MORAY EAST
OFFSHORE WINDFARM

Backfilling Environmental Report

Moray East Offshore Wind Farm

June 2019

Moray Offshore Windfarm (East) Limited

Produced by Royal HaskoningDHV on behalf of Moray Offshore Windfarm (East) Limited	
Produced by	Erin Snaith
Reviewed by	Fiona Moffatt
Document Status	Final
Version	1
File Name	8460001-PPL0050-RHD-REP-002
Date	18/06/2019

Review / Approval

Moray East		
Sarah Pirie [Head of Development]	Jens Hansen [Construction Director]	Marcel Sunier [Project Director]

Table of Contents

List of Abbreviations 6
Executive Summary 8
Definitions 9
1 Introduction 11
1.1 Project Background 11
1.2 Purpose of the Environmental Report 11
2 Project Description 12
3 Existing Environment 15
3.1 Overview 15
3.2 Physical Processes 15
3.3 Benthic Ecology 15
3.3.1 Offshore Wind Farm 15
3.4 Fish and Shellfish 16
3.4.1 Commercial Species 16
3.4.2 Spawning and Nursery Grounds 16
3.4.3 Species of Conservation Importance 16
3.5 Marine Mammals 17
3.5.1 Commonly Sighted Species in the Moray Firth 17
3.6 Ornithology 20
3.6.1 Key Species Commonly Sighted Species in the Moray Firth 21
3.6.2 Sites Designated for Ornithological Receptors 21
3.7 Marine Archaeology 21
3.8 Commercial Fisheries 21
3.9 Shipping and Navigation 22
3.10 Infrastructure and Other Users 22
3.11 Designated Sites 23
4 Assessment of Effects 24
4.1 Approach to Assessment 24
4.2 Physical Processes 24
4.2.1 Increases in SSC 24
4.3 Benthic Ecology 25
4.3.1 Habitat change 25
4.3.2 Increases in SSC 25
4.3.3 Release of Sediment Contaminants 25
4.4 Fish and Shellfish 26

4.4.1 Noise disturbance 26
4.4.2 Increase in SSC 26
4.4.3 Habitat Change 26
4.4.4 Release of Contaminants 27
4.5 Marine Mammals 27
4.5.1 Noise disturbance 27
4.5.2 Increases in SSC and release of sediment contaminants 27
4.5.3 Changes to Prey Availability 27
4.5.4 Vessel Collision 28
4.6 Ornithology 28
4.6.1 Noise Disturbance 28
4.6.2 Changes to Prey Availability 28
4.7 Marine Archaeology 28
4.8 Commercial Fisheries 28
4.9 Shipping and Navigation 29
4.10 Infrastructure and Other Users 29
4.11 Designated Sites (including in-combination effects) 29
4.12 Cumulative Impacts 30
5 Summary 31
6 References 32

List of Figures

Figure 1-1. Moray East Site and OfTI Corridor 11
Figure 2-1. Proposed backfilling locations 12

List of Tables

Table 2-1 Scour protection and backfill footprints 13
Table 3-1 Density (Birds / km^2) and Abundance Estimates (Birds Using the Sea) using density surface models, taken from 2010 to 2012 boat-based survey data (Moray East, 2012) 21
Table 3-2 Designated sites with the potential to interact with backfilling activities 23
Table 4-1 Impact Significance Definitions 24
Table 5-1 Summary of potential impacts 31

List of Abbreviations

AEZ	Archaeological Exclusion Zones
AIS	Automatic Identification System
BAP	Biodiversity Action Plan
CD	Chart Datum
CI	Confidence Interval
CRRU	Cetacean Research and Rescue Unit
CV	Coefficient of Variation
DPFPV	Dynamic Positioned Fall Pipe Vessel
EIA	Environmental Impact Assessment
ES	Environmental Statement
GBS	Gravity Base Structure
ICES	International Council of the Exploration of the Sea
IEEM	Institute of Ecology and Environmental Management
JCP	Joint Cetacean Protocol
MARP	Moray East Archaeological Reporting Protocol
MS-LOT	Marine Scotland – Licensing Operations Team
MU	Management Unit
Nm	Nautical Miles
NRA	Navigational Risk Assessment
OfTI	Offshore Transmission Infrastructure
OSP	Offshore Substation Platform
OWF	Offshore Wind Farm
PEXA	Practice and Exercise Areas
PMF	Priority Marine Features
ROV	Remotely Operated Vehicle
SAC	Special Area of Conservation
SCANS	Small Cetaceans in the European Atlantic and North Sea
SCOS	Special Committee on Seals
SMRU	Sea Mammal Research Unit
SPA	Special Protection Area
SSC	Suspended Sediment Concentrations
TI	Transmission Infrastructure
UK	United Kingdom
UXO	Unexploded Ordnance
WCS	Worst Case Scenario

WTG	Wind Turbine Generator

Executive Summary

During the construction phase of Moray East Offshore Wind Fam and associated Offshore Transmission Infrastructure (OfTI) (the Development), jack-up vessels will be required at multiple stages. A jack-up vessel will be required for pile installation at each Wind Turbine Generator (WTG) and Offshore Substation Platform (OSP) location. In addition, a jack-up vessel will be required during WTG installation at each WTG location.

The use of a jack-up vessel will cause imprints into the seabed due to the penetration of the spud cans on the legs of the jack-up vessel. The depressions in the seabed caused by the jack-up vessel have the potential to impact the structural integrity of the piles and may limit the ability of subsequent jacking up-up by the WTG installation vessel around WTG locations. Therefore, Moray East has identified a need to address the seabed depressions caused by the jack up vessel in order to mitigate these risks. As a result, Moray East is seeking to obtain a Marine Licence from Marine Scotland Licensing Operations Team (MS-LOT) for backfilling of the seabed depressions caused by the jack up vessel spud cans, following WTG and OSP pile installation.

The proposed backfilling will use inert rocks from a quarry to fill the seabed depressions caused by the jack-up vessel. The imprints will be filled up with rock with a tolerance of +/- 50 cm. As the jack-up vessel has four legs, there will be four seabed depressions at each of the 103 WTG and OSP locations, resulting in 412 depressions to be backfilled in total. The worst-case scenario (WCS) for the footprint of each depression which will require backfilling is 92.16 m^2. Therefore, the total footprint which will require backfilling is 37,969.92 m^2, which includes four jack-up leg penetration indents at each of the WTG and OSP locations.

The exact programme for the backfilling activity is unknown as it will be dependent on progress with pile installation. However, the backfilling activity will occur between August 2019 and December 2020, prior to WTG installation (scheduled for 2021). The average duration for backfilling each seabed depression will be 6 hours. As there are a total of 412 depressions the activity will take approximately 103 days to complete. This will take place either as a single operation after the pile installation has occurred or split over two operations, i.e. one backfilling campaign after pilling to fill the depressions closest to the piles and any remaining depressions will be backfilled prior to WTG installation.

This Environmental Report is submitted in support of the Marine Licence application submitted by Moray East for the backfilling activities. An assessment of the potential impacts of the backfilling activities has been carried out in relation to key receptors including: physical processes; benthic ecology; fish and shellfish; marine mammals; ornithology; marine archaeology; commercial fisheries; shipping and navigation; and infrastructure and other users. The impact assessment concluded that there will be no significant impacts due to the proposed backfilling activities.

Definitions

The following definitions have been used throughout this document with respect to the company, the consented wind farms and how these definitions have changed since submission of the Moray East Environmental Statement (ES) in 2012 and the Moray East Modified Transmission Infrastructure (TI) ES in 2014.

- **Moray Offshore Windfarm (East) Limited (formerly known as Moray Offshore Renewables Limited)** – the legal entity submitting this Environmental Report;
- **Moray East Offshore Wind Farm** - the wind farm to be developed in the Moray East site (also referred as the Wind Farm);
- **The Moray East site** - the area in which the Moray East Offshore Wind Farm will be located. Section 36 Consents and associated Marine Licences to develop and operate up to three generating stations on the Moray East site were granted in March 2014. At that time the Moray East site was made up of three sites known as the Telford, Stevenson and MacColl offshore wind farm sites. The Section 36 Consents and Marine Licences were subsequently varied in March 2018;
- **Telford, Stevenson and MacColl wind farms** – these names refer to the three consented offshore wind farm sites located within the Moray East site;
- **Transmission Infrastructure (TI)** - includes both offshore and onshore electricity transmission infrastructure for the consented Telford, Stevenson and MacColl wind farms. Includes connection to the national electricity transmission system near New Deer in Aberdeenshire encompassing AC offshore substation platforms (OSPs), AC OSP interconnector cables, AC export cables offshore to landfall point at Inverboyndie continuing onshore to the AC collector station (onshore substation) and the additional regional Transmission Operator substation near New Deer. A Marine Licence for the offshore TI was granted in September 2014 and a further Marine Licence for two additional distributed OSPs was granted in September 2017. The onshore TI was awarded Planning Permission in Principle in September 2014 by Aberdeenshire Council and a Planning Permission in Principle under Section 42 in June 2015;
- **Offshore Transmission Infrastructure (OfTI)** – the offshore elements of the transmission infrastructure, comprising AC OSPs, OSP inter-connector cables and AC export cables offshore to landfall (for the avoidance of doubts some elements of the OfTI will be installed in the Moray East site);
- **Moray East ES 2012** – The ES for the Telford, Stevenson and MacColl wind farms and Associated Transmission Infrastructure, submitted August 2012;
- **The Development** – the Moray East Offshore Wind Farm and Offshore Transmission Infrastructure (OfTI);
- **OfTI Corridor** – the export cable route corridor, i.e. the OfTI area as assessed in the Moray East Modified TI ES 2014 excluding the Moray East site;
- **Design Envelope** – the range of design parameters used to inform the assessment of impacts;
- **Development area** - the Moray East site and OfTI Corridor together;

Moray East Offshore Wind Farm Consents – are comprised of the following:

Section 36 Consents:

- Section 36 consent for the Telford Offshore Wind Farm (as varied) – consent under section 36 of the Electricity Act 1989 for the construction and operation of the Telford Offshore Wind Farm assigned to Moray East on 19 June 2018.
- Section 36 consent for the Stevenson Offshore Wind Farm (as varied) – consent under section 36 of the Electricity Act 1989 for the construction and operation of the Stevenson Offshore Wind Farm assigned to Moray East on 19 June 2018.
- Section 36 consent for the MacColl Offshore Wind Farm (as varied) – consent under section 36 of the Electricity Act 1989 for the construction and operation of the MacColl Offshore Wind Farm assigned to Moray East on 19 June 2018.

Marine Licences

- Marine Licence for the Telford Offshore Wind Farm (as varied) – Licence Number: 04629/18/1 – consent under the Marine (Scotland) Act 2010 & Marine and Coastal Access Act 2009, Part 4 marine licensing for marine renewables construction works and deposits of substances or objects in the Scottish Marine Area and the United Kingdom Marine Licensing Area transferred to Moray East on the 19 July 2018.
- Marine Licence for the Stevenson Offshore Wind Farm (as varied) – Licence Number: 04627/18/1 – consent under the Marine (Scotland) Act 2010 & Marine and Coastal Access Act 2009, Part 4 marine licensing for marine renewables construction works and deposits of substances or objects in the Scottish Marine Area and the United Kingdom Marine Licensing Area transferred to Moray East on the 19 July 2018.
- Marine Licence for the MacColl Offshore Wind Farm (as varied) – Licence Number: 04628/18/2 - consent under the Marine (Scotland) Act 2010 & Marine and Coastal Access Act 2009, Part 4 marine licensing for marine renewables construction works and deposits of substances or objects in the Scottish Marine Area and the United Kingdom Marine Licensing Area transferred to Moray East on the 19 July 2018.

OfTI Licences – are comprised of the following:

- Marine Licence for the Offshore Transmission infrastructure – Licence Number 05340/14/0 – consent under the Marine (Scotland) Act 2010 & Marine and Coastal Access Act 2009, Part 4 marine licensing for marine renewables construction works and deposits of substances or objects in the Scottish Marine Area and the United Kingdom Marine Licensing Area (referred to as the "OfTI Marine Licence").
- Marine Licence for two additional distributed OSPs – Licence Number 06347/17/1 – consent under the Marine (Scotland) Act 2010 & Marine and Coastal Access Act 2009, Part 4 marine licensing for marine renewables construction, operation and maintenance works and the deposit of substances or objects in the Scottish Marine Area and the United Kingdom Marine Licensing Area (referred to as the "OSP Marine Licence").

1 Introduction

1.1 Project Background

In March 2014, Moray Offshore Windfarm (East) Limited (Moray East) received consents from the Scottish Ministers under Section 36 of the Electricity Act 1989, and the associated Marine Licences under the Marine (Scotland) Act 2010 and the Marine and Coastal Access Act 2009 for the construction and operation of the Moray East Offshore Wind Farm. At that time, the Moray East site was made up of three sites known as "Telford", "Stevenson" and "MacColl" offshore wind farm sites. Moray East plans to develop the three consented wind farms (Telford, Stevenson and MacColl) as a single wind farm (Moray East Offshore Wind Farm) (Figure 1-1 below).

A Marine Licence for the Offshore Transmission Infrastructure (OfTI) was granted in September 2014 and a further Marine Licence for two additional distributed offshore substation platforms (OSPs) was granted in September 2017 (together these are referred to as the OfTI Licences).

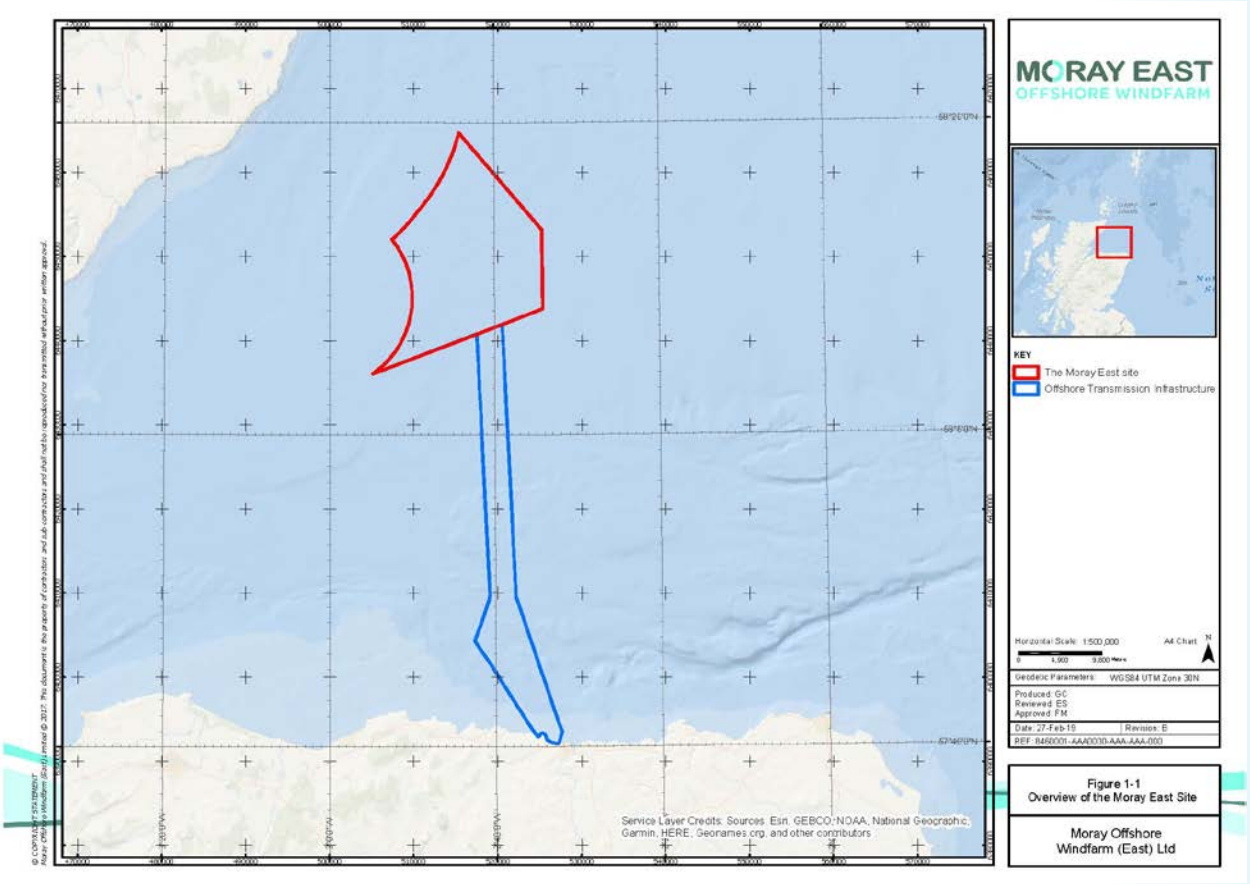

Figure 1-1. Moray East Site and OfTI Corridor

1.2 Purpose of the Environmental Report

In order to undertake backfilling of seabed depressions caused by leg penetration of the jack-up vessel(s) to be used during the construction phase of the Development, a Marine Licence is required from Marine Scotland Licensing Operations Team (MS-LOT). A Marine Licence is required for the backfilling activities under the Marine (Scotland) Act 2010 and the Marine and Coastal Access Act 2009.

This Environmental Report is submitted in support of the Marine Licence application submitted by Moray East to MS-LOT. A description of the backfilling activities is provided in Section 2, a description of the baseline environment is provided in Section 3 and an assessment of impacts is presented in Section 4.

2 Project Description

During the construction phase of the Development jack-up vessels will be required at multiple stages: for pile installation at each WTG and OSP location and again during WTG installation.

The use of a jack-up vessel will cause imprints into the seabed due to the penetration of the spud cans (jack-up legs) on the legs of the jack-up vessel. The depressions in the seabed caused by the jack-up vessel have the potential to impact the structural integrity of the WTG and OSP foundation piles and may limit the ability of subsequent jacking up- by the WTG installation vessel around WTG locations. Therefore, backfilling of the seabed depressions caused by the jack-up spud cans is required. The backfilling activities will be undertaken in the Moray East site, as shown on Figure 2-1 below. As indicated in Figure 2-1 there are three locations where the backfilling licence area will exceed the Moray East site by 100 m due to where the backfilling will be placed, equating to a total area of 295.36 km^2 (Including the Moray East site).

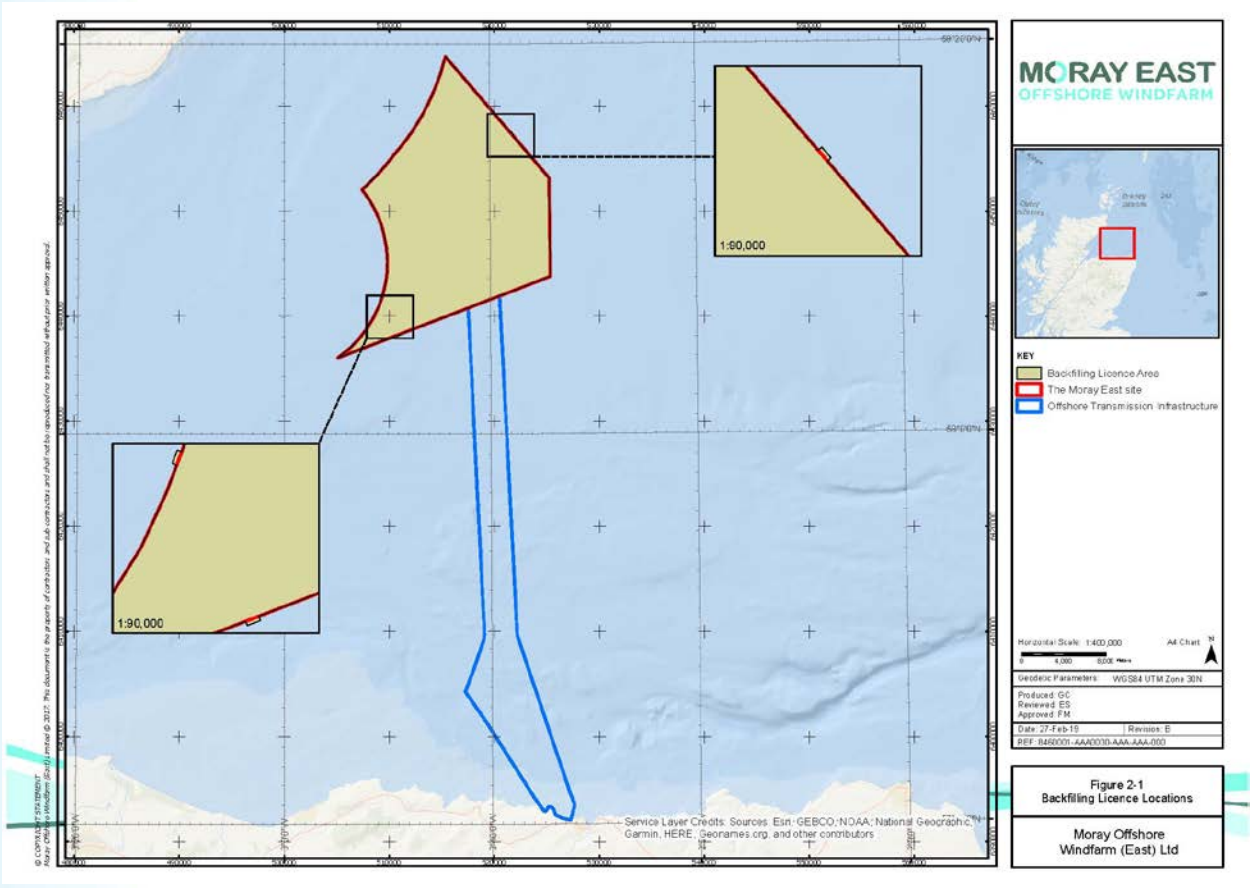

Figure 2-1. Proposed backfilling locations

The proposed backfilling activities will use inert rock from a quarry to fill the seabed depressions caused by the jack-up vessel. The rocks will have a size range of a size range of 5 – 200 mm rock. The rock used will be crushed fresh, un-weathered and chemically stable.

The imprints will be filled with rock with a typical installation tolerance of +/- 50 cm. The backfilling will be undertaken using a Dynamic Positioned Fall Pipe Vessel (DPFPV) which is a purpose-built vessel for the accurate placement of rock / gravel material in a controlled manner by using a fall pipe system. The fall pipe extends from the vessel and is remotely controlled at the bottom end of the fall pipe for precise manoeuvrability and positioning of the fall pipe.

There are 100 WTGs and 3 OSPs to be installed therefore a total of 103 locations which require the use of a jack-up vessel. As the jack-up vessel has four legs, there will be four seabed depressions at each location, resulting in 412 depressions which will require backfilling. The worst case scenario (WCS) for the footprint of each depression which will require backfilling is 92.16 m^2. Therefore, the total footprint which will

require backfilling is 37,969.92 m^2, which includes four jack-up leg penetration indents at each of the WTG and OSP locations.

Table 2-1 below provides a comparison of the Moray East ES 2012 and the Modified TI ES 2014 assessments (taking into account the consented design parameters) and the proposed scour protection parameters for the Development which have since been refined as a result of design engineering (revised parameters). It should be noted that it is assumed scour protection will be required around all the OSPs, but is only likely to be required for up to ten WTGs. The footprint of proposed backfilling material at each location is also provided in Table 2-1 below (revised parameters).

Table 2-1 Scour protection and backfill footprints

Relevant Parameter	Consented Parameters		Revised Parameters	
	WTGs	OSPs	WTGs	OSPs
Scour protection area per foundation, including piles (m^2)	804	1,206	1,700	1,700
Total Wind Farm / OfTI scour protection area, including piles (m^2)	149,588 (186 WTGs)	2,413 (2 OSPs)[1]	17,000[2] (10 WTGs)	5,100 (3 OSPs)
Worst Case Scenario (WCS) scour protection area per foundation, including foundations (m^2)	7,088[3]	7,539[4]	1,700	1,700
WCS total Wind Farm / OfTI scour protection area, including foundations (m^2)	14,338,368 (186 WTGs)	15,078 (2 OSPs)	17,000[2] (10 WTGs)	5,100 (3 OSPs)
Backfilling required at each spud can depression (m^2)	N/A	N/A	92.16	92.16
Backfilling WCS total area (m^2)	N/A	N/A	36,864 (100 WTGs)	1,105.92 (3 OSPs)
Worst case scenario for Moray East site (WTGs and OSPs) (m^2)	**14,353,446**		**60,069.92**	

Table 2-1 above shows that although there is now an additional 37,969.92 m^2 of material to be deposited on the seabed, this equates to approximately 0.42 % of that originally assessed in the Moray East ES 2012 and Moray East TI ES 2014 and consented under the relevant Wind Farm and OfTI Marine Licences.

The exact programme for the backfilling activity has yet to be confirmed and will be dependent on progress with pile installation. However, the backfilling activity will occur between August 2019 and

[1] The presence of scour protection was only assessed for the OSPs covered under the OfTI Marine Licence. No scour protection was considered required for the OSP covered under the OSP Marine Licence.
[2] The design work for the WTG scour protection is still ongoing. It is considered it will be a similar design to the OSP scour protection and it is currently considered that no more than ten WTG will require scour protection.
[3] The WCS on WTG foundation type with regards to permanent habitat loss (as assessed within the Moray East ES 2012) was the gravity base structure (GBS) foundation plus scour protection. The dimensions of the GBS WCS including scour protection was assessed as 95 m diameter.
[4] The WCS on OSP foundation type with regards to permanent habitat loss (as assessed within the Moray East ES 2012) was suction caisson foundations plus scour protection. The dimensions each suction caisson including scour protection was assessed as 40 m diameter. Each foundation would have up to six suction caissons.

December 2020. The average duration for backfilling of each seabed depression will be 6 hours. As there is up to a total of 412 depressions to be backfilled, the activity may take up to approximately 103 days to complete. This will be undertaken as either a single operation after the pile installation has occurred or will be split over two operations, i.e. one backfilling campaign after pilling has occurred to fill the depressions closest to the piles and any remaining depressions will be backfilled prior to WTG installation.

3 Existing Environment

3.1 Overview

A detailed description of the baseline environment for each environmental parameter is available from the Moray East ES 2012 (Moray East, 2012). The following sections provide an overview of the key receptors that may be potentially affected by the backfilling activities required within the Moray East site.

The information utilised to provide details of the key receptors has been drawn from the Moray East ES 2012, the results of more recent post-consent / pre-construction surveys and other publicly available information.

3.2 Physical Processes

The Moray East site encompasses part of the summit and the eastern flank of Smith Bank, a morphological high point in the Outer Moray Firth measuring approximately 35 km long from south-west to north east, and 20 km wide (295 km^2). Water depths in this area range from approximately 35 to 55 mCD (below Chart Datum), with the greatest depths found along the south-eastern margin of the site. Smith Bank is separated from the Caithness coast to the north by a relatively deep channel (up to approximately 75 mCD). Seabed sediments across the Moray East site generally consist of Holocene gravelly sand and sand (Moray East, 2012). Fine (silt and clay sized) particles are largely absent from the Moray East.

The available evidence suggests that (bedload) material is travelling into the Firth from the north, passing along the Caithness coast and towards the Inner Moray Firth (Moray East, 2012). Tidal currents are largely incapable of mobilising anything larger than fine sand-sized material within the Moray East site and as a result, there is only limited net bedload transport of sediment due to tidal currents alone. However, during storm events, it is likely that the commonly present medium-sized sand is regularly mobilised across the Moray East site.

During site characterisation surveys for Moray East ES 2012 levels of sediment contaminants were below guideline levels at all sampling locations within the Development area (Moray East, 2012).

3.3 Benthic Ecology

3.3.1 Offshore Wind Farm

The benthic survey conducted for the Moray East ES 2012 showed that the dominant seabed sediment habitat type within the Moray East site was slightly gravelly sand with patches of shelly gravelly sand, sandy gravel and gravel. The benthic communities associated with these seabed habitat types were found to be rich and diverse and were characterised by polychaete worms (e.g. *S. bombyx*, *Notomastus spp.*, *Lumbrineris gracilis* and *Chone sp.*), the burrowing urchin (*Echinocyamus pusillus)* and the bivalve *Cochlodesma praetenue*. Statistical analysis showed that benthic communities were most influenced by depth and sediment types. The most common biotopes identified within and around the Moray East site include:

- *SS.SSa.CFiSa EpusOborApri (Echinocyamus pusillus, Ophelia borealis* and *Abra prismatica* in circalittoral fine sand);
- *SS.SCS.CCS. MedLumVen (Mediomastus fragilis, Lumbrineris spp.* and venerid bivalves in circalittoral coarse sand or gravel); and
- SS.SSa.OSa. OfusAfil (*Owenia fusiformis* and *Amphiura filiformis* in offshore circalittoral sand or muddy sand) or *SS.SSa.IMuSa. FfabMag* (*Fabulina fabula* and *Magelona mirabilis* with venerid bivalves and amphipods in infralittoral compacted fine muddy sand).

No rare or protected species with respect to the EC Habitats Directive 92/43/EEC and/or the Wildlife and Countryside Act 1981 (as amended) were found within the boundary of the Moray East site. Individual juvenile Icelandic cyprine or Ocean quahog *Arctica islandica* was recorded, which is on the OSPAR List of Threatened and/or Declining Species and Habitats (Region II – Greater North Sea) and the list of Scottish Priority Marine Features (PMF). Other PMF recorded include: the coarse sand biotope, MoeVen (recorded at one reference station outside the boundary of the Moray East site) and sandeels (as sandeel complex *Ammodytes marinus, A. tobianus*), as included within the Scottish PMF list. "Subtidal sands and gravels" habitat was also recorded which is a UK Biodiversity Action Plan (UK BAP) priority habitat as a result of its importance for the conservation of biodiversity. Although the UK BAP has now been succeeded by the post 2010 Biodiversity Framework, "Offshore subtidal sands and gravels" are included in the Scottish PMF list.

3.4 Fish and Shellfish

3.4.1 Commercial Species

The Moray Firth supports a number of commercially targeted fish and shellfish species. The principal shellfish and cephalopod species landed are Nephrops *(Nephrops norvegicus)*, scallops (*Pecten maximus)* and squid (*Loligo spp)*. With respect to fish, haddock (*Melanogrammus aeglefinus)*, herring (*Clupea harengus)*, whiting (*Merlangius merlangus)*, monkfish / anglerfish (*Lophius spp*.), mackerel (*Scomber scombrus)* and cod (*Gadus morhua)* constitute the majority of landings (Moray East, 2012).

3.4.2 Spawning and Nursery Grounds

There are spawning and nursery grounds for a number of species within and in the immediate vicinity of the Moray East site, including cod, herring, lemon sole (*Microstomus kitt)*, Nephrops, plaice (*Pleuronectes platessa)*, sandeel (*Ammodytidae* spp.), and sprat (*Sprattus sprattus*). There are also nursey grounds for the following species: anglerfish, blue whiting (*Micromesistius poutassou)*, haddock, hake (*Merluccius merluccius)*, ling (*Molva molva)*, mackerel, saithe (*Pollachius virens)*, spotted ray (*Raja montagui)*, spurdog (*Squalus acanthias)* and thornback ray (*Raja clavate)*. The Moray East site does not overlap with the spawning grounds of either the Orkney / Shetland or the Buchan herring stocks (the two stocks known to have spawning grounds in the vicinity of the Moray Firth) but it is located within high intensity nursery grounds as defined by Ellis *et al.* (2010).

3.4.3 Species of Conservation Importance

A number of species of conservation importance are found in the Moray Firth and may therefore transit through the Development area. These include diadromous migratory species, (those using the marine and freshwater environments during their life cycle) elasmobranchs (sharks and rays) and commercial fish species.

Diadromous migratory species potentially present include European eel (*Anguilla Anguilla)*, allis and twaite shad (*Alosa alosa, Alosa fallax)*, sea and river lamprey (*Lampetra fluviatilis, Petromyzon marinus)*, smelt (*Osmerus osperlangus)*, salmon (*Salmo salar)* and sea trout (*Salmo trutta)*.

A number of other fish species which are commercially exploited with conservation status may be present in the Development area of the including anglerfish, mackerel, cod, herring and sandeel. Atlantic salmon and sea lamprey are of conservation interest in a number of SAC rivers in the Moray Firth area.

3.5 Marine Mammals

3.5.1 Commonly Sighted Species in the Moray Firth

The Moray Firth is an important area for marine mammals, with at least 14 species of cetacean and two species of seal being recorded in and around the Moray Firth. The bottlenose dolphin (*Tursiops truncates)* and harbour seal (*Phoca vitulina)* populations are both considered to be nationally and internationally important and are primary features of the Moray Firth Special Area of Conservation (SAC) and Dornoch Firth and Morrich More SAC (Moray East, 2012), respectively. Bottlenose dolphin, harbour porpoise (*Phocoena phocoena)*, harbour seal and grey seal (*Halichoerus grypus)* are all listed under Annex II of the Habitats Directive as requiring protection through the designation of SACs (Moray East, 2012). Large cetacean species, including minke whale (*Balaenoptera acutorostrata)*, humpback whale (*Megaptera novaeangliae)* and less frequently killer whale (*Orcinus orca)* and long-finned pilot whales (*Globicephala melas)* have been recorded within the Moray Firth during the summer months as they migrate.

This section sets out the spatial and temporal sensitivities of the key marine mammal species recorded in Moray Firth.

3.5.1.1 Harbour (Common) Seal

A number of haul-out sites for harbour seals are located within the Moray Firth, primarily in the Beauly, Cromarty and Dornoch Firths (Thompson *et al.,* 1996; Special Committee on Seals (SCOS), 2010). Since 2010, there has been substantial re-distribution in the area as counts at the Inner Firth have declined, whilst counts at Culbin Sands and Findhorn have increased rapidly (SCOS, 2017). The harbour seal population in the Moray Firth has declined by 40 % compared to numbers recorded in the mid-1990s, however the population has become relatively stable in recent years (SCOS, 2010; SCOS, 2017). Harbour seals occur throughout the year in these areas, with peak numbers at haul-out sites between June and August when they are used as breeding sites (Thompson & Miller, 1990; Thompson *et al*., 1996). Counts between 2011 and 2016 recorded 940 seals within the Moray Firth haul out sites, the majority of which were recorded within the Inner Firth at Culbin, Loch Fleet and Findhorn (SCOS, 2017). The total population of harbour seals in Scotland was 25,149 in 2011-2016, with 940 within the Moray Firth Management Unit (MU).

Boat-based marine mammal surveys were conducted in the Moray Firth between April 2010 and March 2012, commissioned by Moray East as part of the Environmental Impact Assessment (EIA), in order to provide site specific marine mammal distribution data at an appropriate scale. During the boat-based survey of the Moray East site plus 4 km buffer, six animals were confirmed as harbour seal. A number of seals observed during the surveys were not identified to species level, some of which may have been harbour seals. The harbour seal density across the site is 0.014 individuals per km^2, as calculated from the Russell *et al.* (2017) seals at sea density maps, summarising the mean at sea densities from all 5x5 km grid cells overlapping with the Development area (i.e. the Moray East site and OfTI Corridor).

3.5.1.2 Grey Seal

Grey seals within the Moray Firth are predominantly observed during the summer period, although smaller numbers are present throughout the year. Non-breeding grey seals have been observed at intertidal sites within the Moray Firth, also used by harbour seals. In August 2016, surveys carried out by SMRU recorded a MU population of 1,252 grey seals within the Moray Firth, approximately 350 of which were at Outer Dornoch Firth (SCOS, 2017).

Breeding grey seals are mostly found at the rocky beaches and caves to the north (Thompson *et al.,* 1996). It is thought that grey seals travel into the Moray Firth from different breeding sites (such as Orkney, Firth of Forth and Farne Islands) and use the area for food and non-breeding haul-out (Thompson *et al.,* 1996). The closest breeding site to the Development is Orkney, approximately 42 km to the north of the Development area. The closest haul out site is Helmsdale, which is approximately 42 km from the Development area.

Tagging studies within the Moray Firth have identified grey seals foraged over a much wider area than the harbour seal, with great variation between individuals (Thompson *et al.,* 1996). Grey seals are thought to forage on two geographical scales: on short repeated trips to discrete foraging areas and on long distant trips from one haul-out site to another which can be up to 2,100 km (McConnell *et al.,* 1999). The majority of trips recorded by McConnell *et al.,* (1999) from grey seals tagged at Abertay and the Farne Islands were short and for foraging, around 40 km. High-usage corridors can connect haul out sites to foraging areas, which can be up to 100 km offshore (Jones *et al.,* 2015). Although it is thought that most seals breed in the same region as they forage, Russell *et al.* (2013) found between 21 % and 58 % of females foraged in a different region from where they bred around the UK.

The grey seal density across the site is 0.23 individuals per km^2, as calculated from the Russell *et al.* (2017) seals at sea density maps, summarising the mean at sea densities from all 5x5 km grid cells overlapping with the Development area.

3.5.1.3 Harbour Porpoise

Harbour porpoise are distributed throughout the Moray Firth (Hastie *et al.,* 2003b; Thompson *et al.,* 2010; Robinson *et al.,* 2007). During the warmer months (May to July) there is a seasonal increase of harbour porpoise along the coast due to lactating females and their calves moving inshore, who are then followed by males (Robinson *et al.,* 2007). As bottlenose dolphins are known to attack harbour porpoise where they are present in the same area, the densities of harbour porpoise tend to be lower in areas where bottlenose dolphins are prevalent (Spitz *et al.,* 2006; Evans *et al.,* 2015).

The Joint Cetacean Protocol (JCP) Phase III report (Paxton *et al*., 2016) demonstrated that the Outer Moray Firth has high persistent densities of harbour porpoise during the summer period, with an estimated abundance of 9,000 (Lower Confidence Interval (CI) = 5,800, Upper CI = 13,500), which represents 1.3 % of the North Sea MU population (Paxton *et al*., 2016). The Phase III JCP report outlines the densities of harbour porpoise within specific "*areas of interest for offshore development*" around the UK, including the Moray Firth, both inner and outer, which includes the Development area. The harbour porpoise density in this "*Moray Firth offshore development area*" (an area defined within the JCP Phase III Report and covering the Moray Firth) is estimated at 13,500 in the winter period (97.5 % CI 7,400 – 27,100) and at 5,300 in the autumn (97.5 % CI 3,200 – 9,500), with the estimates for the spring and summer period falling between the estimates for the winter and autumn (Paxton *et al*., 2016). This gives a worst-case density estimate of 1.7 individuals per km^2 based on the winter abundance estimate and the total area of the "*Moray Firth offshore development area*" of 7,899 km^2. Relative density estimates from boat-based surveys at the Moray East site (2010-2012) were 0.16 animals per km^2; slightly lower than those predicted for the Moray Firth by SCANS II.

The second SCANS (Small Cetaceans in the European Atlantic and North Sea) survey (Hammond *et al*., 2013) estimated harbour porpoise densities of 0.274 individuals per km^2 (Coefficient of Variation (CV) = 0.36) in the relevant block for the Development (Block J), with an estimated abundance of 10,254 (CV = 0.36). Preliminary results from the more recent aerial SCANS III surveys showed a slightly lower density estimate of 0.152 individuals per km^2 (CV = 0.28) within the relevant survey block for the Moray Firth (Block S), with an estimated abundance of 6,147 (95 % CI 3,401 – 10,065) (Hammond *et al*., 2017). The estimated MU population for harbour porpoise in the North Sea is 345,373 (95 % CI 246,526 – 495,752) based on the SCANS-III survey results (Hammond *et al*., 2017).

3.5.1.4 Bottlenose Dolphin

A resident population of bottlenose dolphins can be found within the Inner Firth, for which the Moray Firth SAC has been designated. Although the majority of the population (71 to 111 individuals) appear to regularly utilise the Moray Firth SAC (95 % CI: 66 to 161), it is clear that a relatively high number of individuals also frequently utilise areas outside the SAC (Thompson *et al.,* 2006; 2009).

The distribution of bottlenose dolphin sightings within the Moray Firth appear to be coastal, with the majority occurring in the Inner Firth and along the southern coast, generally in waters of less than 25 m deep (Hastie *et al.,* 2003a; Robinson *et al.,* 2007). Some individuals of the resident population exhibit

movement patterns between the Moray Firth and other areas, for example, bottlenose dolphins from the Moray Firth SAC are regularly sighted in the Tay (Thompson *et al.,* 2011). A study conducted by Thompson *et al.,* (2015) used visual data to investigate the abundance and distribution of dolphin species throughout the Moray Firth. A total of 7,870 dolphins were noted during the visual surveys, 7,465 of which were identified as bottlenose dolphin (95%) (Thompson *et al*, 2015). These were predominantly recorded along the coastal areas particularly at the entrance to the inner Moray Firth, with very few recorded in the outer Moray Firth or offshore areas.

Within the Moray East marine mammal baseline surveys, as reported within the EIA, there were relatively few sightings of bottlenose dolphin made within the Moray East site compared to the coastal area, where dolphin species were predominantly bottlenose dolphins (Moray East, 2012). The predictions of bottlenose dolphin abundance were modelled in the same way as outlined for harbour porpoise above, over a 4x4 km grid taking into account survey data and environmental variables. Within the Moray East site, 0 – 0.1 bottlenose dolphins were predicted to be present within a 4x4 km grid, however the coastline area was predicted to have much higher densities, with up to 0.8 individuals present. The estimated density across the Moray East site is 0.0005 individuals per km^2, much lower than the estimated densities from the JCP Phase III report and from SCANS-III.

Within the JCP Phase III report, the bottlenose dolphin density for the "*Moray Firth offshore development area"* was estimated to be between 250 individuals in the summer (97.5 % CI 60-780) and 110 in the autumn (97.5 % CI 40-190) (Paxton *et al.*, 2016). This gives an estimated density of 0.3 individuals per km^2. The SCANS-III density estimate for bottlenose dolphin in Block S is 0.004 individuals per km^2 (95 % CI 0 – 527), with an estimated abundance of 151 (CV = 1.01) (Hammond *et al*., 2017).

3.5.1.5 Minke Whale

Minke whale are present within Moray Firth, and appear to move south into the North Sea and Western Scotland at the beginning of May and remaining present until October, with occasional sightings outside of this period (Evans, 2008; DECC, 2016). Minke whale are the most abundant whale species within the Moray Firth, with sightings being reported throughout the area (Reid *et al*., 2003; Robinson *et al*., 2007; Thompson *et al.,* 2010). Much of the research has concentrated on the southern coast and deeper trench waters, with observations most commonly occurring in deeper waters further from the shore (Robinson *et al*., 2007; Eisfeld *et al*., 2009). Data indicates that minke whales visit the Moray Firth in late summer to forage with the majority of sightings between May and September (Bailey & Thompson, 2009).

Preliminary results of the SCANS III aerial surveys (Hammond *et al.*, 2017) gave a minke whale abundance of 383 (95% CI = 0 to 1,364) and a density of 0.010 animals per km^2 (CV = 0.75) within Block S. The Phase III JCP (Paxton *et al*., 2016) project estimated that within the *Moray Firth offshore development area*, there is an abundance of 210 minke whale in the summer (97.5 % CI 80 - 540) which drops to 20 (97.5 % CI 0 - 60) in the autumn, however in the winter and spring months the abundances of minke whale are much lower. In winter and spring, minke whale abundance estimates within the "*Moray Firth offshore development area"* are 20 (97.5 % CI 0 – 130) and 30 (97.5 % CI 0 – 260) respectively. This equates to a worst-case density of 0.03 individuals per km^2 when using the summer abundance estimate. This is higher than the 0.01 animals per km^2 calculated from the boat-based surveys for the Moray East site (Moray East, 2012), although the small sample size needs to be taken into account when interpreting these results.

3.5.1.6 White-beaked Dolphin

White-beaked dolphins (*Lagenorhynchus albirostris*) are present all year round in Scotland and the east coast of England, however sightings increase in the summer months as animals move towards the shore (Evans, 1992; Northridge *et al.,* 1995; Reid *et al.,* 2003). Sightings within the Moray Firth are low compared to other areas of the northern North Sea.

During surveys carried out in 2011 for the Beatrice Offshore Wind Farm (OWF), most sightings were in offshore areas, with only occasional sightings within the inner Moray Firth (BOWL, 2012). Site specific seasonal variation was not calculated due to the lack of sightings. In surveys of the Moray East site between 2010 and 2012, a total of three of white-beaked dolphins were sighted (Moray East, 2012). The

visual surveys conducted between 1980 and 2010 by Thompson *et al.* (2015) recorded a total of 7,870 dolphin individuals; 168 of which were identified as white-beaked dolphin (2% of all sightings). These were concentrated in the offshore areas of the Moray Firth, with very few sightings in coastal areas.

The Phase III JCP report suggests that numbers within the "*Moray Firth offshore development area"* are highest during the spring, with an estimated abundance of 180 individuals (97.5 % CI 80 – 400), with the lowest numbers in winter (40 individuals; 97.5 % CI 20 – 110) giving a density estimate of 0.02 individuals per km^2 (Paxton *et al.,* 2016). The reference population for white-beaked dolphin in the Celtic and Greater North Seas MU is 15,895 individuals (95 % CI 9,107 – 27,743) (IAMMWG, 2015). Within the SCANS III Block S, the white-beaked dolphin abundance was estimated to be 868 (95 % CI = 0 to 2,258) and a density of 0.021 animals per km^2 (Hammond *et al.,* 2017).

3.5.1.7 Other Cetacean Species

Three common dolphins were recorded during the Moray East surveys carried out between 2010 and 2012 in total (Moray East, 2012). Within the JCP Phase III report, the abundance of common dolphin within the "*Moray Firth offshore development area*" was estimated to be the highest in autumn, with an estimate of 200 individuals (97.5 % CI 80 – 570), and the lowest in winter with 10 (97.5 % CI 0 – 50). This would give a density estimate of 0.025 individuals per km^2. No common dolphin were recorded in Block S of the SCANS-III survey (Hammond *et al.*, 2017). The reference population for common dolphin in the Celtic and Greater North Seas MU is 56,556 individuals (95 % CI 33,014 – 96,920) (IAMMWG, 2015).

Risso's dolphins (*Grampeus griseus)* were also recorded in very low numbers in offshore waters off the Moray Firth during site specific surveys for Beatrice OWF with a total of two sightings (BOWL, 2012). The Moray East site specific surveys recorded a total of one Risso's dolphin (Moray East, 2012). During the CRRU surveys, five individuals were sighted in total along the southern coastline of Moray Firth between 2001 and 2005, all between 20 to 50 m isobaths (Robinson *et al.,* 2007). The JCP Phase III report shows an estimated abundance of 0 in all seasons within the "*Moray Firth offshore development area"* (Paxton *et al.,* 2016), and the preliminary results of the SCANS III aerial surveys (Hammond *et al.*, 2017) did not record Risso's dolphins within survey Block S.

Occasional sightings of killer whale, long-finned pilot whale, fin whale (*Balaenoptera physalus),* humpback whale and sperm whale (*Physeter macrocephalus)* have also been reported in the outer Moray Firth (DECC, 2016). Killer whale sightings are greatest between April and September, whereas long-finned pilot whales have been sighted in waters off Scotland all year round (DECC, 2016). Due to the rarity of the sightings of these species in Moray Firth, no density estimates are available.

3.6 Ornithology

The Moray Firth's coastal and offshore waters are internationally important for populations of seabird, seaduck, wader and wildfowl. Because of this, a number of areas bordering the Moray Firth have been designated as Special Protection Areas (SPAs) under EU Directive 79/409/EEC (the Birds Directive). In addition to resident birds, the area is used for breeding, over-wintering or as a temporary feeding ground during the spring and autumn migrations of species breeding in Scandinavia and the Arctic.

The Moray East ES 2012 described the ornithological environmental baseline, which identified the key ornithological species recorded during boat-based surveys undertaken between April 2010 and March 2012, vantage point surveys undertaken from four coastal locations between 2010 and 2011, and aerial surveys and seabird tracking undertaken in summer 2011. In total, ten species were put forward for consideration of impact assessment for the three Telford, Stevenson and MacColl wind farms (now the Moray East site).

3.6.1 Key Species Commonly Sighted Species in the Moray Firth

Five species (fulmar, kittiwake, guillemot, razorbill and puffin) were recorded frequently during boat–based surveys and are designated features of more than one of the three local SPAs (East Caithness Cliffs SPA, North Caithness Cliffs SPA, and Troup, Pennan and Lion's Heads SPA).

Population density and abundance estimates for those five species have been provided in Table 3-1 below, obtained from boat based surveys conducted from 2010 to 2012 to inform the ornithology baseline for the Moray East ES 2012. The estimates show guillemot has the highest density and abundance estimate and fulmar has the lowest.

Table 3-1 Density (Birds / km^2) and Abundance Estimates (Birds Using the Sea) using density surface models, taken from 2010 to 2012 boat-based survey data (Moray East, 2012)

Species	Breeding Season				Non-Breeding Season			
	Density		Abundance		Density		Abundance	
	Site	4 km Buffer	Site	4 km Buffer	Site	4 km Buffer	Site	4 km Buffer
Fulmar	2.77	1.91	782	750	0.25	0.20	197	189
Kittiwake	7.90	4.69	1,963	1,532	0.79	0.29	261	204
Guillemot	25.57	18.60	6,732	6,943	2.84	3.47	990	1,021
Razorbill	6.03	3.53	1,661	1,674	2.64	3.04	892	899
Puffin	6.55	5.55	1,916	1,971	0.75	1.05	450	463

3.6.2 Sites Designated for Ornithological Receptors

A number of sites designated for ornithological receptors were considered in the Moray East ES 2012. A summary of SPAs relevant to the backfilling activities are provided in Section 3.11 below. Sites include East Caithness Cliffs SPA, North Caithness Cliffs SPA, Troup, Pennan and Lion's Heads SPA and Moray Firth proposed SPA (pSPA).

3.7 Marine Archaeology

The following section outlines the baseline conditions relevant to archaeological and cultural heritage within the Moray East site, as presented in the Moray East ES 2012.

For the Moray East ES 2012 archaeological baseline, a study area was defined as the Inner Study Area which was the three proposed wind farm sites (i.e. the Moray East site) and an Outer Study Area which was a 1 km buffer zone around the Inner Study Area. There are no designated archaeological or cultural heritage assets or targets within the Inner or Outer Study Areas. The following archaeological / cultural heritage assets and targets were identified within the Inner and Outer Study Areas (Moray East ES, 2012): six recorded wreck sites; two recorded obstructions; 20 geophysical anomalies of archaeological potential, comprising three anomalies of high archaeological potential and 17 anomalies of medium archaeological potential.

3.8 Commercial Fisheries

The Moray East ES 2012 indicated that ICES rectangle 45E7, within which the Moray East site is located, records landings values (average 2001 to 2010) that are of moderate importance on a national and regional scale (Figure 5.1-3 and Figure 5.1-4, Volume 6 b). The principal species targeted are: king scallops

(55.4 %); Nephrops (14.1 %); whitefish, including haddock, monks and cod (19.7 %); and squid (7.6 %). The following methods are principally used: boat dredges to target scallops, otter trawls to target Nephrops, seine nets and otter trawls to target whitefish, and demersal trawls to target squid (Moray East, 2012).

The latest ICES data from 2017 shows that the principal species targeted are the following (percentage values per species provided in brackets scallops: (28%), squid (9%), haddock (6%), Nephrops (2%), monk or anglerfish (2%). The recent data shows the landings have largely remained the same from the Moray East ES 2012 baseline (ICES, 2017).

Landings values for all species from rectangle 45E7 are broadly highest between May and September, although there are also moderate landings recorded in April and October. The majority of landings from rectangle 45E7 are into ports in the Moray Firth area. Fraserburgh is the principal port, with 44.8 % of landings (values) from 45E7 (Moray East, 2012).

3.9 Shipping and Navigation

The Moray East site is located within the vicinity of the Jacky Oil Field and the Beatrice Oil Field. The closest platform is located at the Jacky Field, approximately 3.7 nm west of the Stevenson site. The study area, as defined in the Moray East ES 2012 for shipping and navigation, was selected on the basis that it captures navigational features and traffic which could be affected by nearby development (shown in Moray East ES 2012, Figure 5.2-1, Volume 6b). The study area boundary, as defined in the Moray East ES 2012, is approximately 5.4 nm east of the Beatrice Demonstrator WTGs (Moray East, 2012).

Vessel based surveys conducted in April to July 2010 and November 2010 to January 2011 showed in total, there was an average of 14 vessels per day passing within 10 nm of the Moray East site during the winter survey and 18 vessels per day recorded during July 2010. It is noted that the increased traffic recorded in the summer survey can be partly attributed to fishing and recreational vessels passing through the area in more favourable weather and sea conditions.

A Navigational Risk Assessment (NRA) was submitted in 2010 which presented survey data collected via AIS and Radar over a 90 day period between 1 May and 31 July 2010. Further AIS data was recorded between 4 and 31 March 2018 which has been compared to the 2010 AIS data in order to determine the validity of the data. The analysis showed an average of approximately 11 unique vessels per day was recorded in both survey periods. Overall, the difference in the volume of traffic recorded within the study area during the 2010 and 2018 surveys was insignificant. The majority of vessels recorded were cargo and fishing vessels in both 2010 and 2018 (Moray East, 2018b).

3.10 Infrastructure and Other Users

The Moray East site is located adjacent to Beatrice OWF, and approximately 11 km to the northeast of the two-turbine Beatrice Demonstrator WTGs. The Beatrice Demonstrator WTGs are located adjacent to the Beatrice oil field, immediately to the west of the Moray Firth Round 3 Zone. It is comprised of two 5 MW WTGs and has a proposed lifespan of five years and all electricity generated is fed to a nearby oil platform.

There are two operational oil fields to the west of the Moray East site, the Beatrice oil field (Block 11 / 30a) and the Jacky oil field (Block 12 / 21c). These fields and their associated infrastructure do not overlap with the boundary of the Moray East site (Moray East, 2012).

Dredging and disposal activity within the Moray Firth is sporadic and associated with port and harbour maintenance and development and coastal marine disposal sites. Where the proposed OfTI makes landfall, it will travel within several kilometres of the existing “MacDuff” marine disposal site, which historically has received small volumes of dredge arisings, though at no point will overlap with it (Moray East, 2014).

3.11 Designated Sites

There are a number of nature conservation designations within the Moray Firth and in the vicinity of the the Moray East site. Designated sites have been included in the assessment where there is spatial overlap and/or there are mobile features which may occur within the Moray East site. A summary of the designated sites that have the potential to be impacted by the backfilling activities is provided in Table 3-2.

Table 3-2 Designated sites with the potential to interact with backfilling activities

Site name	Screened in qualifying features
Moray Firth SAC	Bottlenose dolphin
Dornoch Firth and Morrich More SAC	Harbour Seal
Berridale and Longwell waters SAC	Atlantic Salmon
River Spey SAC	Atlantic Salmon and Sea Lamprey
River Thurso SAC	Atlantic Salmon
East Caithness Cliff SPA	Annex I species: peregrine Migratory species during breeding season: guillemot, herring gull, kittiwake, razorbill and shag Birds present during breeding season: puffin, great black-backed gull, cormorant, fulmar, razorbill, guillemot, kittiwake, herring gull and shag.
North Caithness Cliff SPA	Annex I species: peregrine Migratory species during breeding season: guillemot Species present during breeding season: puffin, razorbill, kittiwake, fulmar and guillemot
Troup, Pennan and Lion's Head SPA	Migratory species during breeding season: guillemot Species present during the breeding season: razorbill, kittiwake, herring gull, fulmar and guillemot.
Moray Firth pSPA	The European Shag is proposed as a breeding and non-breeding species. The following non-breeding species have also been proposed: Common eider; Common goldeneye; Common scoter; Great northern diver; Greater scaup; Long-tailed duck; Red-breasted merganser; Red-throated diver; Slavonian grebe and Velvet scoter.

4 Assessment of Effects

4.1 Approach to Assessment

The following sections provide an assessment of the potential environmental impacts of the backfilling activities in relation to the following environmental topics: physical processes; benthic ecology; fish and shellfish; marine mammals; ornithology; marine archaeology; commercial fisheries; shipping and navigation; infrastructure and other users and designated sites.

The impact assessment process followed the Institute of Ecology and Environmental Management (IEEM)[5] (2010) Guidelines for Ecological Impact Assessment in Britain and Ireland – Marine and Coastal. These guidelines were also used for the Moray East 2012 ES, however the impact significance has been adapted for this Environmental Report from the impact significance used in Moray East 2012 ES. The impact significance criteria used are provided in Table 4-1 below.

Table 4-1 Impact Significance Definitions

Impact Significance*	Definition
Major	Very large or large change in receptor condition, both adverse or beneficial, which are likely to be important considerations at a regional or district level because they contribute to achieving national, regional or local objectives, or, could result in an exceedance of statutory objectives and / or breaches of legislation.
Moderate	Intermediate change in receptor condition, which are likely to be important considerations at a local level.
Minor	Small change in receptor condition, which may be raised as local issues but are unlikely to be important in the decision-making process.
Negligible	No discernible change in receptor condition.
No impact	No change in receptor condition, therefore no impact.

*A significant impact is any impact significance greater than a minor impact.

4.2 Physical Processes

4.2.1 Increases in SSC

There is potential for an increase in suspended sediment concentrations (SSC) following placement of the backfill material onto the seabed. The seabed disturbance will be limited to each WTG and OSP location where the backfill material is placed and will only occur at the time of backfill placement. It is expected that suspended sediments will be mobilised into the water column and then begin to resettle immediately through natural hydrodynamic processes. The backfill activities will occur at one location at a time, limiting the amount of SSC at any one time. Due to the short-term, temporary and localised nature of the impact, the effects of increased SSC and deposition on the seabed is considered to be **negligible** and no mitigation is considered necessary.

[5] Now the Chartered Institute of Ecology and Environmental Management (CIEEM).

4.3 Benthic Ecology

4.3.1 Habitat change

The placement of backfill material within the Moray East site (and 0.09 km^2 outside the boundary for the Moray East site) has the potential to result in a change of benthic habitat and associated fauna within the backfill footprint. The dominant habitats recorded within the Moray East site, as reported in the Moray East 2012 ES, were slightly gravelly sand with patches of shelly gravelly sand, sandy gravel and gravel. These habitats are also expected to be present in the surrounding area of the Moray East site. Therefore, the placement of the rock material will change the substrate from soft to hard.

The habitats present across the Moray East Site are common and widely distributed throughout the Moray Firth. Therefore, although there will be a change of habitat where the backfill material is placed, the original habitat will still be present in the surrounding area and throughout the Moray Firth.

Within the Moray East ES 2012, a footprint of 7,088 m^2 was assessed for scour protection at each WTG (which included the foundation) and a footprint of 7,539m^2 for scour protection at each OSP (which included the foundation). Since the Moray East ES 2012, the footprint of scour and foundation has reduced to 1,700 m^2 per WTG and OSP foundation (Moray East, 2019). With the addition of the backfill material at each WTG and OSP location, the total footprint (foundation, scour and backfill) is 1,792.16 m^2 which is still smaller than the footprint originally assessed. Therefore, although the backfill will lead to a habitat change, there are no additional impacts predicted to benthic ecology than those assessed in the Moray East 2012 ES.

Due to the ubiquitous nature of habitat which will be lost within the footprint of the backfill placement, coupled with the reduction in footprint of habitat change from the footprint assessed in the Moray East ES 2012, the impact of change on benthic ecology is considered to be **minor** and no mitigation is considered necessary.

4.3.2 Increases in SSC

The sensitivity of benthic communities within the Moray East site was assessed in relation to seabed disturbances and increases in SSC in the Moray East ES 2012. Local receiving habitats are predominately sedimentary in nature and are characterised by sediment burrowing animals and are thus expected to be tolerant to temporary light sediment deposition. Additionally, as stated in Section 254.3.1 above the receiving environment to sediment deposition is widely distributed throughout Moray Firth therefore, recovering from surrounding unaffected areas is likely to be rapid.

Due to the low sensitivity of the benthic communities present and the localised nature of the impact, the impacts of increased SSC and sediment deposition on benthic ecology are considered to be **negligible**.

4.3.3 Release of Sediment Contaminants

During the site characterisation surveys for Moray East ES 2012 levels of sediment contaminants were below guideline levels at all sampling locations (Moray East, 2012). As a result, it is not expected that elevated SSC would result in a release of contaminated sediments.

Given the dispersive and dilutive nature of the environment, any minor elevated levels of contaminants in the water column that may arise in association with the elevated SSC following placement of backfill material are unlikely to result in adverse effects on benthic ecology.

Due to there being no exceedances of guideline levels of contaminants in sediments across the Development area the effect of resuspension of sediment contaminants on benthic ecology is considered to be **negligible**.

4.4 Fish and Shellfish

4.4.1 Noise disturbance

The backfilling activity within the Moray East site has the potential to cause direct disturbance to fish species in the vicinity of the works due to generation of underwater noise. The extent of the impact relates to the proximity of the receptor to the backfilling activity.

The timings of the backfilling activities are not currently known; therefore, it is not known if the backfilling activity will overlap with sensitive times for fish and shellfish species present in the Moray Firth, including migration or spawning periods. However, the noise produced is not expected to be as noisy as other construction activities, such as piling and UXO clearance. Additionally, the noise generated will be intermittent in nature, with material being placed at one WTG at a time, and noise ceasing as soon as the backfill material is placed.

Due to the low level of noise being produced, disturbance impacts are expected to be limited to fish in proximity of the backfilling activity, causing a behavioural response of avoidance. Due to the nature of the impact, **no significant effects** at a population level are predicted to any fish species in the Moray Firth.

4.4.2 Increase in SSC

Indirect disturbance can also occur to fish and shellfish species due to increases in SSC following placement of backfill material on the seabed. Increased SSC has the potential to impact spawning and nursery grounds, as eggs and larvae have relatively high susceptibility to sediment deposition. However, as set out in Section 4.2 above, seabed disturbance will be limited to each WTG and OSP meaning the increase in SSC will be localised to each individual WTG/OSP location. Although there will be an increase in SSC above background concentrations this expected to begin to settle immediately through natural physical processes. Additionally, the spawning and nursery areas present in the vicinity of the Moray East site are extensive and given the highly localised area that will be affected by backfilling it is unlikely that large proportions of any nursery and spawning grounds will be affected.

Mobile fish species are able to avoid localised areas disturbed by increased SSC. Juveniles and adults would be able to move to adjacent undisturbed areas within their normal distribution range and avoid any areas of increased SSC. Therefore, indirect disturbance due to increases in SSC are expected to be **negligible**.

4.4.3 Habitat Change

The placement of backfill material within the Moray East site (and 0.09 km^2 outside the boundary for the Moray East site) has the potential to result in the change of benthic habitat associated fauna within the backfill footprint, leading to indirect impacts to fish and shellfish. However, the communities present across the Moray East site are common and widely distributed throughout the Moray Firth. Therefore, although there will be a change of habitat where the backfill material is placed there will be extensive feeding, nursery and spawning habitat available in the wider area and throughout the Moray Firth.

As described in Section 4.3.1 above, within the Moray East ES 2012 a footprint of 7,088 m^2 was assessed for each WTG which included the foundation and scour protection and a footprint of 7,539 m^2 for each OSP which included foundation and scour protection. Since the Moray East 2012 ES the footprint of scour and foundation has reduced to 1,700m^2 per WTG and OSP foundation (including scour protection). With the addition of backfill material at each WTG and OSP the total footprint (foundation, scour and backfill) is 1,792.16 m^2. Therefore, although the backfill will lead to a habitat change there are no additional indirect impacts predicted to fish and shellfish ecology in relation to habitat change than those assessed in the Moray East ES 2012.

Due to the ubiquitous nature of habitat which will be lost within the footprint of the backfill material, coupled with the reduction in footprint of habitat change from the footprint assessed in the Moray East

ES 2012, the impact of habitat change on fish ecology is considered to be **not significant** for all species except for herring and sandeel which was assessed as **minor significance** within the Moray East 2012 ES.

4.4.4 Release of Contaminants

As discussed in Section 4.3.3 above, records of sediment contamination from across the Moray East site collected for the Moray East ES 2012 were all below guideline levels (Moray East, 2012). Due to there being no exceedances of guideline levels of contaminants in sediments across the Moray East site and the dispersive nature of the environment the effect of resuspension of sediment contaminants on fish and shellfish ecology is considered to be **negligible**.

4.5 Marine Mammals

4.5.1 Noise disturbance

The backfilling activity within the Moray East site has the potential to cause direct disturbance to marine mammals present in the vicinity of the works due to generation of underwater noise. The extent of the impact relates to the proximity of the receptor to the backfilling activity.

The timings of the backfilling are not currently known therefore it is not known if the backfilling activity will overlap with sensitive times for marine mammal species present in the Moray Firth. However, the noise produced is not expected to be louder than other construction activities such as piling and UXO clearance. Additionally, the noise generated will be intermittent in nature, with material being placed at one depression at a time, and noise ceasing as soon as the rock is placed.

Due to the low level of noise being produced disturbance impacts are expected to be limited to marine mammals in proximity of the backfilling activity resulting in a behavioural response of avoidance. Due to the nature of the impact, **no significant effects** at population level are predicted to any marine mammal species in the Moray Firth.

4.5.2 Increases in SSC and release of sediment contaminants

The backfilling activities within the Moray East site have the potential to result in disturbance of the seabed and therefore increased SSC in the water column. However, as discussed in Section 4.2.1, 4.3.2, and 4.4.2 above, this effect would be highly localised around each individual WTG and OSP location is not expected to result in any significant areas of the seabed being disturbed, or significant levels of sediments being released into the water column. Following disturbance, the SSC is expected to resettle through natural physical processes. Marine mammal species are able to avoid areas that have been disturbed by the increase in SSC.

As shown in Section 4.3.3 and 4.4.4 above, levels of sediment contamination across the Moray east site did not show any levels above guideline levels. This, and the dispersive and dilutive nature of the environment, mean that any minor elevated levels of contaminants in the water column following backfilling activities are unlikely to result in any adverse effects on marine mammals. Therefore, the risk to marine mammals from changes to the sediment processes at the site (including increases in SSC and contaminants) are **negligible**, and no mitigation is considered necessary.

4.5.3 Changes to Prey Availability

As discussed in Section 3.4, there are no significant impacts expected to occur fish and shellfish species as a result of the backfilling activities, due to either behavioural disturbance of the fish species from the area, habitat change or the release of SSC. Therefore, any potential indirect effects to marine mammals that target these species are expected to be **negligible**.

4.5.4 Vessel Collision

There is potential for impacts to marine mammals due to vessel collision during the construction phase. The Moray East ES 2012 concluded that any vessel traffic would be slow moving in a predictable manner (along a predefined corridor). As a result, the effects of increased vessel traffic on marine mammals (all species) was considered probable in the immediate vicinity of the vessel but overall, effects would be of low magnitude, medium duration and minor significance. The vessel required for the backfilling activity will also be slow moving and in a predictable manor. Therefore, the addition of the backfilling vessel is not expected to change the impact significant determined during the ES meaning impacts to marine mammals due to backfilling is expected to be **minor**.

4.6 Ornithology

4.6.1 Noise Disturbance

The backfilling has potential to cause disturbance to birds in the vicinity of the vessels used during the backfilling activities. The Moray East ES 2012 determined that construction and decommissioning effects are limited to disturbance arising from WTG installation / removal and associated vessel traffic. The impacts were determined to be of short-term duration and reversible and no significant effects were predicted. Given the level of vessel traffic required during the construction phase, the addition of the backfilling vessel is not expected to lead to significant noise impacts. The noise generated will be short-term, temporary and reversible in nature. Therefore, **no significant** impacts are predicted due to disturbance from the backfilling activities to ornithology.

4.6.2 Changes to Prey Availability

Potential impacts from backfilling activities to bird prey species has potential to indirectly impact birds. Given that potential impacts to benthic ecology and fish and shellfish ecology have been determined to be minor or negligible (Section 4.3 and Section 4.4 above) it is concluded that the indirect impact on seabirds occurring in or around the Moray East site are during the backfilling activities would be **negligible**.

4.7 Marine Archaeology

As the placement of the backfilling material will be limited to the footprint of the spud can indentations, archaeological finds are not expected to be identified during the backfilling activity itself. Any objects identified as potential archaeology during the pile installation will be reported in adherence with the Moray East Marine Archaeological Reporting Protocol (MARP), additionally, AEZs will be avoided unless otherwise agreed with MS-LOT in consultation with Historic Environment Scotland.

Seabed disturbance during placement of the backfill material may cause physical effects to marine archaeology assets through deposition of SSC. However, as set out in Section 4.2 above the increases in SSC from the backfill activities are anticipated to be short term and localised with the associated sediment deposition also localised and discrete.

Due to the planned avoidance of AEZs, implementation of the embedded mitigation measures for archaeology, and the short term and localised nature of increased SSC, the effects of backfilling activities on marine archaeology is considered to be **negligible**.

4.8 Commercial Fisheries

During the placement of the backfill material, interference with commercial fishing activity is not expected. During the construction phase there will be a mandatory “rolling” 500 metres (m) safety zone

established around each wind farm structure (both WTGs and OSPs and / or their foundations whilst construction works are in progress, as indicated by the presence of a construction vessel) (Moray East, 2018b). The backfilling works are within the safety zone that will already be in place during the construction phase, therefore no change in impacts assessed during the Moray East ES 2012 are predicted and impacts are considered **negligible**.

The Moray East ES 2012 determined that some commercial fisheries particularly those operating bottom towed gear may stop fishing within the operational wind farm site because of the presence of infrastructure, resulting in a complete loss of fishing ground. For those that would enter the Moray East site the footprint of WTGs and scour protection was determined to be 7,088 m^2 per foundation (scour protection and foundations) for WTG and 7,539 m^2 (scour and foundations) for the OSP. The current backfilling and proposed scour would only be 1,792.16 m^2 (scour, foundation and backfilling) per foundation. Therefore, change in impacts assessed during the Moray East ES 2012 are predicted and impacts are considered **negligible**.

4.9 Shipping and Navigation

During the backfilling activities, there will be an existing safety zone of 500 m in place around each WTG and OSP while work is being undertaken (Moray East, 2018b). Therefore, there are **no impacts** expected in relation to the vessel required for backfilling activities.

During the operational phase there is potential for impacts from the backfilling material to vessels that interact with the seabed (such as vessel anchoring). However, as stated in Section 4.8 above the footprint of the backfilling, scour and foundation now proposed is smaller than assessed in the Moray East ES 2012. Therefore, any potential for interactions between vessels and the foundations and associated scour/backfilling would be smaller than assessed in the ES. Therefore, no change in impacts assessed during the Moray Firth ES 2012 are predicted and impacts are considered **negligible**.

4.10 Infrastructure and Other Users

As set out in Section 4.9 above, the backfilling activity is not expected to impact infrastructure and other users due to the existing safety zone that will already be in place around the WTG and OSP. Therefore, there are no impacts expected in relation to the vessel required for backfilling. Additionally, as the footprint of the backfill material combined with the footprint of the foundations and scour is smaller than the footprint assessed in the Moray East ES 2012 there are no additional impacts predicted during the operational phase due to the presence of backfilling material than those assessed during the 2012 ES and impacts are considered **negligible**.

4.11 Designated Sites (including in-combination effects)

Further information on potential effects to Atlantic salmon as qualifying features of the Berriedale and Langwell Waters SAC and River Spey SAC are provided in Section 4.4 above. Details of the potential effects on bottlenose dolphin as the qualifying feature for the Moray Firth SAC and for harbour seals as the qualifying feature for the Dornoch Firth and Morrich More SAC are provided in Section 4.5 above. Potential effects on qualifying features of East Caithness Cliffs SPA, North Caithness Cliffs SPA,Troup, Pennan and Lion's Heads SPA and Moray Firth pSPA have been considered in Section 4.6 above. Overall no significant effects are predicted in relation to the designated sites listed in Section 3.11 from the backfilling activities.

4.12 Cumulative Impacts

As set out in Section 3.10 above, the main activity occurring within the vicinity of the Moray East site is Beatrice OWF, due to the close proximity to the Moray East site. Construction of Beatrice OWF is still ongoing, and Moray East understands that construction work may extend until October 2019 . Therefore, there will be an overlap of the backfilling activity with the construction phase of Beatrice of approximately three months. As no significant impacts have been predicted in relation to the backfilling activities and due to the small temporal overlap between the construction phase of Beatrice **no cumulative impacts** are predicted.

There is potential for cumulative impacts in relation to any vessels required during the operation phase of Beatrice OWF and the backfilling vessel. However, embedded mitigation measures will be in place including a 500 m safety zone and a Notice to Mariners. Therefore, **no cumulative impacts** are predicted.

5 Summary

Moray East is seeking to obtain a Marine Licence from MS-LOT for backfilling of the seabed depressions caused by the jack-up spud cans which will be used for WTG and OSP pile installation.

This Environmental Report is submitted in support of the Marine Licence application submitted by Moray East for the backfilling activities. An assessment of the potential impacts of the backfilling activities has been carried out in relation to key receptors including: physical processes; benthic ecology; fish and shellfish; marine mammals; ornithology; marine archaeology; commercial fisheries; shipping and navigation; and infrastructure and other users. A summary of the outcome of the environmental assessment is presented in Table 5-1 below. Overall no significant impacts are predicted due to the proposed backfilling activities.

Table 5-1 Summary of potential impacts

Receptor	Potential Impact	Assessment of effect (post mitigation)
Physical Processes	Increase in SSC and deposition	Negligible
Benthic Ecology	Habitat Change	Minor
	Increase in SSC	Negligible
	Release of contaminated sediment	Negligible
Fish and Shellfish	Noise disturbance	No impact
	Increase in SSC	Negligible
	Habitat change	Minor
	Release of contaminated sediment	Negligible
Marine Mammals	Noise disturbance	No impact
	Increase in SSC and release of contaminants	Negligible
	Changes to prey availability	Negligible
	Vessel collision	Minor
Ornithology	Noise disturbance	No impact
	Changes to prey availability	Negligible
Marine Archaeology	Direct disturbance and sediment deposition	Negligible
Commercial Fisheries	Interference with commercial fishing activities	Negligible
Shipping and Navigation	Obstructions to exiting navigational activities	Negligible
Infrastructure and Other Users	Interference with existing users	Negligible
Cumulative Impacts	Cumulative impacts with other activities	No impact

6 References

Bailey, H. and Thompson, P.M., (2009). Using marine mammal habitat modelling to identify priority conservation zones within a marine protected area. Marine Ecology Progress Series, 378, pp.279-287.

BOWL (2012) Beatrice Offshore Wind Farm Environmental Statement.

DECC (now Department for Business, Energy and Industrial Strategy) (2016). UK Offshore Energy Strategic Environmental Assessment 3 (OESEA3).

Eisfeld, S., Keith, S., Pope, A., Still, D., Dolman, S. and Simmonds, M., (2009). Outer Moray Firth Cetacean Research 2008. Project report for the BBC Wildlife Fund. Whale and Dolphin Conservation Society, 23pp.

Ellis, J.R., Milligan, S., Readdy, L., South, A., Taylor, N. and Brown, M., (2010) Mapping spawning and nursery areas of species to be considered in Marine Protected Areas (Marine Conservation Zones).

Evans, P.G.H., Pierce, G.J., Veneruso, G., Weir, C.R., Gibas, D., Anderwald, P. and Begoña Santos, M. (2015) Analysis of long-term effort-related land-based observations to identify whether coastal areas of harbour porpoise and bottlenose dolphin have persistent high occurrence and abundance. JNCC report No. 543, JNCC, Peterborough.

Evans, P.G.H. (1992) Status Review of Cetaceans in British and Irish waters UK Dept. of the Environment, London. 98pp.

Evans, P.G.H. (Ed) (2008) Selection criteria for marine protected areas for cetaceans. Proceedings of the ECS/ASCOBANS/ASCOBAMS Worskshop held in San Sebastian, Spain, 22nd April 2007, European Cetacean Society Special Publication Series, 48, 1-104.

Hammond P.S., Macleod K., Berggren P., Borchers D.L., Burt L., Cañadas A., Desportes G., Donovan G.P., Gilles A., Gillespie D., Gordon J., Hiby L., Kuklik I., Leaper R., Lehnert K, Leopold M., Lovell P., Øien N., Paxton C.G.M., Ridoux V., Rogano E., Samarraa F., Scheidatg M., Sequeirap M., Siebertg U., Skovq H., Swifta R., Tasker M.L., Teilmann J., Canneyt O.V. and Vázquez J.A. (2013). Cetacean abundance and distribution in European Atlantic shelf waters to inform conservation and management. Biological Conservation 164, 107-122.

Hammond, P.S., Lacey, C., Gilles, A., Viquerat, S., Boerjesson, P., Herr, H., Macleod, K., Ridoux, V., Santos, M., Scheidat, M. and Teilmann, J. (2017). Estimates of cetacean abundance in European Atlantic waters in summer 2016 from the SCANS-III aerial and shipboard surveys. Wageningen Marine Research.

Hastie, G.D., Wilson, B. and Thompson, P.M., (2003a). Fine-scale habitat selection by coastal bottlenose dolphins: application of a new land-based video-montage technique. Can. J. Zool, 81.

Hastie, G.D., Barton, T.R., Grellier, K., Hammond, P.S., SwIFT, R.J., Thompson, P.M. and Wilson, B., (2003b). Distribution of small cetaceans within a candidate Special Area of Conservation; implications for management. Journal of Cetacean research and Management, 5(3), pp.261-266.

IAMMWG (2015). Management Units for cetaceans in UK waters (January 2015). JNCC Report No. 547, JNCC Peterborough.

ICES (2017) Fishing Effort and Quantity and Value of Landings by ICES Rectangle. Available from: https://www2.gov.scot/Topics/Statistics/Browse/Agriculture-Fisheries/RectangleData.

Institute of Ecology and Environmental Management (IEEM) (2010). Guidelines for Ecological Impact Assessment in Britain and Ireland; Marine and Coastal.

Jones, E.L., McConnell, B.J., Smout, S., Hammond, P.S. et al. (2015) Patterns of space use in sympatric marine colonial predators reveal scales of spatial partitioning. Mar Ecol Prog Ser 534:235-249. https://doi.org/10.3354/meps11370.

McConnell, B.J., Fedak, M.A., Lovell, P. and Hammond, P.S. (1999) Movements and foraging of grey seals in the North Sea. Journal of Applied Ecology 36: 573-590.

Moray East (2012) Moray Offshore Renewables Limited - Environmental Statement: Telford, Stevenson and MacColl Offshore Wind Farms and Transmission Infrastructure.

Moray East (2014) Moray Offshore Renewables Limited – Environmental Statement: Modified Transmission Infrastructure for Telford, Stevenson and MacColl Offshore Wind Farms.

Moray East (2018a). Marine Archaeological Reporting Protocol (MARP) and Written Scheme of Investigation (WSI). Moray East Offshore Wind Farm and Associated Offshore Transmission Infrastructure. Document Reference 846001-PCA0010-RHD-REP-001.

Moray East (2018b). Safety Zone Application. Moray Offshore Windfarm (East) Limited.

Moray East (2019). Development Specification and Layout Plan. Moray East Offshore Wind Farm and Associated Offshore Transmission Infrastructure. Document Reference 8460001-PCA0010-MWE-REP-003. Version 3, January 2019.

Northridge, S.P., Tasker, M.L., Webb, A. and Williams, J.M., (1995) Distribution and relative abundance of harbour porpoises (Phocoena phocoena L.), white-beaked dolphins (Lagenorhynchus albirostris Gray), and minke whales (Balaenoptera acutorostrata Lacepède) around the British Isles. ICES Journal of Marine Science: Journal du Conseil, 52(1), pp.55-66.

Paxton, C.G.M., Scott-Hayward, L., Mackenzie, M., Rexstad, E. and Thomas, L. (2016). Revised Phase III Data Analysis of Joint Cetacean Protocol Data Resources with Advisory Note, JNCC Report 517, ISSN 0963-8091: http://jncc.defra.gov.uk/page-7201.

Reid, J.B, Evans, P.G.H. and Northridge, S.P. (2003) Atlas of cetacean Distribution in North west European waters. JNCC, Peterborough.

Robinson, K.P., Baumgartner, N., Eisfeld, S.M., Clark, N.M., Culloch, R.M., Haskins, G.N., Zapponi, L., Whaley, A.R., Weare, J.S. and Tetley, M.J., (2007). The summer distribution and occurrence of cetaceans in the coastal waters of the outer southern Moray Firth in northeast Scotland (UK). Lutra, 50(1), p.19.

Russell, D.J.F., McConnell, B.J., Thompson, D., Duck, C.D., Morris, C., Harwood, J. and Matthiopoulos, J. (2013) Uncovering the links between foraging and breeding regions in a highly mobile mammal. Journal of Applied Ecology, Vol 50, no. 2, pp. 499-509.

Russell, D.J.F, Jones, E.L. and Morris, C.D. (2017). Updated Seal Usage Maps: The Estimated at-sea Distribution of Grey and Harbour Seals. Scottish Marine and Freshwater Science Vol 8 No 25, 25pp. DOI: 10.7489/2027-1.

SCOS (2010). Scientific Advice on Matters Related to the Management of Seal Populations: 2010.

SCOS (2017). Scientific Advice on Matters Related to the Management of Seal Populations: 2017. Available at: http://www.smru.st-andrews.ac.uk.

Spitz, J., Rousseau, Y. and Ridoux, V., (2006). Diet overlap between harbour porpoise and bottlenose dolphin: An argument in favour of interference competition for food? Estuarine, Coastal and shelf science, 70(1-2), pp.259-270.

Thompson, P.M. and Miller, D., (1990). Summer Foraging Activity and Movements of Radio-Tagged Common Seals (Phoca Vitulina. L.) in the Moray Firth, Scotland. Journal of Applied Ecology, 27, pp.492-501.

Thompson, P.M., McConnell, B.J., Tollit, D.J., Mackay, A., Hunter, C. and Racey, P.A. (1996). Comparative distribution, movements and diet of harbour and grey seals from the Moray Firth, N.E. Scotland. Journal of Applied Ecology. 33: 1572-1584.

Thompson, P.M., Corkrey, R., Lusseau, D., Lusseau, S., Quick, N., Durban, J.W., Parsons, K.M. & Hammond, P.S. (2006) An assessment of the current condition of the Moray Firth bottlenose dolphin population. Scottish Natural Heritage Commissioned Report No. 175.

Thompson, P.M, Cheney, B., Cândido, A.T. & Hammond, P.S. (2009) Site Condition Monitoring of bottlenose dolphins within the Moray Firth Special Area of Conservation: Interim report 2005-2007. Internal report to Scottish Natural Heritage.

Thompson, D., Bexton, S., Brownlow, A., Wood, S., Patterson, T. Pye, K., Lonergan, M. and Milne, R. (2010) Report on recent seal mortalities in UK waters caused by extensive lacerations October 2010. Sea Mammal Research Unit. Available online - http://www.smru.st-and.ac.uk/documents/366.pdf

Thompson, P.M., Cheney, B., Ingram, S., Stevick, P., Wilson, B. Hammond, P.S. (2011) Distribution, Abundance and Population Structure of Bottlenose Dolphins in Scottish Waters. Scottish Natural Heritage Commissioned Report No.354. Scottish Natural Heritage, Perth, UK.

Thompson, P. M., Brookes, K. L., & Cordes, L. S. (2015). Integrating passive acoustic and visual data to model spatial patterns of occurrence in coastal dolphins. ICES Journal of Marine Science: Journal du Conseil, 72(2), 651-660.

MORAY EAST
OFFSHORE WINDFARM

Contact

Moray Offshore Windfarm (East) Limited
5th Floor, Atria One, 144 Morrison Street,
Edinburgh, EH3 8EX
Tel: +44 (0)131 556 7602