CALEDONIA
Offshore Wind Farm

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Caledonia Offshore Wind Farm

Geophysical Survey Campaign 2023 - European Protected Species (EPS) Risk Assessment

Caledonia Offshore Wind Farm Limited

Title

Caledonia Offshore Wind Farm Geophysical Survey Campaign 2023 – European Protected Species (EPS) Risk Assessment

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003	November 25, 2022	Final	

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Acronyms and Abbreviations

3D	Three Dimensional
BEIS	Department for Business, Energy and Industrial Strategy
dBht	Decibel Level Above Hearing Threshold
DGPS	Differential Global Positioning System
ECC	Export Cable Corridor
EDR	Effective Deterrent Range
EIA	Environmental Impact Assessment
EPS	European Protected Species
FCS	Favourable Conservation Status
GW	Gigawatt
IAMMWG	Inter-Agency Marine Mammal Working Group
IMO	International Maritime Organization
IUCN	International Union for Conservation of Nature
JNCC	Joint Nature Conservation Committee
MAG	Magnetometer
MBES	Multi-beam Echo-sounder
MMO	Marine Mammal Observer
MS-LOT	Marine Scotland Licensing Operations Team
MU	Management Unit
NCMPA	Nature Conservation Marine Protected Area
NMFS	National Marine Fisheries Services
NOAA	National Oceanic and Atmospheric Administration

OWF	Offshore Wind Farm
PAM	Passive Acoustic Monitoring
PTS	Permanent Threshold Shift
ROV	Remotely Operated Vehicle
SAC	Special Area of Conservation
SBES	Single-beam Echo-sounder
SBP	Sub-bottom Profiler
SCOS	Special Committee on Seals
SEL	Sound Energy Level
SEL_{cum}	Cumulative Sound Energy Level
SMP	Sectoral Marine Plan
SNH	Scottish Natural Heritage
SPL	Sound Pressure Level
SPL_{pp}	Peak-to-peak Sound Pressure Level
SPL_{zp}	Zero-to-peak Sound Pressure Level
SSS	Side-scan Sonar
TTS	Temporary Threshold Shift
UHR	Ultra-high Resolution
USBL	Ultra-short Baseline
UXO	Unexploded Ordnance

1. Introduction

1.1 Background

1.1.1.1 In response to the Scottish Government's target of net-zero emissions of all greenhouse gases by 2045 and the aim to generate 50% of Scotland's overall energy consumption from renewable sources by 2030, Crown Estate Scotland launched the ScotWind Leasing process in 2021, which released new areas of seabed within Scottish waters for future offshore development. The ambition, as set out in the Offshore Wind Policy Statement (Scottish Government, 2020a), was to offer 11 Gigawatts (GW) of offshore capacity within a series of Plan Options identified by the Scottish Government as the most suitable areas for development as set out within the Sectoral Marine Plan (SMP) for Offshore Wind (Scottish Government, 2020b).

1.1.1.2 In January 2022, as part of the ScotWind bidding round, Ocean Winds (the Developer) was successfully awarded an Option Agreement (granting exclusive rights) to develop an offshore wind farm (OWF) within the NE4 Plan Option, which is located within the Moray Firth, off the northeast coast of Scotland. Ocean Winds (via its 100% owned subsidiary Caledonia Offshore Wind Farm Limited) is now currently progressing the proposals for this OWF, which has been named the Caledonia Offshore Wind Farm (Caledonia OWF). The Terms of the Agreement are dependent upon Caledonia OWF being awarded all key consents and permissions to construct and operate the OWF from the relevant regulatory authorities, including Marine Scotland.

1.1.1.3 The Array Area is located within the NE4 Plan Option, with the northern limit of the site being approximately 22 km from Wick and the southern limit of the site being approximately 38 km from Banff. The offshore elements of the Proposed Development incorporate infrastructure within the Array Area (Wind Turbine Generators and foundations, as well as inter-array and interconnector cables) and export cables between the Array Area and landfall location within an Offshore Export Cable Corridor (ECC).

1.1.1.4 In Spring 2023, Ocean Winds is planning to undertake geophysical surveys of the Offshore ECC (plus a 2 km buffer; see Figure 1-1). Ahead of any geophysical surveys, all relevant consents and licences need to be in place, including a European Protected Species (EPS) Licence where applicable:

- Within 12 nautical miles of the coast (territorial sea): An EPS Licence may be required under the Conservation (Natural Habitats, &c) Regulations 1994 (as amended) where there is potential for the presence of vessels or underwater noise from the proposed survey activities to injure or cause disturbance to an EPS.
- Outside 12 nautical miles: An EPS Licence may be required under the Conservation of Offshore Marine Habitats and Species Regulations 2017 where there is potential for the presence of vessels or underwater noise from the proposed survey activities to injure or cause significant disturbance to an EPS (population level effect rather than individual animals).

1.1.1.5 It should be noted that the final area to be surveyed will be along a cable route approximately 3 km wide; however, this cable route has not yet been finalised and, therefore, as contingency Ocean Winds are applying for a EPS Licence in relation to a larger area than needed. The Offshore ECC survey area is partially within 12 nautical miles (360 km^2) and partially outside of the 12 nautical miles boundary (242 km^2). Ocean Winds commissioned GoBe Consultants Ltd to prepare this document to provide the necessary information in support of an EPS Licence

application which will be submitted to the Marine Scotland Licensing Operations Team (MS-LOT).

1.2 European Protected Species (EPS)

1.2.1 EPS Protection

1.2.1.1 All species of cetacean (whale, dolphin and porpoise) occurring in UK waters are listed in Annex IV of the Habitats Directive (European Commission Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Flora and Fauna) as an EPS, meaning that they are species of community interest in need of strict protection, as directed by Article 12 of the Directive. This protection is afforded in Scottish territorial waters (out to 12 nautical miles) under the Conservation (Natural Habitats, &c.) Regulations 1994 (as amended). Regulation 39(1) of the Habitats Regulations makes it an offence, with certain exceptions, to:

- Deliberately or recklessly capture, injure or kill a wild animal of an EPS;
- Deliberately or recklessly:
  - Harass a wild animal or group of wild animals of an EPS;
  - Disturb such an animal while it is occupying a structure or place which it uses for shelter or protection;
  - Disturb such an animal while it is rearing or otherwise caring for its young;
  - Obstruct access to a breeding site or resting place of such an animal, or otherwise to deny the animal use of the breeding site or resting place;
  - Disturb such an animal in a manner that is, or in circumstances which are, likely to significantly affect the local distribution or abundance of the species to which it belongs;
  - Disturb such an animal in a manner that is, or in circumstances which are, likely to impair its ability to survive, breed, or reproduce, or rear or otherwise care for its young; or
  - Disturb such an animal while it is migrating or hibernating.

1.2.1.2 Further protection is afforded through an additional disturbance offence given under Regulation 39(2) which states:

"…it is an offence to deliberately or recklessly disturb any dolphin, porpoise or whale (cetacean)".

1.2.1.3 Outside of 12 nautical miles, the extent of legislative protection against injury is the same as afforded within 12 nautical miles (described above). However, the definition of disturbance outside of 12 nautical miles does not extend to individual animals. Therefore, whilst disturbance of a single animal within 12 nautical miles may be considered an offence and thus require an EPS licence, for an EPS licence to be required outside of 12 nautical miles there must be disturbance of a significant group of animals.

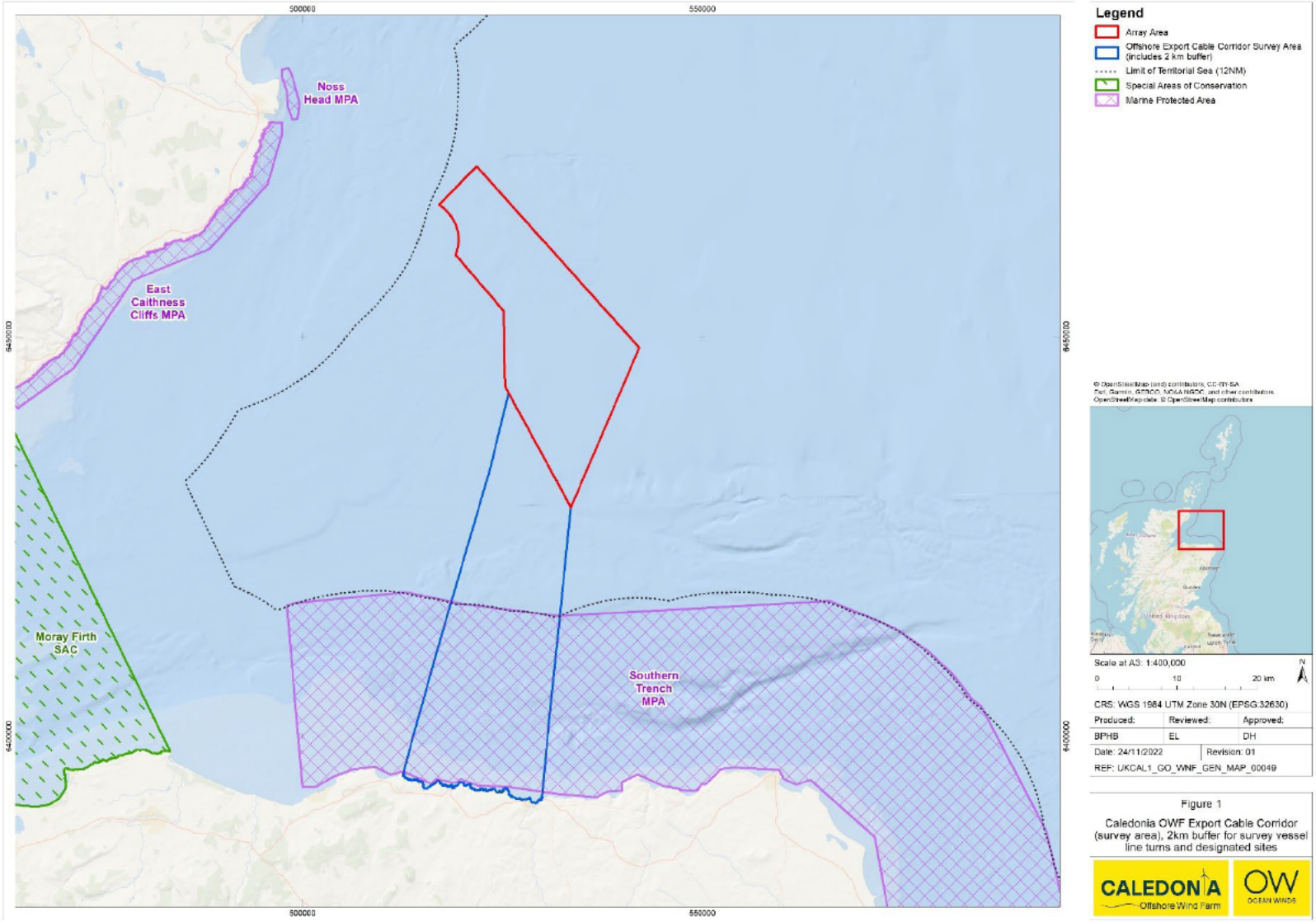

Figure 1-1 Caledonia OWF Export Cable Corridor (survey area), 2 km buffer for survey vessel line turns and designated sites.

1.2.2 Disturbance of an EPS

1.2.2.1 Whether or not a specific activity could cause 'disturbance' depends on the nature of the particular activity and the impact on the particular species. Whilst 'disturbance' is not defined in the Habitats Regulations (for waters within 12 nautical miles of the coast), Marine Scotland (2014) advise that the following matters should be taken into account when considering what constitutes disturbance:

- 'Disturbance' in Article 12(1) (b) should be interpreted in light of the purpose of the Habitats Directive to which this Article contributes. In particular, Article 2(2) of the Directive provides that measures taken pursuant to the Habitats Directive must be designed to maintain or restore protected species at Favourable Conservation Status (FCS);
- Article 12(1)(b) affords protection specifically to species and not to habitats;
- The prohibition relates to the protection of 'species' not 'specimens of species';
- Although the word 'significant' is omitted from Article 12(1)(b) in relation to the nature of the disturbance, that cannot preclude an assessment of the nature and extent of the negative impact and ultimately a judgement as to whether there is sufficient evidence to constitute prohibited 'disturbance' of the species;
- It is implicit that activity during periods of breeding, rearing, hibernation and migration is more likely to have a sufficient negative impact on the species and constitute prohibited 'disturbance' than activity at other times of the year;
- Article 12(1)(b) is transposed into domestic legislation by Habitats Regulation 39(1) and 39(2). Therefore, when considering what constitutes 'disturbance', thought should be given to Habitats Regulation 39(1)(b) which provides a number of specific circumstances where an EPS could be disturbed, and which can potentially have an impact on the status of the species; and
- Disturbance that could be considered an offence may occur in other circumstances and, therefore, be covered under Habitats Regulation 39(2) (see paragraph 1.2.2).

1.2.2.2 Marine Scotland (2020) advises that while the likelihood of acute injury can be relatively easy to determine, auditory injury accumulated over a period of time, and disturbance are not so straightforward. Therefore, assessments of potential disturbance will need to be based on a number of factors including:

- The spatial and temporal distribution of the animal in relation to the activity;
- The duration of the activity;
- Any behaviour learned from prior experience with the activity;
- Similarity of the activity to biologically important signals (particularly important in relation to activities creating sound); and
- The motivation for the animal to remain within the areas (e.g., food availability).

1.2.2.3 As noise can cause disturbance to cetaceans, any application for an EPS licence will require detailed information on the source level of the sound and its frequency. Where there is the possibility for disturbance to any individual EPS to occur, an EPS risk assessment must be carried out and the need for an EPS Licence determined.

1.2.2.4 As Habitats Regulation 39(2) is not applicable to offshore waters (outside 12 nautical miles), disturbance of an individual animal would not necessarily qualify as significant disturbance requiring an EPS Licence. Instead, under the Conservation of Offshore Marine Habitats and Species Regulations 2017 disturbance must occur to a sufficiently large or important group of animals that the ability of that group of animals to survive, breed or rear or nurture their young would be compromised. Alternatively, disturbance could be also considered to occur if the local distribution or abundance of the species was significantly changed.

1.2.3 Determining the Need for an EPS Licence

1.2.3.1 The purpose of the EPS risk assessment presented in this report is to determine whether, when considering appropriate mitigation (see Section 4), there is still potential for the proposed geophysical survey activities to cause deliberate harm or inadvertently cause disturbance to cetaceans or other protected species. The need for an EPS Licence will be determined by MS-LOT as the licensing authority (for purely marine species) with advice from NatureScot based on findings from the EPS risk assessment. Consideration of whether an EPS Licence will be required comprises three tests:

- (1) To ascertain whether the licence is to be granted for one of the purposes specified in Habitats Regulation 44;
- (2) To ascertain whether there are no satisfactory alternatives to the activity proposed (that would avoid the risk of offence); and
- (3) That the licencing of the activity will not be detrimental to the maintenance of the population of the species concerned at FCS.

1.3 Report Structure

1.3.1.1 This report provides the information to support the EPS licensing process and has been structured as follows:

- **Section 2** provides a description of the proposed geophysical survey activities and location;
- **Section 3** provides an assessment of the risk to cetaceans;
- **Section 4** outlines the proposed mitigation measures to be implemented;
- **Section 5** identifies other plans and projects likely to overlap with the proposed survey;
- **Section 6** considers any potential effects on nature conservation designated sites; and
- **Section 7** provides an assessment of potential offence caused by the survey.

2 Description of Proposed Activities

2.1 Location of Proposed Activities

2.1.1.1 The proposed geophysical survey works will be carried out within the Offshore ECC survey area, which covers an area of approximately 602 km^2 in the Moray Firth. Survey area coordinates are provided in Appendix A. This Offshore ECC survey area includes a 2 km buffer to support vessel turnings between lines (see Figure 1-1). It is noted that this represents a wide corridor identified at this early stage of the planning process. This will be refined prior to the geophysical survey, with an indicative cable route approximately 54 km long and 3 km wide (thus covering an area of approximately 162 km^2) being surveyed within the boundary of the Offshore ECC survey area shown in Figure 1-1. Nevertheless, in applying a conservative approach, this EPS risk assessment has considered the potential for the total survey area to be surveyed (i.e., 602 km^2).

2.2 Survey Vessels

2.2.1.1 The contractor that will be employed to undertake the proposed geophysical survey works has not been selected yet and, therefore, exact details on the vessels to be used are not available. However, the details and specifications of the selected vessels will be provided to MS-LOT in advance of the geophysical survey campaign. The vessels detailed in Table 2-1 are of a similar type and size that could be used and have been used as proxy vessels for the purpose of this EPS risk assessment. The vessels encompass the maximum size that could be provided by the contractors (thereby offering maximum flexibility in the survey contractor procurement process).

2.2.1.2 Due to vessel capabilities in shallower waters, there could be up to two vessels undertaking survey work within the Offshore ECC survey area at the same time. This will be defined at a later stage, prior to commencement of the survey. However, to ensure a conservative approach, this EPS risk assessment has considered the survey will involve the use of two vessels. The vessels are expected to have 30-day endurance, but the vessels may need to depart the Offshore ECC survey area at various times (e.g., refuelling, crew change, shelter from poor weather). It could be estimated that this would not exceed 10 transits to and from the Offshore ECC survey area.

2.3 Survey Techniques

2.3.1.1 A range of different geophysical survey techniques could be employed across the Offshore ECC survey area and a summary of these are provided in Table 2-2.

2.4 Activity Schedule

2.4.1.1 The proposed geophysical surveys of the Offshore ECC survey area will take place in Spring 2023, with an earliest start date of 01 March 2023. It is estimated that the total duration of the proposed geophysical survey works will be 30 days (excluding weather downtime). Due to uncertainty of the anticipated start date, it is proposed for the works to take place between 01 March 2023 and 31 July 2023.

2.4.1.2 Survey activities will be determined based on a number of factors including weather and port of mobilisation. In the event of delays (e.g., from poor weather conditions or equipment malfunctions), there may be a requirement to extend the period of time over which the surveys are completed, although the actual total number of survey days (survey duration) will not change and the nature of the survey activities will not change. All survey activities are scheduled to be on a 24-hour working basis.

Table 2-1 Example Survey Vessels that could be used during the Proposed Geophysical Survey Works.

Example Vessel	Description
Fugro Skandi Carla	The Skandi Carla is a purpose-designed vessel for remotely operated vehicle (ROV) surveys and construction support. It is a diesel-electric DP2 vessel and has advanced Differential Global Positioning System (DGPS), ultra-short baseline acoustic system and a Seapath 200. The length is 83.85 m, breadth 19.7 m, deck area is 632 m^2 and the draft is 6.2 m.
Fugro Pioneer	The Pioneer has been constructed to the highest standards demanded of a modern multi-purpose vessel. It has diesel-electric propulsion and a specially designed hull. The rudder propellers maximise station keeping and navigational control while the vessel is kept acoustically quiet during surveys. The length is 53.7 m, beam 12.5 m, aft deck area is 250 m^2 and the draught is 3.1 m.
Fugro Proteus	The Proteus is a new-build DP1 vessel designed for multi-purpose survey operations in shallow and medium water depths. The vessel is suitable for shallow seismic and analogue geophysical surveys, bathymetric surveys, ROV support operations for up to light Work-Class vehicles, and environmental surveys. The vessel has an International Maritime Organization (IMO) certified "Green Passport". The length is 53.7 m, beam 12.5 m, deck area is 250 m^2 and the draught is 3.35 m.
Fugro Galaxy	The Galaxy is equipped with permanently mobilised geophysical and hydrographic survey spreads. It has diesel-electric propulsion and a specially designed hull. The rudder propellers maximise station keeping and navigational control while the vessel is kept acoustically quiet during surveys. The equipment includes multibeam echo sounders, singlebeam echo sounders, sub-bottom profilers and side scan sonar. The length is 65.2 m, beam 14 m, deck area is 250 m^2 and the draught is 5.2 m.

Sources: https://www.fugro.com/about-fugro/our-expertise/vessels-and-jack-up-barges/survey-vessel

Table 2-2 Summary of potential survey equipment that could be used during the Proposed Geophysical Survey Works.

System/Survey Equipment	Description
Ultra-short baseline (USBL)	USBL systems are used to determine the position of subsea survey items, including ROVs, towed sensors, etc. This involves the emission of sound from a hull-mounted transducer to a subsea transponder, thereby introducing sound into the marine environment. A complete USBL system consists of a small transducer array, which is mounted under a ship, and a transponder attached to the subsea unit. An acoustic pulse is transmitted by the transducer, travels through the water and is detected by the shipboard transducer on an onboard computer, which calculates the time from the transmission of the initial acoustic pulse until the reply is detected and is measures by the USBL system. This is converted into a range and bearing, and thus the position of the subsea unit/sampling equipment is determined. These systems can either be used continuously or intermittently through the operation they are supporting. This survey technique **does not** interact with the seabed.
Multi-beam echo-sounder (MBES)	MBES are used to obtain detailed 3-dimensional (3D) maps of the seafloor which show water depths. They measure water depth by recording the two-way travel time of a high frequency pulse emitted by a transducer. The beams produce a fanned arc composed of individual beams (also known as a swathe). MBES can, typically, carry out 200 or more simultaneous measurements. The frequencies used by MBES are generally very high and outside of the main hearing range of all marine mammal hearing groups (Joint Nature Conservation Committee (JNCC) *et al.*, 2010). This survey technique **does not** interact with the seabed.
Ultra-high resolution (UHR)	Ultra-high resolution geophysical survey to assess the subsurface condition of the seabed. This survey technique **does not** interact with the seabed.
Side scan sonar (SSS)	SSS is used to generate an accurate image of the seabed, which may include 3D imagery. An acoustic beam is used to obtain an accurate image of a narrow area of seabed to either side of the instrument by measuring the amplitude of back-scattered return signals. The instrument can either be towed behind a ship at a specified depth or mounted on to a ROV. The frequencies used by SSS are generally very high and outside of the main hearing range of all marine species (JNCC *et al.*, 2010; National Oceanic and Atmospheric Administration (NOAA), 2018). The higher frequency systems provide higher resolution, but shorter-range measurements. This survey technique **does not** interact with the seabed.

System/Survey Equipment	Description
Sub-bottom profiler (SBP)	SBP systems are used to identify and characterise layers of sediment or rock under the seafloor. A transducer emits a sound pulse vertically downwards towards the seafloor, and a receiver records the return of the pulse once it has been reflected off the seafloor. SBPs comprise of boomer, pingers and sparkers, which use an electrical discharge to generate sound similar to boomers, but their use is now infrequent. A high voltage impulse generates a spark across a pair of electrodes forming a gas bubble whose oscillations generate the sound. Sparkers are powerful devices and can be used to penetrate seabed layers up to 1 km (JNCC, 2017). In this case, this technique will be used to interpret the sub-surface sediment conditions to a minimum depth of 60 m. Pingers operate at a higher frequency but smaller bandwidth than boomers, which operate on a lower broadband frequency spectrum. The higher frequencies of operation provide the highest resolution but are limited in amount of penetration below the sea floor. The high frequency profilers are particularly useful for delineating shallow features such as faults, gas accumulations and relict channels. The lower frequencies yield more penetration but provide less resolution; lower frequency systems are more general-purpose tools that provide a good compromise between penetration capacity and resolution. This survey technique **does not** interact with the seabed.
Magnetometer (MAG)/Gradiometer	MAG surveys are used to detect any ferrous metal objects on the seabed, such as wrecks, unexploded ordinance (UXO) or any other obstructions. Marine MAG come in two types: surface towed and near-bottom. Both are towed a sufficient distance (about two ship lengths) away from the ship to allow them to collect data without it being polluted by the ship's magnetic properties. Surface towed MAG allow for a wider range of detection at the price of precision accuracy that is afforded by the near-bottom MAG. These surveys use equipment to record spatial variation in the Earth's magnetic field. This survey technique **does not** interact with the seabed.

3 EPS Risk Assessment

3.1 Overview

3.1.1.1 This section presents information on the presence and use of the Offshore ECC survey area by EPS and an assessment of potential effects of the proposed geophysical survey activities described in Section 2 on those EPS. The mitigation measures that will be implemented during the survey works to prevent any adverse effects on EPS are presented in Section 4.

3.2 EPS Presence in the Offshore ECC Survey Area

3.2.1.1 Annex IV of the Habitats Directive lists all cetacean species as species of community interest in need of strict protection as EPS. Harbour porpoise (*Phocoena phocoena*) and bottlenose dolphin (*Tursiops truncatus*) are listed individually, while the remaining cetacean species are encapsulated in the Habitats Directive as "*all other cetacea*". These species are fully protected in Scottish territorial waters (out to 12 nautical miles) under the Conservation (Natural Habitats, &c.) Regulations 1994 (as amended). Bottlenose dolphin and harbour porpoise are also listed on Annex II of the Habitats Directive and thus require Special Area of Conservation (SAC) designation.

3.2.1.2 A total of 19 cetacean species have been recorded in UK waters (Reid *et al.*, 2003). There are twelve cetacean species known to be present in the Moray Firth, including (Reid *et al.*, 2003; Hammond *et al.*, 2017; 2021):

- Harbour porpoise (*Phocoena phocoena*);
- Bottlenose dolphin (*Tursiops truncatus*);
- White-beaked dolphin (*Lagenorhynchus albirostris*);
- Killer whale (*Orcinus orca*)
- Risso's dolphin (*Grampus griseus*);
- Fin whale (*Balaenoptera physalus*);
- Sperm whale (*Physeter microcephalus*);
- Humpback whale (*Megaptera novaengliae*);
- Long-finned pilot whale (*Globicephala melas*);
- White-sided dolphin (*Lagenorhynchus acutus*);
- Minke whales (*Balaenoptera acutorostrata*); and
- Short-beaked common dolphin (*Delphinus delphis*).

3.2.1.3 Of these, harbour porpoise, bottlenose dolphins, common dolphins, white-beaked dolphins, and minke whales regularly occur within the Moray Firth (Reid *et al.*, 2003; Robinson *et al.*, 2010; Hammond *et al.*, 2017; 2021). The following section provides a summary of the most common species in the Offshore ECC survey area.

3.2.2 Cetacean Species Potentially Present in the Offshore ECC Survey Area

3.2.2.1 Harbour porpoise are the most abundant cetacean species in Scottish waters (Reid *et al*. 2003; Hammond *et al*. 2017; 2021). They often appear in small groups of two to three individuals, though they may form larger groups to forage (Scottish Natural Heritage (SNH), 2014). The global population of harbour porpoise is listed in the International Union for Conservation of Nature (IUCN) Red List of Threatened Species as 'Least Concern'; however, the current population trend is unknown (Braulik *et al*., 2020). In the most recent 2013-2018 reporting by JNCC, the Conservation Status for harbour porpoise within the species range in the North Sea is currently favourable; but the trend in the population covered by the Natura 2000 network is currently classified as unknown (JNCC, 2019).

3.2.2.2 The Moray Firth is an important habitat to the resident population of bottlenose dolphin in the North Sea, which is within the Coastal East Scotland Management Unit (MU) (Inter-Agency Marine Mammal Working Group (IAMMWG), 2015; 2022; Moray Offshore Renewables Ltd, 2018)[1]. Whilst occupation of the Moray Firth by this population varies between years, recent survey data has confirmed that approximately half of the estimated population occupy the area regularly (Graham *et al*., 2016). Designation of the Moray Firth SAC provides protection of bottlenose dolphin and their habitat, with the aim of maintaining the FCS (Moray West, 2018; NatureScot, 2021).

3.2.2.3 The resident bottlenose dolphin of the Moray Firth SAC predominantly utilise the nearshore environment. Habitat modelling of survey data indicates that the southern coastline of the Moray Firth is particularly important habitat to this population (Thompson *et al*., 2014). The conservation status for bottlenose dolphin within the species range is currently favourable and the trend for the population covered by the Natura 2000 network is currently classified as stable (JNCC, 2019).

3.2.2.4 White-beaked dolphin frequent the eastern extent of the Moray Firth year-round, predominantly occupying depths of 50 – 100 m (Reid *et al*., 2003). The density of white-beaked dolphin in the waters in and around the Moray Firth is 0.021 animals/km^2, which is low compared to regions in the east and north of Scotland (Hammond *et al*., 2017; 2021). They are usually found in small groups of 10 or less but have also been observed in large groups of 50 and more.

3.2.2.5 Common dolphin are abundant along shelf breaks and in deeper waters on the west coast of the UK and Europe (Reid *et al*., 2003). Recent data suggests an increasing occurrence of short-beaked common dolphin in the northern North Sea, including the Moray Firth (Robinson *et al*., 2010; Moray Offshore Renewables Limited, 2018). Abundance estimates for this species occurring in the Moray Firth is approximately 0.074 individuals/km^2 (Robinson *et al*., 2010), which is roughly equivalent to abundance estimates in the waters west of Shetland (Hammond *et al*., 2017; 2021). Common dolphin are amongst the most gregarious cetacean species, often forming groups of 50 or more individuals, though groups of 200 or more are not uncommon (Robinson *et al*., 2010).

3.2.2.6 Minke whale are wide-ranging baleen whales which are present in the Moray Firth primarily in the summer months (June – September) (Reid *et al*., 2003; Hammond *et al*., 2017; 2021). They often prefer water depths of up to 200 m and are often solitary or found in pairs, though they occasionally form larger groups (up to 15 individuals) while feeding. Minke whale are also one of the protected features of the Southern Trench Nature Conservation Marine Protected Area (NCMPA). The

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

Conservation Objectives of this site are to conserve the features, specifically to ensure:

"minke whale in the Southern Trench NCMPA are not at significant risk from injury or killing, conserve the access to resources (e.g. for feeding) provided by the NCMPA for various stages of the minke whale life cycle, and conserve the distribution of minke whale within the site by avoiding significant disturbance".

3.2.2.7 The density and abundance of the cetacean species which regularly occur in the Moray Firth is summarised in Table 3-1. Density and population abundance estimates for harbour porpoise, bottlenose dolphin, white-beaked dolphin and minke whale are based on the SCANS-III survey for survey block S which includes the Moray Firth area as well as waters to the north, including around Orkney, with an area of 40,383 km^2 surveyed in June/July 2016 (Hammond *et al.*, 2017; 2021). Common dolphin were not recorded in survey block S during the SCANS-III survey and, therefore, density and population abundance estimates are based on Robinson *et al.* (2010). It should be noted that different population MUs have been used for these species based on available data, including the North Sea MU, Coastal East Scotland MU and Celtic and Greater North Seas MU (IAMMWG, 2015; 2022; Hammond *et al.*, 2017; 2021). Based on density estimates provided in Table 3-1, it is possible to estimate the number of individuals within the Offshore ECC survey area (602 km^2 including 2 km buffer) for harbour porpoise (92), bottlenose dolphin (2.4), common dolphin (45), white-beaked dolphin (13) and minke whale (6.0).

Table 3-1 Density and Population Estimates for the regularly occurring Cetaceans in the Moray Firth.

Cetacean	General Distribution	Density Estimates (individuals/km^2)	Estimated Population	
			Moray Firth	MU
Harbour porpoise	Individuals can be found in nearshore and offshore waters throughout the North Sea	0.152 (Hammond *et al.*, 2021)	6,147 (Hammond *et al.*, 2021)	346,601 (North Sea MU; IAMMWG, 2022)
Bottlenose dolphin	Predominantly nearshore species	0.004 (Hammond *et al.*, 2021)	151 (Hammond *et al.*, 2021)	224 (Coastal East Scotland MU - IAMMWG, 2022)
Common dolphin	Predominantly offshore species	0.074 (Robinson *et al.*, 2010)	1,218 (Robinson *et al.*, 2010)	56,556 (Celtic and Greater North Seas MU; IAMMWG, 2015; 2022)
White-beaked dolphin	Predominantly nearshore species	0.021 (Hammond *et al.*, 2021)	868 (Hammond *et al.*, 2021)	15,895 (Celtic and Greater North Seas MU; IAMMWG, 2015; 2022)
Minke whale	Individuals can be found in nearshore and offshore waters throughout the North Sea	0.010 (Hammond *et al.*, 2021)	383 (Hammond *et al.*, 2021)	23,528 (Celtic and Greater North Seas MU; IAMMWG, 2015; 2022)

3.2.3 Potential Impacts on EPS

3.2.3.1 The primary function of this risk assessment is to identify the potential for injury and disturbance to EPS from the proposed geophysical survey activities within the Moray Firth. This section of the risk assessment addresses potential impacts to protected species, including EPS, regardless of their inclusion as qualifying features of protected sites. An overview of proposed survey activities and their potential impacts to protected species is provided in Table 3-2.

3.2.3.2 As stated in Marine Scotland (2020) guidance, two main factors have the potential to cause death or injury to an animal, resulting in an offence, as follows:

- Physical contact (e.g., collision with vessels); and
- Anthropogenic sound (underwater noise).

3.2.3.3 Cetaceans in particular are considered susceptible to these impacts. Underwater noise emitted by vessels and the physical presence of the vessels during activities associated with the proposed works have the potential to cause injury or disturbance to EPS and other protected species. While some techniques may introduce noise to the marine environment, other activities do not generate sufficient levels of noise to be considered as potential sources of noise-related injury or disturbance to protected species and have been screened out of the detailed assessment, as indicated in Table 3-2.

3.2.3.4 At this stage, the type and technical specification of the equipment to be deployed during the survey is not yet known as this will depend on the survey contractors appointed to undertake the surveys. A Design Envelope approach has therefore been taken in order to ensure the EPS encompasses the full range of survey equipment that could be deployed in order to ensure the assessment considers the 'worst case' in terms of vessel types and underwater noise emissions.

Table 3-2 Overview of Potential Impacts of Geophysical Survey Activities on EPS in the Moray Firth.

Activity/ Equipment	Potential Impacts	Predicted Source Levels and Frequencies relevant to the Marine Environment	Further Information Required as part of the EPS Risk Assessment?
Vessels			
Survey vessels	Propellers, engines, and propulsion activities form the primary noise sources of survey vessels. Vessel noise is generally continuous and comes in both narrowband and broadband emissions. Potential impacts on EPS depend on the duration and location of the surveys and EPS potentially present in the area. Increased vessel activity also has the potential to cause injury from collisions. The risk of collision with an EPS is influenced by the dimensions of the vessel and its speed.	Vessels emissions typically range from 150 – 190 dB re 1µPa (rms). Acoustic energy vessel noise emissions are strongest at frequencies <1 kHz (Prideaux, 2017).	**Yes** – although source levels are likely to be too low to result in injury, they will be audible to most species, and thus have the potential to result in disturbance.
Geophysical Survey			
Ultra-short baseline (USBL)	USBL systems are used to determine the position of subsea items. This involves the emission of sound from a hull-mounted transducer to a subsea transponder, thereby introducing sound into the marine environment. The potential impacts of this sound on cetaceans depends upon the abundance, distribution and sensitivity of the species, and the duration of the operations.	USBL source levels range from 188 – 204 dB re 1µPa (rms), with a frequency range of 17 – 50 kHz (NOAA, 2019).	**Yes** – source levels have a minimum peak pressure level which has been identified as having the potential to cause injury to harbour porpoise (200 dB re 1µPa) and are audible to all species in the area increasing the risk of disturbance.
Multi-beam echo-sounder (MBES)	High frequency pulses created by MBES equipment generate sound waves which produce impulsive underwater noise. Depending on the frequency of the pulses, location and duration of the operations, and the species present, there could be potential impacts on EPS.	MBES source levels range from 200 – 240 dB re 1µPa (rms) (Hartley Anderson Ltd, 2020), the equipment specifications describe the MBES to emit noise over a frequency of 12 – 500 kHz (Prideaux, 2017).	**Yes** – source levels have a minimum peak pressure level which has been identified as having the potential to cause injury to harbour porpoise (200 dB re 1µPa).

Activity/ Equipment	Potential Impacts	Predicted Source Levels and Frequencies relevant to the Marine Environment	Further Information Required as part of the EPS Risk Assessment?
Ultra-high resolution (UHR)	UHR geophysical survey to assess the subsurface condition of the seabed.	Pulsed waveform sparkers used in UHR have a frequency range of 100 Hz to 5kHz, and average approx. 1.5 kHz. Sparker surveys source levels (peak) range from 220 - 226 dB re 1µPa at 1m (Hartley Anderson Ltd, 2020).	**Yes** – they will be audible to most species, and thus have the potential to result in disturbance.
Side scan sonar (SSS)	SSS equipment produces impulsive sound emissions through high frequency pulses used to image the seabed habitat. Potential impacts to EPS depend upon the frequency, location, and duration of the pulses.	SSS source levels (peak) range from 205 – 230 dB re 1µPa at 1m. The SSS specifications report frequencies between 80 – 950 kHz (Hartley Anderson Ltd, 2020).	**Yes** – source levels have a minimum peak pressure level which has been identified as having the potential to cause injury to harbour porpoise (200 dB re 1µPa) and a maximum peak pressure level which has been identified as having the potential to cause injury to bottlenose dolphins (230 dB re 1µPa).
Sub-bottom profiling (SBP)	SBP involves the vertical emission of sound pulses (impulsive noise) to characterise the layers of sediment comprising the seabed. Such activities introduce noise emissions into the marine environment. The potential impacts of this sound depend upon the type of profiler technology used, as well as the abundance, distribution and sensitivity of the species, and the duration of the operations. There are numerous SBP technologies that may be deployed during the survey operations including pingers, chirpers and boomers. Another SBP technology which may be employed during survey activities is a sparker. A sparker uses a spark across a pair of electrodes to create a gas bubble whose oscillations generate the sound.	SBP typically emit noise within the frequency range 100 Hz to 40 kHz, although primary frequency may emit up to 115 kHz. Based on bathymetry and water depth within the Offshore ECC survey area, realistic frequency ranges are anticipated to be between 2 kHz and 40 kHz for the proposed works. SBP source levels (peak) typically range between 185 – 250 dB re 1µPa at 1m (Hartley Anderson Ltd, 2020).	**Yes** – although source levels are likely to be too low to result in injury, they will be audible to most species, and thus have the potential to result in disturbance.

Activity/ Equipment	Potential Impacts	Predicted Source Levels and Frequencies relevant to the Marine Environment	Further Information Required as part of the EPS Risk Assessment?
Magnetometer (MAG)	A MAG will be employed to detect magnetic anomalies in the seabed.	Not applicable	**No** - MAG do not emit noise as a part of their normal functioning, so there is no possibility of injury or disturbance from noise emissions.

3.3 Impact Assessment – Underwater Noise

3.3.1 Overview

3.3.1.1 Noise emissions constitute the greatest potential risk to cetaceans within the vicinity of the Offshore ECC survey area. Underwater noise has the potential to impact cetaceans in two ways:

- Injury – physiological damage to auditory or other internal organs; and
- Disturbance (temporary or continuous) - disruptions to behavioural patterns including, but not limited to, migration, breathing, nursing, breeding, foraging, socialising and/or sheltering. This impact factor does not have the potential to cause injury.

3.3.2 Types of Noise

3.3.2.1 Three different types of sound are identified by Southall *et al*. (2007) and retained in Southall *et al*. (2019):

- Multiple pulsed sound – sound comprising two or more discreet acoustic events in a 24-hour period (e.g., from MBES, SSS or SBP);
- Single pulse sound – sound comprising a single discreet acoustic event in a 24-hour period (e.g., an underwater explosion); and
- Continuous/non-impulsive sound – non-pulsed sound (e.g., vessel noise).

3.3.3 Assessment Criteria – Lethal and Auditory Injury Thresholds

3.3.3.1 To determine the potential for noise to impact cetaceans, perceived sound levels are compared to available empirically-estimated thresholds for injury and disturbance. Several threshold criteria and methods for determining how sound levels are perceived by marine mammals are available (e.g., the level above hearing threshold (dBht) method and other hearing weighted and linear measures) and each has its own advantages and disadvantages. JNCC *et al*. (2010) and Scottish Government (2020) recommends using the injury and disturbance criteria proposed by Southall *et al*. (2007), which is based on a combination of linear (un-weighted) peak sound pressure levels (SPL) and weighted sound exposure levels (SEL). Since the publication of this seminal paper, there has been mounting evidence of marine mammal auditory abilities in novel species and well-researched species alike (e.g., harbour porpoise) which have led to amendments to the auditory thresholds for injury.

3.3.3.2 In July 2016, the National Marine Fisheries Services (NMFS) issued updated guidance on noise assessment metrics for auditory injury developed by NOAA. This guidance was compiled by a number of the same authors and updates the criteria for assessment provided by Southall *et al*. (2007). A revision to the NMFS (2016) guidance was subsequently published in 2018 (NMFS, 2018). However, the revision did not lead to any changes in the thresholds at which different species of marine mammal are predicted to experience changes in their hearing ability (either temporary or permanent) as a result of exposure to sources of anthropogenic underwater noise. Updated guidance presented in Southall *et al*. (2019) also uses the same thresholds as presented in the revised NOAA guidance (NMFS, 2018).

3.3.3.3 The Permanent Threshold Shift (PTS) thresholds are extrapolated from Temporary Threshold Shift (TTS) onset thresholds. These PTS thresholds ultimately are used to indicate the potential number of animals that could be at risk of PTS (i.e., experience permanent hearing sensitivity loss even once exposure to sound ceases

or in between successive sounds exposures) as opposed to the number of animals that will develop TTS (i.e., temporary hearing sensitivity loss that will recover completely once exposure to sound ceases or in between successive sounds exposures). The likelihood of individual animals experiencing PTS and TTS is also dependent on the frequency band at which PTS and TTS is predicted to occur and +whether that frequency band is in the critical hearing sensitivity band for that species. If PTS or TTS is predicted to occur at a frequency outside the critical hearing band, potential effects will be minimal.

3.3.3.4 PTS and TTS thresholds are based on a dual-criteria approach involving two metrics:

- (1) Energy-based metric – a measure of the accumulated sounds energy an animal is exposed to over a period of time (exposure period). For single pulses, this is referred to as the SEL. For multiple pulses over an exposure period, this is referred to as the cumulative Sound Energy Level (SEL_{cum}). The SEL thresholds for PTS therefore take into account received noise levels and duration of exposure over a 24-hour period and are weighted to take into account the different hearing sensitivities of each function hearing group (see table 3-3); and
- (2) Pressure-based metric – referred to as the SPL. This is measured as zero-to-peak sound pressure level (SPL_{zp}) or peak-to-peak sound pressure level (SPL_{pp}). Any single exposure at or above this pressure-based metric is considered to have the potential to cause PTS regardless of exposure duration (Southall *et al.*, 2019). The peak SPL criterion is for unweighted received sound level.

Table 3-3 PTS and TTS Sound Exposure Thresholds for Marine Mammals.

Functional Hearing Group	Estimated Auditory Bandwidth	PTS Onset			TTS Onset	
		Impulsive		Non-Impulsive	Impulsive	Non-Impulsive
		SEL_{cum}	SPL_{peak}	SEL_{cum}	SEL_{cum}	SEL_{cum}
Low-frequency cetaceans (e.g., minke whale)	7 Hz – 35 kHz	183	219	199	168	179
High frequency cetaceans (e.g., bottlenose dolphin)	150 Hz – 160 kHz	185	230	198	170	178
Very High-frequency cetaceans (e.g., harbour porpoise)	160 Hz – 275 kHz	155	202	173	140	153

Note: SEL thresholds are in dB re 1 μPa^2 s and peak SPL thresholds are in dB re 1 µPa.

3.3.4 Disturbance

3.3.4.1 For assessing behavioural disturbance, a qualitative approach has been taken, based on consideration of source level, mitigation measures, length of operations and other factors likely to influence interaction between the survey and cetaceans likely to be present in the Offshore ECC survey area. Marine Scotland (2020) specifies disturbance as occurring if the activity is likely:

"to significantly affect the local distribution or abundance of the species to which it belongs".

3.3.4.2 The relevant European Commission (2007) guidance suggests that a disturbance must significantly impact the local distribution or abundance of a species, including temporary impacts. Guidance proposed by JNCC *et al*. (2010) suggested the following:

"any action that is likely to increase the risk of long-term decline of the population(s) of (a) species could be regarded as disturbance under the Regulations".

3.3.4.3 To consider the possibility of a disturbance offence resulting from the proposed geophysical survey techniques, it is necessary to consider the likelihood that exposure of the animal(s) elicits a response which is likely to generate a significant population-level effect. Assessment of population-level impacts from a temporary disturbance is made complicated by the highly variable nature of the introduced disturbance (e.g., the complex nature of sound and its propagation in the marine environment), the variability of behavioural response in different species and individuals, and the availability of population estimates for EPS in the eastern North Sea.

3.3.4.4 A method for assessing a potential disturbance is to compare the circumstances of the situation with empirical studies (Southall *et al*., 2007). There are currently no agreed thresholds or criteria for modelling the disturbance of marine mammals from underwater noise. As such, noise propagation modelling has not been undertaken for this assessment. JNCC *et al*. (2010) indicated that a score of 5 or more on the Southall *et al*. (2007) behavioural response severity scale, as shown in Table 3-4, could be significant. The more severe the response on the scale, the less time animals will likely tolerate the disturbance before there could be significant negative effects which could constitute a disturbance under the relevant Regulations. The assessment of disturbance by the proposed survey methods considers the potential of the behaviours described by Southall *et al*. (2007) occurring within the limited duration of the geophysical survey activities. Subsequently, the potential for those behaviours to result in a population-level effect (i.e., to commit an offence under Habitats Regulation 39(1) is assessed.

3.3.4.5 Regulation 39(2) goes beyond the specific disturbance circumstances set out in Habitats Regulation 39(1). It provides protection to individuals of a species by making it an offence to deliberately or recklessly disturb a single cetacean in Scottish Territorial Waters (note, the Offshore ECC survey area includes waters within 12 nautical miles and beyond 12 nautical miles of the coast). Where there is a possibility of disturbing an individual animal within 12 nautical miles, it is necessary to apply for an EPS Licence to ensure that an offence is not committed. However, in issuing an EPS Licence, MS-LOT must consider whether or not the FCS of any species will be affected.

Table 3-4 Behavioural Disturbance Scale (Southall *et al.*, 2007).

Response Score	Corresponding Behaviours in Free-ranging Subjects
0	▪ No observable response.
1	▪ Brief orientation response (investigation/visual orientation).
2	▪ Moderate or multiple orientation behaviours; ▪ Brief or minor cessation/modification of vocal behaviour; and ▪ Brief or minor change in respiration rates.
3	▪ Prolonged orientation behaviour; Individual alert behaviour; ▪ Minor changes in locomotion speed, direction, and/or dive profile but no avoidance of sound source; ▪ Moderate change in respiration rate; and ▪ Minor cessation or modification of vocal behaviour (duration < Duration of source operation).
4	▪ Moderate changes in locomotion speed, direction, and/or dive profile but no avoidance of sound source; ▪ Brief, minor shift in group distribution; and ▪ Moderate cessation or modification of vocal behaviour (duration more or less equal to the duration of source operation).
5	▪ Extensive or prolonged changes in locomotion speed, direction, and/or dive profile but no avoidance of sound source; ▪ Moderate shift in group distribution; and ▪ Change in inter-animal distance and/or group size (aggregation or separation); and Prolonged cessation or modification of vocal behaviour (duration > duration of source operation).
6	▪ Minor or moderate individual and/or group avoidance of sound source; Brief or minor separation of females and dependent offspring; ▪ Aggressive behaviour related to sound exposure (e.g., tail/flipper slapping, fluke display, jaw clapping/gnashing teeth, abrupt directed movement, bubble clouds); ▪ Extended cessation or modification of vocal behaviour; Visible startle response; and ▪ Brief cessation of reproductive behaviour.

Response Score	Corresponding Behaviours in Free-ranging Subjects
7	▪ Extensive or prolonged aggressive behaviour; ▪ Moderate separation of females and dependent offspring; ▪ Clear anti-predator response; ▪ Severe and/or sustained avoidance of sound source; and ▪ Moderate cessation of reproductive behaviour.
8	▪ Obvious aversion and/or progressive sensitisation; ▪ Prolonged or significant separation of females and dependent offspring with disruption of acoustic reunion mechanisms; ▪ Long-term avoidance of area (> source operation); and ▪ Prolonged cessation of reproductive behaviour.
9	▪ Outright panic, flight, stampede, attack of conspecifics, or stranding events; and ▪ Avoidance behaviour related to predator detection.

3.4 Assessment of Potential Impacts to EPS (Cetaceans)

3.4.1 Overview

3.4.1.1 The following sections present the results of the impact assessment for the proposed geophysical survey works within the Offshore ECC survey area. In each of the following activities or geophysical survey technique groupings, the assessment considers both injury and disturbance impacts to EPS (cetaceans):

- Vessels;
- Ultra-short baselines (USBL);
- Sidescan sonar (SSS) and Multi-beam echo-sounders (MBES); and
- Sub-bottom profiling (SBP) and Ultra-high Resolution (UHR).

3.4.2 Vessels

3.4.2.1 Vessels used during the proposed geophysical survey works can potentially impact cetaceans in two ways:

- Underwater noise; and
- Risk of collision.

3.4.2.2 In terms of underwater noise, the magnitude and characteristics of vessel noise emitted into the marine environment varies depending on ship type, ship size, mode of propulsion, operational factors and speed. Vessels of varying size produce different frequencies, generally becoming lower frequency with increasing size. The predominant sound frequencies associated with large vessels are below several hundred Hz.

3.4.2.3 The other potential source of impact from survey vessels is physical trauma from collision with the vessel. These injuries include blunt trauma to the body or injuries consistent with propeller strikes. The risk of collision of marine mammals is directly influenced by the type of vessel and the speed with which it is travelling (Laist *et al.*, 2001) and indirectly by ambient noise levels underwater and the behaviour the marine mammal is engaged in.

Injury Impact

3.4.2.4 In terms of injury to cetaceans from vessel noise, Richardson *et al*. (1995) reported that peak emissions ranging between 160 – 175 dB re 1µPa subject to vessel size, are predicted at a range of zero metres from the vessel based on an animal swimming at a constant speed of 1.5 m/s from the noise source. It is therefore concluded that physical and auditory injury impacts are highly unlikely to occur as this would require an animal to be in close vicinity of the noise source for a prolonged duration.

3.4.2.5 With regard to collision risk, Laist *et al*. (2001) predicted that the most severe injuries result from collision with vessels travelling at over 14 knots. Vanderlaan and Taggart (2007) predicted that the probability of lethal injury of a large whale species (North Atlantic right whale) decreases from 0.79 at speeds of 15 knots to 0.21 at 8.6 knots. Given that the vessels involved in the geophysical surveys will be moving along defined line spacings at slow speeds (<5 knots), the potential for collisions are negligible. It is also noted that non-lethal collision has been reported by Van Waerebeek *et al*. (2007), suggesting if collisions do occur between vessels and marine mammals these are not necessarily always fatal.

3.4.2.6 Given that there is predicted to be no risk of injury to any species of cetacean as a result of underwater noise from vessels or collision risk, there is no potential to commit an offence with regards injury. Therefore, there will be no impact on the FCS of any EPS species. As such, there is no offence and therefore no requirement for an EPS Licence in this respect.

3.4.2.7 Nevertheless, all vessels will adhere to the Scottish Marine Wildlife Watching Code (Scottish Natural Heritage (SNH), 2017a) and Guide to Best Practice for Watching Marine Wildlife (SNH, 2017b) (see Section 4). These measures, coupled with the deployment of a trained Marine Mammal Observer (MMO) to monitor for the presence of cetaceans, world further reduce the risk of injury impacts to EPS.

Disturbance Impact

3.4.2.8 Although noise levels from vessels are highly unlikely to cause physical or auditory injury, they could be sufficient to cause local disturbance to sensitive marine mammals in the immediate vicinity of the vessels, depending on ambient noise levels. Thomsen *et al*. (2006) used species hearing detection thresholds to conclude that noise from larger vessels around 0.25 kHz will be detected by harbour porpoise at distances of approximately 1 km, and noise from smaller vessels around 2 kHz will be detected at around 3 km.

3.4.2.9 It has been suggested that harbour porpoise are more likely to be sensitive to vessels that produce medium to high frequency noise components (e.g., Hermannsen *et al*., 2014). Harbour porpoise are known to avoid vessels and behavioural responses have been shown in porpoise exposed to vessel noise that contains low levels of high-frequency components (e.g., Dyndo *et al*., 2015). Wisniewska *et al*. (2018) studied changes in harbour porpoise foraging rates in response to vessel presence, indicating that there is potential for a reduction in foraging activity where animals are exposed to vessel noise greater than 96 dB re 1 µPa for prolonged periods of time. Therefore, the sensitivity of porpoise to vessel noise will likely depend on the frequency of the noise components produced by the vessel.

3.4.2.10 The distance at which animals may react to vessels is difficult to predict. Behavioural responses can vary a great deal depending on context and data specific to harbour porpoise are limited. According to Thomsen *et al*. (2006), harbour porpoise might be expected to respond to vessels of this type at approximately 400 m (Moray West, 2018).

3.4.2.11 There is a possibility that responses to vessels are not related to noise *per se* and that the simple presence of vessels may result in a response. Pirotta *et al*. (2015) demonstrated that the response of bottlenose dolphin in the Moray Firth was related to the number of boats present but did not vary significantly with the levels of overall noise. While this result does provide evidence that a perception of risk can be related to the presence of boats, silent and stationary boats did not elicit a response. It is therefore difficult to disentangle the effect of presence of boats with the noise they emit, although it is expected that observed responses are at least in part due to noise disturbance and in part due to perceived risks of collision (Moray West, 2018).

3.4.2.12 While the predicted source levels associated with the survey vessels have the potential to elicit a behavioural response in cetacean species, the vessel noise would need to be emitted over an extended period to cause a significant disturbance offence as defined under the Habitats Regulations 39(1) or 39(2). As the survey vessels will not be stationary, animals within a particular area will not be exposed to extended periods of noise from the vessels.

3.4.2.13 Given the temporary and transient nature of the geophysical survey works, it is highly unlikely that vessel noise emissions would influence the ability of an animal to survive or reproduce or result in significant impacts to the population abundance or distribution. It has therefore been concluded that there will be no negative impact of the FCS of any EPS.

3.4.2.14 While negative impacts on the survival, reproduction or population abundance or distribution are not expected to result from noise emissions from the survey vessels, it is possible that individual animals may experience some level of disturbance for the short period they may encounter noise emissions from a vessel. As such, an EPS Licence is required for these activities within 12 nautical miles (as per Regulation 39(2)), or in the case of the proposed geophysical survey works within the Offshore ECC survey area which (parts of) is within the 12 nautical mile boundary.

3.4.3 Ultra-short Baselines (USBL)

3.4.3.1 USBL systems will be required for the execution of the majority of survey activities. The length of time the USBL system will be required will depend on the specific survey activities, but there is potential that a USBL could be used continuously throughout a proposed geophysical survey works. The potential impacts of continuous sound from USBL systems on cetaceans that may be present in the survey area are outlined below.

Injury Impact

3.4.3.2 The USBL system is used for determining the position of subsea equipment during the survey. The system operates by emitting a low frequency acoustic pulse between the transponder on the vessel and the transducer on the subsea unit. Since low frequency emissions propagate further than high frequency sounds, cetaceans may be exposed to these noise emissions over a greater spatial area than they would higher frequency sounds (e.g., SSS or MBES).

3.4.3.3 Continuous sound emissions from the USBL system throughout the entire geophysical survey period (i.e., up to 30 days; excluding weather downtime) would present a worst-case scenario that would increase the risk of auditory injury to nearby animals. However, the USBL system is likely to be employed intermittently, with time in-between noise emissions, allowing animals to move away from the source and avoid continuous exposure.

3.4.3.4 Considering that the surveys themselves will be transient (i.e., the vessel will be moving while the USBL is operational), the cumulative exposure level from the USBL system (as measured by the M-weighted SEL) will be lower, as marine mammals are highly unlikely to follow the noise source. As such, there is no potential to commit an offence with regards injury or to affect the FCS of any the cetacean species. Therefore, there is no offence and an EPS licence will not be required.

3.4.3.5 It is also noted that the mitigation measures outlined in JNCC (2017) guidelines have been incorporated for the proposed works (see Section 4). These measures include deployment of an MMO to monitor for the presence of cetaceans within a 500 m mitigation zone prior to commencement of, and during, the surveys.

Disturbance Impact

3.4.3.6 The low noise frequency sound emissions generated by the USBL system are within the hearing range of the cetacean species anticipated to be within the Offshore ECC survey area. For this reason, there is potential for USBL survey activities to

potentially illicit a disturbance response in animals that are present during the proposed geophysical survey works (JNCC *et al*., 2010).

3.4.3.7 The survey period is anticipated to span up to 30 days (excluding weather downtime). However, the survey vessel will be traversing the survey routes during that time, so noise emissions will be localised and temporary. For a disturbance impact to occur, the animals would have to stay in close proximity to, and potentially follow the USBL, for the duration of the survey.

3.4.3.8 Even if the short-term operations result in a response by an animal on its own, this 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. As such, there would be no impact on the FCS of any cetacean species at a population level. However, it is possible that a small number of individual animals may experience some disturbance for the short period they may encounter noise emissions. As such, an EPS Licence is required for activities within 12 nautical miles (as per Regulation 39(2)), or in the case of the proposed geophysical survey works within the Offshore ECC survey area which (parts of) is within the 12 nautical mile boundary. Potential disturbance impacts will be minimised with the implementation of mitigation measures set out in Section 4.

3.4.4 Sidescan Sonar (SSS) and Multi-beam Echo-sounders (MBES)

3.4.4.1 The potential impacts of continuous sound from SSS or MBES on cetaceans that are potentially present along the survey routes are discussed below.

Injury Impact

3.4.4.2 JNCC *et al*. (2010) indicated the potential for echo-sounders operating in mid-range and full ocean depth to cause any auditory injury when very close to cetaceans of the mid-frequency hearing group. In shallower depths, sound emitted by MBES may be audible to some cetaceans, particularly high frequency species such as harbour porpoise. However, higher frequency sounds attenuate faster such that the received sound level rapidly decreases with distance from the source. As such, the animals would have to remain in close proximity to the sound source for potential auditory injury to occur. The likelihood of this occurring is low, particularly as the source will be emitted from a moving vessel, thus the subsequent risk to cetaceans in the survey area is very low (JNCC *et al*., 2010).

3.4.4.3 SSS and MBES generally operate at high frequencies. For the proposed geophysical survey works, the expected frequency range for such operations is likely to be above 200 kHz (Hartley Anderson Ltd, 2020). These frequencies are generally beyond the hearing range of most cetaceans, including high-frequency sensitive species such as harbour porpoise (see Table 3-3). Given the increased attenuation associated with these high frequencies, it can be concluded that these surveys present a negligible risk of injury to cetaceans (JNCC *et al*., 2010). Consequently, the potential to commit an offence is negligible and thus there is no requirement for an EPS Licence in this respect.

3.4.4.4 The available noise emission mitigation measures for MBES surveys are not specifically designed for geophysical surveys in less than 200 m water depth (JNCC, 2017). However, their implementation in shallower waters bolsters mitigation against injury to cetaceans around the survey area. Consequently, the mitigation measures outlined in the JNCC (2017) guidelines have been incorporated for these proposed works (see Section 4). These measures include deployment of an MMO to monitor for the presence of cetaceans within a 500 m mitigation zone prior to commencement of, and during, the surveys.

Disturbance Impact

3.4.4.5 In addition to auditory injury, noise emissions have the potential to modify the behaviours of animals in the vicinity of the noise source. As outlined previously in this section, significant disturbance may occur when an animal is at risk of a sustained or chronic disruption of behaviour or habitat use resulting in population-level effects. SSS and MBES largely operate beyond the hearing sensitive frequencies of most cetaceans (Table 3-3) (JNCC *et al*., 2010); thus, the potential for a disturbance having negative impact on the FCS of a species is extremely low.

3.4.4.6 The geophysical survey programme will extend over a period of up to 30 days (excluding weather downtime). For a disturbance to occur during the geophysical surveys, the animals would have to stay in close proximity to, and potentially follow, the vessel using SSS and MBES while they were actively emitting noise.

3.4.4.7 Given the temporary and relatively short-term nature of the survey activities, it is highly unlikely that SSS and MBES would negatively impact upon the FCS of any of the cetacean species which may be present in the Offshore ECC survey area. This is on the basis that the level of disturbance caused is unlikely to affect the ability of an animal to survive or reproduce or result in a significant population level impact (e.g., by modifying the abundance or distribution of a localised population). However, it is possible that a small number of individual animals may experience some disturbance for a short period that they encounter noise emissions. As such, an EPS Licence is required for the proposed survey activities within 12 nautical miles (as per Regulation 39(2)), or in the case of the proposed geophysical survey works within the Offshore ECC survey area which (parts of) is within the 12 nautical mile boundary.

3.4.4.8 As with the injury impacts discussed above, implementation of mitigation measures outlined in JNCC (2017) for minimising the risk of injury to marine mammals from geophysical surveys (as incorporated for these proposed works; see Section 4) will further help to reduce potential disturbance impacts.

3.4.5 Sub-bottom Profiling (SBP) and Ultra-High Resolution (UHR)

3.4.5.1 SBP and UHR equipment will be utilised during the proposed geophysical survey works within the Offshore ECC survey area. The potential impacts of sound emissions from SBP and UHR equipment on the relevant cetacean species are outlined below.

Injury Impact

3.4.5.2 Sparkers used for sub-bottom surveys operate by emitting a low frequency sound to maximise seabed penetration. Cetaceans may be exposed to the low frequency sounds over a greater spatial area than they would higher frequency sounds (such as those from SSS and MBES). Experience of such modelling studies suggests for a typical SBP system, based on an animal swimming at a constant speed of 1.5 m/s from the noise source, showed that injury may occur at a range of 20 m for most cetaceans and up to 400 m for harbour porpoise. However, these results are contingent on the animal swimming within the direct and very narrow 'beam' from the transducer.

3.4.5.3 As the majority of the species likely to be found near the survey route are less sensitive to low frequency sounds, the potential for impact can be considered low. Furthermore, the majority of the acoustic energy will be directed downward toward the seabed, as opposed to being emitted horizontally. This further reduces the potential for sound emissions to impact animals nearby.

3.4.5.4 As with the SSS and MBES geophysical survey activities, the implementation of the mitigation measures outlined in Section 4 dramatically reduce the risk of injury to animals as a result of SBP operations. These measures include deployment of an MMO to monitor for the presence of cetaceans within a 500 m mitigation zone prior to commencement of, and during, the surveys. Accordingly, the noise-emission characteristics of the SBP coupled with the proposed mitigation strategies preclude the potential to commit an offence with regards to injury, or to affect the FCS of any cetacean species. Therefore, there is no requirement for an EPS Licence.

Disturbance Impact

3.4.5.5 Although the programme of geophysical surveys will be up to 30 days in the Offshore ECC survey area, use of SBP will be intermittent. There will be periods of inactivity during weather downtime. For a significant disturbance impact to result from SBP methods, animals would have to stay in close proximity to, and potentially follow, the vessels operating the SBP. Even if the short-term geophysical survey operations result in a behavioural response, it is not likely that such a response would impair the ability of the animal to survive or reproduce or generate significant population-level impacts. As such, there will be no impact on the FCS of any cetacean species.

3.4.5.6 However, it is possible that a small number of individual animals may experience some level of disturbance while they encounter noise emissions. As such, an EPS Licence is required for activities within 12 nautical miles (as per Regulation 39(2)), or in the case of the proposed geophysical survey works within the Offshore ECC survey area which (parts of) is within the 12 nautical mile boundary. Potential disturbance impacts will be minimised with the implementation of mitigation measures set out in Section 4.

3.5 Impact Ranges Associated with the Geophysical Survey

3.5.1.1 A literature review has been undertaken to identify the most suitable source of information available in order to inform the assessment of impact ranges associated with the proposed geophysical survey works. The estimated number of EPS that may be disturbed by the use of geophysical equipment is presented in Table 3-5.

3.5.1.2 A review of consented offshore wind farms in the Southern North Sea SAC, designated for harbour porpoise, included noise modelling based on the maximum source levels and bandwidths obtained from a range of SBPs (Department for Business, Energy and Industrial Strategy (BEIS), 2020). The results for the deployment of SBPs indicate that the extent at which the onset of PTS is predicted to occur ranges from between 17 m and 23 m from the source. There is potential for disturbance of harbour porpoise to occur out to 2.5 km, encompassing an area of 18.3 km^2, which is considered to be a relatively localised area. The report concludes that there is a very low risk of any harbour porpoise being physically impacted by the use of SBPs (BEIS, 2020).

3.5.1.3 JNCC guidance for assessing the significance of noise disturbance against conservation objectives of harbour porpoises SACs recommends the use of a 5 km effective deterrent range (EDR) for high resolution geophysical surveys, based on SBP sources (JNCC *et al.*, 2020). Therefore, assuming a spherical radius of disturbance of 5 km, the estimated area of potential disturbance at any one location will be 78.5 km^2. However, as noted in Section 2, the proposed geophysical survey works may involve the simultaneous use of up to two vessels. Given the size of the Offshore ECC survey area, it is possible for two vessels to be surveying in discrete areas and thus two separate spherical disturbance areas, equating to 157 km^2 (i.e., 2 x 78.5 km^2).

3.5.1.4 The number of individuals for each cetacean species that could be impacted, assuming the worst-case use of two vessels, has been assessed in Table 3-5 based on the density estimates and reference populations for the Moray Firth and relevant MUs in Table 3-3 for the five regularly occurring cetacean species in the Moray Firth.

3.5.1.5 The results indicate that, for harbour porpoise, the estimated number of individuals that could potentially be disturbed is 23.9, which is equivalent to no more than 0.0069% of the North Sea MU. The results from bottlenose dolphin show less than one bottlenose dolphin could be disturbed, representing 0.3% of the Coastal East Scotland MU. There is potentially up to 11.6 common dolphin, 3.3 white-beaked dolphin and 1.6 minke whale which equates to 0.02%, 0.02% and 0.006% of the Celtic and Greater North Sea MU for each respective population. Based on these results, the total number of individuals that may be disturbed as consequence of the proposed geophysical survey works is relatively low. The proportion of the respective MU or Moray Firth population predicted to be temporarily disturbed is less than 1% for all species (Table 3-5) and, therefore, the impacts from noise arising from geophysical equipment is considered to be negligible.

3.5.1.6 Thompson *et al*. (2013) concluded that noise from seismic surveys did not lead to broader scale displacement and that animals were typically detected again in survey areas within a few hours, and the level of response declined through the survey. There is also evidence from other noise producing activities showing that cetaceans return relatively quickly to an area following displacement (e.g., Thompson *et al*., 2013; Pirotta *et al*., 2014). Consequently, it is predicted that any disturbance impacts arising from the proposed geophysical survey works and vessel positioning equipment within Offshore ECC survey area will be localised, temporary and reversible. While the proposed works may cause an individual to relocate, the transitory nature of geophysical surveys means that the affected individuals will be able to return to an area within a relatively short period of time.

3.5.1.7 Taking into account the Southall *et al*. (2007) behavioural response severity scale (Table 3-4) as a precautionary approach the severity of any potential behavioural response has been assessed as 4 or less. Therefore, the impacts are not considered significant. It is concluded that the impacts will not result in any significant disturbance or be detrimental to the maintenance of the population at a FCS within their natural range for any EPS.

Table 3-5 Assessment of Disturbance to Cetaceans in the Moray Firth based on a 5 km EDR (157 km² - two vessels).

Species	Density Estimates (individuals/km²)	No. of Individuals Within Potential Impact Area	Estimated Population Abundance		% of Population Potentially Disturbed		Potential for Significant Disturbance
			Moray Firth	MU	Moray Firth	MU	
Harbour porpoise	0.152	23.9	6,147	345,373	0.39%	0.0069%	**No** – Less than 1% of North Sea MU or Moray Firth population temporarily disturbed.
Bottlenose dolphin	0.004	0.6	151	195	0.4%	0.3%	**No** – Less than 1% of Coastal East Scotland MU or Moray Firth population temporarily disturbed.
Common dolphin	0.074	11.6	1,218	56,556	0.95%	0.02%	**No** – Less than 1% of Celtic and Greater North Seas MU or Moray Firth population temporarily disturbed.
White-beaked dolphin	0.021	3.3	868	15,895	0.4%	0.02%	**No** – Less than 1% of Celtic and Greater North Seas MU or Moray Firth population temporarily disturbed.
Minke whale	0.010	1.57	383	23,528	0.4%	0.006%	**No** – Less than 1% of Celtic and Greater North Seas MU or Moray Firth population temporarily disturbed.

4 EPS Mitigation Strategy

4.1 Overview

4.1.1.1 An EPS Mitigation Strategy has been prepared to reduce injury and disturbance to EPS from the proposed geophysical survey activities within the Offshore ECC survey area. It contains protection measures which incorporate both visual and acoustic monitoring programmes of EPS located within the vicinity of the proposed works. The mitigation strategies are outlined below and are based on mitigation measures presented in the JNCC guidelines for minimising the risk to marine mammals from geophysical surveys (JNCC, 2017), where appropriate. In addition, the following general measures will be implemented during the proposed survey activities:

- All vessels will adhere to the provisions of the Scottish Marine Wildlife Watching Code (SNH, 2017a); and
- All relevant contractors will be made aware of all protected species within the marine environment, and their responsibility to implement the mitigation in this document.

4.1.1.2 The key components of the EPS Mitigation Strategy in relation to cetaceans include:

- Deployment of a Marine Mammal Observer (MMO) to monitor for the presence of cetaceans prior to the commencement of, and during, marine geophysical operations;
- For activities that take place in hours of darkness and/or in periods of poor visibility and/or during periods when the sea state is greater than Beaufort 3, deployment of a Passive Acoustic Monitoring (PAM) system prior to soft starts to detect for the presence of cetaceans that cannot be detected by the MMO;
- Pre-soft start search;
- 500 m mitigation zone for cetaceans;
- Deployment of soft-start techniques; and
- Reporting.

4.1.1.3 It is noted that a 2 km buffer has been included in addition to the Offshore ECC to allow the survey vessel to turn between survey lines without deactivating all geophysical equipment. However, JNCC (2017) guidelines will be followed during turns, whereby all geophysical equipment will be deactivated if the vessel turn is expected to exceed 40 minutes, and soft-start procedures will be adhered to when reactivating the equipment.

4.2 M1 – Marine Mammal Monitoring

4.2.1.1 There will be MMO coverage for the duration of the proposed geophysical survey activities, with adequately trained and experienced MMO(s) working standard 12-hour shifts. They will have experience of working at sea and will have successfully deployed and used PAM equipment previously, and be equipped with binoculars offering at least 8x magnification. The MMO will be located at a high point on the vessel, providing good all-round visibility.

4.3 M2 – Marine Mammal Observer (MMO)

4.3.1.1 During daylight hours, the MMO(s) will carry out visual observations to monitor for the presence of cetaceans before the soft-start commences and will recommend

delays in the commencement of the geophysical operations should any species be detected within the 500 m mitigation zone (see M5 below; Section 4.6).

4.4 M3 – Passive Acoustic Monitoring (PAM)

4.4.1.1 When visibility is poor (i.e., due to fog or during hours of darkness) and/or during periods when the sea state is greater than Beaufort 3, the PAM system will be operated by a single MMO/PAM operator prior to soft starts. The PAM system shall comprise of at least three hydrophone elements, allowing for directional localisation of detections, together with software allowing real-time automated detection of marine mammal vocalisations (e.g., PAMGuard or equivalent).

4.5 M4 – Pre-start Search

4.5.1.1 Visual (MMO), and acoustic (PAM) monitoring if required, will be conducted for a pre-start search of 30 minutes (i.e., prior to the commencement of marine geophysical survey works; MBES, SSS, SBP, UHR). This will involve a visual (during daylight hours) and acoustic (during poor visibility or at night) assessment to determine if any cetaceans are within 500 m of the activities.

4.5.1.2 As the survey will utilise high resolution survey equipment, if they are to be started sequentially or interchanged during their operation, only one pre-shooting search is required prior to the start of acoustic output. This is only applicable if there are no gaps in data acquisition of greater than 10 minutes and there is an audible source active.

4.6 M5 – Mitigation Zone

4.6.1.1 Should any cetaceans be detected within 500 m of the survey vessel, commencement of geophysical operations will be delayed until their passage, or the transit of the vessel, results in the cetaceans being more than 500 m away from the vessel. In both cases, there will be a 20-minute delay from the time of the last sighting within 500 m of the source to the commencement/recommencement of geophysical operations. It is noted that, once started, geophysical operations will not cease should cetaceans approach the survey vessel.

4.7 M6 – Soft Start

4.7.1.1 The geophysical source will, where feasible, not be operated at full power straight away, but the power will be built-up slowly over at least 15 minutes (and no more than 25 minutes) to give any cetaceans adequate time to leave the area. Build-up of power will occur in uniform stages to provide a constant 'ramp-up' in amplitude. The soft start procedures will be undertaken if the source is stopped for longer than 10 minutes, to avoid injury to any cetaceans which have entered the area during this 'downtime'. MMO or PAM observations will only take place prior to any soft start. Once geophysical operations have commenced, there will be no further observations until another soft start is required.

4.8 M7 – Reporting

4.8.1.1 All recordings of cetaceans will be made using JNCC Standard Forms. At the end of the operations, a monitoring report detailing the cetaceans recorded, methods used to detect them, and details of any problems encountered will be submitted to MS-LOT and NatureScot. The report will also include feedback on how successful the mitigation measures were. This requirement will be communicated to the MMOs at project start up meetings and at crew change. If the MMOs have any queries on the application of the guidelines during the works, they will contact MS-LOT and NatureScot for advice.

4.9 Survey Vessel Speed and Course

4.9.1.1 The project survey vessels will be moving at a speed of approximately 4 knots during geophysical operations to allow cetaceans to move away from the vessel should they be disturbed by the vessel presence or noise emissions. During transit times (i.e., between port of mobilisation and the Offshore ECC survey area), the survey vessels will be travelling at speeds greater than 4 knots. However, these movements are not considered to deviate from normal vessel traffic in the project area. Should an EPS be found to be in the direct path of a survey vessel, during or outside of survey times, the survey vessel will slow down or, if possible, alter course to avoid collision.

4.10 Toolbox Talks

4.10.1.1 As part of routine Toolbox Talks, survey crew will be made aware of all EPS they might encounter and good practice measures for boat control near wildlife through the Scottish Marine Wildlife Watching Code (SNH, 2017a) and Guide to Best Practice for Watching Marine Wildlife (SNH, 2017b).

5 Consideration of Cumulative Impacts

5.1.1.1 Activities and projects have been identified and considered for potential cumulative impacts with the proposed geophysical survey works within the Offshore ECC survey area, as presented in Table 5-1.

5.1.1.2 No cumulative impacts are considered likely to arise as a result of the temporal and geographical overlap of the geophysical surveys and other projects. It is anticipated that all effects associated with the proposed works within the Offshore ECC survey area will be localised and short term in nature and not result in significant adverse impacts. The potential for the proposed geophysical survey works contributing in a cumulative manner is therefore considered minimal. Additionally, there are no other surveys or activities planned within the Offshore ECC survey area during this period of time that could result in cumulative impacts on EPS.

5.1.1.3 The Review of Consents for the Southern North Sea SAC considered the potential for in-combination effects for geophysical surveys and concluded that due to the very low PTS onset impact range (23 m), there is no potential for in-combination effect of geophysical surveys being undertaken at the same time as OWF construction (BEIS, 2020). Similarly, while the potential disturbance range of geophysical surveys are larger than the PTS range (up to 3.77 km as modelled in the Review of Consents), the use of geophysical survey equipment during OWF piling (either a single event or concurrent) was not considered to significantly increase the area of potential disturbance, and the area disturbed would be temporary due to the continual movement of the survey vessel. Therefore, it was concluded that there would be no adverse effect from the in-combination effects of geophysical surveys being undertaken at the same time as a OWF piling event (BEIS, 2020).

5.1.1.4 It is therefore predicted that the relatively localised areas of disturbance and the short period of time that cumulative impacts could arise are such that they will not cause an impact that will affect the FCS of any EPS. Based on the assumption that all the planned projects and activities with the potential for injury or significant disturbance will have mitigation in place, which is similar to or more extensive than the measures being undertaken for the geophysical survey, no EPS will be at risk of injury from these activities. No cumulative effects are considered likely to arise as a result of the proposed geophysical survey works within the Offshore ECC survey area with any other project.

Table 5-1 Potential for Cumulative Impacts.

Project	Licensed Activity	Description and Sound Sources	Estimated Impact
Within 26 km of the Caledonia OWF export cable corridor survey area[2]			
Beatrice Offshore Wind Farm	Post-construction geophysical surveys. Beatrice Offshore Wind Farm holds an active EPS Licence valid from 07 July 2020 to 31 December 2023.	Presence of vessels undertaking geophysical surveys and the deployment of typical geophysical equipment.	Timescales for the post-construction geophysical surveys are unknown; therefore, a temporal overlap with proposed geophysical surveys of the Caledonia OWF Offshore ECC cannot be identified. Assuming that the conditions set out in the EPS Licence are complied with and implemented, and given that there will be very limited geographical impact overlap, no cumulative impacts are likely to arise in the event of temporal overlap.
Moray East Offshore Wind Farm	Offshore Construction EPS Licence valid until 30 September 2021 (i.e., expired).	Jacket and turbine installation. Cable laying.	Piling is complete. Noise generated from these activities is primarily from the presence of vessels within Moray East site. No cumulative impacts are likely to arise due to the very limited geographic impact overlap.
	Met Mast Decommissioning.	Cutting of the monopile and vessels.	Phase 1, including the removal of the monopile is complete. Phase 2 will consist of the removal of the gravity base structure and associated scour protection. The removal is to be completed in 2022 and the main noise activities have been completed. No cumulative impacts are likely to arise due to no temporal overlap.
Moray West Offshore Wind Farm	Geophysical survey activities of Moray West array and export cable corridor. EPS Licence valid from 30 July 2021 to 30 November 2022.	Geophysical surveys include USBL, SSS, MBES, single-beam echo-sounder (SBES), SBP, UHR and MAG.	Geophysical surveys of array and export cable corridor have been completed.
	Offshore construction.	Jacket and turbine installation. Cable laying.	Construction of Moray West OWF array and ECC anticipated to begin between 2022-2024. Timescales for the offshore construction are unknown; therefore, a temporal overlap with proposed geophysical surveys of the Caledonia OWF Offshore ECC cannot be identified. Assuming that the conditions set out in the EPS Licence are complied with and implemented, and given that there will be very limited geographical impact overlap, no cumulative impacts are likely to arise in the event of temporal overlap.

[2] A precautionary 26 km EDR has been used to estimate the potential for cumulative impact with projects and activities that are likely to have a temporal overlap with the proposed geophysical surveys within the Offshore ECC survey area. The use of 26 km is the most precautionary fixed EDR based on empirical evidence on monopile installation recommended in the JNCC guidance for assessing the significance of noise disturbance against conservation objectives of harbour porpoises SACs (JNCC *et al.*, 2020).

Project	Licensed Activity	Description and Sound Sources	Estimated Impact
Stromar (Falck Renewables, BlueFloat Energy and Orsted - NE3)	This project is in the concept/early planning process as with Caledonia OWF.	Timescales for geophysical surveys are unknown; a temporal overlap with proposed geophysical surveys of the Caledonia OWF Offshore ECC cannot be identified.	Assuming that the conditions set out in the EPS Licence are complied with and implemented, and given that there will be very limited geographical impact overlap, no cumulative impacts are likely to arise in the event of temporal overlap.
Broadshore (Falck Renewables and BlueFloat Energy – NE6)	This project is in the concept/early planning process as with Caledonia OWF.	Timescales for geophysical surveys are unknown; a temporal overlap with proposed geophysical surveys at Caledonia OWF cannot be identified.	Assuming that the conditions set out in EPS Licence are complied with and implemented, and given that there will be very limited geographical impact overlap, no cumulative impacts are likely to arise in the event of temporal overlap.
Forth and Tay/Other Wind Farm Developments			
Neart na Gaoithe Offshore Wind Farm	Offshore Construction Licence valid from 01 July 2020 to 01 July 2023.	Anticipated programme: Casing and Pile Installation (piling). August 2020 – November 2021 OSP Jacket Installation. July 2021 – September 2021.	Given that the distance between the project location from Offshore ECC survey area is greater than 26 km (largest disturbance impact range), and the anticipated programme indicating no temporal overlap, no cumulative impacts are likely to result in the event of temporal overlap.
Seagreen Alpha and Bravo	Offshore Construction.	WTG Piled Foundation Substructures: Pile installation April 2023 – July 2023	The exact timing and nature of the actives are unknown. However, given that the distance between the project location from Offshore ECC survey area is greater than 26 km (largest disturbance impact range), no cumulative impacts are likely to result in the event of temporal overlap.
Kincardine Offshore Wind Farm	UXO Clearance EPS Licence valid from 10 April 2021 to 09 August 2021.	UXO clearance activities are proposed between April and August 2021. Detonation of UXO (one UXO confirmed). Use of ADDs.	Timescales for the detonation of the identified UXO is unknown, but based on the EPS Licence period are assumed to be complete. Given that the distance between the project location from Offshore ECC survey area is greater than 26 km (largest disturbance impact range), it is anticipated that no cumulative impacts are likely to result in the event of temporal overlap (if ongoing).
Inch Cape Offshore Wind Farm	Unknown.	There is no information as to when any geophysical surveys may be undertaken. Construction activities are not anticipated to commence in the near future.	The exact timing and nature of the actives are unknown and, therefore, it is not possible to undertake a cumulative impact assessment. However, given that the distance between the project location from Offshore ECC survey area is greater than 26 km (largest disturbance impact range), it is anticipated that no cumulative impacts are likely to result in the event of temporal overlap.

6 Consideration of Likely Significant Effects (LSE)

6.1.1.1 This section provides information in order to determine the potential for the proposed geophysical survey works within the Offshore ECC survey area to have adverse effect on the integrity of designated sites. This includes the following designated sites which include marine mammals as qualifying/protected features (see Figure 1-1):

- Moray Firth SAC;
- Dornoch Firth and Morrich More SAC; and
- Southern Trench NCMPA.

6.2 Designated Sites

6.2.1 Moray Firth SAC

6.2.1.1 The Moray Firth SAC was designated in 2005 for Sandbanks which are slightly covered by sea water all the time (1110) and bottlenose dolphin (1349). The SAC extends from the inner firths to Helmsdale on the north coast and Lossiemouth on the south coast. The Moray Firth supports the only known resident population of bottlenose dolphin in the North Sea, with an estimated 150 individuals. The population is present year-round within the Firth, but they do appear to favour particular areas[3]. The Conservation Objectives for the Moray Firth SAC are:

"to avoid deterioration of the habitats of the qualifying species (bottlenose dolphin) or significant disturbance to the qualifying species, thus ensuring that the integrity of the site is maintained, and the site makes an appropriate contribution to achieving favourable conservation status for the qualifying interest".

6.2.2 Dornoch Firth and Morrich More SAC

6.2.2.1 The Dornoch Firth and Morrich More SAC is designated for harbour seal (*Phoca vitulina*) and otter (*Lutra lutra*). Although seals are not EPS, an assessment in relation to the nearby Dornoch Firth and Morrich More SAC has been included in this EPS risk assessment. [redacted]

6.2.2.2 Dornoch Firth and Morrich More consists of an estuarine system with extensive areas of bordering natural habitat including sand dune, woodland and small lochans. [redacted]

6.2.2.3 The Dornoch Firth is the most northerly large estuary in Britain and supports a significant proportion of the inner Moray Firth population of the harbour seal. The seals, which utilise sand-bars and shores at the mouth of the estuary as haul-out and breeding sites, are the most northerly population to utilise sandbanks and their numbers represent almost 2% of the UK population[4].

6.2.2.4 The Conservation Objectives ensure that the obligations of the Habitats Regulations are met; that is, there should not be deterioration or significant disturbance of the qualifying interest. This will also ensure that the integrity of the site is maintained and that it makes a full contribution to achieving FCS for its qualifying interests.

[3] https://sac.jncc.gov.uk/site/UK0019808
[4] https://sac.jncc.gov.uk/site/UK0019806

The total population of harbour seals in Scotland was 26,864 in 2015-2018, with 962 within the Moray Firth MU (Special Committee on Seals (SCOS), 2020).

6.2.2.5 The number of harbour seal that could potentially be disturbed due to the geophysical survey, based on the precautionary 5 km EDR for up to two vessels, is up to 2.5 (based on 0.016 individuals/km^2, as calculated from Russell *et al.*, 2017), or 0.26% of the Moray Firth MU. There is therefore a negligible risk of disturbance to the harbour seal population.

6.2.2.6 Otters are particularly sensitive to anthropogenic changes to their habitats, as their coastal habitat use is highly dependent on the inclusion of freshwater features (Roos *et al.*, 2015). As such, the location of their holts (or dens) is restricted, and anthropogenic changes to their habitat may have dramatic repercussions, including localised extinctions. Given the distance of from the Offshore ECC survey area and considering the extremely limited nature of the potential effects on otters anticipated to result from the proposed geophysical survey activities, it is concluded that an EPS Licence will not be required for otters.

6.2.3 Southern Trench NCMPA

6.2.3.1 Southern Trench NCMPA is located on the east coast of Scotland, and protects minke whale, burrowed mud, fronts and shelf deeps. Fronts in the Southern Trench are created by mixing of warm and cold waters, which creates an area of high productivity, attracting a number of predators to the area. Minke whale are attracted by the fish species brought to the area by the fronts, as well as the abundance of sandeels in the soft sands. NatureScot advises that, in order to conserve minke whale, risk of injury and death should be minimised, access to resources within the site should be maintained, and supporting features should also be conserved. The Conservation Objectives of this site are to conserve the features, specifically to ensure:

> *"Minke whale in the Southern Trench NCMPA are not at significant risk from injury or killing, conserve the access to resources (e.g. for feeding) provided by the NCMPA for various stages of the minke whale life cycle, and conserve the distribution of minke whale within the site by avoiding significant disturbance"*[5].

6.2.3.2 The supporting features of the minke whale is also protected under the Conservation Objectives for the Southern Trench NCMPA.

6.3 Potential effects

6.3.1.1 As outlined in Section 3.4, there are potential effects from underwater noise produced by survey equipment and vessels to cause disturbance of the qualifying/protected features of the above designated sites. However, with adequate mitigation in place, as outlined in Section 4, there would be negligible disturbance effects as a result of underwater noise during the proposed geophysical survey works and no potential for any LSE.

6.3.1.2 Due to the proximity of these designated sites to the proposed survey area (i.e., the Offshore ECC), there is potential for interaction with qualifying and interest features associated with these designated sites. However, as there is no potential for injury or significant disturbance to marine mammals in the vicinity of the survey, it is considered that there is no potential for any adverse effect on the integrity of the designated sites in relation to the conservation objectives.

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

7 Assessment of Potential Offence

7.1 Overview

7.1.1.1 The proposed geophysical survey works within the Offshore ECC survey area is within and beyond the 12 nautical mile boundary. Following the Marine Scotland (2020) guidance, it can be concluded that, with mitigation for the survey and positioning equipment, potential impacts from the proposed survey work are unlikely to result in the harassment, disturbance, injury or killing of an EPS as defined under Regulation 39(1) of the Habitats Regulations.

7.1.1.2 In relation to Regulation 39(2) of the Habitats Regulations, the percentage of the reference population of each species which has the potential to be disturbed by use of the geophysical survey equipment is considered to be negligible (less than 1% for all cetacean species which occur in the Moray Firth area) and, therefore, not detrimental to the maintenance of the population of the species concerned at a FCS. Any disturbance is likely to be localised and short-term, and with mitigation is considered to be negligible.

7.1.1.3 Disturbance will not be sufficient to cause any population level effects, and thus it is considered that an EPS Licence (to disturb) can be issued under Section 39 of the Conservation (Natural Habitats, &c) Regulations 1994 (as amended in Scotland).

7.1.1.4 As stated in Section 1.2.3, three tests must be passed before an EPS licence can be granted, as discussed below.

7.2 Test 1 – Licence must relate relevant purpose (Regulation 44)

7.2.1.1 The Scottish Government can only issue EPS Licenses under Regulation 44(2) of the Habitats Regulations (as amended) for specific purposes. These purposes include:

- (a) Scientific, research or educational purposes;
- (b) Ringing or marking, or examining any ring or mark on, wild animals;
- (c) Conserving wild animals, including wild birds, or wild plants or introducing them to particular areas;
- (ca) Conserving natural habitats;
- (d) Protecting any zoological or botanical collection;
- (e) Preserving public health or public safety or other imperative reasons of overriding public interest including those of a social or economic nature and beneficial consequences of primary importance for the environment;
- (f) Preventing the spread of disease; or
- (g) Preventing serious damage to livestock, foodstuffs for livestock, crops, vegetables, fruit, growing timber or any other form of property or to fisheries.

7.2.1.2 Caledonia OWF meets the requirements of Regulation 44(2)(e) listed above by demonstrating a direct environmental benefit on a national and international scale and complies with international and national environmental policies. There is an overarching European, UK and Scottish policy requirement for sustainable energy supply from renewables. This need is the subject of national planning and energy policy.

7.2.1.3 Furthermore, the Caledonia OWF project will be a long-term development that will contribute to ensuring the security of energy supply, with long-term environmental benefits. The development will have a direct national and international environmental benefit by significantly reducing carbon emissions to the atmosphere

compared to other sources of non-renewable energy generation. The project complies with a number of national and international policies relating to energy and reducing carbon emissions.

7.3 Test 2 – Must be no satisfactory alternative (Regulation 44(3)(a))

7.3.1.1 There are no satisfactory alternatives to the use of survey or positioning equipment required during the proposed geophysical survey works. Although there might be different types of survey equipment that could be used, this is often constrained by the specific purpose of the geophysical survey and the alternative equipment may not be effective. There are no alternative options to the use of the geophysical equipment required to undertake such surveys.

7.3.1.2 Geophysical surveys are required to map the seabed characteristics of the site to inform the Environmental Impact Assessment (EIA) and project design. For example, the outputs will feed into the baseline characterisation, modelling and impact assessment for coastal processes, subtidal benthic ecology (also informing future benthic sampling) and marine archaeology, among other marine receptors. The proposed geophysical survey of the Offshore ECC will provide detailed data to inform a robust EIA. The proposed survey methods outlined in this document are the only viable way to ensure the safe and accurate collection of data for the Offshore ECC survey area. Thus, it is considered that the 'no satisfactory alternative test' has been met as the project cannot otherwise be designed safely and appropriately.

7.4 Test 3 – Action authorised must not be detrimental to maintenance of relevant species population at a FCS in their natural range (Regulation 44(3)(b))

7.4.1.1 The percentage of the reference population of each species which has the potential to be disturbed by use of the geophysical survey techniques is considered to be negligible (less than 1% for all the cetacean species which occur in the Moray Firth area; see Table 3-5) and, therefore, not detrimental to the maintenance of the population of the species concerned at a FCS level.

8 Conclusions

8.1.1.1 While the proposed geophysical survey works associated with the Caledonia OWF present a temporary disturbance to a localised marine environment, this wider development is an important addition to **Scotland's growing contributions to the UK's renewable energy sector**. It will provide additional support to the UK Government's national and international commitments to reduce greenhouse gasses, while aligning with the UK Government's Energy Security Strategy[6] and Scotland's National Marine Plan[7].

8.1.1.2 The information presented in this EPS risk assessment demonstrates that, with the **implementation of the mitigation measures** detailed in Section 4, there will be no injury resulting from the proposed activities and thus no offence related to injury of any cetacean species under either the inshore or offshore Regulations. In this context, an EPS Licence would not be required.

8.1.1.3 However, the results of the assessment of potential disturbance from the proposed geophysical survey works show that a relatively low number of individuals may experience some level of disturbance for the short period they may encounter noise emissions arising from the geophysical survey operations. The proportion of the MU or Moray Firth population predicted to be temporarily disturbed is **less than 1%** for all species (see Table 3-5).

8.1.1.4 Current and likely future activities and projects have been considered for potential cumulative impacts with the proposed geophysical surveys of the Caledonia OWF Offshore ECC. There is potential for cumulative impacts from a number of different sources, although there is significant uncertainty when these may arise. Based on the assumption that all planned projects and activities will have mitigation in place and that the predicted level of impacts arising from disturbance from each activity will be temporary, it is concluded that **no cumulative effects** are considered likely to arise as a result of the temporal and geographical overlap of the proposed geophysical surveys with the Offshore ECC survey area with any other projects.

8.1.1.5 It is therefore concluded that the impacts will not result in any significant disturbance or be detrimental to the maintenance of the population at a FCS within their natural range for any EPS. An EPS Licence is thus required for activities where there is potential for disturbance to cetaceans as per Habitats Regulation 39(2); this disturbance will not be sufficient to cause any population level effects, and thus it is considered that **an EPS Licence to disturb can be issued**.

8.1.1.6 As there is no potential for injury or significant disturbance to EPS in the vicinity of the survey works, it is considered that there is no potential for any LSE on nature conservation designated sites in relation to the Conservation Objectives for marine mammals.

[6] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1069973/british-energy-security-strategy-print-ready.pdf
[7] https://www.gov.scot/binaries/content/documents/govscot/publications/strategy-plan/2015/03/scotlands-national-marine-plan/documents/00475466-pdf/00475466-pdf/govscot%3Adocument/00475466.pdf

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Appendix A – Survey Area Coordinates

The location coordinates (WGS84) of the Offshore ECC survey area are defined in Table A-1.

Table A-1 Coordinates of Offshore ECC survey area.

No.	Longitude (DMS)	Latitude (DMS)
1	2° 33' 43.38" W	58° 7' 37.51" N
2	2° 25' 55.08" W	57° 59' 54.04" N
3	2° 29' 51.98" W	57° 40' 24.14" N
4	2° 47' 17.31" W	57° 42' 2.29" N
5	2° 33' 43.38" W	58° 7' 37.51" N