Mares Connect Marine Survey

Title	**Ireland Offshore MMO Report - Geo Ocean VI**
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DEFINITIONS AND ABBREVIATIONS

Throughout this document the abbreviations listed in Table 1 are used. Where abbreviations used in this document are not included in Table 1, it may be assumed that they are either equipment brand names or company names.

Table 1: Abbreviations

Acronym	Description	Acronym	Description
BSL	Benthic Solutions Limited	MAG	Magnetometer
cu. in	Cubic Inch	MARA	Maritime Area Regulatory Authority
CPT	Cone Penetration Test	MBES	Multibeam Echosounder
dB	Decibel	MMO	Marine Mammal Observer
DAHG	Department of Arts, Heritage and the Gaeltacht	O.A.	Overall Dimension of Vessel
HDD	Horizontal Directional Drilling	PAM	Passive Acoustic Monitoring
HF	High Frequency	SBP	Sub-bottom Profiler
HVDC	High Voltage Direct Current	SSS	Side Scan Sonar
Hz	Hertz	UKCS	United Kingdom Continental Shelf
JNCC	Joint Nature Conservation Committee	UK	United Kingdom
kHz	Kilohertz	UTC	Universal Coordinated Time
LAT	Lowest Astronomical Tide		

1 INTRODUCTION

1.1 PROJECT OVERVIEW

MaresConnect plans to construct two converter stations—one near the Maynooth 220kV substation west of Dublin, Ireland, and the other near the Bodelwyddan 400kV substation in Denbighshire, Wales. These stations will be linked by two High Voltage Direct Current (HVDC) cables running across the Irish Sea. The cable route travels underground from Bodelwyddan to the coast, continues under the seabed across the Irish Sea, makes landfall near Dublin Bay, and then proceeds underground to Maynooth (Figure 1).

This report outlines the marine mammal mitigation measures applied throughout the geophysical and geotechnical operations in the Irish offshore areas of the MaresConnect cable route. The consent to undertake the survey was granted by the Maritime Area Regulatory Authority (MARA), consent number MUL240008.

The geophysical and the geotechnical survey was conducted by GEOxyz, supported by Benthic Solutions Limited (BSL) providing personnel to implement the mitigation measures taken to minimise harm to marine mammals. Offshore geophysical operations were carried out aboard the *Geo Ocean VI* between the 15th and 30th of July 2025 on a 12-hour daylight schedule. A geotechnical survey was conducted between the 6th and 10th of August 2025 aboard the *Geo Ocean VI*, operating on a 24-hour schedule. The geotechnical phase focused on targeted seabed sampling locations along the offshore and nearshore corridors. These activities provided data to inform engineering parameters such as sediment type, thickness, thermal resistivity, the feasibility of burial techniques, and support the final engineering layout.

Figure 1: Project site overview

1.2 SCOPE OF WORK

The Irish geophysical offshore survey involved acquisition of multibeam echosounder (MBES), side scan sonar (SSS), sub-bottom profiler (SBP), and magnetometer data (MAG). The survey area line plan was defined by the area within the Irish Foreshore Licence boundary (Figure 2).

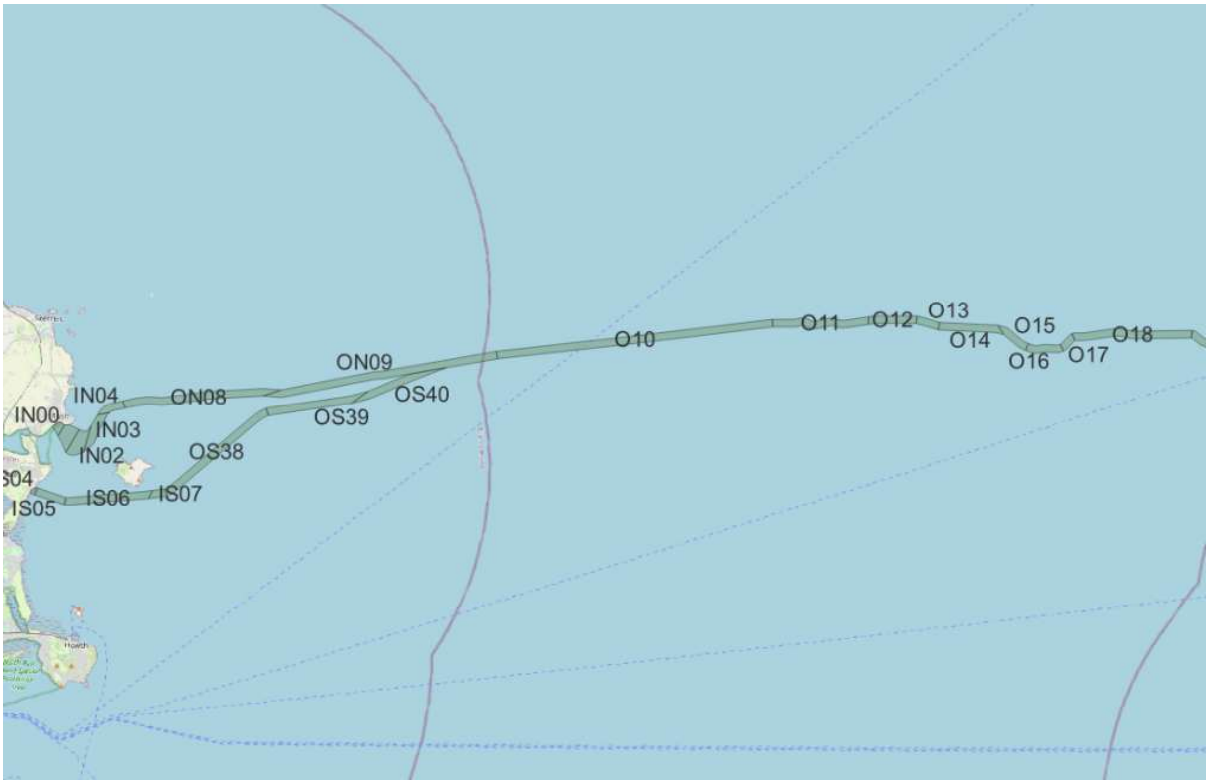

Figure 2: Survey area line plan for geophysical survey

The geotechnical survey involved Vibrocore and Cone Penetration Testing (CPT), and seabed visual inspections, with the objective of obtaining sediment and stratigraphy data critical for the detailed cable burial design and horizontal directional drilling (HDD) assessments at landfall locations. Eight locations were selected for Irish waters (Table 2).

Table 2: Irish waters geotechnical survey locations

Location	Depth (LAT)	Latitude	Longitude
GT_108	16,15m	53° 31.86’ N	006° 01.63’ W
GT_109	21,02m	53°31.94’ N	006°01.07’ W
GT_110	25,23m	53°32.00’ N	005°59.87’ W
GT_111	27,64m	53°32.09’ N	005°58.64’ W
GT_112	29,96m	53°32.22’ N	005°57.66’ W
GT_113	105,24m	53°34.78’ N	005°32.15’ W
GT_114	83,97m	53°35.52’ N	005°24.37’ W
GT_115	81,56m	53°35.63’ N	005°23,25’ W

1.3 SURVEY OBJECTIVES

The key objectives of the geophysical and hydrographic survey were:

- To obtain high-resolution bathymetry, seabed feature mapping and shallow geological data;
- To support cable route engineering, environmental characterisation and risk assessment;
- To investigate and characterise unidentified seabed anomalies and assess potential archaeological interest.

The geotechnical survey aimed to:

- Retrieve high-quality sediment cores via vibrocore;
- Perform CPT to a target penetration depth of 6 m below seabed;
- Conduct visual inspections to verify sampling locations and avoid sensitive habitats;
- Provide geotechnical data to inform HDD landfall design and burial methodology.

1.4 MMO AND PAM OBJECTIVES

The objectives of marine mammal mitigation during the geophysical and geotechnical surveys were:

- Provide advice to the survey team on the implementation of mitigation measures in compliance with relevant Irish and international guidelines;
- Undertake pre-shoot searches prior to the use of the sound sources that require mitigation procedures;
- Record geophysical and geotechnical operations, monitoring effort and marine mammal sightings;
- Supplement visual monitoring, particularly during periods of low visibility or darkness, to ensure continuous mitigation coverage;
- Record and log acoustic detections, specifying the species (where possible), call type, and bearing, to contribute to post-survey analysis and reporting.

1.5 SCOPE OF DOCUMENT

This report describes monitoring procedures and mitigation actions undertaken to reduce the risk of acoustic disturbance or injury to marine mammals, in line with the *Guidance to Manage the Risk to Marine Mammals from Man Made Sources in Irish Waters* (DAHG, 2014) and the conditions of the relevant Foreshore Licence. Marine mammal mitigation was conducted by Benthic Solutions Limited (BSL) in support of GEOxyz. The consent to undertake the survey was granted by the Department of Housing, Local Government and Heritage, consent number 25R0035.

2 METHODOLOGY

2.1 SURVEY VESSEL

Geophysical and geotechnical survey operations in offshore waters were carried out aboard the *Geo Ocean VI* (Table 3).

Table 3: Specifications of survey vessel *Geo Ocean VI*

Geo Ocean VI		
	Length:	53.80 m
	Width:	13.00 m
	Maximum draught:	4.8 m
	Cruising speed:	10 knots
	Main Propulsion:	2x Hybrid propulsion package on Berg CP propellers
	Endurance:	24h day operations (28 days)
	Accommodation:	30
	Positioning:	Station Keeping/Autopilot
	A-Frame:	A-Frame (4.5 x 8.0 m) SWL 15 tonnes
	Crane:	2.4 tonnes @ 8 m

2.2 GEOPHYSICAL EQUIPMENT

The geophysical survey employed a suite of equipment including multibeam echosounder (MBES), side scan sonar (SSS), sub-bottom profiler (SBP), and a Sparker system. All acoustic sources were operated in accordance with the *Guidance to Manage Risk to Marine Mammals from Man-made Sound Sources in Irish Waters* (DAHG, 2014). Sound source parameters are summarised in Table 4.

Table 4: Sound source parameters for offshore phase

Equipment Type	Manufacturer	Model / Type
MBES	R2Sonic	2024, Single Head
SBP	Innomar	SES-2000 Compact
SSS	Edgetech	4205, 300/600 kHz
Magnetometer	Geometrics	G882
Seismic Source	AAE Duraspark 400 Sparker System	Includes 1x AAE CSP-N 2400j PSU for Operation 1x Spare PSU and Umbilical + All HV Connections
Seismic Streamer	AAE single Channel Streamer	20 elements

2.3 GEOTECHNICAL EQUIPMENT

The geotechnical survey utilised a Cone Penetration Testing (CPT) system and a vibrocorer. The vibrocorer was subject to mitigation measures in line with the DAHG (2014) guidelines. Vibrocorer equipment specifications are detailed in Table 5. Only information about equipment that requires mitigation are included on the report.

Table 5: Sound source parameters for geotechnical survey

Equipment Type	Manufacturer	Frequency
Geo-Corer 3000/6000	Geo Marine Survey Systems	28Hz

2.4 MMO AND PAM OPERATOR EXPERIENCE

For the offshore geophysical survey, two JNCC approved MMOs were onboard the MV *Geo Ocean VI* to cover the 12-hour daylight survey schedule. During the geotechnical survey, two JNCC approved MMO/PAM operators were onboard the *Geo Ocean VI* to conduct both visual monitoring and passive acoustic monitoring (PAM). Personnel training and experience are summarised in Table 6.

For further information relating to the noise disturbance mitigation undertaken during the survey, please contact Benthic Solutions Limited (E-mail: enquiries@benthicsolutions.com; Tel: 01603 784726).

Table 6: Summary of MMO/PAM personnel training and experience

Name	Dates Onboard	MMO Training	MMO Experience	PAM Training	PAM Experience
Daniel Pinto	15/07/2025 – 02/08/2025	JNCC MMO; PSO MMS (April 2016)	7 years	PAM training @Seiche (2015)	10 years
Sergio d'Albero	15/07/2025 – 02/08/2025	JNCC MMO; PSO MMS (April 2016)	7 years	PAM Operator Gardline Internal Training (2021)	4 years
Nuno Carrilho	02/08/2025 – 11/08/2025	JNCC MMO; BOEM PSO (2013)	12 years	IMarEST PAM (2025)	1 year
Katia Bolis	03/08/2025 – 11/08/2025	JNCC MMO & BOEM PSO (2023)	2 years	NAV OCEANOGRAFIA AMBIENTAL (2022)	3 years

2.5 MARINE MAMMAL MITIGATION PROCEDURES

To ensure the risk of injury to marine mammals is minimised during the operations two different mitigation procedures were followed. Both based on the *Irish Guidance to Manage Risk to Marine Mammals from Man-made Sound Sources in Irish Waters* (DAHG, 2014).

2.8.1 MITIGATION MEASURES FOR GEOPHYSICAL PHASE

Mitigation procedures were applied to all geophysical surveys conducted in Irish waters. The following DAHG (2014) guidance was implemented and summarised in Table 7:

Pre-shoot search: In survey depths of 3–79 m, a 30-minute pre-shoot search (for water depths <200 m) was conducted by the MMO during daylight. If marine mammals were observed within the 500 m mitigation zone (MBES, SSS, SBP) or 1000 m mitigation zone (Sparker), operations were delayed for at least 30 minutes after the last sighting.

Soft start: Required before starting any source with a peak sound pressure level >170 dB re 1 µPa @ 1 m. Power was gradually increased over 20 minutes (MBES, SBP, SSS) or 40 minutes (sparker).

Source silences: If MBES, SSS, or SBP were off for more than 30 minutes, operations did not resume until a pre-shoot search and soft start had been completed. For the sparker, this period was reduced to 10 minutes.

Line turns: If a line turn was <40 minutes, acoustic sources could remain at full power (all line turns during this survey were <40 minutes).

Shutdowns: Once active, sources were not shut down if marine mammals entered the mitigation zone, as per DAHG (2014) provisions.

Table 7: Summary of geophysical mitigation measures and requirements

Mitigation Zone	500 meters for MBES, SSS and SBP / 1000 metres for Sparker
Pre-Shooting Search Period	30 minutes
Soft Start Length	20 minutes for MBES, SSS and SBP / 40 minutes for Sparker
Soft Start Method	Increase power of sources incrementally
Delay Length	30 minutes after last sighting in mitigation zone or until the animal is seen leaving the mitigation zone
Line Turns	Line Turns under 40 minutes continue at operational power
Shutdown During Works	Not required
Species	Marine mammals

2.8.2 MITIGATION MEASURES FOR GEOTECHNICAL PHASE

During the geotechnical survey, mitigation was also implemented following the DAHG (2014) guidelines for equipment with potential acoustic output (vibrocore). The protocols followed were based on the drilling mitigation measures described by DAHG (2014) In addition, the use of passive acoustic monitoring (PAM) during periods of reduced visibility and darkness was discussed with the Maritime Area Regulatory Authority (MARA). The measures included were:

- Conducting a 30-minute pre-start-up search (or pre-shoot search) prior to vibrocore operations, visually (MMO) during daylight hours and acoustically (PAM) during darkness hours or poor visibility in water depths <200 m;
- Delaying operations if marine mammals were observed within a 500 m mitigation zone until 30 minutes had passed without a sighting;
- Utilising PAM to detect marine mammal presence during periods of reduced visibility or at night, ensuring compliance with mitigation requirements;
- In case of a break in operations exceeding 30 minutes (due to failure or location change), conduct a new 30-minute pre-start-up search;
- Recording all mitigation actions, observation effort, and detections (visual and acoustic) for regulatory reporting.
- Shutdowns: Once active, sources were not shut down if marine mammals entered the mitigation zone, as per DAHG (2014) provisions.

2.6 MARINE MAMMAL MITIGATION

2.8.3 VISUAL MONITORING OF MARINE MAMMALS

During the offshore geophysical and geotechnical survey, two experienced and dedicated JNCC MMOs were onboard the Geo Ocean VI, conducting continuous visual searches for marine mammals. Observations were made from the bridge or from the bow (eye height approximately 9 m above sea level), again adjusting position to ensure full coverage of the mitigation zone.

The sea surface was scanned alternately with the naked eye and using 7 × 50 and 10 x 50 binoculars (with reticules and built-in compass) to maximise the likelihood of sighting animals. Distances to sightings were estimated using binocular reticules calibrated to the observation platform and corroborated with a range finder stick. Observation cues included splashes, dorsal fins, saddle patches, whale blows, and aggregations of seabirds.

An observer's ability to visually detect marine mammals is affected by several environmental conditions including sea state, swell, visibility, and sun glare. Conditions which are considered optimal for cetacean observation are: Beaufort 0-3; sea state glassy to slight, swell < 2 m; visibility > 1 km, and no, weak, or variable sun glare.

Wind speed was classified according to the Beaufort scale; other classifications for sea state, swell, visibility, and glare followed the UK JNCC guidelines. A new effort record was entered every time environmental conditions changed, when the MMOs changed shift, or otherwise approximately every hour.

A digital SLR camera (Panasonic Lumix FZ-300 – 24× optical zoom, 25–600 mm (Leica DC Vario-Elmarit lens, f/2.8) and Canon EOS 2000D – 70-300mm) was used to take images of marine mammals to aid species identification; as was the reference book, 'Whales, Dolphins, and Seals: A Field Guide to the Marine Mammals of the World' by Shirihai and Jarrett (2006).

Data was recorded in the standard JNCC format. The start and end of all geophysical operations, including the start and end of each line or test, the length of soft starts and the times of pre-shooting searches were recorded (Appendix B - Marine Mammal Recording Form: Operations Log).

The start and end of all effort watches, i.e., periods when effort was made to monitor for marine mammals, with descriptors including source status, location, weather, depth, and sea conditions were recorded at least once every hour or when anything changed (Appendix C - Marine Mammal Recording Form: Effort log). Under JNCC methodology, sea state is described as glassy (mirror-like), slight (no or few white caps), choppy (many white caps) or rough (large waves, foam crests, spray); swell height as low (<2 m), medium (2-4 m), or large (>4 m); and visibility as poor (< 1 km), moderate (1-5 km) or good (>5 km).

Sighting location, species, distinguishing characteristics, number of individuals, behaviour and relevant details about any mitigation required or interactions with operations were recorded (Appendix D - Marine Mammal Recording Form: Sightings Log). A sighting was defined as an encounter with an animal, or a discrete group of animals deemed associated behaving in a unified manner, i.e., encountering a pod of ten dolphins at one time, is still counted as one sighting.

2.8.4 PASSIVE ACOUSTIC MONITORING OF MARINE MAMMALS

Acoustic monitoring pre-searches were available as an alternative to marine mammal observation prior to commencing vibrocore operations during periods of poor visibility and darkness. If unsuitable conditions for visual watches were experienced during vibrocore operations, acoustic monitoring was to be undertaken from the *GEO Ocean VI* using custom-built PAM equipment supplied by Subacoustech Environmental Ltd.

While PAM is an effective and well-established method of monitoring marine mammals, it is important to understand and recognise its limitations. Just as MMOs can only detect animals when they are active at the surface, PAM can only detect marine mammals when they are vocalising. It is also entirely possible for vocalising animals to be present but be undetectable by PAM, due to their physical orientation relative to the array and/or a low signal-to-noise ratio masking their vocalisations (Figure 4; Todd et *al.,* 2015).

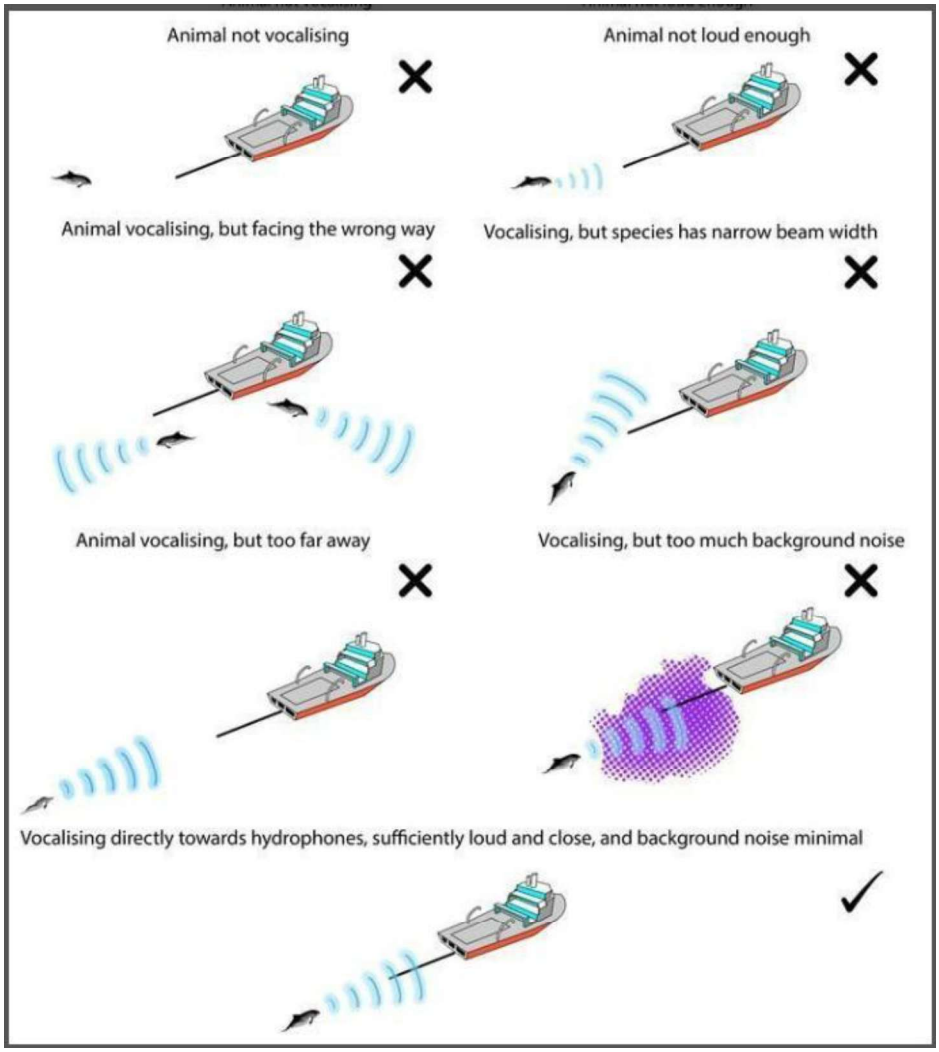

Figure 3: PAM limitations. Source: Todd *et al.* (2015)

The PAM system consisted of a four-element hydrophone array and a depth gauge mounted on a tow cable, connected via a deck cable to a signal processing unit with an audio output and laptop computer running PAMGuard software (version 2.02 .16) in the vessel's workshop (Figure 4).

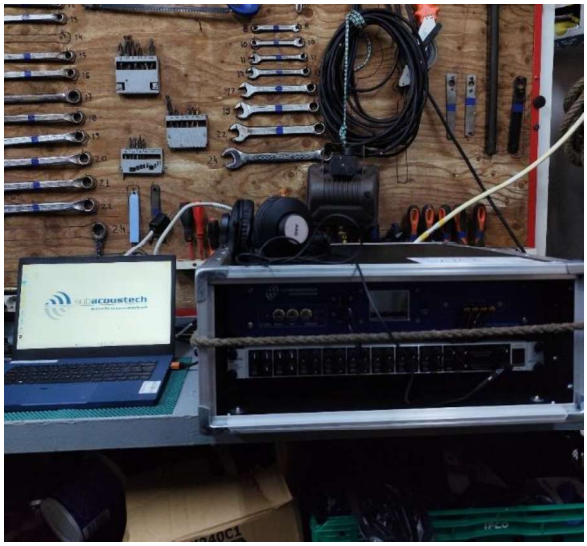

Figure 4: PAM station in the workshop

The array configuration comprised 1 m spacing between hydrophone channel zero and the depth sensor; 2 m spacing between hydrophone channel zero and channel one, and between hydrophone channel one and channel two; 8 m spacing between hydrophone channels two and channel three (Figure 5). All four channels were broadband, capable of detecting signals up to 250 kHz. The depth sensor was located at the end of the array.

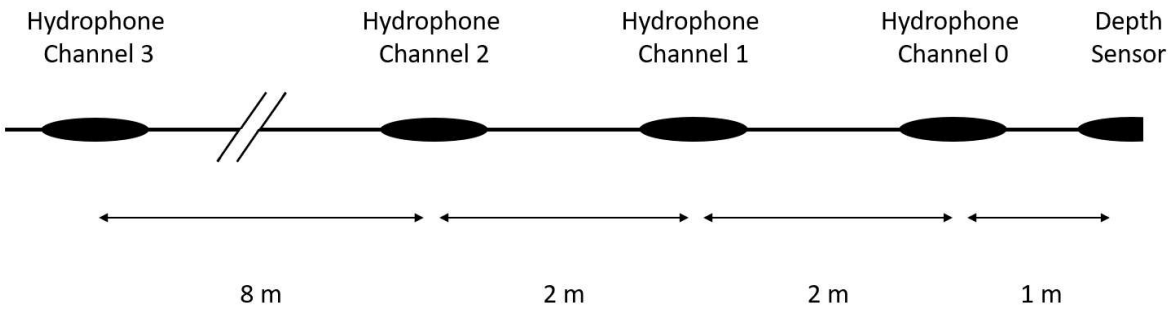

Figure 5: Towed cable array layout (hydrophone section)

The array cable was deployed statically and vertically from the middle of the starboard side of the vessel, approximately 16 m from the vibrocorer. A 5 kg weight was attached to the cable to maintain vertical deployment. This deployment arrangement was considered the optimal available configuration to minimise noise interference from the vessel's thrusters, as background noise levels were high.

Deployment and recovery of the cable were carried out manually in accordance with the "*Operations Procedure GEO Ocean VI – PAM Deployment and Recovery*" (GEOxyz Document Number: GEO-GO6-OPP-6026). The cable was stored in a figure-of-eight pattern around a mooring bollard. A toolbox talk was conducted on the bridge prior to each deployment and recovery.

The incoming acoustic signal was processed in PAMGuard (version 2.02.16) using configurations tailored to high frequency (25kHz to 250kHz), medium frequency (up to 50kHz), and low frequency via a decimator (up to 3kHz).

A click detector, displaying pulse signals in the high-frequency band, was displayed in the amplitude-versus-time window. A whistle and moan detector were configured for the low-frequency spectrogram. The PAM operator regularly switched between the various detectors, adjusting the display duration as appropriate. Additional modules, including a sound recorder and a print screen were incorporated into the configuration (Figure 6 and Table 8).

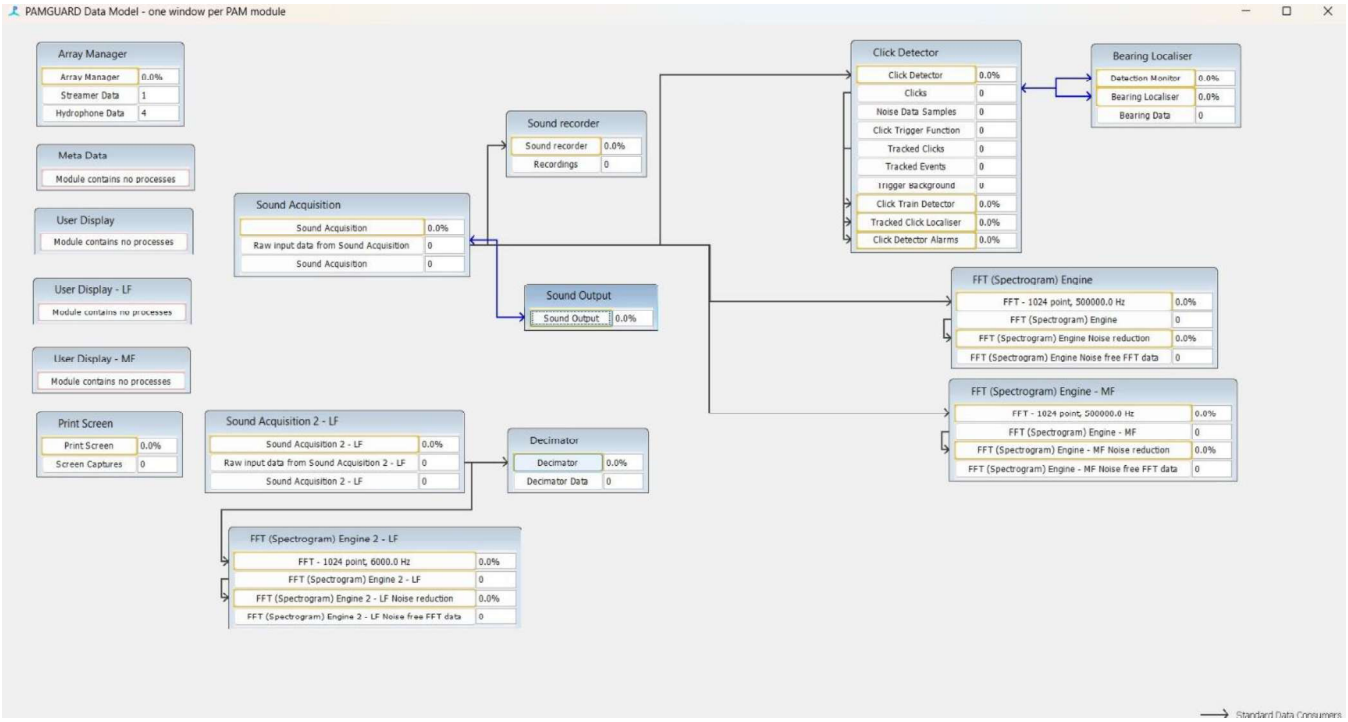

Figure 6: PamGuard data model showing all modules used during the survey

Table 8: PAMGuard detector settings

Laptop	Sound Card / DAQ	Channels / Sample Rate	Detector	Settings	Display	Target Species
MF	TASCAM US-16X08	2 x 96kHz	Human eye	0-48kHz, blue	Spectrogram, 20s window	Odontoceti
MF	TASCAM US-16X08	2 x 96kHz	Whistle & Moan	1-24kHz; length 35, total 70	Spectrogram overlay	Odontoceti
MF	Behringer Ultragain Pro Mic 2200	2 x 48kHz (decimated)	Click detector	500Hz high pass pre-filter; 2kHz band pass trigger filter.	Time vs amplitude, 10 min window, colour by click train	Odontoceti, Sperm whale
MF	TASCAM US-16X08	1 x 2kHz (decimated)	Human eye	0-250Hz, grey scale	Spectrogram, 30 second window	Baleen whales
MF	TASCAM US-16X08	1 x 2kHz (decimated)	Whistle & Moan	10-250Hz; length 20; total 40	Spectrogram overlay	Baleen whales
HF	SAIL DAQ	1 x 500kHz	Click detector	10kHz high pass pre-filter; 15kHz high pass trigger filter PAMGuard default 'porpoise'	Time vs amplitude, 30 second window, colour by click classification	Harbour porpoise, Odontoceti

Due to the vertical deployment of the PAM cable, estimated animal distances from the sound source were based on sound propagation characteristics, operator experience, and in line with the *JNCC Guidance for the Use of PAM in UK Waters to Minimise the Risk of Injury to Marine Mammals from Offshore Activities* (JNCC, 2023).

3 RESULTS AND INTERPRETATION

3.1 MARINE MAMMAL OBSERVATIONS

A total of 132 hours and 5 minutes of visual monitoring were conducted over two periods. Firstly for the geophysical survey between the 18th of July and the 30th of July 2025. Then for the geotechnical survey between the 6th and 10th of August 2025.

While visual monitoring was conducted, the sources were active for 102 hours and 11 minutes and inactive for 29 hours and 54 minutes (Table 9)**.** There were 23 pre-shoot visual searches, all with a minimum duration of 30 minutes.

Table 9: Duration of visual monitoring with and without source activity during geophysical survey

MMO Monitoring	Duration (hh:mm)	
	No Source	Source Active
No Source	29:54	
Soft Start		7:38
Reduced Power		28:39
Full power (lines*,tests and turns)		65:54
Subtotal:	29:54	*102:12*
Total:	**132:05**	

** Includes full power run ins*

Sea conditions were good for sighting marine mammals, with wind force ranging from 1 to 4, coming mostly from the southwest. The sea state was predominantly slight and visibility was good with a low swell and no sun glare (Table 10; further illustrated in Figure 7 to Figure 13)

Table 10:Duration of visual monitoring with environmental conditions during geophysical survey

Wind Force (Beaufort Scale)	Duration (hh:mm)
0	0:00
1	21:42
2	74:25
3	23:01
4	11:45
5	1:12
6	0:00
7	0:00
Total:	**132:05**

Wind direction	Duration (hh:mm)
North	0:00
Northeast	12:34
East	0:00
Southeast	21:36
South	16:39
Southwest	36:18
West	25:54
Northwest	17:55
Total	**132:05**

Sea State	Duration (hh:mm)
Glassy	25:11
Slight	106:05
Choppy	0:49
Rough	0:00
Total:	**132:05**

Precipitation	Duration (hh:mm)
None	129:03
Light	3:02
Moderate	0:00
Heavy	0:00
Total:	**132:05**

Swell	Duration (hh:mm)
Low	132:05
Medium	0:00
Large	0:00
Total:	**132:05**

Visibility	Duration (hh:mm)
Good	128:31
Moderate	3:34
Poor	0:00
Total:	**132:05**

Sun glare	Duration (hh:mm)
None	110:12
Weak Forward	0:32
Strong Forward	3:08
Variable Forward	3:30
Weak Behind	8:00
Strong Behind	2:56
Variable Behind	3:46
Total	**132:05**

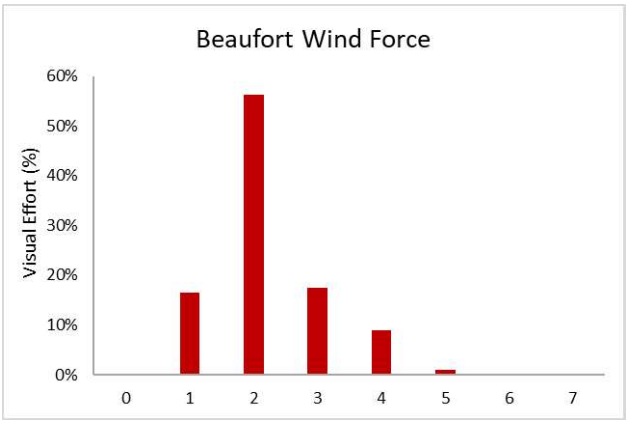

Figure 7: Wind force

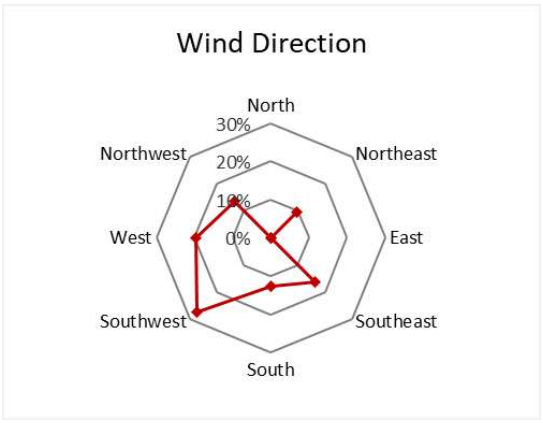

Figure 8: Wind direction

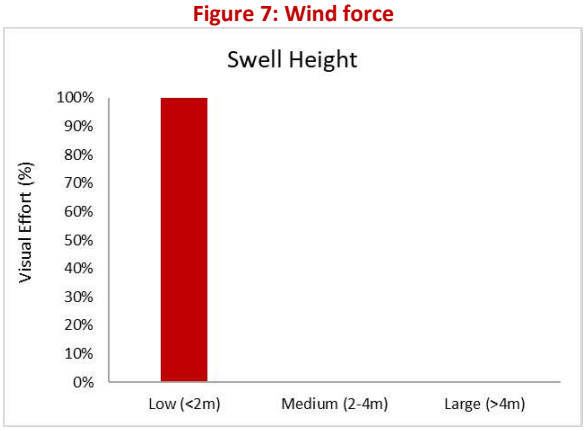

Figure 9: Swell

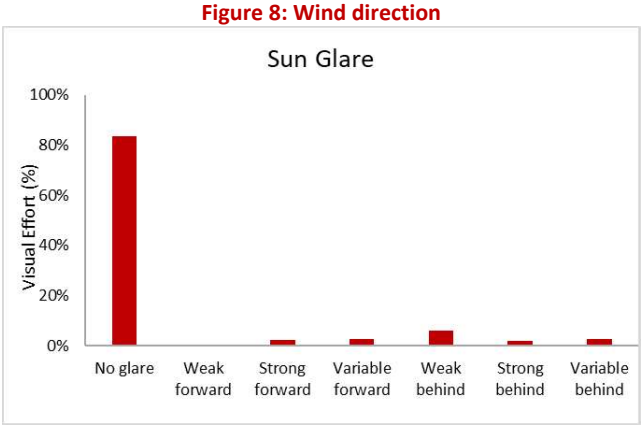

Figure 10: Sun glare

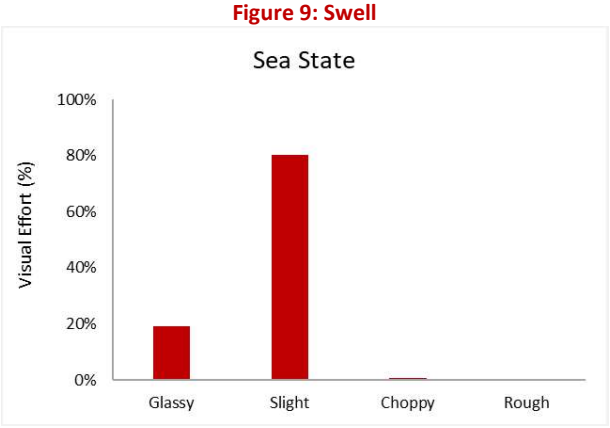

Figure 11: Sea state

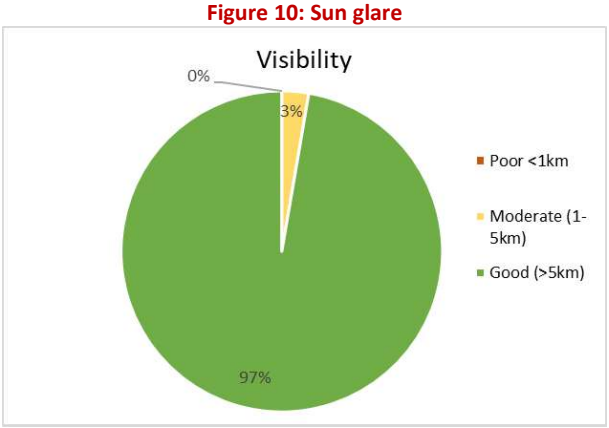

Figure 12: Visibility

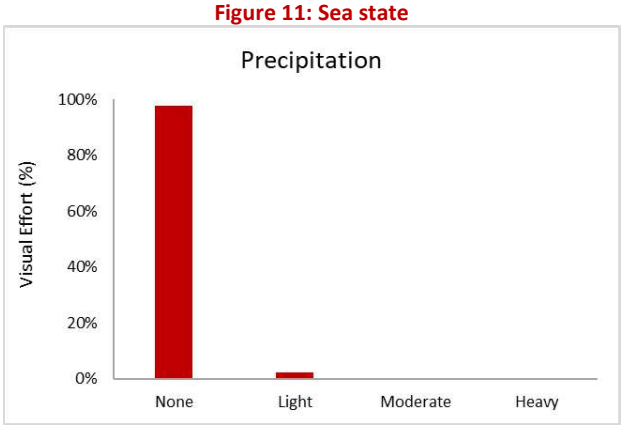

Figure 13: Precipitation

3.2 PASSIVE ACOUSTIC MONITORING

Based on guidance from the Maritime Area Regulatory Authority (MARA), passive acoustic monitoring was available as a contingency to marine mammal observation during geotechnical operations. However, no passive acoustic monitoring was required during this survey, as conditions were suitable for continuous marine mammal observation and vibrocore operations were conducted during daylight hours.

3.3 GEOPHYSICAL SURVEY SUMMARY

There was a total of 14 soft starts, with a cumulative duration of 7 hours and 32 minutes. After a 30-minute pre watch, all soft starts for the MBES, SSS and SBP were at least 20 minutes long. There were 7 extended starts for the sparker, each of these were 40 minutes.

The sources were active for 117 hours and 56 minutes. There were 92 acquired lines in total accounting for 72 hours and 24 minutes. There were 91 line turns totalling 34 hours and 12 minutes. A total of 13 test lines were carried out, with a cumulative total of 2 hours and 38 minutes. (Table 11).

Table 11: Duration of total source activity during geophysical survey

Source Activity	Full Power		Reduced Output	
	Total Duration (hh:mm)	Number	Total Duration (hh:mm)	Number
Soft Starts			7:32	14
Run in	0:36			
Full Power Lines	72:24	92		
Tests	2:38	13		
Run Outs, full power	0:21			
Run Outs, reduced power			0:13	
Line Turns			34:12	91
Subtotal:	*75:59*	*105*	41:57	105
TOTAL Duration:	**117:56**			

3.4 GEOTECHNICAL SURVEY SUMMARY

Vibrocore testing was conducted on nine occasions, all of which were during daylight hours with good visibility. A 30 minute pre-watch was conducted before each vibrocore test.

3.5 SIGHTINGS DURING GEOPHYSICAL SURVEY

There were four sightings of marine mammals during survey (Table 12). No mitigation was required. Three of the sightings were of dolphins, two of which were confirmed to be common dolphins (*Delphinus delphis*). There was also a sighting of a Minke whale *(Balaenoptera acutorostrata)*.

Table 12: Total sightings during the geophysical and geotechnical survey

Sighting/Detection Number	Date	Time (UTC)	Species	Number of Individuals	Distance from Source (m)	Source Activity	Action Taken
1	25/07/2025	12:12	Minke whale (Balaenoptera acutorostrata)	1	300	Active	Not required
2	25/07/2025	16:48	common dolphin (Delphinus delphis)	3	50	Active	Not required

Sighting/Detection Number	Date	Time (UTC)	Species	Number of Individuals	Distance from Source (m)	Source Activity	Action Taken
3	26/07/2025	6:49	common dolphin (Delphinus delphis)	8	10	Active	Not required
4	06/08/2025	15:57	Unidentified dolphin	2	620	Not active	Not required

3.6 DISTURBANCE AND MITIGATION ACTIONS

No mitigation actions were required during both survey phases.

3.7 COMPLIANCE WITH THE MITIGATION PROTOCOL

Geophysical and geotechnical survey operations were conducted in accordance with the DAHG (2014) *"Guidance to Manage the Risk to Marine Mammals from Man-made Sound Sources in Irish Waters"*.

Visual monitoring was maintained during all periods of good visibility for the duration of the survey operations. A 30-minute pre-shoot search was conducted before each use of all equipment and all soft starts for MBES, SSS and SBP were 20 minutes in duration. There was seven soft start required for the Sparker, each of which were 40 minutes long. All line turns were under 40 minutes.

The survey and vessel crew were fully compliant with the discussed mitigation protocols in both the geophysical and geotechnical surveys. No sources were active outside the consented greater working area.

4 CONCLUSION

During all survey, geophysical and geotechnical phases, there were 4 marine mammal sightings. No mitigation measures were required.

The survey was fully compliant with all mitigation protocols. All efforts were made to minimise impacts to marine mammals and adhere to the DAHG (2014) *"Guidance to Manage the Risk to Marine Mammals from Man-made Sound Sources in Irish Waters"*, throughout the survey.

Environmental conditions and weather were good for marine mammal observations for the majority of the time during the survey.

The timings of all pre-shoot searches, soft starts, geophysical and geotechnical operations are recorded in Appendix B - Marine Mammal Recording Form: Operations Log, all visual monitoring effort is recorded in Appendix C - Marine Mammal Recording Form: Effort log and sightings are recorded in Appendix D - Marine Mammal Recording Form: Sightings Log.

5 REFERENCES

Department of Arts, Heritage and the Gaeltacht, (DAHG). 2014 Guidance to Manage the Risk to Marine Mammals from Man Made Sources in Irish Waters

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Shirihai, H., and Jarret, B. 2006. Whales, Dolphins and Seals. A Field Guide to the Marine Mammals of the World. A & C Black Publishers. ISBN 0691127573.

Todd, V., Todd, I., Gardiner, J., and Morrin, E. 2015. Marine Mammal Observer and Passive Acoustic Monitoring Handbook. Pelagic Publishing, Exeter, ISBN 978-1-907807-66-1, pp.282-288.

APPENDIX A - MARINE MAMMAL RECORDING FORM: COVER PAGE

Regulatory reference number	25R0035			
Country	Ireland			
Location	offshore Ireland			
Ship/ platform name	Geo Ocean VI			
Client	Mares Connect Ltd			
Contractor	GEOxyz			
Survey type (site, 2D, 3D, 4D, OBC, VSP, etc.)	site			
Start date	18/07/2025			
End date	30/07/2025			
Number of source vessels	1			
Type of source (e.g., airguns)	MBES	SSS	SBP	Sparker
Number of airguns (only if airguns used)	N/A	N/A	N/A	N/A
Source volume (cu. in.)	N/A	N/A	N/A	N/A
Source depth (metres)	1	8	0.7	0.5
Frequency (kHz)	200-400	230/540	1.7-5.5	5
Intensity (dB re. 1µPa or bar metres)	220	226	238	212
Shot point interval (metres)	N/A	N/A	N/A	N/A
Method of soft start	o	o	o	o
Visual monitoring equipment used	Binoculars			
Magnification of optical equipment	7x50			
Height of eye above water surface (metres)	2.2			
How was distance of animals estimated?	C and B			
Number of dedicated MMOs	2			
Training of MMOs	u			
Was PAM used?	n			
Number of PAM operators (PAM only)	N/A			
Description of PAM equipment (PAM only)	N/A			
Range of hydrophones from airguns (PAM only)	N/A			
Bearing of hydrophones from airguns (PAM only)	N/A			
Depth of hydrophones (PAM only)	N/A			

Regulatory reference number	25R0035
Country	Ireland
Location	Offshore Ireland
Ship/ platform name	Geo Ocean VI
Client	Mares Connect Ltd
Contractor	GEOxyz
Survey type (site, 2D, 3D, 4D, OBC, VSP, etc.)	other
Start date	06/08/2025
End date	10/08/2025
Number of source vessels	1
Type of source (e.g., airguns)	Vibrocore
Frequency (kHz)	28Hz
Method of soft start	N/A
Visual monitoring equipment used	Binoculars
Magnification of optical equipment	7x50, 10X50
Height of eye above water surface (metres)	9.3
How was distance of animals estimated?	C and B
Number of dedicated MMOs	2
Training of MMOs	u
Was PAM used?	Y
Number of PAM operators (PAM only)	2
Description of PAM equipment (PAM only)	SubAcoustech 4 channel
Range of hydrophones from airguns (PAM only)	16m
Bearing of hydrophones from airguns (PAM only)	90
Depth of hydrophones (PAM only)	20m

APPENDIX B - MARINE MAMMAL RECORDING FORM: OPERATIONS LOG

Provided as a separate MS Excel file and available upon request.

APPENDIX C - MARINE MAMMAL RECORDING FORM: EFFORT LOG

Provided as a separate MS Excel file and available upon request.

APPENDIX D - MARINE MAMMAL RECORDING FORM: SIGHTINGS LOG

Provided as a separate MS Excel file and available upon request.

APPENDIX E – SERVICE WARRANTY

This report, with its associated works and services, has been designed solely to meet the requirements of the contract agreed with you, our client. If used in other circumstances, some or all of the results may not be valid and we can accept no liability for such use. Such circumstances include different or changed objectives, use by third parties, or changes to, for example, site conditions or legislation occurring after completion of the work. In case of doubt, please consult Benthic Solutions Limited.