# CP1146 CARRICKMINES TO POOLBEG PROJECT

## Assessment of Impacts of the Maritime Usage (AIMU) Report

CP1146-RPS-00-XX-RP-N-RP1017
A1 C02
01 November 2024

## Document status

| Version | Purpose of document | Authored by | Reviewed by | Approved by | Review date |
|---|---|---|---|---|---|
| S3 P01 | Draft for client review | [redacted] | [redacted] | [redacted] | 03/07/2024 |
| S3 P02 | Updates to Underwater (subsea) noise assessment section | | | | 25/07/2024 |
| S5 P01 | Client Comments | | | | 15/08/2024 |
| S5 P02 | Additional Client comments | | | | 12/09/2024 |
| S5 P03 | Sections 1.4 and 22 added | | | | 23/09/2024 |
| S5 P04 | Additional Client comments | | | | 30/10/2024 |
| A1 C02 | Final Version | | | | 01/11/2024 |

## Approval for issue

[redacted] 1 November 2024



**Prepared by:**

**RPS**

**Prepared for:**

**EirGrid**

Dublin | Cork | Galway | Sligo | Kilkenny
rpsgroup.com

RPS Group Limited, registered in Ireland No. 91911
RPS Consulting Engineers Limited, registered in Ireland No. 161581
RPS Engineering Services Limited, registered in Ireland No. 99795
The Registered office of each of the above companies is West Pier Business Campus, Dun Laoghaire, Co. Dublin, A96 N6T7

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# 1 INTRODUCTION

## 1.1 Overview

EirGrid was established to act as the independent Transmission System Operator (TSO), in line with the requirements of the EU Electricity Directive. EirGrid became operational as the TSO on 1 July 2006 and is a public limited company, registered under the Companies Acts.

While EirGrid operates the flow of power on the grid and plans for its future, ESB Networks is responsible for carrying out maintenance, repairs and construction on the grid as the Distribution System Operator. ESB is the licenced Transmission System Owner pursuant to the Electricity Regulation Act, 1999. EirGrid uses the grid to supply power to industry and businesses that use large amounts of electricity. The grid also powers the distribution network. This supplies the electricity used every day in homes, businesses, schools, hospitals, and farms.

Dublin's electricity infrastructure is ageing and reaching its end of life. Work must be done to transform and modernise the city's electricity infrastructure, so Dublin can continue to develop and thrive, while increasingly using power from renewable sources.

The Powering Up Dublin Programme is a critical programme that will strengthen key electricity infrastructure in Dublin and the surrounding areas, making the city 'renewable ready.' This programme is set to replace and upgrade five 220kV circuits across Dublin city and the surrounding areas.

As part of the ongoing upgrade and development of Ireland’s electrical grid, EirGrid are undertaking a programme to replace and upgrade five of the 220kV circuits across Dublin city and the surrounding areas. This is part of EirGrid’s wider Dublin programme, to ensure continued reliability of electrical supply across the city, while also enabling future development and possible offshore wind farm development.

Replacing the existing circuits in an offline route means the new circuit follows a separate route to the existing circuit. The advantage of this is that there are minimal disruptions to the existing circuit and no, or very few, planned outages would be needed during construction.

Due to the electricity needs of Dublin, an online replacement is not feasible. For this reason, offline installation will be considered for the replacement of this circuit. EirGrid proposes to replace all the existing circuits with cross-linked polyethylene (XLPE) cable primarily on an offline route. These XLPE cables are more efficient and robust, which will enable the grid to carry more power, making the city ‘renewable ready’.

The programme is set to replace and upgrade five 220kV circuits across Dublin city, with this report focusing on the marine section of one of the cable circuits to be replaced, i.e., the CP1146 Carrickmines to Poolbeg project.

## 1.2 Purpose of the Report

This report has been prepared by RPS, on behalf of the EirGrid, to provide information on the marine site investigation (SI) works proposed to be undertaken for the CP1146 Carrickmines to Poolbeg project in support of the Maritime Usage Licence Application (MULA) to MARA. The MULA is for site survey and investigation works to inform engineering design and environmental assessment. The results of these surveys will also provide baseline data for any subsequent environmental assessments, e.g., Appropriate Assessment (AA) – should one be required.

This Assessment of Impacts on the Maritime Usage (AIMU) report provides the required level of detail to the MARA to ensure MARA can fully assess the potential impacts of the SI works .

## 1.3 Statement of Authority

The technical competence of the authors is outlined below:

[redacted] is a Senior Scientist in the Environmental Services Business Unit in RPS. She has over 10 years’ experience in the marine ecology field. She holds an honours degree in Marine Science from NUI, Galway, and a master’s in marine biology from UCC. [redacted] has contributed to numerous marine environmental projects including appropriate assessments, Annex IV species reports, natura impact statements and EIA chapters.

[redacted] is a Scientist in the Environmental Services Business Unit in RPS. She holds a Bachelor's Degree in Marine Science from the University of Galway and Master's Degree in Climate Change and Managing the Marine Environment from Heriot-Watt University Edinburgh. She has three years' experience working in consultancy, assisting on a wide range of projects from offshore renewable energy projects to flood relief schemes, including marine and terrestrial surveys. She is a qualifying CIEEM member.

[redacted] is Technical Director in the Environmental Services Business Unit in RPS. He has over 24 years' experience. He holds an honours degree in Civil Engineering (B.E.) from NUI, Galway, a postgraduate diploma in Environmental Sustainability from NUI, Galway, and a Master's in Business Studies from the Irish Management Institute/ UCC. [redacted] is also a Chartered Engineer and Project Management Professional with the Project Management Institute (PMI-PMP). He has managed the delivery of numerous environmental projects including marine and terrestrial projects that have required environmental impact assessment, appropriate assessment, and Annex IV species reports.

## 1.4 Prioritisation of MUL Applications

EirGrid is aware of MARA's application prioritisation scoring system, as set out on its website, and notes that the prioritisation of applications is reviewed by MARA on a monthly basis.

To assist MARA in understanding the importance of the MUL application, the application has been assessed against MARA's prioritisation criteria in the table below.

As noted above, EirGrid is the Transmission System Operator (TSO) for Ireland responsible for developing, managing and operating the electricity grid. As TSO, EirGrid manages the flow of power on the electricity grid, moving high-voltage electricity around the country, from where it is produced to where it is used, supplying large energy users and the distribution network that powers houses and businesses. EirGrid also has a unique role in leading Ireland's transmission to a low-carbon future by making the electricity grid renewable ready.

The subject MUL application is required to inform the engineering design and environmental assessments of a proposed 220 kV electrical cable circuit crossing Dublin Bay from Blackrock Park to Shellybanks; which is the offshore section of a larger cable circuit between Carrickmines and Poolbeg. The proposed 220 kV electrical cable is part of EirGrid's Powering Up Dublin Programme, which is crucial to strengthening key electricity infrastructure in Dublin and the surrounding areas, making the city 'renewable ready'. As such it is key enabling infrastructure for meeting the Government's target of 80% of electricity demand being supplied by renewable resources by 2030.

Specifically, the proposed electricity cable circuit, is part of a programme of works to replace and upgrade five existing 220kV circuits across Dublin city and the surrounding areas which have reached their end of life. These circuits are critical backbone elements of the Dublin transmission grid and are essential for the optimal use of available and future generation in the city. The programme of works is also required to deliver EirGrid's commitment to replace all Fluid Filled Cables (FFC) from the Dublin electricity transmission system.

The intention of the MUL application is to enable EirGrid to acquire high quality and site specific technical and environmental data site to provide a reliable basis for design development, and to support the consenting (i.e. an application to An Bord Pleanala) and construction phases of the project.

**Having regard to EirGrid's role as TSO, and the fact that the MUL application will directly support delivery of new electricity grid infrastructure, which is required as key enabling infrastructure for meeting the Government's target of 80% of electricity demand being supplied by renewable resources by 2030, EirGrid respectfully requests MARA affords the subject application the highest priority.**

| Criteria | Description | Subject MUL Application |
|---|---|---|
| National and European priorities | Applications identified as contributing to National and European priorities such as:<br>• Security of energy supply (e.g. Offshore Renewable Energy)<br>• European Telecommunication Cables Critical State Infrastructure or Utilities | The subject application supports delivery of new electricity grid infrastructure by Ireland's TSO, directly supporting security of electricity supply commitments and ensuring the grid is capable and flexible to accommodate renewable energy (including from offshore generators). |

| | | |
|---|---|---|
| | • Risk to Life (emergency works)*<br>• Risk (Routine works)<br>• Compliance, enforcement and regularisation priority.<br>*an application linked with emergency works where there is a safety risk to life. | Refer to Section 4 of this Report for information relating to how the proposed development directly contributes to National and European priorities. |
| Policy and Regulatory | Applications linked with national policies and regulatory priorities such as:<br>• The National Ports Policy<br>• Marine Strategy Framework Directive<br>• Water Framework Directive<br>• Climate Action Plan<br>• Designated Maritime Area Plans | The Government's target of 80% of electricity demand being supplied by renewable resources by 2030 set out in the Climate Action Plan 2024 requires significant investment in electricity grid infrastructure. The subject application supports delivery of new electricity grid infrastructure by Ireland's TSO, and is crucial to strengthening key electricity infrastructure in Dublin and the surrounding areas, making the city 'renewable ready'. As such it is key to transitioning Ireland to a low-carbon future.<br>Refer to Section 4 of this Report for information relating to how the proposed development directly contributes to policy and regulatory requirements. |
| Assessment Status | Applications for which all of the required information has been submitted to MARA and the assessment process is close to finalisation. | EirGrid has sought to provide MARA with a complete and comprehensive MUL application.<br>The application includes a Natura Impact Statement (NIS) at the outset, to provide MARA with the necessary level of detail to complete an Appropriate Assessment of the potential for adverse effect(s) on the integrity of (a) European site(s), arising from the SI works either individually or in combination with other plans or projects. |
| Application Age | The date on which a complete application was received by MARA. | November 2024. |

# 2 PROJECT DESCRIPTION

## 2.1 Location

The CP1146 Carrickmines to Poolbeg project is a proposed new underground electricity cable from the Carrickmines 220 kV substation to the Poolbeg 220 kV substation and includes a section of marine cable as shown in Figure 2-1. The cable route for the CP1146 Carrickmines to Poolbeg project traverses the administrative areas of two local authorities: Dun Laoghaire Rathdown County Council and Dublin City Council.

A site location map of the marine section of the CP1146 Carrickmines to Poolbeg project, showing the MULA area (redline boundary), is presented in Figure 2-2 below. Note that the cable route element shown in the figure below represents a 500m wide routing corridor and that final routing will be determined following the surveys being described in this project description. More detailed drawings are provided in Appendix A.

The Area of Interest (AoI) of this report is an area of approximately 2101 Ha extending from Blackrock Park to the Shelley Banks car park on the Poolbeg peninsula. The majority of geophysical and geotechnical surveys will be conducted within the 500m wide corridor, however, some addition surveys may be required within the wider South Dublin Bay area. Therefore the entire 2101 Ha area is the subject of the MULA.

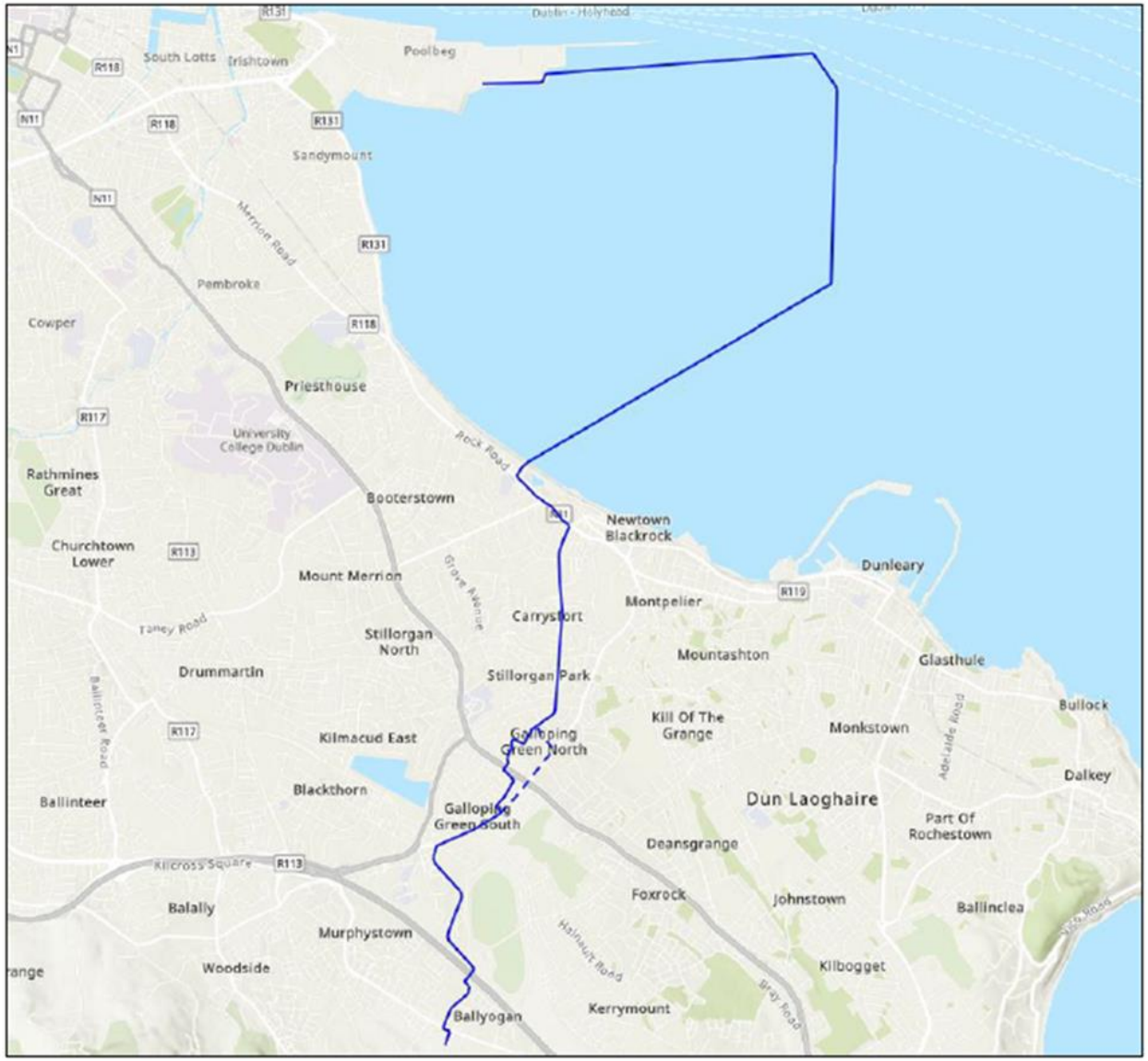


**Figure 2-1 Proposed Entire Route of CP1146 Carrickmines to Poolbeg project**

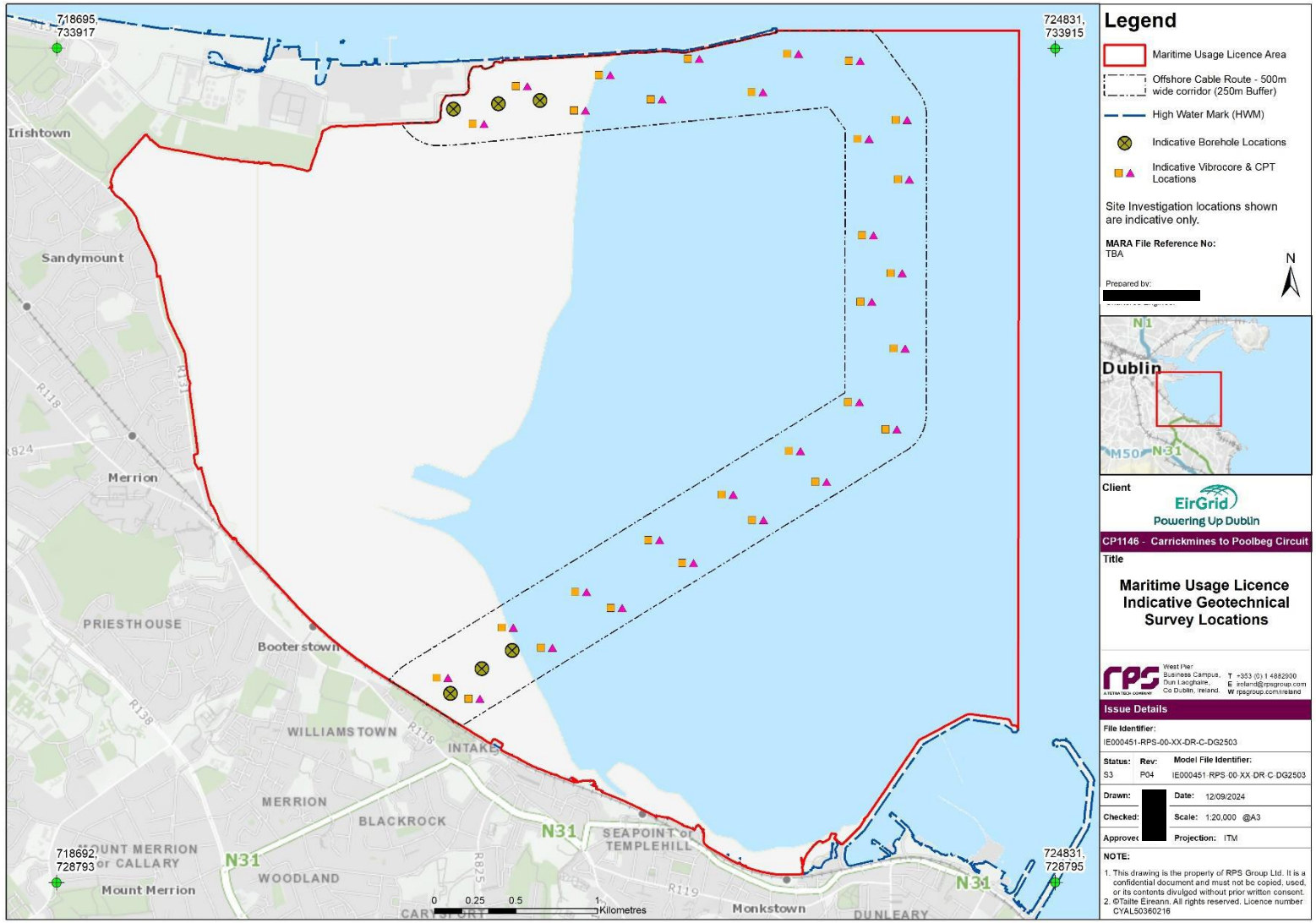


**Figure 2-2 Proposed Marine Cable Section of CP1146 Carrickmines to Poolbeg project (500m wide route corridor) and MULA Area**

## 2.2 Description of the Marine Site Investigation Works

### 2.2.1 Overview

In order to provide a reliable basis for design development, and to support the consenting and construction phases of the marine section of the CP1146 Carrickmines to Poolbeg project, surveys and investigations are necessary. The aim of the site investigation is to acquire data to a high quality and specification for the site as summarised below and described in the following sections.

Marine Site Investigation Works (hereafter SI Works) comprise the following elements:

**Table 2.1 Marine Site Investigation Surveys**

| Survey Type | Survey Elements |
|---|---|
| Marine Geophysical Surveys | Drop-down camera/ video |
| | ROV |
| | Multi Beam Echosounder (MBES) |
| | Side Scan Sonar (SSS) |
| | Sub-bottom profiler (SBP) |
| | Magnetometer |
| | Ultrashort Baseline (USBL) acoustic positioning system |
| | Seismic Refraction |
| | Ground Penetrating Radar |
| | Drones/ UAV |
| Marine Environmental/ Ecological Surveys | Benthic sampling/ grab samples |
| | Water samples |
| | Conductivity, Temperature, Depth (CTD) water measurements |
| | Static underwater noise recorders |
| | Shipping and navigation surveys |
| | Marine archaeology surveys |
| | Marine habitat surveys |
| | Other ecological surveys |
| Metocean Surveys | Acoustic Doppler Current Profiler (ADCP) |
| Geotechnical Investigations/ Surveys | Geotechnical Boreholes |
| | Vibro-core Sampling |
| | Cone Penetration Test (CPT) |

It should be noted that all locations shown are provisional only and subject to change on-site due to the presence of obstructions/ refusals at individual locations, i.e. where a physical object, e.g. a subsurface boulder, prevents the borehole, CPT, etc., from going to its target depth. In such circumstances, the borehole location is moved to another nearby location away from the obstruction and drilled again to the target depth.

The following drawings have been prepared in support of the Maritime Usage Licence to the Maritime Area Regulatory Authority (MARA):

- Proposed Licence Area Map (Dwg Ref: CP1146-RPS-00-XX-DR-C-DG2502)
- Maritime Usage Licence Indicative Geotechnical Survey Locations (Dwg Ref: CP1146-RPS-00-XX-DR-C-DG2503)
- Maritime Usage Licence Indicative Benthic Sample Locations Map (Dwg Ref: CP1146-RPS-00-XX-DR-C-DG2504)

The drawings are included in Appendix A to this report.

### 2.2.2 Marine Geophysical Surveys

The geophysical survey scope is intended to provide significant seabed and sub-seabed information. It is therefore foreseen to gather, as a minimum, detailed information on:

- Water depths, reduced to lowest astronomical tide (LAT), throughout the AoI;
- The nature of any seabed features, obstructions, sediments, and shallow geological conditions throughout the AoI;
- The nature of the sub-seabed conditions and horizons down to circa 10-15m below chart datum (CD) depending on the geological conditions encountered and the choice of system used;
- Seabed conditions/ hazards to any SI works equipment which may need to be located on the seabed;
- Seabed habitats to inform further benthic surveys and preparation of environmental assessments; Identify sensitive marine habitats which will need to be avoided during geotechnical and environmental sampling;
- Archaeological features within the AoI;
- Unexploded ordnance (UXO).

The foreseen scope of marine SI works will consist of primarily non-intrusive survey methods, in that they will not physically interact with the seabed, such as Multi Beam Echosounder (MBES), sub-bottom profiler (SBP), Side Scan Sonar (SSS) and Magnetometer surveys but may also incorporate visual surveys (e.g., drop down video, ROV, etc.) pending the development of the project's ground model.

As detailed in Section 2.2.3 below some intrusive seabed sampling will also be undertaken during the geophysical survey campaign to ground-truth geophysical data, assist in early seabed characterisation and provide data for benthic analyses and archaeological interpretation.

Typical nearshore vessels for geophysical surveys will be circa 10 – 20m in length. See Figure 2-3 for an example of a geophysical survey vessel. A smaller nearshore vessel may be required to complete surveys in the intertidal area, See Figure 2-4 for an example of a typical nearshore vessel.

A brief description of the geophysical survey methods has been provided in the subsequent sections. The exact technical specifications of the equipment to be used will not be known until the survey contract has been awarded however such vessels and equipment will be within the parameters assessed within this document.

However, a description of the typical equipment and survey parameters is described. Typical acoustic properties of equipment are provided in Section 2.2.6.


**Figure 2-3 Typical offshore geophysical survey vessel (GeoSurveyor XI Call Sign; ORVI)**

**Figure 2-4 Typical nearshore geophysical survey vessel (RV GEO)**

The intertidal area will be subject to surveys using predominantly terrestrial geophysical survey methods and techniques such as Ground Penetrating Radar (GPR), shallow seismic refraction, electrical resistivity, magnetometer, drones and photogrammetry.

### 2.2.2.1 Multibeam Echo sounder

Full 100% coverage of the area concerned associated with the survey and area classification will be required. Surveys shall identify the level, nature, and detailed coverage of the seabed to ensure identification of features on the seabed within the area shown, identify potential large upstanding archaeological features and guide habitat mapping with the backscatter function if available. Processing of data sets shall include processing for archaeological indicators. The area shall be surveyed in such a way as to produce a comprehensive data-set required to enable the generation of multiple sections through the survey area in any direction.

**Method:** A remote sensing acoustic device which will be either attached to the vessel(s) hull at the bow or mounted on a side pole.

**Indicative Equipment:**

- Teledyne Reson Seabat T50-R;
- R2 Sonic 2024 (see Figure 2-5); or
- similar.

**Figure 2-5 MBES R2Sonic 2024**

**Swath width**: Swath width will be optimised to provide 100% seafloor coverage with typical swath widths of 3 to 6 times water depth depending on arrangement of equipment hardware.

**Location**: MBES survey may be performed throughout the entire sub-tidal area illustrated in Dwg Ref: CP1146-RPS-00-XX-DR-C-DG2502 (Appendix A). The estimated survey area is 2101 Ha.

### 2.2.2.2 Side Scan Sonar (SSS)

**Method**: A submerged acoustic device (SONAR – Sound Navigation & Ranging) for imaging areas of the seafloor will be either hull mounted or towed.

**Indicative Equipment**:

- Kongsberg Geoacoustic 160
- Edgetech 4200 (see Figure 2-6);
- C-Max CM2 system;
- Klein Hydro Scan; or
- similar.


**Figure 2-6 Edgetech 4200 SSS**

**Swath width**: The swath width will be based on the water depth encountered. A 100% overlap between each swath is envisaged.

**Location**: SSS survey may be performed throughout the entire sub-tidal area illustrated in in Dwg Ref: CP1146-RPS-00-XX-DR-C-DG2502 (Appendix A). The estimated survey area is 2101 Ha.

### 2.2.2.3 Sub-bottom Profiling

A typical sub bottom profiling (SBP) survey is completed using single or multi-channel seismic reflection systems such as Chirp, Sparker, or Parametric system. Sub bottom profiling over the site and specified runs is yet to be determined.

The geophysical SBP survey shall identify the bed level and the nature, thickness, and location of the sub surface strata to rock head.

The survey shall include both items detailed below:

1. Completion of specified runs.
2. Completion of a Free Line Survey.

**Method**: SBP are acoustic devices for imaging sections of the seabed. The images produced are used to produce profiles beneath the seafloor, enabling delimitation of major sedimentary interfaces. They are either mounted on the vessel / pole or towed behind the vessel.

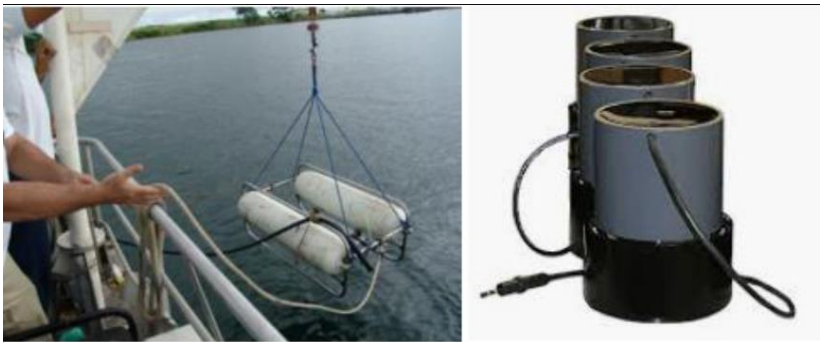

**Figure 2-7 Left - Applied Acoustics AA300 being deployed & Right - Typical Hull Mounted SBP - Edgetech 3300**

**Indicative Equipment:**

- Edgetech 3100;
- Edgetech 3300 (see Figure 2-7);
- Geopulse 5430A (pinger system);
- 400 Joule Generic sparker;
- Innomar Parametric (dual frequency); or
- similar.

**Swath width**: n/a

**Location**: SPB survey may be performed throughout the entire sub-tidal area illustrated in Dwg Ref: CP1146-RPS-00-XX-DR-C-DG2502 (Appendix A). The estimated survey area is 2101 Ha.

### 2.2.2.4 Magnetometer

The magnetometer survey will be undertaken at suitable line spacing to ensure complete coverage of the seabed for archaeological purposes (and in line with UAU guidelines), i.e., identify large metal debris or metallic archaeological remains.

**Method**: Magnetometers provide information on embedded magnetic/ferrous objects such as cable crossings, debris and potentially UXO's. They are towed from the vessel.

**Indicative Equipment:**

- Geometrics G-882 caesium vapour magnetometer – see Figure 2-8;
- Marine Magnetics SeaSPY,
- G-Tec Magwing System; or
- similar.

**Figure 2-8 Geometrics G-882**

**Survey spacing**: Line spacing will be dependent on water depth encountered, with additional runs of higher density line spacing within areas where any magnetic signal is recorded.

**Location**: Magnetometer surveys may be performed throughout the entire sub-tidal area illustrated in Dwg Ref: CP1146-RPS-00-XX-DR-C-DG2502 (Appendix A). The estimated survey area is 2101 Ha.

### 2.2.2.5 Ultrashort Baseline (USBL) – Acoustic Positioning System

An ultrashort baseline acoustic positioning system is a highly accurate and precise method of underwater acoustic positioning. It determines the orientation and position of the transponders relative to the transceiver and can be used during the set up and positioning of other geophysical and geotechnical survey equipment.


**Figure 2-9 Applied Acoustics EasyTrak Nexus Model EZT-2691**

**Method:** The system consists of a transceiver unit and a set of transponders. The transceiver unit emits acoustic signals, which are picked up by the transponders.

**Indicative Equipment:**

- Applied Acoustics EasyTrak Nexus Model EZT-2691 (Figure 2-9); or
- similar.

**Location**: USBL surveys may be performed throughout the entire sub-tidal area illustrated in Dwg Ref: CP1146-RPS-00-XX-DR-C-DG2502 (Appendix A). The estimated survey area is 2101 Ha.

### 2.2.2.6 Seismic Refraction (Beach and Intertidal)

The seismic refraction method utilizes the refraction of seismic waves as they pass through various rock or soil layers to analyse underground geological conditions and structures.


**Figure 2-10 Geometrics Geode Seismograph**

**Method:** Seismic refraction profiles will be conducted using onshore survey tools during low tide in the intertidal zone. A sound source (typically a sledgehammer striking a metal plate) will generate compressional wave energy. These refracted waves will be captured by a series of geophones and logged on a digital seismograph. The locations and elevations of the geophones will be documented using GPS technology.

**Indicative Equipment:**

- Geophone Arrays:
  - Geosense 4.5 Hz Geophones;
  - Mark Products L-28LB Geophone;
  - Geospace GS-11D Geophone; or
  - similar
- Digital Seismographs
  - Geometrics Geode Seismograph (Figure 2-10);
  - Seistronix RAS-24;
  - ABEM Terraloc Pro; or
  - similar

**Location**: Refraction Seismic methods may be undertaken throughout the entire inter-tidal areas illustrated in Dwg Ref: CP1146-RPS-00-XX-DR-C-DG2502 (Appendix A).

### 2.2.2.7 Ground Penetrating Radar (Beach and Intertidal)

Ground Penetrating Radar (GPR) utilizes the reflection of electromagnetic waves as they are returned by rock or soil layers to analyse underground geological conditions and structures.

**Method:** GPR will be completed during low tide in the intertidal zone. A GPR trolley will be pushed over the area to be scanned or a GRP array will be towed using an ATV and the results analysed by a technician to determine subsurface characteristics.

**Figure 2-12 Stream X Towed GPR System**

**Figure 2-11 Leica DS2000 GPR Trolley**

**Indicative Equipment:**

- IDS GeoRadar Stream X Towed GPR System (see Figure 2-12)
- IDS GeoRadar Stream DP GPR System
- Leica DS2000 GPR System (see Figure 2-11); or
- similar.

**Location**: Refraction Seismic methods may be undertaken throughout the entire inter-tidal areas illustrated in Dwg Ref: CP1146-RPS-00-XX-DR-C-DG2502 (Appendix A).

### 2.2.2.8 Drones

Drones or Unmanned Aerial Vehicles (UAVs) are capable of mapping coastal and intertidal areas with a high degree of vertical accuracy. Drones or UAVs equipped with a high-resolution camera can be used to collect high resolution spatial data for coastal and intertidal surveys.

**Method:** Drones/UAVs will be used to survey intertidal zones.

**Location:** Drone surveys may be undertaken throughout the inter-tidal areas illustrated in Dwg Ref: CP1146-RPS-00-XX-DR-C-DG2502 (Appendix A).

## 2.2.3 Marine Environmental/ Ecological Surveys

The aim of the proposed environmental surveys is to collect baseline data which will be used to inform the environmental assessments. Environmental surveys will cover both the onshore area above the high-water mark and areas below the high water mark including intertidal and subtidal areas. This will include a benthic sampling programme using grab sampling, video or still photographs and, where deemed necessary, the deployment of static acoustic monitoring to measure marine mammal activity and other background noise.

### 2.2.3.1 Benthic Sampling/ Grab Samples

Seabed samples will be recovered to inform benthic habitat distribution mapping as well as contamination testing (where relevant). Standard sampling techniques for subtidal and intertidal collection will be employed to include collection of macrofauna and associated sediment particle size and organic content, as described below.

Macrofaunal grab samples may be taken with a number of different grab types depending on the substrate type, e.g., Day grab, Van Veen, mini-Hamon (not suitable for undisturbed samples). The benthic sampling will be complemented by video and still photography. Seabed sampling will likely be undertaken as part of either the geophysical or geotechnical surveys or may be a standalone survey.

**Indicative Quantity**: It is anticipated that approximately 11 no. stations will be required to be sampled. Three (3 no.) replicate benthic samples will be obtained at each sampling location. Two benthic samples from each

sampling location will be processed for macro-invertebrate benthos larger than 1 mm. The remaining one sample will be analysed for sediment particle size analysis and sediment chemistry. Samples will be sent to a suitably accredited (NMBAQC level participation) laboratory for analysis and reporting which will include benthic analysis, sediment particle size analysis and sediment chemistry. GPS coordinates and depths will be recorded for each location.

**Method**: Camera will be used to ensure seabed is suitable for sampling prior to using grab and thereby ensuring any reefs will not be damaged. Surface grab sample by box corer, grab sampler (e.g., Day grab, Van Veen grab or similar). These devices are typically deployed from a crane on the vessel.

**Depth**: Grab sample will be taken on the seabed at depths ranging between -4m CD and -10m CD. It is estimated that each sample will have a size up to 0.1m$^2$.

**Location**: Grab sampling will be performed within the area defined in CP1146-RPS-00-XX-DR-C-DG2504 (Appendix A). The estimated survey area is 2101 Ha. The final sampling locations will be determined based upon interpretation of the geophysical data and selected to sample different marine habitats.

### 2.2.3.2 Water Samples

Water sampling and profiling will take in sufficient locations to provide an even distribution of results across the site. Two water samples shall be taken at each location. Each water sample shall be analysed for the following: conductivity, temperature, pH, dissolved oxygen and turbidity. Where suitable, parameters will be tested in situ to receive accurate data. A Niskin bottle (or similar) will be used to obtain a sufficient sample of water at the surface (< 1m depth) and a second sample just above the seabed (~1m) for the subsequent chemical analysis.

### 2.2.3.3 Conductivity, Temperature and Depth

Conductivity, Temperature, Depth (CTD) water measurements shall be taken at a number of locations at three depths, i.e. near-surface, mid-water, and near-seabed. Measurements shall be taken only after stabilisation of the temperature at each location. At each location conductivity and temperature shall be recorded every hour during a complete semi-diurnal tidal cycle. A CTD profile shall be produced for each location.

### 2.2.3.4 Static Underwater Acoustic Recorders

Static underwater acoustic recorder(s) may be deployed within the sea in the AoI. The recorder(s) will be Wildlife Acoustics Model: SM2M Unit with hydrophones contained in a single unit (see Figure 2-13), or similar. The location for the deployment of the recorder(s) will be determined based on factors such as tide, sediment and currents, as well as distance from shipping/ onshore noise sources that may impact on baseline noise levels. This information will be collected as part of the early SI works and therefore deployment locations are not yet known although they will be within the MUL area.

**Figure 2-13 Deployment of static underwater acoustic recorders**

#### 2.2.3.5 Other Environmental Surveys

Further marine environmental surveys will be undertaken during the course of the project's development comprising the following:

- Shipping and Navigation Surveys
  - The need for shipping and navigation surveys will be determined following consultation with the relevant stakeholders. These will be shore-based visual vessel traffic surveys.
- Marine Archaeology Surveys
  - The aim of the proposed surveys, which will be undertaken by a suitably qualified archaeologist, are to collect baseline data which will be used to inform the cultural heritage impact assessment. Surveys will be undertaken in advance of any intrusive survey work and generally coordinated with the geophysical survey proposed herein. Surveys will comprise an identification programme using marine magnetometer survey (see Section 2.2.2.4), side scan sonar (see Section 2.2.2.2) data analysis and diving as required in order to identify and assess metallics and other targets. They may include dive surveys, wade surveys and archaeological walkover surveys.
- Marine Habitat Surveys
  - The aim of the proposed surveys, which will be undertaken by a suitably qualified marine ecologist, are to collect baseline habitat data which will be used to inform the environmental assessments, e.g., Appropriate Assessment (AA). Surveys will be undertaken in advance of any geotechnical survey work and generally coordinated with the geophysical survey proposed herein. Surveys will comprise drop down camera and/or Remote Operated Vehicle (ROV) inspection and diving as required in order to identify benthic habitats.
  - Intertidal walkover surveys habitat characterisation sampling, with core samples to be analysed for Fauna, Particle Size Analysis & Total Organic Carbon, and chemical analysis, e.g., heavy and trace metals, hydrocarbons, and polycyclic aromatic hydrocarbons (PAH);

    It would be expected that a minimum of 9 primary transect stations are selected per landfall location, with 3 sampling points along each, (minimum 9 transects and a minimum total of 27 sampling points).
- Other Ecological Surveys
  - Terrestrial habitat walkover surveys (including protected and notable flora, and invasive alien plants and animals);
  - Bats roost assessment surveys;
  - Mammal surveys (including otters); and
  - Bird surveys including wintering bird surveys (low and high tide surveys), breeding bird surveys (vantage point surveys, boat based surveys).

It should be noted that these surveys will straddle both the marine and the terrestrial environments.

### 2.2.4 Metocean Surveys

The main purpose of the meteorological and oceanographic (metocean) campaign is to collect accurate wind wave, temperature, current and water levels information from the project site. The information collected will be used to inform engineering design and environmental assessments. The exact details of the surveys (equipment, locations, and deployment/retrieval methods) will be confirmed upon appointment of a preferred contractor.

#### 2.2.4.1 Equipment Deployment & Recovery Vessel

The methodology for deployment of metocean monitoring equipment will be using a suitable vessel to either tow and/or lift and deploy from vessel deck via onboard crane. An example of a suitable vessel for this scope would be a shallow draft anchor handling tug or a utility type vessel such as that shown in Figure 2-14 or similar.

**Figure 2-14 Ocean Energy DP1 Multi Cat 2309**

#### 2.2.4.2 Acoustic Doppler Current Profiler (ADCP) to measure ocean currents.

An Acoustic Doppler Current Profiler (ADCP) is used to collect data on water movements, current speeds, and directions.

**Indicative Quantity**: Three.

**Method**: Deployed to the seabed via a crane from a survey vessel for a duration of at least 5 weeks to capture a full lunar cycle including spring and neap tides.

**Indicative Equipment**: The ADCP unit (Figure 2-15) is mounted in a seabed frame (circa 1.8m wide and 0.6m high) with a weight of approximately 300kg. 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.

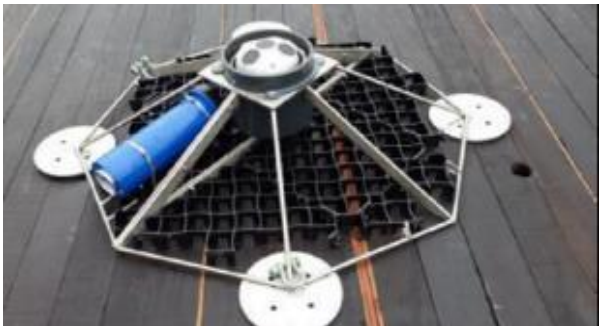

**Figure 2-15 Typical seabed frame with ADCP (Ocean Scientific International Ltd)**

**Location**: Indicative locations for the deployment of ADCP are illustrated on Dwg Ref: IE000451-RPS-00-XX-DR-C-DG2504 (Appendix A). The actual locations will be determined based upon interpretation of the geophysical data and following a navigation safety assessment.

### 2.2.5 Marine Geotechnical Investigations

The aim of the geotechnical survey is to provide sufficient geotechnical data to allow the characterisation of the sub-seabed strata and composition of the seabed and the level of Rock head (including follow on coring to confirm rock head).

Normal industry standards for performance of all positioning, drilling, sampling, SPT testing, CPTu testing, laboratory testing and analysis and reporting will apply. Material sampling, in situ testing, data logging, laboratory testing and reporting (factual and interpretative) will be required.

The works will include the following:

- Sampling/ coring boreholes at 6 locations to a maximum of 20m investigation depth below seabed level.
- Vibro-cores at c. 30 locations.
- Cone Penetration Testing – CPT conducted in the locations of all vibro-cores.

The indicative quantities given above relate to the requirements for the preliminary geotechnical campaign, the final quantity, location, and specification of equipment will be determined following interpretation of the geophysical survey data and considering environmental constraints (i.e., proximity to sensitive receptors). The final proposed locations will be subject to environmental conditions.

### 2.2.5.1 Geotechnical Boreholes

**Indicative Quantity**: 6 focused primarily at the landfall locations of the cable routes.

**Method**: A drill head is lowered to the seabed from the drilling platform (where used) via a drill string. The drill head penetrates the seabed via rotation of the drill string and the application of a downward pressure. Soils and rock samples are then retrieved for laboratory testing via the drill string.

**Sample Diameter**: up to 102mm.

**Depth**: Up to 20m below the seabed, or refusal.

**Indicative Equipment**: Indicative equipment to be used would be Camacchio 205 or Comacchio 602 drill rigs using traditional drill string or a triple core barrel system (e.g., Geobor 'S') and associated ancillary equipment (water bowser, air compressor).

Depending on the specifics of each borehole location the drill rig and ancillary equipment may be deployed in two different methods, the choice of method will be determined based on the geophysical surveys, tidal working windows, as well as availability of plant and equipment.

For investigations at all borehole locations where there is sufficient depth of water (draft) to deploy a jack-up barge, the drill rig and equipment can be mounted on a jack up barge and boreholes completed from this barge during any phase of the tide (see Figure 2-16).

**Figure 2-16 Jack-up Barge and drill rig**

**Figure 2-17 Landing Craft deploying onto beach (MV Spanish Jonh II)**

For investigations located within the intertidal zone where sufficient time is available between inundation by tides, a tracked borehole / CPT rig and ancillary equipment may be deployed from a small landing craft (see Figure 2-17) to complete the borehole during the intertidal window.

**Location**: Indicative geotechnical locations for the boreholes are illustrated on Dwg Ref: IE000451-RPS-00-XX-DR-C-DG2503 (Appendix A). The final borehole locations will be determined based upon interpretation of the geophysical data and selected based on the preliminary engineering design. The micro siting of individual geotechnical site investigation locations will take into consideration environmental constraints such as the position of sensitive habitats or archaeological features.

### 2.2.5.2 Vibro-core Sampling

**Indicative Quantity**: 30 vibrocores.

**Method**: Gravity or piston core (self-weight penetration sampler), deployed from a works vessel equipped with Dynamic Positioning. An example of a suitable vessel for this scope would be a shallow draft anchor handling tug or a utility type vessel such as that shown in Figure 2-14 (above) or similar.

**Sample Diameter**: up to 150mm.

**Depth**: Vibrocore up to 6m depth.

**Indicative Equipment**: The exact equipment to be used will be confirmed following a tender process to procure the site investigation contractor.

**Location:** Vibro-core sampling will be performed at representative locations within the cable route corridor - Refer to Dwg Ref: IE000451-RPS-00-XX-DR-C-DG2503 (Appendix A). The final sampling locations will be determined based upon interpretation of the geophysical data and selected based on the preliminary engineering design. Some locations may need to be avoided due to environmental reasons including sensitive archaeological features or unsuitable substrate types.

#### 2.2.5.3 Cone Penetration Testing (CPT)

**Indicative Quantity**: 30 CPT

**Method**: Cone Penetration Test (CPT) using a cone penetrometer deployed from a works vessel. An example of a suitable vessel for this scope would be a shallow draft anchor handling tug or a utility type vessel such as that shown in Figure 2-14 (above) or similar.

**Sample Diameter**: 32 mm (standard cone diameter).

**Depth**: CPT up to 6m depth, or refusal.

**Indicative Equipment**: The exact equipment to be used will be confirmed following a tender process to procure the site investigation contractor.

**Location:** Cone Penetration Testing will be performed at representative locations within the cable route corridor - Refer to Dwg Ref: IE000451-RPS-00-XX-DR-C-DG2503 (Appendix A). The final sampling locations will be determined based upon interpretation of the geophysical data and selected based on the preliminary engineering design. Some locations may need to be avoided due to environmental reasons including sensitive archaeological features or unsuitable substrate types.

### 2.2.6 Marine Noise Level Summary

All survey works that involve the use of acoustic instrumentation will follow the *Guidance to Manage the Risk to Marine Mammals from Man-made Sound Sources in Irish Waters* (DAHG, 2014).

A summary of the noise sources, for the main activities proposed to be undertaken as part of the SI works surveys is included in Table 2.2 (see Appendix B: Subsea Noise Technical Report for further detail).

**Table 2.2 Summary of Noise Sources and Activities Included in the Subsea Noise Assessment**

| Equipment | Source level [SPL] (as used in model) | Primary decidecade bands (-20 dB width) | Source model details | Impulsive/non-impulsive |
|---|---|---|---|---|
| Survey vessel, Geophysical | 161 dB SPL | 10-16,000 Hz | Based on <20 m generic survey vessel. | Non-impulsive |
| Survey vessel, Geotechnical | 168 dB SPL | 10 – 25,000 Hz | Based on <30 m tug with dynamic positioning system | Non-impulsive |
| MBES | 187 dB SPL (Spherical equivalent level) | 200,000-800,000 Hz | Based on Reason SeaBat T50 & R2 Sonic 2024. | Impulsive |
| SSS | 166 dB SPL (Spherical equivalent level) | 100,000-1,000,000 Hz | Generic SSS from 400-1,000 kHz. | Impulsive |
| USBL | 190 dB SPL | 18,000-31,500 Hz | Active with non-hull mounted SSS* & during vibro-core operations, 2 Hz ping rate, ping length 10 ms. | Impulsive |
| SBP-parametric (P-SBP) | 204 dB SPL | 80,000-150,000 Hz (Primary)<br>2,000-22,000 Hz (Secondary) | Source level adjusted for sediment effects and beam widths.<br>Based on Innomar Standard, worst-case for shallow water. | Impulsive |
| SBP-chirper/pinger (C-SBP) | 181 dB SPL | 2,000-12,000 Hz | Generic shallow water SBP of chirper/pinger type.<br>Source level adjusted for sediment effects and beam widths. | Impulsive |
| SBP-sparker/UHRS (S-SBP) | 184 dB SPL | 600 – 6,300 Hz | Based on GeoSource 400.<br>Firing rate of 1 Hz assumed | Impulsive |

| Equipment | Source level [SPL] (as used in model) | Primary decidecade bands (-20 dB width) | Source model details | Impulsive/non-impulsive |
|---|---|---|---|---|
| ADCP<br><br>(**Not modelled given high frequency**) | 114 dB SPL | 500,000-1,260,000 Hz | Based on suitable ADCP for depths <100 m (e.g. Nortek AWAC, Teledyne Reason Sentinel, Workhorse or Monitor)<br>Source level adjusted for sediment effects and beam widths. | Impulsive |
| Drilling/ rotary coring (Boreholes, no USBL) | 145 dB SPL | 10-500,000 Hz | Based on published levels (Erbe, et al., 2017; Fisheries and Marine Service, 1975; MR, et al., 2010; L-F, et al., 2023) | Non-impulsive |
| Vibro-coring & CPT | 187 dB SPL | 50 – 16,000 Hz | Based on levels from previous work & (Reiser, et al., 2010) | Non-impulsive |

*If the SSS and SBP are hull-mounted, there is no need for a positioning device (USBL) and this noise source should be removed from consideration.

### 2.2.7 Programme and Timescale

EirGrid propose a site investigation activities schedule that will be phased over a two-year period. The intention is to begin survey activities as soon as feasible following license award, with a phased programme of investigations, capitalising on suitable weather windows over this time period. This phased approach will progress the overall development towards detailed design stage. It is worth noting that the exact survey schedule is dependent on the availability of the supply chain and therefore exact timelines for the surveys cannot be determined until closer to the time.

The exact dates for the surveys are to be determined pending the appointment of survey contractors but based on the estimated scope of works to be conducted the duration of each SI works phase scope has been estimated in Table 2.3 below. The estimated durations are subject to change based on variables such as weather conditions onsite, unforeseen seabed conditions, unforeseen obstructions etc. EirGrid will consult with relevant stakeholders where appropriate prior to the commencement of the surveys.

Mobilisation location will be dependent on the survey contractor, who may choose to mobilise from their home port, port of previous job or local port. The local port options for mobilisation, for example, could include Dublin, Dún Laoghaire, Howth or Malahide depending on vessel size and marine traffic restrictions. Any changes to the anticipated project schedule and port mobilisation locations are not predicted to affect the findings in this assessment.

It is proposed to complete a number of follow on geophysical surveys to determined seabed mobility, these will be completed over the course of the two year license period.

**Table 2.3 Estimated SI works Schedule**

| Phase | Scope of Work | Total No of SI Locations | Estimated Duration |
|---|---|---|---|
| Phase One | Marine Geophysical Surveys | n/a | 4-6 weeks (weather dependent) |
| | Benthic Sampling | 11 | 4-6 days (weather dependant) |
| | Intertidal Sampling | 27 | 2-3 days (tide/weather dependant) |

| Phase | Scope of Work | Total No of SI Locations | Estimated Duration |
|---|---|---|---|
| Phase Two | Vibrocore & CPT Sampling | 30 | 4-6 weeks |
| | Borehole Sampling | 6 | 4-6 weeks |
| Phase Three | Follow up Marine Geophysical Surveys | n/a | 4-6 weeks (weather dependent) |
| All Phases | Other Environmental/ Ecological Surveys | Varies | As appropriate to environmental/ ecological survey requirements. |

## 2.3 General Survey Requirements

All appointed survey contractors shall obtain and comply with all necessary marine operational permits including routine and customary vessel/crew/equipment clearances from Customs Agencies, Port Authorities, Marine Survey Office, etc.

### 2.3.1 Quality Assurance

Each of the appointed survey contractors shall comply with the following as a minimum:

- Quality and Environmental Management Systems based on ISO9001:2015.
- Provision of Quality Management Plans for all the marine operations.
- Provision of site and activity specific Method Statements for all the marine operations within their scope.

### 2.3.2 Health & Safety

Health, safety, environment, and welfare considerations will be a priority in the evaluation of possible contractors for the various survey scopes and will be actively managed during the course of the survey scopes of work.

Appointed contractors will be required to comply with all legislation relevant to the activities within their scope of work.

Prior to survey works taking place, both Project Supervisor for Design Process (PSDP) and Project Supervisor for Construction Stage (PSCS) will be appointed under the relevant legislation and project / survey specific HSE plans will be put in place which will form part of the survey project execution plans.

Temporary barriers, warning notices, lighting, and other measures necessary to provide for the safety of the workers on the site and/or the public will be erected and maintained for the duration of the SI works.

### 2.3.3 Working Hours

The working hours for the SI works are proposed to be 24 hours a day, seven days a week. In the nearshore intertidal zone tidal ranges may incur restrictions due to vessel movements.

Weather conditions and/or sea-state will impact on the working hours, and it may be necessary to temporarily suspend operations when adverse weather conditions and/or sea-states are encountered or forecast. Similarly, equipment maintenance and repair may impact on operational activities resulting in downtime.

Following downtime or suspension of operations, recommencement of sound producing activities shall only occur after the successful implementation of the measures contained in the Guidance to Manage the Risk to Marine Mammals from Man-made Sound Sources in Irish Waters (DAHG, 2014).

### 2.3.4 Vessels

All vessels will be fit for purpose, certified and capable of safely undertaking all required survey work. Marine vessels will be governed by the provisions of the Sea Pollution Act 1991, as amended, including the requirements of MARPOL. In addition, all vessels will adhere to published guidelines and best working practices such as: the National Maritime Oil/HNS Spill Contingency Plan (NMOSCP), Marine Pollution Contingency Plan (MPCP), Chemicals Act 2008 (No. 13 of 2008), Chemicals (Amendment) Act 2010 (No. 32 of 2010) and associated regulations.

Vessels shall have a Health, Safety and Environmental Managements system which should conform to the requirements of the latest International Maritime Organization (IMO), Safety of Life at Sea (SOLAS) and environmental requirements for their classification and with any national requirement of the territorial or continental / EEZ waters to be operated in.

The SI works will be undertaken from vessels in accordance with the relevant guidelines required to manage the risk to marine mammals from man-made sound sources in Irish waters.

# 3 NEED AND ALTERNATIVES

Dublin's electricity infrastructure is ageing and reaching its end of life. Work must be done to transform and modernise the city's electricity infrastructure, so Dublin can continue to develop and thrive, while increasingly using power from renewable sources. The Powering Up Dublin Programme is a critical programme that will strengthen key electricity infrastructure in Dublin and the surrounding areas, making the city 'renewable ready.'

The CP1146 Carrickmines to Poolbeg project is one part of a programme of projects set to replace and upgrade five 220kV circuits across Dublin city and the surrounding areas. The CP1146 Carrickmines to Poolbeg project is necessary as it will contribute to accelerating the deployment of renewable energy to replace fossil fuels and delivering a flexible system to support renewables and demand. Further information on the need for the project based on EU and national policy is provided in **Section 4**.

There is currently insufficient baseline geophysical, geotechnical and environmental information available to fully inform the preliminary and detailed design of the marine elements of the CP1146 Carrickmines to Poolbeg project. In order to progress the design elements of the project and carry out the necessary environmental assessments, further baseline data must be obtained. Therefore, SI information and environmental surveys must be undertaken.

With regards to alternatives considered, there are no alternatives to undertaking site investigations.

# 4 PLANNING AND DEVELOPMENT

## 4.1 EU and National Context

### 4.1.1 Habitats and Birds Directives

Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora (as amended) (the Habitats Directive) provides protection for habitats and species of European importance and Council Directive 2009/147/EC of the European Parliament and of the Council of 30 November 2009 on the conservation of wild birds (Codified version) (the Birds Directive) aims to protect all of the 500 wild bird species naturally occurring in the EU.

Special Areas of Conservation (SAC) are areas designated for protection under the Habitats Directive and Special Protection Areas (SPA) are areas designated for protection under the Birds Directive. Collectively, SACs and SPAs are known as Natura 2000 sites. Each EU member is required to designate Natura 2000 sites in their jurisdictions. The establishment of the network of Natura 2000 sites under Articles 3 to 9 of Habitats Directive the key measure to protect nature and biodiversity in the EU.

Articles 6(3) and 6(4) of the Habitats Directive set out the decision-making tests for plans and projects likely to have a significant effect on or to adversely affect the integrity of Natura 2000 sites and Article 7 of the Habitats Directive extends the scope of articles 6(3) and 6(4) to the Birds Directive.

The Habitats and Birds Directives have been transposed into Irish Legislation under the European Communities (Birds and Natural Habitats) Regulations 2011 (S.I. No. 477 of 2011), as amended.

The potential impact(s) from the proposed SI works in relation to the Habitats Directive and the Birds Directive are identified and assessed in the following enclosed report; Supporting Information for Screening for Appropriate Assessment (document ref: CP1146-RPS-00-XX-RP-N-RP1019) and Natura Impact Statement (document ref: CP1146-RPS-00-XX-RP-N-RP1020).

### 4.1.2 Environmental Impact Assessment (EIA) Directive

See Section 22.1.

### 4.1.3 Water Framework Directive (WFD)

See Section 22.2.

### 4.1.4 Marine Strategy Framework Directive (MSFD)

See Section 22.3.

### 4.1.5 Climate Action and Low Carbon Development (Amendment) Act 2021

The *Climate Action and Low Carbon Development (Amendment) Act 2021* (Climate Act 2021), amending the Climate Action and Low Carbon Development Act 2015, was signed into law in July 2021. The enactment of the Climate Act 2021 has now put Ireland on a legally binding path to net zero emissions no later than 2050.

The Climate Act 2021 commits to a National Long Term Climate Action Strategy which will be prepared every five years and embeds the process of carbon budgeting into law. The Government is now required to adopt a series of economy-wide-five-year carbon budgets, including sectoral targets for each relevant sector, on a rolling 15-year basis, starting in 2021. The first of these is titled *Carbon Budgets 2022* and comprises a 5-year carbon budget for the period 2021-2025. This legislation also strengthens the role of the Climate Change Advisory Council tasking it with proposing carbon budgets to the Minister for Environment, Climate, Communications and Transport (the Minister).

In this regard, it is noted that the proposed SI works will support the CP1146 Carrickmines to Poolbeg project. The project will contribute to accelerating the deployment of renewable energy to replace fossil fuels and delivering a flexible system to support renewables and demand.

### 4.1.6 National Energy and Climate Plan 2021-2030

In accordance with the Regulation (EU) 2018/1999 of the European Parliament and of the Council of 11th December 2018 on the Governance of the Energy Union and Climate Action (Governance of the Energy Union and Climate Action Regulation), Ireland's *National Energy and Climate Plan*[1] (NECP) 2021-2030 was prepared. This NECP was prepared to incorporate all planned policies and measures that were identified up to the end of 2019, and which collectively deliver a 30% reduction by 2030 in non-ETS greenhouse gas emissions (from 2005 levels).

In 2020, the European Commission launched the European Green Deal (EGD), a set of policy initiatives with the overarching aim of making Europe climate neutral in 2050. The EGD sets out an increased level of ambition for targets for greenhouse gas emissions than those included in the NECP, i.e., to cut down greenhouse gas emissions by at least 55% by 2030. Delivering these targets will require a transformation of the Irish economy across a range of sectors including transport, construction, agriculture, industry and energy, all of which will have to become more environmentally sustainable.

Ireland's draft updated National Energy and Climate Plan (NECP) 2021-2030 was submitted to the European Commission in July 2024. It outlines Ireland's energy and climate policies for the period from 2021 to 2030 and looks onwards to 2050. This draft incorporates the European Commission's feedback on the 2023 draft as well as feedback from two consultations undertaken in February and June 2024.

In this regard, it is noted that the proposed SI works will support the CP1146 Carrickmines to Poolbeg project. The project will contribute to accelerating the deployment of renewable energy to replace fossil fuels and delivering a flexible system to support renewables and demand. As such, the proposed SI works are considered to be aligned with, and fully supported by, the NECP.

### 4.1.7 Ireland's Transition to a Low Carbon Future 2015-2030

*Ireland's Transition to a Low Carbon Future 2015-2030*[2] is a White Paper sets out a vision for transforming Ireland's fossil fuel-based energy sector into a clean, low carbon system by 2050. The Paper provides policy frameworks to guide the actions that the Government intends to take in regard to energy up to 2030. The Paper takes account of European and International climate change objectives and agreements, as well as Irish social, economic and employment priorities. One of the Paper's objectives, as noted in Chapter 1, is to *guide a transition to a low carbon energy system, which provides secure supplies of competitive and affordable energy to our citizens and businesses*. The Paper notes that a radical transformation of Ireland's energy system is required to meet climate policy objectives.

In this regard, it is noted that the proposed SI works will support the CP1146 Carrickmines to Poolbeg project. The project will contribute to accelerating the deployment of renewable energy to replace fossil fuels and delivering a flexible system to support renewables and demand. Therefore, the proposed SI works are considered to be support Ireland's Transition to a Low Carbon Future 2015-2030.

### 4.1.8 National Marine Planning Framework

The *National Marine Planning Framework*[3], (NMPF) published in 2021 sets out the framework for the forward planning component of Ireland's marine planning system. The NMPF notes the need to transition to a low carbon and climate resilient society while conserving and enhancing natural and environmental resources. It is an objective of the NMPF to "*Support the development of ORE [Offshore Renewable Energy] in Ireland as a driver to significantly reduce greenhouse gas emissions and accelerate the move to cleaner energy in line with national and EU policy*".

The following objectives are included in Chapter 15: Energy – Transmission:

[1] https://www.gov.ie/en/publication/0015c-irelands-national-energy-climate-plan-2021-2030/

[2] https://www.gov.ie/en/publication/550df-the-white-paper-irelands-transition-to-a-low-carbon-energy-future-2015-2030/

[3] https://www.gov.ie/pdf/?file=https://assets.gov.ie/139100/f0984c45-5d63-4378-ab65-d7e8c3c34016.pdf#page=null

- *"Develop the offshore electricity transmission system, and connection between the offshore and onshore electricity grids, which is necessary for wider development of Ireland's offshore renewable energy sector.*
- *Strengthen the existing policy framework to incentivise further future electricity interconnection.*
- *Ensure good regulatory practices in the provision of energy transmission infrastructure, in accordance with best international practice."*

The following objectives are included in Chapter 15: Energy – Offshore Renewable:

- "*Support the development of ORE in Ireland as a driver to significantly reduce greenhouse gas emissions and accelerate the move to cleaner energy in line with national and EU policy.*
- *Increase the sustainable ORE use of our extensive marine resource in an efficient and co-ordinated manner identifying, where possible, potential for synergies and opportunities for multi-use of our shared maritime area.*
- *Support Ireland's decarbonisation journey through increased use of ORE while delivering significant and sustained benefits, import substitution, fiscal return, national and local economic development and technology learning.*
- *Support the strategic growth of the ORE industry recognising the potential to derive benefits particularly for Ireland's coastal communities.*
- *Provide enhanced security of energy supply for Ireland in the short and medium term, in accordance with the Climate Action Plan.*
- *Develop a robust, effective transparent consenting process to ensure appropriate environmental protections are built-in, while enabling sustainable ORE developments to progress.*
- *Ensure good regulatory practices in ORE installation and generation, including decommissioning of existing facilities, at end of life, according to international best practice*."

The following polices are relevant:

**Energy – Offshore Renewables Policy 1***: "Proposals that assist the State in meeting the Government's offshore renewable energy targets, including the target of achieving 5GW of capacity in offshore wind by 2030 and proposals that maximise the long-term shift from use of fossil fuels to renewable electricity energy, in line with decarbonisation targets, should be supported. All proposals will be rigorously assessed to ensure compliance with environmental standards and seek to minimise impacts on the marine environment, marine ecology, and other maritime users."*

**Energy – Offshore Renewables Policy 6***: "Proposals for infrastructure enabling local use of excess energy generated from emerging marine technologies (wave, tidal, floating wind) should be supported."*

**Energy – Offshore Renewables Policy 10:** *"Opportunities for land-based, coastal infrastructure that is critical to and supports development of ORE should be prioritised in plans and policies, where possible."*

**Transmission – Policy 1:** *"Subject to the appropriate environmental assessments, electricity transmission proposals that maintain or improve the security and diversity of Ireland's energy supply should be supported, including interconnectors, relevant EU Projects of Common Interest (PCIs), and projects in receipt of relevant alternative EU priority energy infrastructure classification provided for by the EU TEN-E regulations. This should include development of the offshore transmission system and connection with the onshore transmission system necessary to meet the Government's target of 5 GW of offshore renewables by 2030, as well as development of associated transmission system / interconnector infrastructure for hybrid offshore projects, connecting offshore renewable energy installations with Ireland and one or more other electricity transmission systems."*

**Telecommunications Policy 1:** *"Proposals that guarantee existing and future international telecommunications connectivity which is critically important to support the future needs of society, Government, the provision of Public Services and enterprise in Ireland, should be supported."*

#### 4.1.8.1 Consistency with the National Marine Planning Framework

The proposed SI works are essential to providing scientific, environmental, and engineering information to support the CP1146 Carrickmines to Poolbeg project. The overall CP1146 project will contribute to accelerating the deployment of renewable energy to replace fossil fuels and delivering a flexible system to support renewables and demand. Therefore, the proposed SI works are consistent with the NMPF.

### 4.1.9 Project Ireland 2040: National Planning Framework, 2018 and National Development Plan 2021-2030

The *National Development Plan 2021-2030*[4] (NDP) and the *National Planning Framework*[5] (NPF) combine to form Project Ireland 2040. The NPF sets the vision and strategy for the development of Ireland until 2040 and the NDP provides the enabling investment to implement that strategy.

The NPF sets out the overall national planning policy objectives and targets for the country over the next 20 years. It provides a framework to guide public and private investment "*to create and promote opportunities for our people, and to protect and enhance our environment*".

Ten National Strategic Outcomes (NSOs) articulate the primary objectives of the NPF, while National Policy Objectives (NPOs) outline more precise ambitions and targets. One of the key goals of the NPF (NSO8) is to transition to a low caron and climate resilient society.

> **NPO 55** – "*Promote renewable energy use and generation at appropriate locations within the built and natural environment to meet national objectives towards achieving a low carbon economy by 2050."*

The proposed SI works will support the CP1146 Carrickmines to Poolbeg project, which is part of the overall installation of the Dublin Bay Cables. The Dublin Bay Cables project will enable the city's grid to use the electricity generated from offshore wind energy in Dublin city, and as such is considered to be fully supported by the policies of the NPF.

### 4.1.10 Climate Action Plan

The *Climate Action Plan 2024*[6] (CAP24) is the third annual update to Ireland's *Climate Action Plan 2019*. It implements the carbon budgets and sectoral emissions ceilings and sets out a roadmap for taking decisive action to halve our emissions by 2030 and reach net zero no later than 2050, as committed to in the Programme for Government. CAP24 sets out how Ireland can accelerate the actions that are required to respond to the climate crisis, putting climate solutions at the centre of Ireland's social and economic development. One of the electricity measures and actions is to increase renewable generation to supply 80% of demand by 2030 with a Key Performance Indicator (KPI) to achieve a maximum level of renewables at any one time on the grid of 95-100%.

Section 12.4.1 of CAP24 notes that achieving further emissions reductions between now and 2030 requires a major step up across three key measures:

- Accelerate and increase the deployment of renewable energy to replace fossil fuels;
- Deliver a flexible system to support renewables and demand;
- Manage demand.

The proposed SI works will support the CP1146 Carrickmines to Poolbeg project, which is part of the overall installation of the Dublin Bay Cables. The Dublin Bay Cables project will contribute to accelerating and increasing the deployment of renewable energy to replace fossil fuels and delivering a flexible system to support renewables and demand. The proposed SI works, which form an essential step in delivering the Dublin Bay Cables project, are therefore considered to align with CAP24.

[4] https://www.gov.ie/en/publication/774e2-national-development-plan-2021-2030/

[5] https://www.gov.ie/en/publication/daa56-national-planning-framework-ireland-2040-our-plan-npf-2018/

[6] https://www.gov.ie/en/publication/79659-climate-action-plan-2024/

### 4.1.11 Government Policy Statement on Security of Electricity Supply

The *Government Policy Statement on Security of Electricity Supply*[7] was published in 2021 and sets out a number of updates to national policy in the context of the Programme for Government commitments relevant to the electricity sector, planning authorities and developers.

The Statement notes that the Government recognises that:

- "*Ensuring security of electricity supply continues to be a national priority as the electricity system decarbonises towards net zero emissions;*
- *There is a need for very significant investment in additional flexible conventional electricity generation, electricity grid infrastructure, interconnection and storage in order to ensure security of electricity supply;*
- *In advance of the development of new conventional electricity generation capacity, there is a need to retain existing conventional electricity generation capacity in order to ensure security of electricity supply*".

The proposed SI works are essential to providing scientific, environmental, and engineering information to support the CP1146 Carrickmines to Poolbeg project, which is part of the overall installation of the Dublin Bay Cables. The Dublin Bay Cables project will contribute to accelerating and increasing the deployment of renewable energy to replace fossil fuels, contributing to the security of supply, and delivering a flexible system to support renewables and demand. The proposed SI works are therefore considered to be fully align with the Statement.

### 4.1.12 Government Policy Statement on the Strategic Importance of Transmission and Other Energy Infrastructure

The *Government Policy Statement on the Strategic Importance of Transmission and Other Energy Infrastructure*[8] was published in 2012 by the Department of Communications, Energy and Natural Resources sets out the strategic and economic importance of investment in networks and energy infrastructure, whilst acknowledging the importance of early consultation and engagement with local communities and gaining public and local community acceptance. The Statement notes that Ireland must "*deliver a world class electricity transmission system in all the regions which meets the needs of Ireland in the 21st Century*".

The proposed SI works will support the CP1146 Carrickmines to Poolbeg project, and therefore, are in alignment with this Statement.

## 4.2 EirGrid's Strategic Planning and Development Context

### 4.2.1 Transmission Development Plan 2023

The *Transmission Development Plan 2023 - 2032*[9] *(*the Transmission Development Plan) supersedes the Transmission Development Plan 2021 - 2030 and sets out EirGrid's updated list of projects which are committed to and those that are in the development stages for the progression of the Irish transmission network and interconnection over the next ten years.

The proposed SI works will support the installation of the CP1146 Carrickmines to Poolbeg project which is included in the listed projects in the Transmission Development Plan.

[7] https://www.gov.ie/en/publication/a4757-policy-statement-on-security-of-electricity-supply/

[8] https://cms-prd.eirgrid.dept.ie/government-policy-statement-strategic-importance-transmission-and-other-energy-infrastructure

[9] https://cms.eirgrid.ie/sites/default/files/publications/EirGrid%20Transmission%20Development%20Plan%20%28TDP%29%20December%202023.pdf

### 4.2.2 Draft Grid Implementation Plan 2023 – 2028

The *Draft Grid Implementation Plan 2023 – 2028*[10] states objectives and policies to implement the long term vision statements contained in the *Shaping Our Electricity Future* strategy (see **Section 4.2.6**).

The proposed SI works will support the installation of the CP1146 Carrickmines to Poolbeg project which is included in the list of projects set out in the Draft Grid Implementation Plan.

### 4.2.3 Strategy 2020-25: Transform the Power System for Future Generations

EirGrid published the *Strategy 2020-25: Transform the Power System for Future Generations*[11] in 2019 for the period 2020-25. The overall strategy is set out on page 25, and the purpose of this strategy is to "*Transform the power system for future generations*". The strategy consists of a set of key goals, underpinned by its purpose. The primary goal is to "*Lead the island's electricity sector on sustainability and decarbonisation*". The supporting goals are:

- "*Operate, develop and enhance the all- island grid and market*",
- "*Work with partners for positive change*" and
- "*Engage for better outcomes for all*".

The proposed SI works will support the installation of the CP1146 Carrickmines to Poolbeg project, which is aligned with this strategy in supporting sustainable energy production and transmission.

### 4.2.4 Shaping our Electricity Future

EirGrid published the *Shaping our Electricity Future Roadmap Version 1.1*[12] in 2023 as the result of the review on the original roadmap published in 2021. It outlines a pathway towards meeting enhanced 2030 government electricity ambitions in Ireland and Northern Ireland and provides a foundation to support the broader transition to net zero by 2050.

The proposed SI works will support the CP1146 Carrickmines to Poolbeg project, as listed in the roadmap's projects (Appendix 5). The proposed SI works support the development and optimisation the existing grid and will contribute towards meeting enhanced 2030 government electricity ambitions in Ireland and therefore, support the broader transition to net zero by 2050.

## 4.3 Regional Policy Context

### 4.3.1 Regional Spatial and Economic Strategy

The Eastern and Midland Regional Assembly's *Regional Spatial and Economic Strategy*[13], 2019-2031 (the RSES) outlines the spatial and economic policies and targets for the region. The RSES is a strategic plan and investment framework to shape the future development of the region to 2031 and beyond.

The RSES, prepared in accordance with the NPF, sets the context for each local authority within the Eastern and Midland Region to develop county and city development plans in a manner that will ensure that national, regional and local plans align. Regional Policy Outcomes (RPOs) provide a framework for city and county development plans and align with international, EU and national policy.

Section 7.9 of the RSES relates to Climate Change and notes that we must ensure that future development in the Region will be transitioned to a low carbon usage. The following RPO is of particular relevance to the proposed SI Works:

[10] https://consult.eirgrid.ie/en/consultation/draft-grid-implementation-plan-2023-2028

[11] https://www.eirgrid.ie/about-us/our-strategy-2020-2025

[12] https://cms.eirgrid.ie/sites/default/files/publications/Shaping-Our-Electricity-Future-Roadmap_Version-1.1_07.23.pdf

[13] https://emra.ie/final-rses/

**RPO 10.22 – Energy Infrastructure:** "Support the reinforcement and strengthening of the electricity transmission and distribution network to facilitate planned growth and transmission/ distribution of a renewable energy focused generation across the major demand centres to support an island population of 8 million people, including:

**[…]**

• Facilitate the delivery of the necessary integration of transmission network requirements to allow linkages of renewable energy proposals to the electricity transmission grid in a sustainable and timely manner."

**RPO 10.23 – Energy Infrastructure:** "Support EirGrid's Implementation Plan 2017 – 2022 and Transmission Development Plan (TDP) 2016 and any subsequent plans prepared during the lifetime of the RSES that facilitate the timely delivery of major investment projects subject to appropriate environmental assessment and the outcome of the planning process, in particular, including:

**[…]**

• Support the installation of additional transformer capacity and increased circuit capacity to meet Dublin demand growth to strengthen the network for all electricity users and improve the security and quality of supply."

In this regard, the proposed SI works are essential to providing scientific, environmental, and engineering information to support the installation of the CP1146 Carrickmines to Poolbeg project, which is part of the Dublin Bay Cables project. The Dublin Bay Cables project will enable the city's grid to use the electricity generated from offshore wind energy in Dublin city and will contribute to Ireland's transition to a low carbon electricity future. The proposed SI works are therefore considered to be fully supported by the regional policies set out in the RSES.

## 4.4 Local Level

### 4.4.1 Dublin City Development Plan

The *Dublin City Development Plan 2022-2028*[14] (the City Plan) serves as the key planning policy document for the City and includes policy objectives and development standards for all development types. The aim of the City Plan is to improve the quality of life for its citizens and ensure that Dublin City is an attractive place to live, work and visit. The City Plan states that "*facilitating the provision of critical energy utilities and the transition to alternative, renewable, decarbonised and decentralised energy sources*" is a strategic issue and sets out the following related policies and objectives:

**CA13 – Offshore Wind-Energy Production:** "*To support, encourage and facilitate the implementation of the 2014 'Offshore Renewable Energy Development Plan' (OREDP) and any forthcoming review and to facilitate infrastructure such as grid facilities on the land side of any renewable energy proposals of the offshore wind resource, where appropriate and having regard to the principles set out in the National Marine Planning Framework."*

**CA11 - Energy from Renewable Sources:** "*To support, encourage and facilitate the production of energy from renewable sources, such as from solar energy, hydro energy, wave/tidal energy, geothermal, wind energy, combined heat and power (CHP), heat energy distribution such as district heating/cooling systems, and any other renewable energy sources, subject to normal planning and environmental considerations."*

**SI49 - Support for Energy Utilities**: "*To support the development of enhanced electricity gas supplies, and associated transmission and distribution networks, to serve the existing and future needs of the City, and to facilitate new transmission infrastructure projects and technologies including those to facilitate linkages of renewable energy proposals to the electricity and gas transmission grid that might be brought forward in the lifetime of this Plan. In this respect, the City Council will have regard to the 'Guiding Principles' for facilitating the provision of energy networks set out by the Eastern and Midland Regional Assembly Regional Spatial and Economic Strategy (2019-2031)."*

[14] https://www.dublincity.ie/residential/planning/strategic-planning/dublin-city-development-plan/development-plan-2022-2028

**SI50 - Undergrounding of Energy Utility Infrastructure:** *"To require that the location of local energy services such as electricity, telephone and television cables be underground wherever possible, and to promote the undergrounding of existing overhead cable and associated equipment, where appropriate, in the interests of visual amenity and facilitating compact urban development."*

**SI51 - Renewable Energy Use and Generation:** "*To promote renewable energy generation, use and storage at appropriate locations within the built and natural environment to meet national objectives towards achieving a low carbon economy by 2050."*

**SI52 - Poolbeg Peninsula Strategic Sustainable Infrastructure Hub:** *"To support the development of the Poolbeg Peninsula as a Sustainable Energy and Infrastructure Hub for Dublin with a strategic role in accommodating the City's critical hard infrastructure and to recognise the significant role that it plays in facilitating Dublin's transition to a low carbon and climate-resilient city."*

**SIO30 - Facilitating Offshore Renewable Energy:** "*To support the sustainable development of Ireland's offshore renewable energy resources in accordance with the National Marine Planning Framework (2021) and Offshore Renewable Energy Development Plan (2019) and its successor, including any associated domestic and international grid connection enhancements."*

Having regard for the above, it is noted that the proposed SI works are essential to providing scientific, environmental, and engineering information to support the CP1146 Carrickmines to Poolbeg project, which is part of the Dublin Bay Cables project. The Dublin Bay Cables project will enable the city's grid to use the electricity generated from offshore wind energy in Dublin city and will contribute to Ireland's transition to a low carbon electricity future. In this regard, it is considered that the proposed SI works are fully supported by the policies and objectives set out in the City Plan.

### 4.4.2 Climate Neutral Dublin 2030

Dublin City Council's Climate Action Plan 2024 – 2029, titled *Climate Neutral Dublin 2030*[15], sets out the actions that Dublin City Council is taking to prepare the city and people for the known impacts of climate change, including flooding, sea level rise, extreme weather events and drought. The Action Plan sets out how Dublin City Council will mitigate greenhouse gas emissions and contribute the global effort to limit warming to below 1.5°C, setting out a series of actions to be taken including:

**R3 - Climate Resilient Critical Infrastructure:** "*…Ensuring that our drainage system, utilities, roads, public lighting and communications networks are maintained and upgraded is essential. This requires working in partnership with Uisce Éireann, the OPW, ESB, Eirgrid, NTA, and DECC. Together we will ensure that these critical systems are prepared for the future."*

The proposed SI works will secure the necessary scientific, environmental, and engineering information to support the installation of the CP1146 Carrickmines to Poolbeg project, which will provide the essential upgrades to the electricity grid to prepare for future growth and demand. In this regard, the proposed SI works are considered to support Climate Neutral Dublin 2030.

### 4.4.3 Dún Laoghaire-Rathdown County Development Plan

The *Dún Laoghaire-Rathdown County Development Plan 2022-2028*[16] (CDP) sets out the policy objectives and the overall strategy for the proper planning and sustainable development of the County. The CDP sets out an approach centred on the core principle of sustainability with a focus on creating vibrant, liveable, climate resilient communities.

The CDP supports the use of renewable energy sources to facilitate the transition to a low carbon society, stating that, "*DLR supports the increase in use of renewable energy and low carbon resources, namely solar photovoltaic, geothermal, heat pumps, district heating, solar thermal, hydro, tidal power, offshore wind, small-scale onshore wind and biomass"*. The following policy objectives (POs) are of particular relevance to the proposed SI works:

[15] https://www.dublincity.ie/sites/default/files/2024-03/dcccap-2024-2029-climate-neutral-dublin-2030.pdf

[16] https://www.dlrcoco.ie/CDP2022-2028

**PO CA10 – Renewable Energy: "***It is a Policy Objective to support County, Regional, National and International initiatives and pilot schemes to encourage the development and use of renewable energy sources, including the SEAI Sustainable Energy Community initiatives, as a means of transitioning to a low carbon climate resilient County in line with national renewable energy targets."*

**PO CA11 – Onshore and Offshore Wind Energy and Wave Energy:** "*It is a Policy Objective to support in conjunction with other relevant agencies, wind energy initiatives, both on-shore and offshore, wave energy, onshore grid connections and reinforcements to facilitate offshore renewable energy development when these are undertaken in an environmentally acceptable manner. (Consistent with NSO 8 and NPO 42 of the NPF and RPO 7.36 and 10.24 of the RSES)*."

**PO EI18 – Energy Facilities**: *"It is a Policy Objective to encourage the provision of energy facilities in association with the appropriate service providers and in accordance with 'Government Policy Statement on the Strategic Importance of Transmission and Other Energy Infrastructure' (2012). In addition, the Council will facilitate, subject to the proper planning and sustainable development of the area, the expansion of the services and infrastructure of existing service providers, notably Bord Gáis, Eirgrid, the Electricity Supply Board (ESB), other strategic electricity infrastructure developers and statutory undertakers, in order to ensure satisfactory levels of supply and to minimise constraints for development."*

**PO EI19 – Overhead Cables:** *"It is a Policy Objective to seek the undergrounding of all electricity, telephone and television cables wherever possible, in the interests of visual amenity and public health."*

In this regard, it is noted that the proposed SI works are essential to providing scientific, environmental, and engineering information to support the design and environmental assessmnet of the CP1146 Carrickmines to Poolbeg project. The project will enable the city's grid to use the electricity generated from offshore wind energy in Dublin city and will contribute to Ireland's transition to a low carbon electricity future. As such, it is considered that the proposed SI works are fully supported by the policies of the CDP.

### 4.4.4 Dún Laoghaire-Rathdown County Council Climate Action Plan

Dún Laoghaire-Rathdown County Council's *Climate Action Plan 2024-2029*[17] sets out to achieve, by no later than the end of 2050, the transition to a climate resilient, biodiversity rich, environmentally sustainable and climate neutral County. One of the aims of the Plan is to: "*facilitate and advocate for improved energy efficiency and carbon reduction in our County*".

In this regard, it is noted that the proposed SI works will support the installation of the CP1146 Carrickmines to Poolbeg project. The project will contribute to accelerating the deployment of renewable energy to replace fossil fuels and delivering a flexible system to support renewables and demand. The proposed SI works are therefore considered to be in compliance with the Climate Action Plan.

[17] https://www.dlrcoco.ie/climate-action-plan-2024

# 5 LAND AND SOILS

## 5.1 Assessment of Impact

The assessment of the potential impacts arising from the SI works on Land and Soils within the AoI is presented in Table 5.1. This assessment is based on desk-top information available at the time of this assessment.

**Table 5.1 Assessment of Potential Impacts on Land and Soils**

| Aspect of the Impact | Assessment of the Impact |
|---|---|
| Nature of the Impact | The Land and Soils of the area are described below. The ecological aspects of the marine sediments and habitats are discussed in further detail under the Biodiversity chapter (Section 7).<br><br>According to Geological Survey Ireland (GSI) the bedrock geology of the adjacent landside areas of the AoI are underlain by lower carboniferous dark limestone and shale from the Lucan Formation from Booterstown to Sandmount including Dublin Port. At Willianstown the bedrock geology is dark muddy limestone and shale from the Ballysteen Formation. From Blackrock to Dun Laoghaire the bed rock geology is underlain by granite with microline phenocrysts (Type 2p).<br><br>The drift geology is anticipated to be glacial till at surface, obscuring any outcrop of the channel or its infilling sediments, however industrial sediments (Made Ground) cover the majority of the terrestrial land up to the high water mark. In the transition between the terrestrial and marine environments the Quaternary Sediments are expected to include marine beach sands, estuarine silts and clays, and till derived from limestones.<br><br>In the bay, the intertidal mud and sandflats extend for almost 3 km at their widest with the AoI to extend approximately 2 km farther seaward. The sediments are predominantly sands in which several permanent channels exist, they grade to sandy muds near the shore at Merrion Gates where a small sandy beach occurs at Merrion Gates while some bedrock shore occurs near Dun Laoghaire (NPWS, 2015).<br><br>In the subtidal zone, the benthic broad habitat type is EUNIS 2019[18] code MB52: Atlantic infralittoral sand. Further out this transitions to EUNIS 2019 code MB62: Atlantic infralittoral mud (EMODnet, 2024).<br><br>The GSI has mapped the groundwater vulnerability as being ‘high’ with some pockets of ‘extreme’ groundwater vulnerability around the southern section (Monkstown to Booterstown) area, this gradually transitions to ‘medium’ to ‘low’ indicating that the natural groundwater is likely to be easily contaminated by human activities. There are also areas which are mapped as being rock or at near Surface or Karst. An assessment carried out under the Water Framework Directive (WFD) 2016-2021 groundwater body has concluded that the groundwater within the bedrock aquifer is presently of ‘Good Status’.<br><br>The proposed geophysical survey will not impact on Land and Soils as there is no pathway from the source (geophysical survey equipment) to the receptor (intertidal and sub-tidal sediments, including bedrock). |

[18] Updated EUINS codes taken from EUSeaMap 2023 Broad-Scale Predictive Habitat Map on EMODnet https://emodnet.ec.europa.eu Accessed 17/10/2024

| Aspect of the Impact | Assessment of the Impact |
|---|---|
| | The geotechnical investigations and the environmental sampling will interact with Land and Soils (intertidal and sub-tidal sediments, including bedrock).<br><br>The environmental walkover surveys (birds, mammals, etc.), shipping and navigation, and drone UAV surveys may require surface stations within the maritime area. Given the localised and small scale nature of these works, any impact on Land and Soils will be imperceptible.<br><br>Archaeological surveys will detect any cultural heritage features buried within the seabed. Small areas of investigation may be required, e.g. digging, sampling. However, these will be minor and subject to licencing from the Underwater Archaeology Unit in the National Monuments Service (NMS) and any impacts on land and soils as a result will be negligible.<br><br>The metocean surveys will involve the deployment of an ADCP to the seafloor. This will be temporary and removed once the surveys are complete. Therefore, any potential impact is negligible, confined to the footprint of the device, and the seabed will rapidly recover after removal of the device due to tidal action. |
| Magnitude and spatial extent of the impact | A maximum of 6 boreholes (up to 102 mm diameter each) will be conducted. This equates to a total sampled area of approximately 0.05 $m^2$, which is approximately 0.0000002% of the AoI (2,101 ha).<br><br>A maximum of eleven locations for grab samples will be taken in the AoI with three replicates at each station. The total area sampled equates to approximately 3.3 $m^2$ and is approximately 0.000016% of the AoI (2,101 ha).<br><br>Up to 30 vibrocores (150 mm diameter) will be taken in the AoI. The total sampled area for vibrocores is approximately 0.5 $m^2$ which is 0.0000025% of the AoI (2,101 ha).<br><br>Up to 30 CPTs will be taken in the AoI (32 mm diameter). The total sampled area for CPTs approximately 0.02 $m^2$ which is 0.0000001% of the AoI (2,101 ha).<br><br>Up to 27 intertidal samples will be taken for environmental purposes using a hand-corer. Each sample will be approximately 0.01 $m^2$. The total sampled area for intertidal cores is approximately 0.27 $m^2$ which is 0.000001% of the AoI (2,101 ha).<br><br>The Jack-up barge (JUB) will also disturb land and soils. Assuming a maximum 3 $m^2$ disturbance for each leg (x 4 nr.), the JUB will impact a total area of 12 $m^2$ at each location. It is anticipated that the vibrocores and CPTs will be drilled from a vessel. However, as this cannot be confirmed at this time, a worst-case scenario is assessed whereby the JUB is used to undertake the boreholes, vibrocores and CPTs in the intertidal and sub-tidal areas. This is a total of 36 locations (30 locations for both the vibrocores and CPT plus 6 borehole locations). The total disturbed area for the JUB legs is therefore 432 $m^2$ which is 0.002% of the AoI (2,101 ha).<br><br>Summing the above areas equates to a total area of impact of 439 $m^2$ or 0.044 ha which is 0.002% of the AoI (2,101 ha). |
| Transboundary nature of the impact | None. |
| Intensity and complexity of the Impact | The intensity and complexity of impacts on Land and Soils arising from the SI works are typical to that of similar types of marine surveys that utilise standard SI techniques, with no novel or complex methodologies. The SI phase is anticipated to take place over 4-6 weeks for each survey campaign including geophysical surveys, geotechnical investigations, and environmental sampling. |

| Aspect of the Impact | Assessment of the Impact |
|---|---|
| Probability of the Impact | The geotechnical investigations will result in the removal of sediments and bedrock for sampling and laboratory analysis purposes as well as from the spudding of JUB legs. |
| Expected onset and duration, frequency and reversibility of the Impact | The SI phase is anticipated to take place over 4-6 weeks for each geophysical and geotechnical survey campaign and 2-3 days for the environmental sampling, so impacts related to Land and Soils will be brief to temporary in nature.<br>Each disturbed location will be backfilled within a relatively short timeframe (days to weeks) as a result of collapsing side walls of boreholes and through the deposition of sediments arising from natural tidal and current processes. Over time, the impacts will be fully reversible. Given the dynamic marine environment any impacts are expected to rapidly recover with no permanent impacts predicted. |
| Possibility of effectively reducing the impact | As any impacts on Land and Soils are negligible, then no mitigation measures are required. |

## 5.2 Mitigation

None proposed.

## 5.3 Conclusion

Taking into consideration the limited nature, scale, size, and duration of the SI works, the samples sizes to be taken for laboratory analysis, and the localised disturbance from vessels and equipment, any impact on Land and Soils as a result of the SI works will be negligible.

# 6 WATER

## 6.1 Assessment of Impact

The assessment of the potential impacts arising from the SI works on Water within the AoI is presented in Table 6.1.

**Table 6.1 Assessment of Potential Impacts on Water**

| Aspect of the Impact | Assessment of the Impact |
|---|---|
| Nature of the Impact | The SI works are within South Dublin Bay which is within the Irish Sea. The AoI at South Dublin Bay for the SI works are wholly within the Dublin Bay (EPA ref: IE_EA_090_0000) coastal waterbody which is deemed to be “not at risk” and the water quality is “unpolluted”. The River Liffey Estuary Lower (EPA ID: IE_EA_090_0300) is directly adjacent to the survey area (to the north), the water quality for which is classed as “at risk”.<br><br>The environmental walkover surveys (birds, mammals, etc.), shipping and navigation, archaeological surveys, metocean devices, and drone/ UAV surveys will not have an impact on Water.<br><br>Other than vessel movements (which are described below), the geophysical survey will not result in any impacts on Water.<br><br>The geotechnical investigation works may give rise to a potential pollution risk arising from disturbance of contaminated sediment creating underwater plumes. Plumes of fine sediment carrying suspended silt and/or contaminants, i.e. Suspended Sediment Concentrations (SSC), can potentially cause deterioration of water quality, with subsequent negative impacts on marine habitats and communities, and the species which depend upon them (e.g., fish, foraging birds, harbour porpoise, etc.). However, the SI works will not result in a significant amount of disturbance of sediments given the predominant substrate type in the bay and the relatively small footprint of the equipment and number of stations proposed. As described in the previous section, the total area of disturbance is estimated to be 0.04 ha which equates to 0.002% of the AoI (2,101 ha). In the event that any small amount of SSC does enter the water column, this is not anticipated to be in large enough quantities to significantly impact water quality or aquatic habitats/species. Best practice construction methods and mitigation measures (outlined below) will ensure that impacts on Waters are minimised during the SI works.<br><br>All vessels operating in the marine environment must adhere to the International Convention for the Prevention of Pollution from Ships (MARPOL) which is the main international convention covering prevention of pollution of the marine environment by ships from operational or accidental causes. The Sea Pollution Act, 1991 ratified MARPOL in Ireland. In addition, all substances handled and/or used whilst undertaking the works are required to be handled, used, stored, and documented in accordance with assessments and the Chemicals Act 2008 (No. 13 of 2008) and Chemicals (Amendment) Act 2010 (No. 32 of 2010) and associated Regulations.<br><br>Given the standard legal and regulatory pollution control requirements that apply to all vessels, the nature of the proposed SI works, their limited scale and duration, and the insignificant increase in vessel activity, an accidental pollution event is highly unlikely to occur. |

| Aspect of the Impact | Assessment of the Impact |
|---|---|
| Magnitude and spatial extent of the impact | Given the nature, scale, size, and duration of the SI works, the magnitude of impacts on Water are not deemed significant. |
| Transboundary nature of the impact | None. |
| Intensity and complexity of the Impact | The intensity and complexity of impacts on Water arising from the SI works are typical to that of similar types of marine surveys that utilise standard SI techniques, with no novel or complex methodologies. The SI phase is anticipated to take place over 4-6 weeks for each survey campaign including geophysical surveys, geotechnical investigations, and environmental sampling. Adverse impacts will be mitigated through standard management measures (see mitigation measures below). |
| Probability of the Impact | Significant impacts on Water arising from SI works are not likely. |
| Expected onset and duration, frequency and reversibility of the Impact | The SI phase is anticipated to take place over 4-6 weeks for each geophysical and geotechnical survey campaign and 2-3 days for the environmental sampling.<br><br>No LSE are predicted on Water. Any non-significant impacts will be brief to temporary in nature and will be fully reversible once the SI works have been completed. |
| Possibility of effectively reducing the impact | As any impacts on Water are negligible, then no mitigation measures are required. |

## 6.2 Mitigation

None proposed.

## 6.3 Conclusion

Taking into consideration the limited nature, scale, size, and duration of the SI works, there will be a negligible impact on Water as a result of the SI works.

# 7 BIODIVERSITY

## 7.1 Assessment of Impact

The assessment of the potential impacts arising from the SI works on Biodiversity within the AoI is presented in Table 7.1.

**Table 7.1 Assessment of Potential Impacts on Biodiversity**

| Aspect of the Impact | Assessment of the Impact |
|---|---|
| Nature of the Impact | The SI works will be conducted wholly within the area outlined in the drawings in Appendix A covering an area of 2101 Ha.<br><br>The accompanying documents to the MUL provide more detail on biodiversity and, in particular, European sites. Refer to the Risk Assessment for Annex IV Species (ref: CP1146-RPS-00-XX-RP-N-RP1018), the Supporting Information for Screening for Appropriate Assessment (SISAA) (ref: CP1146-RPS-00-XX-RP-N-RP1019) and the Natura Impact Statement (NIS) (ref: CP1146-RPS-00-XX-RP-N-RP1020).<br><br>As discussed in the SISAA and the NIS, the potential impacts on biodiversity identified due to the proposed SI works are:<br><br>• Visual and above water noise disturbance<br>• Habitat loss, alteration and/or fragmentation<br>• Increased suspended sediment concentration (SSC)<br>• Under water noise (incl. injury and/or displacement)<br>• Accidental pollution event<br>• Risk of collision<br><br>These impacts are discussed below.<br><br>**Visual and above water noise disturbance**<br><br>**Marine mammals - Cetaceans:** Visual and above water noise will not impact cetaceans.<br><br>**Marine mammals - Otter:** Visual and above water noise has the potential to impact on otters. However, based on the available evidence gathered in the desk study (refer to Annex IV report CP1146-RPS-00-XX-RP-N-RP1018 and SISAA report CP1146-RPS-00-XX-RP-N-RP1019) otters (*Lutra lutra*) are unlikely to be present in the vicinity of the SI works. Therefore there will be no impact on otter.<br><br>**Marine mammals - Seals:** Visual and above water noise has the potential to impact on seals if they are present within the immediate vicinity of the SI works. As there are no designated haul out sites for seals within the AoI or adjacent areas, no impacts are predicted to occur.<br><br>**Other marine megafauna (basking sharks/ turtles):** Visual and above water noise will not impact on other marine megafauna including basking sharks (*Cetorhinus maximus*) and turtles. |

| Aspect of the Impact | Assessment of the Impact |
|---|---|
| | **Fish:** Visual and above water noise will not impact on fish species.<br><br>**Birds:** For most survey types (e.g. geophysical, environmental, archaeological and other surveys) noise will not be appreciably above baseline levels (the potential landfalls are accessible recreational areas where human activities e.g., walkers, dog walkers etc. regularly occur). Intrusive surveys that have the potential to emit noise beyond baseline levels are the geotechnical sampling (boreholes etc.) from a jack-up barge (JUB) or a tracked borehole / CPT rig. It should be noted there is an existing level of baseline noise in the area due to industrial and commercial operations at Dublin Port and the Poolbeg peninsula, traffic on nearby roads, the operational railway/ DART line, and normal human activities including walkers (including dogs) in the intertidal area. The intertidal area is free of vehicles/machinery but is popular at low tide resulting in a regular, existing level of human disturbance for intertidal birds.<br><br>There are a number of breeding seabirds known to forage in South Dublin Bay during the summer months. Seabirds from the North-West Irish Sea SPA, Dalkey Island SPA, Howth Head Coast SPA and Irelands Eye SPA may also utilise Dublin Bay. The presence of construction related visual and auditory disturbances gives rise to potential displacement of these seabirds from their foraging grounds in the bay, albeit over a relatively short duration (i.e., days).<br><br>The SI works will take place in the intertidal and subtidal areas of the South Dublin Bay and River Tolka Estuary SPA and potentially overlap with roosting sites NK14, NK09, SMAC2, and SMAC1.<br><br>Dublin Bay's mudflats/sandflats are an open environment such that any temporary structures (e.g. JUB), vessels, people and equipment will be clearly visible and audible. As such, the direct impacts from undertaking the SI works are anticipated to have some disturbance effect on breeding and foraging seabirds, potentially displacing them from Dublin Bay while SI works are being undertaken.<br><br>**Bats:** The presence or otherwise of bats is typically relevant only to onshore SI activities; although bats are known to forage over water and along coastlines, they will not interact with underwater works. Interaction between bats and the proposed SI works although unlikely is still possible due to the potential for disturbance caused by the lighting and noise from intertidal and subtidal SI works (e.g., night time construction and increased night-time activity). However, given the existing use of surrounding area as a busy recreational, commercial and industrial area, including Dublin Port and its environs, it is expected that any bats using the area are habituated to some level of night-time lighting and noise. Therefore, no impacts are predicted on bat species that may utilise the South Dublin Bay area and those areas adjacent to the proposed SI works.<br><br>**Habitat loss, alteration and/or fragmentation**<br><br>**Marine mammals – Cetaceans and Pinnipeds:** The proposed SI works do not overlap spatially with European sites designated for marine mammals, i.e. harbour porpoise (*Phocoena Phocoena*), bottlenose dolphin (*Tursiops truncates*), grey seal (Halichoerus grypus) and harbour seal (*Phoca vitulina*), therefore there is no risk of direct habitat loss, alteration and/or fragmentation to haul-out sites or supporting habitats for these species.<br><br>**Marine mammals - Otter:** The proposed SI works do not overlap spatially with European sites designated for otter. The nearest SAC designated for otter is located 10 km inland to the southwest of the proposed SI works. The proposed SI works will not interact with otter holts or couches as these are not likely to be in the intertidal area below the HWM where |

| Aspect of the Impact | Assessment of the Impact |
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| | the SI works will take place. Therefore there is no risk of direct habitat loss, alteration and/or fragmentation to habitats for otter.<br><br>**Other marine megafauna (basking sharks/ turtles):** Basking shark have been recorded infrequently within Dublin Bay with five individual sightings (most recent sighting in July 2022 to the north of the Great South Wall in Dublin Port) and a single stranding on North Bull Island in August 2013 (NBDC, 2024a). This would indicate that while basking shark may occur on occasion within the Dublin Bay area it is likely of a more transitory nature rather than the area being suitable as a hotspot for activity. From 2005, there are two records of a leatherback turtle (*Dermochelys coriacea*), east of Dublin Bay (approximately 17 km to the east of Dublin Bay) (NBDC, 2024b) from the AoI. One stranding of a loggerhead turtle (*Caretta caretta*) was recorded at Kilbarrick Strand to the north of Dublin Bay in 2004 (NBDC, 2024c). The occurrence of turtles in Irish waters is relatively rare, with the leatherback and loggerhead turtles the most common species. No turtle or basking shark sightings have been recorded within the AoI in Dublin Bay. As sightings of turtles and basking sharks are rare within Dublin Bay with no recordings within the AoI, no habitat loss, alteration and/or fragmentation will occur associated with these species due to the proposed SI works.<br><br>**Fish:** The proposed SI works do not overlap with European sites designated for relevant Annex II migratory fish species (river lamprey (*Lampetra fluviatilis)*, sea lamprey (*Petromyzon marinus*), Atlantic salmon (*Salmo salar)* and twaite shad (*Alosa fallax*)). SACs on the east coast of Ireland which are designated for these fish species include the River Boyne and River Blackwater SAC (002299) located approximately 43 km north of the proposed project and the Slaney River Valley SAC (000781) approximately 109 km to the south where it meets the Irish Sea. As migratory fish migrate to and from their natal rivers, it is considered highly unlikely that migratory fish from other river systems or SACs will migrate through the South Dublin Bay SAC. Given the distance between the SI works AoI and European sites designated for migratory fish, there will be no habitat loss, alteration and/or fragmentation to migratory fish habitats or supporting habitats due to the proposed SI works.<br><br>**Birds:** There is potential for habitat loss, alteration and/or fragmentation to the non-annexed habitat type of the South Dublin Bay and River Tolka Estuary SPA due to the proposed SI works area overlapping four roost sites (NK14, NK09, SMAC2, SMAC1) to the south between Blackrock and Booterstown for common gull (*Larus canus*), black headed gull (*Chroicocephalus ridibundus*) and oystercatcher (*Haematopus Ostralegus*), and to the north along south-wall at Poolbeg for Purple Sandpiper (*Calidris maritima*), Dunlin (*Calidris alpina*) and Turnstone (*Arenaria).*<br><br>**Bats:** The proposed SI works including access/egress from each location will not result in any direct or indirect impacts on any structure or feature which could be used by roosting bats. Therefore, there will be no habitat loss, alteration and/or fragmentation to roosting, resting or breeding bats due to the proposed SI works.<br><br>**Increased suspended sediment concentration (SSC)**<br><br>**Marine mammals – Cetaceans and Pinnipeds:** The proposed SI works do not overlap spatially with European sites designated for marine mammals i.e. harbour porpoise, bottlenose dolphin, grey seal and harbour seal, therefore there is no risk of impacts from SSC on these species due to the proposed SI works.<br><br>**Other marine megafauna (basking sharks/ turtles):** There will be no impact from increased SSC to basking sharks/turtles due to the proposed SI works. |

| Aspect of the Impact | Assessment of the Impact |
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| | **Marine mammals - Otter:** There will be no impact from increased SSC to otters due to the proposed SI works.<br><br>**Fish:** There will be no impact from increased SSC as the proposed SI works do not overlap areas designated for migratory fish species.<br><br>**Birds:** There is potential for indirect effects to SPA QI birds due to SSC impacts on fish prey species. The SI works will take place over a relatively limited extent of the AoI (total area sampled of the AoI equates to 439m$^2$ or 0.002% of the total AoI), particularly when considered alongside the wider availability of suitable habitat within the SPA and surrounding areas. In addition, there will be no significant increase in SSC as a result of the SI works and therefore there will be no impact on fish prey species and no impact on birds as a result.<br><br>**Underwater noise (incl. injury and/or displacement)**<br><br>**Marine mammals - Cetaceans:** The Subsea Noise Technical Report (Appendix B) demonstrates the worst-case scenario for all hearing groups. Species identified in the IWDG (2024) data holds 60 records of cetacean sightings within the Dublin Bay area for the period October 2023 to October 2024 (IWDG, 2024). Species identified were harbour porpoise, common dolphin (*Delphinus delphis*) and bottlenose dolphin. No other cetacean species were recorded in Dublin Bay between October 2023 to October 2024. It is expected that a maximum of two vessels will be operating at any one time within the survey area in connection with the SI works. This introduces the potential for noise disturbance to marine mammals. However, given the busy port area around Dublin and Dun Laoghaire, any marine mammals present in the area are likely to be habituated to marine traffic, and any impact from an increase in vessel noise as a result of the SI works is considered to be negligible. Refer to Chapter 10 for further discussion on underwater noise. Also refer to the Risk Assessment for Annex IV Species report (ref: CP1146-RPS-00-XX-RP-N-RP1018) and the NIS (ref: CP1146-RPS-00-XX-RP-N-RP1020), both of which discuss the underwater noise impacts on marine mammals species in detail.<br><br>**Other marine megafauna (basking sharks/ turtles):** Data on turtle hearing is limited, however, turtles are adapted to detect sound in water and are known to detect sound at less than 1,000 Hz (Popper et al., 2014). The majority of the survey equipment to be used operates across a higher frequency range, and therefore injury and disturbance to turtles unlikely. Due to the rarity of turtles within the South Dublin Bay are, and specifically the AoI, and the limited scale and duration of the SI works, it is concluded that there will be no impact on turtle species as a result of the SI works. As basking shark lack a swim bladder (large oily liver instead), they are only sensitive to the particle motion component of underwater noise. Intrinsically, as with other elasmobranchs, they are considered to have low sensitivity to sound pressure (Popper et al., 2014). As basking shark occurrence within the AoI and the Dublin Bay region is rare, and given the limited scale and duration of the SI works activities, it is concluded that there will be no impact on basking sharks as a result of the SI works.<br><br>**Marine mammals - Otter:** As otters tend to forage within 80 m of the shoreline (NPWS, 2009), any potential effects are likely to be associated with the SI works activity at the potential landfall locations (Blackrock; Shelley Banks) rather than activity further offshore. Both geophysical and geotechnical sound sources have the potential to cause PTS and TTS to the OCW hearing group (of which otter is a member) less than 10 m from the sound source (for all geophysical and geotechnical survey equipment while in use). Behavioural disturbance for OCW range from less than 20 m from the sound source (geotechnical surveys drilling and boreholes) to 8000 m (for Sparker SBP & USBL). It is expected that the physical presence of the vessel and/or JUB will cause otter to avoid the area. Therefore there is no impact predicted to otters due to the proposed SI works. |

| Aspect of the Impact | Assessment of the Impact |
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| | **Marine mammals - Seals:** There is the potential for underwater noise generated during the geophysical survey to result in injury and/or disturbance to grey seals and harbour seals in the vicinity of the proposed SI works (both in the PCW hearing group). The Subsea Noise Technical Report (Appendix B) demonstrates that PTS is out to 10 m and TTS could occur within 180 m from the sound source for the geophysical surveys while behavioural disturbance is out to 8 km from the sound source. PTS is out to 10 m while TTS is out to 160 m from the sound source for the geotechnical surveys and behavioural disturbance is out to 5.7 km from the sound source. Refer to Chapter 10 for further discussion.<br><br>**Fish:** The proposed SI works do not overlap any areas designated for migratory fish, the closest SAC is the River Boyne and River Blackwater SAC 43 km north of the project. As the proposed SI works will have a maximum behavioural disturbance range of 8 km the proposed SI works will not impact on migratory fish species. Refer to Chapter 10 for further discussion.<br><br>**Birds:** There is potential for diving seabirds to interact with the SI works while underwater noise is being produced. However, given the limited extent of sound-producing activity, the limited time diving birds spend underwater, and given that birds are likely to be temporarily displaced to the surrounding area due to the presence of the vessel, it is considered that there is a very low likelihood of interaction between underwater noise sources and diving birds during the proposed SI works. Refer to Chapter 10 for further discussion.<br><br>**Bats:** Increased SSC will not impact bat species.<br><br>**Accidental pollution event**<br><br>The proposed marine SI works will result in a slight increase in the number of vessels using the area. Although the increase is slight, this could in theory increase the risk of an accidental release of pollutants (e.g., fuels, oils, and lubricants) to the marine environment. Dublin Bay is a busy commercial port and in 2023 Dublin Port accounted for 59% of all vessel arrivals in Irish ports (CSO, 2024[19]). Dun Laoghaire was the second busiest port regarding cruise ships in 2023 with 75 arrivals. Along the northern boundary of the AoI on the approaches to Dublin Port to the north and Dun Laoghaire Harbour to the east vessel routes per sq km per year[20] range from 19,848 at Dublin Port to 1,805 at Dun Laoghaire Harbour EMODnet (2024[20]). Given that the surveys would amount to, at most, two additional vessels operating in this area, the likelihood of a collision resulting in a pollution event is considered insignificant. All vessels operating in the marine environment must also adhere to the International Convention for the Prevention of Pollution from Ships (MARPOL) which is the main international convention covering prevention of pollution of the marine environment by ships from operational or accidental causes. Therefore there will be no impact to marine mammals (cetaceans, otters, pinnipeds), other marine megafauna, fish, bird or bat species that utilise the south Dublin Bay from an accidental pollution event.<br><br>**Risk of collision**<br><br>It is expected that a maximum of two vessels will be operating at any one time within the survey area. Due to the nature of the surveys, the vessels will be stationary or travelling |

[19] https://www.cso.ie/en/releasesandpublications/ep/p-spt/statisticsofporttrafficq4andyear2023 Accessed 15 October 2024

[20] EMODnet Route Density data for the years 2019-2023 for all vessels https://emodnet.ec.europa.eu/geoviewer/ Accessed 15 October 2024

| Aspect of the Impact | Assessment of the Impact |
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| | at low speeds. There are standard measures required for all vessels operating offshore in Ireland and internationally. These include broadcasts, navigational aids, buoys, Marine Notices etc. All vessels will display warning notices, signs a lighting in accordance with standard procedures and Marine Notices will be published with all relevant details to warn other marine users of the dates, times, types of activities, and active survey areas. With these measures in place, the probability of any impact on Biodiversity as a result of a collision during the SI works is negligible. |
| Magnitude and spatial extent of the Impact | **Visual and above water noise disturbance**<br><br>Visual and above water noise disturbance is expected to result in a relatively minor increase in background noise levels. Therefore the magnitude is expected to be insignificant in terms of the current noise levels and the spatial extent is considered to be within and immediately adjacent to the AoI.<br><br>The visual and above water noise disturbance has the potential to cause disturbance to roosting and foraging birds within and adjacent to the AoI. However, there are several foraging and roosting grounds available within the South Dublin Bay and River Tolka Estuary SPA, and other coastal areas. Within the AoI, there are 30 intertidal and subtidal roost sites excluding those identified within the 500 m proposed cable route corridor where SI works will take place. Six of these roost sites are located to the north-west of the bay at Sandymount Strand and to the south of Pigeon House Road. These roost sites range from approximately 82 m to 2 km from the proposed cable route corridor. A further 11 roost sites are located between approximately 500 m to 1 km from the SI works area opposite Booterstown. The remaining sites are located between Blackrock and Dun Laoghaire Harbour. These sites range from approximately 300 m to 2 km from the proposed SI works area. Given the availability of additional roosts within South Dublin Bay, coupled with the existing baseline levels of noise and disturbance within the Bay as discussed above, and the short duration of the proposed SI works, impacts on birds from the SI works are considered negligible.<br><br>**Habitat loss, alteration and/or fragmentation**<br><br>There is potential for habitat loss, alteration and/or fragmentation due to the overlapping roost sites identified above. None of the geotechnical survey locations overlap with the four roost sites mentioned above. Therefore, there will be no direct habitat loss, alteration and/or fragmentation to these roost sites. However, as the vibrocore and CPT location to the south of the SI works area (near Blackrock Park) are within 10 m at their closest point to roost site NK14 for common and black headed gull there is potential for indirect habitat loss as a result of the geotechnical surveys. All other roost sites are over 150 m away from the indicative geotechnical survey locations. However, there are several foraging and roosting grounds available within the South Dublin Bay and River Tolka Estuary SPA, and other coastal areas. Within the AoI, there are 30 intertidal and subtidal roost sites excluding those identified within the 500 m proposed cable route corridor.<br><br>**Increased suspended sediment concentration (SSC)**<br><br>There will be no appreciable increase in SSC as a result of the proposed SI works. Therefore the magnitude and spatial impact of SSC from the proposed SI works on Biodiversity is considered to be negligible.<br><br>**Underwater noise (incl. injury and/or displacement)**<br><br>The Subsea Noise Technical Report (Appendix B) shows the underwater noise levels from the impulsive sources. The modelling shows that for porpoises (VHF hearing group) the minimal starting range to avoid TTS risk is 2800 m (for geophysical surveys for |

| Aspect of the Impact | Assessment of the Impact |
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| | chirper/pinger SBP and USBL Active with no soft start). For phocid carnivores in water (PCW) group (which includes grey and harbour seal) minimal starting ranges to avoid TTS risk is 180m (for geophysical survey for sparker SBP and USBL active with no soft start). All other risk ranges for the remaining hearing groups (LF, HF and OCW) PTS for geophysical surveys is below 310 m with no soft start. Introducing a 20-minute soft start, where only some equipment is active, will reduce the risk of TTS for the VHF group to within 1600 m, and to below 10 m for the remaining marine mammals and fishes.<br><br>For geotechnical surveys including drilling and boreholes, all risk ranges to PTS and TTS exceedance for all hearing groups (LH, HF, VHF, OCW, PCW) is below 10m. For vibrocoring and CPT with USBL the VHF group has a TTS exceedance risk up to 2700m with no soft start while all remaining groups have risk ranges for PTS at or below 260m with no soft start. Introducing a 20-minute soft start, where only some equipment is active, will reduce the risk of TTS for the VHF group to within 1500 m, and to below 10 m for the remaining marine mammals and fishes for geotechnical surveys.<br><br>**Accidental pollution event**<br><br>The proposed SI works will introduce a maximum of two vessels into the South Dublin Bay area. This, relative to the background levels of vessel activity in close proximity to Dublin Port, is not significant and will not lead to an increased risk of an accidental pollution event.<br><br>**Risk of collision**<br><br>As stated above, it is expected that a maximum of two vessels will be operating at any one time within the survey area. Due to the nature of the surveys, the vessels will be stationary or travelling at low speeds. There is a very low risk of a collision occurring. |
| Transboundary nature of the Impact | None. |
| Intensity and complexity of the Impact | **Visual and above water noise disturbance**<br><br>The intensity and complexity of impacts on birds arising from the SI works are typical in nature to that of similar types of marine SI works that utilise standard survey techniques, with no novel or complex methodologies. The SI phase will take place over 4-6 weeks for each geophysical and geotechnical survey campaign. Other surveys, such as environmental, archaeological, shipping and navigation, noise surveys, will be discrete surveys undertaken by a small team of people, typically 1-2 individuals. Due to the size, location and nature of the SI works, any impacts will be negligible relative to background levels already noted in the area. Therefore, the intensity and complexity of noise impacts on Birds will be negligible.<br><br>**Habitat loss, alteration and/or fragmentation**<br><br>The intensity and complexity of impacts on birds arising from the proposed SI works relate to the four overlapping roost sites. However, with the availability of additional roost sites across the bay and given that the SI works adjacent to these roost sites will be completed over a number of days, no permanent or significant impacts are predicted. The SI works are typical in nature to that of similar types of marine SI works that utilise standard survey techniques, with no novel or complex methodologies. The SI phase will take place over 4-6 weeks for each geophysical and geotechnical survey campaign and 2-3 days for the environmental sampling. Due to the size, location and nature of the SI |

| Aspect of the Impact | Assessment of the Impact |
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| | works, any impacts will be negligible relative to background levels already noted in the area. Therefore, the intensity and complexity of noise impacts on Birds will be negligible. |
| | **Increased suspended sediment concentration (SSC)**<br><br>The intensity and complexity of impacts on birds arising from the proposed SI works relate to fish prey species. As stated previously the total area sampled of the AoI equates to 439m$^2$ or 0.002% of the total AoI. The SI works are typical in nature to that of similar types of marine SI works that utilise standard survey techniques, with no novel or complex methodologies. The SI phase will take place over 4-6 weeks for each geophysical and geotechnical survey campaign and 2-3 days for the environmental sampling. Due to the size, location and nature of the SI works, any impacts will be negligible relative to background levels already noted in the area. Given the water depth, tidal influence and currents within South Dublin Bay, including the availability of additional feeding grounds within the Bay, the intensity and complexity of increased SSC impacts on Birds will be negligible. |
| | **Underwater noise (incl. injury and/or displacement)**<br><br>The intensity and complexity of impacts of underwater noise on marine mammals arising from the proposed SI works relate primarily to the VHF hearing group i.e. harbour porpoise. The proposed SI works have the potential to contribute to risk ranges out to 500 m from the sound source for PTS and 2,800 m for TTS in the absence of mitigation. The proposed SI works are typical in nature to that of similar types of marine SI works that utilise standard survey techniques, with no novel or complex methodologies. The SI phase will take place over 4-6 weeks for each geophysical and geotechnical survey campaign and 2-3 days for the environmental sampling. With the inclusion of the mitigation measures listed below PTS and TTS risk ranges are reduced to as low as reasonably practicable levels and therefore potential impacts on marine mammals from underwater noise from the SI works is predicted to be negligible. |
| | **Accidental pollution event**<br><br>As stated above the likelihood of an accidental pollution event caused by the proposed SI works is not likely. The vessels associated with the proposed SI works will not contribute to a significant increase in activity in the area. The SI works are typical in nature to that of similar types of marine SI works that utilise standard survey techniques, with no novel or complex methodologies. The SI phase will take place over 4-6 weeks for each geophysical and geotechnical survey campaign and 2-3 days for the environmental sampling. Due to the size, location and nature of the SI works, any impacts will be negligible. |
| | **Risk of collision**<br><br>The area in which the proposed SI works plan to operate is close to a busy port environment including recreational, fishing and commercial activities. The proposed SI works will introduce a maximum of two vessels to conduct the works. This relative to background levels found within the bay will not pose a collision risk, as vessels are already observing slow down measures within the Bay. The SI works are typical in nature to that of similar types of marine SI works that utilise standard survey techniques, with no novel or complex methodologies. The SI phase will take place over 4-6 weeks for each geophysical and geotechnical survey campaign and 2-3 days for the environmental sampling. Due to the size, location and nature of the SI works, any impacts will be negligible. |

| Aspect of the Impact | Assessment of the Impact |
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| Probability of the Impact | **Visual and above water noise disturbance**<br><br>**Birds:** There is likely to be some disturbance to bird species as a result of the SI works within the AoI. However, given the size, location and nature of the SI works, any impacts will be negligible as the bird species are habituated to the existing levels of activity in the area and there are nearby alternative roosting and foraging sites available.<br><br>**Habitat loss, alteration and/or fragmentation**<br><br>**Birds:** There is potential for habitat loss, alteration and/or fragmentation to the non-annexed habitat type of the South Dublin Bay and River Tolka Estuary SPA due to the proposed cable route corridor overlapping four roost sites (NK14, NK09, SMAC2, SMAC1). However given the availability of additional roost sites within the Bay and that the proposed SI works will be brief to temporary in nature and the mitigation measures proposed below. The probability of impact will be negligible.<br><br>**Underwater noise (incl. injury and/or displacement)**<br><br>**Marine mammals and Fish:** Impacts to marine mammals arising from SI works are deemed to be likely, however these impacts will be minimised with the implementation of best practice methods and mitigation measures (outlined below). With the implementation of mitigation measures, residual impacts from underwater noise on marine mammals and species that depend upon them (i.e., other fish, marine mammals) is not deemed significant, however marine mammals may exhibit avoidance behaviour during the active periods of the marine geophysical and geotechnical SI works. The impacts on marine mammals will be significantly reduced through the implementation of the mitigation measures outlined below. |
| Expected onset and duration, frequency and reversibility of the Impact | The SI phase is anticipated to take place over 4-6 weeks for each geophysical and geotechnical survey campaign. The other surveys, including environmental, archaeological and other surveys and investigations may take place at any time over the lifetime of the MUL but will be discrete surveys involving a small number of people (typically 1-2) over a couple of days during daylight hours. The main potential for impacts on Biodiversity will commence when the SI works vessels are in use undertaking the geophysical and geotechnical SI works. After the SI works are complete, all vessels, equipment will be removed. Any disturbed sediments are expected to rapidly recover. Similarly, any disturbance to species will be reversed once the noise producing activities (above water and underwater) are removed. The SI works will be carried out in accordance with best practice and mitigation measures (see below) such that no permanent impacts are predicted. |

## 7.2 Mitigation

The potential effects on Biodiversity during the SI works will be reduced by ensuring that best practice methods are followed and standard control measures for prevention of impacts on the environment during the SI works are complied with.

Mitigation for Biodiversity:

- Access to the intertidal area for plant and machinery will be via existing access points or the sea.
- Machinery will be fitted with noise reducing features e.g., lining of engine compartments, and where noise reducing features are not possible, noise screens will be used.
- Machinery will be turned off when not in use and will be regularly maintained to limit the noise emissions from the vessel(s).

- An Ecological Clerk of Works (ECoW) will be onsite during the SI works to ensure mitigation measures are implemented on-site. The ECoW shall be suitably qualified, and a member of a relevant professional institute.
- A suitably qualified and experienced MMO will be onboard for the duration for the geophysical and geotechnical surveys. They will be responsible for advising and ensuring compliance with the Guidance to Manage the Risk to Marine Mammals from Man-made Sound Sources in Irish Waters (DAHG, 2014) for the duration of the SI works.

## 7.3 Conclusion

With the inclusion of the above best practice methods and mitigation measures, the impact from the proposed SI works on Biodiversity receptors within and adjacent to the AoI as a result of the SI works will be reduced to as low as reasonably practicable such that no significant impacts are predicted.

# 8 FISHERIES AND AQUACULTURE

## 8.1 Assessment of Impact

The assessment of the potential impacts arising from the SI works on Fisheries and Aquaculture within the AoI is presented in Table 8.1.

**Table 8.1 Assessment of Potential Impacts on Fisheries and Aquaculture**

| Aspect of the Impact | Assessment of the Impact |
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| Nature of the Impact | The SI works will be conducted wholly within the area outlined in the drawings in Appendix A and covers a total area of 2101 Ha.<br><br>The two main ports in close proximity to the AoI are Dublin and Dun Laoghaire. Dublin Port is a large port receiving a large number of container vessels, bulk carriers and cruise ships while Dun Laoghaire Port is a busy ferry terminus and recreational vessel harbour. Sea angling occurs all along the coast including boat angling and shore angling (ERFB, 2009).<br><br>There are no designated shellfish waters within Dublin Bay or its environs. There are three known nursery grounds for commercially important fish species including: cod (*Gadus morhua*), haddock (*Melanogrammus aeglefinus*) and horse mackerel (*Trachurus trachurus*) along the Dublin coastline that extend into Dublin Bay. There are two known spawning grounds which also extend into Dublin Bay, these are for whiting and cod. There is also a haddock spawning ground to the east of the AoI at the mouth of Dublin Bay. Given the localised nature of the works, and the water depths within the AoI, the SI works will not have a significant impact on the nursery or spawning grounds for these commercial species.<br><br>The outer regions of Dublin Bay are a busy fishing area with pot and net fishing being the most common methods used within the area. The SI works do not overlap these areas. The SI works will be localised and small scale relative to vessel activity levels in Dublin Bay. Therefore, the SI works are not deemed likely to cause a significant level of disturbance to fishing activities.<br><br>There are no aquaculture sites within Dublin Bay or its environs. The closest Aquaculture site (for mussels) is in Co. Wicklow >70 Km to the south at Clogga bay (site ID: T32-027A). The SI works will have no impact on any aquaculture sites.<br><br>The SI works involve the removal of sediment samples during the environmental and geotechnical surveys (11 benthic sampling stations, 27 intertidal sampling stations, 6 sampling/ coring boreholes, 30 vibrocores and 30 CPTs for geotechnical investigation) and this will result in some localised Suspended Sediment Concentrations (SSC). Localised smothering by deposition from drilling activities (boreholes, CPT, virbocores) and positioning of the equipment on the seabed e.g., JUB legs, moorings/or anchors. In large enough quantities, SSC may cause smothering of habitats or impact on fish. However, this a dynamic marine environment and currents and tides will rapidly cause any SSC to disperse with larger particles settling out of the water column close to the area of disturbance. In addition, Dublin Port is a very busy shipping area handling over 5,000 vessels between Q1 and Q3 in 2023 (CSO, 2024)[21], it is a highly turbid environment and any minor increases in SSC due to the SI works will be insignificant against background levels. As the SI works will be localised in nature SSC is expected to |

[21] Statistics of Port Traffic - CSO - Central Statistics Office Accessed May 2024

| Aspect of the Impact | Assessment of the Impact |
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| | be within the immediate vicinity of the works and insignificant relative to background levels. Therefore, any impact will be negligible. |
| Magnitude and spatial extent of the Impact | The expected disturbance is deemed negligible in overall terms, and it will be limited to the immediate environs of the investigation locations. Given the scale and nature of the SI works, and no overlap between fishing activity and the AoI, any impacts will be confined to vessel movements to/from the AoI. Therefore, the magnitude of impacts on Fisheries will be negligible. |
| Transboundary nature of the Impact | There is not considered to be any risk of transboundary impacts occurring. |
| Intensity and complexity of the Impact | The SI works will not impact on any Aquaculture sites.<br><br>The intensity and complexity of impacts on Fisheries arising from the SI works are typical in nature to that of similar types of marine SI works that utilise standard survey techniques, with no novel or complex methodologies. The SI phase will take place over 4-6 weeks for each geophysical and geotechnical survey campaign and 2-3 days for the environmental sampling. Due to the size, location and nature of the SI works, any impacts will be negligible relative to background levels already noted in the area. Therefore, the intensity and complexity of impacts on Fisheries will be negligible. |
| Probability of the Impact | The SI works will not impact on any Aquaculture sites.<br><br>Given the nature and scale of the SI works, lack of overlap with any Fisheries sites and minimal overlap with nursery areas the probability of impact is negligible. |
| Expected onset and duration, frequency, and reversibility of the Impact | The SI phase is anticipated to take place to take place over 4-6 weeks for each geophysical and geotechnical survey campaign and 2-3 days for the environmental sampling. The potential for impacts on Fisheries will commence when the vessels are in use and may occur across the duration of the SI phases. After the SI works are complete, any impacts will be fully reversible. However, fishing activities are unlikely to be impacted by the SI works as the fishing activities will be undertaken outside of the AoI. Any impact will be confined to the movement of vessels to/from the AoI and therefore negligible. |
| Possibility of effectively reducing the impact | As any impacts on Fisheries and Aquaculture are negligible, then no mitigation measures are required. |

## 8.2 Mitigation

None proposed.

## 8.3 Conclusion

Taking into consideration the limited nature, scale, size, and duration of the SI works, there will be a negligible impact on Fisheries and no impact on Aquaculture as a result of the SI works.

# 9 AIR QUALITY

## 9.1 Assessment of Impact

The Ambient Air Quality and Cleaner Air for Europe (CAFE) Directive (2008/50/EC) deals with each Member State in terms of Zones and Agglomerations. For Ireland, four zones (A, B, C and D) are defined in the Air Quality Standards Regulations 2011. The study area is located within EPA Zone A which is the Dublin Conurbation. Air quality in this zone is consistently classed as 'good' as measured by the EPA monitoring network[22].

Vessel emissions will occur as a result of vessel use. Any substances with the potential to affect air quality will be handled and disposed of in accordance with the requirements of the MARPOL Convention and relevant national regulations (e.g., Ambient Air Quality and Cleaner Air for Europe (CAFE) Directive (2008/50/EC), Air Quality Standards Regulations 2011 (S.I. No. 180 of 2011), Air Pollution Act 1987, Environmental Protection Agency Act 1992, Environmental Noise Regulations 2006).

Emissions to air, predominantly GHG, will occur as a result of vessel and equipment use during the SI works. The emissions within the AoI will be adjacent to Dublin Port, the industrial area at Poolbeg, and the densely populated urban area of Dublin. Therefore there will be an imperceptible impact from the emissions arising from the SI works on Air Quality.

## 9.2 Mitigation

None proposed.

## 9.3 Conclusion

Taking into consideration the limited nature, scale, size, and duration of the SI works, any impact on Air Quality as a result of the SI works will be imperceptible.

[22] Home | AirQuality.ie Accessed June 2024

# 10 NOISE AND VIBRATION

## 10.1 Assessment of Impact

A summary of the assessment of potential impacts from Noise arising from the SI works are presented in Table 10.1.

No impacts from Vibration are considered likely and are therefore not considered further in this assessment.

A separate subsea noise technical report (RPS Ref: CP1146-RPS-00-XX-RP-N-RP1021) has been included in Appendix B to this report. Please refer to this report for details on the activities and equipment that will lead to the generation of subsea noise.

**Table 10.1 Assessment of Potential Impacts from Noise**

| Aspect of the Impact | Assessment of the Impact |
|---|---|
| Nature of the Impact | **Above Water Noise**<br><br>Above water noise will be generated from the geotechnical investigations (intertidal and subtidal) and, to a much lesser extent, the geotechnical survey vessels, environmental, archaeological and other activities. The following paragraphs describe the nature of the impact from above water noise on likely receptors.<br><br>**Fish:** Above water noise will not impact on fish species.<br><br>**Marine Mammals - Cetaceans**: Above water noise will not impact on cetacean species.<br><br>**Marine Mammals - Otter**: Above water noise has the potential to impact on otters. However, based on the available evidence gathered in the desk study, otters are unlikely to be present in the vicinity of the SI works. Therefore there will be no impact on otter.<br><br>**Marine Mammals - Seals:** Above water noise has the potential to impact on seals if they are present within the immediate vicinity of the SI works. As there are no haul out sites for seals within the AoI or adjacent areas, no impacts are predicted to occur.<br><br>**Birds**: For the geophysical, environmental, archaeological and other surveys noise will not be appreciably above baseline levels. Any SI works close to shore in the intertidal areas at the potential landfall locations are accessible recreational areas where human activities e.g., walkers, dog walkers etc. regularly occur, and it is expected that birds will be habituated to this existing baseline.<br><br>There is an existing level of baseline noise in the area due to industrial and commercial operations at Dublin Port and the Poolbeg peninsula, traffic on nearby roads, the operational railway/ DART line, and normal human activities including walkers (including dogs) in the intertidal area. Although birds may be habituated to the existing levels, the geotechnical investigations and activities associated with them, e.g. JUB, vessels and machinery, etc., will emit noise during the SI work that may cause some disturbance to birds roosting or foraging in and around the AoI.<br><br>There are a number of breeding seabirds known to forage in South Dublin Bay during the summer months. The increased noise in the area from the SI works gives rise to potential displacement of these seabirds from their foraging grounds in the bay, albeit over a relatively short duration (i.e., days). The SI works also potentially overlap with roosting sites NK14, NK09, SMAC2, and SMAC1.<br><br>**Human Beings:** The AoI is adjacent to a busy urban area that includes an industrialised area on the Poolbeg peninsula, busy roads along the coastline, and a railway supporting DART, commuter and freight train services. The intertidal area of the AoI is used regularly |

| Aspect of the Impact | Assessment of the Impact |
|---|---|
| | by the public for walking and other recreational purposes (e.g. sailing). There is an existing baseline level of above water noise. Dublin Bay is also a busy commercial and recreational shipping area, with Dublin port handling over 5,000 vessels between Q1 and Q3 in 2023 (CSO, 2024)[23]. The SI works will be of limited duration and scale. They will contribute to a slight increase in noise during geotechnical investigations (e,g. borehole drilling) that has the potential to cause some disturbance to human beings, albeit briefly. The above water noise will cease on completion of the geotechnical works. |

## Underwater Noise

**Fish:** The proposed SI works do not overlap with European sites designated for Annex II migratory fish species. As migratory fish migrate to and from their natal rivers, it is considered highly unlikely that migratory fish from other river systems or SACs will migrate through the South Dublin Bay area.

The Subsea Noise Technical Report (Appendix B) modelled the impact of underwater noise on fish species. In the absence of any mitigation, PTS and TTS worst-case distances for fish were modelled at 10m and 130m from the sound source, respectively. Given the shallow waters within the AoI and that the area is not a busy fishing area, the potential impacts on fish species is considered very low.

**Marine Mammals (cetaceans, seals and otter):** The Irish Whale and Dolphin Group (IWDG) holds 60 records of cetacean sightings within the Dublin Bay area for the period October 2023 to October 2024 (IWDG, 2024). Species identified were harbour porpoise, common dolphin and bottlenose dolphin. No other cetacean species were recorded in Dublin Bay between October 2023 to October 2024. From Phase II of the Irish ObSERVE programme (2021-2022), harbour porpoise was sighted across all strata but predominately observed in the Irish Sea (Stratum 5). Giralt Paradell et al (2024), noted that bottlenose dolphins were recorded more so over the continental shelf waters and only recorded occasionally in the Irish Sea.

It is expected that a maximum of two vessels will be operating at any one time within the survey area in connection with the SI works. This introduces the potential for noise disturbance to marine mammals. However, given the busy port area around Dublin and Dun Laoghaire, any marine mammals present in the area are likely to be habituated to marine traffic, and any impact from an increase in vessel noise as a result of the SI works is considered to be negligible.

When assessing the potential impact of underwater noise sources on the marine environment a range of variables such as source level, frequency, duration, and directivity were considered. Increasing the distance from the sound source usually results in attenuation with distance. The factors that affect the way noise propagates underwater include: water column depth, pressure, temperature gradients, salinity, as well as water surface and seabed type and thickness. When sound encounters the seabed the amount of noise/sound reflected back depends on the composition of the seabed, i.e., mud or other soft sediment will reflect less than rock. The water depth within the AoI is relatively shallow 1-10m with mixed substrate type of fine muds, sands, and potentially coarser gravel types. All factors listed above reduce the propagation of the sound, decreasing the zone of influence of the geophysical survey.

The active acoustic instruments, such as those proposed for this survey, operate by emitting extremely short pulses and are highly directional with narrow beams. While the swathe of the sonars and echosounders will have a maximum range of 6 to 60m in

[23] Statistics of Port Traffic - CSO - Central Statistics Office Accessed June 2024.

| Aspect of the Impact | Assessment of the Impact |
|---|---|
| | diameter, many of the sources used for this survey, such as multibeam, side-scan sonar, sub-bottom profilers (SBP), Ultra Short Base-Line positioning system (USBL), chirper/pinger, and sparker operate at high frequency and attenuate quickly as they spread from the source. Coupled with the narrow beam angle and short duty cycles ('on' for microseconds or milliseconds per second) means that surveying sonars have relatively low acoustic impact.<br><br>Auditory injury in cetaceans can be defined as a permanent threshold shift (PTS) leading to non-reversible auditory injury, or as a temporary threshold shift (TTS) in hearing sensitivity, which can have negative effects on the ability to use natural sounds (e.g., to communicate, navigate, locate prey) for a period of minutes, hours, or days. With increasing distance from the sound source, where it is audible to the animal, the effect is expected to diminish through identifiable stages (i.e., PTS or TTS in hearing, avoidance, masking, reduced vocalisation) to a point where no significant response occurs. Factors such as local propagation and individual hearing ability can influence the actual effect (DAHG, 2014).<br><br>Should the noise levels from sources exceed the PTS and TTS values stated in Table 2.1 of the Subsea Noise Technical Report (Appendix B), there is the potential for underwater noise generated during the geophysical survey to result in injury and/or disturbance to marine mammals in the vicinity of the SI works.<br><br>**Birds**: Subsea noise has the potential to impact on species of diving birds. Hartley Anderson Limited (2020) provide a summary of the available evidence on the auditory abilities and effects of underwater noise of diving birds, however, this evidence is very limited. While seabird responses to approaching vessels are highly variable (e.g. Fliessbach et al. 2019), flushing disturbance would displace most diving seabirds from close proximity to the survey vessel and any towed equipment, thereby limiting their exposure to the highest sound pressures generated. Similarly, behavioural disturbance of seabirds due to acoustic survey activities is most likely to be temporary displacement associated with the physical presence of the vessel, comparable to that experienced by routine shipping traffic (Hartley Anderson Limited, 2020). Given the limited extent of sound-producing activity, the limited time diving birds spend underwater, and given that birds are likely to be temporarily displaced to the surrounding area due to the presence of the vessel, it is considered that there is a very low likelihood of any impacts from underwater noise associated with the SI works on bird species.<br><br>**Human Beings**: There will be no impact on human beings as a result of underwater noise. |
| Magnitude and spatial extent of the Impact | **Above Water Noise**<br><br>Above water noise is expected to result in a relatively minor increase in background noise levels. Therefore the magnitude is expected to be insignificant in terms of the current noise levels and the spatial extent is considered to be within and immediately adjacent to the AoI.<br><br>The above water noise has the potential to cause disturbance to roosting and foraging birds within and adjacent to the AoI. However, there are several foraging and roosting grounds available within the South Dublin Bay and River Tolka Estuary SPA, and other coastal areas. Within the AoI, there are 30 intertidal and subtidal roost sites excluding those identified within the 500 m proposed cable route corridor. Six of these roost sites are located to the north-west of the bay at Sandymount Strand and to the south of Pigeon House Road. These roost sites range from approximately 82 m to 2 km from the proposed cable route corridor. A further 11 roost sites are located between approximately 500 m to 1 km from the proposed cable route corridor opposite Booterstown. The |

| Aspect of the Impact | Assessment of the Impact |
|---|---|
| | remaining sites are located between Blackrock and Dun Laoghaire Harbour. These sites range from approximately 300 m to 2 km from the proposed cable route corridor. Given the availability of additional roosts within South Dublin Bay, coupled with the existing baseline levels of noise and disturbance within the Bay as discussed above, and the temporary nature and short duration of the proposed SI works,<br><br>**Underwater Noise**<br><br>The noise modelling presented in Appendix B shows the underwater noise levels from the impulsive sources. The modelling shows that for porpoises (VHF hearing group) the minimal starting range to avoid TTS risk is 2800 m (for geophysical surveys for chirper/pinger SBP and USBL Active with no soft start). For phocid carnivores in water (PCW) group (which includes grey and harbour seal) minimal starting ranges to avoid TTS risk is 180m (for geophysical survey for sparker SBP and USBL active with no soft start). All other risk ranges for PTS for geophysical surveys is below 310 m with no soft start. Introducing a 20-minute soft start, where only some equipment is active, will reduce the risk of TTS for the VHF group to within 1600 m, and to below 10 m for the remaining marine mammals and fishes.<br><br>For geotechnical surveys including drilling and boreholes, all risk ranges to PTS and TTS exceedance for all hearing groups is below 10m. For vibrocoring and CPT with USBL the VHF group has a TTS exceedance risk up to 2700m with no soft start while all remaining groups have risk ranges for PTS at or below 260m with no soft start. Introducing a 20-minute soft start, where only some equipment is active, will reduce the risk of TTS for the VHF group to within 1500 m, and to below 10 m for the remaining marine mammals and fishes for geotechnical surveys.<br><br>The vessel noise sources (geotechnical survey vessel, 168 SPL unweighted) have moderate source levels that when weighted for the VHF hearing group (harbour porpoise) and the PCW hearing group (seals) are very low compared to the TTS threshold of either group. For the VHF group the weighted source level of the vessel is 147 dB SPL, meaning that TTS (153 dB SEL), will not be exceeded outside a 500 m range even for animals exposed for up to six hours. For animals outside a 100 m range the equivalent duration is c. 40 minutes. For 50 m the duration is c. 15 minutes. For the PCW group the weighted source level of the vessel is 158 dB SPL, meaning that TTS (181 dB SEL), will not be exceeded outside a 100 m range even for animals exposed for a duration greater than 24 hours. For 50 m the duration is c. 12 hours. A worst case approximation for transmission loss (leading to higher received levels) was used for these estimates (See Appendix B, Section 6). |
| Transboundary nature of the Impact | There is not considered to be any risk of transboundary impacts from either above water noise or underwater noise. |
| Intensity and complexity of the Impact | **Above Water Noise**<br><br>The intensity and complexity of noise impacts on Birds arising from the SI works are typical in nature to that of similar types of marine SI works that utilise standard survey techniques, with no novel or complex methodologies. The SI phase will take place over 4-6 weeks for each geophysical and geotechnical survey campaign and 2-3 days for the environmental sampling. Due to the size, location and nature of the SI works, any impacts will be negligible relative to background levels already noted in the area. Therefore, the intensity and complexity of noise impacts on Birds will be negligible.<br><br>**Underwater Noise** |

| Aspect of the Impact | Assessment of the Impact |
|---|---|
| | The DAHG "Guidance to Manage the Risk to Marine Mammals from Man-made Sound Sources in Irish Waters" (DAHG, 2014) contains the following statement:<br><br>*"It is therefore considered that anthropogenic sound sources with the potential to induce TTS in a receiving marine mammal contain the potential for both (a) disturbance, and (b) injury to the animal."*<br><br>This states that TTS constitutes an injury and should thus be the main assessment criteria[24]. However, the guidance goes on to specify the use of thresholds from a 2007 publication (Southall et al 2007) which has since been superseded (by Southall, et al., 2019) and no longer represents best available science, nor reflects best practice internationally. Thus, the following excerpt from the guidance is relevant:<br><br>*"The document will be subject to periodic review to allow its efficacy to be reassessed, to consider new scientific findings and incorporate further developments in best practice."*<br><br>As there has been no such update to date, but the guidance clearly states intent, we have applied the latest guidance (refer to Appendix B), reflecting the current best available method for assessing impact from noise on marine mammals.<br><br>The intensity and complexity of the impacts arising from the SI works due to underwater noise are typical in nature to similar types of marine SI works that utilise these standard techniques, with no novel or complex methodologies. The SI works are anticipated to be completed over 4-6 weeks for each survey campaign. Adverse impacts will be mitigated by standard management measures (see mitigation measures below). Based on the characteristics and location of the SI works, including the application of mitigation measures, the intensity and complexity of the impacts from underwater noise can be managed to reduce the risk to marine mammals to less than significant. |
| Probability of the Impact | **Above Water Noise - Birds**<br><br>There is likely to be some disturbance to bird species as a result of the SI works within the AoI. However, given the size, location and nature of the SI works, any impacts will be negligible as the bird species are habituated to the existing levels of activity in the area and there are nearby alternative roosting and foraging sites available.<br><br>**Underwater Noise - Marine Mammals and Fish**<br><br>Impacts to marine mammals arising from SI works are deemed to be likely, however these impacts will be minimised with the implementation of best practice methods and mitigation measures (outlined below). With the implementation of mitigation measures, residual impacts from underwater noise on marine mammals and species that depend upon them (i.e., other fish, marine mammals) is not deemed significant, however marine mammals may exhibit avoidance behaviour during the active periods of the marine geophysical and geotechnical SI works. The impacts on marine mammals will be significantly reduced through the implementation of the mitigation measures outlined below. |
| Expected onset and duration, frequency, and | The SI phase is anticipated to take place over to take place over 4-6 weeks for each geophysical and geotechnical survey campaign and 2-3 days for the environmental sampling. Noise generating activities will be limited to the survey areas. When a noise |

[24] Injury being the qualifying limit in the Irish Wildlife Act 1976, section 23, 5c : https://www.irishstatutebook.ie/eli/1976/act/39/enacted/en/print#sec23

| Aspect of the Impact | Assessment of the Impact |
|---|---|
| reversibility of the Impact | source ceases emissions, the impact ceases. Therefore, impacts related to noise will be brief lasting less than 1- day. SI activities that contribute to noise will be carried out in accordance with SI works best practice and mitigation measures (see below) to ensure that impacts will be minimised. |

## 10.2 Mitigation

The potential effects of noise during the SI works will be reduced by ensuring that best practice methods are followed and standard control measures for prevention of impacts on the environment during the SI works are complied with.

Mitigation for noise includes:

- A suitably qualified and experienced MMO will be onboard for the duration for the geophysical and geotechnical surveys. They will be responsible for advising and ensuring compliance with the Guidance to Manage the Risk to Marine Mammals from Man-made Sound Sources in Irish Waters (DAHG, 2014) including the use of soft-start procedures.
- Any equipment used should not exceed the modelled equipment broadband levels (see Appendix B, Table 4-1) or band-wise levels for overall levels (Figure 4-13 to Figure 4-22).

## 10.3 Conclusion

With the inclusion of the above best practice methods and mitigation measures, the impact from Noise on receptors within and adjacent to the AoI as a result of the SI works will be reduced to as low as reasonably practicable such that no significant impacts are anticipated.

# 11 LANDSCAPE AND SEASCAPE

## 11.1 Assessment of Impact

The extent of the SI works are described in Section 2 and illustrated in the drawings in Appendix A. They will be visible from land and sea for the duration of the SI works.

In the south bay, the intertidal flats extend for almost 3 km at their widest with the AoI extending approximately 2 km farther seaward. The sediments are predominantly well-aerated sands in which several permanent channels exist, and a small sandy beach occurs at Merrion Gates, while some bedrock shore occurs near Dun Laoghaire.

Vessels associated with the geophysical and geotechnical surveys will be present in the South Dublin Bay area for a period of 4-6 weeks for each survey campaign.

The SI works will take place in and around the seaward side of Blackrock Park, the R131 road (north of Merion Gates), Sandymount Beach and the Shelley Banks area of the Poolbeg peninsula. There is an active railway line (DART, intercity and freight services) between Blackrock Park and the sea which interrupts the view of Dublin Bay from certain viewpoints. However, in general, the vessels and the jack-up-barge (JUB) will be very visible from coastal areas/ viewpoints around South Dublin Bay for the duration of the SI works activities. There will be clear views of the SI works operations from viewers along the intertidal area along Sandymount strand, the R131, at Sandymount Beach and Shelley Banks. Once the SI works are completed the vessels and JUB will be demobilised and there will be no residual impact on landscape and seascape.

The area is regularly the subject of considerable recreational and commercial vessel traffic. It is considered that the survey operations will not create changes to the existing landscape character and visual amenity of the area. The SI work will not permanently affect landscape and scenic views, and as such no mitigation measures are considered necessary.

## 11.2 Mitigation

None proposed.

## 11.3 Conclusion

The SI works are temporary in nature and fully reversible in terms of landscape and seascape impacts and effects. Considering the limited nature, scale, size, and duration of the SI works, particularly in the context of the existing industrial nature of the surrounding areas, there will be a localised, moderate, and temporary impact on landscape and seascape for the duration of the SI works which will be removed once all SI works vessels and equipment have been removed.

# 12 TRAFFIC AND TRANSPORT (INCLUDING SHIPPING AND NAVIGATION)

## 12.1 Assessment of Impact

The two main ports in close proximity to the AoI are Dublin and Dun Laoghaire. Dublin Port is a large port receiving a large number of container vessels, bulk carriers and cruise ships while Dun Laoghaire Port is a busy ferry terminus and recreational vessel harbour. In addition, there is a single designated anchorage area (subdivided into four safe anchoring areas- depth range -12-22m CD) located to the north-west of the Dun Laoghaire Harbour[25]. The Traffic Separation Scheme (TSS) for Dublin port is a safe buoyage channel that runs from Dublin Port out to the "roundabout" (Safe Water mark) in the area between Burford bank and the Liffey entrance. The AoI is to the south of this in a nearshore area that commercial and recreational vessels are advised to avoid due to the shallow water depths.

The average tidal range in the Dublin Bay ranges between 2-4.5 m and tidal currents run on average 2-3 knots in a north-easterly/south-westerly orientation, the strongest tidal currents are experienced on the spring ebb. The prevailing wind direction for the area is a west south westerly at an average speed of 11.9mph. On average the region experiences winds of gale force and above on average eight days annually[26]. The local topography provides shelter from northerly and southerly winds.

A Vessel Traffic Service is provided for Dublin Bay by the Dublin Port Company. All vessels navigating with the Port Limits should establish early contact with VTS and maintain a listening watch on VHF Channel 12. The port limits extend out to a line drawn from the Baily Lighthouse, down along the Burford Bank to Dalkey Island. Messages relating to the movements of vessels, the safety of persons, safety of navigation and emergencies of any nature will be accepted / transmitted. Traffic Clearance is required prior to departing a berth within the Port. Commercial vessels using Dublin Port or Dun Laoghaire Port normally have a qualified pilot or certified master with proven local knowledge on board. Dependant on conditions and vessel size pilots are normally picked up or dropped off near the Burford Bank.

The area is used for a number of regular vessel routes, mostly associated with movement to and from ports and harbours. However, the addition of the extra vessels for the survey activities is highly unlikely to pose a significant increase in local marine traffic. There is the possibility that the regular movement of local vessels, may be temporarily disturbed. For the duration of the limited survey period (4-6 weeks for each survey campaign including geophysical surveys and environmental sampling and geotechnical investigations), it is expected that a maximum of two vessels would be operating at any one time within the survey area. Due to the nature of the surveys, the vessels would be stationary, or travelling at low speeds (<5 kts).

There are standard measures required for all vessels operating offshore in Ireland and internationally. These include broadcasts, navigational aids, buoys, Marine Notices etc. All vessels will display warning notices, signs a lighting in accordance with standard procedures and Marine Notices will be published with all relevant details to warn other marine users of the dates, times, types of activities, and active survey areas. With these measures in place, the probability of any impact on Traffic & Transport (including Shipping and Navigation) as a result of the SI works is negligible.

## 12.2 Mitigation

None proposed.

## 12.3 Conclusion

As the SI works will be carried out for a relatively short period it is unlikely to affect local marine traffic, provided sufficient notice is given to existing local vessels. Significant impacts on marine traffic are considered highly unlikely and no mitigation measures are considered necessary.

[25] https://eoceanic.com/sailing/routes/europe/ireland/18/coastal_overview_for_dublin_bay_to_rosslare_harbour?coastal=0 accessed June 2024

[26] https://www.currentresults.com/Weather/Ireland/wind-speed-annual.php accessed June 2024

# 13 CULTURAL HERITAGE (INCLUDING UNDERWATER ARCHAEOLOGY)

## 13.1 Assessment of Impacts

Marine cultural heritage includes archaeological heritage, built heritage and intangible cultural heritage (e.g., submerged prehistory, shipwrecks, aviation archaeology and intertidal sites, monuments and architectural heritage assets).

There are no known archaeological or cultural heritage assets in immediate proximity to the Shellybanks and Blackrock Park SI works locations, i.e. where the potential cable corridor comes ashore. Therefore, the potential for unrecorded archaeological or cultural heritage assets at both of these locations is considered to be low.

There are no Underwater Heritage Orders located within the immediate vicinity of the proposed location of the geotechnical investigations and environmental grab sample locations. A number of recorded archaeological assets were identified in the AoI and associated buffer (CH060; CH061; CH062; CH063; CH064; CH065; UKHO6965; UKHO77923) which comprise primarily of wreck remains or the site of recorded losses, and wreck fragments/debris (see Figure 13-1).

Given the known archaeological assets within the AoI and the wider South Dublin bay area, there is high potential for the discovery of unrecorded marine archaeology and cultural heritage (ref. WA1 – a dislocated ship timber, CH057, CH058 - the wreck discovery made during the installation of the current sewage pipe across the bay, CH059, UKHO99557); not only maritime related sites and features (wreck, aircraft etc), but also paleoenvironmental and submerged prehistoric features and deposits (e.g., organic material such as peat). Of note are the Later Mesolithic fish traps discovered during works on Spencer Dock, North Wall Quay in Dublin, at a depth of approximately 6m below current ground level (ESB, 2023).

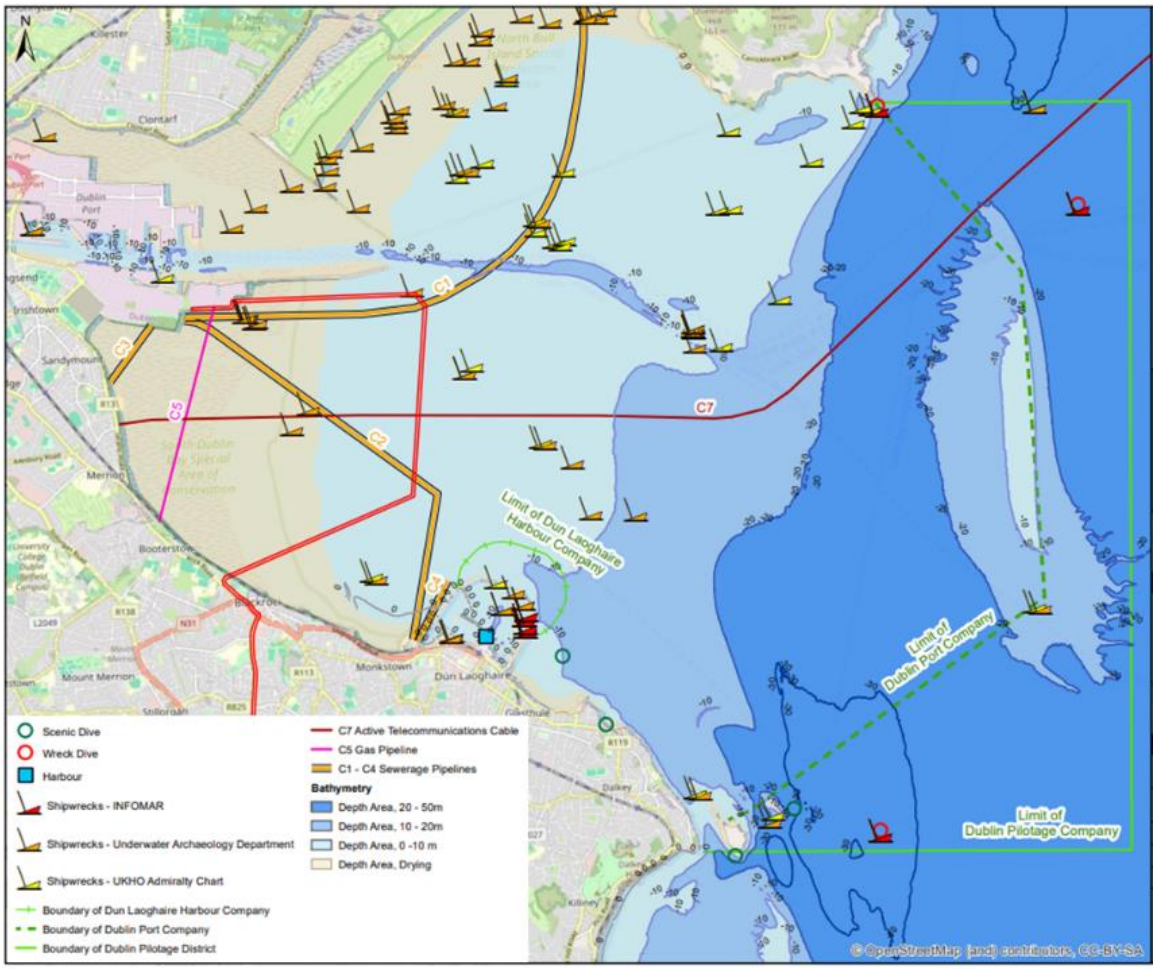



**Figure 13-1 Marine Cultural Heritage Features within the AoI**

## 13.2 Mitigation

Although there are no known archaeological assets within the immediate vicinity of the proposed location of the geotechnical investigations and environmental grab sample locations, further archaeological survey work along the intertidal zone will be undertaken to confirm the presence or not of previously unrecorded archaeological features. Appropriate licences (e.g., detection device licence) will be obtained from the National Monuments Service (NMS) prior to commencement of the geophysical surveys and/or use of detection devices in the intertidal area. Where further, more detailed archaeological investigations are required, including intrusive investigations, wade or dive surveys, these will be carried out in accordance with the requirements of the NMS.

The geophysical survey as part of the SI works will be undertaken in advance of any intrusive investigations, such as geotechnical survey. The specifications for the survey shall comply with the archaeological requirements of the Underwater Archaeology Unit (UAU) of the NMS and shall be carried out under licence from the NMS. This will allow for the review and assessment of the acquired survey data by a qualified marine archaeologist to allow for the identification of any anomalies of archaeological interest, including those that may be associated with the assets noted above in Section 13.1.

Given the paleoenvironmental and submerged prehistoric potential of the Dublin Bay region, following the geotechnical survey, the acquired core logs will be reviewed by a geoarchaeologist as part of a geoarchaeological assessment, and where appropriate, any recommendations for further sampling and assessment agreed in consultation with the UAU of the NMS.

## 13.3 Conclusion

With the inclusion of the above best practice methods and mitigation measures, no impacts on Cultural Heritage (including Underwater Archaeology) from the SI works are predicted.

# 14 POPULATION AND HUMAN HEALTH

## 14.1 Assessment of Impact

The SI works will have no appreciable impact on population demographics. Throughout the proposed works, a variety of vessels and associated machinery will be used on-site, which may give rise to slight negative and temporary impacts on some human receptors from noise and light. Noise from the geotechnical investigations in the AoI beside Blackrock Park has the potential to cause some disturbance to residents living beside or close to the park. Similarly, lights from vessels associated with the SI works, e.g. jack-up-barge (JUB) and vessels, will be visible to onshore viewers. Given the urbanised and industrial nature of much of the onshore area adjacent to the AoI, and that Dublin Bay is already a busy shipping route, there will be a negligible on Population as a result of the SI works. This will reduce to no impact on completion of the SI works.

There is potential for a slight positive and temporary economic impact within the locality associated with a temporary increase in the use of ancillary support services in the supply of services and technical professions.

The SI Works will not interact directly with humans that are not working on the SI works. Therefore, there will be no impact on Human Health as a result of the SI works.

## 14.2 Mitigation

None proposed.

## 14.3 Conclusion

The SI works will not have a negligible impact on population.

The SI works will not have an impact on human health.

# 15 MAJOR ACCIDENTS AND DISASTERS

## 15.1 Assessment of Impact

Seveso sites are industrial sites regulated under what is commonly referred to as the “Seveso Directive.” In Ireland, the Chemicals Act (Control of Major Accident Hazards involving Dangerous Substances) Regulations 2015 (S.I. No. 209 of 2015) (the “COMAH Regulations”), implement the Seveso III Directive (2012/18/EU). Seveso sites are categorised as Lower, or Upper, by the type and quantity of hazardous substances stored at the site. The Health and Safety Authority (HSA) maintain a list of active Seveso sites within Ireland.

There are 14 Upper Tier and 12 Lower Tier Seveso sites in the Dublin city and county area four of the Upper Tier Sites are located on Dublin South Port Poolbeg:

- Dublin Bay Power;
- National Oil Reserves Agency Ltd.;
- Dublin Waste to Energy; and
- ESB Poolbeg Generating Station

The following major hazards have been identified:

- Release of dangerous substances with potential for adverse environmental effects;
- Fire; and
- Fire and explosion.

While the SI works will be taking place adjacent to the power station they will be wholly within the marine environment where no potential impacts have been identified. Therefore, the potential for major accidents and disasters to arise from the SI works is not considered likely.

There is the potential for the SI works to result in a major accident or disaster should geotechnical investigations damage or destroy subsea cables or pipelines or should unexploded ordnance (UXO) be encountered. Therefore, the geophysical survey will be undertaken in advance of any geotechnical investigations to enable the locations of any sub-sea cables/pipelines and UXO to be accurately mapped.

## 15.2 Mitigation

In order to avoid risks of encountering subsea cables/ pipelines and UXO, the geophysical surveys will be undertaken in advance of any geotechnical investigations to enable the locations of sub-sea cables/ pipelines and UXO (if present) to be accurately mapped with an appropriate exclusion zone. The geotechnical borehole and environmental grab sample locations will then be sited away from these cables outside the appropriate exclusion zone.

## 15.3 Conclusion

With the implementation of the above mitigation measure there will be no impact from the SI works on existing cables/ pipelines and UXO that could result in a major accident or disaster.

# 16 CLIMATE

## 16.1 Assessment of Impact

The impacts on Climate from the SI works relate to greenhouse gas (GHG) emissions from vessels and personnel transport. As outlined in Section 2, the SI works are of a relatively short duration (4-6 weeks for each survey campaign including geophysical and geotechnical surveys and environmental sampling). It is expected that a maximum of two vessels will be operating at any one time within the SI survey area (2101 Ha). The survey vessels will be travelling at low speeds (<5 kts) or stationary within the survey area.

Given the baseline level of shipping activity adjacent to the AoI, emissions the SI works are considered imperceptible and will not cause an impact.

There will also be emissions of GHG associated with onshore transport for the small number of operatives who will be undertaking the SI works in the intertidal areas. These emissions are considered imperceptible and will not cause an impact.

## 16.2 Mitigation

None proposed.

## 16.3 Conclusion

The SI works will result in an imperceptible impact from GHG emissions.

# 17 WASTE

## 17.1 Assessment of Impact

The SI works do not involve any demolition or removal of structures, so no demolition waste will be produced.

Wastes associated with vessels will include bilge water, oily residues (sludge), sewage (black water), greywater, plastics, food wastes, domestic wastes, cooking oil, operational wastes, cargo residues, and other non-common waste streams (e.g., ballast water) (EMSA/OP/02/2016). All vessels will be required to manage waste in accordance with the accepted EU and international standards.

All vessels operating in the marine environment must adhere to the International Convention for the Prevention of Pollution from Ships (MARPOL) which is the main international convention covering prevention of pollution of the marine environment by ships from operational or accidental causes. The Sea Pollution Act, 1991 ratified MARPOL in Ireland. In addition, all substances handled and/or used whilst undertaking the works are required to be handled, used, stored, and documented in accordance with assessments and the Chemicals Act 2008 (No. 13 of 2008) and Chemicals (Amendment) Act 2010 (No. 32 of 2010) and associated Regulations. Therefore, there will be no impact from pollution events.

## 17.2 Mitigation

None proposed.

## 17.3 Conclusions

There will be no impact from Waste produced as a result of the SI works.

# 18 MATERIAL ASSETS

## 18.1 Assessment of Impact

The SI works will be conducted wholly within the AoI as outlined in the drawings in Appendix A covering an area of 2101 Ha.

Dublin Port is a very busy shipping area handling over 5,000 vessels between Q1 and Q3 in 2023 (CSO, 2024)[27]. There is extensive use of the bay by sailing, racing and recreational vessels, shore angling, and recreational diving sites within the bay though these activities are generally outside the AoI (Figure 18-1). Many unlit yacht racing markers buoys are laid in Dublin harbour from April to October, and prior contact with the various yacht and sailing clubs will be carried out to avoid potential impacts. The SI works will take place between 4-6 weeks for each survey campaign, and Marine Notices will be published in advance to warn other marine users of the location, activities and call sign of vessels involved in the SI works. Therefore, no impacts are foreseen.

There are harbours and marinas close by, e.g., Dun Laoghaire harbour 1.5 km to the south and Howth harbour 13.5 km to the north. As stated previously, there will be a maximum of two vessels operating at any one time for the SI works. Therefore, relative to the background levels of shipping traffic in Dublin Bay, the increase in vessel traffic due to the SI works is considered negligible.

Details on existing pipelines are provided in Table 18.1 and illustrated in Figure 18-1. Within the AoI in South Dublin Bay there are two cross-bay sewerage pipelines (S1 and S2), a connector pipeline (S3) to the north and one outfall pipe (S4) to the south. Pipeline S.1 carries sewage from the Sutton pumping station in the North of Dublin to Ringsend Wastewater Treatment Works (WwTW). Pipeline S.2 carries sewage from the West Pier pumping station in Dun Laoghaire Rathdown to the Ringsend WwTW.

A high- pressure gas mains (G5) runs into the ESB site at Poolbeg and an active telecommunications cable (C6) which makes landfall at Sandymount beach.

**Table 18.1 Sewage, Gas and Telecommunications Pipelines and Cables withint he AoI**

| Ref | Name | Owner |
|---|---|---|
| S1 | Sutton – Ringsend cross bay sewage line | Dublin City Council |
| S2 | Dun Laoghaire – Ringsend cross bay sewage line | Dun Laoghaire Rathdown |
| S3 | Dodder Twin Lines | Dun Laoghaire Rathdown |
| S4 | Long sea Outfall - Dun Laoghaire | Dun Laoghaire Rathdown |
| G5 | Bord Gais Pipeline | Bord Gais |
| C6 | Esat 2 | Esat BT |

The geophysical survey area extends over the route of these cables but will have no impact on the operation of those cables.

The environmental, archaeological and other surveys will not impact on these utilities.

There is the potential for an interaction between the geotechnical investigation equipment, metocean devices, particularly from anchors and/or moorings and existing subsea infrastructure. Desk-top research has been undertaken to inform the design of the SI works and this will have to be reviewed and updated prior

[27] Statistics of Port Traffic - CSO - Central Statistics Office Accessed June 2024

to the mobilisation of any offshore vessels to ensure that the sub-sea infrastructure is recorded. However, in the absence of the geophysical surveys to confirm the exact location of subsea cables and pipelines, there is the potential for the geotechnical SI works to have a direct impact on unrecorded and/or poorly mapped subsea cables and pipelines.

## 18.2 Mitigation

In order to avoid risks of inadvertently interacting with subsea cables/ pipelines, the desk-top research completed to-date will be reviewed and updated prior to undertaking the geophysical surveys. Subsequently, the geophysical surveys will be undertaken in advance of any geotechnical SI works to enable the locations of sub-sea cables/ pipelines to be accurately mapped. The geotechnical SI works, environmental grab sample locations, and metocean devices will then be sited away from these cables to ensure no interaction with the cables and/or pipelines.

## 18.3 Conclusion

With the inclusion of the above best practice methods and mitigation measures, the SI works will not impact on Material Assets.

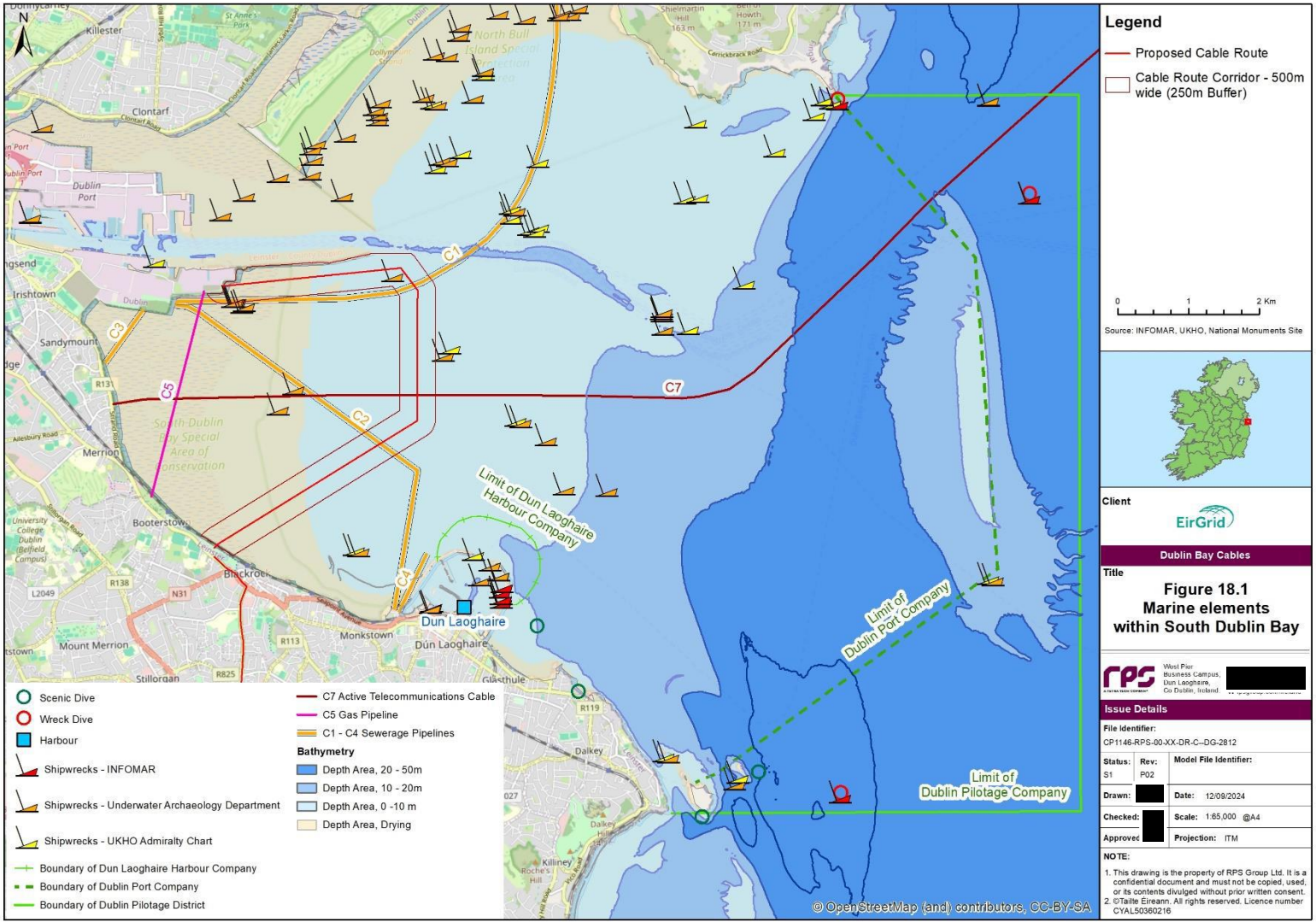



**Figure 18-1 Material Assets considered within South Dublin Bay**

# 19 INTERACTIONS

## 19.1 Assessment of Impacts

This section describes the interactions between the effects described in the previous sections. The potential for there to be interactions between certain topics are summarised in Table 19.1.

**Table 19.1 Potential Interactions Between Impacts**

| Topic | Conclusion | Interaction |
|---|---|---|
| Land and soils | Negligible. | Impacts on Lands and Soils will be negligible. There is a potential interaction with other topics from SSC, e.g. Water, Biodiversity, Fisheries, which are discussed under each topic. The overall impact with respect to the interaction between Land and Soils and these topics will be negligible. |
| Water | Negligible | Impacts on Water will be negligible. There is a potential interaction with other topics from SSC, e.g. Land and Soils, Biodiversity, Fisheries, which are discussed under each topic. The overall impact with respect to the interaction between Water and these topics will be negligible. |
| Biodiversity | Bats: No impact.<br>Birds: Negligible.<br>Cetaceans: As low as reasonably practicable and not significant.<br>Fish: No impact.<br>Otter: No impact.<br>Other megafauna: No impact.<br>Habitats: Negligible. | Impacts on Biodiversity range from no impact to negligible, with underwater noise impacts reduced to as low as reasonably practicable and therefore not significant. The impacts to Biodiversity receptors are also discussed under other topics, e.g. Land and Soils, Water, Fisheries, and Noise.<br>The overall impact with respect to the interaction between Biodiversity and these topics will be negligible. |
| Fisheries and aquaculture | Fisheries: Negligible.<br>Aquaculture: No impact. | Impacts on Fisheries will be negligible. The impacts on Fisheries are considered alongside those from the following topics: Land and Soils, Water, Biodiversity, Noise, Traffic & Transportation (including Shipping and Navigation).<br>The overall impact with respect to the interaction between Fisheries and these topics will be negligible.<br>As there are no impacts on Aquaculture, there will be no interaction impacts. |
| Air quality | Imperceptible | Impacts on Air quality will be imperceptible. Emissions may interact with Traffic & Transportation (including Shipping and Navigation), Population and human health, and Climate.<br>The overall impact with respect to the interaction between Air Quality and these topics will be imperceptible. |
| Noise and vibration | Noise: As low as reasonably practicable and not significant.<br>Vibration: No impact. | Impacts from Noise range from negligible (humans) with underwater noise impacts reduced to as low as reasonably practicable and therefore not significant (marine mammals). The impacts from Noise on other topics are discussed under each topic, e.g. Biodiversity, Fisheries, Traffic & Transportation (including Shipping and Navigation), and Population and human health.<br>The overall impact with respect to the interaction between Noise and these topics will be negligible.<br>As there are no impacts from Vibration, there will be no interaction impacts. |
| Landscape and seascape | Moderate during works. No impact after completion. | Impacts on Landscape and seascape will be moderate during the SI works, reducing to no impact on completion of the SI works.<br>The overall impact with respect to the interaction between Landscape and seascape and Population and human health will be the same. |
| Transport & Traffic (incl. Shipping & Navigation) | No impact. | As there will be no impact from Transport & Traffic (incl. Shipping & Navigation) there will be no interaction impact. |

| Topic | Conclusion | Interaction |
|---|---|---|
| Cultural heritage | No impact. | As there will be no impact on Cultural heritage there will be no interaction impact. |
| Population and human health | Population: Negligible.<br>Human health: No impact. | Impacts on Population will be negligible reducing to no impact on completion of the SI works. Emissions (noise, light) and visual may interact with Noise and Landscape and seascape topics.<br>The overall impact with respect to the interaction between Population and these topics will be negligible reducing to no impact on completion of the SI works.<br>As there will be no impact from Human health there will be no interaction impact. |
| Major accidents and disasters | No impact. | As there will be no impact from Major accidents and disasters there will be no interaction impact. |
| Climate | Imperceptible | Impacts on Climate will be imperceptible. Emissions may interact with Traffic & Transportation (including Shipping and Navigation), Population and human health, and Air quality.<br>The overall impact with respect to the interaction between Climate and these topics will be imperceptible. |
| Waste | No impact. | As there will be no impact from Waste there will be no interaction impact. |
| Material assets | No impact. | As there will be no impact on Material assets there will be no interaction impact. |

Taking into consideration the findings from each of the topics, the overall interaction of impacts across all topics as a result of the SI works is considered to be negligible.

## 19.2 Mitigation

None proposed.

## 19.3 Conclusions

No impacts are predicted as a result of the interactions between the impacts identified under each topic and each other.

# 20 CUMULATIVE EFFECTS

## 20.1 Identification of Projects

Even if projects are unlikely to have significant effects on their own, the effects in-combination (cumulatively) with those of other projects could be significant. The cumulative effects assessment has been carried out to identify other projects that could act cumulatively with the SI works.

Other projects that have the potential to act cumulatively with the proposed SI works are considered to be those that are likely to contribute to the effects identified within each of the preceding sections. On this basis, a range of other projects were considered in terms of their potential to have cumulative effects with the proposed SI works.

MARA's approach for identifying projects was used coupled with professional and scientific judgement to identify relevant projects. The key steps for assessing cumulative effects based on MARA's "stepwise approach" are as follows:

1. Defining the Cumulative Effects Spatial Scope (CESS);
2. Defining the Cumulative Effects Temporal Scope (CETS);
3. Impact identification;
4. Pathway identification;
5. Prediction;
6. Identification of projects that could act in combination;
7. Cumulative Effects Assessment conclusion.

The CESS was identified as 5 km and the CETS was identified as two years. The CESS is based on the acoustic survey equipment deterrence ranges as per JNCC (2020), and the CETS is defined as the Maritime Usage Licence period. However, a further search of projects within the last five years was undertaken to ensure any potential cumulative effect of overlapping licence periods for past projects was considered.

A desk study using online sources was undertaken to determine a list of projects within the zone of impact of the proposed SI works which may have the potential to give rise to cumulative effects. These searches are summarised below:

- Foreshore Applications https://www.gov.ie/en/foreshore-notices/; Accessed 21/10/2024;
- EPA Dumping at Sea (DaS) boundaries; https://gis.epa.ie/GetData/Download; Accessed 21/10/2024;
- MARA website for Maritime Usage Licences and Maritime Area Consents https://www.maritimeregulator.ie/; Accessed 21/10/2024;
- An Bord Pleanála (ABP) case search for marine Strategic Infrastructure Development and other marine developments https://www.pleanala.ie/en-ie/case-search#pnlAllFilters; Accessed 21/10/2024.

A full list of each planning and foreshore application for the last five years was reviewed and is available in Appendix C.

## 20.2 Assessment of Impacts

There are two dredge projects ongoing by Dublin Port (FS007132 and FS007164). FS007132 has a licence term until the 30/09/2029 while FS007164 has a licence term until 13/12/2031. Dredging activities give rise to increased SSC. These dredging activities do not overlap spatially with the AoI, however there is potential for temporal overlap as the licence periods for these dredging activities extends to 2029 and 2031 respectively. As stated above in Section 6 Water, Section 7 Biodiversity and Section 8 Fisheries and Aquaculture, the proposed SI works will result in a negligible impact on Water with any mobilised SSC likely to quickly settle out of the water column or disperse under tidal influences. Given the negligible impact of the SI works and the distance between the AoI and dredge projects, no cumulative impacts are predicted.

There are 20 Dumping at Sea (DaS) boundaries within 5 km of the AoI. None are located within the AoI. These DaS permits ended most recently in 1996. Four of these are located at Dublin Port at the ferry terminal at North Wall between 500 m and 1.4 km northwest of the AoI. The remaining DaS boundaries are

located further offshore to the east of the AoI at the mouth of Dublin Bay. There is no potential for cumulative effects with these DaS boundaries as the proposed SI works do not overlap these boundaries and that the most recent date of permit was in 1996.

There are nine port developments ongoing at Dublin Port and the surrounding environs these include: 320250, 307080, 301798, 304888, 309812, 313918, FS006893, FS006806.

Application 320250 relates to the 3FM project which is Dublin Port's third and final Masterplan 2040 Project. Its primary focus is on the Poolbeg Peninsula and includes the construction of a new bridge across the River Liffey. A new Maritime Village, public park and enhanced public and community amenity will also be provided. The 3FM project planning boundary overlaps the Dublin Cables MULA to the north-east (east of Poolbeg Lighthouse). The application was lodged with An Bord Pleanála on 23rd July 2024 and, according to the case file, it is due to be decided by the 6th February 2025. The application notes that there will be a 12-18 month design and procurement period post-consent and anticipates that construction will only commence on-site in the second half of 2027. Therefore, it is highly unlikely that any construction works for 3FM will commence within the lifetime of this MUL and cumulative effects with the 3FM project are not predicted.

An Bord Pleanála (ABP) applications 307080, 309812, 313918 relate to onshore works which do not spatially overlap the AoI.

Works on 307080 have commenced and will be completed by the end of 2024, therefore there will be no temporal overlap with the proposed SI works.

309812 was granted permission to increase capacity at the powerplant at Dublin port which is currently operational.

309812 will not spatially or temporally overlap with the proposed SI works therefore there will be no cumulative effects.

313918 relates to North Wall Power Generating Station. It is currently at permitting stage and will be developed in a single phase, the project is set to start construction in 2025 and begin commercial operation in 2026. The proposed project is not within the AoI and will not have cumulative effects with the SI works.

ABP application 301798 may give rise to water quality issues within Dublin Bay as this application intends to use the outfall pipe in Dublin Bay to release treated effluent. However, the proposed SI works will not contribute to a decrease in water quality within the Bay and therefore there will be no cumulative effects.

Applications 304888/ FS006893 relate to the MP2 Project of the Dublin Port Masterplan for a 15-year planning permission for development at Oil Berth 3 and Oil Berth 4, Eastern Oil Jetty and at Berths 50A, 50N, 50S, 51, 51A, 49, 52, 53 and associated terminal yards to provide for various elements including new Ro-Ro jetty and consolidation of passenger terminal buildings. Permission was granted in July 2020. There is no spatial overlap between that project and the SI works AoI. There may be temporal overlap in activities. However, the activities associated with 304888 will occur on the northern side of the River Liffey. There is not predicted to be any cumulative impact resulting from any temporal overlap.

A further port development application by Dublin Port was for FS006806, this project has been constructed and is operational. Therefore, there is no potential for cumulative effects between the proposed SI works and FS006806.

Application 320768 to ABP is for the Codling Wind Park. The application was lodged on 6th September 2024 and is due to be decided by ABP in April 2025. The cable route for the Codling Wind Park traverses the AoI for the SI works. The application includes a four-year construction programme with landfall works commencing in year 2. It is therefore considered unlikely that construction works for the Codling Wind Park will take place within the timeframe for the SI works. Therefore, it is no cumulative effects are predicted.

There are six foreshore licence applications for SI works which have the potential for cumulative effects with the proposed SI works, these are: FS007546, FS007188, FS007029, FS007472, FS007367, and FS007134. There are also three MULs: LIC230016, MUL230034, and LIC230007.

The following applications have been determined or granted with conditions:

- FS007546 Codling Wind Park site investigations.
- FS007188 RWE Renewables Ireland Ltd. site investigations for the proposed Dublin Array Offshore Wind Farm.
- FS007029: Innogy Renewables Ireland Ltd. site Investigation for Dublin Array at Kish and Bray Banks, and

- LIC230016: Microsoft Ireland Operations Ltd. geophysical survey and site investigations for a proposed subsea fibre optic cable between Anglesey and Dublin with landfall in Dublin Bay.

The site investigations to be undertaken as part of the above permissions, may result in cumulative effects with the SI works in terms of underwater noise and visual and above water noise. In order to reduce any cumulative effects mitigation measures are proposed, as outlined at the end of this section.

MUL230034 is for SI works associated with the Codling Wind Park and includes investigations within South Dublin Bay. Given the temporal and spatially overlap with the AoI there is the potential for cumulative effects. In order to reduce any cumulative effects mitigation measures are proposed, as outlined at the end of this section.

The following projects are at application stage:

- FS007472,
- FS007367, and
- FS007134.

Geotechnical and geophysical survey activities have the potential to act in-combination with the proposed SI works. These foreshore applications were at early stages of application when Government policy changed to a plan-led approach for the development of offshore wind projects post Phase One. As a result, it is considered unlikely that any of the undetermined foreshore licences for developer-led SI works will be progressed within the CETS of therefore no cumulative effects are predicted.

LIC230007 does not spatially overlap the AoI of the proposed SI works. A final decision on this MUL has not yet been concluded. However, as there is no spatial overlap between the AoI and this MUL area, no cumulative effects are predicted.

Other foreshore applications are FS006786, FS007180, FS005691 and FS007290. These projects are determined and have licence period of between five (FS007180) to 35 years (FS005691).

FS006786 application was to use, occupy and maintain St. Michaels Pier. The works will not reduce habitat area/cause habitat or species fragmentation. There will be no reduction in species density and there will be no discharge to the water column or direct discharge of pollutants therefore water quality will not be affected. Therefore, there is no potential for cumulative effects between FS006786 and the proposed SI works.

There is no spatial overlap between FS007180 and the proposed SI works. The deployment of the data buoy has the potential to contribute to increased SSC due to the mooring system used. However given its small footprint ($1m^2$), there is no potential for cumulative effects between FS007180 and the proposed SI works.

FS005691 relates to the construction of a storm water discharge outfall pipe at Clontarf. There is no spatial overlap between FS005691 and the proposed SI works. Phase two works were programmed to be completed in September 2024. The storm outfall will flow into north Dublin Bay. As there is no spatial overlap and given the tidal nature of Dublin Bay, no cumulative effects will arise from FS005691 and the proposed SI works.

There is no spatial overlap between the proposed SI works and FS007290, these works were completed in June 2024 therefore there is no potential for cumulative effects.

There are four other projects that have the potential to cause cumulative effects due to disturbance these are: 313727, 316225, 313509 and 313738. The first three of these projects (313727, 316225, 313509) are onshore applications where works will be conducted above the high-water mark.

313727 and 316225 works will be carried out at St. Vincent's Hospital. These works are 2 km from the AoI, separated by a busy roadway and DART line. Therefore, there is no potential cumulative effects with the proposed SI works.

313509 works will take place along the bus route in Blackrock. This area is already a busy, residential and commercial area, therefore relative to background levels the works proposed combined with the proposed SI works will not contribute to disturbance above the baseline and therefore there will be no cumulative effects.

313738 was granted permission for a new outfall structure to the River Liffey and all ancillary site works. 313738 does not spatially overlap the AoI for the proposed SI works. Therefore, there is no potential for cumulative effects.

## 20.3 Mitigation

EirGrid will coordinate with other licence holders within and immediately adjacent to the AoI boundary to ensure that no temporal overlap occurs between projects in respect of the geophysical and geotechnical activities of the SI works.

## 20.4 Conclusion

With the inclusion of the above best practice methods and mitigation measures, no cumulative effects are predicted between the above projects and the SI works.

# 21 SUMMARY OF MITIGATIONS

The following Table 21.1 provides a summary of the mitigation measures, beyond standard design features or procedures, presented in each of the preceding sections of this report.

**Table 21.1 Summary of Mitigations**

| Topic | Mitigation |
|---|---|
| Land and soils | None proposed. |
| Water | None proposed. |
| Biodiversity | • Access to the intertidal area for plant and machinery will be via existing access points or the sea.<br>• Machinery will be fitted with noise reducing features e.g., lining of engine compartments, and where noise reducing features are not possible, noise screens will be used.<br>• Machinery will be turned off when not in use and will be regularly maintained to limit the noise emissions from the vessel(s).<br>• An Ecological Clerk of Works (ECoW) will be onsite during the SI works to ensure mitigation measures are implemented on-site. The ECoW shall be suitably qualified, and a member of a relevant professional institute.<br>• A suitably qualified and experienced MMO will be onboard for the duration for the geophysical and geotechnical surveys. They will be responsible for advising and ensuring compliance with the Guidance to Manage the Risk to Marine Mammals from Man-made Sound Sources in Irish Waters (DAHG, 2014) for the duration of the SI works. |
| Fisheries and aquaculture | None proposed. |
| Air quality | None proposed. |
| Noise and vibration | • A suitably qualified and experienced MMO will be onboard for the duration for the geophysical and geotechnical surveys. They will be responsible for advising and ensuring compliance with the Guidance to Manage the Risk to Marine Mammals from Man-made Sound Sources in Irish Waters (DAHG, 2014) including the use of soft-start procedures.<br>• Any equipment used should not exceed the modelled equipment broadband levels (see Appendix B, Table 4-1) or band-wise levels for overall levels (Figure 4-13 to Figure 4-22). |
| Landscape and seascape | None proposed. |
| Transport & Traffic (incl. Shipping & Navigation) | None proposed. |
| Cultural heritage | • The geophysical survey as part of the SI works will be undertaken in advance of any intrusive investigations, such as geotechnical survey. The specifications for the survey shall comply with the archaeological requirements of the Underwater Archaeology Unit (UAU) of the NMS and shall be carried out under licence from the NMS. This will allow for the review and assessment of the acquired survey data by a qualified marine archaeologist to allow for the identification of any anomalies of archaeological interest, including those that may be associated with the assets noted above in Section 13.1.2.<br>• Given the paleoenvironmental and submerged prehistoric potential of the Dublin Bay region, following the geotechnical survey, the acquired core logs will be reviewed by a geoarchaeologist as part of a geoarchaeological assessment, and where appropriate, any recommendations for further sampling and assessment agreed in consultation with the UAU of the NMS. |
| Population and human health | None proposed. |
| Major accidents and disasters | • In order to avoid risks of encountering subsea cables/ pipelines and UXO, the geophysical surveys will be undertaken in advance of any geotechnical investigations to enable the locations of sub-sea cables/ pipelines and UXO (if present) to be accurately mapped with an appropriate exclusion zone. The geotechnical borehole and environmental grab sample locations will then be sited away from these cables outside the appropriate exclusion zone. |
| Climate | None proposed. |
| Waste | None proposed. |

| Topic | Mitigation |
|---|---|
| Material assets | • In order to avoid risks of inadvertently interacting with subsea cables/ pipelines, the desk-top research completed to-date will be reviewed and updated prior to undertaking the geophysical surveys. Subsequently, the geophysical surveys will be undertaken in advance of any geotechnical SI works to enable the locations of sub-sea cables/ pipelines to be accurately mapped. The geotechnical SI works, environmental grab sample locations, and metocean devices will then be sited away from these cables to ensure no interaction with the cables and/or pipelines. |
| Interactions | None proposed. |
| Cumulative Effects | • EirGrid will coordinate with other licence holders within and immediately adjacent to the AoI boundary to ensure that no temporal overlap occurs between projects in respect of the geophysical and geotechnical activities of the SI works. |

# 22 CONSIDERATION AND REASONED CONCLUSIONS IN RELATION TO EU DIRECTIVES

## 22.1 EIA Directive (not of a class)

The requirement for EIA of certain projects was established in the EU Directive (85/337/EEC) as amended by Directive 97/11/EC, 2003/35/EC and 2009/31/EC on the assessment of the effects of certain public and private projects on the environment. The Directive and amendments were codified and replaced by 2011/92/EU of the European Parliament and the Council on the assessment of the effects of certain public and private projects on the environment, which was subsequently amended by Directive 2014/52/EU (hereafter these will be referred to as the 'EIA Directive').

The EIA Directive was transposed into Irish legislation through a number of statutory provisions including the Planning and Development Act 2000, as amended (hereafter, the PDA), and the Planning and Development Regulations 2001, as amended (hereafter, the PDR).

The classes of development that require mandatory EIA must be considered in relation to the SI Works. Section 176 of the PDA gives the Minister the power to make regulations to specify prescribed classes of development for EIA. These prescribed classes of development are set out in Part 1 and Part 2 of Schedule 5 of the PDR as per Regulation 93 of Part 10 of the PDR. Furthermore, Section 172 of the PDA provides the legislative basis for mandatory EIA where any one of the following requirements are met:

- the proposed development would be of a Class specified in Part 1 of Schedule 5 of the PDR and it either equals or exceeds a relevant quantity, area or other limit specified in that Part.
- the proposed development would be of a Class specified in Part 1 of Schedule 5 of the PDR where no quantity, area or other limit is specified.
- the proposed development would be of a Class specified in Part 2 of Schedule 5 of the PDR and it either equals or exceeds a relevant quantity, area or other limit specified in that Part.
- the proposed development would be of a Class specified in Part 2 of Schedule 5 of the PDR where no quantity, area or other limit is specified.

If the proposed development (i.e. the SI Works) does not meet any one of the four criteria above, further consideration for EIA is required if the proposed development is a class of development specified in Part 2 of Schedule 5 of the PDR but is less than any relevant quantity, area or other limit specified in that Part. This is termed sub-threshold development.

If the proposed development does not meet any of the four criteria above and it is not a class of development specified in Part 2 of Schedule 5 of the PDR then a sub-threshold assessment is not required and an EIA is not required.

### 22.1.1 Part 1 of Schedule 5 of the PDR

There are no projects listed in Part 1 of Schedule 5 of the PDR that describe the proposed development. Therefore, the proposed development is not of a Class specified in Part 1 of Schedule 5 of the PDR.

### 22.1.2 Part 2 of Schedule 5 of the PDR

There are no projects listed in Part 2 of Schedule 5 of the PDR that describe the proposed development. Therefore, the proposed development is not of a Class specified in Part 2 of Schedule 5 of the PDR.

### 22.1.3 Sub-Threshold for Part 2 of Schedule 5 of the PDR

As the proposed development is not of a Class specified in Part 2 of Schedule 5, no sub-threshold assessment is required. Therefore it is not required to undertake a preliminary examination or a screening for EIA.

### 22.1.4 Conclusion

As the SI Works are not a class of development include in either Part 1 or Part 2 of Schedule 5 of the PDR, an EIA is not required.

## 22.2 WFD Directive

The European Parliament and Council Directive 2000/60/EC, Establishing a Framework for Community Action in the Field of Water Policy, 2000, known as the *Water Framework Directive* (WFD), has been the main law for water protection in Europe. It applies to inland, transitional, and coastal waters as well as groundwaters.

An objective of the WFD is to achieve the protection of aquatic ecology and habitats, drinking resources and bathing waters through river basin management planning and monitoring. This objective is summarised as Good Ecological Status (GES) and Good Ecological Potential (GEP) for artificial or heavily modified waster bodies.

With the mitigation measures proposed as part of the works (see **Section 21**) and considering the limited nature, scale, size, and duration of the proposed SI works, it is considered that there will not be deterioration in WFD GES in any water body and the works will not impact on the achievement or maintenance of WFD GES.

## 22.3 Marine Strategy Framework Directive (MSFD) Directive

The *EU Marine Strategy Framework Directive*, 2008 (MSFD) aims to protect the marine environment and requires the application of an ecosystem-based approach to the management of marine human activities, enabling a sustainable use of marine goods and services. The MSFD aims to ensure clean, healthy, and productive oceans and seas and sustainable use of marine environment for current and future generations.

In order to implement the MSFD each member state is required to:

- Describe what they consider is a clean, healthy, and productive sea i.e., Good Environmental Status;
- Monitor and assess the quality of their seas against Good Environmental Status; and
- Ensure they take appropriate action by 2020 to maintain or achieve Good Environmental Status.

Good Environmental Status is key to compliance with the MSFD. Good Environmental Status is described by 11 Descriptors, namely: biodiversity; non-indigenous species; population of commercial fish/shellfish; elements of marine food webs; eutrophication; sea floor integrity; alteration of hydrographical conditions; contaminants; contaminants in fish and seafood for human consumption; marine litter; and introduction of energy, including underwater noise.

The basic principle of Good Environmental Status is to ensure sustainable use of marine resources. When assessing a project against MSFD requirements, it is assessed on its impact on Good Environmental Status. A project may not improve a Good Environmental Status, but it should not have a permanent negative impact on any of the Good Environmental Status.

Four of the above descriptors are particularly relevant to the SI works, namely:

- D1 Biodiversity;
- D6 Sea floor integrity;
- D10 Marine litter; and
- D11 Introduction of energy, including underwater noise.

With the mitigation measures proposed as part of the works (see **Section 21**) and considering the limited nature, scale, size, and duration of the proposed SI works, it is considered there will not be deterioration in MSFD Good Environmental Status and the works will not impact on achieving or maintaining MSFD Good Environmental Status.

# 23 STAKEHOLDER ENGAGEMENT

## 23.1 Overview

The Powering Up Dublin Programme is set to replace and upgrade five 220 kV circuits across Dublin city and the surrounding areas.

Due to the electricity needs of Dublin, an online replacement is not feasible. It is therefore proposed to replace all the existing circuits primarily on an offline route. The new cables will be more efficient and robust, which will allow the grid to carry more power, enabling the city to continue to develop and thrive and be 'renewable ready'.

Stakeholder engagement for the Powering Up Dublin Programme has been undertaken having regard to EirGrid's approach to consultation as set out in its Framework for Grid Development (refer to Section 23.2 below). As part of the stakeholder engagement, it was made clear that the works would be carried out by ESB and/or its contractors.

## 23.2 EirGrid's Approach to consultation and public participation

EirGrid's approach to consultation and public participation is driven by its commitment to the EirGrid's Framework for Grid Development, an end-to-end six step process for all EirGrid's grid development projects. At each step, a series of activities are carried out to inform, engage, and consult with stakeholders and facilitate their participation in the project development process. See Figure 23-1 below:

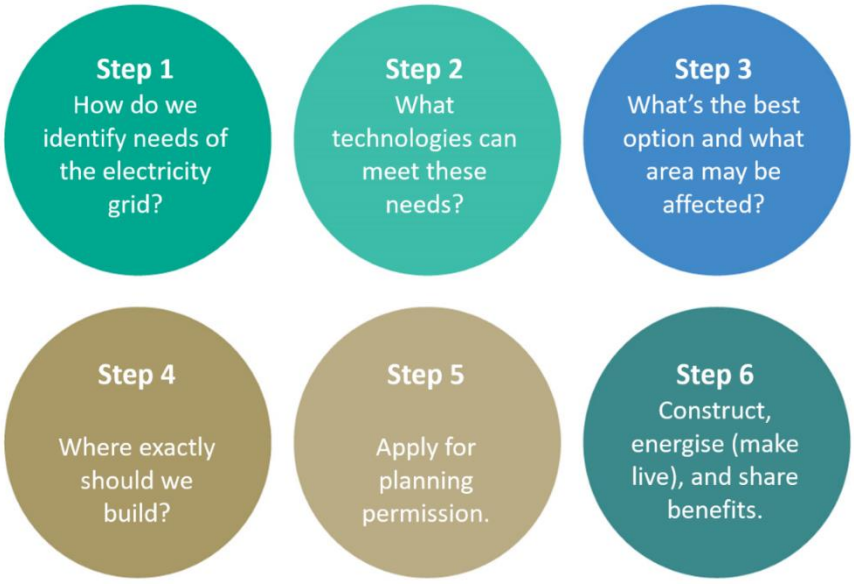



**Figure 23-1 EirGrid's Six Step Grid Development Framework**

## 23.3 Overview of Engagement and Consultation to Date on the Project

For Powering Up Dublin, the requirements (need, location, and technology solution) were known from the outset i.e., underground cable replacement between known substations within Dublin; therefore, the focus quickly moved to Step 4 i.e., where exactly should we build?

A summary table of consultation and engagement activities (focused on CP1146 Carrickmines to Poolbeg project) is set out below. It includes links to various programme and project documentation. Additional detail

relating to consultation and engagement activities is provided in Section 23.5 including consultations and engagement of relevance to marine stakeholders in Dublin Bay.

**Table 23.1 Summary Table of Consultation and Engagement Activities and Publications**

| Year | Month | Engagement Activities | Step in Grid Development Framework |
|---|---|---|---|
| **2022** | **May - Dec** | **Dissemination of Background to Powering Up Programme (Steps 1 – 3). Engagement activities supported by publication of reports and studies, including:** | n/a |
| | Aug | Powering Up Dublin - Strategic Framework for Planning & Environment | |
| | Aug | Study Area | |
| | Dec | EirGrid Dublin Fluid Filled Cables Replacement – Feasibility Study | |
| **2023** | **28th March – 23rd May** | **8-week non-statutory public consultation on the 12 Emerging Best Performing Route Options for the Powering Up Programme. Engagement activities supported by the publication of reports and studies, specifically relating to Carrickmines to Poolbeg circuit:**<br><br>Powering Up Dublin Brochure<br>Carrickmines to Poolbeg Route Options Assessment Technical Report<br>Powering Up Dublin Step 4 Public Consultation Findings Report | **Step 4(a)** |
| **2024** | **January** | **Announcement of Best Performing Routes for three circuits including the Carrickmines to Poolbeg circuit, supported by the publication of reports and studies:**<br><br>• Poolbeg Carrickmines Best Performing Option Brochure<br>• Poolbeg Carrickmines Best Performing Option-Step 4B Report | **Step 4(b)** |
| | **Feb – ongoing** | Engagement and consultation with stakeholders including MARA, Dublin Port, Dublin City Council, Dun Laoghaire-Rathdown County Council, offshore developers with projects / interests in the South Dublin Bay Area (e.g., Codling), NPWS and NMS, and other maritime stakeholders as been carried out to date, and engagement with these stakeholders will be ongoing throughout the remaining stages of the project design and development. | |

A summary of the public consultation events and activities is provided in the infographics presented as Figure 23-2 and Figure 23-3.

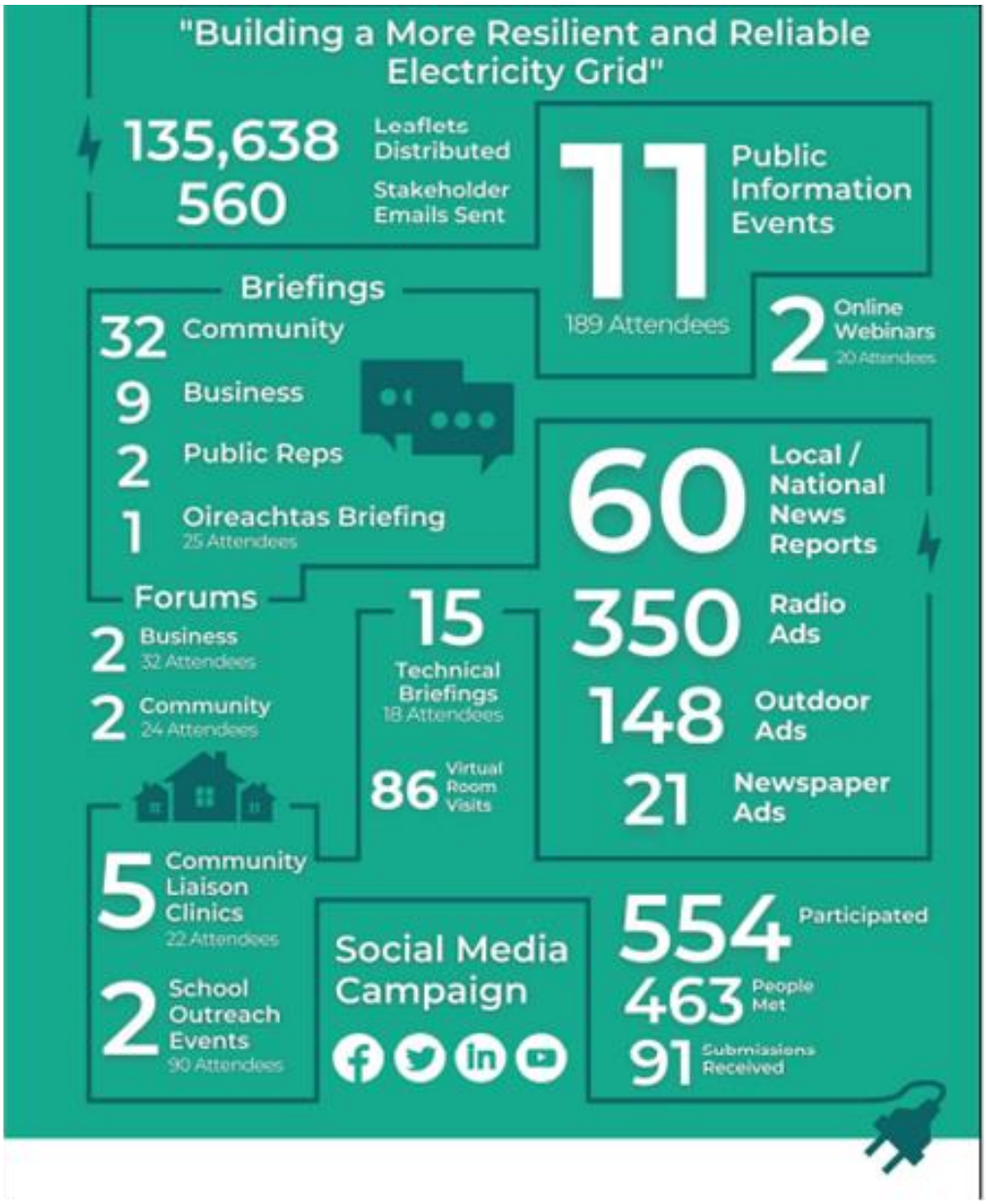



**Figure 23-2: Emerging Best Performing Options Information Events (March to May 2023) (including Carrickmines to Poolbeg Project (CP1416))**


**Figure 23-3: Best Performing Options Information Events for PUD (February – March 2024)**

**(including Carrickmines to Poolbeg Project (CP1416))**

## 23.4 General Project Stakeholder Engagement Actions in Step 4

The objective in Step 4 is to decide where exactly where to build. In the case of PUD, this meant developing detailed options and deciding on the replacement cable routes linking the various substations.

In advance, the project team disseminated background information relating to Steps 1 – 3. The means of engagement included:

- Establishing community, business, and stakeholders' forums;
- Delivering a number of public representative and Oireachtas briefings.
- Consultation and information events; and
- Updates to stakeholders and ongoing meetings with schools, community groups and stakeholders.

### 23.4.1 Public and Stakeholder Engagement Activity in 2022

General Project Stakeholder Engagement Actions which took place in 2022 included:

- In late **May and June 2022**, three publicly accessible informational webinars were held. These gave context about the Powering Up Dublin project.
- In **October and November 2022**, five Dublin Energy Citizens Roadshows were hosted. The events provided information on how EirGrid plans to future-proof the electricity grid in Dublin. It included discussions with our partners ESB Networks, SEAI and Codema. We discussed sustainable energy communities, microgeneration, and district heating.
- In **November 2022,** the first Business Forum and Community Forums took place. These forums take place 3 times a year and coincide with project updates.

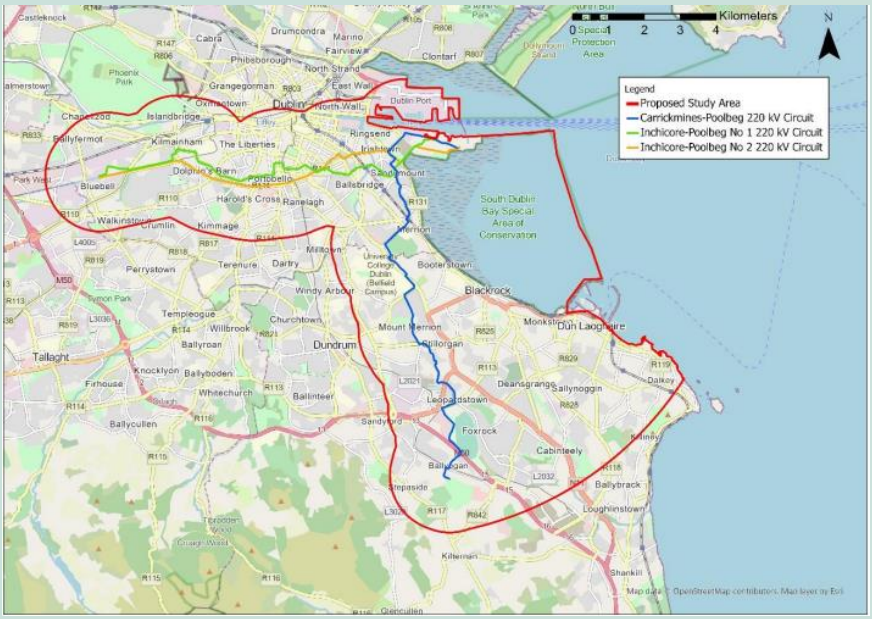
**Marine Focus:** The study area for PUD was published in Q3 2022 and included an offshore section comprising the South Dublin Bay i.e., the offshore area south of the River Liffey in Co. Dublin and extending from the South Wall to the west pier at Dun Laoghaire.

Marine related matters and stakeholders have therefore been an important consideration for the PUD Programme at the outset.

**Marine Focus:** The publication of *EirGrid Dublin Fluid Filled Cable Replacement – Feasibility Report* in December 2022 included an Offshore Cable Constraints Feasibility Assessment (Chapter 5). The key aims included:

- Identify potential feasible landfall areas and submarine cable options within the study area to connect south Dublin with the substation at Poolbeg.
- Outline technically feasible options and assess the likely installation methods which reduce impacts on mudflats.
- Undertake a high-level evaluation of environmental and social constraints;
- Outline high level Appropriate Assessment (Habitat Directive) and consenting considerations; and
- Produce a risk matrix for the technical, environmental, social and deliverability of potential options

The analysis included information regarding the environmental and social constraints relating to the South Dublin Bay area.



### 23.4.2 Public and Stakeholder Engagement Activity in 2023

General Project Stakeholder Engagement Actions which took place in 2023 included:

- In **March 2023** the second meetings for the Business Forum and Community Forum took place.
- In **April 2023** the third meetings for the Business Forum and Community Forum took place.

In **March, April, and May 2023** EirGrid presented the 12 Emerging Best Performing Route Options to the public and stakeholders. Public consultation ran for **8-weeks** between Tuesday 28 March to Tuesday 23 May 2023. Multiple methods were made available for stakeholders to send their feedback: email, post, social media, online survey, in-person events (see below) or engaging with one of the dedicated PUD Community Liaison Officers.

This first public consultation sought views on the 12 Route Options presented, the overall PUD project, any additional information that should be considered in the identification of preferred routes options and information that could inform at the scheduling and construction stages of the project.

A series of engagement collateral was developed to support the consultation, including:

- A dedicated *Powering Up Dublin Project Website* (hosted within the EirGrid website) which included maps of the 12 potential routes, a consultation information brochure link to the consultation survey, link to the portal to make an online submission; and relevant email address and contact information.
- *A Virtual Consultation Room* which included all the information displayed at the in-person events was developed and made available as a link on the project webpage as part of the consultation.
- A *Public Consultation Leaflet* was distributed to over 130,000 homes. This included over 28,000 leaflets in the Carrickmines to Poolbeg area.

Several Public Information Events and Community Liaison Clinics (CLC) were also held across the city. Those held within the Carrickmines to Poolbeg study area, were:

| Location | Dates | Times |
|---|---|---|
| Sandymount Community Centre | Wed 12 April | 1pm to 8pm |
| Ballyogan Parish Centre, Ballyogan | Wed 19 April | 1pm to 8pm |
| Stillorgan Park Hotel | Thurs 11 May | 1pm to 8pm |
| Clanna Gael Fontenoy GAA, Ringsend | Wed 17 May | 1pm to 8pm |
| Pembrook Library, Ballsbridge | Wed 17 May | 12pm to 4pm |
| Mounttown Community Facility, Monkstown | Tue 2 May | 12pm to 4pm |

**Marine Focus:**
One of the 12 options presented to the public and stakeholders during the 8-week consultation period was an offshore option for the Carrickmines to Poolbeg route linking Blackrock Park to Poolbeg, accross the south Dublin Bay area. Consultation material and Public Information Events and Community Liaison Clinics (CLC) all presented information relating to the offshore route.

In **October 2023** EirGrid published its Powering Up Dublin Step 4 Public Consultation Findings Report. It summarises feedback, responses and comments received relating to the first non-statutory public consultation on the first phase of the Powering Up Dublin (PUD) Project.

### 23.4.3 Public and Stakeholder Engagement Activity in 2024

In **February 2024** EirGrid announced the Best Performing routes for three cable circuits as part of the PUD Programme, following the extensive public consultations process. This included the Best Performing Option for the Poolbeg to Carrickmines circuit, which included the section routed across the south Dublin Bay from Blackrock Park to Poolbeg.

**Marine Focus:**
A significant portion of the Best Performing Option for the Poolbeg to Carrickmines cable route was identified to be placed offshore.

Since February, engagement and consultation with various stakeholders has been ongoing. EirGrid and ESB has been working with other utilities and public service providers through the Dublin Infrastructure Forum, as well as Business and Community Forums, to share information and encourage a wide range of feedback for PUD and the Poolbeg to Carrickmines circuit. The CLO team responds to enquires from all interested parties relating to the project.

**Marine Focus:**
Engagement and consultation has been carried out to date with MARA, Dublin Port, Dublin City Council, Dun Laoghaire-Rathdown County Council, offshore developers with projects / interests in the South Dublin Bay Area (e.g., Codling), NPWS and NMS, and other maritime stakeholders, and engagement with these stakeholders will be ongoing throughout the remaining stages of the project design and development.

## 23.5 Specific Stakeholder Briefings

Since 2023, has undertaken pre consultation briefings to all local authority executive, elected members and chambers of commerce. The EirGrid public engagement team has also delivered a series of timetabled and requested briefings/follow up meetings:

- On Wednesday 29 March 2023 an Oireachtas briefing was delivered following an open invite to all Oireachtas members with a total of 25 attendees resulting.
- The PUD Community Liaison Officers made themselves available at request to meet and/or brief stakeholders throughout the consultation period and continue to do so post its closing.
- In total 32 community meetings were held (requested by individual stakeholders), nine meetings were held with members of the business community and two public representatives were met at their request. Dates of the Public Information Events and CLCs are provided in section 1.4 above.
- Technical briefings were delivered by members of the project team on 15 occasions to relevant stakeholders with 18 attendees across the 15 meetings, this included Dublin Port (various dates), Dublin City Council (various dates), and Dun Laoghaire Rathdown County Council (various dates).

The EirGrid public engagement team continues to be proactive engaging with all stakeholders and facilitating briefings with all interested parties including residents and businesses along the route, public representatives, and community organisations.

## 23.6 Stakeholder Engagement as part of the MUL Process

To inform a future development consent for the subsea cable across South Dublin Bay (the subject of this MAC application), EirGrid has applied to MARA for a Marine Usage Licence (MUL). Stakeholder discussions undertaken / to be undertaken in respect of the MUL are summarised below.

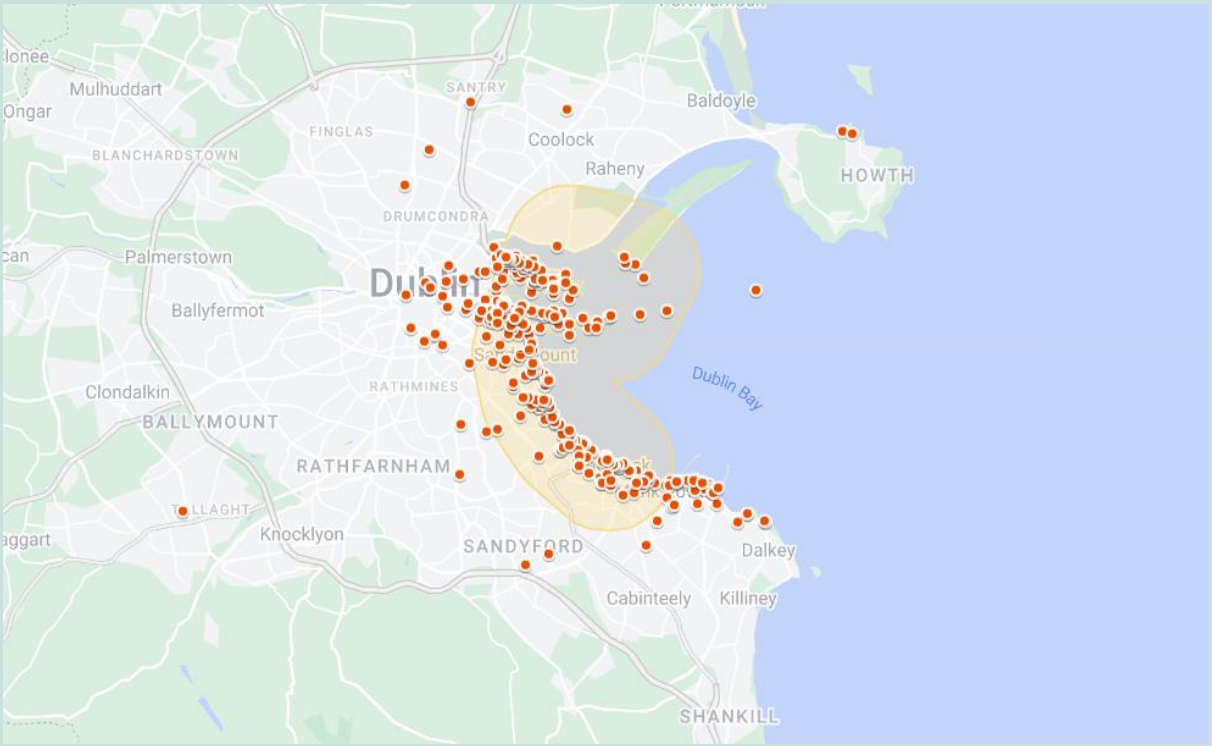
**Marine Stakeholder Consultation (in advance of the MUL application / during assessment of MUL)**
As part of the wider consultation on the PUD EirGrid has engaged in ongoing consultation with Dublin Port, Dublin City Council and Dun Laoghaire-Rathdown County Council in respect of the Best Performing Route Option for the Carrickmines to Poolbeg circuit including the section which proposes to cross Dublin Bay.

Specific consultation relating to the nearshore requirements, including both MUL and MAC, and future development consent requirements has also been initiated with:

- Dublin City Council
- Dun Laoghaire-Rathdown County Council (including Harbour Master)
- Codling
- Fishery interests

EirGrid has requested to meet with NPWS and Dublin Bay Underwater Archaeology. These stakeholders will be informed of the lodgement of the MUL licence application, kept informed on the progress of the project and in due course pre-marine survey activities.

In terms of broader consultation with marine stakeholders, EirGrid undertook a specific marine stakeholder mapping exercise. It identifies 345 stakeholders representing a range of marine interests groups from businesses, and environmental, leisure, sporting interests to also include stakeholders located within 2km of the coast. These stakeholders have been mapped geographically and cross referenced against the wider PUD stakeholder database. These stakeholders will be informed on the progress of the project and consulted with in due course in relation to the MUL and pre-marine survey activities.




**Marine Stakeholder Consultation (post decision on MUL (if granted))**

- **Pre-Marine Survey Activities**
  EirGrid will provide updates to marine stakeholders in advance of marine survey activities.
- **During Marine Survey Activities**
  EirGrid will provide updates to marine stakeholders during survey activities relating to the type of surveys being undertaken and their duration.
- **Post Marine Survey Activities**
  The findings of the surveys will inform the application for development consent to be made to An Bord Pleanála. This application will be subject to statutory consultation including marine stakeholders.

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# Appendix A
# Drawings

718695
733917

7248
7339

Irishtown

Sandymount

R118

R131

824

Merrion

PRIESTHOUSE

Booterstown

R138

WILLIAMSTOWN

R118

INTAKE

Area A - 2101 Ha

MERRION

BLACKROCK

N31

SEAPOINT or TEMPLEHILL

MOUNT MERRION

GALLARY

718692,
728793

N31

WOODLAND

Mount Merrion

R82

R119

N31

7248
7287

0 0.25 0.5 1
Kilometres

# Legend

Maritime Usage Licence Area

Private Foreshore – Folio DN44335F

High Water Mark (HWM)

Where the licence area adjoins or abuts the land the High Water Mark as defined by the Chief Boundary Surveyor is the boundary of the area.

**MARA File Reference No:**
MUL240010

N

Prepared by:
[redacted]
Chartered Engineer


**Client**
EirGrid
Powering Up Dublin

**Carrickmines to Poolbeg Cable Replacement**

**Title**

## Proposed Licence Area Map


RPS
A TETRA TECH COMPANY
West Pier Business Campus
Dun Laoghaire
Co Dublin, Ireland
[redacted]


**Issue Details**

**File Identifier:**
IE000451-RPS-00-XX-DR-C-DG2502

| Status: | Rev: | Model File Identifier: |
|---|---|---|
| S5 | P01 | IE000451-RPS-00-XX-DR- |

**Drawn:** [redacted]
**Date:** 22/10/2024
**Checked:**
**Scale:** 1:20,000 @A3
**Approved:**
**Projection:** ITM

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718695, 733917

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718692, 728793

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Irishtown
Sandymount
Merrion
PRIESTHOUSE
Booterstown
WILLIAMSTOWN
INTAKE
MERRION
BLACKROCK
SEAPOINT or TEMPLEHILL
Monkstown
DUNLEARY
Mount Merrion
WOODLAND
R118
R131
R138
R825
R119
N31

0 0.25 0.5 1 Kilometres

## Legend

- Maritime Usage Licence Area
- Offshore Cable Route - 500m wide corridor (250m Buffer)
- High Water Mark (HWM)
- Indicative Borehole Locations
- Indicative Vibrocore & CPT Locations

Site Investigation locations shown are indicative only.

**MARA File Reference No:**
MUL240010

Prepared by:
[redacted]
Chartered Engineer

N


Client
EirGrid
Powering Up Dublin

**CP1146 - Carrickmines to Poolbeg Circuit**

Title

# Maritime Usage Licence Indicative Geotechnical Survey Locations


RPS A TETRA TECH COMPANY
West Pier Business Campus, Dun Laoghaire, Co Dublin, Ireland.
[redacted]
W rpsgroup.com/ireland


**Issue Details**

**File Identifier:**
IE000451-RPS-00-XX-DR-C-DG2503

| Status: | Rev: | Model File Identifier: |
|---|---|---|
| S5 | P01 | IE000451-RPS-00-XX-DR-C-DG2503 |

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| Drawn: | [redacted] | Date: | 22/10/2024 |
| Checked: | | Scale: | 1:20,000 @A3 |
| Approved: | | Projection: | ITM |

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718695, 733917

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718692, 728793

724831, 728795

Irishtown

Sandymount

Merrion

PRIESTHOUSE

Booterstown

WILLIAMSTOWN

INTAKE

MERRION

BLACKROCK

SEAPOINT or TEMPLEHILL

WOODLAND

Monkstown

DUNLEARY

Mount Merrion

R138

R118

R131

R824

R825

R119

N31

0 0.25 0.5 1 Kilometres

## Legend

- Maritime Usage Licence Area
- Offhsore Cable Route - 250m Buffer
- High Water Mark (HWM)
- Indicative Benthic Sampling Locations

Benthic Sample locations shown are indicative only.

**MARA File Reference No:**
MUL240010

N

Prepared by:
[redacted]
Chartered Engineer


**Client**
EirGrid
Powering Up Dublin

**CP1146 - Carrickmines to Poolbeg Circuit**

**Title**

# Maritime Usage Licence Indicative Benthic Sample Locations

RPS A TETRA TECH COMPANY
West Pier
Business Campus,
Dun Laoghaire,
Co Dublin, Ireland.
[redacted]
www.rpsgroup.com/ireland

## Issue Details

**File Identifier:**
IE000451-RPS-00-XX-DR-C-DG2504

| Status: | Rev: | Model File Identifier: |
|---|---|---|
| S5 | P01 | IE000451-RPS-00-XX-DR-C-DG2503 |

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| Checked: | Scale: 1:20,000 @A3 |
| Approved: | Projection: ITM |

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724831, 733915

718692, 728793

724831, 728795

Irishtown

Sandymount

Merrion

Booterstown

PRIESTHOUSE

WILLIAMSTOWN

INTAKE

MERRION

BLACKROCK

SEAPOINT or TEMPLEHILL

WOODLAND

Mount Merrion

Monkstown

DUNLEARY

R118

R131

R138

R825

R119

N31

0 0.25 0.5 1 Kilometres

# Legend

- Acoustic Doppler Current Profiler Indicative Locations
- Offhsore Cable Route - 250m Buffer
- Maritime Usage Licence Area
- High Water Mark (HWM)

ADCP deployment locations shown are indicative only.

**MARA File Reference No:**
MUL240010

Prepared by:
[redacted]

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**Client**
EirGrid
Powering Up Dublin

**CP1146 - Carrickmines to Poolbeg Circuit**

**Title**

## Maritime Usage Licence Indicative ADCP Locations

RPS A TETRA TECH COMPANY
West Pier
Business Campus,
Dun Laoghaire,
Co Dublin, Ireland.
[redacted]

**Issue Details**

**File Identifier:**
IE000451-RPS-00-XX-DR-C-DG2505

| Status: | Rev: | Model File Identifier: |
|---|---|---|
| S5 | P01 | IE000451-RPS-00-XX-DR-C-DG2505 |

| | |
|---|---|
| Drawn: [redacted] | Date: 22/10/2024 |
| Checked: | Scale: 1:20,000 @A3 |
| Approved: | Projection: ITM |

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# Appendix B
# Subsea Noise Technical Report

# CP1146 CARRICKMINES TO POOLBEG PROJECT

## Subsea Noise Technical Report

CP1146-RPS-00-XX-RP-N-RP1021
A1 C01
23 October 2024

## Document status

| Version | Purpose of document | Authored by | Reviewed by | Approved by | Review date |
|---|---|---|---|---|---|
| S3 P01 | Draft for Client Review | [redacted] | | | 18/07/2024 |
| S5 P01 | Draft | | | | 15/08/2024 |
| S5 P02 | Additional Client comments | | | | 12/09/2024 |
| A1 C01 | Final | | | | 23/10/2024 |

## Approval for issue

[redacted] 23 October 2024



| Prepared by: | Prepared for: |
|---|---|
| RPS | EirGrid |

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The Registered office of each of the above companies is West Pier Business Campus, Dun Laoghaire, Co. Dublin, A96 N6T7

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# Glossary

| Term | Meaning |
|---|---|
| Decibel (dB) | A relative scale most commonly used for reporting levels of sound. The actual sound measurement is compared to a fixed reference level and the "decibel" value is defined to be $10 \cdot \log_{10}$(“actual”/”reference”), where (“actual”/”reference”) is a power ratio. The standard reference for underwater sound pressure is 1 micro-Pascal (µPa), while 20 micro-Pascals is the standard for airborne sound. The dB symbol is often followed by a second symbol identifying the specific reference value (i.e. re 1 µPa). |
| Grazing angle | A glancing angle of incidence (the angle between a ray incident on a surface and the line perpendicular to the surface). |
| Permanent Threshold Shift (PTS) | A total or partial permanent loss of hearing caused by some kind of acoustic trauma. PTS results in irreversible damage to the sensory hair cells of the ear and thus, a permanent reduction of hearing acuity. |
| Temporary Threshold Shift (TTS) | Temporary loss of hearing as a result of exposure to sound over time. Exposure to high levels of sound over relatively short time periods will cause the same amount of TTS as exposure to lower levels of sound over longer time periods. The mechanisms underlying TTS are not well understood, but there may be some temporary damage to the sensory cells. The duration of TTS varies depending on the nature of the stimulus, but there is generally recovery of full hearing over time. |
| Sound Exposure Level (SEL) | The cumulative sound energy in an event, formally: “ten times the base-ten logarithm of the integral of the squared pressures divided by the reference pressure squared”.<br>Equal to the often seen “$L_E$” or “dB SEL” quantity.<br>Defined in: ISO 18405:2017, 3.2.1.5 |
| Sound Pressure level (SPL) | The average sound energy over a specified period of time, formally: “ten times the base-ten logarithm of the arithmetic mean of the squared pressures divided by the squared reference pressure”.<br>Equal to the deprecated “RMS level”, “$dB_{rms}$” and to $L_{eq}$ if the period is equal to the whole duration of an event.<br>Defined in ISO 18405:2017, 3.2.1.1 |
| Peak Level, Peak Pressure Level ($L_P$) | The maximal sound pressure level of an event, formally: “ten times the base-ten logarithm of the maximal squared pressure divided by the reference pressure squared” or “twenty times the base-ten logarithm of the peak sound pressure divided by the reference pressure, where the peak sound pressure is the maximal deviation from ambient pressure”.<br>Defined in ISO 18405:2017, 3.2.2.1 |
| Source Level (SL) | Taken here to mean the level (SEL/SPL/$L_P$) at 1 meter range. If not otherwise stated, it is assumed the source is omnidirectional (equal level in all directions). For sources larger than 1 m in radius, the Source Level is back-calculated to 1 m. |
| Decidecade | Used to refer to a step in frequency, similar to “one-third-octave”, defined as a ratio of $10^{0.1} \approx 1.259$ (one third octave is $21/3 \approx 1.260$). Used interchangeably with “3rd octave”. |
| Noise | Sound that is irrelevant, unwanted or harmful to the organism(s) in question. Noise is often detrimental, but not necessarily so. |
| Kurtosis | A statistical measure of “peakedness” of a distribution (of e.g. pressure values in a sound pulse).<br>Defined in ISO 5479:1997 |

# Acronyms

| Term | Meaning |
|---|---|
| ADD | Acoustic Deterrent Device |
| ADCP | Acoustic Doppler Current Profiler |
| LF | Low Frequency (Cetaceans) |
| HF | High Frequency (Cetaceans) |
| VHF | Very High Frequency (Cetaceans) |
| MF | Mid Frequency (Cetaceans) – **DEPRECATED** only for reference to NOAA/NMFS 2018 groups |
| OW/OCW | Otariid pinnipeds/Other Carnivores in water (refers to the same weighting and animal groups) |
| PW/PCW | Phocid pinnipeds |
| NMFS | National Marine Fisheries Service |
| RMS | Root Mean Square |
| SEL | Sound Exposure Level, [dB] |
| SPL | Sound Pressure Level, [dB] |
| $L_P$ | Peak Pressure Level, [dB] |
| SL | Source Level [dB] |
| TTS | Temporary Threshold Shift |
| PTS | Permanent Threshold Shift |
| SSS | Side Scan Sonar – Towed sonar device typically positioned 10-15 m above the sediment. Its main purpose is to characterise the sediment surface texture. |
| MBES | Multibeam Echosounder – Uses multiple narrow beams to measure the depth across a swath below the vessel. |
| SBP | Sub-Bottom Profiler – Any device/system that uses acoustics to record echoes from within the sediment. Examples include seismic arrays, sparkers, boomers, chirpers, pingers and associated recorder array. |
| USBL | Ultra Short Baseline Array – Small array of at least 4 hydrophones and a pinger to measure positions of equipment under water. |
| UHRS | Ultra High-Resolution Seismic survey – Usually a sparker driven sub-bottom characterisation system. |
| c. | Circa, i.e., approximately |
| CPT | Cone Penetration Testing – insertion/pushing of rod with standardised, cone-shaped front into sediment to measure various characteristics of the sediment. |

# Units

| Unit | Description |
|---|---|
| dB | Decibel (Sound) |
| Hz | Hertz (Frequency) |
| kHz | Kilohertz (Frequency) |
| kJ | Kilojoule (Energy) |
| km | Kilometre (Distance) |
| $km^2$ | Kilometre squared (Area) |
| m | Metre |
| ms | Millisecond ($10^{-3}$ seconds) (Time) |
| $ms^{-1}$ or m/s | Metres per second (Velocity or speed) |
| kn | Knots (speed), 1 kn = 0.514 m/s, 1 m/s = 1.944 kn |
| µPa | Micro Pascal |
| Pa | Pascal (Pressure: newton/$m^2$) |
| psu | Practical Salinity Units (parts per thousand of equivalent salt in seawater, weight-based) |
| $kg/m^3$ | Specific density (of water, sediment or air) |
| Z | Acoustic impedance [$kg/(m^2 \cdot s)$ or $(Pa \cdot s)/m^3$] |

Units will generally be enclosed in square brackets e.g.: “[m/s]”

# 1 INTRODUCTION

The CP1146 Carrickmines to Poolbeg project is a proposed new underground electricity cable from the Carrickmines 220 kV substation to the Poolbeg 220 kV substation and includes a section of marine cable. The marine section is located between Blackrock Park and Shelley Banks car-park on the Poolbeg peninsula, Co. Dublin

This Subsea Noise Technical Report presents the results of a desktop study considering the potential effects of underwater noise on the marine environment from the proposed geophysical and geotechnical surveys in Dublin Bay (hereafter referred to as "SI Works") for the CP1146 Carrickmines to Poolbeg project. The other surveys to be undertaken as part of the SI Works, have not been modelled as they will either not result in underwater noise or will not have any appreciable effect on receptors, e.g. the metocean device (ADCP) operates at frequencies well above the hearing ranges of sensitive receptors.

The aim of the SI Works is to acquire data to a high quality and specification for the site. The SI Works covers an area of 2101 Ha within Dublin Bay between the south side of the Poolbeg peninsula and Dun Laoghaire West Pier. The sediment within the survey area is mostly silty to sandy and water properties in the area are relatively stable given the lack of major river outflows and a modest tidal range. Geophysical and geotechnical surveys such as those proposed for the SI Works use equipment that generate loud and potentially injurious noise to marine life.

Sound is readily transmitted in the underwater environment and there is potential for the sound emissions from anthropogenic sources to adversely affect marine life such as marine mammals or fish. At close ranges from a noise source with high noise levels, permanent or temporary hearing damage may occur to marine species, while at a very close range gross physical trauma is possible. At long ranges (several kilometres) the introduction of any additional noise could, for the duration of the activity, potentially cause behavioural changes, for example to the ability of species to communicate and to determine the presence of predators, food, underwater features, and obstructions.

This report provides an overview of the potential effects due to underwater noise from the SI Works on the surrounding marine environment based on the Southall et al. 2019 and Popper et al. 2014 frameworks for assessing impact from noise on marine mammals and fish.

Consequently, the primary purpose of the underwater noise assessment is to predict the likely range of onset for potential physiological and behavioural effects due to increased anthropogenic noise as a result of the SI Works.

## 1.1 Statement of Authority

[redacted] s a Senior Project Scientist with RPS. He holds a master's degree in biology, biosonar and marine mammal hearing from University of Southern Denmark. [redacted] has over 11 years' experience as a marine biologist and over 9 years' experience with underwater noise modelling and marine noise impact assessments. [redacted] has co-developed commercially available underwater noise modelling software, as well developed multiple source models for e.g. impact piling, seismic airgun arrays and sonars.

[redacted] is an Associate in Acoustics with RPS. He holds a BA BAI in Mechanical Engineering from Trinity College Dublin (2004) and a PhD in Acoustics and Vibration from Trinity College Dublin (2008). He is a Chartered Engineer with Engineers Ireland. [redacted] has 20 years' experience in environmental projects including planning applications and environmental impact assessments for a wide range of strategic infrastructure projects.

[redacted] is Technical Director in the Environmental Services Business Unit in RPS. He has over 24 years' experience. He holds an honours degree in Civil Engineering (B.E.) from NUI, Galway, a postgraduate diploma in Environmental Sustainability from NUI, Galway, and a Master's in Business Studies from the Irish Management Institute/ UCC. [redacted] is also a Chartered Engineer and Project Management Professional with the Project Management Institute (PMI-PMP). He has managed the delivery of numerous environmental projects including marine and terrestrial projects that have required environmental impact assessment, appropriate assessment, and Annex IV species reports.

# 2 ASSESSMENT CRITERIA

## 2.1 General

To determine the potential spatial range of injury and disturbance, assessment criteria have been developed based on a review of available evidence including national and international guidance and scientific literature. The following sections summarise the relevant assessment criteria and describe the evidence base used to derive them.

Underwater noise has the potential to affect marine life in different ways depending on its noise level and characteristics. Assessment criteria generally separate sound into two distinct types, as follows:

- **Impulsive sounds** which are typically transient, momentary (less than one second), broadband, and consist of high peak sound pressure with rapid rise time and rapid decay (ANSI, 2005; ANSI, 1986; NIOSH, 1998). This category includes sound sources such as seismic surveys, impact piling and underwater explosions. Additionally included here are sounds under 1 second in duration with a weighted kurtosis over 40 (see note below*).
- **Non-impulsive** (and continuous) sounds which can be broadband, narrowband or tonal, momentary, brief or prolonged, continuous or intermittent and typically do not have a high peak sound pressure with rapid rise/decay time that impulsive sounds do (ANSI, 1995; NIOSH, 1998).This category includes sound sources such as continuous vibro-piling, running machinery, some sonar equipment and vessels. Additionally included here are sounds over 1 second in duration with a weighted kurtosis under 40 (see note below*).

  * Note that the European Guidance: “Monitoring Guidance for Underwater Noise in European Seas, Part II: Monitoring Guidance Specifications” (MSFD Technical Subgroup on Underwater Noise, 2014) includes sonar as impulsive sources (see Section 2.2). However, the guidance suggests that *“all loud sounds of duration less than 10 seconds should be included”* as impulsive.

  This contradicts research on impact from impulsive sounds suggesting that a limit for “impulsiveness” can be set at a kurtosis[1] of 40 (Martin, et al., 2020). See examples in Appendix A, Impulsiveness.

  This latter criterion has been used for classification of impulsive versus non-impulsive for sonars and similar sources. The justification for departing from the MSFD criterion is that the Southall et al. 2019 and the Popper et al. 2014 framework limits are based on the narrower definition of impulsive as given in “Impulsive sounds” above.

There is scope for some sounds to be classified as both impulsive and non-impulsive, depending on the criteria applied. Examples are pulses from sonar-like sources that can contain very rapid rise times (<0.5 ms), sweep a large frequency range and have high kurtosis. However, given that the scientific work carried out to identify impulsive thresholds were done with “pure” impulses (from a near instantaneous event), sonar-like sounds are sometimes not included in this, impulsive, category. This argument ignores that sounds used for establishing the non-impulsive thresholds (often narrowband slowly[2] rising pulses), are markedly less impulsive (lower kurtosis, narrower bandwidth) than what is sometimes seen in pulses from sonar-like sources and are thus also not representative for all sonar-like pulses.

Given impulsive sound’s tendency to become less impulsive with increased range, a minimal range can be established where the noise is no longer impulsive (here kurtosis <40 is used) (Appendix A, Impulsiveness). This range is established using raytracing, but as the effect varies with exact depth and range of source and receiver, the transition range to non-impulsive used for exposure modelling is doubled from the modelled range where kurtosis goes below 40.

The acoustic assessment criteria for marine mammals and fish in this report has followed the latest international guidance (based on the best available scientific information), that are widely accepted for assessments in the UK, Europe and worldwide (Southall, et al., 2019; Popper, et al., 2014).

[1] Statistical measure of the asymmetry of a probability distribution.

[2] Slowly in this context is >10 ms – slow relative to the integration time of the auditory system of marine mammals.

## 2.2 Effects on Marine Animals

Underwater noise has the potential to affect marine life in different ways depending on its noise level and characteristics. Richardson *et al.* (1995) defined four zones of noise influence which vary with distance from the source and level, to which an additional zone has been added "zone of temporary hearing loss". These are:

- **The zone of audibility**: This is defined as the area within which the animal can detect the sound. Audibility itself does not implicitly mean that the sound will affect the animal.
- **The zone of masking**: This is defined as the area within which sound can interfere with the detection of other sounds such as communication or echolocation clicks. This zone is very hard to estimate due to a paucity of data relating to how animals detect sound in relation to masking levels (for example, humans can hear tones well below the numeric value of the overall sound level). Continuous sounds will generally have a greater masking potential than intermittent sound due to the latter providing some relative quiet between sounds. Masking only occurs if there is near-overlap in sound and signal, such that a loud sound at e.g., 1000 Hz will not be able to mask a signal at 10,000 Hz[3].
- **The zone of responsiveness**: This is defined as the area within which the animal responds either behaviourally or physiologically. The zone of responsiveness is usually smaller than the zone of audibility because, as stated previously, audibility does not necessarily evoke a reaction. For most species there is very little data on response, but for species like harbour porpoise there exists several studies showing a relationship between received level and probability of response (Graham IM, 2019; Sarnoci´nska J, 2020; BOOTH, 2017; Benhemma-Le Gall A, 2021).
- **The zone of temporary hearing loss**: The area where the sound level is sufficient to cause the auditory system to lose sensitivity temporarily, causing loss of "acoustic habitat": the volume of water that can be sensed acoustically by the animal. This hearing loss is typically classified as Temporary Threshold Shift (TTS).
- **The zone of injury / permanent hearing loss**: This is the area where the sound level is sufficient to cause permanent hearing loss in an animal. This hearing loss is typically classified as Permanent Threshold Shift (PTS). At even closer ranges, and for very high intensity sound sources (e.g., underwater explosions), physical trauma or acute mortal injuries are possible.

For this study, it is the zones of injury (PTS) that are of primary interest, along with estimates of behavioural impact ranges. To determine the potential spatial range of injury and behavioural change, a review has been undertaken of available evidence, including international guidance and scientific literature. The following sections summarise the relevant thresholds for onset of effects and describe the evidence base used to derive them.

### 2.2.1 Irish Guidance Interpretation

We note that the DAHG "Guidance to Manage the Risk to Marine Mammals from Man-made Sound Sources in Irish Waters" 2014 (Department of Arts, Heritage and the Gealtacht, 2014) contains the following statement:

*"It is therefore considered that anthropogenic sound sources with the potential to induce TTS in a receiving marine mammal contain the potential for both (a) disturbance, and (b) injury to the animal."*

This states that TTS constitutes an injury and should thus be the main assessment criteria[4]. However, the guidance goes on to specify the use of thresholds from a 2007 publication (Brandon L. Southall, 2007) which has since been superseded (by (Southall, et al., 2019)) and no longer represents best available science, nor reflects best practice internationally. Thus, the following excerpt from the guidance is relevant:

[3] The exact limit of how near a noise can get to the signal in frequency before causing masking will depend on the receivers' auditory frequency resolution ability, but for most practical applications noise and signal frequencies will need to be within 1/3rd octave to start to have a masking effect.

[4] Injury being the qualifying limit in the Irish Wildlife Act 1976, section 23, 5c : https://www.irishstatutebook.ie/eli/1976/act/39/enacted/en/print#sec23

*"The document will be subject to periodic review to allow its efficacy to be reassessed, to consider new scientific findings and incorporate further developments in best practice."*

As there has been no such update to date, but the guidance clearly states intent, we have applied the latest guidance, reflecting the current best available method for assessing impact from noise on marine mammals.

## 2.3 Thresholds for Marine mammals

The zone of injury in this study is classified as the distance over which a fleeing marine mammal can suffer PTS leading to non-reversible auditory injury. Injury thresholds are based on a dual criteria approach using both un-weighted $L_P$ (maximal instantaneous SPL) and marine mammal hearing weighted SEL. The hearing weighting function is designed to represent the sensitivity for each group within which acoustic exposures can have auditory effects. The categories include:

- **Low Frequency (LF) cetaceans**: Marine mammal species such as baleen whales (e.g. minke whale *Balaenoptera acutorostrata*).
- **High Frequency (HF) cetaceans**: Marine mammal species such as dolphins, toothed whales, beaked whales and bottlenose whales (e.g., bottlenose dolphin *Tursiops truncatus* and white-beaked dolphin *Lagenorhynchus albirostris*).
- **Very High Frequency (VHF) cetaceans**: Marine mammal species such as true porpoises, river dolphins and pygmy/dwarf sperm whales and some oceanic dolphins, generally with auditory centre frequencies above 100 kHz) (e.g., harbour porpoise *Phocoena phocoena*).
- **Phocid Carnivores in Water (PCW)**: True seals, earless seals (e.g., harbour seal *Phoca vitulina* and grey seal *Halichoreus grypus*); hearing in air is considered separately in the group PCA.
- **Other Marine Carnivores in Water (OCW)**: Including otariid pinnipeds (e.g., sea lions and fur seals), sea otters and polar bears; in-air hearing is considered separately in the group Other Marine Carnivores in Air (OCA).
- **Sirenians (SI)**: Manatees and dugongs. This group is only represented in the NOAA guidelines.

These weightings are used in this study and are shown in Figure 2-1. It should be noted that not all of the above hearing groups of marine mammals will be present in the SI Works survey area, but all hearing groups are presented in this report for completeness.

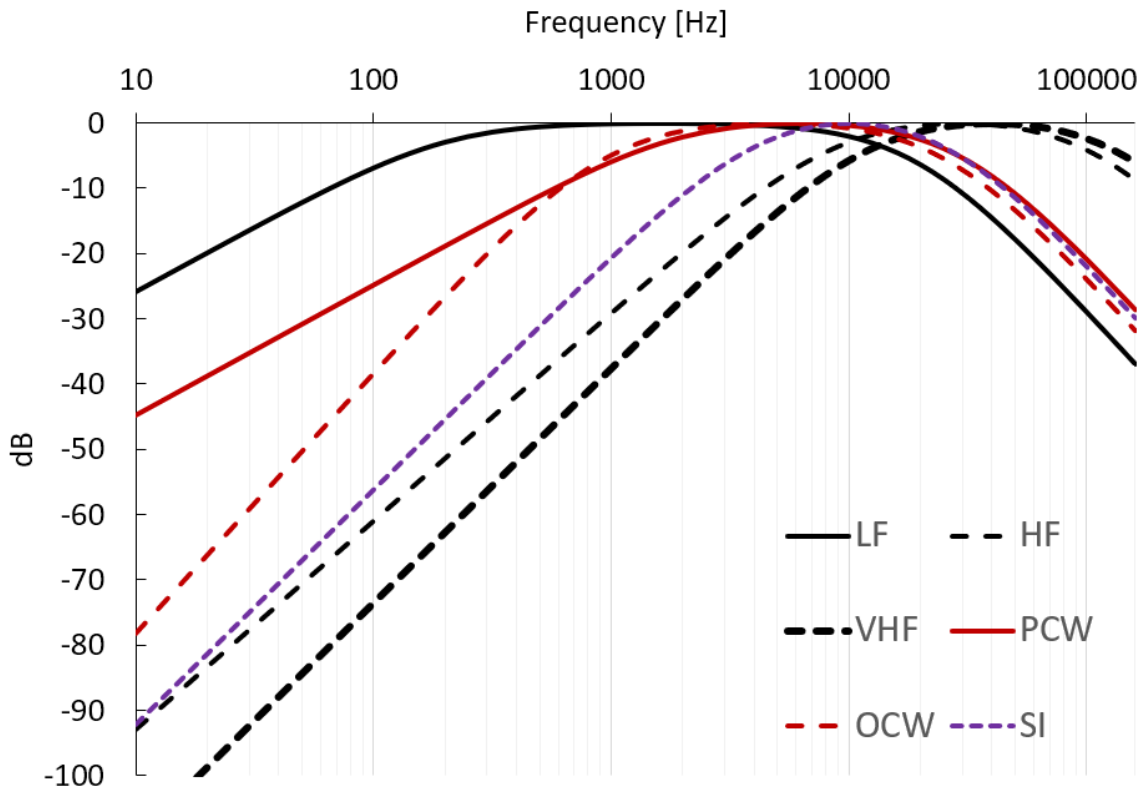


**Figure 2-1: Auditory weighting functions for seals, whales and sirenians (NMFS, 2018; Southall et al. 2019)**

Both the criteria for impulsive and non-impulsive sound are relevant for this study given the nature of the sound sources used during the SI Works. The relevant PTS and TTS criteria proposed by Southall *et al*. (2019) are summarised in Table 2-1.

**Table 2-1: PTS and TTS onset acoustic thresholds (Southall *et al., 2019*; Tables 6 and 7)**

| Hearing Group | Parameter | Impulsive [dB] | | Non-impulsive [dB] | |
|---|---|---|---|---|---|
| | | PTS | TTS | PTS | TTS |
| Low frequency (LF) cetaceans | $L_P$, (unweighted) | 219 | 213 | - | - |
| | SEL, (LF weighted) | 183 | 168 | 199 | 179 |
| High frequency (HF) cetaceans | $L_P$, (unweighted) | 230 | 224 | - | - |
| | SEL, (MF weighted) | 185 | 170 | 198 | 178 |
| Very high frequency (VHF) cetaceans | $L_P$, (unweighted) | 202 | 196 | - | - |
| | SEL, (HF weighted) | 155 | 140 | 173 | 153 |
| Phocid carnivores in water (PCW) | $L_P$, (unweighted) | 218 | 212 | - | - |
| | SEL, (PW weighted) | 185 | 170 | 201 | 181 |
| Other marine carnivores in water (OCW) | $L_P$, (unweighted) | 232 | 226 | - | - |
| | SEL, (OW weighted) | 203 | 188 | 219 | 199 |
| Sirenians (SI) (NOAA only) | $L_P$, (unweighted) | 226 | 220 | - | - |
| | SEL, (OW weighted) | 190 | 175 | 206 | 186 |

These updated marine mammal injury criteria were published in March 2019 (Southall, et al., 2019). The paper utilised the same hearing weighting curves and thresholds as presented in the preceding regulations

document NMFS (2018) with the main difference being the naming of the hearing groups and introduction of additional thresholds for animals not covered by NMFS (2018). A comparison between the two naming conventions is shown in Table 2-2.

The naming convention used in this report is based upon those set out in Southall *et al*. (2019). Consequently, this assessment utilises criteria which are applicable to both NMFS (2018) and Southall *et al*. (2019).

**Table 2-2: Comparison of Hearing Group Names between NMFS (2018) and Southall *et al.* (2019)**

| NMFS (2018) hearing group name | Southall *et al*. (2019) hearing group name |
|---|---|
| Low-frequency cetaceans (LF) | LF |
| Mid-frequency cetaceans (MF) | HF |
| High-frequency cetaceans (HF) | VHF |
| Phocid pinnipeds in water (PW) | PCW |
| Otariid pinnipeds in water (OW) | OCW |
| Sirenians (SI) | Not included |

## 2.4 Disturbance to Marine Mammals

Disturbance thresholds for marine mammals are summarised in Table 2-3. Note that the non-impulsive threshold can often be lower than ambient noise for coastal waters with some human activity, meaning that ranges determined using this limit will tend to be higher than actual ranges. However, the levels are unweighted and ranges to threshold will be dominated by low-frequency sound, which for most hearing groups is outside their hearing range. For hearing groups with low thresholds this can mean that their range to TTS/PTS is *larger* than the range to the behavioural threshold, e.g., the PTS threshold for impulsive sound for the VHS group is 155 dB SEL, while the behavioural threshold is 160 dB SPL. For a typical scenario, for 1 second's exposure (SEL equals SPL for 1-second durations) that means the range to the behavioural threshold will be approximately twice the range to the PTS threshold (a difference of 5 dB). This is just one of the reasons why this behavioural threshold should be interpreted with caution.

**Table 2-3: Disturbance Criteria for Marine Mammals Used in this Study based on Level B harassment of NMFS (National Marine Fisheries Service, 2005)**

| Effect | Non-Impulsive Threshold | Impulsive Threshold |
|---|---|---|
| Disturbance (all marine mammals) | 120 dB SPL | 160 dB $SEL_{single\ impulse}$ or 1-second SEL |

## 2.5 Injury and Disturbance to Fishes

The injury criteria used in this noise assessment are given in Table 2-4 and Table 2-5 for impulsive noises and continuous noise respectively. $L_P$ and SEL criteria presented in the tables are unweighted. Physiological effects relating to injury criteria are described below (Popper, et al., 2014):

- **Mortality and potential mortal injury**: either immediate mortality or tissue and/or physiological damage that is sufficiently severe (e.g., a barotrauma) that death occurs sometime later due to decreased fitness. Mortality has a direct effect upon animal populations, especially if it affects individuals close to maturity.

- **Recoverable injury ("PTS" in tables and figures)**: Tissue damage and other physical damage or physiological effects, that are recoverable, but which may place animals at lower levels of fitness, may render them more open to predation, impaired feeding and growth, or lack of breeding success, until recovery takes place.

  The PTS term is used here to describe this, more serious impact, even though it is not strictly permanent for fish. This is to better reflect the fact that this level of impact is perceived as serious and detrimental to the fish.

- **Temporary Threshold Shift (TTS)**: Short term changes (minutes to few hours) in hearing sensitivity may, or may not, reduce fitness and survival. Impairment of hearing may affect the ability of animals to capture prey and avoid predators, and also cause deterioration in communication between individuals, affecting growth, survival, and reproductive success. After termination of a sound that causes TTS, normal hearing ability returns over a period that is variable, depending on many factors, including the intensity and duration of sound exposure.

Popper et al. 2014 does not set out specific TTS limits for $L_P$ and for disturbance limits for impulsive noise for fishes. Therefore publications: "Washington State Department of Transport Biological Assessment Preparation for Transport Projects Advanced Training Manual" (WSDOT, 2020) and "Canadian Department of Fisheries and Ocean Effects of Seismic energy on Fish: A Literature review" (Worcester, 2006) on effects of seismic noise on fish are used to determine limits for these:

- The criteria presented in the Washington State Department of Transport Biological Assessment Preparation for Transport Projects Advanced Training Manual (WSDOT, 2020). The manual suggests an un-weighted sound pressure level of 150 dB SPL (assumed to be duration of 95 % of energy) as the criterion for onset of behavioural effects, based on work by (Hastings, 2002). Sound pressure levels in excess of 150 dB SPL are expected to cause temporary behavioural changes, such as elicitation of a startle response, disruption of feeding, or avoidance of an area. The document notes that levels exceeding this threshold are not expected to cause direct permanent injury but may indirectly affect the individual fish (such as by impairing predator detection). It is important to note that this threshold is for onset of potential effects, and not necessarily an 'adverse effect' threshold. The threshold is implemented here as either single impulse SEL or 1 second SEL, whichever is greater.
- The report from the Canadian Department of Fisheries and Ocean "Effects of Seismic energy on Fish: A Literature review on fish" (Worcester, 2006) found large differences in response between experiments. Onset of behavioural response varied from 107-246 dB $L_P$, the $10^{th}$ percentile level for behavioural response was 158 dB $L_P$.

Given the large variations in the data from the two sources above, we have rounded the value to 160 dB $L_P$ as the behavioural threshold for fishes for impulsive sound, and 150 dB SPL for non-impulsive sound.

*Note that while there are multiple groups of fish presented, we have used the thresholds of the more sensitive group for all fish thus covering all fishes (203/186 PTS/TTS for impulsive sound & 222/204 PTS/TTS for non-impulsive sound). These lower thresholds also cover "Eggs and Larvae.*

**Table 2-4: Criteria for onset of injury to fish and sea turtles due to impulsive noise. For this assessment the lowest threshold for any group is used for all groups (shown in bold).**

| Type of animal | Unit | Mortality and potential mortal injury [dB] | Recoverable injury (PTS) [dB] | TTS [dB] | Behavioural [dB] |
|---|---|---|---|---|---|
| Fish: no swim bladder (particle motion detection) Example: Sharks. | SEL | 219[1] | 216[1] | 186[1] | 150[3] |
| | $L_P$ | 213[1] | 213[1] | 193[2] | 160[2] |
| Fish: where swim bladder is not involved in hearing (particle motion detection). Example: Salmonoids. | SEL | 210[1] | 203[1] | 186[1] | 150[3] |
| | $L_P$ | 207[1] | 207[1] | 193[2] | 160[2] |
| Fish: where swim bladder is involved in hearing (primarily pressure detection). Example: Gadoids (cod-like). | SEL | 207[1] | **203[1]** | **186** | **150[3] [SPL]** |
| | $L_P$ | 207[1] | **207[1]** | **193[2]** | **160[2]** |
| Sea turtles | SEL | 210[1] | (*Near*) High* (*Mid*) Low (*Far*) Low | - | - |
| | $L_P$ | 207[1] | | - | - |
| Eggs and larvae | SEL | 210[1] | (*Near*) Moderate (*Mid*) Low (*Far*) Low | - | - |
| | $L_P$ | 207[1] | | - | - |

[1] (Popper et al. 2014) table 7.4, [2] (Worcester, 2006), [3] (WSDOT, 2020)

* Indicate (range) and risk of effect, e.g., "(Near) High", meaning high risk of that effect when near the source.

Where Popper et al. 2014 present limits as ">" 207 or ">>" 186, we have ignored the "greater than" and used the threshold level as given.

Relevant thresholds for non-impulsive noise for fishes relating to PTS, TTS, and behaviour are given in Table 2-5. Note that for the behaviour threshold we have used the impulsive threshold as basis for the continuous noise threshold, in absence of better evidence.

**Table 2-5: Criteria for fish (incl. sharks) due to non-impulsive noise from Popper et al. 2014, table 7.7.**

| Type of animal | Unit | Mortality and potential mortal injury | Recoverable injury (PTS) [dB] | TTS [dB] | Behavioural [dB] |
|---|---|---|---|---|---|
| All fishes | SEL | (*Near*) Low (*Mid*) Low (*Far*) Low | 222† | 204† | 150 [SPL]* |

*Based on the impulsive criteria.

†Based 48 hours of 170 dB SPL and 12 hours of 158 dB SPL

# 3 THE SITE ENVIRONMENT

## 3.1 SI Works Area of Interest

The SI Works Area of Interest (AoI) and nearby surroundings are characterised by shallow water (c. 14 m at the deepest extents), generally silty to sandy sediment and stable water properties (Figure 3-1).

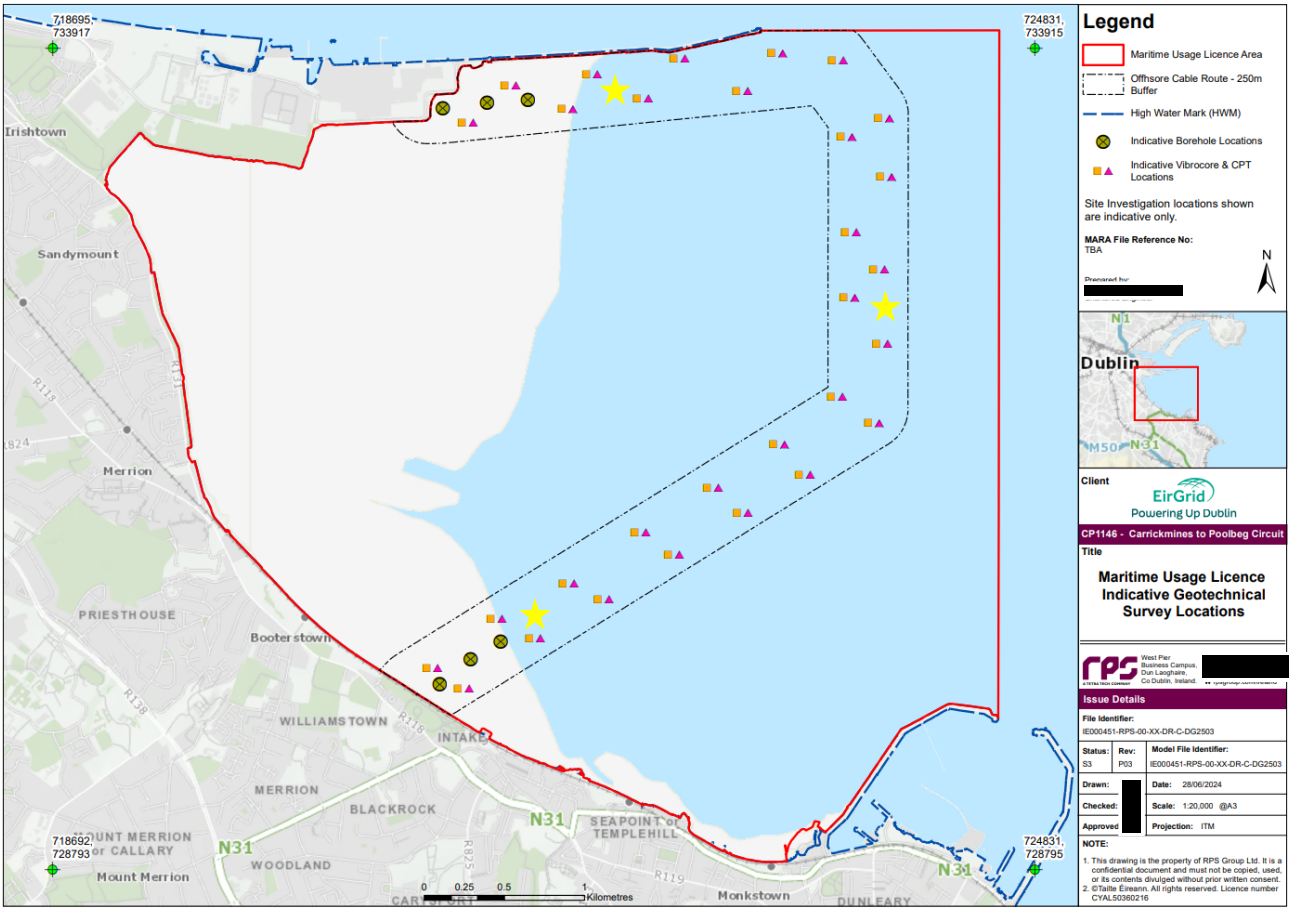


**Figure 3-1: Maximal extent of surveys (red line). Indicative cable route (dot-dash line) with indicative locations for boreholes and geotechnical sampling locations. Additionally (yellow stars) are 3 indicative locations for ADCP deployments.**

The maximal area to be surveyed is 2101 Ha of depths up to 14 meters (at mean high water springs “MHWS”).

The survey speed is expected to be 4 knots (2.1 m/s), limited by the survey equipment. The survey transects plan is yet to be determined so reasonable worst-case locations throughout the survey area have been used as basis for the modelling rather than a specific survey plan.

## 3.2 Water Properties

Water properties were determined from historical data for the area. Where a range of values are expected or observed, the value resulting in the lowest transmission loss was chosen for a more conservative assessment (more noise at range). Thus, this also covers seasonal variation.

- Temperature: 18°C – maximal summer temperature given by seatemperature.net for the past seven years for bay Dublin.

- Salinity: 34.5 psu – Measurements in relation to Ringsend Wastewater Treatment Plant Upgrade Project[5]
- Soundspeed profile: Assumed uniform given high mixing as a result of tidal flows and generally shallow water and absence of river outflows.

## 3.3 Sediment Properties

Sediment properties are based on sediments given in Table 3-1.

Sediment types are informed by the "Folk 7-class Classification" from EMODnet Geology[6] (European Commision, 2024). A sediment model (Ainslie, 2010) was used to derive the acoustic properties of the sediment from the grain size. (Table 3-1).

**Table 3-1: Sediment Properties for the two survey areas.**

| Site | Sediment type (ISO 14688-1:2017) | Density [kg/m³] | Soundspeed [m/s] | Grain size [mm] (nominal) |
|---|---|---|---|---|
| Outer/deeper part of the Survey area | Medium Silt | 1551 | 1544 | 0.011 |
| Inner/shallower part of the Survey area | Sand | 2123 | 1801 | 0.35 |

[5] "Ringsend WwTP - EIAR modelling services" Figure 5.39 available online (2024/07/11)

[6] https://drive.emodnet-geology.eu/geoserver/gtk/wms

# 4 SOURCE NOISE LEVELS

Underwater noise sources are usually quantified in dB scale with values generally referenced to 1 µPa pressure amplitude as if measured at a hypothetical distance of 1 m from the source (called the Source Level). In practice, it is not usually possible to measure at 1 m from a source, but the metric allows for comparison and reporting of different source levels on a like-for-like basis. In reality, for a large sound source, this imagined point at 1 m from the acoustic centre does not exist. Furthermore, the energy is distributed across the source and does not all emanate from an imagined acoustic centre point. Therefore, the stated sound pressure level at 1 m does not occur for large sources. In the acoustic near-field (i.e. close to the source), the sound pressure level will be significantly lower than the value predicted by the back-calculated source level (SL).

## 4.1 Source Models

The noise sources and activities investigated during this assessment are summarised in Table 4-1.

Note that:

1. The ping rate, and therefore the SPL and SEL of the sound source varies with the local depth.

2. Due to differences in sediment, the angle at which the sediment will tend to reflect sound back into the water column changes. As we use this information to derive practical source levels for highly directional sources, this will change with sediment type (further information below and in Appendix A & Figure 8-7).

3. To account for the shallow depth, and therefore assumed short duration of pulses from Multibeam Echo-Sounder (MBES), Side Scan Sonar (SSS) and pinger/chirper, we have assessed the weighted kurtosis in order to determine impulsiveness (Section 2.1).

Sonars and echosounders generally use tone pulses of either constant frequency or as a frequency sweep. These pulses are typically windowed to limit "spectral leakage[7]". We assume use of a Von Hann window (sometimes "Hanning") which gives effective attenuation of frequencies outside the intended frequencies. This means that while a sonar with a centre frequency of 200 kHz is well above the hearing range of any marine mammal, there will be energy at 100 kHz c. 50 dB lower than the source level at 200 kHz. This is accounted for in the assessment. Note that this might contrast with some guidelines, such as the "JNCC guidelines mitigation during geophysical surveys" (JNCC, 2017), which state that "*Multi-beam surveys in shallower waters (<200m) are not subject to these requirements* [mitigation for protection of European Protected Species]". However, given the fact there is substantial energy outside the nominal frequency range of any echo sounder (see example in Figure 4-1), we have included this energy spread here.

[7] Acoustic phenomenon where a sharp change in pressure produces sound in a wide frequency range (similar to an ideal impulse) outside the intended frequencies.

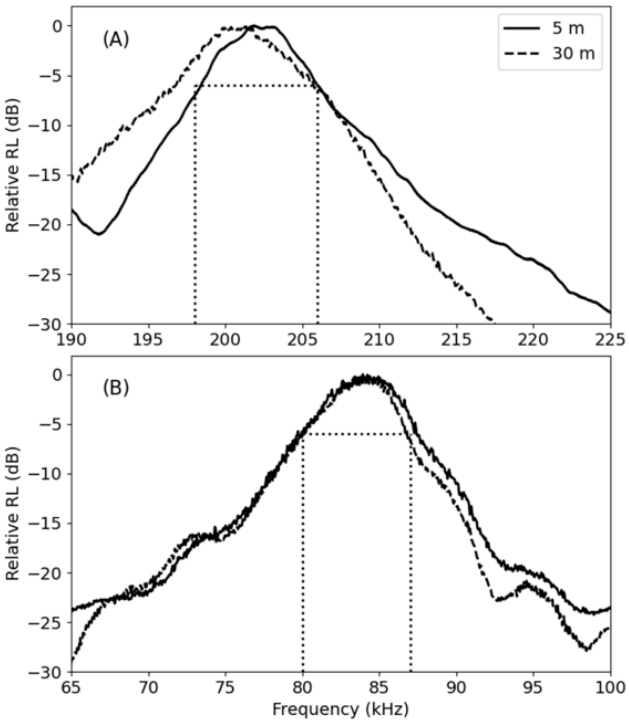


**Figure 4.** The relative received levels (RLs, in decibels (dB)) of the signals of the acoustic frequency bandwidth of the dual-frequency echosounder used in this study, as observed at two different depths. The dotted lines indicate the −6 dB acoustic bandwidths of 198–206 (**A**) and 80–87 kHz (**B**). The peak frequencies of the two channels were found to be 201.5 (**A**) and 84 kHz (**B**).

**Figure 4-1. Example of recorded levels from an echosounder showing significant energy outside the nominal frequencies, necessitating assessment at those frequencies too (Burnham, et al., 2022).**

Highly directional sources with narrow beams (sonars and echosounders) will tend to ensonify only a narrow cone of water at any given time. For multibeam echosounders or side scan sonars, the beam(s) sweeps though the water, side to side, to get wider sediment coverage. For this type of sonar, we have converted the source to an omnidirectional source with the same acoustic energy as the original but represented as omnidirectional. This simplifies the calculation process, but yields identical results, and means that we account for the probabilistic nature of an animal being “ensonified” by the source.

For beams only directed vertically down or up, such as sub-bottom profilers or ADCPs, we incorporate the directivity of the beam as well as the ability of the sediment to reflect the sound emitted. This means that we can account for the fact that primarily, a narrow cone directly below/above the source is ensonified with high sound levels and also that a significant attenuation occurs in the sediment where sound enters at steep angles. In practice, we use the angle with the highest level after accounting for directivity combined with sediment loss to a range of 100 m.

**Table 4-1: Summary of Sound Sources and Activities Included in the Subsea Noise Assessment**

| Equipment | Source level [SPL] (as used in model) | Primary decidecade bands (-20 dB width) | Source model details | Impulsive/non-impulsive |
|---|---|---|---|---|
| Survey vessel, Geophysical | 161 dB SPL | 10-16,000 Hz | Based on <20 m generic survey vessel. | Non-impulsive |
| Survey vessel, Geotechnical | 168 dB SPL | 10 – 25,000 Hz | Based on <30 m tug with dynamic positioning system | Non-impulsive |
| MBES | 187 dB SPL (Spherical equivalent level) | 200,000-800,000 Hz | Based on Reason SeaBat T50 & R2 Sonic 2024. | Impulsive |

| Equipment | Source level [SPL] (as used in model) | Primary decidecade bands (-20 dB width) | Source model details | Impulsive/non-impulsive |
|---|---|---|---|---|
| SSS | 166 dB SPL (Spherical equivalent level) | 100,000-1,000,000 Hz | Generic SSS from 400-1,000 kHz. | Impulsive |
| USBL | 190 dB SPL | 18,000-31,500 Hz | Active with non-hull mounted SSS* & during vibro-core operations, 2 Hz ping rate, ping length 10 ms. | Impulsive |
| SBP-parametric (P-SBP) | 204 dB SPL | 80,000-150,000 Hz (Primary)<br>2,000-22,000 Hz (Secondary) | Source level adjusted for sediment effects and beam widths.<br>Based on Innomar Standard, worst-case for shallow water. | Impulsive |
| SBP-chirper/pinger (C-SBP) | 181 dB SPL | 2,000-12,000 Hz | Generic shallow water SBP of chirper/pinger type.<br>Source level adjusted for sediment effects and beam widths. | Impulsive |
| SBP-sparker/UHRS (S-SBP) | 184 dB SPL | 600 – 6,300 Hz | Based on GeoSource 400.<br>Firing rate of 1 Hz assumed | Impulsive |
| ADCP<br>(**Not modelled given high frequency**) | 114 dB SPL | 500,000-1,260,000 Hz | Based on suitable ADCP for depths <100 m (e.g. Nortek AWAC, Teledyne Reason Sentinel, Workhorse or Monitor)<br>Source level adjusted for sediment effects and beam widths. | Impulsive |
| Drilling/ rotary coring (Boreholes, no USBL) | 145 dB SPL | 10-500,000 Hz | Based on published levels (Erbe, et al., 2017; Fisheries and Marine Service, 1975; MR, et al., 2010; L-F, et al., 2023) | Non-impulsive |
| Vibro-coring & CPT | 187 dB SPL | 50 – 16,000 Hz | Based on levels from previous work & (Reiser, et al., 2010) | Non-impulsive |

*If the SSS and SBP are hull-mounted, there is no need for a positioning device (USBL) and this noise source should be removed from consideration.

The ADCP has not been modelled due to its lowest frequency being significantly above the upper frequency limit of hearing of any marine animal. Furthermore, the extremely high frequencies will attenuate rapidly with range, meaning that on top of the spreading loss there will be an additional c. 140 dB/km loss from absorption[8].

In addition to the activities outlined above, there may also be grab sampling. However, this activity has not been modelled given the low noise levels associated with the activity.

[8] See e.g., APPENDIX A, Figure 8-12 or http://resource.npl.co.uk/acoustics/techguides/seaabsorption/ for further information.

All other surveys undertaken in the intertidal area, e.g. environmental walkover surveys, intertidal sampling, etc. have not been included in this assessment as they will not result in underwater noise.

### 4.1.1 Equipment

This section presents details on each sound source individually. Combined sources, with expected combination of active equipment, are presented in Section 4.1.2.

#### 4.1.1.1 Survey Vessel, Geophysical

A small survey vessel of up to 20 m in length, travelling at 4 knots (equipment limited), has been assessed in this report as this represents the anticipated vessel parameters for the geophysical and geotechnical surveys. Broadband level of the vessel is 161 dB SPL with decidecade band levels given in Figure 4-2 (maximal band level is 150 dB SPL at the 25 Hz band). Smaller vessels will have lower emitted levels and are therefore covered by this assessment.

This vessel is also used as a proxy for a suitable platform for support vessels, representing generic machinery noise.

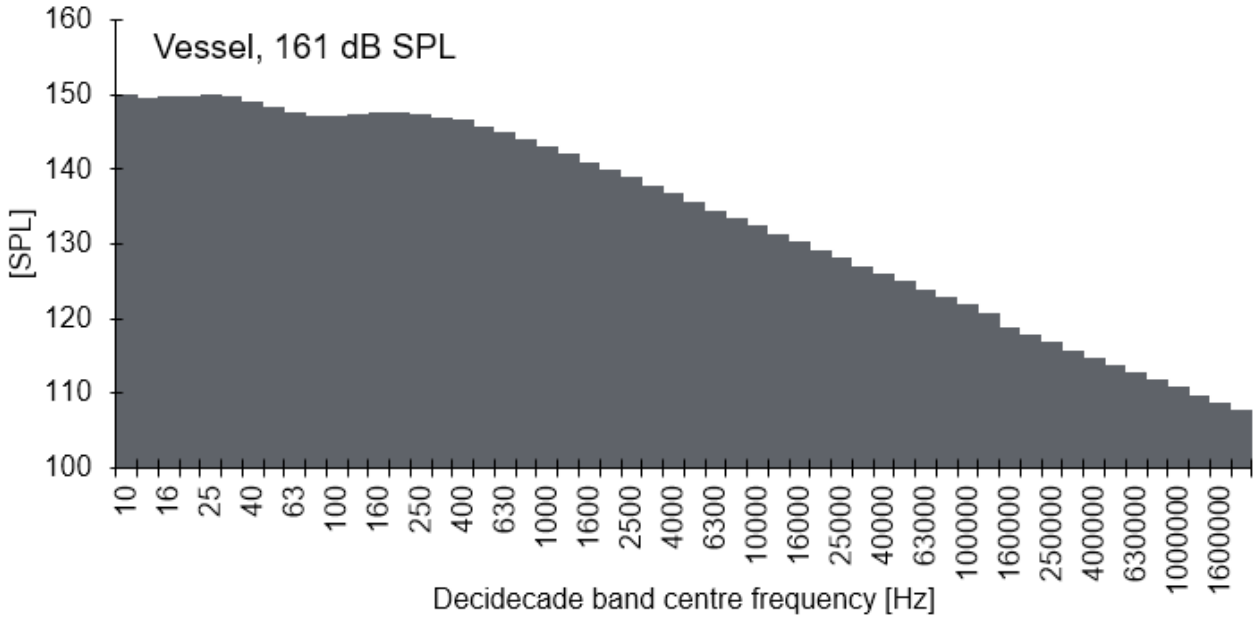


**Figure 4-2. Vessel source band levels. Broadband level: 161 dB SPL. Based on generic survey craft at 4 kn.**

#### 4.1.1.2 Survey Vessel, Geotechnical

A small survey vessel of up to 30 m in length, travelling at 4 knots transiting to SI locations (equipment limited), has been assessed in this report as this represents the anticipated vessel parameters for carrying out the geotechnical survey. Broadband level of the vessel is 168 dB SPL with decidecade band levels given in Figure 4-2 (maximal band level is 157 dB SPL at the 400 Hz band). Smaller vessels will have lower emitted levels and are therefore covered by this assessment.

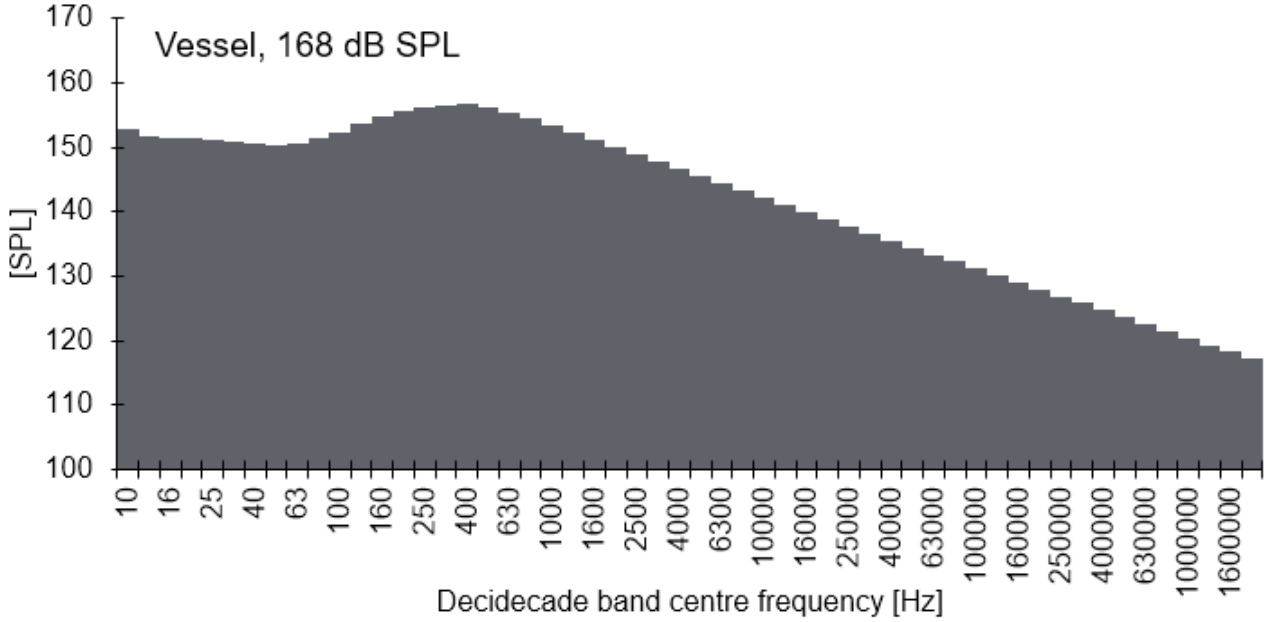


**Figure 4-3. Vessel source band levels. Broadband level: 168 dB SPL. Based on generic tug with DP system at 4 kn.**

### 4.1.1.3 Multibeam Echosounder (MBES)

The “Reason SeaBat T50-P”, “R2 Sonic 2024”, or similar shallow water model, is a likely MBES for this survey. Nominal frequencies from 200 kHz to 800 kHz have been modelled. The equivalent spherical level is 187 dB SPL (maximally 179 dB SPL in each band). Band levels are presented in Figure 4-4.

Given the shallow water (<14 m depth), it is likely that shorter pulses will be used as they offer sufficient energy for a clear returning echo. This will increase kurtosis (“impulsiveness”) for realistic ping rates for the depth. Therefore, the MBES is modelled as an impulsive noise source.

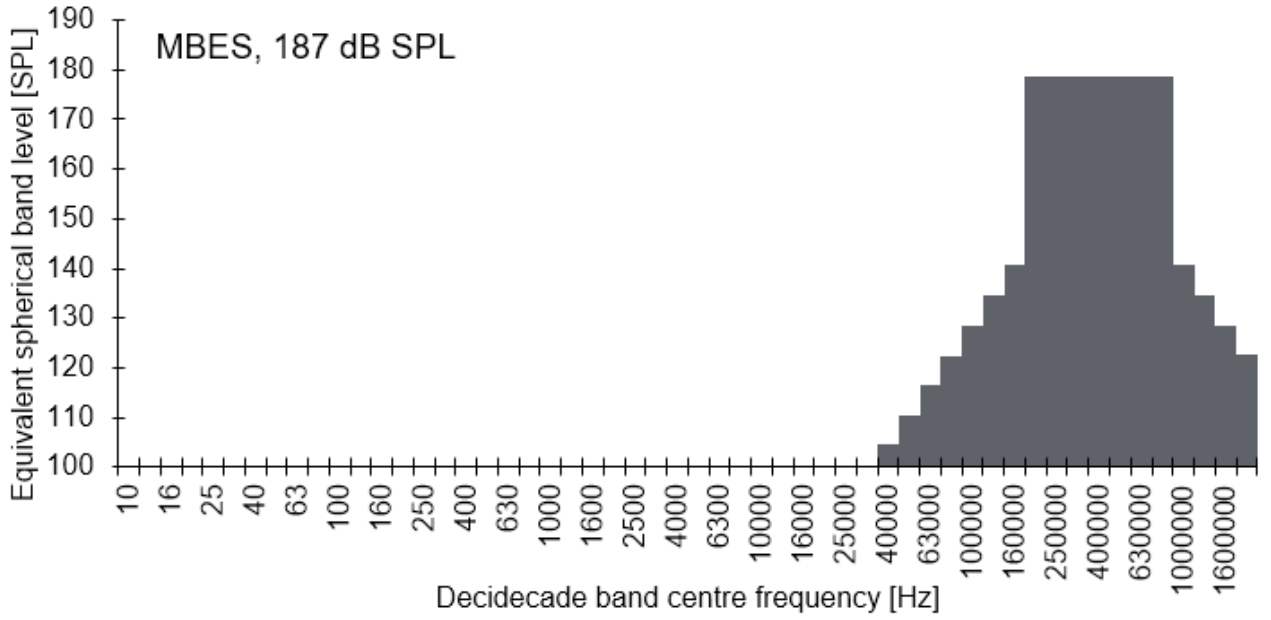


**Figure 4-4. MBES source band levels as equivalent spherical/omnidirectional levels.**

### 4.1.1.4 Side Scan Sonar (SSS)

No specific model of side scan sonar (SSS) has been determined for the survey, except for specification of nominal frequencies of 100 – 1,000 kHz. To address this uncertainty, a generic SSS model has been generated from seven commonly used SSS systems (from EdgeTech, C_MAX and Klein Systems). We have used the 90$^{th}$ percentile level as the representative level. The equivalent spherical broadband level is 166 dB SPL (Figure 4-5).

Given the shallow water (<14 m depth), it is likely that shorter pulses will be used as they offer sufficient energy for a clear returning echo. This will increase kurtosis ("impulsiveness") for realistic ping rates for the depth. Therefore, the SSS is modelled as an impulsive noise source.

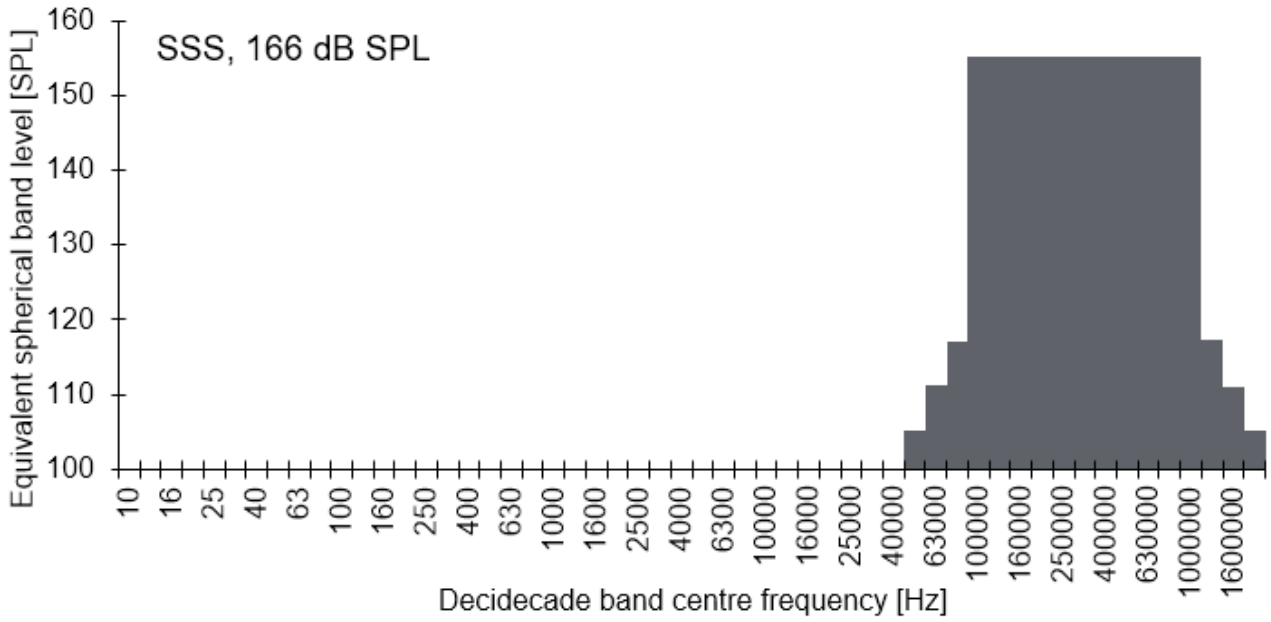


**Figure 4-5. SSS source band levels as equivalent spherical/omnidirectional levels.**

### 4.1.1.5 Ultra Short Base-Line positioning system (USBL)

If the SSS or SBP is deployed as a towfish (towed behind the vessel), its accurate positions will need to be known. A USBL positioning system is a common solution. This is also the case for the deployed Vibro-corer units. Here, a generic USBL is used, with a 10 ms pulse length and 2 Hz ping rate, consistent with popular models (Edgetech BATS, IxBlue GAPS, Sonardyne Ranger). A max SPL [$L_P$] of 210 dB have been modelled, giving an SPL of 190 dB (Figure 4-6).

The relatively short pulses and slow repetition of pulse gives a weighted kurtosis over the limit value (40), therefore, the USBL is modelled as an impulsive noise source.

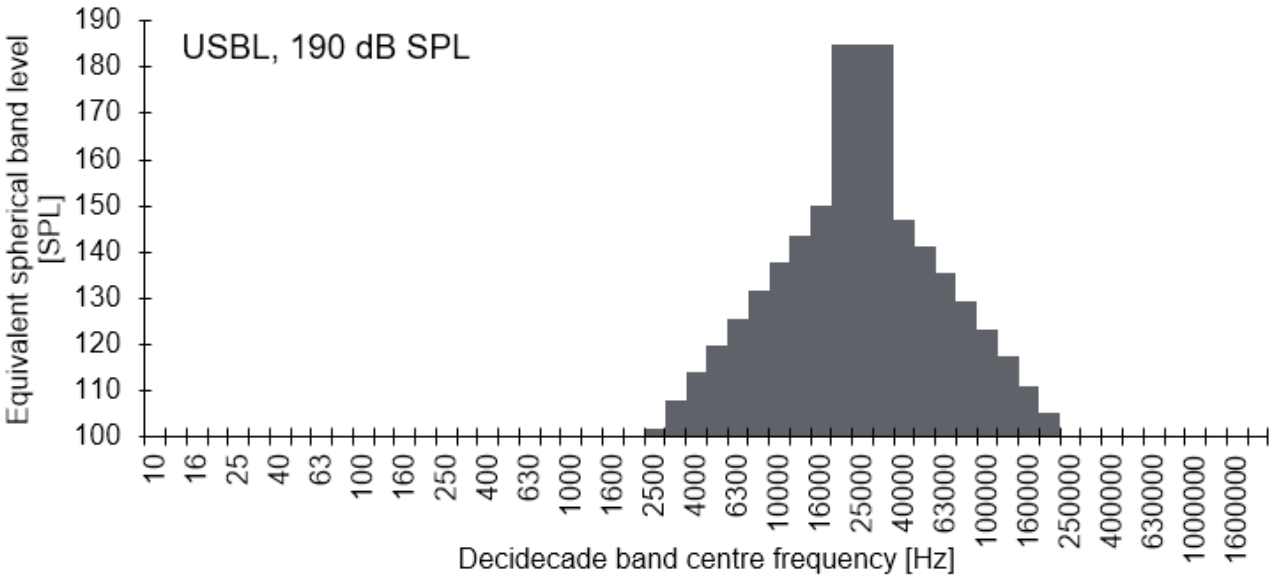


**Figure 4-6. USBL source band levels.**

## 4.1.1.6 Sub-bottom Profilers (SBP)

### 4.1.1.6.1 Parametric SBP (P-SBP)

The survey might use a parametric sub-bottom profiler (SBP) such as the “Innomar standard”. These SBPs use two higher frequencies (“primary frequencies”) to generate an interference pattern at lower frequencies (“secondary frequencies”). This means that the secondary beam can be made extraordinarily narrow, leading to a much smaller sound impact (Appendix A, Figure 8-8). We account for these differences in beam pattern by including the sediment reflection loss at high incidence angles (see Appendix A, Figure 8-7) to reduce the effective source level accordingly.

The source level for the P-SBP is split into two regions according to the nominal frequencies, accounting for some spectral leakage (Figure 4-7) and assuming the full range of frequencies is used during the survey (a conservative assumption). The total, broad band level for the parametric SBP is 204 dB SPL, with the secondary frequencies being 144 dB SPL.

Given the shallow water (<14 m depth), it is likely that shorter pulses will be used as they offer sufficient energy for a clear returning echo. This will increase kurtosis (“impulsiveness”) for realistic ping rates for the depth. Therefore, the P-SBP is modelled as an impulsive noise source.

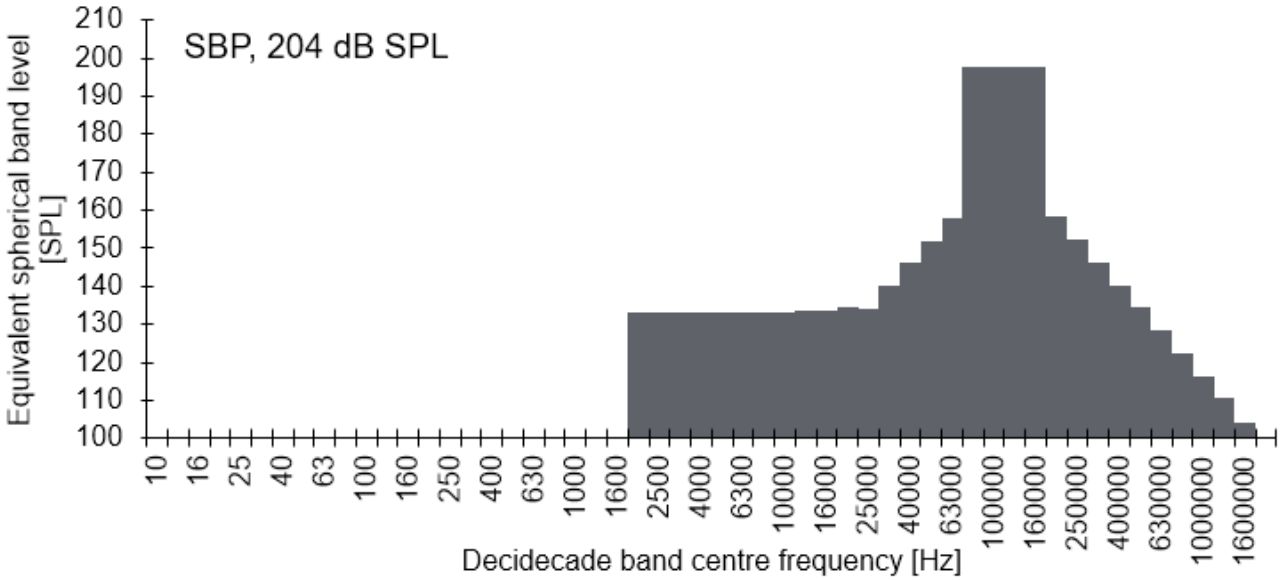


**Figure 4-7. Parametric SBP source band levels as equivalent spherical/omnidirectional levels. Primary frequencies 85 kHz – 150 kHz, secondary frequencies 2 kHz – 22 kHz.**

### 4.1.1.6.2 Chirper/Pinger SBP (C-SBP)

A chirper or pinger type SBP might be used for the survey. As no specific model has been specified, we have used a generic model based on common SBPs of this type. These have wide beams and therefore a comparatively higher noise impact, relative to their in-beam source levels. A single SBP source has been generated to represent both these sources as they are acoustically similar. Total broadband level for this SBP is 181 dB SPL with band levels given in Figure 4-8.

Given the shallow water (<14 m depth), it is likely that shorter pulses will be used as they offer sufficient energy for a clear returning echo. This will increase kurtosis (“impulsiveness”) for realistic ping rates for the depth. Therefore, the C-SBP is modelled as an impulsive noise source.

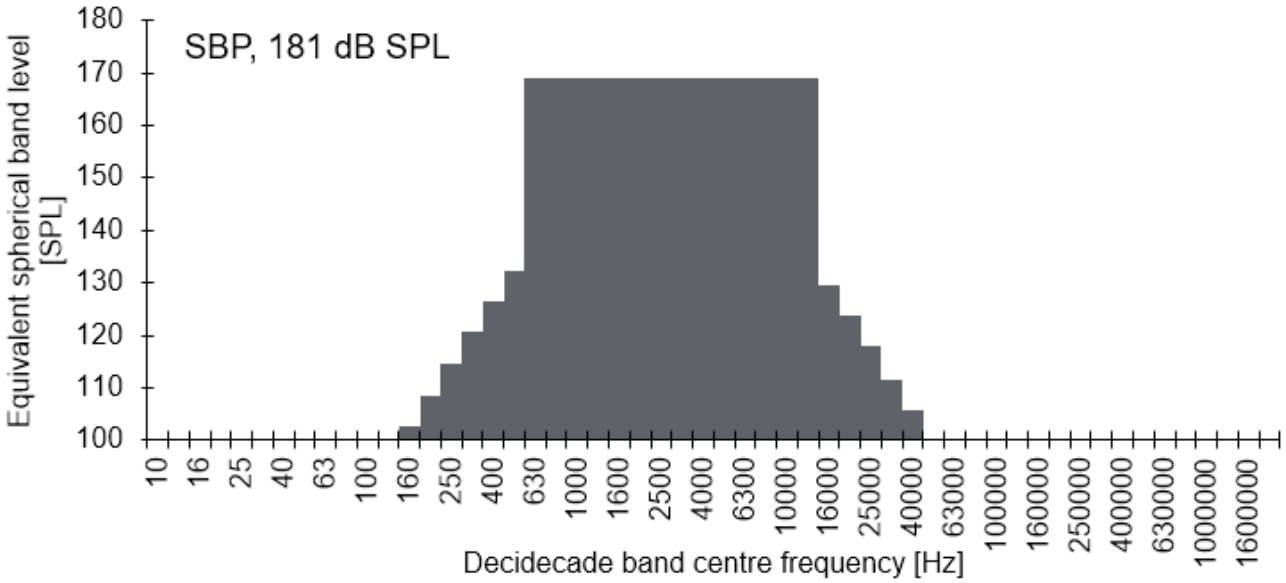


**Figure 4-8. Chirper/Pinger type SBP band levels.**

#### 4.1.1.6.3 Sparker SBP (S-SBP)

A sparker type SBP (sometimes “UHRS”) might be used during the survey. As no specific model has been specified, we have used a generic model based on common SBPs of this type and an energy per firing of 400 J and 1 firing per second. The total broadband level for this SBP is 184 dB SPL, with band levels given in Figure 4-8. Levels at frequencies below 100 Hz are taken from a spectral analysis of the timeseries in Figure 4-10.

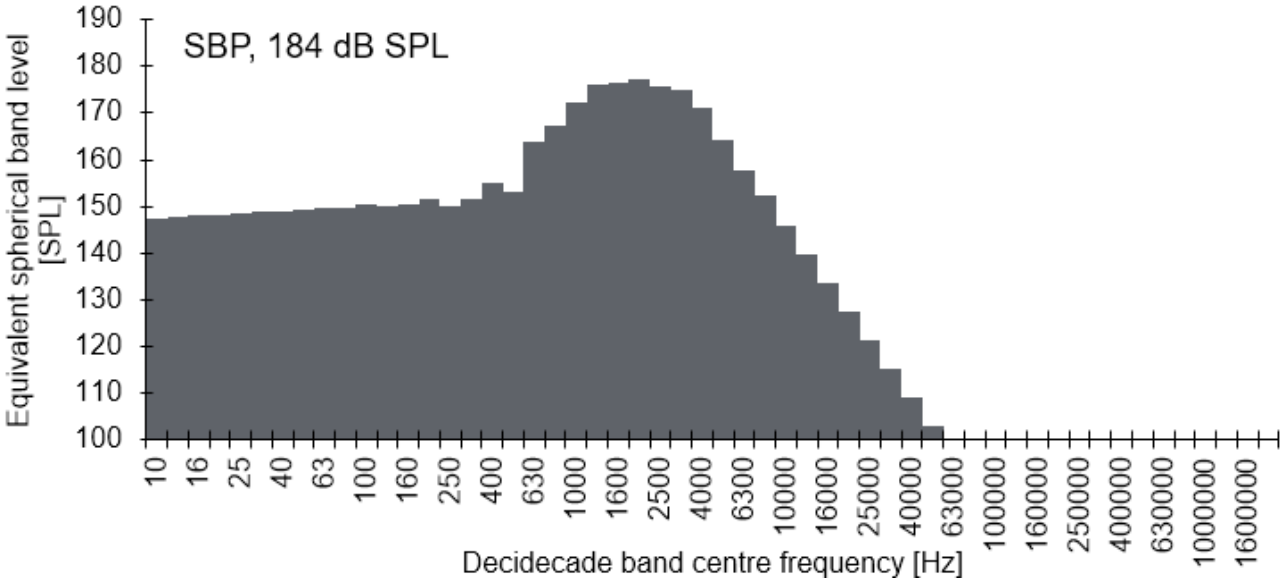


**Figure 4-9. Chirper/Pinger type SBP band levels.**

The very short impulses and slow repetition mean that this source is modelled as an impulsive noise source.

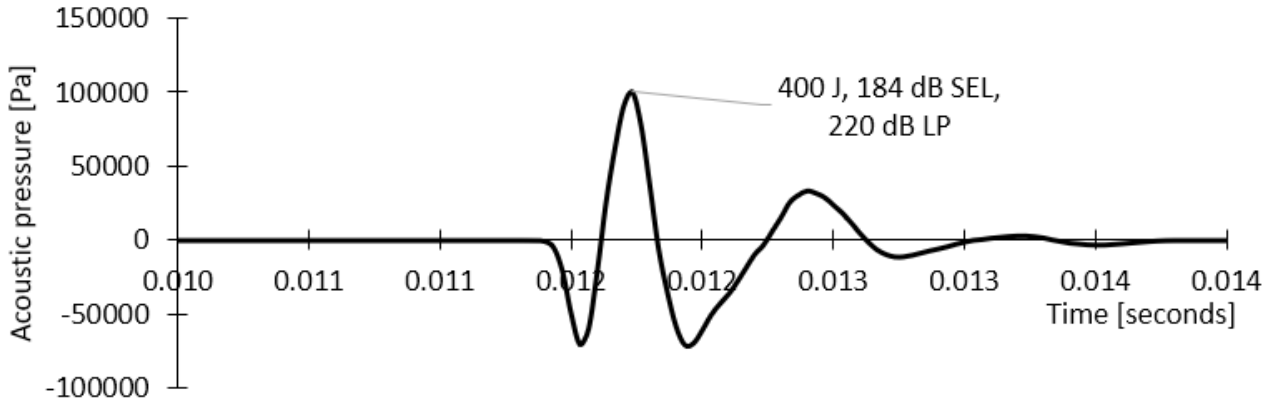


**Figure 4-10. Example of an impulse from a sparker type SBP.**

### 4.1.1.7 Boreholes Drilling

Boreholes are planned in the shallow parts of the SI Works area, with a drill of c. 0.1 m diameter. Recordings from similar equipment has informed the source levels used here (Erbe, et al., 2017; Fisheries and Marine Service, 1975; MR, et al., 2010; L-F, et al., 2023) Figure 4-11. This activity is a non-impulsive sound source with a broadband level of 145 dB SPL.

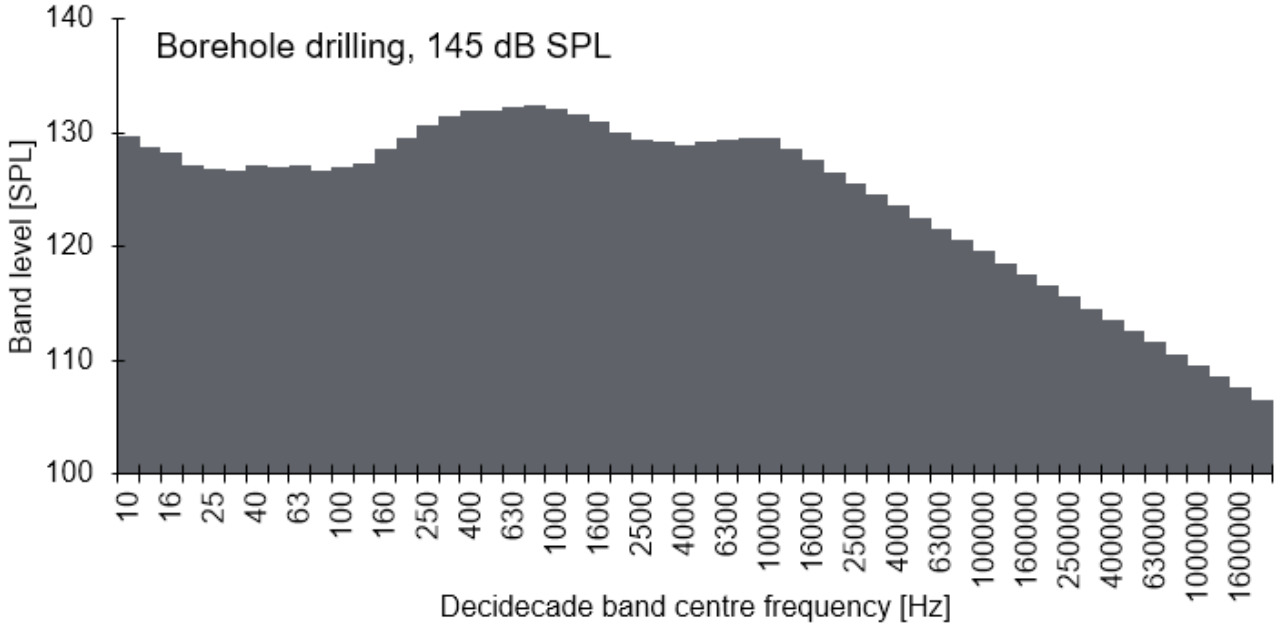


**Figure 4-11. Band levels for drilling, Levels above 25 kHz are extrapolated based on trend in bands at lower frequencies.**

### 4.1.1.8 Vibro-coring & CPT

For extraction of physical samples and sediment testing, vibro-coring and Cone Penetration Testing (CPT) will be carried out. Band levels are shown in Figure 4-11. The “Vibro-coring & CPT” activity is a non-impulsive sound source with a broadband level of 187 dB SPL.

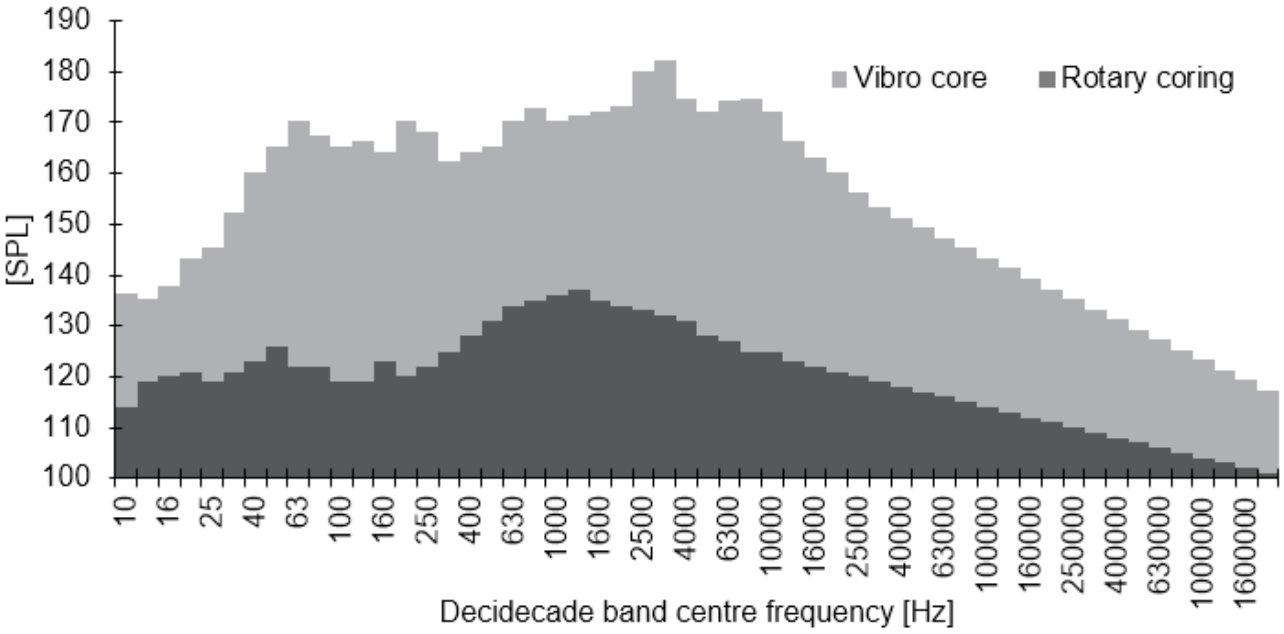


**Figure 4-12. Band levels vibro-coring and CPT. Levels above 25 kHz are extrapolated based on trend in bands at lower frequencies.**

### 4.1.2 Combined Sources

The relevant equipment for each survey type has been grouped into six scenarios that represent the most combinations for the survey equipment proposed to be used in the SI works.

MBES and SSS are active for all combined sources of the geophysical survey.

The “Vessel” noise source is active for all sources of both geophysical and geotechnical surveys.

#### 4.1.2.1 Geophysical Survey (Parametric SBP & USBL Active)

This scenario assumes the geophysical survey is using a parametric SBP and that a towfish is deployed requiring an active USBL. Total broadband level of 204 dB SPL.

Active equipment:

- Vessel
- MBES
- SSS
- USBL
- Parametric SBP

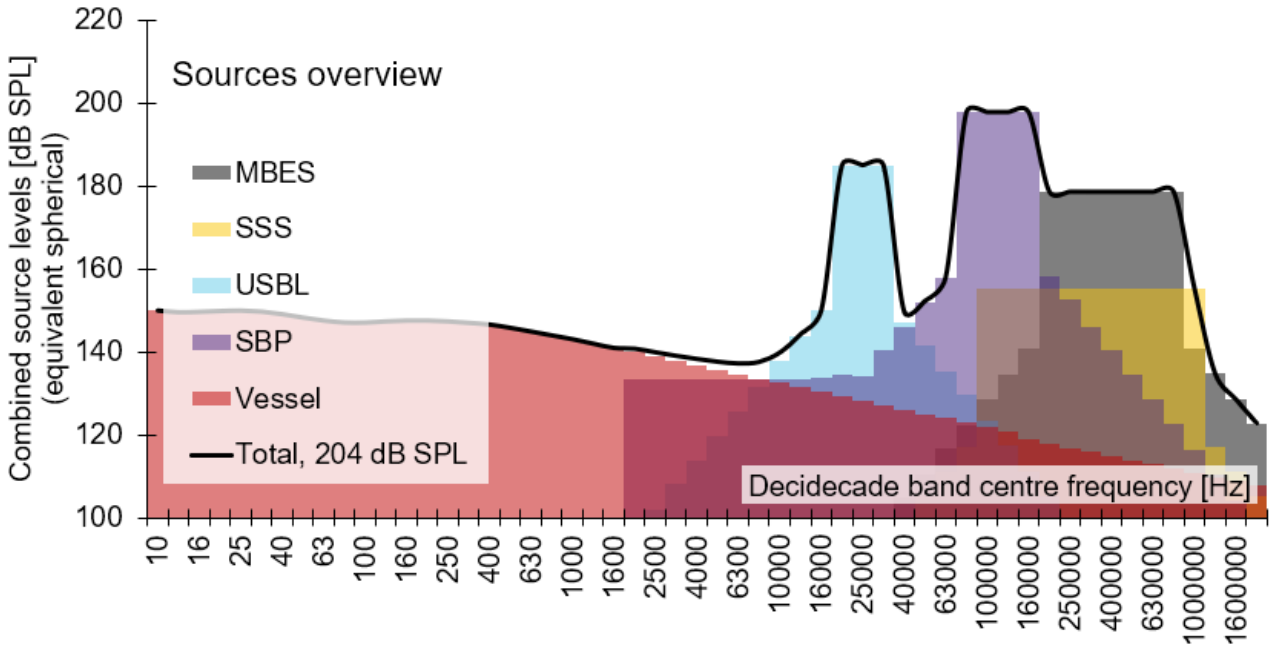


**Figure 4-13. Source band level during geophysical survey (parametric SBP & USBL active).**

### 4.1.2.2 Geophysical Survey (Parametric SBP & USBL Not Active)

This scenario assumes the geophysical survey is using a parametric SBP and that there is no need for a USBL (hull mounted SBP and SSS with known positions). Total broadband level of 204 dB SPL.

Active equipment:

- Vessel
- MBES
- SSS
- Parametric SBP

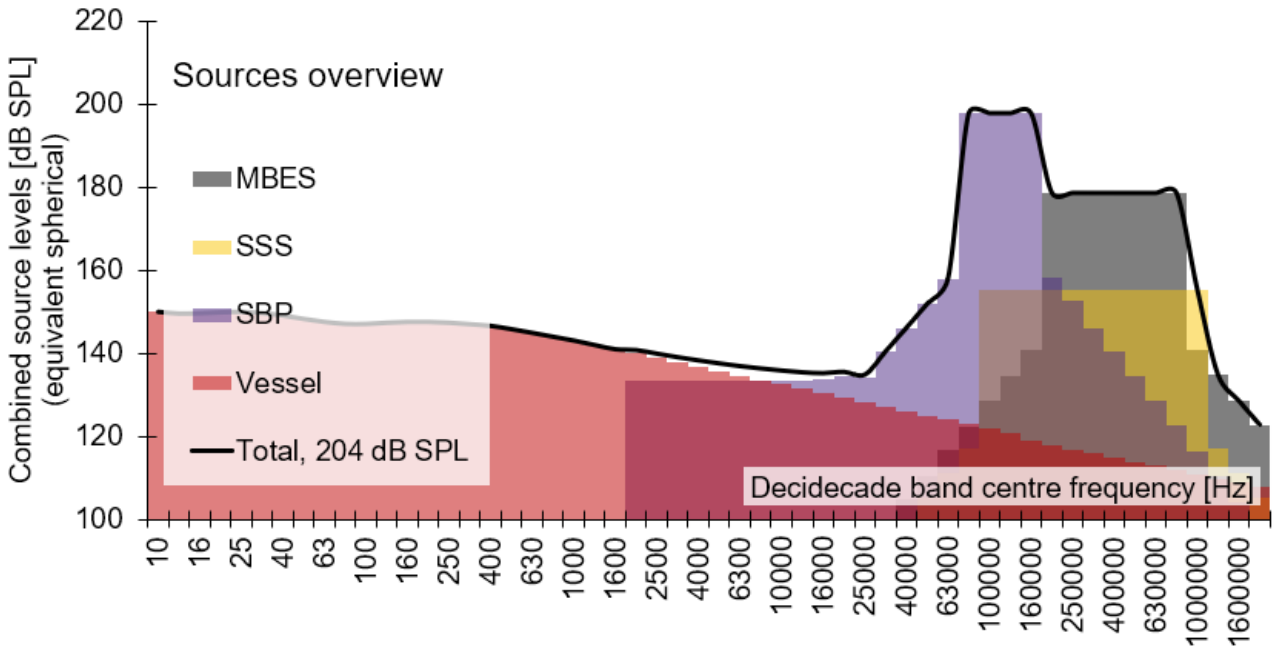


**Figure 4-14. Source band level during geophysical survey (parametric SBP & USBL not active).**

### 4.1.2.3 Geophysical Survey (Chirper/Pinger SBP & USBL Active)

This scenario assumes the geophysical survey is using a chirper or pinger type SBP and that a towfish is deployed requiring an active USBL. Total broadband level of 191 dB SPL.

Active equipment:

- Vessel
- MBES
- SSS
- USBL
- Chirper/pinger SBP

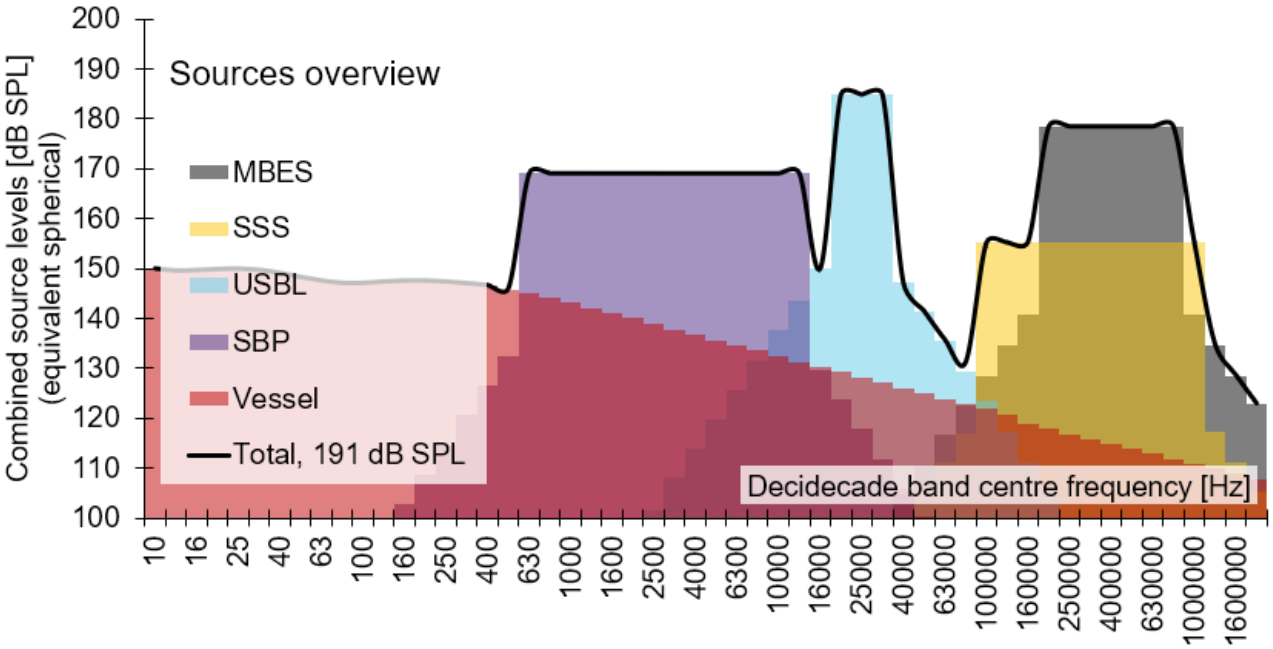


**Figure 4-15. Source band level during geophysical survey (chirper/pinger SBP & USBL active).**

### 4.1.2.4 Geophysical Survey (Chirper/Pinger SBP & USBL Not Active)

This scenario assumes the geophysical survey is using a chirper or pinger type SBP and that there is no need for a USBL (hull mounted SBP and SSS, with known positions). Total broadband level of 183 dB SPL.

Active equipment:

- Vessel
- MBES
- SSS
- Chirper/pinger SBP

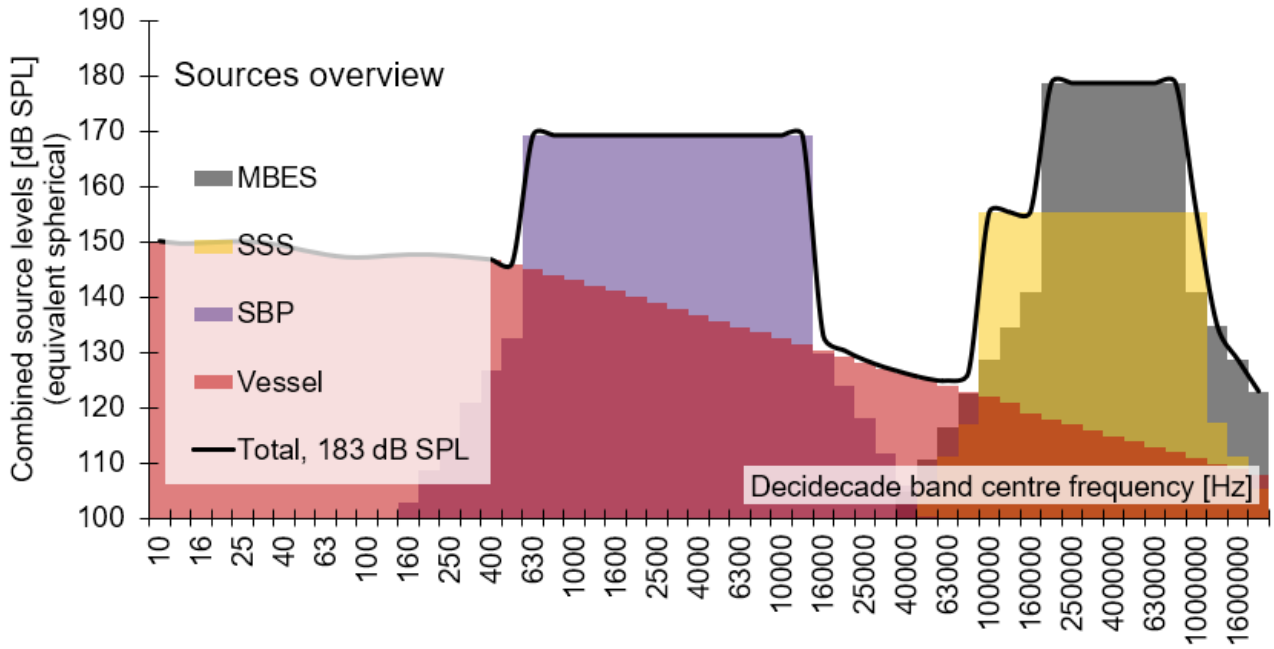


**Figure 4-16. Source band level during geophysical survey (chirper/pinger SBP & USBL not active).**

### 4.1.2.5 Geophysical Survey (Sparker SBP & USBL Active)

This scenario assumes the geophysical survey is using a sparker type SBP and that a towfish is deployed requiring an active USBL. Total broadband level of 191 dB SPL.

Active equipment:

- Vessel
- MBES
- SSS
- USBL
- Sparker

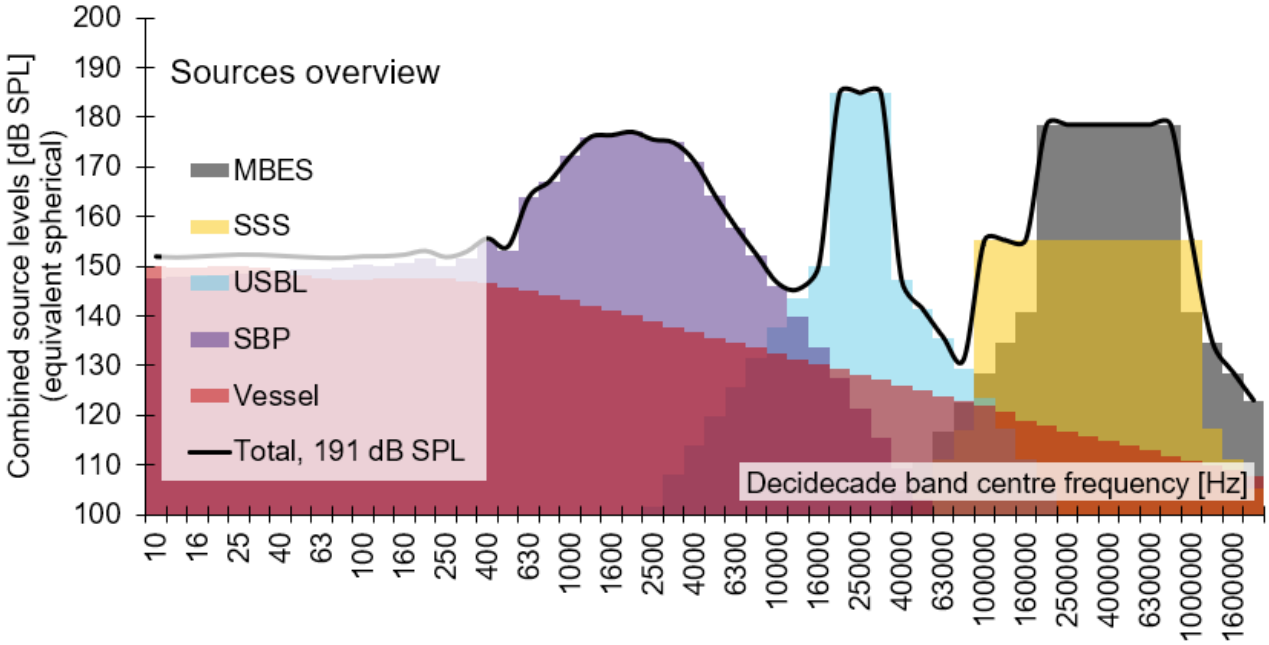


**Figure 4-17. Source band level during geophysical survey (sparker SBP & USBL active).**

### 4.1.2.6 Geophysical Survey (Sparker SBP & USBL not Active)

This scenario assumes the geophysical survey is using a sparker type SBP and that there is no need for a USBL (hull mounted SBP and SSS, with known positions). Total broadband level of 185 dB SPL.

Active equipment:

- Vessel
- MBES
- SSS
- Sparker

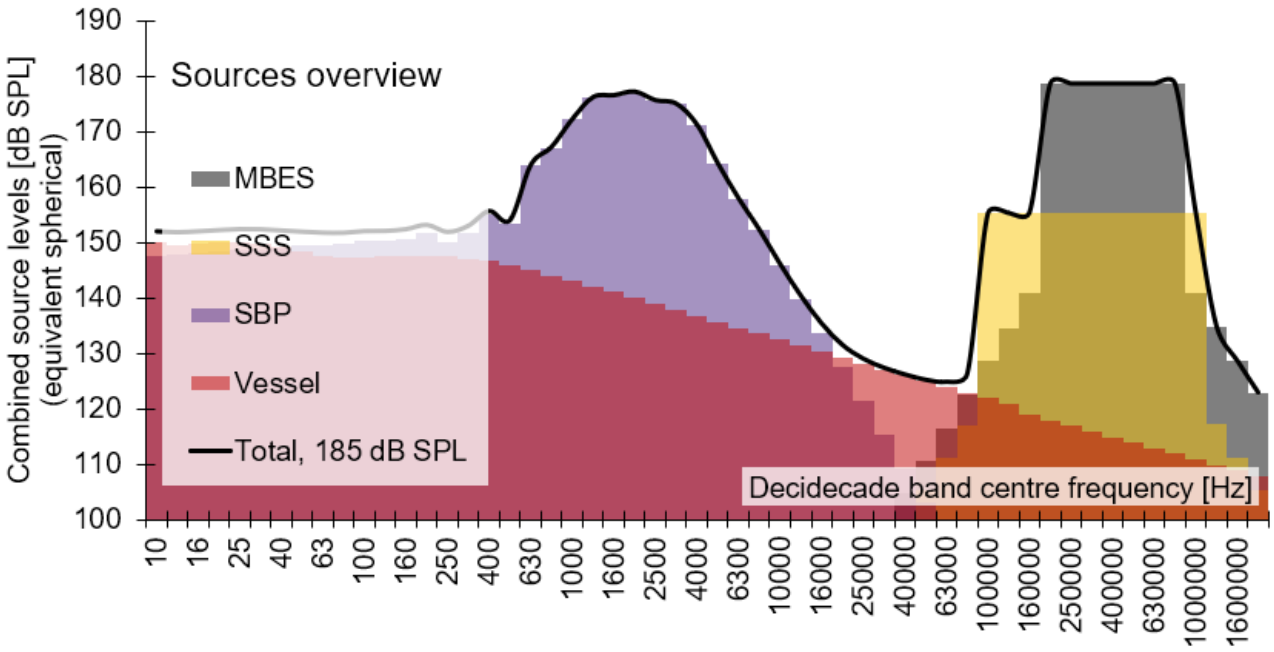


**Figure 4-18. Source band level during geophysical survey (sparker SBP & USBL not active).**

### 4.1.2.7 Soft Start Source (Geophysical)

During soft starts, it is assumed that any SBP and USBL will not be active but the MBES and/or the SSS will be active. Total broadband level of 179 dB SPL.

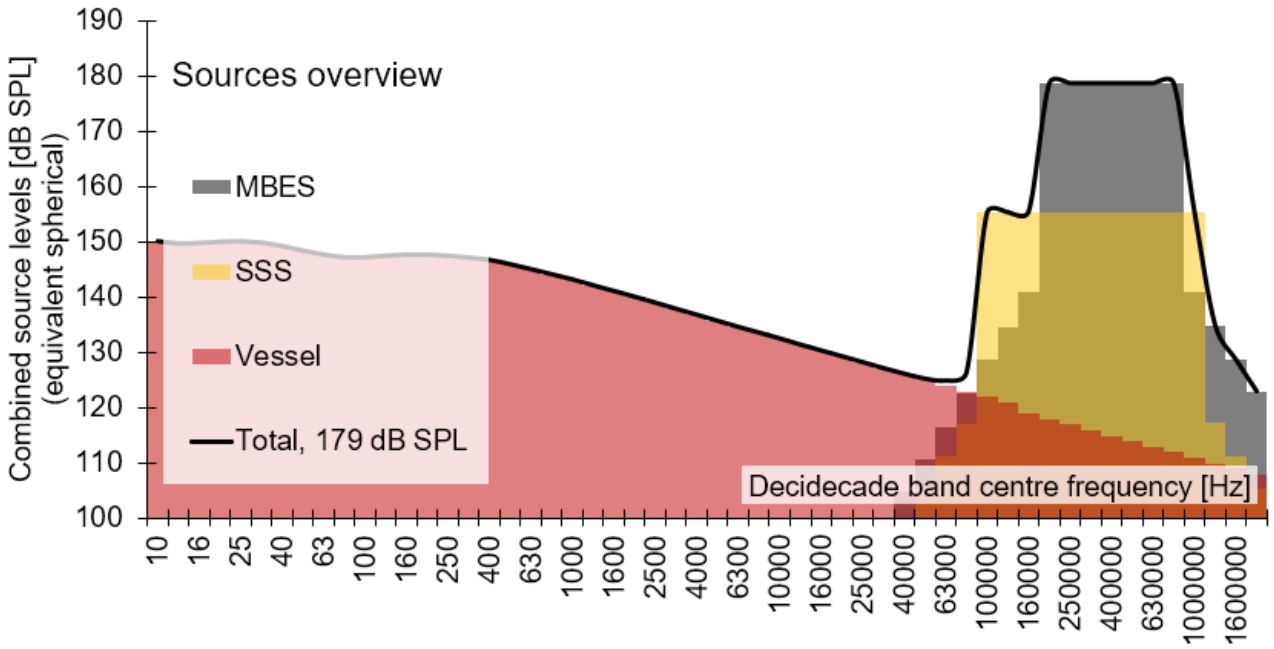


**Figure 4-19. Source band level during geophysical survey soft start.**

### 4.1.2.8 Geotechnical Survey (Drilling, boreholes)

Equipment related to drilling boreholes are active. Additionally, the “Vessel” source is active to account for support vessels and general machinery. Total broadband level of 162 dB SPL.

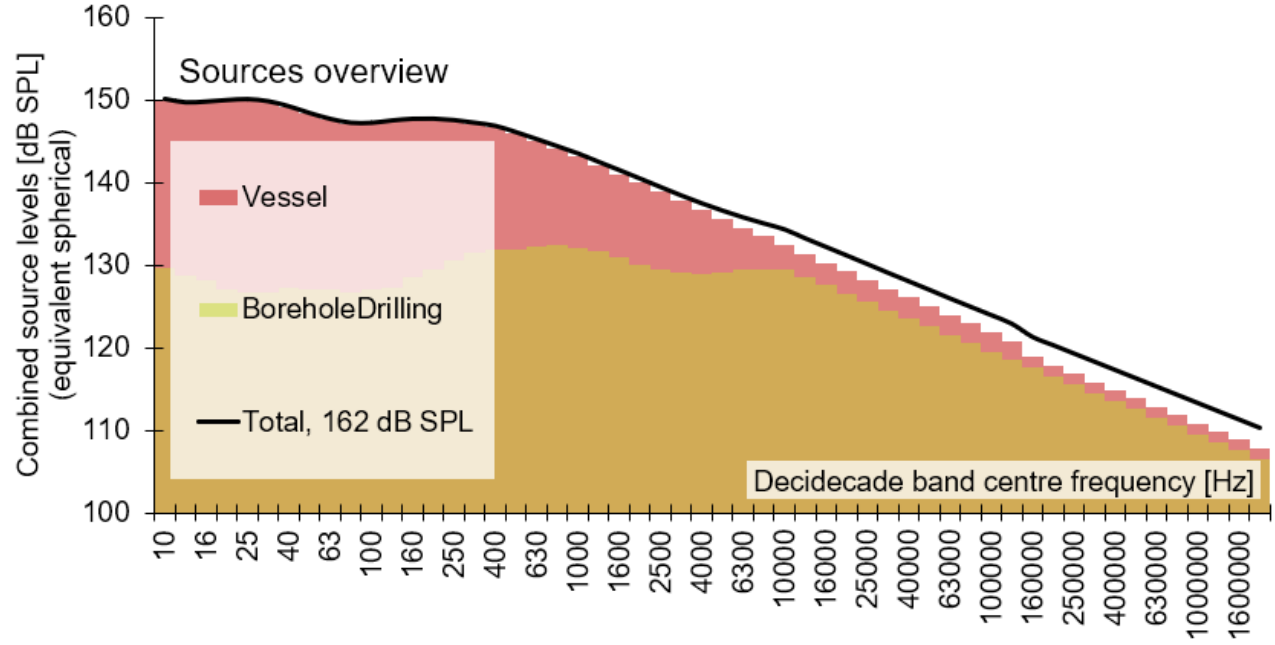


**Figure 4-20. Source band level during geotechnical survey – borehole drilling.**

### 4.1.2.9 Geotechnical Survey (Vibro-coring & CPT)

Vibro-coring, CPT, vessel (geotechnical) and USBL are active. Total broadband level of 192 dB SPL.

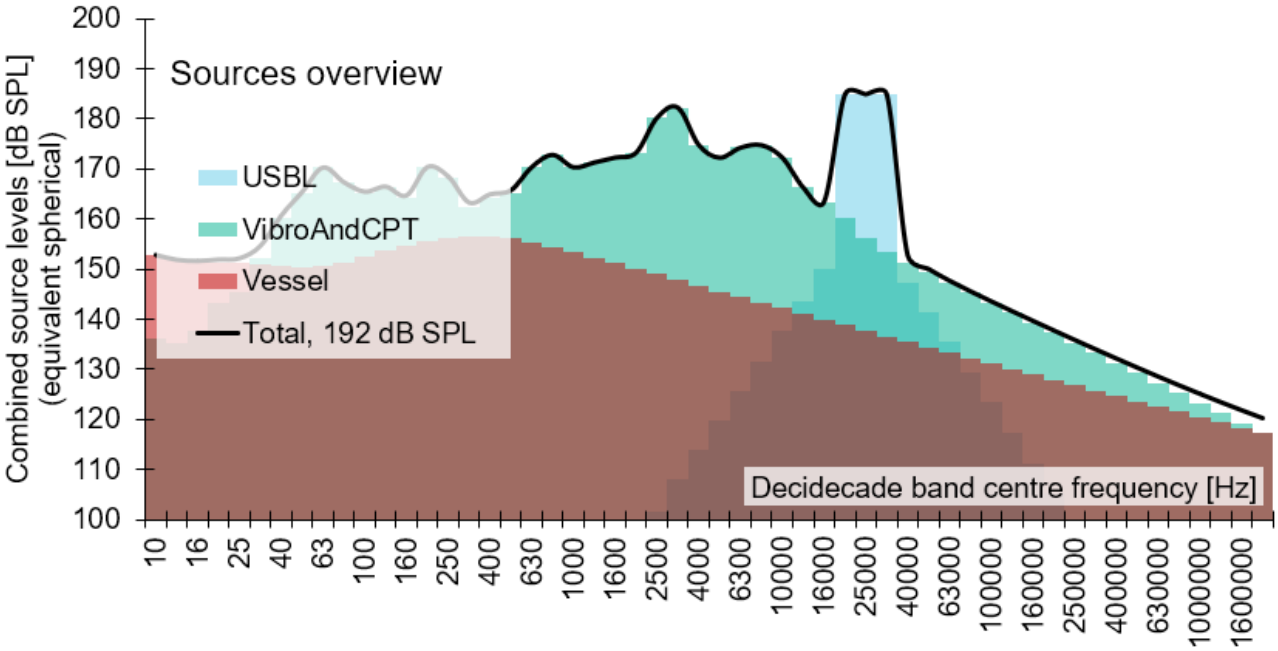


**Figure 4-21. Source band level during geotechnical survey – vibro-coring and CPT.**

### 4.1.2.10 Soft Start Source (Geotechnical – Vibro-coring & CPT)

As the geotechnical survey plans to use a USBL, it is likely that some form of soft start will need to be considered. Here, the vessel itself (with no active USBL) will perform this function. Total broadband level of 168 dB SPL.

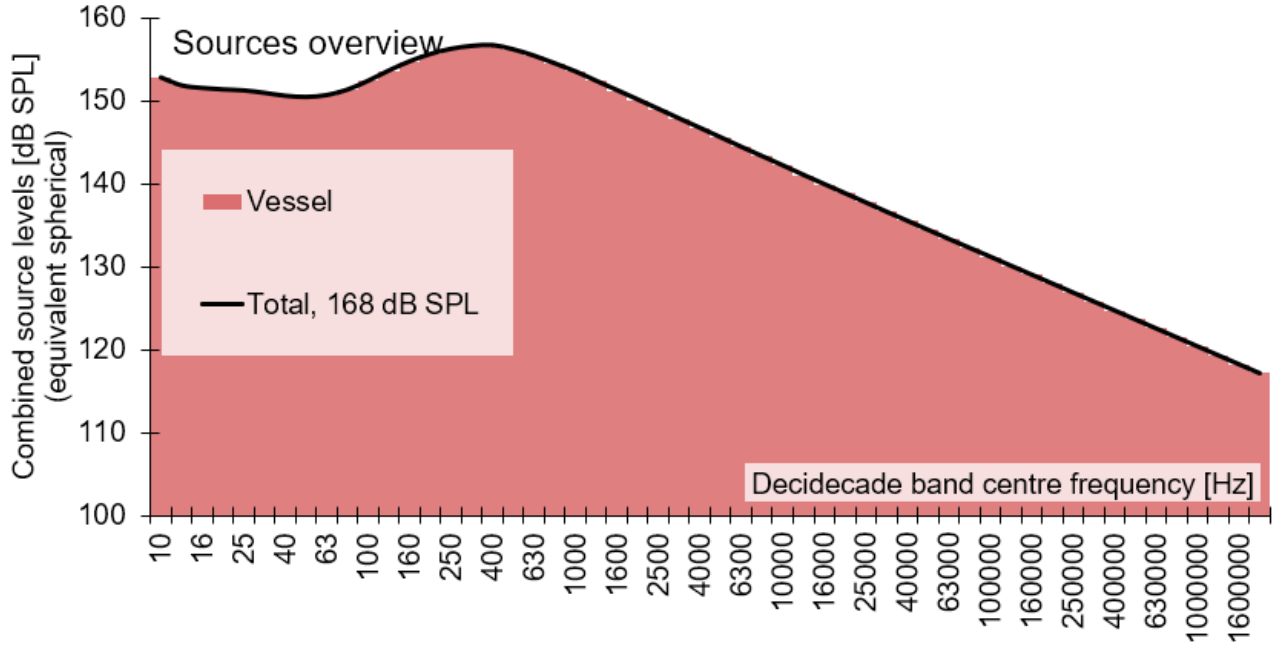


**Figure 4-22. Source band level during geotechnical (vibro-core & CPT) survey soft start.**

# 5 SOUND PROPAGATION MODELLING METHODOLOGY

There are several methods available for modelling the propagation of sound between a source and receiver ranging from very simple models which simply assume spreading according to a $10 \cdot \log_{10}$(range) or $20 \cdot \log_{10}$(range) relationship, to full acoustic models (e.g., ray tracing, normal mode, parabolic equation, wavenumber integration and energy flux models). In addition, semi-empirical models are available which lie somewhere in between these two extremes in terms of complexity (e.g., (Rogers, 1981; Weston, 1971))[9].

For simpler scenarios, such as this one, where the sediment is relatively uniform and mostly flat or where great detail in the sound field is not needed, the speed of these simpler models is preferred over the higher accuracy of numerical models and are routinely used for these types of assessments. For this assessment, we have used the “Roger’s” model (Rogers, 1981), which is suitable to depths of c. 200 m and generally softer sediments.

This model will tend to underestimate the transmission losses (leading to estimates greater than actual impact), primarily due to the omission of surface roughness, wind effects and shear waves in the sediment.

## 5.1 Modelling Assumptions

The main assumptions made for the modelling are:

1. A soft start where no SBP and no USBL is active, but MBES and/or SSS is active (section 4.1.2.7) is a feasible and practical option for the survey operator. This gives the VHF group a c. 9-18 dB reduction in received level for the duration of the soft start, depending on exact equipment configuration.
2. Animals fleeing the area will not return within a 24-hour period.
3. Animals flee for up to 2 hours, after which they will be up to 10.8 km and 3.6 km away for marine mammals and fish, respectively.
4. Modelling assumes high tide; this is a worst-case assumption.
5. Results assume a transition from impulsive (kurtosis >40) to non-impulsive (kurtosis <40) at a 500 m distance from the source. This means that all ranges greater than 500 m are assessed against the non-impulsive thresholds. This assumption is also applicable for the assessment of behavioural disturbance.

## 5.2 Exposure Calculations (dB SEL)

To compare modelled levels with the two impact assessment frameworks (Southall et al. 2019 & Popper et al. 2014) it is necessary to calculate received levels as exposure levels (SEL), weighted for marine mammals and unweighted for fishes. For ease of implementation, sources have generally been converted to an SPL source level, meaning converting to SEL from SPL or from a number of events. The conversion is relatively easy:

To convert from SPL to SEL, the following relation can be used:

$$SEL = \mathrm{SPL} + 10 \cdot Log_{10}(t_2 - t_1) \quad (1)$$

Or, where it is inappropriate to convert SEL from one event to SEL cumulative by relating to the number of events as:

$$SEL_{,n\ events} = SEL_{\ single\ event} + 10 \cdot Log_{10}(n) \quad (2)$$

[9] This model is compared to measurements in the paper (Rogers, 1981) describing it and is capable of accurate modelling in acoustically simpler scenarios. Simpler meaning shallow in relation to the wavelengths and with no significant sound speed gradient in the water column.

And SPL from SEL:

$$SPL = SEL_{\,single\ event} + 10 \cdot Log_{10}\left(\frac{n}{t_2 - t_1}\right) \quad (3)$$

As an animal swims away from the sound source, the noise it experiences will become progressively more attenuated; the cumulative, fleeing SEL is derived by logarithmically adding the SEL to which the mammal is exposed as it travels away from the source. This calculation is used to estimate the approximate minimum start distance for an animal in order for it to be exposed to sufficient sound energy to result in the exceedance of a threshold, or to check if a set exclusion zone is sufficient for an activity (e.g. will an exclusion zone of 500 m be sufficient to prevent exceeding a PTS threshold). It should be noted that the sound exposure calculations are based on the simplistic assumption that the animal will continue to swim away at a constant speed. The real-world situation is more complex, and the animal is likely to move in a more varied manner. Reported swim speeds are summarised in Table 5-1 along with the source papers for the assumptions.

For this assessment, we used a swim speed of 1.5 m/s for marine mammals, and 0.5 m/s for fishes, including sharks.

For very long fleeing durations, the ambient sound itself can exceed the thresholds, e.g., an ambient sound level of 117.5 dB, weighted for the VHF group, will exceed the non-impulsive TTS threshold of 153 dB SEL after 2 hours' exposure[10]. For this assessment, we consider fleeing durations of 2 hours (7200 seconds, allowing 10800 m of fleeing), meaning that weighted levels of 117.5 dB SPL will exceed the VHF group's non-impulsive TTS threshold in the fleeing model.

**Table 5-1: Swim speed examples from literature**

| Species | Hearing Group | Swim Speed (m/s) | Source Reference |
|---|---|---|---|
| Harbour porpoise | VHF | 1.5 | Otani *et al.,* 2000 |
| Harbour seal | PCW | 1.8 | Thompson, 2015 |
| Grey seal | PCW | 1.8 | Thompson, 2015 |
| Minke whale | LF | 2.3 | Boisseau *et al.,* 2021 |
| Bottlenose dolphin | HF | 1.52 | Bailey and Thompson, 2010 |
| White-beaked dolphin | HF | 1.52 | Bailey and Thompson, 2010 |
| Basking shark | Fish (unweighted) | 1.0 | Sims, 2000 |
| All other fish groups | Fish (unweighted) | 0.5 | Popper *et al.,* 2014 |
| Sea turtles | Fish (unweighted) | 0.56-0.84 & 0.78-2.8 | (F, et al., 1997; SA, 2002) |

[10] 117.5 dB SPL + 10*$\log_{10}$(3600 seconds) = 153.1 dB SEL, TTS non-impulsive threshold for the VHF group is 153 dB SEL.

# 6 RESULTS AND ASSESSMENT

Results are presented here as the geographical "risk range" to an auditory threshold (TTS/PTS/Behavioural), as given in Sections 2.3 and 2.5. A given risk range specifies the expected range, within which, a receiver would exceed the relevant threshold. Risk ranges are given for the 90$^{th}$ percentile value.

Several result types are presented for each activity to inform this assessment and to provide flexibility in mitigation:

1. **"1 second exposure risk range":**
   This is the range of acute risk of impact from the activity (a one second exposure) and is presented to indicate instantaneous risk and for comparison with other studies. This assumes a stationary animal (during the 1-second exposure) with all equipment operating at full power and does not include a soft start.

2. **"Minimal starting range for a fleeing animal with no soft start":**
   The minimal range a fleeing animal needs to start fleeing from to avoid being exposed to noise exceeding its TTS/PTS threshold. Animals are moving in a straight line away from the source at a constant speed of 1.5 m/s (0.5 m/s for fish, including sharks).

3. **"Minimal starting range for a fleeing animal with a 20 min soft start with no SBP and no USBL active":**
   The minimal range a fleeing animal needs to start fleeing from to avoid being exposed to noise exceeding its TTS/PTS threshold. Animals are moving in a straight line away from the source at a constant speed of 1.5 m/s (0.5 m/s for fish, including sharks).

4. **"Behavioural response range":**
   The range at which the behavioural limit for the marine mammals (160/120 dB SPL impulsive/non-impulsive) or the fishes (including sharks) (150 dB SPL) is exceeded. No hearing group weightings are applied when assessing against this threshold.

## 6.1 Assumptions and Notes on Results

The results should be read while keeping the following in mind:

- Results are rounded to the nearest 2 significant digits. This can lead to some curious appearing overlaps in risk ranges.
- Results for behavioural disturbance mainly rely on the non-impulsive threshold of 120 dB SPL (for marine mammals), as the impulsive noise transitions to non-impulsive at c. 500 m. This means that there are large ranges of disturbance, but should be considered in relation to, for example, the radiated noise from common vessels, which will also exceed this threshold to ranges of 500-5000 m (assuming 160-175 dB SPL source level).
- The soft start has little effect on the TTS ranges for the VHF group when the USBL is active. This is due to the relatively low threshold for TTS for the VHF group (153 dB SEL) and the logarithmic nature of transmission losses. A constant reduction of received level with a multiplication of range – a 3-6 dB reduction per doubling of distance, such as from 2 km to 4 km (until ranges become large enough for absorption to become significant) – means that fleeing is not very effective at reducing received level.
- Animals are modelled as fleeing in straight lines. Where sites are very confined, the maximal risk ranges will be restricted by line-of-sight ranges (and cut short where they meet land).
- Modelling assumed a maximal fleeing time of 7200 seconds (2 hours). This allows for 10.8 km of fleeing for marine mammals (3.6 km for fish).
- Modelling is limited to a range of 15 km from the source.
- No modelling of risk ranges for *mortality* for fishes are presented as risk ranges to PTS (recoverable injury) are all smaller than 30 m.

- No results are presented for assessment against the $L_P$ thresholds as, for all scenarios, the risk ranges to the TTS thresholds were <30 m for fish (TTS: 193 dB $L_P$) and <20 m for marine mammals (VHF TTS: 196 dB $L_P$).
- Results are *only* given in relation to the behavioural thresholds (SPL) and TTS/PTS thresholds for sound exposure level (SEL).
- The hearing group "Fish" includes sharks and are for unweighted received levels assessed against the lowest thresholds for fishes as found in guidance (Popper, et al., 2014).

## 6.2 Results – Tabulated

For all geophysical survey results, the vessel, SSS and MBES sources are active. Only the type of SBP and presence of a USBL is changing between the scenarios modelled.

### 6.2.1 Geophysical Survey (Parametric SBP & USBL Active)

This scenario assumes that the geophysical survey is using a parametric SBP and that a towfish is deployed, requiring an active USBL (Section 4.1.2.1).

Risk ranges for exceeding PTS is below 50 m for all groups except the VHF group, which risks exceeding the PTS threshold to a range of 500 m with no soft start.

A soft start of 20 minutes will allow sufficient time for the VHF group to swim away to reduce the PTS exceedance risk range to 50 m.

The soft start itself has a PTS risk range of 50 m for the VHF group. Therefore, extension of the soft start duration will not decrease the PTS risk range further.

**Table 6-1: Risk ranges for exceeding the behavioural threshold for all hearing groups during Geophysical survey (Parametric SBP & USBL active).**

| Behavioural Threshold exceedance Risk ranges (SPL thresholds) | LF [m] | HF [m] | VHF [m] | PCW [m] | OCW [m] | Fish [m] |
|---|---|---|---|---|---|---|
| Non-impulsive | 4000 | 4000 | 4000 | 4000 | 4000 | 380 |

**Table 6-2: Risk ranges for exceeding the TTS threshold for all hearing groups during Geophysical survey (Parametric SBP & USBL active).**

| TTS Threshold Exceedance Risk ranges (SEL thresholds) | LF [m] | HF [m] | VHF [m] | PCW [m] | OCW [m] | Fish [m] |
|---|---|---|---|---|---|---|
| One second | <10 | 40 | 770 | <10 | <10 | <10 |
| Fleeing receiver, no soft start | 80 | 310 | 2700 | 140 | <10 | 130 |
| Fleeing receiver, 20 min soft start | <10 | <10 | 1500 | <10 | <10 | <10 |

*See Comments, Section 6.1 on results limitations.

**Table 6-3. Risk ranges for exceeding the PTS threshold for all hearing groups during Geophysical survey (Parametric SBP & USBL active).**

| PTS Threshold Exceedance Risk ranges (SEL thresholds) | LF [m] | HF [m] | VHF [m] | PCW [m] | OCW [m] | Fish [m] |
|---|---|---|---|---|---|---|
| One second | <10 | <10 | 240 | <10 | <10 | <10 |
| Fleeing receiver, no soft start | <10 | 50 | 500 | <10 | <10 | <10 |
| Fleeing receiver, 20 min soft start | <10 | <10 | 50 | <10 | <10 | <10 |

### 6.2.2 Geophysical Survey (Parametric SBP & USBL Not Active)

This scenario assumes that the geophysical survey is using a parametric SBP and that there is no need for a USBL as the SBP and SSS are hull-mounted with known positions (Section 4.1.2.2).

Risk ranges for exceeding PTS is below 40 m for all groups except the VHF group, which risks exceeding the PTS threshold to a range of 470 m with no soft start.

A soft start of 20 minutes will allow sufficient time for the VHF group to swim away to reduce the PTS exceedance risk range to 50 m.

The soft start itself has a PTS risk range of 50 m for the VHF group. Therefore, extension of the soft start duration will not decrease the PTS risk range further.

**Table 6-4: Risk ranges for exceeding the behavioural threshold for all hearing groups during Geophysical survey (Parametric SBP & USBL not active).**

| Behavioural Threshold exceedance Risk ranges (SPL thresholds) | LF [m] | HF [m] | VHF [m] | PCW [m] | OCW [m] | Fish [m] |
|---|---|---|---|---|---|---|
| Non-impulsive | 1100 | 1100 | 1100 | 1100 | 1100 | 330 |

**Table 6-5: Risk ranges for exceeding the TTS threshold for all hearing groups during Geophysical survey (Parametric SBP & USBL not active).**

| TTS Threshold Exceedance Risk ranges (SEL thresholds) | LF [m] | HF [m] | VHF [m] | PCW [m] | OCW [m] | Fish [m] |
|---|---|---|---|---|---|---|
| One second | <10 | 40 | 500 | <10 | <10 | <10 |
| Fleeing receiver, no soft start | <10 | 230 | 640 | 30 | <10 | 120 |
| Fleeing receiver, 20 min soft start | <10 | <10 | 160 | <10 | <10 | <10 |

**Table 6-6. Risk ranges for exceeding the PTS threshold for all hearing groups during Geophysical survey (Parametric SBP & USBL not active).**

| PTS Threshold Exceedance Risk ranges (SEL thresholds) | LF [m] | HF [m] | VHF [m] | PCW [m] | OCW [m] | Fish [m] |
|---|---|---|---|---|---|---|
| One second | <10 | <10 | 210 | <10 | <10 | <10 |
| Fleeing receiver, no soft start | <10 | 40 | 470 | <10 | <10 | <10 |
| Fleeing receiver, 20 min soft start | <10 | <10 | 50 | <10 | <10 | <10 |

### 6.2.3 Geophysical Survey (Chirper/Pinger SBP & USBL Active)

This scenario assumes that the geophysical survey is using a chirper or pinger type SBP and that a towfish is deployed requiring an active USBL (Section 4.1.2.3).

Risk ranges for exceeding PTS is below 10 m for all groups except the VHF group, which risks exceeding the PTS threshold to a range of 490 m with no soft start.

A soft start of 20 minutes will allow sufficient time for the VHF group to swim away to reduce the PTS exceedance risk range to 50 m.

The soft start itself has a PTS risk range of 50 m for the VHF group. Therefore, extension of the soft start duration will not decrease the PTS risk range further.

**Table 6-7: Risk ranges for exceeding the behavioural threshold for all hearing groups during Geophysical survey (Chirper/pinger SBP & USBL active).**

| Behavioural Threshold exceedance Risk ranges (SPL thresholds) | LF [m] | HF [m] | VHF [m] | PCW [m] | OCW [m] | Fish [m] |
|---|---|---|---|---|---|---|
| Non-impulsive | 5700 | 5700 | 5700 | 5700 | 5700 | 270 |

**Table 6-8: Risk ranges for exceeding the TTS threshold for all hearing groups during Geophysical survey (Chirper/pinger SBP & USBL active).**

| TTS Threshold Exceedance Risk ranges (SEL thresholds) | LF [m] | HF [m] | VHF [m] | PCW [m] | OCW [m] | Fish [m] |
|---|---|---|---|---|---|---|
| One second | <10 | 10 | 750 | <10 | <10 | <10 |
| Fleeing receiver, no soft start | 140 | 250 | 2800 | 160 | <10 | 30 |
| Fleeing receiver, 20 min soft start | <10 | <10 | 1600 | <10 | <10 | <10 |

**Table 6-9. Risk ranges for exceeding the PTS threshold for all hearing groups during Geophysical survey (Chirper/pinger SBP & USBL active).**

| PTS Threshold Exceedance Risk ranges (SEL thresholds) | LF [m] | HF [m] | VHF [m] | PCW [m] | OCW [m] | Fish [m] |
|---|---|---|---|---|---|---|
| One second | <10 | <10 | 110 | <10 | <10 | <10 |
| Fleeing receiver, no soft start | <10 | <10 | 490 | <10 | <10 | <10 |
| Fleeing receiver, 20 min soft start | <10 | <10 | 50 | <10 | <10 | <10 |

### 6.2.4 Geophysical Survey (Chirper/Pinger SBP & USBL Not Active)

This scenario that assumes that the geophysical survey is using a chirper or pinger type SBP and that there is no need for a USBL as the SBP and SSS are hull mounted with known positions (Section 4.1.2.4).

Risk ranges for exceeding PTS is below 10 m for all groups except the VHF group, which risks exceeding the PTS threshold to a range of 120 m with no soft start.

A soft start of 20 minutes will allow sufficient time for the VHF group to swim away to reduce the PTS exceedance risk range to 50 m.

The soft start itself has a PTS risk range of 50 m for the VHF group. Therefore, extension of the soft start duration will not decrease the PTS risk range further.

**Table 6-10: Risk ranges for exceeding the behavioural threshold for all hearing groups during Geophysical survey (Chirper/pinger SBP & USBL not active).**

| Behavioural Threshold exceedance Risk ranges (SPL thresholds) | LF [m] | HF [m] | VHF [m] | PCW [m] | OCW [m] | Fish [m] |
|---|---|---|---|---|---|---|
| Non-impulsive | 5200 | 5200 | 5200 | 5200 | 5200 | 90 |

**Table 6-11: Risk ranges for exceeding the TTS threshold for all hearing groups during Geophysical survey (Chirper/pinger SBP & USBL not active).**

| TTS Threshold Exceedance Risk ranges (SEL thresholds) | LF [m] | HF [m] | VHF [m] | PCW [m] | OCW [m] | Fish [m] |
|---|---|---|---|---|---|---|
| One second | <10 | <10 | 70 | <10 | <10 | <10 |
| Fleeing receiver, no soft start | 70 | <10 | 490 | 30 | <10 | <10 |
| Fleeing receiver, 20 min soft start | <10 | <10 | 170 | <10 | <10 | <10 |

**Table 6-12. Risk ranges for exceeding the PTS threshold for all hearing groups during Geophysical survey (Chirper/pinger SBP & USBL not active).**

| PTS Threshold Exceedance Risk ranges (SEL thresholds) | LF [m] | HF [m] | VHF [m] | PCW [m] | OCW [m] | Fish [m] |
|---|---|---|---|---|---|---|
| One second | <10 | <10 | 10 | <10 | <10 | <10 |
| Fleeing receiver, no soft start | <10 | <10 | 120 | <10 | <10 | <10 |
| Fleeing receiver, 20 min soft start | <10 | <10 | 50 | <10 | <10 | <10 |

### 6.2.5 Geophysical Survey (Sparker SBP & USBL Active)

This scenario assumes the geophysical survey is using a Sparker type SBP and that a towfish is deployed requiring an active USBL (Section 4.1.2.5).

Risk ranges for exceeding PTS is below 10 m for all groups except the VHF group, which risks exceeding the PTS threshold to a range of 490 m with no soft start.

A soft start of 20 minutes will allow sufficient time for the VHF group to swim away to reduce the PTS exceedance risk range to 50 m.

The soft start itself has a PTS risk range of 50 m for the VHF group. Therefore, extension of the soft start duration will not decrease the PTS risk range further.

**Table 6-13: Risk ranges for exceeding the peak pressure level impulsive threshold for all hearing groups during Geophysical survey (Sparker SBP & USBL active).**

| Risk ranges ($L_P$ thresholds) | LF [m] | HF [m] | VHF [m] | PCW [m] | OCW [m] | Fish [m] |
|---|---|---|---|---|---|---|
| TTS | 10 | <10 | 20.1 | 10 | <10 | 30.1 |
| PTS | 10 | <10 | 20.1 | 10 | <10 | 10 |

**Table 6-14: Risk ranges for exceeding the behavioural threshold for all hearing groups during Geophysical survey (Sparker SBP & USBL active).**

| Behavioural Threshold exceedance Risk ranges (SPL thresholds) | LF [m] | HF [m] | VHF [m] | PCW [m] | OCW [m] | Fish [m] |
|---|---|---|---|---|---|---|
| Non-impulsive | 8000 | 8000 | 8000 | 8000 | 8000 | 290 |

**Table 6-15: Risk ranges for exceeding the TTS threshold for all hearing groups during Geophysical survey (Sparker SBP & USBL active).**

| TTS Threshold Exceedance Risk ranges (SEL thresholds) | LF [m] | HF [m] | VHF [m] | PCW [m] | OCW [m] | Fish [m] |
|---|---|---|---|---|---|---|
| One second | <10 | 10 | 750 | <10 | <10 | <10 |
| Fleeing receiver, no soft start | 220 | 250 | 2700 | 180 | <10 | 30 |
| Fleeing receiver, 20 min soft start | <10 | <10 | 1500 | <10 | <10 | <10 |

**Table 6-16. Risk ranges for exceeding the PTS threshold for all hearing groups during Geophysical survey (Sparker SBP & USBL active).**

| PTS Threshold Exceedance Risk ranges (SEL thresholds) | LF [m] | HF [m] | VHF [m] | PCW [m] | OCW [m] | Fish [m] |
|---|---|---|---|---|---|---|
| One second | <10 | <10 | 110 | <10 | <10 | <10 |
| Fleeing receiver, no soft start | <10 | <10 | 490 | <10 | <10 | <10 |
| Fleeing receiver, 20 min soft start | <10 | <10 | 50 | <10 | <10 | <10 |

### 6.2.6 Geophysical Survey (Sparker SBP & USBL Not Active)

This scenario assumes the geophysical survey is using a Sparker type SBP and that there is no need for a USBL as the SBP and SSS are hull mounted with known positions (Section 4.1.2.6).

Risk ranges for exceeding PTS is below 10 m for all groups except the VHF group, which risks exceeding the PTS threshold to a range of 50 m with no soft start.

A soft start of 20 minutes will not reduce this range for the VHF group.

The soft start itself has a PTS risk range of 50 m for the VHF group. Therefore, extension of the soft start duration will not decrease the PTS risk range further.

**Table 6-17: Risk ranges for exceeding the peak pressure level impulsive threshold for all hearing groups during Geophysical survey (Sparker SBP & USBL not active).**

| Risk ranges ($L_P$ thresholds) | LF [m] | HF [m] | VHF [m] | PCW [m] | OCW [m] | Fish [m] |
|---|---|---|---|---|---|---|
| TTS | 10 | <10 | 20.1 | 10 | <10 | 30.1 |
| PTS | 10 | <10 | 20.1 | 10 | <10 | 10 |

**Table 6-18: Risk ranges for exceeding the behavioural threshold for all hearing groups during Geophysical survey (Sparker SBP & USBL not active).**

| Behavioural Threshold exceedance Risk ranges (SPL thresholds) | LF [m] | HF [m] | VHF [m] | PCW [m] | OCW [m] | Fish [m] |
|---|---|---|---|---|---|---|
| Non-impulsive | 7900 | 7900 | 7900 | 7900 | 7900 | 120 |

**Table 6-19: Risk ranges for exceeding the TTS threshold for all hearing groups during Geophysical survey (Sparker SBP & USBL not active).**

| TTS Threshold Exceedance Risk ranges (SEL thresholds) | LF [m] | HF [m] | VHF [m] | PCW [m] | OCW [m] | Fish [m] |
|---|---|---|---|---|---|---|
| One second | <10 | <10 | 50 | <10 | <10 | <10 |
| Fleeing receiver, no soft start | 160 | <10 | 330 | 60 | <10 | <10 |
| Fleeing receiver, 20 min soft start | <10 | <10 | 160 | <10 | <10 | <10 |

**Table 6-20. Risk ranges for exceeding the PTS threshold for all hearing groups during Geophysical survey (Sparker SBP & USBL not active).**

| PTS Threshold Exceedance Risk ranges (SEL thresholds) | LF [m] | HF [m] | VHF [m] | PCW [m] | OCW [m] | Fish [m] |
|---|---|---|---|---|---|---|
| One second | <10 | <10 | <10 | <10 | <10 | <10 |
| Fleeing receiver, no soft start | <10 | <10 | 50 | <10 | <10 | <10 |
| Fleeing receiver, 20 min soft start | <10 | <10 | 50 | <10 | <10 | <10 |

### 6.2.7 Geotechnical Survey (Drilling, boreholes)

This scenario assumes the drilling and vessel source is active (Section 6.2.7).

No soft start has been modelled for this activity; this is based on:

1. Risk ranges for exceeding PTS are below 10 meters for all groups.
2. The sampling platform (vessel or barge) will itself emit similar noise to the sampling activity and will serve as a type of soft start exceeding normal soft start durations.
3. The geotechnical equipment itself cannot easily be operated at reduced noise output.

**Table 6-21: Risk ranges for exceeding the behavioural threshold for all hearing groups during drilling.**

| Behavioural Threshold exceedance Risk ranges (SPL thresholds) | LF [m] | HF [m] | VHF [m] | PCW [m] | OCW [m] | Fish [m] |
|---|---|---|---|---|---|---|
| Non-impulsive | <20 | <20 | <20 | <20 | <20 | <10 |

**Table 6-22: Risk ranges for exceeding the TTS threshold for all hearing groups during drilling.**

| TTS Threshold Exceedance Risk ranges (SEL thresholds) | LF [m] | HF [m] | VHF [m] | PCW [m] | OCW [m] | Fish [m] |
|---|---|---|---|---|---|---|
| One second | <10 | <10 | <10 | <10 | <10 | <10 |
| Fleeing receiver, no soft start | <10 | <10 | <10 | <10 | <10 | <10 |

**Table 6-23. Risk ranges for exceeding the PTS threshold for all hearing groups during drilling.**

| PTS Threshold Exceedance Risk ranges (SEL thresholds) | LF [m] | HF [m] | VHF [m] | PCW [m] | OCW [m] | Fish [m] |
|---|---|---|---|---|---|---|
| One second | <10 | <10 | <10 | <10 | <10 | <10 |
| Fleeing receiver, no soft start | <10 | <10 | <10 | <10 | <10 | <10 |

### 6.2.8 Geotechnical Survey (Vibro-coring & CPT)

This scenario assumes the vessel, vibro-corer, CPT and USBL sources are active (Section 4.1.2.9).

Risk ranges for exceeding PTS is below 10 m for all groups except the VHF group, which risks exceeding the PTS threshold to a range of 490 m with no soft start.

A soft start of 20 minutes will allow sufficient time for the VHF group to swim away to reduce the PTS exceedance risk range to less than 10 m.

**Table 6-24: Risk ranges for exceeding the behavioural threshold for all hearing groups during Vibro-coring and CPT.**

| Behavioural Threshold exceedance Risk ranges (SPL thresholds) | LF [m] | HF [m] | VHF [m] | PCW [m] | OCW [m] | Fish [m] |
|---|---|---|---|---|---|---|
| Non-impulsive | 5700 | 5700 | 5700 | 5700 | 5700 | 270 |

**Table 6-25: Risk ranges for exceeding the TTS threshold for all hearing groups during Vibro-coring and CPT.**

| TTS Threshold Exceedance Risk ranges (SEL thresholds) | LF [m] | HF [m] | VHF [m] | PCW [m] | OCW [m] | Fish [m] |
|---|---|---|---|---|---|---|
| One second | <10 | 10 | 750 | <10 | <10 | <10 |
| Fleeing receiver, no soft start | 130 | 250 | 2700 | 160 | <10 | 20 |
| Fleeing receiver, 20 min soft start | <10 | <10 | 1500 | <10 | <10 | <10 |

**Table 6-26. Risk ranges for exceeding the PTS threshold for all hearing groups during Vibro-coring and CPT.**

| PTS Threshold Exceedance Risk ranges (SEL thresholds) | LF [m] | HF [m] | VHF [m] | PCW [m] | OCW [m] | Fish [m] |
|---|---|---|---|---|---|---|
| One second | <10 | <10 | 110 | <10 | <10 | <10 |
| Fleeing receiver, no soft start | <10 | <10 | 490 | <10 | <10 | <10 |
| Fleeing receiver, 20 min soft start | <10 | <10 | <10 | <10 | <10 | <10 |

## 6.3 Results Summary

### 6.3.1 Geophysical Survey

**PTS – hearing injury**

Apart from the VHF hearing group, all risk ranges to PTS exceedance for fleeing receivers is below 50 m with no soft start.

For the VHF hearing group, the risk range for PTS exceedance for fleeing receivers is up to 500 m with no soft start and below 50 m with a 20-minute soft start.

**TTS – temporary hearing impairment**

Apart from the VHF hearing group, all risk ranges to TTS exceedance for fleeing receivers is below 310 m with no soft start and below 10 m with a 20-minute soft start.

For the VHF hearing group, the risk range for TTS exceedance for fleeing receivers is up to 2800 m with no soft start and below 1600 m with a 20-minute soft start.

**Behavioural disturbance**

Ranges for behavioural disturbance for all hearing groups except Fish is up to 8 km (driven by the sparker type SBP). For Fish the range for behavioural disturbance is much less at up to 380 m (driven by the parametric SBP & USBL).

### 6.3.2 Geotechnical Survey

**Drilling, Boreholes**

The drilling of boreholes has virtually no risk of exceeding PTS or TTS thresholds for any hearing group, with all risk ranges to PTS and TTS exceedance below 10 m.

Behavioural threshold is also not exceeded beyond 20 m.

**Vibro-coring & CPT with USBL**

**PTS – hearing injury**

The VHF group has a PTS exceedance risk for moving receivers to 490 m with no soft start, reducing to under 10 m with a 20-minute soft start.

All remaining hearing groups have PTS risk exceedance ranges for moving receivers below 10 m, even with no soft start.

**TTS – temporary hearing impairment**

The VHF group has a TTS exceedance risk for moving receivers to 2700 m with no soft start, reducing to 1500 m with a 20-minute soft start.

All remaining hearing groups have risk ranges for PTS exceedance for moving receivers at or below 260 m, with no soft start, reducing to below 10 m with a 20-minute soft start.

**Behavioural disturbance**

Ranges for behavioural disturbance for all hearing groups except Fish is up to 5700 m (driven by the USBL). For Fish the range for behavioural disturbance is much less at up to 270 m (driven by the USBL).

# 7 CONCLUSIONS

This assessment concludes that the risk of inducing hearing injury (PTS – Permanent Threshold Shift) following noise from the SI Works is below 50 m with no soft start for all hearing groups except the VHF group . The VHF group (harbour porpoise) has an injury risk up to 500m from the active noise sources with no soft start. Applying a 20-minute soft start reduces the injury risk to below 50 m.

There is risk of inducing temporary hearing effects (TTS – Temporary Threshold Shift). This extends to c. 3000 m for the VHF group (harbour porpoise) and below c. 300 m for remaining marine mammals and fishes. Introducing a 20-minute soft start, where only some equipment is active, will reduce the risk of TTS for the VHF group to within 1600 m, and to below 10 m for the remaining marine mammals and fishes.

Behavioural disturbance ranges of up to 8,000 m have been modelled for the geophysical survey for marine mammals while the Sparker type SBP is active. For the geotechnical survey, the use of a USBL means that behavioural disturbance ranges up to 5,700 m. The low noise levels of the borehole drilling means that the behavioural disturbance limit is within 20 m.

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# Appendix A – Acoustic Concepts and Terminology

Sound travels through water as vibrations of the fluid particles in a series of pressure waves. The waves comprise a series of alternating compressions (positive pressure variations) and rarefactions (negative pressure fluctuations). Because sound consists of variations in pressure, the unit for measuring sound is usually referenced to a unit of pressure, the Pascal (Pa). The unit usually used to describe sound is the decibel (dB) and, in the case of underwater sound, the reference unit is taken as 1 µPa, one micro-pascal, whereas airborne sound is usually referenced to a pressure of 20 µPa. To convert from a sound pressure level referenced to 20 µPa to one referenced to 1 µPa, a factor of 20 log (20/1) i.e. 26 dB has to be added to the former quantity. Thus, a sound pressure of 60 dB re 20 µPa is the same as 86 dB re 1 µPa, although care also needs to be taken when converting from in air sound to in water sound levels due to the different sound speeds and densities of the two mediums resulting in a conversion factor of approximately 62 dB for comparing intensities (watt/m²), see Table 8-1 , below.

**Table 8-1: Comparing sound quantities between air and water.**

| | Constant intensity | | Constant pressure | |
|---|---|---|---|---|
| **Properties** | **Air** | **Water** | **Air** | **Water** |
| Soundspeed (C) [m/s] | 340 | 1500 | 340 | 1500 |
| Density (ρ) [kg/m³] | 1.293 | 1026 | 1.293 | 1026 |
| Acoustic impedance (Z=C·ρ) [kg/(m²·s) or (Pa·s)/m³] | 440 | 1539000 | 440 | 1539000 |
| Sound intensity (I=p²/Z) [Watt/m²] | 1 | 1 | 22.7469 | 0.0065 |
| Sound pressure (p=(I*Z)$^{½}$) [Pa] | 21 | 1241 | 100 | 100 |
| Particle velocity (I/p) [m/s] | 0.04769 | 0.00081 | 0.22747 | 0.00006 |
| dB re 1 µPa² | 146.4 | **181.9** | 160.0 | **160.0** |
| dB re 20 µPa² | **120.4** | 155.9 | **134.0** | 134.0 |
| | | | | |
| **Difference dB re 1 µPa² & dB re 20 µPa²** | **61.5** | | **26.0** | |

All underwater sound pressure levels in this report are described in dB re 1 µPa². In water, the sound source strength is defined by its sound pressure level in dB re 1 µPa², referenced back to a representative distance of 1m from an assumed (infinitesimally small) point source. This allows calculation of sound levels in the far-field. For large, distributed sources, the actual sound pressure level in the near-field will be lower than predicted.

There are several descriptors used to characterise a sound wave. The difference between the lowest pressure deviation (rarefaction) and the highest pressure deviation (compression) from ambient is the peak to peak (or pk-pk) sound pressure ($L_{P\text{-}P}$ for the level in dB), Note that $L_{P\text{-}P}$ can be hard to measure consistently, as the maximal duration between the lowest and highest pressure deviation is not standardised. The difference between the highest deviation (either positive or negative) and the ambient pressure is called the peak pressure ($L_P$ for the level in dB). Lastly, the average sound pressure is used as a description of the average amplitude of the variations in pressure over a specific time window (SPL for the level in dB). SPL is equal to the $L_{eq}$ when the time window for the SPL is equal to the time window for the total duration of an event. The cumulative sound energy from pressure is the integrated squared pressure over a given period (SEL for the level in dB). These descriptions are shown graphically in Figure 8-1 and reflect the units as given in ISO 18405:2017, “Underwater Acoustics – Terminology”.

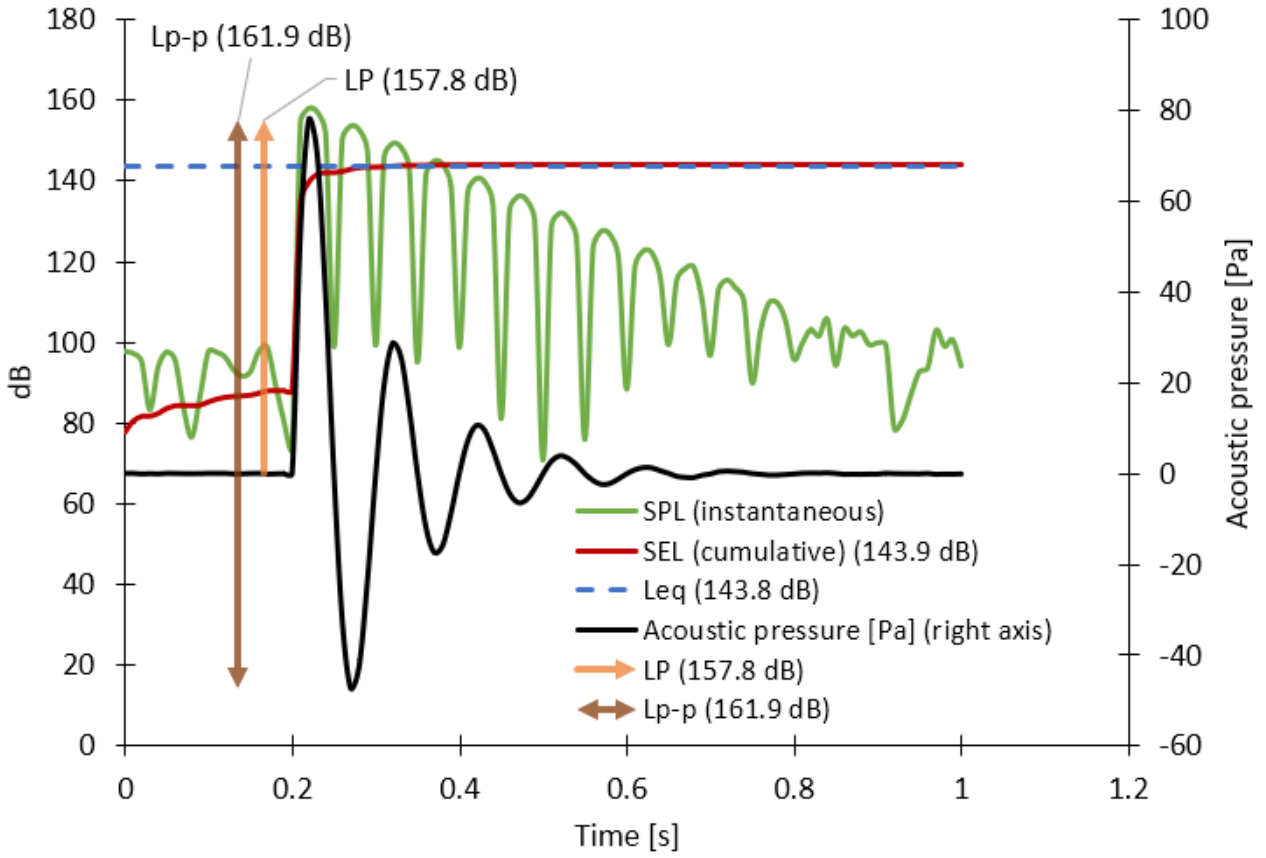


**Figure 8-1: Graphical representation of acoustic wave descriptors ("LE" = SEL).**

The sound pressure level (SPL[11]) is defined as follows (ISO 18405:2017, 3.2.1.1):

$$SPL = 10 \cdot Log_{10}\left(\frac{\overline{p^2}}{1 \cdot 10^{-12} Pa}\right) \quad (1)$$

Here $\overline{p^2}$ is the arithmetic mean of the squared pressure values. Note that $L_P$ is simply the instantaneous SPL (ISO 18405:2017, 3.2.2.1).

The peak sound pressure level, $L_P$, is the instantaneous decibel level of the maximal deviation from ambient pressure and is defined in (ISO 18405:2017, 3.2.2.1) and can be calculated as:

$$L_P = 10 \cdot Log_{10}\left(\frac{max(p^2)}{1 \cdot 10^{-12} Pa}\right)$$

Another useful measure of sound used in underwater acoustics is the Exposure Level, or SEL. This descriptor is used as a measure of the total sound energy of a single event or a number of events (e.g. over the course of a day). This allows the total acoustic energy contained in events lasting a different amount of time to be compared on a like for like basis. Historically, use was primarily made of SPL and $L_P$ metrics for assessing the potential effects of sound on marine life. However, the SEL is increasingly being used as it allows exposure duration and the effect of exposure to multiple events over e.g. a 24-hour period to be taken into account. The SEL is defined as follows (ISO 18405:2017, 3.2.1.5):

$$SEL = 10 \cdot Log_{10}\left(\frac{\int_{t_1}^{t_2} p(t)^2 dt}{1 \cdot 10^{-12} Pa}\right) \quad (2)$$

To convert from SEL to SPL the following relation can be used:

$$SEL = \mathrm{SPL} + 10 \cdot Log_{10}(t_2 - t_1) \quad (3)$$

[11] Equivalent to the commonly seen "RMS-level".

Converting from a single event to multiple events for SEL:

$$SEL_{n\ events} = SEL_{single\ event} + 10 \cdot Log_{10}(n) \quad (4)$$

The frequency, or pitch, of the sound is the rate at which these oscillations occur and is measured in cycles per second, or Hertz (Hz). When sound is measured in a way which approximates to how a human would perceive it using an A-weighting filter on a sound level meter, the resulting level is described in values of dB(A). However, the hearing faculties of marine mammals and fish are not the same as humans, with marine mammals hearing over a wider range of frequencies, fish over a typically smaller range of frequencies and both with different sensitivities. It is therefore important to understand how an animal's hearing varies over the entire frequency range to assess the effects of sound on marine life. Consequently, use can be made of frequency weighting scales to determine the level of the sound in comparison with the auditory response of the animal concerned. A comparison between the typical hearing response curves for fish, humans and marine mammals is shown in Figure 8-2. Note that hearing thresholds are sometimes shown as audiograms with sound level on the y axis rather than sensitivity, resulting in the graph shape being the inverse of the graph shown. It is also worth noting that some fish are sensitive to particle velocity rather than pressure, although paucity of data relating to particle velocity levels for anthropogenic sound sources means that it is often not possible to quantify this effect. Marine reptiles (mostly sea turtles) have relatively poor hearing underwater, lacking a good acoustic coupling mechanism from the sea water to the inner ear.

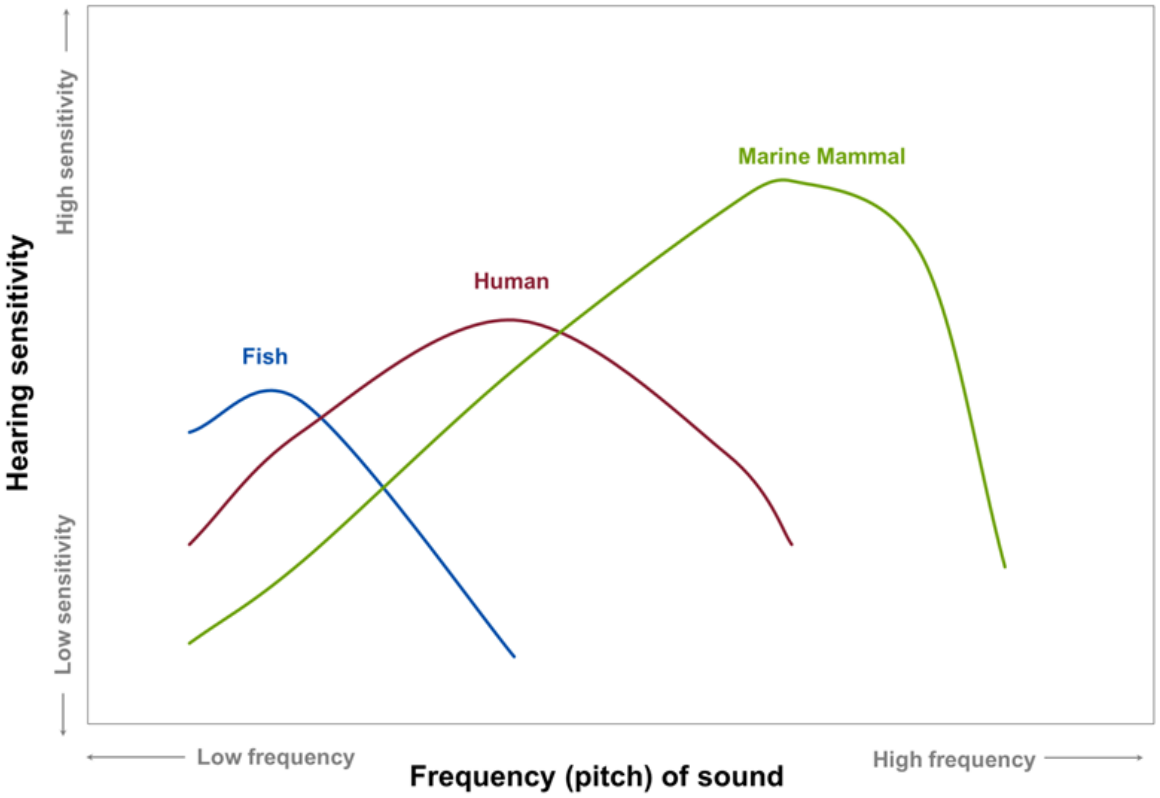


**Figure 8-2: Comparison between hearing thresholds of different marine animals and humans.**

## Impulsiveness

The impulsiveness of a source can be estimated from the kurtosis of the weighted signal (as suggested by Matin et al. in "Techniques for distinguishing between impulsive and non-impulsive sound in the context of regulating sound exposure for marine mammals", Journal of the Acoustical Society of America, 2020)

The consequence of this is that the same equipment can be both impulsive and non-impulsive, depending o marine mammal presence and the local environment.

Below is an example of a hull mounted echo sounder at 15 m depth and at 250 m depth.

In shallow water the ping rate can be high as reflections from the sediment return quickly, but the single pulse duration is usually shorter as less energy in the signal is required due to the short range the pulse must travel. This leads to high repetition rate (decreases kurtosis) and shorter pulses (increases kurtosis). Figure 8-3 shows an example where this leads to a non-impulsive source, to be compared to the thresholds for non-impulsive noise.

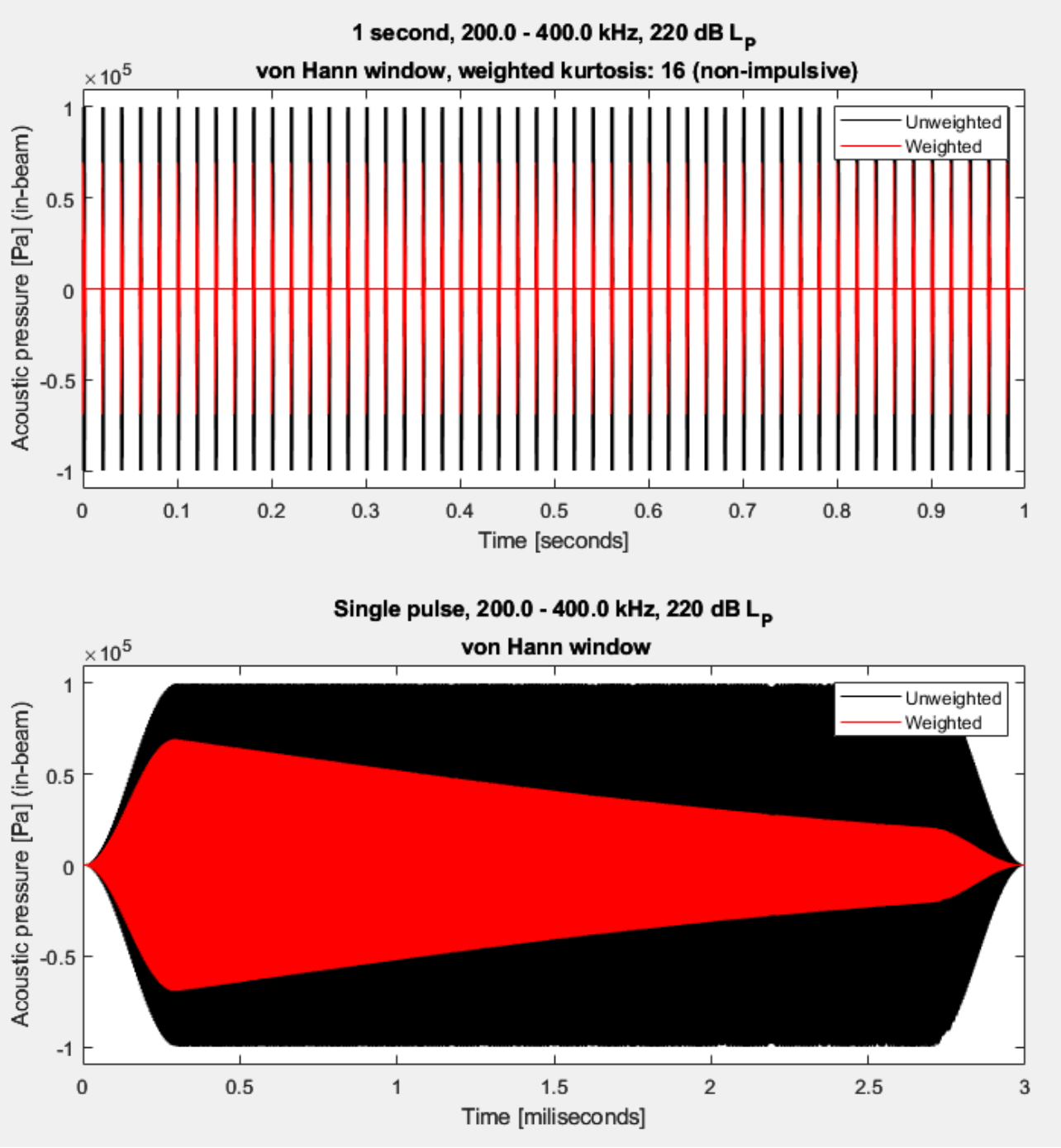


Figure 8-3. Example of a multibeam echosounder at 15 m depth (achieving 50 ping/sec) with a 3 ms ping duration. VHF-weighted kurtosis of 16 – non-impulsive.

In deeper water, the ping rate will usually be slower as echoes take longer to return to the sediment and the pulses will be longer to increase the energy in the pulses and make their echoes easier to detect. This leads to low repetition rate (increases kurtosis) and longer pulses (decreases kurtosis). Figure 8-4 shows an example where this combination resulted in an impulsive source, to be compared to the thresholds for impulsive noise.

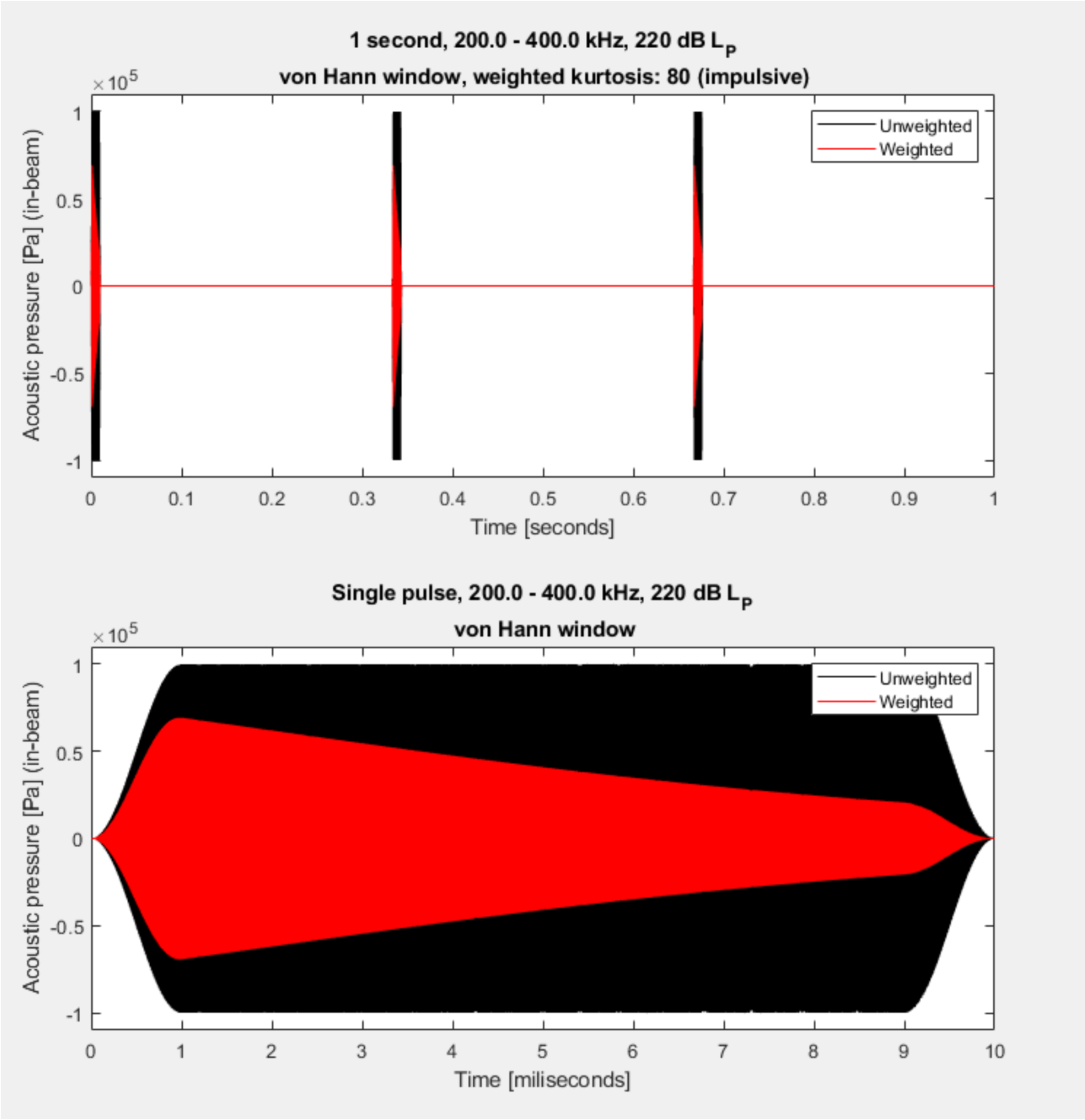


Figure 8-4. Example of a multibeam echosounder at 250 m depth (achieving 3 ping/sec) with a 10 ms ping duration. VHF-weighted kurtosis of 80 – impulsive.

With range, due to multiple reflections and scattering, the kurtosis will decrease with increased range, for shallow water this decrease will be quicker than for deeper water, compare Figure 8-5 & Figure 8-6, where a kurtosis <40 is reached at c. 200 m in 20 m depth, but at over 1000 m at 200 m depth.

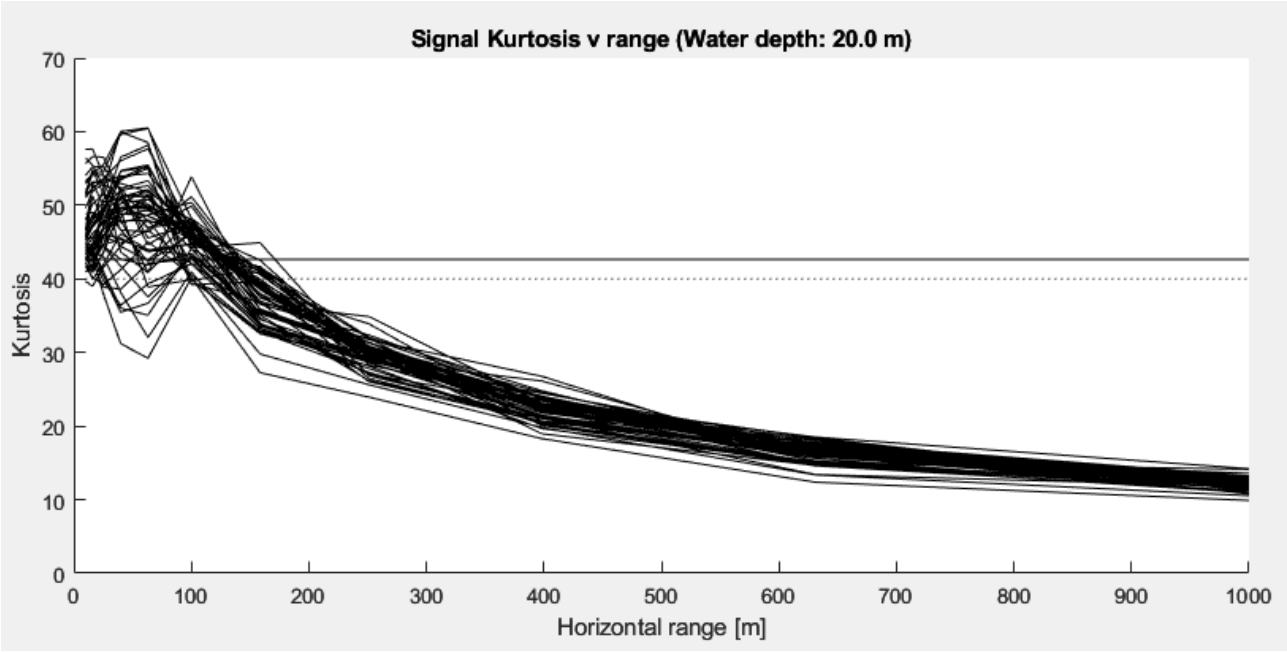


**Figure 8-5. Example of USBL signal kurtosis decreasing with range at 20 m depth. Multiple lines are various combinations of source and receiver depths.**

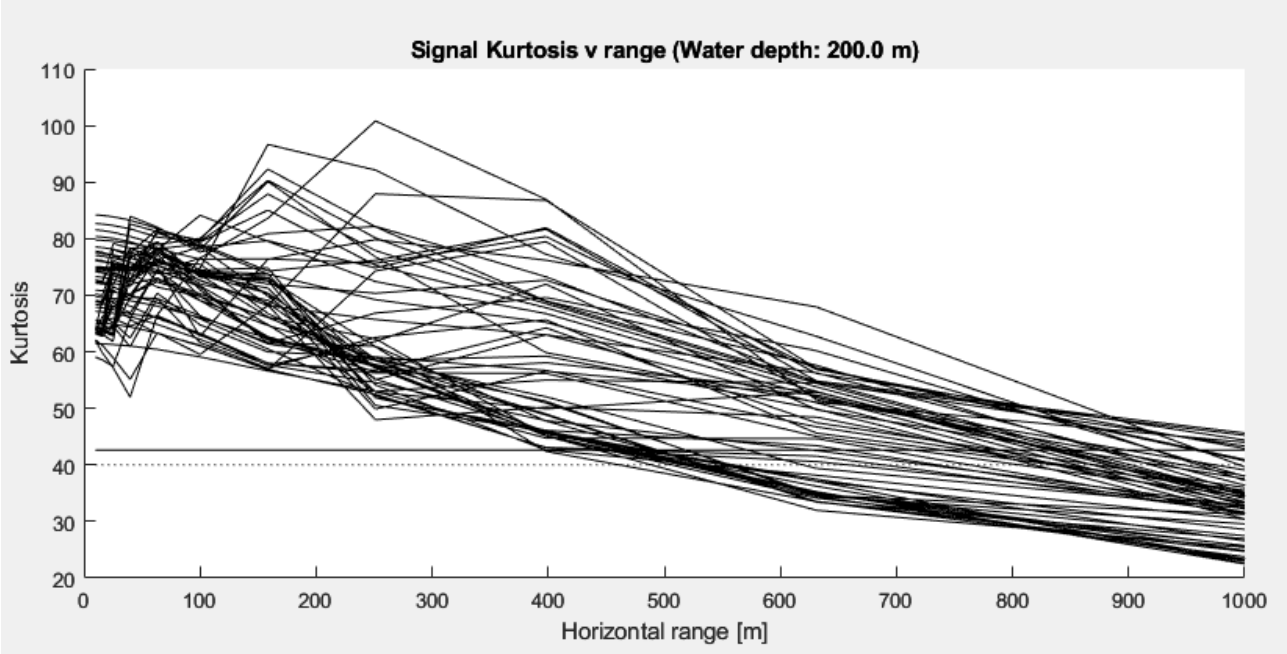


**Figure 8-6. Example of USBL signal kurtosis decreasing with range at 200 m depth. Multiple lines are various combinations of source and receiver depths.**

## Review of Sound Propagation Concepts

Increasing the distance from the sound source usually results in the level of sound getting lower, due primarily to the spreading of the sound energy with distance, analogous to the way in which the ripples in a pond spread after a stone has been thrown in.

The way that the sound spreads will depend upon several factors such as water column depth, pressure, temperature gradients, salinity, as well as water surface and seabed conditions. Thus, even for a given locality, there are temporal variations to the way that sound will propagate. However, in simple terms, the

sound energy may spread out in a spherical pattern (close to the source, with no boundaries) or a cylindrical pattern (much further from the source, bounded by the surface and the sediment), although other factors mean that decay in sound energy may be somewhere between these two simplistic cases.

In acoustically shallow waters[12] in particular, the propagation mechanism is coloured by multiple interactions with the seabed and the water surface (Lurton, 2002; Etter, 2013; Urick, 1983; Brekhovskikh and Lysanov 2003, Kinsler et al., 1999). Whereas in deeper waters, the sound will propagate further without encountering the surface or bottom of the sea, in shallower waters the sound is reflected many times by the surface and sediment.

At the sea surface, the majority of sound is reflected back into the water due to the difference in acoustic impedance (i.e. sound speed and density) between air and water. However, scattering of sound at the surface of the sea is an important factor with respect to the propagation of sound from a source. In an ideal case (i.e. for a perfectly smooth sea surface), the majority of sound wave energy will be reflected back into the sea. However, for rough waters, much of the sound energy is scattered (Eckart, 1953; Fortuin, 1970; Marsh, Schulkin, and Kneale, 1961; Urick and Hoover, 1956). Scattering can also occur due to bubbles near the surface such as those generated by wind or fish or due to suspended solids in the water such as particulates and marine life. Scattering is more pronounced for higher frequencies than for low frequencies and is dependent on the sea state (i.e. wave height). However, the various factors affecting this mechanism are complex. Generally, the scattering effect at a particular frequency depends on the physical size of the roughness in relation to the wavelength of the frequency of interest.

As surface scattering results in differences in reflected sound, its effect will be more important at longer ranges from the source sound and in acoustically shallow water (i.e. where there are multiple reflections between the source and receiver). The degree of scattering will depend upon the water surface smoothness/wind speed, water depth, frequency of the sound, temperature gradient, grazing angle and range from source. Depending upon variations in the aforementioned factors, significant scattering could occur at sea state 3 or more for higher frequencies (e.g. 15 kHz or more). It should be noted that variations in propagation due to scattering will vary temporally (primarily due to different sea-states/wind speeds at different times) and that more sheltered areas (which are more likely to experience calmer waters) could experience surface scattering to a lesser extent, and less frequently, than less sheltered areas which are likely to encounter rougher waters. However, over shorter ranges (e.g. within 10-20 times the water depth) the sound will experience fewer reflections and so the effect of scattering should not be significant. Consequently, over the likely distances over which injury will occur, this effect is unlikely to significantly affect the injury ranges presented in this report, and not including this effect will overestimate the impact.

When sound waves encounter the seabed, the amount of sound reflected will depend on the geoacoustic properties of the seabed (e.g. grain size, porosity, density, sound speed, absorption coefficient and roughness) as well as the grazing angle (see Figure 8-7[13]) and frequency of the sound (Cole, 1965; Hamilton, 1970; Mackenzie, 1960; McKinney and Anderson, 1964; Etter, 2013; Lurton, 2002; Urick, 1983). Thus, seabeds comprising primarily of mud or other acoustically soft sediment will reflect less sound than acoustically harder seabeds such as rock or sand. This effect also depends on the profile of the seabed (e.g. the depth of the sediment layers and how the geoacoustic properties vary with depth below the sea floor). The sediment interaction is less pronounced at higher frequencies (a few kHz and above) where interaction is primarily with the top few cm of the sediment (related to the wavelength). A scattering effect (similar to that which occurs at the surface) also occurs at the seabed (Essen, 1994; Greaves and Stephen, 2003; McKinney and Anderson, 1964; Kuo, 1992), particularly on rough substrates (e.g. pebbles and larger).

[12] Acoustically, shallow water conditions exist whenever the propagation is characterised by multiple reflections with both the sea surface and seabed (Etter, 2013). Consequently, the depth at which water can be classified as acoustically deep or shallow depends upon numerous factors including the sound speed gradient, water depth, sediment type, frequency of the sound and distance between the source and receiver.

[13] The density of “rays” indicate difference in effective propagation angle from the source, with acoustically harder sediments (gravel) having better reflection at steeper angles leading to more “rays” being effectively propagated (no significant bottom attenuation) in the waveguide. Beam shape indicated in left chart, with the black line showing the same received level.

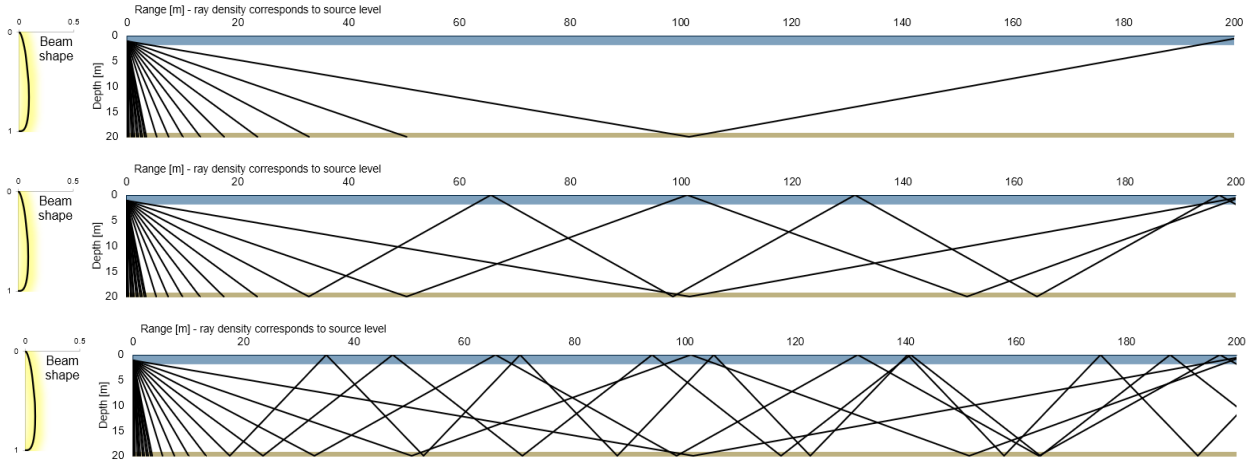


**Figure 8-7: Schematic of the effect of sediment on sources with narrow beams. Sediments range from fine silt (top panel), sand (middle panel), and gravel (lower panel).**

These sediment effects mean that the directivity of equipment such as sub-bottom profilers have a profound effect on the effective source level – the apparent source level to a far-away receiver.

A parametric SBP such as the “Innomar Medium” or “Standard” sub-bottom profiler use two higher frequencies (“primary frequencies”) to generate an interference pattern at lower frequencies (“secondary frequencies”). This means that the secondary beam can be made extraordinarily narrow, e.g. 5 degrees at -10 dB (Figure 8-8), versus c. 50 degrees for a chirper/pinger type, leading to a much smaller sound impact – even when a parametric sub-bottom profiler has higher sound output within the main beam. We account for these differences in beam pattern by including the sediment reflection loss at high incidence angles (Figure 8-7) to reduce the effective source level accordingly.

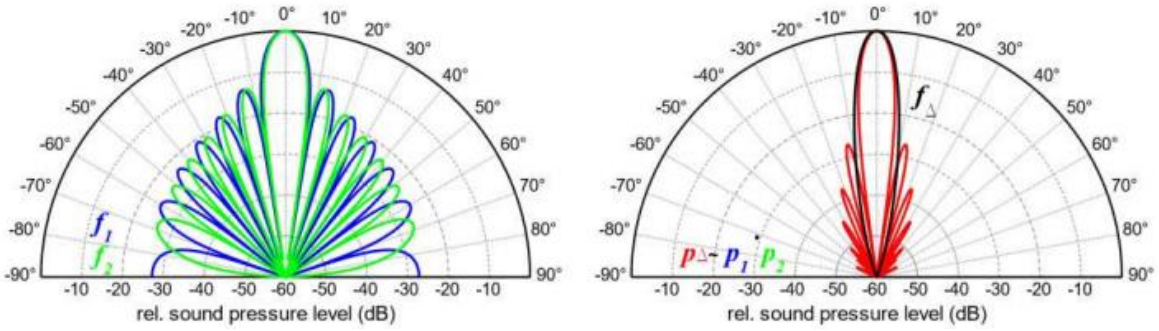


**Figure 8-8. Example of a beam pattern on an Innomar SES 2000. Primary frequencies left (f1 & f2), the interference pattern between the primary frequencies means that the beam pattern for the secondary frequency (right plot) is very narrow (Source: Innomar technical note TN-01).**

Another phenomenon is the waveguide effect which means that shallow water columns do not allow the propagation of low frequency sound (Urick, 1983; Etter, 2013). The cut-off frequency of the lowest mode in a channel can be calculated based on the water depth and knowledge of the sediment geoacoustic properties. Any sound below this frequency will not propagate far due to energy losses through multiple reflections. The cut-off frequency as a function of water depth is shown in Figure 8-9 for a range of seabed types. Thus, for a water depth of 10m (i.e. shallow waters typical of coastal areas and estuaries) the cut-off frequency would be approximately 70Hz for sand, 115Hz for silt, 155Hz for clay and 10Hz for bedrock.

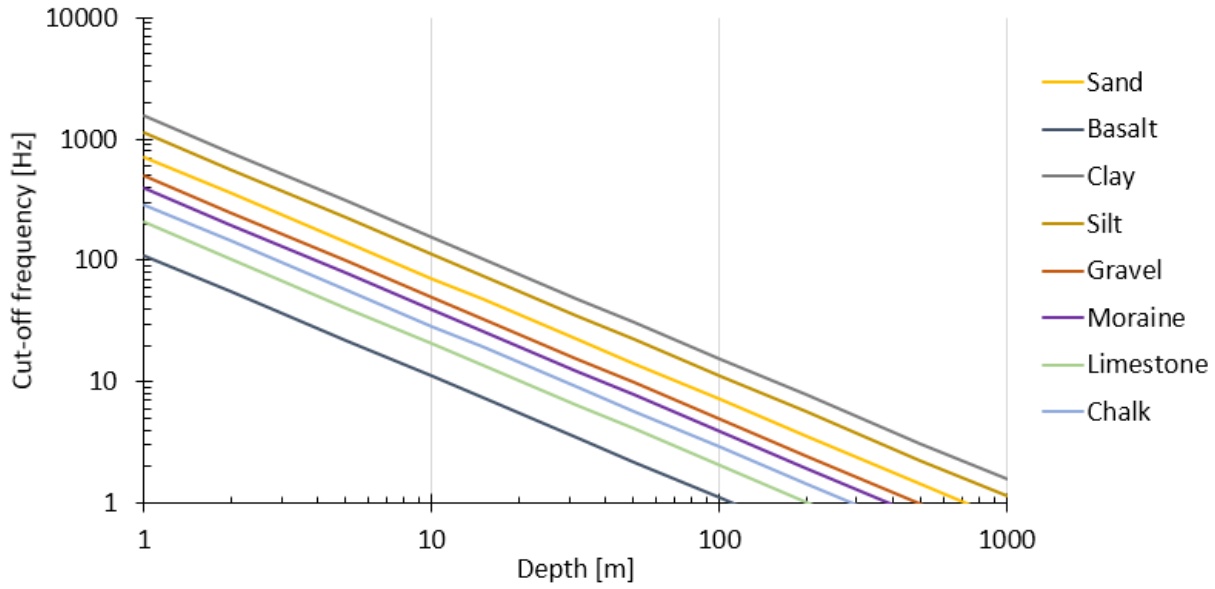


**Figure 8-9: Lower cut-off frequency as a function of depth for a range of seabed types.**

Changes in the water temperature and the hydrostatic pressure with depth mean that the speed of sound varies throughout the water column. This can lead to significant variations in sound propagation and can also lead to sound channels, particularly for high-frequency sound. Sound can propagate in a duct-like manner within these channels, effectively focussing the sound, and conversely, they can also lead to shadow zones. The frequency at which this occurs depends on the characteristics of the sound channel but, for example, a 25m thick layer would not act as a duct for frequencies below 1.5 kHz. The temperature gradient can vary throughout the year and thus there will be potential variation in sound propagation depending on the season.

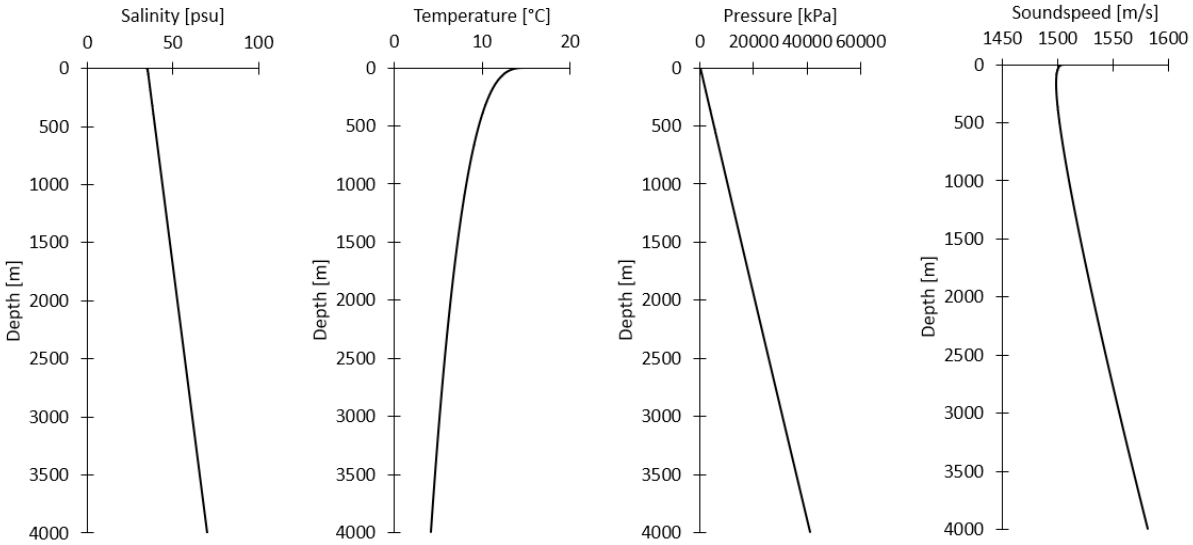


**Figure 8-10: Soundspeed profile as a function of salinity, temperature and pressure.**

Wind can make a significant difference to the soundspeed in the uppermost layers as the introductions of bubbles decreases the soundspeed and refracts (bends) the sound towards the surface, where the increased roughness and bubbles from the wind will cause increased transmission loss.

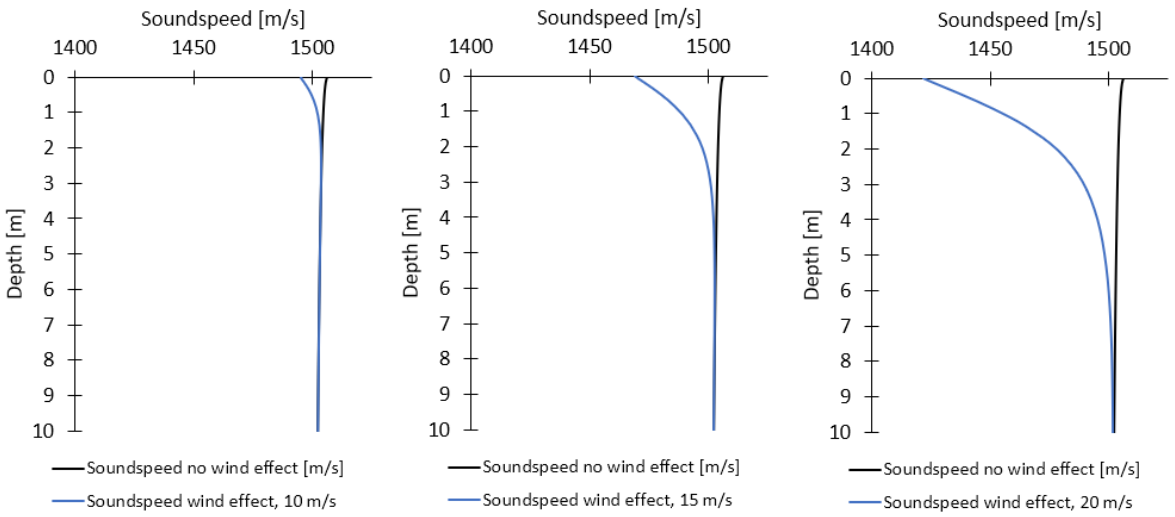


**Figure 8-11: Effect of wind (at 10 m height) on upper portion of soundspeed profile.**

Sound energy can also be absorbed due to interactions at the molecular level converting the acoustic energy into heat. This is another frequency dependent effect with higher frequencies experiencing much higher losses than lower frequencies. This is shown in Figure 8-12 where the variation of the absorption (sometimes called volume attenuation) is shown for various salinities and temperatures. As the effect is proportional to the wavelength, colder water, with slower soundspeed/period and being slightly more viscous, will have more absorption. Higher salinity slightly decreases absorption at low frequencies (mostly due to increase in soundspeed and wavelength/period), but much higher absorption at higher frequencies where interaction with pressure sensitive molecules of magnesium sulphite and boric acid increase the conversion acoustic energy to heat.

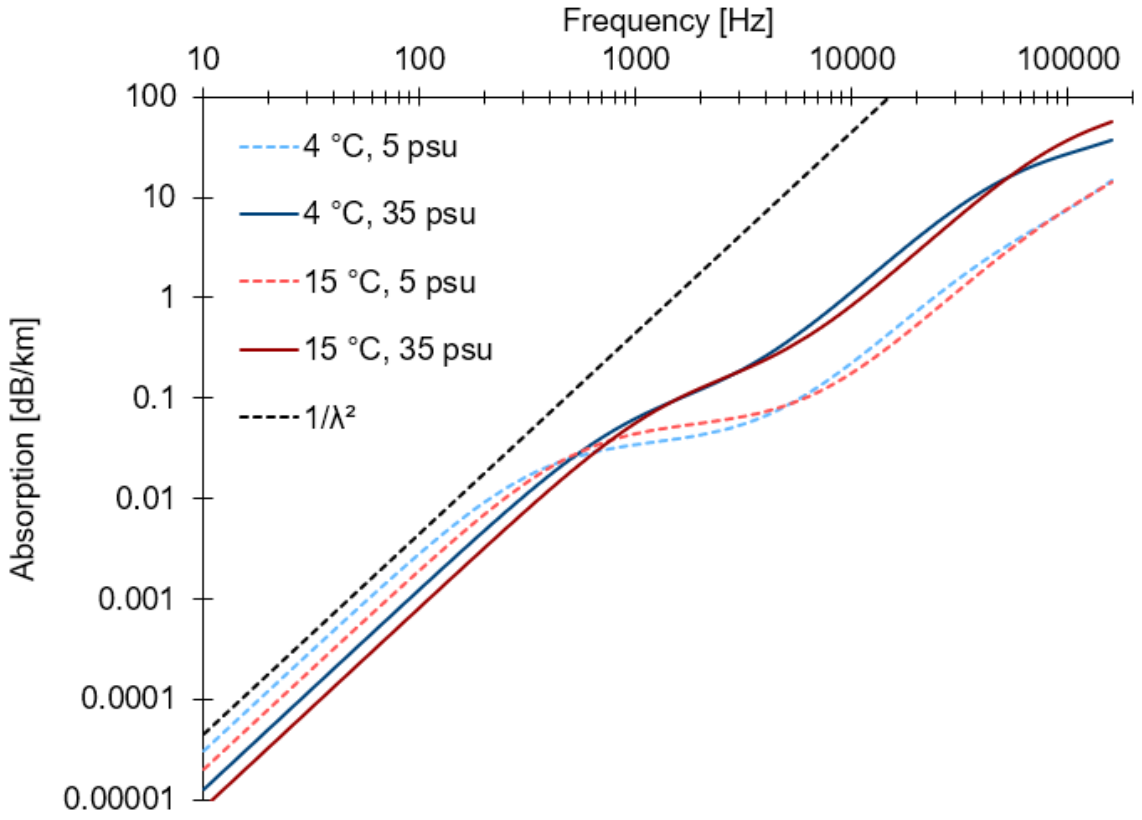


**Figure 8-12: Absorption loss coefficient (dB/km) for various salinities and temperature.**

# Appendix C
# List of Projects for Cumulative Assessment

**Table C.1 List of projects identified for potential cumulative effects following a search of the relevant databases undertaken on the 21/10/2024.**

| Application reference no. | Project | Approximate Distance from MUL Area | Project Status | In-combination Effect |
|---|---|---|---|---|
| FS007472 | Mac Lir Offshore Wind Limited benthic ecology surveys for proposed Offshore Wind Farm, off Counties Wexford, Wicklow and Dublin | Overlaps with Dublin Cables MUL application area | Applied-22/09/2022 | No in-combination effects. |
| FS007367 | Greystones OWL Windfarm Limited is proposing to develop an offshore wind farm at a site off the Wicklow/Dublin coast. | Overlaps with Dublin Cables MUL application area | Applied-29/06/2022 | No in-combination effects. |
| FS007546 | Codling Wind Park Ltd. site investigation works | Overlaps with Dublin Cables MUL application area | Determination-19/05/2023 Grant with Conditions Applied | Spatial and temporal overlap with SI works AoI. |
| MUL230034 | Codling Wind Park Ltd. site investigation works | Overlaps with Dublin Cables MUL application area | Applied to MARA but not determined. | Spatial and temporal overlap with SI works AoI. |
| 320768 | Codling Wind Park Limited Offshore Wind Farm. | Overlaps with Dublin Cables MUL application area | Applied to An Bord Pleanála. Due to be decided April 2025. | No in-combination effects. |
| FS007188 | RWE Renewables Ireland Ltd. Site Investigations for the proposed Dublin Array Offshore Wind Farm. | Overlaps with Dublin Cables MUL application area | Determination 13/01/2023 | Spatial overlap with AoI. Within the CESS. Possible temporal overlap. |
| FS007029 | Innogy Renewables Ireland Ltd. Site Investigation - Dublin Array at Kish and Bray Banks. | Overlaps with Dublin Cables MUL application area | Determination 28/01/2021 | Spatial overlap with AoI. Within the CESS. Possible temporal overlap. |
| FS007134 | ESB Wind Development Limited (ESB), Site Investigations at Sea Stacks Offshore Wind off Dublin and Wicklow. | Overlaps with Dublin Cables MUL application area | Consultation 2020-11-23 | No in-combination effects. |
| 320250 | Dublin Port 3FM Project | Overlaps the MUL application area to the north east (east of Poolbeg lighthouse). | Lodged 23/07/2024, case is due to be decided by 06/02/2025 | No in-combination effects. |
| 313509 | BusConnects Belfield/Blackrock to City Centre Core Bus Corridor Scheme | Less than 1 km | Approve with Conditions-27/03/2024 | No in-combination effects. |
| LIC230016 | Microsoft Ireland Operations Ltd. Geophysical survey and site investigations for a proposed subsea fibre optic cable having a | Less than 1 km | Granted | No spatial overlap with AoI. Within the CESS. Possible temporal overlap. |

| Application reference no. | Project | Approximate Distance from MUL Area | Project Status | In-combination Effect |
|---|---|---|---|---|
| | landfall in Dublin Port, County Dublin and to evaluate options for the route traversing Dublin Bay, across the Irish Sea to Anglesey, Wales. | | | |
| FS007290 | Fendering replacement at Carlisle Pier | Less than 1 km | Determination 03/11/2023 | No in-combination effects. |
| FS007132 | Dublin Port Maintenance Dredging | Less than 1 km | Determination-12/08/2022 | No in-combination effects. |
| FS007164 | Dublin Port Capital Dredging Project | Less than 1 km | Determination-09/01/2024 | No in-combination effects. |
| FS006893 | Dublin Port Company MP2 Project. Construction of a new Ro-Ro Jetty (Berth 53), the re-orientation of the already consented Berth 52, the lengthening of Berth 50A, the redevelopment of Oil Berth 3, the construction of passenger terminal buildings and a heritage zone, dredging and ancillary site works. | Less than 1 km | Determination 23/09/2022 | No in-combination effects. |
| FS006786 | Dun Laoghaire Harbour Company. Use, occupy and maintain St Michael's Pier, associated ramps and part of the new terminal building. | Less than 1 km | Determination 17/05/2022 | No in-combination effects. |
| 301798 | 10-year permission for development of the Ringsend wastewater treatment plant upgrade project including a regional biosolids storage facility | Less than 1 km | Grant Perm. w Conditions-24/04/2019 | No in-combination effects. |
| 307080 | Land to the south of the existing Dublin Bay Power Station, Pigeon House Road. Electrical development associated with a proposed Flexible Thermal Generation Facility (FlexGen) and Battery Energy Storage System (BESS). | Less than 1 km | Is not Strat. Infrast. Dev. 16/09/2020 | No in-combination effects. |
| 304888 | Dublin Port, 15-year permission for development at Oil Berth 3 and Oil Berth 4, Eastern Oil Jetty and at Berths 50A, 50N, 50S, 51, 51A, | 1 km | Grant Perm. w Conditions-01/07/2020 | No in-combination effects. |

| Application reference no. | Project | Approximate Distance from MUL Area | Project Status | In-combination Effect |
|---|---|---|---|---|
| | 49, 52, 53 and associated terminal yards to provide for various elements including new Ro-Ro jetty and consolidation of passenger terminal buildings. | | | |
| 309812 | Increase the capacity of the Dublin Waste to Energy Facility from 600,000 tonnes per annum to 690,000 tonnes per annum | 1 km | Approve subject to conditions-17/12/2021 | No in-combination effects. |
| LIC230007 | Environmental survey and ground investigation works in order to inform the design of proposed Point Bridge and Tom Clarke Widening Project. | 1 km | Applied | No in-combination effects. |
| FS006806 | Dublin Port Company. Foreshore lease application for the provision of a new Pontoon at Berth 50 to accommodate Dublin Port Company Tug Boats | 2 km | Determination 16/01/2019 | No in-combination effects. |
| 313727 | St. Vincent's University Hospital Campus, Elm Park, Dublin 4 Proposed alterations to permitted application PL29S.PA0049 National Maternity Hospital | 2 km | Alter decision - Not a material Alteration (EIAR Case)-05/08/2022 | No in-combination effects. |
| 316225 | St. Vincent's University Hospital Campus, Elm Park, Dublin 4 Proposed installation of a new 110kV/MV station | 2 km | Is not Strat. Infrast. Dev. 01/06/2023 | No in-combination effects. |
| 313738 | Grand Canal Storm Water Outfall Extension comprising of the construction of pipework, transition chambers, floating platforms and new outfall structure at Sir John Rogerson's Quay at the River Liffey including all ancillary site works. | 3 km | Approve subject to conditions 21/11/2023 | No in-combination effects. |
| 313918 | North Wall Power Generating Station, Alexandra Road, Dublin 1. | 3 km | Approve with Conditions-13/09/2022 | No in-combination effects. |
| FS007180 | Tech Works Marine Ltd Data Buoy Deployment-Deployment of a small | 3 km | Determination-2024-05-07 | No in-combination effects. |

| Application reference no. | Project | Approximate Distance from MUL Area | Project Status | In-combination Effect |
|---|---|---|---|---|
| | Data Buoy with multiple environmental (non-acoustic) sensors to test communications technology for data acquisition. | | | |
| FS005691 | Dublin City Council Outfall Culvert | 4 km | Determination 08/04/2022 | No in-combination effects. |