Project:

130355 Orkney Mainland HVAC 220 kV Subsea Link

Document title:

EPS and Basking Shark Risk Assessment (GVI survey and Mattress Installation)

Scope:

The objective of this report is to assess the potential impact of the offshore survey programme and associated concrete mattress installation activities, including the use of a temporary 4-point mooring system, on European Protected Species (EPS) and Basking Shark along the Orkney to Mainland Scotland cable route in order to determine the need for an EPS licence under Annex IV of the Habitats Directive (Council Directive 92/43/EEC).

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1 Introduction

1.1 Introduction Orkney Mainland Project

SSEN (Employer) has awarded Nexans Norway AS (Contractor) a Contract for engineering, manufacturing, installation and trenching of a 70 km HVAC 220 kV Subsea & Land cable, including fibre from the new substation near Finstown on the Orkney main island to the new Dounreay West substation on the north coast of Scotland, see Figure 1-1 for details.

The Orkney Islands represent a major source of renewable electricity potential, and its new connection to the mainland will help decarbonise the UK's electricity production and also secure a better transmission infrastructure between the Scottish mainland and Orkney.

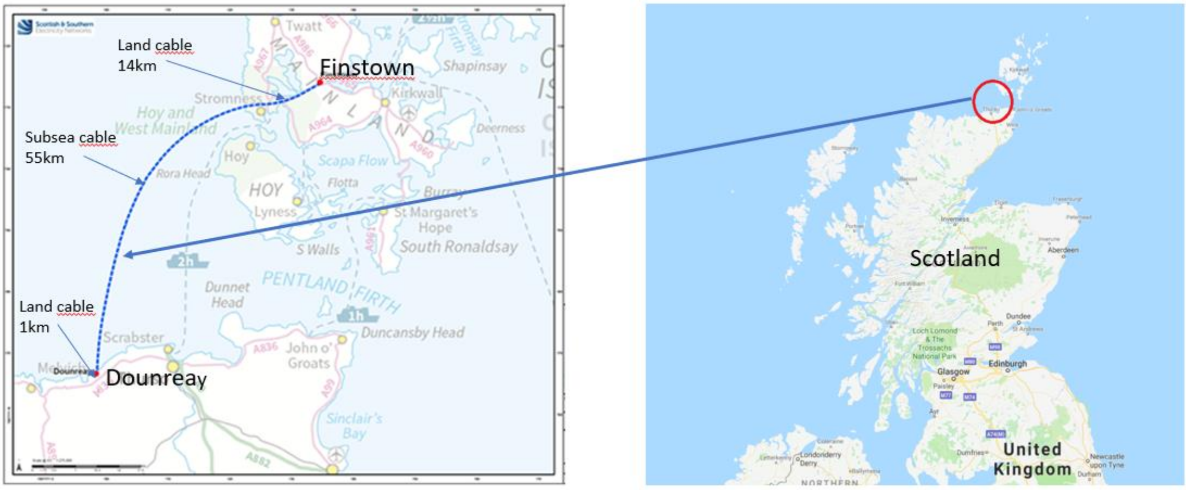

Figure 1-1: Project Description

Nexans have undertaken a pre-lay engineering survey, including a UXO survey, of the cable routing corridor to acquire geophysical data and to identify the presence of potential unexploded ordnance (pUXOs) along the proposed route.

Nexans are now planning a General Visual Inspection (GVI) survey to complement the previously acquired data. The aim is to visually inspect and document subsea cables, mooring lines, fishing nets, hazards, and other components along the route. An optional scope of surveys is also being considered, to generate using high resolution geophysical equipment, a detailed, georeferenced 3D model of the seabed surface and to complete any gaps in the data previously collected. As the previous surveys have identified two known cable crossings and an unknown linear feature, Nexans is anticipating that the scope of the surveys will include these cable crossings, using a cable tracking system. Surveys will be undertaken using equipment deployed from a Remotely Operated Vessel (ROV).Subsequent construction work may involve localised concrete mattress installation at discrete locations where additional seabed protection is required, for example at cable crossings.

1.2 Introduction of document

The objective of this report is to assess the potential impact of the GVI and associated geophysical surveys and mattress installation activities on European Protected Species (EPS) and Basking Shark along the Orkney to Mainland Scotland cable route in order to determine the need for an EPS licence under Annex IV of the Habitats Directive (Council Directive 92/43/EEC).

This report has been prepared to support an application to the Marine Directorate - Licensing Operations Team (MD-LOT) for an EPS Licence and Basking Shark Licence for the proposed GVI and associated geophysical surveys, including any surveys associated with the mattress installation. For the purposes of this assessment, ‘mattress installation activities’ include the localised deployment and positioning of concrete mattresses and any associated vessel station-keeping arrangements, including temporary mooring operations, insofar as these activities may introduce relevant impact pathways (vessel presence and movement, underwater noise generation and the potential for physical interaction).

2 Terms and Abbreviations

Term	Definition
Employer	SSEN – Scottish and Southern Electricity Networks
Contractor	Nexans Norway AS

Abbreviation	Elaboration
AC	Alternating Current
ADCP	Acoustic Doppler Current Profiler
CI	Confidence Interval
dB	decibel
dB_{ht}	dBs referenced to hearing threshold
DPS2024	Development Plan Scheme 2024[1]
EMEC	European Marine Energy Centre
EPS	European Protected Species
EU	European
GVI	General Visual Inspection
HDD	Horizontal Directional Drilling
HF	High Frequency
HV	High Voltage
HVAC	High Voltage Alternative Current
Hz	hertz
IAMMWG	Inter-Agency Marine Mammal Working Group
ICOL	Inch Cape Offshore Limited
JNCC	Joint Nature Conservation Committee
kHz	kilohertz
km	kilometre
km^2	squared kilometre
kN	kilonewton
Kts	knots
kV	kilovolt
LDP	Local Development Plan

[1] Refers to the drafting of the new Orkney Islands Council Local Development Plan

Abbreviation	Elaboration
LF	Low Frequency
m	metre
m^2	squared metre
MBES	Multi-Beam Echo Sounder
MD-LOT	Marine Directorate – Licensing Operations Team
MMO	Marine Mammal Observer
NMFS	National Marine Fisheries Service
PAM	Passive Acoustic Monitoring
PMF	Priority Marine Features
PTS	Permanent Threshold Shift
pUXO	Potential Unexploded Ordnance
rms	root mean square
ROV	Remotely Operated Vehicle
RSK	RSK Environment Ltd
SPL	Sound Pressure Level
SSEN	Scottish and Southern Electricity Networks
TTS	Temporary Threshold Shift
UK	United Kingdom
US	United States
USBL	Ultra Short BaseLine
UXO	Unexploded Ordnance
VHF	Very High Frequency
μPa	micro pascal

3 Project Description

The subsea cable routing corridor is proposed to be approximately 52 km long, 400 m wide and follows a broadly southwest alignment from Warebeth, Orkney, across the western approaches to the Pentland Firth to Dounreay, Caithness. The details of this project can be found under the Marine License application: MS-00010803.

3.1 GVI survey

This assessment will consider a wider corridor than in MS-00010803 to allow for vessel turnarounds. The full length of the survey corridor is shown in Figure 3-1. The equipment that will be used in the proposed surveys is described in the following sections. Survey equipment is to be deployed from the hull or an ROV or similar equipment. The equipment with the potential to impart a significant subsea acoustic signature is presented in Table 3.2.

3.1.1 Summary of Survey Scopes

The proposed period for the survey window is between 1 March and 30 September 2026 with an expected duration of 30 days (including all the optional survey scopes), including local mobilisation, transit, survey and local demobilisation.

The contractor that will be employed for the proposed GVI and associated geophysical surveys is still to be determined. Therefore, in order to undertake a robust assessment, all the vessels proposed by multiple candidate contractors have been described in Table 3.1. It should be noted that the survey scope will likely involve a single survey vessel. Mobilisation and demobilisation could potentially occur from a number of ports, but are expected to occur from Scrabster, Stromness, Aberdeen, Ivergordon or Haugesund.

Table 3.1: Anticipated offshore survey vessel specification and characteristics.

Vessel	Length (m)	Beam (m)	Gross Tonnage	Draught (m)	Max Survey Speed (Kts)	Max Speed (Kts)
TBC	25	6-11	92- 149	2	6	28
TBC	78	15	2051	5.3	6	14
TBC	27.70	12.45	178.8	2.85	6	NA
TBC	85.3	18	4398	6.8	10	15
TBC	79.67	16.4	4071	6.22	9.5	14
TBC	93.8	20	4902	6.5	10	15.5
TBC	95	20.5	5947	7	11.5	14.5
TBC	122.4	22	9423	7.3	10	NA
TBC	98	19.8	8552	8	NA	15.5

Note: Where specific vessels have not yet been confirmed, survey parameters (e.g. speed, duration, equipment use) represent reasonable worst-case assumptions based on typical survey vessels used for comparable offshore geophysical surveys.

The survey corridor is likely to extend to 200 m either side of the routing corridor centreline. This configuration ensures adequate coverage for vessel manoeuvring during turnarounds, particularly for the larger vessel under consideration that requires additional space to complete their operations safely and efficiently. If a potential laying hazard is identified during the survey, a deviation from the planned route for micro routing may be required to ensure safe cable installation.

3.1.2 Scope of work

3.1.2.1 GVI survey

The surveys will be conducted using survey sensors and camera systems deployed from an ROV. The base case will be the GVI survey which will be conducted along the cable route from the 20 m bathymetry line near Warebeth to the 20 m bathymetry line near Dounreay, in order to establish the condition and the seabed configuration. The survey will provide detailed visual data of the seabed, focusing on complex areas such as boulder fields, sediment boundaries, and partially buried features. It will also confirm boulder sizes and identify fishing gear or other hazards previously identified but not precisely mapped during the pre-lay survey. The GVI will be performed using an ROV equipped with Ultra Short BaseLine (USBL) positioning systems. High-definition cameras will capture still images and video to verify seabed conditions and support engineering assessments.

3.1.2.2 Optional Geophysical Survey Scope

In addition to the GVI base scope survey the ROV may be equipped with Multi-beam Echosounder (MBES), sensors that may be used to provide additional survey data within the cable survey corridor.

The ROV will be equipped to deploy MBES, and a magnetometer to provide additional route data if required. The equipment will deliver high-resolution data to assess seabed morphological conditions, including boulders, crossed cables, debris, and other features critical for cable installation planning. The ROV will potentially provide real-time video documentation of the route centreline to identify potential obstacles and cable lay hazards. The MBES system will complement the visual survey by delivering detailed bathymetric data, supporting route optimisation and hazard assessment and will produce a high-resolution digital terrain model.

The GVI survey scope may be extended into the nearshore waters close to the landfall on Orkney between the 20m bathymetry line near Warebeth to the horizontal directional drilling (HDD) pop-out. In these nearshore waters the survey may also acquire overlapping high-resolution still images to create a detailed, georeferenced 3D model of the nearshore seabed surface. This method is particularly useful in nearshore areas or over complex substrates where precise visual characterisation is required. The resulting model will support cable on-bottom stability analysis by providing accurate seabed morphology and texture data. As mentioned the survey will cover the section from the HDD pop-out at Warebeth to the sandy seabed at approximately 20m below Chart Datum.

A further extension to the scope of the survey works will include more detailed surveys at cable crossings. For this scope the ROV will be equipped with a cable tracking system and will include further use of a magnetometer, MBES, DVL and USBL positioning. Two known in-service cable crossings, Northern Lights and Farice, and one unknown linear feature, which will be treated as an additional crossing will be investigated. The objective is to determine the exact position and burial depth of these features. The ROV mounted survey equipment is a compact subsea system that provides accurate, real-time 3D positioning of subsea cables using magnetic survey sensor technologies either fluxgate, magnometers or gradiometers, and inclinometers, detecting energized or tone-bearing cables. Data is collected subsea and transmitted to the surface for integration into the survey workflow. This system is ideal for depth-of-burial measurements, as-built verification, and fault location in challenging offshore environments.

Lastly we may also install temporary acoustic doppler current profilers (ADCPs) on the seabed to measure seabed currents for laying operations risk mitigation.

Figure 3-1: Offshore cable routing corridor. Source: CES (2024)

3.1.2.3 Underwater Noise Sources associated with the pre-lay survey scope

The geoelectrical measurements and magnetometers do not generate significant levels of noise to be considered as potential sources of noise-related injury or disturbance to EPS [27].

Indicative survey equipment systems with the potential to impart significant underwater acoustic signatures are presented in Table 3.2. The equipment outlined in Table 3.2 are considered representative of the equipment required for the proposed surveys even if the specific model changes. Frequencies and peak source intensities show a range within which the equipment used would fall. The equipment in Table 3.2 will be deployed from the ROV unless otherwise indicated.

Table 3.2: Parameters of indicative noise producing geophysical survey equipment.

Survey Equipment	Device(s)	Frequency (kHz)	Estimated Noise Level SPL (dB re 1 µPa @ 1 m)
Multi-beam Echosounder (MBES)	R2Sonic 2024	200-400 or 700	191 (rms); 221 (peak)
	Kongsberg EM2040	200-400	217
	Kongsberg EM124	10.5 - 13.5	230 (rms); 240 (peak)
	Imagenex Model 837BXi "Delta T"	260	200
	Gemini 720is	720	~215–230 (estimate)
	Tritech Gemini 1200ikd	720 or 1200	~215–230 (estimate)
	Norbit WBMS X	200-700	~210–230 (estimate)
Ultra Short BaseLine (USBL) Underwater Positioning	Exail GAPS M7 and AAE transponder	21.5–30.5	191
	Sonardyne MicroRanger	30–60	~190–200 (estimate)
	Dual Kongsberg HIPAP 502	21-31	~190–200 (estimate)
	Sonardyne Mini-Ranger 2/ Sonardyne Wideband® Nano Transponder	20–34	175- 184
	Sonardyne HPT 3000 Transceiver	20-34	194
DVL	Waterlinked A50	1000	<190 (rms)
	Nortek Signature VM 100 ADCP/DVL	70-120	210 (rms); 225 (peak)
	Sonardyne SprintNav-mini INS	200-500	~190–200 (estimate)
	Sonardyne Syrinx DVL	400 or 600	217 (estimated)
ADCP	Nortek AWAC	~400, 600 or 1000	~213-220 (estimated)

An increase in anthropogenic noise has the potential to affect cetaceans (whales, dolphins and porpoises) (most relevant EPS in the area, Section 5.1) occurring in the survey area due to the sensitivity of cetacean hearing. As sound travels much further underwater compared to airborne noise, the resulting effects on cetaceans can be at distance from the sound source. The following sections describe how the acoustic signature from the proposed primary survey sensors and from the vessel itself typically propagate through the water column.

Multibeam Echo Sounder (MBES)

MBES are commonly used to create densely-sampled digital terrain models that can be used to further define topography with detailed seabed information.

MBES transmit sound energy and analyse the return signal (echo) that has bounced off the seafloor or other objects. This is done by emitting sound waves from directly beneath a vessel's hull/ ROV (or similar) to produce fan-shaped coverage of the seafloor. The MBES system records the time taken for the acoustic signal to travel from the transmitter (transducer) to the seafloor (or object) and back to the receiver. MBES produce a “swath” of soundings (i.e. depths) to ensure full coverage of an area. The coverage area on the seafloor is dependent on the depth of the water, with coverage typically being two to four times the water depth.

The MBES systems that are mounted on ROV platforms can acquire high-resolution bathymetric data in a number of situations, which can include areas where directly mounted vessel-based systems cannot operate effectively, such as in shallow or complex environments. The ROV MBES operates similarly to vessel-mounted MBES but benefits from closer proximity to the seabed, resulting in improved resolution. These systems are used for detailed mapping of seabed features, pipelines, and structures.

Ultra-Short Baseline (USBL) Positioning Systems and Transponder Beacons

USBL positioning systems and transponder beacons are used to monitor the position of any remotely operated equipment. These will only be used when the towed or remotely operated equipment is in operation. As soon as these are recovered on the deck of the vessel, the vessel’s USBL can be switched off.

The USBL transceiver mounted on the vessel transmits an acoustic pulse that is detected by the transponder mounted on the subsea equipment (e.g. towed magnetometer). The subsea transponder replies with its own acoustic pulse, which is detected by the shipboard transceiver. The two units work together to communicate the towed devices position relative to the vessel.

A USBL transponder may be placed on the seabed to facilitate calibration of the USBL.

Ship-Based Navigation System

Ship-based navigation systems are used to provide accurate vessel position, heading, and attitude information during marine survey operations. This data is essential for integrating measurements from acoustic sensors such as multibeam echosounders, side-scan sonar, and USBL systems, ensuring that all survey data is correctly georeferenced and meets required accuracy standards.

These systems typically combine Global Navigation Satellite System data with inertial measurements to deliver continuous and reliable positioning, even in challenging conditions such as poor satellite coverage or vessel motion. This integration allows for precise navigation and data acquisition throughout the survey.

Ship-based navigation systems operate at very low acoustic frequencies (around 200 Hz) when transmitting corrections or synchronisation signals to other onboard systems. These signals are minimal compared to active sonar systems and are not considered significant contributors to underwater noise. The primary function of these systems is data integration and navigation rather than seabed mapping or profiling.

DVL

DVL systems are used to measure the velocity of a subsea vehicle relative to the seabed or water column. They emit acoustic beams downward and calculate Doppler shifts in the returned signals to determine speed and direction. DVLs are critical for navigation of and ROVs, providing precise positioning when GPS signals are unavailable underwater.

ADCP

An Acoustic Doppler Current Profiler (ADCP) is an underwater instrument that measures water current velocities over a range of depths. It works by emitting sound pulses into the water and listening for echoes that bounce off particles suspended in the water. Using the Doppler effect—the change in frequency of the returned sound waves caused by the movement of these particles—the ADCP calculates the speed and direction of water currents at different depths, creating a vertical profile of current flow. ADCPs can be mounted on the seabed, on buoys, or on vessels, and are widely used in oceanography, environmental monitoring, and marine engineering.

Vessel

The proposed survey programme will add additional vessels into the offshore marine environment along the cable route corridor. Therefore, it will potentially increase levels of anthropogenic noise.

Noise varies from vessel to vessel but is a continuous noise source; different vessels will generate different frequency characteristics and sound levels depending upon factors such as the propulsion system they are using.

3.2 Concrete Mattress installation

Prior to cable installation, concrete mattresses will be installed as protection to pre-existing cables identified along the cable route during the geophysical and GVI surveys. This is currently estimated to have a duration of 30 days and to take place during spring or summer 2026. Mobilisation is expected to take place from either Kirkwall, Scrabster, Aberdeen, Ivergordon or Haugesund. The contractor for the installation of the concrete mattresses has not been determined at the time of writing.

3.2.1 Mooring Installation

Depending on the contractor appointed, the first stage of the mattress installation will consist of installing the mooring system for the mattress installation vessel. This will apply only to the first vessel listed in Table 3.4; the other vessels will not need to be moored prior to the mattress installation. The vessels described in Table 3.4 are potential vessels proposed by the installation contractor candidates. In the event that moorings are required, it is likely that a single vessel will undertake the mooring installation works. Upon arrival at the site, the crew will prepare the mooring clump assembly for deployment. Drop camera deployment will be performed if the mooring clumps are 50 meters or closer to any submerged object, or if requested by Nexans. A drop down camera will then be connected to the vessel crane wire and deployed over the bow roller. Once the drop down camera view confirms that the seabed is clear of any obstruction, the camera will be recovered to deck and stowed. The following step is the mooring clump deployment via the crane. The mooring clump will be attached to a mooring buoy via a ground chain followed by a riser wire. The operation will be repeated 4 times per location at a total of two locations.

The four-point mooring spread is used as it is easy to deploy, causes minimal disturbance to the seabed and creates a very secure working area for the works, allowing vessels to hold their position for accurate positioning during the installation of the concrete mattresses.

Depending on the contractor selected to install the concrete mattresses, the mooring system may not be required as a DP vessel may be used, which will negate the use of a 4 point mooring system.

Table 3.3 Anticipated offshore mooring installation vessel specification and characteristics

Vessel	Length (m)	Beam (m)	Gross Tonnage	Draught (m)	Max Survey Speed (Kts)	Max Speed (Kts)
TBC	30.17	13.45	430	3	6	10

After deployment of the mooring system is complete, a line boat will be lifted over the vessel to complete final line handling and adjustment as required.

At the end of the mattress installation process, the mooring system will be demobilised.

3.2.2 Mattress installation

The second stage is the concrete mattresses at both cable crossings for cable stabilisation and protection. Once the vessel (see Table 3.4 for potential vessels) is on site, it will be positioned in close proximity to the crossings. If the first vessel in Table 3.4 will be used, the vessel will be moored on the 4-point mooring spread and in close proximity to the crossings or will be positioned using DP. 6 concrete mattresses, 3 per cable crossing, will be lowered down via a deployment frame attached to the vessel crane rigging. A camera and beacons are deployed on the deployment frame.

Table 3.4 Anticipated mattress installation vessel specification and characteristics

Vessel	Length (m)	Beam (m)	Gross Tonnage	Draught (m)	Max Survey Speed (Kts)	Max Speed (Kts)
TBC	30.17	13.45	430	3	6	10
TBC	85.3	18	4398	6.8	10	15
TBC	79.67	16.4	4071	6.22	9.5	14
TBC	93.8	20	4902	6.5	10	15.5
TBC	95	20.5	5947	7	11.5	14.5
TBC	122.4	22	9423	7.3	10	NA
TBC	98	19.8	8552	8	NA	15.5

The mattress laying operations across both cable crossings are detailed in Table 3.5.

Table 3.5 Orkney HVAC Cable Crossings

Description	Cable type	Eastings	Northings	Water Depth (m)
Northern Lights	FO Cable	466658.0799	6515143.159	66
Farice	FO cable	462428.3679	6511086.268	87

3.2.2.1 Underwater Noise Sources associated with the concrete mattress installation work scope

Indicative survey equipment systems with the potential to impart significant underwater acoustic signatures are presented in Table 3.6. As the contractors for the mattress installation operations have not be yet determined a range of equipment specifications has been included,

Table 3.6 Parameters of indicative noise producing equipment used during the mattress installation

Survey Equipment	Device(s)	Frequency (kHz)	Estimated Noise Level SPL (dB re 1 µPa @ 1 m)
MBES	Norbit i77h Winghead	200-700	<224
	R2Sonic 2024	200-400 or 700	191 (rms); 221 (peak)
	Kongsberg EM2040	200-400	217
	Kongsberg EM124	10.5 - 13.5	230 (rms); 240 (peak)
	Imagenex Model 837BXi “Delta T”	260	200
	Gemini 720is	720	~215–230 (estimate)
	Tritech Gemini 1200ikd	720 or 1200	~215–230 (estimate)
	Norbit WBMS X	200-700	~210–230 (estimate)

Survey Equipment	Device(s)	Frequency (kHz)	Estimated Noise Level SPL (dB re 1 μPa @ 1 m)
SVP	Norbit-branded AML 24014-1	200-700	~190 (estimate)*
Mattress Frame Beacon	Mini-Ranger 2	20-34 kHz	184-202

*Actual specification is unknown, figure based on equivalent available information.

As specified in section 3.1.2.3, elevated levels of human-generated noise may affect cetaceans present within the mattress installation area, given their highly sensitive auditory systems. The sections below describe the propagation characteristics of underwater sound arising from the proposed mattress installation equipment and from the installation vessel within the water column.

Beacons

Four beacons will be installed on each corner of the deployment frame, lowering down the concrete mattresses. These beacons allow crew members to decide the deployment location by assessing the live signals from the corners of the deployment frame. Transponder beacons mounted on the offshore deployment frame are used to monitor the position of any towed or remotely operated equipment during operations. These beacons are only active while the deployment frame or associated equipment is in operation. Once the equipment is recovered to the deck of the vessel, the beacons can be switched off.

The beacons emit acoustic signals that are detected by the vessel's positioning or tracking system. These signals allow the location of the deployment frame and associated subsea equipment to be monitored relative to the vessel throughout the operation.

MBES

Multibeam sonar equipment mounted on the vessel is used to collect seabed bathymetry and seabed feature data during offshore operations. The system is only operated while survey activities are being undertaken and is switched off once survey operations are completed.

The MBES transducer includes an integrated sound velocity (SV) sensor to support initial beamforming. To acquire the required data coverage, the vessel will carry out several survey runs over the structure using a multibeam sonar equipment, transmitting acoustic pulses toward the seabed and receiving the reflected signals for processing.

SVP

A sound velocity profiler (SVP) is used to measure the variation of sound velocity through the water column during survey operations. The SVP is only deployed when required to support acoustic data acquisition and is recovered once measurements are completed.

The SVP operates by emitting short-duration acoustic pulses as it is lowered through the water column and by recording the return signals to calculate sound velocity at different depths. These acoustic signals generate low-level, intermittent noise within the water column for the duration of the deployment. The noise produced is localised, temporary, and limited to the immediate vicinity of the profiler, and is considered minor when compared to other acoustic survey systems operating from the vessel. The SVP data are used to correct and calibrate acoustic survey datasets, contributing to improved accuracy of seabed mapping and positioning results.

Vessels

The proposed mattress installation workscope will add additional vessels into the offshore marine environment along the cable route corridor. Therefore, it will potentially increase levels of anthropogenic noise. Noise varies from vessel to vessel but is a continuous noise source; different vessels will generate different frequency characteristics and sound levels depending upon factors such as the propulsion system they are using. During mattress installation works there will also be additional low levels of plant noise from the vessels involved during lifting / lowering operations.

One of the contractors currently under consideration has indicated that they would not utilize the mooring system for their operations. Instead, their vessel would rely on dynamic positioning. As a result, if this contractor is selected, the mooring installation phase would not take place. It is important to note, however, that the use of dynamic positioning generally results in higher levels of underwater noise due to the thruster activity, which may increase noise emissions into the marine environment.

4 Legal Requirements

4.1 Marine Mammals

All species of cetacean in waters around the UK are considered EPS under Annex IV of the European (EU) Habitats Directive (Council Directive 92/43/EEC on the conservation of natural habitats and of wild flora and fauna). The Conservation (Natural Habitats, &c.) Regulations 1994 (as amended in Scotland ; known as the Habitats Regulations) transposes the Habitats Directive into Scottish Law, and the species listed in Annex IV of the Directive are listed in Schedule 2 of these Habitats Regulations. The Habitats Regulations covers Scottish inshore waters (within 12 nm of the coast).

The Habitats Regulations state, under Regulation 39 (1), "that it is an offence to:

a) deliberately or recklessly capture, injure, or kill a wild animal of an EPS

b) deliberately or recklessly –

i. harass a wild animal or group of wild animals of an EPS

ii. disturb such an animal while it is occupying a structure or place which it uses for shelter or protection

iii. disturb such an animal while it is rearing or otherwise caring for its young

iv. 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

v. 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

vi. 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

vii. disturb such an animal while it is migrating or hibernating."

Regulation 39 (2) provides that it is an offence to "deliberately or recklessly disturb any dolphin, porpoise or whale (cetacean)".

It is therefore an offence to disturb, capture, injure or kill deliberately or recklessly disturb a single cetacean in Scottish inshore waters.

If it is determined that an activity would cause an offence under Regulation 39, a licence may be granted which would allow otherwise illegal activities to go ahead in certain specified circumstances.

Three tests must be passed before a licence can be granted:

- The licence must relate to one of the purposes referred to in Regulation 44.
- There must be no satisfactory alternative (Regulation 44 (3a)).
- The action authorised must not be detrimental to the maintenance of the population of the species concerned at a Favourable Conservation Status in their natural range (Regulation 44 (3b)).

4.2 Basking Shark

While basking shark (*Cetorhinus maximus*) are not listed as Annex II or Annex IV species under the EU Habitats Directive, they are given full protection for all coastal waters up to 12 nm under Schedule 5 of the Wildlife and Countryside Act 1981. Under Schedule 5, it is an offence to:

- Intentionally or recklessly kill, injure or take fish.
- Possess or sell fish.
- Intentionally or recklessly disturb or harass fish.

The Nature Conservation (Scotland) Act 2004 enhances this protection, making it an offence for any activity to deliberately or recklessly capture, kill, injure or disturb any basking shark (or dolphin, whale or porpoise). Additionally, basking shark are considered a mobile Priority Marine Feature in Scottish territorial water.

As such, activities in Scottish inshore waters with the potential to disturb basking shark must obtain a Basking Shark Licence to undertake works.

4.3 Guidance

In July 2020 the Marine Directorate[2], in conjunction with NatureScot[3], produced an update of the guidance document (entitled 'The protection of Marine European Protected Species from injury and disturbance'), for Scottish inshore waters [4]. This document relates to Regulation 39 (2) in the Habitats Regulations.

The Marine Directorate recognises that this guidance, which relates to Scottish inshore waters, represents a very precautionary approach to the interpretation of the EU Habitats Directive with regards to EPS '…This guidance reflects a precautionary approach…', and requires careful examination of the potential impacts of proposed offshore activities, and the resultant noise produced, on individual animals likely to be present at the location.

The guidance states that the two main potential causes of death or injury are physical contact (with a vessel) and anthropogenic noise.

Likelihood of disturbance for individuals includes factors such as:

- Spatial and temporal distribution of the animal in relation to 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).
- The motivation of the animal to remain within the areas (e.g. food availability).
- Duration of the activity.

Assessment of likelihood of potential impacts should include the following considerations:

- Type of activity.
- Duration and frequency of the activity.
- Extent of the activity.
- Timing and location of the activity.
- Other known activities in the area at the same time.

[2] At the time operating under the name Marine Scotland.

[3] At the time operating under the name Scottish Natural Heritage.

5 European Protected Species

Cetaceans, some species of marine turtles, otter (*Lutra lutra*) and sturgeon (*Acipenser sturio/Acipenser oxyrinchus*) are the marine EPS listed within the Habitats Regulations, although sturgeon is not thought to be present in the survey area and marine turtles are occasional visitors, as described in Section 5.3 below. This assessment focuses on cetaceans and, where necessary, otters.

While grey seals (*Halichoerus grypus*) and harbour seals (*Phoca vitulina*) are likely to be present in the survey area, are included on Annex II of the EU Habitats Directive and are Scottish Priority Marine Features (PMFs), they are not EPS. Seabirds are also not classified as EPS and have their own protection under other regulations. Therefore, these species are not assessed further in this document.

5.1 Cetaceans

A total of 19 cetaceans are known to occur within the northern North Sea [5]. Cetacean presence within the survey area has been informed by a combination of large-scale survey programmes and regionally specific sightings datasets. Large-scale offshore context is provided by SCANS-IV data; however, recognising the limited coverage of inshore waters and the nature of these surveys, additional presence data specific to Orkney has been used. These include long-term shore-based sightings from Whale and Dolphin Conservation Shorewatch, effort-based records from the Sea Watch Foundation, and regional research outputs from the Orkney Marine Mammal Research Initiative (OMMRI). These datasets confirm regular cetacean use of Orkney waters, including in nearshore areas, and are considered appropriate for confirming species presence, although they do not provide quantitative density estimates.

The survey area overlaps with Small Cetaceans in European Atlantic waters and the North Sea (SCANS)-IV Block CS-K where an abundance and density estimates of four cetaceans have been recorded [6]:

- Harbour porpoise (*Phocoena phocoena*).
- Risso's dolphin (*Grampus griseus*).
- White-beaked dolphin (*Lagenorhynchus albirostris*).
- Minke whale (*Balaenoptera acutorostrata*).

Abundance[4] and density estimates calculated in [6] for species recorded within Block CS-K are outlined in Table 5.1.

Table 5.1: Abundance and density estimates to cetacean species within Block CS-K.

Species	Abundance (CI low–CI high)	Density (animals per km^2)
Harbour porpoise	11,357 (4,946–21,173)	0.28
Risso's dolphin	1,519 (9–5,099)	0.97
White-beaked dolphin	5,460 (191–12,812)	0.61
Minke whale	467 (2–1,655)	0.79

Source: [6]

While mobilisation/demobilisation ports such as Aberdeen lie outside the project SCANS block, vessel transits to and from these locations are not anticipated to result in notable impacts on EPS

[4] IAMMWG Management Units are not used to assessed abundance here due to the large areas they cover. Use of the SCANS-IV data gives abundance and density estimates for a more targeted area relevant to the survey area.

Other cetacean species may also occur within the survey area at any given time, based on regional sightings data, including killer whale (*Orcinus orca*) and Atlantic white-sided dolphin (*Lagenorhynchus acutus*), as well as humpback whale (*Megaptera novaeangliae*), bottlenose dolphin (*Tursiops truncatus*) and short-beaked common dolphin (*Delphinus delphis*). These species are typically present at lower densities and/or episodically within Orkney waters. Their inclusion reflects confirmed regional presence rather than changes to abundance assumptions used within the assessment.

5.2 Otters

Otters are also known to occur across the coastal areas around Orkney. They have specifically been recorded in incidental sightings in the vicinity of the Orkney landfall area around Warebeth[8]. Additionally, it is anticipated that otter holts may occur in proximity to landfall on the Scottish mainland near Dounreay.

5.3 Marine Turtles

Four marine turtle species are documented as occasional visitors to Scottish waters; species include the leatherback (*Dermochelys coriacea*), loggerhead (*Caretta caretta*), Kemp's ridley (*Lepidochelys kempii*) and green turtle (*Chelonia mydas*). The leatherback turtle is the most common species, adapted for the colder Scottish seas [9]. As they are only occasional visitors, marine turtles are not assessed further within this document.

5.4 Basking Shark

The basking shark is the largest fish species in UK waters and listed as Endangered on the IUCN Red List. Basking shark presence in UK waters is seasonal, with presence around Orkney recorded between July and September [10]. In the winter months, individuals move into waters of the continental shelf and shelf edge [11]. The waters around Orkney are not considered key habitat for basking shark, with few sighting records in the area [12].

There is no reference population available for basking shark in the waters around Orkney. Observed adjusted densities of basking shark across all seasons from 2000-2012 gives a density of 0.0-0.10 individuals per 5 km^2. Since the area of the cable route is 53 km long, it can be estimated that as a very conservative worst-case scenario, two individuals may be impacted as a result of the proposed activities. This can be considered highly precautionary given the extremely low sightings of basking shark in the area of the cable route corridor [12].

5.5 Favourable Conservation Status

Favourable Conservation Status of a species is defined in Article 1(i) of the Habitats Directive as when:

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

Table 5.2 summarises the conservation status of cetaceans and otters around the UK. Conservation status from the 2019 assessment is unknown as the method used to assign conservation status had changed. There has been no genuine change in conservation status of any of the five most commonly occurring EPS in the survey area [13].

Table 5.2: Favourable Conservation Status of the EPS considered to occur regularly in the survey area.

Species	Conservation Status 2013 Assessment	Conservation Status 2019 Assessment	Population estimates used in 2019 Assessment*
Harbour porpoise *(Phocoena phocoena)*	Favourable	Unknown	197,579 (95% CI 163,294 – 239,063)
Risso's dolphin (*Grampus griseus*)	Unknown	Unknown	7,864 (95% CI 2,613 – 23,664)
White-beaked dolphin (*Lagenorhynchus albirostris*)	Favourable	Unknown	30,172 (95% CI 17,346 – 52,483)
Minke whale *(Balaenoptera acutorostrata)*	Favourable	Unknown	12,340 (95% CI 6,912 – 22,032)
Killer whale (*Orcinus orca*)	Favourable	Unknown	124
Atlantic white-sided dolphin (*Lagenorhynchus acutus*)	Favourable	Unknown	28,836 (95% CI 7,590– 109,556)
Otter (*Lutra lutra*)	Favourable	Favourable	21,441 (minimum)**

** population estimates are for the Marine Atlantic region*

*** population estimates based on a minimum estimate by number of map 1x1 km grid cells*

Source: [13; 14]

6 Risk Assessment

Cetaceans have been recorded within the survey area all year round.

It is possible that at least some of the cetacean species listed in Section 5.1 above will be present during the survey programme, most likely those listed in Table 5.1:

- Harbour porpoise.
- Risso's dolphin.
- White-beaked dolphin.
- Minke whale.

These four species will be used as proxy species for the cetacean community likely to be present going forwards in this assessment. The four species used as proxy receptors are considered representative of the cetacean community for the purposes of assessing disturbance effects, with other less frequently occurring species, including killer whale and Atlantic white-sided dolphin, expected to respond similarly or more conservatively to the proposed activities.

This risk assessment considers the proposed survey programme together with the associated concrete mattress installation activities.

The main routes to impact for cetaceans are considered to be:

- Anthropogenic noise from:
  - Geophysical survey systems.
  - Increased noise from vessels.
- Collision risk/entanglement from vessels and equipment.

For otters, the main routes to impact are considered to be collision risk/entanglement and disturbance due to the physical presence of the survey vessels.

6.1 Anthropogenic Noise

The anthropogenic noise assessment considers noise from survey systems and positioning equipment and any comparable non-impulsive sources associated with concrete mattress installation activities.

Due to the high sensitivity of cetaceans to noise impacts, additional background information is presented on sound propagation, cetacean hearing sensitivities and thresholds.

6.1.1 Sound Propagation

In general, sound sources that have high sound pressure levels and low frequency (i.e. large airgun array seismic sources) travel the greatest distance underwater. The spread of low frequency sound in the sea is efficient, with little loss due to attenuation (i.e. due to absorption and scattering). Conversely, high frequency sources (such as those emitted from the geophysical survey equipment associated with the GVI survey scope, such as MBES and ADCP) tend to have greater attenuation over distance. The process is non-linear with the rate of absorption varying roughly as the square of the frequency. The overall degree of attenuation is also dependent on the water pressure, temperature and salinity.

Spherical spreading describes the decrease in level when a sound wave propagates away from a source uniformly in all directions. Overall, the intensity of sound waves decay exponentially and although low-level signals travel for long distances, higher amplitude waves lose much of their energy very close to the sound source [15]. Sound also propagates further in deeper water.

6.1.2 Cetacean Hearing Sensitivities and Thresholds

An animal's ability to detect sounds produced by anthropogenic activities depends on the amount of natural ambient or background sound. Wind, precipitation, vessel traffic, and biological sources all contribute to ambient sound.

Cetaceans are sensitive to underwater noise, with the sensitivity of cetaceans to noise being dependent on the specific hearing abilities of the species.

Using sea otters (*Enhydra lutris*) as a proxy, otters are not considered sensitive to underwater noise as sea otters are primarily adapted to hearing airborne sounds and are not specialized for detecting signals in background noise [16], therefore underwater anthropogenic noise impacts are not considered further for otters.

The species present have differing auditory ranges, and hence are not equally sensitive to the same noise sources. Table 6.1 presents the estimated auditory bandwidths for the functional hearing group relevant to the four species likely to be present in the vicinity of the proposed survey activities.

Table 6.1: Hearing sensitivity information for the four main EPS likely to present in the vicinity of the survey area.

Functional hearing group	Relevant species	Generalised hearing range*	Species specific information
Low-frequency (LF) cetaceans (Baleen whales)	Minke whale	7 Hz to 35 kHz	No species-specific studies
High-frequency (HF) cetaceans (Most toothed whales and dolphins)	Risso's dolphin	150 Hz to 160 kHz	BEH: 1.6 to 100 kHz AEP: <4 to 142 kHz
	White-beaked dolphin		AEP: <16 to 160 kHz
High-frequency (HF) cetaceans	Harbour porpoise	250 Hz to 180 kHz	BEH: 0.3 to 160 kHz AEP: <10 to 160 kHz

** Represents the generalized hearing range for the entire group as a composite (i.e., all species within the group), where individual species' hearing ranges are typically not as broad.*

BEH – behavioural studies

AEP – auditory evoked potential studies

Sources: adapted from [17] and [18].

There are various potential effects of exposure to sound from anthropogenic activities such as geophysical surveys that can be characterised as physiological or behavioural. The main potential effects can be summarised as:

- Auditory Injury.
- Behavioural response, such as disturbance effects.

There is negligible potential of lethal or physical effects from the survey programme or concrete mattress installation activities.

6.1.3 Basking Shark Hearing Sensitivity and Threshold

Unlike cetaceans, basking sharks do no rely on acoustic signals for communication or foraging [19]. Little is known about their hearing capabilities. In general, shark species are considered to have poor hearing sensitivity compared to teleost fish species with a narrow range of hearing frequencies (20 Hz – 1.5 kHz), with peak sensitivity around 200-600 Hz [20; 21].

Given that their peak sensitivity range falls below that of the noise-generating survey equipment and there is no evidence of stress or injury caused by sound within the expected ranges for the survey and concrete mattress installation activities, basking shark are not considered at risk of impact via anthropogenic noise from the proposed activities and are not considered further with regards to this impact.

6.1.4 Auditory Injury

A brief exposure to extremely high sound levels or more prolonged exposure to lower levels of continuous sound can cause injury to the auditory system of cetaceans [22]. This auditory injury may be in the form of permanent threshold shifts (PTS) and/or temporary threshold shifts (TTS).

A 130 dB_{ht} (species) level was suggested as suitable criteria for predicting the onset of traumatic hearing loss in cetaceans, which is similar to that used for human exposure in air [23].

Indicative thresholds for Sound Pressure Levels (SPLs) that have the potential to cause auditory injury (PTS and TTS) in cetaceans were provided by [18], which correspond with the US National Marine

Fisheries Service (NMFS) indicative thresholds [17]. These thresholds are based on unweighted, instantaneous peaks (SPLs).

Sources of sound were divided into impulsive[5] and non-impulsive:

- Impulsive: produce sounds that are typically transient, brief (less than 1 second), broadband, and consist of high peak sound pressure with rapid rise time and rapid decay
- Non-impulsive: produce sounds that can be broadband, narrowband or tonal, brief or prolonged, continuous or intermittent) and typically do not have a high peak sound pressure with rapid rise/decay time that impulsive sounds do [17].

SPL thresholds for impulsive sources are presented in Table 6.2. For non-impulsive or continuous noise the SPL onset threshold for PTS remains 230 dB re 1 µPa Peak [18].

Table 6.2: Unweighted SPL onset thresholds for PTS and TTS for impulsive sources.

Functional Hearing Group	PTS	TTS
LF cetaceans	219	213
HF cetaceans	230	224
VHF cetaceans	202	196

Source: adapted from [17] and [16]

It should be stressed that no cetacean mortality or damage to tissue has been documented for exposure to geophysical surveys, and that the exposure level for injury is a theoretical value extrapolated from experimental data. Also, it is recognised that many variables affect the nature and extent of responses to a particular stimulus. Such variables may include the recent experience of cetaceans with the sound stimulus, and their current activity (e.g. feeding vs. migrating).

6.1.5 Behavioural Response

The estimated hearing sensitivities of species present in the survey area are shown in Table 6.1. For very high-frequency (VHF) cetaceans, such as harbour porpoise, the frequency of best hearing is thought to be 105 kHz, while for high-frequency (HF) cetaceans (dolphin species including Risso's dolphin and white-beaked dolphin), the frequency of best hearing is 55 kHz [18]. While there are no species-specific studies for minke whales (low frequency, LF), indirect evidence suggests they are most sensitive to frequencies between 20 Hz and 19 kHz [24; 25].

The dBht (species) metric [23] has been developed as a means of quantifying the potential for a behavioural effect on a species in the underwater environment. As sound is perceived differently by different species the species' name must be appended e.g. dBht (harbour porpoise). Table 6.3 summarises the dBht assessment criteria for a behavioural response.

Table 6.3: Assessment criteria to estimate the potential behavioural responses by cetaceans to underwater noise.

Level in dBht (species)	Reaction
0	None
0 to 50	Mild reaction in minority of individuals, probably not sustained

[5] The term "impulsive" relates specifically to noise-induced hearing loss and specifies the physical characteristics of an impulsive sound source, which likely gives them a higher potential to cause auditory TTS/PTS. This definition captures how these sound types may be more likely to affect auditory physiology and is not meant to reflect categorisations associated with behavioural disturbance [17].

Level in dBht (species)	Reaction
50 to 90	Stronger reaction by majority of individuals, but habituation may limit effect
90 and above	Strong avoidance reaction by virtually all individuals
Above 110	Tolerance limit of sound; unbearably loud

Source: [23]

6.2 Anthropogenic Noise from Geophysical Survey Systems

As described in Sections 3.1.1, the survey will use acoustic survey and positioning equipment. The GVI survey systems and positioning equipment onboard the vessel / ROV will increase levels of anthropogenic noise in the marine environment because they operate by producing and receiving sound.

This section applies to the operation of acoustic survey and positioning equipment during the GVI and associated geophysical surveys, and also to any equivalent acoustic equipment operated during the localised concrete mattress installation works for positioning, tracking, or data acquisition (for example vessel-mounted MBES, ADCP, beacons/transponders and any sound velocity profiling undertaken in support of these activities). Our understanding is that both a pre- and post-mattress installation geophysical survey will be required.

As sound travels much further underwater compared to airborne noise, the resulting effects on cetaceans can be at distance from the sound source, depending on the species-specific hearing sensitivities.

6.2.1 Impact on EPS

Thompson *et al*. [26] observed harbour porpoise avoidance of (seismic) survey vessels in the Moray Firth out to 10 km, with animals detected again at the affected sites within a few hours. This 10 km disturbance radius is considered highly conservative as:

- It was observed as a consequence of oil and gas seismic surveys, using equipment that produces significantly higher source levels (and also different operating frequencies) than the equipment to be used in this survey.
- The waters of the Moray Firth are deep and sound travels further in deeper water, although certain frequencies, particularly mid/high frequencies, can propagate in shallow waters depending on sea surface and seabed; however, these frequencies are likely to be outside the hearing range of many of the species present (see discussion below).

As a consequence, the impact radius has been decreased to 5 km, and an impact area of 78.5 km^2 was used in Table 6.4 (simple calculation of πr^2), and this disturbance radius was also used for the consideration of potential impacts on dolphin species and minke whales, due to the lack of comparative studies. This is considered a conservative proxy, as evidence from Thompson et al.'s research [26] suggests that short-term disturbance does not lead to long-term displacement of harbour porpoises.

Table 6.4: Estimated number of individuals of the four cetacean species potentially disturbed during the operation of GVI survey and positioning equipment.

Species	No. of individuals within the area of potential impact	% of Block CS-K population which has the potential to be affected	% of Marine Atlantic region population which has the potential to be affected
Harbour porpoise	22	0.19	0.01
Risso's dolphin	76	5.02	0.97
White-beaked dolphin	48	0.88	0.16

Species	No. of individuals within the area of potential impact	% of Block CS-K population which has the potential to be affected	% of Marine Atlantic region population which has the potential to be affected
Minke whale	62	13.29	0.50

Note: SCANS-IV abundance and density estimates used in calculations from [6]*; Marine Atlantic region population estimates used in Favourable Conservation Status from [13].*

The estimates of individuals in Table 6.4 are based on the SCANS-IV Block CS-K density estimates, however, based on behavioural evidence (i.e. harbour porpoise and minke whales are solitary, while Risso's dolphins are generally seen in small groups, and will be transient along the survey route) it is unlikely that many individuals would be present in the impact area at the same time. Therefore these numbers of individuals potentially disturbed by the survey and positioning equipment (either operated during the GVI/geophysical survey activities or during mattress installation support activities) are considered highly conservative, and therefore the Marine Atlantic region population is used as the reference population used in Section 7: Assessment of Potential Offence.

6.2.1.1 Auditory Injury

The equipment stated in Table 3.2, or variations of this equipment, will be used during the survey programme. The MBES systems, DVL and ADCP operate at relatively high frequencies that are outside the hearing range of the cetaceans known to be present in the survey area (see Table 6.1). There is the potential for any of this equipment to cause auditory injury to all cetaceans at very close range due to the source levels (Table 3.2) although individuals would have to be within a few metres of the sound source for a prolonged length of time, with VHF cetaceans (harbour porpoise) most at risk of PTS and TTS (onset thresholds; Table 6.2). However, considering natural avoidance behaviour of harbour porpoise, the peak source level of the sound source and the SPL onset threshold for injury, injury is unlikely to occur. It should be noted that the proposed source level of 240 dB re 1μPa @1 m is a maximum and will drop exponentially due to spherical spreading and greater attenuation of high frequencies, and that as the survey area is relatively shallow (<200 m as defined in the JNCC guidelines), particularly along the survey route where water depths are between 0-91 m LAT, the high frequency sounds produced by this equipment are likely to attenuate more quickly than lower frequencies used in deeper waters [27].

The USBL positioning systems and transponder beacons operate at a much lower frequency (Table 3.2) and are therefore audible to the LF and HF cetaceans likely to be present in the survey area, although probably not to the VHF harbour porpoise (best hearing around 105 kHz). However, the USBL equipment in particular operate at a very low sound pressure intensity level. The onset of PTS from this equipment may be induced at greater distances from source if animals remain stationary and associated with the vessel. As it is unlikely that species will remain animals remain stationary and associated with the vessel for the entire period of operation the USBL system the risk of PT onset is limited.

6.2.1.2 Behavioural Response

As noted above, most of the sound emitted by the survey equipment will not be audible to the cetaceans in the survey area. Therefore, it is unlikely the MBES and ADCP will cause more than very temporary disturbance to cetaceans.

The lower frequencies generated by USBL positioning systems and transponder beacons, have the potential to cause localised short-term impacts on behaviour for all cetaceans present in the survey area, possibly resulting in temporary avoidance at close proximities [28]. It is estimated that strong avoidance according to a 90 dB_{ht} strong avoidance impact criterion may occur within the impact area. However, it is not considered likely that this GVI survey equipment will cause significant disturbance to these cetaceans, due to the low operating frequencies of the acoustic pulses from the USBL positioning systems and transponder beacons.

6.3 Anthropogenic Noise from Mattress Installation Activities

Any acoustic survey or positioning equipment operated in support of mattress installation activities is assessed in Section 6.2; this section considers only operational noise associated with mattress deployment and placement activities.

Concrete mattress installation is a localised activity undertaken at discrete cable crossing locations. The principal noise sources associated with mattress installation are expected to comprise:

- vessel and auxiliary machinery noise (addressed separately in Section 6.4);
- low-level, non-impulsive operational noise associated with crane use and controlled lowering/positioning of the mattress deployment frame, addressed here in section 6.3; and
- any acoustic positioning, tracking or survey equipment operated to support placement (for example beacons/transponders and vessel-mounted MBES), which is assessed under Section 6.2 as part of the wider geophysical and acoustic positioning equipment assessment.

There is limited published source level data specific to concrete mattress lowering operations. Where quantitative proxies are used below, they are applied as precautionary bounds and are expected to overestimate the likely effect ranges for mattress installation. Trenching and rock placement acoustic sources have been used here only as precautionary proxies, as these activities typically involve greater seabed interaction and higher energy operations than controlled lowering and placement of concrete mattresses.. Given the expected natural avoidance of marine mammals from the operations, it is considered highly unlikely that animals will be close enough to experience injury from these activities.

A previous assessment using a threshold of strong avoidance behaviour by virtually all individuals of 90 dB_{ht} predicted impact ranges for marine mammals to be less than 150 m for trenching and less than 100 m for rock placement [30]. Noise from vessels involved in the mattress installation works is considered within Section 6.4 below.. With an impact radius of 150 m, the estimated number of individuals potentially disturbed by concrete mattress installation activities are presented in Table 6.5.

Table 6.5 Estimated number of individuals of the four cetacean species potentially disturbed during the mattress installation activities

Species	No. of individuals within the area of potential impact	% of Block CS-K population which has the potential to be affected	% of Marine Atlantic region population which has the potential to be affected
Harbour porpoise	0.66	0.01	<0.01
Risso’s dolphin	2.28	0.15	0.03
White-beaked dolphin	1.44	0.03	<0.01
Minke whale	1.86	0.40	0.02

Note: SCANS-IV abundance and density estimates used in calculations from [6]*; Marine Atlantic region population estimates used in Favourable Conservation Status from [13].*

With an estimated mattress installation duration forming part of an overall 30-day offshore campaign (including mobilisation, survey and installation activities), the impact on marine mammals will be temporary with individuals expected to return to normal use of the area after the mattress installation concludes.

Conclusions

Increased anthropogenic noise from the GVI survey and concrete mattress installation activities has the potential to induce the onset of auditory injury (threshold shifts) at relatively close proximity. Any such effects would be limited to a small proportion of the relevant EPS reference populations within the survey area, with temporary behavioural avoidance considered the most likely response.

On a precautionary basis, up to 22 harbour porpoises, 76 Risso's dolphins, 48 white-beaked dolphins and 62 minke whales have the potential to experience disturbance during survey activities. Up to 0.66 harbour porpoise, 2.28 Risso's dolphin, 1.44 white-beaked dolphin and 1.86 minke whale have the potential to be disturbed during mattress installation activities. In both cases, these estimates are highly precautionary.

Following Scottish guidance for inshore waters [4], there is the **potential for disturbance of cetaceans**, as defined in Regulations 39 [4] of the Habitats Regulations, from the operation of geophysical systems and mattress installation activities used for the proposed survey programme.

The predicted disturbance is not considered sufficient to result in population-level effects and would not be detrimental to the maintenance of the populations of the species concerned at Favourable Conservation Status within their natural range.

6.4 Increased Noise from Vessels

The survey programme and mattress installation activities will add additional vessels into the offshore marine environment along the proposed cable route corridor. Therefore, it will potentially increase levels of anthropogenic noise and thus has the potential to affect cetaceans. Increased vessel noise has the potential to cause behavioural responses in cetaceans, as well as auditory injury such as PTS or TTS, and may mask naturally occurring sounds.

Noise varies from vessel to vessel (Table 6.6) but is a continuous noise source; different vessels will generate different frequency characteristics and sound levels depending upon factors such as the propulsion system they are using.

In the event that the vessel uses dynamic positioning in order to maintain precise position on station then there will be occasional use of thrusters and main engines resulting in higher intensity underwater.

Table 6.6: Noise specifications of vessels.

Size	Length	Type	Sound pressure level	Frequencies	Comments
Large	>100 m	Container / cargo ships, super-tankers, cruise liners	180-190 dB re 1μPa @ 1m rms	Few hundred Hz	depends on type, size and operational mode
Medium	50 – 100 m	crew-boats, larger fishing / trawler, research vessels, tug-boats	165-180 dB re 1μPa @ 1m rms	mimics large vessels	tend to have slower revving engines and power trains, with majority of sound energy below 1 kHz
Small	<50 m	jet skis, speed boats, light commercial runabouts, motor yachts, fishing vessels, small trawlers	160 – 180 dB re 1μPa @ 1m rms	20 Hz - >10 kHz	greater portion of sound produced is mainly above 1kHz mostly from propeller cavitation

6.4.1 Impact on EPS

The vessels proposed to carry out the GVI surveys are still to be confirmed. The potential vessels presented in Table 3.1 range from small to large. The proposed mattress installation vessels are also likely to be a range of size options. Therefore the use of large sized vessels is considered an appropriate worst-case scenario.

6.4.1.1 Auditory Injury

Auditory injury may occur from noise from large vessels if animals of any hearing group are less than one metre from the sound source. However, it is unlikely that PTS will occur further away from vessels as the estimated SPL is lower than the SPL onset threshold for continuous noise of 230 dB re 1 µPa [18].

Noise levels for merchant shipping compiled from a number of academic studies are published in Richardson et al., (1995). These estimated source levels of 160-190 dB re 1µPa-m for merchant vessels under transit (as shown in Table 6.6). Vessel noise during dynamic positioning station keeping operations is of a similar low frequency broadband level, with sound levels of between 180 to 197 dB re 1µPa-m during thruster usage (Talisman Energy, 2006 ; Wyatt, 2008 ; & Xodus, 2014). Noise levels during dynamic positioning station keeping will vary with climatic and tidal conditions, which affect a vessels ability to maintain position, since these factors change the amount of thrust required to keep the vessel in position. It is anticipated that the Pentland firth is an area of moderate and strong wind, sea state and current conditions, and as such, a vessel using DP is anticipated to produce noise at the upper level of the estimated range.

6.4.1.2 Behavioural Response

Predicted 90 dB_{ht} (species) impact ranges for large vessels [31] are presented below (Table 6.7).

Noise from vessels is unlikely to cause disturbance to individual animals, except when in very close proximity to a vessel. During concrete mattress installation, vessels will be held on a temporary 4-point mooring system and are therefore expected to be stationary or operating at very low speeds, which further limits the likelihood of sustained disturbance due to vessel movement. Given that the largest potential impact range predicted for a strong avoidance reaction is 11 m (for VHF cetaceans, harbour porpoise), coupled with existing vessel movements within the area, it is considered that sound from vessel activity associated with the survey and mattress installation activities will not significantly add to the background noise levels from vessels already present.

To put the predicted displacement impact ranges caused by vessels into context, the number of individuals likely to be disturbed is estimated for the 90 dB_{ht} (species) impact range. Using the density estimates from SCANS-IV Block CS-K [6] (Table 4.1), and the predicted impact range as radii in the simple calculation of area πr2, less than one individual of any species is likely to be disturbed by noise from large vessel noise at the 90 dB_{ht} (Table 5.6).

Table 6.7: Estimated number of individuals of the four cetacean species potentially disturbed by vessel noise from survey and installation vessels (precautionary worst-case)

Species	90 dB_{ht} (species) impact range (m)	Area of potential impact (km^2)	Number of individuals within the area of potential impact
Harbour porpoise	11	<0.001	<1
Risso’s dolphin (bottlenose dolphin impact range used)	4	<0.001	<1
White-beaked dolphin (bottlenose dolphin impact range used)	4	<0.001	<1
Minke whale	2	<0.001	<1

Source: 90 dB_{ht} (species) impact range adapted from [31]

The noise produced by vessel DP thrusters and main engines during DP operations can be imparted at a higher intensity with little graduation in intensity, reducing opportunity to become either habituated or flee. As such the potential for a startle response could be increased.

6.4.2 Conclusions

It is highly unlikely that vessel noise will cause auditory injury in any species of cetacean or will elicit a behavioural response over and above that caused by the usual vessel activity within the area. Any short-term behavioural responses that may occur are expected to be limited, temporary and localised, and would not result in injury or population-level effects. Therefore the potential for the onset of auditory injury to be induced or a long-term, negative behavioural response is negligible.

However, it is likely that the use of DP vessel may impact the behavioural response of marine mammal in close proximity to the mattress installation activities, due to the fact that the noise intensity may increase rapidly during DP operation and potentially create a startling response.

Following Scottish guidance for inshore waters [4], it is considered that there is **minimal potential in the event DP vessels are used, for an offence** to be committed as defined in Regulations 39 (1) (a), (b) and 39 (2) of the Habitats Regulations 1994 (as amended in Scotland).

6.5 Collision Risk

The physical presence of survey vessels and vessels undertaking localised concrete mattress installation, has the capacity to pose a collision risk to EPS. During mattress installation, the installation vessel is expected to be stationary or operating at very low speeds within a defined work area, which reduces collision likelihood relative to transit.

Cetaceans are vulnerable to collisions with larger vessels. Vessel strikes are a known cause of injury and/or mortality in cetaceans [32], with collisions potentially occurring with vessels of all sizes. The more serious incidents tend to be caused by very large vessels, with large slow-moving whales considered most susceptible to vessel strike. There may be a reporting bias towards larger whales as many vessels may not be aware that they had collided with smaller species [32], although smaller cetaceans and otters are generally considered sufficiently mobile to avoid vessels either in their path or moving towards them. Vessels going at speeds of 14 knots or more are also more likely to cause incidents. Injuries sustained can include fracturing, bruising, nicks or slicing off parts of fins, and the most serious accidents can result in death of the animal, although death may not be immediate [33].

6.5.1 Impact on EPS

Avoidance behaviour by cetaceans is often associated with fast, unpredictable vessels such as speedboats and jet-skis [34; 35; 36; 37], while neutral or positive reactions have been observed with larger, slower moving vessels such as cargo ships [36; 38]. Harbour porpoise, in particular, generally respond negatively to high-speed planning-hulled vessels [39].

The number of survey vessels to be used for the survey programme is still to be decided. The vessels will transit to and from the survey route along predefined corridors. Furthermore, during the surveys themselves, the vessels will follow a predefined survey corridor, and will be travelling at a working speed of less than 6 knots approximately with a transit speed of 10 knots approximately. Likewise, the mattress installation vessel and guard vessels will travel to the cable crossings along predefined corridors and travel along the cable corridor at a slow working speed. During the concrete mattress installation activities themselves, vessels will be stationary as will be moored or installing / recovering the moorings.

The predefined transit corridors to site and predefined linear routes for the surveys and mattress installation make it easy for animals to predict and avoid project vessel movement, and thus greatly reduces the risk of collision.

Basking shark are thought to have little to no awareness of approaching vessels [40], which makes them unlikely to be disturbed by vessels but also makes them susceptible to collision due to lack of evasive behaviour [41]. Given the temporary nature of the works and the low likelihood of encountering basking shark during project activities, the risk of collision is considered to be extremely low. The slow speed of the vessels and use of predefined corridors is considered to further reduce risk to basking shark.

6.5.2 Conclusions

Following Scottish guidance for inshore waters [4], there is negligible potential for injury or disturbance to EPS, as defined in Regulations 39 (1) (a) and (b) and 39 (2) of the Habitats Regulations, from collision with vessels associated with the proposed work.

Vessel activity associated with the proposed works is expected to be temporary and localised, and the likelihood of collision with EPS is considered very low. Any interaction would not be expected to result in injury, mortality or population-level effects.

No offence will be committed under Regulation 39 of the Habitats Regulations.

6.6 Entanglement risks

The physical presence of vessels, ROVs and the associated potential umbilicals, undertaking the GVI and optional geophysical survey scope and the concrete mattress installation vessels, together with associated mooring systems, anchoring arrangements, chains, and lifting lines, has the potential to pose an entanglement risk to EPS and Basking Sharks.

Entanglement is a recognised cause of injury and, in some cases, mortality in cetaceans. Incidents most commonly involve larger baleen whale species due to their size, anatomy, and feeding behaviour; however, smaller cetaceans may also be affected, particularly where lighter chains or cables are present in the water column. Entanglement can result in a range of injuries, including abrasions, lacerations, constriction wounds, restricted movement, and increased drag. These effects may impair foraging and swimming efficiency and, in severe cases, may interfere with surfacing and respiration, potentially leading to exhaustion, drowning, or delayed mortality if the animal is unable to free itself.

6.6.1 Impact on EPS

The likelihood of cetaceans and otters becoming entangled in survey or mattress installation equipment is influenced by animal behaviour, equipment configuration, and the spatial and temporal extent of the works.

All works will be undertaken within predefined areas, with vessels following planned routes and operating at slow speeds with controlled and predictable movements. The installation of the concrete mattresses and associated deployment and recovery of moorings will be a stationary activity at two discrete locations. This predictability, combined with the controlled deployment of chains, cables, and lifting equipment, is expected to substantially reduce the likelihood of entanglement.

The mobility of cetaceans and otters, the slow speed or stationary nature of the project vessels while operational and the predefined working routes will also reduce the risk of entanglement. For the offshore area, the availability of useable habitat for cetacean species negates any barrier effects caused by towed survey or mattress installation equipment, also reducing the risk of entanglement.

Basking sharks may seasonally occur within offshore waters; however, entanglement incidents involving basking sharks are rare and are most commonly associated with static fishing gear rather than temporary construction or survey activities. Given the temporary nature of the works, their limited spatial extent, controlled deployment methods, and the low likelihood of basking sharks being present within the project area during survey and installation activities, the risk of entanglement for this species is considered to be extremely low.

All mooring lines and associated equipment will be fully demobilised following completion of the works, ensuring that any potential entanglement risk is limited to the short duration of active operations and that no long-term or post-works risk to EPS or basking sharks remains.

6.6.2 Conclusions

Following Scottish guidance for inshore waters [4], there is negligible potential for injury or disturbance to European Protected Species (EPS), as defined in Regulations 39 (1) (a) and (b) and 39 (2) of the Habitats Regulations, from entanglement with survey equipment, mooring systems, chains, or cables associated with the proposed survey or mattress installation works.

The use of controlled installation methods, active supervision of equipment and the temporary nature of these activities means that the likelihood of entanglement is very low. Any interaction is not expected to result in injury, mortality or population-level effects.

No offence will be committed under Regulation 39 of the Habitats Regulations.

6.7 Indirect Impacts

There is potential that some of the activities may result in noise impacts on fish and shellfish prey resources (Table 6.8). However, significance of these potential effects is deemed to be negligible. In addition there is the potential for temporary and localised impacts on the seabed during the deployment and recovery of mooring systems and installation of the concrete mattresses with associated potential for temporary and localised suspension of seabed sediments into the water column. The significance of these potential effects is also deemed to be of negligible significance. Therefore, no offence will be committed, no mitigation is considered to be necessary, and an EPS licence will not be required for these potential impacts (indirect effects).

Table 6.8: Assessment of potential indirect effects of the survey programme and mattress installation activities.

Cause of potential indirect effect	Prediction	Significance
Disturbance to the seabed	Sediment disturbance and increases in suspended sediment concentrations are predicted to be highly localised and therefore will not result in significant areas of seabed being disturbed or significant levels of sediment being released into the water column	Negligible
	Following disturbance, levels of suspended sediment are not expected to be significantly greater than background levels and are likely to settle back to the seabed relatively rapidly. In addition, mobile cetaceans and otters are able to avoid localised areas disturbed by increased suspended sediment concentration.	
Changes in fish and shellfish prey resources	Impacts to fish species due to physical presence of the survey vessel(s), electromagnetic field effects or anthropogenic noise are considered to not be significant; therefore, any potential indirect effects on the cetaceans and otters that target these species are also expected to not be significant.	Negligible

6.8 Cumulative Impacts

The transient and linear nature of the GVI survey and discrete offshore locations and limited duration for the concrete mattress installation works along with project planning will ensure that any potential in-combination impacts from the proposed operations on EPS are minimised, and as such in-combination effects are not considered significant.

Other projects in proximity to the offshore surveys have been identified via the Marine Scotland Licence Application Register as follows:

- A Wave Energy Converter Array owned Simply Blue Energy (Orkney) Limited at European Marine Energy Centre (EMEC)'s Billia Croo Wave Test Site; an array of 14 individual wave energy converters (total capacity 5 MW) will be deployed to provide operational data to enable larger arrays to be deployed globally. A marine licence has been submitted in March 2023 and granted in April 2024, project works are expected to be conducted in parallel to the offshore surveys.

- Pentland Floating Offshore Wind Farm owned by Highland Wind Ltd: an offshore wind farm with up to seven wind turbine generators on floating substructures, including inter-array cabling and an onshore facilities at Dounreay. The Marine Licence was granted 28 June 2023, and a Section 36 variation was applied for on 11 October 2023 and granted in April 2024, however the project was not successful in the UK's sixth Contract for Difference (CfD) Allocation Round (AR6), so no project works is currently expected to be conducted in parallel to the offshore surveys
- West of Orkney Wind Farm owned by Offshore Wind Power Limited: an offshore wind farm of up to 125 wind turbine generators on fixed-bottom foundations, including associated offshore transmission infrastructure and associated inshore infrastructure with landfall options at Greeny Geo or Crosskirk. A marine licence has been submitted in September 2023 with further information submitted in November 2024. The licence has been granted on June 2025, key dates set for construction are to begin around 2027 (onshore) and 2028 (offshore).

This list above only includes projects that may have active investigative, construction or maintenance works occurring concurrently; established projects (pipelines, other cables etc.) will have no cumulative impacts with these surveys as there will be not concurrent works. Due to the localised and temporary nature of the survey and installation activities, and their limited impacts, there are unlikely to be cumulative impacts with other projects should works commence in the same time frame. There may be potential for a cumulative impact due to increased underwater anthropogenic noise if the survey activity, such as USBL use, corresponds with other noisy activities in the area. However, given the transient nature of the survey activities in it unlikely that this would result in significant cumulative impacts.

7 Assessment Potential Offence

Following Scottish guidance [4], it can be concluded that, with mitigation, potential impacts from the proposed survey campaign and mattress installation activities are unlikely to result in the harassment, disturbing, injuring or killing of an EPS as defined under Regulation 39(1) of the Habitats &c.) Regulations 1994 (as amended in Scotland).

In relation to Regulation 39(2) of the Habitats Regulations, the percentage of the reference population[6] of each cetacean species which has the potential to be disturbed by the GVI survey or mattress installation activities is considered to be negligible (less than 1% of each of the four most common cetacean species in the survey area) and therefore not detrimental to the maintenance of the population of the species concerned at a Favourable Conservation Status.

Disturbance is likely to be localised and short-term, and with mitigation is considered to be negligible. This disturbance is considered unlikely to have an impact on the Favourable Conservation Status of any cetacean EPS. Accordingly, while disturbance is not considered detrimental to the maintenance of the populations concerned at Favourable Conservation Status, an **EPS licence (to disturb) is required** in relation to the potential for disturbance arising from anthropogenic noise under Regulation 39 of the Habitats Regulations 1994 (as amended in Scotland).

As stated in Section 4, three tests must be passed before an EPS licence can be granted.

7.1 Test 1: The licence must relate to one of the purposes referred to in Regulation 44

Regulation 44 (2) of the Habitats Regulations 1994 (as amended in Scotland) provides a list of purposes where an EPS licence can be granted. These are as follows:

- Scientific or educational purposes.
- Ringing or marking, or examining any ring or mark on, wild animals.
- Conserving wild animals or wild plants or introducing them to particular areas.
- Protecting any zoological or botanical collection.
- 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.
- Preventing the spread of disease.
- Preventing serious damage to livestock, foodstuffs for livestock, crops, vegetables, fruit, growing timber or any other form of property or to fisheries.

The proposed Orkney – Mainland Subsea Link meets the requirements of Regulation 44 (2) (e) by providing a direct economic and environmental benefit on a national scale, through the development of a transmission network in Orkney in order to provide increased capacity to accommodate increased generation from renewable energy in the Orkney area. The need for a transmission link from Orkney is centred around the development and connection of a significant volume of new renewable generation on the archipelago. The generation of renewable energy contributes to achieving the targets sets in the Climate Change (Emissions Reduction Targets) (Scotland) Act 2019. This Act sets targets to reduce Scotland's emissions of all greenhouse gases to net-zero by 2045 at the latest, with interim targets for reductions of at least 56% by 2020, 75% by 2030 and 90% by 2040.

The Project helps further Policy 7c (i) of the Orkney Local Development Plan (LDP) (2017) which states, "*The development of renewable and low carbon energy schemes, including the onshore infrastructure and/or buildings required for offshore marine renewable energy developments, and related transmission infrastructure, will be supported where it has been demonstrated that the proposal will not result in significant adverse effects on known constraints, either individually or*

[6] In this instance the Marine Atlantic region populations used to calculate Favourable Conservation Status is considered the reference population.

cumulatively.", through the development of a transmission solution to facilitate large scale renewable generation export to the Scottish mainland and onwards towards the major demand centres in the south. The LDP in undergoing review and a new one is being drafted, which is known as the Development Plan Scheme 2024 (DPS2024).

The project also furthers "Strategic Renewable Electricity Generation and Transmission Infrastructure", a national development part of the National Planning Framework 4, which supports the delivery of sustainable places through "*electricity generation and associated grid infrastructure throughout Scotland, providing employment and opportunities for community benefit, helping to reduce emissions and improve security of supply. Additional electricity generation from renewables and electricity transmission capacity of scale is fundamental to achieving a net zero economy and supports improved network resilience in rural and island areas. Island transmission connections in particular can facilitate capturing the significant renewable energy potential in those areas as well as delivering significant social and economic benefits*." The project aims to provide a transmission connection that will facilitate the connection of renewable generation through a marine cable linking Mainland Orkney and Mainland Scotland.

This EPS licence application is for the implementation of a GVI survey programme and mattress installation works. The EPS licence application is founded on Imperative Reasons of Overriding Public Interest (IROPI) identified above.

Nexans therefore consider that there is significant overriding public interest for the development of the Orkney – Mainland Subsea Link and thus the granting of an EPS licence for the proposed GVI survey campaign and mattress installation works that will help to enable the project's development.

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

To fulfil regulation 44, 3a of the Habitats Regulations, alternatives to the proposed GVI survey campaign and mattress installation methods have been considered. The alternatives identified and assessed are the use of lower impact survey equipment than that listed in Section 3, use of different mattress installation methods, and a "do nothing" scenario consisting of not conducting the proposed activities at all. These alternatives are further considered below.

7.2.1 Alternative Option 1 – Use of Lower Impact Survey Equipment

As explained in Section 6, the most significant risk to EPS (cetaceans) from the survey campaign is the potential impacts of anthropogenic noise produced by the survey equipment. The equipment likely to cause the biggest impact is the low frequency USBL, which operate within the hearing frequency of cetaceans known to be in the area. The USBL is needed to accurately position and control the survey equipment underwater. Not tracking the equipment would have potentially severe consequences including loss of equipment, having both economic and environmental impacts, and potential health and safety effects on other sea users.

Options for the use of alternative higher frequency devices have been explored but conclude that the specification of the proposed devices (Table 3.2) are the least impactful whilst still providing the required level of detail. Impacts on cetaceans in the area are minimised as far as possible, whilst the survey still provides the required data to identify seabed obstructions and sediment information to allow an accurate burial assessment, ensuring the flowline can be safely installed and operated. While there is a range of subsea positioning equipment (i.e., USBL/transponders) available on the market, our assessment has concluded that they would all utilise the same range of frequencies described in Table 3.2, as this is currently the best available technology and industry standard. It is therefore concluded that the use of lower impact survey equipment is not a viable alternative option.

7.2.2 Alternative Option 2 – Use of Different mattress installation Methods

The mattress installation methods presented have been selected for having a low impact on EPS while providing localised protection and stabilisation of the cable and those existing cables being crossed, at discrete locations. As detailed in Section 3.3.2, these activities are not expected to create high levels of disturbance. Alternative concrete mattress installation approaches, such as the use of heavier placement frames, would not materially reduce the potential for disturbance to EPS and could result in similar or greater levels of operational noise.

7.2.3 Alternative Option 3 – Do Nothing

As it is not viable to use alternative lower impact equipment to conduct the proposed surveys and it is believed that the best practicable environmental option to undertake mattress installation at the crossings has been selected, the only remaining alternative would be to not undertake the survey campaigns or mattress installation works (i.e., “do nothing”). The surveys are required to inform engineering of the cable installation and thus a “do nothing” alternative presents significant risks to the project including unknown seabed conditions, unknown locations of potential unidentified UXOs and other obstructions, unknown habitat locations and unknown geotechnical conditions resulting in an unsafe construction programme. The lack of this information would result in any works in the area to lay the cable being dangerous, unjustifiable, and thus non-viable. The crossings of existing infrastructure by the proposed Orkney – Mainland Subsea Link are a requirement and without stabilisation works at these crossing locations there is the potential for damage to existing infrastructure as well as to the proposed project, as such safe crossing methods are fundamental to the projects viability. Therefore, it can be reasonably concluded that if the proposed survey campaign and concrete mattress installation works were not to go ahead then the Orkney – Mainland Subsea Link would not be able to be developed. As identified in Section 7.1, the project will aid in the development of a transmission network in Orkney in order to provide increased capacity to accommodate increased generation from renewable energy in the Orkney area.

It can therefore be reasonably concluded that there are no satisfactory alternatives to the proposed survey campaigns and associated use of positioning and survey equipment due to the need to accurately position and control the underwater equipment and characterise obstructions on the seabed, as well as the layers of sediment or rock below the seabed. These surveys are essential to the construction of the Orkney – Mainland Subsea Link, thus support the Scottish and UK Governments in reaching their renewable energy targets. Therefore the ‘no satisfactory alternative test’ is considered to have been met.

As discussed in Section 7.1, there is a need for a transmission cable between Orkney and mainland Scotland and any route taken will require safe crossings of existing seabed infrastructure. Therefore the ‘no satisfactory alternative test’ is considered to have been adequately met and a “do nothing” alternative to the mattress installation methods is therefore not considered a viable option.

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

The percentage of the reference population of each cetacean species which has the potential to be disturbed by use of the survey equipment and the mattress installation works are considered to be negligible (less than 1% of the harbour, porpoise, Risso’s dolphin, white-beaked dolphin and minke whale occurring in the survey area). There are no significant impacts on otters. Therefore, the GVI survey campaign and mattress installation are not detrimental to the maintenance of the population of the species concerned at Favourable Conservation Status.

7.4 Basking Shark Licence

As discussed within Sections 6.2.1 and 6.5.1, the risk for impact on basking sharks from anthropogenic noise associated with the survey and mattress installation or from vessel collision or entanglement is considered negligible. The risk is further reduced via the mitigation measures as described in Section 8 below, which reduce risks of impact on basking shark in the same manner as marine mammals. Furthermore, with the low density of basking shark in the area and the infrequency of sightings, it is assessed that any impact experienced would be of low magnitude. However, because the risk for impact on basking shark cannot be completely ruled out, a Basking Shark licence will be sought for the proposed activities.

8 MARINE MAMMAL MITIGATION PLAN

Operation of GVI survey systems and positioning equipment during the survey and the survey activities and works associated with the mattress installation have the potential to cause auditory injury to EPS (cetaceans) at very close range. Therefore, mitigation in the form of pre-work searches will be undertaken prior to the use of acoustic survey systems, use of positioning equipment. Where possible, soft-start procedures will also be implemented, with sound emitting equipment “ramped up” to operating frequencies.

Since the release of the JNCC guidelines for minimising the risk of injury to marine mammals from geophysical surveys in April 2017, MBES surveys in shallow waters (<200 m) are not subject to mitigation requirements as it is thought the higher frequencies typically used fall outside the hearing frequencies of cetaceans and the sounds produced are likely to attenuate more quickly than the lower frequencies used in deeper waters. JNCC does not, therefore, advise mitigation is required for multi-beam surveys in shallow waters’. However, as part of best practice, mitigation is to be put in place for the use of all survey equipment, including MBES.

These mitigation measures for cetacean EPS [27] are also deemed to be appropriate for seals and basking shark, as well as marine turtles and otter.

8.1 Pre-work Searches

Mitigation for EPS will be implemented in accordance with JNCC (2017) *Guidelines for Minimising the Risk of Injury to Marine Mammals from Geophysical Surveys*. The measures set out below are consistent with the JNCC Guidelines and are considered appropriate for nature and scale of the proposed survey activities.

Given the low level of risk to marine mammals from the positioning equipment (low likelihood of encounter and low risk of PTS due to power source level of equipment), there is a limited range for auditory injury and/or disturbance from the equipment in use. However, the recommended mitigation zone is the quoted 500 m, due to the operating frequencies of some of the equipment being within the hearing range of cetaceans. Pre-watch searches will be carried out for a period of at least 30 minutes duration. If a marine mammal is observed during the pre-watch period within the mitigation zone, activation of the sound source (or soft start) will be delayed until the animal has no longer been sighted in the mitigation zone for a minimum of 20 minutes. Watches will be conducted via visual methods when conditions allow (i.e., suitable daylight, sea state and visibility). During times when conditions do not allow for reliable visual searches, primarily during the hours of darkness, the pre-watches searches will be conducted using passive acoustic monitoring (PAM). Visual and acoustic watches will be conducted by suitably certified and experienced MMO/PAM personnel. This will allow for coverage for 24-hour operations as needed.

Due to the nature of the positioning equipment and anticipated operational mode, once any subsea equipment (e.g. towed device) is deployed, the USBL positioning system and transponder beacons will be activated and remain operational for the duration of the survey. It follows that USBL positioning system and associated subsea survey equipment, once deployed, will normally be functioning until the subsea equipment is removed from the water.

It is assumed that as the USBL positioning system and transponder beacons will be switched off when not in use preventing continuous noise in the marine environment. When the USBL positioning system and transponder beacons are working alongside other geophysical equipment emitting sound, it is proposed that additional pre-work mammal watches would only be required if there was a significant break in the operation with deactivation of the USBL positioning system, and as per the revised JNCC guidance [27]. The guidance states that if there is an unplanned break in the USBL positioning system ‘activation’ of longer than 10 minutes, then a 30-minute pre-watch before starting up again is necessary. If the break is planned, then the observer would watch during the ‘deactivation’ period, and if there are no cetaceans seen then the USBL positioning system and transponder beacons can be started again even if the break is longer than 10 minutes.

The same procedures will apply to the use of survey equipment associated with the mattress installation activities for the same reasons that the noise-generating activity being ongoing will act as a deterrent, reducing the potential that animals will approach within a distance at which injury could occur.

Pre-work searches should be carried out prior to the activation of all geophysical systems, particular MBES, and prior to the commencement of mooring deployment / recovery and mattress installation activities at each of the two locations. Additional pre-work mammal watches would be required where there is a significant break in the operation with deactivation of the sound source, as per the revised JNCC guidance [27] stated above.

8.2 Soft Start of Survey Equipment

As per the revised JNCC guidance [27], where practical, the power of electromagnetic sources (i.e. MBES) should be ramped up in a uniform manner. This controlled build-up of acoustic energy output shall occur in consistent stages to provide a steady and gradual increase over the ramp-up period (e.g., output peak sound pressure level of 170 dB->180 dB->190 dB->200 dB->200+ dB over 20 minutes). Where soft starts are not possible according to the operational parameters of any equipment, the device shall be switched “on” and “off” in a consistent sequential manner over a period of 20 minutes prior to commencement of the full necessary output.

Soft start should commence after a 500 m area around the vessel has been confirmed clear of species during the pre-work searches.

8.3 Transit Watches

A nominated competent observer on the bridge of the survey and installation works vessels will keep watch for marine mammals during transit between port and the survey corridor. Any sightings will be communicated to the Vessel Master as soon as is practicable and the following actions, as per the Scottish Marine Wildlife Watching Code [42], implemented:

- The Vessel Master will ensure that marine mammals are avoided to a safe distance (100 m or more) in all possible circumstances.
- The Vessel Master will minimise high powered manoeuvres where this does not impair safety.

8.4 Reporting

A log of all Marine Mammal Observer (MMO) (suitably briefed crew member or dedicated MMO) effort and geophysical survey systems and positioning equipment operations will be kept (using the JNCC Marine Mammal Recording Forms[7]).

Following completion of the survey programme, a report will be submitted to MD-LOT, which will include the following:

- Completed Marine Mammal Recording Forms
- Dates, locations and details of activities
- Details of all MMO operator effort including information about any marine mammals detected
- Details of any technical problems encountered and actions taken.

The Marine Noise Registry close-out report will also be completed.

[7] Available with the JNCC 2017 guidelines [27].

9 Conclusions

This assessment of the potential for impacts on cetacean EPS and basking shark from the proposed GVI and associated geophysical survey campaign and localised concrete mattress installation activities (including any associated temporary mooring operations), considering increased anthropogenic noise from use of the survey systems, increased vessel noise, collision risk, and indirect effects, from a worst-case scenario concluded that, post-mitigation:

- The potential for auditory injury is considered to be **negligible**
- The potential for disturbance is considered to be **negligible** within the context of the wider populations of EPS.

Following Scottish guidance [4] entitled "The protection of Marine European Protected Species from injury and disturbance: Guidance for Scottish Inshore Waters (July 2020 Version)", **there is potential for disturbance** to marine EPS (cetaceans), as defined in Regulations 39 (2) of the Habitats Regulations 1994 (as amended in Scotland), from increased anthropogenic noise during the survey and mattress installation.

Disturbance is expected to be localised, short-term and not detrimental to the maintenance of the populations concerned at Favourable Conservation Status. However, as disturbance arising from anthropogenic noise cannot be completely ruled out, an EPS licence is required in relation to disturbance.

Therefore an EPS licence will be required for this potential impact (increased anthropogenic noise).It is considered that a licence can be granted because the three tests relating to the requirements of Regulation 44 of the Habitats Regulations that must be passed before a licence can be granted (detailed in Section 4) have been satisfied (see Section 7).

In addition, a Basking Shark licence will be sought on a precautionary basis due to an inability to completely rule out potential impacts from increased anthropogenic noise and vessel presence.

10 References

10.1 Project References

Ref.	Document title	Doc. no.	Employer doc. no.
1	Construction Method Statement (CMS) for Marine License Application	00907106	
2	LT17 Orkney - Mainland HVAC 220 kV Subsea Link Environmental Appraisal	A-100413-S02-REPT-002	
3	Marine (Scotland) Act 2010, Part 4 Marine Licensing Licence To Construct, Alter Or Improve Works In The Scottish Marine Area	MS-00010803	

10.2 Internal References

Ref.	Document title	Doc. no.

10.3 External References

Ref.	Document title	Doc. no.
4	'The protection of Marine European Protected Species from injury and disturbance: Guidance for Scottish Inshore Waters (July 2020 Version)' - Marine Scotland and SNH (2020)	
5	'Atlas of cetacean distribution in north-west European waters' - Reid et al., 2003	
6	'Estimates of cetacean abundance in European Atlantic waters in summer 2022 from the SCANS-IV aerial and shipboard surveys' - Gilles et al. (2023)	
7	'Cetaceans of Orkney'. Available online: http://orcadianwildlife.co.uk/wPress/cetaceans-in-orkney/ - Orcadian Wildlife (2024)	
8	'Baseline surveys to inform SSEN Orkney Grid Connection Project' - ERM Ltd. (2019)	
9	'Scotland's Marine Atlas: Information for The National Marine Plan' - Scottish Government (2011)	
10	Statistical approaches to aid the identification of Marine Protected Areas for minke whale, Risso's dolphin, whitebeaked dolphin and basking shark' - Paxten et al. (2014)	

Ref.	Document title	Doc. no.
11	'Seasonal movements and behaviour of basking sharks from archival tagging: no evidence of winter hibernation' - Sims et al. (2008)	
12	Hebridean Whale and Dolphin Trust Sightings Map' Available online at: https://whaletrack.hwdt.org/sightings-map/ - HWDT (2024)	
13	'Fourth Report by the United Kingdom under Article 17 on the implementation of the Directive from January 2013 to December 2018: Conservation status assessments for Species: S1351, Harbour porpoise (*Phocoena phocoena*); Species: S2030, Risso's dolphin (*Grampus griseus*); Species: S2032, White-beaked dolphin (*Lagenorhynchus albirostris*); Species: S2618, Minke whale (*Balaenoptera acutorostrata*); and Species: S1355, Otter (*Lutra lutra*)' - JNCC (2019)	
14	'Third Report by the United Kingdom under Article 17 on the implementation of the Directive from January 2007 to December 2012: Conservation status assessments for Species: S1351, Harbour porpoise (*Phocoena phocoena*); Species: S2030, Risso's dolphin (Grampus griseus); Species: S2032, White-beaked dolphin (*Lagenorhynchus albirostris*); Species: S2618, Minke whale (*Balaenoptera acutorostrata*); and Species: S1355, Otter (*Lutra lutra*)' - JNCC (2013)	
15	'Proceedings on workshop on the effects of anthropogenic noise in the marine environment' - Gisiner (1998)	
16	'Auditory sensitivity and masking profiles for the sea otter (*Enhydra lutris*)' - Ghoul & Reichmuth (2016)	
17	'2018 Revisions to: Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing (Version 2.0): Underwater Acoustic Thresholds for Onset of Permanent and Temporary Threshold Shifts' - NMFS (2018)	
18	'Marine mammal noise exposure criteria: Updated Scientific recommendations for residual hearing effects' - Southall et al. (2019)	
19	'Argyll Array Wind farm basking shark draft chapter for Environmental Statement' - Booth et al. (2013)	
20	'Sharks senses and shark repellents' - Hart and Collin (2015)	
21	'The effect of underwater sounds on shark behaviour' - Chapuis et al. (2019)	
22	'Marine Mammals and Noise' - Richardson et al. (1995)	
23	'Assessment of underwater noise during the installation of export power cables at the Beatrice Offshore Wind Farm' - Nedwell et al., 2007	
24	'Hearing abilities of Baleen Whales' – Erbe (2002)	

Ref.	Document title	Doc. no.
25	'A prediction of the minke whale (*Balaenoptera acutorostrata*) middle-ear transfer function' - Tubelli et al. (2012)	
26	'Short-term disturbance by a commercial two-dimensional seismic survey does not lead to long-term displacement of harbour porpoises' - Thompson et al. (2013)	
27	'JNCC guidelines for minimising the risk of injury to marine mammals from geophysical surveys' - JNCC (2017) – draft update February 2025	
28	'Assessment of potential for significant disturbance/ disruption to cetaceans present in and around Broadhaven Bay, Co. Mayo, from pipeline construction operations'. Subacoustech Report No. 824R0113 for RSK Environment Ltd. – Nedwell et al. (2008)	
29	'Assessment of underwater noise during the installation of export power cables at the Beatrice Offshore Wind Farm' - Nedwell et al. (2012)	
30	'Underwater noise assessment for the Caithness to Moray transmission cable installation. Subacoustech Report No. E483R0104' - Barham et al. (2014)	
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33	'Cetacean Ship Strikes' - Sea Watch Foundation (2009)	
34	'Site fidelity and behaviour of bottlenose dolphins (*Tursiops truncatus*) in Cardigan Bay, Wales' - Bristow & Reeves (2001)	
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37	'Effects of watercraft noise on the acoustic behaviour of bottlenose dolphins, *Tursiops truncatus*, in Sarasota Bay, Florida' - Buckstaff (2004)	
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39	Reactions of harbour porpoise (*Phocoena phocoena*) to vessel traffic in the coastal waters of South West Wales, UK' - Oakley et al. (2017)	
40	'Basking shark Hotspots on the West Coast of Scotland: Key sites, threats and implications for conservation of the species' - Speedie et al. (2009)	

Ref.	Document title	Doc. no.
41	'Quantifying the effect of boat disturbance on bottlenose dolphin foraging activity' - Pirotta et al. (2018)	
42	'The Scottish Marine Wildlife Watching Code' Available at: https://www.nature.scot/doc/scottish-marine-wildlife-watching-code-smwwc-part-1 - SNH (2017)	

11 List of Appendices

N/A