Inis Ealga Application for Site Investigation – Schedule of Survey Woks

Foreshore Licence Ref FS006859

Date: 20 January 2020

1. Survey Schedule

The survey works will be carried out between April and October within the five years following award of the Foreshore licence and subject to weather conditions.

- **Geophysical survey (including Archaeology and Benthic)**: Summer 2020 (3 months window Mid-April to Mid-July) in association with the benthic sampling programme.
- **Geotechnical:** Option for preliminary survey Summer 2022 (2-month window August to September) and main survey Spring/Summer 2023 (4-month window).
- **Wind Resource Monitoring**: Start Summer 2020 for a minimum of 12 months and a maximum of 36 months.
- **Metocean Survey:** Current resource monitoring – Start Summer 2020 for a period of 3 months
- **Intertidal:** Spring 2021
- **Birds & Marine Mammal:** Spring 2020 (2 years duration seasonal)

2. Geophysical survey

Objective: The objective of the proposed geophysical survey is to:

- Map the seabed and sub-surface to optimise positioning of moorage/anchoring and cable routing within the application area and to enable assessment of cable burial depth;
- Plan the scope and positioning of the geotechnical sampling programme in the application area;
- Identify marine habitat areas from which the benthic survey can be undertaken;
- Identify sensitive marine habitats that may need to be avoided during geotechnical and environmental sampling and infrastructure installation; and
- Provide the geophysical data from which a marine archaeological assessment can be undertaken as part of the consenting process.

Location: At this time the Area of Searches (AoSs) and potential export cable locations are based on desktop assessments, therefore, to be judicious it has been assumed that the geophysical surveys will be conducted across the whole of the application area. The survey will be undertaken within the boundary and along the potential cable export routes and across mooring/anchorage areas.

Equipment: Indicative equipment for the survey is provided below:

A. **Multibeam echosounder (MBES) -** Equipment suppliers include: Konsberg and Teledyne RESON.
B. **Side scan sonar (SSS) -** Examples include: GeoAcoustics 160 system, Klein Hydro Scan or similar. The SSS will be a dual frequency hydrographic sonar with a lowest operating

frequency of not less than 100 kHz. Due to consent conditions in Irish waters, the higher frequency of the side scan sonar must be between 410 and 500 kHz.

C. **Sub-bottom profiler (SBP) –** It is likely that two different systems will be used; a high-resolution profiler that will emphasise the top 3 to 5m of sediment with a resolution of 0.25m or better in a variety of geological conditions; and a system that provides increased penetration of up to twenty metres. Three systems (pinger, boomer and chirp) will be made available so that the most appropriate system can be chosen dependent on the seabed conditions. Examples include: GeoAcoustics 5430A profiling system, Edgetech 3100 or similar pinger system, Ultra High Resolution Seismic (UHRS) (sparker/boomer), Applied acoustics boomer plate AA251/AA301 or similar, Seismic Energy Source Applied Acoustics CSP-L or similar. The sub bottom profiler used during the proposed survey will only target the top 10m of sediments. Seismic equipment used in oil and gas industry is a lot more powerful, targeting hundreds of meters of sediment. Therefore, sounds generated from the proposed survey will be less intense and less harmful than sounds generated from oil and gas seismic surveys.

D. **Magnetometer survey -** The marine magnetometer will be of the Caesium Vapour type and capable of recording variations in magnetic field strength during survey to an accuracy of±0.5nT. Examples include: Magnetometry (Total magnetic field survey) Geometrics G-882 caesium vapour magnetometer, Seaspy or similar.

Survey points and spacing: The swathe width for each piece of equipment will depend on water depth encountered. It is anticipated that the width of each swathe will allow for a 50% overlap between each swathe.

Vessel: Geophysical survey vessels are typically between 15m and 60m in length and have an endurance of up to 14 days. These vessels are likely to use a local port for mobilisation and replenishment.

3. Geotechnical survey

Objective: The purpose of the proposed geotechnical survey is to evaluate the nature and mechanical properties of the superficial seabed sediments and intertidal sediments in the application area.

Location: At this time the Area of Searches (AoSs) and potential export cable locations are based on desktop assessments, therefore, to be judicious it has been assumed that the geotechnical sampling will be conducted across the whole of the application area. However, once the geophysical data has been analysed, the geotechnical sampling will be undertaken within the boundary of the site, along the potential cable export route, and across mooring/anchorage areas.

Vessel: Geotechnical survey vessels are typically between 55m and 90m in length and have an endurance of up to 28 days. Their port of mobilisation will depend on previous work but may be Irish, UK, or another European location.

Survey points and spacing: The exact location, quantity, type, and penetration of the geotechnical samples will be determined following interpretation of geophysical survey. Proposed geotechnical sample locations will be communicated to the National Monuments Service – Underwater Archaeology Unit for approval ahead of works commencing. Proposed locations will be accompanied by an assessment of the geophysical data by a qualified and experienced marine archaeologist.

Equipment: Geotechnical sampling will comprise:

a. 200 no. Vibrcores (VC)

Method: A vibrocore will be used to retrieve a soil sample by the lowering of a sample tube that is vibrated into the seabed.

Location: To be determined following review of geophysical data but indicative locations are provided in Figure 13 below.

Dimensions: Vibrocores may penetrate up to 6m into the seabed and have a diameter of 150mm. Therefore, sample volumes will be up to 0.12m^3. For 100 collected samples, the worst-case volume of sediment removed will be 24m^3.

Equipment: Indicative equipment to be used is a high performance corer (HPC) or a modular vibrocorer.

b. 200 no. Cone Penetration Test (CPT)

Method: A CPT will be used to test the characteristics of the soil by pushing an instrumented cone into the ground at a constant speed, with continuous measurement of the cone end resistance, the friction along the sleeve of the cone, and the pore water pressure.

Location: To be determined following review of geophysical data but indicative locations are provided in Figure 13 below.

Dimensions: CPT can achieve penetrations of up to 40m. No sediment will be removed from the seabed.

Equipment type: Indicative equipment to be used is a Seacalf seabed cone penetrometer test (CPT) system or similar and a deck mounted CPT.

c. 2 no. Boreholes

Method: There is potential for two boreholes to be drilled at the chosen landfall. A borehole is a method of drilling into the seabed to recover samples and enable downhole geotechnical testing to be completed. A drilling head is lowered to the seabed via a drill string. The drill string is then rotated to commence boring. Tools are lowered into the drill string to recover samples or conduct in-situ soil testing.

Equipment: The two boreholes will be drilled from a jack-up barge (JUB) using a percussion and a rotary corer. The number of legs used by the JUB is dependent on seabed conditions, current strength and wave action. For the application area, four legs are the most likely scenario. Each leg has a seabed footprint of approximately 2.54m^2.

Location: The exact location of boreholes will not be known until the preferred export cable route and landfall has been chosen. At this time, it is assumed that it could be any landfall area in the application area.

Dimensions: Each borehole will acquire a core sample up to 112mm in diameter, creating a hole (and therefore a seabed footprint) 143mm in diameter (0.016m^2). Assuming a borehole depth of 25m (the likely maximum depth), the core sample removed will be approximately 0.25m^3. Risings dispersed around the drill site will have a volume of approximately 0.15m^3. Assuming cuttings will form a simple cone with an 18° slope angle around the drill head it has been estimated that they will cover an area of 1.82m^2. The borehole will be left to collapse naturally following completion of drilling where the cuttings are likely to fall back down the hole.

The total expected seabed footprint of the geotechnical borehole sampling is shown in Table 1-1 below.

Table 1-1 Calculated footprint for 2 boreholes

Activity	**Seabed footprint (m^2)**
Jack-up barge legs (worst case assumes 4 legs deployed)	20.32
Borehole extraction*	0.032
Drill cuttings	3.64
Total	**23.96m^2**
***Footprint from borehole extraction is not included within total as it is assumed that it will be within the area of seabed disturbed by drill cuttings	

4. Environmental Survey

Objective: The purpose of the proposed environmental survey is to map the distribution and extent of marine benthic habitats.

Location: Environmental sampling will be undertaken within the boundary of the site, along the three potential cable export routes, and across mooring/anchorage areas.

Survey points and spacing: The exact location and quantity of the environmental samples will be determined following interpretation of geophysical survey.

Equipment: Environmental survey will indicatively comprise:

a. 80 no. Grab stations

Method: A grab sampler will be used to retrieve a soil sample of the seabed by the lowering of a mechanical grab. The grab will be launched from a vessel crane or A-frame. It is likely that three grab samples will be taken at each station; two for faunal analysis and one for sediment and chemical analysis.

Dimensions: Each grab samples a volume of approximately 0.1m^3. Grabs are required to obtain a sample greater than 5cm in depth, to try and achieve this, samples will be repeated for up to three attempts. If three samples are taken at each of 80 stations, then grab sampling will remove approximately 24m^3 of sediment.

Location: To be determined following review of geophysical data but indicative locations (informed by EMODnet habitat data) are provided in Figure 13 below.

Equipment: Indicative equipment is Day or Hamon Grab.

b. Drop-down camera and video transects

Method: A minimum of four still photographs will be acquired at each environmental sampling station. Additional photographs or video footage will be acquired along transects to characterise sensitive habitats or features.

Dimensions: This technique involves no intrusive seabed sampling.

Location: To be determined following review of geophysical data but indicative locations (informed by EMODnet habitat data) are provided in Figure 13 below.

Equipment: Indicative equipment to be used is a SeaSpyder using Canon EOS 100D Digital Still Camera with dedicated strobe and an integrated video system capable of performing full HD recordings.

c. Intertidal

Objective: The aim of the survey will be to identify and map the extent and distribution of intertidal biotopes.

Method: Intertidal floral and faunal surveys at proposed cable landfall locations to include transects, quadrats and core sampling.

Location: The exact location of the intertidal survey will not be known until the preferred export cable route and landfall has been chosen. At this time, it is assumed that it could take place at any landfall area in the application area.

5. Birds & Marine Mammal

Objective: To record the species type and distribution of marine mammal, turtle and bird species observed in the application area.

Method: Boat based marine mammals/reptile and seabird surveys including towed hydrophonic acoustic array and static acoustic monitoring using C-PODS.

Location: Location will depend on the location of the geophysical and geotechnical survey.

6. Wind Resource and Metocean Survey:

Objective: To evaluate wind, wave and tidal conditions within the application area.

Equipment: Deployment of three seawatch wind LiDAR buoys or similar. Deployment of three acoustic doppler current profilers (ADCP) with marker buoys next to the LiDAR buoys.

Method: The LiDAR will be mounted on a buoy and will be moored using 150m long mooring chain and 3 tonne concrete anchor. The buoy will be moored to the seabed for a duration of 12 to 36 months and will be powered by solar panels and micro wind turbine generators. The buoy will be yellow in colour and will be clearly marked with two navigation lights (flashing amber, 5 flashes every 20 seconds, nominal range 3-6 nm visibility and fitted with a Radar reflector. The ADCP will be deployed via a vessel on-board crane and will sit on the seabed.

Location: Exact details of the LiDAR buoy, and ADCP deployment location within the application area, associated mooring arrangement and installation vessel will not be available until a contract has been awarded.

7. General Requirements

The survey contractor and vessels will comply with international and national statute as appropriate. In addition, the following standard environmental procedures/protocols will be followed during the survey campaign:

- All vessels will comply with the latest International Maritime Organization (IMO) and Safety of Life at Sea (SOLAS) and environmental requirements for their classification and with any national requirement of the territorial or offshore waters to be operated in.
- The contractor will take particular care when handling or storing hazardous materials, radiation sources and chemicals.
- Liquid or non-liquid pollutants or waste material will not be dumped, thrown or otherwise disposed of into the sea.
- All refuse and materials shall be kept onboard the vessel and safely disposed of onshore according to the MARPOL convention.
- All substances handled and/or used whilst undertaking the works will be handled, used, stored and documented in accordance with assessments and recommendations of the Control of Substances Hazardous to Health (COSHH) Regulations 1994.
- Where Fuels, Oils and Lubes are required to bestowed on boats, suitable containers will be used and stowed to allow ventilation and safe dissipation of any accidental leaked gas and retention of any leaked liquid.
- No liquid will be discharged into the water at any stage of the work on site. No smoking will be permitted in the vicinity of fuel in storage or when in use.
- The survey contractor will follow the Department of Arts Heritage and the Gaeltacht (DAHG) 'Guidance to Manage the Risk to Marine Mammals from Man-made sound sources in Irish Waters' (DAHG 2014); in particular Section 4.3.4 (ii) applicable to MBES, SSS and SBP surveys.

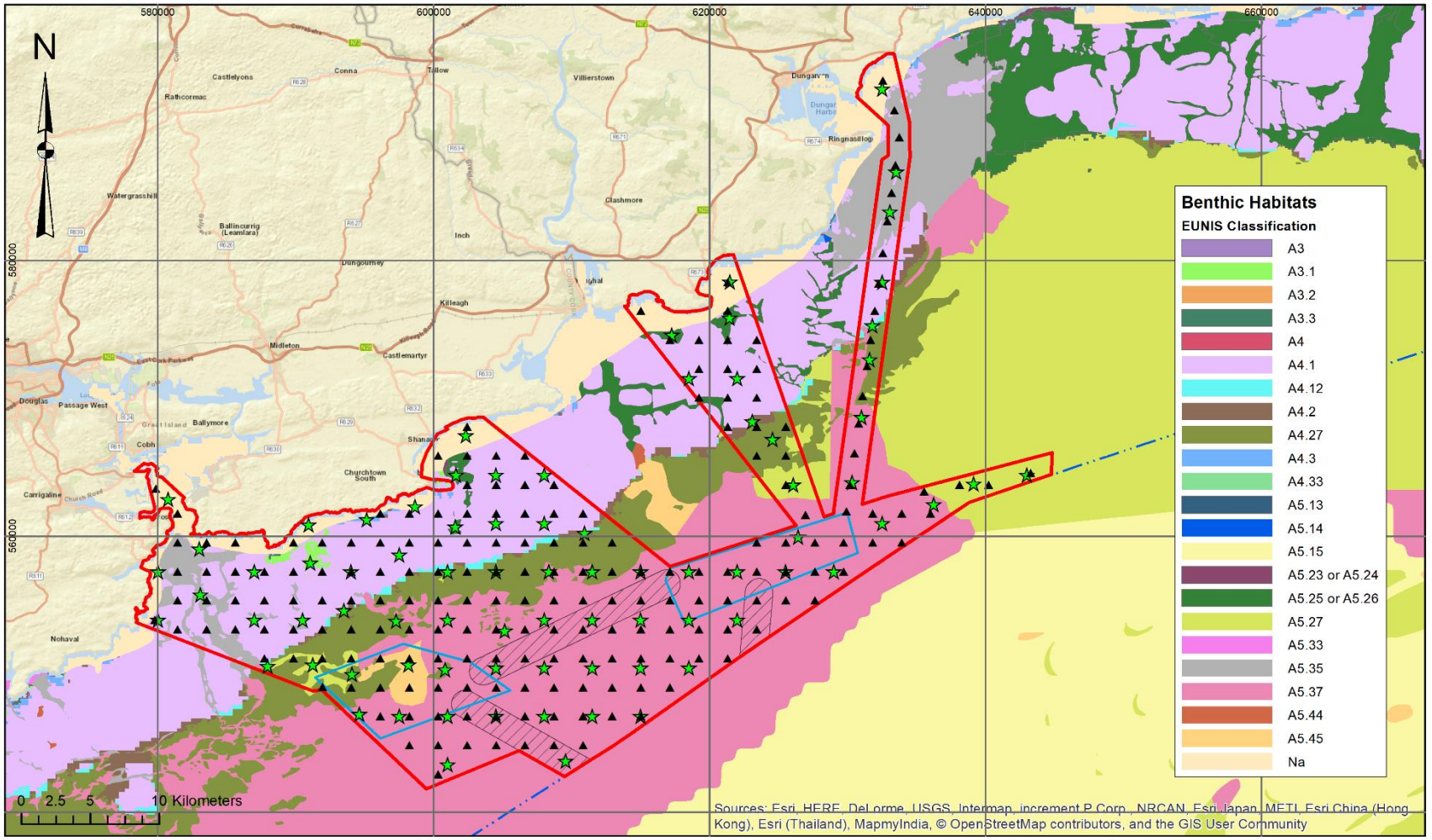

Figure 13

Indicative Sampling Locations

File Number: FS006859

Inis Ealga Marine Energy Park

Legend

- Indicative VC/CPT Positions
- Indicative Grab Sample Positions
- Foreshore Licence Area
- Potential Locations of Wind Turbines
- Area for Potential Cable Connection between Sites
- Irish Territorial Sea 12nm Limit

Data Source: EMODnet, DCCAE

Ver	Date	Drawn by	Checked	Approved
V1	20/01/2020	AM	CMG	SDP

Map prepared by: Agnieszka Matysik, MEngSc in Environmental Engineering, PGD in Sustainable Energy, HDG GIS

Filename: Figure13_IndicativeSamplingLocations | Size A3

Scale: 1:350,000 Printed @ A3

Coordinate System: IRENET95 Irish Transverse Mercator
Projection: Transverse Mercator

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