result in adverse effects on the marine mammal conservation objectives of assessed SACs.

The subsequent SAC-specific assessments comprise the following sections:

- A description of the SAC considered in the assessment with details of the site and overview of the site qualifying interests for which the SAC is being assessed;
- A description of the SAC conservation objectives, against which the potential impacts of the Offshore Development on Annex II marine mammals are being assessed;
- An assessment of the adverse impacts of the Offshore Development alone on the qualifying interests of the SAC being assessed;
- An assessment of the adverse effects of the Offshore Development in-combination together with other developments in the marine environment; and
- A summary of the potential impacts of the Offshore Development on the integrity of Annex II marine mammal populations of relevant SACs.

8.4 Key Data Sources

8.4.1 Site-specific Digital Aerial Survey Data

Aerial surveys of the PFOWF Array Area were undertaken on a monthly basis over several years to collect data on marine mammals and seabirds across an area encompassing the PFOWF Array Area and portions of the Offshore Export Cable Corridor.

Surveys were run by HiDef across the original Offshore Development Area between September – August 2021 and the same area was surveyed between January – December 2015 for the Hexicon Dounreay Trì Project. Additionally, HiDef was commissioned by the Highlands and Islands Enterprise (HIE) Dounreay Demonstration Centre project to survey a larger area to the west of the Offshore Site (HiDef, 2016). The survey coverage from this project overlaps the PFOWF Array Area and a small portion of the Offshore Export Cable Corridor. Details on these aerial surveys, including survey methods and depictions of the different line transects used, are provided in Offshore EIAR (Volume 3): Chapter 11: Marine Mammals and Other Megafauna – Section 11.4.3.

The outcomes of these surveys, in terms of species sighted and months of sightings, are provided in Table 8.4. Of the Annex II species under consideration within this report, only harbour porpoise and grey seals were identified as present during the dedicated aerial surveys. There is potential that some unidentified species may include bottlenose dolphins and/or harbour seals; however, it is not possible to resolve those sightings records to the species level at this stage.

Table 8.4 Annex II cetacean and pinniped sightings recorded during dedicated aerial surveys of the Offshore Site

Aerial Survey Data Source	Species Names[1]	Number of Animals Sighted	Month(s) of Sighting(s)
HiDef (2021)	Harbour porpoise	24	January, March, April, June, July, August
	Unidentified cetacean species	1	September
	Unidentified seal species	1	June
	Unidentified seal/small cetacean species	2	January, July
HiDef (2016)	Harbour porpoise	12	May, July, September, January, March
	Unidentified seal/small cetacean species	2	July, January
	Grey Seal	1	May
	Unidentified seal species	1	February
HiDef (2015)	Harbour porpoise	3	May, June, November
	Unidentified seal/small cetacean species	4	January, May, November
	Grey Seal	3	March, June, July
	Unidentified seal species	2	March

[1] In some cases, specific species were unable to be determined and therefore remain unidentified within the table.

8.4.2 Telemetry Data and SAC-specific Estimates of Seal At-Sea Distribution

There is no direct overlap in the impact area predicted for the Offshore Development and any harbour or grey seal breeding colony SAC boundary. However, it is acknowledged that seals are highly mobile and that SAC populations are at risk of impact from activities beyond the SAC boundaries. NatureScot advice received during consultation is that, based on telemetry data, they generally advise a screening buffer of 50 km for harbour seals and 20 km for grey seals to reflect the at-sea distribution of these animals during the breeding season, however, they advise that, in this region, there is evidence that harbour seals are foraging at > 50 km from haul-outs (see Table 4.1). Additionally, telemetry data for grey seals outside of the breeding season indicate wide-ranging foraging trips to locations 100 km or more offshore (Jones *et al.,* 2015; Carter *et al.,* 2020).

Therefore, to better assess potential connectivity between the Offshore Development and seal SACs, and potential effects on qualifying interests, an assessment of relevant telemetry data is presented in the sections below. These data are held by The Sea Mammal Research Unit (SMRU) at the University of St Andrews.

Additionally, regional habitat-based models of seal distribution around the British Isles first presented in Carter *et al*. (2020) have recently been used to generate estimates of the at-sea distribution of seals hauling out at specific SACs during the main foraging season (Carter *et al*., 2022). For each SAC in the UK and Ireland, 5 x 5 km resolution grids are provided. The value of each cell provides an estimated mean % of the at-sea population for that SAC, such that all cells sum to 100%, representing at-sea distribution of all individuals hauling-out in the SAC during the main foraging season. These distribution maps provide a useful resource for apportioning at-sea abundance to designated sites and, therefore, assessing the connectivity between the Offshore Development and SACs.

8.4.2.1 Harbour seals

In total, 105 harbour seals have been tagged in the NCO MU. The telemetry tracks from these seals show that they primarily remain within the NCO MU (see Figure 8.3), with only three of the seals recording telemetry data in the Shetland MU. Of the 64 harbour seals with telemetry track data recorded within the disturbance impact area from impact piling at the Offshore Development (which extends to a maximum of c. 50 km from the Offshore Site), none showed any connectivity with the Sanday SAC, whilst one single seal transited through the Mousa SAC and showed limited connectivity with the Yell Sound Coast SAC on Shetland. These data suggest that there is limited connectivity between the affected area at the Offshore Development and harbour seal SACs.

Telemetry tracks of nine individuals overlap Sanday SAC, of which four were tagged within the SAC (see Figure 8.3). All nine animals were adults, three of which were females. These tracks do not illustrate the distribution of animals confirmed to breed at Sanday SAC, however, they do illustrate the distribution of adult animals which have used Sanday SAC as a haul-out site, and are likely to provide some indication of the at-sea distribution of animals which breed there. The tracks suggest that a majority of animals using Sanday SAC primarily use waters between the north-west and north-east of the Orkney archipelago, at distances of > 50 km from the Offshore Site.

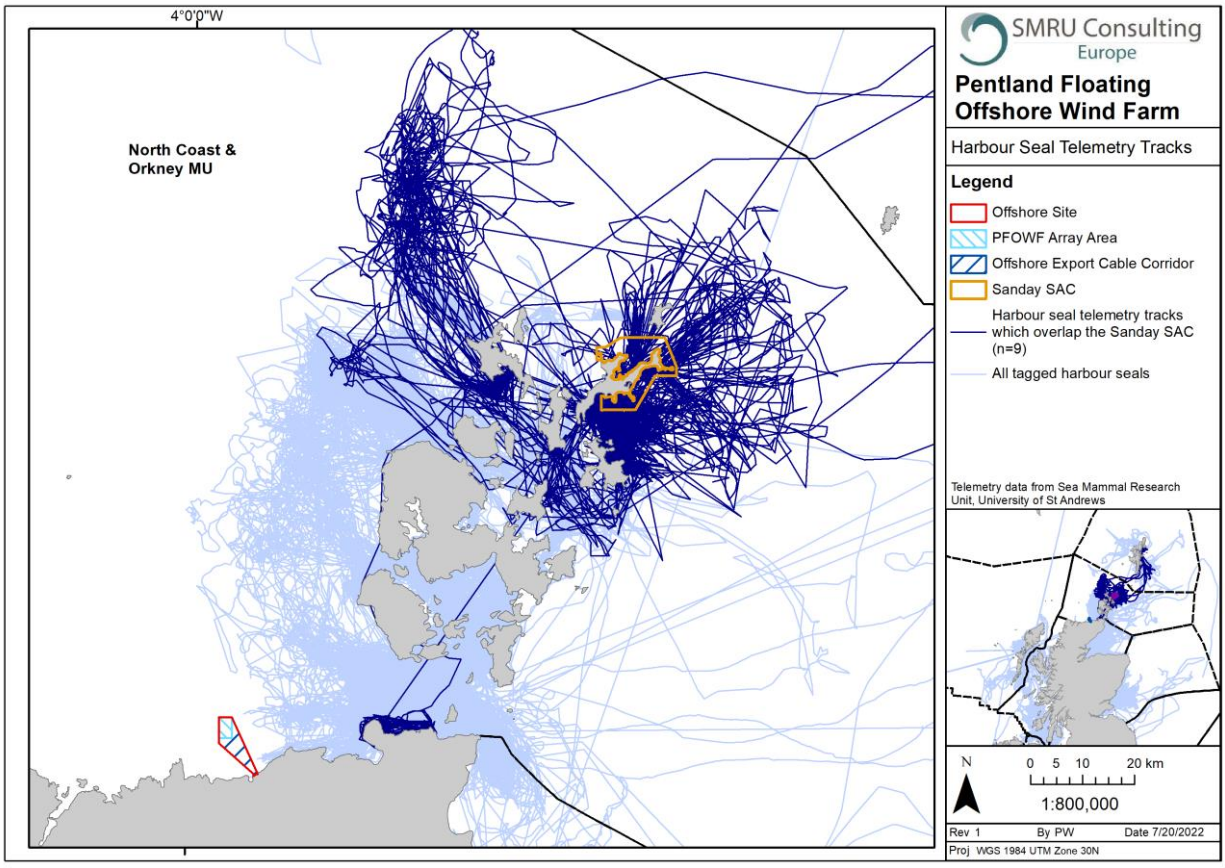


Figure 8.3 Harbour seal telemetry tracks for individuals which overlap the Sanday SAC (n=9) in relation to the Offshore Development

The SAC-specific estimates of at-sea distribution of harbour seals hauling out at Sanday SAC provide similar evidence of the lack of connectivity between the site and Offshore Development (see Figure 8.4). The most-far reaching predicted impacts to harbour seals are disturbance arising from impact piling of anchor piles, with the outer boundary of impact contours predicted by noise modelling (at which only a small proportion of animals are expected to exhibit behavioural response) extending to a maximum of c. 50 km from the Offshore Site (see Section 8.5). Taking this boundary as the maximum disturbance impact area (impact piling) of the Offshore Development, and combining it with the Sanday SAC-specific harbour seal at-sea distribution estimates, results in a total of < 0.01% of seals which haul out at the SAC during the primary foraging season overlapping with the predicted area of impact piling disturbance from the Offshore Development.

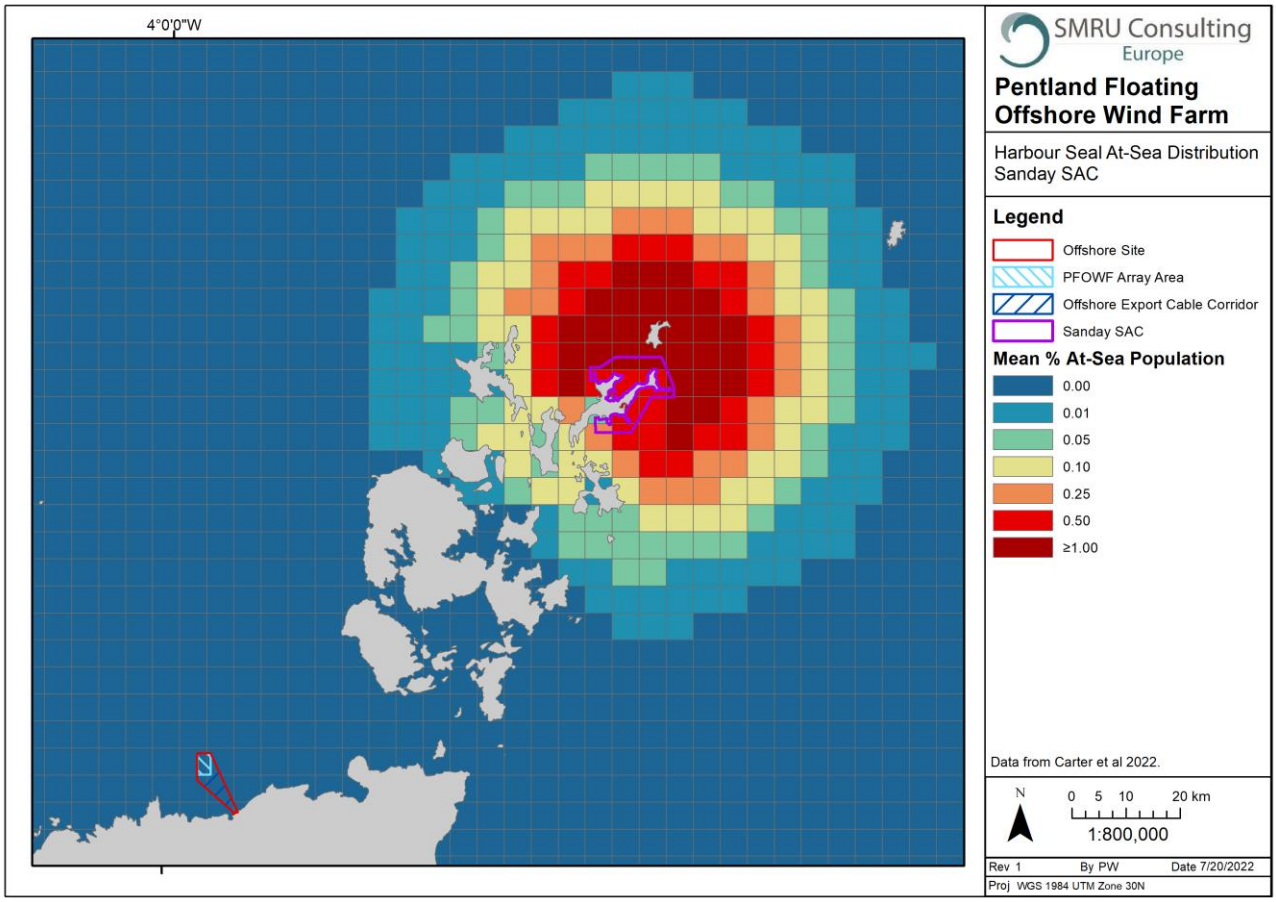


Figure 8.4 Estimates of at-sea distribution of harbour seals (during the main foraging season) hauling out at Sanday SAC in relation to the Offshore Development

8.4.2.2 Grey seals

In total, 47 grey seals have been tagged in the NCO MU. The telemetry tracks from these seals show that grey seals range far further than harbour seals, with grey seal tracks from animals tagged in the NCO MU being recorded in the Shetland, the Moray Firth, the East Scotland, the North-East England, the West of Scotland and the Western Isles MUs (see Figure 8.5). Of the 47 grey seals tagged in the NCO MU, they showed connectivity to only one grey seal SAC: the Faray and Holm of Faray SAC.

In total, including all grey seals tagged both within and outside the NCO MU, a total of 36 grey seals have recorded telemetry data within the disturbance impact area from impact piling at the Offshore Development (which extends to a maximum of c. 50 km from the Offshore Site). Whilst no seals have been tagged within Faray and Holm of Faray SAC itself, telemetry tracks of 18 individuals overlap the SAC, including 13 adults (F=7, M=6), two juveniles and three pups (see Figure 8.5). These tracks do not illustrate the distribution of animals confirmed to breed at Faray and Holm of Faray SAC, however, they do illustrate the distribution of animals which have used the SAC as a haul-out site, a majority of which are adults, and are therefore likely to

provide some indication of the at-sea distribution of animals which breed there. The tracks suggest that animals using Faray and Holm of Faray SAC exhibit a wide at-sea distribution around the Orkney archipelago, particularly coastal waters around the northern part of the archipelago and the Pentland Firth. These tagged individuals also showed use of offshore waters > 50 km off the north coast of mainland Scotland, and with much time spent in the North Sea (see Figure 8.5). Whilst 50% (n=9) of these individuals showed connectivity to the disturbance impact area from impact piling at the Offshore Development (which extends to a maximum of c. 50 km from the Offshore Site), as described above, telemetry data indicated that waters beyond this area accounted for the majority of these animals' at-sea distribution.

Whilst North Rona SAC lies in the adjacent Western Isles MU, and was therefore not screened in for assessment, it was mentioned in the consultation feedback. The site is distant to the Offshore Site (121 km), and significant connectivity is unlikely. Nonetheless, telemetry data and SAC-specific at-sea distribution estimates are provided here to confirm this and support the site not being screened in for full assessment. No data are available for grey seals tagged within North Rona SAC, however, telemetry tracks of five adult individuals (Females =2, Males=3) overlap the SAC (see Figure 8.5). These tracks do not illustrate the distribution of animals confirmed to breed at North Rona SAC; however, they do illustrate the distribution of adult animals which have used the SAC as a haul-out site, and are therefore likely to provide some indication of the at-sea distribution of animals which breed there. The tracks of these five animals show animals to use waters across a large area of the continental shelf, with some movements between Orkney and the north-west coast of the Scottish mainland. A majority of tracks extend between the north and south-west of North Rona, with animals appearing to make repeated trips to the shelf edge. Whilst the tracks of two individuals overlap the disturbance impact area from impact piling at the Offshore Development (which extends to a maximum of c. 50 km from the Offshore Site), this appears to be a less-frequented area compared to water further west and north, and no tracks come within c. 25 km of the Offshore Site.

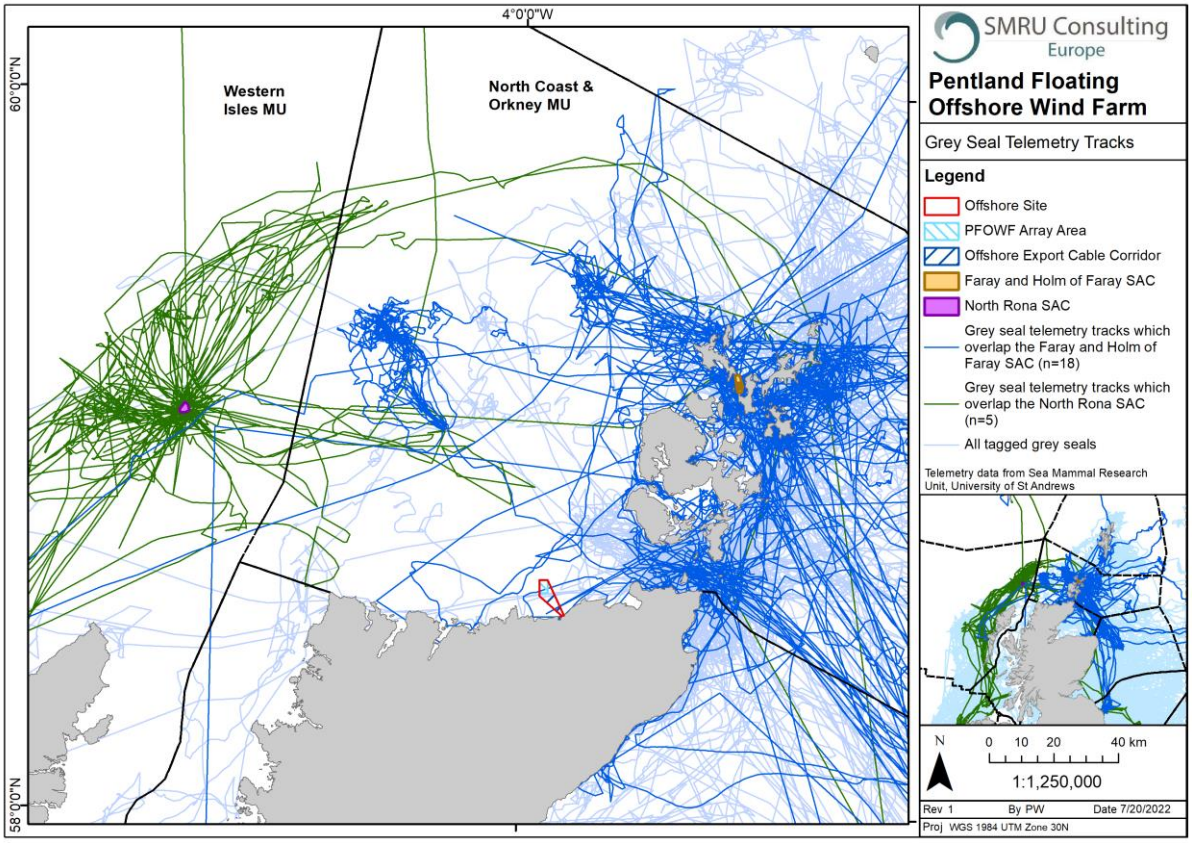


Figure 8.5 Grey seal telemetry tracks for individuals which overlap the Faray and Holm of Faray SAC in relation to the Offshore Development

The SAC-specific estimates of at-sea distribution of grey seals hauling out at Faray and Holm of Faray SAC and North Rona SAC provide similar evidence of the limited connectivity between the site and the Offshore Development as do the telemetry tracks (see Figure 8.6 and Figure 8.7). For Faray and Holm of Faray SAC, the estimated at-sea distribution suggests that 3.03% of seals hauling out at the site in the main breeding season overlap with the predicted disturbance impact area of the Offshore Development. For North Rona SAC, the estimated at-sea distribution suggests that 0.05% of seals hauling out at the site in the main foraging season overlap with the predicted disturbance impact area of the Offshore Development. As such, the available evidence does not support the potential for ecologically meaningful connectivity between the Offshore Development and the grey seals associated with the North Rona SAC. For this reason, the North Rona SAC has not been considered further within this assessment.

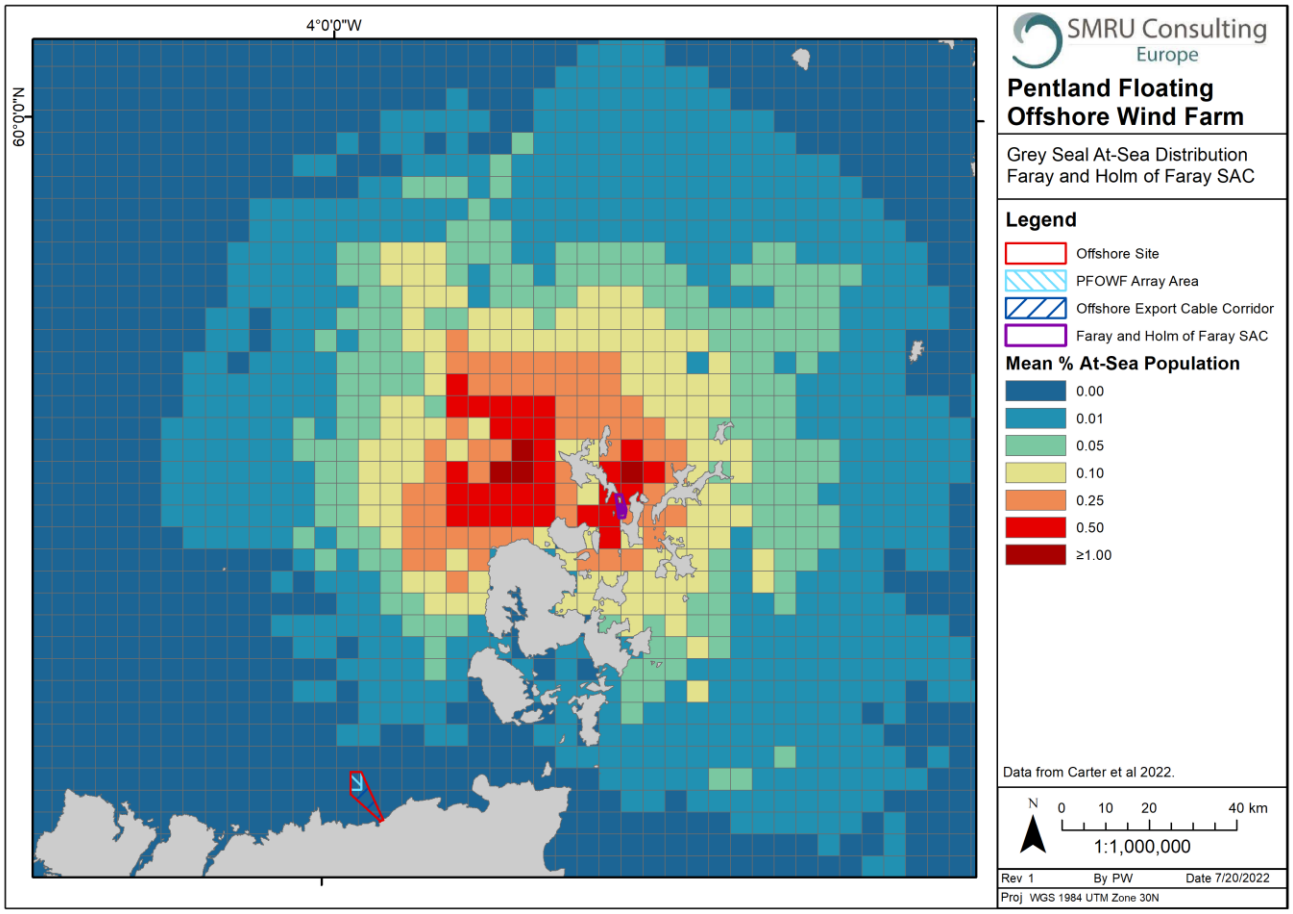


Figure 8.6 Estimates of at-sea distribution of grey seals (during the main foraging season) hauling out at Faray and Holm of Faray SAC, in relation to the Offshore Development

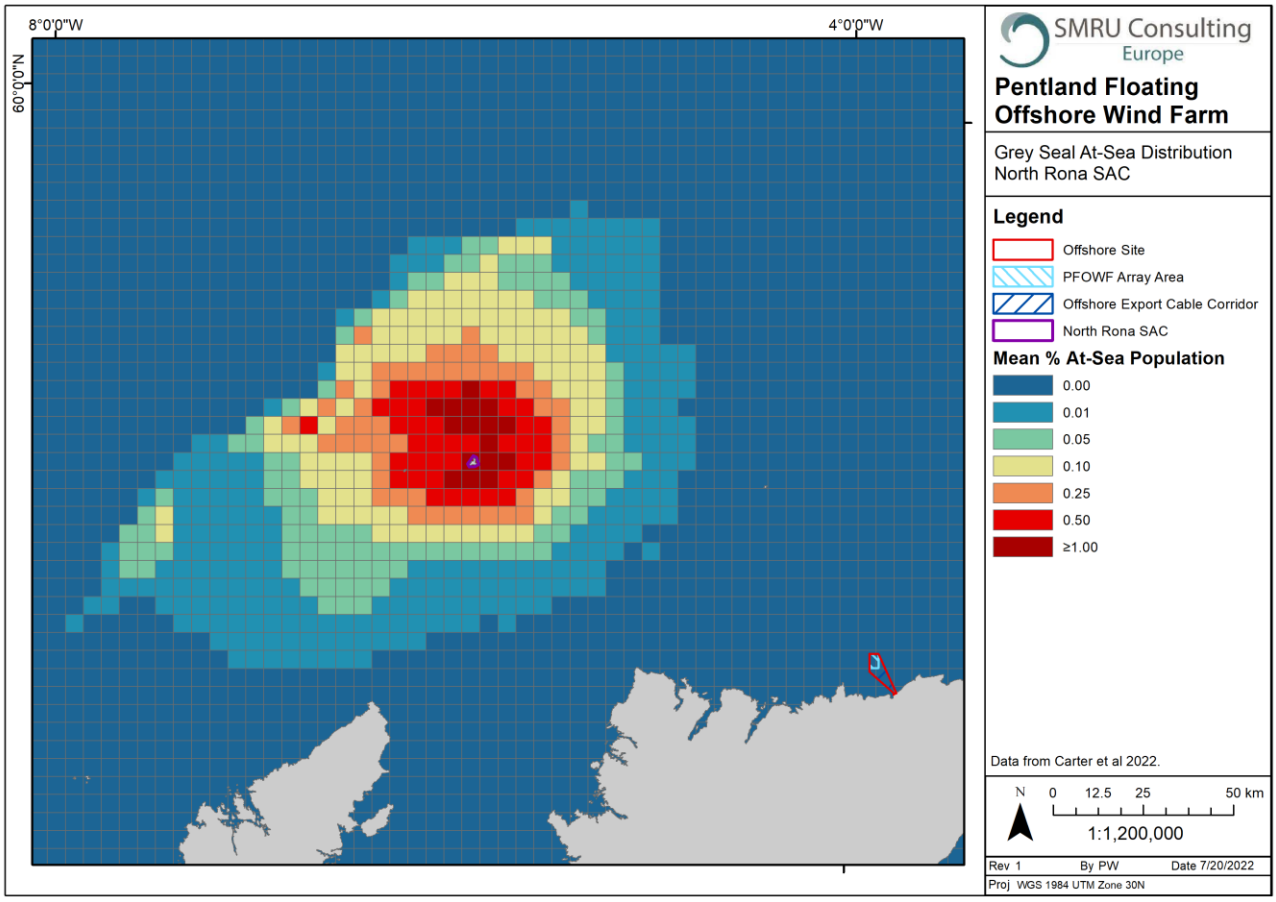


Figure 8.7 Estimates of at-sea distribution of grey seals (during the main foraging season) hauling out at North Rona SAC, in relation to the Offshore Development

8.5 Potential Impact Pathways Assessed

8.5.1 Underwater Noise

8.5.1.1 Modelling

To estimate the underwater noise levels likely to be generated by the proposed construction activities, predictive noise modelling has been undertaken, based on best practice techniques described in Robinson *et al.* (2014). Impact piling forms the most important noise source, due to both the sound pressure levels generated and the duration of the activity; as such, it is the primary focus of the Underwater Noise impact Assessment.

The modelling of impact piling sound was undertaken using the INSPIRE semi-empirical underwater noise propagation model (Version 5.1) which uses numerical modelling and measured source level data as inputs. This model is designed to calculate the propagation of noise in shallow, mixed water, typical of the conditions around the UK and as such is very well suited to the region of the Pentland Firth. The model has been trained on 80 datasets of underwater noise propagation from monitoring during offshore piling activities. It provides estimates of unweighted peak sound pressure levels (SPL_{peak}), sound exposure levels with a soft-start (SEL_{ss}), and cumulative sound exposure levels over a 24-hour period (SEL_{cum}). From these outputs, distances at which an individual animal would experience sound levels which would exceed the hearing thresholds for auditory injury can be identified.

Hearing thresholds for potential injury to cetacean and pinniped taxa are defined in Southall *et al.* (2019) and equate to the onset of a permanent threshold shift (PTS) in hearing levels. They have been derived from *in situ*

measurements of audition in various marine mammal species and modelled to supply threshold levels representative of different taxa, based on their hearing sensitivities (Southall *et al.*, 2019). It is worth noting that sounds occurring at source pressure levels which meet the criteria for the onset of PTS do not necessarily equate to an injury in an animal. Rather, the hearing thresholds are used to conservatively estimate whether an injury *may* occur if an individual encounters it so that a conservative range of impact may be estimated.

As hearing thresholds are not defined for the more subjective issue of disturbance, which is behavioural response to perceived sound, several methods have been applied to characterising impact magnitude for the various construction activities based on available data and best practice.

Table 8.5 summarises the methods used to characterise injury and disturbance impacts to marine mammals and determine the range of impact (i.e. the distance from the noise source within which an effect is likely to occur) for each activity. Details on these methods are provided in the Pentland Floating Offshore Wind Farm (PFOWF): Underwater Noise Impact Assessment - SMRU Consulting Report No. SMRUC-XOD-2022-002 (Offshore EIAR [Volume 3]: Technical Appendix 11.1).

Table 8.5 Approach to the assessment of injury and disturbance to marine mammals from underwater noise sources

Injury			Disturbance			
Piling	**UXO**	**Other[1]**	**Geophysical Surveys**	**Other [1]**	**Piling**	**UXO**
SPL_{peak} and SEL_{cum} impact ranges for PTS-onset from Southall *et al.* (2019)		Evidence in the literature on disturbance ranges.	All cetacean species: Dose-response function based on harbour porpoise responses to impact pile-driving during the first phase of construction at the Beatrice wind farm, Moray Firth (Graham *et al.,* 2017). All seal species: Dose-response function based on harbour seal responses to impact pile-driving at the Lincs wind farm, Greater Wash area (Whyte *et al.,* 2020).		26 km effective deterrent range (EDR) for high-order detonation (JNCC, 2020) 5 km EDR for low-order deflagration (JNCC, 2020) Temporary Threshold Shift (TTS) onset as defined in Southall *et al.* (2019) has been used as a proxy	

[1] 'Other' refers to the remaining construction activities that are proposed which will generate underwater noise levels which are audible to marine mammals (i.e. vessel noise from installation works, cable laying, trenching, and rock placement, etc.)

[2] Dose-response functions are modelled relationships between received noise levels and a measure of animal responses, based on empirical data, which provide estimates of the proportion of animals which will respond (from 1 to 0) at different noise levels. The function is combined with predicted noise level isopleths from the noise propagation modelling, to estimate the total number of animals that will respond (i.e. be disturbed).

8.5.1.2 Assessment of potential effects on Annex II marine mammals

The Underwater Noise Impact Assessment (Offshore EIAR [Volume 3]: Technical Appendix 11.1) provides species-specific assessments of underwater noise impacts for several activities and project phases, including:

- Construction: geophysical surveys; UXO clearance; anchor pile installation; other construction activities (i.e. vessel noise, cable laying, trenching, and rock placement as a form of remedial cable protection);
- Operation and Maintenance: mooring line 'pinging', geophysical surveys, and vessel noise; and
- Decommissioning: various noise sources which are expected to be proportional to those generated during construction activities, excluding potential UXO clearance and piling.

Potential underwater noise effects fall into two categories: hearing injury and disturbance. The following sections provide a summary of the key findings of the underwater noise impact assessment of relevance to Annex II marine mammal species.

8.5.1.2.1 Geophysical surveys

The equipment to be used in geophysical surveys (i.e. MBES, SSS, USBL) will generate sounds of a frequency and/or source level such that there will be no risk of hearing injury (PTS) to any marine mammal species. The JNCC guidelines for minimising the risk of injury to marine mammals from geophysical surveys (JNCC, 2017) do not advise that mitigation to avoid injury from use of USBL is necessary, nor is it considered necessary for MBES in shallow (< 200 m) waters, where higher frequency equipment is used (as is planned within the Offshore Site). EPS Guidance (JNCC *et al.*, 2010) on the use of SSS states that "this type of survey is of a short-term nature and results in a negligible risk of an injury or disturbance offence (under the Regulations)" and an equivalent conclusion was reached by DECC (2011).

Only USBL generates noise of a frequency which may result in behavioural response by marine mammals, but any such responses are predicted to be highly localised, short-term and temporary and exhibited by a small number of individuals. Assuming disturbance throughout the entire Offshore Site plus a 500 m buffer (highly conservative), disturbance of a total of 10 harbour porpoise, 28 harbour seal and ≤1 individual of other species was predicted. For all species, the impact was assessed as of negligible magnitude. It is noted that any geophysical surveys would be subject to subsequent EPS licensing, with applications supported by an EPS risk assessment.

8.5.1.2.2 UXO clearance

UXO clearance is not anticipated or planned, and is not included within the consent application which this assessment supports. Nonetheless, an indicative initial assessment of potential worst case impacts on marine mammals was undertaken. For high-order detonation of a worst case 525 kg UXO, < 1 harbour seal, < 1 bottlenose dolphin, 12 grey seals (0.03% of the MU) and 81 harbour porpoises (0.02% of NS MU or 0.3% of WS MU) were predicted to experience noise levels sufficient to result in the onset of hearing injury (PTS).

Considering the embedded mitigation in Section 5.3, precaution and uncertainties in the assessment, and the very limited effect such a level of PTS is considered to have on vital rates, the impact magnitude and effect significance for all species was assessed as negligible. The predicted PTS onset impact ranges were 2.5 km for seals, 730 m for bottlenose dolphin and 13 km for harbour porpoise. The predicted behavioural disturbance impacts from high-order UXO clearance varies according to the method adopted, with an EDR of 26 km providing the most conservative predictions of disturbance. This EDR equates to a disturbance impact to 4.43% of the NCO MU for grey seal and 2.67% for harbour seal, 3.57% for bottlenose dolphin in the CES MU, and 0.09% for harbour porpoise in the NS MU and 1.1% for the WS MU. These estimates of population-level effects are greater than those estimated for other impact pathways assessed for the Offshore Development. However, considering the very short-term nature of the disturbance and precautionary nature of the assessment (there is no empirical evidence to support a 26 km EDR for UXO clearance and alternative TTS-onset impact ranges were substantially smaller), it is highly unlikely that this activity could generate adverse effects on the individual, local or population scale to any marine mammal receptors or their conservation status due to disturbance.

As stated previously, an initial desk-based UXO assessment undertaken by Ordtek (2021) has indicated a low likelihood of UXO being encountered in the Offshore Site and it is anticipated that it will be possible to avoid any UXO identified prior to construction. Should it be determined from planned UXO surveys that further mitigation be required, such as clearance or detonation, this would be subject to separate assessment and licence applications.

8.5.1.2.3 Impact piling

Considering a worst-case scenario, it was calculated that instantaneous PTS-onset impact ranges are small for all groups, with a maximum range of 0.65 km for harbour porpoise (considered to be the most sensitive species of Annex II marine mammal), and equated to < 1 animal for all species. These impact ranges support the efficacy of the embedded mitigation in which marine mammal monitoring precludes individuals from

entering the zone of impact for injurious sound. The cumulative PTS-onset impact range for harbour porpoise, which considers the impulsive nature of piling over the course of a day, was 8.7 km and equates to 0.007% of the NS MU and 0.08% of the WS MU (or 0.006% of the two MUs combined). For all other species, the cumulative PTS-onset impact range was <0.1 km equating to < 1 animal and therefore < 1% of any MU. It should be noted that the modelled impact ranges for cumulative PTS-onset are highly precautionary and should be regarded as over-estimates (see Pentland Floating Offshore Wind Farm (PFOWF): Underwater Noise Impact Assessment - SMRU Consulting Report No. SMRUC-XOD-2022-002 (Offshore EIAR [Volume 3]: Technical Appendix 11.1). Mitigation such as the implementation of a piling MMMP will support the minimisation of the number of animals which could potentially experience PTS-onset over a 24-hour period. Consequently, the probability of effects from piling noise resulting in changes to the vital rates of any marine mammal population is expected to be very low. Overall, the predicted magnitude of effect from noise-induced injury, using either instantaneous or cumulative PTS-onset criteria, was assessed as negligible for all marine mammal species.

The results of the impact assessment for disturbance from the worst case impact piling scenario, using dose-response functions for harbour porpoise and harbour seal, indicated a large maximum range of predicted disturbance with rapidly diminishing response-effects with distance from the PFOWF Array Area. Numbers of animals predicted to experience disturbance on a piling day included 323 harbour porpoise in the NS MU (0.09% of NS MU) and 318 in the WS MU (1.1% of WS MU), six bottlenose dolphins (2.57%) in the CES MU and four in the CWSH MU (7.88%), and 116 harbour seals (5.93%) and 1,890 grey seals (5.03%) as a part of the NCO MUs.

For grey seal, harbour seal and bottlenose dolphin, models were run in the interim Population Consequences of Disturbance (iPCoD) framework to estimate whether this predicted level of disturbance would be sufficient to cause population-level effects. For both seal species, model outputs showed that there was no predicted effect on the population as a result of disturbance from the piling activity, with the affected population expected to remain the same as the unaffected population. For bottlenose dolphin, the results of the modelling showed that there was an extremely small or no predicted effect on most combinations of two different piling scenarios, time periods (1-12 years after the disturbance) and the two MUs. Predicted effects were slightly greater for the CWSH MU, and for a less realistic piling schedule of 63 consecutive days piling vs piling spread over 4 months. Whilst the models for the CWSH MU suggest a slight decline at 1 year and 12 -year simulations, these are considered to be highly unlikely scenarios given that baseline data indicate a very low probability of bottlenose dolphin presence in the impact area, particularly those associated with the CWSH MU. As such, for all cetacean and seal species, disturbance effects from impact piling were assessed as of negligible magnitude, with the exception of bottlenose dolphin in the CWSH MU which were assessed as of low magnitude.

8.5.1.2.4 Other construction activities

For all other construction activities, including cable laying, trenching, rock placement for cable protection and vessel noise, the cumulative PTS impact ranges were calculated to be <100 m. These values mean that animals would have to stay within close proximity (<100 m) for 24 hours before they experienced injury, which is an extremely unlikely scenario given that any marine mammal within the injury zone is likely to move away from the vicinity of the noise-generating activity. Therefore, the magnitude of predicted PTS impact of non-piling construction noise was assessed to be negligible.

Noise modelling suggested a low potential for disturbance associated with other construction activities, with responses not predicted to extend beyond 1 km from noise sources. Recent studies from the Moray Firth reported a significant reduction in porpoise occurrence within 4 km of non-piling construction activity at the Beatrice and Moray East wind farms - projects of much larger scale than the Offshore Development. Considering the evidence available and the scale of the planned activities associated with the Offshore Development, other construction-related activities are predicted to result in a relatively localised (i.e. up to 4 km), temporary reduction in marine mammals within the Offshore Site at short-term, intermittent scales over a period of several months. These responses are unlikely to significantly affect marine mammal vital rates, and were assessed as of negligible magnitude for all species.

8.5.1.2.5 Other operational and maintenance or decommissioning phase activities

Noise related impacts during the Operation and Maintenance phase of the Offshore Development are anticipated to be less than those assessed during the Construction phase. Vessel noise will be reduced in comparison to the Construction phase of the Offshore Development, as fewer, smaller vessels (approximately half the number of the Construction phase) will be on site, for shorter durations and on an *ad hoc* basis.

Given the nature of the decommissioning activities, which will largely be a reversal of the installation process, without the potential for impact piling, the noise-related effects during the Decommissioning phase are expected to be less than those assessed for the Construction phase. Noise sources will largely be comparable to those for other construction activities (i.e. localised, temporary disturbance to low numbers of animals at short-term, intermittent scales over a period of several months).

8.5.1.2.6 Mooring line 'pinging'

Underwater noise made by the sudden re-tension in a mooring line following a period of slackness was reported at the Hywind Demonstrator project. Such a phenomenon is undesirable from an engineering perspective and not anticipated at the Offshore Development during the operational life-cycle of the project. However, an assessment was made, based on measurements and modelling undertaken at the Hywind Demonstrator project. Worst case predictions indicated no potential for injury to any marine mammals. There are currently no reliable disturbance thresholds that would be recommended for the kind of intermittent/rare noise signals that would be generated from mooring line pinging. Use of a criterion for mild behavioural disturbance to marine mammals for impulsive sounds suggested by Southall *et al.* (2007) predicts that such impacts may extend up to approximately 250 m from each noise source (i.e. close proximity to the WTG). Therefore, this potential effect is considered to result in no more than highly localised, low level disturbance, and will be of negligible magnitude for all species.

8.5.2 Displacement or Barrier Effects

During the Operation and Maintenance phase of the Offshore Development, the physical presence of the WTGs and substructures introduces the potential for displacement or barrier effects to marine mammal populations occurring within the Offshore Site and its surrounding waters. This impact pathway may result from the presence of multiple novel structures altering the movement patterns and/or behaviours of individuals or populations in such a way as to compromise access to key habitats or inhibit migratory movements.

Displacement in this instance refers to spatial displacement, or the loss of access to the area comprising the Offshore Site, due to the persistent presence of infrastructure during the possible 30-year operational timeline of the Offshore Development. Barrier effects focus less on the Offshore Site itself, but rather the reduction in access to the areas surrounding it due to the presence of infrastructure within the site. Migratory species reliant on the utilisation of key pathways or seasonal habitats are particularly vulnerable to barrier effects from obstructions. Migratory species may be impacted by obstructions from large-scale engineering projects, such as offshore wind arrays, if they limit access to key seasonal sites for foraging and reproduction.

As the vast majority of the Offshore Export Cable(s) will be buried, or will include remedial cable protection where this is not possible, this infrastructure will not limit the passage of any animals within the water column. Individuals will continue to move freely between locations to the east and west of the site, and along the coastline to the south and to the islands in the north, by traversing the Offshore Export Cable Corridor or travelling around the PFOWF Array Area. Furthermore, the location of the Offshore Site will not obstruct access to any bays, inlets or sea lochs. It is therefore considered that there is limited scope for barrier effects to be introduced during the Operation and Maintenance phase of the Offshore Development.

The PFOWF Array Area will have structures which will be maintained within the water column for the duration of the Operation and Maintenance phase, however, which could potentially result in displacement effects. The Offshore Development will consist of up to seven WTGs separated by a minimum distance of 800 m and connected by (up to) a 5,000 m network of 300 mm inter-array cabling with a total below-sea surface area of up to 9,425 m^2. The semi-submersible design for the WTG substructure will introduce the greatest below-sea surface area (up to 25,625 m^2) when considering a depth of 20 m and a square design. The semi-taut catenary mooring system design is anticipated to have the largest pelagic footprint of up to 33,075 m of line within the water column, giving a total surface area of 36,368 m^2 when considering the worst case scenario, synthetic rope (350 mm thickness), is used. This equates to a total maximum surface area of 0.074 km^2 of infrastructure which will be floating within the water column across the entirety of the 10 km^2 PFOWF Array Area (i.e. <1 % of the PFOWF Array Area will have floating infrastructure).

When considering the scale of the infrastructure against the size of the animals in question (i.e. approximately 2 m in length), it is considered to be highly unlikely that 150 – 350 mm diameter cables and lines, or a 125 m x 125 m substructure, would prevent the functional habitat use of any individuals across the site. Individuals would swim around the comparatively large substructures and, as the cabling and mooring lines between them predominate in the mid to low water column where they radiate outward to the anchor and touchdown points, surface and near-surface movements are unlikely to be affected in the areas between WTGs. Consequently, habitat use by seals, bottlenose dolphins or harbour porpoise is unlikely to be hindered by the physical presence of seabed infrastructure during the Operation and Maintenance phase. If any individuals from the relevant MUs are displaced from the 10 km^2, it would not influence the vital rates of those individuals, nor affect the population(s) they are associated with.

Given the scale of the infrastructure compared to the animals likely to be encountered, it is considered that harbour porpoise, bottlenose dolphins, and grey and harbour seals can readily move between and around the WTGs, substructures and cables and mooring lines. Moreover, the actual proportion of infrastructure which will be within the water column is considerably low across the Offshore Site and there is ample available habitat for marine mammals which remains. Consequently, marine mammals are not anticipated to be subject to displacement or barrier effects which would impact baseline habitat use or distribution due to the physical presence of the Offshore Development.

8.5.3 Risk of Injury or Mortality from Entanglement

Systems which utilise mooring lines and/or cables in the water column can introduce the potential for injury or death from entanglement to marine megafauna, and this is particularly true for large animals such as baleen whales (Benjamins *et al.*, 2014). Entanglement occurs when an animal(s) incidentally comes into contact with a static line (e.g. rope, cable or mooring line which is attached to a static object) causing their capture or restraint (Benjamins *et al.*, 2014). When an animal remains bound to the static line for a prolonged period, the repercussions of an entanglement event can be fatal.

Additionally, fishing gear, particularly nets and gillnets, can unintentionally capture non-target species as bycatch whilst fishing. When fishing gear is lost at sea, they may continue incidentally to entangle marine mammals, which is referred to as ‘ghost fishing’. Lost gear can wrap around lines and structures in the water column, creating an opportunity for indirect or secondary entanglement with the line, through adverse interactions between animals and the attached fishing gear(s) (Benjamins *et al.*, 2014). The resulting secondary entanglement may cause injury or mortality. However, the magnitude of effect is dependent upon the characteristics of the material which have become entangled on the mooring lines (i.e. its thickness, length, number of loops, spread on the line, etc.) and the biological and behavioural traits of the individual animal which encounters them (i.e. how it moves, feeds, visual acuity, size, maturity, etc.).

The risk of direct entanglement between mooring lines and cables and marine mammals rests on the design characteristics of the infrastructure, whilst the risk of secondary entanglement rests on the maintenance of the infrastructure and the types of fishing gears regularly utilised within surrounding waters.

Baleen whales are considered particularly vulnerable to entanglement, based on decades of evidence from interactions with fishing gear and their associated ropes (Benjamins *et al.*, 2014; Copping *et al.*, 2020), and entanglement has been attributed to the cause of death for nearly half of the baleen whale strandings in Scotland (Northridge *et al.*, 2010). However, such evidence does not exist for small cetaceans (i.e. porpoise

and dolphins) in the UK, likely because mooring ropes are more easily avoided by smaller, more nimble species. There is, however, a large body of evidence for the bycatch of pinnipeds and small cetaceans in fishing gear and sublethal injuries from marine debris are regularly observed in global populations (Read *et al.*, 2006; Benjamins *et al.*, 2014). Although evidence of entanglement among seals within Scotland is lacking, there is potential that seal injury and mortality associated with ropes and marine debris remain underreported in Scottish waters (Brownlow pers. comm., as referenced in Benjamins *et al*., 2014).

Similar to the mooring systems employed by other marine renewables projects, the Offshore Development will be utilising chains and ropes in exceedance of 100 mm in diameter (Benjamins *et al.*, 2014), in this case with chains or cables of 175 mm diameter and synthetic ropes of 350 mm diameter. Fishing gears which pose the greatest entanglement risk to small cetaceans and seals typically falls between 1 to 7 mm in diameter (Wilcox *et al.*, 2015). Moreover, the semi-taut and catenary mooring configurations, which have the least tension on the individual mooring lines, will nevertheless be too taut to generate entangling loops. This is because increased slackness on the lines would dramatically limit the mooring infrastructure's ability to maintain the position of the WTGs. Thus, marine mammals are more likely to be at risk from secondary entanglement from interactions with lost debris and fishing, than through direct entanglement with large, thick mooring line or cable components (Read *et al.*, 2006).

The accumulation of marine debris on floating lines and cables has the potential to generate adverse interactions between mobile marine species and the Offshore Development infrastructure. Derelict fishing gears are of particular concern due to the entanglement risk they introduce to marine megafauna, including marine mammals. Mooring lines and floating inter-array cables will be inspected with a risk-based frequency during the operational life-cycle of the Offshore Development, starting at a higher frequency and likely declining after a number of years, based on evidence gathered during inspections. Any inspected or detected debris on the floating lines and cables will be recovered based on a risk assessment which takes impact on environment, risk to asset integrity, and cost into account.

The design of the mooring systems and cables associated with the Offshore Development preclude direct entanglement with seals and harbour porpoise or bottlenose dolphins. The embedded mitigation protocols for the removal of debris from floating lines and cables during the Operation and Maintenance phase of the project minimise the risk of debris, including derelict fishing gears, from accumulating on the floating infrastructure and generating opportunities for secondary entanglement events. It is, therefore, considered that none of the Annex II marine mammal species are at significant risk of injury or death from entanglement with the floating infrastructure and the potential for secondary entanglement will be significantly minimised through the embedded mitigations.

8.5.4 Collision Risk with Floating Infrastructure

During the Operation and Maintenance phase of the Offshore Development, the presence of the WTGs and substructures has the potential to increase the risk of injury to marine mammals through collision with novel floating infrastructure. To date, there is no evidence of marine mammal collision with floating offshore wind infrastructure, nor fixed wind or floating marine renewable energy infrastructure, and the risk of adverse physical interactions remains poorly characterised for these technologies.

For the proposed Offshore Development, the semi-submersible is the floating substructure which will have the greatest surface area within the water column and, therefore, the greatest potential for interaction with mobile animals. Whilst the majority of the substructure will be above the water's surface (60%), there will still be a total of up to 25,625 m^2 of structure (per substructure) within the water column when considering the full array (i.e. up to seven WTGs and their substructures). This surface area will be within the upper 20 m of the water column where diving animals may be surfacing and/or resting between dives. The likelihood of an adverse interaction taking place will be influenced by a receptor's ability to perceive the floating substructure and anticipate its movements.

Each semi-submersible has been designed to be up to 125 m in length and breadth, which is over fifty times the length of a harbour porpoise. So, the issue of limited awareness of the surrounding environment, such as during key activities like foraging or socialising, is eroded by the relative scale of the structure. All floating substructures will be fixed in place by taut, catenary or semi-taut mooring systems, designed to dampen the movement of the WTGs, for the 30 year life-cycle of the Offshore Development or at least for the duration of

the WTG's deployment within that period. During this time, it is considered very unlikely that any individuals would collide with the floating substructures, given their size and predictability within three-dimensional space. It is also reasonable to believe that the small array will become less novel to localised marine mammal populations, such as seals from nearby haul-outs, as they habituate to the presence of the infrastructure with the passage of time, further reducing the likelihood of a collision.

Overall, the PFOWF Array Area does not specifically provide key habitat to harbour porpoise, bottlenose dolphins, grey or harbour seals, or their prey, such that occupancy within the operational Offshore Site would be elevated. The proposed floating surface and subsurface infrastructure predominantly occupies the upper limit of the water column, where animals come to surface (breathe) and rest. Moreover, the Offshore Development has been designed to limit the movement of subsurface infrastructure and does not include any rotating infrastructure within the water column which would elevate collision risk. For these reasons, marine mammals are not considered to be at significant risk of injury or death from collision with the floating infrastructure of the Offshore Development.

8.6 Cetaceans

The sections below provide an assessment of adverse effects against site integrity for the protected sites with cetacean qualifying interests identified in Section 8.1.1. Site assessments are presented in order of distance from the Offshore Site.

8.6.1 Inner Hebrides and the Minches SAC

8.6.1.1 Site Description

The Inner Hebrides and the Minches SAC, designated in 2018, covers 1,381,391.4 ha (13,813.91 km^2) of waters on the Scottish west coast, extending from the Sound of Jura in the south to the North Minch. This site is bounded by the east coast of the Outer Hebrides and encompasses the islands of Skye, Mull, Lismore, the island group within the Firth of Lorn and Colonsay. The site is considered to be one of the best areas for harbour porpoise in the UK, though the habitat use of this species within the SAC remains data deficient. The Inner Hebrides and the Minches SAC is located 112 km from the Offshore Site.

8.6.1.2 Site Qualifying Interests

The site is designated for the conservation of the harbour porpoise. The Inner Hebrides and the Minches SAC supports persistently high densities of the species in both summer and winter relative to the wider WS MU, accounting for 32% of this population (NatureScot, 2020)[xi]. The condition and broader conservation status of the qualifying interests have been summarised in Table 8.6 (NatureScot, 2021a).

Table 8.6 Protected Interests and Condition for the Inner Hebrides and the Minches SAC

Protected Interests	Feature Condition	Assessment Date	Broader Conservation Status
Harbour porpoise	Favourable	2016	UK: Favourable European Region: Favourable

8.6.1.3 Site Objectives

The objectives of the Inner Hebrides and the Minches SAC are to avoid the deterioration of the qualifying species and ensuring that the integrity of the site is maintained to a Favourable Conservation Status. Table 8.7 provides the high-level conservation objective statements for the Inner Hebrides and the Minches SAC (NatureScot, 2021a).

[xi] Note: The West Scotland MU is estimated to contain 28,936 porpoise (IAMMWG, 2021). If 32% of these are attributed to the Inner Hebrides and the Minches SAC, this equates to 9,260 porpoise within the SAC.

Table 8.7 Inner Hebrides and the Minches SAC Conservation Objectives

Inner Hebrides and the Minches SAC
> To ensure that the Inner Hebrides and the Minches SAC continues to make an appropriate contribution to harbour porpoise and maintaining a favourable condition; and > To ensure for harbour porpoise within the context of environmental changes, that the integrity of the Inner Hebrides and the Minches SAC is maintained.
For Harbour Porpoise
> Harbour porpoise within the Inner Hebrides and the Minches SAC are not at significant risk from injury or death; > The distribution of harbour porpoise throughout the site is maintained by avoiding significant disturbance; and > The condition of supporting habitats and the availability of prey for harbour porpoise are maintained.

Conservation and Management Advice for the Inner Hebrides and the Minches SAC (NatureScot, 2020) identifies that harbour porpoise are considered sensitive to the following impact pathways which are relevant to the proposed Offshore Development, and which have been screened in for assessment:

> The removal of non-target and target species (i.e. resulting in entanglement in fishing gears[xii] and removal of prey species); and

> Underwater noise (e.g. from acoustic surveys) which may result in species relocation, interference with species communication, navigation, and foraging activities.

Additionally, NatureScot (2020) provides advice on activities which are considered to be capable of affecting harbour porpoise as a qualifying feature of the Inner Hebrides and the Minches SAC. Those that are of relevance to the Offshore Development are listed in Table 8.8.

Table 8.8 Advice to support the management of the Inner Hebrides and the Minches SAC

Activity	Advice to Support Management	PFOWF
Renewable energy	Reduce or limit pressures Activities associated with renewable energy development that increase the risk of acoustic injury and disturbance, collisions and entanglement of harbour porpoise, such as piling and blasting and the deployment of mooring lines should be minimised by implementing appropriate mitigation based on existing and recommended best practice guidelines. Reduce the risk of renewable energy development providing a barrier to species movement i.e. restricting access through channels for harbour porpoise. Minimise the potential impact of renewable energy development on the habitat of sandeels. This should focus on the appropriate siting of development and consideration of foundation types and adopting best practice mitigation to minimise the footprint.	HWL has committed to implementing MMMPs for all key sources of underwater noise with the potential to result in injury effects (UXO clearance and impact piling) in order to minimise the risk of PTS to negligible levels. These MMMPs will also provide a mechanism for defining measures to reduce the impact of disturbance. HWL has committed to implementing a VMP to minimise the impacts of vessel activity on marine mammals.
Seismic and other acoustic surveys	Reduce or limit pressures Minimise the impact of seismic or other acoustic surveys which may cause injury or disturbance to harbour porpoise through	Survey operations, particularly during periods of vessel transit, will adhere to the VMP, which includes following the SMWWC (SNH 2017)

[xii] The relevant element of this impact pathway for the Offshore Development is secondary interactions with derelict fishing gears.

Activity	Advice to Support Management	PFOWF
	following the JNCC (2017) *Guidelines for minimising the risk of injury and disturbance to marine mammals from seismic surveys.*	in order to minimise the risk of disturbance to marine mammals during project activities. An EPS licence to cover seismic and acoustic surveys may be required; this would be informed by an EPS risk assessment. Mitigation measures identified by the risk assessment will be implemented in line with the MMMP developed for the project, which includes consideration of the JNCC (2017) Guidelines where appropriate, based on the risk associated with the types of geophysical survey equipment being employed.

The assessment below is guided by this Conservation and Management Advice (NatureScot, 2020) and the best practice protocols for mitigation and management of impacts to marine mammals provided in the embedded mitigations (Section 6.1).

8.6.1.4 Assessment of Adverse Effects Alone

There is no direct overlap between the Inner Hebrides and the Minches SAC boundary and either the Offshore Development or its predicted impact area for harbour porpoise. Therefore, there is very limited potential for adverse effects in terms of the site's conservation objectives (i.e. no potential for injury or death to porpoise within the site, no potential for change to the distribution of porpoise throughout the site or significant disturbance, no potential for impacts to the condition of supporting habitat and prey availability). However, it is acknowledged that harbour porpoise are highly mobile (e.g. Nielsen *et al.*, 2018) and that the SAC population is at risk of impact from activities beyond the SAC boundary, and therefore an assessment is required of the extent to which impacts in the WS MU may affect the site's contribution to Favourable Conservation Status. There is no data available to assess the level of connectivity between the Offshore Development impact area and the Inner Hebrides and the Minches SAC.

8.6.1.4.1 Auditory injury from Permanent Threshold Shift (PTS)

There is not considered to be a risk of injury to any marine mammal from noise arising from geophysical surveys as equipment will be operated at a level below which could cause the onset of PTS and/or appropriate embedded mitigation will be implemented to reduce the risk of injury to negligible. The impact assessment concluded that there will be no significant impact of PTS on harbour porpoise from UXO clearance (if it was required) if a UXO MMMP is implemented.

The impact ranges for instantaneous PTS-onset from impact piling were negligible for harbour porpoise, resulting in <1 porpoise predicted to experience instantaneous PTS-onset per piling day. The cumulative PTS-onset impact ranges for pile-driving are larger, extending to a maximum of 8.7 km, which equates to a maximum of 23 harbour porpoise predicted to experience cumulative PTS-onset per piling day (this equates to 0.08% of the WS MU). As stated in Offshore EIAR (Volume 3): Appendix 11.1: Underwater Noise Impact Assessment, the modelled ranges for cumulative PTS-onset are highly precautionary and should be regarded as over-estimates. Despite this, the number of animals predicted to experience PTS-onset per piling day is low and the probability of the PTS causing a change in vital rates is expected to be very low. Therefore, it is not expected that a sufficient number of animals would experience a change in vital rates, and that any change is expected to be barely detectable and will not affect conservation status or integrity of the receptor. HWL is committed to implementing an impact piling MMMP to reduce the risk of PTS to negligible levels.

Therefore, it is concluded that there will be **no adverse effect** on the Inner Hebrides and the Minches SAC site integrity as a result of PTS-onset from underwater noise associated with the pre-construction and construction activities for the Offshore Development.

8.6.1.4.2 Disturbance from underwater noise

For the majority of noise-generating activities (i.e. geophysical surveys, vessel noise, and construction activities other than impact piling or UXO clearance), the potential for disturbance to harbour porpoise is considered to be of limited spatial extent, temporary and intermittent in nature. Considering the low anticipated occurrence of harbour porpoise in the Offshore Site, disturbance from these activities will be of negligible magnitude and no impacts to vital rates or the long-term viability of the WS population are predicted.

Even under the highly conservative assumption that, over the course of the geophysical and UXO surveys, all marine mammals in the Offshore Site plus a 500 m buffer will be disturbed, this results in predicted effects to 10 harbour porpoise on a survey day. Therefore, there is expected to be no significant disturbance effect, no change in the distribution of harbour porpoise within the Inner Hebrides and the Minches SAC and no change to the favourable conservation status of the qualifying feature.

Using TTS-onset as a proxy for disturbance, the impact assessment predicted disturbance effects to 253 harbour porpoise for the high-order detonation of a UXO with a charge size of 525 kg (plus donor). As described in Offshore EIAR (Volume 3): Appendix 11.1: Underwater Noise Impact Assessment, using TTS-onset as a proxy for disturbance for a single pulse sound source is expected to over-estimate the true behavioural response. Alternatively, if low-order detonation is assumed, and a corresponding 5 km EDR is applied, then only 12 harbour porpoise are expected to experience behavioural disturbance given their expected very low densities in the area. Therefore, there is expected to be no significant disturbance effect, no change in the distribution of harbour porpoise within the Inner Hebrides and the Minches SAC and no change to the favourable conservation status of the qualifying feature.

A maximum of 641 harbour porpoise were predicted to experience behavioural disturbance as a result of impact piling. If all this impact is attributed to the WS MU, then this equates to 2.22% of the MU. The level of connectivity between the Offshore Development and the Inner Hebrides and the Minches SAC is unknown. Therefore, the worst case scenario is to assume all porpoise disturbed by impact piling activities at the Offshore Development are attributable to the SAC.

In an expert elicitation, experts in marine mammal physiology, behaviour and energetics discussed the nature, extent and potential consequences of disturbance to harbour porpoise from exposure to low frequency broadband pulsed noise (e.g. pile-driving) (Booth *et al.,* 2019). Assuming that disturbance resulted in six hours of zero energy intake, experts concluded that it would take >200 days of repeated disturbance before there was any effect on fertility rates. The low number of piling days at PFOWF (maximum 63 days, depending on how many piles are installed per day) means that this level of activity would not be expected to result in any change to porpoise fertility rates. The experts agreed that calf survival could be reduced by only a few days of repeated disturbance to a mother/calf pair during early lactation; however, the assumption of six hours zero energy intake is highly conservative. A recent study by Benhemma-Le Gall *et al.* (2021) found that porpoise were not completely displaced from the piling site and that detections of both clicks (echolocation) and buzzing (associated with prey capture) increased above baseline levels with increasing distance from the pile, which suggests that those porpoises which are displaced from the near-field may compensate by increasing foraging activities beyond the impact range. Therefore, porpoise are expected to be able to compensate for the lost foraging opportunities and increased energy expenditure of fleeing. In conclusion, the disturbance effects from impact piling at the Offshore Development are not expected to have any effect on porpoise vital rates, and thus there will be no effect on the favourable conservation status of porpoise associated with the Inner Hebrides and the Minches SAC.

Therefore, there is expected to be **no adverse effects** on the Inner Hebrides and the Minches SAC site integrity as a result of disturbance from underwater noise associated with construction activities at the Offshore Development.

8.6.1.4.3 Other impact pathways during the Operation and Maintenance phase of the Offshore Development

Displacement or barrier effects:

Considering the design of the Offshore Export Cable(s) and the PFOWF Array infrastructure and their location within the Pentland Firth, the Offshore Development is not considered to generate any barrier or displacement effects on habitat use by harbour porpoise. The Offshore Export Cable Corridor is readily traversable, and the

scale and placement of the PFOWF Array Area is not expected to limit movement or habitat use by individuals therein. Any unanticipated displacement effects resulting from individuals avoiding swimming around the floating array infrastructure would be limited to the 10 km^2 PFOWF Array Area. Consequently, < 2 individuals would be impacted, when the most representative density estimate is employed, and therefore < 0.01% of the WS MU would experience these unlikely restrictions on movement within the PFOWF Array Area. For these reasons, there is expected to be **no adverse effects** on the Inner Hebrides and the Minches SAC site integrity over the operational life-cycle of the Offshore Development.

Risk of injury or mortality from entanglement:

Harbour porpoise are not at risk of direct entanglement with the proposed floating infrastructure, although secondary entanglement with derelict fishing gears poses a threat to animals utilising the PFOWF Array Area. This is particularly true if the entangled gears are monofilament fishing nets and lines, which are responsible for the vast majority of bycatch in small cetaceans and seals (Read *et al.*, 2006). The embedded mitigation of monitoring and removing debris from the floating lines and cables greatly diminishes the likelihood that a substantial quantity of entangling materials would become caught on the array infrastructure. Therefore, it is considered that harbour porpoise, as a part of the WS MU, or in association with the Inner Hebrides and the Minches SAC, are not at risk of injury or mortality from direct or secondary entanglement with the Offshore Development infrastructure and **no adverse effects** on the Inner Hebrides and the Minches SAC site integrity are predicted for this impact pathway.

Collision risk with floating infrastructure:

The floating infrastructure is of a scale several orders of magnitude greater than the size of a harbour porpoise. The associated mooring infrastructure has been designed to limit the movement of the WTGs and substructures, and there are no moving parts associated with the substructures within the water column (e.g. submerged rotating WTGs, etc.). For these reasons, the potential for a harbour porpoise to collide with either the WTGs, substructures or floating cables or mooring lines is considered extremely small. Animals are expected to readily swim around this infrastructure, avoiding collision. Accordingly, there is expected to be no adverse effects to harbour porpoise, either individually or at the population-level, and therefore **no adverse effects** on the Inner Hebrides and the Minches SAC site integrity as a result of collision risk.

8.6.1.5 Assessment of adverse effects in-combination

The Inner Hebrides and the Minches SAC is located within the WS MU for harbour porpoise. There were no offshore projects screened into this assessment that are located within this MU. Therefore, no in-combination assessment is presented for this SAC.

8.6.1.6 Summary

This assessment has shown that there is expected to be:

- No change to the favourable conservation status of harbour porpoise as a feature of the Inner Hebrides and the Minches SAC; and
- No significant risk of injury of disturbance to harbour porpoise within the Inner Hebrides and the Minches SAC; and
- No change in the distribution of harbour porpoise throughout the Inner Hebrides and the Minches SAC site.

Therefore, there is expected to be **no adverse in-combination effects** on the Inner Hebrides and the Minches SAC site integrity as a result of disturbance from underwater noise associated with construction activities at the Offshore Development, or from displacement or barrier effects, and entanglement or collision risk during the Operation and Maintenance phase of the Offshore Development. There is no impact pathway for in-combination effects on this SAC.

8.6.2 Moray Firth SAC

8.6.2.1 Site Description

The Moray Firth is a large bay in the north-east of Scotland, stretching from Duncansby Head to Inverness and Fraserburgh. Designated in 2005, this 151,273.98 ha (1512.73 km^2) site is characterised by sea inlets and supports both Annex I habitats and Annex II species. It is one of the only two known 'outstanding localities' for resident bottlenose dolphin populations within the UK, and the only one which has been identified within the North Sea (NatureScot, 2021b). The Moray Firth SAC is located 125 km from the Offshore Site.

8.6.2.2 Site Qualifying Interests

The Moray Firth SAC provides key habitat for the CES MU population of bottlenose dolphins. The current abundance estimate for the CES MU is 224 dolphins (95% CI: 214-234) (Arso Civil *et al.*, 2021). The range of this population extends well beyond the boundaries of the SAC as animals utilise waters off the southern Moray Firth, Grampian and Fife coasts to the south of the SAC (Cheney *et al.,* 2013). Recent surveys have shown that 53.8% of the total population use the Tay Estuary and adjacent waters (Arso Civil *et al.*, 2021). Additionally, new photo identification (ID) data have confirmed that individuals from this population have been sighted in the Netherlands and in Ireland in 2019 which had never previously been recorded. This highlights the potential for the CES population to have a much wider range than previously assumed, or that the population has continued to expand its range over time.

Less survey effort has been conducted in coastal waters north of the SAC, although their occurrence in this area is considered to be much lower than waters of the SAC and further south. For example, long-term monitoring through the East Coast Marine Mammal Acoustic Study (ECOMMAS) indicated very low detections of broadband dolphin vocalisations (attributed to bottlenose dolphins) at sites off the east Caithness coast north of the SAC (Palmer *et al*., 2019); no bottlenose dolphins were confirmed in any of the site-specific surveys (see Section 4.1); and, density estimates for the Offshore Site and surrounding waters are very low (e.g. Hammond *et al*. 2021).

Results of long-term monitoring of the CES MU population suggest that between 2001 and 2016 there was a slight decrease in the proportion of the total population using the Moray Firth SAC, but this seems to be driven by an increase in overall population size rather than a reduction in the number of dolphins using the SAC (Cheney *et al*., 2018).

The condition and broader conservation status of bottlenose dolphins have been summarised in Table 8.9 below (NatureScot, 2021b).

Table 8.9 Protected Interests and Condition for the Moray Firth SAC

Protected Interests	Interest Condition	Assessment Date	Broader Conservation Status
Bottlenose Dolphin	Favourable	2016	UK: Unknown European Region: Unknown

8.6.2.3 Site Objectives

The objectives of the Moray Firth SAC are to avoid the deterioration of the qualifying species and ensure that the integrity of the site is maintained to a Favourable Conservation Status. Table 8.10 provides the high-level conservation objective statements for the Moray Firth SAC (NatureScot, 2021b).

Table 8.10 Moray Firth SAC Conservation Objectives

Moray Firth SAC
> To ensure that the qualifying interests of the Moray First SAC are in favourable condition and make an appropriate contribution to achieving a Favourable Conservation Status; and > To ensure that the integrity of the Moray Firth SAC is maintained or restored in the context of environmental changes by meeting the objectives of the qualifying feature.
For Bottlenose Dolphin
> The population of bottlenose dolphin is a viable component of the site; > The distribution of bottlenose dolphin throughout the site is maintained by avoiding significant disturbance; and > The supporting habitat and processes relevant to bottlenose dolphin and the availability of prey are maintained.

Conservation and Management Advice for the Moray Firth SAC (NatureScot, 2021b) identifies that bottlenose dolphins are considered sensitive to the following impact pathways which are relevant to the proposed Offshore Development, and which have been screened in for assessment:

> The removal of non-target and target species (i.e. resulting in entanglement in fishing gears[xiii] and removal of prey species); and

> Underwater noise (i.e. from acoustic surveys) which may result in species relocation, interference with species communication, navigation, and foraging activities.

Additionally, NatureScot (2021b) provides advice on activities which are considered to capable of affecting bottlenose dolphins as a qualifying feature of the Moray Firth SAC. Those that are of relevance to the Offshore Development are listed in Table 8.11.

Table 8.11 NatureScot (2021) advice to support the management of the Moray Firth SAC

Activity	Advice to Support Management	PFOWF
Renewable energy	Reduce or limit pressures (disturbance, collision and entanglement mortality). Piling, blasting and the deployment of mooring lines should be minimised by implementing appropriate mitigation based on existing and recommended best practice guidelines	HWL has committed to implementing MMMPs for all key sources of underwater noise with the potential to result in injury (i.e. UXO clearance (if needed) and impact piling) in order to minimise the risk of injury to negligible levels. These MMMPs will also provide a mechanism for defining measures to reduce the impact of disturbance from underwater noise. Mooring lines will not be deployed within the boundaries of the SAC.

The assessment below is guided by this Conservation and Management Advice (NatureScot, 2021b) and the best practice protocols for mitigation and management of impacts to marine mammals provided in the embedded mitigations (Section 6.1).

[xiii] The relevant element of this impact pathway for the Offshore Development is secondary interactions with derelict fishing gears.

8.6.2.4 Assessment of Adverse Effects Alone

There is no direct overlap between the Moray Firth SAC boundary and either the Offshore Development or its predicted impact area for bottlenose dolphin. Therefore, there is very limited potential for adverse effects in terms of the site's conservation objectives (per Table 8.10). However, it is acknowledged that bottlenose dolphins are highly mobile, and the SAC population are at risk of effects from activities beyond the site boundary. Therefore, any effects to the viability of the CES population (i.e. long-term population-level effects) may comprise an adverse effect on the integrity of the Moray Firth SAC. The sections below address impacts to site integrity for the Moray Firth SAC in these terms.

8.6.2.4.1 Auditory injury (PTS)

The impact assessment presented in Offshore EIAR (Volume 3): Appendix 11.1: Underwater Noise Impact Assessment - SMRU Consulting, as summarised in Section 8.5.1, estimated extremely small predicted PTS-onset impact ranges for bottlenose dolphins for all noise-related construction activities, including impact piling and (currently unplanned) potential UXO clearance. Less than one individual is predicted to be impacted for all activities, with embedded mitigations effective at ensuring a negligible risk of PTS. No risk of PTS was identified for any Operation and Maintenance phase or Decommissioning phase activities.

8.6.2.4.2 Disturbance from underwater noise

For the majority of noise-generating activities (i.e. geophysical surveys, vessel noise, and construction activities other than impact piling or UXO clearance), the potential for disturbance to bottlenose dolphins is considered to be of limited spatial extent, temporary and intermittent in nature. Considering the low anticipated occurrence of animals in the Offshore Site, disturbance from these activities will be of negligible magnitude and no effects to vital rates or the long-term viability of the CES population are predicted.

The most conservative prediction of behavioural disturbance from high-order UXO clearance was an effect to 8 individuals (3.57% of the CES MU, if all impacted animals are conservatively assigned to the CES MU). Considering the very short-term nature of the disturbance, precautionary nature of the assessment (e.g. there are no empirical evidence to support a 26 km EDR for UXO clearance, and alternative TTS-onset impact ranges were substantially smaller), it is concluded that disturbance effects from UXO clearance do not have to potential to result in a population-level effect for this species.

Under the worst case scenario for impact piling of anchor piles, a maximum of 6 bottlenose dolphins from the CES MU (2.57%), which is the population relevant to the Moray Firth SAC, are predicted to experience behavioural disturbance. Results of associated iPCoD modelling showed an extremely small predicted effect on the bottlenose dolphin population as a result of the piling activity, with the population trajectory of both the affected and un-affected populations expected to be stable in the long-term. Moreover, the disturbance impact contours are not expected to extend to the east coast of Scotland, as a function of topographic barriers, and therefore effects to the CES MU for bottlenose dolphins are expected to be further diminished across the principle range of this population (see Offshore EIAR (Volume 3): Appendix 11.1: Underwater Noise Impact Assessment - SMRU Consulting). There remains a low chance that a very small number of bottlenose dolphins associated with the SAC may experience a limited amount of behavioural disturbance as a result of impact piling at the Offshore Development. However, this is not expected to generate a significant disturbance effect, and changes to the distribution of bottlenose dolphins within the Moray Firth SAC and to the favourable conservation status of the species as a qualifying feature are not predicted.

In summary, there is expected to be **no adverse effects** on the Moray Firth SAC site integrity as a result of underwater noise associated with any construction activities at the Offshore Development.

8.6.2.4.3 Other impact pathways during the Operation and Maintenance phase of the Offshore Development

Displacement or barrier effects:

Considering the design of the Offshore Export Cable(s) and the PFOWF Array infrastructure and their location within the Pentland Firth, the Offshore Development is not considered to generate any barrier or displacement effects on habitat use by bottlenose dolphins. The Offshore Export Cable Corridor is readily traversable, and the scale and placement of the PFOWF Array Area is not expected to limit movement or habitat use by

individuals therein. Any unanticipated displacement effects resulting from individuals avoiding swimming around the floating array infrastructure would be limited to the 10 km^2 PFOWF Array Area. Consequently, < 1 bottlenose dolphin would be affected, when the most conservative density estimate is employed, and therefore < 1% of the CES MU would experience these unlikely restrictions on movement within the Array Area. For these reasons, there is expected to be **no adverse effects** on the Moray Firth SAC site integrity over the operational life-cycle of the Offshore Development.

Risk of injury or mortality from entanglement:

Bottlenose dolphins are not at risk of direct entanglement with the proposed floating infrastructure, although secondary entanglement with derelict fishing gears poses a threat to animals utilising the PFOWF Array Area. This is particularly true if the entangled gears are monofilament fishing nets and lines, which are responsible for the vast majority of bycatch in small cetaceans and seals (Read *et al.*, 2006). The embedded mitigation of monitoring and removing debris from the floating lines and cables greatly diminishes the likelihood that a substantial quantity of entangling materials would become caught on the array infrastructure. Therefore, it is considered that bottlenose dolphins as a part of the CES MU or in association with the Moray Firth SAC are not at risk of injury or mortality from direct or secondary entanglement with the Offshore Development infrastructure and **no adverse effects** on the Moray Firth SAC site integrity are predicted for this impact pathway.

Collision risk with floating infrastructure:

The floating infrastructure is of a scale several orders of magnitude greater than the size of a bottlenose dolphin. The associated mooring infrastructure has been designed to limit the movement of the WTGs and substructures, and there are no moving parts associated with the substructures within the water column (e.g. submerged rotating WTGs, etc.). For these reasons, the potential for a bottlenose dolphin to collide with either the WTGs, substructures or floating cables or mooring lines is considered extremely small. Animals are expected to readily swim around this infrastructure, avoiding collision. Accordingly, there is expected to be no adverse effects to bottlenose dolphins, either individually or at the population-level, and therefore **no adverse effects** on the Moray Firth SAC site integrity as a result of collision risk.

8.6.2.5 Assessment of adverse effects in-combination

This in-combination assessment is focussed on the potential for disturbance from the Offshore Development in combination with disturbance effects from the construction of other offshore developments and projects within the CES MU for bottlenose dolphins. This in-combination assessment only includes projects that are scheduled to construct within the period 2025-2026; therefore, the following projects were screened into the in-combination assessment for bottlenose dolphins:

- Green Volt offshore wind farm (floating);
- Hatston Pier Proposed Extension and Reclamation (port development);
- Scapa Deep Water Quay (port development);
- NorthConnect (cables); and
- Scotland England Green Link 1 & 2 (cables).

Construction periods also overlap with the Faray slipway extension and landing jetty, which lies within the CES MU, however, no effects to bottlenose dolphins were predicted in the EIA for this project (ITPEnergised, 2021) (the predicted extent of disturbance from this project is very small 26 km^2 and the density of dolphins in the area is also low).

At this time, the only information available for the Green Volt offshore wind farm comes from the Scoping Report, submitted in November 2021, and the Scoping Opinion response received in April 2022, which identified disturbance from underwater noise as a potential impact pathway. As the project is located > 70 km offshore, the only noise impact pathway considered here for the bottlenose dolphin CES MU and Moray Firth SAC is that from other construction activities associated with export cable installation, with landfall planned in the Peterhead area on the Aberdeenshire coast, where it will overlap the boundaries of the CES MU. Applying a precautionary EDR of 5 km, as has been suggested by some authors for harbour porpoise responses to

dredging activity (Verboom, 2014; McQueen *et al.*, 2020), and the density of the relevant SCANS-III block (block R = 0.0298 dolphins/km^2, Hammond *et al.*, 2021) results in a total of two individuals predicted to be affected at any one time during cable laying activities within the CES MU.

At this time, scoping reports provide the only available environmental assessment information for Hatston Pier Proposed Extension and Scapa Deep Water Quay. No quantitative assessment is provided of effects to marine mammals, but both projects note the potential for impact piling (tubular (i.e. pin) or sheet piles) and the potential for effects on marine mammals. Assuming the density of the relevant SCANS-III survey block (block S = 0.0037 dolphins/km^2; Hammond *et al.*, 2021) and a 15 km EDR for disturbance from piling[xiv], one individual is predicted to be affected per piling day at Scapa Deep Water Quay and <1 individual at Hatston Pier Proposed Extension.

The marine mammal ecological impact assessment conducted for the NorthConnect project determined that the maximum predicted disturbance range for all marine mammals would be 464 m for the sub-bottom profiler, with smaller impact ranges for vessel noise and cable burial works (NorthConnect KS 2018). No piling was proposed. Therefore, a maximum EDR of 500 m was assumed here to represent the number of animals that could be affected at any one time from sub-bottom profiler surveys. Assuming the density of the relevant SCANS-III survey block (block R = 0.0298 dolphins/km^2, Hammond *et al.*, 2021), <1 bottlenose dolphin is expected to be affected.

The Scotland England Green Link 1 & 2 projects will involve the installation of subsea cables, including planned landfalls in Scotland at Torness and Peterhead, which are predicted to result in disturbance effects to marine mammals. The Environmental Statement does not quantify the number of animals predicted to be disturbed. Assuming the density of the relevant SCANS-III survey block (block R = 0.0298 dolphins/km^2, Hammond *et al.*, 2021) and a 5 km EDR for disturbance from cable installation to represent the number of animals that could be affected at any one time, a total of two bottlenose dolphins are expected to be affected at each of the two projects.

Therefore, if all seven projects construct at the same time, and considering impact piling at the Offshore Development as the maximum disturbance scenario, up to 14 bottlenose dolphins from the CES MU are predicted to be disturbed per day of activity, representing 6.25% of the CES MU[xv]. To assess whether this (highly precautionary) predicted level of disturbance would be sufficient to cause a population level effect, the iPCoD population model was run for a worst case schedule of disturbance assumed to 14 animals on 63 consecutive days centred on May-June. The results of the modelling showed that there was an extremely small predicted effect, with affected populations predicted to be 99.1%, 99.3% and 99.7% of unaffected populations at 1, 6 and 12 years after the disturbance, respectively. This is not considered to represent an adverse effect on the conservation status or integrity of the population.

Whilst there remains a low chance that a very limited number of bottlenose dolphins associated with the SAC may experience a limited amount of behavioural disturbance from the in-combination assessment, there is expected to be no significant disturbance effect, no effect on the population size and no change in the distribution of bottlenose dolphins within the Moray Firth SAC and as such, no change to the favourable conservation status of the bottlenose dolphin feature or the integrity of the Moray Firth SAC.

Therefore, there is expected to be **no adverse in-combination effects** on the integrity of the Moray Firth SAC.

8.6.2.6 Summary

This assessment has shown that there is expected to be:

- No change to the favourable conservation status of bottlenose dolphins as a feature of the Moray Firth SAC;
- No change to the bottlenose dolphin population as a viable component of the Moray Firth SAC; and
- No change to the distribution of bottlenose dolphin throughout the Moray Firth SAC site.

[xiv] The 15 km EDRs for Hatston and Scapa projects were trimmed to exclude land masses and waters in the acoustic shadow from land masses. The resulting assumed impact areas were 57 km^2 (Hatston) and 165 km^2 (Scapa).
[xv] The total number of bottlenose dolphins disturbed is up to 16 (7.14% of the CES MU), if high-order UXO clearance, which does not form part of the consent application to which this assessment supports, is considered the maximum disturbance scenario for PFOWF.

Therefore, there is expected to be **no adverse effects** on the Moray Firth SAC site integrity as a result of disturbance from underwater noise associated with construction activities at the Offshore Development alone, or in-combination with construction related activities at the Green Volt OWF, the NorthConnect interconnector and the Scotland England Green Link 1 & 2 interconnector projects. Additionally, there will be **no adverse effects** from displacement or barrier effects, and entanglement or collision risk during the Operation and Maintenance phase of the Offshore Development.

8.6.3 Skerries and Causeway SAC

8.6.3.1 Site Description

The Skerries and Causeway SAC is located on the north coast of Ireland, stretching from the Inishowen peninsular to the west and the Benbane Head to the east with an area of 10,867.43 ha (108.67 km^2). The site was designated in 2017 for a number of qualifying interests including Annex I habitats (sandbanks which are slightly covered by sea water all the time, reefs and submerged or partially submerged sea caves) and Annex II species (harbour porpoise). The Skerries and Causeway SAC is located 401 km from the Offshore Site.

8.6.3.2 Site Qualifying Interests

The Skerries and Causeway SAC is considered to be one of the best areas for harbour porpoise in the UK, supporting a local population of harbour porpoise throughout the year. However, habitat use by this species within the site remains data poor and harbour porpoise are not currently listed as a primary reason for site selection (JNCC, 2022). Additionally, the Skerries and Causeway SAC is noted for its utilisation by harbour seals, grey seals and bottlenose dolphins. However, these species do not occur in significant numbers to be included as qualifying interests of the site and are therefore precluded from further assessment against site-specific impacts.

The NCA Screening Report (HWL, 2022) identified the Skerries and Causeway SAC as a site where marine mammals are a qualifying interest where there was LSE. The condition and broader conservation status of the qualifying interests have been summarised in Table 8.12 (DAERA, 2017).

Table 8.12 Protected Interests and Condition for the Skerries and Causeway SAC

Protected Interests	Interest Condition	Assessment Date	Broader Conservation Status
Harbour porpoise *(Phocoena phocoena)*	Unfavourable	2010	UK: Favourable European Region: Favourable

8.6.3.3 Site Objectives

The objectives of the Skerries and Causeway SAC are to avoid the deterioration of the qualifying species and ensuring that the integrity of the site is maintained to a Favourable Conservation Status. Table 8.13 provides the high-level conservation objective statements for the Skerries and Causeway SAC (DAERA, 2017).

Table 8.13 Skerries and Causeway SAC Conservation Objectives

Skerries and Causeway SAC
> To maintain (or restore where appropriate) the reefs, sandbanks, submerged and partially submerged sea caves and harbour porpoise.
For Harbour Porpoise
> Favourable conservation status is achieved when: > Population dynamics data on the species concerned indicate that it is maintaining itself on a long-term basis as a viable component of its natural habitats;

Skerries and Causeway SAC
> The natural range of the species is neither being reduced nor is likely to be reduced for the foreseeable future, and;
> There is, and will probably continue to be, a sufficiently large habitat to maintain its population on a long term basis.

Advice to support the management of harbour porpoise against these conservation objectives are not yet available from the statutory advisors for the Skerries and Causeway SAC. Therefore, the precautionary approach has been applied and it is considered that, based on biological and behavioural knowledge, harbour porpoise are considered sensitive to the following impact pathways which have been screened in for assessment:

- Underwater noise;
- Entanglement;
- Collision risk; and
- Displacement and barrier effects.

In the absence of specific management guidance, the assessment has been conducted under the *Guidance for assessing the significance of noise disturbance against conservation objectives of harbour porpoise SACs (England, Wales and Northern Ireland)* (JNCC, DAERA and Natural England, 2020) and the best practice protocols for mitigation and management of impacts to marine mammals provided in the embedded mitigations (Section 6.1).

8.6.3.4 Assessment of adverse effects alone

8.6.3.4.1 Auditory injury from PTS

There is not considered to be a risk of injury to any marine mammal from noise arising from USBL use during the geophysical surveys as it will be operated at a level below which could cause the onset of PTS. The impact assessment concluded that there will be no adverse effects of PTS on harbour porpoise from UXO clearance (if determined to be required following planned UXO surveys) if a UXO MMMP is implemented.

The impact ranges for instantaneous PTS-onset from impact piling were negligible for harbour porpoise, resulting in <1 porpoise predicted to experience instantaneous PTS-onset per piling day. The cumulative PTS-onset impact ranges for impact piling are larger, extending to a maximum of 8.7 km, which equates to a maximum of 23 harbour porpoise predicted to experience cumulative PTS-onset per piling day. As stated in Offshore EIAR (Volume 3): Appendix 11.1: Underwater Noise Impact Assessment - SMRU Consulting, the modelled ranges for cumulative PTS-onset are highly precautionary and should be regarded as over-estimates. Despite this, the number of animals predicted to experience PTS-onset per piling day is low and the probability of the PTS causing a change in vital rates is expected to be very low. Therefore, it is not expected that a sufficient number of animals would experience a change in vital rates, and that any change is expected to be barely detectable and will not affect conservation status or integrity of the receptor. HWL is committed to implementing a piling MMMP to reduce the risk of PTS to negligible levels.

Therefore, it is concluded that there will be **no adverse effects** on the Skerries and Causeway SAC site integrity as a result of PTS-onset from underwater noise associated with pre-construction and construction activities at the Offshore Development.

8.6.3.4.2 Disturbance from underwater noise

Guidance has been provided on how to assess the significance of noise disturbance against the Conservation Objectives of harbour porpoise SACs in England, Wales and Northern Ireland (JNCC, 2020). This guidance provides the following definition of significant disturbance: "*noise disturbance within an SAC from a plan/project, individually or in combination, is considered to be significant if it excludes harbour porpoises from more than:*

1. 20% of the relevant area of the site in any given day, or

2. an average of 10% of the relevant area of the site over a season."

Given the location of the Offshore Development in relation to the Skerries and Causeway SAC (404 km apart), there is no possibility for disturbance impacts at the Offshore Site to overlap with the SAC. Since the definition of significant noise disturbance relates to the proportion of the SAC that is directly affected (JNCC, 2020), there will be **no adverse effects** on the Skerries and Causeway SAC site integrity as a result of disturbance from underwater noise associated with construction activities at the Offshore Development.

8.6.3.4.3 Other impact pathways during the Operation and Maintenance phase of the Offshore Development

Displacement or barrier effects:

Considering the design of the Offshore Export Cable(s) and the PFOWF Array infrastructure and their location within the Pentland Firth, the Offshore Development is not considered to generate any barrier or displacement effects on habitat use by harbour porpoise. The Offshore Export Cable Corridor is readily traversable, and the scale and placement of the PFOWF Array Area is not expected to limit movement or habitat use by individuals therein. Any unanticipated displacement effects resulting from individuals avoiding swimming around the floating array infrastructure would be limited to the 10 km^2 PFOWF Array Area. Consequently, < 2 individuals would be impacted, when the most representative density estimate is employed, and therefore < 0.01% of the WS MU would experience these unlikely restrictions on movement within the PFOWF Array Area. For these reasons, there is expected to be **no adverse effects** on the Skerries and Causeway SAC site integrity over the operational life-cycle of the Offshore Development.

Risk of injury or mortality from entanglement:

Harbour porpoise are not at risk of direct entanglement with the proposed floating infrastructure, although secondary entanglement with derelict fishing gears poses a threat to animals utilising the PFOWF Array Area. This is particularly true if the entangled gears are monofilament fishing nets and lines, which are responsible for the vast majority of bycatch in small cetaceans and seals (Read *et al.*, 2006). The embedded mitigation of monitoring and removing debris from the floating lines and cables greatly diminishes the likelihood that a substantial quantity of entangling materials would become caught on the array infrastructure. Therefore, it is considered that harbour porpoise as a part of the WS MU or in association with the Skerries and Causeway SAC are not at risk of injury or mortality from direct or secondary entanglement with the Offshore Development infrastructure and **no adverse effects** on the Skerries and Causeway SAC site integrity are predicted for this impact pathway.

Collision risk with floating infrastructure:

The floating infrastructure is of a scale several orders of magnitude greater than the size of a harbour porpoise. The associated mooring infrastructure has been designed to limit the movement of the WTGs and substructures, and there are no moving parts associated with the substructures within the water column (e.g. submerged rotating WTGs, etc.). For these reasons, the potential for a harbour porpoise to collide with either the WTGs, substructures or floating cables or mooring lines is considered extremely small. Animals are expected to readily swim around this infrastructure, avoiding collision. Accordingly, there is expected to be no adverse effects to harbour porpoise, either individually or at the population-level, and therefore **no adverse effects** on the Skerries and Causeway SAC site integrity as a result of collision risk.

8.6.3.5 Assessment of adverse effects in-combination

The Skerries and Causeway SAC is located within the WS MU for harbour porpoise. There were no offshore projects screened into this assessment that are located within this MU. Therefore, no in-combination assessment is presented for this SAC.

8.6.3.6 Summary

This assessment has shown that there is expected to be:

- No change to the harbour porpoise population as a viable component of the Skerries and Causeway SAC; and
- No significant disturbance to harbour porpoise within the Skerries and Causeway SAC.

Therefore, there is **no adverse effects** on the Skerries and Causeway SAC site integrity as a result of disturbance from underwater noise associated with construction activities at the Offshore Development. Additionally, there will be **no adverse effects** from displacement or barrier effects, and entanglement or collision risk during the Operation and Maintenance phase of the Offshore Development.

8.6.4 Southern North Sea SAC

8.6.4.1 Site Description

The Southern North Sea SAC is located off the east coast of England. The site covers an area of 3,695,054 ha (36,950.54 km^2). The site is characterised by sea inlets and is designated for the conservation of the Annex II species, harbour porpoise (JNCC, 2021a). The majority of the Southern North Sea SAC lies offshore; however, there are areas that cross the 12 nautical mile boundary into coastal waters, resulting in the requirement of considering statutory advice from both Natural England and the JNCC. The Southern North Sea SAC is located 439 km from the Offshore Site.

8.6.4.2 Site Qualifying Interests

The Southern North Sea SAC is considered to be one of the best areas for harbour porpoise in the UK, wherein habitat use is expansive and varies seasonally. It is estimated that this area supports approximately 17.5% of the UK harbour porpoise population, with individuals present in high numbers in the northern region of the site during the summer season and migrating to the southern portion of the site in the winter. The site supports consistently higher densities of harbour porpoise relative to elsewhere in the North Sea MU (JNCC, 2021a).

The NCA Screening Report (HWL, 2022) identified the Southern North Sea SAC as a site where marine mammals are qualifying interests where there was LSE. The condition and broader conservation status of the qualifying interests have been summarised in Table 8.14(JNCC, 2021a).

Table 8.14 Protected Qualifying Interests and Condition for the Southern North Sea SAC

Protected Interests	Interest Condition	Assessment Date	Broader Conservation Status
Harbour porpoise	Favourable	2017	UK: Favourable European Region: Favourable

8.6.4.3 Site Objectives

The objectives of the Southern North Sea SAC are to avoid the deterioration of the qualifying species and ensuring that the integrity of the site is maintained to a Favourable Conservation Status. The Conservation Objectives have been set taking account of European Commission guidance (EC, 2012). Table 8.15 provides the high-level conservation objective statements for the Southern North Sea SAC (JNCC, 2021a).

Table 8.15 Southern North Sea SAC Conservation Objectives

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

JNCC and Natural England (2019) identifies the key activities that are expected to impact harbour porpoise:

- Anthropogenic underwater sound (Mortality, internal injury, disturbance leading to physical and acoustic behavioural changes (potentially impacting foraging, navigation, breeding, socialising) and habitat changes/loss); and
- Death or injury by collision[xvi] (mortality and injury from Shipping, recreational boating, tidal energy installations).

Additionally, JNCC and Natural England (2019) provide advice on activities which are considered to be capable of affecting harbour porpoise as a qualifying interest of the Southern North Sea SAC. Those that are of relevance to the Offshore Development are listed in Table 8.16.

Table 8.16 JNCC and Natural England (2019) advice to support the management of the Southern North Sea SAC

Activity	Advice to Support Management	PFOWF
Pile driving	Reduce or limit underwater noise pressures that have the potential to result in PTS. Mitigation may be required in line with best practice guidelines, including the use of sound dampers and the use of alternative foundation types.	HWL has committed to implementing MMMPs for all key sources of underwater noise with the potential to result in injury (i.e, UXO clearance and impact piling) in order to minimise the risk of injury to negligible levels. These MMMPs will also provide a mechanism for defining measures to reduce the impact of disturbance from underwater noise. Impact piling will not occur within the boundaries of the SAC.
Geophysical surveys (including seismic surveys)	It is currently unknown whether sub-bottom profilers cause disturbance to harbour porpoise. Further research is needed to understand the range of impact of these types of equipment. Cumulative impacts of geophysical surveys should be considered.	Geophysical surveys will not occur within the boundaries of the SAC.
Unexploded ordnances (UXOs)	Projects that could inadvertently explode UXOs must undertake a survey to search for possible ordnance ahead of the project commencing. Most ordnance found is exploded on site or removed for health and safety reasons. Discussions are ongoing between industry, regulators and SNCBs on the most	Based on an initial desk-based UXO assessment (Ordtek, 2021), it is assumed that, during construction, it will be possible to avoid any UXO identified during the UXO survey and should further mitigation be required, such as clearance or detonation, this would be subject to separate assessment and applications.

[xvi] The relevant element of this impact pathway for the Offshore Development is collision with floating infrastructure.

Activity	Advice to Support Management	PFOWF
	appropriate suite of mitigation measures for UXO clearance (including the possible use of bubble curtains). This will depend on the size of UXOs likely to be encountered and the practicality of deployment of the mitigation measure, amongst other factors.	HWL has committed to implementing MMMPs for all key sources of underwater noise, including from potential UXO clearance if it was required. Any UXO clearance which is identified as being required will not occur within the boundaries of the SAC.

The assessment below is guided by this Conservation and Management Advice (JNCC and Natural England, 2019), the *Guidance for assessing the significance of noise disturbance against conservation objectives of harbour porpoise SACs (England, Wales and Northern Ireland)* (JNCC, DAERA and Natural England, 2020), and the best practice protocols for mitigation and management of impacts to marine mammals provided in the embedded mitigations (Section 6.1).

8.6.4.4 Assessment of adverse effects alone

8.6.4.4.1 Auditory injury from PTS

There is not considered to be a risk of injury to any marine mammal from noise arising from USBL use during the geophysical surveys as it will be operated at a level below which could cause the onset of PTS. The impact assessment concluded that there will be no significant impact of PTS on harbour porpoise from UXO clearance (if determined to be required following planned UXO surveys) if a UXO MMMP is implemented.

The impact ranges for instantaneous PTS-onset from impact piling were negligible for harbour porpoise, resulting in <1 porpoise predicted to experience instantaneous PTS-onset per piling day. The cumulative PTS-onset impact ranges for impact piling are larger, extending to a maximum of 8.7 km, which equates to a maximum of 23 harbour porpoise predicted to experience cumulative PTS-onset per piling day. As stated in Offshore EIAR (Volume 3): Appendix 11.1: Underwater Noise Impact Assessment - SMRU Consulting, the modelled ranges for cumulative PTS-onset are highly precautionary and should be regarded as over-estimates. Despite this, the number of animals predicted to experience PTS-onset per piling day is low and the probability of the PTS causing a change in vital rates is expected to be very low. Therefore, it is not expected that a sufficient number of animals would experience a change in vital rates, and that any change is expected to be barely detectable and will not affect conservation status or integrity of the receptor. HWL is committed to implementing a piling MMMP to reduce the risk of PTS to negligible levels.

Therefore, it is concluded that there will be **no adverse effects** on the Southern North Sea SAC site integrity as a result of PTS-onset from underwater noise associated with pre-construction and construction activities at the Offshore Development.

8.6.4.4.2 Disturbance from underwater noise

Given the location of the Offshore Development in relation to the Southern North Sea SAC (447 km apart), there is no possibility for disturbance impacts at the Offshore Development to overlap with the SAC. Given that the definition of significant noise disturbance relates to the proportion of the SAC that is directly affected (JNCC, 2020), there will be **no adverse effects** on the Southern North Sea SAC site integrity as a result of disturbance from underwater noise associated with construction activities at the Offshore Development.

8.6.4.4.3 Other impact pathways during the Operation and Maintenance phase of the Offshore Development

Displacement or barrier effects:

Considering the design of the Offshore Export Cable(s) and the PFOWF Array infrastructure and their location within the Pentland Firth, the Offshore Development is not considered to generate any barrier or displacement effects on habitat use by harbour porpoise. The Offshore Export Cable Corridor is readily traversable, and the scale and placement of the PFOWF Array Area is not expected to limit movement or habitat use by individuals therein. Any unanticipated displacement effects resulting from individuals avoiding swimming around the floating array infrastructure would be limited to the 10 km^2 PFOWF Array Area. Consequently, < 2 individuals would be affected, when the most representative density estimate is employed, and therefore < 0.001% of the

NS MU would experience these unlikely restrictions on movement within the PFOWF Array Area. For these reasons, there is expected to be **no adverse effects** on the Southern North Sea SAC site integrity over the operational life-cycle of the Offshore Development.

Risk of injury or mortality from entanglement:

Harbour porpoise are not at risk of direct entanglement with the proposed floating infrastructure, although secondary entanglement with derelict fishing gears poses a threat to animals utilising the PFOWF Array Area. This is particularly true if the entangled gears are monofilament fishing nets and lines, which are responsible for the vast majority of bycatch in small cetaceans and seals (Read *et al.*, 2006). The embedded mitigation of monitoring and removing debris from the floating lines and cables greatly diminishes the likelihood that a substantial quantity of entangling materials would become caught on the array infrastructure. Therefore, it is considered that harbour porpoise as a part of the NS MU or in association with the Southern North Sea SAC are not at risk of injury or mortality from direct or secondary entanglement with the Offshore Development infrastructure and **no adverse effects** on the Southern North Sea SAC site integrity are predicted for this impact pathway.

Collision risk with floating infrastructure:

The floating infrastructure is of a scale several orders of magnitude greater than the size of a harbour porpoise. The associated mooring infrastructure has been designed to limit the movement of the WTGs and substructures, and there are no moving parts associated with the substructures within the water column (e.g. submerged rotating WTGs, etc.). For these reasons, the potential for a harbour porpoise to collide with either the WTGs, substructures or floating cables or mooring lines is considered extremely small. Animals are expected to readily swim around this infrastructure, avoiding collision. Accordingly, there is expected to be no adverse effects to harbour porpoise, either individually or at the population-level, and therefore **no adverse effects** on the Southern North Sea SAC site integrity as a result of collision risk.

8.6.4.5 Assessment of Adverse Effects In-combination

As described above, the potential for injury or mortality effects on the harbour porpoise NS MU from the Offshore Development is negligible and not expected to affect the viability of this population. Additionally, the Southern North Sea SAC is > 400 km from the Offshore Site and therefore there is no potential for significant disturbance, as defined by JNCC (2020), or effects to the site's supporting habitats, processes, or availability of prey over this distance.

Although harbour porpoise are known to travel great distances, particularly in the North Atlantic (surrounding Greenland), tagging data suggests smaller home ranges (i.e. the area occupied by an individual > 50% of the time) within North Sea populations (Sveegaard *et al.*, 2011; Nabe-Nielsen *et al.*, 2013) and evidence of philopatry (i.e. return to natal habitat) in North Sea males (Nielsen *et al.*, 2018), indicating the importance of site fidelity to this species. A study of harbour porpoise movement in the North Sea utilising satellite telemetry estimated a home range distance of approximately 380 km in Danish waters from 64 tagged animals (Sveegaard *et al.*, 2011). Another tagging study based in Denmark indicated a displacement distance of up to 300 km for 34 individuals over a six-month period, with a majority of individuals returning to the location of tag deployment on occasion (Nabe-Nielsen *et al.*, 2013). These studies provide some evidence of ranging patterns and site fidelity in North Sea harbour porpoise populations, and indicate that long-range movements are likely to represent a minor component of their typical ranging patterns.

The time of year also appears to influence harbour porpoise distributions, with individuals showing higher levels of site fidelity during the reproductive period in the spring and summer, and are more apt to travel further afield in the winter months, possibly in response to seasonally depleted prey resources (Sveegaard *et al.*, 2011). A seasonal distribution pattern is seen in the harbour porpoise population affiliated with the Southern North Sea SAC as well. Higher densities of animals are reported in northern and central parts of the site in the summer months, and higher densities in southern parts of the site in winter months, though harbour porpoise densities also appear to peak over a much greater area further offshore to the north-east of the site during winter (JNCC, 2015).

These data suggest high levels of site fidelity within the SAC and immediately adjacent to it within offshore waters, all of which remain several hundreds of kilometres from the Offshore Development and the proposed activities therein.

With this evidence and the timing of the proposed activities (i.e. during the summer months) in mind, there is limited scope for connectivity with this site. Therefore, there is not considered to be a potential for in-combination effects from activities associated with the Offshore Development and activities taking place over the wider region and there will be **no adverse in-combination effects** on the Southern North Sea SAC site integrity as a result.

8.6.4.6 Summary

This assessment has shown that there is expected to be:

- No change to the favourable conservation status of harbour porpoise as a feature of the Southern North Sea SAC;
- No change to the harbour porpoise population as a viable component of the Southern North Sea SAC;
- No significant disturbance to harbour porpoise within the Southern North Sea SAC; and
- No change to the supporting habitat and processes relevant to harbour porpoise are their prey.

Therefore, there is **no adverse effects** on the Southern North Sea SAC site integrity as a result of disturbance from underwater noise associated with construction activities at the Offshore Development. Additionally, there will be **no adverse effects** from displacement or barrier effects, and entanglement or collision risk during the Operation and Maintenance phase of the Offshore Development.

8.6.5 European SACs

All of the European SACs which have been screened in for further consideration have been designated for the protection of harbour porpoise within the North Sea MU. The UK SAC assessments presented above demonstrate **no adverse effect** on the integrity of any UK sites designated for the protection of harbour porpoise or any Annex II cetacean species. Consequently, the European (non-UK) SACs are unlikely to experience adverse effects given their larger distances from the Offshore Site (all are located > 500 km from the Offshore Site).

Although harbour porpoise are known to travel great distances, particularly in the North Atlantic (surrounding Greenland), tagging data suggests smaller home ranges (i.e. the area occupied by an individual > 50% of the time) within North Sea populations (Sveegaard *et al.*, 2011) and evidence of philopatry (i.e. return to natal habitat) in North Sea males (Nielsen *et al.*, 2018), indicating the importance of site fidelity to this species. A study of harbour porpoise movement in the North Sea utilising satellite telemetry estimated a home range distance of approximately 380 km in Danish waters from 64 tagged animals (Sveegaard *et al.*, 2011). Another tagging study based in Denmark indicated a displacement distance of up to 300 km for 34 individuals over a six-month period, with a majority of individuals returning to the location of tag deployment on occasion (Nabe-Nielsen *et al.*, 2013). These studies provide some evidence of ranging patterns and site fidelity in North Sea harbour porpoise populations, and indicate that long-range movements are likely to represent a minor component of their typical ranging patterns.

The time of year also appears to influence harbour porpoise distributions, with individuals showing higher levels of site fidelity during the reproductive period in the spring and summer and are more apt to travel further afield in the winter months, possibly in response to seasonally depleted prey resources (Sveegaard *et al.*, 2011). A seasonal distribution pattern is demonstrated by the harbour porpoise population affiliated with the Southern North Sea SAC, where higher densities of animals are reported in northern and central parts of the site in the summer months and higher densities in southern parts of the site in winter months, though harbour porpoise densities also appear to peak over a much greater area further offshore to the north-east of the site during winter (JNCC, 2015).

With this evidence and the timing of the noise-generating activities in mind (i.e. construction is planned for the summer months), it is unlikely that harbour porpoises associated with protected sites within northern European and Scandinavian waters have the potential to experience LSE due to the Offshore Development. As all of the European SACs are well over 500 km from the Offshore Development, there is no potential for significant disturbance to harbour porpoise, as defined by JNCC (2020), or impacts to any site's supporting habitats, processes or the availability of prey resources over this distance.

Any potential impacts to European (non-UK) SACs are expected to be less than those attributed to the closer UK SACs, for which **no adverse effects** to any sites are predicted. Therefore, it is concluded that there are **no adverse effects** on the site integrity of any European SACs as a result of disturbance from underwater noise associated with construction activities and there will be **no adverse effects** from displacement or barrier effects, and entanglement or collision risk during the Operation and Maintenance phase of the Offshore Development.

8.7 Pinnipeds

The Section below provides an assessment of LSE against site integrity for the protected site with pinnipeds as qualifying interests identified in Section 3.3.2, and as informed by the telemetry data provided in Section 8.4.2.

8.7.1 Faray and Holm of Faray SAC

8.7.1.1 Site Description

The Faray and Holm of Faray SAC, designated in 2005, covers an area of 781.33 ha (7.81 km^2) surrounding the Isle of Faray, which lies between Eday and Westray in the Orkney Isles. These two uninhabited islands support a well-established breeding colony of grey seals. The grey seal is among the rarest seal species in the world, with the UK grey seal population accounting for approximately 40% of the global population and 95% of the EU population (SCOS, 2020). The Faray and Holm of Faray SAC supports the second-largest breeding colony of grey seals in the UK, contributing approximately 9% of the annual pup production in the UK (JNCC, 2021b). This SAC is located 93 km from the Offshore Site. As described in Section 8.4.2.2, telemetry data and SAC-specific at-sea habitat use predictions indicate limited connectivity between the SAC and the Offshore Development, with 3% of seals hauling out at the site in the main breeding season predicted to overlap with the predicted disturbance impact area of the Offshore Development (Carter *et al*., 2022).

8.7.1.2 Site Qualifying Interests

The Faray and Holm of Faray SAC provides key habitat for the Western Isles population of grey seal, the second largest population in Scotland. This site provides undisturbed breeding, moulting and haul-out sites, with ease of access to freshwater areas and rookery locations (NatureScot, 2006). Pup production reached a stable level of ~18-19,000 pups in Orkney in 2000 and has remained stable since (SCOS, 2021). Approximately 15% of these Orkney pups are born in the Faray and Holm of Faray SAC, which equates to 2,700 – 2,850 pups born in the SAC. The pup count in 2016 for Faray was 1,655 and for the Holm of Faray was 1,035 (data provided by Chris Morris, SMRU).

The NCA Screening Report (HWL, 2022) identified the Faray and Holm of Faray SAC as a site where marine mammals are a qualifying interest where there was LSE. The feature condition and broader conservation status of the qualifying interests have been summarised in Table 8.17 (NatureScot, 2021).

Table 8.17 Protected Interests and Condition for the Faray and Holm of Faray SAC

Protected Qualifying Interests	Interest Condition	Assessment Date	Broader Conservation Status
Grey seal *(Halichoerus grypus)*	Favourable	2014	UK: Favourable European Region: Favourable

8.7.1.3 Site Objectives

The objectives of the Faray and Holm of Faray SAC are to avoid the deterioration of the qualifying species and ensuring that the integrity of the site is maintained to a Favourable Conservation Status. Table 8.18 provides the high-level conservation objective statements for the Faray and Holm of Faray SAC.

Table 8.18 Faray and Holm of Faray SAC Conservation Objectives

Faray and Holm of Faray SAC
> To avoid deterioration of the habitats of the qualifying species or significant disturbance to the qualifying species, thus ensuring that the integrity of the site is maintained, and the site makes an appropriate contribution to achieving favourable conservation status for each of the qualifying interests.
For Grey Seals
> To ensure that for the qualifying species that the following are maintained: > Population of the species as a viable component of the site; > Distribution of the species within the site; > Distribution and extent of habitats supporting the species; > Structure, function and supporting processes of habitats supporting the species; and > No significant disturbance of the species.

Advice to support the management of grey seals against these conservation objectives are not yet available from the statutory advisors for the Faray and Holm of Faray SAC. A report which outlines Advice under Regulation 33(2) (SNH, 2006) is the closest available document which provides conservation and management advice; however, it does not identify any activities or impact pathways which are relevant to the Offshore Development.

For these reasons, the precautionary approach has been applied and it is considered that, based on biological and behavioural knowledge, grey seals are considered sensitive to the following impact pathways which have been screened in for assessment:

> Underwater noise;

> Entanglement;

> Collision risk; and

> Displacement and barrier effects.

In the absence of specific management guidance, the assessment has been guided by the best practice protocols for mitigation and management of impacts to marine mammals provided in the embedded mitigations (Section 6.1).

8.7.1.4 Assessment of adverse effects alone

8.7.1.4.1 Auditory injury from PTS

There is not considered to be a risk of injury to any marine mammal from noise arising from USBL use during the geophysical surveys as it will be operated at a level below which could cause the onset of PTS. The impact assessment concluded that there will be no adverse effects of PTS on grey seals from UXO clearance (if determined to be required following planned UXO surveys) if a UXO MMMP is implemented. The impact ranges for PTS-onset from impact piling were negligible for grey seals, resulting in <1 seal predicted to experience PTS-onset per piling day. Therefore, there is expected to be **no adverse effects** on the Faray and Holm of Faray SAC site integrity as a result of PTS-onset from underwater noise associated with pre-construction and construction activities at the Offshore Development.

8.7.1.4.2 Disturbance from underwater noise

For the majority of noise-generating activities (i.e. geophysical surveys, vessel noise, and construction activities other than impact piling or UXO clearance), the potential for disturbance to grey seals is considered to be of limited spatial extent, temporary and intermittent in nature.

During the breeding season, grey seals at-sea distribution is largely restricted to within 20 km of their haul-out; with the Faray and Holm of Faray SAC being located 93 km from the Offshore Development, and the predicted maximum spatial extent of disturbance being c. 50 km from the PFOWF Array Area, there is very limited potential for disturbance of SAC-associated animals during the breeding season. Whilst SAC-associated animals will range more widely outside of the breeding season, and as piling within the PFOWF Array Area is scheduled outside of the grey seal breeding season (September to December; Marine Scotland, 2014), the main potential for disturbance effects on grey seal interests of Faray and Holm of Faray SAC relates to disturbance of seals outwith the breeding season when they are more widely dispersed.

Under the highly conservative assumption that, over the course of the geophysical and UXO surveys, all marine mammals in the Offshore Site (with a 500 m buffer) will be disturbed, a total of 28 grey seals are predicted to be disturbed on single survey day.

Using TTS-onset as a proxy for disturbance, the impact assessment predicted disturbance effects to 40 grey seals for the high-order detonation of a UXO with a charge size of 525 kg (plus donor). As described in Offshore EIAR (Volume 3): Appendix 11.1: Underwater Noise Impact Assessment - SMRU Consulting, using TTS-onset as a proxy for disturbance for a single pulse sound source is expected to over-estimate the true behavioural response.

A maximum of 1,890 grey seals are predicted to experience behavioural disturbance as a result of impact piling per piling day. Population modelling conducted as part of the impact assessment (using iPCoD – see Offshore EIAR (Volume 3): Appendix 11.1: Underwater Noise Impact Assessment - SMRU Consulting for details) concluded that there was no predicted impact on the grey seal population, such that the impacted population is expected to remain the same size as the unaffected population. There is therefore expected to be no effect on grey seal vital rates as a result of piling at the Offshore Development, and thus there will be no change to the population or favourable conservation status of grey seals within the Management Unit within which the SAC is located.

Whilst there remains a low chance that a very limited number of grey seals associated with the SAC may experience a limited amount of behavioural disturbance outside of the breeding season as a result of construction activity at the Offshore Development, the number of animals affected is anticipated to be very low. For example, use of the Faray and Holm of Faray SAC-specific at-sea predicted distribution layer for the main foraging season recently presented in Carter *et al*. (2022) suggests that only 3% of SAC-associated seals (corresponding to as few as 13 individuals) are predicted to be disturbed per piling day as a result of the Offshore Development (see Section 8.4.2.2 and below in Section 8.7.1.5). Therefore, there is expected to be no change to the population size, no change to the distribution of grey seals within the site and no significant disturbance to grey seals within or associated with the SAC. Therefore, there is expected to be **no adverse effects** on the Faray and Holm of Faray SAC site integrity as a result of disturbance from underwater noise associated with construction activities at the Offshore Development.

8.7.1.4.3 Other impact pathways during the Operation and Maintenance phase of the Offshore Development

Displacement or barrier effects:

Considering the design of the Offshore Export Cable(s) and the PFOWF Array infrastructure and their location within the Pentland Firth, the Offshore Development is not considered to generate any barrier or displacement effects on habitat use by grey seals (see Figure 8.6). The Offshore Export Cable Corridor is readily traversable, and the scale and placement of the PFOWF Array Area is not expected to limit movement or habitat use by individuals therein. Any unanticipated displacement effects resulting from individuals avoiding swimming around the floating array infrastructure would be limited to the 10 km^2 PFOWF Array Area. Consequently, approximately 6 grey seals would be affected, when the mean at-sea density estimate from Carter *et al*. (2020) is employed, and therefore < 0.02% of the NCO MU would experience these unlikely restrictions on movement within the PFOWF Array Area. For these reasons, there is expected to be **no adverse effects** on the Faray and Holm of Faray SAC site integrity over the operational life-cycle of the Offshore Development.

Risk of injury or mortality from entanglement:

Grey seals are not at risk of direct entanglement with the proposed floating infrastructure, although secondary entanglement with derelict fishing gear or other debris poses a threat to animals utilising the PFOWF Array

Area. This is particularly true if the entangled gears are monofilament fishing nets and lines, which are responsible for the vast majority of bycatch in small cetaceans and seals (Read *et al.*, 2006). The embedded mitigation of monitoring and removing debris from the floating lines and cables greatly diminishes the likelihood that a substantial quantity of entangling materials would become caught on the array infrastructure. Therefore, it is considered that grey seals, as a part of the NCO MU or in association with the Faray and Holm of Faray SAC, are not at risk of injury or mortality from direct or secondary entanglement with the Offshore Development infrastructure and **no adverse effects** on the Faray and Holm of Faray SAC site integrity are predicted for this impact pathway.

Collision risk with floating infrastructure:

The floating infrastructure is of a scale several orders of magnitude greater than the size of a grey seal. The associated mooring infrastructure has been designed to limit the movement of the WTGs and substructures, and there are no moving parts associated with the substructures within the water column (e.g. submerged rotating WTGs, etc.). For these reasons, the potential for a grey seal to collide with either the WTGs, substructures or floating cables or mooring lines is considered extremely small. Animals are expected to readily swim around this infrastructure, avoiding collision. Accordingly, there is expected to be no adverse effects to bottlenose dolphins, either individually or at the population-level, and therefore **no adverse effects** on the Faray and Holm of Faray SAC site integrity as a result of collision risk.

8.7.1.5 Assessment of Adverse Effects In-combination

Three projects (port developments) were screened into the in-combination assessment for Faray and Holm of Faray SAC: the Faray slipway extension and landing jetty, Hatston Pier Proposed Extension and Reclamation, and Scapa Deep Water Quay. These projects are due to overlap the schedule for the Offshore Development, which falls outwith the grey seal breeding season, when animals would be expected to be within 20 km of the SAC. For this reason, the assessment of in-combination effects focuses on disturbance to animals when they have dispersed further offshore during the at-sea foraging season.

The EIA for the Faray slipway extension and landing jetty (ITPEnergised, 2021) predicted an area of disturbance of 7.99 km^2 (corresponding to the modelled extent of the SPL_{rms} 160 dB re 1 µPa noise contour) and used a grey seal density of 35 grey seals/km^2. This resulted in predicted effects to 277 grey seals per piling day, over a maximum of 21 days between May-June 2025. It should be noted that the number of animals estimated to be disturbed presented for this project are considered to be precautionary due to the likelihood of bubble curtains being deployed around sheet piling to mitigate the potential for PTS, and therefore reducing the extent of disturbance.

At this time, scoping reports provide the only available environmental assessment information for Hatston Pier Proposed Extension and Scapa Deep Water Quay. No quantitative assessment is provided of effects to marine mammals, but both projects note the potential for impact piling (tubular (i.e. pin) or sheet piles) and the potential for effects on marine mammals. Assuming a 15 km EDR for disturbance from piling[xvii], combined with the predicted at-sea density values for grey seals in the British Isles (Carter *et al*., 2022) results in a prediction of 78 grey seals to be affected per piling day at Hatston Pier Proposed Extension and 453 at Scapa Deep Water Quay.

Combined with the 1,890 grey seals predicted to be disturbed during impact piling at the Offshore Development, this results in a worst case scenario of 2,698 grey seals disturbed per piling day.

iPCoD modelling was conducted to assess whether this combined level of effect was likely to impact the NCO MU, and also the “SAC population”. There is little information available on the number of grey seals that use the Faray and Holm of Faray SAC. A report by SNH (2006) states that the Faray and Holm of Faray SAC produces about 3,300 pups per year, which equates to a population of about 12,000 seals at the site.

[xvii] The 15 km EDRs for Hatston and Scapa projects were trimmed to exclude land masses and waters in the acoustic shadow from land masses. The resulting assumed impact areas were 57 km^2 (Hatston) and 165 km^2 (Scapa).

Therefore, the modelling assumed an "SAC population" size of 12,000 grey seals. Two schedules of disturbance were considered:

- 'even spread' - 63 days of overlapping activity, with 63 days of piling impact from PFOWF, Hatston and Scapa projects evenly spread across a four-month piling window, 21 days of which also included piling impacts from Faray slipway; and,
- 'consecutive' - 63 consecutive days of overlapping activity, 21 of which also included piling impacts from Faray slipway.

The results of the modelling showed that there was no predicted effect on the NCO MU grey seal population as a result of the cumulative disturbance activity for either schedule. Considering the low anticipated occurrence of animals in the Offshore Site, disturbance from piling or any of the proposed activities will be of negligible magnitude and no effects to vital rates or the long-term viability of the NCO population are predicted.

Where all effects were considered to occur to an SAC site population of 12,000 grey seals, there was no predicted effect as a result of the cumulative disturbance activity for either piling schedule, with the mean impacted and unimpacted population sizes predicted to be exactly the same up to 12 years from the disturbance. It is also noted that, considering the level of connectivity between the Offshore Development and the SAC, these scenarios greatly overestimate the number of SAC-associated seals which will be disturbed.

To address this lack of connectivity, alternative iPCoD scenarios were modelled using the recently published SAC-specific at-sea seal distribution layers presented in Carter *et al*. (2022). These include a layer representing the predicted at-sea distribution of seals hauling out at the Faray and Holm of Faray SAC during the main foraging season (Carter *et al*., 2022). The layer was combined with the most recent August haul-out count for the site in 2019 of 228 grey seals, scaled to account for the proportion hauled-out at that time (25.15%; SCOS 2022 cited in Carter *et al.*, 2022) to estimate a non-breeding season site population of 907, which are expected to spend a mean of 86.16% of time at-sea during the main foraging season (corresponding to an at-sea site population of 781). The scaled layer was overlaid with impact contours and or areas from the Offshore Development, Hatston Pier Proposed Extension and Scapa Deep Water Quay to estimate disturbance to 13, three and one SAC-associated grey seals, respectively. It was assumed that all 277 seals predicted to be disturbed by the Faray slipway extension and landing extension were associated with the Faray and Holm of Faray SAC. Based on these numbers of animals disturbed (maximum of 293 per piling day) and an August site population of 907, models were run for the two piling scenarios. Model outputs showed that there was no predicted effect on the site population as a result of the cumulative disturbance activity for either piling schedule, with the mean affected and unaffected population sizes predicted to be exactly the same.

Therefore, there is expected to be **no adverse in-combination effects** on the Faray and Holm of Faray SAC site integrity as a result of disturbance from underwater noise associated with construction activities at the Offshore Development in-combination with construction activities at the Faray slipway extension and landing jetty, Hatston Pier Proposed Extension and Reclamation, and Scapa Deep Water Quay.

8.7.1.6 Summary

This assessment has shown that there is expected to be:

- No significant disturbance to grey seal within or associated with the Faray and Holm of Faray SAC;
- No change to the grey seal population size or distribution within the Faray and Holm of Faray SAC; and
- No change to the structure, function and supporting processes of habitats supporting the grey seal population within the Faray and Holm of Faray SAC.

Therefore, there is expected to be **no adverse effects** on the Faray and Holm of Faray SAC site integrity as a result of disturbance from underwater noise associated with construction activities at the Offshore Development alone or in-combination with construction activities at the Faray slipway extension and landing jetty. Additionally, there will be **no adverse effects** from displacement or barrier effects, and entanglement or collision risk during the Operation and Maintenance phase of the Offshore Development.

8.7.2 Sanday SAC

8.7.2.1 Site Description

Sanday is one of the larger inhabited islands situated in the north-east of the Orkney archipelago, with a population of 550 people. Designated as an SAC in 2005, this 10976.97 ha (109.76 km^2) site encompasses a number of important habitats including marine areas (sea inlets), tidal rivers, salt marshes, coastal sand dunes, bogs and improved grassland (JNCC, 2021c). The Sanday SAC also supports the largest discrete group of harbour seals in Scotland, with associated nearshore kelp beds providing important foraging areas for this population (JNCC, 2021c).

The Sanday SAC is located 117 km from the Offshore Site. As described in Section 8.4.2.1, telemetry data and SAC-specific at-sea habitat use predictions indicate limited connectivity between the SAC and the Offshore Development, with < 0.01% of seals hauling out at the site in the main breeding season predicted to overlap with the predicted disturbance impact area of the Offshore Development (Carter *et al*., 2022).

8.7.2.2 Site Qualifying Interests

The Sanday SAC provides key habitat for the NCO SMU population of harbour seal – one of the largest populations of harbour seal in Scotland. The current abundance estimates for the Sanday SAC harbour seal population constitutes approximately 4% of the UK harbour seal population (JNCC, 2021c). The Sanday SAC harbour seal population is linked to a very large harbour seal colony that surrounds the Orkney archipelago (JNCC, 2021c).

The NCA Screening Report (HWL, 2022) identified the Sanday SAC as a site where marine mammals are a qualifying interest where there was potential for LSE. The condition and broader conservation status of the relevant qualifying interests have been summarised in Table 8.19 (NatureScot, 2021c; JNCC, 2019).

Table 8.19 Protected Interests and Condition for the Sanday SAC

Protected Qualifying Interests	Interest Condition	Assessment Date	Broader Conservation Status
Harbour seal *(Phoca vitulina)*	Unfavourable: Declining	2013	UK: Unfavourable European Region: Favourable

8.7.2.3 Site Objectives

The objectives of the Sanday SAC are to avoid the deterioration of the qualifying species and ensuring that the integrity of the site is maintained to a Favourable Conservation Status. Table 8.20 provides the high-level conservation objective statements for the Sanday SAC.

Table 8.20 Sanday SAC Conservation Objectives

Sanday SAC
> To avoid deterioration of the habitats of the qualifying species or significant disturbance to the qualifying species, thus ensuring that the integrity of the site is maintained, and the site makes an appropriate contribution to achieving favourable conservation status for each of the qualifying interests.
For Harbour Seals
> To ensure that for the qualifying species that the following are maintained in the long term: > Population of the species as a viable component of the site; > Distribution of the species within the site; > Distribution and extent of habitats supporting the species; > Structure, function and supporting processes of habitats supporting the species; and > No significant disturbance of the species.

Advice to support the management of harbour seals against these conservation objectives are not yet available from the statutory advisors for the Sanday SAC. Marine Scotland undertook consultation on the management of inshore SACs and MPAs, including Sanday SAC (Marine Scotland, 2014), to gain consensus on management measures for these types of sites. However, the resulting management advice for the Sanday SAC focuses on inshore fishing including the prohibition of specific gear types within the site, and does not identify any activities or impact pathways which are relevant to the Offshore Development.

For these reasons, the precautionary approach has been applied and it is considered that, based on biological and behavioural knowledge, harbour seals are considered sensitive to the following impact pathways which have been screened in for assessment:

- Underwater noise;
- Entanglement;
- Collision risk; and
- Displacement and barrier effects.

In the absence of specific management guidance, the assessment is therefore guided by the best practice protocols for mitigation and management of impacts to marine mammals provided in the embedded mitigations (Section 6.1).

8.7.2.4 Assessment of adverse effects alone

8.7.2.4.1 Auditory injury from PTS

There is not considered to be a risk of injury to any marine mammal from noise arising from USBL use during the geophysical surveys as it will be operated at a level below which could cause the onset of PTS. The impact assessment concluded that there will be no adverse effect of PTS on harbour seals from UXO clearance if a UXO MMMP is implemented. The impact ranges for PTS-onset from impact piling were negligible for harbour seals, resulting in <1 seal predicted to experience PTS-onset per piling day. Therefore, there is expected to be **no adverse effects** on the Sanday SAC site integrity as a result of PTS-onset from underwater noise associated with pre-construction and construction activities at PFOWF.

8.7.2.4.2 Disturbance from underwater noise

For the majority of noise-generating activities (e.g. geophysical surveys, vessel noise, and construction activities other than impact piling or UXO clearance), the potential for disturbance to harbour seals is considered to be of limited spatial extent, temporary and intermittent in nature. Considering the low anticipated

occurrence of animals in the Offshore Site, disturbance from these activities will be of negligible magnitude and no effects on vital rates or the long-term viability of the population are predicted.

The proposed schedule for the Offshore Development overlaps the harbour seal breeding season (May to July), when seals are expected to remain within 50 km of their haul-out (Marine Scotland, 2014). However, the at-sea movements of harbour seals also remain fairly restricted to the waters adjacent their haul-out outwith the breeding season. The distance between the impact footprint of the proposed activities (c 50 km) and the expected distribution of harbour seals around the Sanday SAC limits the potential for disturbance to seals associated with this site at any time of year. However, it is acknowledged that some seals may travel further than 50 km from their haul-out within the Sanday SAC, hence a full assessment of potential effects to this site has been undertaken below.

Even under the highly conservative assumption that over the course of the geophysical and UXO surveys, all marine mammals in the Offshore Site (with a 500 m buffer) will be disturbed, it is estimated that <1 harbour seal would be affected on a survey day.

Using TTS-onset as a proxy for disturbance, the impact assessment predicted disturbance effects to <1 harbour seal for the high-order detonation of a UXO with a charge size of 525 kg (plus donor). As described in Offshore EIAR (Volume 3): Appendix 11.1: Underwater Noise Impact Assessment - SMRU Consulting, using TTS-onset as a proxy for disturbance for a single pulse sound source is expected to over-estimate the true behavioural response, and as such even this estimate is considered conservative.

A maximum of 116 harbour seals within the NCO MU are predicted to experience behavioural disturbance as a result of impact piling per piling day. Population modelling conducted as part of the impact assessment (using iPCoD – see Offshore EIAR (Volume 3): Appendix 11.1: Underwater Noise Impact Assessment - SMRU Consulting for details) concluded that there was no effect on the harbour seal population, such that the affected population is expected to remain the same size as the unaffected population. Therefore, no effects on harbour seal vital rates as a result of piling at the Offshore Development are anticipated, and there will be no change to the population or conservation status of harbour seals within the MU within which the SAC is located.

Whilst there remains a low chance that a very small number of harbour seals associated with the SAC may experience a limited amount of behavioural disturbance as a result of construction activity at the Offshore Development, the number of animals affected is anticipated to be very low. For example, use of the Sanday SAC-specific at-sea predicted distribution layer for the main foraging season recently presented in Carter *et al*. (2022) suggests that < 0.01% of seals which haul out at the SAC (corresponding to zero individuals) overlap with the predicted area of impact piling disturbance from the Offshore Development (see Section 8.4.2.1 and below in Section 8.7.2.5). Therefore, there is expected to be no change to the population size, no change to the distribution of harbour seals within the site and no significant disturbance to harbour seals within or associated with the SAC. Therefore, there is expected to be **no adverse effects** on the Sanday SAC site integrity as a result of disturbance from underwater noise associated with construction activities at the Offshore Development.

8.7.2.4.3 Other impact pathways during the Operational Phase of the Development

Displacement or barrier effects:

Considering the design of the Export Cable(s) and the Offshore Array infrastructure and their location within the Pentland Firth, the PFOWF is not considered to generate any barrier or displacement effects on habitat use by harbour seals. The Offshore Export Cable Corridor is readily traversable, and the scale and placement of the Offshore Array Area is not expected to limit movement or habitat use by individuals therein. Any unanticipated displacement effects resulting from individuals avoiding swimming around the floating array infrastructure would be limited to the 10 km^2 Offshore Array Area. Consequently, < 1 harbour seal would be affected, when the mean at-sea density estimate from Carter *et al.* (2020) is considered, and therefore < 0.1% of the NCO MU would experience these unlikely restrictions on movement within the Array Area. For these reasons, there is expected to be **no adverse effects** on the Sanday SAC site integrity over the operational life-cycle of the PFOWF.

Risk of injury or mortality from entanglement:

Harbour seals are not at risk of direct entanglement with the proposed floating infrastructure, although secondary entanglement with derelict fishing gear or debris poses a threat to animals utilising the Array Area. This is particularly true if the entangled gears are monofilament fishing nets and lines, which are responsible for the vast majority of bycatch in small cetaceans and seals (Read *et al.*, 2006). The embedded mitigation of monitoring and removing debris from the mooring lines and cables greatly diminishes the likelihood that a substantial quantity of entangling materials would become caught on the array infrastructure. Therefore, harbour seals from the NCO MU or the Sanday SAC are not considered to be at risk of injury or mortality from direct or secondary entanglement with the Offshore Development infrastructure and **no adverse effects** on the Sanday SAC site integrity are predicted for this impact pathway.

Collision risk with floating infrastructure:

The floating infrastructure is of a scale several orders of magnitude greater than the size of a harbour seal. The associated mooring infrastructure has been designed to limit the movement of the WTGs and substructures, and there are no moving parts associated with the substructures within the water column (e.g. submerged rotating WTGs, etc.). For these reasons, the potential for a harbour seal to collide with either the WTGs, substructures or floating cables or mooring lines is considered extremely small. Animals are expected to readily swim around this infrastructure, avoiding collision. Accordingly, there is expected to be no adverse effects to harbour seals, either individually or at the population-level, and therefore **no adverse effects** on the Sanday SAC site integrity as a result of collision risk.

8.7.2.5 Assessment of adverse effects in-combination

Three projects (port developments) were screened into the in-combination assessment for the Sanday SAC: the Faray slipway extension and landing jetty, Hatston Pier Proposed Extension and Reclamation, and Scapa Deep Water Quay. These projects are due to overlap the schedule for the Offshore Development, which falls within the harbour seal breeding season, when animals would be expected to be within 50 km of the SAC.

The EIA for the Faray slipway extension and landing jetty (ITPEnergised, 2021) predicted an area of disturbance of 7.99 km^2 (corresponding to the modelled extent of the SPL_{rms} 160 dB re 1 µPa noise contour) and used a harbour seal density of 0.19 seals/km^2. This resulted in predicted effects to two harbour seals per piling day, over a maximum of 21 days between May-June 2025. It should be noted that the number of animals estimated to be disturbed presented for this project are considered to be precautionary due to the likelihood of bubble curtains being deployed around sheet piling to mitigate the potential for PTS, and therefore reducing the extent of disturbance.

At this time, scoping reports provide the only available environmental assessment information for Hatston Pier Proposed Extension and Scapa Deep Water Quay. No quantitative assessment is provided of effects on marine mammals, but both projects note the potential for impact piling (tubular (i.e. pin) or sheet piles) and the potential for effects on marine mammals. Assuming a 15 km EDR for disturbance from piling[xviii], combined with the predicted at-sea density values for harbour seals in the British Isles (Carter *et al*., 2022) results in a prediction of seven harbour seals to be affected per piling day at Hatston Pier Proposed Extension and 37 at Scapa Deep Water Quay.

Combined with the 116 harbour seals predicted to be disturbed during impact piling at the Offshore Development, this result in a worst case scenario of 162 harbour seals disturbed per piling day. iPCoD modelling was conducted to assess whether this combined level of effect was likely to impact the NCO MU, as presented in Offshore EIAR (Volume 3): Appendix 11.1: Underwater Noise Impact Assessment and Offshore EIAR (Volume 2): Chapter 11: Marine Mammals and Other Megafauna. As for grey seals, two schedules of disturbance were considered:

- ‘even spread’ - 63 days of overlapping activity, with 63 days of piling impact from PFOWF, Hatston and Scapa projects evenly spread across a four-month piling window, 21 days of which also included piling impacts from Faray slipway; and,

[xviii] The 15 km EDRs for Hatston and Scapa projects were trimmed to exclude land masses and waters in the acoustic shadow from land masses. The resulting assumed impact areas were 57 km^2 (Hatston) and 165 km^2 (Scapa).

- ‘consecutive’ - 63 consecutive days of overlapping activity, 21 of which also included piling impacts from Faray slipway.

The results of the modelling showed that there was no predicted effect on the NCO MU harbour seal population as a result of the in-combination disturbance activity for either schedule. The affected populations are expected to remain the same as the unaffected populations.

An examination of telemetry data and SAC-specific predicted at-sea distribution maps revealed very low connectivity between animals associated with the Sanday SAC and the Offshore Development’s predicted impact footprint (Section 8.4.2.1). In an attempt to address this lack of connectivity in assessments of how many SAC-associated animals might be disturbed by the Offshore Development in-combination with other projects, the recently published SAC-specific at-sea seal distribution layers presented in Carter *et al*. (2022) were used. These include a layer representing the predicted at-sea distribution of seals hauling out at the Sanday SAC during the main foraging season (Carter *et al*., 2022). The layer was combined with the most recent August haul-out count for the site in 2019 of 77 harbour seals, scaled to account for the proportion hauled-out at that time (72%; SCOS 2022 cited in Carter *et al.*, 2022) to estimate an August site population of 107, which are expected to spend a mean of 82.36% of time at-sea during the main foraging season (corresponding to an at-sea site population of 88). The scaled layer was overlain with impact contours and or areas from the Offshore Development, Hatston Pier Proposed Extension and Scapa Deep Water Quay to estimate disturbance to zero harbour seals from each of the three projects. It was conservatively assumed that the two harbour seals predicted to be disturbed by the Faray slipway extension and landing jetty were associated with the Sanday SAC. Based on this total of two harbour seals (1.9% of the site population) associated with the Sanday SAC disturbed from one project for up to 21 days, and no seals disturbed by the Offshore Development or two other relevant projects, no additional iPCoD modelling was considered necessary. 8.4.2.

Therefore, there is expected to be **no adverse in-combination effects** on the Sanday SAC site integrity as a result of disturbance from underwater noise associated with construction activities at the Offshore Development in-combination with construction activities at the Faray slipway extension and landing jetty, Hatston Pier Proposed Extension and Reclamation, and Scapa Deep Water Quay. Additionally, there will be **no significant in-combination effects** from displacement or barrier effects, and entanglement or collision risk during the Operation and Maintenance phase of the Offshore Development.

8.7.2.6 Summary

This assessment has shown that there is expected to be:

- No significant disturbance to harbour seals within or associated with the Sanday SAC;
- No change to the harbour seal population size or distribution within the Sanday SAC; and
- No change to the structure, function and supporting processes of habitats supporting the harbour seal population within the Sanday SAC.

In addition to the low levels of disturbance which are unlikely to effect upon the viability or conservation status of the Sanday SAC population, the telemetry data has shown that there is expected to be very limited to no connectivity between the Offshore Site and affected area and the Sanday SAC; therefore, even if very low numbers of seals were disturbed by the Offshore Development, it would be highly unlikely to result in any adverse in-combination effects on the Sanday SAC.

It is important to note that, in line with the population decline in the NCO MU, the counts within the Sanday SAC are also in decline at 17.8% p.a. since 2006 (Thompson *et al.*, 2019). Therefore, the conservation objectives of the Sanday SAC are not being met, even in the absence of disturbance from the Offshore Development. However, considering the limited potential for connectivity with this site based on distance and harbour seal behaviour, and the conclusion of no impact on the population trajectory of the NCO MU or the Sanday SAC due to the proposed activities, it is not expected that the Offshore Development will have any further adverse effect on this rate of decline, should it continue.

Therefore, there is expected to be **no adverse effects** on the Sanday SAC site integrity as a result of disturbance from underwater noise associated with the Offshore Development’s construction activities either

alone or in combination Faray slipway extension and landing jetty, Hatston Pier Proposed Extension and Reclamation, and Scapa Deep Water Quay.

8.8 Conclusion

A summary of the Offshore Development's screening assessment on protected sites with Annex II marine mammals as qualifying interests is shown in Table 8.21.

Table 8.21 Summary of Results of Assessment against SACs with Marine Mammal Qualifying Interests

Protected Site	Qualifying Interest	Potential Effect	Conclusion
Inner Hebrides and the Minches SAC	Harbour porpoise	Auditory Injury from Permanent Threshold Shift (PTS)	No adverse effects on site integrity or conservation objectives are anticipated.
		Disturbance from Underwater Noise	
		Other Impact Pathways During the Operational Phase of the Development	
		In-combination effects	
Moray Firth SAC	Bottlenose dolphin	Auditory Injury from PTS	No adverse effects on site integrity or conservation objectives are anticipated.
		Disturbance from Underwater Noise	
		Other Impact Pathways During the Operational Phase of the Development	
		In-combination effects	
Skerries and Causeway SAC	Harbour porpoise	Auditory Injury from PTS	No adverse effects on site integrity or conservation objectives are anticipated.
		Disturbance from Underwater Noise	
		Other Impact Pathways During the Operational Phase of the Development	
		In-combination effects	
Southern North Sea SAC	Harbour porpoise	Auditory Injury from PTS	No adverse effects on site integrity or conservation objectives are anticipated
		Disturbance from Underwater Noise	
		Other Impact Pathways During the Operational Phase of the Development	
		In-combination effects	
Faray and Holm of Faray SAC	Grey seal	Auditory Injury from PTS	No adverse effects on site integrity or conservation objectives are anticipated
		Disturbance from Underwater Noise	
		Other Impact Pathways During the Operational Phase of the Development	
		In-combination effects	

Protected Site	Qualifying Interest	Potential Effect	Conclusion
Sanday SAC	Harbour seal	Auditory Injury from PTS	No adverse effects on site integrity or conservation objectives are anticipated
		Disturbance from Underwater Noise	
		Other Impact Pathways During the Operational Phase of the Development	
		In-combination effects	
European (non-UK) SACs	Harbour porpoise	Auditory Injury from PTS	No adverse effects on site integrity or conservation objectives are anticipated
		Disturbance from Underwater Noise	
		Other Impact Pathways During the Operational Phase of the Development	
		In-combination effects	

8.8.1 Additional Mitigation and Monitoring

Having given consideration to embedded mitigation measures for the Offshore Development, the RIAA concluded no adverse effects to the integrity of the European Sites assessed, and therefore there is no requirement for additional mitigation over and above the embedded mitigation measures.

It is anticipated that any monitoring that may be proposed by HWL, in order to support the RIAA conclusions and provide supporting information for future floating offshore wind farm developments will be established through consent conditions and the development of a PEMP in consultation with relevant stakeholders. All qualifying activities (i.e. those generating low-frequency impulsive noise) will be submitted to the Marine Noise Registry.

9 SPECIAL PROTECTED AREAS WITH ORNITHOLOGY INTERESTS

9.1 Introduction

This Section provides an assessment of the adverse effects from the Offshore Development on SPAs and Ramsars designated for the conservation of protected bird species (termed 'SPA qualifying interests'). This section also provides information that should be used to determine the potential effects of the Offshore Development on the conservation objectives of the SPAs screened in for assessment. The legal context for assessment is provided in Section 2.1 and an overview of the process as it applies to SPA qualifying interests is given in Section 9.4.

9.2 Summary of Screening

Screening was conducted in order to identify potential exposure pathways between the SPA qualifying interests and the Offshore Development. The SPA qualifying interests screened in for assessment are presented in Section 3.4. and Table 3.7

The range of potential pathways for ornithological impacts arising from all of the different phases (construction, operation and maintenance, and decommissioning) of the Offshore Development are set out in full in the NCA Screening Report (HWL, 2022), updated to include risk of entanglement as identified in Marine Scotland advice (letter dated 1st April 2022). The final list of potential pathways scoped in and under consideration is presented in Table 9.1. For some potential impact pathways an assessment approach common to all SPAs has been undertaken in Section 9.6 whilst for collision risk and displacement impacts (where assessment is carried out on a specific SPAs basis) these are provided in Sections 9.10 to 9.43. No potential impact pathways have been screened out of assessment in the RIAA.

Table 9.1 Potential pathways to impact for ornithological receptors

Impact	Project phase			Assessed on a SPA-specific basis?
	Construction	Operation and Maintenance	Decommissioning	
Disturbance and/or displacement of seabirds due to vessel activity and underwater noise	Yes	Yes	Yes	No
Collision risk with WTG blades	No	Yes	No	Yes
Disturbance and/or displacement of seabirds due to presence of WTGs	Yes	Yes	Yes	Yes
Barrier effects due to physical presence of WTGs	No	Yes	No	Yes
Indirect effects on seabirds due to changes in distribution or availability of prey	Yes	Yes	Yes	No
Accidental pollution events	Yes	Yes	Yes	No
Entanglement with debris caught on mooring lines	No	Yes	No	No

Impact	Project phase			Assessed on a SPA-specific basis?
	Construction	Operation and Maintenance	Decommissioning	
Impacts arising from the Offshore Export Cable(s) where it passes through the marine section of North Caithness Cliffs SPA	Yes	Yes	Yes	Yes

9.3 Project Design Envelope Parameters Relevant to Quantitative Assessment for SPA Qualifying Interests

As outlined in the Project Description (see Offshore EIAR [Volume 2] Chapter 5: Project Description), this assessment considers the Offshore Development parameters which are likely to result in the greatest environmental impact on the receptor, known as the 'cautionary realistic worst case scenario' identified for those potential impacts quantitatively assessed (collision risk / displacement) in respect of SPA qualifying interests (see Table 9.2). More detail can be found in Table 12.11 of the Offshore EIAR (Volume 2): Chapter 12: Marine Ornithology.

The realistic worst case scenario represents, for any given receptor and potential impact on the receptor, various options in the Design Envelope that would result in the greatest potential for change to the receptor in question (Offshore EIAR [Volume 2] Chapter 5: Project Description). In this way, use of the realistic worst case scenario provides for a cautious assessment of the potential impacts of the Offshore Development on the environment in line with Marine Scotland's (2022) Guidance for applicants on using the Design Envelope for applications under section 36 of the Electricity Act 1989.

Confidence can be held that development of any other scenario within the Design Envelope (see Table 9.2), will not result in any effects greater or worse than the 'worst cases' assessed in this RIAA. Only those pathways and the Design Envelope where a quantitative assessment has been carried out are provided.

Table 9.2 Worst case design scenarios quantitively assessed for potential impacts on SPA Qualifying Interests

Potential Impact	Design Envelope Scenario Assessed
Potential collision risk with operational WTGs;	> Maximum number of WTGs: seven. > Maximum total rotor diameter of 316,673 m^2, based on a rotor radius: 120 m. > Air gap: 35 m. > Further details on CRM are provided in the Offshore EIAR (Volume 3): Technical Appendix 12.3: Collision Risk Modelling.
Potential displacement and barrier effects due to physical presence of WTGs.	> Displacement assessment using SNCB (2017) matrices is based on the PFOWF Array Area + 2 km buffer. > SeabORD modelling addresses both displacement and barrier effects and sets input parameters and model assumptions based on the PFOWF Array Area. > Further details on each assessment approach are provided in the Offshore EIAR (Volume 3): Technical Appendix 12.4: Displacement Analysis.

It is worth noting that through the application process HWL has refined the Project Design Envelope. Potential collision risk and displacement effects on seabirds has been key to a number of these design decisions. For example, the applicant has:

- Reduced the footprint of the Array development (where the WTGs will be located) by 50% from that presented during Scoping;
- Reduced the maximum number of WTGs to be deployed down from ten to seven; and
- Increased the minimum airgap from 22m to 35m.

These refinements within the design parameters mitigate the impacts on collision risk and displacement insofar as possible whilst still ensuring the viability of the project.

9.4 Approach to Assessment

As set out in Section 2.2, for those SPA qualifying interests screened in for assessment (Section 3.2.1), where there is risk of LSE then an 'appropriate assessment' must be undertaken by the Competent Authority, based on advice from NatureScot and considering any implications for the SPA conservation objectives (see Table 9.3). These conservation objectives follow a standard format across all SPAs and require protection of the qualifying interests and protection of their supporting habitat.

Table 9.3 SPA conservation objectives

SPA Conservation Objectives
> To ensure that site integrity is maintained by: (i) Avoiding deterioration of the habitats of the qualifying species. (ii) Avoiding significant disturbance to the qualifying species. > To ensure for the qualifying species that the following are maintained in the long term: (iii) Population of the species as a viable component of the site (iv) Distribution of the species within the site (v) Distribution and extent of habitats supporting the species (vi) Structure, function and supporting processes of habitats supporting the species (vii) No significant disturbance of the species

It is important to recognise that the conservation objectives primarily offer site-based protection and that some of them will not be affected due to there being no pathway to impact for the supporting habitats; this is particularly true of objectives (i), (v) and (vi) which relate to the supporting habitats within the SPA. In respect of these three conservation objectives, further consideration is only required for the Offshore Export Cable(s) where it passes through the marine section of North Caithness Cliffs SPA. This is addressed in Section 9.10.

Conservation objectives (ii), (iv) and (vii) will also require further consideration of the Offshore Export Cable(s) where it passes through the marine section of North Caithness Cliffs SPA, as these objectives relate to disturbance and distribution of the qualifying interests whilst within the SPA.

In respect of all other SPAs, it is Conservation Objective (iii) that is relevant, *Maintenance of the population of the bird species as a viable component of the SPA*, to be considered under appropriate assessment. This Conservation Objective (iii) is the one which addresses the population-level consequences of potential seabird mortalities arising from collision risk or displacement (impacts (including disturbance) occurring to the birds whilst they are outwith the SPA boundaries.

9.5 Key Data Sources

The assessment of potential impacts on seabirds has been dependent on baseline data on the abundance of seabirds within the Offshore Development. A programme of monthly digital video aerial surveys was undertaken to collect data on seabirds and other marine megafauna in the PFOWF Array Area and portions of the OECC. Thirteen surveys were undertaken between January and December 2015 for Dounreay Trì (twelve monthly surveys plus one extra survey in June), and a further twelve months between September 2020 and August 2021 for the PFOWF Array Area. Details on these aerial surveys, including survey areas, survey methods and depictions of the different line transects used, are provided in Offshore EIAR (Volume 3): Technical Appendix 12.1: Baseline Data. Monthly and mean seasonal peak density and abundance estimates were used to assess the potential magnitude of collision and displacement impacts on the relevant species.

To scope the other projects requiring in-combination assessment, a range of information was referred to including the RIAAs and Marine Scotland Appropriate Assessments for other offshore wind farms in Scottish waters, as well as the Marine Scotland Appropriate Assessments for Meygen and the European Marine Energy Centre (EMEC) (see Table 9.4). A review was undertaken of available information for Hornsea Project Three (determined) and Hornsea Project Four (application) (see Table 9.4) with the latter being used as the reference source for data on kittiwake non-breeding season collision mortalities from all other offshore wind farm development in the North Sea. This review of available data informs the project screening carried out for in-combination assessment presented in Section 9.9.

Table 9.4 Information checked for in-combination HRA on SPA qualifying interests

Project	Document Reference	Decision Year	Competent Authority
Moray West offshore windfarm application and decision	marine.gov.scot/ml/moray-west-offshore-windfarm	2019	Marine Scotland
Moray East offshore wind farm application and decision	marine.gov.scot/ml/moray-east-offshore-wind farm	2014	Marine Scotland
Beatrice offshore wind farm application and decision	marine.gov.scot/ml/beatrice-offshore-wind farm	2014	Marine Scotland
Hywind Scotland offshore wind farm application and decision	marine.gov.scot/ml/hywind-scotland-pilot-park	2015	Marine Scotland
Kincardine floating offshore windfarm application and decision	marine.gov.scot/ml/kincardine-offshore-wind farm-0	2016	Marine Scotland
European Offshore Wind Deployment Centre (EOWDC)	marine.gov.scot/ml/european-offshore-wind-deployment-centre	2014	Marine Scotland
Seagreen offshore wind farm (optimised project) application and decision	marine.gov.scot/ml/seagreen-alpha-and-bravo-offshore-wind-farms	2018	Marine Scotland
Inch Cape offshore wind farm (revised design) application and decision	marine.gov.scot/ml/inch-cape-offshore-wind farm-revised-design	2021	Marine Scotland

Project	Document Reference	Decision Year	Competent Authority
Neart na Gaoithe offshore wind farm (revised design) application and decision	marine.gov.scot/ml/neart-na-gaoithe-offshore-wind-farm-revised-design	2019	Marine Scotland
Hornsea Project Three offshore wind farm application and decision	https://infrastructure.planninginspectorate.gov.uk/projects/eastern/hornsea-project-three-offshore-wind-farm/	2020	Planning Inspectorate
Hornsea Project Four offshore wind farm application	https://infrastructure.planninginspectorate.gov.uk/projects/yorkshire-and-the-humber/hornsea-project-four-offshore-wind-farm/	current	Planning Inspectorate
Meygen	https://marine.gov.scot/ml/meygen-tidal-energy-project	2017	Marine Scotland
EMEC	https://marine.gov.scot/themes/european-marine-energy-centre-wildlife-observation	2019	Marine Scotland

9.5.1 Avian Influenza

Whilst it is not a potential impact arising from the Offshore Development, it was felt important to acknowledge the current outbreak of avian influenza (commonly referred to as 'avian flu' or 'bird flu') occurring at seabird colonies around the UK.

Avian flu is a virus that causes disease in birds, affecting the respiratory, digestive and/or nervous system of many species. Typically, infections are from a low pathogenic viral strain which causes mild illness. However, strains can mutate from, low to high, which cause severe symptoms, often with high mortality rates and may spread quickly causing an outbreak. The virus has become a disease of global significance due to poultry intensification creating conditions favourable for highly pathogenic strains, globalisation of the poultry market creating pathways of transmission globally and increased domestic-wild bird interactions due to changing land use (Gilbert and Xiao, 2008).

In October 2021, a new strain of highly pathogenic avian flu (H5N1) was identified in the UK. Since then, 111 further locations of infection in captive birds and poultry, have been identified across the UK, and 288 separate locations of infection across wild birds of 49 species have been identified across 76 countries worldwide (DEFRA, 2022), as of 19th July 2022). This has been the highest recent occurrence of highly pathogenic avian flu in the UK with 90 cases of outbreak, compared with 28 in winter 2016 / 17 and 13 in 2020 / 21 (Lean *et al*., 2022). The greatest proportion of infections has been observed in Anseriformes (swans, geese and ducks) who form a natural reservoir of the virus. Charadriiformes (waders, gulls and auks) and Accipitriformes (hawks, eagles, vultures, and kites) have also observed high occurrences of the 2021/22 avian flu (DEFRA, 2022).

Avian flu cases in wild birds are continuing to increase in Scotland. Defra have reported 508 cases observed among 28 species and over 139 locations as of 14th July 2022 in Scotland, with highest cases observed in gannet, skua, geese and gull species (NatureScot, 2022a). It is estimated that as many as 64% of great skua on St Kilda and 85% on Rousay have died as of June 2022 (NatureScot, 2022b). More than 10% of the breeding adult great skua had also died at Fair Isle during the 2021 / 22 outbreak. (Banyard *et al*., 2022). Other species, such as gannet, are also being impacted, with significantly reduced numbers on Bass Rock in June 2022 and 1 in 10 dead at Hermaness, Shetland, with early estimates of up to 15-25% decline of the species (Martin, 2022).

Shortly after observing their first avian flu case on the 21st June 2022, a large die off of guillemot was reported at St Abbs Head National Nature Reserve, which included 68 chicks (Hall, 2022). The Isle of May recorded their first cases on 30th June 2022 following testing of two dead kittiwakes (Steel, 2022), with early estimates

of 9,120 kittiwake mortalities, and large number of gulls and Arctic tern also affected by the outbreak (Steel, *pers comm*. 19th July 2022).

In response to the rising number of cases, NatureScot announced an Avian Flu task force on 14th July 2022 to co-ordinate a national response to the outbreak (NatureScot, 2022a), and important islands for seabird colonies in Scotland such as Isle of May, Isle of Noss and Farne Islands have been closed to visitors.

The immediate and long-term impact of avian flu on seabird colonies is still unknown and uncertain. However, in respect of the submitted RIAA, it is clear that the low levels of potential seabird mortality predicted to arise from the Offshore Development would likely not cause additional pressures upon seabird colonies on top of those caused by avian flu.

9.6 Impact Assessments for Each Impact Pathway

As set out in Section 9.2, there are two key impact pathways assessed in a SPA-specific manner (Sections 9.10 to 9.43): collision risk with operational WTGs and displacement/barrier effects if birds avoid the area of these operational WTGs. For these impact pathways detailed analysis has been undertaken with these impacts apportioned to the specific SPA in question. Other impact pathways are dealt with in this section, in a qualitative manner, to cover all SPAs.

9.6.1 Collision Risk Modelling (CRM)

Collision risk is explained and modelled in the Offshore EIAR (Volume 3): Technical Appendix 12.3: Collision Risk Modelling. In respect of the SPA seabirds screened in for assessment, CRM was undertaken for kittiwake, fulmar, gannet and great skua with the outputs and the estimates of collision mortality summarised in Section 12.6.2.1 of the Offshore EIAR (Volume 2): Chapter 12: Marine Ornithology. CRM was not undertaken for those species not at risk of the impact due to their low flight height.

Project-alone CRM impacts were modelled using both mean and maximum monthly densities recorded in the PFOWF Array Area across the two years of digital aerial survey work and are set out in Table 9.5. Whilst mortality estimates are provided based on both mean and maximum densities, it is the mean density figures that have been used for the in-combination assessments as these provide an estimate of average annual risk and also allow a 'like-for-like' comparison across the different offshore wind farms that have been screened in (as it is the mean density figures that were considered for these projects).

Table 9.5 Annual collision mortality estimates for each season. Numbers in brackets represent mortality estimates based on maximum densities but not used in assessments

Species	Breeding Season			
	BDMPS[1]	Autumn Migration	Non-breeding	Spring Migration
Kittiwake	7 (12)	1 (3)	Not applicable[2]	0
Fulmar	0	0	0	0
Gannet	2 (4)	0	Not applicable	0
Great skua	0	0	0	0

[1] Furness (2015) defines species-specific non-breeding season seabird populations at biologically defined minimum population scales (BDMPS) to enable the apportioning of potential impacts of marine renewable developments during the non-breeding season.

[2] "Not-applicable" means that the season is not defined as such for a particular species by Furness (2015)

9.6.2 Displacement / Barrier Effects

Displacement / barrier effects are explained and modelled in the Offshore EIAR (Volume 3): Technical Appendix 12.4: Displacement Analysis. The following SPA seabirds were screened in for displacement

assessment: kittiwake, guillemot, razorbill, puffin, fulmar, gannet and great skua. In this regard, there are two methods used:

- SeabORD (Searle et al. 2014; 2018), an individual-based model which predicts the energetic consequences to seabirds due to any changes in their flight paths around the PFOWF Array Area; and
- SNCB (2017) displacement matrices where advised rates of displacement and mortality are applied to the mean seasonal peak populations of birds recorded in the PFOWF Array Area plus 2 km buffer.

9.6.2.1 SeaBORD model outputs

Marine Scotland / NatureScot requested that SeabORD modelling be used for kittiwake, guillemot, razorbill and puffin, and this was carried out in respect of the populations of each species at North Caithness Cliffs SPA. SeabORD is described and discussed in the Offshore EIAR (Volume 3): Technical Appendix 12.4: Displacement Analysis and it is recommended as 'best available evidence' (NatureScot email, 18th March 2022) and a more realistic approach compared to the displacement matrices.

North Caithness Cliffs SPA comprises five sub-sites which were treated as separate colonies in the model, meaning it was only possible to use SeabORD for this one SPA. North Caithness Cliffs is the closest SPA to the PFOWF Array Area and the one predicted by apportioning as likely to receive most impact (Offshore EIAR [Volume 3]: Technical Appendix 12.2: Connectivity and Apportioning).

The five sub-sites are as follows and shown on Figure 9.1. The distances quoted are those between each SPA sub-site and the PFOWF Array Area (distances are measured from the closest point of the PFOWF Array Area to a mid-point along the coast for each sub-site, and not in relation to any seaward extent of the marine extensions):

- Melvich, 7.5 km;
- Holburn Head, 18 km;
- Dunnet Head, 25 km;
- Stroma, 41 km; and
- Duncansbay Head; 48 km.

A 'sense-check' was undertaken to compare the baseline survival rates and baseline mortalities predicted by SeabORD (the outputs for the baseline scenario without any wind farms present) against the default survival rates that are used in PVA (Horswill & Robinson, 2015) as applied to the SPA sub-site populations. In this regard, the SeabORD baseline outputs appeared to be sensible and realistic for razorbill, kittiwake and puffin, and likely over-estimated for guillemot (Section 3.1 of the Offshore EIAR (Volume 3): Technical Appendix 12.4).

The SeabORD estimates for North Caithness Cliffs SPA are provided in Table 9.6. The values presented are for those presented in the SeabORD outputs for the "moderate environmental conditions" scenario. For the PFOWF Array Area, SeabORD predicted very low impacts arising from displacement on the kittiwake, guillemot, razorbill and puffin populations of North Caithness Cliffs SPA; i.e. no change to breeding adult survival rates for any of the species modelled and minimal predicted mortalities.

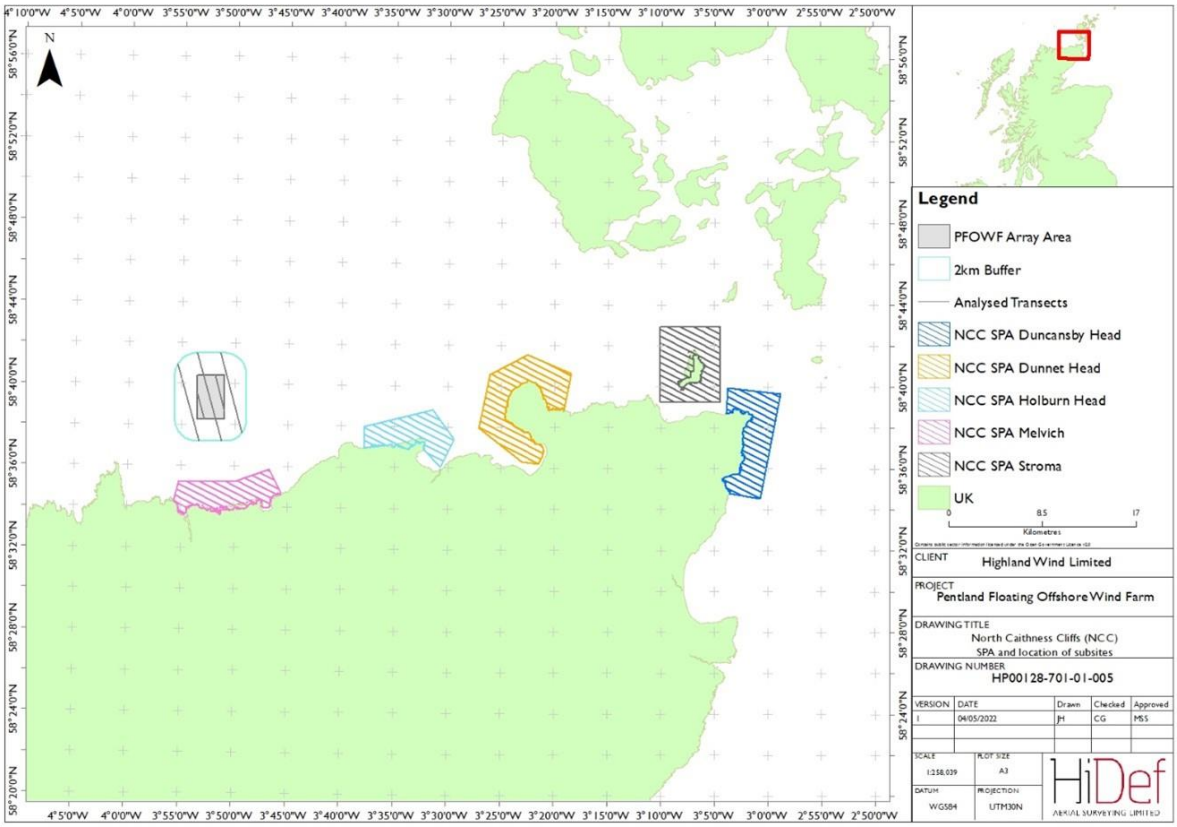


Figure 9.1 PFOWF Array Area in relation to the North Caithness Cliffs SPA and sub sites

Table 9.6 SeabORD estimates for North Caithness Cliffs SPA for Kittiwake, Guillemot, Razorbill and Puffin

Species	Displacement Value for North Caithness Cliffs, per SeabORD Analysis (the 'moderate environmental conditions' Scenario)
Kittiwake	2.60
Guillemot	5.54
Razorbill	1.30
Puffin	1.80

9.6.2.2 Matrix approach outputs

Full displacement matrix outputs are provided in the Offshore EIAR (Volume 3): Technical Appendix 12.4: Displacement Analysis. A summary of the un-apportioned matrix outputs is provided in Table 9.7. SeabORD indicates that the advised Marine Scotland / NatureScot rates of displacement and mortality (as used in the SNCB (2017) matrix approach) include a high level of precaution, at least for a small-scale wind farm of up to seven WTGs. The displacement matrix outputs are presented for other SPAs (other than North Caithness Cliffs) and similarly are expected to include a high level of precaution. Displacement mortality estimates for guillemot, razorbill and puffin at other mortality rates are not presented here but can be referenced for information in the Offshore EIAR (Volume 3): Technical Appendix 12.4: Displacement Analysis.

Table 9.7 Summary of estimated seasonal displacement mortalities

Species	Percentage of Birds Displaced (%)	Breeding Season Mortality (%)	Non-Breeding Season Mortality (%)	Number of Birds Displaced			
				Breeding Season Mortality	Autumn Migration Mortality	Non-Breeding Season Mortality	Spring Migration Mortality
Kittiwake	30	2	2	3	1	n/a [1]	0
Guillemot	60	1	1	7	n/a	4	n/a
Razorbill	60	2	1	2	0	0	0
Puffin[2]	60	1	1	7	n/a	0	n/a
Fulmar	30	1	1	3	0	0	1
Gannet	70	1	1	1	0	n/a	0
Great skua	30	1	1	0	0	0	0

[1] "Not-applicable" means that the season is not defined as such for a particular species by Furness (2015)

[2]The displacement matrices appear to be substantially over-estimating the level of potential mortality to puffin, compared to SeabORD modelling. Consequently, the figure presented for puffin is for the PFOWF Array Area alone and excludes the 2 km buffer.

9.6.3 Qualitative Assessment of Petrels and Shearwaters

In the Scoping Opinion (MS-LOT, 2021) and the Screening Opinion (MS-LOT, 2022) it is noted that nocturnally active species, including petrels and shearwaters, may be attracted into the PFOWF Array Area due to the artificial lighting on the WTGs. In this regard, petrel species such as European storm petrel (*Hydrobates pelagicus*) hereafter 'storm petrel', and Leach's storm petrel (*Hydrobates leucorhous*) hereafter 'Leach's petrel' and shearwater species, such as Manx shearwater (*Puffinus puffinus*), are all SPA qualifying interests with large foraging ranges.

Neither storm petrel nor Leach's petrel were recorded during the two years of digital aerial surveys (2015 and 2020/21) and there were only incidental records of Manx shearwater (see Tables A3.1 in Offshore EIAR [Volume 3]: Technical Appendix 12.1, Baseline Data). However, it is recognised that the surveys are only a 'snapshot' in time and they need to be undertaken during the day owing to light conditions. As petrel and shearwater species may be more active during dawn and dusk periods their occurrence could potentially be missed due to survey timings. RSPB Scotland advise that they could potentially forage in coastal waters at night (D'Elbée & Hémery, 1998; Thomas *et al*., 2006; Bolton, 2021) and so may potentially occur within the PFOWF Array Area over this time due to its proximity to the coast.

Seabird species, including petrels and shearwaters, have been observed to circle lit structures at night, particularly during poor weather such as rain and fog (Jones, 1980; Longcore *et al.*, 2013; Ronconi *et al.*, 2015). WTG lighting requirements (for aviation and navigational lighting) will be set out in the Lighting and Marking Plan (Offshore EIAR [Volume 2], Chapter 5: Project Description).

The potential for impacts arising from collisions has already been screened out due to the low flight heights of these species (Cook, 2012). Storm petrels have previously been found to fly in the lowest 10 m height band above the sea (Cramp, 1977) and Manx shearwaters are considered to have a maximum flight height of 20 m, based on available tracking data and academic advice (as reported in the Erebus EIAR)[xix] and in line with Johnston *et al.,* 2014. On this basis, whilst this artificial lighting could potentially attract nocturnally active species (including storm petrel, Leach's petrel and Manx shearwater) into the PFOWF Array Area it should not in any way increase their exposure to collision risk, as there should be no significant change to their flight

[xix] https://www.bluegemwind.com/wp-content/uploads/2020/07/Erebus-ES-Vol-1-Chapter-11-Offshore-Ornithology_final.pdf

height (i.e. there is no evidence that the lights would lure them higher) and the birds will continue to fly well below the sweep of the WTG blades (which will be a minimum of 35 m above Mean High Water Springs).

Petrels and shearwaters are also not flagged as being at risk from offshore wind displacement impacts (Furness *et al.,* 2013). They show little disturbance in response to ship or helicopter traffic, and they are flexible in their habitat use as evidenced by their large foraging ranges. The likelihood of there being significant displacement or disturbance for these species is also minimal given the combination of low numbers occurring within the PFOWF Array Area, the large distance to the SPAs in question (52-307 km), and the species' ability to exploit a wide range of foraging opportunities across large sea areas (Furness *et al.* 2012).

Quantification of any potential impacts (either collision risk or displacement) to storm petrel, Leach's petrel or Manx's shearwater is not possible, however, it can be concluded that there is minimal risk of individual mortalities and zero risk of any population-level consequences or effects on population viability at any SPA for which there may be connectivity (i.e. for which the PFOWF Array Area lies within foraging range).

There will therefore be **no adverse effect on site integrity** on storm petrel, Leach's petrel or Manx's shearwater at any SPA for which they are a qualifying interest; as a result of the Offshore Development either alone or in-combination with the other projects screened in for assessment in Section 9.9.

9.6.4 Wildfowl and Wader Collision Risk on Migration

The UK wintering grounds of a range of wildfowl and wader species are protected through designations as SPAs and Ramsar sites. The PFOWF Array Area is located on a migration flyway for various wildfowl and wader species, particularly those migrating from Iceland, and the WTGs of the Offshore Development may present a collision risk to individuals as they fly over. The digital aerial survey work commissioned for baseline characterisation and for impact assessment is not designed to provide information on the migratory movements of these species, but will of course detect any species flying over the PFOWF Array Area during the survey. Dedicated tracking work such as that carried out by the Wildfowl and Waders Trust (WWT)[xx] is required to inform migratory routes.

In order to take an overview of these issues and to support assessments for the UK offshore wind industry, a report was commissioned by the Strategic Ornithological Support Service (SOSS) to explore and collate information on the migratory pathways of a range of different species including all key over-wintering wildfowl and wader species, with the work undertaken by the British Trust for Ornithology (BTO) (Wright *et al.,* 2012). This report presented a series of maps showing the broad-scale migratory flyways for the range of species considered and has formed the basis for further subsequent work[xxi].

The collision risk to wildfowl and waders from wind farm development in Scottish waters was strategically assessed by WWT (2014) in a report commissioned by Marine Scotland: *Strategic assessment of collision risk of Scottish offshore wind farms to migrating birds*. The WWT (2014) report collated further information on migratory pathways, determined the migratory fronts (focusing on Scottish waters) and undertook strategic CRM in relation to the migratory populations of each species accounting for all offshore wind farm developments in Scottish waters at the time assessment was carried out.

Species which may potentially migrate over the Offshore Development (for which data were available in WWT, 2014) include whooper swan, pink-footed goose, greylag goose, wigeon, teal, pintail, tufted duck, scaup, long-tailed duck, common scoter and golden plover. None of these species were recorded during the two years of digital aerial survey work except golden plover for which there is an incidental record of one bird recorded on 24th September 2020. This lack of survey sightings is not surprising, as noted above, given the focus of digital aerial surveys on diurnal seabird flight activity at sea.

Informed by the strategic CRM that was undertaken (by co-authors MacArthur Green), the WWT (2014) report confirmed that 'the populations of non-seabird species which pass through Scottish waters do not appear to be at risk of significant levels of additional mortality due to collisions with Scottish offshore wind farms.' This conclusion was informed by use of an indicative threshold value of 1% of the passage population modelled, and CRM mortality estimates based on a precautionary 98% avoidance rate. The conclusion is still valid at the

[xx] Tracking and technologies | WWT

[xxi] Strategic Ornithological Support Services Project SOSS-05: Review of bird migration routes in relation to offshore wind farm development zones | BTO - British Trust for Ornithology

current time as amount of development considered in the WWT (2014) report remains 'worst case'. A larger number of projects and their associated WTGs were modelled for wildfowl and wader collision risk than what has actually been consented and built out. The Offshore Development along with the other small-scale demonstrators (Kincardine and Hywind) all fall within the 'worst case' CRM assessment and do not alter the outcomes or conclusions of WWT (2014).

WWT (2014) has been relied upon to inform the consent decisions for all offshore wind farms in Scottish Waters to date and it is due to be updated by further work commissioned by Marine Scotland[xxii], as advised in the Scoping Opinion (MS-LOT, 2021) and further discussed at the pre-application meeting held with MS-LOT, Marine Scotland, NatureScot and RSPB on 24th November 2021. In this regard, the new Marine Scotand study was not available in time to inform this RIAA for the Offshore Development, however, it remains imminent. The Screening Opinion (MS-LOT, 2022) and associated Marine Scotland/NatureScot consultation advice therefore supported use of 'a qualitative assessment, highlighting the previous report (WWT, 2014) as guidance.'

As the levels of collision mortality predicted in the WWT (2014) report do not result in any significant effect on the SPA migratory populations they will also not affect the individual populations of each species at the relevant SPAs of concern.

Thus, it can be concluded that there will be **no adverse effect on site integrity** as a result of the Offshore Development (either alone or in-combination) upon SPAs or Ramsar sites designated with wildfowl and wader qualifying interests.

9.6.5 Disturbance / Displacement due to Vessel Activity and Underwater Noise

Construction, operation and maintenance, and decommissioning of the Offshore Development may lead to disturbance, displacement or exclusion of seabirds from the area where the activity is taking place, effectively resulting in temporary habitat loss. This includes installation and decommissioning of the WTGs, floating substructures and associated moorings, and the OECC, where such activity can result in increased levels of vessel activity an underwater noise. There will also be vessel activity during operation for maintenance activities, which will be at a lower level than during construction and decommissioning.

The sensitivity of seabirds to displacement / disturbance by construction and decommissioning activities, including the presence of vessels, and associated noise is generally low in comparison to the operational phase of offshore wind farms (ABPmer, 2019). However, some species present at the PFOWF Array Area, such as auks (and red-throated diver, although in very low numbers) show sensitivity to disturbance/displacement, albeit most studies have been concerned with displacement from operational wind farms and there is a paucity of data about reactions to construction activities.

A variety of vessels will likely be present during installation and decommissioning of the WTG sub-structures and anchors, including tugs and anchor handling vessels: with a maximum of ten vessels to be on-site at any one time and a total estimated number of 660 vessel movements during the three-year duration offshore installation campaign. Vessel activity during operation for maintenance activities will be at a lower level.

This level of vessel activity associated with WTG installation and decommissioning (substructures and anchors) is similar to the baseline of vessel activity observed in the wider Pentland Firth area; where AIS data indicate a mean number of 21 vessel movements per day in the area, with a mean length of vessels within the area of 88 m (Offshore EIAR [Volume 2]: Chapter 14: Shipping and Navigation). Also, vessels involved in WTG installation will transit to the area utilising existing and pre-defined shipping corridors, thereby reducing the spatial extent of any potential impact.

Construction phase disturbance/displacement impacts will be localised around the construction activity and associated vessels, occur intermittently likely to be during April to September 2024-26 and will be temporary in nature.

[xxii] Study to examine how seabird collision risk, displacement and barrier effects could be integrated for assessment of offshore wind developments (ITQ-0246). Marine Scotland commissioned study. Publication imminent.

These construction activities will be managed through the adoption and implementation of a CEMP, employment of an ECoW and provision of a VMP, all proposed as embedded mitigation in Section 6.1, Table 6.1).

Whilst individual birds may experience a degree of disturbance / displacement due to vessel activity and underwater noise, this will not result in any population consequences or impacts on population viability for any species at any of the SPAs screened in for assessment.

There will therefore be **no adverse effect on site integrity** from this impact at any of the SPAs during construction, operation and maintenance, or decommissioning of the Offshore Development. There will also be **no adverse effect on site integrity** in relation to this impact from the Offshore Development in-combination with the other projects screened in for assessment in Section 9.9.

Section 9.10.2.1 addresses any potential disturbance / displacement impacts arising from vessel activity or underwater noise associated with the OECC (installation, operation and maintenance, or decommissioning) where it passes through North Caithness Cliffs SPA marine extension.

9.6.6 Indirect Effects on Seabirds due to changes in Prey Distribution / Availability

Below-water noise during construction and decommissioning of the Offshore Development may potentially displace noise-sensitive mobile seabird prey species. Furthermore, construction and decommissioning phase impacts upon prey species may also occur via increased suspended sediment levels causing fish and mobile invertebrates to avoid affected areas or may smother and hide immobile benthic prey. Both such impacts would temporarily reduce the quality of foraging habitat within affected areas during the construction phase. During the operation and maintenance, phase, the Offshore Development has potential to result in a number of effects on foraging birds; these will include impacts associated with the displacement of certain sensitive species from within the site and as such, a small loss of foraging habitat.

The vulnerability of seabird species to changes in habitat quality or abundance and distribution of prey depends on their foraging flexibility, in particular their specific habitat and dietary requirements. Furness *et al.* (2012) identifies the following seabird species as having low or very low habitat specialisation scores (i.e. high levels of foraging flexibility): kittiwake, storm petrel, Leach's petrel, fulmar, Manx shearwater, gannet and great skua. These species are able to exploit a wide range of foraging opportunities across large sea areas. In the breeding season, any changes to the availability of prey associated with construction, operation and maintenance, or decommissioning phase activities at the Offshore Development are likely to be negligible when considering the area of the site in relation to the total potential foraging ranges of these species (Woodward *et al*., 2019). In non-breeding seasons these species also forage over large areas as they are unrestricted by the necessity to provision young, furthermore several of these species (storm petrel, Leach's petrel, Manx shearwater, gannet and great skua) are partially or entirely migratory, moving away from sea areas surrounding the Offshore Development during non-breeding seasons.

Furness *et al.* (2012) identifies the following seabird species as having moderate habitat specialisation scores (i.e. moderate levels of foraging flexibility): guillemot, razorbill and puffin. During the breeding and post-breeding periods guillemot preferentially forage for sandeels (and, to a lesser extent, other wide-ranging mobile prey species), whilst razorbill and puffin feed mainly on sandeels, sprat and herring. Whilst there may be intermittent displacement of prey from a region around the wind farm, there is no indication that the overall availability of prey for the auk species will be reduced. It is expected that during breeding and post-breeding periods, when auk abundances peak and construction activities may coincide, that these species will redistribute themselves in relation to the availability of prey abundance. The significance of impacts on the prey resource and habitats of auk species from the effects of construction impacts, as detailed in the Offshore EIAR (Volume 2) Chapter 9: Benthic Ecology and Chapter 10: Fish and Shellfish Ecology are assessed at most as minor adverse. It is therefore considered that the construction of the Offshore Development would not affect foraging resources for guillemot, razorbill or puffin to an extent that it would have a detectable effect on any SPA populations screened in for assessment (see Table 3.7).

Furness *et al.* (2012) identify red-throated diver as having a high level of habitat specialisation (i.e. a low level of foraging flexibility) and therefore potentially particularly susceptible to effects due to changes in prey distribution or availability. Observed use of the PFOWF Array Area and surrounding 2 km buffer by red-throated diver was, however, extremely limited (a total of five individuals recorded during the two years of baseline

surveys), which indicates that affected areas do not coincide with frequently used red-throated diver foraging areas. It is therefore considered that the construction of the Offshore Development would not affect foraging resources for red -throated diver to an extent that it would have a detectable effect on any SPA populations screened in for assessment (see Table 3.7).

It is not anticipated that indirect effects on these bird species from changes in prey distribution or availability will result in any population consequences or impacts on population viability for any species at any of the SPAs screened in for assessment (see Table 3.7). There will therefore be **no adverse effect on site integrity** from this impact at any of the SPAs during construction, operation or decommissioning of the Offshore Development. There will also be **no adverse effect on site integrity** in relation to this impact from the Offshore Development in-combination with the other projects screened in for assessment in Section 9.9.

Changes in prey distribution or availability arising from installation or operation of the OECC where it passes through the North Caithness Cliffs SPA marine extension are addressed in Section 9.10.2.1

9.6.7 Accidental Pollution Events

Accidental release of litter or pollutants during the construction, operational and decommissioning phases of the Offshore Development may result in mortality or injury to seabirds within affected areas. Water quality changes as a result of accidental spillage may also impact seabird prey species, thereby reducing the quality of foraging habitat within affected areas. With regard to the Offshore Development, the main potential route by which pollution events may occur will be leaks or spills of fuel supply (diesel or oil) from vessels involved in construction or maintenance activities. The quantities of potentially polluting substances associated with the WTGs, substructures and cables (e.g. lubricants and grout) are limited, and if released would be of insufficient quantities to result in population level effects upon any species.

Species that spend large amounts of time in the water (e.g. pursuit feeders such as auks and red-throated diver) or on the sea surface (loafing) (auks) are considered to be more vulnerable to pollution incidents than surface feeding species such as kittiwake and fulmar.

In the event a spill or leak does occur (which is considered highly unlikely as would involve a vessel collision or significant damage to a vessel), given that the majority of vessels involved in construction and maintenance activities will be smaller support or guard vessels, the quantities of fuel released are likely to also be limited. Furthermore, where a pollution incident does occur, given the location of the Offshore Development within the strong tidal currents occurring in the Pentland Firth it is likely that any released substances will be rapidly diluted, dispersed and broken down by natural hydrodynamic processes.

Should a pollution incident occur, the potential for this to have a population level effect is limited due to the low quantities of pollutants that are likely to be released, and the likelihood of a pollution event occurring being very low. The potential for accidental pollution events to occur will be mitigated by the implementation of protocols set out in standard post consent plans (e.g. a CEMP including a Marine Pollution Contingency Plan [MPCP]). These plans will include planning for accidental spills, address all potential contaminant releases and include key emergency contact details and will also set out industry good practice and OSPAR (Oslo-Paris), International Maritime Organisation (IMO) and MARPOL (International Convention for the Prevention of Pollution from Ships) guidelines for preventing pollution at sea so as to ensure that the risk of a pollution incident remains low and to minimise the potential effects of any potential incident.

Taking these embedded mitigation measures into account (outlined in Section 6.1), it can be concluded that there will be **no adverse effect on site integrity** arising from the Offshore Development in relation to accidental pollution events for any of the qualifying interests of the any of the SPAs screened in for assessment (see Table 3.7), either from the project alone or in-combination with the other projects screened in for assessment in Section 9.9.

9.6.8 Entanglement

Entanglement with submerged infrastructure, specifically in debris caught on submerged infrastructure (i.e. derelict fishing gear), may result in mortality to diving seabird species during the operational phase of the Offshore Development.

Species that spend large amounts of time submerged within the water column (e.g. pursuit feeders such as auks and red-throated diver) are considered to potentially be vulnerable to entanglement effects, whilst surface feeding species are not.

Within the Offshore Development area auk species (guillemot, razorbill and puffin) and gannet (and red-throated diver, although in very low numbers) all forage for prey in the water column and are able to dive to considerable depths.

The risk of entanglement events occurring will be mitigated by the implementation of measures set out in the Operation and Maintenance Programme to prevent the fouling of subsea infrastructure. This programme will include measures to regularly and frequently monitor and remove fouled materials from the Offshore Development infrastructure.

Although the overall operation and maintenance strategy for the Offshore Development will be developed post-consent, it is anticipated that the inspections will follow the inspection scheme stipulated by the mooring line Original Equipment Manufacturer (OEM). In this regard there will be inspections to collect and remove debris (such as abandoned fishing nets, pots and other marine rubbish) amongst the mooring lines. This proposed mitigation will help reduce the potential likelihood of any entanglement occurring.

Taking these embedded mitigation measures into account (outlined in Section 6.1), it can be concluded that there will be **no adverse effect on site integrity** arising from the Offshore Development in relation to entanglement for any of the qualifying interests of the any of the SPAs screened in for assessment (see Table 3.7) either from the project alone or in-combination with the other projects screened in for assessment in Section 9.9.

9.7 Apportioning Collision and Displacement Between SPAs

9.7.1 Breeding Season

Once impacts (estimated collision risk and displacement/barrier mortalities) have been quantified for the Offshore Development, these are summed (where relevant) and then apportioned between the relevant SPAs for assessment using the apportioning methodologies as set out in the Offshore EIAR (Volume 3): Technical Appendix 12.2: Connectivity and Apportioning.

For each of the SPAs listed in Table 3.7 (Section 3.4) the apportioning assessment has been used to predict the impacts on each species on that particular SPA. The scoped-in SPAs are presented in Table 9.8 to Table 9.14 below. These tables list the SPAs in alphabetical order and include a measurement of distance between each SPA and the PFOWF Array Area, measured from the nearest boundary of the PFOWF Array Area to the nearest boundary of the relevant SPA (the ‘at sea’ distance rather than straight-line).

The output of this apportioning assessment is a weighting which is then used to apportion collision and displacement estimates to each SPA. The collision estimates presented are those based on mean input densities, given these present the average level of site use during the survey period. Displacement mortality estimates are derived from the mean seasonal peaks across the two years of baseline survey. Displacement mortality estimates presented for kittiwake, guillemot, razorbill and puffin at North Caithness Cliffs are those derived from SeabORD modelling (Section 9.6.2.1), whilst all other displacement estimates are derived from the matrix approach (Section 9.6.2.2).

9.7.2 Non-breeding Season

Estimated collision mortalities and displacement mortalities[xxiii] in the non-breeding season for kittiwake and guillemot have been apportioned between relevant SPAs following the respective methodologies set out in Sections 4.2 and 4.3 of the Offshore EIAR (Volume 3): Technical Appendix 12.2: Connectivity and Apportioning. For kittiwake, the approach for non-breeding season apportioning is based on the seasonal and population definitions in Furness (2015): this report defines non-breeding season populations of seabirds in UK waters and provides estimates of the population sizes for Biologically Defined Minimum Population Scales

[xxiii] Displacement mortalities estimated using displacement matrices (SNCB, 2017).

(BDMPS). For guillemot, the approach follows the specific advice received from NatureScot in relation to this species (Offshore EIAR [Volume 3] Technical Appendix 12.6: Consultation Advice).

Non-breeding season mortalities for all other species are zero, except fulmar and great black-backed gull. For fulmar there is a single displacement mortality in the non-breeding season; this has wholly been apportioned to North Caithness Cliffs SPA for simplicity as set out in Section 4.7 of the Offshore EIAR (Volume 3): Technical Appendix 12.4: Displacement Analysis. For great black-backed gull, the species is only recorded onsite in the non-breeding season, therefore there are no breeding SPAs screened in for assessment.

Table 9.8 therefore includes both the breeding and non-breeding apportioned displacement mortality estimates for guillemot potentially arising from the Offshore Development. In respect of kittiwake, the project-alone impacts during the non-breeding season are so low (a total of two birds for collision risk and displacement together) that the apportioned estimates are not presented in Table 9.7. Non-breeding season apportioning for kittiwake at North Caithness Cliffs SPA becomes relevant when considering in-combination impacts from collision risk at other offshore wind farms in the North Sea (Section 9.10.3).

9.7.3 Apportioned Collision and Displacement Estimates

Table 9.8 Kittiwake SPAs: apportioning weightings and apportioned annual mortality estimates (numbers of birds)

Kittiwake SPAs	Distance to PFOWF Array Area (km)	Population Count	Apportioning Weighting	Apportioned Collision Mortalities	Apportioned Breeding Season Displacement Mortalities
Buchan Ness to Collieston Coast	204	11,295 AON* (2019)	0.000	0.000	0.000
Calf of Eday	99	142 AON (2018)	0.000	0.000	0.000
Canna and Sanday	289	1257 AON (2019)	0.000	0.000	0.000
Cape Wrath	51	3,622 AON (2017)	0.025	0.177	0.075
Copinsay	73	955 AON (2015)	0.004	0.028	0.012
East Caithness Cliffs	73	24,460 AON (2015)	0.080	0.561	0.240
Fair Isle	167	448 AON (2021)	0.000	0.000	0.000
Flannan Isles$^{\Sigma}$	229	1,392 AON (1998)	0.000	0.000	0.000
Foula	191	425 AON (2021)	0.000	0.000	0.000
Fowlsheugh	275	14,039 AON (2018)	0.000	0.000	0.000
Handa	98	3,749 AON (2018)	0.006	0.041	0.018
Hoy	30	304 AON (2016/17)	0.010	0.068	0.030
Marwick Head	58	906 AON (2018)	0.026	0.179	0.078
North Caithness Cliffs	7.5	5,573 AON (2015/16)	0.717	5.020	2.600$^{\#}$
North Rona and Sula Sgeir	157	1,253 AON (2012)	0.000	0.000	0.000

Kittiwake SPAs	Distance to PFOWF Array Area (km)	Population Count	Apportioning Weighting	Apportioned Collision Mortalities	Apportioned Breeding Season Displacement Mortalities
Noss	243	76 AON (2019)	0.000	0.000	0.000
Rousay	76	330 AON (2016)	0.005	0.036	0.015
Sumburgh Head	206	1,407 AON (2017/21)	No output given by Marine Scotland Apportioning Tool		
Troup, Pennan and Lion's Heads	169	10,504 AON (2017)	0.001	0.010	0.003
West Westray	85	2,755 AON (2017)	0.063	0.444	0.189
*AON: Apparently Occupied Nest Σ Out of date population count for Flannan Isles SPA, however, it's included in Marine Scotland's Apportioning Tool as this uses Seabird 2000 data. #Displacement values for North Caithness Cliffs SPA come from seaBORD					

Table 9.9 Guillemot SPAs: apportioning weightings and apportioned annual mortality estimates (numbers of birds)

Guillemot SPAs	Distance to PFOWF Array Area (km)	Population Count (individuals)	Apportioning Weighting (breeding; non-breeding)	Apportioned Collision Mortalities	Apportioned Displacement Mortalities (breeding; non-breeding)
Calf of Eday	99	5,524 (2018)	0.000; 0.021	Not applicable	0.000; 0.084
Cape Wrath	51	38,109 (2017)	0.017;0.092	Not applicable	0.119; 0.368
Copinsay	73	18,473 (2015)	0.004; 0.019	Not applicable	0.028; 0.076
East Caithness Cliffs	73	148,805 (2015)	0.041; 0.360	Not applicable	0.287; 1.440
Handa	98	54,664 (2018)	0.034; 0.128	Not applicable	0.238; 0.512
Hoy	30	12,198 (2016/2017)	0.056; 0.021	Not applicable	0.392; 0.084
Marwick Head	58	11,985 (2018)	0.045; 0.038	Not applicable	0.315; 0.152
North Caithness Cliffs	7.5	38,898 (2015/2016)	0.695; 0.159	Not applicable	5.540[#]
Rousay	76	5,911 (2016/2018)	0.002;0.021	Not applicable	0.014; 0.0844
Sule Skerry and Sule Stack	52	10,068 (2018)	0.004; 0.026	Not applicable	0.028; 0.104
West Westray	85	28,697 (2017)	0.021; 0.115	Not applicable	0.147; 0.46

#Displacement values for North Caithness Cliffs SPA come from seaBORD

“Not-applicable” = collision risk modelling was not undertaken due to flight heights being below the rotor swept area of the WTGs

Table 9.10 Razorbill SPAs: apportioning weightings and apportioned annual mortality estimates (numbers of birds)

Razorbill SPAs	Distance to PFOWF Array Area (km)	Population Count (individuals)	Apportioning Weighting	Apportioned Collision Mortalities	Apportioned Breeding Season Displacement Mortalities
Cape Wrath	51	3,246 (2017)	0.029	Not applicable	0.058
East Caithness Cliffs	73	30,003 (2015)	0.162	Not applicable	0.324
Handa	98	8,207 (2019)	0.159	Not applicable	0.318
North Caithness Cliffs	7.5	3,609 (2015/2016)	0.357	Not applicable	1.300[#]
North Rona and Sula Sgeir	157	513 (2012)	0.001	Not applicable	0.002
West Westray	85	2,159 (2017)	0.015	Not applicable	0.030

#Displacement values for North Caithness Cliffs SPA come from seaBORD

“Not-applicable” = collision risk modelling was not undertaken due to flight heights being below the rotor swept area of the WTGs

Table 9.11 Puffin SPAs: apportioning weightings and apportioned annual mortality estimates (numbers of birds)

Puffin SPAs	Distance to PFOWF Array Area (km)	Population Count (Individuals)	Apportioning Weighting	Apportioned Collision Mortalities	Apportioned Breeding Season Displacement Mortalities
Cape Wrath	51	2,244 (2018)	0.007	Not applicable	0.049
Fair Isle	167	6,666 (2015)	0.002	Not applicable	0.014
Flannan Isles	*229*	*15,761 (1991/2001)*	*Not included in NatureScot (2018) apportioning calculation undertaken by HiDef due to out-of-date population count*		
Foula	191	6,351 (2016)	0.001	Not applicable	0.007
Handa	98	1,210 (2021)	0.001	Not applicable	0.007
Hoy	30	361 (2016/2017)	0.003	Not applicable	0.021
North Caithness Cliffs	7.5	3,053 (2015/2016)	0.698	Not applicable	1.800[#]
North Rona and Sula Sgeir	*157*	*5,442 (1998/2001)*	*Not included in NatureScot (2018) apportioning calculation undertaken by HiDef due to out-of-date population count*		
Noss	243	1,174 (2017)	0.000	Not applicable	0
Sule Skerry and Sule Stack	52	95,484 (2018)	0.282	Not applicable	1.974

#Displacement values for North Caithness Cliffs SPA come from seaBORD

“Not-applicable” = collision risk modelling was not undertaken due to flight heights being below the rotor swept area of the WTGs

Table 9.12 Fulmar SPAs: apportioning weightings and apportioned annual mortality estimates (numbers of birds)

Fulmar SPAs	Distance to PFOWF Array Area (km)	Population Count (AOS*)	Apportioning Weighting	Apportioned Collision Mortalities	Apportioned Breeding Season Displacement Mortalities
Buchan Ness to Collieston Coast	204	826 (2019)	0.000	0.000	0.000
Calf of Eday	99	1,836 (2018)	0.000	0.000	0.000
Cape Wrath	51	1,477 (2017)	0.001	0.000	0.003
Clare Island	714	667 (2015)	0.000	0.000	0.000
Cliffs of Moher	829	4,801 (2015)	0.000	0.000	0.000
Copinsay	73	1,585 (2015)	0.001	0.000	0.003
Deenish Island and Scariff Island	963	24 (2018)	0.000	0.000	0.000
Dingle Peninsula	880	625 (2018)	0.000	0.000	0.000
Duvillaun Islands	681	547 (2015)	0.000	0.000	0.000
East Caithness Cliffs	73	13,707 (2015)	0.006	0.000	0.018
Fair Isle	167	32,491 (2021)	0.003	0.000	0.009
Fetlar	297	8,518 (2018)	0.000	0.000	0.000
Flannan Isles	229	2,263 (2013)	0.000	0.000	0.000
Foula	191	10,253 (2021)	0.001	0.000	0.003
Fowlsheugh	275	525 (2018)	0.000	0.000	0.000
Handa	98	1,423 (2017)	0.000	0.000	0.000

Fulmar SPAs	Distance to PFOWF Array Area (km)	Population Count (AOS*)	Apportioning Weighting	Apportioned Collision Mortalities	Apportioned Breeding Season Displacement Mortalities
Hermaness, Saxa Vord and Valla Field	300	13,208 (2016)	0.000	0.000	0.000
High Island, Inishshark, Davillaun	733	1,561 (2015/2016)	0.000	0.000	0.000
Horn Head to Fanad Head	499	545 (2015/2018)	0.000	0.000	0.000
Hoy	30	21,101 (2016/2017)	0.058	0.000	0.174
Iveragh Peninsula	954	306 (2018)	0.000	0.000	0.000
Kerry Head	870	128 (2015)	0.000	0.000	0.000
Lambay Island	721	375 (2015)	0.000	0.000	0.000
Mingulay and Berneray	326	7,048 (2017/2021)	0.000	0.000	0.000
North Caithness Cliffs	7.5	13,405 (2015/2016)	0.925	0.000	2.775
North Rona and Sula Sgeir	*157*	*1,438 (2012)*	*Not included in NatureScot (2018) apportioning calculation undertaken by HiDef due to slightly out-of-date population count*		
Noss	243	5,092 (2016)	0.000	0.000	0.000
Puffin Island	943	50 (2021)	0.000	0.000	0.000
Rathlin Island	491	1,049 (2014/2021)	0.000	0.000	0.000
Rousay	76	2,159 (2016/2018)	0.001	0.000	0.003
Saltee Islands	897	225 (2015/2018)	0.000	0.000	0.000
Skelligs	951	733 (2020)	0.000	0.000	0.000

Fulmar SPAs	Distance to PFOWF Array Area (km)	Population Count (AOS*)	Apportioning Weighting	Apportioned Collision Mortalities	Apportioned Breeding Season Displacement Mortalities
St Kilda	307	29,186 (2015/2016)	0.000	0.000	0.000
Sumburgh Head	206	7437 (2017/2021)	0.000	0.000	0.000
Tory Island	511	507 (2015)	0.000	0.000	0.000
Troup, Pennan and Lion's Heads	169	1,894 (2017)	0.000	0.000	0.000
West Donegal Coast	531	585 (2018)	0.000	0.000	0.000
West Westray	85	1,198 (2017/2021)	0.000	0.000	0.000
*AOS: Apparently Occupied Site					

Table 9.13 Gannet SPAs: apportioning weightings and apportioned annual mortality estimates (numbers of birds)

Gannet SPAs	Distance to PFOWF Array Area (km)	Population Count	Apportioning Weighting	Apportioned Collision Mortalities	Apportioned Breeding Season Displacement Mortalities*
Fair Isle	167	4,971* (2021)	0.027	0.054	0.027
Forth Islands	365	75,259** (2014)	0.111	0.222	0.111
Hermaness, Saxa Vord and Valla Field	300	25,580** (2014)	0.041	0.082	0.041
North Rona and Sula Sgeir	157	11,230** (2013)	0.102	0.204	0.102
Noss	243	13,765* (2019)	0.035	0.070	0.035
St Kilda	307	60,290** (2013)	0.105	0.210	0.105
Sule Skerry and Sule Stack	52	9,065*** (2013/2018)	0.527	1.054	0.527
Troup, Pennan and Lion's Heads (non-SPA gannet colony)	169	4,825* (2019)	0.029	0.058	0.029
Seas off St Kilda	307	50,332 (Individuals)	0.027	0.050	0.027

*Apparently occupied nest

**Apparently occupied site

Table 9.14 Great skua SPAs: apportioning weightings and apportioned annual mortality estimates (numbers of birds)

Great skua SPAs	Distance to PFOWF Array Area (km)	Population Count (AOT *)	Apportioning Weighting	Apportioned Collision Mortalities	Apportioned Breeding Season Displacement Mortalities*
Fair Isle	167	430 (2020)	0.025	0.000	0.000
Fetlar	297	852 (2017)	0.015	0.000	0.000
Foula	191	1,846 (2015)	0.081	0.000	0.000
Handa	98	283 (2018)	0.049	0.000	0.000
Hermaness, Saxa Vord and Valla Field	300	955 (2018)	0.017	0.000	0.000
Hoy	30	438 (2018)	0.800	0.000	0.000
Noss	243	476 (2018)	0.013	0.000	0.000
+Worst case scenario *AOT: Apparently Occupied Territory					

9.8 Population Modelling

The estimated collision risk and displacement / barrier mortalities thus modelled and apportioned (Section 9.7) were then considered in respect of conservation objective (iii): population of the species as a viable component of the site (see Table 9.3). In this regard, Marine Scotland / NatureScot have provided advice on a 'threshold of significance' for considering the population consequences of such mortality, using Population Viability Analysis (PVA) (MS-LOT, 2021).

"*Where effects are assessed to be potentially significant either from the proposed development alone or in-combination with other developments, PVA modelling should be used to better understand population level impacts for protected sites (SPA populations). NatureScot suggest a threshold of 0.2% change in adult survival rate. However, Marine Scotland advise that there should be further discussion to agree appropriate thresholds for when PVA should be undertaken; the 0.2% change in adult survival value may be appropriate for some species but given interspecific variation in annual survival a percentage of background mortality may be a more appropriate approach.*"

For each SPA population of each qualifying interest screened in for appropriate assessment (Sections 9.10 - 9.43), the default adult survival rates (Horswill & Robinson, 2015) have been applied to the most recent SPA population counts to give a measure of baseline mortality; it is the factor (1-survival rate) that is applied. The recommended 0.2% threshold of significance is then applied to these mortalities to give an indication of the amount of 'allowable' mortality before PVA is required. This was then used to inform whether a PVA would be used. The PVA methods (using the NE PVA tool) and detail of this population modelling are set out in the Offshore EIAR (Volume 3): Technical Appendix 12.5: Population Modelling and it has been undertaken for the following three SPA qualifying interests:

- Kittiwake at North Caithness Cliffs SPA;
- Guillemot at North Caithness Cliffs SPA; and
- Puffin at North Caithness Cliffs SPA.

The impacts that have been modelled against these populations are set out in Tables 3, 4 and 5 of the Offshore EIAR (Volume 3): Technical Appendix 12.5 and take account of project-alone and in-combination impacts (as discussed in Section 9.9). The detail of how each impact scenario is derived in set out in Annex A of Technical Appendix 12.5 (Section A1 Kittiwake, Section A2 Guillemot and Section A3 Puffin). PVA model outputs (population metrics) are presented in Section 3 Results: Table 6 Kittiwake, Table 7 Guillemot and Table 8 Puffin (Offshore EIAR [Volume 3]: Technical Appendix 12.5). These are discussed in Section 4 of that appendix and inform the relevant species appraisals presented for North Caithness Cliffs SPA in this RIAA (Section 9.10).

All other predicted mortalities arising from the Offshore Development either do not surpass, or lie very close to (within one to two birds), the 0.2% threshold, for example razorbill at North Caithness Cliffs SPA (as further discussed in Section 9.10.2.4). There is therefore no population modelling required to be able to inform judgements on adverse impact on site integrity.

9.9 In-combination Impacts

The screening of risks and potential in-combination impacts to consider was discussed with MS-LOT, Marine Scotland, NatureScot and RSPB at the meeting held on 21st February 2021, with a paper provided by HiDef setting out the initial screening process for other projects requiring consideration.

The consideration of which projects could result in potential in-combination impacts is informed by outcomes from the project-alone assessment using the expert judgement of the specialist consultant and following advice from Marine Scotland, NatureScot and RSPB Scotland (MS-LOT, 2021). In this regard, the project-screening for in-combination impacts follows a species-specific and SPA-by-SPA approach, considering whether other projects could be significantly affecting the same SPA populations of birds as the Offshore Development.

9.9.1 Projects at Pre-scoping and Scoping Stages

For projects at pre-scoping or scoping stage, the following approach was shared and agreed upon with MS-LOT, confirmed via email on 6th December 2021.

- Quantitative assessment of projects submitted to Scoping up to six months prior to submission of PFOWF application submission;
- Qualitative assessment of projects submitted to Scoping up to five months prior to submission of the PFOWF application submission; and
- Acknowledgement of projects submitted to Scoping between five and two months prior to submission of the PFOWF application submission.

ScotWind Projects and Offshore Wind Round 4 Projects at the pre-scoping stage are acknowledged but no assessment has been undertaken. In the future, when these projects reach application stage, they will need to provide a cumulative assessment that includes consideration of the Offshore Development, as appropriate.

Although Berwick Bank was submitted for scoping six months prior to the PFOWF application submission; it is not possible to do any quantitative assessment of in-combination impacts considering that the project-alone impacts have not themselves been quantified yet. Also, the only in-combination impacts relevant to consider for Berwick Bank are its potential collision risk / displacement mortalities to gannet as a qualifying interest of Forth Islands SPA. In this regard, qualitative assessment has been agreed upon with MS-LOT, NatureScot, Marine Scotland and RSPB, so Berwick Bank is included for consideration alongside the consented Forth and Tay wind farms; (see Table 9.15 and Section 9.40).

West of Orkney Windfarm reached scoping on the cusp of the five month cut-off, however it was requested by RSPB that the ornithology assessment should include a qualitative assessment of ScotWind sites so, given that the West of Orkney Windfarm could potentially impact upon some of the same SPA qualifying interests and SPAs as the Offshore Development, a high level qualitative assessment has been included. However, as it is still in the early stages of the pre-application process there is not yet any HRA screening report available. Once further progressed, West of Orkney will undertake a quantitative in-combination assessment with the Offshore Development to support their application for development consent.

9.9.2 Consented Offshore Wind Farms (including those built and operational)

For the consented Scottish offshore wind farms (those already in operation and those still to be constructed) the RIAAs and Marine Scotland's Appropriate Assessments were reviewed. Marine Scotland's Appropriate Assessments for Meygen and EMEC (see Table 9.4) have also been considered and a review was also undertaken of available information for Hornsea Project Three (consented) and Hornsea Project Four (examination). This work confirmed that Hywind Scotland, Kincardine and the EOWDC are not affecting the same SPA populations of seabirds during the breeding season as the Offshore Development, so they are not considered further in this regard.

The apportioning undertaken for the Offshore Development (Offshore EIAR (Volume 3: Technical Appendix 12.2: Connectivity and Apportioning) indicated that there could be a level of mortality assigned against gannet at Forth Islands SPA. The level of apportioned mortality is very low (less than one bird, displacement and collision risk combined) and further to discussion at the cumulative impacts meeting held on 21st February 2021, it was agreed that no quantitative assessment is required cumulatively with the Forth and Tay wind farms; Neart na Gaoithe, Inch Cape or Seagreen (Marine Scotland and NatureScot advice as provided by MS-LOT on 31st March 2022).

Table 9.15 presents the short-list of consented offshore wind farms included for quantitative and site-specific assessment of in-combination collision risk and displacement impacts on the qualifying interests scoped in for assessment at each SPA scoped in for assessment (Sections 9.10 to 9.43).

These projects have also been included for qualitative assessment in relation to the other potential impact pathways addressed in Sections 9.6.5 to 9.6.8.

9.9.3 Tidal Developments

Phase 1 of the Meygen tidal energy project (fully operational since February 2017) is potentially affecting some of the same seabirds (guillemot, razorbill and puffin) at North Caithness Cliffs SPA. Marine Scotland advised that for MeyGen (phase 1) the potential risk of collision has been modelled using an exposure time-based encounter model. It is confirmed that the predicted levels of seabird collisions from the four 1.5 MW operational WTGs are so low that there is unlikely to be any population-level consequences and therefore the mortalities have not been apportioned between SPAs for any quantitative assessment. Meygen (phase 1) is therefore included for qualitative assessment in relation to the other potential impact pathways addressed in Sections 9.6.5 to 9.6.8.

Whilst Meygen was recently awarded a Contract for Difference[xxiv] on 7th July 2022, future phases of the project are acknowledged but have not been further assessed (qualitatively or quantitatively) in this RIAA; as agreed upon with MS-LOT in respect of cut-off dates for the cumulative assessment.

EMEC and other tidal developments are also included for qualitative assessment in relation to the other potential impact pathways addressed in Sections 9.6.5 to 9.6.8.

9.9.4 Other Developments

Ports and harbours (including Scapa and Hatston projects) and SHE Transmission Orkney – Caithness project have also been included for qualitative assessment in relation to the other potential impact pathways addressed in Sections 9.6.5 to 9.6.8.

The SpaceHub in Sutherland has also been considered but there is no pathway to impact for the ornithological receptors addressed in the RIAA. So, no project-alone impacts arising from the SpaceHub on any of the SPAs scoped in for assessment in Sections 9.10 to 9.43 and no need to consider qualitatively in respect of the impact pathways addressed in Sections 9.10 to 9.43.

Table 9.15 List of projects included for quantitative in-combination assessment of collision risk and displacement impacts against SPA qualifying interests

Development Type	Project	Status	Species Considered	Summary of Project Screening and Risk of In-combination Impacts
Offshore wind farm	Beatrice	Operational	Kittiwake, guillemot, razorbill, puffin and fulmar	Yes, in relation to North Caithness Cliffs SPA (addressed in Section 9.10).
Offshore wind farm	Moray East	Operational		
Offshore wind farm	Moray West	Consented		
Offshore wind farm	Neart na Gaoithe	Under construction	Gannet	No, potential impacts (collision risk/displacement) from the Offshore Development are minimal and do not affect the population viability of gannet at Forth Islands SPA (Section 9.40).
Offshore wind farm	Inch Cape	Consented		
Offshore wind farm	Seagreen	Under construction		
Offshore wind farm	Forthwind Original / Revised	Consented / Scoping		
Offshore wind farm	Berwick Bank	Scoping		

[xxiv] Contracts for Difference - GOV.UK (www.gov.uk)

Development Type	Project	Status	Species Considered	Summary of Project Screening and Risk of In-combination Impacts
Onshore wind farms, various		Various	Red-throated diver	No potential impacts (collision risk/displacement) from the Offshore Development are minimal and do not affect the population viability of red-throated diver at Caithness and Sutherlands SPA (Section 9.12)
North Sea offshore wind farms*		Various	Kittiwake	Considered specifically in relation to kittiwake at North Caithness Cliffs SPA (Section 9.10.2.2)
* These North Sea offshore wind farms are listed in Section 9.10.3.1 in relation to kittiwake collision mortalities apportioned to North Caithness Cliffs SPA in the non-breeding season				

9.10 North Caithness Cliffs SPA

9.10.1 Site Description and Qualifying Species Screened In for Assessment

Details of this SPA can be found at https://sitelink.nature.scot/site/8554. The species screened in for assessment for this SPA were fulmar, kittiwake, guillemot, puffin, razorbill and peregrine.

Table 9.16 Screened-in Protected Seabird Interests and Baseline Annual Mortalities for the North Caithness Cliffs SPA

Protected Interests	Adult Survival Rate (Horswill & Robinson, 2015)	SPA Breeding Population (individuals)	Baseline Mortality (individuals)	0.2% of Baseline Mortalities (individuals)
Fulmar	0.936 (±0.055 SD)	26,810	1,716	3
Kittiwake	0.800 (±0.051 SD)	11,146	2,229	4
Guillemot	0.939 (±0.015 SD)	38,898	2,373	5
Puffin	0.906 (±0.083 SD)	3,053	287	1
Razorbill	0.895 (±0.067 SD)	3,609	379	1

9.10.2 Assessment of Adverse Effects Alone

This assessment considers collision impacts in respect of kittiwake and fulmar, and displacement impacts in respect of guillemot, razorbill, puffin and fulmar. Impacts arising from the OECC are also considered below.

9.10.2.1 Offshore export cable - all species

The location of the OECC is shown on Figure 12.1 of the Offshore EIAR (Volume 2): Chapter 12: Marine Ornithology. It connects the PFOWF Array Area to the landfall site located within the SPA (Melvich sub-site) adjacent to the Vulcan Naval Reactor Test Establishment (NRTE). Full details of the export cable(s) are provided in Section 12.4.4.14 of Chapter 12.

The cable will pass through the marine section of the Melvich SPA sub-site; therefore it can be anticipated that the birds found nesting within the SPA are likely to be using this designated area at sea for foraging and other behaviours, particularly during the breeding season. On this basis, potential impacts on guillemot, razorbill,

kittiwake, puffin and fulmar need to be considered. Cable landfall may be occurring within or adjacent to the SPA and will need to be considered in respect of breeding seabird colonies found in the SPA.

Whilst the SPA is also designated for a breeding population of peregrine nesting on cliffs along the coast, there is no suitable nesting habitat within the OECC or in proximity to the cable landfall (Jackson, 2022) so it is not anticipated that there will be any pathways to impact on peregrine (including risk of disturbance) from installation or operation of the Export Cable(s), and therefore they are not considered further in this regard.

Construction impacts related to the landfall HDD and cable installation at sea require consideration under the SPA conservation objectives to '*avoid significant disturbance to the qualifying species'*. There will be no disturbance to birds at nests as the nearest colonies are over 1 km from the OECC and landfall point: the closest colonies of fulmar, kittiwake, razorbill and puffin are all at least 1 km to the west of the OECC on Sandside Head; and the closest guillemot colonies are at least 2.5 km to the west of the OECC west of Sandside Head (Jackson, 2022).

Vessels engaged in the offshore export cable-laying will generally move slowly and will be static for long periods, with the process emitting very low levels of noise. Therefore, only limited disturbance or displacement of seabirds around the cable-laying activities is likely, with any effects being temporary and localised. Where cable-laying passes through areas of potential foraging habitat, any habitat loss or disturbance from these locations will be minimal and is unlikely to affect the fitness of breeding birds (even those displaced daily) with negligible impacts on any survival rates of the SPA seabird populations under consideration (Searle *et al*., 2014, 2017). An such minimal changes to the distribution of birds within the SPA will only be short-term during the installation period.

As the OECC overlaps with the boundary of the North Caithness Cliffs SPA, there may be some habitat loss to a maximum area of <0.05 km^2. This will be confirmed in the Cable Plan (CaP) and Cable Burial Risk Assessment (CBRA), which will include details of the final route and cabling methods. Micro-siting will also be used to minimise impacts on sensitive habitats as far as possible. Whilst some habitat loss may be unavoidable, this embedded mitigation will ensure it is kept to a minimum so that: overall degradation of the SPA habitats is avoided; the structure, function and supporting processes of habitats are maintained; and there is no population-level impact on the qualifying species of the SPA.

It is therefore concluded that there will be no impact arising from the installation or operation of the Offshore Export Cable(s) on the conservation objectives of the North Caithness Cliffs SPA, and there will be **no adverse effect on site integrity** for the qualifying species.

9.10.2.2 Offshore Development – Kittiwake

The Offshore EIAR (Volume 3): Technical Appendix 12.3: Collision Risk Modelling (see Table 11) sets out the estimated breeding season collision mortalities for kittiwake (mean and max densities), as apportioned to the SPA using the weightings derived from Marine Scotland's Apportioning Tool (see Table 10, Offshore EIAR (Volume 3): Technical Appendix 12.2: Connectivity and Apportioning). These figures were estimated at 5.02 birds (mean densities) and 8.60 birds (maximum densities).

Non-breeding season apportioning was undertaken for kittiwake at the SPA using the relevant weighting for the autumn migration BDMPS, a value of 0.023 (Section 4.2, Technical Appendix 12.2: Connectivity and Apportioning). This gives non-breeding collision mortalities of 0.02 birds (mean densities) and 0.07 birds (maximum densities) to assign against the SPA in addition to the breeding season impacts.

The estimate of annual mortalities arising from displacement, taken from the SeabORD analysis, is 2.6 individuals.

The Offshore EIAR (Volume 3): Technical Appendix 12.5: Population Modelling. sets out the methodology for PVA, the assumptions used and the model outputs. Table 6 in that Technical Appendix sets out the two project-alone impact scenarios modelled for kittiwake, adding together SeabORD displacement mortalities with each of the CRM estimates at mean and max densities.

The 'worst case' project alone impact scenario (SeabORD and CRM at maximum densities) is an estimate of 11.27 kittiwake (see Table 3 of the Technical Appendix). This level of predicted mortality results in a reduction in end population size of 3% (compared to baseline) over the 30-year modelled period, which is not considered to significantly affect population viability.

As the predicted number of kittiwake mortalities (collision/displacement) arising from the Offshore Development on its own are determined not to impact the viability of the kittiwake population at North Caithness Cliffs SPA, it is therefore judged that there will be **no adverse effect on site integrity** in this regard.

9.10.2.3 Offshore Development – Guillemot

As set out in the Offshore EIAR (Volume 3): Technical Appendix 12.4: Displacement Analysis, SeabORD predicts up to 5.54 (annual) guillemot displacement mortalities attributable to the SPA. This level of impact appears to accord with use of a 60% displacement rate and 1% mortality rate in respect of guillemot (which results in an annual displacement mortality estimate of 5.51 birds apportioned against the SPA.

The Offshore EIAR (Volume 3): Technical Appendix 12.5: Population Modelling. sets out the methodology for PVA, the assumptions used and the model outputs. The population consequences of the guillemot displacement mortalities predicted by SeabORD have been modelled under PVA (impact scenario 1 in Table 4 of the Technical Appendix). This level of predicted mortality results in a reduction in end population size of 0.4% (compared to baseline) over the 30-year modelled period, which is not considered to significantly affect population viability.

As the predicted number of guillemot displacement mortalities arising from the Offshore Development on its own are determined not to impact the viability of the guillemot population at North Caithness Cliffs SPA, it is therefore judged that there will be **no adverse effect on site integrity**.

9.10.2.4 Offshore Development – Razorbill

As set out in the Offshore EIAR (Volume 3): Technical Appendix 12.4: Displacement Analysis. SeabORD predicts 1.30 (annual) razorbill displacement mortalities attributable to the SPA, under moderate environmental conditions.

Given the low level of estimated displacement mortality, and that this was only just over the 0.2% of baseline mortality threshold, PVAs were not undertaken for this species. These numbers equate to a 0.3% change in baseline mortality which is still very low and would not result in any population-level consequences at the SPA.

The predicted number of razorbill displacement mortalities arising from the Offshore Development on its own are determined not to impact the viability of the razorbill population at North Caithness Cliffs SPA, and therefore it is judged that there will be **no adverse effect on site integrity**.

9.10.2.5 Offshore Development – Puffin

As set out in the Offshore EIAR (Volume 3): Technical Appendix 12.4: Displacement Analysis., SeabORD predicts up to 1.80 (annual) puffin displacement mortality attributable to the SPA. This level of impact is much less than that estimated through use of displacement matrices, indicating that the matrix-derived displacement mortality rates are too precautionary.

For information, puffin displacement mortalities have also been estimated using the SNCB (2017) displacement matrix applied to the PFOWF Array Area alone and to the PFOWF Array Area plus 2 km buffer. Using a 60% displacement rate with a 1% mortality rate gives estimated breeding season puffin mortalities apportioned to the SPA of 5.07 birds for the PFOWF Array Area alone, and 27.22 birds for the PFOWF Array Area plus 2 km buffer (see Table 17, Technical Appendix 12.4: Displacement Analysis.). In the non-breeding season, there are zero puffin mortalities estimated by the displacement matrix.

The Offshore EIAR (Volume 3): Technical Appendix 12.5: Population Modelling. sets out the methodology for PVA, the assumptions used and the model outputs. Table 5 in that Technical Appendix includes the project-alone impact scenarios modelled for puffin: scenario 1 for the SeabORD mortalities and scenario 2 for the Array Alone displacement matrix outputs (at 60%/1%). Table 8 presents the PVA model outputs which show respective reductions in end population size of 3% and 4.3% (compared to baseline) over the 30-year modelled period, neither of which are considered to significantly affect population viability. As these predicted numbers of puffin displacement mortalities arising from the Offshore Development on its own are determined not to impact the viability of the puffin population at North Caithness Cliffs SPA, it is therefore judged that there will be **no adverse effect on site integrity**.

9.10.2.6 Offshore Development – Fulmar

The Offshore EIAR (Volume 3): Technical Appendix 12.4: Displacement Analysis, (see Table 18) sets out the estimated breeding season displacement mortality for fulmar as apportioned to the SPA: a figure of 2.78 birds. There were zero estimated collision mortalities in either the breeding or the non-breeding season for fulmar (Technical Appendix 12.3: Collison Risk Modelling). The project alone impacts are just below the 0.2% threshold of baseline mortality (three birds) and are therefore considered not to result in any effect on population viability without a PVA needing to be run.

The predicted number of fulmar mortalities (collision / displacement) arising from the Offshore Development on its own are determined not to affect the viability of the fulmar population at North Caithness Cliffs SPA, and therefore it is judged that there will be **no adverse effect on site integrity**.

9.10.3 Assessment of Adverse Effects In-combination

Review of the impacts from the Offshore Development alone indicated that there are three species at North Caithness Cliffs SPA requiring further consideration in respect of potential in-combination impacts, these are kittiwake, guillemot and puffin, as assessed below.

These impacts have been modelled under PVA as reported in Offshore EIAR (Volume 3) Technical Appendix 12.5: Population Modelling, based on the scenarios for each species set out in Table 3 (kittiwake), Table 4 (guillemot) and Table 5 (puffin) of that Technical Appendix. The detail of how each impact scenario is derived is set out in Annex A of the Technical Appendix (Section A1 kittiwake, Section A2 guillemot and Section A3 puffin) which presents the supporting calculations (including the apportioning weightings used for the Moray Firth wind farms) and the literature that was referenced. Table 9.17 presents the key mortality estimates (collision/displacement) for each species and each wind farm screened in for assessment, based on the information provided in Annex A of Offshore EIAR (Volume 3) Technical Appendix 12.5: Population Modelling.

Table 9.17 Summary of in-combination displacement and collision estimates for kittiwake, guillemot and puffin

Species	Moray West	Moray East	Beatrice	Wider North Sea[xxv]
Kittiwake				
Displacement: breeding (30% displacement, 2% mortality)	1.25	0.55	0.34	n/a [xxvi]
Collision: breeding	1.19	1.00	2.46	n/a
Collision: non-breeding	0.20	0.54	1.11	n/a
Collision: autumn	n/a	n/a	n/a	33.90
Collision: spring	n/a	n/a	n/a	31.12
Guillemot				
Displacement: breeding (60% displacement, 1% mortality)	4.25	3.00	4.16	n/a
Displacement: non-breeding	9.32	0.31	0.67	n/a
Puffin				
Displacement: breeding (60% displacement, 2% mortality)	1.98	25.99	11.87	n/a

[xxv] Developments included are found in Technical Appendix 12.5 Marine Ornithology: Population Modelling
[xxvi] "Not-applicable" means that the season is not defined as such for a particular species by Furness (2015)

9.10.3.1 Kittiwake

Application of Marine Scotland / NatureScot advice (Section 9.9) and review of the available literature (see Table 9.4) indicates that the three Moray Firth wind farms; Beatrice, Moray East and Moray West, need consideration in respect of their potential impacts (collision risk and displacement) on kittiwake at North Caithness Cliffs SPA.

An in-combination non-breeding season assessment was also carried out whereby kittiwake collision mortalities (for autumn and spring migration BDMPS), were calculated for other offshore wind farms in the North Sea BDMPS and apportioned against North Caithness Cliffs SPA (see Table A.1.3.1, Annex A; Offshore EIAR (Volume 3): Technical Appendix 12.5: Population Modelling). This is a larger list of projects assessed during the non-breeding season, compared to the breeding season, due to birds being more widely distributed during this period. NatureScot/Marine Scotland advice is that all projects within the North Sea BDMPS be included in respect of kittiwake non-breeding season impacts.

There are no figures available for potential kittiwake displacement mortalities for these other North Sea wind farms as kittiwake displacement analysis has not previously been requested and has not been carried out at these other projects. Therefore, the in-combination assessment for the Offshore Development has only been able to take into account potential collision risk in respect of these other North Sea wind farms, and not displacement (as was also the case for the Moray West assessment; MOWWL, 2018).

9.10.3.2 Offshore Development and Moray Firth wind farms

Details of how the in-combination mortality scenarios have been determined are presented in the Offshore EIAR (Volume 3): Technical Appendix: Population Modelling (Annex A,) and summarised in Table 3 of that Technical Appendix. Impact scenario 3 models the annual cumulative kittiwake mortality estimates (collision risk/displacement) arising from the Offshore Development in-combination with the Moray Firth wind farms; a total of 17.99 birds to model under PVA.

PVA indicates that this level of mortality may result in a 0.2% reduction in population growth rate over 30 years of modelled impacts and a 4.8% reduction in end population size compared to baseline. It is therefore judged that these in-combination impacts in-combination will not affect the viability of the kittiwake population at North Caithness Cliffs SPA, and that there is therefore **no adverse effect on site integrity** from these developments in cumulation.

9.10.3.3 Non-breeding season kittiwake collision mortalities apportioned from other North Sea wind farms

Estimated non-breeding season North Sea kittiwake collisions are apportioned to North Caithness Cliffs SPA using the methodology set out in Section 4.2 of the Offshore EIAR (Volume 3): Technical Appendix 12.2 Connectivity and Apportioning. In so doing, a strong note of caution needs to be applied as there is great uncertainty in the BDMPS figures provided by Furness (2015). Kittiwake are flagged as 'red' indicating that the true BDMPS values may lie more than 50% below or 80% above the figures quoted. Most of the SPA counts presented in Annex 1 of the BDMPS report pre-date 2012 and are not the most recent values recommended by Marine Scotland / NatureScot for use in assessment. It is therefore questionable whether non-breeding SPA apportioning should be attempted at present given these issues with the currently available data.

If this apportioning is to be undertaken, it indicates that a total of 65 kittiwake collisions[xxvii] are to be assigned against North Caithness Cliffs SPA in respect of these other North Sea wind farms. The population consequences of this estimated mortality are modelled under PVA as kittiwake impact scenario 4 (see Table 3 of the Offshore EIAR [Volume 3]: Technical Appendix 12.5), with the model outputs presented in Table 6. The PVA outputs indicate a 0.5% reduction in population growth rate over 30 years of modelled impacts with a 14.6% reduction in end population size compared to baseline.

For comparison, Moray West modelled a cumulative total of 45 birds for all offshore wind farms in the North Sea BDMPS (see Table 3.51 of the Moray West EIA Addendum) (MOWWL, 2018). This resulted in an 11.3% reduction in end population size compared to baseline.

[xxvii] The North Sea kittiwake collision mortality estimates referenced by the Offshore Development are those in Table 5.60 of Hornsea Project Four, ES Volume A2, Chapter 5, Offshore and Intertidal Ornithology (Orsted, 2021)

The difference of 19 kittiwake mortalities between the Moray West and Hornsea Project Four (values presented in Table 3.51 of their EIAR Addendum) figures is primarily due to the discrepancies presented in Table 9.18, the reasons for which could not be ascertained. As agreed during pre-application discussions, the most recently published information (from the Hornsea Project Four ES, Orsted 2021) has been referenced, but it is acknowledged that it is the apportioned Moray West estimates agreed for use in assessment (in Scotland), and on which the Scottish Ministers' consenting decisions have been based.

Note that the discrepancies between the figures relate to apportioned values and not to the underlying mortality estimates for each wind farm which appear to correspond. Half of the discrepancy between the two sets of figures relates to the Forth and Tay wind farm apportioned values (see Table 9.18).

Table 9.18 Differences in apportioned kittiwake collision mortalities between Moray West EIA addendum and

Wind Farm	North Sea Non-breeding Season Kittiwake Collision Mortalities Apportioned to North Caithness Cliffs SPA		
	Figures from Moray West EIA addendum	Figures from Hornsea Project Four ES	Differences
Seagreen	8	13.9	5.9
Inch Cape	4	6.9	2.9
Neart na Gaoithe	0	1.4	1.4
Dogger Bank Creyke Beck	8	11.4	3.4
Dogger Bank Teeside	5	8.2	3.2
Hornsea Project Three	Not applicable	0.2	0.2
Hornsea Project Four	Not applicable	1.6	1.6
Total difference in figures for apportioned kittiwake collision mortalities			18.6

In previously considering these matters for the Moray West appropriate assessment, the Scottish Ministers took into account the SPA conservation objectives, the population at the site, the predicted levels of effect, the population consequences and the levels of precaution in assessment (Scottish Ministers, 2019) They took the view that use of precautionary assumptions "make it unlikely the number of impacted individuals will be as large as the values presented in the assessment" and that, in relation to cumulative kittiwake mortalities, "there will be no adverse effect on the site integrity of North Caithness Cliffs SPA".

9.10.3.4 Kittiwake mortalities from the Offshore Development and Moray Firth wind farms in-combination with the non-breeding season collision mortalities from other North Sea wind farms

The apportioned non-breeding season kittiwake collision mortalities from other North Sea wind farms (Section 9.10.3.3), have been considered from the Offshore Development and Moray Firth projects (Section 9.10.3.2). This results in a further 4.1% decline in end population size after 30 years of modelled impacts. This is a predicted population of 2,847 birds, compared to a predicted population of 2,526 birds under baseline conditions (in the absence of any wind farms whatsoever) where the declining population trend for kittiwake at the SPA has been projected forward by 50 years (see Table 6 of the Offshore EIAR [Volume 3]: Technical Appendix 12.5: Population Modelling).

It is therefore judged that the 4.1% reduction in impacted population sizes arising from the Offshore Development and Moray Firth wind farms in addition to the impacts from the other North Sea wind farms (already determined to be acceptable by Scottish Ministers) does not make a material difference to the viability of the kittiwake population at North Caithness Cliffs SPA. The minor additional impacts (7.64 kittiwake mortalities) predicted to arise from the Offshore Development will result in **no adverse effect on site integrity** in-combination with the Moray Firth and other North Sea windfarms (as already consented).

9.10.3.5 Guillemot

Application of Marine Scotland / NatureScot advice and review of the available literature (see Table 9.4) indicates that the three Moray Firth wind farms; Beatrice, Moray East and Moray West, need to be considered in respect of their breeding and non-breeding displacement impacts on guillemot at the SPA.

There is a single in-combination mortality scenario modelled for guillemot as detailed in the Offshore EIAR (Volume 3): Technical Appendix 12.5: Population Modelling (Annex A, Section A2) and presented in Table 4 of that Technical Appendix (impact scenario 2).

This models the predicted guillemot displacement mortalities from SeabORD for the Offshore Development in-combination with the estimated mortalities from the Moray Firth wind farms, applying a 60% displacement rate and a 1% mortality rate to both breeding and non-breeding mean seasonal peaks of birds apportioned to the SPA. This gives a total of 27 (annual) guillemot displacement mortalities to model under PVA. The PVA results for this scenario indicate that this may result in a <0.01% reduction in population growth rate over 30 years of modelled impacts and a 0.9% reduction in end population size compared to baseline.

It is therefore judged that these in-combination displacement impacts will not affect the viability of the guillemot population at North Caithness Cliffs SPA, and that there is therefore **no adverse effect on site integrity** from these developments in cumulation.

9.10.3.6 Puffin

Application of Marine Scotland/NatureScot advice and review of the available literature (see Table 9.4) indicates that the three Moray Firth wind farms; Beatrice, Moray East and Moray West, require consideration in respect of puffin impacts at the SPA. In this regard, minimal puffin numbers have been recorded at the Offshore Development during the non-breeding season and this is not surprising as all puffin in the UK disperse from their breeding colonies and adjacent waters by late August (Furness 2015, Wernham *et al*. 2002; Harris & Wanless 2011). They are known to overwinter in the open ocean, and possibly in the central North Atlantic (Wernham *et al.* 2002), although on the latter there is little ringing evidence to be certain (Harris & Wanless 2011).

Therefore, for puffin the project alone and in-combination impact assessment focuses on the breeding season displacement impacts that could possibly be attributable to the SPA. The detail of how the in-combination mortality scenarios have been determined is presented in the Offshore EIAR (Volume 3) Technical Appendix 12.5: Population Modelling (Annex A, Section A.3) and summarised in Table 5 of that Technical Appendix. For the project alone assessment, the implications of SeabORD model outputs should be accounted for in respect of cumulative displacement assessment for puffin, to consider the most appropriate choice of impact scenario to reflect the likely risks.

The predicted number of puffin mortalities modelled for the Moray Firth wind farms was based on displacement matrix outputs at a 60% displacement rate and 2% mortality rate (impact scenario 4, Table 5 Offshore EIAR (Volume 3): Technical Appendix 12.5: Population Modelling), a figure of 39.83 puffin mortalities. This is the cumulative mortality estimate that was considered in the Scottish Ministers' appropriate assessment for Moray West (Scottish Ministers, 2019). It was agreed that no population modelling was required and it was advised by NatureScot that these ~40 puffin mortalities would not result in an adverse effect on SPA site integrity (Scottish Ministers, 2019). Scottish Ministers further took the view that the use of precautionary assumptions "make it unlikely the number of impacted individuals will be as large as the values presented in the assessment".

Comparison of SeabORD model outputs with those presented in the displacement matrices indicate that it may be appropriate to use a 60% displacement rate and 1% mortality rate to estimate potential puffin displacement mortalities arising from the Moray Firth wind farms (impact scenario 3, Table 5 Offshore EIAR [Volume 3]: Technical Appendix 12.5: Population Modelling, a figure of 19.91 puffin mortalities). In this regard, impact scenario 5 (see Table 5) may be the most appropriate cumulative scenario to consider, modelling project-alone SeabORD outputs in-combination with these 19.91 puffin mortalities for Moray Firth developments (a cumulative total of 21.71 puffin mortalities).

PVA modelling demonstrates that the population consequences of this level of collision mortality (a reduction in end population size of 16.4%. Table 8) is still less than that already consented (a 27.6% reduction in end population size) determined not to constitute an adverse effect on site integrity (Scottish Ministers, 2019).

It is considered that the very minor levels of puffin mortality (1.80 birds) predicted by SeabORD for the Offshore Development make immaterial difference to the PVA outputs now available for the already consented Moray Firth wind farms. In this regard, the additional impacts arising from the Offshore Development do not alter the conclusion of **no adverse effect on site integrity** already determined by Scottish Ministers for puffin at North Caithness Cliffs SPA.

9.10.4 Summary

An assessment has been undertaken above for the species screened in for Appropriate Assessment (kittiwake, guillemot, puffin, razorbill, fulmar and peregrine). It is concluded that there will be **no adverse effect on site integrity**, either for the Offshore Development alone or in-combination with the other projects considered.

9.11 Hoy SPA

9.11.1 Site Description and Qualifying Species Screened In for Assessment

Details of this SPA can be found at https://sitelink.nature.scot/site/8513. The species screened in for assessment for this SPA were fulmar, guillemot, great skua, kittiwake and puffin.

9.11.2 Assessment of Adverse Effects Alone

This assessment considers collision impacts in respect of fulmar, great skua guillemot, kittiwake, and puffin, and displacement impacts in respect of fulmar, guillemot and great skua.

9.11.2.1 Fulmar

There were zero estimated collision mortalities in either the breeding or the non-breeding season for fulmar, therefore there was no further consideration of collision risk for the species at Hoy SPA. The estimated breeding season displacement mortalities for fulmar at the SPA are given in Table 18 of the Offshore EIAR (Volume 3): Technical Appendix 12.4: Displacement Analysis. These have been estimated using a displacement matrix (SNCB, 2017) with a 30% displacement rate and 1% mortality rate. The resulting displacement mortality estimate of 0.17 birds will not affect the viability of the SPA fulmar population and thus there is **no adverse effect on site integrity.**

9.11.2.2 Guillemot

Outcomes from the SeabORD modelling undertaken of the Offshore Development (Section 9.6.2.1) indicate that zero guillemot displacement mortalities are likely at Hoy SPA.

However, displacement assessment has also been undertaken using displacement matrices (SNCB, 2017). During the breeding season, the displacement mortalities thus assessed for birds associated with the Hoy SPA using a 60% displacement rate and 1% mortality rate gives an estimate of 0.39 birds (see Table 14 in the Offshore EIAR [Volume 3]: Technical Appendix 12.4: Displacement Analysis). Additional non-breeding mortalities have been apportioned following the NatureScot advice for guillemot (Section 4.3 of the Offshore EIAR (Volume 3): Technical Appendix 12.2: Connectivity and Apportioning) giving an estimate of 0.08 birds (60%/1%). This level of impact will not affect the viability of the SPA guillemot population and thus there is **no adverse effect on site integrity.**

9.11.2.3 Great skua

Great skua were only recorded in the PFOWF Array Area during the breeding season at minimal densities. Zero collision and displacement mortalities have therefore been estimated for great skua so there will be no effects on the viability of the SPA population and **no adverse effect on site integrity**.

9.11.2.4 Kittiwake

The estimated breeding season collision mortalities for kittiwake was apportioned between the key SPA breeding colonies using the weightings derived from NatureScot (2018) guidance (Offshore EIAR [Volume 3]: Technical Appendix 12.2: Connectivity and Apportioning). During the breeding season, collision mortalities for birds associated with this SPA were estimated at 0.030 birds (mean densities). This level of impact will not affect the viability of the SPA kittiwake population and thus there is **no adverse effect on site.**

9.11.2.5 Puffin

The estimated breeding season displacement mortalities for puffin were apportioned between the key SPA breeding colonies using the weightings derived from the Marine Scotland Apportioning Tool (Offshore EIAR [Volume 3]: Technical Appendix 12.2: Connectivity and Apportioning).

During the breeding season, displacement mortalities for birds associated with this SPA were assessed for 60% displacement rate and a 1% mortality rates; giving an estimate of 0.021 apportioned to this SPA. Zero predicted puffin mortalities are expected in the non-breeding season.

This level of impact will not affect the viability of the SPA puffin population and thus there is **no adverse effect on site integrity.**

9.11.3 Adverse Effects In-combination

Only project alone impacts are considered for the Offshore Development as the agreed projects screened in to the in-combination assessment do not impact on this SPA. There will therefore be **no adverse effects on site integrity** of this SPA arising from in-combination effects.

9.11.4 Summary

An assessment has been undertaken above for the species screened in for Appropriate Assessment (fulmar, guillemot, great skua, kittiwake, and puffin). It is concluded that there will be **no adverse effect on site integrity**, either for the site alone or in-combination with other projects.

9.12 Caithness and Sutherland Peatland SPA and Ramsar

9.12.1 Site Description and Qualifying Species Screened In for Assessment

Details of this SPA can be found at https://sitelink.nature.scot/site/8476. Details of the Ramsar site can be found at https://sitelink.nature.scot/site/8412. The species that was screened in for this site was red-throated diver.

9.12.2 Assessment of Adverse Effects Alone

This assessment considers displacement impacts in relation to red-throated diver.

9.12.2.1 Red-throated diver

According to the advice given by Furness *et al.,* (2013), red-throated divers are sensitive to potential displacement or barrier effect with operational WTGs but are considered to be at low risk of collision, with only up to 5% of birds flying at blade height.

The details of survey observations from the two years of digital aerial video survey are presented in Table 5 to Table 8 in the Offshore EIAR (Volume 3) Technical Appendix 12.1: Baseline Data. Table 9.19 below presents a summary of the sightings.

Table 9.19 Red-throated diver observations at the Offshore Development

Survey month / year	Red-throated Diver Observations	
	PFOWF Array Area	2 km Survey Buffer
September 2015	0	1
January 2021	1	0
June 2021	1	2

As observations are intermittent and recorded numbers so low, it has not been possible to derive site population estimates for the PFOWF Array Area plus 2 km buffer. Therefore, it is not possible to quantify a level of mortality to red-throated diver from either displacement or collision risk impacts, but it will effectively be zero.

There is no risk that the Offshore Development could affect the viability of the red-throated diver population at this SPA, and therefore there will be **no adverse effects on site integrity**.

As there is no risk that the Offshore Development could affect the viability of the red-throated diver population at this SPA, it will not add to any in-combination impacts with other projects, specifically considering collision risk or displacement mortalities arising from onshore wind farm developments. There will therefore be **no adverse effects on site integrity**.

9.12.3 In-combination Summary

An assessment has been undertaken above for the species screened in for Appropriate Assessment (red-throated diver). It is concluded that there will be **no adverse effect on site integrity**, either for the site alone or in-combination with other projects.

9.13 Cape Wrath SPA

9.13.1 Site Description and Qualifying Species Screened In for Assessment

Details of this SPA can be found at https://sitelink.nature.scot/site/8481. The species that were screened in for this SPA were fulmar, kittiwake, guillemot, razorbill and puffin.

9.13.2 Assessment of Adverse Effects Alone

This assessment considers collision impacts in relation to kittiwake and fulmar and displacement impacts in respect of guillemot, puffin, fulmar and razorbill.

9.13.2.1 Fulmar

There were zero estimated collision mortalities in either the breeding or the non-breeding season for fulmar, therefore there was no further consideration of collision risk for the species at this SPA. The estimated breeding season displacement mortalities for fulmar at the SPA are given in Table 18 of the Offshore EIAR (Volume 3): Technical Appendix 12.4: Displacement Analysis. These have been estimated using a displacement matrix (SNCB, 2017) with a 30% displacement rate and 1% mortality rate. The resulting displacement mortality estimate of 0.003 birds will not affect the viability of the SPA fulmar population and thus there is **no adverse effect on site integrity.**

9.13.2.2 Kittiwake

The estimated breeding season collision mortalities for kittiwake was apportioned between the key SPA breeding colonies using the weightings derived from NatureScot (2018) guidance (Offshore EIAR [Volume 3]: Technical Appendix 12.2: Connectivity and Apportioning).

During the breeding season, collision mortalities for birds associated with the Cape Wrath SPA were estimated at 0.18 birds (mean densities) and 0.30 birds (maximum densities).

This level of impact will not affect the viability of the SPA kittiwake population and thus there is **no adverse effect on site integrity**.

9.13.2.3 Guillemot

The estimated breeding season displacement mortalities for guillemot were apportioned between the key SPA breeding colonies using the weightings derived from the Marine Scotland Apportioning Tool (Offshore EIAR [Volume 3]: Technical Appendix 12.2: Connectivity and Apportioning).

During the breeding season, displacement mortalities for birds associated with the Cape Wrath SPA were assessed for 60% displacement rate and 1% mortality rates, giving a displacement mortality estimate of 0.119 birds, which is below the 0.2% baseline mortality threshold.

During the non-breeding season, displacement mortalities for birds associated with the Cape Wrath SPA were assessed for 60% displacement rate and 1% mortality rates, giving a displacement mortality estimate of 0.368 birds.

This level of impact will not affect the viability of the SPA guillemot population and thus there is **no adverse effect on site integrity**.

9.13.2.4 Razorbill

The estimated breeding season displacement mortalities for guillemot were apportioned between the key SPA breeding colonies using the weightings derived from the Marine Scotland Apportioning Tool (Technical Appendix 12.2: Connectivity and Apportioning).

During the breeding season, displacement mortalities for birds associated with the Cape Wrath SPA were assessed for 60% displacement rate and a 1% mortality rate, giving a mortality estimate of 0.058. Zero predicted razorbill mortalities are expected in the non-breeding season.

This level of impact will not affect the viability of the SPA razorbill population and thus there is **no adverse effect on site integrity**.

9.13.2.5 Puffin

The estimated breeding season displacement mortalities for puffin were apportioned between the key SPA breeding colonies using the weightings derived from the Marine Scotland Apportioning Tool (Offshore EIAR [Volume 3]: Technical Appendix 12.2: Connectivity and Apportioning).

During the breeding season, displacement mortalities for birds associated with this SPA were assessed for 60% displacement rate and 1% mortality rates; giving an estimate of 0.049 birds apportioned to this SPA. Zero predicted puffin mortalities are expected in the non-breeding season.

This level of impact will not affect the viability of the SPA puffin population and thus there is **no adverse effect on site integrity**.

9.13.3 Assessment of Adverse Effects In-combination

Only project alone impacts are considered for the Offshore Development as the agreed projects screened in to the in-combination assessment do not impact on this SPA. There will therefore be **no adverse effects on site integrity** of this SPA arising from in-combination effects.

9.13.4 Summary

An assessment has been undertaken above for the species screened in for Appropriate Assessment (fulmar, guillemot, kittiwake, puffin and razorbill). It is concluded that there will be **no adverse effect on site integrity**, either for the site alone or in-combination with other projects.

9.14 Sule Skerry and Sule Stack SPA

9.14.1 Site Description and Qualifying Species Screened In for Assessment

Details of this SPA can be found at https://sitelink.nature.scot/site/8581. The species that were screened in were gannet, puffin, guillemot, Leach's petrel, and storm petrel.

9.14.2 Assessment of Adverse Effects Alone

This assessment considers collision impacts in relation to gannet, storm petrel and Leach's petrel and displacement in respect to puffin and guillemot.

9.14.2.1 Gannet

The estimated breeding season collision mortalities for gannet (mean and max densities) and displacement mortalities were apportioned between the key SPA breeding colonies using the weightings derived from NatureScot (2018) guidance and the Marine Scotland Apportioning Tool respectively (Offshore EIAR [Volume 3]: Technical Appendix 12.2: Connectivity and Apportioning).

During the breeding season, collision mortalities for birds associated with the Sule Skerry and Sule Stack SPA were estimated at 1.05 birds (mean densities) and 2.10 birds (maximum densities).

Displacement mortalities during the breeding season for birds associated with the Sule Skerry and Sule Stack SPA were assessed for 70% displacement rate and 1% mortality rate, giving a mortality estimate of 0.53 birds apportioned to this SPA.

This level of impact will not affect the viability of the SPA gannet population and thus there is **no adverse effect on site integrity**.

9.14.2.2 Puffin

The estimated breeding season displacement mortalities for puffin were apportioned between the key SPA breeding colonies using the weightings derived from the Marine Scotland Apportioning Tool (Offshore EIAR [Volume 3]: Technical Appendix 12.2: Connectivity and Apportioning).

During the breeding season, displacement mortalities for birds associated with the Sule Skerry and Sule Stack SPA were assessed for 60% displacement rate and 1% mortality rate (for the PFOWF Array Area alone), which gave a displacement mortality estimate of 1.97 birds apportioned to the SPA (Offshore EIAR [Volume 3]: Technical Appendix 12.4: Displacement Analysis), which is less than the Zero predicted puffin mortalities are expected in the non-breeding season.

This level of impact will not affect the viability of the SPA puffin population and thus there is **no adverse effect on site integrity**.

9.14.2.3 Guillemot

The estimated breeding season displacement mortalities for guillemot were apportioned between the key SPA breeding colonies using the weightings derived from the Marine Scotland Apportioning Tool (Offshore EIAR [Volume 3]: Technical Appendix 12.2: Connectivity and Apportioning).

During the breeding season, displacement mortalities for birds associated with this SPA were assessed for 60% displacement rate and 1% mortality rate; which gives an estimate of 0.028 apportioned to this SPA. Predicted displacement scenarios were under the 0.2% baseline mortality threshold.

During the non-breeding season, displacement mortalities for birds associated with this SPA were assessed for 60% displacement rate and 1% mortality rate, giving an estimate of 0.104 apportioned to this SPA.

This level of impact will not affect the viability of the SPA guillemot population and thus there is **no adverse effect on site integrity**.

9.14.2.4 Storm petrel

A qualitative assessment has been undertaken for this species in Section 9.6.3. This concludes the level of impact will not affect the viability of the SPA storm petrel population and thus there is **no adverse effect on site integrity**.

9.14.2.5 Leach's petrel

A qualitative assessment has been undertaken for this species in Section 9.6.3. This concludes the level of impact will not affect the viability of the SPA Leach's petrel population and thus there is **no adverse effect on site integrity**.

9.14.3 Assessment of Adverse Effects In-combination

Only project alone impacts are considered for the Offshore Development as the agreed projects screened in to the in-combination assessment do not impact on this SPA. There will therefore be **no adverse effects on site integrity** of this SPA arising from in-combination effects.

9.14.4 Summary

An assessment has been undertaken above for the species screened in for Appropriate Assessment (gannet, puffin, guillemot, storm petrel and Leach's petrel). It is concluded that there will be **no adverse effect on site integrity**, either for the site alone or in-combination with other projects.

9.15 Marwick Head SPA

9.15.1 Site Description and Qualifying Species Screened In for Assessment

Details of this SPA can be found at https://sitelink.nature.scot/site/8544. The species that were screened in were guillemot and kittiwake.

9.15.2 Assessment of Adverse Effects Alone

This assessment considers collision impacts in relation to kittiwake and displacement impacts in respect to guillemot.

9.15.2.1 Kittiwake

The estimated breeding season collision mortality for kittiwake were apportioned between the key SPA breeding colonies using the weightings derived from the Marine Scotland Apportioning Tool (Offshore EIAR (Volume 3: Technical Appendix 12.2: Connectivity and Apportioning).

During the breeding season, collision mortalities for birds associated with the Marwick Head SPA were estimated at 0.18 birds (mean densities) and 0.30 birds (maximum densities). The level of impact will not affect the viability of the SPA kittiwake population and thus there is **no adverse effect on site integrity**.

9.15.2.2 Guillemot

Estimated guillemot displacement mortalities in the breeding season were apportioned between key SPAs using the weightings derived from the Marine Scotland Apportioning Tool (Offshore EIAR [Volume 3]: Technical Appendix 12.2: Connectivity and Apportioning). In the non-breeding season, mortality estimates were apportioned between SPAs following the method advised for guillemot by NatureScot as set out in Section 4.3 of the Offshore EIAR (Volume 3): Technical Appendix 12.2: Connectivity and Apportioning.

During the breeding season, displacement mortalities for birds associated with the Marwick Head SPA were assessed with 60% displacement rates and 1%mortality rate of 0.315 birds apportioned to the SPA. In the non-breeding season, displacement mortalities were assessed with 60% displacement and 1% mortality rates to give a predicted estimate of 0.15 birds.

The level of impact will not affect the viability of the SPA guillemot population and thus there is **no adverse effect on site integrity**.

9.15.3 Assessment of Adverse Effects In-combination

Only project alone impacts are considered for the Offshore Development as the agreed projects screened in to the in-combination assessment do not impact on this SPA. There will therefore be **no adverse effects on site integrity** of this SPA arising from in-combination effects.

9.15.4 Summary

An assessment has been undertaken above for the species screened in for Appropriate Assessment (guillemot and kittiwake). It is concluded that there will be **no adverse effect on site integrity**, either for the site alone or in-combination with other projects.

9.16 East Caithness Cliffs SPA

9.16.1 Site Description and Qualifying Species Screened In for Assessment

Details of this SPA can be found at https://sitelink.nature.scot/site/8492. The species that were screened in were kittiwake, guillemot, razorbill and fulmar.

9.16.2 Assessment of Adverse Effects Alone

This assessment considers collision impacts in relation to kittiwake and fulmar and displacement impacts in respect to fulmar, guillemot and razorbill.

9.16.2.1 Kittiwake

The estimated breeding season collision mortalities for kittiwake (mean and max densities) were apportioned between the key SPA breeding colonies using the weightings derived from NatureScot (2018) guidance and (Offshore EIAR [Volume 3]: Technical Appendix 12.2: Connectivity and Apportioning).

During the breeding season, collision mortalities for birds associated with the East Caithness Cliffs SPA were estimated at 0.56 birds with displacement mortalities estimated at 0.16 birds (at a 30% displacement rate and 1% mortality rate). This level of impact will not affect the viability of the SPA kittiwake population and thus there is **no adverse effect on site integrity**.

9.16.2.2 Guillemot

The estimated breeding season displacement mortalities for guillemot were apportioned between the key SPA breeding colonies using the weightings derived from the Marine Scotland Apportioning Tool (Offshore EIAR [Volume 3]: Technical Appendix 12.2: Connectivity and Apportioning).

During the breeding season, displacement mortalities for birds associated with the East Caithness Cliffs SPA were assessed for 60% displacement and 1% mortality rates, giving a displacement mortality estimate of 0.29 birds.

During the non-breeding season, displacement mortalities for birds associated with East Caithness Cliffs SPA were assessed for 60% displacement rate and a 1% mortality rate, giving a mortality estimate of 1.44 birds. This level of impact will not affect the viability of the SPA guillemot population and thus there is **no adverse effect on site integrity**.

9.16.2.3 Razorbill

The estimated breeding season displacement mortalities for razorbill were apportioned between the key SPA breeding colonies using the weightings derived from the Marine Scotland Apportioning Tool (Offshore EIAR [Volume 3]: Technical Appendix 12.2: Connectivity and Apportioning).

During the breeding season, displacement mortalities for birds associated with the East Caithness Cliffs SPA were assessed for 60% displacement rate and 1% mortality rate, which gave 0.32 birds apportioned to this SPA. Zero predicted mortalities were estimated for the non-breeding season.

This level of impact will not affect the viability of the SPA razorbill population and thus there is **no adverse effect on site integrity**.

9.16.2.4 Fulmar

There were zero estimated collision mortalities in either the breeding or the non-breeding season for fulmar. The estimated breeding season displacement mortalities for fulmar at the SPA are presented in the Offshore EIAR (Volume 3): Technical Appendix 12.4: Displacement Analysis. These have been estimated using a displacement matrix (SNCB, 2017) with a 30% displacement rate and 1% mortality rate. The resulting displacement mortality estimate of 0.018 birds will not affect the viability of the SPA fulmar population and thus there is **no adverse effect on site integrity**.

9.16.3 Assessment of Adverse Effects In-combination

In previously considering in-combination impacts for the Moray West appropriate assessment (involving Beatrice and Moray East), the Scottish Ministers took into account the SPA conservation objectives, the population at the site, the predicted levels of effect, the population consequences and the levels of precaution in assessment (Scottish Ministers, 2019). They took the view that use of precautionary assumptions *"*make it unlikely the number of impacted individuals will be as large as the values presented in the assessment" and that, in relation to cumulative kittiwake mortalities, "there will be no adverse effect on the site integrity of East Caithness Cliffs SPA" allowing them to *"*consider the levels of assessed impact to be reasonable" and to be *"*convinced that there will be no adverse impacts on site integrity of any of the SACs, SPAs or the pSPA considered*"*.

Given the very minor additional impacts predicted to arise from the Offshore Development in relation to all the SPA species considered (above), it is not considered that it will have any significant effect on their population viability and therefore will result in **no adverse effect on site integrity** in combination with the Moray Firth wind farms (as already consented).

9.16.4 Summary

An assessment has been undertaken above for the species screened in for Appropriate Assessment (kittiwake, guillemot, fulmar and razorbill). It is concluded that there will be **no adverse effect on site integrity**, either for the site alone or in-combination with other projects.

9.17 Copinsay SPA

9.17.1 Site Description and Qualifying Species Screened In for Assessment

Details of this SPA can be found at https://sitelink.nature.scot/site/8485. The species that were screened in for this site were kittiwake, guillemot and fulmar.

9.17.2 Assessment of Adverse Effects Alone

This assessment considers collision impacts in relation to kittiwake and fulmar and displacement impacts in respect to fulmar and guillemot.

9.17.2.1 Kittiwake

The estimated breeding season collision mortalities (mean and max densities) were apportioned between the key SPA breeding colonies using the weightings derived from NatureScot (2018) guidance (Offshore EIAR [Volume 3]: Technical Appendix 12.2: Connectivity and Apportioning).

During the breeding season, collision mortalities for birds associated with this SPA were estimated at 0.012.

This level of impact will not affect the viability of the SPA kittiwake population and thus there is **no adverse effect on site integrity**.

9.17.2.2 Guillemot

The estimated breeding season displacement mortalities for guillemot were apportioned between the key SPA breeding colonies using the weightings derived from the Marine Scotland Apportioning Tool (Offshore EIAR [Volume 3]: Technical Appendix 12.2: Connectivity and Apportioning).

During the breeding season, displacement mortalities for birds associated with this SPA were assessed for 60% displacement rate and 1% mortality rate, giving an estimate of 0.028 guillemot mortalities apportioned to this SPA.

During the non-breeding season, displacement mortalities for birds associated with this SPA were assessed for 60% displacement rate and 1% mortality rate, giving an estimate of 0.076 guillemot mortalities apportioned to this SPA.

The level of impact will not affect the viability of the SPA guillemot population and thus there is **no adverse effect on site integrity**.

9.17.2.3 Fulmar

There were zero estimated collision mortalities in either the breeding or the non-breeding season for fulmar, therefore there was no further consideration of collision risk for the species at this SPA. The estimated breeding season displacement mortalities for fulmar at the SPA are presented in the Offshore EIAR (Volume 3): Technical Appendix 12.4: Displacement Analysis. These have been estimated using a displacement matrix (SNCB, 2017) with a 30% displacement rate and 1% mortality rate. The resulting displacement mortality estimate of 0.003 birds will not affect the viability of the SPA fulmar population and thus there is **no adverse effect on site integrity**.

9.17.3 Assessment of Adverse Effects In-combination

Only project alone impacts are considered for the Offshore Development as the agreed projects screened in to the in-combination assessment do not impact on this SPA. There will therefore be **no adverse effects on site integrity** of this SPA arising from in-combination effects.

9.17.4 Summary

An assessment has been undertaken above for the species screened in for Appropriate Assessment (fulmar, guillemot and kittiwake). It is concluded that there will be **no adverse effect on site integrity**, either for the site alone or in-combination with other projects.

9.18 Rousay SPA

9.18.1 Site Description and Qualifying Species Screened In for Assessment

Details of this SPA can be found at https://sitelink.nature.scot/site/8573. The species that were screened in were kittiwake, guillemot and fulmar.

9.18.2 Assessment of Adverse Effects Alone

This assessment considers collision impacts in relation to kittiwake and fulmar and displacement in respect to fulmar and guillemot.

9.18.2.1 Kittiwake

The estimated breeding season collision mortalities (mean and max densities) were apportioned between the key SPA breeding colonies using the weightings derived from NatureScot (2018) guidance (Offshore EIAR [Volume 3]: Technical Appendix 12.2: Connectivity and Apportioning).

During the breeding season, collision mortalities for birds associated with this SPA were estimated at 0.026.

The level of impact will not affect the viability of the SPA kittiwake population and thus there is **no adverse effect on site integrity**.

9.18.2.2 Guillemot

The estimated breeding season displacement mortalities for guillemot were apportioned between the key SPA breeding colonies using the weightings derived from the Marine Scotland Apportioning Tool (Offshore EIAR [Volume 3]: Technical Appendix 12.2: Connectivity and Apportioning).

During the breeding season, displacement mortalities for birds associated with this SPA were assessed for 60% displacement rate and 1%mortality rate, giving an estimate of 0.014 apportioned to this SPA.

During the non-breeding season, displacement mortalities for birds associated with this SPA were assessed for 60% displacement rate and 1%mortality rates, giving an estimate of 0.084 apportioned to this SPA.

The level of impact will not affect the viability of the SPA guillemot population and thus there is **no adverse effect on site integrity**.

9.18.2.3 Fulmar

There were zero estimated collision mortalities in either the breeding or the non-breeding season for fulmar, therefore there was no further consideration of collision risk for the species at this SPA. The estimated breeding season displacement mortalities for fulmar at the SPA are presented in the Offshore EIAR (Volume 3): Technical Appendix 12.4: Displacement Analysis. These have been estimated using a displacement matrix (SNCB, 2017) with a 30% displacement rate and 1% mortality rate. The resulting displacement mortality estimate of 0.003 birds will not affect the viability of the SPA fulmar population and thus there is **no adverse effect on site integrity**.

9.18.3 Assessment of Adverse Effects In-combination

Only project alone impacts are considered for the Offshore Development as the agreed projects screened in to the in-combination assessment do not impact on this SPA. There will therefore be **no adverse effects on site integrity** of this SPA arising from in-combination effects.

9.18.4 Summary

An assessment has been undertaken above for the species screened in for Appropriate Assessment (fulmar, guillemot and kittiwake). It is concluded that there will be **no adverse effect on site integrity**, either for the site alone or in-combination with other projects.

9.19 West Westray SPA

9.19.1 Site Description and Qualifying Species Screened In for Assessment

Details of this SPA can be found at https://sitelink.nature.scot/site/8589. The species that were screened in were kittiwake, fulmar, guillemot and razorbill.

9.19.2 Assessment of Adverse Effects Alone

This assessment considers collision impacts in relation to kittiwake and fulmar and displacement impacts were considered for fulmar, guillemot and razorbill.

9.19.2.1 Kittiwake

The estimated breeding season collision mortalities (mean and max densities) were apportioned between the key SPA breeding colonies using the weightings derived from NatureScot (2018) guidance (Offshore EIAR [Volume 3]: Technical Appendix 12.2: Connectivity and Apportioning).

During the breeding season, collision mortalities for birds associated with the West Westray SPA were estimated at 0.44 birds (mean densities) and 0.76 birds (maximum densities).

The level of impact will not affect the viability of the SPA kittiwake population and thus there is **no adverse effect on site integrity**.

9.19.2.2 Fulmar

There were zero estimated collision mortalities in either the breeding or the non-breeding season for fulmar, therefore there was no further consideration of collision risk for the species at West Westray SPA. The estimated breeding season displacement mortalities for fulmar at the SPA are presented in the Offshore EIAR (Volume 3): Technical Appendix 12.4: Displacement Analysis. These have been estimated using a

displacement matrix (SNCB, 2017) with a 30% displacement rate and 1% mortality rate. The resulting displacement mortality estimate of 0 birds will not affect the viability of the SPA fulmar population. This concludes the level of impact will not affect the viability of the SPA fulmar population and thus there is **no adverse effect on site integrity**.

9.19.2.3 Guillemot

The estimated breeding season displacement mortalities for guillemot were apportioned between the key SPA breeding colonies using the weightings derived from the Marine Scotland Apportioning Tool (Offshore EIAR [Volume 3]: Technical Appendix 12.2: Connectivity and Apportioning).

During the breeding season, displacement mortalities for birds associated with this SPA were assessed for 60% displacement rate and 1%mortality rate, giving an estimate of 0.15 apportioned to this SPA.

During the non-breeding season, displacement mortalities for birds associated with this SPA were assessed for 60% displacement rate and 1%mortality rate, giving an estimate of 0.46 apportioned to this SPA.

The level of impact will not affect the viability of the SPA guillemot population and thus there is **no adverse effect on site integrity**.

9.19.2.4 Razorbill

The estimated breeding season displacement mortalities for razorbill were apportioned between the key SPA breeding colonies using the weightings derived from Marine Scotland Apportioning Tool (Offshore EIAR [Volume 3]: Technical Appendix 12.2: Connectivity and Apportioning).

During the breeding season, displacement mortalities for birds associated with this SPA were assessed for 60% displacement rate and 1% mortality rate, giving an estimate of 0.030 apportioned to this SPA. There were zero predicted displacement mortalities for razorbill in the non-breeding season.

This level of impact is therefore considered to result in **no adverse effect on site integrity** for this species.

9.19.3 Assessment of Adverse Effects In-combination

Only project alone impacts are considered for the Offshore Development as the agreed projects screened in to the in-combination assessment do not impact on this SPA. There will therefore be **no adverse effects on site integrity** of this SPA arising from in-combination effects.

9.19.4 Summary

An assessment has been undertaken above for the species screened in for Appropriate Assessment (fulmar, kittiwake, guillemot and razorbill). It is concluded that there will be **no adverse effect on site integrity**, either for the site alone or in-combination with other projects.

9.20 Auskerry SPA

9.20.1 Site Description and Qualifying Species Screened In for Assessment

Details of this SPA can be found at https://sitelink.nature.scot/site/8466. The species that was screened in for this site was storm petrel.

9.20.2 Assessment of Adverse Effects Alone

This assessment considers displacement impacts for storm petrel.

9.20.2.1 Storm Petrel

A qualitative assessment has been undertaken for this species in Section 9.6.3. This concludes that the level of impacts are not considered to result in an adverse effect on site integrity for this species.

9.20.3 Assessment of Adverse Effects In-combination

Only project alone impacts are considered for the Offshore Development as the agreed projects screened in to the in-combination assessment do not impact on this SPA. There will therefore **be no adverse effects on site integrity** of this SPA arising from in-combination effects.

9.20.4 Summary

An assessment has been undertaken above for the species screened in for Appropriate Assessment (storm petrel. It is concluded that there will be **no adverse effect on site integrity**, either for the site alone or in-combination with other projects.

9.21 Handa SPA

9.21.1 Site Description and Qualifying Species Screened In for Assessment

Details of this SPA can be found at https://sitelink.nature.scot/site/8511. The species that were screened in for this site were skua, razorbill, fulmar, guillemot and kittiwake.

9.21.2 Assessment of Adverse Effects Alone

Assessment considers collision impacts in relation to great skua, fulmar and kittiwake and displacement impacts in respect of razorbill and guillemot.

9.21.2.1 Great skua

Great skua were only recorded in the PFOWF Array Area during the breeding season at minimal densities. Zero collision and displacement mortalities have therefore been estimated for great skua so there will be no effects on the viability of the SPA population and **no adverse effect on site integrity**.

9.21.2.2 Razorbill

The estimated breeding season displacement mortalities for razorbill were apportioned between the key SPA breeding colonies using the weightings derived from Marine Scotland Apportioning Tool (Offshore EIAR [Volume 3]: Technical Appendix 12.2: Connectivity and Apportioning).

During the breeding season, displacement mortalities for birds associated with the Handa SPA were assessed with 60% displacement rates and 1% mortality rate, giving a predicted displacement mortality of 0.318 birds apportioned to this SPA. There were zero predicted displacement mortalities for razorbill in the non-breeding season.

This level of impact will not affect the viability of the SPA razorbill population and thus there is **no adverse effect on site integrity**.

9.21.2.3 Guillemot

The estimated breeding season displacement mortalities for razorbill were apportioned between the key SPA breeding colonies using the weightings derived from Marine Scotland Apportioning Tool (Offshore EIAR [Volume 3]: Technical Appendix 12.2: Connectivity and Apportioning). Non-breeding season mortality estimates are apportioned between SPAs following the method advised for guillemot by NatureScot as set out in Section 4.3 of the same document.

During the breeding season, displacement mortalities for birds associated with the Handa SPA were assessed with 60% displacement rates and 1% mortality rate, giving a predicted displacement mortality of 0.24 birds apportioned to this SPA. Levels of predicted impact were not deemed to be significant. In the non-breeding season, displacement mortalities were assessed with 60% displacement rates and 1% mortality rate, giving a predicted displacement mortality of 0.51 apportioned birds.

This level of impact will not affect the viability of the SPA guillemot population and thus there is **no adverse effect on site integrity**.

9.21.2.4 Fulmar

There were zero estimated collision or displacement mortalities in either the breeding or the non-breeding season for fulmar, therefore there was no further consideration of collision risk for the species at this SPA. This level of impact will not affect the viability of the SPA fulmar population and thus there is **no adverse effect on site integrity**.

9.21.2.5 Kittiwake

The estimated breeding season collision mortalities (mean and max densities) were apportioned between the key SPA breeding colonies using the weightings derived from NatureScot (2018) guidance (Offshore EIAR [Volume 3]: Technical Appendix 12.2: Connectivity and Apportioning).

During the breeding season, collision mortalities for birds associated with this SPA were estimated at 0.01.

This level of impact will not affect the viability of the SPA kittiwake population and thus there is **no adverse effect on site integrity**.

9.21.3 Assessment of Adverse Effects In-combination

Only project alone impacts are considered for the Offshore Development as the agreed projects screened in to the in-combination assessment do not impact on this SPA. There will therefore be no **adverse effects on site integrity** of this SPA arising from in-combination effects.

9.21.4 Summary

An assessment has been undertaken above for the species screened in for Appropriate Assessment (great skua, razorbill, guillemot, fulmar and kittiwake). It is concluded that there will be **no adverse effect on site integrity**, either for the site alone or in-combination with other projects.

9.22 Calf of Eday SPA

9.22.1 Site Description and Qualifying Species Screened In for Assessment

Details of this SPA can be found at https://sitelink.nature.scot/site/8478. The species that were screened in for this site were kittiwake, guillemot and fulmar.

9.22.2 Assessment of Adverse Effects Alone

This assessment considers collision impacts in relation to kittiwake and fulmar and displacement impacts were considered for fulmar and guillemot.

9.22.2.1 Kittiwake

The estimated breeding season collision mortalities (mean and max densities) were apportioned between the key SPA breeding colonies using the weightings derived from NatureScot (2018) guidance (Offshore EIAR [Volume 3]: Technical Appendix 12.2: Connectivity and Apportioning).

During the breeding season, collision mortalities for birds associated with this SPA were estimated at <0.01.

This level of impact will not affect the viability of the SPA kittiwake population and thus there is **no adverse effect on site integrity**.

9.22.2.2 Guillemot

The estimated breeding season displacement mortalities for guillemot were apportioned between the key SPA breeding colonies using the weightings derived from the Marine Scotland Apportioning Tool (Offshore EIAR [Volume 3]: Technical Appendix 12.2: Connectivity and Apportioning).

During the breeding season, displacement mortalities for birds associated with this SPA were assessed for 60% displacement rate and 1% mortality rate, giving an estimate of <0.01 apportioned to this SPA.

During the non-breeding season, displacement mortalities for birds associated with this SPA were assessed for 60% displacement rate and 1% mortality rate, giving an estimate of 0.08 apportioned to this SPA.

This level of impact will not affect the viability of the SPA guillemot population and thus there is **no adverse effect on site integrity**.

9.22.2.3 Fulmar

There were zero estimated collision or displacement mortalities in either the breeding or the non-breeding season for fulmar, therefore there was no further consideration of collision risk for the species at this SPA. This level of impact is therefore considered to result in **no adverse effect on site integrity** for this species.

9.22.3 Assessment of Adverse Effects In-combination

Only project alone impacts are considered for the Offshore Development as the agreed projects screened in to the in-combination assessment do not impact on this SPA. This level of impact will not affect the viability of the SPA fulmar population and thus there is **no adverse effect on site integrity**.

9.22.4 Summary

An assessment has been undertaken above for the species screened in for Appropriate Assessment (guillemot, kittiwake and fulmar). It is concluded that there will be **no adverse effect on site integrity**, either for the site alone or in-combination with other projects.

9.23 Priest Island SPA

9.23.1 Site Description and Qualifying Species Screened In for Assessment

Details of this SPA can be found at https://sitelink.nature.scot/site/8567. The species that was screened in for this site was storm petrel.

9.23.2 Assessment of Adverse Effects Alone

Assessment considers displacement impacts for storm petrel.

9.23.2.1 Storm petrel

A qualitative assessment has been undertaken for this species in Section 9.6.3. This level of impact will not affect the viability of the SPA storm petrel population and thus there is **no adverse effect on site integrity**.

9.23.3 Assessment of Adverse Effects In-combination

Only project alone impacts are considered for the Offshore Development as the agreed projects screened in to the in-combination assessment do not impact on this SPA. There will therefore **be no adverse effects on site integrity** of this SPA arising from in-combination effects.

9.23.4 Summary

An assessment has been undertaken above for the species screened in for Appropriate Assessment (storm petrel. It is concluded that there will be **no adverse effect on site integrity**, either for the site alone or in-combination with other projects.

9.24 North Rona Sula Sgeir SPA

9.24.1 Site Description and Qualifying Species Screened In for Assessment

Details of this SPA can be found at https://sitelink.nature.scot/site/8558. The species screened in for this site were storm petrel, Leach's petrel, fulmar, kittiwake, puffin, and razorbill.

9.24.2 Assessment of Adverse Effects Alone

This assessment considers collision impacts in relation to gannet, kittiwake and fulmar and displacement impacts in respect of puffin and razorbill.

9.24.2.1 Gannet

The estimated breeding season collision mortalities (mean and max densities) and displacement mortalities were apportioned between the key SPA breeding colonies using the weightings derived from NatureScot (2018) guidance and the Marine Scotland Apportioning Tool respectively (Offshore EIAR [Volume 3]: Technical Appendix 12.2: Connectivity and Apportioning).

During the breeding season, collision mortalities for birds associated with the North Rona and Sula Sgeir SPA were estimated at 0.20 birds (mean densities) and 0.41 birds (maximum densities).

Displacement mortalities for gannet associated with the SPA were assessed with 70% displacement rates and 1%, giving a predicted displacement mortality of 0.10. There were zero predicted displacement mortalities for gannet in the non-breeding season.

This level of impact will not affect the viability of the SPA gannet population and thus there is **no adverse effect on site integrity**.

9.24.2.2 Storm petrel

A qualitative assessment has been undertaken for this species in Section 9.6.3. This level of impact will not affect the viability of the SPA storm petrel population and thus there is **no adverse effect on site integrity**.

9.24.2.3 Leach's petrel

A qualitative assessment has been undertaken for this species in Section 9.6.3. This level of impact will not affect the viability of the SPA Leach's petrel population and thus there is **no adverse effect on site integrity**.

9.24.2.4 Kittiwake

The estimated breeding season collision mortalities (mean and max densities) were apportioned between the key SPA breeding colonies using the weightings derived from NatureScot (2018) guidance (Offshore EIAR [Volume 3]: Technical Appendix 12.2: Connectivity and Apportioning).

During the breeding season, collision mortalities for birds associated with this SPA were estimated at <0.01.

This level of impact will not affect the viability of the SPA kittiwake population and thus there is **no adverse effect on site integrity**.

9.24.2.5 Fulmar

There were zero estimated collision mortalities in either the breeding or the non-breeding season for fulmar, therefore there was no further consideration of collision risk for the species at this SPA. This level of impact will not affect the viability of the SPA fulmar population and thus there is **no adverse effect on site integrity**.

9.24.2.6 Puffin

The estimated breeding season displacement mortalities for puffin were not included in NatureScot (2018) apportioning calculations undertaken by HiDef due to an out-of-date population count (Offshore EIAR [Volume 3]: Technical Appendix 12.2: Connectivity and Apportioning). However, given the distance of the SPA to the PFOWF is similar to that of Fair Isle, a similar level of apportioning would be expected, which would give an annual apportioned displacement mortality estimate of <0.1 individual.

This level of impact will not affect the viability of the SPA puffin population and thus there is **no adverse effect on site integrity**.

9.24.2.7 Razorbill

The estimated breeding season displacement mortalities for razorbill were apportioned between the key SPA breeding colonies using the weightings derived from Marine Scotland Apportioning Tool (Offshore EIAR [Volume 3]: Technical Appendix 12.2: Connectivity and Apportioning).

During the breeding season, displacement mortalities for birds associated with this SPA were assessed for 60% displacement rate and 1% mortality rate, giving an estimate of 0.002 apportioned to this SPA.

9.24.3 Assessment of Adverse Effects In-combination

Only project alone impacts are considered for the Offshore Development as the agreed projects screened in to the in-combination assessment do not impact on this SPA. There will therefore be **no adverse effects on site integrity** of this SPA arising from in-combination effects.

9.24.4 Summary

An assessment has been undertaken above for the species screened in for Appropriate Assessment (fulmar, gannet, kittiwake, puffin, razorbill, storm petrel and Leach's petrel). It is concluded that there will be **no adverse effect on site integrity**, either for the site alone or in-combination with other projects.

9.25 Fair Isle SPA

9.25.1 Site Description and Qualifying Species Screened In for Assessment

Details of this SPA can be found at https://sitelink.nature.scot/site/8496. The species screened in for this site were gannet, skua, kittiwake, fulmar, puffin.

9.25.2 Assessment of Adverse Effects Alone

Assessment considers collision impacts in relation to gannet, great skua, kittiwake and fulmar and displacement impacts were considered for fulmar and puffin.

9.25.2.1 Gannet

The estimated breeding season collision mortalities (mean and max densities) and displacement mortalities were apportioned between the key SPA breeding colonies using the weightings derived from NatureScot (2018) guidance and the Marine Scotland Apportioning Tool respectively (Offshore EIAR [Volume 3]: Technical Appendix 12.2: Connectivity and Apportioning).

During the breeding season, collision mortalities for birds associated with the Fair Isle SPA were estimated at 0.05 birds (mean densities) and 0.11 birds (maximum densities).

Displacement mortalities for gannet associated with the SPA were assessed with 70% displacement rates and 1% mortality rate, giving a predicted displacement mortality of 0.027 birds apportioned to this SPA. There were zero predicted displacement mortalities for gannet in the non-breeding season.

This level of impact will not affect the viability of the SPA gannet population and thus there is **no adverse effect on site integrity**.

9.25.2.2 Great Skua

Great skua were only recorded in the PFOWF Array Area during the breeding season at minimal densities. Zero collision mortalities have therefore been estimated for great skua

There will be no effect on the viability of the SPA population **no adverse effect on site integrity**.

9.25.2.3 Kittiwake

The estimated breeding season collision mortalities (mean and max densities) were apportioned between the key SPA breeding colonies using the weightings derived from NatureScot (2018) guidance (Offshore EIAR [Volume 3]: Technical Appendix 12.2: Connectivity and Apportioning).

During the breeding season, there were zero collision mortalities for birds associated with this SPA. There will therefore be no effect on the viability of the SPA kittiwake population and **no adverse effect on site integrity**.

9.25.2.4 Fulmar

There were zero estimated collision mortalities in either the breeding or the non-breeding season for fulmar, therefore there was no further consideration of collision risk for the species at this SPA. The estimated breeding season displacement mortalities for fulmar at the SPA are presented in the Offshore EIAR (Volume 3): Technical Appendix 12.4: Displacement Analysis. These have been estimated using a displacement matrix (SNCB, 2017) with a 30% displacement rate and 1% mortality rate. The resulting displacement mortality estimate of 0.009 birds will not affect the viability of the SPA fulmar population. This concludes the level of impact will not affect the viability of the SPA fulmar population and thus there is **no adverse effect on site integrity**.

9.25.2.5 Puffin

The estimated breeding season displacement mortalities for puffin were apportioned between the key SPA breeding colonies using the weightings derived from the Marine Scotland Apportioning Tool (Offshore EIAR [Volume 3]: Technical Appendix 12.2: Connectivity and Apportioning).

During the breeding season, displacement mortalities for birds associated with this SPA were assessed for 60% displacement rate and 1% mortality rate, giving an estimate of 0.014 apportioned to this SPA. Zero predicted puffin mortalities are expected in the non-breeding season.

This level of impact will not affect the viability of the SPA puffin population and thus there is **no adverse effect on site integrity**.

9.25.3 Assessment of Adverse Effects In-combination

Only project alone impacts are considered for the Offshore Development as the agreed projects screened in to the in-combination assessment do not impact on this SPA. There will therefore be **no adverse effects on site integrity** of this SPA arising from in-combination effects.

9.25.4 Summary

An assessment has been undertaken above for the species screened in for Appropriate Assessment (gannet, great skua, kittiwake, fulmar, puffin). It is concluded that there will be **no adverse effect on site integrity**, either for the site alone or in-combination with other projects.

9.26 Troup, Pennan and Lion's Head SPA

9.26.1 Site Description and Qualifying Species Screened In for Assessment

Details of this SPA can be found at https://sitelink.nature.scot/site/8587. The species screened in for this site were fulmar, gannet, and kittiwake.

9.26.2 Assessment of Adverse Effects Alone

This assessment of collision and displacement impacts were considered for fulmar and kittiwake.

9.26.2.1 Fulmar

There were zero estimated collision or displacement mortalities in either the breeding or the non-breeding season for fulmar, therefore there was no further consideration of collision risk for the species at this SPA. This

level of impact will not affect the viability of the SPA fulmar population and thus there is **no adverse effect on site integrity**.

9.26.2.2 Kittiwake

The estimated breeding season collision mortalities (mean and max densities) were apportioned between the key SPA breeding colonies using the weightings derived from NatureScot (2018) guidance (Offshore EIAR [Volume 3]: Technical Appendix 12.2: Connectivity and Apportioning).

During the breeding season, collision mortalities for birds associated with this SPA were estimated at 0.01 birds (mean densities).

This level of impact will not affect the viability of the SPA kittiwake population and thus there is **no adverse effect on site integrity**.

9.26.3 Assessment of Adverse Effects In-combination

Only project alone impacts are considered for the Offshore Development as the agreed projects screened in to the in-combination assessment do not impact on this SPA. There will therefore be no adverse effects on site integrity of this SPA arising from in-combination effects.

9.26.4 Summary

An assessment has been undertaken above for the species screened in for Appropriate Assessment (fulmar, gannet, kittiwake). It is concluded that there will be **no adverse effect on site integrity**, either for the site alone or in-combination with other projects.

9.27 Foula SPA

9.27.1 Site Description and Qualifying Species Screened In for Assessment

Details of this SPA can be found at https://sitelink.nature.scot/site/8504. The species that were screened in for this site were great skua, Leach's petrel, fulmar, kittiwake, and puffin.

9.27.2 Assessment of Adverse Effects Alone

Assessment of collision impacts were considered for great skua, fulmar and kittiwake and displacement impacts in respect to fulmar and puffin.

9.27.2.1 Great skua

Great skua were only recorded in the PFOWF Array Area during the breeding season at minimal densities. Zero collision mortalities have therefore been estimated for great skua so there will be no effect on the viability of the SPA population and **no adverse effect on site integrity**.

9.27.2.2 Leach's petrel

A qualitative assessment has been undertaken for this species in Section 9.6.3. This level of impact will not affect the viability of the SPA Leach's petrel population and thus there is **no adverse effect on site integrity**.

9.27.2.3 Fulmar

There were zero estimated collision mortalities in either the breeding or the non-breeding season for fulmar. The estimated breeding season displacement mortalities for fulmar at the SPA are presented in the Offshore EIAR (Volume 3): Technical Appendix 12.4: Displacement Analysis. These have been estimated using a displacement matrix (SNCB, 2017) with a 30% displacement rate and 1% mortality rate. The resulting displacement mortality estimate of 0.003 birds will not affect the viability of the SPA fulmar population. This concludes the level of impact will not affect the viability of the SPA fulmar population and thus there is **no adverse effect on site integrity**.

9.27.2.4 Kittiwake

The estimated breeding season collision mortalities (mean and max densities) were apportioned between the key SPA breeding colonies using the weightings derived from NatureScot (2018) guidance (Offshore EIAR [Volume 3]: Technical Appendix 12.2: Connectivity and Apportioning).

During the breeding season, collision mortalities for birds associated with this SPA were estimated at <0.01.

This level of impact will not affect the viability of the SPA kittiwake population and thus there is **no adverse effect on site integrity**.

9.27.2.5 Puffin

The estimated breeding season displacement mortalities for puffin were apportioned between the key SPA breeding colonies using the weightings derived from the Marine Scotland Apportioning Tool (Offshore EIAR [Volume 3]: Technical Appendix 12.2: Connectivity and Apportioning).

During the breeding season, displacement mortalities for birds associated with this SPA were assessed for 60% displacement rate and 1%, giving an estimate of <0.01 apportioned to this SPA. Zero predicted puffin mortalities are expected in the non-breeding season.

This level of impact will not affect the viability of the SPA puffin population and thus there is **no adverse effect on site integrity**.

9.27.3 Assessment of Adverse Effects In-combination

Only project alone impacts are considered for the Offshore Development as the agreed projects screened in to the in-combination assessment do not impact on this SPA. There will therefore be **no adverse effects on site integrity** of this SPA arising from in-combination effects.

9.27.4 Summary

An assessment has been undertaken above for the species screened in for Appropriate Assessment (fulmar, great skua, kittiwake, puffin and Leach's petrel). It is concluded that there will be **no adverse effect on site integrity**, either for the site alone or in-combination with other projects.

9.28 Buchan Ness to Collieston Coast SPA

9.28.1 Site Description and Qualifying Species Screened In for Assessment

Details of this SPA can be found at https://sitelink.nature.scot/site/8473. The species screened in for this site were fulmar and kittiwake.

9.28.2 Assessment of Adverse Effects Alone

This assessment considers collision and displacement impacts in relation to fulmar and kittiwake.

9.28.2.1 Fulmar

There were zero estimated collision or displacement mortalities in either the breeding or the non-breeding season for fulmar, therefore there was no further consideration of collision risk for the species at this SPA. This level of impact will not affect the viability of the SPA fulmar population and thus there is **no adverse effect on site integrity**.

9.28.2.2 Kittiwake

The estimated breeding season collision mortalities (mean and max densities) were apportioned between the key SPA breeding colonies using the weightings derived from NatureScot (2018) guidance (Offshore EIAR [Volume 3]: Technical Appendix 12.2: Connectivity and Apportioning).

During the breeding season, collision mortalities for birds associated with this SPA were estimated at <0.01 birds.

This level of impact will not affect the viability of the SPA kittiwake population and thus there is **no adverse effect on site integrity**.

9.28.3 Assessment of Adverse Effects In-combination

Only project alone impacts are considered for the Offshore Development as the agreed projects screened in to the in-combination assessment do not impact on this SPA. There will therefore be **no adverse effects on site integrity** of this SPA arising from in-combination effects.

9.28.4 Summary

An assessment has been undertaken above for the species screened in for Appropriate Assessment (fulmar and kittiwake). It is concluded that there will be **no adverse effect on site integrity**, either for the site alone or in-combination with other projects.

9.29 Sumburgh Head SPA

9.29.1 Site Description and Qualifying Species Screened In for Assessment

Details of this SPA can be found at https://sitelink.nature.scot/site/8582. The species screened for this site were fulmar and kittiwake.

9.29.2 Assessment of Adverse Effects Alone

Assessment considers collision and displacement impacts in relation to fulmar and kittiwake.

9.29.2.1 Fulmar

There were zero estimated collision or displacement mortalities in either the breeding or the non-breeding season for fulmar, therefore there was no further consideration of collision risk for the species at this SPA. This level of impact will not affect the viability of the SPA fulmar population and thus there is **no adverse effect on site integrity**.

9.29.2.2 Kittiwake

Technical Appendix 12.2: Connectivity and Apportioning). However, given the distance of the SPA to the PFOWF is similar to that of Buchan Ness to Collieston SPA, a similar level of apportioning would be expected, which would give an annual apportioned displacement mortality estimate of <0.01 individuals.

This level of impact will not affect the viability of the SPA kittiwake population and thus there is **no adverse effect on site integrity**.

9.29.3 Assessment of Adverse Effects In-combination

Only project alone impacts are considered for the Offshore Development as the agreed projects screened in to the in-combination assessment do not impact on this SPA. There will therefore be **no adverse effects on site integrity** of this SPA arising from in-combination effects.

9.29.4 Summary

An assessment has been undertaken above for the species screened in for Appropriate Assessment (fulmar and kittiwake). It is concluded that there will be **no adverse effect on site integrity**, either for the site alone or in-combination with other projects.

9.30 Mousa SPA

9.30.1 Site Description and Qualifying Species Screened In for Assessment

Details of this SPA can be found at https://sitelink.nature.scot/site/8551. The species screened in for this site were storm petrel.

9.30.2 Assessment of Adverse Effects Alone

Assessment of displacement impacts were considered for storm petrel.

9.30.2.1 Storm petrel

A qualitative assessment has been undertaken for this species in Section 9.6.3. This level of impact will not affect the viability of the SPA Storm petrel population and thus there is **no adverse effect on site integrity**.

9.30.3 Assessment of Adverse Effects In-combination

Only project alone impacts are considered for the Offshore Development as the agreed projects screened in to the in-combination assessment do not impact on this SPA. There will therefore **be no adverse effects on site integrity** of this SPA arising from in-combination effects.

9.30.4 Summary

An assessment has been undertaken above for the species screened in for Appropriate Assessment (storm petrel. It is concluded that there will be **no adverse effect on site integrity**, either for the site alone or in-combination with other projects.

9.31 Flannan Isles SPA

9.31.1 Site Description and Qualifying Species Screened In for Assessment

Details of this SPA can be found at https://sitelink.nature.scot/site/8502. The species screened in for this site were kittiwake, puffin, fulmar, and Leach's petrel.

9.31.2 Assessment of Adverse Effects Alone

This assessment considers collision impacts in respect of fulmar and kittiwake and displacement impacts in respect of fulmar, guillemot, Leach's petrel and puffin.

9.31.2.1 Kittiwake

The estimated breeding season collision mortalities (mean and max densities) were apportioned between the key SPA breeding colonies using the weightings derived from NatureScot (2018) guidance (Offshore EIAR [Volume 3]: Technical Appendix 12.2: Connectivity and Apportioning).

During the breeding season, collision mortalities for birds associated with this SPA were estimated at <0.01 birds. This level of impact will not affect the viability of the SPA kittiwake population and thus there is **no adverse effect on site integrity**.

9.31.2.2 Puffin

The estimated breeding season displacement mortalities for puffin were not included in NatureScot (2018) apportioning calculations undertaken by HiDef due to an out-of-date population count (Offshore EIAR [Volume 3]: Technical Appendix 12.2: Connectivity and Apportioning). However, given the distance of the SPA to the PFOWF is similar to that of Fair Isle, a similar level of apportioning would be expected, which would give an annual apportioned displacement mortality estimate of <0.1 individual.

This level of impact will not affect the viability of the SPA puffin population and thus there is **no adverse effect on site integrity**.

9.31.2.3 Fulmar

There were zero estimated collision or displacement mortalities in either the breeding or the non-breeding season for fulmar, therefore there was no further consideration of collision risk for the species at this SPA. This level of impact will not affect the viability of the SPA fulmar population and thus there is **no adverse effect on site integrity**.

9.31.2.4 Leach's petrel

A qualitative assessment has been undertaken for this species in Section 9.6.3. This level of impact will not affect the viability of the SPA Leach's petrel population and thus there is **no adverse effect on site integrity**.

9.31.3 Assessment of Adverse Effects In-combination

Only project alone impacts are considered for the Offshore Development as the agreed projects screened in to the in-combination assessment do not impact on this SPA. There will therefore be **no adverse effects on site integrity** of this SPA arising from in-combination effects.

9.31.4 Summary

An assessment has been undertaken above for the species screened in for Appropriate Assessment (guillemot, puffin Leach's petrel and kittiwake). It is concluded that there will be **no adverse effect on site integrity**, either for the site alone or in-combination with other projects.

9.32 Noss SPA

9.32.1 Site Description and Qualifying Species Screened In for Assessment

Details of this SPA can be found at https://sitelink.nature.scot/site/8561. The species that were screened in for this site were gannet, great skua, fulmar, kittiwake and puffin.

9.32.2 Assessment of Adverse Effects Alone

This assessment considers collision and displacement impacts in respect of gannet, great skua, fulmar, puffin and kittiwake.

9.32.2.1 Gannet

The estimated breeding season collision mortalities (mean and max densities) and displacement mortalities were apportioned between the key SPA breeding colonies using the weightings derived from NatureScot (2018) guidance and the Marine Scotland Apportioning Tool respectively (Offshore EIAR [Volume 3]: Technical Appendix 12.2: Connectivity and Apportioning).

During the breeding season, collision mortalities for birds associated with the Noss SPA were estimated at 0.07 birds.

Displacement mortalities for gannet associated with the SPA were assessed with 70% displacement rates and 1%, giving a predicted displacement mortality of 0.035 birds apportioned to this SPA. There were zero predicted displacement mortalities for gannet in the non-breeding season.

This level of impact will not affect the viability of the SPA gannet population and thus there is **no adverse effect on site integrity**.

9.32.2.2 Great Skua

Great skua were only recorded in the PFOWF Array Area during the breeding season at minimal densities. Zero collision and displacement mortalities have therefore been estimated for great skua so there will be no effects on the viability of the SPA population and **no adverse effect on site integrity**.

9.32.2.3 Fulmar

There were zero estimated collision or displacement mortalities in either the breeding or the non-breeding season for fulmar so there will be no effects on the viability of the SPA population and **no adverse effect on site integrity**.

9.32.2.4 Kittiwake

The estimated breeding season collision mortalities (mean and max densities) were apportioned between the key SPA breeding colonies using the weightings derived from NatureScot (2018) guidance (Offshore EIAR [Volume 3]: Technical Appendix 12.2: Connectivity and Apportioning).

During the breeding season, collision mortalities for birds associated with this SPA were estimated at <0.01.

This level of impact will not affect the viability of the SPA kittiwake population and thus there is **no adverse effect on site integrity**.

9.32.2.5 Puffin

The estimated breeding season displacement mortalities for puffin were apportioned between the key SPA breeding colonies using the weightings derived from the Marine Scotland Apportioning Tool (Offshore EIAR [Volume 3]: Technical Appendix 12.2: Connectivity and Apportioning).

During the breeding season, displacement mortalities for birds associated with this SPA were assessed for 60% displacement rate and 1% mortality rate, giving an estimate of <0.01 apportioned to this SPA. Zero predicted puffin mortalities are expected in the non-breeding season.

This level of impact will not affect the viability of the SPA puffin population and thus there is **no adverse effect on site integrity**.

9.32.3 Assessment of Adverse Effects In-combination

Only project alone impacts are considered for the Offshore Development as the agreed projects screened in to the in-combination assessment do not impact on this SPA. There will therefore be **no adverse effects on site integrity** of this SPA arising from in-combination effects.

9.32.4 Summary

An assessment has been undertaken above for the species screened in for Appropriate Assessment (gannet, great skua, fulmar, kittiwake and puffin). It is concluded that there will be **no adverse effect on site integrity**, either for the site alone or in-combination with other projects.

9.33 Ramna Stacks and Gruney SPA

9.33.1 Site Description and Qualifying Species Screened In for Assessment

Details of this SPA can be found at https://sitelink.nature.scot/site/8568. The species screened in for this site was Leach's petrel.

9.33.2 Assessment of Adverse Effects Alone

Assessment considers displacement impacts for Leach's petrel.

9.33.2.1 Leach's petrel

A qualitative assessment has been undertaken for this species in Section 9.6.3. This level of impact will not affect the viability of the SPA Leach's petrel population and thus there is **no adverse effect on site integrity**.

9.33.3 Assessment of Adverse Effects In-combination

Only project alone impacts are considered for the Offshore Development as the agreed projects screened in to the in-combination assessment do not impact on this SPA. There will therefore be **no adverse effects on site integrity** of this SPA arising from in-combination effects.

9.33.4 Summary

An assessment has been undertaken above for the species screened in for Appropriate Assessment (Leach's petrel). It is concluded that there will be **no adverse effect on site integrity**, either for the site alone or in-combination with other projects.

9.34 Fowlsheugh SPA

9.34.1 Site Description and Qualifying Species Screened In for Assessment

Details of this SPA can be found at https://sitelink.nature.scot/site/8505. The species that were screened in for this site were kittiwake and fulmar.

9.34.2 Assessment of Adverse Effects Alone

Assessment considers collision and displacement impacts in respect of kittiwake and fulmar.

9.34.2.1 Kittiwake

The estimated breeding season collision mortalities (mean and max densities) were apportioned between the key SPA breeding colonies using the weightings derived from NatureScot (2018) guidance (Offshore EIAR [Volume 3]: Technical Appendix 12.2: Connectivity and Apportioning).

During the breeding season, collision mortalities for birds associated with this SPA were estimated at <0.01.

This level of impact will not affect the viability of the SPA kittiwake population and thus there is **no adverse effect on site integrity**.

9.34.2.2 Fulmar

There were zero estimated collision or displacement mortalities in either the breeding or the non-breeding season for fulmar, so there will be no effects on the viability of the SPA population and **no adverse effect on site integrity**.

9.34.3 Assessment of Adverse Effects In-combination

Only project alone impacts are considered for the Offshore Development as the agreed projects screened in to the in-combination assessment do not impact on this SPA. There will therefore be **no adverse effects on site integrity** of this SPA arising from in-combination effects.

9.34.4 Summary

An assessment has been undertaken above for the species screened in for Appropriate Assessment (kittiwake and fulmar). It is concluded that there will be **no adverse effect on site integrity**, either for the site alone or in-combination with other projects.

9.35 Canna and Sanday SPA

9.35.1 Site Description and Qualifying Species Screened In for Assessment

Details of this SPA can be found at https://sitelink.nature.scot/site/8480. The species that was screened in was kittiwake.

9.35.2 Assessment of Adverse Effects Alone

Assessment considers collision and displacement impacts for kittiwake.

9.35.2.1 Kittiwake

The estimated breeding season collision mortalities (mean and max densities) were apportioned between the key SPA breeding colonies using the weightings derived from NatureScot (2018) guidance (Offshore EIAR [Volume 3]: Technical Appendix 12.2: Connectivity and Apportioning).

During the breeding season, collision mortalities for birds associated with this SPA were estimated at <0.01.

This level of impact will not affect the viability of the SPA kittiwake population and thus there is **no adverse effect on site integrity**.

9.35.3 Assessment of Adverse Effects In-combination

Only project alone impacts are considered for the Offshore Development as the agreed projects screened in to the in-combination assessment do not impact on this SPA. There will therefore be n**o adverse effects on site integrity** of this SPA arising from in-combination effects.

9.35.4 Summary

An assessment has been undertaken above for the species screened in for Appropriate Assessment (kittiwake). It is concluded that there will be **no adverse effect on site integrity**, either for the site alone or in-combination with other projects.

9.36 Rum SPA

9.36.1 Site Description and Qualifying Species Screened In for Assessment

Details of this SPA can be found https://sitelink.nature.scot/site/8574. Manx shearwater were screened in for assessment.

9.36.2 Assessment of Adverse Effects Alone

This assessment considers collision and displacement impacts for Manx shearwater.

9.36.2.1 Manx shearwater

A qualitative assessment has been undertaken for this species in Section 9.6.3. This level of impact will not affect the viability of the SPA Manx shearwater population and thus there is **no adverse effect on site integrity**.

9.36.3 Assessment of Adverse Effects In-combination

Only project alone impacts are considered for the Offshore Development as the agreed projects screened in to the in-combination assessment do not impact on this SPA. There will therefore be **no adverse effects on site integrity** of this SPA arising from in-combination effects.

9.36.4 Summary

An assessment has been undertaken above for the species screened in for Appropriate Assessment (kittiwake and Manx shearwater). It is concluded that there will be **no adverse effect on site integrity**, either for the site alone or in-combination with other projects.

9.37 Fetlar SPA

9.37.1 Site Description and Qualifying Species Screened In for Assessment

Details of this SPA can be found at https://sitelink.nature.scot/site/8498. The species that were screened in were great skua and fulmar.

9.37.2 Assessment of Adverse Effects Alone

This assessment considers collision and displacement impacts for great skua and fulmar.

9.37.2.1 Great skua

Great skua were only recorded in the PFOWF Array Area during the breeding season at minimal densities. Zero collision and displacement mortalities have therefore been estimated for great skua so there will be no effects on the viability of the SPA population and **no adverse effect on site integrity**.

9.37.2.2 Fulmar

There were zero estimated collision or displacement mortalities in either the breeding or the non-breeding season for fulmar, so there will be no effects on the viability of the SPA population and **no adverse effect on site integrity**.

9.37.3 Assessment of Adverse Effects In-combination

Only project alone impacts are considered for the Offshore Development as the agreed projects screened in to the in-combination assessment do not impact on this SPA. There will therefore be **no adverse effects on site integrity** of this SPA arising from in-combination effects.

9.37.4 Summary

An assessment has been undertaken above for the species screened in for Appropriate Assessment (great skua and fulmar). It is concluded that there will be **no adverse effect on site integrity**, either for the site alone or in-combination with other projects.

9.38 Hermaness, Saxa Vord and Valla Field SPA

9.38.1 Site Description and Qualifying Species Screened In for Assessment

Details of this SPA can be found at https://sitelink.nature.scot/site/8512. The species that were screened in for assessment were gannet, great skua, and fulmar.

9.38.2 Assessment of Adverse Effects Alone

Assessment considers collision and displacement impacts in respect of gannet, fulmar and great skua.

9.38.2.1 Gannet

The estimated breeding season collision mortalities (mean and max densities) and displacement mortalities for gannet were apportioned between the key SPA breeding colonies using the weightings derived from NatureScot (2018) guidance and the Marine Scotland Apportioning Tool respectively (Offshore EIAR [Volume 3]: Technical Appendix 12.2: Connectivity and Apportioning).

During the breeding season, collision mortalities for gannet associated with the Hermaness, Saxa Vord and Valla Field SPA were estimated at 0.08 birds (mean densities) and 0.16 birds (maximum densities).

Displacement mortalities for gannet associated with the SPA were assessed with 70% displacement rates and 1% mortality rate, giving predicted a displacement mortality of 0.04 birds. There were zero predicted displacement mortalities for gannet in the non-breeding season.

This level of impact will not affect the viability of the SPA gannet population and thus there is **no adverse effect on site integrity** i.

9.38.2.2 Great skua

Great skua were only recorded in the PFOWF Array Area during the breeding season at minimal densities. Zero collision and displacement mortalities have therefore been estimated for great skua so there will be no effects on the viability of the SPA population and **no adverse effect on site integrity**.

9.38.2.3 Fulmar

There were zero estimated collision or displacement mortalities in either the breeding or the non-breeding season for fulmar, so there will be no effects on the viability of the SPA population and **no adverse effect on site integrity**.

9.38.3 Assessment of Adverse Effects In-combination

Only project alone impacts are considered for the Offshore Development as the agreed projects screened in to the in-combination assessment do not impact on this SPA. There will therefore be **no adverse effects** on site integrity of this SPA arising from in-combination effects.

9.38.4 Summary

An assessment has been undertaken above for the species screened in for Appropriate Assessment (gannet and great skua). It is concluded that there will be **no adverse effect on site integrity**, either for the site alone or in-combination with other projects.

9.39 St Kilda SPA

9.39.1 Site Description and Qualifying Species Screened In for Assessment

Details of this SPA can be found at https://sitelink.nature.scot/site/8580. The species that were screened in for assessment were storm petrel, Leach's petrel, Manx shearwater, fulmar, kittiwake, and great skua.

9.39.2 Assessment of Adverse Effects Alone

This assessment considers collision and displacement impacts in respect of gannet, fulmar and great skua.

9.39.2.1 Gannet

The estimated breeding season collision mortalities (mean and max densities) and displacement mortalities for gannet were apportioned between the key SPA breeding colonies using the weightings derived from NatureScot (2018) guidance and the Marine Scotland Apportioning Tool respectively (Offshore EIAR [Volume 3]: Technical Appendix 12.2: Connectivity and Apportioning).

During the breeding season, collision mortalities for birds associated with the St Kilda SPA were estimated at 0.21 birds.

Displacement mortalities for birds associated with the SPA were assessed with 70% displacement rates and 1% mortality rate, giving a predicted displacement mortality of 0.11 birds. There were zero predicted displacement mortalities for gannet in the non-breeding season.

This level of impact will not affect the viability of the SPA gannet population and thus there is **no adverse effect on site integrity**.

9.39.2.2 Storm petrel

A qualitative assessment has been undertaken for this species in Section 9.6.3. This level of impact will not affect the viability of the SPA storm petrel population and thus there is **no adverse effect on site integrity**.

9.39.2.3 Leach's petrel

A qualitative assessment has been undertaken for this species in Section 9.6.3. This level of impact will not affect the viability of the SPA Leach's petrel population and thus there is **no adverse effect on site integrity**.

9.39.2.4 Manx shearwater

A qualitative assessment has been undertaken for this species in Section 9.6.3. This level of impact will not affect the viability of the SPA Manx shearwater population and thus there is **no adverse effect on site integrity**.

9.39.2.5 Fulmar

There were zero estimated collision or displacement mortalities in either the breeding or the non-breeding season for fulmar, so there will be no effects on the viability of the SPA population and **no adverse effect on site integrity**.

9.39.2.6 Great skua

Great skua were only recorded in the PFOWF Array Area during the breeding season at minimal densities. Zero collision and displacement mortalities have therefore been estimated for great skua so there will be no effects on the viability of the SPA population and **no adverse effect on site integrity**.

9.39.3 Assessment of Adverse Effects In-combination

Only project alone impacts are considered for the Offshore Development as the agreed projects screened in to the in-combination assessment do not impact on this SPA. There will therefore be **no adverse effects on site integrity** of this SPA arising from in-combination effects.

9.39.4 Summary

An assessment has been undertaken above for the species screened in for Appropriate Assessment (gannet). It is concluded that there will be **no adverse effect on site integrity**, either for the site alone or in-combination with other projects.

9.40 Forth Islands SPA

9.40.1 Site Description and Qualifying Species Screened In for Assessment

Details of this SPA can be found at https://sitelink.nature.scot/site/8500. The species that was screened in for this site was gannet.

9.40.2 Assessment of Adverse Effects Alone

This assessment considers collision and displacement impacts for gannet.

9.40.2.1 Gannet

The estimated breeding season collision mortalities (mean and max densities) and displacement mortalities for gannet were apportioned between the key SPA breeding colonies using the weightings derived from NatureScot (2018) guidance and the Marine Scotland Apportioning Tool respectively (Offshore EIAR [Volume 3]: Technical Appendix 12.2: Connectivity and Apportioning).

During the breeding season, collision mortalities for birds associated with the Forth Islands SPA were estimated at 0.22 birds.

Displacement mortalities for birds associated with the Forth Islands SPA were assessed with 70% displacement rates and 1% mortality rate, giving a predicted displacement mortality of 0.11 birds apportioned to this SPA. There were zero predicted displacement mortalities for gannet in the non-breeding season.

This level of impact will not affect the viability of the SPA gannet population and thus there is **no adverse effect on site integrity**.

9.40.3 Assessment of Adverse Effects In-combination

As agreed with MS-LOT, Marine Scotland, NatureScot and RSPB during pre-application discussion, qualitative assessment has been made of the in-combination effects on the SPA gannet population from the Offshore Development in-combination with Inch Cape, Seagreen and Neart na Gaoithe offshore wind farms (all consented) and including consideration of Berwick Bank

In this regard, the very minor additional impacts arising from the Offshore Development do not make any material difference to the viability of the SPA gannet population and thus there is **no adverse impact on site integrity** in combination with the Forth & Tay wind farms.

9.40.4 Summary

An assessment has been undertaken above for the species screened in for Appropriate Assessment (gannet). It is concluded that there will be **no adverse effect on site integrity**, either for the site alone or in-combination with other projects.

9.41 Remaining SPAs Screened in for Fulmar

9.41.1 Site Descriptions

The remaining SPAs screened in for fulmar, along with the link to SPA details are as follows:

- Mingulay and Berneray SPA (https://sitelink.nature.scot/site/8545)
- Rathlin Island SPA (https:www.npws.ie/protected-sites/spa/004120)
- Horn Head to Fanad Head SPA (https:www.npws.ie/protected-sites/spa/004194)
- Tory Island SPA (https:www.npws.ie/protected-sites/spa/004073)
- West Donegal Coast SPA (https:www.npws.ie/protected-sites/spa/004150)
- Duvillaun Islands (https://www.npws.ie/protected-sites/spa/004111)
- Clare Island (https:www.npws.ie/protected-sites/spa/004136)
- Lambay Island (https:www.npws.ie/protected-sites/spa/004069)
- High Island, Inishshark and Davilaun (https:www.npws.ie/protected-sites/spa/004144)
- Cliffs of Moher (https:www.npws.ie/protected-sites/spa/004005)
- Kerry Head (https:www.npws.ie/protected-sites/spa/004189)
- Dingle Peninsula (https:www.npws.ie/protected-sites/spa/004153)
- Saltee Islands (https:www.npws.ie/protected-sites/spa/004002)
- Puffin Island (https:www.npws.ie/protected-sites/spa/004003)
- Skelligs (https:www.npws.ie/protected-sites/spa/004007)
- Iveragh Peninsula (https:www.npws.ie/protected-sites/spa/004154)
- Deenish Island and Scariff Island (https:www.npws.ie/protected-sites/spa/004175)

9.41.2 Assessment of Adverse Effects Alone

Assessment considers collision and displacement impacts for fulmar.

9.41.2.1 Fulmar

There were zero estimated collision or displacement mortalities in either the breeding or the non-breeding season for fulmar, therefore there was no further consideration of collision risk for the species at these SPAs. This level of impact will not affect the viability of the SPA fulmar population and thus there is **no adverse effect on site integrity**.

9.41.3 Assessment of Adverse Effects In-combination

Only project alone impacts are considered for the Offshore Development as the agreed projects screened in to the in-combination assessment do not impact on these SPAs. There will therefore be no adverse effects on site integrity of this SPA arising from in-combination effects.

9.41.4 Summary

An assessment has been undertaken above for gannet for these additional SPAs screened in for Appropriate Assessment. For each of these SPAs it is concluded that there will be **no adverse effect on site integrity**, either for the site alone or in-combination with other projects.

9.42 Copeland Islands SPA

9.42.1 Site Description and Qualifying Species Screened In for Assessment

Details of this SPA can be found at https://www.daera-ni.gov.uk/publications/special-protection-area-copeland-islands.

9.42.2 Assessment of Adverse Effects Alone

Assessment considers collision and displacement impacts for manx shearwater.

9.42.2.1 Manx shearwater

A qualitative assessment has been undertaken for this species in Section 9.6.3. This level of impact will not affect the viability of the SPA Manx shearwater population and thus there is **no adverse effect on site integrity**.

9.42.3 Assessment of Adverse Effects In-combination

Only project alone impacts are considered for the Offshore Development as the agreed projects screened in to the in-combination assessment do not impact on this SPA. There will therefore be **no adverse effects on site integrity** of this SPA arising from in-combination effects.

9.42.4 Summary

An assessment has been undertaken above for the species screened in for Appropriate Assessment (Manx shearwater). It is concluded that there will be **no adverse effect on site integrity**, either for the site alone or in-combination with other projects.

9.43 Ailsa Craig SPA

9.43.1 Site Description and Qualifying Species Screened In for Assessment

Details of this SPA can be found at https://sitelink.nature.scot/site/8463.

9.43.2 Assessment of Adverse Effects Alone

This assessment considers collision and displacement impacts for gannet.

9.43.2.1 Gannet

The estimated breeding season collision mortalities (mean and max densities) and displacement mortalities for gannet were apportioned between the key SPA breeding colonies using the weightings derived from NatureScot (2018) guidance and the Marine Scotland Apportioning Tool respectively (Offshore EIAR [Volume 3]: Technical Appendix 12.2: Connectivity and Apportioning).

During the breeding season, collision mortalities for birds associated with this SPA were estimated at <0.1 birds.

Displacement mortalities for birds associated with this SPA were assessed with 70% displacement rates and 1% and 3% mortality rates, giving predicted displacement mortalities of < 0.1 birds respectively. There were zero predicted displacement mortalities for gannet in the non-breeding season.

This level of impact will not affect the viability of the SPA gannet population and thus there is **no adverse effect on site integrity**.

9.43.3 Assessment of Adverse Effects In-combination

Only project alone impacts are considered for the Offshore Development as the agreed projects screened in to the in-combination assessment do not impact on this SPA. There will therefore be **no adverse effects on site integrity** of this SPA arising from in-combination effects.

9.43.4 Summary

An assessment has been undertaken above for the species screened in for Appropriate Assessment (gannet). It is concluded that there will be **no adverse effect on site integrity**, either for the site alone or in-combination with other projects.

9.44 Conclusions of the Assessment

The screening process undertaken for the impacts associated with the construction, operation and maintenance, and decommissioning of the PFOWF could not discount LSE on SPA and Ramsar qualifying interests for a number of SPAs and therefore a systematic assessment of the potential impact pathways for adverse effect on the integrity of the site's conversation objectives has been carried out.

There is no indication from the assessment undertaken that the long-term maintenance of the SPAs will be altered in regard to maintaining populations of species as a viable component of the site. The Offshore Development alone or in-combination with other relevant projects and plans will not alter the distribution of species within the site, nor is there any indication that the construction, operation and maintenance, or decommissioning of the Offshore Development will lead to a deterioration of the habitats of the qualifying species or significant disturbance to these species.

With respect to the population of each of the qualifying interests, the likely mortality arising from the construction and operation and maintenance of the Offshore Development alone and in-combination with other relevant projects has been predicted with no conclusions of adverse effect on site integrity reached. Table 9.20 below summarises the SPA's and Ramsar sites assessed and concludes whether there is potential for an adverse effect on the integrity of the sites and their qualifying interests.

Table 9.20 Summary of conclusions of assessment on each SPA

SPA/ pSPA	Conclusions
North Caithness Cliffs SPA	The likely effects of the construction, operation and maintenance, and decommissioning of the Offshore Development on the ornithological qualifying interests of the SPA have been assessed alone and in-combination with other projects. The assessment has concluded that, with the inclusion of mitigation (Section 6.1), there will be **no adverse effect on site integrity**.
Hoy SPA	The likely effects of the construction, operation and maintenance, and decommissioning of the Offshore Development on the ornithological qualifying interests of the SPA have been assessed alone and in-combination with other projects. The assessment has concluded that, with the inclusion of mitigation (Section 6.1), there will be **no adverse effect on site integrity**.
Caithness and Sutherland Peatlands SPA and Ramsar	The likely effects of the construction, operation and maintenance, and decommissioning of the Offshore Development on the ornithological qualifying interests of the SPA and Ramsar site have been assessed alone and in-combination with other projects. The assessment has concluded that, with the inclusion of mitigation (Section 6.1), there will be **no adverse effect on site integrity**.
Cape Wrath SPA	The likely effects of the construction, operation and maintenance, and decommissioning of the Offshore Development on the ornithological qualifying interests of the SPA have been assessed alone and in-combination with other projects. The assessment has concluded that, with the inclusion of mitigation (Section 6.1), there will be **no adverse effect on site integrity**.
Sule Skerry and Sule Stack SPA	The likely effects of the construction, operation and maintenance, and decommissioning of the Offshore Development on the ornithological qualifying interests of the SPA have been assessed alone and in-combination with other projects. The assessment has concluded that, with the inclusion of mitigation (Section 6.1), there will be **no adverse effect on site integrity**.
Marwick Head SPA	The likely effects of the construction, operation and maintenance, and decommissioning of the Offshore Development on the ornithological qualifying interests of the SPA have been assessed alone and in-combination with other projects. The assessment has concluded that, with the inclusion of the mitigation (Section 6.1), there will be **no adverse effect on site integrity**.
East Caithness Cliffs SPA	The likely effects of the construction, operation and maintenance, and decommissioning of the Offshore Development on the ornithological qualifying interests of the SPA have been assessed alone and in-combination with other projects. The assessment has concluded that, with the inclusion of mitigation (Section 6.1), there will be **no adverse effect on site integrity**.
Copinsay SPA	The likely effects of the construction, operation and maintenance, and decommissioning of the Offshore Development on the ornithological qualifying interests of the SPA have been assessed alone and in-combination with other projects. The assessment has concluded that, with the inclusion of mitigation (Section 6.1), there will be **no adverse effect on site integrity**.
Rousay SPA	The likely effects of the construction, operation and maintenance, and decommissioning of the Offshore Development on the ornithological qualifying interests of the SPA have been assessed alone and in-combination with other projects. The assessment has concluded that, with the inclusion of mitigation (Section 6.1), there will be **no adverse effect on site integrity**.
West Westray SPA	The likely effects of the construction, operation and maintenance, and decommissioning of the Offshore Development on the ornithological qualifying interests of the SPA have been assessed alone and in-combination with other

SPA/ pSPA	Conclusions
	projects. The assessment has concluded that, with the inclusion ofmitigation (Section 6.1), there will be **no adverse effect on site integrity**.
Auskerry SPA	The likely effects of the construction, operation and maintenance, and decommissioning of the Offshore Development on the ornithological qualifying interests of the SPA have been assessed alone and in-combination with other projects. The assessment has concluded that, with the inclusion ofmitigation (Section 6.1), there will be **no adverse effect on site integrity**.
Handa SPA	The likely effects of the construction, operation and maintenance, and decommissioning of the Offshore Development on the ornithological qualifying interests of the SPA have been assessed alone and in-combination with other projects. The assessment has concluded that, with the inclusion of mitigation (Section 6.1), there will be **no adverse effect on site integrity**.
Calf of Eday SPA	The likely effects of the construction, operation and maintenance, and decommissioning of the Offshore Development on the ornithological qualifying interests of the SPA have been assessed alone and in-combination with other projects. The assessment has concluded that, with the inclusion of the mitigation (Section 6.1), there will be **no adverse effect on site integrity**.
Priest Island SPA	The likely effects of the construction, operation and maintenance, and decommissioning of the Offshore Development on the ornithological qualifying interests of the SPA have been assessed alone and in-combination with other projects. The assessment has concluded that, with the inclusion of mitigation (Section 6.1), there will be **no adverse effect on site integrity**.
North Rona and Sula Sgier SPA	The likely effects of the construction, operation and maintenance, and decommissioning of the Offshore Development on the ornithological qualifying interests of the SPA have been assessed alone and in-combination with other projects. The assessment has concluded that, with the inclusion of mitigation (Section 6.1), there will be **no adverse effect on site integrity**.
Fair Isle SPA	The likely effects of the construction, operation and maintenance, and decommissioning of the Offshore Development on the ornithological qualifying interests of the SPA have been assessed alone and in-combination with other projects. The assessment has concluded that, with the inclusion ofmitigation (Section 6.1), there will be **no adverse effect on site integrity**.
Troup, Pennan and Lion's Head SPA	The likely effects of the construction, operation and maintenance, and decommissioning of the Offshore Development on the ornithological qualifying interests of the SPA have been assessed alone and in-combination with other projects. The assessment has concluded that, with the inclusion of mitigation (Section 6.1), there will be **no adverse effect on site integrity**.
Foula SPA	The likely effects of the construction, operation and maintenance, and decommissioning of the Offshore Development on the ornithological qualifying interests of the SPA have been assessed alone and in-combination with other projects. The assessment has concluded that, with the inclusion of mitigation (Section 6.1), there will be **no adverse effect on site integrity**.
Buchan Ness to Colliestion Coast SPA	The likely effects of the construction, operation and maintenance, and decommissioning of the Offshore Development on the ornithological qualifying interests of the SPA have been assessed alone and in-combination with other projects. The assessment has concluded that, with the inclusion of mitigation (Section 6.1), there will be **no adverse effect on site integrity**.
Mousa SPA	The likely effects of the construction, operation and maintenance, and decommissioning of the Offshore Development on the ornithological qualifying interests of the SPA have been assessed alone and in-combination with other

SPA/ pSPA	Conclusions
	projects. The assessment has concluded that, with the inclusion of mitigation (Section 6.1), there will be **no adverse effect on site integrity**.
Flannan Isles SPA	The likely effects of the construction, operation and maintenance, and decommissioning of the Offshore Development on the ornithological qualifying interests of the SPA have been assessed alone and in-combination with other projects. The assessment has concluded that, with the inclusion of mitigation (Section 6.1), there will be **no adverse effect on site integrity**.
Noss SPA	The likely effects of the construction, operation and maintenance, and decommissioning of the Offshore Development on the ornithological qualifying interests of the SPA have been assessed alone and in-combination with other projects. The assessment has concluded that, with the inclusion of mitigation (Section 6.1), there will be **no adverse effect on site integrity**.
Ramna Stacks and Gruney SPA	The likely effects of the construction, operation and maintenance, and decommissioning of the Offshore Development on the ornithological qualifying interests of the SPA have been assessed alone and in-combination with other projects. The assessment has concluded that, with the inclusion of mitigation (Section 6.1), there will be **no adverse effect on site integrity**.
Fowlesheugh SPA	The likely effects of the construction, operation and maintenance, and decommissioning of the Offshore Development on the ornithological qualifying interests of the SPA have been assessed alone and in-combination with other projects. The assessment has concluded that, with the inclusion of mitigation (Section 6.1), there will be **no adverse effect on site integrity**.
Canna and Sanday SPA	The likely effects of the construction, operation and maintenance, and decommissioning of the Offshore Development on the ornithological qualifying interests of the SPA have been assessed alone and in-combination with other projects. The assessment has concluded that, with the inclusion of mitigation (Section 6.1), there will be **no adverse effect on site integrity**.
Rum SPA	The likely effects of the construction, operation and maintenance, and decommissioning of the Offshore Development on the ornithological qualifying interests of the SPA have been assessed alone and in-combination with other projects. The assessment has concluded that, with the inclusion of mitigation (Section 6.1), there will be **no adverse effect on site integrity**.
Fetlar SPA	The likely effects of the construction, operation and maintenance, and decommissioning of the Offshore Development on the ornithological qualifying interests of the SPA have been assessed alone and in-combination with other projects. The assessment has concluded that, with the inclusion of mitigation (Section 6.1), there will be **no adverse effect on site integrity**.
Hermaness, Sax Vord and Valla Field SPA	The likely effects of the construction, operation and maintenance, and decommissioning of the Offshore Development on the ornithological qualifying interests of the SPA have been assessed alone and in-combination with other projects. The assessment has concluded that, with the inclusion of mitigation (Section 6.1), there will be **no adverse effect on site integrity**.
St. Kilda SPA	The likely effects of the construction, operation and maintenance, and decommissioning of the Offshore Development on the ornithological qualifying interests of the SPA have been assessed alone and in-combination with other projects. The assessment has concluded that, with the inclusion of mitigation (Section 6.1), there will be **no adverse effect on site integrity**.
Forth Islands SPA	The likely effects of the construction, operation and maintenance, and decommissioning of the Offshore Development on the ornithological qualifying interests of the SPA have been assessed alone and in-combination with other

SPA/ pSPA	Conclusions
	projects. The assessment has concluded that, with the inclusion of mitigation (Section 6.1), there will be **no adverse effect on site integrity**.
Copeland Islands SPA	The likely effects of the construction, operation and maintenance, and decommissioning of the Offshore Development on the ornithological qualifying interests of the SPA have been assessed alone and in-combination with other projects. The assessment has concluded that, with the inclusion of mitigation (Section 6.1), there will be **no adverse effect on site integrity**.
Ailsa Craig SPAs	The likely effects of the construction, operation and maintenance, and decommissioning of the Offshore Development on the ornithological qualifying interests of the SPA have been assessed alone and in-combination with other projects. The assessment has concluded that, with the inclusion of mitigation (Section 6.1), there will be **no adverse effect on site integrity**.
SPAs for Fulmar	
> Mingulay and Berneray SPA > Rathlin Island SPA > Horn Head to Fanad Head SPA > Tory Island SPA > West Donegal Coast SPA > Duvillaun Islands SPA > Clare Island SPA > Lambay Island SPA > High Island, Inishshark and Davilaun SPA > Cliffs of Moher SPA > Kerry Head SPA > Dingle Peninsula SPA > Saltee Islands SPA > Puffin Island SPA > Skelligs SPA > Iveragh Peninsula SPA > Deenish Island and Scariff Island SPA	The likely effects of the construction, operation and maintenance, and decommissioning of the Offshore Development on the ornithological qualifying interests of these SPA have been assessed alone and in-combination with other projects. The assessment has concluded that, with the inclusion of mitigation (Section 6.1), there will be **no adverse effect on site integrity**.

10 CONCLUSION OF THE RIAA

As part of the HRA process, a Report to Inform Appropriate Assessment has been undertaken to provide information to allow the Competent Authority to ascertain whether the proposed Offshore Development will or will not adversely affect the integrity of a European Site. The conclusions of the migratory fish, marine mammal and ornithology assessments presented within this document show that there are no adverse effects either from the Offshore Development alone, or in-combination with other developments, on the site integrity or conservation objectives of the European Sites screened into the individual assessments.

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