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OFFSHORE LIMITED

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Inch Cape Offshore Wind Farm

European Protected Species Risk Assessment Generating Station Works

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Acronyms & Abbreviations

Acronym	Term
ADD	Acoustic Deterrent Device
CES	Coastal East Scotland
DAS	Digital Aerial Surveys
EIA	Environmental Impact Assessment
EIAR	Environmental Impact Assessment Report
EPS	European Protected Species
ES	Environmental Statement
FTRAG	Forth and Tay Regional Advisory Group
GS	Generating Station
HRA	Habitats Regulations Appraisal
ICOL	Inch Cape Offshore Limited
JNCC	Joint Nature Conservation Committee
km	Kilometre
MD-LOT	Marine Directorate - Licensing Operations Team
MS-LOT	Marine Scotland - Licensing Operations Team (now MD-LOT)
MU	Management Unit
nm	Nautical Miles
OSP	Offshore Substation Platform

Acronyms & Abbreviations

Acronym	Term
OWF	Offshore Wind Farm
PAM	Passive Acoustic Monitoring
PEMP	Project Environmental Monitoring Programme
PS	Piling Strategy
PTS	Permanent Threshold Shift
S36	Section 36
SAC	Special Area of Conservation
SELcum	Cumulative Sound Exposure Level
SMU	Seal Management Unit
SNH	Scottish Natural Heritage (now NatureScot)
SPLpk	Peak Sound Pressure Level
UK	United Kingdom
UXO	Unexploded Ordnance
WDC	Whale and Dolphin Conservation
WTG	Wind Turbine Generator

Executive Summary

The Inch Cape Offshore Wind Farm (OWF) project is a nationally significant renewable energy development proposed by Inch Cape Offshore Limited (ICOL), located in the North Sea approximately 15 to 22 km off the Angus coastline. The project comprises up to 72 Wind Turbine Generators (WTGs), inter array cables and associated offshore transmission infrastructure, including an Offshore Substation Platform (OSP) and two export cables.

This European Protected Species (EPS) Risk Assessment (RA) has been prepared to assess the potential impacts of offshore construction activities — particularly piling operations — on marine mammals protected under the Conservation (Natural Habitats, &c.) Regulations 1994 and the Conservation of Habitats and Species Regulations 2017.

A comprehensive overview of the construction of WTGs and full details on the on the underwater noise modelling scenarios and results are provided in the Inch Cape Piling Strategy for the Generating Station (PS-GS) (IC02-INT-EC-OFC-005-INC-STR-002). The precautionary assumptions underpinning the underwater modelling for pile driving activities are summarised below.

Table 1 Existing precautionary assumptions in the noise assessment for auditory injury from pile driving

Aspect	Precautionary Assumption Applied
Hammer energy	120% of maximum hammer energy modelled for extended periods, which is unlikely to be the case for most of piling locations. The final best estimate predictions from the hammer supplier indicate no locations require such high energy. This results in Overestimates sound levels and associated impact ranges relative to expected operational levels.
Animal swim speed	The swimming speeds modelled are typical swimming speeds, not fleeing speeds. This results in extended predicted exposure duration and increases estimated risk of cumulative PTS.
Blow rates	High blow rates modelled, which inflates cumulative sound exposure levels (SEL) and exaggerates potential impacts.
Recovery/ equal energy hypothesis	No allowance for recovery between piling strikes / equal energy hypothesis adopted. This assumes worst-case continuous exposure, increasing predicted risk.
Density of minke whales	The assessment considers the average density of minke whales across the NS-D SCANS IV survey block, resulting in densities within the impact range are overestimated. The more recent SCANS IV modelled density surface shows lower minke whale densities in the south of this block at the ICOL site.
Impulsive/non-impulsive noise	The model does not incorporate decline in impulsiveness with distance, which will reduce rapidly with distance. The largest impact ranges are predicted for low-frequency and very high-frequency cetaceans, and at the upper extent of these distances any risk will be substantially reduced, but this cannot currently be quantified.

To allow an EPS licence to be granted, ICOL demonstrated that the Inch Cape OWF meets the three EPS licence test: (1) There must be a licensable purpose for which licences can be granted; (2) There is no satisfactory alternative for the development; and (3) The action authorised will not be detrimental to the maintenance of the population of the species concerned at a favourable conservation status (FCS) in their natural range.

The conclusions of the assessment for impacts of auditory injury and disturbance on cetacean EPS and seals from the piling of WTGs are that:

- After mitigation, the risk of instantaneous or cumulative auditory injury (PTS) is considered negligible, such that an EPS license to injure is not required:
    - The use of pre-piling ADD will fully mitigate instantaneous PTS; and
    - The use of pre-piling ADD combined with 30 minutes soft start constitutes the best practice measures which would reduce the risk of cumulative PTS. There are no requirements to fully mitigate modelled cumulative PTS as it is acknowledged these are highly precautionary. In addition, seasonal restrictions are proposed for 12 locations with challenging ground conditions that are predicted to require higher hammer energies, as described in Section 8.1.5.
- There is a potential for EPS to be disturbed by construction activities at the Inch Cape OWF alone. However, any disturbance is deemed short-term, sporadic, reversible, and without any likely negative effect on the species.

EPS licenses are therefore required (inshore and offshore waters), as summarized in Table 2 below, for ADD testing, pile driving activities, geophysical surveys and non-piling construction works (route preparation activities, cable lay operation, scour and cable protection).

Table 2 EPS RA summary of conclusions

<table>
<tr><th rowspan="2">Species</th><th colspan="2">Injury</th><th rowspan="2">Disturbance</th><th rowspan="2">EPS Licence Required</th></tr>
<tr><th>Instantaneous PTS</th><th>Cumulative PTS</th></tr>
<tr><td colspan="5">Piling driving</td></tr>
<tr><td>Harbour porpoise</td><td>Fully mitigated with ADD</td><td rowspan="2">Highly precautionary modelled ranges. Residual risk to be mitigated with pre-piling ADD,a minimum of a 30 minute soft start,</td><td rowspan="2">Disturbance expected, with no changes to the favourable conservation status of the population.</td><td rowspan="2">EPS licence to disturb is required and can be granted.

EPS Licence for injury not required.</td></tr>
<tr><td>Minke whale</td><td>Fully mitigated with ADD</td></tr>
</table>

Species	Injury		Disturbance	EPS Licence Required
	Instantaneous PTS	Cumulative PTS		
Piling driving				
		and seasonal restrictions at selected locations.		
Dolphins	Negligible	Residual risk to be mitigated with pre-piling ADD and a minimum of a 30 minute soft start.		
Grey seal	Negligible			
Harbour seal	Negligible			
Geophysical surveys				
All marine mammals	Negligible risk of auditory injury		Disturbance expected, with no changes to the favourable conservation status of the population.	EPS licence to disturb is required and can be granted. EPS Licence for injury not required.
Non-piling construction activities				
All marine mammals	Negligible risk of auditory injury		Disturbance expected, with no changes to the favourable conservation status of the population.	EPS licence to disturb is required and can be granted. EPS Licence for injury not required.
ADD testing				
All marine mammals	Negligible risk of auditory injury		Disturbance expected, with no changes to the favourable conservation status of the population.	EPS licence to disturb is required and can be granted. EPS Licence for injury not required.

1 Introduction

1.1 Background

The Inch Cape Offshore Wind Farm (OWF) and Offshore Transmission Infrastructure (OfTI) are being developed by Inch Cape Offshore Limited (ICOL). In 2013 an Environmental Statement (ES) was produced to accompany the initial application based on the original design of the Inch Cape OWF. This was subsequently updated in 2018 with the production of an Environmental Impact Assessment Report (EIAR) to enable the use of progressions in technology following the original consent. The EIAR updated the 2013 ES and where impacts were predicted to be less than those already assessed, a new assessment was not undertaken as the conclusions drawn in the original 2013 ES remained valid.

The Inch Cape OWF will be located approximately 15 to 22 km (eight to 12 nautical miles (nm)) off the Angus coastline, to the east of the Firth of Tay, and will comprise up to 72 wind turbines. The location and extent of the Inch Cape OWF is shown in Figure 1-1. Installation of wind turbine generators (WTGs) is expected to commence in late 2025 or early 2026. Further details on the WTG installation works are provided in the Inch Cape OWF Piling Strategy for the Generating Station (PS-GS) (ref: IC02-INT-EC-OFC-005-INC-STR-002), which outlines the proposed methods, mitigation measures, and monitoring to be adopted during piling operations, recognising the potential risks to marine mammals from underwater noise.

The piling activities during WTG installation generate underwater noise which may present a risk of auditory injury (e.g. hearing damage) or disturbance to noise-sensitive protected species, namely marine mammals. As European Protected Species (EPS), listed on Annex IV of the EU Habitats Directive, it is an offence to kill, injure or disturb **cetaceans**; if such an offence is likely to occur, an EPS licence is required. Further detail of the legislative context is provided in Section 2. The objective of this report is to assess the risk of auditory injury and disturbance to EPS as a result of proposed works required during construction of the Inch Cape OWF both within and out with 12 nm.

While **seals** are not EPS, they may be interest features of protected sites, including Special Areas of Conservation (SACs) under the Habitats Directive, and as such potential effects on harbour and grey seals are also assessed.

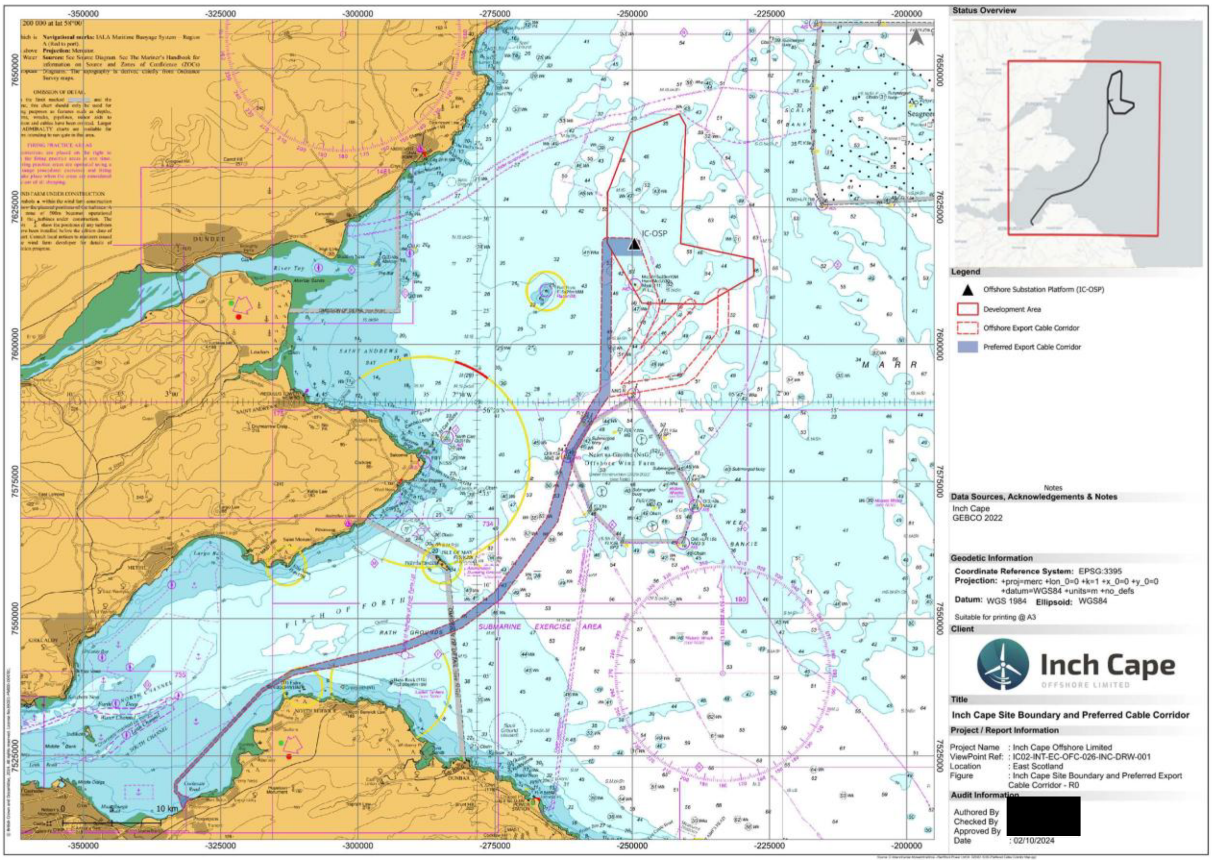

Figure 1-1 Inch Cape OWF Project Location

2 Legislative context

2.1 EPS

Annex IV of the EC Habitats Directive (European Council Directive 92/43/EEC on the conservation of natural habitats and of wild flora and fauna) lists species of European interest in need of strict protection – EPS. All species of cetacean whose natural range includes waters around the UK are marine EPS. The Habitats Directive is transposed into UK and Scots law by different regulations which define offences in relation to EPS. Those of relevance to this risk assessment are described in Table 2-1.

Table 2-1 Legislation and offences relating to EPS in Scottish inshore and offshore waters.

Cetaceans: European Protected Species
Legislation: *The Conservation (Natural Habitats, &c.) Regulations 1994 (as amended)* **Applicable to:** Scottish inshore waters (<12 nm) **Offence(s): Regulation 39(1)** makes it an offence to deliberately or recklessly to capture, injure, kill, harass or disturb a wild animal of a European protected species; further, **Regulation 39(2)** provides that it is an offence to deliberately or recklessly disturb <u>any</u> dolphin, porpoise or whale (cetacean). This offence is considered to relate to disturbance at the individual level.
Legislation: *The Conservation of Habitats and Species Regulations 2017* **Applicable to:** UK offshore waters (<12 nm) **Offence(s): Part 3 (Section 43)** states that it is an offence to deliberately capture, kill or injure any wild animal of a European protected species. It is also an offence to deliberately disturb wild animals of any such species, with disturbance defined as that which is likely to impair their ability to: survive, breed, reproduce, or nurture young; migrate or hibernate; or which might affect significantly its local distribution or abundance.
Legislation: *The Conservation of Offshore Marine Habitats and Species Regulations 2017* **Applicable to:** UK offshore waters (>12 nm) **Offence(s): Part 3 (Section 45)** states that it is an offence to deliberately capture, kill or injure any wild animal of a European protected species. It is also an offence to deliberately disturb wild animals of any such species, with disturbance defined as that which is likely to impair their ability to: survive, breed, reproduce, or nurture young; migrate or hibernate; or which might affect significantly its local distribution or abundance.

Should an EPS licence be required, for it to be granted the Habitats Regulations specify three tests which need to be met: (i) there must be a licensable purpose; (ii) there must be no satisfactory alternative; and, (iii) the activity must not be detrimental to the maintenance of the population of the species concerned at favourable conservation status in their natural range. This third test relates to impacts which might damage the status of the species in the long-term.

Specifically, the conservation status will be taken as 'favourable' when:

- population dynamics data on the species concerned indicates that it is maintaining itself on a long-term basis as a viable component of its natural habitats; and
- the natural range of the species is neither being reduced nor is likely to be reduced for the foreseeable future; and
- there is, and will probably continue to be, a sufficiently large habitat to maintain its populations on a long-term basis.

Since the Inch Cape OWF will be located between eight to 12 nm from the coast, the proposed WTG installation could potentially affect both Scottish territorial and offshore waters therefore both the Conservation (Natural Habitats &c.) Regulations 1994 and the Conservation of Offshore Marine Habitats and Species Regulations 2017 apply. As such, this risk assessment considers piling of WTGs as a whole and does not differentiate between activities within and out with of 12 nm.

2.2 Non EPS species

While seals are not EPS, they are also sensitive to underwater noise, and in Scottish inshore waters it is an offence to kill, injure or take a seal, or harass a seal at a designated haul-out site. Additionally, seals may be interest features of protected sites, including Special Areas of Conservation (SACs) under the Habitats Directive. Therefore, potential effects on harbour and grey seals are also assessed.

Basking sharks are protected under Schedule 5 of the Wildlife and Countryside Act 1981. There have been few sightings of this species in the North Sea (Drewery, 2012, Wilson *et al.*, 2020) which indicates a low abundance in the vicinity of the Inch Cape OWF. Due to their habit of feeding at slow speed very close to the surface, basking sharks are potentially at risk from collision with boat traffic (Wilson *et al.*, 2020). In contrast, although there is little information on sound detection in basking sharks, there is no direct evidence of sound causing basking shark mortality or stress (Wilson *et al.*, 2020). Although the potential effects of noise on basking sharks have not therefore been assessed, any mitigation measures proposed for EPS will also be applied to basking sharks.

2.3 Relevant guidance

This risk assessment has been prepared with consideration of the following guidance:

- JNCC *et al.* (2010). The protection of marine European Protected Species from injury and disturbance. Guidance for the marine area in England and Wales and the UK offshore marine area (June 2010 – Draft).

- Marine Scotland (2020). The protection of Marine European Protected Species from injury and disturbance. Guidance for Scottish Inshore Waters (July 2020 Version).
- JNCC (2010) - Statutory nature conservation agency protocol for minimising the risk of injury to marine mammals from piling noise.
- JNCC (2025) - DRAFT JNCC guidelines for minimising the risk of injury to marine mammals from geophysical surveys.

3 Planned Activities

3.1 WTG installation

The Development comprises a total of 72 WTGs, using two different types of substructures. A total of 54 WTGs will be supported by monopile foundations, while the remaining 18 WTGs will be supported by jackets.

3.1.1 Piling works

All 54 monopiles will have a top diameter of 8 m and a maximum bottom diameter of either 11.0 m or 11.5 m. The maximum length of the monopiles will be up to 101.25m. The monopiles will be installed with a maximum hammer energy of up to 6,600 kJ (120% of the hammer capacity using a “boost” mode).

The jacket pin piles will be 3.5 m in diameter and up to 39.42 m in length. There will be three pin piles per jacket structure, resulting in 54 pin piles in total across the site. These will be installed using a hammer with energy of up to 4,400 kJ.

A 30-minute soft start[1] will be implemented with a maximum hammer energy of 550 kJ for monopiles and 440 kJ for jacket pin piles (10% of typical full power, 8.3% of maximum boost power). The rate of ramp up following the 30-minute soft start will vary depending on the location, ground conditions and hammer limitations.

In addition, as described in Section 8.1.3, pre-piling Acoustic Deterrent Devices (ADD) will be used as a mitigation. Testing of the main device and a back-up device may be undertaken prior to starting the works, either before a vessel departs port, for example, through an initial deployment and test while the vessel is docked at the Port of Leith, or at the wind farm site. Piling activities are expected to range from 1.5 to 3.5 hours per monopile or pin pile, including soft start and ramp-up, depending on the pile

[1] The standard recommended soft start of 20 minutes (JNCC, 2010) was extended to allow animals additional time to flee during the low hammer energy period thus reducing the cumulative PTS risk.

length and ground conditions. These durations are indicative, and the specific durations estimates for each location are still to be defined.

It is anticipated that a single monopile foundation or three consecutive pin piles can be installed within a 24-hour window. Piling works for the monopiles and pin piles (jackets) will be completed using different vessels. Therefore, concurrent installation of one monopile and three pin piles in one day may happen if there is overlap between two installation vessels.

A comprehensive overview of the construction of WTGs is given in Section 4 of the Inch Cape OWF Piling Strategy – Wind Turbine Generators (PS-GS) (IC02-INT-EC-OFC-005-INC-STR-002) (Inch Cape Offshore Limited, 2025).

3.1.1.1 Underwater noise modelling for piling activities

Underwater noise modelling to assess the effects of the installation of the WTG foundations was undertaken by Subacoustech Environmental Ltd. using the INSPIRE model v5.3. The drivability analysis was used to identify three monopile modelling locations and one jacket pin-pile location to take forward to the underwater noise modelling:

- Average Monopile L010 is representative of 29 WTG locations;
- Intermediate Monopile L026 is representative of 11 WTG locations, specifically considered due to a relatively faster energy ramp-up due to stronger soils at shallow depth
- Worst-case Monopile L019 is representative of 14 WTG locations; and
- Jacket L055 is representative of all 18 jacket WTG locations.

Full details on the underwater noise modelling scenarios and results are provided in Section 5: Underwater Noise Modelling of the Inch Cape OWF PS-GS (Inch Cape Offshore Limited, 2025). The model also includes scenarios for concurrent piling of a monopile and a jacket (pin piles).

3.1.2 WTG foundations and topside installation

Following piling works, jackets and/or transition pieces will be installed. For jackets, preparatory activities will include soil plug removal and marine growth removal, using either high-pressure water jetting or brush tools. Marine growth removal will also be undertaken for monopiles. Grouting will then be completed within the annulus between the piles and jacket legs, and between the monopile and transition piece.

The WTG towers, nacelle hubs, and blades will be installed using a jack-up vessel. Scour protection will be placed at the foundation footings, which may include rock placement, rock bags, or mattresses. Once installation is complete, the foundation area and base of the structure will be resurveyed to confirm the required coverage and verify that the rock profile meets design specifications.

3.2 Inter-array cables installation

The inter array cables (IAC) installation works will follow the seabed preparation works, comprising geophysical survey, boulder clearance, and Unexploded Ordnance (UXO) identification and clearance. These are currently ongoing and are all covered under separate EPS Licences (EPS/BS-00011203; EPS/BS-00011286; and EPS/BS-00011281).

Detailed information on the construction of the IAC is provided in the Inch Cape Offshore Wind Farm Cable Plan – Inter Array Cable (CaP - IAC) (IC02-INT-EC-OFC-012-INC-PLA-001) (ICOL, 2025c).

3.2.1 Pre-Installation Preparatory Works

3.2.1.1 Pre-Lay Grapnel Run

A Pre-Lay Grapnel Run (PLGR) will be conducted along the IAC routes. The PLGR involves a vessel towing a grapnel train over the cable routes. The objective is to find and recover debris (e.g. wires or fishing nets) presented within the cable installation corridor. Depending on the size and type of debris, it will be either removed from the route or recovered to the vessel deck.

3.2.1.2 Pre-lay surveys

Pre-lay surveys to inform cable micro-siting will be undertaken using Sub-Bottom Profiling (SBP), Side Scan Sonar (SSS), Multi Beam Echo Sounders (MBES) and visual methods (e.g. remotely operated vehicle (ROV), drop down videos). These will provide the final identification of objects on the seabed surface, such as boulders and debris, and assess seabed morphology prior the installation works. The contractor may wish to carry out additional geotechnical surveys along the route in order to gather more data on the soil conditions. This would be through cone penetration test or vibrocore, penetrating no more than 6m below seabed. Input from the pre-installation survey will be used for final route engineering of the subsea cable. The route will be adjusted where possible and required.

Surveys will be carried out either from sensors mounted on surface vessels, or sensors mounted to ROV’s or other subsea tools used during cable installation/ trenching. For some survey types, surveys may be carried out by Unmanned Surface Vessels (USV’s).

3.2.2 Cable Installation

The cables will be installed onto the seabed to a minimum target depth varying from 0.4 m to 1 m, depending on the soil type. The Cable Lay Vessel (CLV) will take position using Dynamic Positioning (DP) systems.

For each section of cable, the installation process can be split into five components (as outlined in the CaP – IAC):

- First end cable pull-in, where the cable connects to a WTG or the OSP;
- Surface laying, where the cable is surface laid along the cable route;

- Second end pull-in, where the cable is connected to a WTG or the OSP;
- Trenching and burial, including a pre-lay trenching and combination of methods such as ploughs, jetting, CFE and mechanical cutters; and
- Deployment of additional cable protection, such as rock placement, mattresses and other protection materials.

Cable surveys, monitoring and testing will be performed at various stages during the cable installation operations, and following completion of the works to provide the as built conditions.

3.3 Proposed Vessels

Several types of vessels may be required for the WTG and IAC construction works. Not all of these vessels will be used at the same time. The proposed vessel types are:

- Construction support vessels (including multipurpose vessels, Anchor Handling Tugs (AHT), tug boats, ROV support vessels, multicat workboats, safety boats, supply vessels, and others);
- Heavy lift vessel (HLV);
- Jack up vessel (JUV);
- Cargo vessel;
- Cable lay vessel (CLV);
- Rock installation vessel/ barge or fall pipe vessel;
- Trenching support vessel (TSV);
- Survey support vessels;
- Diving support vessels (DSV);
- Crew Transfer Vessels (CTV);
- Guard vessels; and
- Cable transport vessel.

3.4 Sound emitting survey and positioning equipment

All aspects of the IAC construction works (pre-installation preparatory works, cable lay operations and post installation surveys) and some elements of the WTG installation will require the use of sound emitting survey and positioning equipment. Examples of equipment which may be used include Ultra-

Short Base Line (USBL) systems, MBES, Sub-Bottom Imagers (SBI), SSS and other sonars (see section 7.1.2 for a list of equipment).

3.5 Timing and Duration

Offshore construction of Inch Cape commenced in June 2025 and is anticipated to take approximately two and a half years, running to August 2027. The offshore GS works are due to start in December 2025. Construction works will be caried out 24/7 (i.e. 24-hours per day, seven days a week).

Piling works are expected to take 6-10 months, starting as early as December 2025, and extending up to September 2026, with a risk to run over to the end of October, in the event of unfavourable weather conditions, breakdowns and other unplanned delays. The detailed programme for pile installation activities is being finalised, and the final piling schedule is subject to several factors, such as vessel availability windows, coordination with other construction activities (e.g. installation of transition piece and cables), weather conditions and other unanticipated programme constraints.

Note that, for the purpose of the marine mammal disturbance assessment using iPCoD a few schedule scenarios were considered, which are discussed in Section 4.1.4.1.

Details of the full programme for the construction works are provided in the Construction Programme (CoP) (IC02-INT-EC-OFC-004-INC-PRG-001).

4 Marine Mammal Impact Assessment

4.1 Assessment Methodology

4.1.1 Species

Four cetacean species are considered to occur on a relatively common basis in the vicinity of the Inch Cape OWF: Minke whale (*Balaenoptera acutorostrata*), bottlenose dolphin (*Tursiops truncatus),* white-beaked dolphin (*Lagenorhynchus albirostris*) and harbour porpoise (*Phocoena phocoena*). Additionally, two species of seals are also considered: grey seal (*Halichoerus grypus*) and harbour seal (*Phoca vitulina*).

4.1.1.1 Abundance and conservation status

The population estimate for the North Sea (NS) Management Unit (MU) is 346,601 harbour porpoise (95% CIs: 289,498 - 419,967, CV: 0.09) (IAMMWG, 2023). The UK portion of this MU is 159,632 harbour porpoise (95% CIs: 127,442 - 199,954, CV: 0.12) (IAMMWG, 2023). The most recent favourable conservation status assessment for harbour porpoise in the UK concluded an overall assessment of "*Unknown*" (JNCC, 2019a). The assessment was based on now outdated data (SCANS III in 2016, (Hammond *et al.*, 2017)) but concluded for the North Sea that there was no evidence of a change in abundance over the period 1994 - 2016. The more recent SCANS IV surveys concluded there is no evidence for a change in harbour porpoise abundance in the North Sea since the mid-1990s (Gilles *et al.*, 2023).

All white-beaked dolphins and minke whales in UK waters are considered to be part of the Celtic and Greater North Seas (CGNS) MU. The CGNS MU has an estimated minke whale population size of 20,118 animals (95% CIs: 14,061 - 28,786), of which 10,288 (95% CIs: 6,210 - 17,042) are estimated within the UK EEZ (IAMMWG, 2023). The most recent favourable conservation status assessment for minke whales in the UK concluded an overall assessment of "*Unknown*" (JNCC, 2019c). The assessment was based on now outdated data (SCANS III in 2016, (Hammond *et al.*, 2017)) but concluded for the North Sea that there was no evidence of a change in abundance over the period 1994 - 2016. The more recent SCANS IV surveys concluded there is no support for a change in abundance in the North Sea since 1989 (Gilles *et al.*, 2023). The abundance estimate of white-beaked dolphin for this MU is 43,951 animals (95% CIs: 28,439 - 67,924) of which 34,025 (95% CIs: 20,026 – 57,807) are estimated within the UK Exclusive Economic Zone (EEZ) (IAMMWG, 2023). The most recent favourable conservation status assessment for white-beaked dolphins in the UK concluded an overall assessment of "*Unknown*" (JNCC, 2019b). The assessment was based on now outdated data (Hammond *et al.*, 2017) but concluded for the North Sea that there was no evidence of a change in abundance over the period 1994 - 2016. The more recent SCANS IV surveys concluded there is no significant change in the abundance of white-beaked dolphins in the North Sea since 1994 (Gilles *et al.*, 2023).

The weighted mean estimate of the number of bottlenose dolphins in the Coastal East Scotland (CES) MU from 2020 - 2022 was 226 individuals (Cheney *et al.*, 2024). The most recent site condition monitoring for the Moray Firth SAC and CES MU (2017-2022) concluded that the east coast population is increasing and thus the condition status was recommended as "*Favourable (maintained)*" (Cheney *et al.*, 2024).

Inch Cape OWF is located in the East Scotland Seal Monitoring Unit (SMU). The assessment for both harbour and grey seals will be provided against the population of the East Scotland SMU[2]. The latest harbour seal August haul-out count of the East Scotland SMU was 262 seals in 2021 (SCOS, 2023). This count is scaled by the proportion of seals expected to be hauled-out at the time of the count (72% (Lonergan *et al.*, 2013)) to obtain a population estimate of 364 harbour seals. The latest grey seal August haul-out count of the ES SMU was 2,712 seals in 2021 (SCOS, 2023). This count is scaled by the proportion of seals expected to be hauled-out at the time of the count (25.15% (Russell and Morris, 2021)) to obtain a population estimate of 10,783 grey seals.

4.1.1.2 *Density*

Density surfaces for harbour porpoise and white-beaked dolphins were obtained from the most recent SCANS-IV design-based density estimates (Gilles *et al.*, 2023). Inch Cape OWF is located in SCANS-

[2] None of the modelled impact contours for auditory injury or disturbance for seals extend beyond the boundary of the ES SMU.

IV block NS-D. The density estimate for harbour porpoise in this block is 0.5985 porpoise/km^2 and for white-beaked dolphins is 0.0799 dolphins/km^2. If noise contours extend beyond the boundary of block NS-D, then the proportion of the impacted area within the adjacent block will use the block specific density estimate of relevance[3].

It is important to note that minke whales are highly seasonal in the area, and varying seasonal density estimates for minke whale are required to be considered. Although minke whales are present in Scottish waters all year round, sightings in the Southern Trench MPA, located north from the Inch Cape OWF, are highest during June to October inclusive (NatureScot, 2025). The SCANS-IV surveys conducted between June and August provide the resulting density estimates for minke whales during the summer months: 0.0419 whales/km^2 for SCANS-IV block NS-D (Gilles *et al.*, 2023). To obtain representative seasonal density estimates, the SCANS-IV block NS-D density estimate has been scaled for non-summer months (Table 4-1) using the Paxton *et al.* (2016) seasonal abundance point estimates for the east coast of Scotland commercial area of interest in 2010 (Table 4-1). It is noted that the SCANS-IV density estimates used correspond to the average within the NS-D block. Based on the SCANS-IV observations, it is expected that higher densities of minke whales will be present in the northern portion of the NS-D block, as it approaches the Southern Trench MPA boundaries. Recent work has become available in May 2025 (Gilles et al., 2025), which provides a density surface that reflects an uneven density distribution within the NS-D block. This has also been included in the assessment, and seasonally scaled in the same way.

Table 4-1 Minke whale seasonal density estimates obtained by scaling the SCANS-IV NS-D block density by the 2010 seasonal point estimates from Paxton *et al.* (2016) for the East coast of Scotland area.

Season	Autumn	Winter	Spring	Summer
Months	Oct Nov Dec	Jan Feb Mar	Apr May Jun	Jul Aug Sep
East coast of Scotland point estimate in 2010 (Paxton *et al.*, 2016)	20	20	60	360
East coast of Scotland density estimate (#/km^2) in 2010 (Paxton *et al.*, 2016)	0.0014	0.0014	0.0042	0.0253
SCANS-IV Block NS-D Density estimate	**0.0023**	**0.0023**	**0.0070**	**0.0419**

[3] For harbour porpoise, Digital Aerial Surveys (DAS) conducted at Inch Cape between 2016 - 2017 and 2019 - 2020 resulted in adjusted (absolute) density estimates, averaged between December and May of 0.2133 porpoise/km^2 (HiDef 2020b) and 0.4467 porpoise/km^2 (HiDef 2020a) respectively. Both of these density estimates are lower than the SCANS IV density estimate so were not used in the assessment.

Season	Autumn	Winter	Spring	Summer
seasonally scaled from SCANS-IV (#/km^2)				
SCANS-IV average density estimate across ICOL array area from the modelled density surface (Gilles *et al.*, 2025)	**0.0008**	**0.0008**	**0.0025**	**0.0151**

Recent monitoring for bottlenose dolphins on the east coast of Scotland confirmed that approximately 50% of the CES MU bottlenose dolphin population uses the Tayside and adjacent waters (Cheney *et al.*, 2024). The distribution of the CES MU has also experienced further expansion south, into northeast England (Cheney *et al.*, 2024). To calculate bottlenose dolphin density within the CES MU, the weighted average for the east coast bottlenose dolphin population from 2020 - 2022 (226, CIs: 214 – 239, Cheney et al., 2024) was assumed to be split 50:50 between the Moray Firth and the remaining area of the CES MU (from Inverallochy south). The distribution of bottlenose dolphins within the CES MU is restricted to coastal areas within the 2 - 20 m depth contour and approximately 2 km of the shore (Quick *et al.*, 2014). As such, a 2 km coastal buffer was used to differentiate between the 'coastal strip' (where CES bottlenose dolphins tend to be encountered) and the offshore waters. The 113 individuals assumed to be present on the east coast (i.e. 50% of the population of 226 individuals) were distributed evenly across the area inside the 2 km coastal buffer from Inverallochy to the southern boundary of the CES MU. This resulted in a density of 0.095 dolphins/km^2 across the 1,190.6 km^2 coastal strip area.

The density estimates used in the quantitative assessment for harbour and grey seal are the grid-cell specific densities from the Carter *et al.* (2020), Carter *et al.* (2022) habitat preference maps.

4.1.1.3 Summary

Species, abundance and density estimates used in the quantitative assessment of the piling of WTG at Inch Cape OWF are provided in Table 4-2.

Table 4-2 Summary of densities and reference populations taken forward to the assessment

Species	Density (#/km^2)		Reference population	Abundance	
	Estimate	Reference		Estimate	Reference
Harbour	0.5985	Gilles *et*	NS MU	346,601	IAMMWG

<table>
<tr><th rowspan="2">Species</th><th colspan="2">Density (#/km²)</th><th rowspan="2">Reference population</th><th colspan="2">Abundance</th></tr>
<tr><th>Estimate</th><th>Reference</th><th>Estimate</th><th>Reference</th></tr>
<tr><td>porpoise</td><td></td><td>al. (2023)</td><td>UK portion of NS MU</td><td>159,632</td><td>(2023)</td></tr>
<tr><td>Bottlenose dolphin</td><td>0.095</td><td>Calculated</td><td>CES MU</td><td>226</td><td>Cheney et al. (2024)</td></tr>
<tr><td rowspan="2">White-beaked dolphin</td><td rowspan="2">0.0799</td><td rowspan="2">Gilles et al. (2023)</td><td>CGNS MU</td><td>43,951</td><td rowspan="2">IAMMWG (2023)</td></tr>
<tr><td>UK portion of CNGS MU</td><td>34,025</td></tr>
<tr><td rowspan="2">Minke whale</td><td colspan="2" rowspan="2">SCANS-IV Block NS-D (Gilles et al., 2023):
• A/W = 0.0023
• Sp = 0.0070
• Su = 0.0419
SCANS-IV density surface (Gilles et al., 2025)(average across array area):
• A/W = 0.0008
• Sp = 0.0025
• Su = 0.0151</td><td>CGNS MU</td><td>20,118</td><td rowspan="2">IAMMWG (2023)</td></tr>
<tr><td>UK portion of CNGS MU</td><td>10,288</td></tr>
<tr><td>Grey seal</td><td colspan="2">Grid cell specific based on Carter et al. (2022)
Average across Array: 1.011</td><td>East Scotland SMU</td><td>10,783</td><td>SCOS (2023)</td></tr>
<tr><td>Harbour seal</td><td colspan="2">Grid cell specific based on Carter et al. (2022)
Average across Array: 0.003</td><td>East Scotland SMU</td><td>364</td><td>SCOS (2023)</td></tr>
</table>

A/W = Autumn and Winter (Oct-Mar)
Sp = Spring (Apr-Jun)
Su = Summer (Jul-Sep)

4.1.1.4 Special Areas of Conservation (SACs)

There is a number of SACs supporting certain marine mammal species that are sensitive to underwater noise and are likely to have some degree of connectivity with areas in the vicinity of the Inch Cape OWF (Table 4-3).

Table 4-3 Special Areas of Conservation considered in EPS Risk Assessment; distance is measured by the sea.

SAC	Site Features of relevance to this risk assessment	Distance to the array area (km)
Isle of May	Annex II species: Grey Seal	33.1
Berwickshire and North Northumberland Coast	Annex II species: Grey seal	52.2
Firth of Tay and Eden Estuary	Annex II species: Harbour seal	25.2
Moray Firth	Annex II species: Bottlenose Dolphin	210.8

4.1.2 Auditory Injury

Exposure to loud sounds can lead to a reduction in hearing sensitivity (a shift in hearing threshold). This threshold shift results from physical injury to the auditory system and may be temporary (Temporary Threshold Shift, TTS) or permanent (Permanent Threshold Shift, PTS). The point at which threshold shifts occur in marine mammals is species specific (i.e. functional hearing group dependent, see Table 4-4). The risk assessment includes PTS only and thresholds used are those presented in Southall *et al.* (2019). These include two different thresholds covering 'instantaneous' PTS (SPL_{peak}, sound pressure from a single noise pulse), and 'cumulative' PTS (SEL_{cum}, accumulated sound energy over 24 hours), with the latter thresholds being frequency-weighted to marine mammal functional hearing groups.

Table 4-4: Auditory injury (PTS) thresholds (Southall *et al.*, 2019)

Hearing group	Species	Instantaneous PTS (SPL_{peak} dB re 1µPa unweighted)	Cumulative PTS (SEL_{cum} dB re 1µPa^{2}s weighted)
Very High Frequency (VHF) Cetacean	Harbour porpoise	202	155
High Frequency (HF) Cetacean	Bottlenose dolphin White-beaked dolphin	230	185
Low Frequency (LF) Cetacean	Minke whale	219	183
Phocid Carnivores in Water (PCW)	Harbour seal Grey seal	218	185

4.1.2.1 Key precautions in the cumulative PTS modelling

- Selected analysis locations: The high estimate pile driving behaviour for three monopile locations and one jacket location was analysed for input to the noise modelling analyses. Three of these locations represent worst-case conditions, with the fourth location intended to represent a cautious average monopile location. The high estimate analyses are also highly precautionary, representing soil resistances 25% above expected values.

- The maximum blow energy: The modelling accounts for the use of the largest hammer available, the IQIP IQ6 operating at 100- 120%, for in excess of an hour in the worst case scenarios. This is highly unlikely based on driveability studies performed by multiple parties (note: the final best estimate predictions from the hammer supplier indicate no locations require 120% energy), and thus highly precautionary.

- Total duration and blows: Using drivability analyses the modelling has attempted to apply realistic durations to the modelling, from 1 hour 46 minutes to 2 hours 30 minutes. The total blows were 3,400 to 6,200 per pile, scenario dependent. This relatively short driving duration means that a high blow rate was applied, up to 50 bpm, which is very precautionary.

There are also significant precautions inherent in the model which are known and accepted by the industry, but as they cannot currently be quantified, have not been included in the predictions. The calculated contours therefore show distances that are expected to be much greater than those where any real risk of cumulative PTS to marine mammals would occur.

- Recovery/equal energy hypothesis: A receptor's exposure to noise and risk of PTS does not accumulate as per the standard exposure calculations, as there will be recovery in its auditory system even over short timescales (i.e. between pile strikes). While the scale of studies that would be required to quantify this effect across all species would take many years, it has been demonstrated in captive studies, at least across aquatic mammalian species, that some recovery between pulses will occur (e.g. Finneran, 2015; Kastak et al., 2005; Mooney et al., 2009; Finneran et al., 2010; Kastelein et al., 2013; Kastelein et al., 2014; Kastelein et al., 2015).

- Impulsive/non-impulsive noise: The impulsiveness of noise influences its harmfulness, and this will reduce rapidly with range, and the sound will not be fully impulsive beyond roughly 3.5 km (Hastie et al., 2019) to 5 km (Martin et al., 2020). Some of the largest cumulative PTS impact ranges from piling are predicted for low-frequency and very high-frequency cetaceans, and are well beyond the ranges where impulsiveness has been shown to be significantly reduced.

- Swimming speeds: speeds specified by NatureScot have been used in the modelling, although studies have shown that these are typical swimming speeds (Williams, 2009), whereas fleeing speeds have been shown to be much faster during high noise conditions (McGarry et al., 2017; Kastelein et al., 2018). Using a fleeing speed would lead to much smaller cumulative PTS impact ranges and consequently fewer impacted individuals. While the faster flee speeds may or may not apply over extended timescales, the swim speeds requested by NatureScot are the lowest available and highly precautionary.

- Any PTS calculation is that of onset of the effect (Southall et al. 2019, NMFS 2024). The defined threshold will only be the point at which PTS may start to be seen.

All of these elements are not acting in isolation but will combine and contribute to the significant degree of precaution in the assessment. Although the total area within a contour necessarily represents a single effect ("cumulative PTS onset"), the risk at all distances is not the same and this cannot be shown in the modelling. The risk is greater close to the pile than it is at the outer edges of the modelled cumulative PTS impact range contour.

4.1.3 Disturbance

Two methods of assessing disturbance have been presented: Effective Deterrence Ranges (EDRs) and dose-response functions. EDRs assume that all animals within the EDR are disturbed to balance out the reality that animals show variable responses to noise exposure, such that some animals are not expected to be disturbed within this range, whereas some animals are expected to be disturbed at greater ranges. The dose-response function assumes that the proportion of animals that are disturbed changes with the received noise level.

4.1.3.1 EDR

Both JNCC (2023a) and JNCC (2020) recommend the use of EDRs to assess significant disturbance to harbour porpoise by applying a 26 km EDR for impact piling for a monopile and a 15 km EDR for impact piling for jacket pin pile. Brown et al. (2023) conducted a detailed examination of the evidence available to support piling EDRs, and concluded that studies on harbour porpoise responses to pile-driving show temporary disturbance to impact ranges of 10-20 km. Since then, an EDR of 9.4 km was estimated using passive acoustic data in the Moray Firth collected concurrent with the instalment of large monopiles without noise abatement at Moray West Offshore Wind Farm (Benhemma-Le Gall *et al.*, 2024). Although the Inch Cape OWF PS-GS (Inch Cape Offshore Limited, 2025) presents the number of animals predicted to be disturbed by piling for each EDR threshold (9.4 km, 15 km and 26 km), this EPS RA only includes the most conservative assessment. Thus, only a 26 km EDR is presented here.

It should be noted that EDRs are based on evidence for harbour porpoise only. In the absence of EDRs for other species, the porpoise 26 km EDR has been assumed here for all marine mammals. This is likely to be conservative given the differences in hearing groups and sensitivity to underwater noise between species.

4.1.3.2 Dose-response: cetaceans

To estimate the number of porpoise predicted to experience behavioural disturbance as a result of pile driving, this impact assessment uses the porpoise dose-response function presented in Graham *et al.* (2017) developed using data on harbour porpoise collected during the first six weeks of piling during Phase 1 of the Beatrice OWF monitoring program. Since the initial development of the dose-response function in 2017, additional data from the remaining pile driving events at Beatrice OWF have been processed and are presented in (Graham *et al.*, 2019). The passive acoustic monitoring showed a 50% probability of porpoise response within 7.4 km at the first location piled, with decreasing response levels over the construction period (excluding pre-construction surveys) to a 50% probability of response within 1.3 km by the final piling location (Graham *et al.*, 2019).

In the absence of species-specific data for dolphin species or minke whales, the Graham *et al.* (2017) dose-response function has been adopted for all cetaceans. However, it should be noted that various studies have shown that other cetacean species show comparatively less of a disturbance response from underwater noise compared with harbour porpoise, meaning this approach is highly precautionary (Kastelein *et al.*, 2006, Moray Offshore Renewables Limited, 2012, Niu *et al.*, 2012, Culloch *et al.*, 2016).

4.1.3.3 Dose-response: seals

For seals, the dose-response function adopted was based on the data presented in Whyte *et al.* (2020). The study used telemetry data from harbour seals tagged in the Wash (SE England) to assess how seal usage changed in relation to the pile driving activities at the Lincs Offshore Wind Farm in 2011-2012. Given the large confidence intervals on the data, the assessment presents the mean number of seals predicted to be disturbed using both the mean dose-response and the 95% confidence intervals (CI) (as advised by the authors).

There are no corresponding data for grey seals and, as such, the harbour seal dose-response function is applied to the grey seal disturbance assessment. This is considered to be an appropriate proxy for grey seals, since both species are categorised within the same functional hearing group. However, it is likely that this overestimates the grey seal response, since grey seals are considered to be less sensitive to behavioural disturbance than harbour seals (Aarts *et al.*, 2018, Booth *et al.*, 2019, Hastie *et al.*, 2021).

4.1.4 Population modelling

The interim Population Consequences of Disturbance (iPCoD) framework (version 5.2) (Harwood *et al.*, 2014, King *et al.*, 2015) was used to predict the potential population consequences of the predicted amount of disturbance resulting from the piling. This helps inform the assessment in terms of the third EPS test related to maintaining populations at a favourable conservation status. Simulations were run comparing projections of the baseline population (i.e., under current conditions, assuming current estimates of demographic parameters persist into the future) with a series of paired 'impact' scenarios with identical demographic parameters, incorporating a range of estimates for disturbance. Each simulation was repeated 1,000 times and each simulation draws parameter values from a distribution describing the uncertainty in the parameters. This creates 1,000 matched pairs of population trajectories, differing only with respect to the effect of the disturbance and the distributions of the two trajectories can be compared to demonstrate the magnitude of the long-term effect of the predicted impact on the population, as well as demonstrating the uncertainty in predictions.

4.1.4.1 iPCoD Inputs

Two indicative piling schedules were created for the iPCoD modelling, based on a range of vessel availability scenarios. It is noted that the precise distribution of piling days within the schedule programme windows (as shown in Figure 4-1), including the estimated number of days of concurrent piling, is subject to a number of factors, such as vessel availability, logistics, coordination with other construction works, weather and others. The assumptions on distribution of piling days and number of concurrent piling days below were considered for the purpose of population modelling.

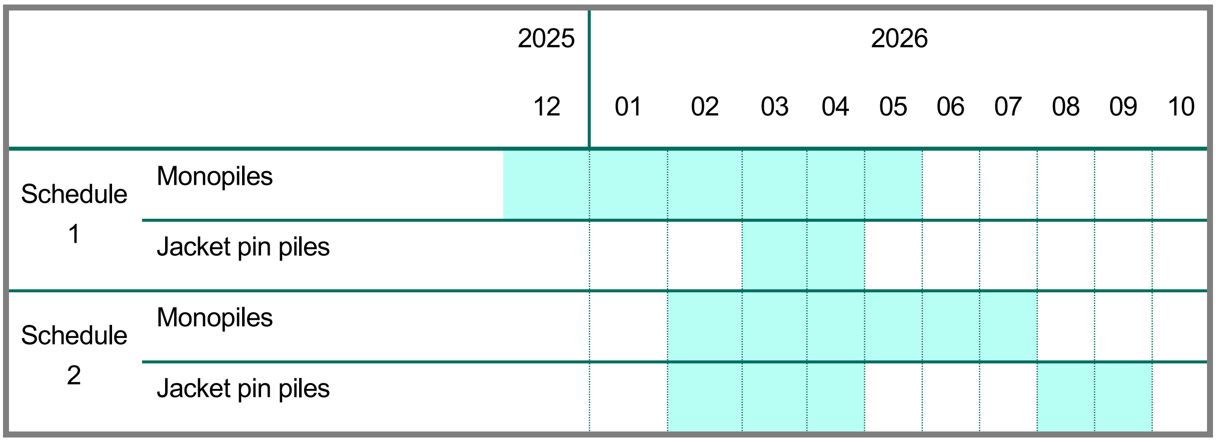

Figure 4-1 Piling installation programme schedule

Piling Schedules

Piling Schedule 1: piling between December 2025 and May 2026 (Figure 4-2). This consists of 47 days piling for monopiles only (Dec-May), 11 days piling for jackets only (Mar-Apr) and 7 days with concurrent monopile and jacket piling (Mar-Apr). This assumes that 1 monopile is installed per day, and that 1 entire jacket foundation (3 pin piles) is installed per day.

Piling Schedule 2: piling between February 2026 and September 2026 (Figure 4-3). This consists of 51 days piling for monopiles only (Feb-Jul), 15 days piling for jackets only (12 between Feb-Apr, then 6 between Aug-Sep) and 3 days with concurrent monopile and jacket piling (Mar). This assumes that 1 monopile is installed per day, and that 1 entire jacket foundation (3 pin piles) is installed per day.

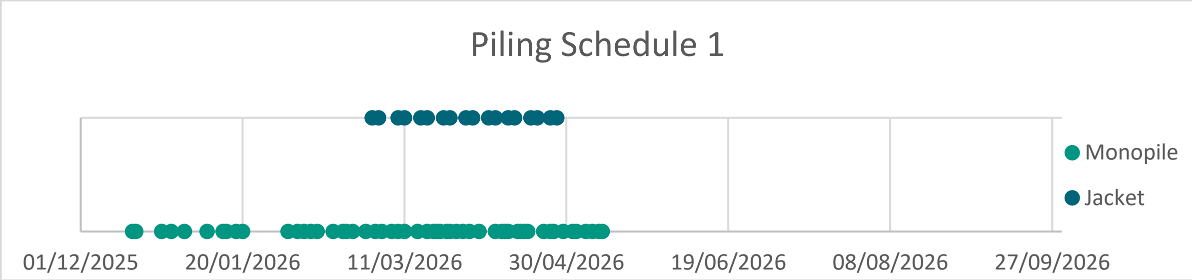

Figure 4-2 Piling schedule 1

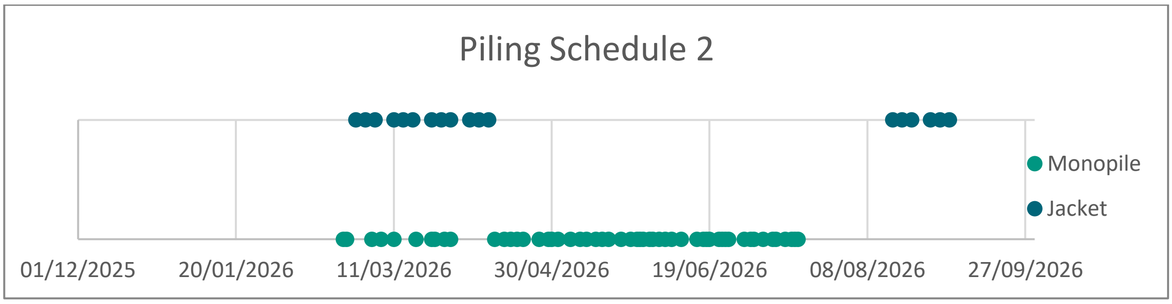

Figure 4-3 Piling schedule 2

Demographic parameters were obtained from Sinclair *et al.* (2020) (see Inch Cape OWF PS-GS (Inch Cape Offshore Limited, 2025) for details) and it was assumed that disturbance occurs only on the disturbance day (e.g., no residual disturbance).

4.2 Consultation

There has been email consultation with NatureScot on the mitigation of the instantaneous and cumulative PTS from piling for marine mammals (November 2024). NatureScot confirmed agreement with the following:

Instantaneous PTS (based on the peak Sound Pressure Level (SPL_{peak}) metric) should be mitigated.

There is no requirement to fully mitigate the modelled cumulative PTS (based on the cumulative Sound Exposure Level (SEL_{cum}) metric) ranges as it is acknowledged that they are over-precautionary given current modelling methods. NatureScot advise that best practice measures which could reduce the risk of cumulative PTS is welcomed but not required.

ICOL suggests that pre-piling Acoustic Deterrent Device (ADD) use (beyond the minimum time required to mitigate instantaneous PTS) in combination with a 30-minute soft start (beyond the minimum advised in the JNCC et al. (2010) guidance) constitutes "*best practice measures which would reduce the risk of cumulative PTS*". If these methods are implemented to reasonably reduce the risk of cumulative PTS (without fully mitigating the over-precautionary modelled SEL_{cum} ranges), then the project would not require an EPS license to injure. NatureScot confirmed agreement with this on 26 November 2024.

NatureScot encouraged monitoring of underwater noise levels during piling as this will enable NatureScot to refine their advice going forward and inform future proportionate mitigation measures, especially regarding cumulative PTS.

There has also been email consultation with NatureScot on the requirement for an EPS license to disturb animals when testing the ADD at the Port of Leith prior to a pile installation trip (August 2025). NatureScot confirmed that when testing the ADD in coastal waters within 12 nm, an EPS risk assessment is required for disturbance. They also agreed with ICOLs suggestion to carry out testing before departure during the initial mobilisation, and then at every other port call when the vessel returns to load piles.

Further advice from NatureScot was received in September 2025, in response to a consultation to the PS-GS (Rev 0). Some elements of this advice diverge from earlier guidance, particularly in relation to concerns around potential cumulative permanent threshold shift (PTS) impacts and the precautionary basis of the modelling applied. In response to this, the minke whale densities have been updated to include the new SCANS-IV density surface (Gilles *et al.*, 2025) and additional context has been added to the results regarding the modelled cumulative PTS impact ranges.

5 Risk Assessment – ADD testing

The Lofitech seal scarer[4] will be used as a mitigation tool to reduce the risk of auditory injury during pile driving activities – see detail in Inch Cape OWF PS-GS (Inch Cape Offshore Limited, 2025). It is anticipated that the ADD will be tested prior to departure (as per the latest JNCC advice provided in Phillips *et al.* (2025)) during the initial mobilisation from the Port of Leith, and at every other port call when the vessel returns to load piles. Alternatively, testing may also take place at the wind farm site, before starting the works. In the most probable case, where the ADD is tested while the vessel is docked within the boundary of the Port of Leith, the risk of disturbance to marine mammals is considered very low (due to the low likelihood of species presence and the physical boundary limiting noise propagation beyond the port). This risk assessment focuses on the potential for the disturbance when the ADD is tested within the wind farm development area.

The latest evidence base for disturbance ranges for the Lofitech seal scarer are presented in Phillips *et al.* (2025). This states the following:

- Harbour porpoise: Significant deterrence effect out to 7.5 km (Brandt *et al.*, 2012), with potential

[4] https://www.lofitech.no/

for disturbance out to >21 km (Thompson *et al.*, 2020)

- Dolphin species: no data available
- Minke whales: Measured response from exposure at 1 km range (McGarry *et al.*, 2017)
- Seals: minimum approach distance was 473 m, and behavioural response when seals within 1 km of sound source (Gordon *et al.*, 2015).

The number of individuals that are predicted to be disturbed by ADD testing has been estimated in Table 5-1. Considering the estimates provided in Table 5-1 there is the potential for temporary behavioural avoidance. However, the number of animals expected to be disturbed is very low, any such avoidance is very unlikely to significantly affect the local distribution or abundance of any species.

There is potential for the ADD testing to result in disturbance of individual EPS within Scottish inshore (<12 nm) waters. Therefore, it is proposed that an **EPS licence is required for disturbance within Scottish inshore waters.**

Table 5-1: The number of individuals estimated to have the potential to be disturbed by ADD testing

Species	Density (#/km^2)	EDR	Area Impacted (km^2)	# animals
Harbour porpoise	0.5985	7.5 km	176.7	106
		21 km	1,385.4	829
Bottlenose dolphin	0	unknown	0	0
White-beaked dolphin	0.0799	Unknown – assume 1 km	3.14	<1
		Unknown – assume 7.5 km	176.7	14
Minke whale	SCANS-IV Block NS-D: A/W = 0.0023 Sp = 0.0070 Su = 0.0419 SCANS-IV density surface (average across array area): A/W = 0.0008 Sp = 0.0025 Su = 0.0151	1 km	3.14	<1
Harbour seal	Average across Array: 0.003	1 km	3.14	<1

Species	Density (#/km²)	EDR	Area Impacted (km²)	# animals
Grey seal	Average across Array: 1.011	1 km	3.14	3

A/W = Autumn and Winter (Oct-Mar)
Sp = Spring (Apr-Jun)
Su = Summer (Jul-Sep)

6 Risk Assessment – Piling Works

A description of the planned activities included in this risk assessment are outlined in detail in Section 3. Potential impacts from WTG piling on cetacean EPS and seals have been assessed quantitatively using the abundance and density estimates as outlined in Section 4.1.1. The assessment followed methodology outlined in Section 4.1.

6.1 Auditory Injury

Full results for the auditory injury (PTS) for both metrics, SPL_{peak} and SEL_{cum}, are presented in Inch Cape OWF PS-GS (Inch Cape Offshore Limited, 2025). The results presented in this section are based on the worst-case scenario for each species.

6.1.1 Instantaneous PTS (SPL_{peak})

6.1.1.1 Monopiles

The largest instantaneous PTS impact range across all species for monopiles is 920 m for harbour porpoise at location L026 (Table 6-1). It would take a harbour porpoise starting at the pile location 11 minutes, fleeing at 1.4 m/s, to exit this range. Therefore, in order to ensure the instantaneous PTS impact zone is clear of marine mammals prior to the start of piling, pre-piling ADD use for 15 minutes is recommended for monopiles.

Table 6-1: Area, maximum range and number of animals at risk of experiencing instantaneous PTS during piling at monopiles. The monopile location which represents the worst case scenario for each species is indicated; "All" means that results were the same for all three monopile locations (L010, L026 and L019).

Species	Area (km²)	Max Range (m)	# animals	Monopile Location
Minke whale	0.02	80	A/W: <1 Sp: <1 Su: <1	All
Bottlenose dolphin	<0.01	<50	0	All
White-beaked dolphin	<0.01	<50	<1	All

Species	Area (km^2)	Max Range (m)	# animals	Monopile Location
Harbour porpoise	2.6	920	2	L026
Harbour seal	0.02	90	<1	All
Grey seal	0.02	90	<1	All

A/W = Autumn and Winter (Oct-Mar)
Sp = Spring (Apr-Jun)
Su = Summer (Jul-Sep)

6.1.1.2 *Jackets*

The largest instantaneous PTS impact range for jackets is 630 m for harbour porpoise (Table 6-2). It would take a harbour porpoise starting at the pile location 7.5 minutes, fleeing at 1.4 m/s, to exit this range. Therefore, in order to ensure the instantaneous PTS impact zone is clear of marine mammals prior to the start of piling, **pre-piling ADD use for 10 minutes is recommended** for jackets.

Table 6-2: Area, maximum range and number of animals at risk of experiencing PTS during piling at jacket (L055).

Species	Area (km^2)	Max Range (m)	# animals
Minke whale	0.02	50	A/W: <1 Sp: <1 Su: <1
Bottlenose dolphin	<0.01	<50	<1
White-beaked dolphin	<0.01	<50	<1
Harbour porpoise	1.2	630	1
Harbour seal	0.02	60	<1
Grey seal	0.02	60	<1

A/W = Autumn and Winter (Oct-Mar)
Sp = Spring (Apr-Jun)
Su = Summer (Jul-Sep)

6.1.2 Cumulative PTS (SEL_{cum})

As discussed in Section 4.2, the advice from NatureScot is that there is no requirement to fully mitigate cumulative PTS. A minimum of a 30-minute soft start, in combination with pre-piling ADD use, constitutes best practice measures which would reduce the risk of cumulative PTS. Therefore, while the impact ranges and number of animals within the impact range are presented below, they do not inform the mitigation requirements.

6.1.2.1 *Monopiles*

The largest cumulative PTS impact range across all species for monopiles is 19 km for minke whales (L026 soft start option 1, fleeing at 2.1 m/s; Table 6-3). Using the uniform SCANS-IV block density (which is expected to over-estimate the number of minke whales impacted): There is expected to be a maximum of two minke whales within this impacted area in the autumn and winter, a maximum of five minke whales within this impacted area in the spring and 32 in summer. Using the SCANS-IV density surface (which is expected to be a better estimate of the number of minke whales impacted): There is expected to be a maximum of 1 minke whales within this impacted area in the autumn and winter, a maximum of 2 minke whales within this impacted area in the spring, and 12 in summer. For minke whales, there is limited data on the deterrence range from ADDs. The use of the pre-piling ADD means that animals will be further away from the pile at the start of piling, which means that the level of injurious and impulsive characteristics they are exposed to is reduced (as we know impulsiveness and noise level decreases with distance). This means that the noise they are exposed to will be less impulsive and less injurious as a result of pre-piling ADD. To what degree the impulsiveness will have reduced is unknown (though the RADIN project showed kurtosis significantly decreases within 1 km Matei *et al.* (2024)), and this cannot be incorporated into the model.

The maximum cumulative PTS-onset impact range for harbour porpoise is 4.8 km (L026 soft start option 1, fleeing at 1.4 m/s). For harbour porpoise, there is evidence that an ADD can significantly deter porpoise out to 7.5 km (Brandt *et al.*, 2013). If the ADD is activated for 15 minutes prior to pile driving, and assuming the animal flees at 1.97 m/s (Kastelein *et al.*, 2018), then it will move 1.77 km over the 15 minutes of ADD operation. This will be in addition to the deterrent effect of vessel presence, which has been detected up to 3 km away (Benhemma-Le Gall *et al.*, 2021). Therefore, combined vessel presence and ADD activation have the potential to deter animals up to 4.77 km from the pile. This deterrent effect, combined with the known highly precautionary cumulative PTS modelled ranges (e.g., it does not account for recovery of threshold shift between pulses or incorporate decline in impulsiveness with distance, etc.) results in a negligible risk of porpoise accumulating sufficient noise exposure to reach the PTS threshold.

There are expected to be a maximum of 40 harbour porpoise within this impacted area. The maximum cumulative PTS-onset impact range for both dolphin and seal species is less than 100 m.

Table 6-3: Area, maximum range and number of animals at risk of experiencing cumulative PTS during piling at monopiles. The monopile location which represents the worst case scenario for each species is indicated; All means that results were the same for all three monopile locations (L010, L026 and L019).

Species	Swim Speed (m/s)	Area (km^2)	Max Range (m)	# animals	Monopile Location
Minke whale	2.1	760	19,000	SCANS-IV Block NS-D: A/W: 2 Sp: 5 Su: 32 SCANS-IV density surface (average across array area): A/W : 1 Sp : 2 Su : 12	L026
Bottlenose dolphin	1.52	< 0.1	< 100	0	All
White-beaked dolphin	1.52	< 0.1	< 100	<1	All
Harbour porpoise	1.4	66	4,800	40	L026
Harbour seal	1.8	< 0.1	< 100	<1	All
Grey seal	1.8	< 0.1	< 100	<1	All

A/W = Autumn and Winter (Oct-Mar)
Sp = Spring (Apr-Jun)
Su = Summer (Jul-Sep)

6.1.2.2 *Jackets*

The largest cumulative PTS impact range across all species for jackets is 21 km for minke whales (L055 soft start option 1, fleeing at 2.1 m/s; Table 6-4). Using the uniform SCANS-IV block density (which is expected to over-estimate the number of minke whales impacted): There is expected to be a maximum of two minke whales within this impacted area in the autumn and winter, a maximum of seven minke whales within this impacted area in the spring, and 43 in summer. Using the SCANS-IV density surface (which is expected to be a better estimate of the number of minke whales impacted): There is expected to be a maximum of 1 minke whales within this impacted area in the autumn and winter, a maximum of 3 minke whales within this impacted area in the spring, and 21 in summer. For minke whales, there is limited data on the deterrence range from ADDs. The use of the pre-piling ADD means that animals will be further away from the pile at the start of piling, which means that the level of injurious and impulsive characteristics they are exposed to is reduced (as we know impulsiveness and noise level decreases with distance). This means that the noise they are exposed to will be less impulsive and less injurious as a result of pre-piling ADD. To what degree the impulsiveness will have reduced is unknown (though the RADIN project showed kurtosis significantly decreases within 1 km Matei *et al.* (2024)), and this cannot be incorporated into the model.

The maximum cumulative PTS impact range for harbour porpoise is 6.9 km (L055 soft start option 1, fleeing at 1.4 m/s). For harbour porpoise, there is evidence that an ADD can significantly deter porpoise out to 7.5 km (Brandt *et al.*, 2013). If the ADD is activated for 10 minutes prior to pile driving, and assuming the animal flees at 1.97 m/s (Kastelein *et al.*, 2018), then it will move 1.18 km over the 15 minutes of ADD operation. This will be in addition to the deterrent effect of vessel presence, which has been detected up to 3 km away (Benhemma-Le Gall *et al.*, 2021). Therefore, combined vessel presence and ADD activation have the potential to deter animals up to 4.18 km from the pile. This deterrent effect, combined with the known highly precautionary cumulative PTS modelled ranges (e.g., it does not account for recovery of threshold shift between pulses or incorporate decline in impulsiveness with distance, etc.) results in a negligible risk of porpoise accumulating sufficient noise exposure to reach the PTS threshold.

There are expected to be a maximum of 76 harbour porpoise within this impacted area. The maximum cumulative PTS-onset impact range for both dolphin and seal species is less than 100 m.

Table 6-4: Cumulative PTS for Jacket L055. The soft start option which represents the worst case scenario for each species is indicated.

Species	Area (km^2)	Max Range (m)	# animals
Minke whale	1,000	21,000	SCANS-IV Block NS-D: A/W: 2 Sp: 7 Su: 43 SCANS-IV density surface (average across array area): A/W: 1 Sp: 3 Su: 21
Bottlenose dolphin	<0.1	<100	0
White-beaked dolphin	<0.1	<100	<1

Species	Area (km^2)	Max Range (m)	# animals
Harbour porpoise	130	6,900	76
Harbour seal	<0.1	<100	<1
Grey seal	<0.1	<100	<100

A/W = Autumn and Winter (Oct-Mar)
Sp = Spring (Apr-Jun)
Su = Summer (Jul-Sep)

6.1.2.3 *Concurrent monopile & jacket*

The maximum cumulative PTS impact area for minke whales is 1,800 km^2. Using the uniform SCANS-IV block density (which is expected to over-estimate the number of minke whales impacted): there is expected to be a maximum of four minke whales within this impacted area in the autumn and winter, a maximum of 12 minke whales within this impacted area in the spring, and 74 in summer (Table 6-5). Using the SCANS-IV density surface (which is expected to be a better estimate of the number of minke whales impacted): There is expected to be a maximum of 2 minke whales within this impacted area in the autumn and winter, a maximum of 5 minke whales within this impacted area in the spring, and 32 in summer. For minke whales, there is limited data on the deterrence range from ADDs. The use of the pre-piling ADD means that animals will be further away from the pile at the start of piling, which means that the level of injurious and impulsive characteristics they are exposed to is reduced (as we know impulsiveness and noise level decreases with distance). This means that the noise they are exposed to will be less impulsive and less injurious as a result of pre-piling ADD. To what degree the impulsiveness will have reduced is unknown (though the RADIN project showed kurtosis significantly decreases within 1 km Matei *et al.* (2024)), and this cannot be incorporated into the model.

The maximum cumulative PTS impact area for harbour porpoise is 400 km^2 (Monopile L026 and Jacket L055 fleeing at 1.4 m/s). There is expected to be a maximum of 242 harbour porpoise within this impacted area. For harbour porpoise, there is evidence that an ADD can significantly deter porpoise out to 7.5 km (Brandt *et al.*, 2013). If the ADD is activated for 15 minutes prior to pile driving, and assuming the animal flees at 1.97 m/s (Kastelein *et al.*, 2018), then it will move 1.77 km over the 15 minutes of ADD operation. This will be in addition to the deterrent effect of vessel presence, which has been detected up to 3 km away (Benhemma-Le Gall *et al.*, 2021). Therefore, combined vessel presence and ADD activation have the potential to deter animals up to 4.77 km from the pile. This deterrent effect, combined with the known highly precautionary cumulative PTS modelled ranges (e.g., it does not account for recovery of threshold shift between pulses or incorporate decline in impulsiveness with distance, etc.) results in a negligible risk of porpoise accumulating sufficient noise exposure to reach the PTS threshold.

For seals, the impact area is predicted to be 62 km^2. This is predicted to impact a maximum of 69 grey seals, but no harbour seals. There is no overlap of the cumulative PTS impact ranges for concurrent piling for both dolphin species.

Table 6-5 Cumulative PTS for concurrent piling of monopiles and jacket pin piles.

Species	Area (km^2)	# animals	Concurrent Piling Locations
Minke whale	1,800	SCANS-IV Block NS-D: A/W: 4 Sp: 12 Su: 74 SCANS-IV density surface (average across array area): A/W: 2 Sp: 5 Su: 32	Monopile L026 & Jacket L055
Dolphins	No overlap of concurrent contours		All Concurrent Scenarios
Harbour porpoise	400	242	Monopile L026 & Jacket L055
Harbour seal	62	0	All Concurrent Scenarios
Grey seal	62	69	Monopile L026 & Jacket L055

A/W = Autumn and Winter (Oct-Mar)
Sp = Spring (Apr-Jun)
Su = Summer (Jul-Sep)

6.2 Disturbance Results

As discussed in Section 4.1.3, two methods for the assessment of disturbance are presented: EDRs and dose-response functions. Full results for the disturbance are presented in Inch Cape OWF PS-GS (Inch Cape Offshore Limited, 2025). The results presented in this section are based on the worst-case scenario for each species across different soft-start options.

6.2.1 Harbour porpoise

For the largest EDR assumed (26 km for monopiles), it is predicted that up to 1,271 harbour porpoise (0.37% NS MU) will be disturbed per piling day (Table 6-6). Using the dose-response approach, up to a maximum of 3,335 harbour porpoise (0.96% NS MU) are predicted to be disturbed per piling day for a monopile (L010) and 3,187 harbour porpoise (0.92% NS MU) are predicted to be disturbed per piling day for jacket pin piles (L055; Table 6-6). For concurrent piling, up to a maximum of 3,709 harbour porpoise (1.07% NS MU) are predicted to be disturbed per piling day for concurrent piling of monopile L026 and jacket L055 when using the dose-response approach.

Table 6-6 Number of harbour porpoise disturbed per piling day using the 26 km EDR approach (not location-specific since the density surface is uniform) and using the dose-response approach for monopile and jacket foundations (worst-case scenario) alone, and concurrently.

Disturbance assessment method	# porpoise disturbed	% NS MU	% UK NS MU
26 km EDR	1,271	0.37%	0.80%
Dose-response (Monopile L010)	3,335	0.96%	2.09%
Dose-response (Jacket L055)	3,187	0.92%	2.00%
Dose-response (Concurrent monopile L026 & jacket L055)	3,709	1.07%	2.32%

To determine if the piling of monopiles and jackets alone as well as concurrently would result in a NS MU population effect, iPCoD modelling was undertaken for each piling schedule outlined in Section 4.1.4 using numbers of harbour porpoise disturbed based on the dose-response approach. The results are as follows:

- **Piling schedule 1**: the level of disturbance predicted for Inch Cape OWF is not sufficient to result in any changes at the population level (deviation in the mean impacted population size from the mean un-impacted population size is within <1%). The impacted population is predicted to continue at a stable trajectory, the same as the un-impacted population, and at 99.99% of the size of the mean NS MU un-impacted population size (99.96 - 99.97% UK NS MU).

- **Piling schedule 2:** the level of disturbance predicted for Inch Cape OWF is not sufficient to result in any changes at the population level (deviation in the mean impacted population size from the mean un-impacted population size is within <1%). The impacted population is predicted to continue at a stable trajectory, the same as the un-impacted population, and at 99.98 to 99.99% of the size of the mean NS MU un-impacted population size (99.96 - 99.97% UK NS MU).

The assessment presented here for disturbance from WTG pile driving concludes that there will be no change to the NS MU population trend, and thus no change to the favourable conservation status of the species. For more details regarding the iPCoD modelling see Appendix B: Marine mammal population modelling (iPCoD) of the Inch Cape OWF PS-GS (Inch Cape Offshore Limited, 2025)).

6.2.2 Bottlenose dolphin

The overlap with the bottlenose dolphin habitat will vary, depending on the WTG location. Therefore, EDRs were modelled for all 72 WTG locations to understand the range in overlap with dolphin habitat. For the largest EDR assumed (26 km for monopiles), noise contours during piling of 59 WTG locations are likely to have some overlap with the bottlenose dolphin habitat. The largest area overlap is predicted for WTG L069 (monopile) where approximately 133.3 km^2 overlap with bottlenose dolphin habitat was estimated, which equates to 13 dolphins disturbed (5.8% CES MU; Table 6-7). On average, across the 72 WTGs, 6 dolphins are at risk of experiencing disturbance (2.7% CES MU) per piling day.

Using the dose-response approach, up to a maximum of 17 bottlenose dolphins (7.52% CES MU) are predicted to be disturbed per piling day for a monopile (L019) and 12 bottlenose dolphins (5.31% CES MU) are predicted to be disturbed per piling day for jackets (L055; Table 6-7). For concurrent piling, up to a maximum of 18 bottlenose dolphin (7.96% CES MU) are predicted to be disturbed per piling day for concurrent piling of monopile L019 or L026 and jacket L055 when using the dose-response approach. However, it should be noted that there is no evidence that the porpoise dose-response function is applicable to bottlenose dolphins and these results should be treated with caution.

Table 6-7 Number of bottlenose dolphin disturbed per piling day using the 26 km EDR approach (minimum, average and maximum across all 72 WTG (monopiles) locations), and using the dose-response approach for monopile and jacket foundations (worst-case scenario) alone, and concurrently.

Disturbance assessment method	# bottlenose dolphins disturbed	% Coastal East Scotland MU
26 km EDR	Min: 0 Average: 6 Max (Monopile L069): 13	Min: 0% Average: 2.7% Max (Monopile L069): 5.8%
Dose-response (Monopile L019)	17	7.52%
Dose-response (Jacket L055)	12	5.31%
Dose-response (concurrent monopile L019 or L026 & jacket L055)	18	7.96%

To determine if the piling of monopiles and jackets alone as well as concurrently would result in a population-level effect on the CES MU, iPCoD modelling was undertaken for each piling schedule outlined in Section 4.1.4 using numbers of bottlenose dolphin disturbed based on the dose-response approach. The results are as follows:

- **Piling schedule 1:** the level of disturbance predicted for Inch Cape OWF is not sufficient to result in any change at the population level (deviation in the mean impacted population size from the mean un-impacted population size is within <1%). The impacted population is predicted to continue on an increasing trajectory, the same as the un-impacted population, and at 98.78 - 99.34% of the size of the mean un-impacted population size.
- **Piling schedule 2:** the level of disturbance predicted for Inch Cape OWF is not sufficient to result in any change at the population level (deviation in the mean impacted population size from the mean un-impacted population size is within <1%). The impacted population is predicted to continue on an increasing trajectory, the same as the un-impacted population, and at 99.22 - 99.59% of the size of the mean un-impacted population size.

The assessment presented here for disturbance from WTG pile driving concludes that there will be no change to the CES MU population trend, and thus no change to the favourable conservation status of the species. For more details regarding the iPCoD modelling see Appendix B: Marine mammal population modelling (iPCoD) of the Inch Cape OWF PS-GS (Inch Cape Offshore Limited, 2025)).

6.2.3 White-beaked dolphin

For the largest EDR assumed (26 km for monopiles), it is predicted that up to 170 white-beaked dolphins will be disturbed per piling day (0.39% CGNS MU; Table 6-8). Using the dose-response approach, up to a maximum of 445 white-beaked dolphins (1.01% CGNS MU) are predicted to be disturbed per piling day for a monopile (L010) and 425 white-beaked dolphins (0.97% CGNS MU) are predicted to be disturbed per piling day for jacket pin piles (L055). For concurrent piling, up to a maximum of 495 white-beaked dolphin (1.13% CGNS MU) are predicted to be disturbed per piling day for concurrent piling of monopile L026 and jacket L055 when using the dose-response approach. However, it should be noted that there is no evidence that the porpoise dose-response function is applicable to white-beaked dolphins and these results should be treated with caution.

Table 6-8 Number of white-beaked dolphin disturbed per piling day using the 26 km EDR approach (not location specific since the density surface is uniform), using the dose-response approach for monopile and jacket foundations (worst-case scenario) alone, and concurrently.

Disturbance assessment method	# white-beaked dolphins disturbed	% CGNS MU	% UK CGNS MU
26 km EDR	170	0.39%	0.50%
Dose-response (Monopile L010)	445	1.01%	1.31%
Dose-response (Jacket L055)	425	0.97%	1.25%
Dose-response (Concurrent monopile L026 & jacket L055)	495	1.13%	1.45%

It is not possible to run iPCoD for white-beaked dolphins as the model has not yet been parameterised for this species. However, given the low proportion of the population predicted to be impacted per piling day (~1% CGNS MU), it is unlikely that this would result in a population level effect.

The assessment presented here for disturbance from WTG pile driving concludes that there will be no change to the CGNS MU population trend, and thus no change to the favourable conservation status of the species.

6.2.4 Minke whale

Using the uniform SCANS-IV block density (which is expected to over-estimate the number of minke whales impacted): For the largest EDR assumed (26 km for monopiles), it is predicted that up to five minke whales would be disturbed per day in the autumn/winter, 15 minke whales per day in the spring and 89 minke whales per day in the summer (Table 6-9). Using the dose-response approach, up to a maximum of 13 minke whales are predicted to be disturbed per piling day for a monopile (L010) in the autumn/winter, 39 disturbed per piling day in the spring and 234 disturbed per piling day in the summer. For jackets (L055), up to 12 minke whales are predicted to be disturbed per piling day in the autumn/winter, 37 disturbed per piling day in the spring and 223 disturbed per piling day in the summer. For concurrent piling, up to a maximum of 14 minke whales in the autumn/winter, 43 disturbed per piling day in the spring and 260 disturbed per piling day in the summer, per piling day for concurrent piling of monopile L026 and jacket L055 when using the dose-response approach.

Using the SCANS-IV density surface (which is expected to be a better estimate of the number of minke whales impacted): For the largest EDR assumed (26 km for monopiles), it is predicted that up to 2 minke whales would be disturbed per day in the autumn/winter, 5 minke whales per day in the spring and 34 minke whales per day in the summer (Table 6-9). Using the dose-response approach, up to a maximum of 8 minke whales are predicted to be disturbed per piling day for a monopile (L010) in the autumn/winter, 19 disturbed per piling day in the spring and 120 disturbed per piling day in the summer. For jackets (L055), up to 7 minke whales are predicted to be disturbed per piling day in the autumn/winter, 18 disturbed per piling day in the spring and 114 disturbed per piling day in the summer. For concurrent piling, up to a maximum of 9 minke whales in the autumn/winter, 22 disturbed per piling day in the spring and 139 disturbed per piling day in the summer, per piling day for concurrent piling of monopile L026 and jacket L055 when using the dose-response approach.

However, it should be noted that there is no evidence that the porpoise dose-response function is applicable to minke whales and these results should be treated with caution, irrespective of the density estimate used.

Table 6-9 Number of minke whale disturbed per piling day using the 26 km EDR approach, and using the dose-response approach for monopile and jacket foundations (worst-case scenario) alone, and concurrently

Disturbance assessment method	Density	# minke whale disturbed	% Celtic and Greater North Sea MU	% UK MU
26 km EDR (Monopile L010)	SCANS-IV Block NS-D	A/W: 5 Sp: 15 Su: 89	A/W: 0.02% Sp: 0.07% Su:0.44%	A/W: 0.05% Sp: 0.15% Su: 0.86%
	SCANS-IV density surface	A/W: 2 Sp: 5 Su: 34	A/W: 0.01% Sp: 0.03% Su: 0.17%	A/W: 0.02% Sp: 0.05% Su: 0.33%

Disturbance assessment method	Density	# minke whale disturbed	% Celtic and Greater North Sea MU	% UK MU
Dose-response (Monopile L010)	SCANS-IV Block NS-D	A/W: 13 Sp: 39 Su: 234	A/W: 0.06% Sp: 0.19% Su: 1.16%	A/W: 0.13% Sp: 0.38% Su: 2.27%
	SCANS-IV density surface	A/W: 8 Sp: 19 Su:120	A/W: 0.04% Sp: 0.09% Su: 0.60%	A/W: 0.07% Sp: 0.18% Su: 1.17%
Dose-response (Jacket L055)	SCANS-IV Block NS-D	A/W: 12 Sp: 37 Su: 223	A/W: 0.06% Sp: 0.18% Su: 1.11%	A/W: 0.12% Sp: 0.36% Su: 2.17%
	SCANS-IV density surface	A/W: 7 Sp: 18 Su: 114	A/W: 0.04% Sp: 0.09% Su: 0.57%	A/W: 0.07% Sp: 0.17% Su: 1.11%
Dose-response (Concurrent monopile L026 & jacket L055)	SCANS-IV Block NS-D	A/W: 14 Sp: 43 Su: 260	A/W: 0.07% Sp: 0.21% Su: 1.29%	A/W: 0.14% Sp: 0.42% Su: 2.53%
	SCANS-IV density surface	A/W: 9 Sp: 22 Su: 139	A/W: 0.04% Sp: 0.11% Su: 0.69%	A/W: 0.08% Sp: 0.21% Su: 1.35%

A/W = Autumn and Winter (Oct-Mar)
Sp = Spring (Apr-Jun)
Su = Summer (Jul-Sep)

To determine if the piling of monopiles and jackets alone as well as concurrently would result in a population-level effect on the CGNS MU, iPCoD modelling was undertaken for each piling schedule outlined in Section 4.1.4 using numbers of minke whale disturbed based on the dose-response approach. The results are as follows:

- **Piling schedule 1:** the level of disturbance predicted for Inch Cape OWF is not sufficient to result in any changes at the population level (deviation in the mean impacted population size from the mean un-impacted population size is 0.00%). The impacted population is predicted to continue at a stable trajectory, at exactly the same as the un-impacted population for both the CGNS MU and the UK CGNS MU.
- **Piling schedule 2:** the level of disturbance predicted for Inch Cape OWF is not sufficient to result in any changes at the population level (deviation in the mean impacted population size from the mean un-impacted population size is 0.00%). The impacted population is predicted to continue at a stable trajectory, at exactly the same as the un-impacted population for both the

CGNS MU and the UK CGNS MU.

The assessment presented here for disturbance from WTG pile driving concludes that there will be no change to the CGNS MU population trend, and thus no change to the favourable conservation status of the species. For more details regarding the iPCoD modelling see Appendix B: Marine mammal population modelling (iPCoD) of the Inch Cape OWF PS-GS (Inch Cape Offshore Limited, 2025)).

6.2.5 Harbour seal

For the largest EDR assumed (26 km for monopiles), it is predicted that up to 33 harbour seals (9.07% ES SMU) will be disturbed per piling day (Table 6-10). Using the dose-response approach up to a maximum of 21 (2 - 39) harbour seals (5.77% (0.55 - 10.71%) East Scotland SMU) are predicted to be disturbed per piling day for a monopile (L019 or L026) and 12 (1 - 24) harbour seals (3.30% (0.27 - 6.59%) East Scotland SMU) are predicted to be disturbed per piling day for jacket pin piles (L055). For concurrent piling, up to a maximum of 21 (2 - 39) harbour seal per piling day (5.77% (0.55 - 10.71) East Scotland SMU) for concurrent piling of monopile L019 or L026 and jacket L055 when using the dose-response approach.

Table 6-10 Number of harbour seals disturbed per piling day using the 26 km EDR approach, and using the dose-response approach (with 95% CI presented in brackets) for monopile and jacket foundations (worst-case scenario) alone, and concurrently.

Disturbance assessment method	# harbour seals disturbed	% ES SMU
26 km EDR	33	9.07%
Dose-response (Monopile L019 or L026)	21 (2 - 39) for L019 (2-38) for L026	5.77% (0.55 - 10.71) for L019 (0.55-10.44) for L026
Dose-response (Jacket L055)	12 (1 - 24)	3.30% (0.27 - 6.59)
Dose-response (Concurrent monopile L019 or L026 & jacket L055)	21 (2 - 39)	5.77% (0.55 - 10.71)

To determine if the piling of monopiles and jackets alone as well as concurrently would result in a population-level effect on the East Scotland SMU, iPCoD modelling was undertaken for each piling schedule outlined in Section 4.1.4 using numbers of harbour seals disturbed based on dose-response approach. It should be noted that in 2021, a complete survey of the East Scotland SMU was conducted which showed that the population was in decline (the 2021 count was 24% lower than the previous survey in 2016) (SCOS, 2023). Thus, the un-impacted population in the iPCoD scenario was set to result in a decline. The results are as follows:

- **Piling schedule 1:** the level of disturbance predicted for Inch Cape OWF is not sufficient to result in any change at the population level (deviation in the mean impacted population size from the mean un-impacted population size is 0.00%). The impacted population is predicted to decrease, at exactly the same size of the un-impacted population.
- **Piling schedule 2:** the level of disturbance predicted for Inch Cape OWF is not sufficient to result in any change at the population level (deviation in the mean impacted population size from the mean un-impacted population size is 0.00%). The impacted population is predicted to decrease, at exactly the same size of the un-impacted population.

The assessment presented here for disturbance from WTG pile driving concludes that there will be no change to the East Scotland SMU population trend. While the East Scotland SMU is predicted to continue on a declining trajectory, the pile driving of WTGs at Inch Cape OWF has no influence on this. For more details regarding the iPCoD modelling see Appendix B: Marine mammal population modelling (iPCoD) of the Inch Cape OWF PS-GS (Inch Cape Offshore Limited, 2025)).

6.2.6 Grey Seal

For the largest EDR assumed (26 km for monopiles), it is predicted that up to 2,610 grey seals (24.20% East Scotland SMU) will be disturbed per piling day (Table 6-11). Using the dose-response approach, up to a maximum of 2,752 (310 - 5,152) grey seals (25.52% (2.87 - 47.78%) East Scotland SMU) are predicted to be disturbed per piling day for a monopile (L010) and 2,568 (268 - 4,856) grey seals (23.82% (2.49 - 45.06%) East Scotland SMU) are predicted to be disturbed per piling day for jacket pin piles (L055).For concurrent piling, up to a maximum of 2,974 (345 - 5,527) grey seal per piling day (27.58% (3.20 - 51.26%) East Scotland SMU) for concurrent piling of monopile L026 and jacket L055 when using the dose-response approach.

Table 6-11 Number of grey seals disturbed per piling day using the 26 km EDR approach, and using the dose-response approach (with 95% CI presented in brackets) for monopile and jacket foundations (worst-case scenario) alone, and concurrently.

Disturbance assessment method	# grey seals disturbed	% East Scotland SMU
26 km EDR	2,610	24.20%

Disturbance assessment method	# grey seals disturbed	% East Scotland SMU
Dose-response (Monopile L010)	2,752 (310 - 5,152)	25.52% (2.87 - 47.78)
Dose-response (Jacket L055)	2,568 (268 - 4,856)	23.82% (2.49 - 45.03)
Dose response (Concurrent monopile L026 & jacket L055)	2,974 (345 - 5,527)	27.58% (3.20 - 51.26)

To determine if the piling of monopiles and jackets alone as well as concurrently would result in a population-level effect on the East Scotland SMU, iPCoD modelling was undertaken for each piling schedule outlined in Section 4.1.4 using numbers of grey seal disturbed based on the dose-response approach. The results are as follows:

- **Piling schedule 1:** the level of disturbance predicted for Inch Cape OWF is not sufficient to result in any change at the population level (deviation in the mean impacted population size from the mean un-impacted population size is 0.02%). The impacted population is predicted to increase, at 99.98 - 99.99% the size of the un-impacted population.
- **Piling schedule 2:** the level of disturbance predicted for Inch Cape OWF is not sufficient to result in any change at the population level (deviation in the mean impacted population size from the mean un-impacted population size is 0.00%). The impacted population is predicted to increase, at 100.00% the size of the un-impacted population.

The assessment presented here for disturbance from WTG pile driving concludes that there will be no change to the ES SMU population trend, and thus no change to the favourable conservation status of the species. For more details regarding the iPCoD modelling see Appendix B: Marine mammal population modelling (iPCoD) of the Inch Cape OWF PS-GS (Inch Cape Offshore Limited, 2025)).

6.3 Piling EPS Conclusion

The risk of instantaneous PTS can be mitigated with pre-piling ADD use. Therefore, an EPS license to injure is not required.

The advice from NatureScot is that there is no requirement to fully mitigate cumulative PTS. It was agreed that a minimum of a 30-minute soft start, in combination with pre-piling ADD use constitutes best practice measures which would reduce the risk of cumulative PTS such that an EPS license to injure is not required. Further advice from NatureScot was received on 4th November in relation to seasonal restrictions and underwater noise monitoring. These were addressed in Section 8.1.5.

An EPS license will be required for disturbance from pile driving activities since there is the potential for individual marine mammals to be disturbed (both within Scottish inshore (<12 nm) waters, as well as in UK offshore waters).

6.4 HRA consideration

A separate assessment has been carried out to determine if the conclusions from the 2018 Habitat Regulations Assessment (HRA) conducted for the Inch Cape OWF (Inch Cape Offshore Limited, 2018a) with respect to pile driving of the WTGs remain valid (SMRUC, 2025).

The assessment found that WTG piling at Inch Cape OWF will not have a negative effect on conservation objectives of four European sites: Isle of May SAC, Berwickshire and North Northumberland Coast SAC, Firth of Tay and Eden Estuary SAC and Moray Firth SAC. A such, WTG piling at Inch Cape will not adversely affect the integrity of the sites. The report highlighted that whilst it is unlikely that the Firth of Tay and Eden Estuary SAC will achieve favourable conservation status for harbour seals in the long term (irrespective of piling at Inch Cape OWF), the impacts associated with the WTG pile driving are not predicted to have a bearing on this outcome.

As such, the 2018 conclusions drawn for the Isle of May SAC, Berwickshire and North Northumberland Coast SAC, Firth of Tay and Eden Estuary SAC and Moray Firth SAC with respect to marine mammal protected features remain valid, and it can be concluded that the pile driving works for the installation of the WTGs, alone or in combination, will not cause adverse effects on the integrity of any SAC designated for marine mammal species.

7 Risk Assessment – IAC installation and WTG construction

The main activities associated with the IAC installation and WTG construction (non-piling) that might increase the level of anthropogenic noise to a level that might impact marine EPS and seals are:

- Seabed preparation activities (e.g., PLGR), cable installation (laying, trenching and burial), jacket installation, and deployment of protection materials at the cable route and foundations (e.g. rock protection, mattresses, etc.) – hereafter referred to as 'increased anthropogenic noise from construction work'; and
- Geophysical survey equipment carried by the vessels, ROVs and other remote systems.

In addition, collision risks are also considered given the increased vessel traffic resulting from the works.

7.1.1 Non-piling Construction Work

The proposed cable preparation works, and cable laying activities have the potential to increase levels of anthropogenic noise in the marine environment (and therefore the potential to affect marine EPS and seals). Due to the general assumption that construction operations have minimal impact there is relatively little empirical data on noise emission source levels. While underwater noise modelling of these activities has not been carried out specifically for Inch Cape, there is information available from previous acoustic modelling for these activities (for example, the Caledonia Offshore Wind Farm Underwater Noise Assessment[5]). These estimates are not site-specific and so apply equally to the activities at Inch Cape. Estimated PTS impact ranges are <100 m for all marine mammal species (Table 7.1).

Table 7.1: Estimated source levels of non-pulsed route preparation activities and cable installation (data from Subacoustech Environmental)

	Activity	Estimated unweighted source level (dB re 1 µPa @ 1 m) (RMS)	Expected PTS impact range
Route preparation activities	PLGR	172	<100 m for all species
Cable Lay Operation	Cable laying	171	<100 m for all species
	Dredging	165-186	<100 m for all species
	Trenching	172	<100 m for all species
Scour and cable protection	Rock placement	172	<100 m for all species

7.1.1.1 Prediction of Potential Impact

Auditory Injury

There is no potential for auditory injury from the proposed IAC installation and non-piling WTG construction work as predicted auditory impact ranges were <100 m for all marine mammal species (Table 7.1). **Therefore, it is proposed that an EPS licence for injury is not required.**

Behavioural response

There is a lack of information in the literature on disturbance ranges for construction activities such as cable laying, trenching, burial and deployment of cable protection such as rock placement.

While construction-related activities (acoustic surveys, dredging, rock trenching, pipe laying and rock placement) for an underwater pipeline in northwest Ireland resulted in a decline in harbour porpoise

[5] Subacoustech Environmental (2024). Volume 7 Appendix 6 Caledonia Offshore Wind Farm: Underwater noise assessment. Subacoustech Environmental Report No. P323R0204

detections, there was a considerable increase in detections after construction-activities ended which suggests that any impact is localised and temporary (Todd *et al.*, 2020).

In the absence of sufficient available literature review on constructions activities at the seabed (e.g., PLGR, cable laying, burial, trenching and deployment of protection materials), information from dredging activities has been considered as a proxy:

- **Harbour porpoise:** Dredging at a source level of 184 dB re 1 µPa at 1m resulted in harbour porpoise avoidance up to 5 km from the dredging site (Verboom, 2014). Conversely, Diederichs *et al.* (2010) found much more localised impacts; using PAM there was short term avoidance (~3 hours) at distances of up to 600 m from the dredging vessel, but no significant long- term effects. Modelling potential impacts of dredging using a case study of the Maasvlatke port expansion (assuming maximum source levels of 192 dB re 1 µPa) predicted a disturbance range of 400 m, while a more conservative approach predicted avoidance of harbour porpoise up to 5 km (McQueen *et al.*, 2020).
- **Dolphins:** Increased dredging activity at Aberdeen Harbour was associated with a reduction in bottlenose dolphin presence and, during the initial dredge operations, bottlenose dolphins were absent for five weeks (Pirotta *et al.*, 2013). Based on the results of this study, Pirotta *et al.* (2015) have assumed that dredging activities exclude dolphins from a 1 km radius of the dredging site.
- **Minke whales:** In northwest Ireland, construction-related activity (including dredging) has been linked to reduced minke whale presence (Culloch *et al.*, 2016). Minke whale distance to construction site increased and relative abundance also decreased during dredging activities in Newfoundland (Borggaard *et al.*, 1999).
- **Seals:** Based on the generic threshold of behavioural avoidance of pinnipeds (140 dB re1µPa SPL) (Southall *et al.*, 2007), acoustic modelling of dredging demonstrated that disturbance could be caused to individuals between 400 m to 5 km from site (McQueen *et al.*, 2020).

To be precautionary, a 5 km EDR has been assumed for all marine mammal species to calculate the potential number of animals disturbed by non-piling construction activities (Table 7-2). The impact is expected to be short-term, temporary and localised nature, impacting `low numbers of individuals and very small proportions of the relevant management units.

There is potential for the IAC installation and non-piling WTG construction work to result in disturbance of individual EPS within Scottish inshore (<12 nm) waters, as well as individuals in UK offshore waters. Therefore, it is proposed that an **EPS licence is required for disturbance both within Scottish inshore waters and in UK offshore waters.**

Table 7-2 The number of individuals estimated to have the potential to be disturbed per day by non-piling construction work

Species	Density (#/km^2)	# within 5 km EDR (78.5 km^2)	% whole MU	% UK MU
Harbour porpoise	0.5985	47	0.01%	0.03%
Bottlenose dolphin	0	0	0.00%	NA
White-beaked dolphin	0.0799	6	0.01%	0.02%
Minke whale (SCANS-IV block)	A/W = 0.0023 Sp = 0.0070 Su = 0.0419	A/W = <1 Sp = <1 Su = 3	A/W = 0.00% Sp = 0.00% Su = 0.01%	A/W = <0.01% Sp = <0.01% Su = 0.03%
Minke whale (SCANS-IV average density across array area)	A/W = 0.0008 Sp = 0.0025 Su = 0.0151	A/W = <1 Sp = <1 Su = 1	A/W = 0.00% Sp = 0.00% Su = 0.00%	A/W = <0.01% Sp = <0.01% Su = 0.01%
Harbour seal	Average across Array: 0.003	<1	<0.27%	NA
Grey seal	Average across Array: 1.011	Array: 79	Array: 0.73%	NA

A/W = Autumn and Winter (Oct-Mar)
Sp = Spring (Apr-Jun)
Su = Summer (Jul-Sep)

7.1.2 Sound Emitting Geophysical Survey and Positioning Equipment

The use of geophysical survey and positioning equipment which emits sound has the potential to increase levels of anthropogenic noise in the marine environment (and therefore the potential to affect marine mammals). Typical geophysical, positioning, monitoring and navigational equipment carried by the vessels, ROVs and other remote systems likely to be used as part of the IAC installation and construction work have been examined and those which emit sound assessed. A summary of the likely frequency ranges and source levels of this equipment is provided in Table 7-3.

Table 7-3 Details of the proposed types of geophysical survey equipment which emit sound

Equipment Type*	Typical Frequency Range	Typical SPL (dB re 1 μPa @ 1 m)
Ultra-Short Base Line (USBL)	20-34 kHz	196 (peak), 188 (rms)
Multi Beam Echo Sounder (MBES)	400 kHz	
Sub-Bottom Imager (SBI)	4-14 kHz	192 (peak)
Side Scan Sonar (SSS)	>200 kHz	210 (peak)

Equipment Type*	Typical Frequency Range	Typical SPL (dB re 1 µPa @ 1 m)
Multi Beam Imaging/ Profiling Sonar	>200 kHz	
Dual Head Scanning Sonar	>200 kHz	<210
Doppler velocity log	>200 kHz	
Altimeter	50-60 Hz	70-75
Transponder (cNode)	20-30 Hz	188-203

**The frequency and source levels presented are deemed to be representative of each equipment type.*

Prior to an evaluation in relation to each item of equipment, the overlap between typical survey equipment operating characteristics and marine mammal functional hearing capability (Table 7-4) is considered. Where there is no overlap between hearing capability and functional hearing, there is no potential for disturbance effects to occur. Although high magnitude pressure waves may result in physiological damage to organs regardless of hearing range overlap, i.e., blast trauma from underwater explosions, the acoustic signals from high frequency geophysical sources (e.g., MBES, SSS) which are above the hearing range of marine mammals, are not impulsive enough to have the potential to result in hearing injury or other harm through such a mechanism.

Table 7-4 Generalised hearing ranges for marine mammals (NMFS, 2024)

Hearing Group	Species	Generalised hearing range[6]
Low frequency cetaceans	Minke whale	7 Hz – 36 kHz[7]
High frequency cetaceans	Bottlenose and white-beaked dolphins	150 Hz – 160 kHz
Very high frequency cetaceans	Harbour porpoise	200 Hz – 165 kHz
Pinnipeds in water	Harbour and grey seal	40 Hz – 90 kHz

[6] It is expected that "*Outside the generalized hearing range[s], the risk of auditory impacts from sounds is considered highly unlikely or very low (the exception would be if a sound above/below this range has the potential to cause physical injury, i.e., lung or gastrointestinal tract injury from underwater explosives)*" (NMFS, 2024)

[7] As stated in NMFS (2024): "*It is important to note that the information on the LF cetacean hearing group in NMFS (2024) was extremely limited, relying on assumptions of hearing sensitivity based on vocalisation frequencies, anatomical models, behavioural reactions, and extrapolation from other marine mammals. However, since then the first direct hearing measurements from a baleen whale have been recorded. Houser et al. (2024) showed that minke whales are sensitive to frequencies much higher than previously believed, with auditory brain stem responses detected at 45 – 90 kHz. This new data suggests that baleen*

7.1.2.1 *Prediction of Potential Impact*

Auditory Injury

SSS, Multi Beam Imaging/ Profiling Sonar, Dual Head Scanning Sonar, and Doppler velocity log,: The typical frequency ranges of the sounds produced by this equipment are >200 kHz which is outside the hearing range of the marine mammals assessed (Table 7-4). It is expected that "*outside the generalized hearing range[s], the risk of auditory impacts from sounds is considered highly unlikely or very low*" (NMFS, 2024).

MBES & SSS: JNCC (2025) states that marine mammal mitigation is not required when multi-beam equipment is used in isolation in shallow waters (<200 m) where the MBES used are of high frequencies (as they are planned to be here). EPS Guidance (JNCC *et al.*, 2010) for use of SSS states that "*this type of survey is of a short-term nature and results in a negligible risk of an injury or disturbance offence (under the Regulations).*" An equivalent conclusion was reached by (DECC, 2011). Furthermore, a recent comprehensive assessment of the characteristics of acoustic survey sources proposed that MBES should be considered de minimis in terms of being unlikely to result in PTS to marine mammals (Ruppel *et al.*, 2022). The extent and duration of the impact (underwater noise during MBES & SSS) is expected to be localised and short-term. As discussed in Ruppel *et al.* (2022), the effect is unlikely to occur due to radiated power, exposure duration and number of pings exceeding the injury threshold. As the consequence, it is anticipated that no animals will experience injury.

USBL & SBI: The source levels of the USBL and SBI are expected to be below the minimum instantaneous threshold for PTS-onset for marine mammals (see Table 4-4) and therefore pose no risk of auditory injury to EPS or seals.

The altimeter will be operating at a frequency of 50-60 Hz which overlaps with the generalised hearing range of minke whales and seals. However, the source level (70-75 dB re 1 μPa @ 1 m) is significantly below the minimum instantaneous threshold for PTS-onset for marine mammals (see Table 4-4) and therefore pose no risk of auditory injury to EPS or seals.

Therefore, it is proposed that an **EPS licence for injury is not required.**

Behavioural response

The sounds produced by the USBL, SBI, altimeter and transponder fall within the hearing range of the marine mammals assessed and therefore has the potential to cause animals to respond behaviourally.

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whales may not be solely sensitive to relatively low-frequency sounds. It should be noted that in NMFS (2024), the data collected by Houser et al. (2024) have implications for not only the generalised hearing range for low-frequency cetaceans but also on their weighting function. Therefore, NMFS expects to update the information on low frequency hearing groups in due course".

A recent sound source verification exercise in the Danish North Sea reported measured noise levels from several HRG sources, including an Innomar parametric SBP, sparker SBP and USBL, at sampling stations with closest points of approach of 0 m, 100 m and between 500 m and 2 km (Pace *et al.*, 2021). They reported noise levels for a USBL operating at 25-40 kHz attached to a SSS operating at 100 and 900 kHz. The effective source level estimated for the combined SSS and USBL was 184 dB re 1 µPa^2@1 m(SPL_{rms}). At 100 m distance, broadband received levels were 147.9 dB re 1 µPa^2 (SPL_{rms}), while received levels in the 20-30 kHz band, of relevance to the USBL, were 140.4 dB re 1 µPa^2 s (per pulse SEL). The USBL appeared fairly omnidirectional with an estimated transmission loss of c. 15logR. When the USBL was active, the combined source was detectable above background noise at 2 km; however, application of VHF cetacean (harbour porpoise) frequency weighting indicated noise levels of < 120 dB re 1 µPa^2 (SPL_{rms}, VHF frequency-weighted) at a distance of ~1 km from the source. These results illustrate the potential for behavioural disturbance within a limited spatial extent (i.e. a few hundred metres).

For sub-bottom profiler surveys and multibeam echosounders, JNCC (2023b) recommends the use of a 5 km EDR and a resulting daily disturbance footprint of 256 km^2. The number of individuals for each marine mammal species assessed which have the potential to be affected has been estimated in Table 7-5. Considering the estimates provided in Table 7-5 there is the potential for temporary behavioural avoidance from all marine mammal species assessed quantitatively as a result of sub-bottom profiler surveys. However, any such avoidance is very unlikely to significantly affect the local distribution or abundance of any species.

When considering the short-term, temporary and localised nature of disturbance predicted from the geophysical surveys in the array area, the low numbers of individuals disturbed and small proportions of the relevant management units, such disturbance effects would not be likely to impair the ability of an animal to survive or reproduce or result in any significant impacts to the local populations or distribution. There is potential for the geophysical surveys to result in disturbance of individual EPS within Scottish inshore (<12 nm) waters, as well as individuals in UK offshore waters. Therefore, it is proposed that an **EPS licence is required for disturbance both within Scottish inshore waters and in UK offshore waters.**

Table 7-5 The number of individuals estimated to have the potential to be disturbed per day by geophysical survey activities

Species	Density (#/km^2)	# within 256 km^2 daily disturbance footprint	% whole MU	% UK MU
Harbour porpoise	0.5985	153	0.04%	0.10%
Bottlenose dolphin	0	0	0.00%	NA

Species	Density (#/km^2)	# within 256 km^2 daily disturbance footprint	% whole MU	% UK MU
White-beaked dolphin	0.0799	20	0.05%	0.06%
Minke whale (SCANS-IV block)	A/W = 0.0023 Sp = 0.0070 Su = 0.0419	A/W = <1 Sp = 2 Su = 11	A/W = 0.00% Sp = 0.01% Su =0.05%	A/W = <0.01% Sp = 0.02% Su = 0.10%
Minke whale (SCANS-IV density surface average across array area)	A/W = 0.0008 Sp = 0.0025 Su = 0.0151	A/W = <1 Sp = <1 Su = 4	A/W = 0.00% Sp = 0.00% Su = 0.02%	A/W = <0.01% Sp = <0.01% Su = 0.04%
Harbour seal	Average across Array: 0.003	<1	<0.27%	NA
Grey seal	Average across Array: 1.011	259	2.40%	NA

A/W = Autumn and Winter (Oct-Mar)
Sp = Spring (Apr-Jun)
Su = Summer (Jul-Sep)

7.2 Collision Risk

Vessel strikes are a known cause of mortality in marine mammals and basking sharks (Laist *et al.*, 2001). Non-lethal collisions have also been documented (Laist *et al.*, 2001, Van Waerebeek *et al.*, 2007). Injuries from such collisions can be divided into two broad categories: blunt trauma from impact and lacerations from propellers. Injuries may result in individuals becoming vulnerable to secondary infections or predation.

Avoidance behaviour by marine mammals (e.g., bottlenose dolphins), is often associated with fast, unpredictable boats such as speedboats and jet-skis (Bristow and Rees, 2001, Buckstaff, 2006), while neutral or positive reactions for other species have been observed with larger, slower moving vessels such as cargo ships (Sini *et al.*, 2005).

7.2.1 Prediction of Potential Impact

The proposed construction work for the WTG will require HLV, JUV and transport barges and tugs. During the piling activities, installation of the foundations and turbines, the vessels will be stationary, or travelling at low working speeds or transiting in a predictable manner. Therefore, the potential for collisions with marine mammals and basking sharks is considered to be negligible.

The proposed IAC installation work may require several types of vessels, working in different phases of the works. The majority of the work will require a single large vessel following the pre-defined cable corridor at low working speeds, except during transit. At one time, there may be 4-5 vessels working in the IAC (CLV / Trenching / Testing & Termination / Guard vessel and eventually a CTV. This number may vary depending on the programme. Predictability of vessel movement by marine mammals is known to be a key aspect in minimising the potential risks imposed by vessel traffic (Nowacek *et al.*, 2001, Lusseau, 2003, 2006). The embedded mitigation of a VMP will ensure that vessel traffic moves along predictable routes, set recommended speed and define how vessels should behave in the presence of marine mammals. Additionally, the presence of the IAC construction vessels is unlikely to significantly increase the vessel traffic in the area, especially as these will be performing activities in different phases. Therefore, the increase in potential collision risk for marine mammals and basking sharks is considered to be negligible.

All vessels to be used during the works will adhere to the Vessel Management Plan and Navigational Safety Plan (VM&NSP) (IC02-INT-EC-OFC-008-INC-PLA-001), which establishes indicative vessel transit corridors for major construction vessels and adherence to the Scottish Marine Wildlife Watching Code (SMWWC) to ensure best practice during transits. The adoption of these measures will minimise the potential for the collision to take place.

8 Marine Mammal Mitigation

8.1 Piling works

As agreed in consultation (Section 4.2), the marine mammal mitigation has been primarily designed to mitigate the risk of auditory injury using the instantaneous PTS impact range. The largest instantaneous PTS impact range for monopiles across all marine mammal species is 920 m for harbour porpoise (see Section 6.1.1).

The advice from NatureScot received in November 2024 is that there is no requirement to fully mitigate cumulative PTS. A minimum of a 30-minute soft start, in combination with pre-piling ADD use constitutes best practice measures which would reduce the risk of cumulative PTS.

The current guidance on minimising the risk of injury to marine mammals from piling noise (JNCC, 2010) does not take into consideration the advancement in our understanding of the effects of noise on marine mammals, and increased evidence that ADDs are effective at deterring marine mammals from the instantaneous PTS mitigation zone. ICOL suggests that pre-piling ADD use (beyond the minimum time required to mitigate instantaneous PTS) in combination with a 30-minute soft start (beyond the minimum advised in the JNCC guidance) constitutes "*best practice measures which would reduce the risk of cumulative PTS*".

More detailed reasoning and evidence behind these proposed mitigation measures are provided in Section 6.1: 'Consultation' of the Inch Cape OWF PS-GS (Inch Cape Offshore Limited, 2025).

8.1.1 Soft start

The JNCC (2010) guidance to minimise the risk of injury to marine mammals from piling noise defines the soft start as "*the gradual ramping up of piling power, incrementally over a set time period, until full operational power is achieved*". Thus, technically the guidance considers all piling before the maximum hammer energy is reached to be the soft start. The guidance states that the soft start duration should be no less than 20 minutes. Initiating piling at a lower hammer energy will effectively reduce the underwater noise levels allowing the animal to move away from the noise source to a greater distance at which the likelihood of injury is reduced.

It is recommended that all WTG pile driving will include a soft start of 30 minutes at 10% of the maximum hammer energy, before the ramp up of hammer energy commences. This is 50% longer than the minimum soft start requirements outlined in the JNCC (2010) guidance, in order to reasonably lower the risk of cumulative PTS to both minke whales and harbour porpoise (species with the largest potential injury ranges). The rate of ramp up following the 30 minute soft start will vary depending on the location, ground conditions and hammer limitations.

8.1.2 Pre-piling ADDs

The use of pre-piling ADD is proposed prior of the soft start. The use of the Lofitech AS Seal Scarer ADD, has proven effective for marine mammal mitigation during piling activities at variety of Scottish OWFs, including Beatrice OWF (Thompson *et al.*, 2020) and the Moray East OWF (Graham *et al.*, 2019). Thompson *et al.* (2020) has shown that within the 3-h period following an ADD playback, there was a >50% chance of porpoise response at distances up to 21.7 km. Analysis of acoustic data has shown that animals move away from the source in a directional manner (Graham *et al.*, 2023), supporting the estimation of ADD duration using directional flee speeds from the source. See Section 8.2: 'Pre-piling ADDs' of the Inch Cape OWF PS-GS (Inch Cape Offshore Limited, 2025) for more details regarding ADD evidence base.

8.1.3 ADD Use

Trained ADD personnel will be responsible for operation, monitoring and reporting of the device. Testing of the main device and a back-up device should be undertaken prior to starting the works, either before a vessel leaves port, e.g. through an initial deploy and test whilst the vessel is docked, or at the wind farm site. The devices should be tested to ensure that they are working, i.e. by using a hydrophone system and computer interface with appropriate software.

The ADD should be activated prior to the commencement of the soft start procedure. The duration of ADD activation should allow for the animal to move beyond the potential injury zone (see Section 4). It is vital that the duration of the ADD is sufficient to ensure a negligible risk of auditory injury to marine mammals, while minimising the potential for unnecessary far-field disturbance impacts (Graham et al., 2019). As advised by NatureScot in consultation, pre-piling mitigation and hence ADD duration is based on the maximum instantaneous PTS injury ranges.

The largest instantaneous PTS impact range for monopiles is 920 m for harbour porpoise. It would take a harbour porpoise starting at the pile and fleeing at 1.4 m/s, 11 minutes to exit this range. Therefore, to ensure the instantaneous PTS impact zone is clear of marine mammals prior to the start of piling, **pre-piling ADD use for 15 minutes** is recommended for monopiles.

The largest instantaneous PTS impact range for jackets is 630 m for harbour porpoise. It would take a harbour porpoise starting at the pile 7.5 minutes, fleeing at 1.4 m/s, to exit this range. Therefore, to ensure the instantaneous PTS impact zone is clear of marine mammals prior to the start of piling, **pre-piling ADD use for 10 minutes** is recommended for jackets.

8.1.4 Breaks in piling activity

To minimise the potential for unnecessary disturbance the ADD will not be redeployed unless a break in piling activity greater than 6 hours occurs. This follows advice previously provided on Marine Mammal Mitigation Protocols for other OWF developments (e.g. Moray East OWF and Moray West OWF). Studies have shown that harbour porpoise detections remained low up to 6 hours after ADD exposure (Brandt *et al.,* 2013).

The engineers and piling contractors have highlighted that it is unlikely to be practicable to do a full 30-minute soft start for breaks in piling between 10 minutes and 1 hour. Therefore, a slight modification to the piling procedure has been suggested:

1. **For breaks in piling less than 10 minutes:** no further mitigation is proposed. Pile driving activities may restart using the last hammer energy and strike rate (or lower) without the need to redeploy the ADD.
2. **For breaks in piling of more than 10 minutes and up to 1.5 hour:** a 15-minute soft start will be implemented prior to restarting the piling activity using the lowest practicable hammer energy, wherever this is safe and practicable to do so, without the need to redeploy the ADD.
3. **For breaks in piling of more than 1.5 hour but less than 6 hours:** a full 30-minute soft start will be implemented prior to restarting the piling activity using the lowest practicable hammer energy, wherever this is safe and practicable to do so, without the need to redeploy the ADD.
4. **For breaks in piling greater than 6 hours:** the full piling mitigation procedure of pre-piling ADD deployment and a full 30 min soft-start using the lowest practicable hammer energy will be implemented prior to restarting the piling activity, wherever this is safe and practicable to do so.

8.1.5 Seasonal restrictions

There are 12 locations with challenging ground conditions that are predicted to require higher hammer energies. These are defined based on geotechnical design and monopile driveability analysis (Geowynd, 2025). ICOL will plan that all of these locations will be piled prior to the 1st of June to 1st October Seasonal Restriction.

In the event that these piles require installation during the Seasonal Restriction period, then no piling will be undertaken at these 12 locations using energy levels in excess of 5,500 kJ, unless underwater noise monitoring has validated the predictions of the cumulative PTS being within the adverse case predictions in the Piling Strategy (Section 6.3.2) for these high energies for minke whales.

If the noise monitoring has not validated these forecasts, then further mitigation measures for minke whales will be discussed and agreed with MD-LOT. The future mitigations may include extended soft start, reduction in blow counts, or extended use of ADD.

8.2 IAC and WTG non-piling Construction Works

No mitigation measures (other than transit watches, see Section 8.3) have been deemed necessary to protect marine EPS, seals and basking sharks from the IAC and WTG construction work activities excluding piling. This is because neither the increased anthropogenic noise from IAC and WTG non-piling construction works nor from the sound emitting geophysical survey and positioning equipment will be of sufficient duration or level to have the potential to cause auditory injury.

8.3 Transit Watches

All vessels will adhere to the Scottish Marine Wildlife Watching Code[8] (SMWWC) where appropriate during all construction activities. Any sightings will be communicated to the Officer on watch as soon as is practicable who will ensure that marine EPS, basking sharks and seals are avoided where safe to do so. The observer may be the Master of the vessel, a member of the bridge crew, another member of the ship's crew. The Officer on watch will minimise high powered manoeuvres or rapid changes of course, where this does not impair safety, to avoid collisions.

9 Consideration of Cumulative Impacts

A review of publicly available data was conducted to identify projects that involved piling or other construction activities within one year before and after the piling of WTGs at Inch Cape OWF, which is the main source of noise anticipated during the construction of the GS. Below is a summary of the identified projects for which data was collected, along with their respective timeframes where available.

9.1 Completed Projects with Potential Piling Activities

Port of Leith Outer Berth: The deepening of the approach channel to the Port of Leith was expected to take approximately 15 months (Royal Haskoning DHV, 2023). This included sheet piling works for an improved quay, utilising either percussive or vibratory piling methods. Given that these methods produce significantly lower noise levels, they result in more localised effects compared to impact piling. The works were anticipated to be completed by Q3 2024.

Re-development of Dundee Port: The re-development of port at Dundee involved both impact and

[8] Scottish Marine Wildlife Watching Code | NatureScot

vibratory piling (Wildlife Consulting Ltd., 2020). The piling activities occurred between October 2020 and June 2022 (with impact piling limited to a maximum of four hours within a 24-hour period), and the project has since been completed.

Levenmouth Demonstration Turbine: Also known as the Fife Energy Park Offshore Demonstration Wind Turbine, this project is located at the Fife Energy Park in Methil, within the Firth of Forth. The turbine is currently operational, and there are no additional in-combination effects beyond the established baseline.

Neart na Gaoithe: All foundation jacket installations for this offshore wind farm have been completed[9]. Wind turbine installations are currently ongoing. Guard vessels remain present in the wind farm area and within the export cable corridor.

Seagreen: The Seagreen OWF has been fully commissioned. Current and future operations are focused on operations and maintenance[10].

9.2 Upcoming Projects

Seagreen 1A: This project is requesting a variation in its consent to allow construction between January 2029 and December 2032, which is significantly later than the originally planned 2025 start (Seagreen, 2024).

Berwick Bank: This project has received consent on 31 July 2025. The EIA report (RPS, 2022) states that offshore construction is expected to take place between 2025 and 2032, however, given the delays to consent it is more likely to commence in 2028 at the earliest.

9.3 Projects with Limited Information

Port of Dundee Expansion and Marine Aggregate Extraction: A scoping report for this project was submitted in 2013 (Royal Haskoning DHV, 2013), however, there have been no further updates on the Marine Scotland Government website.

Edinburgh Marine & Granton Harbour: There is no available information regarding the timing of this project on the Marine Scotland Government website[11]. Dredging activities have been mentioned, but no further details are provided.

9.4 Summary

All identified projects that could contribute to cumulative effects associated with piling on marine mammals have now been completed or are anticipated to occur more than one year after WTG pile driving at Inch Cape OWF. While vessel activity may continue in the area due to other construction

[9] Neart na Gaoithe Weekly Notice of Operations
[10] Seagreen Offshore Wind Farm Weekly Notice of Operations
[11] Edinburgh Marina, Granton Harbour Redevelopment | marine.gov.scot

activities at Neart na Gaoithe and operation and maintenance Seagreen, the most noise-intensive construction activities at these wind farms have concluded. As a result, there is no potential for cumulative effects from piling (or other construction activities) on EPS and further consideration of the cumulative effects is not necessary.

10 Assessment of Potential Offence(s)

The conclusions of the assessment for impacts of auditory injury and disturbance on cetacean EPS and seals from the piling of WTGs are that:

- After mitigation, the risk of instantaneous or cumulative auditory injury (PTS) is considered negligible, such that an **EPS license to injure is not required**:
    - The use of pre-piling ADD will fully mitigate instantaneous PTS; and
    - The use of pre-piling ADD combined with 30 minutes soft start constitutes the best practice measures which would reduce the risk of cumulative PTS. There are no requirements to fully mitigate modelled cumulative PTS as it is acknowledged these are highly precautionary. In addition, seasonal restrictions are proposed for 12 locations with challenging ground conditions that are predicted to require higher hammer energies, as described in Section 8.1.5.
- There is a potential for EPS to respond behaviourally for the Inch Cape OWF alone, therefore **an EPS licence (to disturb) will be required**. However, any disturbance is deemed short-term, sporadic, reversible, and without any likely negative effect on the species; and
- There is no potential for cumulative effects from piling (or other construction activities) at Inch Cape OWF and other projects on EPS and further consideration of the cumulative effects is not necessary.

To demonstrate that the conclusions from this work justify that an EPS licence can be granted, ICOL must demonstrate that the Inch Cape OWF meets the three EPS licence tests. The three tests are:

- **Purpose of Development:** There must be a licensable purpose for which licences can be granted. The reason for the licence must relate to one of several purposes specified in regulation 44(2) of the Conservation (Natural Habitats &c.) Regulations 1994 (as amended);
- **No Satisfactory Alternatives:** There is no satisfactory alternative for the development (Regulation 44(3) of the Conservation (Natural Habitats &c.) Regulations 1994); and
- **Maintaining Favourable Conservation Status:** The action authorised will not be detrimental to the maintenance of the population of the species concerned at a favourable conservation status (FCS) in their natural range (Regulation 44, 3b of the Conservation (Natural Habitats &c.)

Regulations 1994).

10.1 Purpose of Development

Offshore wind generation has been identified at European and national level as a key technology in the transition to a low-carbon economy. It can make a significant contribution towards the provision of new renewable energy projects which will help the Scottish Government meet legally binding national and international targets on climate change.

Inch Cape Offshore Wind Farm will feature 72 turbines sited in the North Sea, 15 - 22 km kilometres off the Angus coast. The project will make a significant contribution towards the UK's offshore wind ambitions and will generate enough green energy to power the equivalent of more than half the homes in Scotland and constitutes 10% of the Scottish Government's ambition of 11 GW of offshore wind installed by 2030.

Inch Cape OWF therefore represents not only a substantial investment in the UK's renewable energy infrastructure, but also a tangible step towards Scotland's Net Zero future, bringing with it associated economic opportunities and benefits for local communities.[12].

10.2 No Satisfactory Alternatives

ICOL have undertaken extensive design research for the development of Inch Cape OWF. Since the revised EIA published in 2018 (Inch Cape Offshore Limited, 2018b), which included 213 WTGs as the worst case. Recent site geotechnical data has been collected for 80 potential WTG locations, of which 72 locations will be chosen for WTG placement. To be able to successfully pile monopile foundations in all ground conditions expected within the array area, it is anticipated that a maximum of 6,600 kJ hammer energy will be required, and alternative installation methods are not possible.

Measures that ICOL have taken to reduce potential risks to marine mammals include:

- The development and implementation of mitigation measures designed to reduce the risk of auditory injury to EPS as a result of piling (Inch Cape Offshore Limited, 2025).
- Use of regular vessel routes and vessel operators following the Scottish Marine Wildlife Code (SNH, 2017a, b) maintaining a suitable buffer between vessels and marine mammals in order to reduce the risk of collision.

10.3 Maintaining Favourable Conservation Status

The risk assessment presented above demonstrates that there is no risk to the FCS of harbour porpoise, bottlenose dolphin, white-beaked dolphin, and minke whale management unit populations as a result of the Inch Cape OWF. Although seals are not considered EPS, this risk assessment also

[12] https://www.inchcapewind.com/about/

demonstrates that there is no risk to the current conservation status of grey and/or harbour seal SMU.

An EPS licence (to disturb) will be required and can be granted for the disturbance from pile driving activities, ADD testing, geophysical surveys and other non-piling construction works, as advised from the guidance provided in the Conservation of Habitats and Species Regulations 1994 (as amended in Scotland).

The following EPS licenses are required:

- EPS license to disturb marine mammals during ADD testing (both inshore and offshore);
- EPS license to disturb marine mammals during pile driving (both inshore and offshore);
- EPS license to disturb marine mammals during geophysical surveys (both inshore and offshore); and
- EPS license to disturb marine mammals during non-piling construction works (route preparation activities, cable lay operation, scour and cable protection) (both inshore and offshore).

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