MORAY OFFSHORE WINDFARM (WEST) LIMITED

Construction UXO Clearance European Protected Species – Risk Assessment

Document Name: 8460005-DG0207-MWW-REP-000010

Revision: 3

Status: Final

Date: 27-03-2024

Version Control				
Revision	Date	Status	Revision Description	Distribution List
0	30-10-2022	Draft	Submission to Moray West for review	Moray West
1	11-12-2023	Final	First Submission to MD-LOT	MD-LOT
2	26-02-2024	Final	Second Submission to MD-LOT	MD-LOT
3	27-03-2024	Final	Third Submission to MD-LOT	MD-LOT

Document Approval (Rev 01)			
Prepared by:	Reviewed by:	Approved by:	Approved by:
[redacted]	[redacted]	[redacted]	[redacted]

Table of Contents

1 Introduction 8
1.1 Background 8
1.2 Purpose of the Risk Assessment 9
2 Description of the Proposed Works 11
2.1 Potential for UXO 11
2.1.1 Background 11
2.1.2 Potential UXO Sources 11
2.1.3 Number of cUXO Cleared To Date 12
2.2 The Moray West Approach 12
2.3 Licensable Activities (UXO Clearance Activities) 13
2.3.1 Identification Operations 13
2.3.2 Explosive Ordnance Disposal Operations 14
2.3.2.1 Deflagration 15
2.3.3 Non-UXO Debris Clearance 16
3 Existing Environment 17
3.1 17
3.2 Species within the Moray Firth 17
3.3 Cetacean species potentially present in the Development Site 18
3.3.1 Harbour porpoise 18
3.2.2 Bottlenose dolphin 19
3.2.3 White-beaked dolphin 20
3.2.4 Common dolphin 20
3.2.5 Minke whale 20
3.2.6 Summary 21
4 Potential Impacts for Marine Mammals 22
4.1 UXO Underwater Noise Modelling 24
4.1.1 Low-order clearance 25
4.2 PTS from UXO clearance 25
4.2.1 Harbour porpoise 26

4.2.2 Bottlenose dolphin 27
4.2.3 White-beaked dolphin 27
4.2.4 Common dolphin 28
4.2.5 Minke whale 29
4.3 TTS from UXO clearance 29
4.3.1 Harbour porpoise 30
4.3.2 Bottlenose dolphin 31
4.3.3 White-beaked dolphin 31
4.3.4 Common dolphin 32
4.3.5 Minke whale 32
4.4 Potential disturbance for low-order deflagration 33
4.5 Potential disturbance from ADD 34
4.6.1 Efficacy of ADDs 34
4.6.2 Planned ADD Mitigations for UXO Clearance 35
4.6.3 Assessment of Disturbance due to ADD use 35
4.6 Impacts due to an Increase in Vessel Presence 36
4.6.4 Increased Risk of Collision 36
4.6.5 Disturbance from Vessels 37
4.7 Changes in water quality 37
4.8 Changes in prey availability 37
4.9 Mitigation 38
4.10 Cumulative Impact Assessment (CIA) 38
5 Potential Effects on Designated Sites 42
5.1 Special Areas of Conservation (SACs) 42
5.1.1 Moray Firth SAC 42
5.1.2 Dornoch Firth and Morrich More SAC 43
5.2 Nature Conservation Marine Protected Area (NCMPA) 44
5.2.1 Southern Trench NCMPA 44
5.3 Protected Seal Haul-Out Sites 45
6 Assessment of Potential Offence 47

6.1 EPS Licencing Tests 47
7 References 49
Appendix A – Defined Terms 54
Appendix B - Marine Mammal Mitigation Protocol 56
B.1 Introduction 56
B.2 UXO Clearance Techniques 57
B.3 UXO Mitigation Procedures 57
Mitigation Zone 57
B.4 Acoustic Deterrent Device 59
Pre-deployment tests 59
ADD locations 60
ADD activation times 60
B.5 Post-clearance search 61
B.6 Roles and Responsibilities 61
Marine Mammal Observers 61
Passive Acoustic Monitoring Operator 62
ADD operator 62
Explosive Ordnance Disposal Supervisor 64
B.7 Reporting 64
B.8 Communication protocol 65
B.9 Summary of Mitigation Procedures 66
B.11 References 68
Appendix C - UXO Deflagration Impact Rages 69

Abbreviations and Acronyms

Acronym / Abbreviation	Description
AAA	Anti-aircraft Artillery
AC	Alternating Current
ADD	Acoustic Deterrent Devices
ADD-Op	ADD Operator
AEoSI	Adverse Effect on Site Integrity
CES	Coastal East Scotland
CGNS	Celtic and Greater North Seas
CI	Confidence Interval
CIA	Cumulative Impact Assessment
CV	Coefficient of Variation
cUXO	Confirmed Unexploded Ordnance
EIA	Environmental Impact Assessment
EOD	Explosive Ordnance Disposal
EPS	European Protected Species
ES	Environmental Statement
FCS	Favourable Conservation Status
FRC	Fast Rescue Craft
GNS	Greater North Sea
HE	High Explosive
HF	High Frequency
IAMMWG	Inter-Agency Marine Mammal Working Group
IUCN	International Union for Conservation of Nature
JNCC	Joint Nature Conservation Committee
kg	Kilograms
LAT	Lowest Astronomical Tide
LF	Low Frequency
MA	Monitoring Area
MC	Medium Capacity
MF	Mid Frequency
ML	Marine Licence
MLA	Marine Licence Application
m	Metre
mm	Millimetres
MMMP	Marine Mammal Mitigation Protocol
MMO	Marine Mammal Observer
MD-LOT	Marine Directorate Licensing Operations Team
MU	Management Unit
NCMPA	Nature Conservation Marine Protected Area

Acronym / Abbreviation	Description
NEQ	Net Explosive Quantity
nm	Nautical Miles
NCMPA	Nature Conservation Marine Protected Area
NMFS	National Marine and Fisheries Service
NOAA	National Oceanographic and Atmospheric Administration
NS	North Sea
OfTI	Offshore Transmission Infrastructure
OFTO	Offshore Transmission Owner
OWF	Offshore Wind Farm
OSP	Offshore Substation Platform
OWF	Offshore Wind Farm
PAM	Passive Acoustic Monitoring System
PAM-Op	PAM Operator
PCW	Phocid Carnivores in Water
PTS	Permanent Threshold Shift
pUXO	Potential Unexploded Ordnance
RIAA	Report to Inform an Appropriate Assessment
RIB	Rigid (hull) Inflatable Boat
ROV	Remotely Operated Vehicle
SAC	Special Area of Conservation
SCANS III	The Small Cetaceans in European Atlantic waters and the North Sea III
SEL	Sound Exposure Level
SNCB	Statutory Nature Conservation Body
SNH	Scottish Natural Heritage
SNS	Southern North Sea
SPL	Sound Pressure Level
TI	Transmission Infrastructure
TNT	Trinitrotoluene
TTS	Temporary Threshold Shift
UK	United Kingdom
UXO	Unexploded Ordnance
VHF	Very high-frequency
WROV	Work-class Remotely Operated Vehicle
WTGs	Wind Turbine Generators

1 Introduction

1.1 Background

The Moray West Offshore Wind Farm and associated Offshore Transmission Infrastructure (OfTI) (referred to as 'the Development') is being developed by Moray Offshore Windfarm (West) Limited (known as 'Moray West'; see **Appendix A** for defined terms). Consent for the Development was granted on 14 June 2019 under Section 36 (S36) of the Electricity Act 1989 (as amended), Part 4 of the Marine (Scotland) Act 2010 and the Marine and Coastal Access Act 2009 from Scottish Ministers. One S36 consent was granted by Scottish Ministers for the wind farm (012/OW/MORLW-8) and two Marine Licenses were granted by Scottish Ministers, one for the wind farm and another for the offshore transmission infrastructure.

Variations of the S36 consent and wind farm Marine Licence were granted by the Scottish Ministers on 7 March 2022, and further variations of the Wind Farm Marine Licence (licence number: MS-00009774) and OfTI Marine Licence (licence number: MS-00010585) were granted on 7 March 2022 and 8 February 2024 respectively. The revised S36 consent and associated Marine Licences are referred to collectively as 'offshore consents'.

The Moray West Site covers an area of approximately 225 km^2 on the Smith Bank in the Outer Moray Firth approximately 22 km from the Caithness coastline (**Figure 1**). The Moray West Offshore Wind Farm will comprise 60 wind turbine generators (WTGs), associated substructures and seabed foundations, inter-array cables, one offshore substation platform (OSP) inter-connector cable and any scour protection around substructures or cable protection. The OfTI comprises two OSPs which will be located within the Moray West Site, and two offshore export cable circuits which will be located within the OfTI Corridor and will be used to transmit the electricity generated by the offshore wind farm to shore. The Moray West Offshore Windfarm Development Site is comprised of both the Moray West Site and the OfTI Corridor.

The offshore export cable circuits will come ashore at Sandend Bay, which is located on the Aberdeenshire Coast at Broad Craig, approximately 65 km south of the Moray West Site. There will be two underground circuits from landfall at Sandend Bay to Whitehillock where the onshore substation will be located. There will also be further underground cabling between Whitehillock substation and Blackhillock substation. Moray West will transfer ownership of the transmission asset to an Offshore Transmission Owner (OFTO) who will manage the transmission infrastructure.

The development is aiming to be operational in 2024/25, achieving a formal Commercial Operation Date at the end of July 2025, when the commissioning of the Development will be completed, and have an operational life of 25 years from the date of final commissioning of the Development.

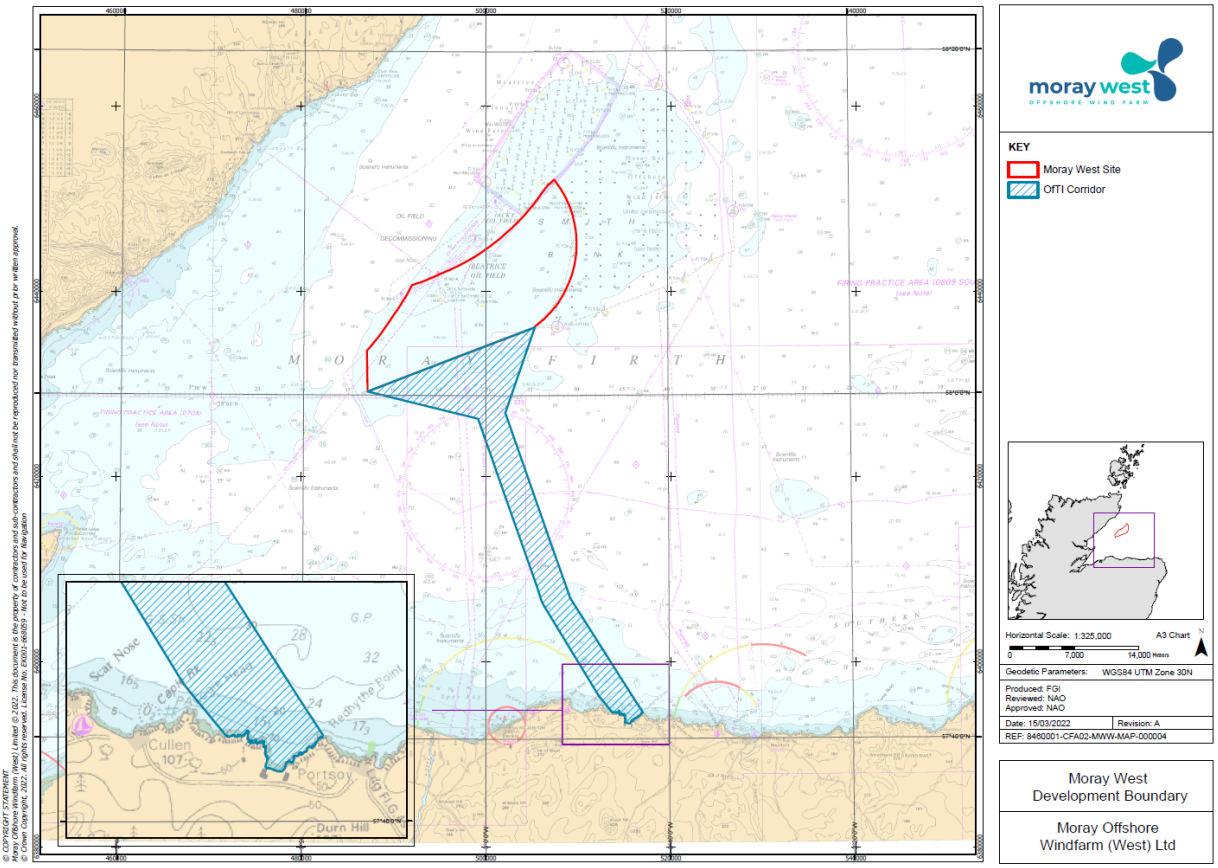


Figure 1 Moray West Offshore Windfarm Development Site (Moray West Site and OfTI Corridor).

1.2 Purpose of the Risk Assessment

In order to safely undertake unexploded ordnance (UXO) clearance at the Development Site, a European Protected Species (EPS) Licence is required and an application for a licence to disturb or injure marine EPS will be applied for from Marine Directorate Licensing Operations Team (MD-LOT). An overview of the of the decision making process associated with the UXO activities is provided in **Section 2.1** and the methods associated with the licensable activities are detailed in **Section 2.2** and **Section 2.3.** This Risk Assessment is submitted in support of the EPS Licence application submitted by Moray West for UXO clearance and the use of acoustic deterrent devices (ADDs).

Whilst all known confirmed UXO (cUXO) have now been cleared by low order deflagration, there remains the potential for previously unidentified potential UXO (pUXO) to be encountered during the construction up to the Commercial Operation Date at the end of July 2025, when the commissioning of the Development will be completed, and depending upon their location these may need to be cleared. Any cUXO that was not identified in the UXO survey but may be encountered during the construction until the end of July 2025, must be removed from the areas in the vicinity of the WTGs and OSP foundations and

inter-array and offshore export cables before the construction of these key project elements can commence.

The number of cUXO that may need to be cleared cannot be known in advance, because any cUXO encountered at this stage of the project would, by definition, be UXO that were not identified in the previous UXO surveys and are therefore unknown until they are discovered during construction, operation and maintenance works. Therefore, for the purposes of this Risk Assessment, rather than specifying the maximum number of UXO that may be cleared, Moray West has instead specified the maximum number of low order deflagration attempts and the size of the donor charges that may be used (up to 20 deflagration attempts and up to 0.25kg donor charges).

In order to undertake this necessary activity, a European Protected Species (EPS) Licence is required from Marine Directorate Licensing Operations Team (MD-LOT) under the Conservation of Offshore Marine Habitats and Species Regulations 2017 for UXO clearance activities.

In addition, a a Marine Licence is required from Marine Directorate Licensing Operations Team (MD-LOT) under the Marine (Scotland) Act 2010 and the Marine and Coastal Access Act 2009 to undertake the UXO clearance within the Development Site. A separate application for a Marine Licence is submitted alongside this document.

The information contained within this report is presented in support of the EPS Licence application to MD-LOT for the UXO clearance works that may be required at the Development Site. This document is intended to provide the necessary information to MD-LOT (and statutory advisers, where relevant) to facilitate the EPS Licence decision-making process.

2 Description of the Proposed Works

The following section provides a description of the UXO clearance activities that may be required, including the maximum number of low order deflagration attempts and the size of the donor charges that would be used. As described in Section 1, all previously identified cUXO have already been cleared by low order deflagration and therefore the remaining UXO clearance activities described here can by definition not specify the type, size or location of any confirmed UXO that may be found during the remaining construction, operation or maintenance works and need to cleared. Therefore, the approach taken is to describe the potential for UXO, the methodology that would be used to clear any cUXO (low order deflagration) and to define the type and maximum number of low order deflagration attempts and size of the donor charges that would be used.

2.1 Potential for UXO

2.1.1 Background

All military technology has a baseline failure rate, meaning that a subset of all ordnance used will not function as the designer intended, either during training or operational use. Consequently, the totality of military activities and conflicts over the 20th century has resulted in munitions contamination of the marine environment, and now it is not uncommon to encounter UXO during intrusive seabed activities.

During WWII, the failure rate of aerially delivered bombs was at least 10%. In addition, bombs often missed targets or were dumped from aircraft to reduce weight (6 Alpha, 2022). During the conflicts of the 20th century, sea mines were deployed in significant quantities, and there was a common practice of dumping small arms ammunition at sea which occurred without regard to the accurate recording of dumping position (6 Alpha, 2022). This has resulted in a scenario where UXO, particularly WWII UXO, is extant in the marine environment in unknown locations and at a sufficiently high abundance to pose a significant threat to activities interacting with the seabed in the marine environment.

2.1.2 Potential UXO Sources

The potential for UXO to exist within the Development Site has been assessed through a desktop risk assessment (6 Alpha, 2022) and through experience on the pre-construction UXO clearance campaign, which has identified the following key UXO threats that may be encountered across the Development:

- Aerially delivered High Explosive (HE) bombs
- Projectiles (naval and anti-aircraft artillery (AAA))
- Torpedoes
- Naval mines
- Shipwreck related munitions

Table 2.1: Anticipated worst case UXO items for each category that could be encountered			
UXO item	**Ferrous Mass**	**Net explosive quantity (NEQ)**	**Dimensions**
6" Artillery Projectile	39.4kg	6kg	582mm x 152mm
15" Projectile	879kg	20.7kg	1,300mm x 381mm
60" Anti-Submarine Projectile	29.5kg	16kg	1,448mm x 305mm
Air dropped 500lb mine	226kg	89kg	900mm x 300mm
Air dropped 250lb mine	115kg	51kg	699mm x 254mm
10" Projectile	250kg	105kg	1000mm x 254mm
Luftmine B (LMB) magnetic influence mine	14kg	705kg	2640mm long x 635mm wide

2.1.3 Number of cUXO Cleared To Date

UXO surveys in the Moray West Site and OfTI Corridor were completed in February 2023, and these provided up-to-date information to inform UXO clearance activities. A total of 82 cUXO were cleared between April 2023 and September 2023, all using low order deflagration. Closeout reports have been submitted to MD-LOT as required by condition of the Marine Licences that permitted these works, and noise monitoring reports have also been submitted for the 31 UXO where noise monitoring was required to be undertaken.

2.2 The Moray West Approach

The process for dealing with any pUXO that may be encountered during construction until the end of July 2025 (Commercial Operations Date when the commissioning of the Development will be completed) will be the same as the process that was followed for the pUXO encountered during the UXO survey campaign and is described below.

In cases where the target is confirmed as non-UXO debris, the debris will be either recovered to the deck of the vessel for disposal onshore, or the debris will be repositioned on the seabed. Where debris could not be repositioned or recovered to the deck of the vessel, they will be avoided through re-routing. The same procedure would be followed for any debris encountered during construction, operation and maintenance.

In cases where the target is confirmed as UXO (cUXO), the preference will be to avoid this target where practicable. If avoidance was not possible, the target was subject to Explosive Ordnance Disposal (EOD) operations. There are three options for UXO disposal which can be used as part of EOD operations:

1. UXO clearance in situ – this is the preferred option for health and safety reasons;
2. Relocation of the UXO on the seabed and then clearance by deflagration – an example of when this would occur are in instances when clearance by deflagration in situ could potentially compromise the safety of existing nearby assets. In the instance where third party assets are situated nearby, Moray West will contact the third party prior to clearance activities in order to establish a safe distance between the asset and clearance site.; and
3. Recovery of the UXO to the deck of the vessel – this would be undertaken for small items of UXO e.g., hand grenades, or as a last resort for larger items should options 1 or 2 not be possible.

After clearance of the UXO by deflagration, an as left survey is conducted to confirm disposal of the target. The same procedure would be followed for any cUXO encountered during construction, operation and maintenance.

2.3 Licensable Activities (UXO Clearance Activities)

2.3.1 Identification Operations

Identification operations will utilise a Remotely Operated Vehicle (ROV) to localise, excavate and identify pUXO. The procedure is as follows:

1. The ROV spread will begin by covering a 10 x 10 m, centred on the target position, using electromagnetic sensors at a height of < 0.5 m above seabed.
2. Once the target is located, localised dredging works will commence and continue until the target is visible. Dredging will be carried out with the dredge-pump attached to the ROV until the target is free from sediment.
3. If the target is confirmed as non-UXO, the object will be checked for being of potential archaeological interest. If it is not of archaeological interest, the object will be relocated either to the vessel, or outside the 10 x 10 m box. This will ensure it is placed outside the clearance corridor.
4. The target location will then be inspected again with the electromagnetic sensor to make sure that no second target is hidden under the first target.
5. If a target inspection results in a confirmed UXO identification, it will be treated according to the protocol outlined below in Section 2.3.2

Dredging of targets will be carried out with a 4” dredge-pump excavation/jetting system (e.g., Tritech Merlin; see **Figure 2-1**) fitted on the ROV. Dredging will excavate up to 3 m (depth) of sediment and deposit it immediately adjacent to the excavated area. No sediment will be brought on the board the launch vessel.

Figure 2-1: Tritech Dredge Pump.

2.3.2 Explosive Ordnance Disposal Operations

The following describes the sequencing of the EOD operations. It should be noted that all EOD operations will be undertaken in accordance with the Marine Mammal Mitigation Protocol (MMMP) as included in **Appendix B**, and the information below is provided as a summary of that procedure only. Please see the full MMMP for all mitigation requirements.

UXO clearance may be undertaken at any point during the construction, until the end of July 2025. Any clearance works would take place during daylight hours and in sea state no greater than 3 (estimated working limits for disposal operations are wind speed no greater than 25 knots and wave height of 2.5 m). Firstly, after any identified pUXO targets have been inspected (after consideration of whether they can be avoided), the confirmed and unavoidable UXO targets will need to be cleared by deflagration. It is anticipated that two vessels will be required:

- an inspection/operations vessel from which the (ROV) will be deployed and
- a launch vessel.

The Acoustic Deterrent Device (ADD) and portable Passive Acoustic Monitoring System (PAM) equipment will be deployed from the operations vessel, along with the Marine Mammal Observers (MMOs) and PAM Operator (PAM-Op).

A 250 m radius exclusion zone shall be implemented around the confirmed UXO target, the position noted, and all relevant authorities notified.

Once the target inspections is complete, the vessel will return to the confirmed UXO target, and the geodetic position of the item will be correlated and confirmed with the Client Representative, survey team and EOD Superintendent, at which point the EOD system will be deployed by the ROV and placed in the optimum firing position.

Whichever EOD system is used by the EOD contractor, the system shall be safe and reliable, and will have undergone a proven safety and performance testing regime.

2.3.2.1 Deflagration

The UXO clearance method to be utilised during EOD operations at the Development Site is deflagration. Following confirmation by hand-diving or uncrewed vehicle that the anomaly is indeed a UXO requiring clearance by deflagration, the methodology below would be completed:

- A plastic casing would be attached directly to the UXO by hand by a diver or an uncrewed vehicle, containing the materials used to make-safe the UXO.
- Once environmental and safety mitigation has been applied, the initiation of the Deflagration will begin with the contents of the plastic casing causing a 'rapid burning' through the UXO.
- This begins the incineration of the UXOs contents which in-turn builds up a gas pressure whilst consuming the UXOs explosive contents.
- Once the contents ignite and the UXO reaches a critical pressure, the case bursts and the UXO is made safe.
- The methodologies employed allow for all the remains of the UXO to be concentrated at its original location.
- Once considered safe to do so, the remains of the neutralised UXO will be recovered from the seabed following deflagration for final safe disposal at an environmentally accredited site ashore..

After deflagration there will be residual UXO explosive fill remaining, some of which will remain within the UXO and some scattered around the item out to a distance of 1-2 m. The remnants within the UXO will be brought back to the vessel deck along with the UXO carcass, this will be recovered using the vessel crane and grab system. Any scattered remnants will be scooped up by the work-class Remotely Operated Vehicle (WROV) using a fine mesh net and also brought to the vessel deck. The recovery of the UXO fill within a short space of time will limit the release of any small amounts of the UXOs contents to the marine environment.

The recovered explosives are to be dealt with by storing them inside one of the explosive magazines held onboard the vessel. When the vessel arrives in port the explosives will be transported to a licensed incinerator facility for burning.

Although Deflagration is still a kinetic process, it has greatly reduced effects on the surrounding environment from those created during a clearance by detonation, i.e. detonating the UXO with the same explosive results the UXO was designed for.

2.3.2.2 Number and Size of Deflagration Donor Charges

For the reasons described above, it is not possible for Moray West to define the exact number of cUXO that may be encountered and need to be cleared. Therefore, this application and report takes the approach of describing the maximum number of deflagration donor charges that would be used, and the maximum size of each donor charge. This does therefore define the maximum number of cUXO that could

be cleared (because each cUXO would need at least one donor charge, so the total number of cUXO could not be greater than the total number of donor charges) but does not mean that the maximum number of cUXO would always be the same as the maximum number of donor charges (because more than one donor charge may be used for each cUXO).

Moray West would use a maximum number of 20 deflagration donor charges, with each donor charge having a maximum charge weight of 0.25kg.

2.3.3 Non-UXO Debris Clearance

In the event a target is identified as non-UXO (debris) by an EOD expert, a decision will be made regarding the threat of the object to construction activities, and the object will either be left in situ or relocated. This may be through re-location on the seabed at a pre-determined lay down area or through recovery to the vessel deck with subsequent disposal at an onshore disposal facility. The non-UXO debris may be transported to an alternative location hanging from a crane grab or "held" by the ROV in the water column. Otherwise, the non-UXO item (debris) will be recovered to the deck of the vessel for transport, depending on the size and weight of the target. Items relocated to the seabed will have their coordinates logged. Waste disposal onshore will be undertaken by a suitably registered and licensed contractor.

3 Existing Environment

3.1

Annex IV of the Habitats Directive lists all cetacean species as species of community interest in need of strict protection as EPS. Harbour porpoise *Phocoena phocoena* and bottlenose dolphin *Tursiops truncatus* are listed individually, while the remaining cetacean species are encapsulated in the Directive as "All other cetacea". Bottlenose dolphin and harbour porpoise are also listed on Annex II of the Habitats Directive and thus require Special Area of Conservation (SAC) designation.

Although seals are not considered under the EPS species, designated sites are included in the assessments. Therefore, due to the Dornoch Firth and Morrich More SAC, harbour seal has been included within the designated site assessments.

3.2 Species within the Moray Firth

A total of 19 cetacean species have been recorded in UK waters (Reid *et al.*, 2003). To date, a total of 14 cetacean species have been recorded alive within the Moray Firth (see **Table 3.1**). Other species have been found stranded within the Moray Firth area, but are not discussed here due to the uncertainty of the animals' location before death. Cetaceans found within the Moray Firth can be divided into three groups – those present all year, those that occur seasonally and those which are considered rare visitors.

The cetacean (EPS) species, based on SCANS-IV surveys (Gilles *et al*., 2023), a data review by Waggitt *et al*. (2019) and other data sources, that could be present in and around the UXO clearance areas are:

- Harbour porpoise *Phocoena phocoena*
- Bottlenose dolphin *Tursiops truncates*
- Common dolphin *Delphinus delphis*
- White-beaked dolphin *Lagenorhynchus albirostris*
- Minke whale *Balaenoptera acutorostrata*

Species that are considered 'occasional' or 'rare' in **Table 3.1** are included for illustration purposes only and have not been assessed further in this report. However, all mitigation in place will be applicable to all marine mammal species during the UXO clearance activities.

Table 3.1: List of cetaceans recorded within the Moray Firth (adapted from a variety of sources). Species included in this assessment are highlighted in bold.

Common name	Latin name	Occurrence in the Moray Firth
Harbour porpoise	***Phocoena phocoena***	**Common, all year**
Bottlenose dolphin	***Tursiops truncatus***	**Common, all year**

Table 3.1: List of cetaceans recorded within the Moray Firth (adapted from a variety of sources). Species included in this assessment are highlighted in bold.		
Common name	**Latin name**	**Occurrence in the Moray Firth**
Common dolphin	***Delphinus delphis***	**Common, seasonal**
White-beaked dolphin	***Lagenorhynchus albirostris***	**Common, seasonal**
Minke whale	***Balaenoptera acutorostrata***	**Common, seasonal**
Risso dolphin	*Grampus griseus*	Occasional
White-sided dolphin	*Lagenorhynchus acutus*	Occasional
Killer whale	*Orcinus orca*	Occasional
Pilot whale	*Globicephala melas*	Rare
Humpbacked whale	*Megaptera novaengliae*	Rare
Fin whale	*Balaenoptera physalus*	Rare
Sperm whale	*Physeter macrocephalus*	Rare
Northern bottlenose whale	*Hyperoodon ampullatus*	Rare
Beluga whale	*Delphinapterus leucas*	Rare

A comparison has been made between the results of the original Moray West Environmental Impact Assessment (EIA) Report 2018 and the results of the assessment based on the revised project design parameters. Overall, the results are generally the same as those presented in the Moray West EIA Report 2018.

3.3 Cetacean species potentially present in the Development Site

3.3.1 Harbour porpoise

Harbour porpoise are the most abundant cetacean species in Scottish waters (Reid *et al.* 2003; Gilles *et al.* 2023). They are also the most frequently encountered species in both visual and acoustic surveys in and around the proposed Moray West Offshore Wind Farm Site and are present throughout the Moray Firth all year (Moray West, 2018). The global population of harbour porpoise is listed in the International Union for Conservation of Nature (IUCN) Red List of Threatened Species as *Least Concern*; however, the current population trend is unknown (Braulik *et al.*, 2020). In the most recent 2013-2018 reporting by the Joint Nature Conservation Committee (JNCC), the overall assessment of Conservation Status was unknown and the overall trend in Conservation Status is also unknown (JNCC, 2019).

Since the Moray West EIA Report 2018, the harbour porpoise abundance estimate for the North Sea Management Unit (MU)[1] has been updated. The current estimate for the North Sea MU is 346,601 porpoise (95% Confidence Interval (CI): 289,498- 419,967; Coefficient of Variation (CV) = 0.09)), of which 159,632 animals are considered as UK portion (Inter-Agency Marine Mammal Working Group (IAMMWG), 2023). This is slightly higher than the MU reference population estimate used in the Moray West EIA (345,373, 95% CI: 246,526- 495,752). The density surface used in Moray West EIA was a 4x4 km grid surface density, created for Moray East (Moray Offshore Renewables Ltd, 2012). There is no updated surface density estimate available for harbour porpoise, and thus the same density estimate of 1.468 harbour porpoise per kilometre squared (km^2) is used in the impact assessment presented in this report. This is greater than the density estimate of 0.2813 harbour porpoise per km^2 for survey block CS-K which covers the Moray Firth, from Small Cetaceans in European Atlantic waters and the North Sea (SCANS) IV survey (Gilles *et al*., 2023) and density estimates of 0.368-0.481 / km^2 in July for the Moray Firth area in Waggitt *et al*. (2019).

3.2.2 Bottlenose dolphin

The Moray Firth is an important habitat to the resident population of bottlenose dolphin in the North Sea, which is in the Coastal East Scotland (CES) MU (Moray West, 2018; IAMMWG, 2021). Whilst occupation of the Moray Firth by this population varies between years, recent survey data has confirmed that approximately half of the estimated population occupy the area regularly (Graham *et al.*, 2016). Designation of the Moray Firth Special Areas of Conservation (SAC) provides protection of bottlenose dolphin and their habitat, with the aim of maintaining the FCS (SNH, 2006; Moray West, 2018). The resident bottlenose dolphin of the Moray Firth SAC predominantly utilise the nearshore environment. Habitat modelling of survey data indicates that the southern coastline of the Firth is particularly important habitat to this population (Thompson *et al.*, 2014). Based on the most recent 2013-2018 reporting by the JNCC, the overall Conservation Status for bottlenose dolphin is currently classified as unknown (JNCC, 2019).

Since the Moray West EIA, the estimated CES MU size for bottlenose dolphins has been updated. The current estimate for the CES MU is 224 dolphins (95% CI: 214- 234) (Arso Civil *et al.,* 2021; IAMMWG, 2023). This is slightly higher than the MU estimate used in the Moray West EIA (195, 95% CI: 164-224). The Moray Firth is also part of the wider Greater North Sea (GNS) MU for the bottlenose dolphin which has a current estimate is 1,885 dolphins (CV = 0.8; 95% CI = 476 – 7,461; IAMMWG, 2023).

The surface density estimate of 0.00048/km^2 used in Moray West EIA was a 4x4 km grid surface density, created for Moray West, revised from the density surface used for Moray East (Moray Offshore Renewables Ltd, 2012). There is no updated surface density estimate available for bottlenose dolphins. In the latest SCANS IV survey there were no sightings of bottlenose dolphin within the relevant survey block for Moray West (Gilles *et al*., 2023). However, as a precautionary approach the higher density estimate of

[1] Management Units (MUs) are agreed upon spatial scales at which the impacts of proposed activities on the UK's seven most common cetacean species are assessed by UK Statutory Nature Conservation Bodies (SNCBs)

0.0037 bottlenose dolphin per km^2 from the SCANS-III survey block S in the Moray Firth (Hammond *et al*., 2021), has been used in the assessments. This is greater than the density estimates of 0.001-0.002 / km^2 for the Moray Firth area in Waggitt *et al*. (2019).

3.2.3 White-beaked dolphin

White-beaked dolphin frequent the eastern extent of the Moray Firth year-round, predominantlyat depths of 50 – 100 m (Reid *et al*., 2003). The density of white-beaked dolphin in the waters inand around the Moray Firth (survey block CS-K) is 0.1352 animals/km^2 (Gilles *et al*., 2023). They are usually found in small groups of 10 or less but have also been observed in large groups of 10 and more. Based on the most recent 2013-2018 reporting by the JNCC, the overall Conservation Status and trend in Conservation Status for white-beaked dolphin is currently classified as unknown (JNCC, 2019).

There is a single MU for white-beaked dolphin, the Celtic and Greater North Seas (CGNS) MU. The reference population for white-beaked dolphin in the CGNS MU is 43,951 animals (CV = 0.22; 95% CI = 28,439 – 67,924; IAMMWG, 2023). The density estimates of up to 0.1352 animals/km^2 white-beaked dolphin per km^2 for the SCANS IV survey block CS-K has been used for the assessments, as this is greater than the Waggitt *et al*. (2019) density estimate of 0.123 /km^2.

3.2.4 Common dolphin

Common dolphin are abundant along shelf breaks and in deeper waters on the west coast of the UK and Europe (Reid *et al*., 2003). Recent data suggests an increasing occurrence of short-beaked common dolphin in the northern North Sea, including the Moray Firth (Robinson *et al.*, 2010; Moray West, 2018). Density estimates for this species occurring in the Moray Firth isapproximately 0.074 individuals/km^2 (Robinson *et al.*, 2010), which is roughly equivalent to density estimates in the waters west of Shetland (Hammond *et al*., 2021). Common dolphin are amongst the most gregarious cetacean species, often forming groups of 50 or more individuals, though groups of 200 or more are not uncommon (Robinson *et al.*, 2010). Based on the most recent 2013-2018 reporting by the JNCC, the overall Conservation Status and trend in Conservation Status for common dolphin is currently classified as unknown (JNCC, 2019).

Common dolphin were not recorded in survey block CS-K during the SCANS-IV survey (Gilles *et al*., 2023); therefore, the density estimate of 0.074 individuals/km^2 from Robinson *et al*. (2010) is used in the assessments. This is greater than density estimates of 0.024-0.044 / km^2 in July for the Moray Firth area in Waggitt *et al*. (2019). There is a single MU for common dolphin, the CGNS MU. The reference population for common dolphin in the CGNS MU is 102,656 animals (CV = 0.29; 95% CI = 58,932 – 178,822; IAMMWG, 2023).

3.2.5 Minke whale

Minke whale are wide-ranging baleen whales which are present in the Moray Firth primarily in the summer months (June – September) (Reid *et al.,* 2003; Hammond *et al.,* 2021). They often prefer water depths of up to 200 m and are often solitary or found in pairs, though they occasionally form larger groups (up to 15 individuals) while feeding. Based on the most recent 2013-2018 reporting by the JNCC, the overall Conservation Status and trend in Conservation Status for minke whale is currently classified as

unknown (JNCC, 2019). Minke whale are also one of the protected features of the Southern Trench Nature Conservation Marine Protected Area (NCMPA), through which the Offshore Export Cable Corridor passes. The Conservation Objectives of this site are to conserve the features, specifically to ensure "*minke whale in the Southern Trench NCMPA are not at significant risk from injury or killing, conserve the access to resources (e.g. for feeding) provided by the NCMPA for various stages of the minke whale life cycle, and conserve the distribution of minke whale within the site by avoiding significant disturbance*".

Since the Moray West EIA, the estimated CGNS MU size for minke whales has been updated. The current estimate for the CGNS MU is 20,118 whales (CV = 0.18; 95% CI: 14,061-28,786; IAMMWG, 2023). This is slightly lower than the MU estimate used in the Moray West EIA (23,528, 95% CI: 13,989-39,572). The density estimate for the SCANS-IV survey block CS-K was 0.0116/km^2 (Gilles *et al.*, 2023). The density estimates in Waggitt *et al.* (2019) ranges from of 0.008-0.023 / km^2 in July for the Moray Firth area. Therefore, as a precautionary approach, density estimate of 0.023 / km^2 has been used in the assessments.

3.2.6 Summary

The density and abundance of the cetacean species which regularly occur in the Moray Firth is summarised in **Table 3.2.** Reference population for harbour porpoise is the North Sea MU (IAMMWG, 2023). The reference population for bottlenose dolphin is the CES MU, the reference population for common dolphin, white-beaked dolphin and minke whale is CGNS MU (IAMMWG, 2023; **Table 3.2**).

Table 3.2: Density and abundance estimates for the five regularly occurring cetacean species in the Moray Firth

Species	Density estimates (individuals/km^2)	Estimated population abundance in the relevant MU	References
Harbour porpoise	1.468*	346,601	Moray West (2018); IAMMWG (2023)
Bottlenosedolphin	0.0037	224	Hammond et al. (2021); Arso Civil et al. (2021); IAMMWG (2023)
White-beaked dolphin	0.1352	43,951	Gilles *et al.* (2023); IAMMWG (2023)
Common dolphin	0.074	102,656	Robinson *et al.* (2010); IAMMWG (2023)
Minke whale	0.023	20,118	Waggitt *et al.* (2019); IAMMWG (2023)

** Maximum density cell within the Development Site*

4 Potential Impacts for Marine Mammals

Potential impacts assessed for marine mammals during UXO clearance are:

- permanent change in hearing sensitivity / auditory injury (Permanent Threshold Shift (PTS)) from underwater noise;
- temporary change in hearing sensitivity (Temporary Threshold Shift (TTS)) from underwater noise;
- disturbance from underwater noise from Low order clearance;
- potential disturbance from ADD;
- increased collision risk and disturbance from vessels;
- changes to water quality; and
- changes to prey species.

The marine mammal impact assessments have been based on the worst-case for using donor charges with a maximum charge weight of 0.25kg (NEQ) for up to 20 low-order deflagration attempts.

The severity of the consequences of UXO clearance will depend on many variables, but principally, on the charge weight and its proximity to the receptor. The marine mammal impact assessment methodology used in this section is provided in **Table 4.1**.

Table 4.1: Definitions of levels of impact used for potential impacts on marine mammals

	Permanent Effect	Temporary Effect
High	Assessment indicates that >1% of the reference population are anticipated to be exposed to the effect.	Assessment indicates that >10% of the reference population are anticipated to be exposed to the effect.
Moderate	Assessment indicates that between >0.01% and <=1% of the reference population anticipated to be exposed to effect.	Assessment indicates that between >5% and <=10% of the reference population anticipated to be exposed to effect.
Low	Assessment indicates that between >0.001 and <=0.01% of the reference population anticipated to be exposed to effect.	Assessment indicates that between >1% and <=5% of the reference population anticipated to be exposed to effect.
Negligible	Assessment indicates that <=0.001% of the reference population anticipated to be exposed to effect	Assessment indicates that <=1% of the reference population anticipated to be exposed to effect.

Underwater noise has the potential to impact marine mammals if the frequency is within their hearing range (Table 4.2~~Table 4.2~~) and / or the sound levels are greater than thresholds for the species (**Table 4.4)** (Southall *et al*., 2019).

The potential for auditory injury is not just related to the level of the underwater sound and its frequency relative to the hearing bandwidth of the animal, but is also influenced by the duration of exposure.

Table 4.2 Marine mammal hearing ranges (from Southall *et al*., 2019)

Species Hearing Group	Generalised Hearing Range
Harbour porpoise Very high-frequency cetaceans (VHF)	275 Hz to 160 kHz
Bottlenose dolphin and white-beaked dolphin High-frequency cetaceans (HF)	150 Hz to 160 kHz
Minke whale Low-frequency cetaceans (LF)	7 Hz to 35 kHz
Grey seal and harbour seal Phocid carnivores in water (PCW)	50 Hz to 86 kHz

Southall *et al*. (2019) gives individual criteria based on whether the noise source is considered impulsive or non-impulsive. Southall *et al*. (2019) categorises impulsive noises as having high peak sound pressure, short duration, fast rise-time and broad frequency content at source, and non-impulsive sources as steady-state noise. Seismic airguns are considered impulsive noise sources. Sonars, vessels and other low-level continuous noises are considered non-impulsive. A non-impulsive noise does not necessarily have to have a long duration.

Southall *et al*. (2019) presents single strike, unweighted peak criteria (SPL_{peak}) and cumulative (i.e. more than a single sound impulse) weighted sound exposure criteria (SEL_{cum}) for both permanent threshold shift (PTS), where unrecoverable hearing damage may occur, and temporary threshold shift (TTS), where a temporary reduction in hearing sensitivity may occur in individual receptors (Table 4.3~~Table 4.3~~).

The assessments are based on the Southall *et al*. (2019) impact criteria which uses thresholds and weightings in relation to the different marine mammal species hearing sensitivity (Table 4.3~~Table 4.3~~). The thresholds indicate the risk of PTS and TTS in species of marine mammal that could be present in and around the UXO clearance areas. Note that the Southall *et al*. (2019) Marine Mammal Noise Exposure Criteria are the same as the National Marine and Fisheries Service (NMFS) (2018) criteria, although Southall *et al*. (2019) renames the species groupings: Medium-Frequency (MF) Cetaceans are now classed as High-Frequency (HF) Cetaceans, and previous HF Cetaceans as Very High Frequency (VHF) Cetaceans (Table 4.4~~Table 4.4~~).

The Sound Exposure Level (SEL) criteria are weighted, which corrects the sound level based on the sensitivity of the receiver, for example, harbour porpoise are less sensitive to low frequency sound than minke whales. The weighting takes that difference into account. Southall *et al.* (2019) also includes criteria based on peak Sound Pressure Level (SPL_{peak}), which are unweighted and do not take species sensitivity into account.

Table 4.3: Marine mammal threshold and criteria for underwater noise (from Southall *et al.*, 2019)

Species Hearing Group	Unweighted SPL_{peak} (dB re 1 µPa)		Weighted SEL_{cum} (dB re 1 μPa^2s)			
	Impulsive		Impulsive		Non-impulsive	
	PTS	TTS	PTS	TTS	PTS	TTS
Harbour porpoise Very high-frequency cetaceans (VHF)	202	196	155	140	173	153
White-beaked dolphin High-frequency cetaceans (HF)	230	224	185	170	198	178
Minke whale Low-frequency cetaceans (LF)	219	213	183	168	199	179

There are currently no agreed thresholds and criteria for disturbance from underwater noise. However, unweighted impulsive single-strike criteria from Lucke *et al*. (2009) for behavioural response in harbour porpoise, based on impulsive seismic airgun stimuli, is:

- 145 dB re 1 μPa^2s (SEL_{ss})

Please note that both Sound Pressure Level (SPL) and Sound Exposure Level (SEL) values are included in the results, which are specific to respective criteria used, and should not be confused or compared directly. All decibel SPL values are referenced to 1 µPa; all SEL values are referenced to 1 μPa^2s.

4.1 UXO Underwater Noise Modelling

A number of UXO devices with a range of charge weights (or quantity of contained explosive) may be present within the Development Site. These may need to be removed during construction as required. There are expected to be a variety of explosive types, many of which are likely to have been subject to degradation or burying over time. Two otherwise identical explosive devices are likely to produce different blasts in the case where one has spent an extended period on the seabed..

A comparison has been made with the modelling results produced for the Moray East Offshore Windfarm (OWF) UXO clearance (Moray East, 2019) investigated by Subacoustech Environmental Ltd. Comparisons

have also been made to similar projects (Seagreen Wind Energy Ltd, 2021; Dogger Bank B; **Appendix C**) to ensure consistency and realistic impacts have been presented.

4.1.1 Low-order clearance

Deflagration is an alternative technique to high-order clearance, which reduces the noise impacts. This method results in a 'low order' burn of the explosive material in a UXO, which destroys but does not detonate the internal explosive.

Deflagration is a safer technique for UXO disposal as it is intended to avoid the high pressures associated with an explosion, which would lead to an increased risk of adverse effects to marine life. Where the UXO device cannot be moved, deflagration represents the best-case scenario in respect to environmental effects.

Where the technique proceeds as intended, it is still not without noise impact. The process requires an initial shaped explosive charge, typically less than 250 g, to breach the casing and ignite the internal HE material without full detonation. The shaped charge and burn will both produce noise, although it will be significantly less than a high-order detonation. It may not destroy all of the HE, necessitating further deflagration events or collection of the remnants.

Underwater noise modelling for low-order clearance has been undertaken for Erebus OWF (Erebus Floating OWF, 2021 and Seagreen (Seagreen Wind Energy Ltd, 2021) (**Appendix C**) which will be applied to the assessment.

4.2 PTS from UXO clearance

All species of cetaceans rely on sonar for navigation, finding prey and communication; they are therefore highly sensitive to permanent hearing damage (Southall et al., 2007). The MMMP for UXO to reduce the risk of PTS in marine mammals is presented in **Appendix B**.

The risk of PTS in marine mammals would be reduced by using low-order clearance such as deflagration for the clearance of the UXOs. The maximum predicted impact ranges for PTS in harbour porpoise, bottlenose dolphin, white-beaked dolphin, common dolphin and minke whale, from possible charge weights (NEQ) up to 0.25 kg for low-order clearance are presented in **Table 4.4**.

Table 4.4: The maximum predicted impact ranges (impact area) for PTS in marine mammals from a range of possible charge weights for low-order clearance

Species	PTS Criteria and Threshold (Southall *et al.*, 2019)	Possible charge weight for low-order clearance*
		0.25kg
Harbour porpoise (VHF)	PTS SPL_{peak} 202 dB re 1 µPa Unweighted Impulsive criteria	0.99 km (3.08km^2)
	PTS SEL 155 dB re 1 µPa^{2}s Weighted Impulsive criteria	0.08 km (0.02km^2)

Table 4.4: The maximum predicted impact ranges (impact area) for PTS in marine mammals from a range of possible charge weights for low-order clearance		
Species	**PTS Criteria and Threshold (Southall *et al.*, 2019)**	**Possible charge weight for low-order clearance***
		0.25kg
Bottlenose dolphin, white-beaked dolphin and common dolphin (HF)	PTS SPL_{peak} 230 dB re 1 µPa Unweighted Impulsive criteria	0.06 km (0.011km²)
	PTS SEL 185 dB re 1 µPa²s Weighted Impulsive criteria	<0.01 km (0.0003km²)
Minke whale (LF)	PTS SPL_{peak} 219 dB re 1 µPa Unweighted Impulsive criteria	0.17 km (0.091km²)
	PTS SEL 183 dB re 1 µPa²s Weighted Impulsive criteria	0.23 km (0.17km²)

** based on Erebus Floating OWF (2021) Subacoustech modelling of low-order UXO clearance. UXO modelling is not site specific and therefore is appropriate to use for the Development Site.*

4.2.1 Harbour porpoise

The maximum number of harbour porpoise that could potentially be at risk of PTS for low-order clearance are presented in **Table 4.5**, as well the resultant impact.

Table 4.5: The maximum number of harbour porpoise that could be at risk of PTS from the charge weights for low-order clearance, and the resultant impact (based on Table 4.1)			
Species	**PTS criteria and maximum impact area**	**Maximum number of harbour porpoise and % of reference population based on maximum potential impact area**	**Impact**
Harbour porpoise	PTS SPL_{peak} (0.25kg = 3.08 km²)	4.5 harbour porpoise (0.0013% of North Sea MU) based on site survey density 1.468/km²	Low (i.e. 0.01% to 0.001% of the North Sea MU reference population anticipated to be exposed to the permanent impact).
	PTS SEL (0.25kg = 0.02 km²)	0.03 harbour porpoise (0.00001% of North Sea MU) based on site survey density 1.468/km²	Negligible (i.e. less than 0.001% of the North Sea MU reference population anticipated to be exposed to the permanent impact).

The impact of the potential risk of physical injury or permanent auditory injury / change in hearing sensitivity (PTS) to harbour porpoise as a result of any underwater UXO clearance has been assessed as negligible to low (as shown in **Table 4.5**). However, the impact will be less when taking into account the proposed mitigation within the MMMP.

4.2.2 Bottlenose dolphin

The maximum number of bottlenose dolphin that could potentially be at risk of PTS for low-order clearance are presented in **Table 4.6**, as well the resultant impact.

Table 4.6: The maximum number of bottlenose dolphin that could be at risk of PTS from the charge weights for low-order clearance, and the resultant impact (based on Table 4.1)

Species	PTS criteria and maximum impact area	Maximum number of bottlenose dolphin and % of reference population based on maximum potential impact area	Impact
Bottlenose dolphin	PTS SPL_{peak} (0.25kg = 0.011 km^2)	0.00004 bottlenose dolphin (0.000002% of CES MU) based on the density estimate of 0.0037/km^2	Negligible (i.e. 0.001% or less of the reference population anticipated to be exposed to the permanent impact).
	PTS SEL (0.25kg = 0.0003 km^2)	0.000001 bottlenose dolphin (0.0000005% of CES MU) based on the density estimate of 0.0037/km^2	Negligible (i.e. 0.001% or less of the reference population anticipated to be exposed to the permanent impact).

The potential risk of physical injury and permanent auditory injury / change in hearing sensitivity (PTS) to bottlenose dolphin as a result of any underwater UXO clearance has been assessed as having a negligible impact (as shown in **Table 4.6**).

It is also important to note that the assessments for bottlenose dolphin have been based on a very precautionary approach, as there is currently no density estimate for the UXO clearance areas. In addition, bottlenose dolphin are more likely to be present close to shore, rather than the offshore areas. Therefore, the risk of PTS to bottlenose dolphin is likely to be less than in the worst-case assessment.

4.2.3 White-beaked dolphin

The maximum number of white-beaked dolphin that could potentially be at risk of PTS for low-order clearance are presented in **Table 4.7**, as well the resultant impact.

Table 4.7: The maximum number of white-beaked dolphin that could be at risk of PTS from the charge weights for low-order clearance, and the resultant impact (based on Table 4.1)			
Species	**PTS criteria and maximum impact area**	**Maximum number of white-beaked dolphin and % of reference population based on maximum potential impact area**	**Impact**
White-beaked dolphin	PTS SPL_{peak} (0.25kg = 0.011 km^2)	0.0015 white-beaked dolphin (0.000003% of CGNS MU) based on the density estimate of 0.1352/km^2	Negligible (i.e. 0.001% or less of the CGNS MU reference population anticipated to be exposed to the permanent impact).
	PTS SEL (0.25kg = 0.0003 km^2)	0.00004 white-beaked dolphin (0.00000009% of CGNS MU) based on the density estimate of 0.1352/km^2	Negligible (i.e. 0.001% or less of the CGNS MU reference population anticipated to be exposed to the permanent impact).

The impact for the potential risk of physical injury and permanent auditory injury / change in hearing sensitivity (PTS) to white-beaked dolphin as a result of any underwater UXO clearance has been assessed as negligible (as shown in **Table 4.7**).

4.2.4 Common dolphin

The maximum number of common dolphin that could potentially be at risk of PTS for low-order clearance are presented in **Table 4.8**, as well the resultant impact.

Table 4.8: The maximum number of common dolphin that could be at risk of PTS from the charge weights for low-order clearance, and the resultant Impact (based on Table 4.1)			
Species	**PTS criteria and maximum impact area**	**Maximum number of common dolphin and % of reference population based on maximum potential impact area**	**Impact**
Common dolphin	PTS SPL_{peak} (0.25kg = 0.011 km^2)	0.0008 common dolphin (0.0000008% of CGNS MU) based on the density estimate of 0.074 /km^2	Negligible (i.e. 0.001% or less of the CGNS MU reference population anticipated to be exposed to the permanent impact).
	PTS SEL (0.25kg = 0.0003 km^2)	0.00002 common dolphin (0.00000002% of CGNS MU) based on the density estimate of 0.074 /km^2	Negligible (i.e. 0.001% or less of the CGNS MU reference population anticipated to be exposed to the permanent impact).

The impact has been as assessed as negligible for the potential risk of physical injury and permanent auditory injury / change in hearing sensitivity (PTS) to common dolphin as a result of any underwater UXO clearance (as shown in **Table 4.8**).

4.2.5 Minke whale

The maximum number of minke whale that could potentially be at risk of PTS for low-order clearance are presented in **Table 4.9**, as well the resultant impact.

Table 4.9: The maximum number of minke whale that could be at risk of PTS from the charge weights for low-order clearance, and the resultant Impact (based on Table 4.1)

Species	PTS criteria and maximum impact area	Maximum number of minke whale and % of reference population based on maximum potential impact area	Impact
Minke whale	PTS SPL_{peak} (0.25kg = 0.091 km^2)	0.002 minke whale (0.00001% of CGNS MU) based on the density estimate of 0.023/km^2	Negligible (i.e. 0.001% or less of the CGNS MU reference population anticipated to be exposed to the permanent impact).
	PTS SEL (0.25kg = 0.17 km^2)	0.004 minke whale (0.00002% of CGNS MU) based on the density estimate of 0.023/km^2	Negligible (i.e. 0.001% or less of the CGNS MU reference population anticipated to be exposed to the permanent impact).

The impact has been assessed as negligible for the potential risk of physical injury and permanent auditory injury / change in hearing sensitivity (PTS) to minke whale as a result of any underwater UXO clearance (as shown in **Table 4.9**).

4.3 TTS from UXO clearance

Marine mammals within the potential impact area are considered to have limited capacity to avoid such impacts, although any impacts on marine mammals would be temporary and they would be expected to return to the area once the activity had ceased.

The MMMP (**Appendix B**) outlines the mitigation measures to reduce the risk of PTS in marine mammals which would also reduce the number of animals at risk of TTS.

The risk of TTS in all marine mammals would be reduced by using low-order clearance such as deflagration for the clearance of the UXOs (**Table 4.10**). The maximum predicted impact ranges for TTS from possible charge weights (NEQ) for low-order clearance are presented in **Table 4.10**.

Table 4.10: The maximum predicted impact ranges for TTS in marine mammals from a range of possible charge weights for low-order clearance

Species	TTS Criteria and Threshold (Southall *et al.*, 2019)	Possible charge weights for low-order clearance*
		0.25 kg
Harbour porpoise (VHF)	TTS SPL_{peak} 196 dB re 1 µPa Unweighted Impulsive criteria	0.99 km (3.08km^2)
	TTS SEL 140 dB re 1 μPa^2s	0.75 km (1.8km^2)

Table 4.10: The maximum predicted impact ranges for TTS in marine mammals from a range of possible charge weights for low-order clearance		
Species	**TTS Criteria and Threshold (Southall *et al.*, 2019)**	**Possible charge weights for low-order clearance***
		0.25 kg
	Weighted Impulsive criteria	
Bottlenose dolphin, white-beaked dolphin and common dolphin (HF)	TTS SPL_{peak} 224 dB re 1 µPa Unweighted Impulsive criteria	0.1 km ($0.03km^2$)
	TTS SEL 170 dB re 1 μPa^2s Weighted Impulsive criteria	0.02 km ($0.001km^2$)
Minke whale (LF)	TTS SPL_{peak} 213 dB re 1 µPa Unweighted Impulsive criteria	0.32 km ($0.32km^2$)
	TTS SEL 168 dB re 1 μPa^2s Weighted Impulsive criteria	3.2 km ($32.17km^2$)

** based on Erebus Floating OWF (2021) Subacoustech modelling of low-order UXO clearance. UXO modelling is not site specific and therefore is appropriate to use for the Development Site.*

4.3.1 Harbour porpoise

The risk of TTS would be reduced by using low-order clearance such as deflagration for the clearance of the UXOs. The maximum number of harbour porpoise that could potentially be at risk of TTS for low-order clearance are presented in **Table 4.11**, as well the resultant impact.

Table 4.11: The maximum number of harbour porpoise that could be at risk of TTS from the charge weights for low-order clearance, and the resultant impact (based on Table 4.1)			
Species	**TTS criteria and maximum impact area**	**Maximum number of harbour porpoise and % of reference population based on maximum potential impact area**	**Impact**
Harbour porpoise	TTS SPL_{peak} ($0.25km = 3.08km^2$)	3.1 harbour porpoise (0.001% of North Sea MU) based on site survey density $1.468/km^2$	Negligible (i.e. less than 1% of the North Sea MU reference population anticipated to be exposed to the temporary impact).
	TTS SEL ($0.25km = 1.8km^2$)	2.6 harbour porpoise (0.0007% of North Sea MU) based on site survey density $1.468/km^2$	Negligible (i.e. less than 1% of the North Sea MU reference population anticipated to be exposed to the temporary impact).

The impact of the potential risk of TTS to harbour porpoise as a result of any underwater UXO clearance has been assessed as negligible (as shown in **Table 4.11**).

4.3.2 Bottlenose dolphin

The maximum number of bottlenose dolphin that could potentially be at risk of TTS for low-order clearance are presented in **Table 4.12**, as well the resultant impact.

Table 4.12: The maximum number of bottlenose dolphin that could be at risk of TTS from the charge weights for low-order clearance, and the resultant effect (based on Table 4.1)

Species	TTS criteria and maximum impact area	Maximum number of bottlenose dolphin and % of reference population based on maximum potential impact area	Impact
Bottlenose dolphin	TTS SPL_{peak} (0.25km = 0.03km²)	0.0001 bottlenose dolphin (0.00005% of CES Sea MU) based on density estimate of 0.0037/km²	Negligible (i.e. less than 1% of the CES MU reference population anticipated to be exposed to the temporary impact).
	TTS SEL (0.25km = 0.001km²)	0.000005 bottlenose dolphin (0.000002% of CES MU) based on density estimate of 0.0037/km²	Negligible (i.e. less than 1% of the CES MU reference population anticipated to be exposed to the temporary impact).

The impact of the potential risk of TTS to bottlenose dolphin as a result of any underwater UXO clearance has been assessed as negligible (as shown in **Table 4.12**).

4.3.3 White-beaked dolphin

The maximum number of white-beaked dolphin that could potentially be at risk of TTS for low-order clearance are presented in **Table 4.13**, as well the resultant impact.

Table 4.13: The maximum number of white-beaked dolphin that could be at risk of TTS from the charge weights for low-order clearance, and the resultant impact (based on Table 4.1)

Species	TTS criteria and maximum impact area	Maximum number of white-beaked dolphin and % of reference population based on maximum potential impact area	Impact
White-beaked dolphin	TTS SPL_{peak} (0.25km = 0.03km²)	0.004 white-beaked dolphin (0.00001% of CGNS MU) based on density estimate of 0.1352/km²	Negligible (i.e. less than 1% of the CGNS MU reference population anticipated to be exposed to the temporary impact).

Table 4.13: The maximum number of white-beaked dolphin that could be at risk of TTS from the charge weights for low-order clearance, and the resultant impact (based on Table 4.1)			
Species	**TTS criteria and maximum impact area**	**Maximum number of white-beaked dolphin and % of reference population based on maximum potential impact area**	**Impact**
	TTS SEL (0.25km = 0.001km^2)	0.0002 white-beaked dolphin (0.0000004% of CGNS MU) based on density estimate of 0.1352/km^2	Negligible (i.e. less than 1% of the CGNS MU reference population anticipated to be exposed to the temporary impact).

The impact of the potential risk of TTS to white-beaked dolphin as a result of any underwater UXO clearance has been assessed as negligible (as shown in **Table 4.13**).

4.3.4 Common dolphin

The maximum number of common dolphin that could potentially be at risk of TTS for low-order clearance are presented in **Table 4.14**, as well the resultant impact.

Table 4.14: The maximum number of common dolphin that could be at risk of TTS from the charge weights for low-order clearance, and the resultant impact (based on Table 4.1)			
Species	**TTS criteria and maximum impact area**	**Maximum number of common dolphin and % of reference population based on maximum potential impact area**	**Impact**
Common dolphin	TTS SPL_{peak} (0.25km = 0.03km^2)	0.002 common dolphin (0.000002% of CGNS Sea MU) based on density estimate of 0.074/km^2	Negligible (i.e. less than 1% of the CGNS MU reference population anticipated to be exposed to the temporary impact).
	TTS SEL (0.25km = 0.001km^2)	0.0001 common dolphin (0.0000001% of CGNS MU) based on density estimate of 0.074/km^2	Negligible (i.e. less than 1% of the CGNS MU reference population anticipated to be exposed to the temporary impact).

The impact for the potential risk of TTS to common dolphin as a result of any underwater UXO clearance has been assessed as negligible (as shown in **Table 4.14**).

4.3.5 Minke whale

The maximum number of minke whale that could potentially be at risk of TTS for low-order clearance are presented in **Table 4.15**, as well the resultant impact.

Table 4.15: The maximum number of minke whale that could be at risk of TTS from the charge weights for low-order clearance, and the resultant impact (based on Table 4.1)			
Species	**TTS criteria and maximum impact area**	**Maximum number of minke whale and % of reference population based on maximum potential impact area**	**Impact**
Minke whale	TTS SPL_{peak} (0.25km = 0.32km²)	0.007 minke whale (0.00004% of CGNS Sea MU) based on density estimate of 0.023/km²	Negligible (i.e. less than 1% of the CGNS MU reference population anticipated to be exposed to the temporary impact).
	TTS SEL (0.25km = 32.17km²)	0.7 minke whale (0.004% of CGNS MU) based on density estimate of 0.023/km²	Negligible (i.e. less than 1% of the CGNS MU reference population anticipated to be exposed to the temporary impact).

The impact for the potential risk of TTS to minke whale as a result of any underwater UXO clearance has been assessed as negligible (as shown in **Table 4.15**).

4.4 Potential disturbance for low-order deflagration

The potential disturbance for low-order clearance using deflagration is currently unknown; however, as a precautionary approach it has been assumed that there could be an estimated worst-case of 5 km disturbance range (78.54 km²) including vessels[2]. As a worst-case, marine mammals could be temporarily disturbed from this area for up to 20 days across the UXO campaign, assuming one day for each of the 20 deflagration donor charges. Using the 5 km disturbance range for the temporary disturbance of all marine mammal species is a precautionary approach to the assessments.

The impact for temporary disturbance from low-order clearance such as deflagration has been assessed as **negligible** for harbour porpoise, bottlenose dolphin, white-beaked dolphin, common dolphin and minke whale (**Table 4.16**), with 1% or less of the reference population anticipated to be exposed to the effect (**Table 4.1**).

[2] This figure is based on expert judgement, based on estimated disturbance from vessels and low-order deflagration.

Table 4.16: The maximum number (based on Table 4.1), and impact of marine mammals that could be disturbed during low-order clearance (including vessels)	
Species	**Low-order clearance Temporary disturbance 5km (78.54 km²)**
Harbour porpoise	114.7 harbour porpoise (0.03% of North Sea MU) Impact = negligible
Bottlenose dolphin	0.3 bottlenose dolphin (0.13% of CES MU) Impact = negligible
White-beaked dolphin	10.6 white-beaked dolphin (0.02% of CGNS MU) Impact = negligible
Common dolphin	5.8 common dolphin (0.01% of CGNS MU) Impact = negligible
Minke whale	1.8 minke whale (0.009% of CGNS MU) Impact = negligible

4.5 Potential disturbance from ADD

As outlined in the MMMP (**Appendix C**), Moray West will use Acoustic Deterrence Devices (ADDs) to mitigate the risk of physical or auditory injury to cetaceans from the UXO clearance; the ADD will be used to ensure marine mammals are beyond the maximum potential impact range for PTS. The ADD will be activated at the appropriate time during the marine mammal observations of the 1 km radius monitoring area prior to any UXO clearance..

4.6.1 Efficacy of ADDs

Based on a detailed review and assessment as set out below, it is proposed to use the Lofitech seal scarer. The Lofitech seal scarer has successfully been used in a number of projects for a range of industries, including for aquaculture projects and the offshore wind industry. The Lofitech device has been designed to have a source noise level of 189 dB, with numerous field measurements confirming the device to have recorded source levels of 179 to 194 dB (Coram *et al.,* 2014) with a narrow band frequency output between 10 kHz and 20 kHz, with a peak at 15 kHz (McGarry *et al*., 2017).

Overall, there is good evidence for the effective deterrence ranges of the ADDs on harbour porpoises and harbour seals, but less available for minke whales and none for dolphin species (McGarry *et al*., 2020). The evidence available suggests that the Lofitech is highly effective in deterring harbour porpoise to at least 7.5 km (i.e., near exclusion) with some deterrence observed to 15 km range (Brandt *et al*., 2013a; Brandt *et al*., 2013b). A recent study also showed strong deterrence from a single 15 min ADD exposure,

including >50% chance of a porpoise response at distances up to 21.7 km within the 3 hours after exposure (Thompson *et al*., 2020). For minke whale, consistent avoidance to a 15 min exposure has been reported to >1 km, with several animals continuing to swim further away to a distance of between c. 3 km and 4.5 km (McGarry *et al*., 2017). Deterrence to ~1 km has been reported in harbour seals (Gordon *et al.,* 2015; Gordon *et al*., 2019), with suggestions that this can also be applied to grey seals (Sparling *et al*., 2015).

4.6.2 Planned ADD Mitigations for UXO Clearance

ADD use for Low Order Clearance Events

For low-order clearance, ADD would be activated for 11 minutes, during which harbour porpoise would move at least 0.99 km away, based on precautionary swimming speed of 1.5m/s (Otani *et al*., 2000), dolphin species would move at least 1.003 km away, based on precautionary swimming speed of 1.52m/s (Bailey and Thompson, 2006), and minke whale would move 1.518 km, based on swimming speed of 2.3m/s (Boisseau *et al.,* 2021).

Distances have been based on precautionary swimming speed of 1.5m/s for harbour porpoise (Otani *et al*., 2000); however, Kastelein *et al*. (2018) recorded swimming speeds of 1.97m/s in harbour porpoise during playbacks of pile driving sounds.

4.6.3 Assessment of Disturbance due to ADD use

Based on the flee speeds of each species group (as noted above, and based on 11 minutes of ADD activation, the following disturbance ranges and areas of effect have been used to inform the below assessment[3];

- Harbour porpoise would flee to 0.99km from the ADD (equating to a disturbance area of 3.08km^2);
- Bottlenose dolphin, common dolphin, and white-beaked dolphin would flee to 1.003km from the ADD (equating to a disturbance area of 3.16km^2); and
- Minke whale would flee to 1.518km from the ADD (equating to a disturbance area of 7.24km^2).

The impact for disturbance from ADD has been assessed as negligible (with 1% or less of the reference population effected as defined in **Table 4.1**) for harbour porpoise, bottlenose dolphin, white-beaked dolphin, common dolphin and minke whale (**Table 4.17**).

ADD would only be activated for the minimum time required to ensure effective mitigation and would only be deployed as a worst case on up to 20 days, based on one deflagration attempt per day as a result of UXO clearance that may be required during construction until the end of July 2025. Therefore, ADD activation will not result in negligible disturbance of marine mammals.

[3] Disturbance area assumes the flee range is the radius of a circle

Table 4.17: The maximum number of marine mammals that could be temporary disturbed during ADD activation, and the resultant impact (based on Table 4.1)	
Species	**Low-order clearance**
	11 minutes
Harbour porpoise	4.5 harbour porpoise (0.001% of North Sea MU) Impact = negligible
Bottlenose dolphin	0.01 bottlenose dolphin (0.006% of CES population) Impact = negligible
White-beaked dolphin	0.4 white-beaked dolphin (0.001% of CGNS MU) Impact = negligible
Common dolphin	0.2 common dolphin (0.0002% of CGNS MU) Impact = negligible
Minke whale	0.2 minke whale (0.0008% of CGNS MU) Impact = negligible

It should be noted that the disturbance as a result of ADD activation is within the maximum impact range assessed for TTS / disturbance from UXO clearance and is therefore not an additive effect to the overall area of potential disturbance.

4.6 Impacts due to an Increase in Vessel Presence

4.6.4 Increased Risk of Collision

There is the potential for a small number of vessels to be required for the UXO clearance works, ranging from large vessels to small craft. Dynamic positioning is likely to be the most appropriate method for maintaining location during clearance works.

Marine mammals are able to detect and avoid vessels, although vessel strikes are known to occur. However, it is unlikely that marine mammals present in the UXO clearance area would be at increased collision risk with vessels, as the vessels would be stationary or slow moving. In addition, the number of vessels moving to and from the sites would be very small compared to the existing vessel movements in and around the area. All vessel operators will use good practice to reduce any risk of collisions with marine mammals as outlined in the Scottish Marine Wildlife Watching Code[4]. Therefore, the potential impact for any increased collision risk during the proposed UXO clearance has been assessed as negligible.

[4] *Available at: https://www.nature.scot/professional-advice/land-and-sea-management/managing-coasts-and-seas/scottish-marine-wildlife-watching-code*

Marine mammals present within or around the UXO clearance area are likely to be habituated to the presence of vessels given the existing levels of marine traffic and would therefore be expected to detect and avoid vessels.

4.6.5 Disturbance from Vessels

Disturbance from underwater noise and the presence of vessels is likely to be restricted to the area around the vessel. For example, underwater noise modelling for the East Anglia TWO ES (SPR, 2019), indicated that the impact range for TTS / fleeing response for marine mammals, including harbour porpoise, dolphin species, minke whale, grey and harbour seal, was less than 100 m for large and medium sized vessels. Therefore, any potential disturbance as a result of vessel noise or the presence of vessels associated with the UXO clearance work would be less than the area of potential disturbance assessed for in **Section 4.2**. Also, these vessels would be within the area of potential disturbance assessed for, therefore there would be no increase in disturbance as a result of vessels. As a result, the potential impact for any increased disturbance from vessels during the proposed UXO clearance has been assessed as negligible.

No further mitigation measures are proposed for the potential increased collision risk or increased disturbance from vessels during UXO clearance.

4.7 Changes in water quality

The proposed UXO clearance works will result in the disturbance of small amounts of sediment, on a localised spatial scale. UXO clearance at each location (and overall) will affect a very small percentage of the UXO clearance area for a very short period of time and will be intermittent. Given the small spatial and temporal scale of the UXO clearance works, and that the mitigation put in place through the MMMP will ensure that there are no marine mammals close to the works. Increased turbidity is unlikely to have a substantial direct impact on marine mammals that often inhabit naturally turbid or dark environments. This is likely because other senses are utilised, and vision is not relied upon solely. Therefore, the potential impact for any changes in water quality during the proposed UXO clearance has been assessed as negligible for all species.

No further mitigation measures are proposed or required for the potential changes to water quality during UXO clearance for marine mammals.

4.8 Changes in prey availability

The underwater noise modelling (see **Appendix C.1**) indicates that the maximum potential range for potential mortal injury in fish species for the largest potential UXO is less than 1 km without mitigation. Whilst it is recognised that the impact ranges for recoverable injury and disturbance effects will be larger than those presented for mortal injury, given that the potential for impact from underwater noise arising from the UXO clearance works will relate to a limited number of very discrete sources of underwater noise, even for the most sensitive species, the limited scale and temporal nature of the works is considered to be of a negligible impact for fish species.

Similarly, any potential impacts on fish as a result of disturbance of the seabed are likely to be in close proximity to the clearance activities it is therefore considered that there will be negligible impacts on fish.

As a result, the potential impact for any changes in prey availability to marine mammal species as a result of the UXO clearance works has been assessed as low. As only a relatively small number of prey species would be at risk of potential mortal injury in the area around the UXO during clearance and any disturbance of prey species as a result of underwater noise or seabed disturbance would be temporary and localised, with fish expected to return to the area after completion of the UXO clearance works.

Harbour porpoise, bottlenose dolphin, white-beaked dolphin, common dolphin and minke whale feed on a range of prey species and their diet can vary geographically and seasonally depending on available prey resources.

No further mitigation measures, other than those proposed in the MMMP to reduce the risk of auditory injury, are required for the potential changes to prey species during UXO clearance.

4.9 Mitigation

A UXO-specific MMMP has been prepared to support the Marine Licence Application for the UXO clearance works. The MMMP details the proposed mitigation to avoid or reduce the potential for auditory injury in marine mammals during UXO clearance (see **Appendix B**), this includes:

- Low-order clearance as the chosen method to dispose of UXO;
- All UXO clearance to take place in daylight and, when possible, in favourable conditions with good visibility (sea state 3 or less);
- Establishment of a monitoring area with minimum of 1 km radius.
    - The observation of the monitoring area will be by dedicated and trained Marine Mammal Observers (MMOs) during daylight hours and suitable visibility, pre- and post-clearance;
- The deployment of Passive Acoustic Monitoring (PAM) devices, if required, and if the equipment can be safely deployed and retrieved;
- The activation of ADD; and
- The controlled deflagration of the UXO will be undertaken by specialist contractors, using the minimum amount of explosive required (up to 0.25 kg) in order to achieve safe disposal of the UXO.

4.10 Cumulative Impact Assessment (CIA)

The Cumulative Impact Assessment (CIA) includes both current and proposed projects, plans and activities. The assessment includes other types of development and activities in the wider area as well as other offshore wind farms.

As each project is required to provide mitigation for any potential for PTS, there is no potential for cumulative PTS impacts to occur. Therefore, the assessment only considers the potential for TTS and disturbance cumulative impacts.

The following projects have been identified and considered for potential cumulative impacts with the UXO clearance, presented in **Table 4.34**. For wide ranging species (such as cetaceans), it is important to consider projects over a wider area. For cetaceans, due to the extent of the MU are associated with, projects are considered if they are located within the Moray Firth, as well as off the east coast of Scotland.

Table 4.18 Potential for Cumulative Impacts

Project	Location (approx. distance from the Development)	Stage	Date of Activity	Included in Assessment
Moray West Offshore Windfarm	Same Development Site	Offshore Construction (including piling, vessel activity)	Piling up to April 2024	Considered further due to potential overlap.
Moray East Offshore Windfarm	Moray Firth, 0 km adjacent to the Development	Operational	Operational since April 2022	Screened out, noise from Moray East OWF will be included in the baseline for the area.
Beatrice Offshore Wind Farm	Moray Firth, 0 km adjacent to the Development	Operational	Operational since summer 2019	Screened out, noise from Moray East OWF will be included in the baseline for the area.
Caledonia Offshore Wind Farm	Moray Firth, 0 km adjacent to the Development	Pre-application	N/A	Screened out, due to no known upcoming activity. Geophysical surveys have been completed.
Nigg Energy Park East Quay	Cromarty Firth, approximately 60 km	Construction completed	July 2022	Screened out, due to no further potential activity.
Stromar Offshore Wind Farm	Moray Firth, approximately 50km	Pre-application	N/A	Screened out, due to no known upcoming activity.
Broadshore Offshore Wind Farm	Fraserburgh, approximately 55km	Pre-application	N/A	Screened out, due to no known upcoming activity.
Sea Wall Repair and Extension – Alexandra Parade	Peterhead, approximately 189 km	Application approved	Construction 2020-2024	Screened out, no potential for cumulative impacts due to distance

Table 4.18 Potential for Cumulative Impacts				
Project	**Location (approx. distance from the Development)**	**Stage**	**Date of Activity**	**Included in Assessment**
Seagreen Alpha and Bravo Offshore Wind Farms (Optimised Project)	FIrth of Forth, approximately 196 km from windfarm site	Application approved	Operational from October 2023	Screened out, and underwater noise (or any other potential impacts) considered to be part of the baseline for the area.
Inch Cape Offshore Windfarm Revised Design	Firth of Forth, approximately 215 km from windfarm site	Application approved	Construction expected from 2024/2025	Screened out, no potential for cumulative impacts due to distance
Neart na Gaoithe Offshore Wind Farm (Revised Design)	Firth of Forth, approximately 255 km from windfarm site	Under construction	Construction from 2019-2022	Screened out, no potential for cumulative impacts due to distance

The only project screened in with relevant potential effects for marine mammals is the Moray West piling activity that may occur at the same time as the UXO clearance. As Moray West have already considered potential mitigation piling, there is no potential for cumulative PTS impacts to occur. Therefore this assessment only considers disturbance cumulative impacts as the potential disturbance ranges are highest (maximum range of 5 km for disturbance for all species). As seen in Table 4.19~~Table 4.19~~, it has been concluded that there are no cumulative impacts as a result of disturbance.

Table 4.19 Cumulative assessment for marine mammals

Cumulative project	Moray West UXO assessment		Cumulative project assessment		Overall cumulative assessment
	Potential impact	Assessment	Potential impact	Assessment	
Moray West (piling)	Potential disturbance effects due to the potential overlap of piling and UXO clearance (up to 5km effect range).	• 114.7 harbour porpoise (0.03% of NS MU) • 0.3 bottlenose dolphin (0.13% of CES MU) • 10.6 white-beaked dolphin (0.02% of CGNS MU) • 5.8 common dolphin (0.01% of CGNS MU) • 1.8 minke whale (0.009% of CGNS MU)	Disturbance from piling (as the worst case) for both monopile and pin-pile at the same time as UXO clearance at Moray West.	• 1609 harbour porpoise (0.49% of NS MU) • 14.6 bottlenose dolphin (7.5% of CES MU) • White-beaked dolphin not assessed • Common dolphin not assessed • 30.1 minke whale (0.135% of CGNS MU)	Within the Moray West EIA, population modelling indicated there would be no long term population effects from disturbance for bottlenose dolphin, the disturbance impact was assessed as low. Other species were assessed as negligible. Due to the localised (maximum range of 5km) and the temporary nature of the UXO clearance with the low disturbance impact of piling activity, it has been concluded there will be no cumulative impacts as a result of disturbance.

5 Potential Effects on Designated Sites

5.1 Special Areas of Conservation (SACs)

SACs are designated under Regulation 33(2) of the Conservation (Natural Habitats, &c.) Regulations 1994 (as amended in Scotland). Part II of the Habitats Regulations sets out the provisions for the selection of Special Areas of Conservation (SACs) for Annex I habitats and Annex II species. Key to the designation of SACs is Paragraph 7 (2), the relevant part of which states: "...*For aquatic species which range over wide areas, such sites will be proposed only where there is a clearly identifiable area representing the physical and biological factors essential to their life and reproduction*".

5.1.1 Moray Firth SAC

The Moray Firth SAC (approximately 17 km from the Development Site) was designated in 2005 under the European Habitats Directive (92/43/EEC) for bottlenose dolphin. This SAC extends from the inner firths to Helmsdale on the north coast and Lossiemouth on the south coast covers an area of 1,510km^2 (NatureScot, 2021). The Moray Firth supports the only known resident population of bottlenose dolphin in the North Sea, with an estimated 224 individuals (CV = 0.023; 95% CI = 214 - 234; Arso Civil *et al*., 2021; IAMMWG, 2023).

The population is present year-round within the Firth, but they do appear to favour particular areas. The Conservation Objectives are "*to avoid deterioration of the habitats of the qualifying species (bottlenose dolphin) 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 the qualifying interest*."

There could be the potential for the proposed UXO clearance activity to disturb bottlenose dolphin. As a precautionary approach it has been assumed that any bottlenose dolphin in the Development could be from the Moray Firth SAC, therefore the assessments have been presented in the context of the latest estimate for the east coast of Scotland population of 224 bottlenose dolphin.

Assessments indicate in **Section 4.4** that up to 0.3 bottlenose dolphin could be disturbed during low order clearance, which is 0.13% of the east coast of Scotland population. As less than 1% of the reference population is exposed to the effect, the impact is negligible. Given these findings, the UXO clearance for Moray West is not expected to contribute to a long-term decline in the use of the SAC site by bottlenose dolphins, nor result in a behavioural change that would reduce survival or reproduction.

The MMMP (**Appendix B**) for UXO clearance at the Development Site will reduce the risk of PTS in bottlenose dolphin and therefore there would be negligible impact. As previously stated, the only method proposed for any UXO that require clearance is low-order deflagration.

The assessments in **Section 4.7** indicate that vessels during the proposed UXO clearance at the Development Site will not increase the collision risk or disturbance of bottlenose dolphin, therefore there is only the potential of negligible impact.

The assessments in **Section 4.7** and **4.8**, indicate that any changes to water quality or prey resources as a result of the proposed UXO clearance work would be temporary and localised and has been assessed as having a negligible to low impact.

The assessment in **Section 4.5** indicates there would be negligible disturbance from ADD as a result of ADD activation.

Overall the assessments presented in **Section 1** indicate that through the application of mitigation as outlined in the MMMP (see **Appendix B**) there is **no potential Adverse Effect on Site Integrity (AEoSI) of the Moray Firth SAC in relation to the conservation objectives for bottlenose dolphin** as a result of any disturbance from underwater noise during UXO clearance.

5.1.2 Dornoch Firth and Morrich More SAC

Although seals are not EPS, an assessment in relation to the nearby Dornoch Firth and Morrich More SAC (approximately 46 km from the Development Site) has been included in this report.

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[5]. The Conservation Objectives ensure that the obligations of the Habitats Directive are met; that is, there should not be deterioration or disturbance of the qualifying interest. This will also ensure that the integrity of the site is maintained and that it makes a full contribution to achieving favourable conservation status for its qualifying interests.

The MMMP (**Appendix B**) for UXO clearance at the Development Site will reduce the risk of PTS in seals and therefore there would be negligible impact. As previously stated, the only method proposed for any UXO that require clearance is low-order deflagration.

As part of the Strategic Regional Marine Mammal Monitoring Programme for the Moray Firth, a total of 57 harbour seals were tagged at Loch Fleet with GPS/GSM tags in September 2014, February 2015 and February-March 2017 (Graham *et al*., 2017). These telemetry data show that harbour seals tagged in the Moray Firth MU do not all remain within the Moray Firth, with seals showing movement out of the Moray Firth and into the North Coast and Orkney MU (Graham *et al*., 2017). Therefore, there is connectivity between the two MUs and as such it is most appropriate to consider that the relevant population against which to assess impacts on the Dornoch Firth and Morrich More SAC population is the combined Moray Firth and North Coast and Orkney MUs. Combining the most recent haul-out count for the Moray Firth MU (690) with the most recent haul-out count for the North Coast and Orkney MU (1,405), results in a total August haul-out count of 2,095 harbour seals (SCOS, 2022).

[5] *https://sac.jncc.gov.uk/site/UK0019806*

The number of harbour seal that could potentially be disturbed due to the UXO clearance, based on the precautionary 5 km disturbance range, is up to 1.4 animals (based on the 0.0182 individuals per km^2, density estimate), or 0.07% of the combined Moray Firth and North Coast and Orkney MUs.

The impact for temporary disturbance from low-order clearance such as deflagration has been assessed as negligible for harbour seal due to being less than 1% of the reference population anticipated to be exposed to effect.

The assessment indicates that through the application of mitigation as outlined in the MMMP (see **Appendix B**) there is **no potential AEoSI of the Dornoch Firth and Morrich More SAC in relation to the conservation objectives for harbour seal** as a result of any disturbance from underwater noise during UXO clearance.

5.2 Nature Conservation Marine Protected Area (NCMPA)

Under Section 82 of the Marine (Scotland) Act 2010, MD-LOT is required to consider whether a licensable activity is capable of affecting a protected feature in a Nature Conservation Marine Protected Area (NCMPA), or any ecological or geomorphological process on which the conservation of any protected feature in an NCMPA is dependent. If MD-LOT determine there is or may be a significant risk of a project hindering the achievement of the conservation objectives, then they must notify the relevant conservation bodies. It is an offence to intentionally or recklessly kill, remove, damage, or destroy any protected feature of an NCMPA. Marine Directorate must be sure that consenting/licensing decisions do not cause a significant risk to the conservation objectives of any NCMPA.

5.2.1 Southern Trench NCMPA

Southern Trench NCMPA is located on the east coast of Scotland, and is proposed to protect minke whale, burrowed mud, fronts and shelf deeps. Fronts in the Southern create an area of high productivity, attracting a number of predators to the area. Minke whale are attracted by the fish species brought to the area by the fronts, as well as the abundance of sandeels in the soft sands. SNH advises that, in order to conserve minke whale, risk of injury and death should be minimised, access to resources within the site should be maintained, and supporting features should also be conserved. The Conservation Objectives of this site are to conserve the features, specifically to ensure "*Minke whale in the Southern Trench NCMPA are not at significant risk from injury or killing, conserve the access to resources (e.g. for feeding) provided by the NCMPA for various stages of the minke whale life cycle, and conserve the distribution of minke whale within the site by avoiding significant disturbance*"[6]. The supporting features of the minke whale is also protected under these Conservation Objectives.

Minke whale are wide-ranging baleen whales which are present in the Moray Firth primarily in the summer months (June – September) (Reid *et al.,* 2003; Hammond *et al.,* 2021). They often prefer water

[6] *https://www.nature.scot/sites/default/files/2019-06/Southern%20Trench%20possible%20MPA%20-%20Conservation%20and%20Management%20Advice.pdf*

depths of up to 200 m and are often solitary or found in pairs, though they occasionally form larger groups (up to15 individuals) while feeding.

The MMMP (**Appendix B**) for UXO clearance at the Development Site will reduce the risk of PTS for minke whale and therefore there would be negligible impact. As previously stated, the only method proposed for any UXO that require clearance is low-order deflagration.

The assessments in **Section 4.7** indicate that vessels during the proposed UXO clearance at the Development Site will not increase the collision risk or disturbance of minke whale, therefore there the impact is assessed as negligible.

The assessments in **Section 4.7** and **4.8**, indicate that any changes to water quality or prey resources as a result of the proposed UXO clearance work would be temporary and localised and have been assessed as a negligible to low impact.

The assessment in **Section 4.5** indicates there would be negligible disturbance from ADD as a result of ADD activation.

There could be the potential for the proposed UXO clearance in the Development Site to disturb minke whale associated with the Southern Trench NCMPA. As a precautionary approach it has been assumed that any minke whale in the Development Site could be connected to the Southern Trench NCMPA, therefore the assessments have been presented in the context of the latest estimate for the population in the Moray Firth is based on SCANS-IV abundance for survey block CS-K of 467 animals which encompasses the Development Site and the majority of the Southern Trench NCMPA (Gilles *et al.,* 2023), as opposed to the CGNS MU as a whole as seen in **Section 4.4**.

The number of minke whale that could potentially be disturbed due to the UXO clearance, based on the precautionary 5 km disturbance range, is less than 2 animals (0.39% of estimated Moray Firth population).

The assessment indicates that through the application of mitigation as outlined in the MMMP (see **Appendix B**) there is **no potential AEoSI of the Southern Trench NCMPA in relation to the conservation objectives for minke whale** as a result of any disturbance from underwater noise during UXO clearance.

5.3 Protected Seal Haul-Out Sites

Seal haul-out sites are coastal locations that seals use to breed, moult and rest. Almost 200 seal haul-out sites have been designated through The Protection of Seals (Designation of Haul-Out Sites) (Scotland) Order 2014 which was amended with additional sites in 2017. These haul-out sites are protected under Section 117 of the Marine (Scotland) Act 2010. The Act is designed to assist in protecting the seals when they are at their most vulnerable, and as such provide additional protection from intentional or reckless harassment.

The MMMP (**Appendix B**) for UXO clearance at the Development Site will apply all measures to seals and reduce the risk of PTS and therefore there would be negligible impact. As previously stated, the only method proposed for any UXO that require clearance is low-order deflagration.

However, considering the location of the planned UXO clearance activities relative to the shore (≥ 22 km) the worst-case TTS impact range of 0.57 km (weighted impulsive SEL; **Appendix C**) and nearest designated haul-out site (≥ 21 km, Dunbeath-Helmsdale and ≥ 22 km, Dunbeath-Wick both designated for grey seal) there is no potential for harassment of seals at designated haul-out sites and such effects are not considered further.

6 Assessment of Potential Offence

Following the Marine Scotland (2020) guidance, relevant to injury and disturbance, which would occur in waters within the 12 nautical mile limit, it can be concluded that, with mitigation for UXO clearance activities, potential impacts are unlikely to result in the harassment, disturbance, injury or killing of an EPS as defined under regulation 39(1) of the Habitats Regulations.

In relation to regulation 39(2) of the Habitats Regulations, the percentage of the reference population of each species, which has the potential to be disturbed during UXO clearance activities at the Development Site, is considered to be negligible (less than 1% for all cetacean species which occur in the area) and therefore not detrimental to the maintenance of the population of the species concerned at a FCS. Any disturbance would be localised and short-term, and with mitigation is considered to be negligible. Disturbance will not be sufficient to cause any population level effects, and thus it is considered that a Marine EPS licence (to disturb) can be issued under regulation 39 of the Habitats Regulations.

6.1 EPS Licencing Tests

Test 1: The licence must relate to one of the purposes referred to in Regulation 44(2).

The Scottish Government can only issue licenses under Regulation 44(2) of the Habitats Regulations for specific purposes. For the purposes of the proposed UXO clearance activities, this purpose is:

- 44(2)(e) preserving public health or public safety or other imperative reasons of overriding public interest including those of a social or economic nature and beneficial consequences of primary importance for the environment.

Offshore wind is a key growth sector in Scotland, and the generation and development of offshore wind infrastructure is a key component for reaching Scotland's target to reduce greenhouse gas emissions (by 75% by 2030), and for being net-zero by 2045. Part of the next round of offshore wind development in Scotland (currently being bid for through the ScotWind process) is to ensure that 25% of the offshore wind industry is provided by local business.

There is an overarching European, UK and Scottish policy requirement for sustainable energy supply from renewables. This need is the subject of national planning and energy policy. The proposed UXO clearance activities are required to ensure the safe construction of the Development. UXO represent a material risk to the safe construction of the Development and therefore their identification, assessment and clearance is essential.

Test 2: There must be no satisfactory alternative (Regulation 44(3a)).

UXO represent a material risk to the safe construction of the Development and, therefore, their identification, assessment and clearance is essential. The proposed approach to UXO clearance activities will utilise low order deflagration, which is a lower-impact alternative to explosive detonation and, in particular, high-order detonation.

There is an initial preference for leaving the UXO in situ and micro-site construction work and infrastructure around it supplying a do-nothing scenario which would have no impact on EPS species within the vicinity of the Development Site. If it is not possible to safely leave the UXO in situ and micro-site, an appropriate clearance approach will be selected. In order of preference, these are:

1. UXO clearance in situ – this is the preferred option for health and safety reasons;
2. Relocation of the UXO on the seabed and then clearance by deflagration – an example of when this would occur are in instances when clearance by deflagration in situ could potentially compromise the safety of existing nearby assets. In the instance where third party assets are situated nearby, Moray West will contact the third party prior to clearance activities in order to establish a safe distance between the asset and clearance site.; and
3. Recovery of the UXO to the deck of the vessel – this would be undertaken for small items of UXO e.g., hand grenades, or as a last resort for larger items should options 1 or 2 not be possible.

High-order disposal represents the most commonly used approach to date for disposal of underwater UXO in situ, although this method would not be used in the Moray West UXO clearance works. This method involves deliberate detonation initiated by a small donor charge placed on the UXO to initiate an explosion of the main charge; therefore, neutralising it. The resulting shock wave and noise level is therefore expected to be proportional to the combined explosive mass of the donor and main charge. By contrast, low-order methods aim to neutralise the UXO without detonation of the main charge and, therefore, the energy generated should relate to the detonation of the donor charge only.

Consequently, for a given size of UXO, the potential for impacts to marine life from low-order disposal are considerably less than would be expected from a high-order disposal.

Test 3: The action authorised must not be detrimental to the maintenance of the population of the species concerned at a FCS in their natural range (Regulation 44(3b)).

Regulation 44(3)(b) of the Habitat Regulations 1994 and Regulation 55(9)(c) of the Marine Habitats and Species Regulations 2017 requires the Scottish Ministers to be satisfied that the Licensed Operations must not be detrimental to the maintenance of the population of species concerned at a FCS in their natural range.

The percentage of the reference population of each species, which has the potential to be impacted by the potential UXO clearance at the Development, has been shown to be negligible (less than 1 % of the reference populations for all the cetacean species which occur in the Moray Firth area), and therefore not detrimental to the maintenance of the population of the species concerned at a FCS level.

7 References

Alpha Associates Ltd. (2022) Unexploded Ordnance Threat and Risk Assessment with Risk Mitigation Strategy. Project: Moray West Offshore Wind Farm. Document number: MWW-ALP1-SA-RSK-000001

Arso Civil, M., Quick, N.J., Cheney, B., Pirotta, E., Thompson, P.M. and Hammond, P.S., (2019). Changing distribution of the east coast of Scotland bottlenose dolphin population and the challenges of area-based management. Aquatic Conservation: Marine and Freshwater Ecosystems, 29, pp.178-196.

Arso Civil, M., Quick, N., Mews, S., Hague, E., Cheney, B.J., Thompson, P.M. & Hammond, P.S. (2021). Improving understanding of bottlenose dolphin movements along the east coast of Scotland. Final report. Report number SMRUC-VAT-2020-10 provided to European Offshore Wind Deployment Centre (EOWDC), March 2021 (unpublished).

Bailey, H. and Thompson, P. (2006). Quantitive analysis of bottlenose dolphin movement patterns and their relationship with foraging. Journal of Animal Ecology 75: 456-465.

Boisseau, O., McGarry, T., Stephenson, S., Compton, R., Cucknell, A. C., Ryan, C., McLanaghan, R. and Moscrop, A. (2021). *Minke whales Balaenoptera acutorostrata avoid a 15 kHz acoustic deterrent device (ADD)*. Marine Ecology Progress Series, 667, 191-206..

Brandt, M. J., C. Hoeschle, A. Diederichs, K. Betke, R. Matuschek, and G. Nehls. (2013a). Seal scarers as a tool to deter harbour porpoises from offshore construction sites. Marine Ecology Progress Series 475:291-302.

Brandt, M. J., C. Hoeschle, A. Diederichs, K. Betke, R. Matuschek, S. Witte, and G. Nehls. (2013b). Farreaching effects of a seal scarer on harbour porpoises, *Phocoena*. Aquatic Conservation-Marine and Freshwater Ecosystems 23(2):222-232.

Braulik, G., Minton, G., Amano, M. and Bjørge, A., 2020. Phocoena phocoena. The IUCN Red List of Threatened Species 2020: e. T17027A50369903.

Carter, M., L. Boehme, C. Duck, W. Grecian, G. Hastie, B. McConnell, D. Miller, C. Morris, S. Moss, D. Thompson, P. Thompson, and D. Russell. (2020). Habitat-based predictions of at-sea distribution for grey and harbour seals in the British Isles. Sea Mammal Research Unit, University of St Andrews, Report to BEIS, OESEA-16-76/OESEA-17-78.

Erebus Floating OWF. (2021). Project Erebus Environmental Statement. December 2021. https://www.bluegemwind.com/planning/documents/

Gilles, A, Authier, M, Ramirez-Martinez, NC, Araújo, H, Blanchard, A, Carlström, J, Eira, C, Dorémus, G, Fernández-Maldonado, C, Geelhoed, SCV, Kyhn, L, Laran, S, Nachtsheim, D, Panigada, S, Pigeault, R, Sequeira, M, Sveegaard, S, Taylor, NL, Owen, K, Saavedra, C, Vázquez-Bonales, JA, Unger, B, Hammond, PS (2023). Estimates of cetacean abundance in European Atlantic waters in summer 2022 from the SCANS-

IV aerial and shipboard surveys. Final report published 29 September 2023. 64 pp. https://tinyurl.com/3ynt6swa

Gordon, J., C. Blight, E. Bryant, and D. Thompson. (2015). Tests of acoustic signals for aversive sound mitigation with harbour seals. Sea Mammal Research Unit report to Scottish Government. MR 8.1 Report. Marine Mammal Scientific Support Research Programme MMSS/001/11.

Gordon, J., C. Blight, E. Bryant, and D. Thompson. (2019). Measuring responses of harbour seals to potential aversive acoustic mitigation signals using controlled exposure behavioural response studies. Aquatic Conservation Marine and Freshwater Ecosystems. 29(S1):157-177.

Graham, I. M., B. Cheney, R. C. Hewitt, L. S. Cordes, G. D. Hastie, D. J. F. Russell, M. Arso Civil, P. S. Hammond, and P. M. Thompson. 2016. Strategic Regional Pre-Construction Marine Mammal Monitoring Programme Annual Report 2016. University of Aberdeen.

Graham, I. M., B. Cheney, R. C. Hewitt, L. S. Cordes, G. Hastie, and P. Thompson. (2017). Strategic Regional Pre-Construction Marine Mammal Monitoring Programme Annual Report 2017. University of Aberdeen.

Hammond, P.S., Lacey, C., Gilles, A., Viquerat, S., Boerjesson, P., Herr, H., Macleod, K., Ridoux, V., Santos, M., Scheidat, M., Teilmann, J., Vingada, J., and Oien, N. (2021). Estimates of cetacean abundance in European Atlantic waters in summer 2016 from the SCANS-III aerial and shipboard surveys. Wageningen Marine Research. Available from: https://synergy.st-andrews.ac.uk/scans3/files/2021/06/SCANS-III_design-based_estimates_final_report_revised_June_2021.pdf

IAMMWG. 2022. Updated abundance estimates for cetacean Management Units in UK waters (Revised 2022). JNCC Report No. 680, JNCC Peterborough, ISSN 0963-8091.

IAMMWG. 2023. Review of Management Unit boundaries for cetaceans in UK waters. JNCC Report No. 734, JNCC Peterborough, ISSN 0963-8091.

JNCC. (2019) Conservation status assessment for the species. European Community Directive on the Conservation of Natural Habitats and of Wild Fauna and Flora (92/43/EEC). Fourth Report by the United Kingdom under Article 17 on the implementation of the Directive from January 2013 to December 2018. https://jncc.gov.uk/our-work/article-17-habitats-directive-report-2019-species/

JNCC, Department of Agriculture, Environment and Rural Affairs (DAERA) and Natural England (2020). Guidance for assessing the significance of noise disturbance against Conservation Objectives of harbour porpoise SACs (England, Wales & Northern Ireland). June 2020.

Kastelein, R.A., Van de Voorde, S, and Jennings, N. (2018). Swimming Speed of a Harbour Porpoise (Phocoena phocoena) During Playbacks of Offshore Pile Driving Sounds. Aquatic Mammals: 44(1):92-99.

Lucke, K., Siebert, U., Lepper, P. A. and Blanchet, M. A. (2009). Temporary shift in masked hearing thresholds in a harbor porpoise (*Phocoena phocoena*) after exposure to seismic airgun stimuli, J. Acoust. Soc. Am., 125 (6), pp. 4060-4070.

Marine Scotland. (2020). The protection of Marine European Protected Species from injury and disturbance. Guidance for Scottish Inshore Waters. July 2020. Available at: https://www.gov.scot/publications/marine-european-protected-species-protection-from-injury-and-disturbance/

McGarry, T., O. Boisseau, S. Stephenson, and R. Compton. (2017). Understanding the Effectiveness of Acoustic Deterrent Devices (ADDs) on Minke Whale (*Balaenoptera acutorostrata*), a Low Frequency Cetacean. Report for the Offshore Renewables Joint Industry Programme (ORJIP) Project 4, Phase 2. Prepared on behalf of the Carbon Trust.

McGarry, T., R. De Silva, S. Canning, S. Mendes, A. Prior, S. Stephenson, and J. Wilson. (2020). Evidence base for application of Acoustic Deterrent Devices (ADDs) as marine mammal mitigation, Version 2.0, March 2020, JNCC Report No. 615. Joint Nature Conservation Committe, Peterborough, UK, 107pp.

Moray Offshore Renewables Ltd. (2012). Moray Offshore Renewables Limited Environmental Statement Technical Appendix 7.3 A - Marine Mammals Environmental Impact Assessment. Produced by Natural Power on behalf of Moray Offshore Renewables Ltd.

Moray West (2018) Offshore Environmental Impact Assessment Report. https://marine.gov.scot/data/moray-west-offshore-windfarm-environmental-impact-assessment-report

Moray East (2019). Estimated ranges of impact for various UXO detonations, Moray East OWF. https://marine.gov.scot/sites/default/files/moray_east_uxo_clearance_marine_mammal_assessment_update_19022019.pdf

NatureScot (2020) Southern Trench MPA. Conservation and Management Advice. Available at: https://sitelink.nature.scot/site/10477

NatureScot (2021). Conservation and Management Advice, Moray Firth SAC. March 2021. https://apps.snh.gov.uk/sitelink-api/v1/sites/8327/documents/59

NMFS (National Marine Fisheries Service) (2018). 2018 Revisions to: Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing (Version 2.0): Underwater Thresholds for Onset of Permanent and Temporary Threshold Shifts. U.S. Dept. of Commer., NOAA. NOAA Technical Memorandum NMFS-OPR-59, 167 p.

Otani, S., Naito, T., Kato, A. and Kawamura, A. (2000). Diving behaviour and swimming speed of a free-ranging harbour porpoise (*Phocoena phocoena*). Marine Mammal Science, Volume 16, Issue 4, pp 811-814, October 2000.

Port Dolphin Energy LLC (2011).
http://www.nmfs.noaa.gov/pr/pdfs/permits/portdolphin_loa_application2011.pdf

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., Eisfeld, S.M., Costa, M. and Simmonds, M.P. (2010). Short-beaked common dolphin (Delphinus delphis) occurrence in the Moray Firth, north-east Scotland. Marine Biodiversity Records, 3.

SCOS. (2020). Scientific Advice on Matters Related to the Management of Seal Populations: 2020

SCOS. (2022). Scientific Advice on Matters Related to the Management of Seal Populations: 2022

ScottishPower Renewables (SPR) (2019). East Anglia TWO Offshore Windfarm Environmental Information Statement. Volume 1. Document Reference: EA2-DWF-ENV- REP-IBR-000903 Rev 01.

Seagreen Wind Energy Ltd. (2021) Seagreen Alpha and Bravo Site UXO clearance – European Protected Species Risk Assessment and Marine Mammal Mitigation Plan. Document Reference LF000009-CST-OF-LIC-REP-0007. https://marine.gov.scot/sites/default/files/eps_risk_assessment_3.pdf

Sparling, C., C. Sams, S. Stephenson, R. Joy, J. Wood, J. Gordon, D. Thompson, R. Plunkett, B. Miller, and T. Götz. (2015). ORJIP Project 4, Stage 1 of Phase 2: The use of Acoustic Deterrents for the mitigation of injury to marine mammals during pile driving for offshore wind farm construction. Final Report. SMRUC-TCT-2015-006, Submitted To The Carbon Trust, October 2015 (Unpublished).

Southall, B.L., Bowles, A.E., Ellison, W.T., Finneran, J.J., Gentry, R.L., Greene Jr., C.R., Kastak, D., Ketten, D.R., Miller, J.H., Nachtigall, P.E., Richardson, W.J., Thomas, J.A., and Tyack, P.L., (2007). Marine Mammal Noise Exposure Criteria: Initial Scientific Recommendations. Aquatic Mammals, 33 (4), pp. 411-509.

Southall, B., J. J. Finneran, C. Reichmuth, P. E. Nachtigall, D. R. Ketten, A. E. Bowles, W. T. Ellison, D. Nowacek, and P. Tyack. (2019). Marine Mammal Noise Exposure Criteria: Updated Scientific Recommendations for Residual Hearing Effects. Aquatic Mammals **45**:125-232.

Southall, B.L., Nowacek, D.P., Bowles, A.E., Senigaglia, V., Bejder, L. and Tyack, P.L., (2021). Marine mammal noise exposure criteria: assessing the severity of marine mammal behavioral responses to human noise. Aquatic Mammals, 47(5), pp.421-464. DOI 10.1578/AM.47.5.2021.421.

Thompson, D. (2015). Parameters for collision risk models. Report by Sea Mammal Research Unit, Univ St Andrews, Scottish Natural Heritage.

Thompson, P. M., K. L. Brookes, and L. S. Cordes. 2014. Integrating passive acoustic and visual data to model spatial patterns of occurrence in coastal dolphins. ICES Journal of Marine Science:11.

Thompson, P. 2015. Annex 3. Framework for a risk-based assessment to underpin the adoption of alternative mitigation measures during piling at the BOWL and MORL Offshore Wind Farms. 28th July 2015. In: Beatrice Offshore Windfarm Ltd. (2015). Beatrice Offshore Wind Farm Piling Strategy. Prepared by RPS, GoBe Consultants Ltd and Brown and May Marine. Report number LF000005. November 2015.

Thompson, P. M., I. M. Graham, B. Cheney, T. R. Barton, A. Farcas, and N. D. Merchant. (2020). Balancing risks of injury and disturbance to marine mammals when pile driving at offshore windfarms. Ecological Solutions and Evidence 1(2) doi: 10.1002/2688-8319.12034

Waggitt, J.J., Evans, P.G., Andrade, J., Banks, A.N., Boisseau, O., Bolton, M., Bradbury, G., Brereton, T., Camphuysen, C.J., Durinck, J. and Felce, T. (2019). Distribution maps of cetacean and seabird populations in the North-East Atlantic. Journal of Applied Ecology, 57(2), pp.253-269

Appendix A – Defined Terms

Term	Description
Design Envelope	The range of design parameters used to inform the assessment of impacts.
Marine Licence for the Generating Station	Marine Licence for the Moray West Offshore Wind Farm - Licence Number: MS-00009774 - granted under the 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 UK Marine Licensing Area granted to Moray West on 14 June 2019 and varied on 7 March 2022 and 11 April 2022.
Marine Licence for the Transmission Works	Marine Licence for the Offshore Transmission Infrastructure – Licence Number MS-00010585 – granted under the Marine and Coastal Access Act 2009, & Marine (Scotland) Act 2010, Part 4 Marine Licensing for marine renewables construction works and deposits of substances or objects in the Scottish Marine Area and the UK Marine Licensing Area (referred to as the "OfTI Marine Licence"), granted to Moray West on 14 June 2019 and varied on 11 April 2022 and 8 February 2024.
Moray Offshore Windfarm (West) Limited	The legal entity submitting this environmental report supporting the marine licence application for UXO clearance activities.
Moray West EIA Report	The Environmental Impact Assessment Report for the Moray West Offshore Wind Farm and Associated Transmission Infrastructure, submitted July 2018. Additional information was provided in the Moray West Report to Inform an Appropriate Assessment (RIAA) July 2018 and Moray West Application Addendum Document November 2018.
Moray West Offshore Wind Farm	The wind farm to be developed in the Moray West site (also referred as the Wind Farm).
Offshore Consents	Collective term for the two Marine Licences and the Section 36 consent.
Offshore Consent Conditions	Collective term for the conditions attached to the Section 36 Consent and Marine Licences.
Offshore Transmission Infrastructure (OfTI)	The offshore elements of the transmission infrastructure.
OfTI Corridor	The export cable route corridor, i.e., the OfTI area excluding the Moray West site.
Section 36 Consent	Section 36 consent under Section 36 of the Electricity Act 1989 for the construction and operation of the Moray West Offshore Wind Farm was granted on 14 June 2019 and varied on 7 March 2022.
The Development	The Moray West Offshore Wind Farm and OfTI.
The Development Site	The area outlined in Figure 1 attached to the Section 36 Consent Annex 1, Figure 1 attached to the two Marine Licences, and Figure 1 of this report.

The Moray West Site	The area in which the Moray West Offshore Wind Farm will be located. Section 36 Consents and associated Marine Licence to construct and operate generating stations on the Moray West site were granted in June 2019 and varied in March 2022.
The Works	The construction and O&M activities undertaken for the Development.
Transmission Infrastructure (TI)	Includes both offshore and onshore electricity transmission infrastructure for the consented wind farm. Includes connection to the national electricity transmission system near Broad Craig in Aberdeenshire encompassing Alternating Current (AC) Offshore Substation Platforms (OSPs), AC export cables offshore to landfall point at Broad Craig, near Sandend in Aberdeenshire continuing onshore to the AC collector station (onshore substation) at Whitehillock and the additional regional Transmission Operator substation at Blackhillock near Keith. A Marine Licence for the OfTI was granted in June 2019 and varied on 11 April 2022.

Appendix B - Marine Mammal Mitigation Protocol

B.1 Introduction

This UXO Marine Mammal Mitigation Protocol (MMMP) has been prepared to support both the Marine License (ML) and EPS License application by Moray Offshore Windfarm (West) Limited (the Development) for the mitigation of Explosive Ordnance Disposal (EOD) operations within the Development Site during construction, up to the end of July 2025.

The MMMP outlines the methods and procedures required for the effective mitigation of impacts associated with the clearance of any UXO for marine mammal species expected to be found in the area. In particular, the MMMP will mitigate against the potential risk of physical injury and / or trauma, and PTS exposure on marine mammals.

The JNCC guidance for "*minimizing the risk of injury to marine mammal from use explosives*" (JNCC, 2010[7]) has been consulted in the process of developing this MMMP to determine the best approach for mitigation, and to ensure best practice measures are followed (JNCC, 2010). In addition, this UXO MMMP has been informed by the mitigation implemented during previous work undertaken for the Moray East and the Beatrice OWF UXO protocol included in the MMMP (Moray East, 2018).

The mitigation procedures outlined in this MMMP include;

- Low-order clearance as the chosen method to dispose of UXO;
- the establishment of a mitigation zone of 1 km;
- the observation of the monitoring area by dedicated and trained MMOs during daylight hours and when conditions allow suitable visibility, pre- and post-clearance;
- the deployment of PAM devices, if required, and if the equipment can be safely deployed and retrieved;
- the activation of ADDs;
- all UXO clearances to take place in daylight and, when possible, in favourable conditions with good visibility (sea state 3 or less);
- the controlled deflagration of the UXO will be undertaken by specialist contractors, using the minimum amount of explosive (up to 0.25 kg) required in order to achieve safe disposal of the device; and
- the fusing of multiple devices - if there are multiple UXO in close proximity (e.g., within 20 m of each other) then one may be moved to be cleared with the other.

[7] https://data.jncc.gov.uk/data/24cc180d-4030-49dd-8977-a04ebe0d7aca/JNCC-Guidelines-Explosives-Guidelines-201008-Web.pdf

B.2 UXO Clearance Techniques

Current mitigation methods, for the protection of mammals and fish, are well established and have been shown to be effective in removing mammals and fish from the areas where they would be negatively affected by UXO clearance, providing them with sufficient protection and safeguarding from the noise of EOD operations. Where possible and safe to do so the preferred options would be as follows, in order of preference:

1. UXO will be avoided and left in-situ.
2. Micro-siting of infrastructure, if possible, to avoid any potential UXO, so clearance is not required.
3. Relocation of UXO to where it is not in close proximity to existing or planned infrastructure, so that the UXO can be cleared in a less sensitive area (i.e., outside of a designated site). If the UXO appears structurally sound and there is no risk, the UXO could potentially be moved to a location that is not in a sensitive area for subsequent clearance, subject to a proportional assessment of the risk posed to the vessel and staff from a health and safety perspective.

If these options are not possible, and UXO clearance is the only option, then low-order disposal (deflagration) will be the clearance method. The decision-making hierarchy when clearing a UXO will be as follows:

1. An agreed number of low-order disposal attempts at each UXO clearance will take place; the number is dependent on the surrounding environment and situation and will be determined by the UXO clearance contractor.
2. If clearance of the UXO is successful, it will be declared safe, removed from the seabed and disposed of at a licenced facility onshore.

B.3 UXO Mitigation Procedures

Mitigation Zone

The monitoring area (MA) is the area which a pre-clearance search is required to be undertaken by trained, dedicated and experienced MMOs. The MA with 1 km radius is measured out from the UXO clearance site with a 360° coverage, with the overall diameter of the monitoring area of 2 km. **Figure 2** provides a simple diagram of the monitoring area in relation to the UXO clearance site.

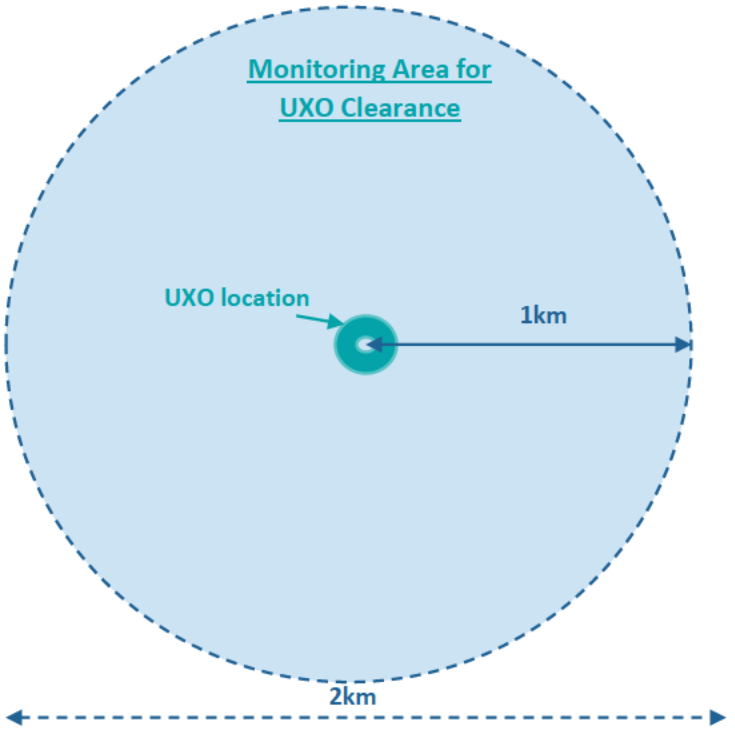


Figure 2 MA of 1 km around each UXO clearance location prior to UXO clearance event.

Surveys of the MA will be conducted by dedicated and trained MMOs during daylight hours and suitable visibility and sea states[8] prior to UXO clearance, to minimise the potential for marine mammals to be present within the MA prior to UXO clearance activity taking place, in order to reduce the risk of PTS.

The pre-clearance search will commence at least one hour prior to the start of the clearance event and continue until the clearance event takes place, with dedicated and trained MMOs positioned so the entire MA can be monitored at all times. A pre-clearance search will last at least one hour (with the ADD activated after 49 minutes). The MMOs will be in close contact with each other to ensure any sighting of a marine mammal within the MA is communicated.

PAM shall be employed for all pre-clearance searches. The PAM hydrophones should be located as close as possible to the UXO clearance location. It is possible to deploy from the vessels already located at the site, however it should be noted that they may be too far from the UXO clearance location to provide effective monitoring of the entire mitigation zone. Preference will be given to clearance operations to take place in good viewing conditions during daylight.

A PAM system may not always be able to determine the range of a marine mammal detection, or for all species expected to be present in the area. If this is the case, the PAM-Op will need to use experience and expert judgement to determine the range of the individual/s detected and whether it is within the 1 km

[8] Good visibility means being able to see at least 2 km in all directions, and suitable sea states are 3 or below.

mitigation zone. If the PAM-Op is unsure of whether an individual/s is within the mitigation zone or not, the precautionary principle should always be applied and it therefore should be assumed that the marine mammal/s is within the mitigation zone.

The pre-clearance search will commence prior to all clearance events or sequences, or after any break in the clearance event or sequence, and at the end of a clearance event or sequence. The visual observations by the MMOs will commence at least one hour prior to the clearance event. This will continue until one hour has passed and no marine mammals have been detected within the MA within the previous 30 minutes, the MMOs will then advise that UXO clearance can commence.

If a marine mammal has been sighted within the MA, it will be monitored and tracked until it is clear of the MA, and the Explosive Ordnance Disposal (EOD) team notified. The marine mammals must be clear of the MA for at least 30 minutes before low-order clearance.

The ADD will be activated at the appropriate time during the pre-clearance search of the MA, whether there is marine mammal presence or not. If a marine mammal is detected within the MA during the pre-clearance search, the commencement of the ADD activation will continue at the required time.

If the marine mammal(s) remains clear of the MA for at least 30 minutes and the one hour pre-search has been completed, then the UXO clearance can proceed.

A precautionary approach should always be used. Therefore, if the MMOs cannot be sure whether the individual is within the MA or not, or whether there is a confirmed sighting of a marine mammal within the MA, then the operation should be delayed accordingly until the MMOs are sure that there are no marine mammals present within the MA.

The mitigation team must be a safe distance from the clearance site prior to any UXO clearance.

B.4 Acoustic Deterrent Device

ADD will be activated prior to any UXO low-order deflagration to ensure marine mammals are deterred from the area and reduce the risk of any physical or auditory injury.

ADDs have proven to be effective mitigation for harbour porpoise, dolphin species, minke whale, grey and harbour seal (Sparling *et al.,* 2015; McGarry *et al.,* 2017, 2020; Boisseau *et al*., 2021). ADDs have been widely used as mitigation to deter marine mammals during offshore wind farm piling and UXO clearance at sites in Europe (for example, Brandt *et al.,* 2011, 2012, 2013a, b) and offshore wind farm sites in the UK, including but not limited to, Galloper, Dudgeon, East Anglia ONE, Moray East.

Pre-deployment tests

The ADD will be tested prior to each pre-clearance search to ensure they are working correctly. If there are any technical problems with the ADD then the pre-clearance search should be delayed until these issues are resolved.

The ADD-Op will also ensure that the communications are in place between themselves, the MMOs and the EOD supervisor.

The ADD would be deployed and ready to be activated once at the correct time during the one-hour pre-clearance search (49 minutes after the start of the one-hour pre-clearance search).

ADD locations

The ADD will be positioned within the water column in close proximity to the clearance site. It is proposed that the ADD will be deployed from vessels within the MA at a location where it is safe to be positioned prior to the commencement of the UXO clearance.

The best location to deploy the ADD, and the method to provide power to the devices, will be decided through a pre-deployment survey of the vessel or vessels by the ADD operator, MMOs, EOD supervisor and vessel operational manager. Once the best location for the ADD has been determined, the control unit and power supply should be temporarily installed. For deployment of the ADD, the transducer part of the device will be lowered over the side of the deck (they should not be activated at this time) to a water depth that is below the draft of the vessel to ensure the sound can be emitted in all directions and not dampened by the presence of the vessel.

ADD activation times

ADD activation will commence during the one-hour pre-clearance search of the monitoring area and immediately prior to the clearance event to allow marine mammals to move beyond the area of potential PTS risk.

If more than one deflagration attempt is required in a 24 hour period the ADD will not be activated during transit to another clearance event, and will be activated prior to all clearance events or sequences.

After the ADD has been activated for the required duration, the ADD operator will deactivate and recover the ADD and undertake routine checks to ensure it is still working correctly, ready for the next deployment and activation.

The MMOs will maintain their pre-clearance search during the ADD activation time. If any marine mammals are sighted within the MA during the ADD activation time, the ADD should remain activated until the required activation time has been completed.

If a marine mammal is still observed in the MA after the ADD activation, then the UXO clearance must be delayed and the ADD paused, and a further one-hour pre-clearance search should be undertaken, and the ADD can be re-activated at the appropriate time (i.e. the standard procedure should be re-started).

The ADD activation times for low-order clearance are based on swim speed of 1.5m/s are presented in **Table 7.1.**

The ADD activation time has been based on a swim speed of 1.5 m/s for harbour porpoise, 1.52 m/s dolphin species (Bailey and Thompson, 2010), 1.8m/s seal species (Thompson, 2015), and of 2.3m/s for minke whale, based on Boisseau *et al.,* 2021. However, Kastelein *et al*. (2018) recorded swimming speeds of 1.97m/s in harbour porpoise during playbacks of pile driving sounds. The distance at which marine mammal species are expected to travel within the ADD activation period is shown in the following table.

Table 7.1 ADD activation times for low-order clearance	
Mitigation	**Low-order clearance**
Maximum PTS range (worst-case of harbour porpoise)	**Up to 0.99 km**
ADD activation	11 minutes = 0.99 km

B.5 Post-clearance search

The MMOs will maintain a post-clearance search within the monitoring area **for at least 15 minutes** after the final clearance to look for evidence of injury to marine life, including any fish kills (following the JNCC (2010) guidance). Any other unusual observations will also be noted within the report.

B.6 Roles and Responsibilities

There are a number of people that would be required in the compliance with this MMMP for UXO clearance activities, including;

- Marine Mammal Observers (MMOs)
- Passive Acoustic Monitoring Operator (PAM-Op)
- Acoustic Deterrent Device Operator (ADD-Op)
- Explosive Ordnance Disposal Technician

More information on each of the above's specific responsibilities are outlined below, including information on the experience of each that would be required.

Marine Mammal Observers

Dedicated and JNCC accredited MMOs will need to be present and on-watch for the pre-clearance and for the post-clearance searches (see **Section B.3**). Dedicated means that this should be the persons sole responsibility (however in this case it should be noted that the MMO could also act as the ADD operator, although the ADD procedure would more likely be undertaken by the PAM-Op). Two MMOs will be required to cover the entire mitigation zone, with good viewing platforms to allow for 360° coverage. The MMOs must be able to determine the extent of the 1 km mitigation zone from their location, unless poor visibility does not allow.

The MMOs will need to be equipped with binoculars, and a tool to estimate distance i.e. range finding stick or binoculars with reticules and the JNCC reporting forms. The MMOs should scan the mitigation zone with the unaided eye and use binoculars when needed to determine detail (such to look in detail at the area where a possible sighting has been made). Binoculars should not be used continually as they restrict peripheral vision and views close to the vessel.

Marine mammal observations will be carried out to monitor the MA:

- during the pre-clearance search;
- during ADD activation;
- during UXO clearance; and
- during the post-clearance search.

There will be clear communication channels between the MMOs, the PAM-Op (if present), the ADD-Op and the EOD team. The communication procedures will be established and agreed prior to any UXO clearance with regards to the communication of any marine mammals observed within the MA, the deployment of the ADD, and when the MA is clear for the clearance to commence.

The MMOs and ADD operator will be notified and ready to begin the mitigation protocol at a minimum of 2 hours prior to UXO clearance, for any clearance by low-order deflagration.

The MMOs will record all periods of marine mammal observations, including start and finish time of pre-detonation searches, ADD activation, use of PAM (if required), and conditions during observations (e.g., sea state, visibility, weather, etc.). Any sightings of marine mammals around the vessel(s) will also be recorded.

"Dedicated" means trained MMOs who are employed for the sole purpose of undertaking visual observations to detect marine mammals and advising on and monitoring the implementation of the guidelines.

Experienced MMOs will have a minimum of 20 weeks' experience of implementing JNCC guidelines in UK waters within the previous five years. Furthermore, they will be experienced at identifying UK marine mammal species and be familiar with their behaviour.

Passive Acoustic Monitoring Operator

PAM is able to detect the vocalizations of marine mammals, and works best for echolocating species that are near-continually vocalizing such as harbour porpoise and dolphin species. PAM will be required in periods of low visibility to complement the monitoring by the MMOs. PAM-Ops should be experienced and trained in PAM hardware and software, as they will be required to determine the range of a detected marine mammal to the hydrophone location (note that this will be located between 100 and 300 m from the EOD operation) if the PAM software is unable to, and to interpret the detected sounds.

The PAM-Ops responsibilities will be the same as those for the MMO outlined above. A dedicated PAM-Op will also be responsible for the deployment, maintenance and operation of the PAM hydrophone, including any spares, and notifying the ADD operator of any issues during the testing of the ADD.

ADD operator

ADD-Op will be responsible for deployment, maintenance and operation of the ADD, including spare equipment, in relation to all UXO activities.

An ADD-Op may be:

- An existing member of the EOD team, who has received the appropriate training in both the MMMP and ADD operation, and would be available to carry out the required duties as a priority in addition to their existing role, or
- An additional member of trained staff employed with the sole responsibility of ADD operation, or
- Undertaken in combination with another environmental role, e.g. fisheries liaison officer or member of the mitigation team.

The ADD-Op duties would be to verify the operation of the ADD before deployment, to operate the ADD throughout the pre-clearance period, ensure batteries are fully charged and that spare equipment is available in case of any problems, and record and report on all ADD and UXO clearance activity.

The ADD-Op will ensure that the ADD devices and spares are functioning correctly before the vessel leaves port. If practical, and in agreement with the Nominated Contact (EOD Supervisor or other appropriate member of the EOD team), testing should also be achieved through an initial deploy and test from the vessel, whilst docked. On site, the ADD will be re-tested prior to the start of the mitigation sequence.

The ADD-Op will also be required to record any marine mammal observations prior to and during ADD deployment.

As outlined in **Section B.4**, the ADD-Op will maintain a detailed record of all ADD deployments and activation. These reports will include a record of all ADD start and stop times, a record of each verification of ADD activation and a record of any issues with ADD deployment and activation.

A list of tasks to be undertaken by the ADD-Op include, but is not limited to:

- preparation and update of risk assessment for ADD in collaboration with vessel personnel;
- maintain, test and operate ADD, including spares;
- keep an inventory of spares and advise on any required repairs necessary to ADD including back-ups;
- deploy, test and monitor ADD;
- liaise and communicate with the EOD Supervisor or other nominated appointee to ensure compliance with the mitigation procedure;
- instruct vessel personnel during mitigation procedure to ensure smooth running of tasks;
- update database / reports at the end of each shift with records, including when the ADD was deployed and activated, in relation to UXO clearance, and any marine mammal observations; and
- provide reports to the Client Representative or other nominated appointee as outlined in **Section B.8** to ensure compliance reporting to the Marine Directorate – Licensing Operations Team (MD-LOT).

For every shift one ADD-Op will be required for the ADD deployment and activation.

It is anticipated that the ADD-Op, taking into account their primary ADD duties, would also be able to undertake marine mammal observations, if their position as ADD operator allows them uninterrupted views of the MA and they are fully trained.

If crew members are to be the ADD-Op, they also must have undertaken the required JNCC MMOs course, if being used in both roles, as well as the required MMMP and ADD training.

The ADD-Op will be suitably trained to required standards, with an appropriate level of experience. Details of the ADD operators will need to be supplied in advance for notification to the MMO in accordance with consent conditions.

Explosive Ordnance Disposal Supervisor

The EOD Supervisor has the overall responsibility for the UXO clearance operation and will be based on the inspection vessel. The EOD Supervisor will be the main point of communication between the mitigation team (MMOs, PAM-Op (if present) and the ADD-Op) and the EOD support teams (who are responsible for carrying out the UXO clearance activities). The EOD Supervisor will be in control of initiating, delaying or pausing the detonation activities.

B.7 Reporting

Reports will be completed detailing the marine mammal mitigation activities and timings, and any detections, and will be submitted to JNCC after the operation has been completed. These reports will include information on the relevant UXO clearance activities, date and location, information on charge sizes, start times of clearances, start and end of pre- and post-clearance watches by MMOs, details of activity during the relevant watches.

Marine Mammal Recording Forms[9] will be completed (including the cover page, operations sheet, effort sheet, and sightings sheet). Deck forms can be used if preferred with the information transferred to the spreadsheet at the end of the watch. Details of ADD used and observations of their efficacy, and any problems encountered and instances of non-compliance with the JNCC guidelines and variations from the agreed procedure will also be reported.

The ADD operator will maintain a detailed record, including all ADD deployment, activation and recovery times, a record of each verification of ADD activation and a note of any issues encountered with regard to the ADD deployment and activation.

After each UXO clearance event, a summary of monitoring and mitigation activities will be prepared and sent to the Client Representative or other nominated responsible person.

In the event of a marine mammal sighting and/or detection, the MMOs will report the following information:

- species, number of individuals, age, sex and size (e.g., juvenile or adult);

[9] https://hub.jncc.gov.uk/assets/24cc180d-4030-49dd-8977-a04ebe0d7aca

- physical description of individual features if unable to identify to species level;
- behaviour when first sighted (e.g., travelling, foraging, resting);
- bearing and distance;
- time, vessel position, vessel speed, vessel activity;
- water depth (if known), sea state, visibility, glare; and
- any other vessels in the area.

Weekly reports will be collated and provided to the MD-LOT on a monthly basis.

In addition to the weekly reports, a final report will be provided which will be submitted to the MD-LOT. The final report will include any data collected during UXO clearance operations, details of ADD deployment and activation, a detailed description of any technical problems encountered and what, if any, actions were taken. The report will also discuss the protocols followed and put forward recommendations on the use of ADD as mitigation during the construction period that could benefit future construction projects.

B.8 Communication protocol

Clear communication channels between the MMOs, PAM-Op (if present), the ADD-Op and the EOD team are required, and the communication procedures will be established and agreed prior to any clearance event with regard to the communication of any detection within the monitoring area, the deployment of ADD, and when the monitoring area is clear for clearance to take place. The EOD team will assign a person responsible for communication with the Lead Operator of the mitigation team.

A member of the mitigation team (ADD-Op, MMO) will be nominated as **Lead Operator** and will liaise directly with the **Nominated Contact** (EOD Supervisor or other appropriate member of the EOD team) via VHF/UHF radio or mobile phone. They will also ensure that information is relayed to the rest of the mitigation team.

The Nominated Contact will keep the Lead Operator updated with timings for UXO clearance events as appropriate to allow sufficient time to commence the ADD deployment and activation in accordance with the procedures set out in this MMMP.

The Lead Operator will inform the Nominated Contact of any delays in the ADD deployment or if any marine mammals are observed not moving out of the MA during the ADD activation period and therefore if a delay in clearance is required.

A communications protocol will be developed between the mitigation team and the Nominated Contact.

This communications protocol will include, but not be limited to:

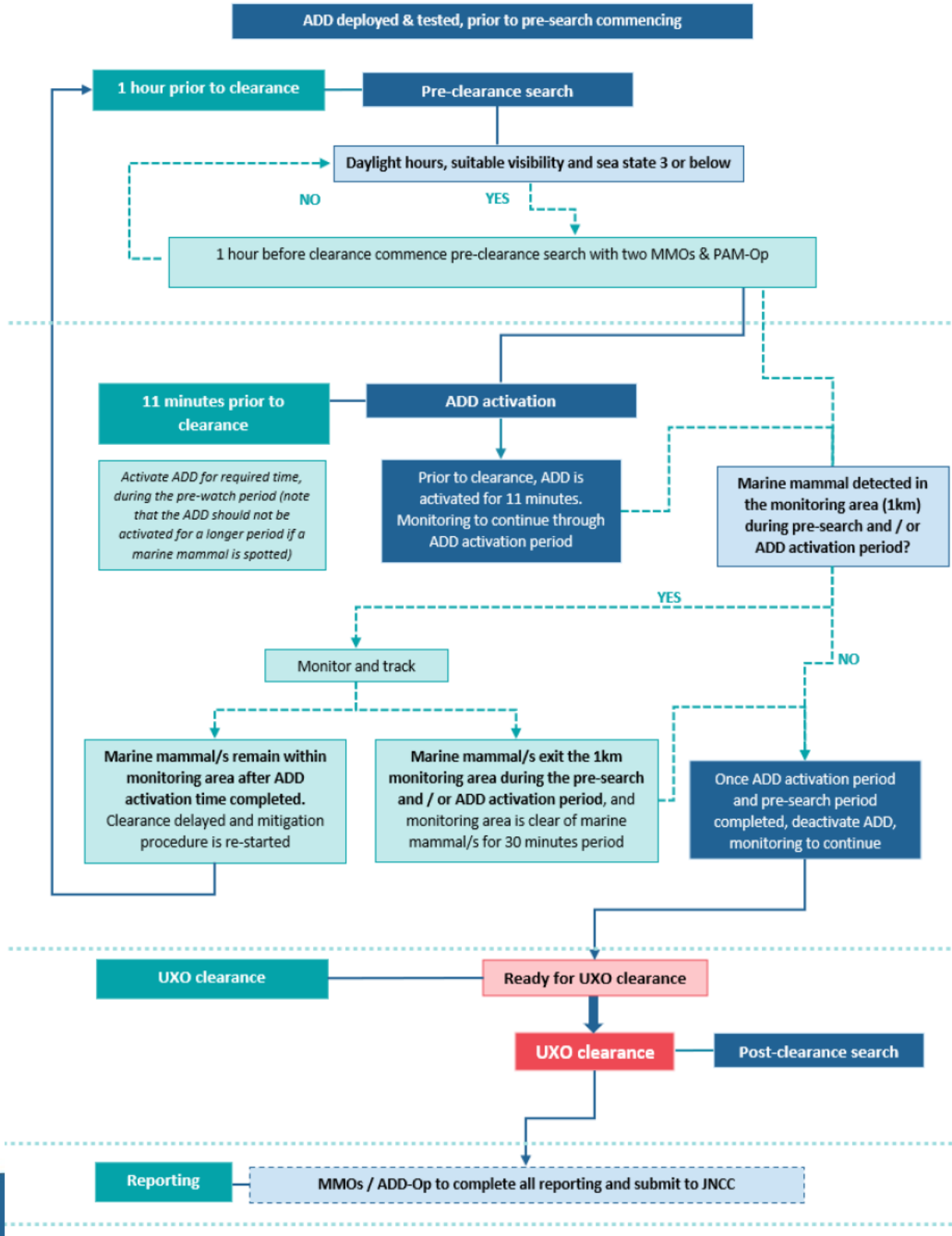
- Notification required prior to UXO clearance vessel deployment to ensure ADD and all equipment required is tested and ready for deployment.

- Once on board, the notification required to set-up equipment, test and deploy ADD to allow for the required activation prior to UXO clearance commencing.
- Procedure to notify the Nominated Contact that deployment of ADD and activation for the required time has been successful, and next steps in the mitigation can commence, or if deployment of ADD and activation has not been successful that clearance activities will be delayed.
- Procedure to notify the Lead Operator that each stage of the mitigation is successfully underway, and when the ADD can be switched off and retrieved from the water.
- Procedure to notify the Lead Operator that further ADD activation is required.
- Procedure to notify the Lead Operator that the UXO clearance operations have been successfully completed.

B.9 Summary of Mitigation Procedures

The outline mitigation procedure (as outlined above) is summarised below in the respective flow charts.

Low Order Clearance



B.11 References

Bailey, H., Senior, B., Simmons, D., Rusin, J., Picken, G. and Thompson, P.M. (2010). *Assessing Underwater Noise Levels during Pile-Driving at an Offshore Windfarm and Its Potential Effects on Marine Mammals*. Marine Pollution Bulletin 60 (6): 888–97.

Boisseau, O., McGarry, T., Stephenson, S., Compton, R., Cucknell, A-C., Ryan, C., McLanaghan, R. and Moscrop, A., 2021. Minke whales *Balaenoptera acutorostrata* avoid a 15 kHz acoustic deterrent device (ADD). Marine Ecology Progress Series, 667, 191-206. https://doi.org/10.3354/meps13690.

Joint Nature and Conservation Committee (JNCC), 2010. JNCC guidelines for minimising the risk of injury to marine mammals from using explosives. August 2010.

JNCC, 2017, JNCC guidelines for minimising the risk of injury to marine mammals from geophysical surveys. April 2017.

Kastelein, R.A., Van de Voorde, S, and Jennings, N., 2018. Swimming Speed of a Harbour Porpoise (*Phocoena phocoena*) During Playbacks of Offshore Pile Driving Sounds. Aquatic Mammals: 44(1):92-99.

McGarry, T., Boisseau, O., Stephenson, S. and Compton, R., 2017. Understanding the Effectiveness of Acoustic Deterrent Devices (ADDs) on Minke Whale (*Balaenoptera acutorostrata*), a Low Frequency Cetacean. ORJIP Project 4, Phase 2. RPS Report EOR0692. Prepared on behalf of The Carbon Trust. November 2017.

McGarry, T., De Silva, R., Canning, S., Mendes, S., Prior, A., Stephenson, S. and Wilson, J., 2020. Evidence base for application of Acoustic Deterrent Devices (ADDs) as marine mammal mitigation (Version 2.0). *JNCC Report No. 615*, JNCC, Peterborough. ISSN 0963-8091.

Morey East. 2018. UXO Clearance Cetacean Risk Assessment Moray East Offshore Wind Farm. https://marine.gov.scot/data/moray-east-offshore-windfarm-unexploded-ordinance-eps-licence-application https://marine.gov.scot/data/piling-strategy-2016-moray-east-offshore-wind-farm

Otani S., Naito T., Kato A. and Kawamura A., 2000. Diving behaviour and swimming speed of a free-ranging harbour porpoise (*Phocoena phocoena*). Marine Mammal Science, Volume 16, Issue 4, pp 811-814, October 2000.

Ordtek, 2019. Unexploded Ordnance (UXO) Hazard and Risk Assessment with Risk Mitigation Strategy, Creyke Beck A & B Offshore Wind Farms – Main Array.

Sparling, C., Sams, C., Stephenson, S., Joy, R., Wood, J., Gordon, J., Thompson, D., Plunkett, R., Miller, B. and Gotz, T., 2015. The use of Acoustic Deterrents for the mitigation of injury to marine mammals during pile driving for offshore wind farm construction. ORJIP Project 4, Stage 1 of Phase 2. Final Report.

Thompson, P. 2015. Annex 3. Framework for a risk-based assessment to underpin the adoption of alternative mitigation measures during piling at the BOWL and MORL Offshore Wind Farms. 28th July 2015. In: Beatrice Offshore Windfarm Ltd. (2015). Beatrice Offshore Wind Farm Piling Strategy. Prepared by RPS, GoBe Consultants Ltd and Brown and May Marine. Report number LF000005. November 2015.

Appendix C - UXO Deflagration Impact Rages

Comparison modelled of impact ranges

The maximum predicted impact ranges (km) for PTS and TTS in marine mammals from a range of possible charge weights for low-order clearance

Species	Sound Exposure Criteria		Erebus OWF	
			0.1 kg	0.25 kg
Harbour porpoise (VHF)	Unweighted SPL_{peak}	PTS 202 dB	0.73	0.99
		TTS 196 dB	1.30	1.80
	Weighted SEL	PTS (Impulsive) 155 dB	0.05	0.08
		TTS (Impulsive) 140 dB	0.54	0.75
Dolphin Species (HF)	Unweighted SPL_{peak}	PTS 230 dB	0.04	0.06
		TTS 224 dB	0.08	0.10
	Weighted SEL	PTS (Impulsive) 185 dB	<0.01	<0.01
		TTS (Impulsive) 170 dB	0.01	0.02
Minke whale (LF)	Unweighted SPL_{peak}	PTS 219 dB	0.13	0.17
		TTS 213 dB	0.23	0.32
	Weighted SEL	PTS (Impulsive) 183 dB	0.14	0.23
		TTS (Impulsive) 168 dB	2.00	3.20
Seal species (PCW)	Unweighted SPL_{peak}	PTS 218 dB	0.14	0.19

The maximum predicted impact ranges (km) for PTS and TTS in marine mammals from a range of possible charge weights for low-order clearance				
Species	**Sound Exposure Criteria**		**Erebus OWF**	
			0.1 kg	**0.25 kg**
		TTS 212 dB	0.26	0.36
	Weighted SEL	PTS (Impulsive) 185 dB	0.03	0.04
		TTS (Impulsive) 170 dB	0.36	0.57