MORAY WEST
OFFSHORE WINDFARM

Moray West Offshore Habitats Regulations Appraisal

HRA Screening Report

September 2017

Moray Offshore Windfarm (West) Limited

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Glossary

AA	Appropriate Assessment
AC	Aberdeenshire Council
Birds Directive	Directive 2009/147/EC of 30 November 2009 on the conservation of wild birds
BOWL	Beatrice Offshore Wind Farm Limited
CA	Competent Authority
CES	Central East Scotland
cSAC	Candidate Special Area of Conservation
DDV	Drop down video
DECC	Department of Energy and Climate Change
dSAC	Draft Special Area of Conservation
DTI	Department of Trade and Industry
ECC	East Caithness Cliffs
EDPR	EDP Renovaveis
EDPR UK	EDP Renewables UK Ltd
EIA	Environmental Impact Assessment
EIA Regulations	The Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2017
EMF	Electromagnetic Field
ER	Environmental Report (referred to as the Environmental Statement and the EIA Report in different pieces of EIA legislation)
ES	Environmental Statement (referred to as the Environmental Report and the EIA Report in different pieces of EIA legislation)
ESAS	European Seabirds at Sea
FAME	Future of the Atlantic Marine Environment
GAM	Generalised Additive Model
GBS	Gravity Base Structure
GNS	Greater North Sea
GPS	Global Positioning System
GW	Gigawatt
GWDTE	Groundwater dependent terrestrial ecosystem
Habitats Directive	Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora
Habitats Regulations	Conservation (Natural Habitats, &c.) Regulations 1994 (as amended)
HAT	Highest astronomical tide
HDD	Horizontal directional drilling
HDPE	High density polyethylene
HRA	Habitats Regulations Appraisal
HVAC	High voltage alternating current
IAMMWG	Interagency Marine Mammal Working Group
IROPI	Imperative Reasons of Overriding Public Interest
JCP	Joint Cetacean Protocol
JNCC	Joint Nature Conservation Committee
km	Kilometre
kV	Kilovolt
LAT	Lowest astronomical tide
LSE	Likely Significant Effect
MC	Moray Council

MHWS	Mean High Water Springs
MLWS	Mean Low Water Springs
MMMP	Marine Mammal Monitoring Programme
Moray East	Moray Offshore Windfarm (East) Limited
Moray East Offshore Wind Farm	The wind farm to be developed in the Moray East Site
Moray East Site	The area of the Zone in which the Moray East Offshore Wind Farm will be located, previously known as the Eastern Development Area
Moray Firth Zone	UK offshore wind Round 3 Zone 1 area held under a Zone Development Agreement (ZDA) by Moray Offshore Renewable Power Limited which is comprised of the Moray East Site and the Moray West Site
Moray West	Moray Offshore Windfarm (West) Limited
Moray West Offshore Wind Farm	The wind farm being proposed by Moray West
Moray West Site	The area of the Zone in which the Moray West Offshore Wind Farm and elements of the Moray West OfTI will be located, previously known as the Western Development Area
MORL	Moray Offshore Renewables Limited (now known as Moray East)
MPA	Marine Protected Area
MS-LOT	Marine Scotland Licensing Operations Team
MSS	Marine Scotland Science
MSW	Multi Sea Winter
MU	Management Unit
MW	Megawatt
Natura site	A Natura 2000 site which forms a network of nature protection areas in the territory of the European Union. It is made up of SACs and SPAs designated respectively under the Habitats Directive and Birds Directive. The network includes both terrestrial and marine sites (MPAs).
NCC	North Caithness Cliffs
NETS	National Electricity Transmission System
nm	Nautical mile
NMPi	National Marine Planning Interactive
NNR	National Nature Reserve
NRMSD	National Research and Monitoring Strategy for Diadromous Fish
Offshore ECC	Offshore Export Cable Corridor
Offshore Habitats Regulations	The Offshore Marine Conservation (Natural Habitats &c) Regulations 2007 (as amended)
OfTI	Offshore Transmission Infrastructure
O&M	Operation and maintenance
OnTI	Onshore Transmission Infrastructure
OSP	Offshore Substation Platform
PAM	Passive Acoustic Monitoring
PCOD	Population consequences of disturbance
pSAC	Possible Special Area of Conservation
pSPA	Potential Special Protection Area
PTS	Permanent Threshold Shift
QA	Quality Assurance

Ramsar	A wetland site designated of international importance under the Ramsar Convention. The Convention on Wetlands, known as the Ramsar Convention, is an intergovernmental environmental treaty established in 1971 by UNESCO, and coming into force in 1975.
REZ	Renewable Energy Zone
RIAA	Report to Inform an Appropriate Assessment
RSBP	Royal Society for the Protection of Birds
SAC	Special Area of Conservation
SCANS	Small Cetaceans in the European Atlantic and North Sea
Scoping Study Area	The area of search for the OnTI that is located landward of MLWS, as illustrated in Figure 1.1.1
SCI	Site of Community Interest
SCOS	Special Committee on Seals
SMRU	Sea Mammal Research Unit
SNCBs	Statutory Nature Conservation Bodies
SNH	Scottish Natural Heritage
SPA	Special Protection Area
SPP	Scottish Planning Policy
STAR	Seabird Tracking and Research
TCE	The Crown Estate
The Project	The Moray West OfTI, OnTI and Offshore Wind Farm combined together
TI	Transmission Infrastructure
WTG	Wind Turbine Generator
WWT	Wildfowl and Wetlands Trust
ZDA	Zone Development Agreement

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- Niras; and
- Scottish Mammal Research Unit.

1 Introduction

1.1 Background

Moray Offshore Windfarm (West) Limited (known as Moray West) is promoting the development of the Moray West Offshore Wind Farm. The wind farm will be located in the Outer Moray Firth (Figure 1.1.1), approximately 22 km south of the Caithness coastline at its nearest point. It will comprise an offshore array of Wind Turbines Generators (WTGs), connected to one another by subsea inter-array cables, which will in turn connect the WTGs to the Offshore Transmission Infrastructure (OfTI).

The OfTI will comprise one or two Offshore Substation Platform(s) (OSP(s)) (joined by an interconnector cable if two are required) and up to two offshore export cable circuits that carry the power to an onshore landfall location to join the Onshore Transmission Infrastructure (OnTI). Each OfTI circuit is likely to comprise three core cables in a trefoil arrangement with a typical voltage of 132 to 400 kilovolts (kV) and may also include a fibre optic communication link either embedded within the cables or as separate, smaller cables running alongside in the same trench. The OnTI will comprise up to two onshore cable circuits that will transmit the power inland to a new onshore substation where it will be transformed before being fed (via buried cables) into the National Electricity Transmission System (NETS) at the existing Blackhillock substation, approximately 1.5 km south of Keith in Moray.

1.2 The Moray Firth Zone Development Strategy

In January 2010, Moray Offshore Renewables Limited was awarded a Zone Development Agreement (ZDA) by The Crown Estate (TCE) to develop Zone 1 of the nine UK offshore wind Round 3 zones. Zone 1 (the Moray Firth Zone) is located within the Outer Moray Firth within the UK Renewable Energy Zone (REZ) (Figure 1.1.1). The ZDA is now held by Moray Offshore Renewable Power Limited which owns 100% of Moray West.

Using a zonal constraints analysis, Moray East identified two distinct development areas, the Moray East Site and the Moray West Site.

Moray East was the first of the two development areas to be progressed and was subject to Environmental Impact Assessment (EIA) under Section 36 of the Electricity Act 1989, with consent awarded in March 2014.

After updating the zonal constraints analysis following consent award for Moray East, a decision was taken to commence development work on Moray West Site. The Moray West Offshore Windfarm and the associated OfTI will require Marine Licences under the Marine (Scotland) Act 2010 and Marine and Coastal Access Act 2009. A consent under Section 36 of the Electricity Act 1989 will also be required for the wind farm. A Scoping exercise was undertaken in May 2016 for the Moray West Offshore Wind Farm (offshore wind turbines, foundations and substructures, and inter-array cables) and a Scoping Opinion was received from the Scottish Ministers in August 2016. A separate Scoping exercise for the Moray West OfTI commenced in May 2017 with the Scoping Opinion being issued on 30 August 2017.

A planning application for Planning Permission in Principle will be submitted to both Moray Council (MC) and Aberdeenshire Council (AC) for construction of the OnTI under the Town and Country Planning (Scotland) Act 1997 as amended by the Planning etc. (Scotland) Act 2006. A Scoping exercise for the OnTI commenced in June 2017 with the Scoping Opinion being issued on 8 August 2017.

An integral part of the planning process is to demonstrate due regard to the European Council Directives 92/43/EEC on the Conservation of Natural Habitats and of Wild Flora and Fauna Habitats Directive (European Commission, 1992; 'Habitats Directive') and 2009/147/EC of the European Parliament and of

the Council of 30 November 2009 on the conservation of wild birds (codified version) (European Commission, 2009; 'Birds Directive') with the promoter required to provide sufficient information to enable the competent authority (CA) (which is the Scottish Ministers in the case of offshore works for Moray West) to undertake an Appropriate Assessment (AA). This offshore Habitats Regulation Appraisal (HRA) Screening Report considers the Moray West Offshore Windfarm and the OfTI together. Any HRA requirements for the OnTI will be addressed separately.

1.3 Definitions

The definitions listed below have been applied throughout this HRA Screening Report. They provide an update to the definitions used in the Moray West Offshore Wind Farm Infrastructure EIA Scoping Report (Moray West, 2016) and reflect the recent establishment of Moray West, distinct from Moray East.

- **Moray Firth Zone** - UK offshore wind Round 3 Zone 1 area held under a ZDA by Moray Offshore Renewable Power Limited which is comprised of the Moray East Site and the Moray West Site.
- **Moray West** - Moray Offshore Windfarm (West) Limited.
- **Moray West Site** - The area of the Moray Firth Zone in which the Moray West Offshore Wind Farm will be located, previously known as the Western Development Area.
- **Moray West Offshore Wind Farm** - The wind farm to be developed in the Moray West Site.
- **Moray West Offshore Transmission Infrastructure (OfTI)** - The Offshore Transmission Infrastructure associated with the Moray West Offshore Wind Farm.
- **Moray West OfTI Site** - The area within which the OfTI will be located. It includes the Moray West Site, within which the OSP(s) and a portion of the export cable circuits will be located, and the Offshore Export Cable Corridor within which the remainder of the export cable circuits will be located.
- **Moray West OnTI Site** – The area within which the OnTI will be located. It includes onshore transition bays at landfall, up to two onshore cable circuits that transmit power to a new onshore substation along with buried interconnecting cables that connect into the NETS.
- **Moray West Onshore Transmission Infrastructure (OnTI)** - The Onshore Transmission Infrastructure associated with the Moray West Offshore Wind Farm.
- **The Project** - Moray West Offshore Wind Farm, Moray West OfTI and the Moray West OnTI.
- **Moray East** - Moray Offshore Windfarm (East) Limited, formerly known as Moray Offshore Renewables Limited (MORL).
- **Moray East Site** - The area of the Moray Firth Zone in which the Moray East Offshore Wind Farm will be located, previously known as the Eastern Development Area.
- **Moray East Offshore Wind Farm** - The wind farm to be developed in the Moray East Site.
- **Moray East Modified Transmission Infrastructure (TI)** - Offshore and onshore electricity transmission infrastructure associated with the Moray East Offshore Wind Farm.
- **Telford, Stevenson and MacColl offshore wind farms** - The three consented offshore wind farms proposed to be located within the Moray East Site and collectively comprising Moray East Offshore Wind Farm.

1.4 Purpose of this Document

This Offshore HRA Screening Report has been produced to inform the HRA process for the Moray West Site, as requested by MS-LOT in their Scoping Opinion following the EIA Scoping process for Moray West Offshore Windfarm (Moray West, 2016). This Offshore HRA screening is required for the Moray West Offshore Wind Farm as it has the potential to affect the site integrity and / or the qualifying features of nearby Natura (European) sites. A similar HRA screening request is expected to be made by the consenting authorities for the OfTI (also MS-LOT) as part of their EIA Scoping process.

This document provides information to enable offshore HRA screening of the Moray West Site with respect to likely significant effects (LSEs) on European sites of nature conservation importance. As the substation site and preferred onshore cable route are yet to be identified, there will be a separate Onshore HRA Screening Report, if required. The intention is to then produce one Report to Inform Appropriate Assessment (RIAA) that covers both onshore and offshore proposals, which would be submitted with the consent and planning applications.

The steps in the HRA process and associated reporting requirements are described in Section 2 and Figure 2.2.1.

The assessment provided in this document is based on the current understanding of the baseline environment and the scope and nature of the proposed project activities. Further environmental survey and assessment work, consultee and advisor responses to this document, and refinements to the project design may change this assessment. These changes will be reflected in any future Report to Inform Appropriate Assessment (RIAA) that will be submitted with the consent and planning applications for the Moray West Offshore Wind Farm, OfTI and OnTI.

1.5 Structure of this Document

This Offshore HRA Screening Report is structured as outlined in Table 1.5.1 below.

Table 1.5.1 HRA Screening Report Structure

Section	Heading	Overview
Section 1	Introduction	Introduces the project and sets out the background to the proposals and the need for an Offshore HRA Screening Report, along with stating the purpose of the Offshore HRA Screening Report.
Section 2	The HRA Process	Sets out and defines the basis for HRA, the legal requirements and need for the process along with identifying the various stages of assessment that make up the overall process.
Section 3	Description of Development	Provides a description of each of the key components of the Moray West Offshore Wind Farm and the Moray West OfTI and outlines the approach being applied at the construction, operation and maintenance and decommissioning phases of the project.
Section 4	Screening	Provides details of the screening criteria that have been applied to identify European sites and qualifying features requiring consideration, identification of the European sites and Ramsar sites with connectivity to the Moray West Site and OfTI, and determination of routes to impact. Concludes with a summary of the qualifying features and the European sites / Ramsar that have potential for LSE.

Section	Heading	Overview
Section 5	Assessment for Non-Trivial Abundance and Determination of LSE	Identification of the qualifying features and routes to impact that can be screened out due to non-trivial abundance and those that will require further consideration within the RIAA due to potential LSE, with a summary of screening in or out conclusions.
Section 6	In-combination Assessment	Consideration of the cumulative LSE of the Moray West Site and OfTI in combination with other Offshore Wind Farms (e.g. Moray East and Beatrice Offshore Wind Farm), other marine development projects and other projects currently in the planning system, consented or under construction within that may, together with the Moray West Site and OfTI, have cumulative effects upon European sites or Ramsar (and their qualifying features).
Section 7	References	Sources of information that have been used to inform the baseline characterisation, the HRA Screening appraisal and the conclusions.

2 The HRA Process

2.1 Legislative Context

Within Scotland, the Conservation (Natural Habitats, & c.) Regulations 1994, as amended (referred to as the 'Habitats Regulations') and the Offshore Marine Conservation (Natural Habitats &c) Regulations 2007, as amended (referred to as the 'Offshore Habitats Regulations') implement the Habitats Directive and the Birds Directive.

Under Article 6(3) of the Habitats Directive, a HRA is required where a plan or project is likely to have a significant effect upon a European site (also known as a 'Natura 2000' site) either individually or in combination with other plans or projects. European sites include the following:

- Special Areas of Conservation (SACs) designated under the Habitats Directive for their habitats and/or species of European importance; and
- Special Protection Areas (SPAs) classified under the Birds Directive for rare, vulnerable and regularly occurring migratory bird species and internationally important wetlands.

In the UK, the requirements of the Habitat Regulations also extend to the consideration of effects on:

- Sites that are proposed for designation and inclusion in the Natura 2000 network and sites that are currently in the process of being classified such as potential SPAs (pSPAs), candidate and possible SACs (cSACs and pSACs) and Sites of Community Importance (SCIs).

The Habitats Regulations specify, amongst other issues, how development control decisions which could directly or indirectly affect Natura sites are to be reached. It is Scottish Government policy (as outlined in Scottish Planning Policy (SPP); Scottish Government, 2014) that the Regulations should also apply to sites identified as Ramsar sites (under the Ramsar Convention on Wetlands of International Importance) and these are also referred to as 'Natura Sites'. The relevant sections of the Habitats Directive are Articles 6(3) and 6(4) (as implemented in the Habitats Regulations by Regulations 48 and 49).

Article 6(3) of the Habitats Directive [92/43/EEC] states:

"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 therefore necessary, in the first instance, to determine whether it is possible to conclude that there is no LSE on the site. Only where it is not possible to conclude this, does an AA need to be carried out by the CA. The European Court of Justice ruling in the case of Waddenzee (Case C-127/02), stated that an AA of a project is necessary, "if it cannot be excluded, on the basis of objective information, that it will have a significant effect on the site." It is therefore clear that if it cannot be objectively ruled out, then an effect is likely. The test is therefore negative, and embeds precaution within it.

Regulation 48 of the Habitats Regulations states that an AA must be undertaken by the CA before any decision to give consent for any plan or project that is not directly connected with or necessary to the [conservation] management of a European site and which could significantly affect that site (either alone or in combination with other known plans or projects). An AA is required for all plans or projects "likely to have a significant effect" on a Natura site and applies only to the qualifying interests of the Natura site.

2.2 The Habitats Regulations Appraisal Process

The European Commission's guidance on Planning for the Protection of European Sites: Appropriate Assessment (European Commission, 2001) identifies a staged process to the assessment of the effects of plans or projects on European sites. Cumulatively, these stages are referred to as a Habitats Regulations Appraisal, in order to clearly distinguish the whole process from the second stage within it, which is referred to as AA.

There are potentially up to four stages:

- HRA Stage 1 - Screening;
- HRA Stage 2 - AA;
- HRA Stage 3 – Mitigation and Alternatives; and
- HRA Stage 4 – Assessment of "Imperative Reasons of Overriding Public Interest" (IROPI).

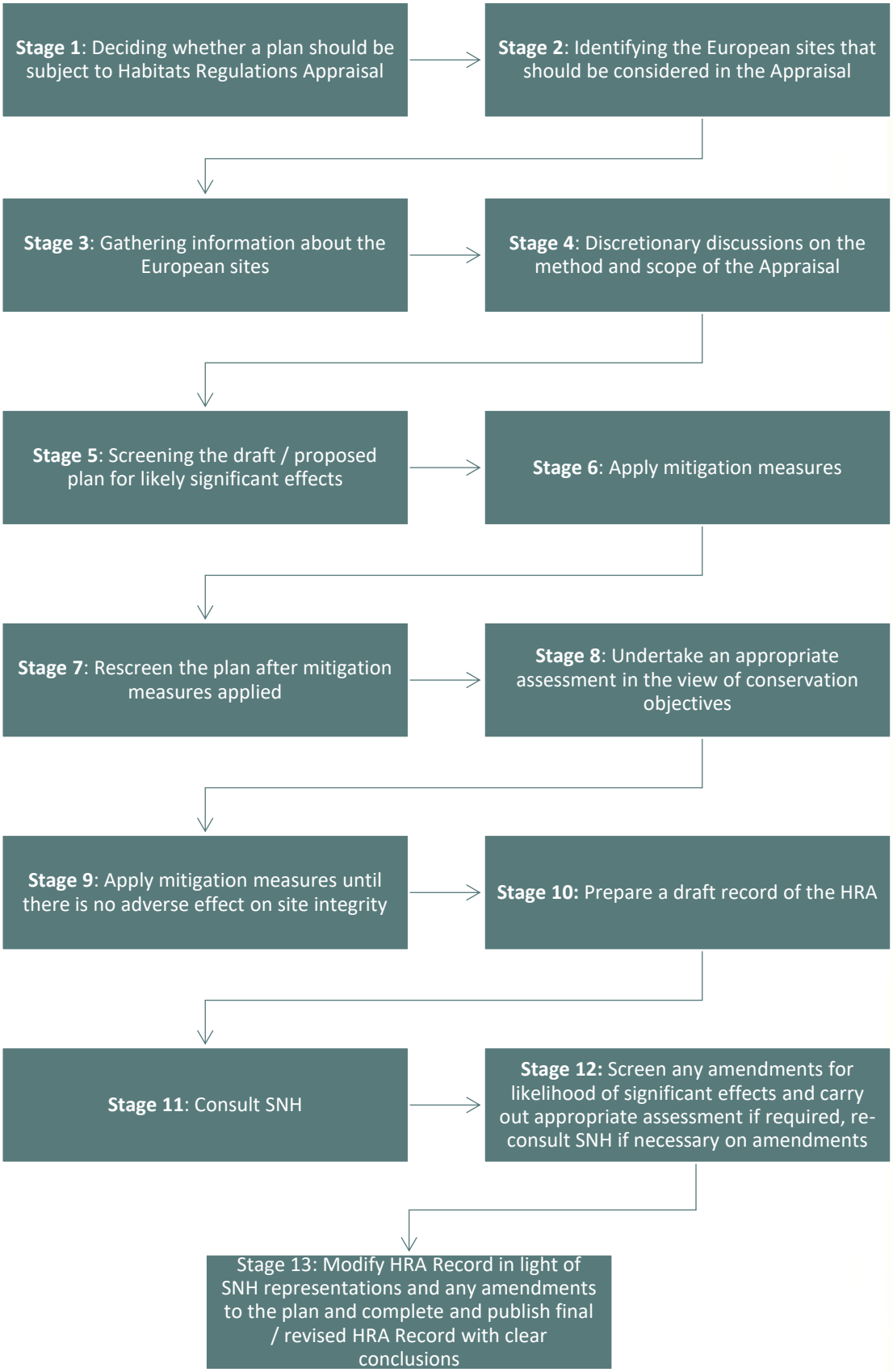
This report comprises the "Screening" stage, where the identification of LSE is reported. In this context, LSE is defined as 'any effect that may reasonably be predicted as a consequence of a plan or project that may affect the conservation objectives of the features for which the site was designated, but excluding trivial or inconsequential effects' (English Nature, 1999). Within the SNH Guidance (Tyldesley, D and Associates, 2015) paragraph 4.3 defines LSE as 'one that cannot be ruled out on the basis of objective information. The test is a 'likelihood' of effects rather than a 'certainty' of effects'. LSE should therefore 'not simply be interpreted as 'probable' or 'more likely than not', but rather whether a significant effect can objectively be ruled out'.

Within Scotland, the HRA process draws upon and follows the advice provided within the Scottish Natural Heritage (SNH) HRA guidance document 'Habitats Regulations Appraisal of Plans. Guidance for Plan-making Bodies in Scotland' (Tyldesley, D and Associates, 2015). This guidance sets out a 13-stage process of statutory procedures which are designed to assess the potential effects of plans and projects on European sites. The guidance is referred to within 'Planning Circular 6 2013. Development Planning' (Scottish Government, 2013). The 13 steps and the order in which they are applied are illustrated in Figure 2.2.1. This document is set out to address Stages 5 - 13 (screening and assessment stages).

Other guidance documents that have been used to inform this appraisal include:

- 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.

Figure 2.2.1 Illustration of HRA Process as set out within SNH Guidance (Tyldesley, D and Associates, 2015).



2.3 Approach to Screening

Screening is a relatively coarse filter to identify those European sites and qualifying features with connectivity to the Moray West Site for which a LSE cannot be discounted. In order to screen for LSE, it is necessary to consider three hierarchical aspects:

- Connectivity;
- Route to impact; and
- Non-trivial abundance.

Connectivity is defined as the presence of the qualifying feature of an SPA, SAC or Ramsar site in the zone of influence of a project. So, if a qualifying feature has no connectivity to the Moray West site, it leads to the conclusion of no LSE. Where connectivity cannot be objectively ruled out for any one qualifying feature, it is necessary to conclude that LSE cannot be excluded on the grounds of connectivity.

The next stage of the LSE consideration process is to consider potential for a route to impact (be it direct or indirect). Where connectivity has been identified, but it is determined that there is no route to impact on the qualifying feature, then it may still be possible to objectively conclude no LSE. If, however, a route to impact exists then a conclusion of LSE cannot be ruled out at this stage. Site-specific screening criteria are identified that assist with this part of the appraisal (Section 4.1).

Finally, if (following confirmation of potential for connectivity and route to impact) the abundance of a qualifying feature within the zone of influence is deemed trivial, it may be argued that no LSE can be concluded, as the conservation objectives of the site will not be compromised. The classification of trivial abundance is considered on a case by case basis and will vary between features, based on their habitat extent or population size.

Following the above process, for each European site (and their qualifying features) considered within the HRA screening it will be concluded that either:

- There are no LSEs on the European site(s) and their qualifying features, so therefore no further assessment is required; or
- LSEs on the European site(s) and their qualifying features cannot be discounted and therefore an AA requires completion by the CA.

Given the comparatively high level nature of screening a precautionary approach will be applied and so where any doubt as to the potential for LSE exists then the feature will be screened into the subsequent stage of the HRA process.

With respect to in-combination effects, this screening report identifies the categories of plans and projects that will need to be considered, but recognises that further discussion with the CA will be required to identify specific projects for inclusion in the in-combination assessment. The HRA will include, for those European sites and qualifying features screened into the assessment, a detailed in-combination assessment drawing on the findings of the EIA (including cumulative assessment) that will be undertaken specifically for the Moray West Site to understand the magnitude of those effects and whether they may lead to an adverse effect on site integrity.

3 Description of the Development

3.1 Introduction

This section provides a description of the infrastructure associated with the proposed Moray West Offshore Wind Farm and the OfTI. It is based on the design information available at the time of writing and it should be noted that the design of the Project infrastructure will be subject to further refinement throughout the pre-application phase. However, the level of detail presented below is deemed sufficient to inform HRA Screening, with any further refinement to the design and programme information being made available to inform any future RIAA that may be required by the CA as part of any future AA process.

3.2 Development Location and Boundaries

As described in Section 1.1 and shown on Figure 1.1.1, the Moray West Site is located within the Outer Moray Firth. The Project comprises the Moray West Offshore Wind Farm, the OfTI and the OnTI.

The Moray West Offshore Wind Farm is situated approximately 22 km from the Caithness coast, covering an area of approximately 225 km^2 and will comprise an offshore array of WTGs, connected to one another by subsea inter-array cables, which will in turn connect the WTGs to the OfTI. The Moray West Offshore Wind Farm is located on the western edge of an area known as Smith Bank.

The OfTI will be located within the Outer Moray Firth, and the export cables will make landfall on the Moray / Aberdeenshire coastline as shown in Figure 1.1.1. The OfTI will comprise one or two Offshore Substation Platform(s) (OSP(s))s to be located within the wind turbine array in the Moray West Offshore Wind Farm (their precise location within the array is yet to be confirmed), which will transform the power generated by the turbines before being transported via offshore export cable circuits, located within an Offshore Export Cable Corridor, to a shoreline landfall location on the Moray or Aberdeenshire coast where it joins the OnTI.

The OnTI will comprise onshore transition bays near the landfall where the offshore and onshore cable circuits are joined together, two underground onshore cable circuits located with the Onshore Export Cable Corridor from landfall to a new Moray West substation and buried interconnecting cables between the new substation and existing Blackhillock substation. The precise location of these infrastructure remains under investigation and will be presented in greater detail within the Onshore EIA and any Onshore HRA Screening Report that may be produced.

3.3 Offshore Wind Farm Infrastructure

3.3.1 Offshore Wind Turbines

Table 3.3.1 provides a summary of the indicative wind turbine parameters currently proposed.

Table 3.3.1 Indicative Wind Turbine Parameters

Indicative Parameter	Parameter Range
Indicative capacity (MW)	Up to 850 MW
Indicative number of turbines	Up to 90
Hub height range (m HAT)	118 - 155
Maximum rotor diameter (m)	250
Maximum tip height (m HAT)	280

Indicative Parameter	Parameter Range
Minimum air draft range (m HAT)	22
Minimum downwind spacing (m)	1,200
Minimum crosswind spacing (m)	1,050
Layout concept	The wind turbine layout will have some form of regularity in plan (i.e. Grid or Diamond patterns with minimum spacings as stated above) with the exception of the wind turbines around the perimeter which could have a tighter spacing compared to the ones within the wind farm array. It should be noted that there may be empty spaces within the layout pattern.

3.3.2 Offshore Wind Farm Infrastructure Foundations and Substructures

This section includes information on the foundations and substructures for the wind turbines and meteorological mast (if required). Table 3.3.2 provides a summary of the indicative parameters currently proposed for foundations and substructures.

Table 3.3.2 Indicative Foundation and Substructure Parameters

Infrastructure Type	Indicative Parameter	Maximum Parameter
Gravity Base Structures (GBS)	Maximum base diameter (m)	55
Steel lattice jacket (with pin piles)	Maximum number of legs	4
	Maximum depth (m)	60
	Maximum number of piles per foundation	4
	Maximum diameter of pile (m)	4
Steel lattice jacket (with suction caissons)	Maximum diameter with scour protection (m)	45
Suction Caisson	Maximum diameter (m)	25
Monopile	Maximum diameter of Pile (m)	15

Based on the known physical properties within the Moray West Site and the inherent uncertainty with the seabed properties a range of foundations and substructures are being considered. These include the following:

- Three or four legged steel lattice jacket structure with pin piles;
- Three or four legged steel lattice jacket structure with suction caissons;
- GBS;
- Suction caisson; and
- Monopile.

At this current time, due to changing economic and technological circumstances that may prove one or another technology more appropriate nearer the time of construction, Moray West is not currently excluding any of the above foundation types. Turbine support structures will include access facilities and

appropriate lighting and marking for surface navigation. Options for the configuration of the support structures, and details of their potential environmental impacts, will be included in the RIAA.

3.3.2.1 Steel Jacket Structure

Jackets are steel structures with three or four legs, each of which is fixed to the seabed using a steel "pin" pile or use of a suction caisson. Jacket structures can assume different configurations with sub–concepts including braced monopods, tripod structures and three or four-legged lattice structures. Pin piles are generally expected to be driven but drilling may be required at some locations. Pin pile diameters would vary depending on specific design but are expected to be up to 4 m in diameter. It is possible that suction caisson foundations could be used at the base of the jacket instead of the pin piles. These would be of a greater diameter, possibly up to 25 m (45 m including scour). Scour protection (e.g. scour mats or rock) may be used around each leg. Corrosion protection will be required for the steel structures, both above and below water level. This is likely to take the form of cathodic protection and / or protection coatings for the submerged areas, and protective coating for areas above the water line.

3.3.2.2 Gravity Base Structure

The generic GBS is composed of one or more hollow concrete base, which is filled with ballast for stability, and either a concrete or steel structure on top. The GBS may have a steel "skirt" which penetrates the seabed. The maximum base diameter of the structure is anticipated to be 81 m. The concept may require the preparation of the seabed with the installation of a flat gravel bed to provide a stable foundation for the GBS. Depending on the seabed soil conditions an area of seabed may require to be dredged prior to the installation of the gravel bed. If dredging is required it is expected that the area of seabed which is excavated will be greater than the final area of the laid gravel bed. In some cases, grouting injected under the GBS or rubber friction-enhancing mats may be a suitable alternative to the gravel bed foundation. The placing of scour protection around the concrete base (graded rock placement, concrete mattress or scour mats) is likely. As with a steel jacket or monopile, corrosion protection will be required for any steel work (including boat landings and ladders) of the substructure. This is likely to take the form of cathodic protection and / or protective coatings for the submerged areas, and protective coating for areas above the water line.

3.3.2.3 Suction Caisson

This concept has had limited use to date in the offshore wind industry but has been used extensively in oil and gas as alternatives to piles at the base of jackets. The concept consists of a steel cylindrical skirt or skirts up to an anticipated diameter of 25 m which penetrate into the seabed. Corrosion protection will be required for this substructure. This is likely to take the form of cathodic protection and / or protective coatings for the submerged areas, and protective coating for areas above the water line.

3.3.2.4 Monopile

This concept is the most commonly used solution on operational wind farm developments to date in water depths typically ranging up to 35 m, but technology evolution is making possible its use in deeper waters. The structure consists of a steel cylindrical pile with an anticipated maximum diameter of 15 m. Conical transitions are occasionally used to reduce the diameter of the structure at the top of the foundation. Corrosion protection will be required for this substructure. This is likely to take the form of cathodic protection and / or protective coatings for the submerged areas, and protective coating for areas above the water line. Scour Protection The substructure and foundation concept as well as the environmental conditions (current and waves) determines the type and extent of scour protection required, and typically a 'scour allowance' is specified during the design phase. Generally as foundation size increases the potential scour depth around the structure also increases and hence there is a greater need to protect

the foundation. Measures to minimise the extent of scour include the installation of rock armour on the seabed around foundations or the gravel bed in the case of a GBS foundation. Such a method has been commonly used in the North Sea, including the Moray East Offshore Meterological Mast. This involves the placement of carefully specified graded rock to act as a scour protection blanket. The suitability of installing rock armour or mattresses for cable protection especially around turbine bases will be assessed based on seabed sediment information and using the seabed current data across the Moray West Site.

3.3.3 Inter-Array Cabling

Table 3.3.3 provides a summary of the indicative parameters currently proposed for the network of subsea inter-array cables that will connect the wind turbines to the OSPs.

Table 3.3.3 Indicative Inter-Array Cable Network Parameters

Indicative Parameter	Parameter Range
Voltage of Cabling (kV)	33 to 72.5
Entry / Exit Method from Turbine	J-tube or Flexible Conduit Type Arrangement
Target Burial Depth (m)	0-3
Indicative Cable Installation Method	Ploughing, Jetting, Trenching, Rock Cutting
Protection where Burial Unachievable	Rock placement, Concrete Mattresses, Proprietary Steel, Plastic Ducting, Protecting Sleeves, Grout Bags.

The electrical infrastructure required in order to collect the energy generated by the wind turbines will comprise inter-array cabling between the turbines and any OSP(s). These cables are likely to be designed to operate at a voltage in the range of 33 to 72.5kV and may include fibre optic communication links.

3.4 Offshore Transmission Infrastructure

The OfTI will collect the energy generated by the Offshore Wind Farm (as described in the Moray West Offshore Wind Farm Infrastructure EIA Scoping Report, May 2016), located in the Outer Moray Firth, and transfer the energy to the OnTI, which will in turn connect the offshore wind farm to the onshore national electricity transmission system.

OfTI components are as follows:

- Up to two OSPs – these are the offshore equivalent of onshore electrical substations; they collect and transform the electricity generated by WTGs before it is transmitted to shore. The OSPs will be high voltage alternating current (HVAC) OSP colouring, lighting and marking requirements will be as per current relevant standards and guidance, as well as being informed through consultation with relevant bodies;
- OSP foundations and substructures – these structures, fixed to the seabed, support the topsides of the OSP(s), which sit above the surface of the sea. The substructure and foundation options being considered for the OSP(s) are GBSs, monopiles and steel lattice (or jacket) structures;
- Interconnector cables (if required) – these subsea cables connect multiple OSP(s) to one another. The voltage range will be between 33 -400 kV. The extent of the possible cabling between OSP(s) has not yet been determined and cable length will depend upon the distance between OSP(s), which will be located within the Moray West Site;

- Offshore export cables – these subsea cables (comprising up to two cable circuits installed in separate trenches) transmit the electricity generated by the wind farm, from the OSP(s) to the shore. Spacing between the cables has yet to be determined, but will be in the region of four times water depth; and
- Landfall – this is the location where the subsea offshore export cables are physically brought ashore and where they connect to the onshore export cables, which form part of the OnTI. The limit of the OfTI for application purposes is mean high water spring (MHWS). The export cable circuits will make landfall on the Moray or Aberdeenshire coast between Portknockie and Portsoy, as shown in Figure 1.1.1. The means by which the cables will be installed at landfall will depend upon the characteristics of the selected landfall location. The export cables will be buried, and will either be installed in a trench or routed below the shoreline using other techniques, such as horizontal directional drilling (HDD).

3.5 Construction Programme

The current indicative programme for the Moray West site suggests a start to construction in 2022 at the earliest, with the onshore substation installation starting first in Quarter 2 (Q2) 2022 with completion in Q1 2023. The offshore turbine foundations and substructure installation would start in Q2 2022 and be completed in Q3 2023. The inter-array cables would be installed between Q1 and Q4 in 2023, with the OSP(s) installed in Q2 / Q3 2023. Following installation of the OSP(s), the export cables would be installed between Q3 2023 and Q1 2024. WTG installation would then take place between Q1 2024 and Q4 2024. The overall construction programme is therefore scheduled to take approximately 34 months from first installation of infrastructure to first generation, with full generation anticipated for Q4 2024.

It is likely that construction of the onshore substation and installation of the onshore cable circuits will occur in parallel. However, installation of the onshore cable circuits will be transient in that it will progress along the chosen route, with construction activities occurring in any one location for a short period only. This would be the same for the offshore export circuits.

3.6 Operation and Maintenance

Once operational, the Moray West Offshore Wind Farm and OfTI will require regular inspections, service and maintenance throughout its lifetime. It is likely that the Moray West Offshore Wind Farm and the OfTI will each be managed, operated and maintained from their own onshore facility. Onshore activities will include the following:

- Control room for remote operation of the Moray West Offshore Wind Farm and OfTI;
- Port facilities where vessels, maintenance equipment, spares and consumables are stored;
- Onshore operations base for management of work and personnel; and
- Helicopter hangar and base (if required).

Operation and maintenance (O&M) activities may be required at any time, 24 hours per day, 365 days per year.

The majority of control activities will be undertaken remotely from shore using a control centre, however offshore access and intervention will be required to maintain and potentially repair or refit plant and equipment. Maintenance can be generally separated into three categories:

- Planned maintenance: This includes general inspection and testing, investigation of faults and minor fault rectification, as well as replacement of consumables. It is anticipated that these events will be undertaken during summer months as the weather is likely to be more

favourable, offering an increased maintenance window. Scheduled maintenance and inspection of each OSP is likely to occur every six to twelve months. Inspections of subsea cables will be performed on a periodic basis;

- Unplanned maintenance: This applies to defects occurring that require rectification out-with the planned maintenance periods. The scope of such maintenance would range from small defects on non-critical systems to failure or breakdown of main components potentially requiring them to be repaired or replaced; and
- Periodic overhauls: These will be carried out in accordance with equipment manufacturer's warranty and specifications. These are likely to be planned for execution in periods of the year with the best access conditions.

The Crown Estate Scotland lease for Moray West Offshore Wind Farm will be for 50 years, with the design life of the turbines and other components of the wind farm being of a similar order when repowering is considered.

3.7 Decommissioning

Decommissioning requirements are set out in the Energy Act 2004 and will influence all stages of design of the Moray West Offshore Wind Farm and OfTI. This will be a key requirement under the Crown Estate Scotland lease agreement.

The Moray West Offshore Wind Farm, OSP(s) and cables will be decommissioned following the end of their operational life. The extent of decommissioning is dependent on the type of foundations / substructures adopted for the WTGs and OSP(s), so options will be assessed in conjunction with the design of the development in the ER.

A Decommissioning Programme will be prepared for the Wind Farm and OfTI prior to construction, in line with the requirements of the Energy Act 2004. For the purpose of this Scoping Report the following has been assumed; that foundations and substructures of the OSP(s) would be removed, where practicable, with piled foundations removed to just below seabed. There is no statutory requirement for decommissioned subsea cables to be removed, though the approach to decommissioning, including cable decommissioning, will be reviewed as part of the Decommissioning Programme. It is expected that OfTI decommissioning will require similar vessels to those used in construction and take a similar period of time.

4 Screening

4.1 Screening Criteria

The criteria by which European sites and features are identified as having connectivity or having the potential for a LSE with the Moray West Site and or OfTI boundary are set out in Table 4.1.1.

Table 4.1.1 Screening Criteria for the Initial Identification of European Sites.

Criteria for the initial identification of European Sites	Specific Criteria
European site or Ramsar that overlaps with the Moray West Site and / or OfTI	All: physical overlap between project boundary and designated site.
SACs supporting mobile populations of qualifying features (e.g. Annex II marine mammals or migratory fish) that may interact with potential effects associated with the Moray West Site and / or OfTI.	Extent of the mobile species study area – e.g. management units for marine mammals.
European site or Ramsar with qualifying features whose mean maximum foraging or migratory range overlaps with the Moray West Site and / or OfTI.	Birds – based on standard ranges; Seal – based on standard foraging range from haul out sites; and Marine mammals & migratory fish – based upon known key migrations routes.
European sites with marine mammal and migratory fish qualifying features who may be exposed to auditory injury (Permanent Threshold Shift (PTS) and Temporary Threshold Shift (TTS)).	Based on hearing thresholds identified through research and published data and project specific underwater noise modelling outputs
European sites with marine mammal and migratory fish qualifying features who may suffer behavioural changes or effects.	Assessment of behavioural responses to underwater noise taking into consideration published research findings.
European site or Ramsar and / or a qualifying feature located within the potential extent of impacts associated with the Moray West Site and / or OnTI.	Indirect pathways to features e.g. pollution or suspended sediment reaching designated sites / features.
European site or Ramsar qualifying species recorded during site specific surveys.	Presence of a qualifying species that can be associated with a designated site.

4.2 Identification of Sites and Features with Connectivity

This section identifies the European sites and Ramsar (and qualifying features) for which there is potential connectivity with the Moray West Site and OfTI. These sites and their qualifying features have been identified through the application of the criteria set out within Table 4.1.1 and in accordance with the approach set out in Section 2.3. Those sites for which there is connectivity will be taken forward for determination of LSE.

The Scoping Opinion received from Marine Scotland for the Moray West Offshore Wind Farm (Marine Scotland, 2016) clearly identifies the European sites and Ramsar that the CA and its statutory advisors consider to require assessment as part of the AA. However, a review of all sites that have potential to have connectivity with the Moray West Site and OfTI has been undertaken within this report to ensure that all screening out is justified and validated.

The Moray West Site does not overlap with any European site or Ramsar, whilst the OfTI overlaps with the Moray Firth pSPA in the near shore extent. Therefore, with the exception of the pSPA, any

connectivity will be associated with either the potential for mobile species to be present within the zone of influence from the Project, or for the zone of influence to extend out to European or Ramsar sites that are close by.

Consideration has been given to the existing Moray East AA (Marine Scotland, 2014) and also the feedback from key stakeholders to date on the Moray West Site scoping report. From these sources it is identified that consideration would need to be given to mobile marine mammal, ornithological and fish receptors from designated sites whose presence within the Project's zone of influence may be anticipated. In addition to these receptors that may be connected to designated sites considerable distance from the Project, consideration is also given to any European sites or Ramsar within the Moray Firth, where non-mobile designated species / features may have the potential to be affected either directly or in-directly by the Project.

4.2.1 Sites Designated for Ornithological Features

The Offshore Export Cable Corridor component of the Moray West OfTI partially overlaps the Moray Firth pSPA (see Figure 4.2.1 and Table 4.2.1), as a result the potential for a LSE on the features of this pSPA cannot be discounted. The features include breeding and wintering shag (*Phalacrocorax aristotelis*), wintering red-throated diver (*Gavia stellata*), great northern diver (*Gavia immer*), common scoter (*Melanitta nigra*), velvet scoter (*Melanitta fusca*), eider (*Somateria mollissima*), goldeneye (*Bucephala clangula*), long-tailed duck (*Clangula hyemalis*), scaup (*Aythya marila*) and Slavonian grebe (*Podiceps auritus*).

Table 4.2.1 European Sites (SPAs) and Ramsar which Overlap with the Moray West Site and OfTI.

Site	Qualifying Features	Overlap With	
		Moray West Offshore Wind Farm	OfTI
Moray Firth pSPA	Shag, breeding and non-breeding; Common scoter, non-breeding; Eider, non-breeding; Goldeneye, non-breeding; Great northern diver, non-breeding; Long-tailed duck, non-breeding; Red-breasted merganser (*Mergus serrator*), non-breeding; Red-throated diver, non-breeding; Scaup, non-breeding; Slavonian grebe, non-breeding; and Velvet scoter, non-breeding.	No	Yes

In addition to impacts resulting from direct effects (i.e. based on overlap between the Moray West Site and the Moray Firth pSPA), there may be potential for LSE on ornithological qualifying features of sites located further afield, where birds forage and / or migrate through the Moray West Site. These features include:

- Breeding birds;
- Migratory seabirds; and
- Waterbirds (waders and wildfowl).

The criteria used in Table 4.1.1 for screening of sites with these features are given below by feature type.

4.2.1.1 Sites Designated for Mobile Breeding Ornithological Features

During the breeding season foraging birds may travel some distance from their breeding colonies. The information available on the distances that breeding birds will forage depends on the species. Thaxter *et al.* (2012) provide data on recorded foraging ranges for a wide range of species, including the mean and maximum distances travelled. Typically, the mean-maximum range (i.e. the mean average of the maximum foraging trips recorded) has been used as a criterion for establishing whether there is likely to be connectivity (and hence risk of a LSE between an SPA breeding colony and the Moray West Site.

In some cases, more specific information is available from GPS / satellite tracking studies such as, for example, the initiatives for great black-backed gull and herring gull as part of Moray East EIA and the Future of the Atlantic Marine Environment (FAME) / Seabird Tracking and Research (STAR) programmes implemented by the Royal Society for the Protection of Birds (RSPB) and others.

Mean-maximum foraging ranges as reported by Thaxter *et al.* (2012) have been used to determine potential connectivity with the Moray West Site and OfTI, unless specific relevant tracking data are available (where the latter is deemed to have priority).

Those species observed within the Moray West Site that have the potential to be associated with designated sites are summarized in Appendix 2.

Figure 4.2.2 to Figure 4.2.11 present foraging ranges for ten breeding qualifying features of SPAs (fulmar (*Fulmarus glacialis*), cormorant (*Phalacrocorax carbo*), shag, guillemot (*Uria aalge*), razorbill (*Alca torda*), puffin (*Fratercula arctica*), kittiwake (*Rissa tridactyla*), herring gull (*Larus argentatus*), great black-backed gull (*Larus marinus*) and sandwich tern (*Thalasseus sandvicensis*)). All other breeding seabird qualifying features are disregarded for the purposes of this report, as the Moray West Offshore Wind Farm is understood to lie considerably beyond mean-maximum (or even maximum) foraging range. For these species it is concluded that there is therefore a lack of connectivity between an SPA and the Moray West Site during the breeding season.

Two SPAs in Orkney (Hoy SPA and Copinsay SPA) include breeding seabird qualifying features whose foraging ranges stretches as far as Moray West. The Moray East ES (Moray East, 2012) considered these sites and no impacts were deemed appropriate to apportion to the populations in question (due to distance and likely distribution of features foraging away from colonies). No LSE on the SPAs were therefore predicted and these sites are therefore screened out at this stage of the report and are not considered further.

Fulmar

The mean-maximum foraging range for fulmar is substantial at 400 km. Although sites such as Forth Islands and those in Orkney / Shetland technically fall within range, only those sites considered previously by Moray East are included here. Considering the wide foraging range of the species and their catholic foraging preferences, the likelihood of significant Fulmar connectivity between these sites and Moray West is considered low. Indeed, no effect on the three nearest SPAs including fulmar as qualifying feature were predicted in Moray East (2012) and therefore a high degree of certainty was attached to predicted no effects on SPAs further distant. Mean-maximum foraging ranges from all regional SPAs where this species qualifies (East Caithness Cliffs, North Caithness Cliffs, Troup, Pennan and Lion's Head and Buchan Ness to Collieston Coast SPAs) are connected with the Moray West Site (Figure 4.2.2). On this basis, the potential for a LSE on this species from each of these sites cannot be discounted (for both the Moray West Offshore Wind Farm and OfTI).

Cormorant

Cormorant has a mean-maximum of 25 km and this range from East Caithness Cliffs SPA extends to the Moray West Offshore Wind Farm (Figure 4.2.3). When a single standard deviation on the published foraging range is considered, the northern elements of the OfTI also lie within range of the SPA. On this basis, the potential for a LSE on this species from this site cannot be discounted (for both Moray West Offshore Wind Farm and the OfTI).

Shag

Shag is a qualifying feature of both East Caithness Cliffs and Buchan Ness to Collieston Coast SPAs. Shag has a limited mean-maximum foraging range of 14.5 km, so that the Moray West Site lies outside of projected interaction from both SPAs even when a single standard deviation is considered (Figure 4.2.4). On this basis, the potential for a LSE on this species from these two sites is discounted (for both the Moray West Offshore Wind Farm and the OfTI).

Guillemot

Figure 4.2.5 shows the mean maximum foraging ranges plus one standard deviation for guillemot from regional SPAs (84.2 km). Guillemot is a feature of four SPAs in the region; the Moray West Offshore Wind Farm and OfTI lie within this range for three of these SPAs (North Caithness Cliffs, East Caithness Cliffs and Troup, Pennan and Lion's Head SPAs). The Moray West OfTI also lies within mean-maximum foraging range from Buchan Ness to Collieston Coast SPA as does the Moray West Offshore Wind Farm when a single standard deviation is considered (Figure 4.2.5). On this basis, the potential for a LSE on this species from each of these four sites cannot be discounted (for both the Moray West Offshore Wind Farm and the OfTI).

Razorbill

Figure 4.2.6 shows the mean maximum foraging ranges plus one standard deviation for razorbill from regional SPAs (48.5 km). Razorbill is a feature of three SPAs in the region; the Moray West Offshore Wind Farm lies within this range for two of these SPAs (North Caithness Cliffs and East Caithness Cliffs) while the OfTI lies within range of East Caithness Cliffs and Troup, Pennan and Lion's Head SPA. When a single standard deviation on the foraging range is considered, the Moray West Site is within reach of all three SPAs (Figure 4.2.6). On this basis, the potential for a LSE on this species from each of these three sites cannot be discounted (for both the Moray West Offshore Wind Farm and the OfTI).

Puffin

Puffin has a mean-maximum of 105.4 km and this range from North Caithness Cliffs SPA extends to the Moray West Site (Figure 4.2.7). On this basis, the potential for a LSE on this species from this site cannot be discounted (for both the Moray West Offshore Wind Farm and the OfTI). SNH are recommending to Government that puffin be removed from the East Caithness Cliffs SPA citation as a named assemblage species. It is understood that breeding puffin are restricted to North Caithness Cliffs as SPA.

Kittiwake

Figure 4.2.8 shows the mean-maximum foraging range for kittiwake from all relevant SPAs in the region. The mean-maximum foraging range of 60 km for this species suggests that the Moray West Site is within range of East Caithness Cliffs, North Caithness Cliffs and, Troup, Pennan and Lion's Head. On this basis, the potential for a LSE on this species from each of three sites cannot be discounted. Buchan Ness to Collieston Coast SPA is within range of the OfTI only. Therefore an LSE on the kittiwake feature of Buchan Ness to Collieston Coast SPA is discounted for the proposed wind farm but it cannot be discounted for any effects associated with the OfTI.

Herring Gull

Figure 4.2.9 shows the mean-maximum foraging range for herring gull from all relevant SPAs in the region. The mean-maximum foraging range of 61.1 km for this species suggests that the Moray West Site lies within range of East Caithness Cliffs and, Troup, Pennan and Lion's Head while the OfTI is within reach of Buchan Ness to Collieston Coast SPA. When considered the single standard deviation on foraging range, the Moray West Offshore Wind Farm is within reach of Buchan Ness to Collieston Coast SPA (Figure 4.2.9). On this basis, the potential for a LSE on this species from each of three sites cannot be discounted (for both the Moray West Offshore Wind Farm and the OfTI). It is however noted that tracking work from East Caithness Cliffs in 2014 (Moray East, 2015) found that none of the herring gulls fitted with tags foraged within the boundary of the Moray West Site.

Great Black-backed Gull

Figure 4.2.10 shows the mean-maximum foraging range for great black-backed gull from all relevant SPAs in the region. The mean-maximum foraging range of 60 km for this species suggests that the Moray West Site lies within range of East Caithness Cliffs SPA (Figure 4.2.10). On this basis, the potential for a LSE on this species from each of three sites cannot be discounted (for both the Moray West Offshore Wind Farm and the OfTI). It is however noted that tracking work from East Caithness Cliffs in 2014 (Moray East, 2015) found that none of the great black-backed gulls fitted with tags foraged within the boundary of the Moray West Site.

Sandwich Tern

Figure 4.2.11 shows the mean-maximum foraging range for Sandwich tern from the relevant SPA in the region (Loch of Strathbeg). The mean-maximum foraging range of 49 km for this species suggests that the Moray West Site does not lie within range of the SPA (Figure 4.2.11). When the single standard deviation is considered, sandwich tern may potentially forage to the Moray West Offshore Wind Farm. On this basis, the potential for a LSE on this species from the SPA cannot be discounted (for the OfTI only).

Summary of Sites with Breeding Features Taken Forward for Determination of LSE

Table 4.2.2 presents a summary of sites and designated ornithological features with foraging ranges relating to the Moray West Site and OfTI.

Table 4.2.2 Mobile Species Supported by European and Ramsar Sites Whose Mean Maximum Foraging and / or Migratory Range Overlaps with the Moray West Site.

Site	Designated Species	Migratory or Foraging Range (km)	Distance To Closest Point (km)	
			Moray West Offshore Wind Farm	OfTI
East Caithness Cliffs SPA[1]	Shag; Cormorant; Fulmar; Guillemot; Razorbill; Great black-backed gull; Herring gull; and Kittiwake.	14.5 ± 3.5 25.0 ± 10.0 400 ± 245.8 84.2 ± 50.1 48.5 ± 35.0 60 61.1 ± 44.0 60.0 ± 23.3	19.8	30.0

[1] SNH are recommending to Government that puffin be removed from the East Caithness Cliffs SPA citation as a named assemblage species.

Site	Designated Species	Migratory or Foraging Range (km)	Distance To Closest Point (km)	
			Moray West Offshore Wind Farm	OfTI
North Caithness Cliffs SPA	Fulmar; Guillemot; Razorbill; Puffin; and Kittiwake.	400 ± 245.8 84.2 ± 50.1 48.5 ± 35.0 105.4 ± 46.0 60.0 ± 23.3	41.8	57.1
Troup, Pennan and Lion's Heads SPA	Fulmar; Guillemot; Razorbill; Herring gull; and Kittiwake.	400 ± 245.8 84.2 ± 50.1 48.5 ± 35.0 61.1 ± 44.0 60.0 ± 23.3	52.4	20.8
Buchan Ness to Collieston Coast SPA	Shag; Fulmar; Guillemot; Herring gull; and Kittiwake.	14.5 ± 3.5 400 ± 245.8 84.2 ± 50.1 61.1 ± 44.0 60.0 ± 23.3	92.9	59.8
Loch of Strathbeg SPA	Sandwich tern.	49.0 ± 7.1	76.7	47.7

4.2.1.2 Breeding Seabird Features in the Non-Breeding Season

Seabird species in general disperse widely during non-breeding seasons, so that impacts to some degree may be felt on the SPA populations during these seasons. The species are not constrained by extents of central-place foraging and for that reason a LSE on all species detailed above that are SPA / pSPA qualifying or non-listed assemblage features cannot be discounted. It is however expected that densities of species will be lower in the non-breeding seasons (especially in the case of herring gull) or lower apportioning values to the relevant SPA will be appropriate (compared to the breeding season).

4.2.1.3 Sites Designated for Migratory Seabirds and Waterbirds

Seabirds that breed in sites designated as SPAs in areas of the UK that are distant from the Moray West Site have some potential to interact with the Moray West Offshore Wind Farm during bi-annual migratory movements. In order to determine whether there is potential for a LSE with respect to the Moray West Site, the RIAA will include an extended screening exercise for migratory seabirds. The process involves calculating the proportion of each species' migratory front represented at the Moray West Site which is then incorporated into, for example, collision risk modelling. Any projected SPAs that have relevance to this modelling are not specifically listed in this HRA Screening report.

The movement of migratory waders and wildfowl is characterised by long distance flights, which occur as a series of flights between discrete wetlands or 'staging areas'. The majority of these movements occur across broad fronts with radar studies showing that waders will migrate at altitudes of 500 m - 4,000 m (e.g. van de Kam *et. al.*, 2004). Only when migrating waders encounter unfavourable weather will birds descend to lower heights following landscape features such as coastlines until they reach suitable staging areas.

Table 4.2.3 lists SPAs on the north-east Scotland coastline that support migratory waders and wildfowl as features. Those species / sites already screened in through direct overlap with the Moray West Site (i.e. Moray Firth pSPA) with foraging range connectivity (Table 4.2.2) are not included.

Table 4.2.3 Mobile Species Supported by European and Ramsar Sites which may Interact with Potential Effects Associated with the Moray West Site.

Site	Designated Species	Mobile Species Study Area	Distance To Closest Point (km)	
			Moray West Offshore Wind Farm	OfTI
Moray and Nairn Coast SPA	Bar-tailed godwit (*Limosa lapponica*), non-breeding; Common scoter, non-breeding; Dunlin (*Calidris alpina alpina*), non-breeding; Greylag goose (*Anser anser*), non-breeding; Long-tailed duck, non-breeding; Osprey (*Pandion haliaetus*), breeding; Oystercatcher (*Haematopus ostralegus*), non-breeding; Pink-footed goose (*Anser brachyrhynchus*), non-breeding; Red-breasted merganser, non-breeding; Redshank (*Tringa totanus*), non-breeding; Velvet scoter, non-breeding; Waterfowl assemblage, non-breeding; and Wigeon (*Anas penelope*), non-breeding.	NE Scotland	36.8	10.5
Dornoch Firth and Loch Fleet Ramsar	Bar-tailed godwit, non-breeding; Greylag goose, non-breeding; and Wigeon, non-breeding.	NE Scotland	36.2	36.2
Dornoch Firth and Loch Fleet SPA	Bar-tailed godwit, non-breeding; Curlew (*Numenius arquata*), non-breeding; Dunlin, non-breeding; Greylag goose, non-breeding; Osprey, breeding; Oystercatcher, non-breeding; Teal (*Anas crecca*), non-breeding; and Wigeon, non-breeding.	NE Scotland	36.2	36.2

Site	Designated Species	Mobile Species Study Area	Distance To Closest Point (km)	
			Moray West Offshore Wind Farm	OfTI
Cromarty Firth SPA	Bar-tailed godwit, non-breeding; Common tern (*Sterna hirundo*), breeding; Curlew, non-breeding; Dunlin, non-breeding; Greylag goose, non-breeding; Knot (*Calidris canutus*), non-breeding; Osprey, breeding; Oystercatcher, non-breeding; Pintail (*Anas acuta*), non-breeding; Red-breasted merganser, non-breeding; Redshank, non-breeding; Scaup, non-breeding; Whooper swan (*Cygnus cygnus*), non-breeding; and Wigeon, non-breeding.	NE Scotland	54.7	54.7
Cromarty Firth Ramsar	Bar-tailed godwit, non-breeding; and Greylag goose, non-breeding.	NE Scotland	54.7	54.7
Inner Moray Firth SPA	Bar-tailed godwit, non-breeding; Common tern, breeding; Cormorant, non-breeding; Curlew, non-breeding; Goldeneye, non-breeding; Goosander (*Mergus merganser*), non-breeding; Greylag goose, non-breeding; Osprey, breeding; Oystercatcher, non-breeding; Red-breasted merganser, non-breeding; Redshank, non-breeding; Scaup, non-breeding; Teal, non-breeding; and Wigeon, non-breeding.	NE Scotland	63.1	61.5
Inner Moray Firth Ramsar	Bar-tailed godwit, non-breeding; Greylag goose, non-breeding; Red-breasted merganser, non-breeding; and Redshank, non-breeding.	NE Scotland	63.1	61.5

4.2.1.4 Designated Habitat Within a SPA or Ramsar

The potential effects on designated habitat of sites supporting ornithological features is limited to the Moray Firth pSPA, which directly overlaps with the Moray West OfTI.

4.2.1.5 Bird Species Recorded in Site Specific Surveys

Although no analysis has yet been undertaken of the recently completed digital aerial surveys of the Moray West Site, a list of the species recorded is available. Table 4.2.4 details the species recorded by month of survey from April 2016 to March 2017.

Both shag and cormorant were completely absent confirming the conclusion that LSE can be discounted for the former species (as the SPAs are outwith the mean maximum foraging range for shag) and strongly suggesting that it can also be discounted for the latter species (SPAs were identified as being within the mean maximum foraging range for cormorant even though cormorant was recorded as absent). The surveys were not designed to record species associated with the OfTI, however two qualifying species of Moray Firth pSPA, great northern diver and common eider were recorded in single months of survey.

Table 4.2.4 European or Ramsar Qualifying Species Recorded During Site Specific Surveys By Month Between April 2016 to March 2017.

Month / Species	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Guillemot												
Razorbill												
Herring gull												
Kittiwake												
Shag												
Great black-backed gull												
Cormorant												
Fulmar												
Puffin												
Sandwich tern												

4.2.2 Sites Designated for Marine Mammal Features

As identified earlier in Appendix 2, within the Scoping Opinion for Moray West (Marine Scotland, 2016) SNH and JNCC identified that the key species to address for the Moray West Offshore Wind Farm were harbour (or common) seal (*Phoca vitulina*), bottlenose dolphin (*Tursiops truncatus*), harbour porpoise (*Phocoena phocoena*), minke whale (*Balaenoptera acutorstrata*) and grey seal (*Halichoerus grypus*). As this report addresses the requirements of HRA Screening, minke whale are not a SAC qualifying feature so there is no connectivity with this species in terms of HRA. SACs with marine mammal qualifying features are shown in Figure 4.2.12.

The following species of marine mammal have therefore been identified as requiring consideration in this HRA Screening:

- Harbour seal;
- Grey seal;
- Bottlenose dolphin; and

- Harbour porpoise.

4.2.2.1 SACs Supporting Mobile Populations of Marine Mammals

SACs with marine mammal qualifying features that have been identified as having connectivity due to mobile populations are presented below in Table 4.2.5. For harbour seal and grey seal, foraging ranges of 50 km and 200 km were identified as appropriate for identifying connectivity. For bottlenose dolphin it was considered that although the Moray Firth population are highly resident, there are increasing sightings of individuals outwith the Moray Firth, with individuals known to travel to the Firth of Tay and the Firth of Forth (Appendix 2). This range has been established for this specific population.

The Inner Hebrides and Minches cSAC is currently under review by the European Commission, but this cSAC is considered to be too far from the Moray Firth and comprise a different population of harbour porpoise to those that are encountered in the Moray Firth (as indicated by IAMMWG, 2015 and other data). As such it is considered that there is no connectivity to this cSAC. Similarly, the Southern North Sea pSAC is also considered to be outwith the foraging range of the Moray Firth for harbour porpoise and is considered to have no connectivity.

Table 4.2.5 Mobile Marine Mammal Species Supported by SACs Which May Interact With Potential Effects Associated With the Moray West Site.

Site	Qualifying Species	Mobile Species Study Area	Distance To Closest Point (km)	
			Moray West Offshore Wind Farm	OfTI
Moray Firth SAC	Bottlenose dolphin	North Sea	17.2	17.2
Dornoch Firth and Morrich More SAC	Harbour seal	North Sea	42.5	42.5
Faray and Holm of Faray SAC	Grey seal	North Sea	110.0	126.1
Isle of May SAC	Grey seal	North Sea	205.1	166.3
Monach Islands SAC	Grey seal	North Sea	264.8	278.9

4.2.2.2 SACs with Qualifying Marine Mammals Recorded During Site Specific Surveys

During the site specific surveys identified in Appendix 2 (with the exception of the digital aerial video surveys that have not been analysed), the qualifying species of marine mammal identified in Table 4.2.6 were recorded.

Table 4.2.6 SAC Qualifying Species Recorded During Site Specific Surveys.

Species	Distance To Closest Point (km)		Site Identified in Table 4.2.5
	Moray West Offshore Wind Farm	OfTI	
Harbour seal	Within Site	Within Site	Yes
Grey seal	Within Site	Within Site	Yes
Bottlenose dolphin	Within Site	Within Site	Yes

Species	Distance To Closest Point (km)		Site Identified in Table 4.2.5
	Moray West Offshore Wind Farm	OfTI	
Harbour porpoise	Within Site	Within Site	No – scoped out in Section 4.2.2.1

4.2.3 Sites Designated for Migratory Fish Features

Section 6.2 of the Moray West OfTI Scoping Report (Moray West, 2017a) set out the baseline conditions for the migratory fish interests that are present in relation to the Moray West Offshore Wind Farm and the OfTI. Diadromous fish species such as Atlantic salmon (*Salmo salar*) and European eel (*Anguilla anguilla*) may be present in the area, particularly adult salmon migrating to the nearby SACs, or salmon smolts migrating from the SACs into the open sea. The following SACs (Figure 4.2.13) were identified during scoping as potentially being affected upon by Moray West:

- Berriedale and Langwell Waters SAC – Atlantic salmon;
- River Borgie SAC – Atlantic salmon and freshwater pearl mussel (*Margaritifera margaritifera)*;
- River Dee SAC - Atlantic salmon and freshwater pearl mussel;
- River Naver SAC - Atlantic salmon and freshwater pearl mussel;
- River Thurso SAC – Atlantic salmon;
- River Oykel SAC - Atlantic salmon and freshwater pearl mussel;
- River Moriston SAC - Atlantic salmon and freshwater pearl mussel; and
- River Spey SAC – Atlantic salmon, sea lamprey (*Petromyzon marinus*) and freshwater pearl mussel.

Freshwater pearl mussels are reliant on salmonids for successful juvenile recruitment and population sustainability so there is connectivity between these species. This needs to be considered in parallel with the test for no LSE on SACs for Atlantic salmon. The qualifying features of brook lamprey, freshwater pearl mussel and freshwater habitats are not considered to have connectivity to Moray West (due to their wholly freshwater lifecycles as well as there being no SACs within the Scoping Study Area of the OnTI). Otter associated with SACs are also not considered to have connectivity, due to no SACs being located within the Scoping Study Area. These species are scoped out of any future offshore HRA on this basis Otter will be considered and assessed for LSE as required within any future Onshore HRA.

The following species of migratory fish have therefore been identified as requiring consideration in this HRA Screening:

- Atlantic salmon; and
- Sea lamprey.

The Scoping Opinion for the Moray West Offshore Wind Farm (Marine Scotland, 2016) and the previous AA undertaken by Marine Scotland for the Moray East Site (Marine Scotland, 2012) are clear on which European sites and features should be addressed within the HRA and given that Moray West is not aware of any new SACs being brought forward for these features then a similar suite of sites would seem logical given the likely similar nature in the zone of influence between Moray West and Moray East. Notwithstanding this, the criteria used in Table 4.1.1 for screening of sites supporting marine mammal

and migratory fish qualifying features outlined above are also applied in this assessment to validate screening, or to clarify where there is not a clear response in the scoping (migratory fish).

4.2.3.1 SACs Supporting Mobile Populations of Migratory Fish

SACs with migratory fish qualifying features that have been identified as having connectivity due to mobile populations are presented below in Table 4.2.7. Movement of Atlantic salmon and post-smolts is not clearly understood within the Moray Firth and the wider North Sea, although these species are documented as generally using the coastal and near shore waters (Appendix 2).

Table 4.2.7 Mobile Migratory Fish Species Supported by SACs Which May Interact With Potential Effects Associated With the Moray West Site.

Site	Qualifying Species	Mobile Species Study Area	Distance To Closest Point (km)	
			Moray West Offshore Wind Farm	OfTI
Berriedale and Langwell Waters SAC	Atlantic salmon	Moray Firth / North Sea / Norwegian Sea	22.7	25.6
River Borgie SAC	Atlantic salmon		79.2	82.0
River Dee SAC	Atlantic salmon		96.1	60.2
River Naver SAC	Atlantic salmon		68.7	70.0
River Thurso SAC	Atlantic salmon		40.2	43.4
River Oykel SAC	Atlantic salmon		68.1	68.1
River Moriston SAC	Atlantic salmon		121.1	114.7
River Spey SAC	Atlantic salmon Sea lamprey	Moray Firth / North Sea	37.0	11.3

4.2.4 Designated sites with non-mobile features within the Moray Firth

Within their scoping response (Marine Scotland, 2016), SNH requested that with respect to physical processes, qualifying habitats within the Moray Firth SAC, Dornoch Firth and Morrich More SAC and Culbin Bar SAC should be appraised within the HRA.

As well as being designated for its bottlenose dolphins, the Moray Firth SAC is also designated for Annex I habitat of 'Sandbanks which are slightly covered by sea water all the time. The Moray Firth SAC is approximately 17 km in distance from the Moray West Site and OfTI at its closest point so there is no spatial overlap in habitats. Although unlikely that hydrodynamic changes due to the presence of WTG and OSP foundations would cause a LSE, this cannot be ruled out at this point so there may be connectivity. The physical processes modelling and assessment work being undertaken as part of the EIA will determine whether there will be a LSE on these SAC habitats.

The Dornoch Firth and Morrich More SAC has qualifying habitats of Atlantic salt meadows, coastal dune heathland, dune grassland, glasswort (*Salicornia* spp.) and other annuals colonising mud and sand, dunes with juniper thickets, estuaries, humid dune slacks, intertidal mudflats and sandflats, lime-deficient dune heathland with crowberry, reefs, shifting dunes, shifting dunes with marram and subtidal sandbanks. The Culbin Bar SAC has qualifying habitats of Atlantic salt meadows, coastal shingle vegetation outside the reach of waves and shifting dunes. For the same reasons provided above, it is considered that any changes

in physical processes and sediment transportation will be localised and too far in distance from the marine and estuarine related habitats associated with these two SACs to have any significant or noticeable impact. As such they are considered not to be connected to the Moray West Site or OfTI and LSE is discounted.

4.2.4.1 Comparison of findings to previous AA conclusions for Moray East

The AA carried out by Marine Scotland for the Moray East Site (Marine Scotland, 2014) made no reference to the qualifying habitats of the Moray Firth SAC, Dornoch Firth and Morrich More SAC and Culbin Bar SAC, having previously screened these out from HRA and confirming that there were no connectivity or LSE.

The European sites and Ramsar identified above are in agreement with the sites identified within the Scoping Opinion (Marine Scotland, 2016) and the AA for Moray East (Marine Scotland, 2014).

4.3 Potential Routes to Impact

The next stage of the screening process is to consider whether there is a route to impact for any of the designated features identified within the connectivity assessment.

Within the Scoping Opinion for the Moray West Offshore Wind Farm (Marine Scotland, 2016) it is considered that the sites with the potential to be most significantly affected, and thus meriting the greatest attention in the HRA report, are marine mammal SACs, and SPAs classified for breeding seabirds, with those closest to the project being those most likely to be affected, but with effects also possible to sites further afield, depending on the foraging range of qualifying species and hence connectivity.

As mentioned in Appendix 2, there are potential routes to impact upon the following key features that therefore require inclusion and consideration within this HRA Screening Report:

- Ornithological features (particularly breeding colonies) associated with the suite of SPAs identified as having connectivity;
- Marine mammals and the assessment of key species associated with SACs with connectivity (harbour seal, bottlenose dolphin, harbour porpoise and grey seal); and
- Migratory fish and relevant SACs with connectivity.

For ornithology, the potential impacts are focused on the breeding season as the period of key concern where there could be significant effects on SPA breeding colonies. While the consequences of impacts outwith the breeding season on SPA breeding colonies are less clearly understood, these are also becoming increasingly important and further discussions / modelling work are required on ornithological interests to be scoped in or out in this regard.

In respect of marine mammals, the approach to EIA identified that the probability of risk to marine mammals from toxic contaminants, operational noise or electromagnetic fields is low and these potential effects have been scoped out of HRA as confirmed within the Scoping Opinion (Marine Scotland, 2016). Potential LSE from EMF upon marine mammals was also considered to be not significant and scoped out. Scoping confirmed that the key concern was the potential disturbance of marine mammals due to construction noise (particularly from pile-driving the turbine foundations) and collision risk with vessels.

For migratory fish, as outlined within Appendix 2, the key concern was associated with the likely routes to impact from underwater noise upon migration of adult salmon and smolts, as well as the effects of EMF.

Table 4.3.1 sets out the potential routes to impact that may lead to LSE from the Moray West Site as identified within the Scoping Opinion for Moray West Offshore Wind Farm (Marine Scotland, 2016) and does not include those already scoped out from further appraisal by the CA and SNCBs.

Table 4.3.1 Potential for Route to Impact and LSE arising from Moray West Site and / or OfTI

Receptor Type	Marine Mammals	Migratory Fish	Ornithology	Habitats	Justification
Construction and Decommissioning◆					
Physical / auditory injury and behavioural effects from underwater noise.	Y	Y	N	N/A	Mammals & migratory fish are sensitive to underwater noise at the frequencies emitted from the construction activity associated with the Project and therefore this presents a route to impact. Ornithological receptors spend majority of time above or at water surface therefore, less sensitive. The main diving birds are present near shore (associated with the pSPA) and therefore, beyond the likely extent of significant underwater noise. Habitats are not sensitive to noise.
Collision risk from presence of vessels.	Y	N/A	N/A	N/A	The increased vessel traffic during construction may result in an increased collision risk to marine mammals. Collision risk is not applicable to migratory fish, ornithology and habitats.
Foraging abilities may be impaired.	N	N	N/A	N/A	Due to the localised increase of sedimentation around foundations and cable laying activities and the mobile nature of the species involved, as well as application of soft start procedures, the potential for impaired ability to forage has been scoped out.
Increased suspended sediment concentrations.	N	N	N	N	No route to impact on marine mammals, migratory fish and ornithology has been identified. Due there being no spatial connectivity, but also a distance of approximately 17 km between the Moray Firth SAC and no potential for the effects of the WTG and OSP foundations or the cable laying activities to result in effects upon the sandbank habitat, this potential impact is scoped out.
Indirect effects on sediments due to changes in waves / tidal flows.	N/A	N/A	N/A	N	Evidence from similar projects (i.e. Moray East) suggest effects will be limited in their magnitude and localised. Marine mammals, migratory fish and ornithological receptors are not sensitive to such small scale effects. The designated habitats have the potential to be sensitive, however, given the distance between such features and the Project (17 km) it is considered that they are likely to be beyond the zone of influence and this potential impact is scoped out.

Receptor Type	Marine Mammals	Migratory Fish	Ornithology	Habitats	Justification
Risk of harm from toxic contaminants.	N	N	N/A	N/A	The risk of toxic contaminants affecting marine mammals was considered insignificant and scoped out within the Scoping Opinion for the Moray West Offshore Wind Farm. The same will apply to migratory fish. No route to impact is present for ornithological interests of habitats associated with the Moray Firth SAC due to the distance from the Moray West Site and OfTI (or any other further away SACs).
Disturbance of birds from important feeding grounds and roosting areas.	N/A	N/A	Y	N/A	The impact of construction activities such as increased vessel activity, underwater noise, and cable installation may result in direct disturbance or displacement of birds from important feeding and roosting areas. Applicable to ornithology only.
Disturbance and displacement of prey for important feeding areas.	N	N	Y	N/A	Due to the migratory nature of marine mammals and migratory fish and the Moray West Site not featuring as a key feeding ground for these species, this has been scoped out. Also this has not been identified as an HRA issue within the Scoping Opinion for Moray West Offshore Wind Farm. The impact of construction activities such as increased vessel activity, underwater noise, and cable installation may result in disturbance or displacement of prey from important bird feeding areas.

Receptor Type	Marine Mammals	Migratory Fish	Ornithology	Habitats	Justification
Operation					
Risk of physical / auditory injury and behavioural changes from increased underwater noise during operation.	N	N	N/A	N/A	This potential route to impact was scoped out from HRA within the Scoping Opinion for the Moray West Offshore Wind Farm. It is considered that the operational noise from the WTG and OSPs will not be sufficiently significant to cause an impact. There is no route to impact upon ornithology and habitats.
Collision risk from presence of vessels.	Y	N/A	N/A	N/A	Increased vessel traffic during operation may result in an increased collision risk to marine mammals. Collision risk is not applicable to migratory fish, ornithology and habitats.
Barrier effects and displacement.	N/A	N/A	Y	N/A	Barrier effects caused by the physical presence of WTGs and ancillary structures may prevent clear transit of birds between foraging and breeding sites, or on migration. Additional energetic costs incurred may reduce fitness and survival rate of a species.
Collision risk from presence of WTG's.	N/A	N/A	Y	N/A	Collision with rotating turbine blades will result in direct mortality of an individual bird. Increased mortality may reduce species' survival rates.
Changes to prey availability.	N	N	Y	N/A	Indirect effects upon birds may be associated with changes in prey resources. Due to the migratory nature of marine mammals and migratory fish and the Moray West Site not featuring as a key feeding ground for these species. This has been scoped out Also once constructed there will be no change to availability in prey. This has not been identified as an HRA issue within the Scoping Opinion for Moray West Offshore Wind Farm.
Disturbance and displacement arising from EMF from cables.	Y	Y	N/A	N/A	The impact of EMF (arising from installed cables) may result in disturbance and displacement of adult Atlantic salmon, smolts or sea lamprey during migration and emigration.

◆ The impacts during the decommissioning phase are considered to be similar to those outlined for the construction phase, but with a lesser potential LSE due to current proposals that infrastructure below the seabed / buried underground would be left in-situ. LSE will be further considered within the Decommissioning Plan once further confirmation of decommissioning processes and methods takes place.

4.4 Summary of Initial Screening

A summary of the European sites or Ramsar that have been screened in as having connectivity and a route(s) to impact for which LSE cannot be discounted, including the qualifying feature(s) for which each site is designated, is presented in Table 4.4.1.

Table 4.4.1 Summary of European Sites and Ramsar Requiring Consideration for LSE.

European Site / Ramsar	Qualifying Feature(s)
SPA / Ramsar	
Moray Firth pSPA	All migratory / mobile features
East Caithness Cliffs SPA	Fulmar; Guillemot; Razorbill; Great black-backed gull; Herring gull; and Kittiwake.
North Caithness Cliffs SPA	Fulmar; Guillemot; Razorbill; Puffin; and Kittiwake.
Troup, Pennan and Lion's Heads SPA	Fulmar; Guillemot; Razorbill; Herring gull; and Kittiwake;
Buchan Ness to Collieston Coast SPA	Fulmar; Guillemot; Herring gull; and Kittiwake.✪
Loch of Strathbeg	Sandwich tern✪
Moray and Nairn Coast SPA	All migratory / mobile features
Dornoch Firth and Loch Fleet SPA / Ramsar	All migratory / mobile features
Cromarty Firth SPA / Ramsar	All migratory / mobile features
Inner Moray Firth SPA / Ramsar	All migratory / mobile features
SAC	
Moray Firth SAC	Bottlenose dolphin
Dornoch Firth and Morrich More SAC	Harbour seal
Faray and Holm of Faray SAC	Grey seal
Isle of May SAC	Grey seal
Monach Islands SAC	Grey seal
Berriedale and Langwell Waters SAC	Atlantic salmon
River Borgie SAC	Atlantic salmon
River Dee SAC	Atlantic salmon

European Site / Ramsar	Qualifying Feature(s)
River Naver SAC	Atlantic salmon
River Thurso SAC	Atlantic salmon
River Oykel SAC	Atlantic salmon
River Moriston SAC	Atlantic salmon
River Spey SAC	Atlantic salmon Sea lamprey

✪ OfTI only.

5 Assessment for Non-Trivial Abundance and Determination of Likely Significant Effects

For each designated site screened in within Table 4.4.1, the potential for LSE is considered, taking into account non-trivial abundance and recent research or studies that would lead to the conclusion of no LSE. Each possible LSE that has been identified in Table 4.3.1 is discussed and appraised to determine whether:

- There is no LSE upon the European Site or qualifying feature (and so screening out of any future RIAA can take place); or
- There is likely to be a LSE and hence further consideration within a RIAA is required to assess affects upon the integrity of the European site.

5.1 Determination of LSE for SPAs and Ramsar and Qualifying Features

5.1.1 Disturbance (Construction)

During the construction phase seabed disturbance may lead to a reduction in suitable habitat for birds. Any loss of foraging habitat would be temporary, being primarily associated with the presence of machinery whilst construction works are undertaken. In addition, the anticipated habitat disturbed will be very small in the context of the wide areas in which seabirds are able to forage. Disturbance during construction may occur as a result of increased vessel activity and underwater noise. This may displace birds from an area of sea, effectively resulting in habitat loss during the period of disturbance (Drewitt and Langston, 2006).

As indicated in Table 4.3.1, bird species most likely to be vulnerable to underwater noise are those that forage by diving after fish or shellfish, and include auks, divers and seaduck. Gull and tern species feed at the surface only and are considered the least vulnerable, with no apparent responses to piling activity recorded at Egmond aan Zee by Leopold and Camphuysen (2007). Moray West is beyond the mean maximum or maximum foraging ranges for the majority of breeding seabirds potentially affected so that potential impacts on species such as auks are likely only to occur in the non-breeding season.

Taking the information above, the potential for a LSE via disturbance is relevant to features screened in for Moray Firth pSPA, East Caithness Cliffs SPA, North Caithness SPA, Troup, Pennan and Lions Head SPA, Buchan Ness to Collieston Coast SPA. Species not considered sensitive to disturbance include herring gull and great black-backed gull. For sites designated for wildfowl and waders that are outside of the boundary of the Moray West Site and OfTI, they are not considered vulnerable to disturbance during construction.

5.1.2 Disturbance of Prey (Construction)

There is potential for indirect impacts to occur on birds associated with disturbance and displacement of prey species as a result of the construction phase of Moray West. The distribution of seabirds across the wider area may indicate that those that are displaced due to indirect impacts will be able to relocate to other suitable foraging areas in response to any changes in local prey distribution. During the non-breeding period the potential foraging area for displaced seabirds is greater than during the breeding season and displaced birds that feed on widely occurring fish species will be able to relocate to other suitable foraging areas within their normal range of distribution at this time.

Taking the information above, the potential for a LSE via disturbance to prey species is relevant to features screened in for Moray Firth pSPA, East Caithness Cliffs SPA, North Caithness SPA, Troup, Pennan and Lions Head SPA, Buchan Ness to Collieston Coast. SPA Species not considered sensitive to disturbance include herring gull and great black-backed gull. For sites designated for wildfowl and waders that are outside of

the boundary of the Moray West array site and OfTI, they are not considered vulnerable to disturbance to prey species during construction.

5.1.3 Barrier Effects (Operation)

The physical presence of Moray West may result in a barrier to the movement of some bird species. Where birds avoid flying through the area of the offshore wind farm an increase in flying distance to reach their destination may occur. This may lead to increased energy expenditure, which may have a detrimental effect on fitness and / or reduce survival or fecundity rates. This is of particular concern if the area in which the wind farm is located is used for regular, daily movements (i.e. to foraging areas from a breeding colony).

The foraging ranges of the seabirds in the North Sea are relatively large during the breeding period with migratory movements through the North Sea occurring across a broad front (e.g., Thaxter *et. al*., 2012; Wemham *et. al*., 2002). Many of the species subject to this assessment migrate many thousands of kilometres each year and it is therefore anticipated that they will be capable of flying around or over Moray West should they choose to do so without a significant increase in distance travelled. The duration, magnitude and extent of impact resulting from barrier effects on SPA qualifying species are assessed as being unlikely to compromise the conservation objectives of any designated SPA. Whilst, therefore, there is no indication that barrier effects could lead to a LSE on any feature for the purposes of this screening exercise, further species-specific information is required to rule out LSEs due to barrier effects.

Taking the information above, the potential for a LSE via disturbance on birds is identified for all species screened in for East Caithness Cliffs SPA, North Caithness SPA, Troup, Pennan and Lions Head SPA, Buchan Ness to Collieston Coast SPA. Barrier effects are not considered relevant to features impacted by the OfTI only.

5.1.4 Displacement (Operation)

Evidence from existing offshore wind farms indicates that some species of seabird may avoid entering wind farms and therefore be displaced from areas that they may otherwise utilise (e.g., Zucco *et. al*., 2006). The level of displacement is species specific and the duration of displacement may vary across species, with some species avoiding offshore wind farms immediately post-construction and returning to the area after a period of time and other species showing little or no evidence of returning to the wind farm area post-construction. The likely scale of displacement effects varies by species, therefore, depending on their sensitivity (Langston, 2010) and the density within the proposed wind farm (and adjoining) areas. The implications for birds displaced from wind farms will also vary depending on the availability of other habitats which can support those birds. Quantifying the risk to birds requires, therefore, predictions based on modelling which takes into account these variables. Typically this involves estimating the proportion of birds present that are likely to be displaced and then the proportion of those birds that are displaced that will be unable to successfully relocate (leading to death or emigration). It also requires disaggregating the risk to birds that are associated with those populations that form designated SPA features from other populations that are not SPA features (as the birds recorded at a wind farm site are usually a mixture of both).

Pending more detailed displacement analysis, it is assumed that where a species vulnerable to displacement has been recorded at the Moray West Site, and where a population of that species is also a feature of an SPA that is within foraging range (for that species) of the wind farm, then, for the purposes of this screening exercise, it is assumed that a LSE could occur. This is on the basis that there is potential for foraging birds from the SPA to rely upon habitats within the operational wind farm from which they

will become excluded (wholly or partially), although at this stage the scale of that risk has yet to be quantified.

Taking the information above, the potential for a LSE via operational displacement on birds is identified for sensitive species screened in for Moray Firth pSPA, East Caithness Cliffs SPA, North Caithness SPA, Troup, Pennan and Lions Head SPA, Buchan Ness to Collieston Coast SPA. Barrier effects are not considered relevant to features impacted by the OfTI only or on wildfowl or wader features of SPAs outside of the boundary of the Moray West array site or OfTI.

5.1.5 Collision Risk (Operation)

The risk of collision with wind turbine generators depends on a number of variables, such as species-specific near and far field avoidance rates, flight heights, speed of flight, frequency of movements in or near to the turbines as well as the size and location of the turbines themselves. Further, additional factors such as weather and species' behaviour can also affect the risk of collision. Quantifying the risk to birds requires, therefore, predictions based on modelling which takes into account these variables. It also requires disaggregating the risk to birds that are associated with those populations that form designated SPA features from other populations that are not SPA features (as the birds recorded at a wind farm site are usually a mixture of both).

Pending a detailed collision risk assessment for Moray West, it is assumed that where a species vulnerable to collision impacts has been recorded during site specific surveys, and where a population of that species is also a feature of an SPA that is within foraging range (for that species) of the wind farm, then, for the purposes of this screening exercise, it is assumed that a LSE could occur. This is on the basis that there is likelihood that foraging birds from the SPA could occur within the operational wind farm and be exposed to collision risk, although at this stage the scale of that risk has yet to be quantified.

Taking the information above, the potential for a LSE via operational displacement on birds is identified for sensitive species screened in for East Caithness Cliffs SPA, North Caithness SPA, Troup, Pennan and Lions Head SPA, Buchan Ness to Collieston Coast SPA. Auk species (guillemot, razorbill and puffin) and fulmar are not sensitive to collision risk due to their low prevailing flight heights and as such there is no potential for LSE on these species. Collision risk are not considered relevant to features impacted by the OfTI only. With respect to costal SPAs supporting wildfowl and waders (including Moray Firth pSPA) the risk of collision refers to biannual migratory movements only.

5.2 Determination of LSE on SACs and Qualifying Features

5.2.1 Physical / Auditory Injury and Behavioural Effects Upon Marine Mammals Due to Increased Underwater Noise (Construction and Operation / Maintenance)

The introduction of piling activities (and other noise producing construction activities such as rock dumping and cable laying), particularly during the construction phase of the Moray West Site, is recognised as producing significant sources of underwater noise that can be detrimental to marine mammals that may be present within the Moray West Site, that are passing through, or are within the wider regional area. Underwater noise may also be increased during the operational and maintenance period arising from underwater repair work such as cable protection or burial repairs. As identified, there are potential risks to several species of marine mammal.

There is currently little information available on the levels of underwater noise that will be produced and the distances that noise is projected to occur at from each WTG / OSP foundation, as the design of the infrastructure and construction methods are not yet progressed sufficiently. Noise modelling will be

required for each of the key species of marine mammal in relation to the worst case scenario that will be applied during construction (e.g. taking the design parameters for piles rather than GBSs and using these to model the worst case scenario for noise levels). Once the noise modelling is complete, it will be possible to assess and identify any suitable mitigation that may assist to reduce potential LSE on marine mammals.

In addition, the number, type and frequency of construction vessels that will be required during construction, operation and maintenance are currently unknown. Noise from increased vessel presence could also have a potential LSE upon the marine mammal populations.

It is therefore considered that the potential for LSE, upon marine mammals connected to SACs (harbour seal, grey seal and bottlenose dolphin), as a result of underwater noise during construction and operation / maintenance (and potential for auditory injury or behavioural changes) cannot be screened out and will require further consideration in any future RIAA. Harbour porpoise have previously been screened out from HRA due to no connectivity with European sites with this qualifying feature.

5.2.2 Disturbance and / or Displacement to Migratory Fish from Underwater Noise (Construction)

There is limited knowledge of the migration behaviour of Atlantic salmon and sea lamprey once they reach the sea as post-smolts and during the return of adults to spawn within their native rivers. It has been established that Atlantic salmon prefer to use the coastal and near shore waters during migration (Malcolm *et al*, 2015; Malcolm *et al*., 2010) but the extent of how long they are present in these areas prior to migration into deeper waters to their feeding areas near Greenland, as well as the routes they migrate along through the open sea (and in this case the Moray Firth) remain little understood (Gill and Bartlett, 2010; Malcolm *et al*., 2015). The National Research and Monitoring Strategy for Diadromous Fish (NRMSD) has been set up by Marine Scotland in order to prioritise the collection of information to fill this gap in knowledge, this research is ongoing.

However, even though the movements of migratory fish are not clearly known within a local or regional context, recent research by Harding *et al.* (2016) has demonstrated that the hearing threshold of salmonids is not as sensitive as other fish species and that the noise produced from piling activities from offshore wind farm construction does not appear to have significant effects upon the movement behaviour or physiological behaviour of Atlantic salmon and individuals do not show a startle response or stress to this source of underwater noise.

Research reports that Atlantic salmon are known to detect low frequency acoustic stimuli below 380 Hz, coinciding with the dominant frequencies produced during impact piling operations (100 Hz to 2 kHz; Hawkins & Johnstone, 1978). More recent research has been undertaken on the hearing capabilities of Atlantic salmon (Harding *et al.*, 2016), whereby a series of hearing sensitivity tests were undertaken on wild and captive post-smolts and adult Atlantic salmon. The research reported similar findings to the previous research in terms of hearing thresholds, but also found evidence of a response to sounds at higher frequencies (400-800 Hz). Slightly less sensitive hearing was noted at 100 Hz than reported in Hawkins & Johnstone, 1978, but found more sensitive hearing than the earlier study at frequencies >200 Hz. Atlantic salmon are not as sensitive to noise as some other species (such as clupeids) due to a lack of secondary hearing modifications linking the swim bladder to the auditory system. The recent research went on to test individual salmon of both migratory phases to exposure of piling noise. In terms of behavioural effects, the findings reported no startle response was shown to individual hammer strikes and the noise of piling did not drive any differences in behaviour. Physiologically, there was no change in the active metabolism rate when exposure to pile driving noise took place. No evidence of avoidance behaviour was recorded. It was considered that Atlantic salmon are sound insensitive as they lack specialist hearing mechanisms. They therefore have a poorer ability to distinguish specific acoustic cues.

Mitigation measures that are adopted during construction of the WTG and OSP foundations, such as the application of 'soft start' procedures, will also provide additional measures to ensure that underwater noise is introduced slowly to migratory fish so as to avoid any harm or injury. By operating 'soft start' procedures, any fish will be able to react and avoid sources of noise efficiently.

On the basis of this recent research, the application of suitable mitigation measures and on the basis of the opinion expressed by SNH and JNCC within their scoping response to the Moray West Offshore Wind Farm Scoping Report (Moray West, 2017) it is considered that the effects of underwater noise can be screened out at this time and do not require further consideration within any future RIAA. Similarly, this is considered to be the case for sea lamprey, which have a similar hearing range underwater (Appendix 2 provides further details of the species' ecology). Research indicates that sea lamprey respond to sound at frequencies of between 20 Hz and 100 Hz (Lenhardt & Sismour 1995), they do not possess a swim bladder and are less sensitive to sound than fish that do possess a swim bladder (Maes et al. 2004).

During the previous HRA for the Moray East Site (JNCC & SNH, 2014), it was stated that the relevant conservation objective to consider for sea lamprey is whether or not the Moray East Site would result in any impacts on the viability of the sea lamprey population of the River Spey SAC. It was concluded at that time that while there may be some level of noise disturbance to individuals during construction this would not result in population level effects. JNCC and SNH were satisfied that operational noise would not result in LSE to sea lamprey. With proposals to adopt soft-start piling methods to help mitigate any noise disturbance and to bury cables to reduce EMF both organisations were satisfied that this mitigation would further reduce impacts to individuals, and avoid population level effects, therefore not resulting in any impact to the site integrity of the River Spey SAC.

5.2.3 Collision Risk between Marine Mammals and Vessels (Construction and Operation / Maintenance)

Marine mammals passing through the Moray West Site will be exposed to increased numbers of construction vessels, as well as some being anchored for significant periods of time. Collision of vessels with marine mammals could be significant and can result in serious injury or death. Some ducted propeller (DP) vessel activity at offshore wind farms had been associated with the phenomenon referred to as 'corkscrew' deaths or injury of marine mammals, particularly with seal species, however research undertaken by the University of Durham and SMRU in 2014 and 2015 later observed this type of injury resulting from grey seal predation by adult male grey seal. It is considered that seal predation is the main cause of his type of injury encountered but that injury / death from DP cannot currently be discounted altogether[2].

Currently the project-specific information on the numbers and types of construction vessels is not available, along with detailed information on their presence and number / frequency of journeys. It is considered that further information will be required in order to fully appraise the collision risk with marine mammals and so this potential LSE for harbour seal, grey seal and bottlenose dolphin cannot be screened out and will require further consideration in any future RIAA.

5.2.4 Disturbance and / or Displacement to Migratory Fish from EMF (Operation)

All electrical cable produce EMF and concern is sometimes raised that EMF emissions from underwater cables can have a potential LSE upon marine organisms including fish and shellfish. Over the years there has also been some concern that EMF can potentially affect the migration of Atlantic salmon and

[2] Further information can be found at:
http://www.smru.st-andrews.ac.uk/documents/scotgov/MMiS_scientific_research_supporting_policy.pdf

potentially prevent them from returning to their native rivers, or from migrating to their feeding grounds near Greenland.

Recent studies show that AC cables, as proposed at Moray West, do not emit EMF strong enough to influence salmonids and other species sensitive to EMF (Armstrong *et al*., 2015). Armstrong *et al.* (2015) reported that the effects of EMF at 50Hz (like those emitted from AC cables) result in no unusual behaviour being observed in Atlantic salmon (both adult and smolt stages). Research (Godfrey *et al*., 2014; Malcom *et al*., 2010), demonstrates that Atlantic salmon are known to migrate using coastal routes and generally only congregate at the mouths of their natal rivers prior to ascending them, so the Moray West Offshore Wind Farm is unlikely to affect migrations.

The evidence to date, based on the power rating of cables currently used by the offshore industry, is that EMFs are unlikely to get to the upper levels of sensitivity where marine animals may be repelled. The more likely outcome is that the EMFs are in the lower range and therefore provide an attractant stimulus (Copping *et al*., 2016). The design of the cable and shielding of emissions through cable burial or seabed protection measures also assists to lower EMF. With an additional distance of separation being present between cable protection material and the seabed, this also assists with reducing EMF and is considered to result in no LSE from EMF.

It is therefore proposed that the potential effects from EMF are screened out from HRA and that EMF will not require further consideration in any future RIAA. This conclusion is also validated through the outcomes of the Moray East and BOWL HRAs for which no LSE from EMF was accepted.

5.3 Summary of LSE

Table 5.3.1 Determination for Potential LSE

Potential Impact	Justification	Site and Species	Conclusion on LSE
Construction / Decommissioning			
Disturbance of birds from foraging / roosting areas.	Direct overlap with OfTI.	Moray Firth pSPA – all species	Y
	Species within foraging range of Moray West Site	East Caithness Cliffs SPA – fulmar, guillemot, razorbill, great black-backed gull, herring gull, kittiwake	Y
		North Caithness Cliffs SPA – fulmar, guillemot, razorbill, puffin, kittiwake	Y
		Troup, Pennan & Lion's Head SPA – fulmar, guillemot, razorbill, herring gull, kittiwake	Y
		Buchan Ness to Collieston Coast SPA – fulmar, guillemot, herring gull, kittiwake	Y
		Loch of Strathbeg SPA – Sandwich tern	Y
Disturbance and displacement of prey.	Direct overlap with OfTI.	Moray Firth pSPA – all species	Y
	Species within foraging range of Moray West Site.	East Caithness Cliffs SPA – fulmar, guillemot, razorbill, great black-backed gull, herring gull, kittiwake	Y
		North Caithness Cliffs SPA – fulmar, guillemot, razorbill, puffin, kittiwake	Y

Potential Impact	Justification	Site and Species	Conclusion on LSE
		Troup, Pennan & Lion's Head SPA – fulmar, guillemot, razorbill, herring gull, kittiwake.	Y
		Buchan Ness to Collieston Coast SPA – fulmar, guillemot, herring gull, kittiwake	Y
		Loch of Strathbeg SPA – Sandwich tern	Y
Physical / auditory injury and behavioural effects upon marine mammals due to increased underwater noise.	Several species that are qualifying features of SACs with connectivity to the Moray West Site have been recorded as present in and around the Project.	Bottlenose dolphin – Moray Firth SAC; Harbour seal – Dornoch Firth and Morrich More SAC; Grey Seal – Faray and Holm of Faray SAC	Y Y Y
Collision risk between marine mammals and vessels.	Several species that are qualifying features of SACs with connectivity to the Moray West Site have been recorded as present.	Bottlenose dolphin – Moray Firth SAC; Harbour seal – Dornoch Firth and Morrich More SAC; Grey Seal – Faray and Holm of Faray SAC.	Y Y Y
Disturbance and / or displacement to Migratory fish from underwater noise.	Migratory fish species that are qualifying features of SACs with connectivity to the Moray West Site may be present.	Atlantic salmon – Berriedale and Langwell Waters SAC, and the Rivers Borgie, Dee, Naver, Thurso, Oykel, Moriston and Spey SACs; Sea lamprey – River Spey SAC.	N
Operation / Maintenance			
Barrier effects.	Species within foraging range of the Moray West Site.	East Caithness Cliffs SPA – fulmar, guillemot, razorbill, great black-backed gull, herring gull, kittiwake.	Y
		North Caithness Cliffs SPA – fulmar, guillemot, razorbill, puffin, kittiwake.	Y
		Troup, Pennan & Lion's Head SPA – fulmar, guillemot, razorbill, herring gull, kittiwake.	Y
		Buchan Ness to Collieston Coast SPA – fulmar, guillemot, herring gull, kittiwake.	Y
Displacement.	Direct overlap with the OfTI for species sensitive to disturbance.	Moray Firth pSPA – all species.	Y
	Seabird species vulnerable within foraging range or likely to occur in non-breeding seasons.	East Caithness Cliffs SPA – fulmar, guillemot, razorbill, kittiwake.	Y
		North Caithness Cliffs SPA – fulmar, guillemot, razorbill, kittiwake.	Y
		Troup, Pennan & Lion's Head SPA – fulmar, guillemot, razorbill, kittiwake.	Y
		Buchan Ness to Collieston Coast SPA – fulmar, guillemot.	Y

Potential Impact	Justification	Site and Species	Conclusion on LSE
Collision.	Seabird species sensitive to collision within foraging range or likely to occur in non-breeding seasons.	East Caithness Cliffs SPA –great black-backed gull, herring gull, kittiwake.	Y
		North Caithness Cliffs SPA – kittiwake.	Y
		Troup, Pennan & Lion's Head SPA – herring gull, kittiwake.	Y
		Buchan Ness to Collieston Coast SPA – kittiwake.	Y
	Migratory wildfowl and wader features with the potential to cross through array site.	Moray Firth pSPA – all species	Y
		Moray and Nairn Coast SPA – all wildfowl/wader features.	Y
		Dornoch Firth and Loch Fleet SPA / Ramsar – all wildfowl and wader features.	Y
		Cromarty Firth SPA / Ramsar – all wildfowl and wader features.	Y
		Inner Moray Firth SPA / Ramsar – all wildfowl and wader features.	Y
Physical / auditory injury and behavioural effects upon marine mammals due to increased underwater noise.	Several species that are qualifying features of SACs with connectivity to the Moray West Site have been recorded as present.	Bottlenose dolphin – Moray Firth SAC; Harbour seal – Dornoch Firth and Morrich More SAC; Grey Seal – Faray and Holm of Faray SAC.	Y Y Y
Collision risk between marine mammals and vessels.	Several species that are qualifying features of SACs with connectivity to the Moray West Site have been recorded as present.	Bottlenose dolphin – Moray Firth SAC; Harbour seal – Dornoch Firth and Morrich More SAC; Grey Seal – Faray and Holm of Faray SAC.	Y Y Y
Disturbance and / or displacement to migratory fish from EMF from cables.	Migratory fish species that are qualifying features of SACs with connectivity to the Moray West Site may be present.	Atlantic salmon – Berriedale and Langwell Waters SAC, and the Rivers Borgie, Dee, Naver, Thurso, Oykel, Moriston and Spey SACs; Sea lamprey – River Spey SAC.	N N

6 In-combination Assessment

This section sets out how the LSE of in-combination effects will be appraised as part of the RIAA. It sets out the other developments that have been identified at this time as requiring consideration with in combination effects and then proposes what information will be presented within the RIAA.

Offshore, it is likely that it will be primarily other offshore wind farms that are most likely to potentially cause LSE on similar European sites as Moray West. These projects include Beatrice Offshore Wind Farm and Moray East Offshore Wind Farm. In addition, other non-wind related project that have been identified are the Caithness to Moray Interconnector and the decommissioning of the Beatrice Oil Field. Further discussion will be held with MS-LOT and other statutory consultees including SNH, to identify any other relevant plans and projects that should be included.

For each project, a review of all available information will take place and the current position with the project or plan will be identified. The potential channels for in-combination effects to occur will be identified through review of project or plan programmes and elements of the projects that will have potential LSE / adverse effects upon site integrity will be fully considered cumulatively with the Project.

It is envisaged that each project, in turn, will be appraised individually in-combination with the Moray West Project, followed by an appraisal of all projects that may take place simultaneously with the Moray West Project (for example, the Moray West Site will be appraised in combination with the Moray East Project, and then both will be appraised with any other projects or plans that also overlap in terms of construction activities or programmes).

The cumulative LSE and any adverse effects upon the integrity of European site or qualifying features will be presented within the RIAA and the need for any specific mitigation requirements to reduce any adverse effects upon the integrity of the European sites or Ramsar will be identified.

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Appendix 1 - Figures

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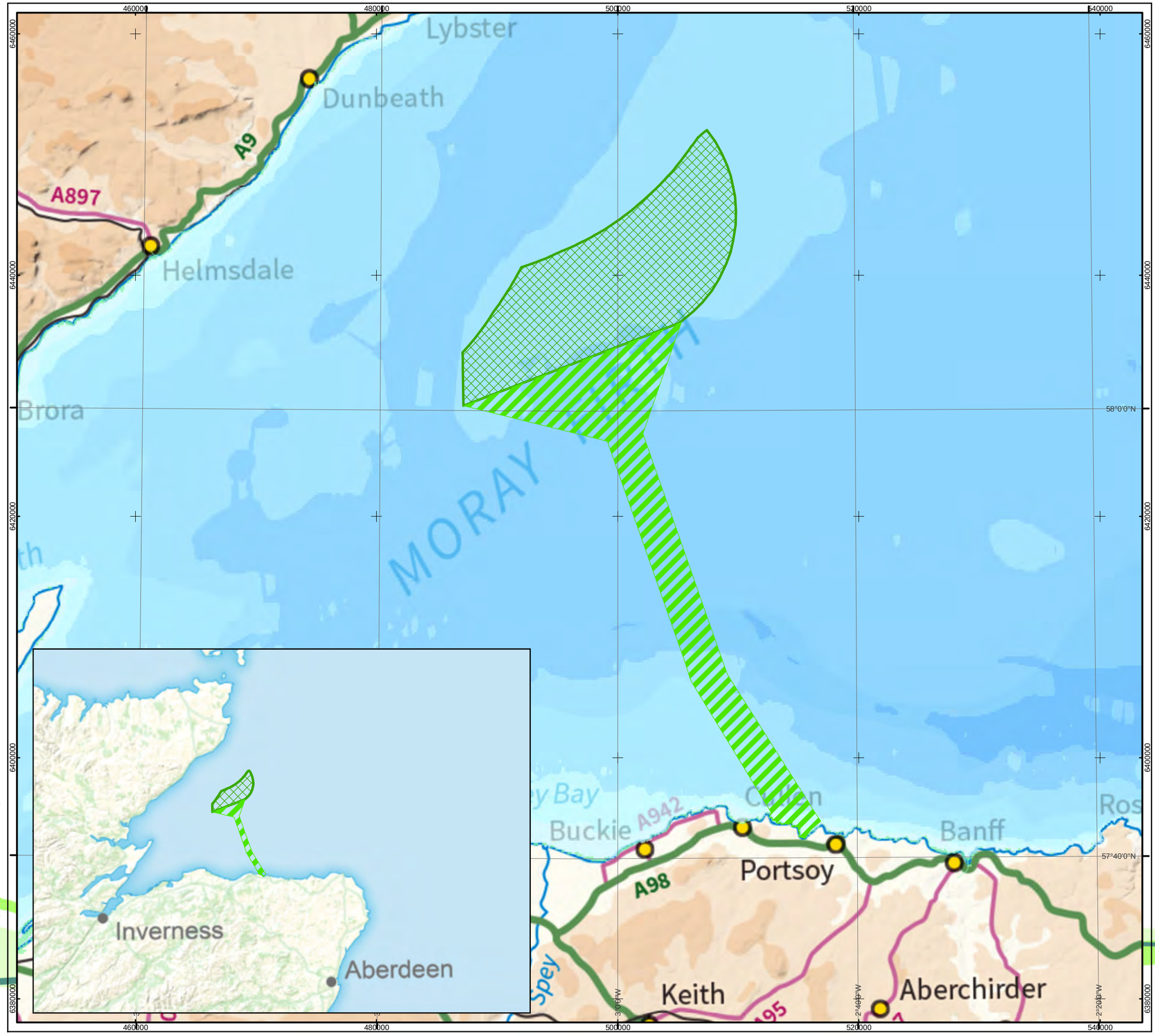


MORAY WEST
OFFSHORE WINDFARM

KEY

- Offshore Export Cable Corridor
- Moray West Site

Bathymetry (Metres)

- <=500
- <=100
- <=50
- <=20
- <=10
- >=0

Horizontal Scale: 1:300,000 A3 Chart

0 5,000 10,000 Meters

N

Geodetic Parameters:	WGS84 UTM Zone 30N
Produced: RC Reviewed: GB Approved: FG	
Date: 04/09/2017	Revision: B
REF: 8460005-PPW0160-GOE-MAP-001	

Figure 1.1.1. Moray West Site (Moray West Offshore Wind Farm and OfTI)

Moray Offshore Windfarm (West) Ltd

MORAY WEST
OFFSHORE WINDFARM

KEY

- Moray Forth potential SPA (pSPA)
- Special Protection Areas
- Moray West Site
- Moray West Offshore Cable Export Route

Horizontal Scale: 1:700,000 A3 Chart

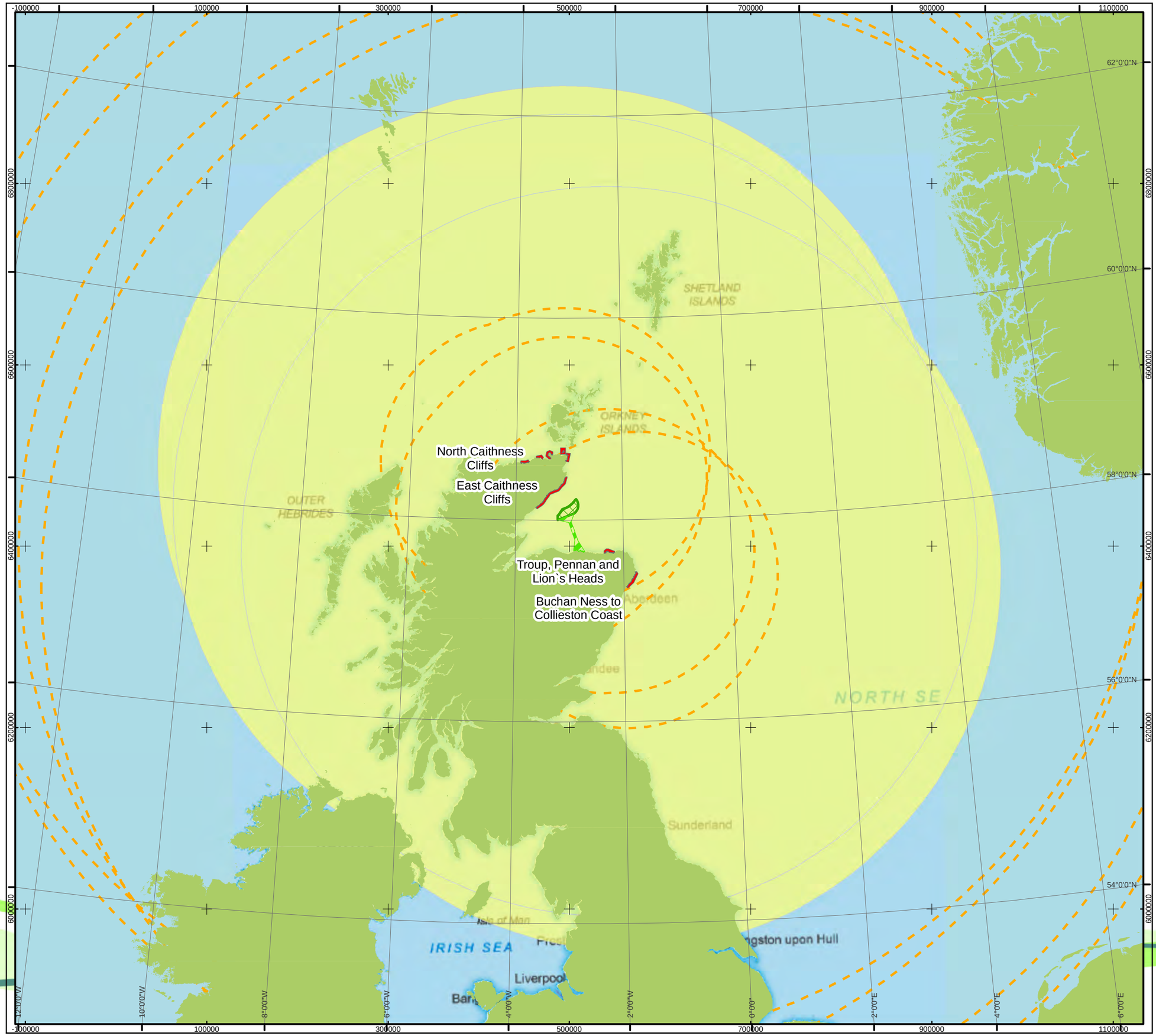
0 12,500 25,000 Meters

N

Geodetic Parameters:	WGS84 UTM Zone 30N
Produced: HAZ Reviewed: RC Approved: FG	
Date: 08/09/2017	Revision: A
REF: 8460005-PPW0160-GOE-MAP-002	

Figure 4.2.1 Special Protection Areas (SPAs)

Moray Offshore Windfarm (West) Ltd



MORAY WEST
OFFSHORE WINDFARM

KEY

- Moray West Site
- Moray West Offshore Cable Export Route
- Special Protection Areas
- Mean-max foraging range ± 1 standard deviation (400 ± 245.8 km)
- Mean-max foraging range (400 km)

Horizontal Scale: 1:4,000,000 A3 Chart

0 66,000 132,000 Meters

N

Geodetic Parameters: WGS84 UTM Zone 30N

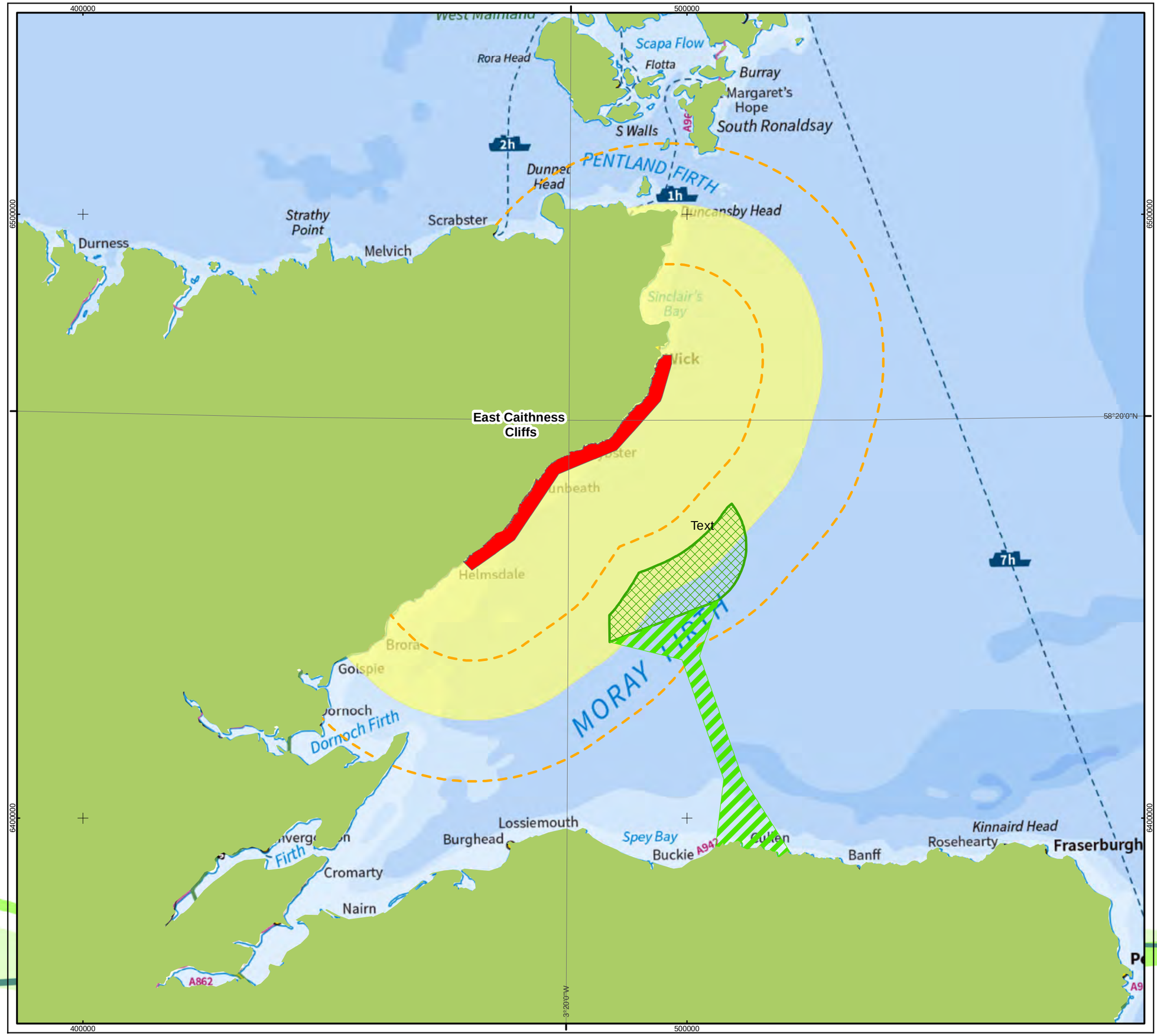
Produced: HAZ
Reviewed: RC
Approved: FG

Date: 08/09/2017 | Revision: A

REF: 8460005-PPW0160-GOE-MAP-003

Figure 4.2.2: Fulmar Foraging Ranges

Moray Offshore Windfarm (West) Ltd



MORAY WEST
OFFSHORE WINDFARM

KEY

- Moray West Site
- Moray West Offshore Cable Export Route
- Mean-max foraging range (25km)
- Mean-max foraging range ± 1 standard deviation (25 ± 10km)
- Special Protection Areas (SPAs)

Horizontal Scale: 1:600,000 A3 Chart

0 12,500 25,000 Meters

N

Geodetic Parameters: WGS84 UTM Zone 30N

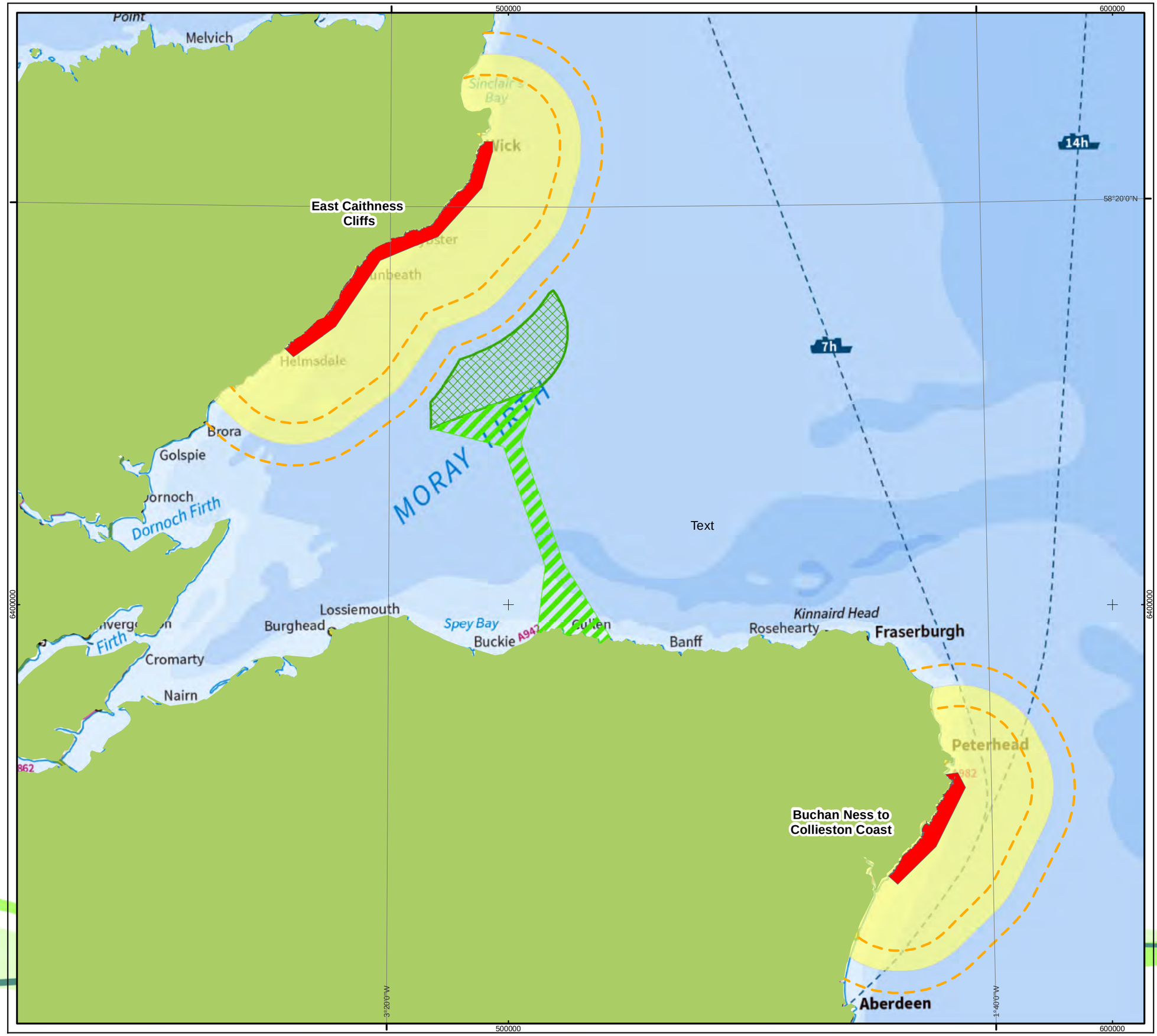
Produced: HAZ
Reviewed: RC
Approved: FG

Date: 07/09/2017 | Revision: B

REF: 8460005-PPW0160-GOE-MAP-004

Figure 4.2.3. Cormorant Foraging Ranges

Moray Offshore Windfarm (West) Ltd



MORAY WEST
OFFSHORE WINDFARM

KEY

- Moray West Site
- Moray West Offshore Cable Export Route
- Mean-max foraging range (14.5km)
- Mean-max foraging range ± 1 standard deviation (14.5 ± 3.5km)
- Special Protection Areas (SPAs)

Horizontal Scale: 1:600,000 A3 Chart

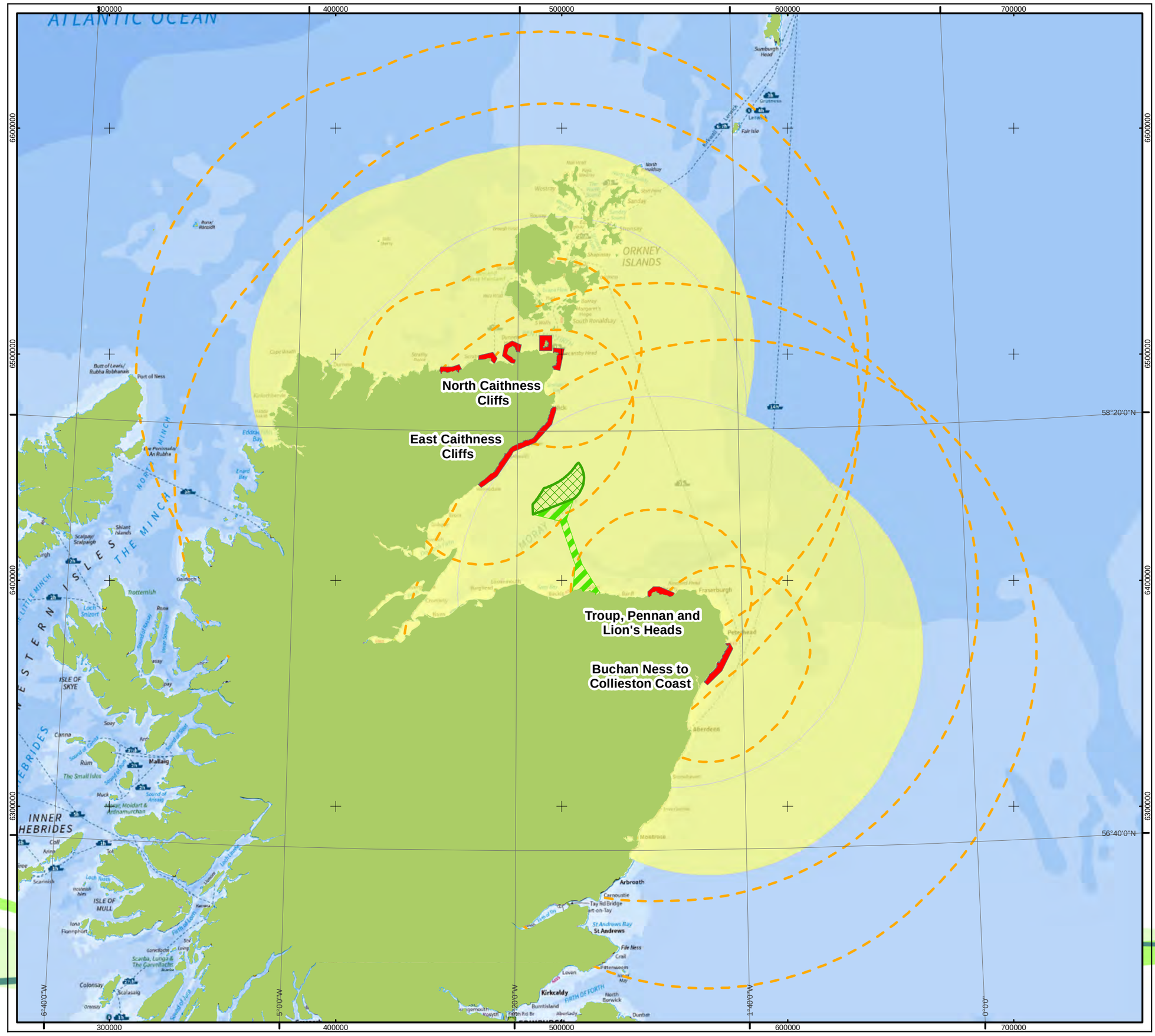
0 12,500 25,000 Meters

N

Geodetic Parameters:	WGS84 UTM Zone 30N
Produced: HAZ Reviewed: RC Approved: FG	
Date: 07/09/2017	Revision: B
REF: 8460005-PPW0160-GOE-MAP-005	

Figure 4.2.4. Shag Foraging Ranges

Moray Offshore Windfarm (West) Ltd



MORAY WEST
OFFSHORE WINDFARM

KEY

- Moray West Site
- Moray West Offshore Cable Export Route
- Mean-max foraging range (82.4km)
- Mean-max foraging range ± 1 standard deviation (82.4 ± 50.1km)
- Special Protection Areas (SPAs)

Horizontal Scale: 1:1,600,000 A3 Chart

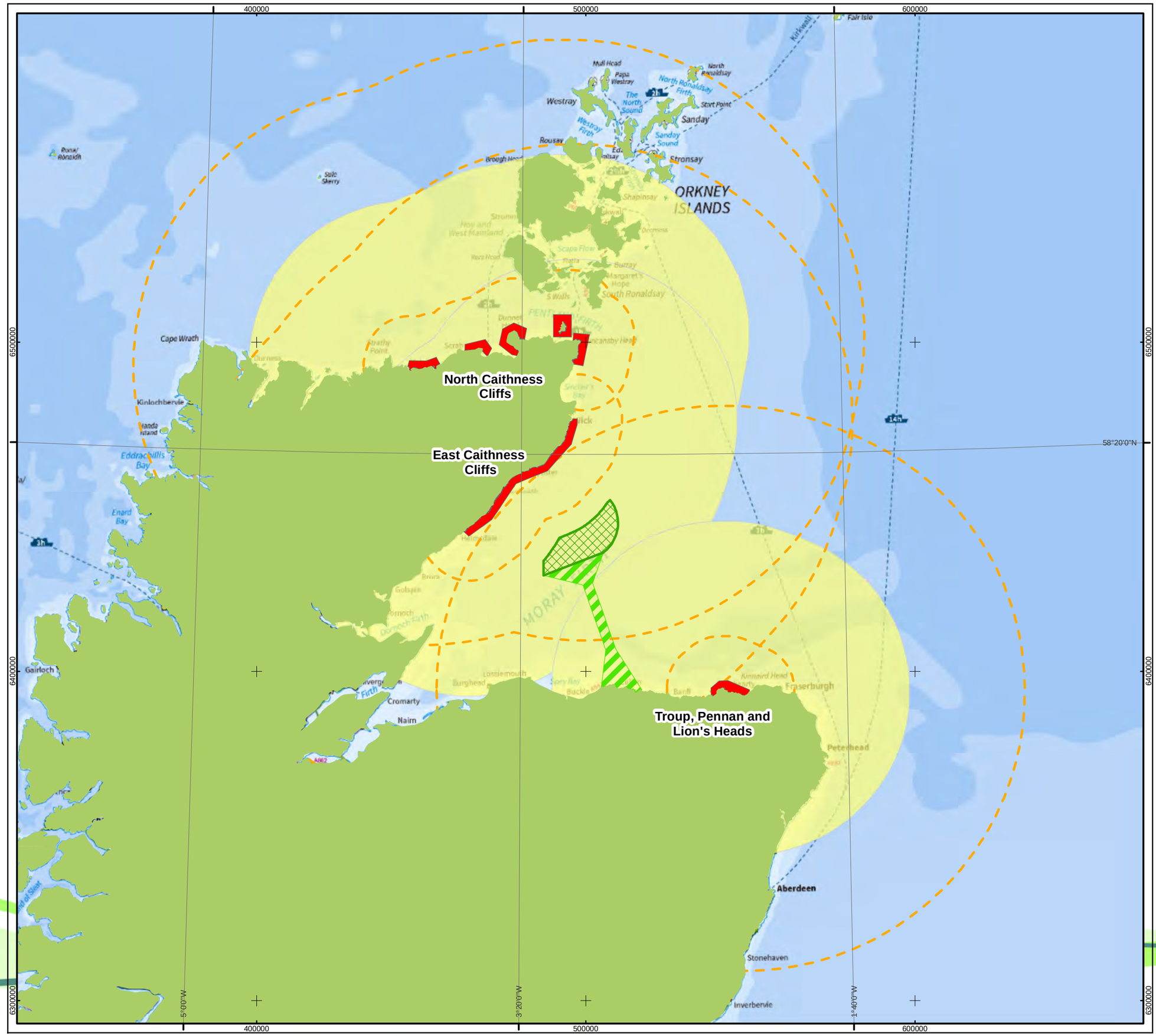
0 25,000 50,000 Meters

N

Geodetic Parameters:	WGS84 UTM Zone 30N
Produced: HAZ Reviewed: RC Approved: FG	
Date: 07/09/2017	Revision: B
REF: 8460005-PPW0160-GOE-MAP-006	

Figure 4.2.5. Guillemot Foraging Ranges

Moray Offshore Windfarm (West) Ltd



MORAY WEST
OFFSHORE WINDFARM

KEY

- Moray West Site
- Moray West Offshore Cable Export Route
- Mean-max foraging range (48.5km)
- Mean max foraging range ± 1 standard deviation (48.5 ± 35.0km)
- Special Protection Areas (SPAs)

Horizontal Scale: 1:1,100,000 A3 Chart

0 25,000 50,000 Meters

N

Geodetic Parameters: WGS84 UTM Zone 30N

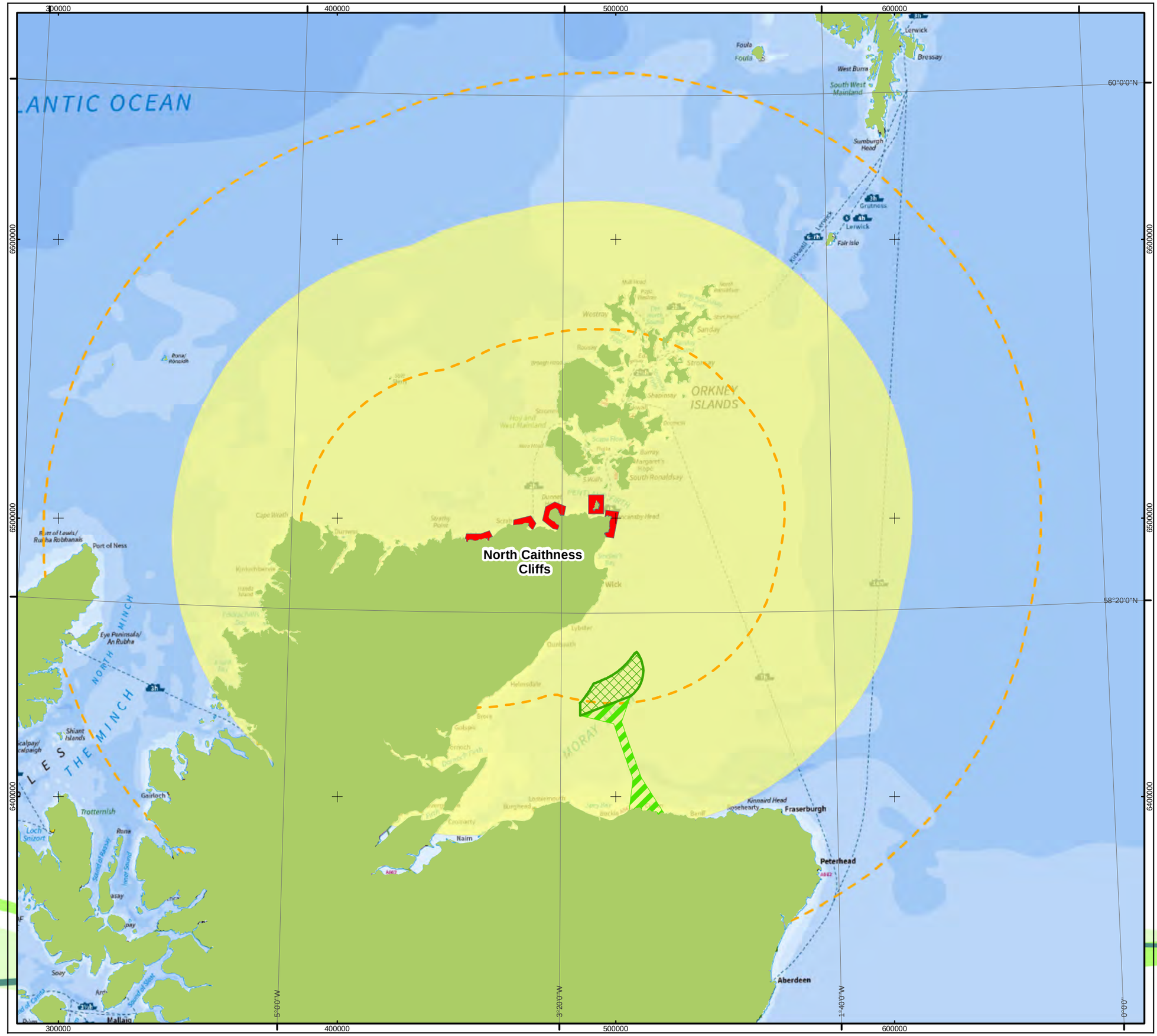
Produced: HAZ
Reviewed: RC
Approved: FG

Date: 07/09/2017 | Revision: B

REF: 8460005-PPW0160-GOE-MAP-007

Figure 4.2.6. Razorbill Foraging Ranges

Moray Offshore Windfarm (West) Ltd



MORAY WEST OFFSHORE WINDFARM

KEY

- Moray West Site
- Moray West Offshore Cable Export Route
- Mean-max foraging range (105.4km)
- Mean-max foraging range ± 1 standard deviation (105.4 ± 46.0km)
- Special Protection Areas (SPAs)

Horizontal Scale: 1:1,300,000 A3 Chart

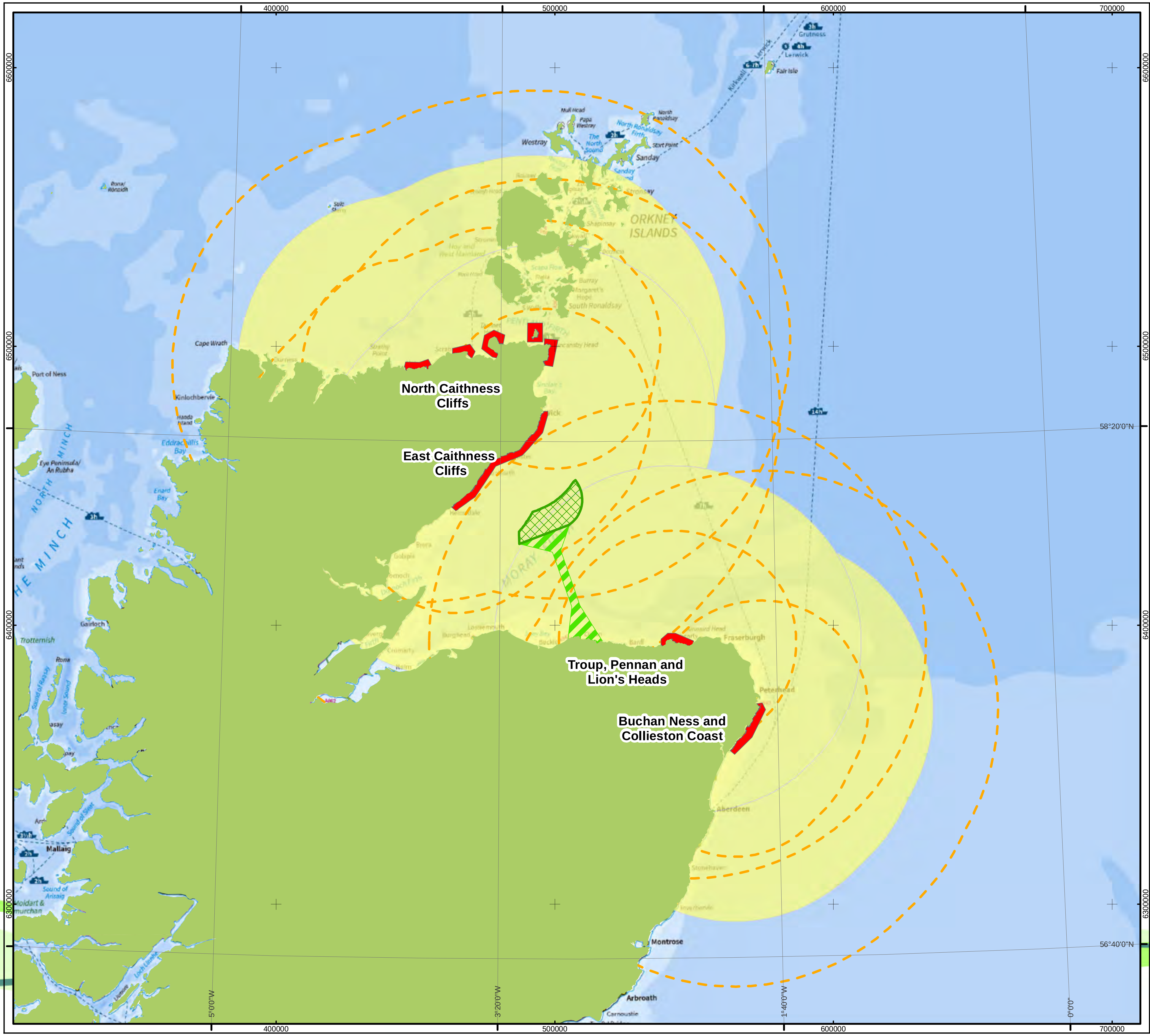
0 25,000 50,000 Meters

N

Geodetic Parameters:	WGS84 UTM Zone 30N
Produced: HAZ Reviewed: RC Approved: FG	
Date: 07/09/2017	Revision: B
REF: 8460005-PPW0160-GOE-MAP-008	

Figure 4.2.7. Puffin Foraging Ranges

Moray Offshore Windfarm (West) Ltd



MORAY WEST
OFFSHORE WINDFARM

KEY

- Moray West Site
- Moray West Offshore Cable Export Route
- Mean-max foraging range (60km)
- Mean-max foraging range ± 1 standard deviation (60 ± 23.3km)
- Special Protection Areas (SPAs)

Horizontal Scale: 1:1,300,000 A3 Chart

0 25,000 50,000 Meters

N

Geodetic Parameters: WGS84 UTM Zone 30N

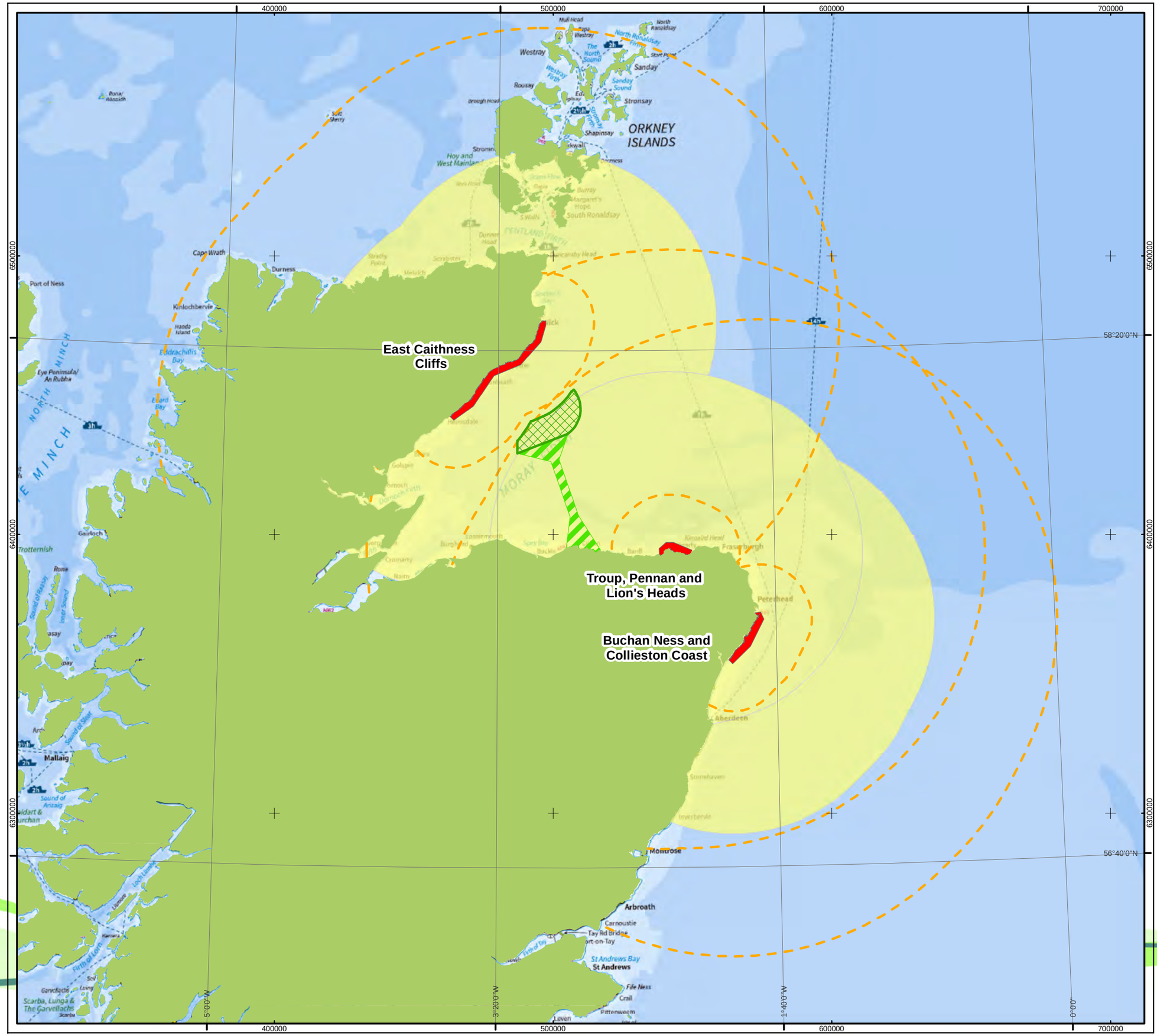
Produced: HAZ
Reviewed: RC
Approved: FG

Date: 07/09/2017	Revision: B

REF: 8460005-PPW0160-GOE-MAP-009

Figure 4.2.8. Kittiwake Foraging Ranges

Moray Offshore Windfarm (West) Ltd



MORAY WEST
OFFSHORE WINDFARM

KEY

- Moray West Site
- Moray West Offshore Cable Export Route
- Mean-max foraging range (61.1km)
- Mean-max foraging range ± 1 standard deviation (61.1 ± 44.0km)
- Special Protection Areas (SPAs)

Horizontal Scale: 1:1,300,000 A3 Chart

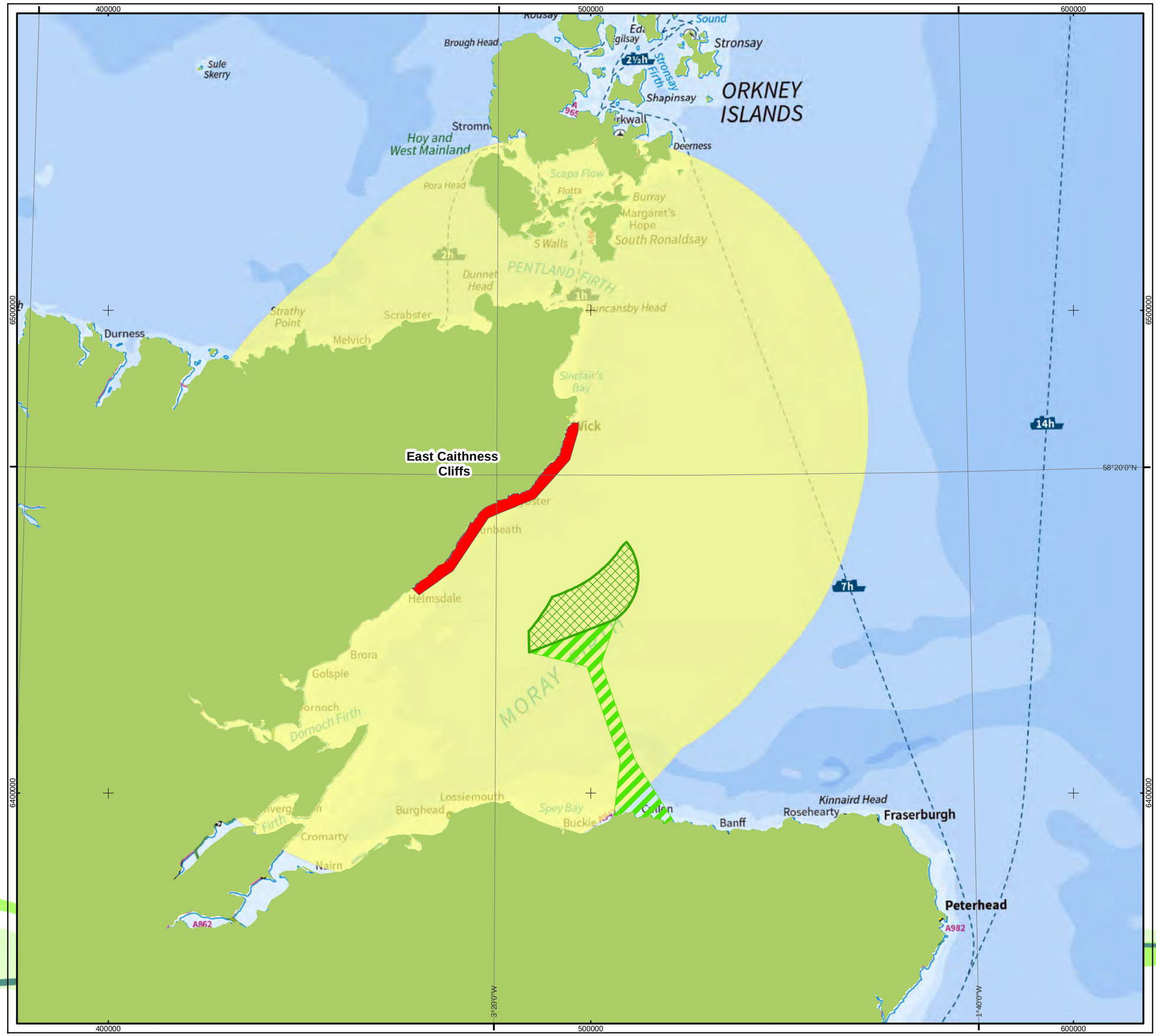
0 25,000 50,000 Meters

N

Geodetic Parameters:	WGS84 UTM Zone 30N
Produced: HAZ Reviewed: RC Approved: FG	
Date: 07/09/2017	Revision: B
REF: 8460005-PPW0160-GOE-MAP-010	

Figure 4.2.9. Herring Gull Foraging Ranges

Moray Offshore Windfarm (West) Ltd



MORAY WEST
OFFSHORE WINDFARM

KEY

- Moray West Site
- Moray West Offshore Cable Export Route
- Foraging range (60km)
- Special Protection Areas (SPAs)

Horizontal Scale: 1:750,000 A3 Chart

0 12,500 25,000 Meters

N

Geodetic Parameters: WGS84 UTM Zone 30N

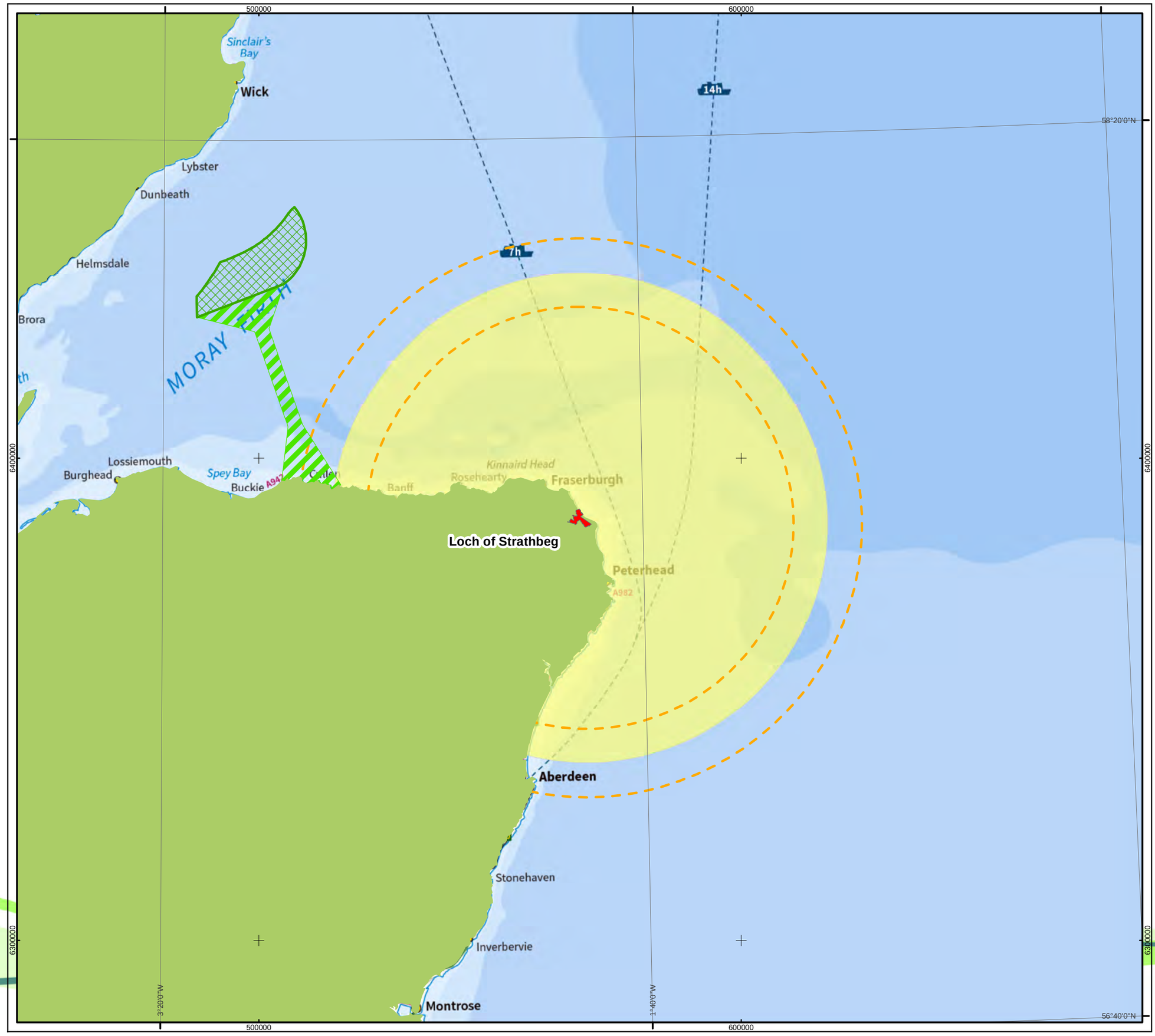
Produced: HAZ
Reviewed: RC
Approved: FG

Date: 07/09/2017 | Revision: B

REF: 8460005-PPW0160-GOE-MAP-011

Figure 4.2.10. Great Black-backed Gull Foraging Range

Moray Offshore Windfarm (West) Ltd



MORAY WEST
OFFSHORE WINDFARM

KEY

- Moray West Site
- Moray West Offshore Cable Export Route
- Mean-max foraging range (49km)
- Mean max foraging range ± 1 standard deviation (49.0 ± 7.1km)
- Special protection Areas (SPAs)

Horizontal Scale: 1:750,000 A3 Chart

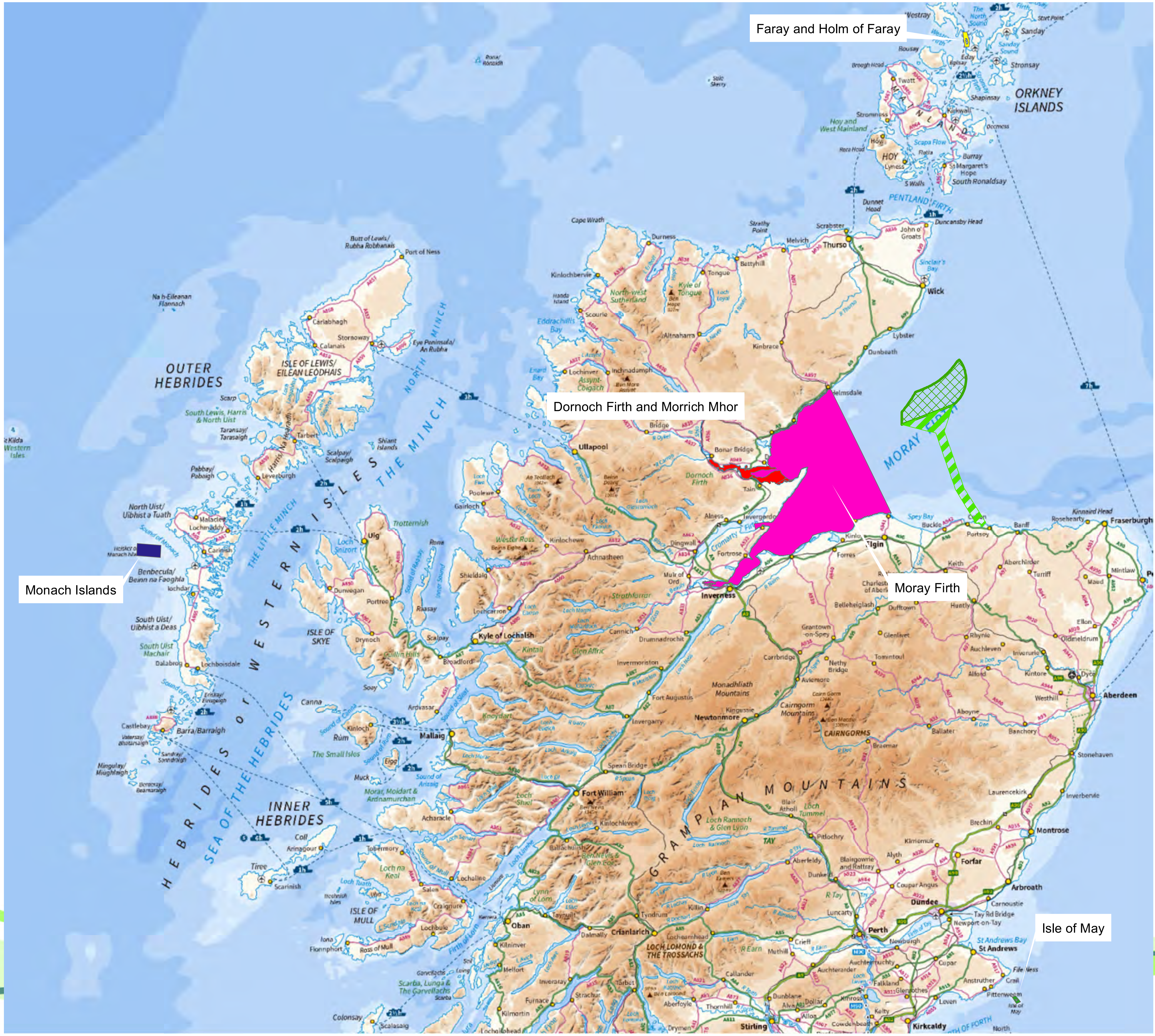
0 12,500 25,000 Meters

N

Geodetic Parameters:	WGS84 UTM Zone 30N
Produced: HAZ Reviewed: RC Approved: FG	
Date: 07/09/2017	Revision: B
REF: 8460005-PPW0160-GOE-MAP-012	

Figure 4.2.11. Sandwich Tern Foraging Ranges

Moray Offshore Windfarm (West) Ltd



MORAY WEST OFFSHORE WINDFARM

KEY

- Moray West Site
- Offshore Export Cable Corridor

Special Area of Conservation with Marine Mammal Features

- Dornoch Firth and Morrich More
- Faray and Holm of Faray
- Isle of May
- Monach Islands
- Moray Firth

Horizontal Scale: 1:1,300,000 A3 Chart

0 20,000 40,000 Meters

Geodetic Parameters: WGS84 UTM Zone 30N

Produced: RC
Reviewed: GB
Approved: FG

Date: 04/09/2017 Revision: C

REF: 8460005-PPW0160-GOE-MAP-013

Figure 4.2.12: Location of SAC's with Marine Mammal Qualifying Features

Moray Offshore Windfarm (West) Ltd

MORAY WEST
OFFSHORE WINDFARM

KEY

- Moray West Site
- Offshore Export Cable Corridor
- Special Area of Conservation with Migratory Fish Features

Horizontal Scale: 1:700,000 A3 Chart

0 10,000 20,000 Meters

N

Geodetic Parameters:	WGS84 UTM Zone 30N
Produced: RC Reviewed: GB Approved: FG	
Date: 04/09/2017	Revision: C
REF: 8460005-PPW0160-GOE-MAP-014	

Figure 4.2.13: Location of SAC's with Migratory Fish Qualifying Features

Moray Offshore Windfarm (West) Ltd

Appendix 2 – Environmental Baseline: European Sites and Ramsar and Qualifying Features

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Environmental Baseline

European Sites and Ramsars

Moray Firth pSPA

The Moray Firth proposed Special Protection Area (pSPA) comprises an area of 1762.36 square kilometres (km^2). The Moray basin is an extensive site stretching seaward from the Helmsdale coast in the north, to Portsoy in the east and it includes the Outer Dornoch and Cromarty Firths, Beauly and Inverness Firths, as well as part of the wider Moray Firth.

This area attracts the largest British non-breeding populations of long-tailed duck, velvet scoter and shag, as well as the second largest population of scaup and the largest Scottish non-breeding populations of common scoter and goldeneye. Important numbers of four other marine birds also spend winter in the Firth. In summer, the site continues to provide important feeding grounds for breeding shag, making local foraging trips from their breeding grounds along the sea cliffs.

East Caithness Cliffs SPA

The East Caithness Cliffs SPA is located on the east coast of Caithness and comprises most of the sea-cliff areas between Wick and Helmsdale. The cliffs are formed from Old Red Sandstone and are generally between 30-60 m high, rising to 150 m at Berriedale. Cliff ledges, stacks and geos provide ideal nesting sites for internationally important populations of seabirds, especially gulls and auks. The seabirds nesting on the East Caithness Cliffs feed outside the SPA in inshore waters as well as further away. The cliffs overlook the Moray Firth, an area that provides rich feeding areas for fish-eating seabirds.

North Caithness Cliffs SPA

The North Caithness Cliffs SPA is located on the north coast of Caithness in northern Scotland. The site comprises most of the sea-cliff areas between Red Point and Duncansby Head on the north mainland coast, and the western cliffs on the island of Stroma. The cliffs are formed from Old Red Sandstone and are generally between 30-60 m high, rising to 120 m at Dunnet Head. Cliff ledges, stacks and geos provide ideal nesting sites for important populations of seabirds, especially gulls and auks. The seabirds nesting on the North Caithness Cliffs feed outside the SPA in the surrounding waters of the Pentland Firth, as well as further afield.

Troup, Pennan and Lion's Head SPA

Troup, Pennan and Lion's Head SPA is a 9 km stretch of sea-cliffs along the Banff and Buchan coast of Aberdeenshire in north-east Scotland. As well as cliffs, the site also includes adjacent areas of grassland and heath, and several small sand or shingle beaches punctuate the otherwise rocky shore. The cliffs rise to 150 m and provide ideal nesting sites for seabirds, which feed in the rich waters offshore and outside the SPA. Different parts of the cliffs are used by different species of seabirds according to varying ecological requirements. The site is particularly important for its numbers of gulls and auks.

Buchan Ness and Collieston Coast SPA

Buchan Ness to Collieston Coast SPA is located on the coast of Aberdeenshire in north-east Scotland. It is a 15 km stretch of south-east facing cliff formed of granite, quartzite and other rocks running to the south of Peterhead, interrupted only by the sandy beach of Cruden Bay. The low, broken cliffs (generally less than 50 m high) show many erosion features such as stacks, arches, caves and blowholes. The varied coastal vegetation on the ledges and cliff tops includes maritime heath, grassland and brackish flushes. The site is of importance as a nesting area for a number of seabird species (gulls and auks). These birds feed outside the SPA in the nearby waters, as well as more distantly.

Moray and Nairn Coast SPA

The Moray and Nairn Coast SPA is located on the south coast of the Moray Firth in north-east Scotland. The site comprises the intertidal flats, saltmarsh and sand dunes of Findhorn Bay and Culbin Bar, and the alluvial deposits and associated woodland of the Lower River Spey and Spey Bay. It is of outstanding nature conservation and scientific importance for coastal and riverine habitats and supports a range of wetland birds throughout the year. In summer it supports nesting osprey *Pandion haliaetus*, whilst in winter it supports large numbers of Iceland/Greenland pink-footed goose *Anser brachyrhynchus*, Icelandic greylag goose *Anser* and other waterbirds, especially ducks, sea-ducks and waders. The geese feed away from the SPA on surrounding agricultural land during the day. The sea-ducks feed, loaf and roost over inundated intertidal areas within the site, but also away from the SPA in the open waters of the Moray Firth.

Moray and Nairn Coast SPA forms an integral ecological component of the Moray Basin Firths and Bays, of which it is the easternmost unit.

Dornoch Firth SPA

The Dornoch Firth is located in north-eastern Scotland and is one of the two northernmost estuaries in the Moray Basin ecosystem. The Dornoch Firth and Loch Fleet SPA is one of the best examples in northwest Europe of a large complex estuary which has been relatively unaffected by industrial development, whilst Loch Fleet itself is an example of a shallow, bar-built estuary. Extensive sand-flats and mud-flats are backed by saltmarsh and sand dunes with transitions to dune heath and alder *Alnus glutinosa* woodland. The tidal flats support internationally important numbers of waterbirds on migration and in winter, and are the most northerly and substantial extent of intertidal habitat for wintering waterbirds in the UK, as well as Europe. The Firth is also of importance as a feeding area for locally breeding Osprey.

Dornoch Firth and Loch Fleet SPA forms an integral ecological component of Moray Basin Firths and Bays of which it forms the most northerly component area.

Cromary Firth SPA

Cromarty Firth is located in north-eastern Scotland and is one of the major firths on the east shore of the Moray Firth. It contains a range of high-quality coastal habitats including extensive intertidal mud-flats and shingle bordered locally by areas of saltmarsh, as well as reedbeds around Dingwall. The rich invertebrate fauna of the intertidal flats, with beds of eelgrass *Zostera* spp., glasswort *Salicornia* spp., and *Enteromorpha* algae, all provide important food sources for large numbers of wintering and migrating waterbirds (swans, geese, ducks and waders). With adjacent estuarine areas elsewhere in the Moray Firth, it is the most northerly major wintering area for wildfowl and waders in Europe. The Firth is also of importance as a feeding area for locally breeding osprey as well as for breeding terns.

Cromarty Firth SPA forms an integral ecological component of Moray Basin Firths and Bays.

Inner Moray Firth SPA

The Inner Moray Firth is located to the north of Inverness in Scotland and is one of the major arms of the Moray Firth. It comprises the Beauly Firth and Inverness Firth (including Munlochy Bay) which together form the easternmost estuarine component of the Moray Basin ecosystem. The site contains extensive intertidal flats and smaller areas of saltmarsh. The rich invertebrate fauna of the intertidal flats, with beds of eelgrass *Zostera* spp., Glasswort *Salicornia* spp., and *Enteromorpha* algae, all provide important food sources for large numbers of wintering and migrating waterbirds (geese, ducks and waders). With adjacent estuarine areas elsewhere in the Moray Firth, this site is the most northerly major wintering area

for wildfowl and waders in Europe. The Firth is also of importance as a feeding area for locally breeding Osprey well as for breeding terns.

The Inner Moray Firth SPA forms an integral ecological component of Moray Basin Firths and Bays.

Moray Firth SAC

The Moray Firth SAC was designated in March 2005 and covers an area of 15,1274 hectares (ha). The primary reason for designation is due to its population of Annex II species, bottlenose dolphin. The Moray Firth in north-east Scotland supports the only known resident population of bottlenose dolphin Tursiops truncatus in the North Sea. The population is estimated to be around 130 individuals (Wilson et al. 1999). Dolphins are present all year round, and, while they range widely in the Moray Firth, they appear to favour particular areas (JNCC, 2015a). The bottlenose population were last recorded as being in 'favourable recovered' condition in September 2010. The Moray Firth SAC is also designated for its Annex I habitat of 'Sandbanks which are slightly covered by sea water all the time'. The condition of the habitat is currently 'favourable maintained' as recorded in August 2004. The conservation objectives for the bottlenose dolphin are presented in Table A2.1.

Table A2.1 Conservation Objectives for the Bottlenose Dolphin Population of the Moray Firth SAC.

Moray Firth SAC – Conservation Objectives For Qualifying Species
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 features; and; To ensure for the qualifying species that the following are established then maintained in the long term: • Population of the species as a viable component of the site; • Distribution of the species within site; • Distribution and extent of habitats supporting the species; • Structure, function and supporting processes of habitats supporting the species; and • No significant disturbance of the species.

Dornoch Firth and Morrich More SAC

The Dornoch Firth and Morrich More SAC was designated in March 2005 and covers an area of 8,701 ha. The primary reason for designation is due to its Annex I habitats, which include 'estuaries', 'mudflats and sandflats not covered by seawater at low tide', 'Salicornia and other annuals colonizing mud and sand', 'Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)', 'embryonic shifting dunes', 'Shifting dunes along the shoreline with *Ammophila arenaria* (white dunes)', 'Fixed dunes with herbaceous vegetation (grey dunes)', 'Decalcified fixed dunes with *Empetrum nigrum*', 'Atlantic decalcified fixed dunes (*Calluno-Ulicetea*)', 'Humid dune slacks', and 'Coastal dunes with *Juniperus* spp'. Otter and harbor seal are Annex II species that are listed as primary features. The Dornoch Firth is the most northerly large estuary in Britain and supports a significant proportion of the inner Moray Firth population of the Harbour seal. The seals, which utilise sand-bars and shores at the mouth of the estuary as haul-out and breeding sites, are the most northerly population to utilise sandbanks. Their numbers represent almost 2% of the UK population (JNCC, 2015b). In August 2013, the population of harbor seal was recorded as being in 'unfavourable declining' condition. The Conservation Objectives for harbour seal are set out in Table A2.1.

Other Annex I habitats present as a qualifying feature, but not a primary reason for designation include 'Sandbanks which are slightly covered by sea water all the time' and 'Reefs'.

Faray and Holm of Faray SAC

The Faray and Holm of Faray SAC was designated in March 2005 and covers an area of 781 ha. The primary reason for designation is its Annex II species of grey seal. These two uninhabited islands in the northern part of Orkney support a well-established grey seal breeding colony. The seals tend to be found in areas where there is easy access from the shore, and freshwater pools on the islands appear to be particularly important. The islands support the second-largest breeding colony in the UK, contributing around 9% of annual UK pup production. (JNCC, 2015c). The condition of the population was last reported as 'favourable maintained' in November 2014. The conservation objectives that are applicable to this species are set out within Table A2.1.

Isle of May SAC

The Isle of May SAC was designated in March 2005 and covers an area of 357 ha. The primary reason for designation is due to its Annex II species of grey seal. The Isle of May, lying at the entrance to the Firth of Forth on the east coast of Scotland, supports a breeding colony of grey seals. The site is the largest east coast breeding colony of grey seals in Scotland and the fourth-largest breeding colony in the UK, contributing approximately 4.5% of annual UK pup production (JNCC, 2015d). The condition of the population was last reported as 'favourable maintained' in November 2014. The conservation objectives that are applicable to this species are set out within Table A2.1. The Annex I habitat of 'Reef' is also a qualifying feature, but not a primary reason for selection.

Monach Islands SAC

The Monach Islands SAC was designated in March 2005 and covers an area of 3,647 ha. The primary reason for designation is due to its Annex I habitat comprising 'Machairs' and its Annex II species of grey seal. In addition to these, the Annex I habitats of 'Shifting dunes along the shoreline with Ammophila arenaria (white dunes)' and 'Fixed coastal dunes with herbaceous vegetation (grey dunes)' are present, but are not primary reasons for designation. The Monach Islands, off the Outer Hebrides, offer a wide area of largely undisturbed habitat for breeding grey seal, and there is easy access to the grassy swards and dune systems of the islands. These islands hold the largest breeding colony in the UK, contributing over 20% of annual UK pup production (JNCC, 2015e). The grey seal population is described as being of 'favourable maintained' condition (November, 2014) and the conservation objectives that are applicable to this species are set out within Table A2.1.

Berriedale and Langwell Waters SAC

The Berriedale and Langwell Waters SAC was designated in March 2005 and covers an area of 58 ha. The primary reason for designation is due to its Annex II species of Atlantic salmon. A description of this population of Atlantic salmon is presented in Table A2.9. The salmon population is described as being of 'favourable maintained' condition (July, 2011) and the conservation objectives that are applicable to this species are set out within Table A2.2.

Table A2.2 Conservation Objectives for the Atlantic Salmon Population of the Berriedale and Langwell Waters SAC.

Berriedale and Langwell Waters SAC – Conservation Objectives For Qualifying Species
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 features; and 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 and extent of habitats supporting the species; • Structure, function and supporting processes of habitats supporting the species; and • No significant disturbance of the species.

River Borgie SAC

The River Borgie SAC was designated in March 2005 and covers an area of 34 ha. The primary reason for designation is due to its Annex II species of freshwater pearl mussel. The Annex II species of Atlantic salmon and otter are also listed as qualifying features, although not as primary reasons for designation. A description of this population of Atlantic salmon is presented in Table A2.9. The salmon population is described as being of 'favourable recovered' condition (October, 2011) and the conservation objectives that are applicable to this species are set out within Table A2.3.

Table A2.3 Conservation Objectives for the Atlantic Salmon Population of the River Borgie SAC.

River Borgie SAC – Conservation Objectives For Qualifying Species
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 features; and 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 and extent of habitats supporting the species; • Structure, function and supporting processes of habitats supporting the species; • No significant disturbance of the species; • Distribution and viability of freshwater pearl mussel host species; and • Structure, function and supporting processes of habitats supporting freshwater pearl mussel host species.

River Naver SAC

The River Naver SAC was designated in March 2005 and covers an area of 1044 ha. The primary reason for designation is due to its Annex II species of freshwater pearl mussel and Atlantic salmon. A description

of this population of Atlantic salmon is presented in Table A2.9. The salmon population is described as being of 'favourable recovered' condition (August, 2011) and the conservation objectives that are applicable to this species are set out within Table A2.3.

River Thurso SAC

The River Thurso SAC was designated in March 2005 and covers an area of 348 ha. The primary reason for designation is due to its Annex II species of Atlantic salmon. A description of this population of Atlantic salmon is presented in Table A2.9. The salmon population is described as being of 'unfavourable recovering' condition (October, 2011) and the conservation objectives that are applicable to this species are set out within Table A2.2.

River Oykel SAC

The River Oykel SAC was designated in March 2005 and covers an area of 921 ha. The primary reason for designation is due to its Annex II species of freshwater pearl mussel. The Annex II species of Atlantic salmon is also a qualifying feature, although not a primary reason for designation. A description of this population of Atlantic salmon is presented in Table A2.9. The salmon population is described as being of 'favourable recovered' condition (July, 2011) and the conservation objectives that are applicable to this species are set out within Table A2.3.

River Moriston SAC

The River Moriston SAC was designated in March 2005 and covers an area of 194 ha. The primary reason for designation is due to its Annex II species of freshwater pearl mussel. The Annex II species of Atlantic salmon is also a qualifying feature, although not a primary reason for designation. A description of this population of Atlantic salmon is presented in Table A2.9. The salmon population is described as being of 'unfavourable no change' condition (July, 2011) and the conservation objectives that are applicable to this species are set out within Table A2.3.

River Spey SAC

The River Spey SAC was designated in March 2005 and covers an area of 5760 ha. The primary reason for designation is due to its Annex II species of freshwater pearl mussel, Atlantic salmon, sea lamprey and otter. A description of this population of Atlantic salmon is presented in Table A2.9. The salmon population is described as being of 'unfavourable recovering' condition (September, 2011) and the conservation objectives that are applicable to this species are set out within Table A2.2. The River Spey represents the sea lamprey in the northern part of its range in the UK. It is absent from rivers north of the Great Glen, and the River Spey is virtually at the northern limit for this species. Recent surveys show that sea lamprey larvae are widely distributed throughout the middle and lower reaches of the river, where the particularly fast-flowing waters of the River Spey provide ideal spawning conditions for this species. In addition, as an unpolluted and relatively little modified system, the River Spey matches the other key habitat requirements of the sea lamprey in terms of good water quality, clean gravels and marginal silts and an unhindered migration route to the sea (JNCC, 2015f). The conservation objectives for sea lamprey are set out in Table A2.3 and the population condition is described as 'favourable maintained' (September 2011).

Qualifying Features

Through EIA Scoping of the Moray West Offshore Wind Farm (Marine Scotland, 2016), the following ecological aspects have been identified as requiring consideration within the HRA process in relation to European sites and qualifying features of interest:

- Ornithology;
- Marine mammals; and
- Migratory fish.

This section presents a summary of the baseline environmental characterisation of these three key ecological aspects in relation to the Moray West Offshore Wind Farm and Moray West OfTI. Baseline characterisation is informed through site specific surveys, desk studies and review of other published literature and publicly available datasets. These sources of information are referenced within the individual baseline descriptions presented below.

Ornithology

The following guidance and published work has informed the baseline characterisation of the ornithological interests:

- A review of assessment methodologies for offshore wind farms (Maclean et al., 2009);
- Assessing vulnerability of marine bird populations to offshore wind farms (Furness et al., 2013);
- Biologically appropriate, species-specific, geographically non-breeding season population estimates for seabirds (Furness, 2015);
- Seabird foraging ranges as a preliminary tool for identifying candidate Marine Protected Areas (Thaxter et al., 2012);
- Using a collision risk model to assess bird collision risk for offshore wind farms (Band 2012);
- Developing an avian collision risk model to incorporate variability and uncertainty. (Masden, 2015);
- The avoidance rates of collision between birds and offshore turbines (Cook et al., 2014);
- Joint Response from the Statutory Nature Conservation Bodies to the Marine Scotland Science Avoidance Rate Review (JNCC et al., 2014);
- JNCC et al. (2017). Interim Displacement Advice Note Advice on how to present assessment information on the extent and potential consequences of seabird displacement from Offshore Wind Farm developments;
- Assessing the risk of offshore wind farm development to migratory birds designated as features of UK SPAs Special Protection Areas (Wright et al., 2012);
- Developing guidelines on the use of Population Viability Analysis for investigating bird impacts due to offshore wind farms (Wildfowl and Wetland Trust (WWT) Consulting, 2012);
- Moray West (2016). Environmental Impact Assessment. Scoping Report. Western Development Area. Offshore Wind Farm Infrastructure: Offshore Wind Turbines, Foundations / Substructures and Inter-Array Cables May 2016;
- Moray East (2012). Environmental Statement. Technical Appendix 4.5 A - Ornithology. Telford, Stevenson, MacColl Wind Farms and associated Transmission Infrastructure Environmental Statement;
- SOSS-05: Assessing the risk of offshore wind farm development to migratory birds designated as features of UK Special Protection Areas (and other Annex 1 species); and
- Wade et al. (2016). Incorporating data uncertainty when estimating potential vulnerability of Scottish seabirds to marine renewable energy developments.

The waters of the Outer Moray Firth and the nearshore waters off the Moray and Aberdeenshire coasts are important feeding areas for seabirds and seaduck (Tasker, 1996). Of the seabirds, fulmars are widely distributed in the offshore export cable corridor throughout the year, whilst gannet, kittiwake and auk numbers peak during the summer or autumn. The surrounding coastal waters are of particular year-round importance for shags and herring gulls (Department of Trade and Industry (DTI), 2004; DECC, 2009).

An extensive ornithological dataset exists for the Moray Firth with this further indicating importance of the area for seabirds in both the breeding season and non-breeding season as evident from SPA designations in and around the Moray Firth area. Because of the mix of birds present, it is probable that the Moray West Offshore Wind Farm and OfTI areas are used at different times by birds (i) overwintering in the area; (ii) foraging from nearby breeding coastal colonies; and (iii) on post-breeding dispersal, migration and pre-breeding return.

As well as true pelagic seabirds (e.g. gannet, fulmars and auks), other species that spend part of their annual life cycle at sea (e.g. divers, gulls and seaducks) may also be present in particular months.

Site Specific Surveys

Digital aerial video surveys have been undertaken monthly, over a period of 12 months between April 2016 and March 2017. The surveys consisted of a series of parallel transects, each spacing 2.531 km apart, aligned in a south-east to north-west orientation within the Moray West Site and 4 km buffer. The survey was designed to allow for a 10.21% coverage of the survey area. Surveys were undertaken at a height of 550 m above sea level and data collected at a 2 cm resolution. Figure A2.1 provides an overview of the proposed transect survey design (the transects at the eastern and western boundaries of the survey area have been increased to 4 km in line with the size of the buffer).

The following data was collected:

- Date and time of each bird recorded;
- Global Positioning System (GPS) coordinate location of each bird recorded, ± error in the location;
- Survey transect number;
- Species Identification (structured approach to, and confidence in identification is needed);
- Bird age, gender and moult status (where possible);
- Whether the individual is in flight or on the sea surface;
- Behaviour in flight (e.g. part of a flock, carrying fish, diving);
- Flight height (± an appropriate error and confidence);
- Flight orientation (in compass degrees to true North); and
- Sea state (at the time of the image being collected.

Historical Moray Firth Surveys

As mentioned above, there is an extensive amount of ornithology data for the Moray Firth which has previously been detailed in the Moray East Environmental Statement. Technical Appendix 7.3 G - Habitat Regulations Appraisal: Marine Mammals. Telford, Stevenson, MacColl Wind Farms and associated Transmission Infrastructure Environmental Statement (Moray East, 2012). Further data that was reported in the Moray West Offshore Wind Farm Scoping Report (Moray West, 2016) included great back-backed gull and herring gull tagging work as well as regional strategic monitoring (commissioned by Marine

Scotland Science (MSS)). Table A2.4 provides an overview of the existing seabird datasets relevant to the Moray West HRA.

Table A2.4 Ornithological Datasets in the Moray Firth with Contextual Relevance to the Moray West HRA

Dataset / Technical Report	Main Content	Geographical Coverage	Source	Date
Moray East boat-based surveys	Data from 28 boat-based surveys including population estimates and densities for key ornithological receptors	Moray East Site plus 4 km buffer	Moray East	Apr 2010 – Mar 2012
Moray East aerial surveys	Six aerial surveys collecting relative abundance estimates of birds from relevant breeding colonies	Wide strip from the East Caithness Cliffs (ECC) and North Caithness Cliffs (NCC) SPAs to the Moray Coast	Moray East	May – July 2011
Tracking data for fulmar, kittiwake, guillemot and razorbill from the southern part of the ECC SPA	GPS data collected from a range of species at the ECC SPA	Moray Firth	Moray East	2011 breeding season
Migration surveys (during Moray East and BOWL boat-based surveys and at four coastal vantage points)	Additional data on migrating swans and geese flying through the Moray East Site	Moray Firth	Moray East	Autumn 2010 and Spring 2011
BOWL boat-based surveys	Data from boat-based surveys including population estimates, densities and behavioural data	BOWL site plus a 4 km buffer	BOWL	Oct 2009 – Sep 2011
Beatrice Demonstrator monthly vantage point watches (Talisman)	-	Moray Firth	Talisman	2005 – 2008
Aerial surveys (HiDef, WWT)	-	Wide area in Moray Firth including the entire Zone plus 4 km buffer	-	Breeding season 2009 and winter 2009/2010
Tracking of large gulls (great black-backed gull and herring gull) at ECC SPA	Tracking of 11 great black-backed gulls and 10 herring gulls	Moray Firth	MORL	May – Jun 2014
Marine Scotland seabirds strategic surveys	-	East Coast Scotland	MSS	2014 – 2015

Dataset / Technical Report	Main Content	Geographical Coverage	Source	Date
BOWL pre-construction aerial surveys	-	Area between the ECC SPA and the BOWL site plus 10 km buffer	-	May – Aug 2015
Seabird 2000 census	Population counts for relevant breeding colonies	UK	-	1998-2002
East Caithness Cliffs SPA colony monitoring (SNH)	-	East Caithness Cliffs SPA	-	2015

The geographical extent of the above data sets in relation to Moray West is present in Figure A2.2.

A total of six digital aerial surveys were carried out by between May and July 2011. The survey area covered a strip between the ECC and NCC SPAs in the north, to the Troup, Pennan and Lion's Head SPA in the Moray Coast in the south. The survey aircraft was flown along transects 2 km apart from each other, aligned in a north-northeast to south-southeast direction, and images were captured every 250 m along each transect line. Relative abundance estimates from the aerial surveys are included in Table A2.5 below. These data describe the relative abundance of birds across the survey area.

Table A2.5 Relative Abundance Estimates from the 2011 Digital Imaging Surveys

Species	Abundance Estimate
Guillemot	69,485
Razorbill	58,846
Puffin	11,780
Fulmar	21,241
Great black-backed gull	950
Kittiwake	47,765

Seven aerial surveys were undertaken over the Moray Firth Round 3 zone in 2009 (May, June, August, November and December) and 2010 (two in February). The surveys covered the entire Moray Firth Round 3 zone plus a 4 km buffer. The key findings from these data as a whole were:

- The most frequently recorded bird species / species groups in this area were auks, with high numbers of fulmar, kittiwake and other gulls also recorded;
- Other bird species recorded within the Moray Firth site included gannet, along with very low numbers of divers, Leach's petrel, Arctic skua, great skua, and unidentified terns; and
- Seasonal variations in bird numbers present within the Moray Firth Site included: increasing numbers of fulmar in November compared to other months; highest numbers of gannet and kittiwake in June and August, with low numbers during the winter; and higher numbers of auks during May and June compared to the winter.

A seabird tracking study was undertaken in 2011 by the Marine Biology and Ecology Research Centre, University of Plymouth at the ECC SPA. GPS loggers were attached to four key species of seabirds (fulmar, kittiwake, guillemot and razorbill). Full details of the methodology and results can be found in Technical

Appendix 4.5 C of the Moray East ES (Moray East, 2012). The large majority of the guillemots, razorbill and kittiwakes tracks were recorded within the inner part of the Moray Firth, with a small number commuting through the western part of the Moray West Offshore Wind Farm and OfTI areas. Fulmars travelled over a much wider area compared with the other three species, heading to more offshore foraging grounds.

A total of 28 boat-based surveys were carried out between April 2010 and March 2012. The survey area covered the Moray West Site plus a 4 km buffer (part of which overlaps with the Export Cable Corridor (see Technical Appendix 4.5 A of the Moray East ES (Moray East, 2012) for full details on the boat-based survey methodology). A summary of the seasonal abundance of the key species recorded, are presented in Table A2.6.

Table A2.6 Abundance Estimates for Key Species at Moray East Offshore Wind Farm (Taken From 2010 to 2012 Boat–Based Survey Data)

Species	Breeding Season		Non-breeding Season	
	Site	Buffer	Site	Buffer
Fulmar	782	750	197	189
Gannet	100	86	23	20
Great skua	101	62	n/a	n/a
Kittiwake	1,963	1,532	261	204
Herring gull	7	18	41	47
Great black-backed gull	271	526	106	77
Arctic tern	229	1,903	n/a	n/a
Guillemot	6,732	6,943	990	1,021
Razorbill	1,661	1,674	892	899
Puffin	1,916	1,971	450	263

Herring gulls and great black-backed gulls were tracked at ECC SPA during May and June 2014 (Archibald *et al*. 2014). Eleven great black-backed gulls and 10 herring gulls were caught on the nest and fitted with a 26 g remotely downloadable GPS / accelerometer tag. The results of this study showed that great back-backed gulls foraged mainly across inshore areas (maximum distance recorded from the nest was around 20 km although the vast majority of trips shorter than this). Herring gulls were also largely coastal, but foraged further to the south-east compared with great back-backed gulls, to waters north of the Cromarty.

Further contextual information on seabird density in the Moray Firth can be taken from an analysis of 26 years of European seabirds at sea (ESAS) surveys undertaken by JNCC (Kober *et al*., 2010); these are summarised in A2.7.

Table A2.7 Summary of JNCC ESAS Survey Data Analysis For The Moray Firth (Kober *et al*., 2010)

Species	Season	Density/km^2
Fulmar	Breeding	5 – 16
	Winter	3 - 7

Gannet	Breeding	0.9 – 2.9
	Winter	0.4 – 1.0
Cormorant	Breeding	0.03 – 0.3
	Winter	0 – 0.2
Shag	Breeding	0 – 5.7
	Winter	0 – 8.0
Arctic skua	Breeding	0.02 – 0.2
	Winter	0.01 – 1.1
Great skua	Breeding	0.1 – 0.2
	Winter	0.01 – 0.3
Kittiwake	Breeding	0.1 – 185.0
	Winter	0.1 – 20.5
Black-headed gull	Winter	0.01 – 3.0
Great black-backed gull	Breeding	0.01 – 0.8
	Winter	0.01 – 1.2
Lesser black-backed gull	Breeding	0.1 – 4.0
	Winter	0.1 – 4.0
Herring gull	Breeding	0.1 – 44.8
	Winter	0.1 – 9.2
Arctic tern	Breeding	0.01 – 0.9
Guillemot	Breeding	0.1 – 713.4
	Autumn	0.1 – 254.8
	Winter	0.1 – 62.7
Razorbill	Breeding	0.1 – 22.0
	Autumn	0.1 – 30.5
	Winter	0.1 – 15.8
Puffin	Breeding	0.1 – 14.8
	Winter	0.1 – 3.8

Determining a Robust Baseline for Moray West

Digital aerial surveys of the proposed Moray West site have recently been completed. Whilst this year of site-specific survey data provides a characterisation of the bird fauna of the Moray West Site across all seasons, it provides more limited information on the variability of bird densities over a wider temporal span than is normally the case for offshore wind farm impact assessments (given that it is a 12-month data set).

It is considered that recent, site-specific data are the most relevant for the purposes of HRA. The intention is, therefore, to focus primarily on the most recent site-specific data for the purpose of impact assessment. To better understand the variability in bird densities at the Moray West Site and the factors

driving that variability, Moray West proposes to undertake an analysis of historical data for which there is a wealth of in this area as identified above.

An initial review has indicated there are survey data available that can be usefully analysed to supplement the recent site-specific aerial surveys (2016-17) of the Moray West Site.

The proposed approach to the use of these data for informing impact assessment is summarised in Table A2.8.

Table A2.8 Proposed Approach To The Use Of Data Within the Impact Assessment

Characteristic	Data and Approach
Abundance / Density	Site-specific aerial surveys (2016-17) will form the primary data-set on the abundance and density of seabirds within the wind farm area and buffer. Previously collected (historical) seabird survey data will be analysed to provide an historical context to inform an understanding of the likely variability in abundance of key species at the wind farm site. The approach to this analysis is set out below. Where the recent data is considered to be representative of the site (i.e. comfortably within the ranges observed historically) the values for abundance and density observed during those recent surveys will be used to inform collision risk and displacement assessment. If the recent data appear to be exceptional, then the historical data will be further examined to identify a suitably precautionary assumption for the purposes of impact assessment.
Flight Heights	Site-specific aerial surveys (2016-17) will form the primary data-set for flight heights. Historical boat-based survey data will also be interrogated for information on the flights heights of key species. These data will inform the collision risk assessment.
Connectivity	Tracking data will provide information on potential connectivity between breeding colonies and the wind farm site.

The second stage of the process focuses, on the estimation of abundance and density from existing survey datasets to provide an historical context against which the results of the 2016-17 surveys can be set.

Boat-based surveys will be analysed using distance sampling (Buckland *et al.*, 2001) to estimate abundance in each survey area using distance (Thomas *et al.*, 2009, Thomas *et al.*, 2010). The expected outcome of this design-based analysis is an estimated population, with confidence intervals for a defined survey block.

A model-based approach will be used for digital aerial surveys. Each relevant survey dataset will be modelled to produce a density surface map which can be used to calculate the density of a species within a given region along with confidence intervals. Seasonality can be included as a factor in the model, or data from different seasons can be analysed separately.

In addition an evaluation will be made as to whether model predictions can be enhanced through the use of co-variates, which the literature search indicates could, potentially include:

- Static features: depth, distance to breeding colony, seabed slope or roughness, seabed habitat type; and
- Dynamic features: SST, chlorophyll, fronts.

The intention is to tabulate the resulting abundance / density estimates (and confidence limits) by species and season. The results of the most recent survey programme (2016-17) will then be compared to these

data to determine their representativeness. Assuming that the results of the recent surveys are considered to be representative, it is proposed that these data are used for the purposes of risk assessment (i.e. collision risk modelling and displacement analysis).

Marine Mammals

Desk Based Study and Literature Review

The following data sources have been used to describe the baseline conditions for marine mammals within and surrounding Moray West:

- Marine Scotland's National Marine Plan interactive (NMPi) mapping http://marine.gov.scot/maps/nmpi - for data on cetaceans and seals distribution and information on population consequences of disturbance (PCOD);
- Atlas of Cetacean distribution in north-west European waters (2003) http://jncc.defra.gov.uk/page-2713 - Joint Cetacean Database maps depicting cetacean occurrence (distribution and/or sightings) within the study area, including the Moray Firth;
- Data from the Joint Cetacean Protocol (JCP) Phase III http://jncc.defra.gov.uk/pdf/JNCC_Report_517_FINAL_web.pdf [Accessed May 2017];
- Small Cetaceans in the European Atlantic and North Sea (SCANS) survey data – SCANS II http://biology.st-andrews.ac.uk/scans2/inner-finalReport.html and SCANS III https://synergy.st-andrews.ac.uk/scans3/;
- Seal management areas are determined by the Special Committee on Seals (SCOS): http://www.smru.st-andrews.ac.uk/documents/SCOS.pdf;
- UK seal usage of the sea maps http://www.smru.st-andrews.ac.uk/smrudownloader/ [Accessed May 2017];
- Seal density data from SCOS http://www.smru.st-andrews.ac.uk/files/2017/04/SCOS-2016.pdf [Accessed May 2017];
- Guidance on cetacean management units from: http://jncc.defra.gov.uk/pdf/Report_547_webv2.pdf;
- information on the draft Southern Trench Marine Protection Area (MPA) is available from: http://www.snh.gov.uk/protecting-scotlands-nature/protected-areas/national-designations/marine-protected-areas-%28mpa%29/scottish-mpa-network-advice/;
- MORL (2016). Environmental Impact Assessment. Scoping Report. Western Development Area. Offshore Wind Farm Infrastructure: Offshore Wind Turbines, Foundations / Substructures and Inter-Array Cables May 2016; and
- MORL (2012). Environmental Statement. Technical Appendix 7.3 G - Habitat Regulations Appraisal: Marine Mammals. Telford, Stevenson, MacColl Wind Farms and associated Transmission Infrastructure Environmental Statement.

According to the UK Cetacean Atlas (Reid et al., 2003), there are a total of nine species of cetacean that are known to visit the Moray Firth. These are humpback whale (*Megaptera novaeangliae*), Minke whale (*Balaenoptera acutorostrata*), fin whale (*Balaenoptera physalus*), bottlenose dolphin (*Tursiops truncatus*), white-beaked dolphin (*Lagenorhynchus albirostris*), Risso's dolphin (*Grampus griseus*), killer whale (*Orcinus orca*), long-finned pilot whale (*Globicephala melas*) and harbour porpoise (*Phocoena phocoena*).

Within the UK the only marine mammals that form part of the qualifying features for SACs are grey seal (*Halichoerus grypus*), harbour (or common) seal (*Phoca vitulina*) and bottlenose dolphin. In addition to the current suite of designated SACs for these species, there are proposals to designate six additional SACs

around the UK for harbour porpoise and one of these proposals is the Inner Hebrides and Minches candidate SAC (cSAC), which has now been submitted to the European Commission for consideration.

Moray West is located within the Coastal East Scotland (CES) Management Unit for cetaceans which covers the inner Moray Firth area, as well as the Greater North Sea (GNS) Management Unit which covers the Outer Moray Firth.

Moray West is located within the Moray Firth Seal Management Area and within a conservation area for harbour seals (Marine Scotland, 2017). Designated seal haul-out sites are locations on land where seals come ashore to rest, moult or breed. There are no seal haul-out sites that will be directly affected by Moray West with the closest being located approximately 22 km to the north west at Dunbeath-Helmsdale, Lothmore, Brora, Loch Fleet and Findhorn (see Figure A2.3) (Marine Scotland, 2017). The nearest grey seal pupping sites (breeding colonies) are to the north west of Moray West, on the coastline between Dunbeath and Helmsdale and Wick to Lybster at a distance of 20.5 km and 20.0 km respectively (see Figure A2.4).

UK wide seal usage at sea mapping is available from the Sea Mammal Research Unit (SMRU). This data shows the average number of seals in each 5km by 5km grid square at any point in time (Jones *et al.*, 2015). For Moray West, the average number of grey seal is between 1 and 10 individuals. For harbour seal it is 0.01 to 5 individuals. More fine-scale at sea usage maps for harbour seal are available for the north of Scotland, but does not include the Moray Firth. Telemetry data collected from the movement of tagged seals between 2003 and 2015 has been used by (SMRU) to produce fine-scale 'usage' maps. These have then been scaled to population levels using data collected in aerial survey counts at haul-out sites, to produce estimates of mean density (Jones *et al.*, 2016).

Based upon 18 years of data collection, the Moray Firth is reported to have a persistently high density of harbour porpoise during the summer months but not during the winter (Heinänen and Skov, 2015). Mapping shows this area of high density to be present to the north of Moray West but the main areas used by harbour porpoise are on the west coast of Scotland and to the south, in England. The JCP and SCANS data show similar results of a harbour porpoise hotspot in the Moray Firth. SCANS III estimates of abundance for harbour porpoise and bottlenose dolphin are available; harbour porpoise abundance and density (animals/km^2) estimates were 6,147 individuals and 0.152 (overall density average of 0.351). Bottlenose dolphin abundance and density (animals/km^2) estimates were 151 individuals and 0.004 (overall density average of 0.016).

The location of all SACs with marine mammal qualifying features that are potentially connected to the Moray West proposal are illustrated in Figure 4.2.12. Further more detailed baseline information on marine mammals is presented within the Moray East Environmental Statement and supporting Technical Appendices (Moray East, 2012) and in the Moray West Scoping Report (Moray West, 2016).

Site Specific Surveys

To date, no specific marine mammal surveys have been undertaken at the Moray West Site, however site specific surveys were previously completed as part of the consent application for the Moray East Site (Moray East, 2012). Surveys included boat-based surveys over the period April 2010 to March 2012 and these are reported within Technical Appendix 4.4 A Marine Mammal Baseline of the previous Environmental Statement (Moray East, 2012). The digital aerial video surveys undertaken monthly between April 2016 and March 2017 for the ornithological assessment have also recorded marine mammals and provide a source of data (not yet analysed).

Passive acoustic monitoring (PAM) studies have been funded by Marine Scotland and will provide further site specific data in the near future, as will incidental observations made during boat based bird surveys and during aerial surveys (by HiDef) that are due to take place for Moray West. This additional data will be used to further inform any future RIAA.

BOWL and MORL 2015 and 2016 MMMP Results

In 2014 BOWL and MORL agreed, as part of their consents, to undertake a joint regional Marine Mammal Monitoring Programme (MMMP) and a proposed methodology and programme was drawn up and agreed with MS-LOT. This MMMP comprises of harbour seal and bottlenose dolphin monitoring that will be undertaken pre, during and post construction.

As Beatrice is currently under construction, some of this programme of works has been completed and was reported in 2015 (Graham et al., 2015) and 2016 (Graham et al., 2016). During 2014 and 2015, Harbour seal work has focused upon the breeding population in Loch Fleet National Nature Reserve (NNR). A total of 54 females were seen with a pup at Loch Fleet in 2014 and the fecundity rate was estimated to be 0.83. The median pupping date was the 19th June, later than for the preceding seven years from 2007 to 2013. In 2014, a total of 183 individuals were identified at Loch Fleet: 92 females, 76 males and 15 individuals of unknown sex. The mean count of adult harbour seals at Loch Fleet was 93 (± 4) during pupping and 123 (± 8) during the moult. Counts at Loch Fleet have been increasing since the mid-1990s. In 2015, a total of 179 individuals were identified at Loch Fleet: 101 females, 75 males and 3 individuals of unknown sex. This included 55 reproductive females that were seen with a pup at Loch Fleet, providing a direct estimate for the 2015 fecundity rate of 0.81. The median pupping date in 2015 was the 21st June, later than the preceding nine years from 2006. In September 2014 and February 2015, 25 harbour seals were captured at Loch Fleet and fitted with GPS/GSM tags, which are providing information on foraging distribution and diving behaviour.

Bottlenose dolphin photo-identification surveys were focused in the Moray Firth SAC. Seven calves were seen with known females in the SAC in 2014 and the fecundity rate was estimated to be 0.26. In 2014, a total of 41 well-marked individuals were seen in the SAC: 20 females, 14 males and 7 individuals of unknown sex. The estimated number of dolphins using the SAC in the summer of 2014 was 78. In 2015, a total of 53 well-marked individuals were seen in the SAC: 30 females, 16 males and 7 individuals of unknown sex. The estimated number of dolphins using the SAC in the summer of 2015 was 98. There was no evidence of a trend in the estimated abundance of dolphins using the SAC from 1990 to 2015. Data from across the population's range suggests that the east coast of Scotland dolphin population is increasing, with annual estimates of 101 in 1990 and 195 in 2015. Over 2014 and 2015 PAM with CPODs was used to determine baseline levels of occurrence in favoured areas. Dolphin occurrence was highest at the Sutors and Chanonry and lower at sites along the south coast. Dolphin detections varied seasonally but were generally highest from May to August.

Species Accounts

Within the Scoping Opinion for Moray West (Marine Scotland, 2016) SNH and JNCC identified that the key species to address for the Moray West Offshore Wind Farm were harbour seal, bottlenose dolphin, harbour porpoise, minke whale and grey seal. As this report addresses the requirements of HRA Screening, a species account is presented for all except minke whale (not an SAC qualifying feature).

For each species, the account has been broken down into the following subsections:

- Ecology and habitat;
- Abundance and distribution; and
- Protected sites.

Harbour Seal

Ecology and Habitat

Adult harbour seals typically weigh 80-100 kg and are slightly smaller than grey seals. Males are slightly larger than females. Like grey seals, harbour seals are long-lived with individuals living up to 20-30 years. Harbour seals normally feed within 40-50 km around their haul out sites. They take a wide variety of prey

including sandeels, gadoids, herring and sprat, flatfish, octopus and squid. Diet varies seasonally and from region to region. Because of their smaller size, harbour seals eat less food than grey seals; 3-5 kg per adult seal per day depending on the prey species (SCOS, 2016). Harbour seals give birth to their pups in June and July and moult in August.

Approximately 30% of European harbour seals are found in the UK; this proportion has declined from approximately 40% in 2002. Harbour seals are widespread around the west coast of Scotland and throughout the Hebrides and Northern Isles. On the east coast, their distribution is more restricted with concentrations in the major estuaries of the Thames, The Wash and the Moray Firth. Scotland holds approximately 79% of the UK harbour seal population.

Abundance and Distribution

According to Duck *et al.* (2016), in the Moray Firth, 705 harbour seals were counted in the area surveyed annually (Helmsdale to Findhorn) in 2015, compared with 693 counted in 2014. These are the two lowest counts for this area, just over 20% lower than the mean count between 2002 and 2013 (909).

SNH and JNCC have requested that the population of the Moray Firth seal MU should be used as the reference population for HRA as this is taken to be equivalent to the SAC population. In 2016, it was estimated that the total population for the UK in 2015 was 43,300 harbour seals (SCOS, 2016), with a count of 745 individuals within the Moray Firth seal Management Unit (MU) in 2015. This, scaled to account for the proportion of animals at sea at the time of the count, equates to a population estimate of 1,034 harbour seals in the MU, which accounts for 2.39% of the total UK population or 2.93% of the Scottish population. The current estimated total number of harbour seals in Scotland of 20,427 is 31% less than the total of 29,600 for the previous complete survey carried out in 1996/97.

Both the Dornoch Firth and Morrich More SAC and the Loch Fleet NNR have been counted annually during the August moult counts. These data show that the Loch Fleet NNR counts have increased from 59 animals in 2002 to 144 animals in 2015 (average p.a. increase of 8.94%). If the 2015 count of 144 is scaled to include the proportion of seals in the water at the time of the count, the abundance of harbour seals in Loch Fleet during the 2015 August moult is estimated as 200 animals. Unlike the Loch Fleet site, the annual moult count at the Dornoch Firth and Morrich More SAC has fluctuated annually from 220 in 2002 to a maximum of 290 in 2003 and a minimum of 111 in 2014. Over the period between 2002 and 2015 the counts show an average per annum 0.38% decline in counts. If the 2015 count of 120 is scaled to include the proportion of seals in the water at the time of the count, the abundance of harbour seals in the Dornoch Firth and Morrich More SAC during the 2015 August moult is estimated as 167 animals.

Overall, the UK population has increased since the late 2000s and is close to the 1990s level. However, there are significant differences in the population dynamics between regions. As reported in SCOS 2008 to 2015, there have been general declines in counts of harbour seals in several regions around Scotland, particularly in the Northern Isles and East Coast management units, but the declines are not universal with some populations either stable or increasing. From Moray East 2012, the results of the presence-absence Generalised Additive Model (GAM) indicated that seals from the Moray Firth population were likely to be dispersed widely across the Moray Firth, particularly over offshore sandbanks.

Harbour seals in Scotland by 1km squares from surveys in August 2007-2009 indicate a count of less than 1,000 individuals. The harbour seal population over much of the east coast and the Northern Isles has shown a marked decline in recent years which has thought to be attributed to a number of factors such as competition with grey seals, reduced prey availability, disease, increased predation from killer whales, shooting, elevated biotoxin loading, reduced fecundity and corkscrew injuries.

Protected Sites

As harbour seal generally forage within 50 km of their haul out sites (Sharples et al., 2012), all SACs within this distance are considered to have connectivity with Moray West. The only SAC within 50 km with harbour seal as a qualifying interest (Annex II species that are a primary reason for selection of this site) is the Dornoch Firth and Morrich More SAC (Figure 4.2.12) and SNH / JNCC have advised, during scoping, that there is connectivity between Moray West and this SAC.

Bottlenose Dolphin

Ecology and Habitat

The bottlenose dolphins found in the Moray Firth SAC are part of a Scottish east coast population of approximately 200 animals that ranges south past Aberdeen to the Firths of Tay and Forth. Analysis of photo-identification data collected since 1989 within and outside the Moray Firth SAC estimate a low probability of dolphins temporarily emigrating outside the study area, which is consistent with this being a highly resident population, although the portion of the population that are regularly seen outside of the SAC has been increasing in recent years (Cheney *et al.*, 2013). Dolphins in the Moray Firth and Firth of Tay are also seen throughout the year, with most sightings between May and December in the Moray Firth and from May to October in the Firth of Tay (Thompson et al. 2011). 2009). Bottlenose dolphins are a social dolphin, commonly forming groups of 2-25 individuals with larger schools occurring in offshore areas (Reid et al. 2003). Bottlenose dolphins in Scotland have been found to feed primarily on gadoids such as cod, saithe and whiting as well as Atlantic salmon and cephalopods.

Abundance and Distribution

Bottlenose dolphins in the CES Management Unit are primarily located in the coastal waters, with very few individuals recorded in the GNS Management Unit. Individuals recorded in the GNS Management Unit are thought to be associated with the CES group. The abundance counts for the CES are for a resident population estimated to contain 195 bottlenose dolphins (Cheney et al. 2013), with zero for the GNS.

Protected Sites

As bottlenose dolphin within the Moray Firth are known to move down the east coast as far as the Firth of Forth and are a qualifying feature of the Moray Firth SAC, this site is of relevance. SNH and JNCC have advised that there is connectivity between Moray West and this designated site.

Harbour Porpoise

Ecology and Habitat

The harbour porpoise is the smallest cetacean in the north-east Atlantic, reaching up to approximately 2m, and is abundant in the waters off north-west Scotland (SMRU, 2010). Around the UK, mating and calving is estimated to take place between May and September, peaking in June and July. In terms of diet, in Scottish waters, porpoise tend to feed on two to four main species, for example whiting and sandeel. Harbour porpoise is a characteristically shy species, and generally do not approach vessels or other anthropogenic activities (SMRU, 2010).

Much work has been undertaken to determine the preferred habitat of the harbour porpoise, in order to inform areas for potential designation, and this is summarised within 'Protected Sites' below. As their name suggests, however, the species is frequently found in estuaries, harbours, bays and fjords. This also explains why they are generally the most frequently-recorded species around the west coast of Scotland.

Abundance and Distribution

The North Sea Management Unit for harbour porpoise contains an estimated abundance of 227,298 animals for which 110,433 individuals (approximately 49%) are in the UK (IAMMWG 2015). Passive

acoustic monitoring indicates that harbour porpoise can be found throughout the Moray Firth (Moray East ES, 2012, Appendix 4.4A Marine Mammals Baseline). Predicted density surfaces from previous work indicate a widespread offshore distribution with considerable spatial variability in at-sea density. Using the SCANS II data, predicted harbour porpoise densities range between 0.305 and 0.373 porpoise/km^2 within Moray West (Hammond et al. 2013)

Passive acoustic monitoring indicated that harbour porpoise can be found throughout the Moray Firth. Harbour porpoise habitat models utilising a number of survey data (Appendix 4.4 A of Moray East, 2012), showed a preference for intermediate depths with increasing levels of sand and gravel, such as the Smith Bank.

SNH and JNCC have confirmed that on the basis of the data collected so far, harbour porpoise are likely to be the most abundant marine mammal species recorded in Moray West.

Protected Sites

The Inner Hebrides and Minches cSAC is currently under review by the European Commission, but this cSAC is considered to be too far from the Moray Firth and comprise a different population of harbour porpoise to those that are encountered in the Moray Firth (as indicated by IAMMWG, 2015 and other data). As such it is considered that there is no connectivity to this cSAC.

Grey Seal

Ecology and Habitat

Approximately 38% of the world's grey seals breed in the UK and 88% of these breed at colonies in Scotland with the main concentrations in the Outer Hebrides and in Orkney. The grey seal is the larger of the UK's two resident seal species, with adult males reaching over 300kg in weight, and females around 200kg (SCOS, 2016). Males and females can live up to 20 and 30 years, respectively, with breeding ages from ten and five years, again, respectively. Grey seals tend to forage mainly on small demersal fish species, such as sandeel, whitefish and flatfish, which they find in open sea conditions, before returning to haul-out sites to rest, moult and breed. Most foraging activity occurs within 100km of haul-out sites, and in waters up to 100m in depth (SCOS, 2011), although longer trips between different haul-out sites can be up to several hundred kilometres. Foraging trips can last anywhere between 1 and 30 days. Compared with other times of the year, grey seals in the UK spend longer hauled out during their annual moult (between December and April) and during their breeding season (between August and December). In north and west Scotland, pupping occurs mainly between September and late November.

Abundance and Distribution

The population estimate for the Moray Firth Seal Management Unit for the 2009 pup production was 119,400 for the UK and 105,072 (88%) for Scotland. The most recent surveys of the Scottish grey seal breeding sites flown in 2014, produced a pup production estimate of 60,500 pups and it was estimated that there was approximately 139,800 UK grey seals at that time (1+ aged population).

Protected Sites

From radio tagging and telemetry research, the foraging distances and movements of grey seal are known to vary extensively, with short distance movements regularly taking place between haul out sites and local foraging areas, as well as long distance movements often taking place with individuals travelling at speeds of up to 75km – 100 km per day (McConnell *et al.*, 1999). For this HRA screening exercise, the foraging distance of grey seal from their haul out sites is considered to extend up to 200 km in distance, and any SAC within this distance with grey seal as a qualifying feature is considered to have connectivity to the Moray West site (unless proven otherwise). There are no SAC designations for this species in the Moray Firth and one within 200 km that are designated for grey seal (closest being the Faray and Holm of Faray SAC in Northern Orkney, approximately 112 km from the Moray West Offshore Wind Farm (and 126 km

from the OfTI). The next closest are the Isle of May (Firth of Forth) at 205 km form the Moray Firth Site and Monach Islands (Outer Hebrides) at 264 km from the Moray West Site. SNH and JNCC have, during scoping, confirmed that they do not advise connectivity between Moray West and any grey seal SACs.

Migratory Fish

Within the MS-LOT Scoping Opinion (Marine Scotland, 2016), SNH stated that they had reviewed the advice given at the application stage for the Moray East Site in relation to diadromous fish and freshwater pearl mussels (*Margaritifera margaritifera*) as qualifying interests of SACs. SNH had concluded that on the basis of that advice, and because an extensive monitoring programme in support of the National Research and Monitoring Strategy for Diadromous Fish had been committed to by Moray East, SNH wished 'to discuss whether SAC fish interests could be scoped out of assessment'.

However, Marine Scotland Science (MSS) requested, within their scoping response, that inclusion of an updated authoritative view on the likely distribution of the various life stages of the diadromous fish species, including salmon, sea trout and eels, in the development locality, whether they are likely to be close to the coast or offshore, and the extent to which they are likely to be in the immediate vicinity of the development, and swimming depths, based as far as possible on real information for the locality or elsewhere was required. In the case of salmon and sea trout this should include updated information on the likely origin / destination of fish using the area. Updated information, bringing in the latest knowledge, on the likely impacts of underwater noise on diadromous fish and their behaviour, and appropriate mitigation to minimise impacts of pile driving noise during construction should be provided. There would need to be consideration of what further research and monitoring relating to diadromous fish with respect to the Moray West Site will be appropriate. MSS also stated that because of the long range movements of salmon, developments could have the potential to impact on salmon populations associated with rivers substantial distances from development sites. It was suggested that the ES should review first what information is available on where salmon in the area are likely to be from, or destined for, before the selection is made. This statement would also be applicable to the HRA and selection of SACs.

Desk Based Study and Literature Review

The following data sources have been used to describe the baseline conditions for migratory fish within and surrounding Moray West:

- D Armstrong, D-C Hunter, R J Fryer, P Rycroft & J E Orpwood (2015). Scottish Marine and Freshwater Science. Volume 6 Number 9. Behavioural Responses of Atlantic Salmon to Mains Frequency Magnetic Fields;
- Gill, A. B. and Bartlett, M. (2010). Literature review on the potential effects of electromagnetic fields and subsea noise from marine renewable energy developments on Atlantic salmon, sea trout and European eel. Scottish Natural Heritage, Commissioned Report No. 401. Available online from: http://www.snh.org.uk/pdfs/publications/commissioned_reports/401.pdf.
- Godfrey, J.D., Stewart, D.C., Middlemas, S.J. & Armstrong, J.D. (2014). Depth use and movements of homing Atlantic salmon (*Salmo salar*) in Scottish coastal waters in relation to marine renewable energy development. Scottish Marine and Freshwater Science Vol 05, No 18.;
- Harding, H., Bruintjes, R., Radford, A. and Simpson, S. (2016). Measurement of Hearing in the Atlantic salmon (*Salmo salar*) using Auditory Evoked Potentials, and effects of Pile Driving Playback on salmon Behaviour and Physiology Scottish Marine and Freshwater Science Report Vol 7 No 11;

- Malcolm, I., Godfrey, J. and Youngson, A.F. (2010). Review of migratory routes and behaviour of Atlantic salmon, sea trout and European eel in Scotland's coastal environment: implications for the development of marine renewables. Scottish Marine and Freshwater Science Report, 1(14). http://www.scotland.gov.uk/Resource/Doc/295194/0111162.pdf;
- Moray West (2016). Environmental Impact Assessment. Scoping Report. Western Development Area. Offshore Wind Farm Infrastructure: Offshore Wind Turbines, Foundations / Substructures and Inter-Array Cables May 2016;
- Moray West (2017a). Moray West Offshore Transmission Infrastructure. Scoping Report. June 2017;
- Moray West (2017b). Moray West Onshore Transmission Infrastructure. Scoping Report. June 2017; and
- Shearer, W.M. (1992). The Atlantic Salmon. Natural History, Exploitation and Future Management. Fishing News Books.

Section 6.2 of the Moray West OfTI Scoping Report (Moray West, 2017a) and Section 5.2 of the Moray West OnTI Scoping Report (Moray West, 2017b) set out the baseline conditions for the migratory fish interests that are present in relation to the Moray West Offshore Wind Farm and the OfTI. Diadromous fish species such as Atlantic salmon (*Salmo salar*) and European eel (*Anguilla anguilla*) may be present in the area, particularly adult salmon migrating to the nearby SACs, or salmon smolts migrating from the SACs into the open sea. The following SACs (Figure 4.2.13) were identified during scoping as potentially being impacted upon by Moray West:

- **Berriedale and Langwell Waters SAC** – Atlantic salmon;
- **River Borgie SAC** – Atlantic salmon and freshwater pearl mussel;
- **River Dee SAC** - Atlantic salmon and freshwater pearl mussel;
- **River Naver SAC** - Atlantic salmon and freshwater pearl mussel;
- **River Thurso SAC** – Atlantic salmon;
- **River Oykel SAC** - Atlantic salmon and freshwater pearl mussel;
- **River Moriston SAC** - Atlantic salmon and freshwater pearl mussel; and
- **River Spey SAC** – Atlantic salmon, sea lamprey (*Petromyzon marinus*) and freshwater pearl mussel.

Freshwater pearl mussels are reliant on salmonids for successful juvenile recruitment and population sustainability so there is connectivity between these species. This needs to be considered in parallel with the test for no LSE on SAC's for Atlantic salmon. The qualifying features of brook lamprey, freshwater pearl mussel and habitats are not considered to have connectivity to Moray West (due to their wholly freshwater lifecycles as well as there being no SACs within the Scoping Study Area of the OnTI). Otter associated with SACs are also not considered to have connectivity, due to no SACs being located within the Scoping Study Area. These species are scoped out of any future HRA on this basis.

Site Specific Studies

Site-specific surveys have been completed for the Moray East Site for benthic ecology, fish and shell fish in order to characterize the general fish populations that are present within the Moray East Site. No specific surveys were completed however for migratory fish species and during these surveys no sea lamprey or Atlantic salmon were caught. Specific surveys have been undertaken for sandeels and cod.

BOWL has also undertaken site-specific surveys at the Beatrice Offshore Wind Farm, including benthic surveys and several pre-construction surveys. Benthic surveys at this site have included beam trawling, drop down video (DDV) and grab sampling. Species specific surveying has included sandeels, cod and herring larvae studies.

Scientists from Marine Scotland are working with the Beatrice Offshore Windfarm Ltd, in association with Glasgow University and local migratory fish interests, to monitor Atlantic Salmon smolt (Salmo salar) and seatrout smolt (Salmo trutta) as they migrate from the Cromarty Firth to their feeding grounds (https://blogs.gov.scot/marine-scotland/2016/07/15/tracking-atlantic-salmon-and-seatrout-smolts/). As part of a programme, the fish are being tagged in rivers feeding the Cromarty Firth and Marine Scotland has installed 40 acoustic receivers on a line from Burghead to Tarbat Ness to pick up signals from the tagged fish as they swim past. Additional receivers in the Cromarty Firth will separately monitor smolt movement and survival in the Firth. The aim of the survey is to determine whether or not the smolts natural migration route indicates that it may bring them into contact with any of the Renewable projects in the Moray Firth.

No other specific surveys have been completed for Atlantic salmon or sea lamprey.

Species Accounts

The only species of migratory fish that are listed as qualifying features for SACs are Atlantic salmon, Twaite shad (*Alosa fallax*), Allis shad (*Alosa alosa*), river lamprey, brook lamprey and sea lamprey. As mentioned in Section 4.2.2, brook lamprey are not connected to the Moray West Site due to their wholly freshwater lifecycle. River lamprey are not associated with any of the SACs that have been defined in Section 4.2.2 and Table 4.2.5 as having connectivity to the Moray West Site, so this species is screened out from any further HRA process. For the same reason, Twaite shad and Allis shad are also screened out, with MSS confirming in their scoping response that there are few records of these species in the Moray Firth. Species that are potentially present within the Moray West Site that may be connected to SAC populations are therefore identified as Atlantic salmon and sea lamprey.

Atlantic Salmon

The life history of Atlantic salmon is well documented. Adult salmon migrate from the sea to their home rivers to spawn. The main feeding grounds for Scottish salmon stock is within the waters around Greenland. Adult salmon have already spent anywhere between one year (grilse) and up to five years (multi-sea-winter (MSW)) when they return to spawn. The individual salmon ascent the rivers, where they pair up and spawn. Eggs are usually laid within a nest (redd) which is created in areas of gravel and cobble substrate within stretches of fast flowing, well oxygenated water. When temperature and other environmental factors are suitable, alevins hatch from the eggs and live within the interstices of the gravel and cobble. From here, they grow to become fry, emerging from the gravels to feed within the water column. The fry then develop into parr where they then spend between one year and four years within the river system. The parr eventually become smolts as they metamorphose to allow migration to the saltwater of the sea. At a certain time of the year when conditions are suitable, these smolts leave the river system, migrating downstream and out into the estuaries and coastal waters. They then make their way to their feeding grounds near Greenland.

Atlantic salmon are only found within rivers that do not contain impassable barriers. The species is known for its leaping capabilities that allow adults to surpass certain obstructions such as waterfalls. Some adult salmon are capable of returning to sea once they have spawned and live to return to spawn another time. Others die within the river system after spawning.

Within Scotland, most rivers with access to the sea and no insurmountable barriers support populations of Atlantic salmon. There are specific, key seasonal periods associated with the lifecycle of Atlantic salmon. Adult salmon migrate to rivers from the sea all year round but often have a main run period between October and February. Individuals can spawn between mid-October and late February (Shearer, 1992). Eggs usually hatch during June and July, while smolts often migrate to sea during April, May or June (usually with the main smolt run taking place within a short time period of weeks).

For the SACs identified in Section 4.2.2, the information presented in Table A2.9 is applicable.

Table A2.9 SAC Specific Information for Atlantic Salmon

SAC	Condition Status (Assessment Date) / Specific Information on Atlantic Salmon Population*
Berriedale and Langwell Waters	Favourable Maintained (July 2011)
	Small but high quality population. The rivers have two separate catchments, but share a short length of river just before they meet the sea. Whilst they are comparatively small rivers and support only a small proportion of the Scottish salmon resource, their long history of low management intervention means that they score highly for naturalness. Recent records indicate that the full range of Atlantic salmon life-history types return to the river, with grilse, spring and summer salmon all being caught.
River Borgie	Favourable Recovered (October 2011)
	Qualifying feature, but not a primary reason for site selection.
River Dee	Favourable Maintained (July 2011)
	Supports a high quality population. The high proportion of the river accessible to salmon has resulted in it supporting the full range of life-history types found in Scotland, with sub-populations of spring, summer salmon and grilse all being present. The headwaters which drain the southern Cairngorm and northern Grampian mountains are particularly important for multi sea-winter spring salmon, but there has been a significant decline in their abundance in recent years. The extensive areas accessible to salmon means the River Dee supports a significant proportion of the Scottish salmon resource. In recent years it has contributed about 4 or 5% of all salmon caught in Scotland.
River Naver	Favourable Recovered (August 2011)
	Supports a high quality population. Northerly extent of the species' range. The northern location of the River Naver and the cooler ambient water temperature results in the Atlantic salmon producing a higher proportion of slower-growing parr which smolt at an older age. These fish often return as multi sea-winter salmon (which have spent more than one year at sea). The full range of Atlantic salmon life-history types return to the system, with grilse, spring and summer salmon all being present. The site also scores highly for being relatively free from flow modifications, allowing unhindered migration.
River Thurso	Unfavourable Recovering (October 2011)
	The river supports a higher proportion of multi sea-winter salmon Salmo salar than is found in many rivers further south in the species' range. This is aided by the northerly location of the river and the cooler ambient water temperature, resulting in slower-growing juveniles which smolt at an older age, and tend to return as older multi sea-

	winter salmon. In addition to these multi sea-winter fish, grilse also return to the River Thurso, meaning that the river supports the full range of salmon life-history types.
River Oykel	Favourable Recovered (July 2011)
	Qualifying feature, but not a primary reason for site selection.
River Moriston	Unfavourable No Change (July 2011)
	Qualifying feature, but not a primary reason for site selection.
River Spey	Unfavourable Recovering (September 2011)
	Supports one of the largest Scottish populations. Adults spawn throughout virtually the whole length of the river, and good quality nursery habitat is found in abundance in the main river and numerous tributaries. The salmon population includes fish of all ages including migrating smolts and returning adults, possibly reflecting genetic differences within the Spey stock.

✪ Extracted information from JNCC website (accessed June 2017).
http://jncc.defra.gov.uk/ProtectedSites/SACselection/species.asp?FeatureIntCode=S1106

Smolt migration routes towards their feeding grounds at Greenland are thought to follow a migration route northwards off the western coast of Scotland along the continental shelf edge and out to the Norwegian Sea, apparently making use of the dominant ocean currents. Post-smolts from the east coast of Scotland are thought to migrate in near-shore waters but this movement is poorly understood. As part of the MASTS programme a salmon smolt tracking program using acoustic tags has been proposed for the Berriedale Water (Youngson *et al.*, 2015), but no further information is currently available.

National level research undertaken recently (Malcolm, *et al.*, 2015) reports that smolt emigration within the sea takes place within the coastal waters and a 'sensitive window' for development can be identified for Scotland between days 103 - 145, where large numbers of migrating salmon smolts could be expected in the coastal zone. There is however, no information on the amount of time that smolts will spend in the coastal zone.

The National Research and Monitoring Strategy for Diadromous Fish (NRMSD) has been set up by Marine Scotland to identify, assist with prioritising and gathering data to fill current gaps in knowledge regarding salmon migration movements and behaviour. Moray East are already committed to input to this programme if the consented Moray East Site is progressed.

Sea lamprey

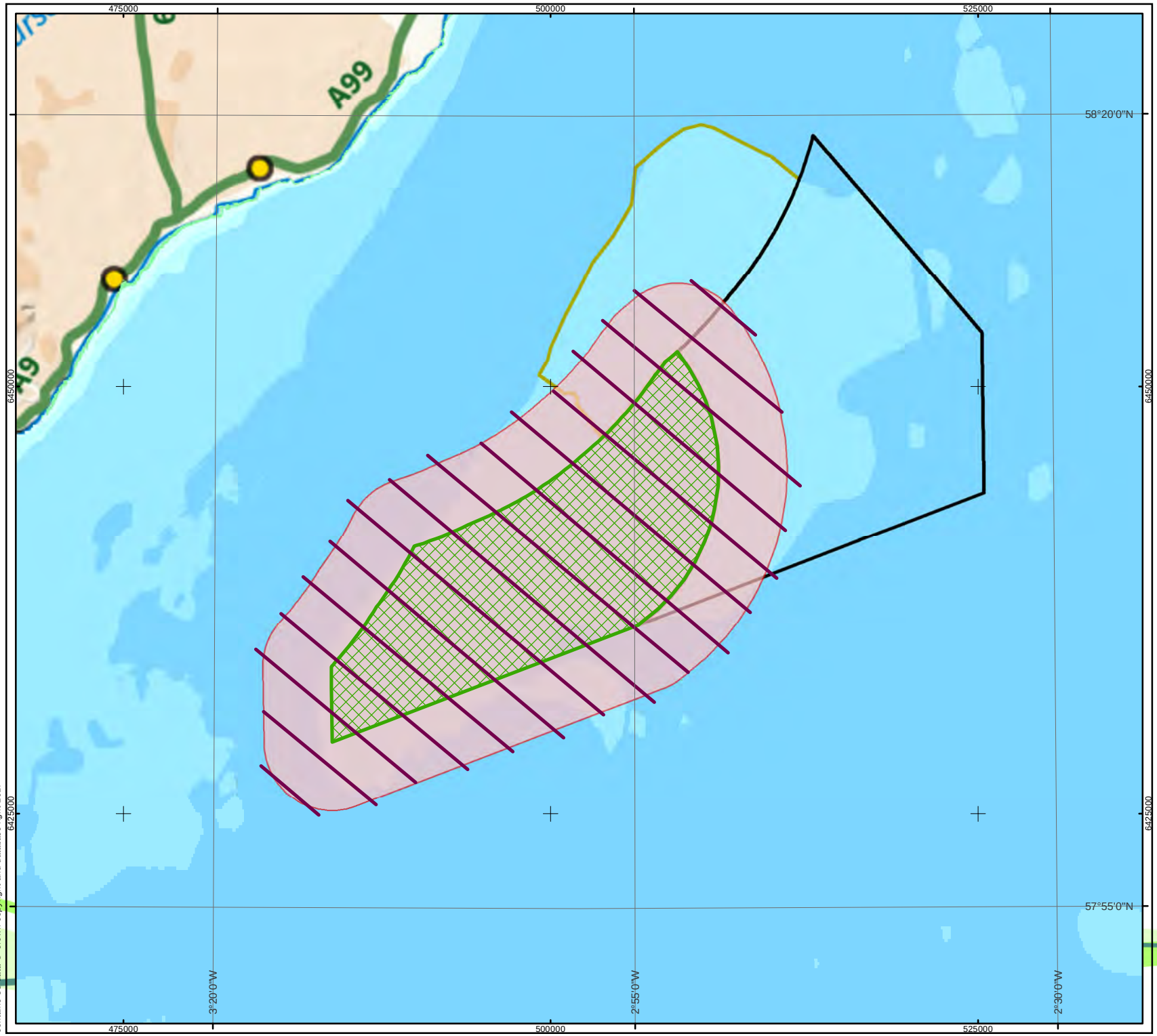
There are no records of sea lamprey being recorded within the Moray West Site during site-specific surveys or from a desk based study, however there is potential for this species to pass through or be present within the Moray West Site.

Adult sea lamprey are the largest of the three lamprey species found within the UK and are generally found within inshore and estuarine waters although they can travel considerable distances out to sea (Igoe *et al.*, 2004). Sea lamprey are bottom living and after spending one or two years within the sea, the adults migrate upstream into river systems (during the night) where they spawn within nests (created by the male) that are located in reaches of faster flowing, good quality water. Migration upstream usually occurs between March and June (but can start as early as September), with spawning taking place in May and June. The adult sea lamprey die once spawning has taken place. Once eggs hatch and the ammocoete emerge, the young inhabit area of river bed comprised of sandy / silty / muddy substrate where they filter feed on microorganisms. After a period of between four to five years of freshwater life, the ammocoetes metamorphose and migrate downstream to the sea. This migration downstream to sea usually occurs in

late autumn or early winter. Within the sea, the species becomes a hematophagous feeder (feeds off blood). Sea lampreys generally feed on other fish species, often becoming parasitic.

Sea lamprey are considered to be at the northern limit of their range within the Moray Firth. There is little information available on the migration movements within and the use of the Moray Firth by sea lamprey and it is considered that construction noise and electromagnetic fields (EMF) from installed inter-array and export cables may potentially have a LSE on the SAC population.

Research indicates that sea lamprey respond to sound at frequencies of between 20 Hz and 100 Hz (Lenhardt & Sismour 1995) they do not possess a swim bladder and are less sensitive to sound than fish that do possess a swim bladder (Maes et al. 2004).



MORAY WEST
OFFSHORE WINDFARM

KEY

- Moray West Aerial Surveys 2016-17
- Aerial Survey Transects
- Moray West Site

Offshore wind farms

- Beatrice
- Moray East

Bathymetry (metres)

- >10000
- <=10000
- <=5000
- <=1000
- <=500
- <=100
- <=50
- <=20
- <=10
- >=0

Horizontal Scale: 1:300,000
0 4,000 8,000 Meters

A4 Chart

N

Geodetic Parameters: WGS84 UTM Zone 30N

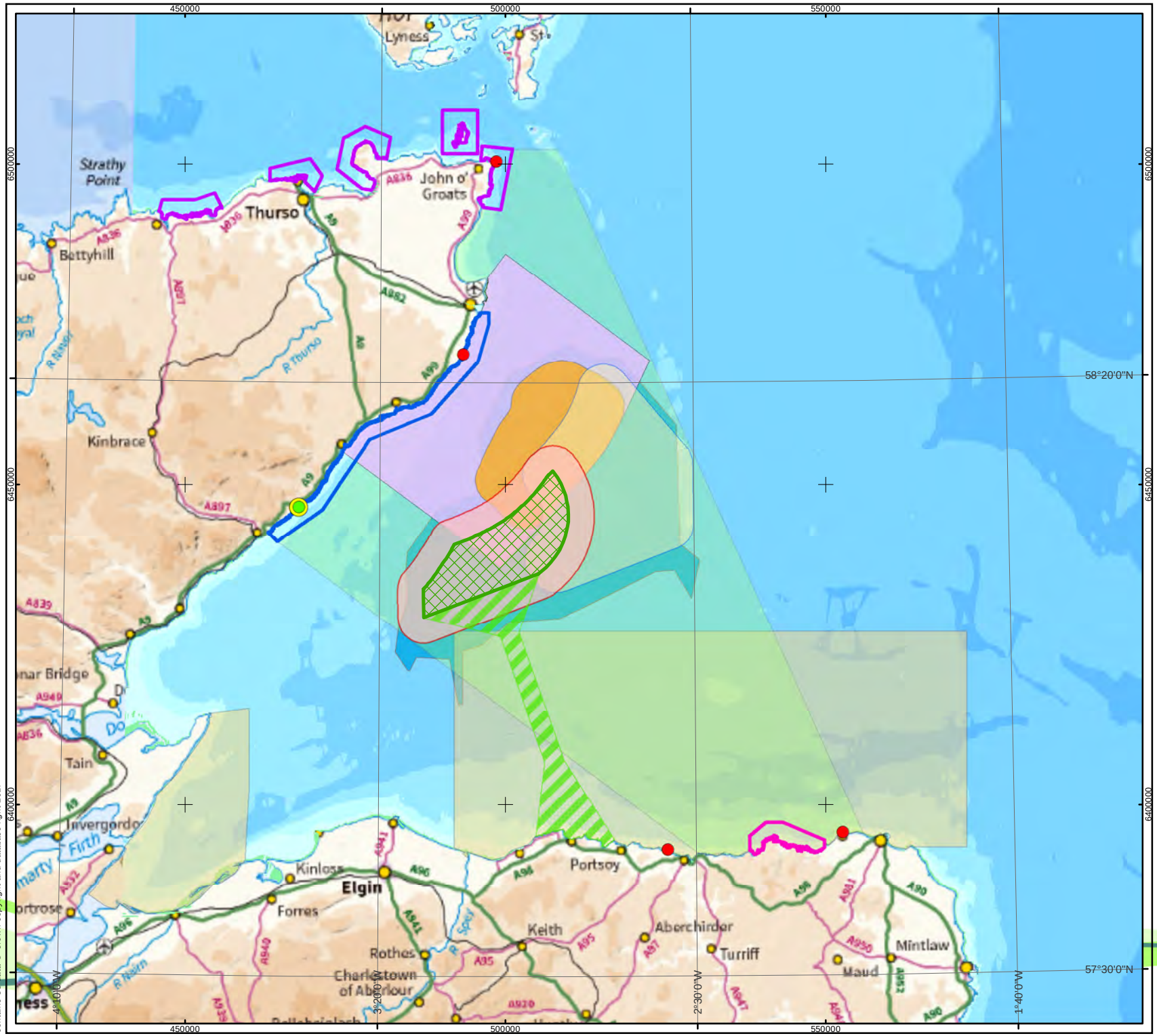
Produced: HAZ
Reviewed: SM
Approved: RC

Date: 04/09/2017 | Revision: A

REF: 8460005-PPW0160-GOE-MAP-015

Figure A2.1
Moray West Aerial Surveys

Moray Offshore
Windfarm (West) Ltd



MORAY WEST
OFFSHORE WINDFARM

KEY

- Moray West Site
- Moray West Offshore Export Cable Corridor
- Moray West Aerial Surveys 2016-17
- Autumn 2010 and Spring 2011 Migration Surveys
- 2011 Tagging Surveys (Fulmar, Kittiwake, Guillemot and Razorbill)
- 2014 Great Black-backed Gull and Herring Gull Tagging

Special Protection Area

- North Caithness Cliffs SPA
- East Caithness Cliffs SPA
- Troup, Pennan and Lion's Head SPA

Ornithological Surveys

- MORL Boat-based Surveys 2010-12 (4 km Boundary)
- BOWL Boat-based Surveys 2009-11
- BOWL Pre-construction Aerial Survey 2015
- Moray East 2011 Aerial Surveys
- Marine Scotland Strategic Seabird Surveys 2014-15
- TCE 2009 Aerial Surveys (HiDef)

Bathymetry (metres)

- <=500
- <=100
- <=50
- <=20
- <=10
- >=0

Horizontal Scale: 1:800,000
0 10,000 20,000 Meters
A4 Chart
N

Geodetic Parameters: WGS84 UTM Zone 30N

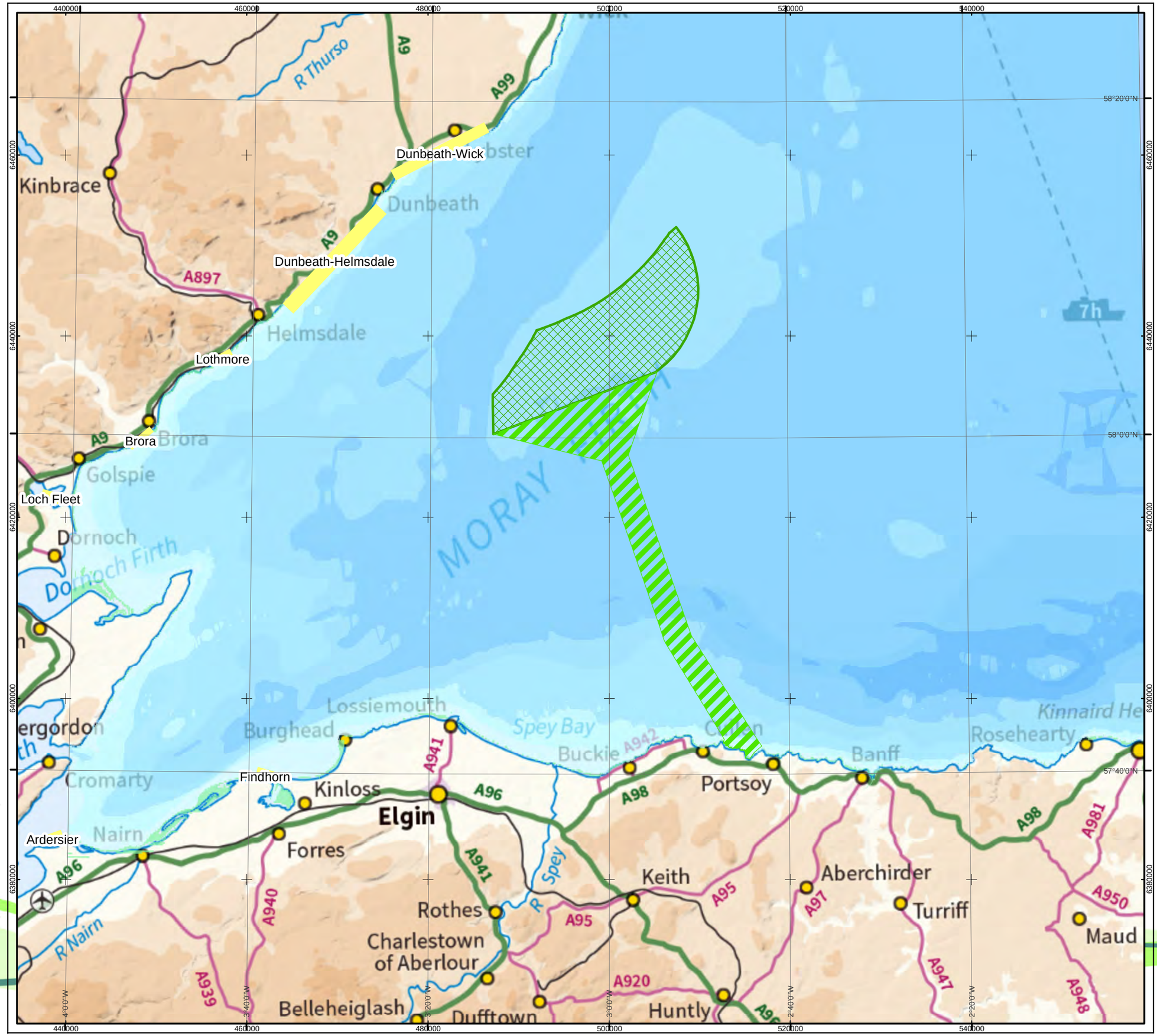
Produced: HAZ
Reviewed: SM
Approved: RC

Date: 04/09/2017 | Revision: C

REF: 8460005-PPW0160-GOE-MAP-016

Figure A2.2
Existing Datasets

Moray Offshore Windfarm (West) Ltd



KEY

- Moray West Site
- Offshore Export Cable Corridor
- Harbour Seal Haul Outs

Bathymetry (Metres)

- <=500
- <=100
- <=50
- <=20
- <=10
- >=0

Horizontal Scale: 1:400,000 — A3 Chart — N

0 5,000 10,000 Meters

Geodetic Parameters: WGS84 UTM Zone 30N

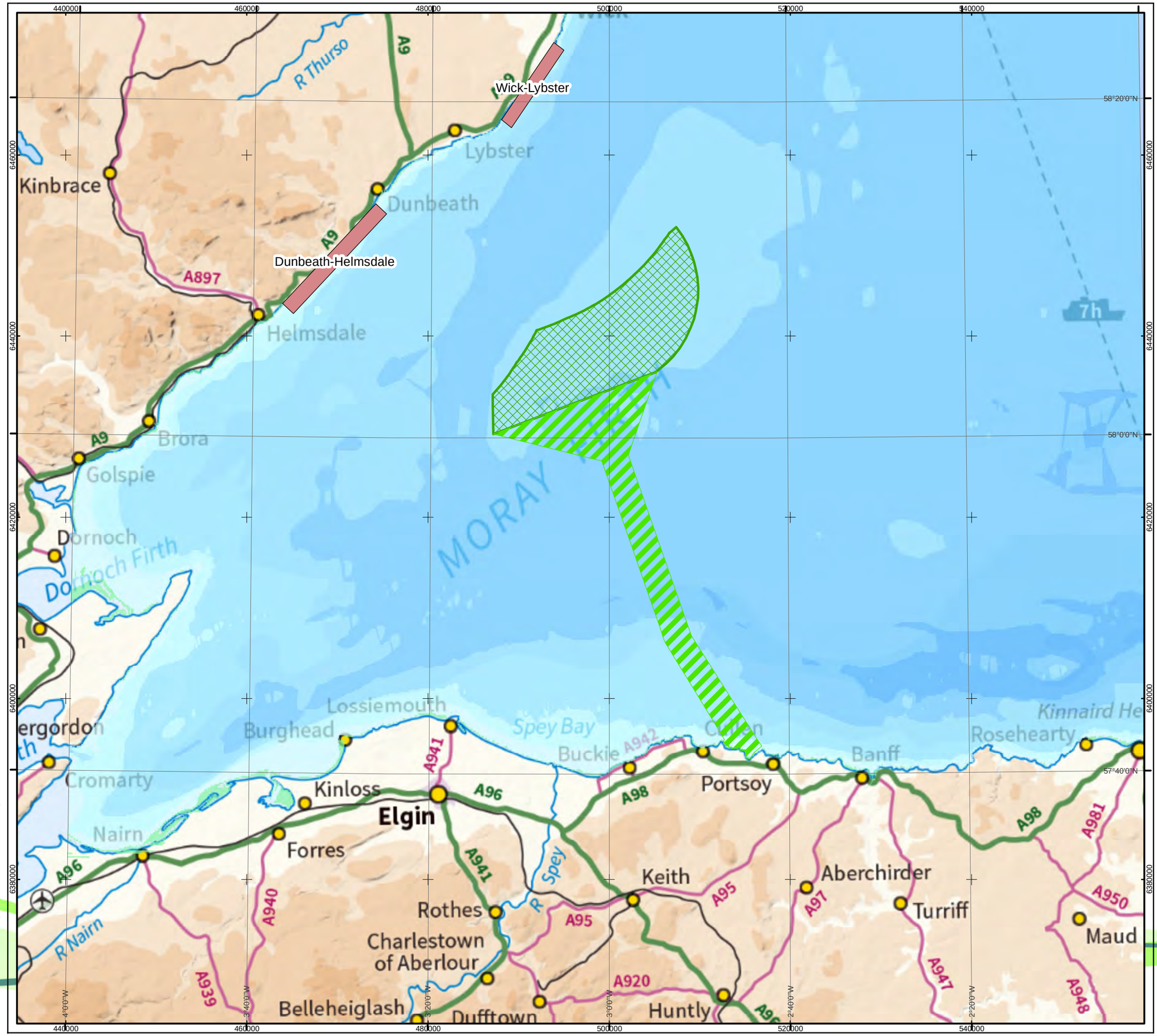
Produced: RC
Reviewed: GB
Approved: FG

Date: 04/09/2017 | Revision: C

REF: 8460005-PPW0160-GOE-MAP-017

Figure A2.3: Harbour Seal Haul Out Sites

Moray Offshore Windfarm (West) Ltd



MORAY WEST
OFFSHORE WINDFARM

KEY

- Moray West Site
- Offshore Export Cable Corridor
- Grey Seal Pupping Sites

Bathymetry (Metres)

- <=500
- <=100
- <=50
- <=20
- <=10
- >=0

Horizontal Scale: 1:400,000 — A3 Chart — N

0 5,000 10,000 Meters

Geodetic Parameters: WGS84 UTM Zone 30N

Produced: RC
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Date: 04/09/2017 | Revision: C

REF: 8460005-PPW0160-GOE-MAP-018

Figure A2.4: Grey Seal Pupping Sites.

Moray Offshore Windfarm (West) Ltd

MORAY WEST
OFFSHORE WINDFARM

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