MERC Consultants
environmental and conservation services

EU Habitats Directive: Annex IV Risk Assessment

Department of Climate, Energy and the Environment (DCEE): South Coast Designated Maritime Area Plan (SCDMAP) geophysical reconnaissance, metocean, geotechnical, benthic and passive acoustic surveys.

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1. Introduction

Ireland has adopted a plan-led approach to achieving its offshore wind targets. The Minister for the Department of Climate, Energy and the Environment (DCEE) has commissioned the preparation of a Marine Usage Licence (MUL) application to conduct and support marine surveys in the South Coast Designated Maritime Area Plan (DMAP), including geophysical, geotechnical, metocean, and biological surveys (a brief description of the survey specifications is provided in). Surveying for marine data is a crucial step in the preparation for the Offshore Renewable Electricity Support Scheme (ORESS) auctions. Providing extensive, accurate, and high-quality data helps inform and de-risk auctions, leading to lower energy prices for consumers.

DCEE is preparing a Marine Usage Licence (MUL) application to support marine baseline surveys within and adjacent to the South Coast Designated Maritime Area Plan (SC-DMAP).

The programme is expected to be implemented over a multi-year period, with key survey components anticipated to mobilise in Q2/Q3 2026 or 2027 (subject to vessel and contractor schedules). Survey works include activity within the SC-DMAP maritime areas off Waterford and Wexford and transit and corridor lines to support site characterisation and cable route identification, with certain works extending across the wider SC-DMAP area where required. Survey activities are scheduled intermittently between 2026 and 2030 (including longer-term metocean and passive acoustic deployments).

The survey programme comprises geophysical, geotechnical, biological, benthic, acoustic and metocean components. The proposed broad geophysical target survey area covers 5,653.88 km² and extends from the nearshore to the 75 m depth contour, from approximately 37 km southeast of Carnsore Point (Co. Wexford) westwards to Oysterhaven (Co. Cork) (Figure 1). Survey activity will be concentrated within the three SC-DMAP maritime areas (Lí Bán B, Manannán C and Danu D), with some work also proposed in Tonn Nua (A). Additional activities will include connecting corridors and transit lines within the MUL boundary, including routes from Cork Harbour.

The coastal area incorporated in the Cork Harbour approaches is to facilitate the acquisition of baseline geophysical data in support of power cable routing for grid connection to offshore wind infrastructure.

This report provides an assessment of the potential impact the proposed project might have on Habitats Directive (92/43/EEC) Annex IV species identified as having the potential to be present in the project area.

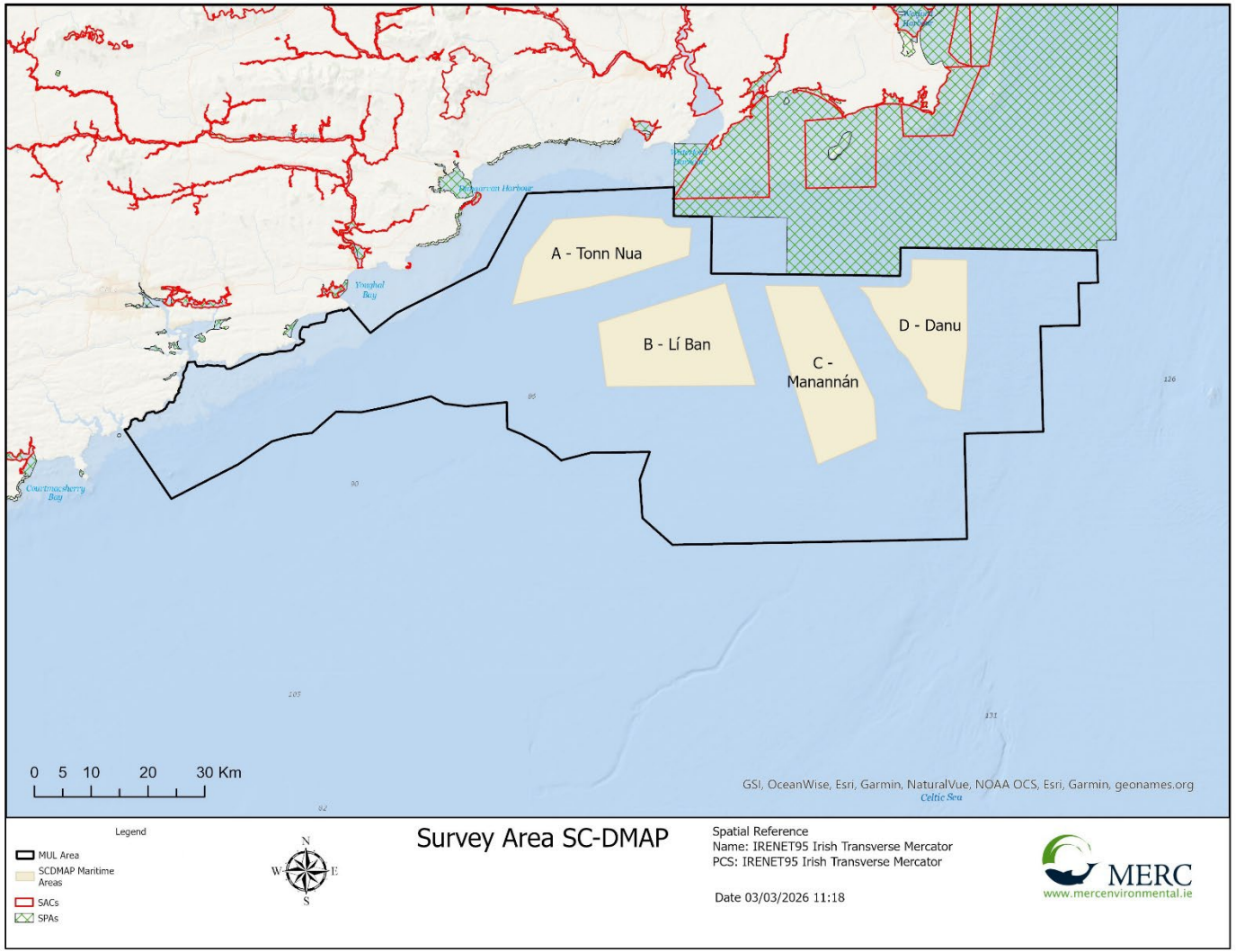

Figure 1. Overview of proposed survey location relative to European sites.

2. Legislation

Article 12 of the EU Habitats Directive states:

Member States shall take the requisite measures to establish a system of strict protection for the animal species listed in Annex IV (a) in their natural range, prohibiting:
(a) all forms of deliberate capture or killing of specimens of these species in the wild.
(b) deliberate disturbance of these species, particularly during the period of breeding, rearing, hibernation and migration.
(c) deliberate destruction or taking of eggs from the wild.
(d) deterioration or destruction of breeding sites or resting places.

2. For these species, Member States shall prohibit the keeping, transport and sale or exchange, and offering for sale or exchange, of specimens taken from the wild, except for those taken legally before this Directive is implemented.

3. The prohibition referred to in paragraph 1(a) and (b) and paragraph 2 shall apply to all stages of life of the animals to which this Article applies.

4. Member States shall establish a system to monitor the incidental capture and killing of the animal species listed in Annex IV (a). In the light of the information gathered, Member States shall take further research or conservation measures as required to ensure that incidental capture and killing does not have a significant negative impact on the species concerned.

The Habitats Directive is transposed into Irish law by S.I. No. 477/201- European Communities (Birds and Natural Habitats) Regulations, 2011-2021. Annex IV species are subject to strict protection under Regulation 51/52 of this Statutory Instrument.

Project design and mitigation has been applied to prevent prohibited acts (capture/killing/disturbance, and deterioration/destruction of breeding sites or resting places). A Regulation 54 derogation is considered only where the residual risk of a prohibited act remains. Any derogation must pass the three cumulative tests in sequence: (1) it is required for a reason listed in Regulation 54(2)(a)–(e); (2) there is no satisfactory alternative (including 'do nothing'), noting that alternatives cannot be rejected solely on cost/delay grounds; and (3) it is not detrimental to maintaining the population at favourable conservation status in its natural range, with precaution applied where scientific uncertainty persists.

This document presents an Annex IV risk assessment to address the strict protection provisions for Annex IV species. The focus being on avoiding prohibited acts (injury/killing, deliberate disturbance, and deterioration/destruction of breeding sites or resting places) for Annex IV species within the Zone of Influence of the proposed project.

3. Scope of work

The reconnaissance survey data collected by this initial and future survey works will provide information in the upper 100 m of sub-surface geology, to inform the potential suitability of marine areas for possible offshore wind and grid infrastructure development, should these areas be identified as suitable for offshore wind and/or grid development within the final South Coast DMAP.

The proposed broad geophysical target survey area is 5,653.88 km^2. It encompasses an area from the nearshore out to the 75m contour stretching from approximately 37 km southeast of Carnsore Point off the Wexford coast, west to Oyster Haven, County Cork (Figure 1).

The biological surveys will also contribute to the Regional Level Surveys, as required by the SC-DMAP Implementation Plan, which will support the implementation and monitoring of the SC-DMAP and inform cumulative and in-combination assessments at project level for development permission applications within Maritime Areas B, C and D. Works will be conducted primarily within three maritime areas off Waterford and Wexford, with indicative transit lines from the Tonn Nua cable corridor (Cork side) to Li Ban, and a second indicative corridor beyond Li Ban within the SC-DMAP/MUL boundary. The overall objective of the surveys is to characterise seabed and sub-seabed conditions and to collect baseline metocean, benthic, and acoustic data to support the feasibility, design, and environmental assessment of future offshore wind and grid infrastructure. Coverage focuses on the three SC-DMAP maritime areas (Li Ban B, Manannán C, and Danu D), with some work at Tonn Nua (A), off Waterford/Wexford, potential transit lines from Cork Harbour, and corridors between sites.

The MUL scope also comprises survey works across the wider SC-DMAP area, including locations outside the development areas. This is relevant to pre- and post-construction monitoring under the SC-DMAP implementation plan, which is expected to focus on biological surveys (benthic monitoring and passive acoustic monitoring) and may be undertaken at a regional scale. Small-scale benthic sampling is anticipated to inform the selection of long-term monitoring stations. In addition, passive acoustic monitoring will take place within the wider SC-DMAP area to support regional baseline and future monitoring needs. Geophysical transit corridor lines for EirGrid cable route identification may also extend beyond the development areas.

Table 1 summarises the planned surveys and their data-acquisition scopes to support offshore wind site assessment. The works comprise an integrated programme of geophysical, geotechnical, biological, benthic, acoustic, and metocean surveys, designed to characterise seabed and sub-seabed conditions, establish baseline environmental receptors, and provide the datasets required for engineering feasibility, constraint mapping, and subsequent consenting/auction support processes.

Table 1. Survey type and scope.

Survey Type	Survey Scope
Geophysical	• Multibeam echo sounder (MBES) • Sub bottom profiler • Side scan sonar • Magnetometer • Ultra-short baseline (USBL) acoustic positioning system • Sparker system • Air gun • Deployment of a Day or Hamon grab (ground truthing)
Geotechnical	• Cone Penetration Testing (CPT/TCPT) • Vibrocore sampling Boreholes (shallow and deep)
Biological / explorative	**Passive acoustic monitoring** • Autonomous Multichannel Acoustic Recorder (AMAR) and/or F-PODs • Towed Hydrophone array **Digital Aerial Survey** • Aerial camera surveys **Benthic** • Day grab and/or Hamon grab • Dropdown video/stills • ROV video/stills • Water sampling • Sediment chemistry sampling
Metocean	• Up to 2 x Metocean Buoys with associated passive monitoring equipment, which may include floating Lidar, wind, current and water quality sensors and solar panels) • Tidal measurements for water level variations • Water Depth – CTD

Table 2 summarises the acoustic and benthic sampling equipment to be operated from the survey vessel, including example models/manufacturers, deployment methods, and the intended purpose of each system. For acoustic sources and sonars, the table also provides indicative operating frequencies and sound pressure levels, where available.

Table 2. Acoustic and benthic sampling equipment proposed to be operated on board the R.V. Tom Crean/ jack-up barge.

Equipment	Model (example)	Deployment	Company (example)	Purpose	Frequency	Sound Pressure Level (dB re 1 µPa @ 1 m)
Multibeam Echo sounder	EM2040 (200/300/400 kHz)	Retractable hull mount	Kongsberg Maritime	Collect topographical data from the seabed	200, 300 and 400 kHz	210
Sparker System & 48-channel hydrophone array	Dura-speak seismic sound source	Towed system	Subsea Technologies	Seismic sound source (sub-seabed profiling)	300 Hz – 1.2 kHz	226
Sparker (backup)	Geospark 200	Towed system	Geus	Identify geological layers and sediment thickness beneath the seabed	250 Hz – 1.75 kHz	223
Sub-bottom Profiler	Knudsen 3250 CHIRP	Vessel mount	Knudsen	Identify geological layers and sediment thickness beneath the seabed	3.5 – 12 kHz	223
Mini airgun	Mini G Gun	Towed system	Sercel	Identify geological layers and sediment thickness beneath the seabed	< 250 Hz	230
Side scan Sonar	4205 sidescan	Towed system	Edgetech	Determine sediment characteristics and seabed features	300 – 900 kHz	228
Magnetometer	N/A	Towed system (towfish)	N/A	Measure the Earth's magnetic field	N/A	N/A

Equipment	Model (example)	Deployment	Company (example)	Purpose	Frequency	Sound Pressure Level (dB re 1 µPa @ 1 m)
Ultra-Short Baseline (USBL)	N/A	Vessel mounted transceiver + beacon on towed gear	N/A	Determines position of submerged object or vehicle	15 – 40 kHz	190–210
Hamon Grab	N/A	Overboard	N/A	Overboard, benthic sampling	N/A	N/A
Day Grab	N/A	Overboard	N/A	Overboard, benthic sampling	N/A	N/A
Camera System	N/A	Overboard (drop frame / towed sledge)	N/A	Overboard benthic imaging	N/A	N/A
Cone Penetration Testing (CPT/TCPT)	CPT/TCPT rig (static push system)	From jack-up / geotechnical vessel (over-the-side or via guide frame)		In-situ sediment strength/stratigraphy profiling	N/A	160–190 dB re 1 µPa @ 1 m (estimate)
Vibrocore sampling	Vibrocorer (electric/hydraulic head)	Jack-up / drilling vessel		In-situ sediment strength/stratigraphy profiling	Typically, 20-50Hz	160–190 dB re 1 µPa @ 1 m (estimate)
Boreholes (shallow and deep)	Geotechnical drill rig (e.g., rotary/wireline coring system)	Jack-up / drilling vessel	Fugro	Obtain cores/log strata	Typically, low frequency dominated up to 600 Hz	145-190 dB @ 1 m

Equipment	Model (example)	Deployment	Company (example)	Purpose	Frequency	Sound Pressure Level (dB re 1 µPa @ 1 m)
Passive acoustic monitor (click detector)	AMAR/F-POD	Seabed mooring / frame (static deployment)	Chelonia Ltd	Detect and log odontocete echolocation clicks (e.g., harbour porpoise/dolphins) to describe presence and temporal activity patterns	Detection band typically ~20–160 kHz (listening only)	N/A (passive receiver – no sound emission)
Gradiometer (optional magnetic survey tool)	Marine gradiometer towfish	Towed system (towfish)	N/A	Detect spatial gradients in the magnetic field to support UXO/archaeology and seabed characterisation (alternative/adjunct to magnetometer)	N/A	N/A (no acoustic emission)
ROV (qualitative soft sediment)	Observation-class ROV (e.g., VideoRay / Saab Seaeye class)	Tethered from a survey vessel (overboard)	N/A	Qualitative seabed inspection/video transects; habitat/feature verification; supports target selection for sampling	N/A (thrusters only)	N/A (no standard published source level; low–moderate localised noise from thrusters)
Static acoustic recorder (fixed array)	AMAR (Autonomous Multichannel Acoustic Recorder)	Seabed mooring/frame with a Deep F-POD (static)	JASCO / others	Passive acoustic monitoring of ambient sound/cetacean vocalisations (presence/activity; soundscape)	Listening only (depends on configuration)	N/A (passive receiver – no emission)
Towed passive acoustic array	4-element hydrophone array (LF/HF elements)	Towed from survey vessel	N/A	Passive acoustic monitoring while underway (cetacean detections, bearing/relative localisation depending on system)	Listening only (e.g., LF ~20 Hz–40 kHz; HF ~2–200 kHz as described)	N/A (passive receiver – no emission)
Metocean wave buoy (if treated separately from “metocean buoys” row)	Directional wave buoy (accelerometer-based)	Surface buoy on mooring	N/A	Wave parameters (Hs, period, direction, etc.); metocean baseline	N/A	N/A (typically passive; minor incidental chain/mooring noise only)

Equipment	Model (example)	Deployment	Company (example)	Purpose	Frequency	Sound Pressure Level (dB re 1 µPa @ 1 m)
Floating LiDAR buoy/system	FLiDAR (floating LiDAR)	Surface buoy on mooring	N/A	Wind climate (speed/direction/vertical profile) for energy yield and design inputs	Optical (laser); no underwater acoustic emission	N/A (LiDAR itself; minor incidental mooring noise only)
CTD profiler	CTD (with optional turbidity/fluorometer add-ons)	Overboard cast / profiling	N/A	Water column structure: conductivity/salinity, temperature, depth;	N/A	N/A (no acoustic emission)
Water quality sondes/sensors (if not already covered in metocean row)	Multiparameter sonde (DO, pH, conductivity, turbidity, chlorophyll)	Buoy-mounted or overboard profiling	N/A	Baseline water quality time series and/or profiles - often turbidity and chlorophyll fluorescence	N/A	N/A (no acoustic emission)
GNSS / GPS time synchronisation	GNSS receiver/logger	Vessel mounted / buoy system	N/A	Common time base and accurate positioning for metocean/acoustic systems	RF (above water)	N/A (no underwater acoustic emission)

Towed equipment will be restricted to a single 48 channel hydrophone and tail buoy, active streamer length approximately 150m, total towed instrumentation length approximately 200m. This will slightly restrict vessel maneuverability.

3.1 Survey vessel and jack-up barge

Subject to availability, the Irish multi-purpose marine research vessel, *RV Tom Crean*, or a comparable vessel, will be used for the proposed surveys (Figure 2). The *RV Tom Crean* was specifically designed as a low-noise research vessel to meet the stringent requirements of the ICES 209 underwater noise standard for fisheries research. Vessel specifications are provided in Table 2, with the noise profile across a range of operating speeds presented in Figure 3 to Figure 5.

Figure 2. R.V. Tom Crean

Table 3. RV Tom Crean: Vessel specifications

Vessel size	
Vessel length	52.8m
Beam	14m
Draught	5.2m (maximum)
Tonnage (GRT)	1935 Tonnes
Main diesel generators	
Make	Mitsubishi
Type	S16R-(Z3) MPTAW
Number and power	2 x ~1437kW
Speed	1500 rpm
Mounting	Double resilient
Exhaust silencers	SCR system with 45dB(A) attenuation
Auxiliary diesel generators	
Make	Scania
Type	DI 13-91 M
Power	426 kWm
Speed	1500 rpm
Mounting	Resilient
Exhaust silencers	At least 25 dB(A)
Propulsion motor	
Make	Indar
Type	Squirrel cage – Induction motor IMU-710-X/8
Power	2000 kW at 179rpm
Rated frequency	12.6 Hz

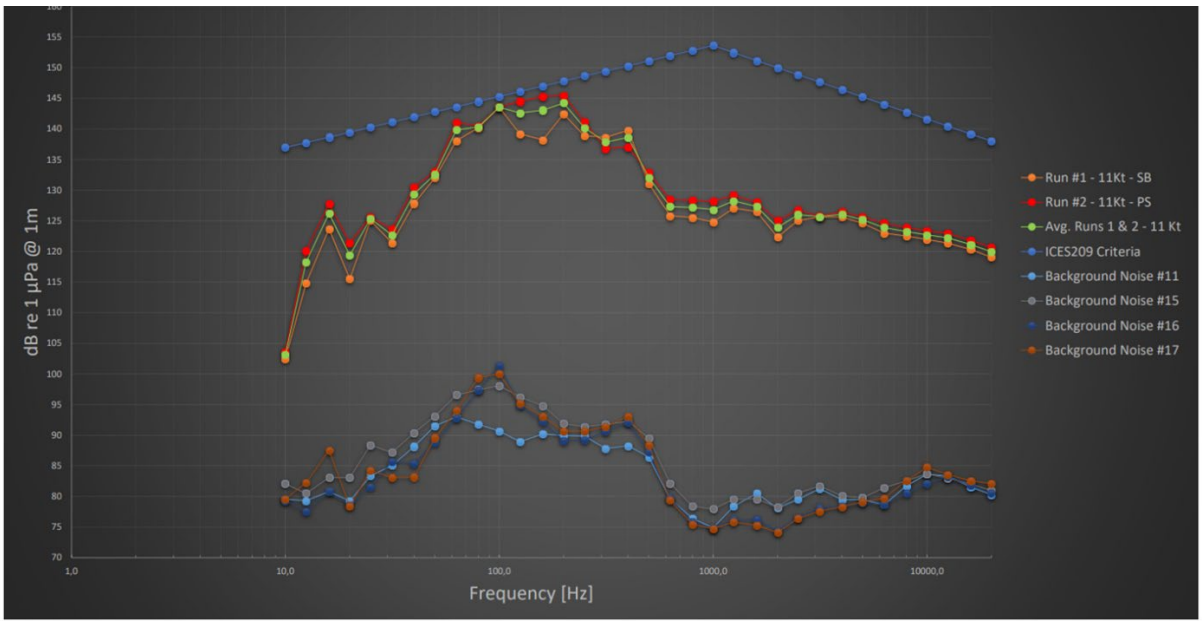

Figure 3. (Run ID no. 1 and 2). Main verification at 11Kt distance corrected and averaged Distance correction is based on derived correction factors from the transmission loss function.

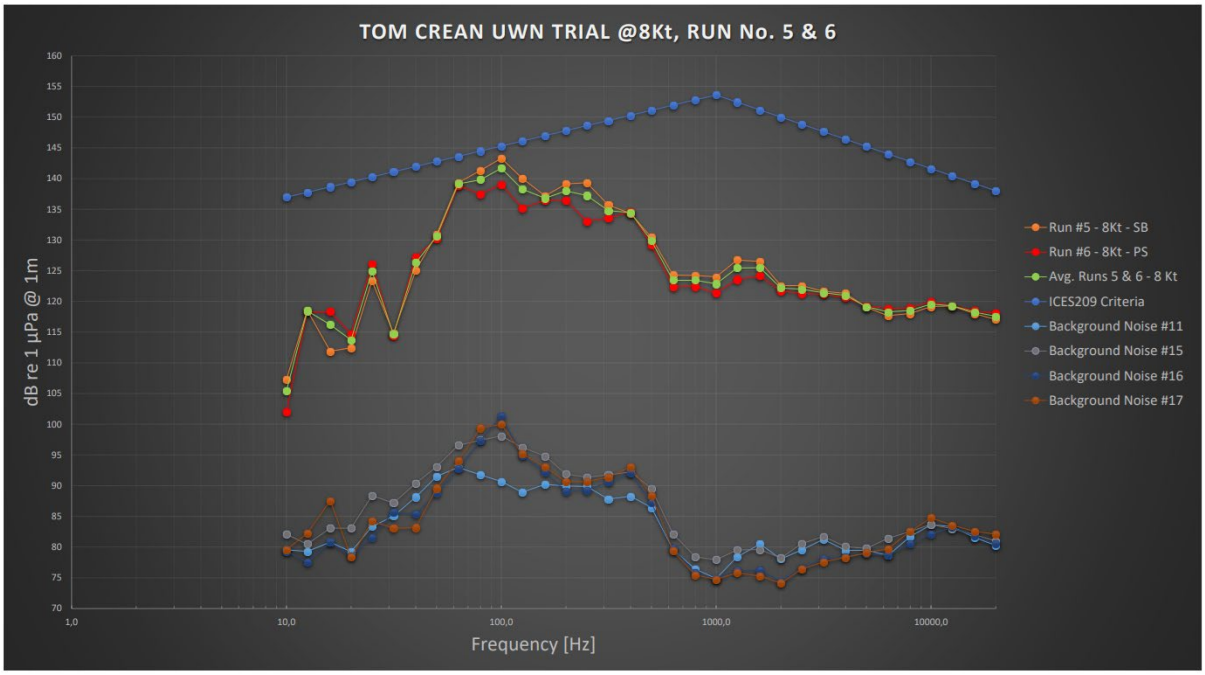

Figure 4. Run Id no. 5 and 6 at 8Kt distance corrected and averaged.
Distance correction is based on derived correction factors from the transmission loss function.

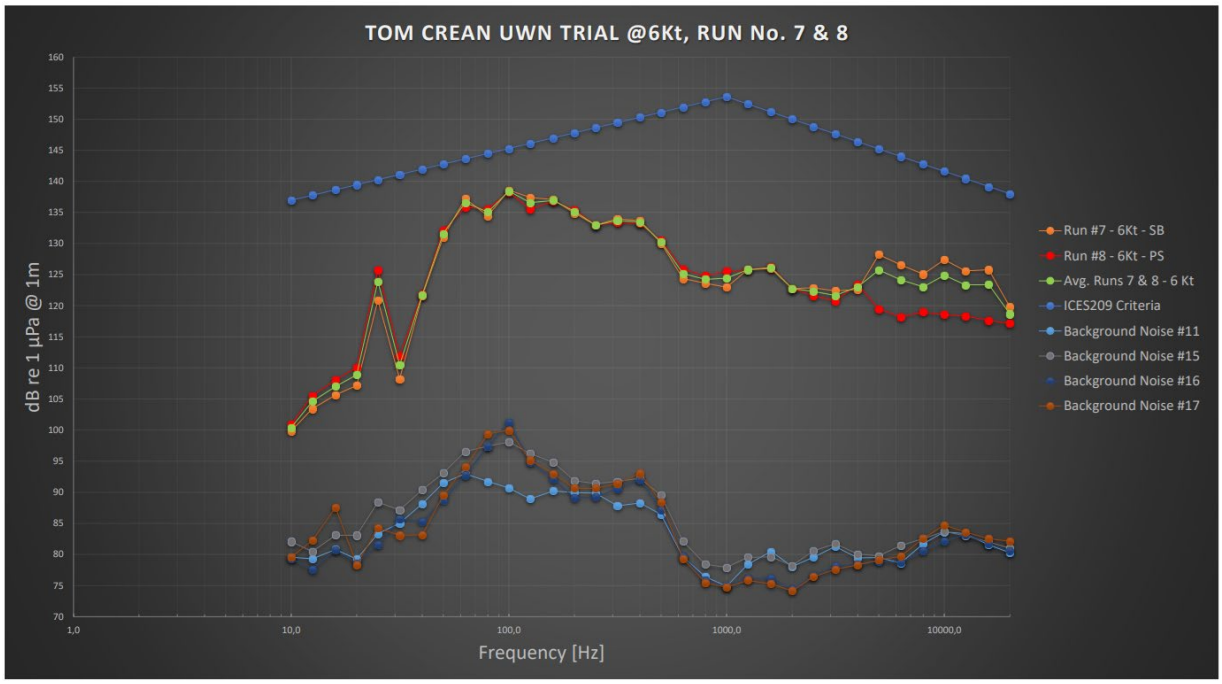

Figure 5. Run Id No. 7 and 8 at 6Kt distance corrected and averaged.

Distance correction is based on derived correction factors from the transmission loss function.

If the RV *Tom Crean* is unavailable, an alternative vessel may have higher noise output; however, this is not expected to add materially to existing background noise levels.

Figure 6 shows an example of a jack-up barge used as a stable offshore work platform in shallow to moderate water depths. It is brought to the site by a tug vessel with its legs raised, then lowers the legs to the seabed and jacks the hull clear of the water to create a fixed, level platform for operations such as geotechnical drilling, CPT testing and equipment handling. Once on station, the elevated platform reduces motion from waves and swell, improving safety and data quality during site investigation works.

Figure 6. Example Jack Up Barge

3.2 Equipment descriptions

3.2.1 Multibeam echosounder

A multibeam echosounder (MBES) is a type of sonar frequently used to map bathymetry. It operates by emitting an acoustic wave in a fan shape beneath the point of its transceiver attached to the hull of the vessel. The time it takes for the sound waves to bounce off the seabed and return to the transceiver is used to calculate the water depth within the arc of the fan. The proposed MBES operates at a sound pressure level of 210 dB re 1µPa at 1m with a peak frequency between 200-400 kHz.

3.2.2 Sparker system and hydrophone array

A sparker is a device used for sub-seabed investigations where deeper acoustic penetration is required. It is generally more powerful than a Sub-bottom profiler and is used to explore very coarse/compacted seabed's. The sound source is generated by an electrical arc that creates a bubble. As it collapses, the bubble produces a broadband (500 Hz–4 kHz) omnidirectional pulse that penetrates a few hundred meters into the subsurface. Hydrophone arrays towed near the acoustic source receive the returning signals.

3.2.3 Mini airgun

A mini airgun emits a blast of compressed air, resulting in an acoustic signal consisting of an initial high-amplitude pressure pulse followed by a decaying series of "bubble pulses" formed by oscillations of the resulting air bubble.

3.2.4 Sub-bottom profiler

A Sub-bottom profiler employs an acoustic signal, to provide the information required to identify and measure marine sediment layers that exist below the sediment/water interface. The proposed equipment comprises a Knudsen Chirp system which transmit a sweep of frequencies (e.g. 2-10 kHz) in a single pulse. Depending on the profile of the seabed (rock, sand, mud etc.) and level of compaction, the energy reflected back can be related to the sub-bottom composition.

3.2.5 Side scan

Side scan Sonar (SSS) is another device that transmits sound pulses that provide the information required to map the seabed. It differs from MBES in that SSS has a finer beam width and smaller footprint to MBES and therefore higher resolution. It is generally towed behind the vessel very close to the seabed and emits fan-shaped acoustic pulses down toward the seafloor which are recorded as a series of cross-tracks. The sound frequencies used by side-scan sonar range generally range from 100 to 1000kHz; higher frequencies yielding better resolution but less range.

3.2.6 Magnetometer

A magnetometer is used to detect and measure variations in the Earth's magnetic field and can reveal objects or geological features with magnetic properties. A marine magnetometer (e.g., Geometrics G-882) will be towed behind the survey vessel to detect magnetic anomalies associated with ferrous debris, shipwrecks, or UXO. The instrument is passive and does not generate underwater noise.

3.2.7 Ultra-Short Baseline (USBL)

USBL systems emit acoustic signals underwater to determine the position of a submerged equipment (e.g., ROVs).

These systems work by sending and receiving sound pulses between a transceiver (on a surface vessel) and a transponder or beacon (attached to the underwater target).
USBL Sound Emission:

- Frequency Range: Operates in the 15 kHz to 40 kHz range, higher frequencies offer better accuracy but shorter range, while lower frequencies provide longer range but less accuracy.
- Pulse Duration: Emits short pulses of sound (milliseconds in duration), often referred to as "pings."
- Signal Type: Signals are usually coded acoustic pulses to avoid interference and ensure accurate signal identification and timing.
- Sound Pressure Level (SPL): Typical SPL values are in the range of 190–210 dB re 1 µPa @ 1m, which is standard for underwater acoustic systems.

3.2.8 Day Grab and Hamon Grab

A day grab is an instrument used for sampling soft seabed sediments. When deployed overboard it is lowered on a winch to the seabed where the jaws open to take a small (approx. 15L) sample of the surface sediment (top 20cm). A Hamon grab is a very similar type of sampler, but the jaw mechanism is slightly different which allows it to sample coarser sediments (e.g. gravel and shelly sediments). The samples retained can then be analysed to obtain an overview of the sediment fauna, and particle size. Both samplers are routinely used for surveillance monitoring to support a number of EU Directives such as the Habitats Directive and Water Framework Directive. A 0.1 m^2 Day grab or 0.1 m2 Hamon grab will be deployed from a suitable vessel to collect sediment samples. It is envisaged that these samples will be taken throughout the SC-DMAP area.

3.2.9 Camera systems

Dropdown underwater camera systems or camera systems deployed on Remotely Operated Vehicles (ROVs) may be used for visual inspection of the existing environmental conditions within MUL area. This activity will be passive and non-intrusive and will not interact with the seabed. The video footage will be analysed in real time and will provide information on the habitat and associated species present and may aid in determining the suitability of survey stations for grab sampling.

3.2.10 Mooring systems

Mooring systems will be used for station-keeping of vessel, passive acoustic monitoring devices (F-PODS and AMARs), metocean buoys (2) and ADCPs, which will be installed in seabed frames with associated ground line, clump weight and acoustic release/retrieval systems.

3.2.11 Aerial surveys

Digital aerial surveys will record standardised information on birds, marine mammals and other megafauna (e.g., position, time, coordinates, species ID, behaviour and movement), alongside survey conditions (sea state, glare, turbidity, wind, cloud cover and flight parameters) to aid interpretation of sightings and potential influencing factors such as vessels or other activities.

3.2.12 Boreholes

A drill head is lowered to the seabed from the vessel via a drill string and stabilised using a seabed frame. The drill head penetrates the seabed via rotation of the drill string and the application of a downward pressure. Drilling mud may also be used. Soil samples and rock cores are then retrieved for laboratory testing via the drill string. Sampling and coring may be combined with *in-situ* testing such as cone penetration testing or down the hole testing at some investigative locations. Up to 70m below the seabed. Five to forty-five may be conducted.

3.2.13 Cone Penetration Testing

In situ Cone Penetration Test (CPT) will be carried out on a seabed frame, and/or deck-push CPT from the vessel via a moonpool. *In situ* thermal tests may be performed using a built-in sensor within the CPT equipment. Up to 70m below the seabed. Ten – forty may be carried out.

Shallow cone penetration tests (CPTs) including thermal testing at certain depth elevations TCPTs) with a minimum thrust at refusal of 50 kN will be undertaken from the geotechnical survey vessel crane or dedicated launch and recovery system to test *in-situ* soil characteristics at the seabed. At shallower water depths, CPTs/TCPTs may be deployed from a JUB. The survey involves pushing an instrumented steel cone into the ground at a constant rate with continuous measurement of the cone end resistance, the friction along the sleeve of the cone, and the pore water pressure and thermal soil properties. No material will be removed from the seabed during CPT testing.

A deep drive CPT device with minimum thrust of 200 kN, and minimum stroke capability of 20m, will be utilized at various points within the survey area. The Deep Drive CPT equipment will be deployed from the geotechnical survey vessel using the same principles as described for the shallow CPT testing.

3.2.14 Vibrocore

Details of the specific vibrocoring equipment to be used are not currently known and are subject to a tendering process. Appointed survey contractors will be required to use equipment which aligns with the parameters of the standard equipment described and assessed in the MUL in order to ensure that no greater environmental impacts than those assessed in this MUL will arise. Standard vibrocorers consist of steel coring barrel of between 75 – 120 mm diameter housed within a steel support frame designed to enable stable deployment to the sea floor from the survey vessel. The steel coring barrel is equipped with a cutting shoe and contains within it a plastic liner to capture the procured sample. A spring steel core catcher is fitted to the cutting shoe to retain the sample once the corer assembly has advanced to the required depth, or refusal. Linear electric motors enclosed in a pressure housing provide vibratory motion to advance the coring barrel into the seabed to the specified target depth of 6 m below seafloor (BSF). Electrical power is provided from the survey vessel to the vibrocorer assembly through an electrical control umbilical.

3.2.15 Metocean buoys

Up to two metocean buoys will be deployed within sites B-D to gather metocean data necessary to inform future OSS design. Mounted within the buoy is an accelerometer which registers the rate at which the buoy rises or falls as it follows the pattern of waves. By integrating against time, the acceleration signal can be converted to vertical displacement. The buoy may also incorporate Floating

LiDAR (FLiDAR) technology or a stand-alone FLiDAR buoy may be deployed. In addition, the buoy is specified to gather:

- Wind and water current velocities and directions.
- Atmospheric pressure, temperature, humidity, radiation and precipitation.
- Water quality: dissolved oxygen, pH, conductivity, temperature, salinity, turbidity, chlorophyll and cyanobacteria.
- The metocean buoys may be equipped with solar panels, aids to navigation positioning, data recording and telemetry systems. It will be deployed for a minimum of twelve consecutive months.

Although the wave buoy is passive equipment, deployment will require an anchoring system that will necessarily interact with the seabed. Although the details of the buoy and associated anchor system are subject to a tendering exercise and not confirmed, it is conservatively estimated based on standard metocean buoy equipment that 10 m^2 of the seabed will be potentially disturbed by the anchor system for the duration of deployment. Appointed metocean buoy survey contractors will be required to use equipment which aligns with these parameters in order to ensure that no greater environmental impacts than those assessed in this MUL will arise.

Location: The metocean buoy will be deployed within the sites B-D at a location not yet specified until the survey operator has been appointed over the five-year programme licence. The tender for metocean surveys within Lí Ban will be awarded in mid-January, after which more detailed regarding deployment and equipment types can be provided.

3.2.16 Acoustic Doppler Current Profiler (ADCP)

An Acoustic Doppler Current Profiler (ADCP) is used to collect data on water movements, current speeds, and directions. The ADCP will be deployed to the seabed via a crane from a survey vessel for a duration of at least twelve months. Up to three ADCP units may be deployed at any one time within the sites. The ADCP unit is mounted in a seabed frame (1.8m wide and 0.6m high) with a weight of 300 kg. This will be attached to a ground line, a clump weight and to an acoustic release system carrying a rope retrieval system. The precise equipment utilised will depend on the water depths at the locations proposed for survey. ADCPs will operate at or above a frequency of 300 kHz to avoid impacts on marine species.

Location: The ADCP will be deployed within the sites B-D at a location not yet specified until the survey operator has been appointed over the five-year programme licence.

3.2.17 Floating Lidar (FLS)

The purpose of the FLS is to collect accurate wind-climate and metocean information from the project site, which will be used to conduct energy-yield assessments for the wind farm design. The FLS normally consists of the following essential components: LiDAR, FLS operating system, power system, data logging and communication, safety system, and the floating platform and station-keeping system. The supplier shall supply all components as an integrated system suitable for use in a marine environment and have certification and/or warranties that meet the planned campaign duration. One per site is proposed. A surface FLS will be deployed within the survey area and held in position via a suitable specified mooring configuration comprising a mooring chain/rope and anchor. FLS will be deployed on-site for a minimum of 12–24 months to capture the full seasonal variations of the site.

The FLS may be deployed for a longer period if data recovery does not accurately capture seasonal variations or to better understand site conditions.

Location: The FLS will be deployed within the sites B-D.

3.2.18 Acoustic Monitoring

A combined approach of using towed and fixed array acoustic monitoring will be utilised in the SC-DMAP. It is envisaged that Static Acoustic Monitoring (SAM) will be carried out within each one of the SC-DMAP development areas. Each SAM mooring will consist of one Autonomous Multichannel Acoustic Recorder (AMAR) unit and one Deep F-POD.

Acoustic data will also be collected using a towed hydrophone array throughout the survey area. It is envisaged that this will consist of a 400 m tow cable and a 10 m oil-filled streamlined sensor section, which contains four hydrophone elements.

4. Receiving environment: Annex IV Species

For the purposes of this Annex IV assessment, the receiving environment is considered with respect to Annex IV species that may occur within, or transit through, the survey area and associated vessel routes. These species comprise cetaceans and other species likely to occur in the wider area, such as leatherback turtle, otter and bats. Minke whale is presented as a representative Annex IV cetacean receptor for quantitative/illustrative purposes; however, the assessment and mitigation are intended to apply to Annex IV cetaceans more generally, with species-specific reviews being provided where pertinent.

4.1 Cetaceans

Under Article 12 of the Directive, all cetaceans should receive strict protection within the Exclusive Economic Zone. A total of 26 cetacean species have been recorded in Ireland. A marine Mammal Database compiled and managed by the National Biodiversity Data Centre has collated data from numerous sources (e.g. Irish Whale and Dolphin Group, ObSERVE project) on the distribution of cetaceans off the coast of Ireland. These data sources show that the area in and surrounding the proposed project area are used by a wide range of cetacean species. The density and distribution of which varies over time and season.

This includes frequent live sightings of Common dolphin (*Delphinus delphis*), Harbour Porpoise (*Phocoena phocoena*), Fin Whale (*Balaenoptera physalus*), Humpback Whale (*Megaptera novaeangliae*), and Minke Whale (*Balaenoptera acutorostrata*) within the Zone of Influence of the proposed project. While occasional records for live sightings of additional cetacean species including Bottlenose Dolphin (*Tursiops truncatus*) and Risso's Dolphin (*Grampus griseus*) are also available.

4.2 Otter

Coastal otters are known to utilise the marine habitat for foraging, feeding on a variety of fish and shellfish species depending on the time of year. Otter hearing is not adapted for life underwater; however, one study did record behavioural responses in otters in experimental trials. While otters utilise the marine environment for foraging, they would not be impacted by the proposed project as they are known to forage close inshore, generally less than 100m. Although records for otter 2-300m from shore have been recorded in the UK this is considered to be an unusual occurrence. East of Knockadoon Head the proposed project area is between 6 and 30 km from the shore. West of Knockadoon Head to Oyster Haven it is closer to the shore and within approximately 80 to 100 meters at some locations. There are no records for otter within the proposed survey area. In the sections where the survey area extends to within 300m of the shore there is no recorded otter commuting habitat. It is therefore considered that impacts on otters would be highly unlikely.

4.3 Reptiles (marine turtles)

Leathery Turtle (*Dermochelys coriacea*) are recorded occasionally from around the entire coast of Ireland. However, no records for this species were found for the area within or adjacent to the proposed project site.

4.4 Bats

All bat species in Ireland are listed in Annex IV of the EU Habitats Directive. These include:

- Common pipistrelle (*Pipistrellus pipistrellus*)
- Soprano pipistrelle (*Pipistrellus pygmaeus*)
- Nathusius' pipistrelle (*Pipistrellus nathusii*)
- Leisler's bat (*Nyctalus leisleri*)
- Brown long-eared bat (*Plecotus auritus*)
- Daubenton's bat (*Myotis daubentonii*)
- Whiskered bat (*Myotis mystacinus*)
- Natterer's bat (*Myotis nattereri*)
- Lesser horseshoe bat (*Rhinolophus hipposideros*)

With the exception of Whiskered bat and Lesser horseshoe bat, records for all of the aforementioned species are available for the south coast of Ireland within the 100km grid squares that cover the coastline and their adjacent waters. While bats are typically classed as terrestrial mammals, some evidence suggests they may follow prey insects into coastal water depending on the prevailing weather conditions. Recent evidence also notes that bats can migrate considerable distances over open marine waters. However, it is considered highly unlikely they would make use of the proposed project area for foraging due to its highly exposed nature.

5. Risk assessment

5.1 Sources of impact

An Analysis of the zone of Influence (ZoI) of the proposed project was carried out (MERC, 2026). The following sources of potential impact, relative to Annex IV species, were identified:

- Underwater noise as a result of vessel operations and equipment use.
- Disturbance as a result of vessel presence.
- Sediment disturbance as a result of borehole and cone penetration testing works, the collection of benthic samples and the deployment of static underwater instrumentation.

Table 4 provides a summary of the potential sources of impact, as identified in MERC, 2026 relevant to Annex IV marine mammals, and sections 5.2 to 5.5 detail the potential for interaction on the identified receptors as a result of aforementioned potential impacts.

Table 4. Source-Path-Receptor matrix

Element	Potential Source (pressure)	Area of impact (Direct)
Vessel presence	Disturbance, harm or injury as a result of vessel operations	Negligible (See section 5.2 for rationale)
Multibeam echosounder. Sparker System & hydrophone array. Sub-Bottom Profiler. Mini airgun, sparker Ultra-Short Baseline (USBL)	Disturbance, harm or injury as a result of underwater noise	Marine mammals: 3km to include area of impact identified for cumulative TTS*** (See section 5.2 for rationale)

CPT/TCPT. Vibrocore sampling. Borehole drilling. Jack-up barge	Physical disturbance; drilling noise/vibration	Localised to each borehole and immediate working area (incl. drill spread/anchoring where relevant). (See section 5.2 for rationale)
Metocean buoys. ADCPs (Acoustic Doppler Current Profilers)	Physical presence/entanglement/snag risk from mooring lines, minor underwater noise from line/chain movement; vessel activity during deployment/retrieval	Localised to instrument location and mooring/anchor footprint; short-duration disturbance during deployment/retrieval. (See section 5.2 for rationale)

5.2 Cetaceans

The effects of underwater noise on marine mammals can lead to disturbance, harm or injury depending on the type and frequency of the noise and distance of the receptor.

Cetacean sensory systems are adapted to life in the water. They rely on sound to navigate, to communicate with one another and to sense and interpret their surroundings. Behavioural responses of marine mammals, including cetaceans, to a sound are known to be strongly influenced by the context of the event and individual factors such as the animal's experience, motivation, conditioning and activity (Southall *et al*, 2007). Such features and variability may also require consideration in the case-specific assessment of impact on marine mammals from introduced sound sources (NPWS 2014). Sound waves dissipate through the water with distance from the source. While local oceanographic conditions affect the path of the sound and its transmission.

Depending on the exposure levels from underwater noise, auditory injury to marine mammals can occur. This may result in temporary loss in hearing sensitivity, known as Temporary Threshold Shift (TTS) or more permanent damage, known as Permanent Threshold Shift (PTS). The potential for auditory injury is related to the noise frequency relative to the hearing bandwidth of the marine mammal and is also influenced by the duration of exposure. The level of impact on an individual is a function of the Sound Exposure Level (SEL) that an individual receives as a result of underwater noise.

Table 5 details the various functional groups relative to hearing for the majority of cetaceans encountered in Irish waters.

Table 5. Cetacean functional groups relative to hearing at different sound frequencies.

Low frequency 7 Hz-22 kHz	**Mid-frequency** 150 Hz-160 kHz	**High frequency** 200 Hz–180 kHz
Baleen whales	Most toothed whales, dolphins	Certain toothed whales, porpoise
Species- Ireland Humpback whale Blue whale Fin whale Sei whale Minke whale	**Species– Ireland** Sperm whale Killer whale Long-finned pilot whale Beaked whale species Dolphin species	**Species– Ireland** Pygmy sperm whale Harbour porpoise

After: NPWS (2014). Guidance to Manage the Risk to Marine Mammals from Man-made Sound Sources in Irish Waters.

Southall *et al* (2007) describes the sound pressure levels associated with the various functional groups as detailed in Table 6. This has been revised (Southall *et al,* 2019) to further refine functional hearing groups but similar injury criteria as relevant to the proposed project apply.

Table 6. Sound pressure levels associated with Temporary Threshold Shift (TTS) and Permanent Threshold Shift (PTS)

Functional group	Injury Criteria (based on single pulse)	
	TTS	PTS
Low frequency cetaceans	224dB re: 1µPa (peak	230dB re: 1µPa (peak
Mid frequency cetaceans	224dB re: 1µPa (peak)	230dB re: 1µPa (peak)
High frequency cetaceans	224dB re: 1µPa (peak)	230dB re: 1µPa (peak
Pinnipeds (in water)	212dB re: 1µPa (peak)	218 dB re: 1µPa (peak

The noise modelling and environmental risk assessment (Thomsen *et al*, 2023) carried out for the proposed project indicated that the use of the sparker would have a limited area of impact on minke whales, and therefore other marine mammals with a functional hearing range that includes all or part of the frequency range emitted by the sparker (e.g. other baleen whale species, Bottlenose dolphin and Harbour porpoise). The results (Table 7) indicated that the impact distance from source would be a maximum of 1.1 km relative to a behavioural response and 0.9km relative to cumulative TTS.

With regard to the use of the mini airgun, the results (Table 8) show that area of impact would increase to 1.9km relative to behavioural response and 2.9km relative to cumulative TTS with an impact area of 19.7km.

Table 7. Threshold distances and impact areas obtained for the minke whale, resulting from operation of sparker in the study area. (from Thomsen et al, 2023).

Impact on minke whales when the sparker is on operation			
Noise effect	**Average distance all transects [km]**	**Max. distance [km]**	**Impact area [km²]**
Behavioural response	0.9	1.1	2.7
TTS single strike	0.1	0.1	0.03
TTS cumulative	0.9	1.1	2.5
PTS single strike	0.1	0.1	0.03
PTS cumulative	0.2	0.2	0.12

Table 8. Threshold distances and impact areas obtained for the minke whale, resulting from operation of mini airgun in the study area. (from Thomsen et al, 2023).

Impact on minke whales when the mini airgun is on operation			
Noise effect	**Average distance all transects [km]**	**Max. distance [km]**	**Impact area [km²]**
Behavioural response	1.4	1.9	6.3
TTS single strike	0.1	0.1	0.03
TTS cumulative	2.5	2.9	19.7
PTS single strike	0.1	0.1	0.03
PTS cumulative	0.3	0.3	0.3

Borehole drilling and CPT/TCPT activities may cause short-duration seabed disturbance at discrete locations, generating localised increases in suspended sediment concentrations during penetration, sampling/coring and retrieval of equipment. Any sediment plume is expected to be small and temporary, with rapid dilution and settling in the offshore receiving environment (water depths c. 15–70 m) and a limited potential for deposition outside the immediate works area. The principal pathway for suspended sediment effects is therefore confined to the near-field around each investigative location.

5.3 Otter

Otter hearing is not adapted for life underwater however, one study did record behavioural responses in otters in experimental trails. While otters utilise the marine environment for foraging, they would not be impacted by the proposed project as they are known to forage close inshore, generally less than 100m. Although records for otter 2-300m from shore have been recorded in the UK this is considered to be an unusual occurrence. East of Knockadoon Head the proposed project area is between 6km and 30km from the shore. West of Knockadoon Head to Oyster Haven it is closer to the shore but never less than 300m at any point. Therefore, otter foraging habitat would be generally outside of the underwater noise range modelled for the proposed project by Thomsen *et al* 2020.

5.4 Reptiles (marine turtles)

Relative to the scale and scope of the project and absence of recorded marine reptiles (marine turtles) in the proposed project area, impacts on marine reptiles are not considered possible.

5.5 Bats

Vessel based acoustic surveys do not have the potential to impact bats, their habitats or roost sites in any way.

6. Conclusion

Based on the results of the noise modelling (Thomsen *et al*, 2023), and taking a worst case scenario for the use of the mini air gun and sparker, the proposed project has the potential to lead to behavioural responses and TTS to a range of cetaceans should they be present within 1.9 to 2.9km of the proposed project area when the mini airgun is being used and a lesser (0.9-1.1km) distance when the sparker is being used. Based on the review of the receiving environment (section 4) the species included with potential for impact are:

- Minke whale (*Balaenoptera acutorostrata*)
- Humpback whale (*Megaptera novaeangliae*)
- Fin whale (*Balaenoptera physalus*),
- Killer whale (*Orcinus orca*)
- Bottlenose Dolphin (*Tursiops truncatus*)
- Harbour porpoise (*Phocoena phocoena*)
- Risso's dolphin (*Grampus griseus*)

- Potentially other cetacean species known to occur in Irish waters

Article 12 of the EU Habitats Directive requires member states to take requisite measures to prohibit "deliberate disturbance of these [Annex IV] species, particularly during the period of breeding, rearing, hibernation and migration". While the range of potential impact is relatively small (2.9km maximum distance) it is nonetheless considered that, based on the precautionary principle, mitigation to avoid disturbance to the aforementioned species should be implemented should be implemented should the proposed project proceed. No impacts on any additional Annex IV species known to occur in Ireland are considered possible.

7. Proposed mitigation

NPWS (2014) provides guidance to manage the risk to marine mammals from man-made sound sources in Irish waters. This document provides guidance and mitigation measures to address key potential sources of anthropogenic sound that may impact negatively on marine mammals in Irish waters. The mitigation methods should follow the guidance prescribed by the National Parks and Wildlife Service. Specifically, in relation to Geophysical acoustic surveys, such as proposed in this project, the guidance set out in NPWS (2014), as stated below, should be fully implemented as detailed below.

Passive acoustic monitoring (PAM): Where feasible, use the proposed towed passive acoustic array to supplement MMO effort during periods of reduced visibility, and document any constraints/limitations (gear conflicts, sea state).

Moorings and seabed frames (F-POD, AMAR, ADCP, metocean buoys): should be designed to minimise entanglement risk (taut lines; minimise slack; avoid netting/loops; use weak links where appropriate), mark and chart all deployments, and implement prompt retrieval and incident response procedures.

Airgun contingency use: confirm in advance whether an airgun is required; if used, apply NPWS (2014) controls and any additional regulator-specified conditions (e.g., enhanced monitoring, restricted commencement conditions).

1. A qualified and experienced marine mammal observer (MMO) shall be appointed to monitor for marine mammals and to log all relevant events using standardised data forms (Appendix 6, NPWS, 2014).
2. Unless information specific to the location and/or plan/project is otherwise available to inform the mitigation process (e.g., specific sound propagation and/or attenuation data) and a distance modification has been agreed with the Regulatory Authority, acoustic surveying using the above equipment shall not commence if marine mammals are detected within a 500m radial distance of the sound source intended for use, i.e., within the Monitored Zone.

Pre-Start Monitoring

3. Sound-producing activities shall only commence in daylight hours where effective visual monitoring, as performed and determined by the MMO, has been achieved. Where effective visual monitoring, as determined by the MMO, is not possible the sound-producing activities shall be postponed until effective visual monitoring is possible.

4. An agreed and clear on-site communication signal must be used between the MMO and the Works Superintendent as to whether the relevant activity may or may not proceed, or resume following a break (see below). It shall only proceed on positive confirmation with the MMO.
5. In waters up to 200m deep, the MMO shall conduct pre-start-up constant effort monitoring at least 30 minutes before the sound-producing activity is due to commence. Sound-producing activity shall not commence until at least 30 minutes have elapsed with no marine mammals detected within the Monitored Zone by the MMO.
6. This prescribed Pre-Start Monitoring shall subsequently be followed by a Ramp-Up Procedure which should include continued monitoring by the MMO.

Ramp-up Procedure

7. In commencing an acoustic survey operation using the proposed acoustic equipment, the following Ramp-up Procedure (i.e., "soft-start") must be used, including during any testing of acoustic sources, where the output peak sound pressure level from any source exceeds 170 dB re: 1µPa @1m:
   (a) Where it is possible according to the operational parameters of the equipment concerned, the device's acoustic energy output shall commence from a lower energy start-up (i.e., a peak sound pressure level not exceeding 170 dB re: 1µPa @1m) and thereafter be allowed to gradually build up to the necessary maximum output over a period of 20 minutes.
   (b) 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.
   (c) Where the acoustic output measures outlined in steps (a) and (b) are not possible according to the operational parameters of any such 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.
8. In all cases where a Ramp-Up Procedure is employed the delay between the end of ramp-up and the necessary full output must be minimised to prevent unnecessary high-level sound introduction into the environment.
9. Once the Ramp-Up Procedure commences, there is no requirement to halt or discontinue the procedure at night-time, nor if weather or visibility conditions deteriorate nor if marine mammals occur within a 500m radial distance of the sound source, i.e., within the Monitored Zone.

Line Changes

10. Where the duration of a survey line or station change will be greater than 40 minutes the activity shall, on completion of the line/station being surveyed, either
   (a) shut down and undertake full Pre-Start Monitoring, followed by a Ramp-Up Procedure for recommencement, or
   (b) undergo a major reduction in seismic energy output to a lower energy state[1] where the output peak sound pressure level from any operating source is 165-170 dB re: 1µPa @1m and then undertake a full Ramp-Up Procedure for recommencement.

[1] *It is important that this significant reduction in sound output is to a minimum point (i.e., minimum peak sound pressure level) that in theory remains audible above most ambient sound and shipping noise and yet is also consistent with the Ramp-up Procedure.*

11. Where the duration of a survey line or station change will be less than 40 minutes the activity may continue as normal (i.e., under full seismic output)

Breaks in sound output

12. If there is a break in sound output for a period greater than 30 minutes (e.g., due to equipment failure, shut-down, survey line or station change) then all Pre-Start Monitoring and a subsequent Ramp-up Procedure (where appropriate following Pre-Start Monitoring) must be undertaken.

13. For higher output survey operations which have the potential to produce injurious levels of underwater sound (see sections 2.4, 3.2) as informed by the associated risk assessment, there is likely to be a regulatory requirement to adopt a shorter 5–10-minute break limit after which period all Pre-Start Monitoring and a subsequent Ramp-up Procedure (where appropriate following Pre-Start Monitoring) shall recommence as for start-up.

Reporting

14. Full reporting on MMO operations and mitigation undertaken must be provided to the Regulatory Authority as outlined in Appendix 6 of NPWS (2014).

8. Assessment of residual risk

With mitigation, no injury/intentional disturbance of Annex IV species is predicted. Residual risk is low, and is managed via MMO/encounter procedures, controls on impulsive sources and entanglement design/management. Therefore, provided the mitigation proposed in section 7 of this document is fully implemented, no residual risk is considered possible.

9. References

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