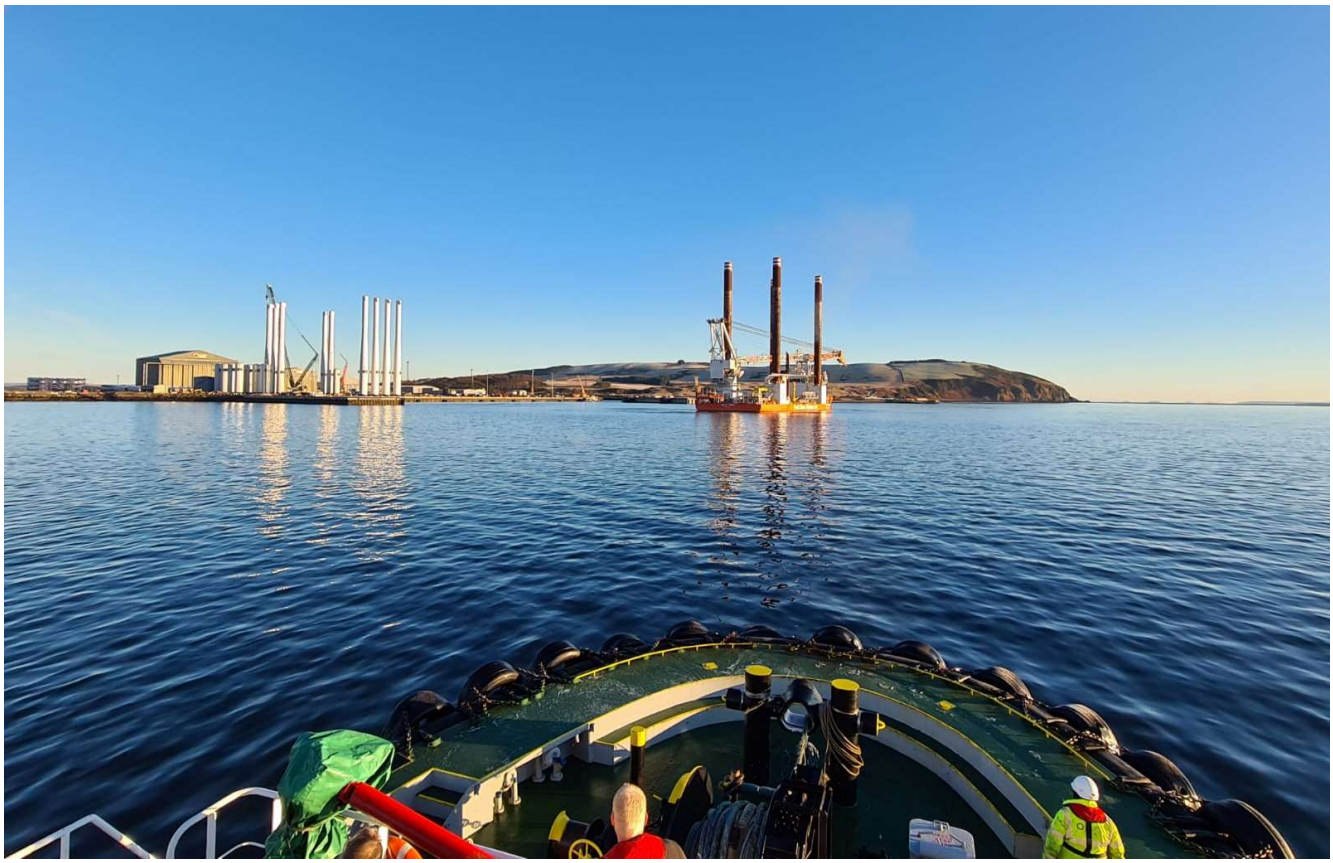
MUIR MHÒR
OFFSHORE WIND FARM

A joint venture between Fred. Olsen Seawind & Vattenfall



Muir Mhòr Offshore Wind Farm

European Protected Species (EPS) Risk Assessment:

Geotechnical Survey Campaign 2024

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EPS Risk Assessment: Geotechnical Survey Campaign 2024

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ACRONYMS & ABBREVIATIONS:

Term	Definition
BEIS	Department for Business, Energy & Industrial Strategy
BOEM	Bureau of Ocean Energy Management
CES	Coastal East Scotland
CGNS	Celtic and Greater North Sea
CPT	Cone Penetration Test
EDR	Effective Deterrent Range
EIA	Environmental Impact Assessment
EIAR	Environmental Impact Assessment Report
EPS	European Protected Species
FCS	Favourable Conservation Status
GNS	Greater North Sea
GW	Gigawatt
IAMMWG	Inter-Agency Marine Mammal Working Group
ICES	International Council for the Exploration for the Seas
INTOG	Innovation and Targeted Oil and Gas
IUCN	The International Union for Conservation of Nature
JNCC	Joint Nature Conservation Committee
JV	Joint Venture
LAT	Lowest Astronomical Tide
LSE	Likely Significant Effects
MAG	Magnetometer
MBES	Multi-Beam Echo Sounder
MD-LOT	Marine Directorate Licensing Operations Team
MU	Management Unit
NCMPA	Nature Conservation Marine Protected Area

Term	Definition
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
OSS	Offshore Substation
OWF	Offshore Wind Farm
PSV	Platform Supply Vessel
PTS	Permanent Threshold Shift
rms	Root mean squared
ROV	Remotely Operated Vehicle
SAC	Special Area of Conservation
SBES	Single-Beam Echo-Sounders
SBP	Sub Bottom Profiler
SCANS	Small Cetaceans in European Atlantic waters and the North Sea
SCOS	Special Committee on Seals
SEL	Sound Exposure Levels
SNH	Scottish Natural Heritage
SPL	Sound Pressure Level
SSS	Side-scan Sonar
TTS	Temporary Threshold Shift
UHRS	Ultra-High Resolution Seismic
USBL	Ultra-Short Baseline
WTG	Wind Turbine

Glossary:

Term	Definition
Array Area	The area of the Offshore Wind Farm (OWF) where the wind turbine generators will be situated.
Benthic Ecology	Benthic ecology encompasses the study of the organisms living in and on the sea floor, the interactions between them and impacts on the surrounding environment.
Cone Penetration Test (CPT)	Used to determine the geotechnical properties of soils and delineating soil stratigraphy.
Cumulative Effects	The combined effect of Muir Mhòr in combination with the effects from a number of different projects, on the same single receptor/resource.
De minimus	Lacking significance or importance
E2	The ScotWind Plan Option Area within which the proposed development is located.
Elasmobranch	Cartilaginous fishes such as sharks, rays, and skates.
Export Cable Corridor (ECC)	Referring to the offshore ECC that runs from the wind farm array area to the point of landfall, within which the offshore export cables will be installed.
Geotechnical Survey Area	Referring to both the array and ECC geotechnical survey areas.
Inter-Array Cables	Cables which link the wind turbines generators to each other and the Offshore Electrical Platform(s).
Landfall	The area above Mean Low Water Springs (MLWS) where the offshore export cable(s) will be brought onshore.
Offshore Export Cable Corridor (ECC)	The area within which the offshore export cable(s) will be installed.
proposed development	The offshore Muir Mhòr Offshore Wind Farm project elements to which this Offshore Scoping Report relates.
Sound Exposure Levels	The decibel level of the time integral (summation) of the squared pressure over the duration of a sound event; units of dB re 1 $\mu Pa^2/s$.
Sound Pressure Level (SPL)	Is a means of characterising the amplitude of a sound. There are several ways sound pressure can be measured. The most common of these are the root-mean-square (rms) pressure, the peak pressure, and the peak-to-peak pressure.
Subsea	Subsea comprises everything existing or occurring below the surface of the sea.
The Developer	The Developer (Muir Mhòr Offshore Wind Farm Limited) is a Joint Venture between Fred. Olsen Seawind Limited and Vattenfall Wind Power Limited

Term	Definition
Ultra-Short Baseline (USBL)	A method of underwater acoustic positioning.

1 Introduction

1.1 Background

1.1.1 As part of the Crown Estate Scotland ScotWind Leasing process in January 2022, Muir Mhòr Offshore Wind Farm Limited (a joint venture (JV) between Fred. Olsen Seawind and Vattenfall – hereafter the Developer) were identified as the successful bidder and awarded an Option Agreement (granting exclusive rights) for what the Developer has named the Muir Mhòr Offshore Wind Farm (OWF) (hereafter the Project), located within the E2 Plan Option area.

1.1.2 The Muir Mhòr array area covers 200 km^2 and is located approximately 63 km east of Peterhead on the east coast of Scotland as shown in Figure 1. The Project is anticipated to have a capacity of approximately 1 gigawatt (GW) comprising floating offshore wind technology.

1.1.3 In June 2023, an Offshore Environmental Impact Assessment (EIA) Scoping Report was submitted to request a formal Scoping Opinion from the Marine Directorate – Licensing Operations Team (MD-LOT), on behalf of Scottish Ministers in relation to the offshore elements of the Project.

1.1.4 In 2024, the Developer intends to apply for the relevant consents and permissions required to enable construction, operation, and maintenance (O&M) and decommissioning of the Project. This process will be subject to EIA, with an EIA Report (EIAR) to be prepared to underpin any applications. If consented, construction of the Project is expected to commence in 2027.

1.1.5 The Developer plans to undertake a geotechnical survey of the Muir Mhòr array area and offshore Export Cable Corridor (ECC) to provide technical data which will facilitate the detailed design of the Project (Figure 1). The offshore geotechnical survey of the array area and ECC are planned to take place over a maximum of 75 days (with additional days for mobilisation, crew changes, demobilisation, and weather allowance). Ahead of any geotechnical surveys, a European Protected Species (EPS) Licence potentially needs to be secured where:

- 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).

1.1.6 The Muir Mhòr geotechnical survey will occur within and outwith 12 nm. The Developer has commissioned GoBe Consultants Limited to prepare this document to provide the necessary information in support of EPS Licence applications, which will be submitted to MD-LOT.

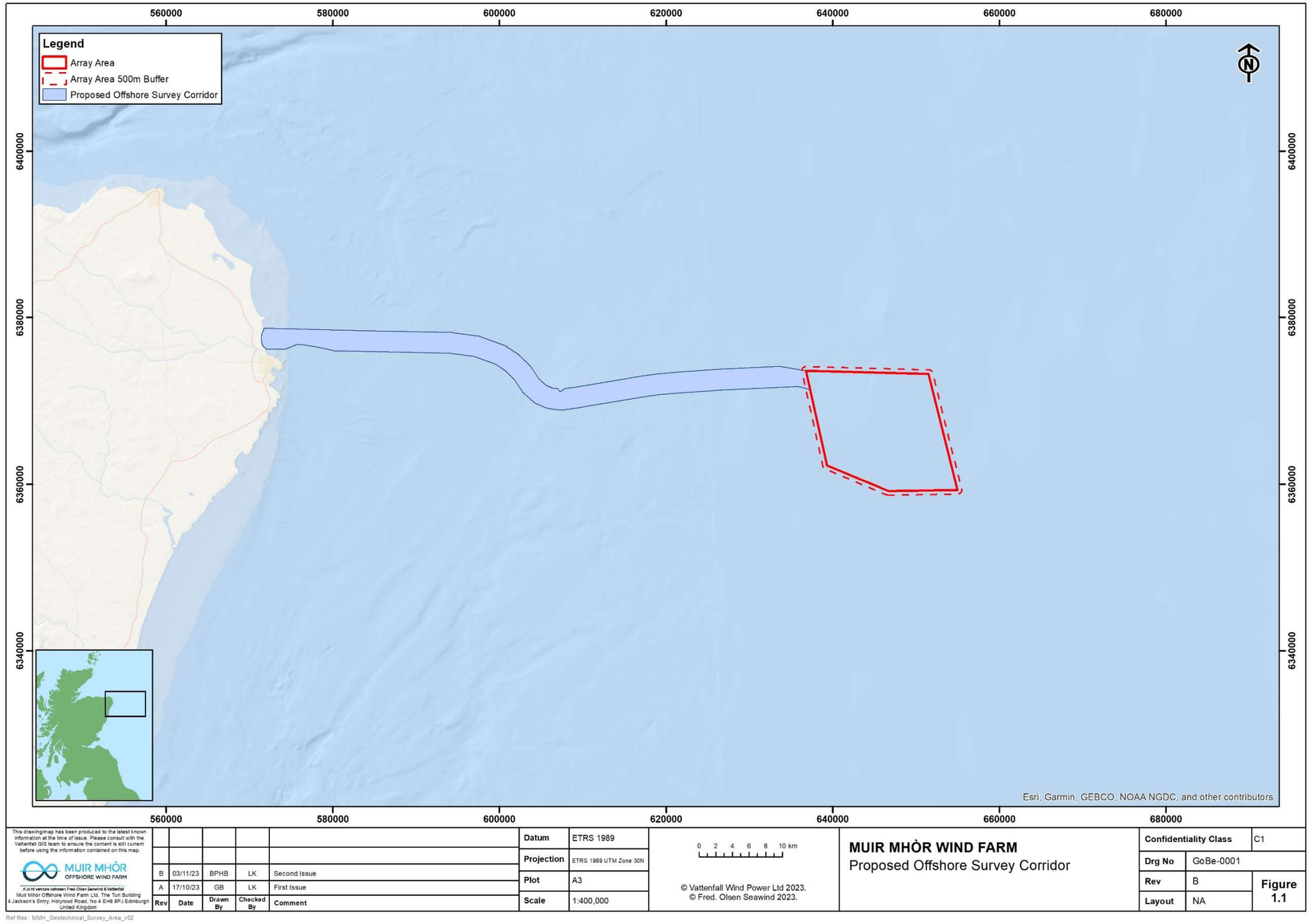

Figure 1: Location of the Muir Mhòr Geotechnical Survey Area.

1.2 European Protected Species (EPS)

EPS Protection

1.2.1 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.

1.2.2 Species qualifying as an EPS means 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.

1.2.3 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)".

1.2.4 Outside of 12 nautical miles, the extent of legislative protection against injury is the same as afforded within 12 nautical miles however, the definition of disturbance outside of 12 nautical miles does not extend to individual animals. Therefore, for an EPS licence to be required outside of 12 nautical miles, there must be disturbance of a significant group of animals, not just an individual.

Disturbance of an EPS

1.2.5 Whether or not an 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 several 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 1.2.3).

1.2.6 Marine Scotland (2020) advise that while the likelihood of acute injury can be relatively easy to determine, auditory injury accumulated over a period, 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).

1.2.7 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.

1.2.8 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 such 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.

Determining the Requirement for an EPS Licence

1.2.9 Where there is potential to harm or disturb an EPS, it is necessary to assess and determine whether an EPS Licence is required before an activity takes place. The need for an EPS Licence will be determined by MD-LOT as the licensing authority (for purely marine species) with advice from NatureScot based on findings from the EPS risk assessment (this document). The findings from the assessment presented in this document are designed to support the decision-making process regarding the requirement for an EPS Licence, where granting of an EPS Licence depends on the following three tests:

- That the licence is to be granted for one of the purposes specified in the Regulations;
- That there are no other satisfactory alternatives to the activity proposed; and
- That the licensing of the activity will not be detrimental to the maintenance of the population of the species concerned at an FCS.

2 Description of Proposed Activities

2.1 Location of Proposed Activities

2.1.1 The proposed geotechnical survey works will be carried out across the Muir Mhòr array area, approximately 63 km east of Peterhead on the east coast of Scotland and at locations along the offshore ECC.

2.1.2 The survey area (Figure 1) includes a 500 m buffer around the Muir Mhòr array area and ECC. The array area and ECC survey areas combined, including the 500 m buffer around each, covers a total area of approximately 399 $km^{2.}$

2.2 Survey Vessels

2.2.1 Table 1 describes the types of vessels anticipated to be used during the geotechnical survey works.

Table 1. Vessels to be used during the proposed Muir Mhòr geotechnical survey campaign.

Vessel	Description
Shallow Geotechnical Vessel	A Platform Supply Vessel (PSV) specifically for shallow geotechnical investigations. Example shallow water limit is 10 m Lowest Astronomical Tide (LAT).
Deep Geotechnical Vessel	The vessel will carry out geotechnical seabed Cone Penetration Tests (CPTs), typically includes Remotely Operated Underwater Vehicles (ROV). Example shallow water limit 20 m LAT. Vessel would typically include an offshore crane.
Drilling Vessel	The vessel will carry out the borehole drilling and CPTs. Example shallow water limit 20 m LAT.

2.3 Survey Techniques/Equipment

2.3.1 The geotechnical survey will comprise the acquisition of geotechnical data in the form of CPTs, vibrocores, and boreholes. Ultra Short Baseline (USBL) acoustic positioning systems will be used in conjunction with the survey to provide accurate positional data for the vessel and equipment.

Table 2: Details of survey techniques/equipment.

Survey Equipment	Description
CPTs	A CPT is a rod-shaped tool, with a cone on the end at an apex angle. It is used to give an indication of the substrate strength of the seabed, using the resistance to penetration. It can also measure functional resistance, pore water pressure and undrained shear strength. Up to 40 CPTs will be carried out in the array area to inform Wind Turbine (WTG) and Offshore Substation (OSS) design, with up to 90 CPTs carried out for cables (both inter-array cables within the array area and export cables along the ECC).
Vibrocores	Vibrocores are used to determine the sediment structure and composition of the seabed. The unit is typically deployed via a crane or 'A' frame to recover a continuous seabed sample or core. The attached core tube is driven into sediment by the force of gravity, enhanced by vibration energy. The vibrations cause a thin layer of material to mobilize along the inner and outer tube wall, reducing friction and easing penetration into the substrate. Up to 90 vibrocores will be undertaken for cables (both inter-array cables within the array and export cables along the ECC).
Boreholes	A borehole is a method of drilling into the seabed to recover samples and enable downhole geotechnical testing to be completed. A drilling head is lowered to the seabed via a drill string and stabilised using a seabed frame. The drill string is then rotated to commence boring. Tools are lowered into the drill string to recover samples or conduct in-situ soil testing. Up to 11 boreholes will be collected in the array area to inform WTG and OSS design.
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 measured 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.

2.4 Activity Schedule

2.4.1 The earliest start date for the Muir Mhòr offshore geotechnical survey campaign is 1st March 2024 and survey works are planned to take place over a maximum of 75 days (with additional days for mobilisation, crew changes, demobilisation, and weather allowance). The geotechnical survey campaign will be complete no later than 31st October 2024.

3 EPS Risk Assessment

3.1 Overview

3.1.1 This section outlines the presence and the use of the geotechnical survey area by EPS, as well as an assessment of potential effects of the proposed geotechnical survey activities on those EPS. In line with Test 2 (Regulation 44(3)(a)) of the Habitats Regulations, the Project has also assessed *not* undertaking the Geotechnical survey ('Do Nothing Scenario' see Sections 7.1.7 to 7.1.10).

3.1.2 As part of the survey campaign, the survey activities include the following key categories:

- Vessel activity;
- Geotechnical surveys of the seabed (vibrocores, CPT and boreholes); and
- USBL.

3.2 EPS Presence in the Geotechnical Survey Area

3.2.1 As listed in Annex IV of the Habitats Directive, all cetacean species are of community interest in need of strict protection as EPS. These species are fully protected in Scottish territorial waters (out to 12 nautical miles) under the Conservation (Natural Habitats, &c.) Regulations 1994 (as amended), and are protected by the Conservation of Offshore Marine Habitats and Species Regulations 2017 outwith 12 nm. 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".

3.2.2 A total of 19 cetacean species have been recorded in UK waters (Reid *et al.*, 2003). Of these, there are 12 cetacean species known to be present off the east coast of Scotland (Reid *et al.*, 2003; Hammond *et al.*, 2017) comprising:

- 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*).

3.2.3 Of these, harbour porpoise, bottlenose dolphin, common dolphin, white-beaked dolphin, white-sided dolphin and minke whale regularly occur within the vicinity of the central North Sea (Reid *et al*., 2003; Hammond *et al*., 2021). The following section provides a summary of the most common species in the survey area.

Cetacean Species Potentially Present in the Survey Area

3.2.4 Small Cetaceans in European Atlantic waters and the North Sea (SCANS) aerial and ship-based surveys were carried out in 2016 and used to estimate the abundance of cetaceans across European Atlantic waters (Hammond *et al*., 2021). These 2016 surveys are termed SCANS III.

3.2.5 More recent aerial and ship-based surveys were conducted June to October 2022 (SCANS IV) (Gilles *et al.*, 2023). Species abundance was estimated using the same methodology as for SCANS III (see Gilles *et al*., 2023).

3.2.6 SCANS surveys indicated the presence of the species listed in Table 3 across the Muir Mhòr geotechnical survey area. This table summarises density (individuals/km^2) and abundance estimates for the survey. For SCANS III, the Muir Mhòr geotechnical survey area falls within Block R that covers the east coast of Scotland which were surveyed during the summer of 2016 (Hammond *et al.*, 2021). For SCANS IV, the Muir Mhòr geotechnical survey area falls within Block NS-D that covers the east coast of Scotland, surveyed during June to October 2022 (Gilles *et al.* 2023).

Table 3: SCANS III and Scans IV Density and population estimates for regularly occurring cetaceans off the east coast of Scotland and wider MU.

Cetacean	General Distribution	Density Estimates (individual/km^2)		Estimated Population		
		SCANS III (Hammond *et al.*, 2021)	SCANS IV (Gilles *et al.*, 2023)	SCANS III (Hammond *et al.*, 2021)	SCANS IV (Gilles *et al.*, 2023)	Management Unit
Harbour porpoise	Individuals can be found in nearshore and offshore waters throughout the North Sea	0.599	0.5985	38,646	38,577	346,601 (North Sea MU (Inter-Agency Marine Mammal Working Group (IAMMWG), 2023)) 338,918 (North Sea MU (Gilles *et al.*, 2023))
Common dolphin	Predominantly an offshore species	0.000	-	0.000	-	102,656 (Celtic and Greater North Sea (CGNS) MU – (IAMMWG, 2023)
Bottlenose dolphin	The coastal east Scotland population is predominantly found in nearshore areas, whilst other populations are found in deeper offshore areas	0.0298	-	1,924	-	2,022 (GNS MU (IAMMWG, 2023)) - relevant to the array 195 (CES MU – (IAMMWG, 2015)) - relevant to the ECC
White-beaked dolphin	Predominantly an offshore species	0.243	0.0799	15,694	5,149	43,951 (CGNS MU (IAMMWG, 2023))
White-sided dolphin	Predominantly an offshore species which prefers shelf habitat	0.0100	-	644	-	18,128 (CGNS MU (IAMMWG, 2023))

Cetacean	General Distribution	Density Estimates (individual/km^2)		Estimated Population		
		SCANS III (Hammond *et al.*, 2021)	SCANS IV (Gilles *et al.*, 2023)	SCANS III (Hammond *et al.*, 2021)	SCANS IV (Gilles *et al.*, 2023)	Management Unit
Minke whale	Individuals can be found in nearshore and offshore waters throughout the North Sea	0.0387	0.0419	2,498	2,702	20,118 (CGNS MU (IAMMWG, 2023))

3.2.7 Harbour porpoises are found in abundance throughout Scottish waters, usually as pairs or groups of three with larger foraging groups sometimes appearing (Reid *et al*., 2003; Scottish Natural Heritage (SNH), 2014; Hammond *et al*., 2021). Globally, harbour porpoises appear on the International Union for Conservation of Nature (IUCN) Red List as a threatened species of 'least concern'; however, there is a gap in the knowledge regarding the current population trend (Braulik *et al*., 2020). The relevant International Council for the Exploration of the Seas (ICES) Assessment Unit for harbour porpoise covers the entire North Sea. Joint Nature Conservation Committee (JNCC) reported North Sea harbour porpoise populations to be in an unknown condition and the Natura 2000 network is currently classified as unknown (JNCC, 2019).

3.2.8 Common dolphin were not recorded in Block R of the SCANS III survey (Hammond *et al.*, 2021) or Block NS-D of the SCANS IV survey (Gilles *et al.*, 2023), however, they have been recorded throughout the CGNS MU (Hammond *et al.*, 2021) and they have been found in the Moray Firth. In the Moray Firth, the estimated population was 1,218 and the estimated density was 0.074 individuals/km^2 (Robinson *et al.*, 2010). The conservation status of common dolphin is currently unknown owing to data limitations (JNCC, 2019).

3.2.9 The conservation status of bottlenose dolphin within the species range is currently listed as good and the Natura 2000 network population trend is currently stable (JNCC, 2019). There is a resident bottlenose dolphin population within the Moray Firth, in relatively close proximity to the Muir Mhòr geotechnical survey area. Estimates for this population do vary between years, however, recent survey data indicates that half of the estimated population occupy the area regularly (Graham *et al*., 2016). The Moray Firth Special Area of Conservation (SAC) has been designated for the protection and conservation of this resident population and the habitat they rely on (NatureScot, 2021). Please see Section 6.2 for further information on this designated site and the designated features.

3.2.10 White-beaked dolphin are usually found in small groups of 10 or less (however, they can be seen in groups of 50 or more) and they usually occupy depths of 50 – 100 m (Reid *et al*., 2003). They are usually found along the east coast of Scotland during the Summer months. The favourable reference population for white-beaked dolphin is currently unknown (JNCC, 2019).

3.2.11 White-sided dolphin were found throughout Block R of the SCANS survey with an estimated density of 0.010 individuals/km^2 (Hammond *et al*., 2021), with none sighted in Block NS-D of the SCANS IV survey (Gilles *et al*., 2023). Sightings of white-sided dolphin are rare with animals only being seen in three survey blocks in SCANS III (Hammond *et al*., 2021) and five survey blocks in SCANS IV (Gilles *et al*., 2023), all of which were off the north and north-east coast of Scotland. White-sided dolphin is relatively unstudied compared to other cetaceans in throughout UK waters.

3.2.12 Minke whales are geographically wide-ranging and are usually present along the east coast of Scotland during the summer months (June – September) (Reid *et al*., 2003; Hammond *et al*., 2017). Minke whale are found in water depths up to 200 m, usually individually or as pairs but they do form larger groups (up to 15 individuals) whilst foraging. The Southern Trench Nature Conservation Marine Protected Area (NCMPA) has been designated for the protection of minke whale. Specifically, this designated site has the conservation objective 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".

3.2.13 The estimated density of minke whale in the area was 0.0387 individuals/km^2 in SCANS III and 0.0419 individuals/km^2 in SCANS IV which were the highest estimated abundance of minke whale out of all blocks that were surveyed for these surveys (Hammond *et al.*, 2021; Gilles *et al.*, 2023). The favourable reference population for minke whale is currently unknown (JNCC, 2019).

Potential Impacts on EPS

3.2.14 The objective of this risk assessment is to identify the potential for injury and disturbance to EPS from the proposed geotechnical survey activities. This section highlights potential impacts to protected species, including EPS, regardless of their inclusion as qualifying features of protected sites. A summary of proposed survey activities and their potential impacts to EPS is provided in Table 4.

3.2.15 The Marine Scotland (2020) guidance states the following two key factors that have the potential to cause death or injury to an animal:

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

3.2.16 Cetaceans are considered particularly susceptible to these impacts as underwater noise emitted by vessels and the physical presence of the vessels have the potential to cause injury or disturbance to EPS. While some techniques may introduce noise to the marine environment (such as USBL), other activities do not generate sufficient levels of noise to be considered as potential sources of noise-related injury or disturbance to EPS (vibrocores, boreholes and CPT) and have been screened out of the detailed assessment, as indicated in Table 4.

Table 4: Summary of proposed survey activities and their potential impacts on EPS.

Activity/ equipment	Potential impacts	Predicted source levels and frequencies relevant to the marine environment	Further information required as part of the EPS Risk Assessment
Survey vessels			
Noise impacts	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.	Vessel emissions typically range from 150 – 190 dB re 1µPa (root mean squared (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. Mitigation measures set out in Section 4.
Collision risk	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 will be most at risk of colliding with a cetacean whilst moving from port to the survey area and returning to port as this will be when the vessel is travelling at faster speeds.	Yes – Mitigation measures as set out in Section 4 will be used to reduce the risk of collisions.
Geotechnical survey			
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 (National Oceanic and Atmospheric Administration (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 (physical injury or Permanent Threshold Shift (PTS)) (200 – 202 dB re 1µPa) and are audible to all species in the area increasing the risk of 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
Vibrocores	There is strong acoustic coupling between the vibrator and water because the entire apparatus is submerged during operation. The sounds produced consist of a series of impulses corresponding to the movement and impacts of the vibrator on the pipe.	Expected Sound Pressure Levels (SPL_{rms}) generated by vibrocore equipment would be approximately 187.4 dB re 1 mPa @ 1 m (LGL, 2010; Reiser *et al*., 2011). The frequency vibrocores operate at are between 20-30 Hz.	No – although noise generated by vibrocoring may be audible to some species of marine mammals (depending on the frequency), it will not cause disturbance or permanent injury to animals (Southall *et.al.*, 2019).
CPTs	CPTs are used to determine the geotechnical engineering properties of sediments. The device may include a single-phase hydraulic pump motor, which drives the tip of the penetrometer into the seabed to a penetration depth of up to 5m and can emit noise as part of operations.	There is very little published information on the sound pressure levels generated from CPT profiling equipment, either collected from field experimentation or from manufactures specifications. Data from a similar device, deep boring, indicates that SPL levels are typically within the range 118 - 145 dB re 1 mPa @ 1 m at frequency of 120 Hz (Bureau of Ocean Energy Management (BOEM), 2012).	No – although noise generated by CPTs may be audible to some species of marine mammals (depending on the frequency), it will not cause disturbance or permanent injury to animals (Southall *et.al.*, 2019).
Boreholes	Noise emitted by the drilling associated with borehole sampling.	Drilling noises associated with boreholes are non-impulsive sounds with the fundamental frequencies of approximately 45 Hz, and source levels of approximately 155.9 dB re 1mPa @ 1 m (SPL_{rms}) (Huang *et al*., 2023).	No – although noise generated by boreholes may be audible to marine mammals (depending on the frequency), it will not cause disturbance or permanent injury to animals (Southall *et.al.*, 2019).

3.3 Impact Assessment – Underwater Noise

3.3.1 Noise emissions present the highest potential risk of disturbance to cetaceans within the vicinity of the Muir Mhòr geotechnical survey area. Underwater noise has the potential to impact cetaceans, either through injury or disturbance. Injury from noise emissions includes physiological damage to auditory or other internal organs while disturbance can result in temporary or continuous disruption to behavioural patterns such as migration, breathing, nursing, feeding, foraging, socialising, and sheltering.

3.3.2 Vessel strike has a higher likelihood of resulting in injury or mortality to cetaceans than noise emissions and so has also been assessed here.

Types of Noise

3.3.3 According to Southall *et al*. (2019) and NOAA (2018), sound can be categorised into distinct 'types', as detailed in Table 5.

Table 5: Types of sound as defined by Southall *et al.* (2019) and NOAA (2018).

Noise type	Description
Impulsive	Sounds which are short in duration (i.e., less than one second long) and temporary, occupy a broadband bandwidth, and have rapid rise and decay times with a high peak pressure level. This can be further defined as: • Multiple pulsed sound – sound comprising two or more discreet acoustic events in a 24-hour period (e.g., from USBL); and • Single pulse sound – sound comprising a single discreet acoustic event in a 24-hour period (e.g., an underwater explosion).
Non-impulsive	Sounds which may occupy a broadband, narrowband or tonal bandwidth, can be brief, prolonged, continuous, or intermittent in nature, and are not characterised by rapid rise and decay times or a high peak pressure level. Vessel noise would be an example of non-impulsive/continuous sound.

Assessment Criteria – Lethal and Auditory Injury Thresholds

3.3.4 To determine the potential for noise to impact cetaceans, perceived sound levels are compared to available empirically estimated thresholds for injury and disturbance. JNCC *et al.*, (2010) and Scottish Government (2020) recommends using the injury and disturbance criteria proposed in Southall *et al.*, (2007) which is based on a combination of linear (un-weighted) peak SPL and weighted sound exposure levels (SEL). Since publication there has been additional evidence which has led to amendments to the auditory thresholds for injury.

3.3.5 Updated guidance presented in Southall et al. (2019) (from Southall *et al.*, (2007)) uses the same thresholds as presented in the revised NOAA guidance (National Marine Fisheries Service (NMFS), 2018).

3.3.6 Southall *et al.* (2019) present the sound level at which it is expected that a marine mammal may be at risk of experiencing hearing impairment because of the received sound. Hearing impairment, specifically, a change in the hearing sensitivity (or threshold at which a sound

can be detected) can either be temporary (Temporary Threshold Shift; TTS) or permanent (PTS). PTS is considered to be an injury under UK legislation. All experiment studies are limited to identification of TTS-onset, with no studies able to directly identify PTS-onset as this would be unethical; as such, PTS-onset is extrapolated from the measured TTS-onset values. The likelihood of individual animals experiencing PTS and TTS is dependent on both the received sound level and the frequency of the sound received.

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

- (1) Energy-based metric – a measure of the accumulated sound energy an animal is exposed to over a period (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 SEL (SEL_{cum}). The SEL thresholds for PTS therefore consider received noise levels and duration of exposure over a 24-hour period and are weighted to consider the different hearing sensitivities of each function hearing group (see Table 5); and
- (2) Pressure-based metric – referred to as the SPL. This is measured as peak SPL (SPL_{peak}). 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 6: Southall *et al* (2019) cetacean functional groups and PTS/TTS criteria.

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 dolphins)	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

Disturbance

3.3.8 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".

3.3.9 Behavioural disturbance has been assessed using a qualitative approach based on the consideration of factors such as source level, mitigation measures and length of operations. In addition, factors likely to influence interaction between the survey works and cetaceans likely to be present in the survey area is assessed.

3.3.10 European Commission (2007) guidance indicates that a disturbance must significantly impact the local distribution or abundance of a species, including temporary impacts, while guidance proposed by JNCC *et al*. (2010) states 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".

3.3.11 To consider the possibility of a disturbance offence because of the proposed geotechnical survey, it is necessary to consider the likelihood that exposure of the animal(s) produces a response which is likely to generate a significant population-level effect.

3.3.12 Assessment of population-level impacts from a temporary disturbance is complex due to the highly variable nature of the introduced disturbance, the variability of the behavioural response between different species and individuals, and the availability of population estimates for EPS in a given area of the North Sea.

3.3.13 A method for assessing a potential disturbance is to compare the factors the proposed geotechnical survey works are predicted to produce with empirical studies (Southall *et al*., 2007). However, there are currently no agreed thresholds or criteria for modelling the disturbance of marine mammals from underwater noise.

3.3.14 Noise propagation modelling has therefore not been undertaken for this assessment. Table 7 shows a scoring system developed by JNCC *et al*. (2010) where a score of 5 or more on the Southall *et al*. (2007) behavioural response severity scale, could be significant.

Table 7: 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

Response Score	Corresponding behaviours in free-ranging subjects
	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; 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.
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.

3.3.15 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.

3.3.16 The assessment of disturbance by the proposed survey methods incorporates the potential of the behaviours described by Southall *et al*. (2007) that would occur within the limited duration of the geophysical survey activities. As such, the potential for those behaviours to result in a population-level and individual level effect is assessed, the impact on the FCS of any species will then be assessed.

3.4 Assessment of potential Impacts to EPS (Cetaceans)

3.4.1 The results of the impact assessment for the proposed geotechnical survey works within the Muir Mhòr array area and ECC are outlined below in the following sections. The assessment considers both injury and disturbance impact to EPS (cetaceans) under each of the following activities and geophysical survey techniques:

- Vessel activity; and
- USBL.

Vessel Activity

3.4.2 The presence of vessels potentially impacts cetaceans through underwater noise and collision risk. The risk of collision along with the level of noise emitted into the marine environment by a vessel depends on the vessel type, size, mode of propulsion, operational factors, and speed. Different frequencies of sound are emitted from different sizes of vessels, where larger vessels tend to emit lower frequency noise, though this noise tends to fall below several hundred Hz.

3.4.3 Injury to cetaceans is also a risk through collision with survey vessels and this includes blunt trauma to the body or injuries consistent with propeller strikes. The risk of collision 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.

3.4.4 Survey vessels will typically be stationary during geotechnical operations which will allow cetaceans to move away from the vessel if they are disturbed by vessel emissions and/or noise emissions. If an EPS is seen within the direct path of a survey vessel outside of survey times, the survey vessel will slow down to allow the EPS to swim outside of the vessel path. Alternatively, if safe to do so, the vessel will deviate from the intended course to avoid the cetacean in its original path.

3.4.5 Please see Section 4 for further details of mitigation.

Injury Impact

3.4.6 Laist *et al*. (2001) predicted that the most severe injuries resulting from collision are with vessels travelling at over 14 knots, and the probability of lethal injury of a large whale species decreases from 0.79 at a speed of 15 knots to 0.21 at 8.6 knots (Vanderlaan and Taggart, 2007). The risk of collision with a cetacean appears to increase with increased vessel speeds and vessel size. There is also a correlation between increased severity of injury and vessel speed and size.

3.4.7 Given that the geotechnical survey vessels will be typically stationary during geotechnical operations, the potential for collisions only exists when they are in motion (i.e. transiting

to and from sampling location), and as such the risk is low. Furthermore, Van Waerebeek *et al*. (2007) have reported that non-lethal collisions do occur between vessels and marine mammals, suggesting that in the instance of vessel collisions with marine mammals, they are not necessarily always fatal.

3.4.8 In relation to PTS in cetaceans due to vessel noise, Richardson *et al*. (1995) reported that peak emissions that range between 160 – 175 dB re 1µPa, are predicted to impact an animal swimming at a constant speed of 1.5 m/s from the source at zero metres from the vessel. As such, it is 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.

3.4.9 Therefore, it is predicted that there will be no risk of injury to any species of cetacean because of underwater noise from vessels or collision risk from the geotechnical surveys. Consequently, there is no potential to commit an offence with regards injury or impact on the FCS of any EPS and thus no requirement for an EPS Licence in this respect.

Disturbance Impact

3.4.10 Despite noise levels from the geotechnical survey vessels being unlikely to cause physical or auditory injury, they could be sufficient to cause local disturbance to marine mammals that are in close proximity to 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.

3.4.11 Harbour porpoise have been reported to be more sensitive to vessels that produce medium to high frequency noise (e.g., Hermannsen *et al*., 2014). Where porpoise are exposed to vessel noise that contains low levels of high frequencies, they appear to avoid vessels (e.g., Dyndo *et al*., 2015). Wisniewska *et al*. (2018) have also recorded changes in harbour porpoise foraging rates in response to vessel presence, indicating the 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.

3.4.12 Behavioural responses can vary greatly depending on context and as data specific to harbour porpoise is also limited, the distance at which animals may react to vessels is challenging to predict. However, Thomsen *et al*. (2006) documented that harbour porpoise might be expected to respond to geotechnical survey vessels at approximately 400 m.

3.4.13 There is a possibility that responses from marine mammals can arise due to the simple presence of vessels. A study by Graham *et al*. (2019) indicated that harbour porpoise were effectively displaced by approximately 1 km due to the presence of construction vessels which would be of a similar size to geotechnical survey vessels. Pirotta *et al*. (2015) concluded that the response of bottlenose dolphin in the Moray Firth was related to the number of boats present, rather than the levels of overall noise. However, while this study provides evidence that a perception of risk can be related to the presence of boats, silent and stationary boats did not elicit a response.

3.4.14 Although the predicted source levels associated with the survey vessels have the potential to elicit a behavioural response in cetacean species, it would require the vessel noise to be emitted over an extended period to cause a significant disturbance offence as defined

under the Habitats Regulations. As the survey vessels will be moving around the geotechnical survey area, animals within a particular location will not be exposed to extended periods of noise from the vessels.

3.4.15 Due to the temporary and transient nature of the geotechnical survey works, it is 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. Consequently, there is no potential to commit an offence with regards to a disturbance impact on the FCS of any EPS.

USBL

3.4.16 The length of time the USBL systems will be required is dependent on the specific survey activities, however there is potential that a USBL could be used continuously throughout a proposed geotechnical survey works. The potential impacts of continuous sound from USBL equipment on cetaceans that may be present in the survey area are described in the sections below.

3.4.17 The USBL system is used for controlling the position of subsea equipment during the survey, and it operates by emitting a low frequency acoustic pulse between the transponder on the vessel and the transducer on the subsea unit.

3.4.18 The low frequency sound generated by the USBL system are within the hearing range of the cetacean species anticipated to be within the project area. As such, there is potential for USBL survey activities to potentially cause a disturbance response in animals that are present during the proposed geotechnical survey works (JNCC *et al*., 2010).

Injury impact

3.4.19 The USBL is targeted with very small beamwidth and therefore there is limited propagation and risk of injury to marine mammals. Additionally, USBLs are classed as non-impulsive sound sources which reduces the risk of potential injury due to the relatively high thresholds required at which injurious effects would occur (Southall *et al*., 2019). It can be concluded that any injurious zone would therefore be limited to the immediate vicinity of the vessel. Consequently, there would be no risk of injury and any effect would be contained fully within the disturbance area from the presence of the vessel itself (Graham *et al*., 2019).

3.4.20 As such, there is no potential to commit an offence with regards to injury or to affect the FCS of any EPS, or any individuals, through the use of the USBL system. Therefore, there is no risk of offence, and an EPS licence will not be required in this respect.

Disturbance impact

3.4.21 The survey period is anticipated to span up to 75 days. During this time the survey vessel will be sampling, and transiting between the sampling locations, resulting in localised and temporary noise generation.

3.4.22 The utilisation and frequencies of USBLs result in a short propagation distance and therefore the sound is unlikely to impact marine mammals (CSA Ocean Sciences Inc, 2020). It has been demonstrated in CSA Ocean Sciences Inc, (2020) that emitted sound

levels from non-impulsive sound sources, such as USBLs, will attenuate to 120 dB SPL root-mean square (rms) (i.e., 120 dB re 1µPa SPL_{rms}) within 50 m from the source (National Marine Fisheries Service (NMFS), 2018). It can therefore be concluded that any disturbance to marine mammals would therefore be limited to the immediate vicinity of the vessel equipment. Consequently, any small displacement effect would be contained fully within the disturbance area from the presence of the vessel itself (Graham *et al*., 2019) and that the potential for impact on marine mammals at an individual or population level is no greater than that of a transiting vessel.

3.4.23 If the short-term USBL operations resulted in a response by a solitary animal, this would be unlikely to impair the ability of an animal to survive, reproduce or result in any significant impacts to the local population and distribution. There would therefore be no impact on the FCS of any EPS at a population level. However, as there is still a potential for disturbance to EPS at an individual level from USBL, an EPS Licence to disturb is considered to be required.

3.5 Impact Ranges Associated with the Geotechnical Survey

3.5.1 A desk-based review of available data sources has been carried out to determine the estimated impact ranges of geotechnical survey activity on cetaceans. Table 8 indicates the estimated number of EPS that may be impacted by the geotechnical surveys.

3.5.2 Assessment guidance from JNCC for noise disturbance against conservation objectives of SACs designated for harbour porpoise recommends a 5 km effective deterrent range (EDR) for geophysical surveys (which could be interpreted to include USBL, albeit over-precautionarily), based on JNCC *et al*., 2020). This gives an overall coverage of 78.5 km^2 from one potential location (assuming a spherical range) and is considered a conservative estimate based on a study by CSA *et al*. (2020). The number of individuals that could potentially be impacted in and around the survey area is presented in Table 8.

3.5.3 Several studies have indicated that displacement effects of surveys on cetaceans do not have significant impacts and that cetaceans return to survey areas a few hours after displacement (Thompson *et al*., 2013; Pirotta *et al*., 2014). A study by Thompson *et al*. (2013) indicated that noise produced by seismic surveys did not lead to significant displacement over a large spatial scale. Cetaceans were detected within the survey area several hours after displacement and cetacean response levels to the sound from surveys decreased throughout the survey. The results of these surveys indicate that any impacts of the Muir Mhòr geotechnical surveys will be temporary, small-scale, and reversible in nature.

3.5.4 The behavioural response severity scale by Southall *et al*. (2007) (Table 7) has been used as a precautionary approach to the severity of a potential behavioural response and potential behavioural response has been assessed as a 4 or less and are not considered significant in causing disturbance to any EPS in the area. It is concluded that the impacts will not result in any significant disturbance or be detrimental to the maintenance of the population at an FCS within their natural range for any EPS.

3.5.5 The assessment of disturbance to cetaceans in the Muir Mhòr geotechnical survey area is the same for harbour porpoise, common dolphin, white-beaked dolphin, white-sided dolphin and minke whale. This is due to species all being sampled within Block R of the SCANS III survey/Block NS-D of the SCANS IV survey, and all having a significant MU

that covers both the ECC and array area. Bottlenose dolphin being assessed for the array area fall under the GNS MU, whilst the bottlenose dolphin being assessed for the ECC survey are predominantly under the CES MU and so they have different estimates for the survey (Table 8). Using the CES MU will provide a more accurate and worst-case-scenario estimate of the individuals to be impacted by the survey rather than using the larger CGNS MU. Bottlenose dolphins are primarily an inshore species which tends to stay within the coastal inshore waters and so using the CES MU will likely capture the individuals that will be within the Muir Mhòr geotechnical survey area. Where densities differ between SCANS III and SCANS IV, the greatest density has been used for calculations to provide a worst-case scenario. Similarly, where estimated population sizes differ, the smallest population size has been used.

Table 8: Assessment of disturbance to cetaceans off the east coast of Scotland based on a 5 km EDR (78.5 km^2).

Species	Density Estimates (individuals/km^2)	No. of Individuals Within Potential Impact Area	Estimated Population Abundance		% of Population Potentially Disturbed		Potential for Significant Disturbance
			SCANS Survey Block	MU	SCANS Survey Block	MU	
Harbour porpoise	0.599 SCANS III (Hammond *et al.*, 2021)	47.0	38,577 SCANS IV (Gilles *et al.*, 2023)	338,918 North Sea MU (Gilles *et al.*, 2023)	0.122	0.014	No – Less than 1% of North Sea MU or SCANS survey block population temporarily disturbed.
Common dolphin	0.000 SCANS III (Hammond *et al.*, 2021)	0.0	0.000 SCANS III (Hammond *et al.*, 2021)	102,656 Celtic and Greater North Sea (CGNS) MU – (IAMMWG, 2023)	0.000	0.000	No – 0% of GNS MU and 0% of SCANS survey block population.
Bottlenose dolphin	0.0298 SCANS III (Hammond *et al.*, 2021)	2.3	1,924 SCANS III (Hammond *et al.*, 2021)	2,022 GNS MU (IAMMWG, 2023)) - array 195 (CES MU – (IAMMWG, 2015)) - ECC	0.120	0.114 (array) 1.180 (ECC)	No – Less than 1% of the SCANS survey block population (array and ECC) and of the GNS MU population temporarily disturbed (array area). with less than 1.2% for the CES MU population in the ECC.
White-beaked dolphin	0.243	19.1	5,149	43,951	0.371	0.043	No – Less than 1% of CGNS MU or SCANS survey block population temporarily disturbed.

Species	Density Estimates (individuals/km^2)	No. of Individuals Within Potential Impact Area	Estimated Population Abundance		% of Population Potentially Disturbed		Potential for Significant Disturbance
			SCANS Survey Block	MU	SCANS Survey Block	MU	
	SCANS III (Hammond *et al.*, 2021)		SCANS IV (Gilles *et al.*, 2023)	CGNS MU (IAMMWG, 2023)			
White-sided dolphin	0.0100 SCANS III (Hammond *et al.*, 2021)	0.8	644 SCANS III (Hammond *et al.*, 2021)	18,128 CGNS MU (IAMMWG, 2023)	0.124	0.004	No – Less than 1% of CGNS MU or SCANS survey block population temporarily disturbed.
Minke whale	0.0419 SCANS IV (Gilles *et al.*, 2023)	3.3	2,498 SCANS III (Hammond *et al.*, 2021)	20,118 CGNS MU (IAMMWG, 2023)	0.132	0.016	No – Less than 1% of CGNS MU or SCANS survey block population temporarily disturbed.

4 EPS Mitigation Strategy

4.1 Overview

4.1.1 This EPS Mitigation Strategy has been prepared with the intention to reduce injury and disturbances to EPS from the proposed geotechnical survey activities. Survey vessels will be required to adhere to the Scottish Marine Wildlife Watching Code provisions (SNH, 2017a) and all parties contracted as part of the survey works will be made aware of the presence of any EPS within the area.

4.2 USBL Operation

4.2.1 The USBL will be operated at the lowest possible sound levels and over the shortest period to reduce the risk of disturbance to EPS. The survey will also be undertaken within as localised area as possible. This will reduce the potential extent and duration of any possible disturbance.. This will allow any marine mammals within the potential range at which disturbance could occur to swim away.

4.3 Survey Vessel Speed and Course

4.3.1 Survey vessels will typically be stationary during geotechnical operations which will allow cetaceans to move away from the vessel if they are disturbed by vessel emissions and/or noise emissions.

4.3.2 During transition periods between port and the survey area, the vessel will be moving at speeds similar to normal vessel traffic. However, if an EPS is seen within the direct path of a survey vessel outside of survey times, the survey vessel will slow down to allow the EPS to swim outside of the vessel path. Alternatively, if safe to do so, the vessel will deviate from the intended course to avoid the cetacean in its original path.

4.4 Toolbox Talks

4.4.1 As part of routine Toolbox Talks, survey crew will be made aware of all potential EPS that may be encounter during surveys and good practice measures of 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 Table 9 lists projects that are considered to have potential cumulative impacts alongside the geotechnical survey works for this Project. These other projects are derived from publicly available data on the Marine Scotland Information portal.

5.1.2 Cumulative impacts are not expected to arise because of spatial or temporal overlap between projects and all effects of the geotechnical survey are expected to be localised and short-term and therefore not result in significant adverse impacts. There are also no other surveys specific to the Muir Mhòr project that might result in cumulative impacts on EPS.

5.1.3 The PTS impact range is considered low (23 m) according to the Review of Consents for the Southern North Sea SAC which was considering the potential for in-combination effects as a result of geophysical surveys (which could be conservatively assumed to include USBL). According to the Department for Business, Energy & Industrial Strategy (BEIS) (2020), there is no potential for in-combination effects of geophysical surveys being carried out alongside OWF construction activities.

5.1.4 The use of geophysical survey equipment during OWF piling (either a single event or concurrent events) was not considered to significantly increase the area of potential disturbance. This area would also only be temporarily disturbed due to the continual travel of the survey vessel. BEIS (2020) therefore concluded that there would not be any significant effects as a result of in-combination effects of piling and geotechnical surveys (specifically USBL element).

5.1.5 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 geotechnical survey, no EPS will be at risk of injury from these activities.

5.1.6 No cumulative effects are considered likely to arise because of the proposed Muir Mhòr geotechnical survey works with any other project. It should also be noted that the Muir Mhòr array area and ECC are planned to be surveyed sequentially. However, potentially they may be surveyed simultaneously, dependent on vessel availability. No significant cumulative effects are considered likely to arise under either scenario.

Table 9: Potential for Cumulative Impacts.

Project	Licensed Activity	Description and Sound Source	Estimated Impact
Projects within 26 km^2 of the Muir Mhòr OWF survey area			
MarramWind and CampionWind (Shell and Scottish Power Renewables – E2)	This project is in the concept/early planning process.	Timescales for geophysical survey for MarramWind as stated in the Project EPS Risk Assessment are March to September 2023. MarramWind has a Marine Scotland license to undertake Geotechnical survey from March 2023 to 31 December 2024. Timescales for geophysical and geotechnical surveys for CampionWind are not publicly available.	There is no temporal overlap with the Marram Wind geophysical survey. Assuming 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 with MarramWind Geotechnical surveys, and CampionWind geophysical and geotechnical surveys.
Projects from the wider region (Moray Firth, Forth and Tay etc.)			
Hywind Scotland Demonstration	Project has been fully operational since 2017. There are no active EPS Licences for this project, however future applications may be made.	Potential for future presence of vessels undertaking geophysical surveys and geophysical survey equipment deployment.	Geophysical surveys of the array and export cable corridor have been completed. Timescales for geotechnical surveys for Hywind are not publicly available.
Beatrice OWF	Post-construction geophysical surveys.	Beatrice OWF holds an active EPS Licence valid from 07 July 2020 to 31 December 2023. Presence of vessels undertaking geophysical surveys and the	The EPS license for the post-construction geophysical surveys expires on 31 December 2023. A potential temporal overlap with the proposed 2024 geophysical surveys for the Muir Mhòr OWF cannot be confirmed.

Project	Licensed Activity	Description and Sound Source	Estimated Impact
		deployment of typical geophysical equipment.	However, if 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.
	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 decommissioning environmental report states the removal was to be completed in 2022, and the main noise activities are now complete. No cumulative impacts are likely to arise due to no temporal overlap with the 2024 Muir Mhòr Geotechnical survey.
Moray West OWF	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, Side-scan Sonar (SSS), Multi-Beam Echo Sounder (MBES), Sub Bottom Profiler (SBP), single-beam echosounder (SBES), Ultra-High Resolution Seismic (UHRS) and Magnetometer (MAG).	Geophysical surveys of the array area and export cable corridor have been completed.
	Offshore construction.	Jacket and turbine installation. Cable laying.	Construction of the Moray West OWF array and ECC is currently ongoing. Timescales for completion of offshore construction are not publicly available; therefore, a temporal overlap with proposed geophysical surveys at Muir Mhòr OWF cannot be identified. Assuming 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.

Project	Licensed Activity	Description and Sound Source	Estimated Impact
Caledonia OWF (Ocean Winds – NE4)	This project is in the concept/early planning process.	Timescales for geophysical surveys were provided within the EPS licensing documentation as between 17 July 2022 and 17 July 2023. A variation to licence then amended this period to the start of 17 September 2023. The Caledonia OWF geophysical survey involved MBES, SBES, SBP, SSS and UHRS surveys.	There is no temporal overlap with the Caledonia geophysical survey.
Stromar OWF (Falck Renewables, BlueFloat Energy and Orsted – NE3)	Geophysical survey activities of Stromar array and export cable corridor	Stromar OWF currently has an EPS licence for geophysical survey valid from 28 July 2023 to 31 October 2023.	There is no temporal overlap with the Stromar OWF geophysical survey.
Broadshore OWF (Falck Renewables and BlueFloat Energy – NE6)	This project is in the concept/ early planning process.	Timescales for geophysical surveys for Broadshore OWF are not publicly available. It is unknown if there will be geographical overlap with Muir Mhòr	Assuming 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.
Neart na Gaoithe OWF	Offshore Construction Licence valid from 01 July 2020 to 01 July 2023.	Anticipated programme: Casing and Pile Installation (piling). August 2020 – November 2021 Offshore Substation Platform Jacket	Given the distance between the project location from Muir Mhòr OWF survey area is greater than 26 km (largest disturbance impact range), and the anticipated programme indicates no temporal overlap, no cumulative impacts are likely to result.

Project	Licensed Activity	Description and Sound Source	Estimated Impact
		Installation. July 2021 – September 2021.	
Inch Cape OWF	Geophysical survey activities of Inch Cape array and ECC	Inch Cape OWF currently has an EPS licence for geophysical survey valid from 28 April 2023 to 31 October 2023. Use of SBP and USBL.	There is no temporal overlap with the Inch Cape OWF geophysical survey.
Green Volt OWF Innovation and Targeted Oil & Gas (INTOG)	No EPS license in the public domain	Information on timing of geophysical surveys is not publicly available. The planned location of this OWF is north-east of Muir Mhòr and there is potential that there will be overlap between both projects' ECCs.	There is potential for both spatial and temporal overlap of surveys for both projects. Given the planned location of Green Volt OWF, any overlap would likely be small-scale and short-term, as it would likely just be the ECC.
Ossian OWF	Geophysical survey activities of Ossian North and South ECC	Ossian OWF currently has an EPS licence for geophysical survey valid from 7 December 2022 to March 31, 2023.	There is no temporal overlap with the Ossian OWF geophysical survey.

6 Consideration of Likely Significant Effects (LSE)

6.1 Overview

6.1.1 This section of the EPS risk assessment discusses the potential adverse effect that the Muir Mhòr geotechnical survey may have on sites designated for nature conservation in proximity to the survey location. The following sites are near the Muir Mhòr geotechnical survey area and include marine mammals as qualifying features.

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

6.2 Designated Sites

Southern Trench NCMPA

6.2.1 This site is located on the south-eastern corner of the Moray Firth. The inshore region of the site stretches from Buckle to Peterhead. The nearest point to the Muir Mhòr array geotechnical survey area is approximately 40 km and the ECC geotechnical survey area will likely cross the Southern Trench NCMPA. This site protects minke whale, burrowed mud, shelf deeps and fronts. The fronts are the results of cold and warm waters mixing, which create highly productive areas which support the local and regional ecosystem and encourage apex predators including minke whale which are attracted to the fish species brought into the area by the fronts. It is therefore NatureScot's advice that access to the site's resources should be maintained and supporting features should be conserved.

6.2.2 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" [1].

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

Moray Firth SAC

6.2.4 The Moray Firth SAC is located within the inshore region of the Moray Forth from Lossiemouth on the south coast to Helmsdale on the north coast of the Moray Firth. At its closest point to the geotechnical survey area, the Moray Firth SAC is approximately 153 km from the Muir Mhòr array area and 90 km from the Muir Mhòr ECC survey area. The site has been designated for Annex I sandbanks which are slightly covered by sea water at all times (1110) and bottlenose dolphin (1349) (Arso Civil *et al.*, 2021).

6.2.5 The Moray Firth supports the only known resident bottlenose dolphin population in the North Sea, with an estimated 150 individuals which are present year-round. This particular population

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

is known to travel extensively along the eastern Scottish coastline, with individuals travelling to the Firth of Tay, Firth of Forth and as far south as northern England. However, this species tends to stay within inshore waters (2km from the coast).

6.2.6 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 FCS for the qualifying interest".

6.2.7 Owing to the assessment set out in Section 3.3, it is considered unlikely that the Muir Mhòr geotechnical survey will have an impact on the Moray Firth SAC bottlenose dolphin population.

Dornoch Firth and Morrich More SAC

6.2.8 This site has been designated for harbour seal (*Phoca vitulina*) and otter (*Lutra lutra*).The site is approximately 175 km from the Muir Mhòr array area and approximately 115 km from the nearest part of the Muir Mhòr ECC. Seals are not EPS, an assessment in relation to the nearby Dornoch Firth and Morrich More SAC has been included in this report. Otter is an EPS, albeit they are typically associated with coastal/riverine waters (as opposed to the offshore marine environment).

6.2.9 The region is an estuarine system with bordering habitat that includes sand dunes, woodland and small lochans. The River Evelix and River Oykel feed into the site and provide habitat for the population of otters the area supports.

6.2.10 The area supports a significant population of harbour seals (approximately 2% of the UK population) which use sandbars and shores at the mouth of the estuary as haul-out and breeding sites.

6.2.11 The Conservation Objectives of the site ensure that obligations of the Habitats Regulations are met and there will not be significant disturbance to qualifying features and the integrity of the site is maintained. 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).

6.2.12 Otter populations are susceptible to anthropogenic change in habitat as they are dependent on freshwater sources (Roos *et al*. 2015) and the location of holts is therefore restricted. It is not anticipated that the Muir Mhòr geotechnical survey will have a significant impact on this otter population owing to distance from the area and the limited nature of the potential effects.

6.3 Potential Effects

6.3.1 Section 3.4 discusses the potential effects from underwater noise produced by the geotechnical surveys that may disturb qualifying/protected features of the above designated sites. Owing to the mitigation measures that are being implemented (listed in Section 4), the impacts on the sites as a result of the geotechnical survey works would not be significant.

7 Assessment of Potential Offence

7.1.1 The Muir Mhòr geotechnical survey will occur within and out with the 12 nautical mile boundary of the UK. The mitigation measures being implemented here indicate that any potential impacts of the survey work are unlikely to result in harassment, disturbance, injury, or mortality of an EPS as defined under Regulation 39(1) of the Habitats Regulations.

7.1.2 In relation to Regulation 39(2) of the Habitats Regulations, the percentage of the total population which has the potential to be disturbed by the geotechnical survey activity is considered to be negligible (less than 0.4% all cetaceans occurring in SCANS survey blocks and less than 1.18% of the MU of all species (Table 8)). Therefore, the impact is considered to not be detrimental to the maintenance of the population of the species concerned at an FCS. It is also thought that disturbance will be short-term and small-scale in nature.

7.1.3 However, without the application of mitigation, as there is potential to disturb individuals of the EPS species identified, it is therefore assumed that disturbance has the potential to cause an individual level effect and therefore on a precautionary basis, an EPS Licence (to disturb) under Section 39 of the Conservation (Natural Habitats, &c) Regulations 1994 (as amended in Scotland) and under Section 45 of the Offshore Regulations, may be required.

7.1.4 As stated in Section 1.2, three tests must be passed before an EPS licence can be granted, as discussed below.

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

7.1.5 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.

7.1.6 Muir Mhòr meets the Regulation 44(2)(e) requirement listed above as the planned wind farm demonstrates a direct environmental benefit on a national and international scale and complies with national and international environmental policies. There is an overarching requirement for sustainable energy supply from renewables within Scotland subject to national planning and energy policy. The Muir Mhòr OWF will have long-term environmental benefits and will significantly reduce carbon emissions (Scottish Government, 2022).

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

7.1.7 There are no satisfactory alternatives to these proposed geotechnical surveys. Alternative equipment could be used; however, this may limit the effectiveness of the geotechnical surveys and the survey results.

7.1.8 The Muir Mhòr geotechnical surveys are necessary to refine the foundation and landfall design, marine cable routing and associated installation methodologies for the Project.

7.1.9 The key areas where the geotechnical survey results will be used within the EIA are within the baseline characterisation of multiple technical topics. The geotechnical survey will provide information on seabed stratigraphy, rock formations, the mechanical strength, and an indication of soil strength. Additionally, the geotechnical survey results can provide information for coastal processes, benthic ecology, and marine archaeology. This survey is fundamental to ensure a robust EIA is carried out for the Muir Mhòr OWF. It is therefore considered that the 'no satisfactory alternative test' has been met and the Project cannot be safely developed without the survey.

7.1.10 Most importantly, public safety is paramount, and it is not possible to safely construct a wind farm without understanding ground conditions to enable appropriate design and installation of foundation structures or subsea cables, or ensuring there is no UXO present within the area. Should the work not proceed, the completion of the Muir Mhòr OWF would not be possible.

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

7.1.11 The percentage of the reference population of each species which has the potential to be disturbed by use of the geotechnical survey techniques is considered negligible (<1.18% for all species) and, therefore, not detrimental to the maintenance of the population of the species concerned at an FCS level.

8 Conclusions

8.1.1 The conclusions of this EPS risk assessment are as follows:

- The geotechnical surveys will create a very temporary, localised disturbance to EPS in the area. However, the overwhelming benefits that the Muir Mhòr OWF will have to Scotland and the UK's renewable energy contributions are significant and in accordance with Scottish planning policies (e.g., draft NPF4). The proposed development will align with the UK Government's Energy Security Strategy[2] and Scotland's National Marine Plan[3] ;
- A low percentage of the population of EPS in a localised area will be impacted for a short period of time. This disturbance will likely arise because of noise impacts arising from USBL operations which will be *de minimus* in the scale of geophysical or seismic surveys typically carried out;
- Without the application of mitigation, as there is potential to disturb individuals of the EPS species identified, it is therefore assumed that disturbance has the potential to cause an individual level effect and therefore on a precautionary basis, an EPS Licence (to disturb) under Section 39 of the Conservation (Natural Habitats, &c) Regulations 1994 (as amended in Scotland) and under Section 45 of the Offshore Regulations, may be required.
- Potential cumulative impacts have been considered for both existing and projects in development and it has been concluded that no potential cumulative impacts will result from the Muir Mhòr geotechnical surveys and other projects. The assumption has been made that all future projects will have mitigation in place to reduce the potential to cause injury. It is also assumed that, similarly to this project, the predicted impact level resulting from disturbance will be temporary and localised in nature;
- There is no potential for injury or disturbance to EPS in the vicinity of the geotechnical survey works where there is a designated nature conservation site.

8.1.2 In conclusion, the impacts are not considered to cause significant long-term disturbance or be detrimental to the FCS of EPS within the region. An EPS Licence is 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.

8.1.3 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.

[2] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1069973/british-energy-security-strategy-print-ready.pdf

[3] 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 1. Basking Sharks

A1.1 Basking sharks (*Cetorhinus maximus*) are not an EPS; however, they are protected under Schedule 5 of the Wildlife and Countryside Act. Schedule 5 of this Act prohibits the killing, injuring or taking of basking sharks. Further to this, the Nature Conservation (Scotland) Act 2004, Part 3 and Schedule 6 amend the Act by prohibiting 'reckless' acts and make it an offence to deliberately harm or harass a basking shark. A Basking Shark Licence would therefore be required for any survey activity that would disturb basking sharks.

A1.2 Basking sharks are only very rarely present within the North Sea area (Paxton *et al*., 2014). The basking shark is an elasmobranch (sharks and rays) which is a group with generally low sensitivity to noise vibrations because they do not have a swim bladder. The hearing range of basking sharks is not known; however, five other elasmobranchs have been found to have a hearing range between 20 Hz to 1 kHz although it is unclear if that range is equally applicable to basking sharks (Macleod *et al*., 2011). As 20 Hz – 1 kHz only encompasses a small proportion of the noise emitted during the proposed geotechnical survey and the activities are of short duration, noise disturbance is not expected to impact basking sharks.

A1.3 Vessel collision also poses a threat to this slow-moving species. Collision risk increases with increasing vessel speed. However, as the survey vessels will be slow-moving and stationary for a large proportion of the sampling campaign (whilst data is collected), the potential for collision risk is generally low.

A1.4 On this basis and considering information on their known distribution, it is considered extremely unlikely that interactions with basking sharks will occur, hence the potential for the proposed survey activities to result in intentional or reckless disturbance or harassment of this species is equally limited. As such, no basking shark licence is required.