ESB MONEYPOINT HUB PROJECT

SI Works – Supporting Information for Screening for Appropriate Assessment

IE000210RP0026
F01
24 November 2023

Document status

Version	Purpose of document	Authored by	Reviewed by	Approved by	Review date
D01	Internal Draft	[redacted]	[redacted]		02 November 2023
A01	Draft for Client Review	[redacted]	[redacted]	[redacted]	16 November 2023
F01	Final	[redacted]	[redacted]	[redacted]	24 November 2023

Approval for issue

GMcE	24 November 2023

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EXECUTIVE SUMMARY

RPS have been commissioned by ESB to prepare a Supporting Information for Screening for Appropriate Assessment (SISAA) report for site investigation (SI) works at Moneypoint Generating Station site in County Clare. The SI works are required in order to inform future development at the ESB Moneypoint site.

This report has been prepared to support a Maritime Usage Licence Application to the Maritime Area Regulatory Authority (MARA) for a licence for SI works. The SI works include geophysical, geotechnical and environmental investigations in both the terrestrial and marine environments as summarised below.

- Phase 1 Marine Site Investigation Works:
  - Task 1: Marine Geophysical Surveys.
  - Task 2: Metocean Surveys.
  - Task 3: Marine Environmental/ Ecological Surveys.
- Phase 2 Marine Site Investigation Works:
  - Task 4: Marine Geotechnical Investigations
- Phase 2 Land-based Site Investigation Works
  - Land-based site investigations previously consented by Clare County Council (planning reference: P23/32, decision dated 18th April 2023).

The aim of the SI works is to acquire data to a high quality and specification for the site.

Clare County Council have separately granted planning permission for the land-based site investigations (planning reference: P23/32, decision dated 18th April 2023).

The application to MARA is for the marine geophysical, geotechnical and environmental investigations. This SISAA report has been prepared in order to provide a sufficient level of information to the MARA for them to complete a Screening for Appropriate Assessment of the potential for likely significant effects on European sites, in view of their conservation objectives, arising from the site investigation works either individually or in combination with other plans or projects.

The overall findings of this SISAA are as follows.

The SI works are not connected with or necessary to the management of the nature conservation interest of any European site.

The SI works are highly unlikely to have a negative impact on the River Shannon and River Fergus Estuaries SPA (004077) as none of the populations of the species for which the site is selected are expected to be present in the area of the SI works in numbers, or for sustained periods. The geotechnical investigations will take place in deep water adjacent to the Moneypoint site and as such will not contribute to loss, alteration, and fragmentation in habitats associated with the species that are QIs of the River Shannon and River Fergus Estuaries SPA (004077).

The SI works, in the absence of mitigation, have the potential to contribute to habitat loss, alteration, and fragmentation in the Lower River Shannon SAC (002165).

It should be noted that the geotechnical investigations will be informed by the geophysical survey outputs which is being undertaken as part of the current scope of SI works to mitigate habitat loss, alternation, and fragmentation effects on the Annex I Habitats Estuaries and/or Reefs.

The geophysical survey will also introduce subsea noise that has the potential to impact on bottlenose dolphin that are a QI species of the Lower River Shannon SAC (002165). Mitigation measures such as those set out in the Guidance to Manage the Risk to Marine Mammals from Man-made Sound Sources in Irish Waters (DAHG, 2014) are required to avoid and/or reduce the potential for negative impacts on marine mammals.

It is our opinion that it cannot be excluded on the basis of objective scientific information that the project, individually or in combination with other plans or projects, will have a significant effect on a European site. It is recommended that a Natura Impact Statement (NIS) be prepared to assist MARA in conducting an Appropriate Assessment should they agree with the findings of this SISAA.

1 INTRODUCTION

1.1 Overview

Offshore wind will play a significant role in Ireland's decarbonisation. A key part of ESB's strategy is to increase their renewable generation capacity and replace coal fired generation with low-carbon and renewable technologies to assist Ireland in moving towards climate neutrality by 2050 as set out in the National Energy & Climate Plan 2021-2030 (DCCAE, 2020). It is envisaged that much of this renewable generation will come from Floating Offshore Wind (FOW) in deep water areas off the west and south coasts, where Ireland is uniquely positioned to avail of the considerable wind resources.

FOW turbines work by connecting the buoyant substructure of the turbine base to the seabed using a system of anchors and mooring cables. FOW turbines can be deployed in deeper waters and are not as dependent on the condition of the seabed as fixed-bottom turbines, thus allowing floating turbines to utilise the strongest and most consistent winds to generate greater volumes of electricity. In addition, wind installations further offshore have a lesser impact on the environment by significantly reducing the visual impact on the landscape/seascape and reducing impacts on migratory birds through collision.

In Ireland, there is no dedicated port facility that is capable of producing FOW turbines on a scale that is necessary to meet the current and future demands. Based on market consultation and comparative studies, it is considered that any dedicated facility would require a deep-water to act as a staging point and sufficient land availability to facilitate the construction of the floating platform structures.

ESB propose to deliver a dedicated hub facility at Moneypoint for the construction and deployment of FOW turbines. The Moneypoint Generating Station site in County Clare was identified as having the essential physical and geographical attributes to act as a FOW Hub and aligns with the site-specific objectives for Moneypoint set out in the Clare County Development Plan 2023-2029 (Clare County Council, 2023a) and the cross-jurisdictional Strategic Integrated Framework Plan (SIFP) for the Shannon Estuary (Clare County Council, 2023b) which aims to facilitate the long term sustainable development of the Shannon Estuary.

ESB intends to undertake a survey campaign at the Moneypoint Generating Station site to inform the engineering design of the proposed Moneypoint Hub Project. The marine surveys will include geophysical, geotechnical, environmental, and met ocean surveys. These surveys are summarised in Section 2 of this report.

1.2 Purpose of the report

This Supporting Information for Screening for Appropriate Assessment (SISAA) report has been prepared in order to provide a sufficient level of information to the Maritime Area Regulatory Authority (MARA) for them to complete a Screening for Appropriate Assessment of the potential for likely significant effects on European sites, in view of their conservation objectives, arising from the site investigation works either individually or in combination with other plans or projects.

This document has been prepared by RPS on behalf of the ESB to provide an overview of the marine site investigation works proposed to be undertaken at the Moneypoint site in support of the Maritime Usage Licence application to MARA. The Maritime Usage Licence application is for site survey and investigation works to inform engineering design. The results of these surveys will also provide baseline data for any subsequent Environmental Impact Assessment Report (EIAR) and Natura Impact Statement (NIS) should the development be taken forward to the planning/consenting stage.

1.3 Statement of Authority

This report has been prepared by RPS on behalf of the ESB. The technical competence of the authors is outlined below:

[redacted] is a Scientist with 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 two 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. 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.

This SISAA report has been prepared in compliance with the legislative and policy requirements described in Section 1.4, below.

1.4 Legislation

1.4.1 European Legislation

Council Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Fauna and Flora (the Habitats Directive) provides protection for habitats and species of European importance; Council Directive 79/409/EEC (the Birds Directive) aims to protect all of the 500 wild bird species naturally occurring in the European Union (EU). Areas designated for protection under the Habitats Directive are described as Special Areas of Conservation (SAC) and those designated under the Birds Directive, as Special Protection Areas (SPA) and the sites are known collectively as Natura 2000 sites (see section 1.4.2.5). As each member of the EU is required to designate areas in their jurisdictions, the establishment of this network of Natura 2000 sites under Articles 3 to 9 of Directive 92/43EEC is 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. Article 7 of the Habitats Directive extends the scope of its articles 6(3) and 6(4) to the Birds Directive.

Article 6(3) establishes the requirement for Appropriate Assessment (AA):

> "*Any plan or project not directly connected with or necessary to the management of the* [Natura 2000] *site but likely to have a significant effect thereon, either individually or in combination with other plans or projects, shall be subjected to appropriate assessment of its implications for the site in view of the site's conservation objectives. Considering the conclusions of the assessment of the implications for the site and subject to the provisions of paragraph 4, the competent national authorities shall agree to the plan or project only after having ascertained that it will not adversely affect the integrity of the site concerned and, if appropriate, after having obtained the opinion of the public.*"

Further detail on the stages of AA is provided in Section 3.2 below.

Each Natura 2000 site has assigned Conservation Objectives (COs) and a list of Qualifying Interests (QI). The CO concept appears in the eighth recital of Directive 92/43/EEC which reads: "whereas it is appropriate, in each area designated, to implement the necessary measures having regard to the conservation objectives pursued". Article 1 then explains that "conservation means a series of measures required to maintain or restore the natural habitats and the populations of species of wild fauna and flora at a favourable status".

The National Parks and Wildlife Service (NPWS) has established COs for each Natura 2000 site in Ireland. These are published on their website. NPWS advise in the general introductory notes of their site-specific conservation objectives (SSCO) series publications, that an appropriate assessment based on their "published conservation objectives will remain valid even if the CO targets are subsequently updated, providing they were the most recent objectives available when the assessment was carried out". NPWS advise that to assist in that regard, it is essential that the date and version are included when objectives are cited.

1.4.2 National Legislation

1.4.2.1 Maritime Area Planning Act

The Maritime Area Planning Act, 2021 (as amended) established the Maritime Area Regulatory Authority (MARA). One of the functions of MARA is to consider licence applications and the granting of licences.

Schedule 7 of the Maritime Area Planning Act, 2021 (as amended) lists maritime usages which may be undertaken in the maritime area pursuant to licence. Of relevance to this site investigation project are the following items within Schedule 7:

3. Marine environmental surveys for the purposes of site investigation or in support of an application under Part XXI of the Act of 2000.
5. The installation of non-permanent platforms, pontoons, or slipways.
6. The deposit of any substance or object, either in the sea or on or under the seabed, from-

   (a) a vehicle, vessel (including a craft capable of travelling on, in or under water, whether or not self-propelled), boat, aircraft or marine structure (other than a pipeline),
7. The use of a vehicle, vessel (including a craft capable of travelling on, in or under water, whether or not self-propelled), boat, aircraft, marine structure (other than a pipeline) or floating container to remove any substance or object from the seabed.
11. The deposit, construction or removal of any mooring not requiring authorisation under any other enactment.
12. (a) The removal of beach material from, or the disturbance of beach material in, the maritime area otherwise than in the course of the ordinary or reasonable recreational enjoyment of the maritime area.

    (b) In this paragraph, "beach material" means sand, clay, gravel, shingle, stones, rocks, mineral substances, seashells, coral and maerl and any flora, in or on the surface of the seabed or suspended in the water of the maritime area, and includes outcrops of rock or any other mineral substance above the surface of the seabed.

The ESB is applying to MARA for the grant of a licence for the above Schedule 7 usages, as more fully described in Section 2 of this report.

1.4.2.2 Requirements in Relation to Appropriate Assessment

The following definitions in relation to Appropriate Assessment (AA) are included in Section 2(1) of the Maritime Area Planning Act, 2021 (as amended):

> *"screening for appropriate assessment" shall be construed in accordance with, as appropriate—*
>
> *(a) section 177U of the Act of 2000, or*
>
> *(b) Part 5 of the European Communities (Birds and Natural Habitats) Regulations 2011 (S.I. No. 477 of 2011)*
>
> *"appropriate assessment" shall be construed in accordance with, as appropriate—*
>
> *(a) section 177V of the Act of 2000, or*
>
> *(b) Part 5 of the European Communities (Birds and Natural Habitats) Regulations (S.I. No. 477 of 2011);*

where the Act of 2000 refers to the Planning and Development Act 2000 (as amended).

The European Communities (Birds and Natural Habitats) Regulations 2011 has also been amended.

Under Section 112 of the Maritime Area Planning Act, 2021 (as amended), the MARA has been designated as a competent authority for the purposes of Part 5 of the European Communities (Birds and Natural Habitats) Regulations 2011 (S.I. No. 477 of 2011); and appropriate assessments to which that Part applies.

The MARA is required to carry out a screening for Appropriate Assessment (AA) in accordance with Section 117(4)(a) of the Act.

Where the MARA determines that an AA is required it shall carry out the AA in accordance with Section 117(7)(a) of the Act.

1.4.2.3 Screening Out for AA

Under Section 177U (5) of the Planning and Development Act 2000 (as amended), the competent authority shall determine that an AA of a proposed development *is not required* if it can be excluded, on the basis of objective information, that the proposed development, individually or in combination with other plans or projects, will have a significant effect on a European site.

Under Regulation 42(7) of the European Communities (Birds and Natural Habitats) Regulations 2011 (as amended) the public authority shall determine that an AA of a project *is not required* where the plan or project is not directly connected with or necessary to the management of the site as a European Site and if it can be excluded on the basis of objective scientific information following screening that the project, individually or in combination with other plans or projects, will have a significant effect on a European site.

1.4.2.4 Screening In for AA

Under Section 177U (4) of the Planning and Development Act 2000 (as amended), the competent authority shall determine that an AA of a proposed development *is required* if it cannot be excluded, on the basis of objective information, that the proposed development, individually or in combination with other plans or projects, will have a significant effect on a European site.

Under Regulation 42(6) of the European Communities (Birds and Natural Habitats) Regulations 2011 (as amended) the public authority shall determine that an AA of a plan or project *is required* where the plan or project is not directly connected with or necessary to the management of the site as a European Site and if it cannot be excluded, on the basis of objective scientific information following screening under this Regulation, that the plan or project, individually or in combination with other plans or projects, will have a significant effect on a European site.

Where the competent authority determines that an AA is required, they shall make a determination under Article 6.3 of the Habitats Directive as to whether or not the proposed development would adversely affect the integrity of a European site and an appropriate assessment shall be carried out by the competent/ public authority before consent is given for the proposed development (see Section 177V(1) of the Planning and Development Act 2000 (as amended) and Regulation 42(11) European Communities (Birds and Natural Habitats) Regulations 2011 (as amended).

1.4.2.5 European Sites and Natura 2000 Sites

The term European site is defined in the European Communities (Birds and Natural Habitats) Regulations 2011 (as amended) as:

> *"European Site" means—*
> *(a) a candidate site of Community importance,*
> *(b) a site of Community importance,*
> *(c) a candidate special area of conservation,*
> *(d) a special area of conservation,*
> *(e) a candidate special protection area, or*
> *(f) a special protection area;*

The term Natura 2000 site is defined in the same Regulations as:

> *"Natura 2000" means the European network of special areas of conservation under the Habitats Directive and special protection areas under the Birds Directive, provided for by Article 3(1) of the Habitats Directive and, for the purposes of these Regulations, includes European Sites.*

The two terms are often used interchangeably. For the purposes of this report, the term European site is used.

2 PROJECT DESCRIPTION

2.1 Site Location

Moneypoint Generating Station Site is located on the northern shore of the Shannon Estuary in Co. Clare, approximately 3 km west of Killimer and 6 km south-east of Kilrush (Figure 2.1 and Figure 2.2). The site was acquired by ESB in the late-1970s to develop a coal fired power plant as part of its strategy to diversify from oil dependent electricity generation. It consists of both a terrestrial and marine area; along with the interface between the two.

The large industrial facility includes the power station and substations as well as overhead powerlines and towers, wind turbines and ash storage areas. At present, marine operations at the sites existing 380m long jetty structure are limited to coal and Heavy Fuel Oil (HFO) importation. The jetty is connected to the landside by a 105m long approach arm carrying a roadway, conveyor housing, oil and water pipeline and electrical cabling. Moneypoint is one of a number of terminals within the Shannon Estuary that handles up to 1,000 ships carrying 12 million tons of cargo per annum (Clare County Council, 2023b).

A car and passenger ferry operates between Killimer, Co. Clare, and Tarbert, Co. Kerry all year-round. Fishing activity also takes place in the estuary. Additionally, a large number of pleasure crafts exist year-round in the estuary.

The total area of the Moneypoint Generating station site is approximately 180 hectares (ha) and comprises lands on either side of the Kilrush-Killimer road (N67) as well as an additional c.40 ha within the marine environment, below the High-Water Mark (HWM). The terrestrial area of the site is inter-connected by a service road running beneath the N67. The main station site (c. 130 ha) is located on the south side of the N67; whilst the ash storage area (c. 50 ha) is located to the northwest on the landward side of the N67 where it adjoins the shoreline of Ballymacrinan Bay.

The general land-side ground conditions comprise of solid rock foundation with successive beds of mudstone, siltstone and sandstone overlain by stiff glacial till of variable thickness. The main site is situated adjacent to the deep sheltered water of the Shannon Estuary. The conditions will be verified through site investigation and associated interpretative studies.

Figure 2.1 Location of Moneypoint Generating Station Site in the context of the Shannon Estuary, Co. Clare

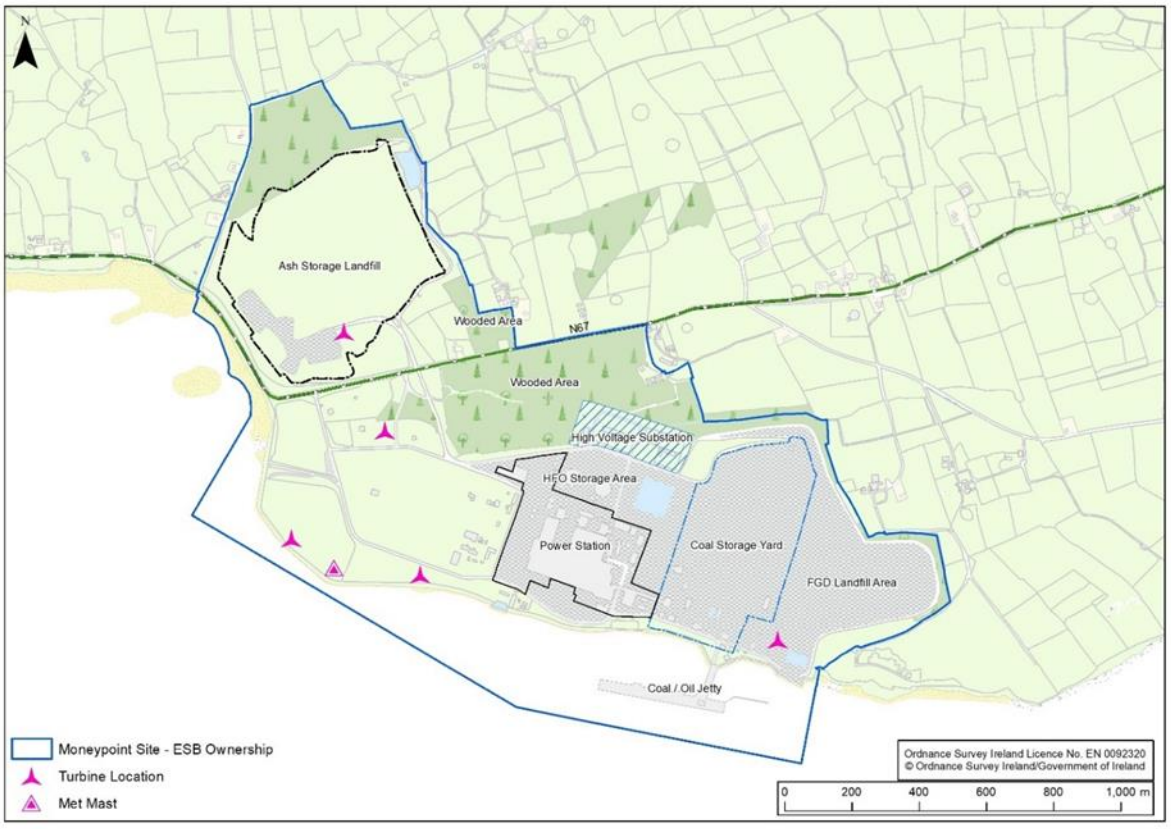

Figure 2.2 Moneypoint Generating Station Site, Co. Clare

2.2 Description of the SI Works

2.2.1 Overview

In order to provide a reliable basis for design and development the following surveys and investigations are considered necessary. The aim of the site investigations is to acquire data to a high quality and specification for the site as summarised below and described in the following sections.

- Phase 1 Marine Site Investigation Works:
  - Task 1: Marine Geophysical Surveys.
  - Task 2: Metocean Surveys.
  - Task 3: Marine Environmental/ Ecological Surveys.
- Phase 2 Marine Site Investigation Works:
  - Task 4: Marine Geotechnical Investigations
- Phase 2 Land-based Site Investigation Works
  - Land-based site investigations previously consented by Clare County Council (planning reference: P23/32, decision dated 18th April 2023).

These works are collectively referred to as the Site Investigation (SI) works throughout this report.

It should be noted that all locations shown are indicative and subject to change on-site due to the presence of obstructions/ refusals at individual locations.

It is noted that the requirement for additional and more refined works may arise as the SI works progress and are analysed. This may include areas of particular interest using more targeted techniques and/or refined borehole locations and quantities.

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

- Site Location Map (Dwg Ref: QS-000339-01-D460-007-001-000);
- Maritime Usage Licence application Area (Dwg Ref: QS-000339-01-D460-007-002-000);
- Geophysical Survey Area Map (Dwg Ref: QS-000339-01-D460-007-003-000);
- Site Investigation Map (Dwg Ref: QS-000339-01-D460-007-004-000); and
- Licenced Aquaculture Sites Map (Dwg Ref: QS-000339-01-D460-007-005-000)

The drawings are included in Appendix A to this report.

2.2.2 Task 1: Marine Geophysical Surveys

The geophysical survey scope is intended to provide significant seabed and sub-seabed information to assist in the consenting, design, and construction phases of the project. It is therefore foreseen to gather, as a minimum, detailed information on:

- Water depths, reduced to LAT, throughout the defined survey area;
- The nature of any seabed features, obstructions, sediments, and shallow geological conditions throughout the defined survey areas;
- The nature of the sub-seabed conditions and horizons down to circa 50m below seabed level (bsbl);
- Seabed conditions/ hazards to any project equipment which may need to be located on the seabed;
- Seabed habitats to inform further benthic surveys and preparation of environmental impact assessment reports (EIAR); Identify sensitive marine habitats which will need to be avoided during geotechnical and environmental sampling;
- Archaeological features within the development area.

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 2.2.4 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.

Figure 2.3 Typical offshore geophysical survey vessel (Fugro Discovery IMO 915882)

Typical vessels for geophysical surveys will be circa 15 – 80m in length (smaller vessels may be used in nearshore / shallower water areas). See Figure 2.3 for an example of a geophysical survey 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, a description of the typical equipment and survey parameters is described. Typical acoustic properties of equipment are provided in Section 2.2.6.

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

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:

- GeoAcoustics GeoSwath Plus interferometric;
- Teledyne Reson SeaBat T50-R;
- R2 Sonic 2024 – see Figure 2.4; or
- similar.

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 area illustrated as "Area A" in Dwg Ref: QS-000339-01-D460-007-003-000 (Appendix A). The estimated survey area is 927.5 hectares (9.27 km^2).

Figure 2.4 MBES R2Sonic 2024 typical configuration and equipment

2.2.2.2 Side Scan Sonar (SSS)

Figure 2.5 Counting pulley for winch-towed C-Max CM2 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;
- C-Max CM2 system (see Figure 2.5);
- Klein Hydro Scan; or
- similar.

Swath width: The swath width will be based on the water depth encountered. It is anticipated that the width of each swath will be approximately 50m with a 100% overlap between each swath.

Location: SSS survey may be performed throughout the entire area illustrated as “Area A” in Dwg Ref: QS-000339-01-D460-007-003-000 (Appendix A). The estimated survey area is 927.5 hectares (9.27 km^2).

2.2.2.3 Sub-bottom Profiling

A typical sub bottom profiling (SBP) survey is completed using a multi-channel seismic reflection system such as a Boomer, Chirp or Sparker 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.

Indicative Equipment:

- Edgetech 3100;
- Edgetech 3300 (see Figure 2.6**)**;
- Geopulse 5430A;
- 400 Joule Generic sparker;
- 350 Joule Generic Boomer;
- Innomar Parametric (dual frequency); or
- similar.

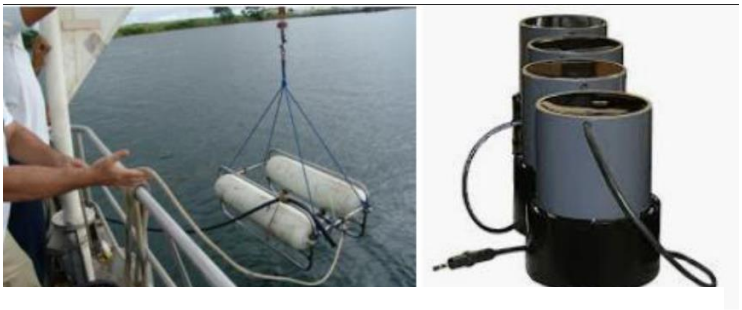

Figure 2.6 Left - Applied Acoustics AA300 being deployed & Right - Typical Hull Mounted SBP - Edgetech 3300

Swath width: n/a

Location: SPB survey may be performed throughout the entire area illustrated as “Area A” in Dwg Ref: QS-000339-01-D460-007-003-000 (Appendix A). The estimated survey area is 927.5 hectares (9.27 km^2).

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, 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 2.7;
- Marine Magnetics SeaSPY;
- G-Tec Magwing System; or
- similar.

Figure 2.7 Geometrics G-882

Survey spacing: 25m centres, 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 area illustrated as "Area A" in Dwg Ref: QS-000339-01-D460-007-003-000 (Appendix A). The estimated survey area is 927.5 hectares (9.27 km^2).

2.2.3 Task 2: 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.

2.2.3.1 Equipment Deployment & Recovery Vessel

The methodology for deployment of metocean monitoring equipment will be through the use of a suitable vessel to either tow &/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 2.8 or similar.

Figure 2.8 Dennis Murphy IMO 9268784

2.2.3.2 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 at the project site.

Indicative Quantity: 1.

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 (see Figure 2.9) is mounted in a seabed frame (circa 1.8m wide and 0.6m high) with a weight of approx. 300kg. This will be attached to a ground line, a clump weight and to an acoustic release system carrying a rope retrieval system.

Figure 2.9 Typical seabed frame with ADCP (Ocean Scientific International Ltd)

Location: An indicative location for the deployment of the ADCP is illustrated on Dwg Ref: QS-000339-01-D460-007-004-000 (Appendix A). The actual location will be determined based upon interpretation of the geophysical data and following a navigation safety assessment.

2.2.4 Task 3: Marine Environmental/ Ecological Surveys

The aim of the proposed environmental surveys is to collect baseline data which will be used to inform the EIAR. This will comprise a benthic sampling programme using grab sampling, video or still photographs and static acoustic monitoring to measure marine mammal activity and other background noise.

2.2.4.1 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.

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 complimented 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 20 no stations will be required to be sampled. It is proposed that two grab samples will be taken at each sampling location, one for macrofaunal analysis and particle size analysis and one for sediment chemistry analysis. GPS coordinates and depths will be recorded for each location.

Method: 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 -15mCD and -25mCD. It is estimated that each sample will have a sample up to 0.1m^2.

Location: Grabs Sampling will be performed within the area of privately held foreshore held by ESB - Refer to Dwg Ref: QS-000339-01-D460-007-004-000 (Appendix A). The final sampling locations will be determined based upon interpretation of the geophysical data and selected to sample different marine habitats.

2.2.4.2 Static Underwater Acoustic Recorders

It is intended to deploy static underwater acoustic recorder(s) within the area of the ESB foreshore. The recorder(s) will be Wildlife Acoustics Model: SM2M Unit with hydrophones contained in a single unit (see Figure 2.10), or similar. The location for the deployment of the recorder(s) is yet to be determined.

Figure 2.10 Deployment of static underwater acoustic recorders

Indicative Quantity: It is anticipated that one static recorder will be deployed.

Method: The recorder will be deployed from a vessel and anchored to the seabed by way of chains, ropes and/ or weights for the duration of the deployment. Deployment is typically from the back of a vessel, usually by means of an 'A' frame or winch. A tethered buoy will be attached to the recorder to facilitate recovery of the recorder, ropes, chains, and weights. It is anticipated that a recorder will be deployed for a two-to-three-week duration.

Depth: The recorders will be positioned within the water column. A marker buoy will clearly highlight the location of the recorder.

Location: An indicative location for the deployment of the static underwater noise recorder is illustrated on Dwg Ref: QS-000339-01-D460-007-004-000 (Appendix A). The actual location will be determined based upon interpretation of the geophysical data and following a navigation safety assessment.

2.2.4.3 Other Environmental Surveys

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

- Ornithology surveys
  - Bird sighting surveys will be undertaken either from a vessel or aerially in addition to onshore vantage point locations.
- Marine Mammal surveys
  - Complimentary to the Static Acoustic Monitoring ongoing within the Shannon estuary, vessel based sighting surveys will be undertaken.
- Shipping and Navigation Surveys
  - The need for Shipping and Navigation surveys will be determined following consultation with the relevant stakeholders.
- Marine Archaeology Surveys
  - The aim of the surveys, which will be undertaken by a suitable qualified archaeologist, is to collect baseline data which will be used to inform the EIAR. 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.
- Marine Habitat Surveys
  - The aim of the surveys, which will be undertaken by a suitably qualified marine ecologist, is to collect baseline habitat data which will be used to inform the EIAR and Appropriate Assessment reports. 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.

2.2.5 Task 4: 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, insitu testing, data logging, laboratory testing and reporting (factual and interpretative) will be required.

The works will include the following:

- Sampling/ coring boreholes at 20 locations to a maximum of 30m investigation depth below seabed level.

- Vibrocores at c.25 locations.

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. The geotechnical survey will be undertaken from either a dedicated geotechnical vessel (length 50-90m, see Figure 2.11) or alternatively a jack-up barge.

Figure 2.11 Typical Offshore geotechnical survey vessel – Fugro Synergy IMO 9452488

2.2.5.1 Geotechnical Boreholes

Indicative Quantity: 20 focused primarily in the survey area in front of the Moneypoint Site.

Method: A drill head is lowered to the seabed from the vessel via a drill string and stabilised using a seabed frame. The drill head penetrates the seabed via rotation of the drill string and the application of a downward pressure. Soils and rock samples are then retrieved for laboratory testing via the drill string.

Sample Diameter: up to 102mm.

Depth: Up to 30m below the seabed or refusal.

Indicative Equipment: Drilling equipment used will follow the ISO and API technical specifications for drilling equipment. Indicative equipment to be used would be traditional API drill string or a triple core barrel system (e.g., Geobor 'S') or similar (see Figure 2.12). For investigation within the intertidal zone, a tracked borehole / CPT rig and ancillary equipment would be used.

Location: Indicative geotechnical locations for the boreholes are illustrated on Dwg Ref: QS-000339-01-D460-007-004-000 (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 micrositing of individual geotechnical site investigation locations will take into consideration environmental constraints such as the position of sensitive habitats or archaeological features.

Figure 2.12 Typical marine drill (Fugro)

2.2.5.2 Vibrocore Sampling

Indicative Quantity: 25 vibrocores

Method: Gravity or piston core (self-weight penetration sampler)

Sample Diameter: up to 150mm

Depth: Vibrocore up to 3m depth,

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

Location: Vibrocore sampling will be performed at representative locations within the development area - Refer to Dwg Ref: QS-000339-01-D460-007-004-000 (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 project surveys is included in Table 2.1.

Table 2.1 Summary of Noise Sources and Activities Included in the Subsea Noise Assessment

Equipment	Source level [SPL]	Primary frequencies (-20 dB width)	Source model details	Impulsive/non-impulsive
Survey vessel (based on "Fugro Discovery", IMO 9152882)	165 dB SPL	10-2,500 Hz	(Wittekind, 2014; Simard, et al., 2016; Heitmeyer, 2001)	Non-impulsive
Multibeam echosounder Based on: "Teledyne Reson Seabat T50-R", "Kongsberg GeoAcoustics GeoSwath Plus interferometric" & "R2 Sonic 2024"	182 dB SPL (ping rate dependent, equivalent spherical level)	200,000 Hz & 250,000 Hz	Source levels based on von Hann windowed FM or CW pulses at max SPL as given by manufacturer.	Impulsive
Side scan sonar Based on: "Kongsberg Geoacoustic 160", "Edgetech 4200", "C-Max CM2 system" & "Klein Hydro Scan"	170 dB SPL (ping rate dependent, equivalent spherical level)	300,000 – 445,000 Hz	Source levels based on von Hann windowed FM or CW pulses at max SPL as given by manufacturer.	Impulsive
Sub-bottom profiler 1 Based on: "Edgetech 3100, "Edgetech 3300, "Geopulse 5430A, "400 Joule Generic sparker", "350 Joule Generic Boomer"	188 dB SPL (ping rate dependent, off-axis level) 220 dB Lp (on-axis)	600 – 12,000 Hz	Source levels based on von Hann windowed FM or CW pulses at max SPL as given by manufacturer as well as generic models for Sparker and Boomer.	Impulsive

Equipment	Source level [SPL]	Primary frequencies (-20 dB width)	Source model details	Impulsive/non-impulsive
Sub-bottom profiler 2 Based on: "Sub-bottom profiler 1" & "Innomar Parametric (dual frequency)"	197 dB SPL (ping rate dependent, off-axis level) 247 dB Lp (on-axis)	1000 – 4,000 Hz & 85,000 – 115,000 Hz	Source levels based on von Hann windowed FM or CW pulses at max SPL as given by manufacturer.	Impulsive
Vibro-coring / drilling	195 dB SPL	10 – 3,000 Hz	(Bureau of Ocean Energy Management) (Center for Marine Acoustics, 2023)	Non-impulsive

2.2.7 Land-based Site Investigations

In January 2023, ESB applied to Clare County Council for planning permission for the onshore site investigation works at Moneypoint Generating Station.

The land-based SI works comprise the drilling of boreholes and excavation of trial pits at various locations cross the site above the High-Water Mark. The investigation aims to determine the sub surface strata and composition of the ground and the level of rockhead (including follow on coring to confirm rock head).

It is proposed that approximately 26 no borehole stations and shallow exploratory investigations will be undertaken. The methods to be employed during the investigation works are cable percussive boreholes, rotary core boreholes, and trial pits. It is anticipated that the maximum depth of the boreholes will be 20m. Trail pits are anticipated to be a maximum of 4.5m deep.

Planning permission for the onshore site investigation works was granted by Clare County Council on 18th April 2023. The expiry date of the grant is 17th April 2028.

2.2.8 Programme and Timescale

ESB propose a site investigation activities schedule that will be phased over a total of 1.5 years (18 months). 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. The exact mobilisation dates will not be known until the process of procuring a contractor is complete.

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 project phase scope has been estimated in Table 2.2 below. The estimated durations are subject to change based on variables such as weather conditions onsite, unforeseen seabed conditions, unforeseen obstructions etc. ESB will consult with relevant stakeholders where appropriate prior to the commencement of the surveys.

Table 2.2 Estimated Project Schedule

Phase	Scope of Work	Total No of SI Locations	Survey Area	Estimated Duration	Estimated Commencement date
Phase One SI	Marine Geophysical Surveys	n/a	927.5 ha	4-6 weeks	Q1 2024
	Benthic Sampling	20	40 ha	4-6 weeks	Q1/Q2 2024
	Deployment of Static Underwater Acoustic Recorders	1	n/a	4-6 weeks	Q1/Q2 2024
	Metocean Surveys (ADCPs)	1	n/a	4-6 weeks	Q1/Q2 2024
Preliminary Engineering Design to be undertaken in Q3 / Q4 2024					

Phase	Scope of Work	Total No of SI Locations	Survey Area	Estimated Duration	Estimated Commencement date
Phase Two SI	Marine Geotechnical Boreholes	20		2-3 months	Q4 2024 / Q1 2025
	Vibrocore Sampling	25		2-3 months	Q4 2024 / Q1 2025
	Land-based Site Investigations	26	105 ha	2-3 months	Q4 2024 / Q1 2025
	Finalised Engineering Design (Q1 2025)				

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.

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-state 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 METHODOLOGY

3.1 Appropriate Assessment Guidance

This report has been completed in consideration of the EU and national guidance documents that pertain in relation to Member States' fulfilling their requirements under the EU Habitats Directive, with particular reference to Article 6(3) and 6(4) of that Directive. The methodology followed in relation to this SISAA has had regard to the following guidance:

- EC (2000). Communication from the Commission on the Precautionary Principle. Office for Official Publications of the European Communities, Luxembourg;
- EC (2002). Assessment of Plans and Projects Significantly Affecting Natura 2000 Sites: Methodological guidance on the provisions of Article 6(3) and (4) of the Habitats Directive 92/43/EEC, Office for Official Publications of the European Communities, Luxembourg. European Commission;
- EC, (2007). Guidance document on the strict protection of animal species of Community interest under the Habitats Directive 92/43/EEC. European Commission;
- DoEHLG (2009, rev. 2010). Appropriate Assessment of Plans and Projects in Ireland Guidance for Planning Authorities. Department of the Environment, Heritage and Local Government;
- EC (2013). Interpretation Manual of European Union Habitats. Version EUR 28. European Commission, Luxembourg;
- EC (2018). European Commission Notice C (2018) 7621 'Managing Natura 2000 Sites: the provisions of Article 6 of the 'Habitats' Directive 92/43/EEC', Office for Official Publications of the European Communities, Luxembourg;
- OPR (2021). Practice Note PN01: Appropriate Assessment Screening for Development Management. Office of the Planning Regulator, Dublin Ireland.
- EC (2021). European Commission Notice C (2021) 6913 'Assessment of plans and projects in relation to Natura 2000 sites – Methodological guidance on Article 6(3) and (4) of the Habitats Directive 92/43/EEC', Office for Official Publications of the European Communities, Luxembourg.

3.2 Stages of Appropriate Assessment

Appropriate Assessment (AA) is a four-stage process with tests at each stage. The four stages are summarised diagrammatically in Figure 3.1 below. An important aspect of the process is that the outcome at each successive stage determines whether a further stage in the process is required.

Stages 1-2 deal with the main requirements for assessment under Article 6(3) of the Habitats Directive. Stage 3 may be part of the Article 6(3) Assessment or may be a necessary precursor to Stage 4. Stage 4 is the main derogation step of Article 6(4).

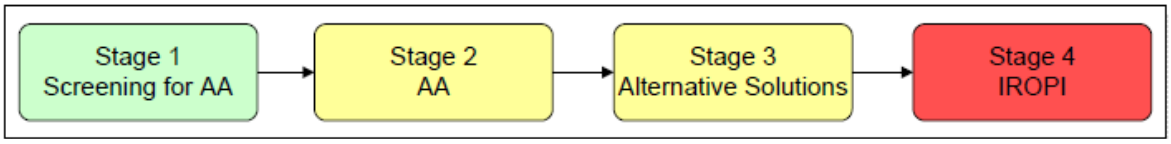

Figure 3.1 Four Stages of Appropriate Assessment

The screening for AA carried out by the public authority/ competent authority (Stage 1), will determine whether an AA (Stage 2) of the proposed project is required. Stage 2 is required if it cannot be excluded, on the basis of the objective information provided at Stage 1, that the proposed project, individually or in combination with other projects or plans, will have a significant effect on a European site, in view of the site's conservation objectives. In this case, a Natura Impact Statement (NIS) must be prepared to assist the public authority/ competent authority to conduct the Stage 2 AA. If it is not possible during Stage 2 to reduce impacts to acceptable, non-significant levels by avoidance and/or mitigation, Stage 3 of the process must be undertaken which is to objectively assess whether alternative solutions exist by which the objectives of the plan or project can be achieved. If alternative solutions exist that do not have negative impacts on European sites; they should be adopted regardless of economic considerations. The process must then return to Stage 2, as any alternative proposal must be subject to a Stage 2 AA before it can be subject to the Article 6(4)

test. If it can be demonstrated that all reasonable alternatives have been considered and assessed, the AA progresses to Stage 4. This final stage is undertaken when it has been determined that negative impacts on the integrity of a European site will result from a plan or project and there are no alternative solutions. At Stage 4 of the AA process, it is the characteristics of the plan or project itself that will determine whether or not the competent authority can allow it to progress. This is the determination of Imperative Reasons for Overriding Public Interest (IROPI).

While there is no prescribed form or content for reporting (DoEHLG, 2009) the methodology and format adopted in this report has been in accordance with the European Commission Methodological Guidance on the provision of Article 6(3) and 6(4) of the 'Habitats' Directive 92/43/EEC (EC, 2021) and the European Commission Guidance 'Managing Natura 2000 sites' (EC, 2018), guidance prepared by the NPWS (DoEHLG, 2009) and by the Office of the Planning Regulator (OPR, 2021).

As per DoEHLG (2009):

> *The first test is to establish whether, in relation to a particular plan or project, appropriate assessment is required.*

In summary, the test for the screening for AA is to assess, in view of objective scientific information, if the proposed development, individually or in combination with other plans/projects is likely to have a significant effect on a European site. The precautionary principle approach is required where there is uncertainty regarding a likely effect. If there are any significant, potentially significant, or uncertain effects, it will be necessary to proceed to Appropriate Assessment and submit an NIS.

3.3 Stage 1 Screening / Test of Significance

This process identifies whether the proposed development is directly connected to or necessary for the management of a European site(s) and identifies whether the development is likely to have significant impacts upon a European site(s) either alone or in combination with other projects or plans.

The screening for AA will incorporate the following steps:

1. Determining whether a project or plan is directly connected with or necessary to the conservation management of any European sites;
2. Describing the project or plan;
3. Identifying the European sites potentially affected by the project or plan;
4. Identifying and describing any potential effects of the project or plan on European sites, alone, in combination and cumulatively with other plans/projects; and
5. Assessing the likelihood of significant effects on European sites.

The output from this stage is a determination for each European site(s) of not significant, significant, potentially significant, or uncertain effects. The latter three determinations will cause that site to be brought forward to Stage 2.

3.4 Desk Study

Information on the receiving environment was analysed to determine the potential for significant effects to qualifying interests (QI) of the European sites with established connectivity to the SI works (see Section 4.4. The following publications and data sources were reviewed.

- Environmental Protection Agency (EPA) online interactive mapping tools (https://gis.epa.ie/EPAMaps) and (https://www.catchments.ie/maps/) for water quality data including surface and ground water quality status, and river catchment boundaries;
- Information on ranges of mobile QI populations in Volume 1 of NPWS' Status of EU Protected Habitats and Species in Ireland (NPWS, 2019), and associated digital shapefiles obtained from the NPWS Research Branch;
- Inland Fisheries Ireland mapping (http://wfdfish.ie/);
- BirdWatch Ireland (https://birdwatchireland.ie/);

- Mapping of European site boundaries and Conservation Objectives for relevant sites, available online from the NPWS included site synopsis, Natura 2000 Data form and Conservation Objective Supporting Documents where available (https://www.npws.ie/protected-sites);
- Distribution records for QI of European sites held online by the National Biodiversity Data Centre (NBDC) (www.biodiversityireland.ie);
- Geohive online Environmental Sensitivity Mapping tool (https://airomaps.geohive.ie/ESM/);
- Geological Survey Ireland (GSI) (https://www.gsi.ie/en-ie/Pages/default.aspx);
- Local surveys of flora, fauna, and habitat available using the Heritage Councils mapping website (https://heritagemaps.ie/WebApps/HeritageMaps/index.html)
- Ordnance Survey of Ireland maps and aerial photography (https://osi.ie)

The identification of relevant European sites to be included in this report was based on the criteria provided in OPR (2021), namely:

- Any European site within or immediately adjacent to the project area; and
- Identification of European sites where a Source-Pathway-Receptor (S-P-R) link exists, explained below in Section 3.5.

3.5 Identification of Relevant European Sites

3.5.1 Source-Pathway-Receptor Model

The identification of relevant European sites to be included in this report was based on the identification of the 'zone of influence' of the SI works using a Source-Pathway-Receptor (S-P-R) model where:

- A 'source' is defined as the individual element of the proposed works that has the potential to impact on a European site, its qualifying features, and its COs;
- A 'pathway' is defined as the means or route by which a source can affect the ecological receptor; and
- A 'receptor' is defined as QI of SACs or SPAs for which COs have been set for the European site(s) being assessed.

An S-P-R model is a standard tool used in environmental assessment. In order for an effect to be likely, all three elements of this mechanism must be in place. The absence or removal of one of the elements of the mechanism results in no likelihood for the effect to occur. The S-P-R model was used to identify a list of European sites, and their QIs, to which the SI works are potentially linked. These are termed as 'relevant' sites/QIs throughout this report.

In terms of describing effects, the terminology used in this report is consistent with that contained in Table 3.4 (pp.50-52) of the EPA publication *Guidelines on the information to be contained in Environmental Impact Assessment Reports* (EPA, 2022).

3.5.2 Zone of Influence

Determination of the project's zone of influence was achieved by assessing the project's requirements and deliverables against the ecological receptors within the project footprint, in addition to the ecological receptors that could be connected to and subsequently impacted by the project through abiotic and biotic vectors.

The proximity of the SI works to European sites, and more importantly, QIs of the European sites, is of importance when identifying potentially likely significant effects. In accordance with the OPR AA Screening Guidelines (2021), the S-P-R model has been used to identify the zone of influence to ensure that relevant European sites are identified. The S-P-R model minimises the risk of overlooking distant or obscure effect pathways, while also avoiding an over reliance on buffer zones (e.g., 15 km), within which all European sites should be considered. This approach follows the DoEHLG 2009 guidance on AA which states that:

"*For projects, the distance could be much less than 15 km, and in some cases less than 100m, but this must be evaluated on a case-by-case basis with reference to the nature, size and location of the project, and the sensitivities of the ecological receptors, and the potential for in combination effects" (DoEHLG, 2009; p.32, para 1).*

The zone of influence of the SI works on mobile species (e.g., birds, mammals, and fish), and static species and habitats (e.g., saltmarshes, woodlands, and flora) is considered differently. Mobile species have 'range' outside of the European sites in which they are QI. The range of mobile QI species varies considerably, from several metres (e.g., in the case of whorl snails *Vertigo* spp.), to hundreds of kilometres (in the case of migratory wetland birds). A project's zone of influence may extend well beyond the project boundary and can impact or have an effect on static species and habitats remote from the SI works; for example, where an aquatic QI habitat or plant is located many kilometres downstream from a pollution source. In particular, hydrological linkages between the SI works and European sites (and their QIs) can occur over significant distances; however, any effect will be site-specific depending on the receiving water environment and nature of the potential impact.

To this end, the zone of influence for this project extends outside of the immediate SI works area to include ecological receptors connected to the project through proximity and connectivity through features such as watercourses and waterbodies in addition to potential connectivity through land and air. See Section 4.4 for the identification of relevant European sites.

4 IDENTIFICATION OF RELEVANT EUROPEAN SITES

4.1 Assessment of Connectivity

Connectivity is identified via the S-P-R model which identifies the potential impact pathways such as land, air, hydrological pathways etc. which may support direct or indirect connectivity between the SI works (source) and European sites and their QIs (receptors).

Where it is evident that there is no connectivity between the SI work and receptors (i.e., European sites and/or habitats and species for which the sites are selected), the receptors are excluded from the AA process. Where connectivity exists between the SI works and receptors, these receptors are taken forward to the assessment of likely significant effects (Section 5.2).

4.2 Identification of Potential Receptors

Receptors with the potential to be affected by the SI works are:

- QI habitats of European sites within the SI works area, or within an area likely to be affected by the proposed SI works;
- QI species of the European sites within or immediately adjacent to the SI works area; and
- Mobile QI species to forage or transit into the SI works area or an area likely to be affected by the SI works (ex situ effects).

Following identification of potential sources of impact, the potential for a pathway to various receptors is considered, followed by the identification of relevant European sites.

4.3 Identification of Potential Sources of Impacts

Identification of a risk of impact does not constitute a prediction that it will occur or, in the event that it does occur, that there is an intrinsic likelihood that it will result in ecological or environmental damage or that it will cause or create a significant effect on the European sites in question. The level and significance of the effect depends upon the magnitude, duration or intensity of the impacts ensuing from the proposal and the existence of a credible or tangible S-P-R link between the SI works and the aforementioned European sites. It is also determined by the extent of the exposure to the risk and the characteristics of the receptor.

When assessing impact, the QI habitats and species are only considered receptors where a credible or tangible S-P-R link exists between the SI works and the receptor. In order for an impact to occur there must be a risk initiated by having a ‘source’ - the origin of potential impacts (e.g., near stream construction works), an impact pathway - the means by which the effect reaches the receptor (air, water, or ground) between the source and the receptor (e.g., a watercourse which connects the development site to the site designated for the protection of a receptor) and a 'receptor' (e.g. a protected species associated aquatic or riparian habitats). If the source, pathway, or receptor is absent, no linkage exists and thus, there will be no potential for an impact to be transmitted.

The potential impacts arising from the SI works have been identified as follows:

Impacts arising from marine SI works:

- Habitat loss or disturbance;
- Increased Suspended Sediment Concentrations (SSC);
- Underwater noise, including injury and or displacement of Annex II marine mammals, otter, and fish from underwater noise and/or the presence of increased marine traffic (visual);
- Accidental pollution event; and,
- Risk of collision.

Impacts arising from land-based SI works (previously consented by Clare County Council)

- Noise, vibration, lighting and human presence-related habitat and species disturbance; and
- Surface water run-off/dust carrying suspended silt or contaminants to the marine environment.

Substrate will be excavated during the land-based SI works but this will take place on predominantly Made Ground on an active industrial site. There will be no land-based excavation within a European site, and therefore, no loss or potential loss of Annex I habitat.

Table 4.1 identifies the SI works associated with each impact, and the receptors with the potential to be affected.

Table 4.1 Source-Pathway-Receptor Assessment for the SI Works

Impact	Potential source of impact	Description of Effect Pathway	Relevant Receptors
Noise, vibration, lighting, and human presence-related species disturbance.	Tasks 1, 2, 3, 4: Vessel activity associated with the marine geophysical and geotechnical surveys, metocean surveys, and marine environmental surveys. Also, the land-based SI works (borehole drilling) previously consented by Clare County Council.	Potential for direct impacts by disturbing species, leading to displacement from the area.	Otter, marine mammals, birds.
Surface water run-off/dust carrying suspended silt or contaminants to the marine environment.	Land-based SI works, namely borehole drilling and trial pits.	Potential for direct effects on sensitive habitats and indirect effects to species which rely on those habitats for feeding and/or breeding.	Marine habitats, marine mammals, otter, fish, birds.
Habitat loss, alteration, and fragmentation.	Tasks 2, 3, 4: Interactions with the seabed resulting from geotechnical surveys (borehole drilling) metocean surveys and marine environmental works (grab sampling).	Potential for direct effects on sensitive habitats and indirect effects to species which rely on those habitats for feeding and/or breeding.	Marine habitats, marine mammals, otter, fish, birds.
Increased Suspended Sediment Concentrations (SSC).	Tasks 2, 3, 4: Interactions with the seabed resulting from geotechnical surveys (borehole drilling) metocean surveys and marine environmental works (grab sampling).	Potential for direct effects on sensitive habitats and indirect effects to species which rely on those habitats for feeding and/or breeding.	Marine habitats, marine mammals, otter, fish, birds.
Underwater noise, Including injury and or displacement of Annex II marine mammals, otter, and fish from underwater noise and/or the presence of increased marine traffic (visual).	Task 1, 2, 3, 4: Noise emissions and increased marine traffic from geophysical and geotechnical (borehole drilling and vibrocores) equipment, vessels and metocean devices associated with marine geophysical surveys, metocean surveys, and marine environmental surveys. May cause injury and/or displacement of Annex II marine mammals, otter, and fish	Potential for direct effects on species in the marine environment including injury, disturbance and/or displacement.	Marine mammals, otter, fish, birds.
Accidental pollution event.	Task 1, 2, 3, 4: Vessel activity associated with the marine geophysical and geotechnical surveys, metocean surveys, and marine environmental surveys.	Potential for direct effects on marine habitats and species, and indirect effects through contamination of supporting habitats.	Marine habitats, marine mammals, otter, fish, birds.
Collision with survey vessels	Task 1, 2, 3, 4: Vessel activity associated with the marine geophysical and geotechnical surveys, metocean surveys, and marine environmental surveys.	Potential for direct effects to large species in the marine environment.	Marine mammals, otter.

4.4 Identification of relevant European sites

Using the S-P-R model to identify the zone of influence for each impact as outlined in Table 4.1, the following summarises the zone of influence of the project within which relevant European sites will be selected:

- Those which occur within or immediately adjacent to the SI works boundary (Figure 4.1);
- The water body within which the SI works will be undertaken to capture any hydrological linkages (i.e., the Shannon Estuary); and
- Foraging ranges of relevant QI species (i.e., potential for ex situ effects).

The Lower River Shannon SAC and the River Shannon and River Fergus Estuaries SPA are within/ immediately adjacent to the SI works area and extend throughout most of the Shannon Estuary, therefore both sites will be considered in this SISAA. The potential for connectivity with receptors from other European sites is considered in the proceeding sections.

4.4.1 Potential for connectivity with *ex situ* Annex II marine mammals

Bottlenose dolphin are a QI of the Lower River Shannon SAC, within which the SI works will occur. Bottlenose dolphins are present throughout the year and are genetically discrete compared to bottlenose dolphins found elsewhere in Irish waters (Mirimin et al. 2011) and that the estuary is an important calving area (MERC, 2021). The population is estimated at around 145 individuals with only 80 adults (Baker et al., 2018 in MERC, 2021). This small, genetically discrete population is vulnerable to even small increases in adult mortality or a reduction in reproduction rates (Blásquez et al., 2021 in MERC, 2021). An overview of existing data on bottlenose dolphin populations in the Lower Shannon Estuary shows that there is a well-known hotspot for the species in the waters off Moneypoint Power Station (MERC, 2021). Rogan et al (2000) recorded bottlenose dolphins in the estuary all year round with a peak from May to September and noted the presence of neo-natal calves from July to September as evidence of a well-defined breeding season in the Shannon Estuary.

Very few sightings of harbour porpoise have been recorded within the Shannon Estuary with no recorded sightings between November 2022 and November 2023 (IWDG, 2023). There was one sighting adjacent to Moneypoint in 2018 (IWDG), and strandings have been recorded as far up the estuary as Foynes (O'Callaghan *et al,* 2021). Violent interactions have been recorded between bottlenose dolphins and harbour porpoise (Ross and Wilson, 1996; Gross *et al*., 2020) and suggested reasons for this aggression include interspecies territoriality, defence of group members, food competition, feeding interference and object-orientated play (Gross *et al*., 2020). From the lack of recorded sightings of harbour porpoise within the Shannon Estuary, it is likely that they largely avoid the area. As a result, spatial overlap with harbour porpoise individuals from other SACs within foraging range is considered highly unlikely, and SACs with harbour porpoise as a QI are not considered relevant for *ex situ* effects.

Telemetry data indicates that harbour seal foraging trips in the south-west of Ireland generally extend no further than 20 km from haul-out sites (Cronin *et al*., 2008). The closest European site designated for harbour seal is the Kenmare River SAC, located approximately 83 km from the SI works area. It is therefore highly unlikely that harbour seals from this SAC will be present within the Shannon Estuary and therefore SACs with harbour seal as a QI are not considered relevant for *ex situ* effects.

Grey seals have been recorded undertaking foraging trips over hundreds of kilometres, although the mean distance travelled in a telemetry study carried out in 2011 for NPWS was 50.85 km (Cronin *et al*., 2011). NPWS-funded aerial thermal-imaging of seal in Ireland (Morris and Duck, 2019) shows very low usage of the Shannon Estuary by both harbour seal and grey seal, indicating that the estuary is not likely to be an important area for hauling out. The closest European site designated for grey seal is the Blasket Islands SAC, located approximately 85 km by sea from the SI works area. While it is possible that individuals from the Blasket Islands population may be present in the Shannon Estuary, it is considered unlikely that the SI works area represents an important foraging ground and as a result SACs with grey seal as a QI are not considered relevant for *ex situ* effects.

Four Annex IV turtle species known to occur in Ireland include the leatherback turtle (*Dermochelys coriacea*), Kemp's Ridley turtle (*Lepidochelys kempii*), loggerhead turtle (*Caretta caretta*) and hawksbill turtle

(*Eretmochelys imbricata*)[1]. Leatherback turtles have been recorded along the west coast of Ireland and within the Lower Shannon Estuary (at Ballylongford (1970) and at Kilkee (IWDG 2017)). Kemps Ridley have been recorded along the west coast at Banna Strand in Co. Kerry (approximately 40 km south-west). This is beyond the SI work boundary with no suspected impacts from the SI works. Loggerheads are also recorded along the west coast of Ireland; one was recorded beyond the Shannon Estuary at Loop Head (approximately 31 km west of the SI works boundary) and therefore no significant impacts are expected. One record of hawks bill has been recorded in the south of Ireland at Cork Harbour as bycatch, no records have been noted along the west coast or in close proximity to the SI works. Of the turtle species noted in Ireland Leatherback turtles have the potential to utilise the Lower River Shannon Estuary based on historical records, but as these counts only amount to one or two individuals across many years it is unlikely that they will be present within the survey area during the SI works.

4.4.2 Potential for connectivity with *ex situ* Annex II migratory fish

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 Shannon Estuary. As such, no other SACs designated for the following QIs are considered to be relevant: Atlantic salmon, sea lamprey, river lamprey. There are no SACs designated for twaite shad on the west coast of Ireland, and as such, it is considered highly unlikely that this species will migrate through the Shannon Estuary.

4.4.3 Potential for connectivity with *ex situ* birds

Certain species of seabird can forage considerable distances from their colonies (Woodward *et al*., 2019), however, given the limited size, scale and duration of the SI works, it is considered unlikely that there is a reasonable impact pathway to SPAs beyond the immediate SI works area, as it becomes increasingly unlikely that individuals from distant SPAs will be present. Seabirds are more likely to forage in the open sea where they can access the rich foraging habitat of continental shelf waters (Cummins *et al*., 2019), as opposed to foraging within estuaries where availability of fish prey may be more limited.

Wintering waders and wildfowl tend to be fairly sedentary once they arrive in their over-wintering areas; often only moving short distances between roosting and feeding areas. Therefore, it is considered unlikely that wintering birds from other SPAs will travel to/from the Shannon Estuary to feed or roost. As a result, no additional SPAs are considered relevant for ex situ effects.

4.5 Relevant European sites

Based on the S-P-R model, connectivity has been established between the SI works and the following European sites:

- Lower River Shannon SAC.
- River Shannon and River Fergus Estuaries SPA.

These European sites are the only sites considered to be within the Zone of Influence of the SI Works.

Table 4.2 lists the QI of these European sites, while Figure 4.1 shows the location of the project relative to these European sites.

[1] https://www.npws.ie/legislation accessed 31/10/2023.

Table 4.2 European sites selected for assessment.

European Site	Proximity to SI works	Qualifying Interests for which the site is selected[2]
European Sites (SAC, cSAC, SPA, pSPA)		
Lower River Shannon SAC (002165).	0 km (SI works take place within and immediately adjacent to the SAC).	Sandbanks which are slightly covered by sea water all the time [1110]
		Estuaries [1130]
		Mudflats and sandflats not covered by seawater at low tide [1140]
		Coastal Lagoons* [1150]
		Large shallow inlets and bays [1160]
		Reefs [1170]
		Perennial vegetation of stony banks [1220]
		Vegetated sea cliffs of the Atlantic and Baltic coasts [1230]
		Salicornia and other annuals colonizing mud and sand [1310]
		Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) [1330]
		Mediterranean salt meadows (*Juncetalia maritimi*) [1410]
		Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation [3260] *Molinia* meadows on calcareous, peaty, or clayey-silt-laden soils (*Molinion caeruleae*) [6410]
		*Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion, Alnion incanae, Salicion albae*) [91E0]
		Freshwater Pearl Mussel *Margaritifera margaritifera* [1029]
		Sea Lamprey *Petromyzon marinus* [1095]
		Brook Lamprey *Lampetra planeri* [1096]
		River Lamprey *Lampetra fluviatilis* [1099]
		Atlantic Salmon *Salmo salar* [1106]
		Bottlenose Dolphin *Tursiops truncatus* [1349]
		Otter *Lutra lutra* [1355]
River Shannon and River Fergus Estuaries SPA (004077).	0km (SI works take place within and immediately adjacent to the SAC).	Cormorant *Phalacrocorax carbo* [A017] (breeding and wintering)
		Whooper Swan *Cygnus cygnus* [A038] (wintering)
		Light-bellied Brent Goose *Branta bernicla hrota* [A046] (wintering)
		Shelduck *Tadorna tadorna* [A048] (wintering)
		Wigeon *Anas penelope* [A050] (wintering)
		Teal *Anas crecca* [A052] (wintering)
		Pintail *Anas acuta* [A054] (wintering)
		Shoveler *Anas clypeata* [A056] (wintering)
		Scaup *Aythya marila* [A062] (wintering)
		Ringed Plover *Charadrius hiaticula* [A137] (wintering)
		Golden Plover *Pluvialis apricaria* [A140] (wintering)

[2] Asterisk indicates a priority habitat under the Habitats Directive

European Site	Proximity to SI works	Qualifying Interests for which the site is selected[2]
		Grey Plover *Pluvialis squatarola* [A141] (wintering)
		Lapwing *Vanellus vanellus* [A142] (wintering)
		Knot *Calidris canutus* [A143] (wintering)
		Dunlin *Calidris alpina* [A149] (wintering)
		Black-tailed Godwit *Limosa limosa* [A156] (wintering)
		Bar-tailed Godwit *Limosa lapponica* [A157] (wintering)
		Curlew *Numenius arquata* [A160] (wintering)
		Redshank *Tringa totanus* [A162] (wintering)
		Greenshank *Tringa nebularia* [A164] (wintering)
		Black-headed Gull *Chroicocephalus ridibundus* [A179] (wintering)
		Wetlands [A999]

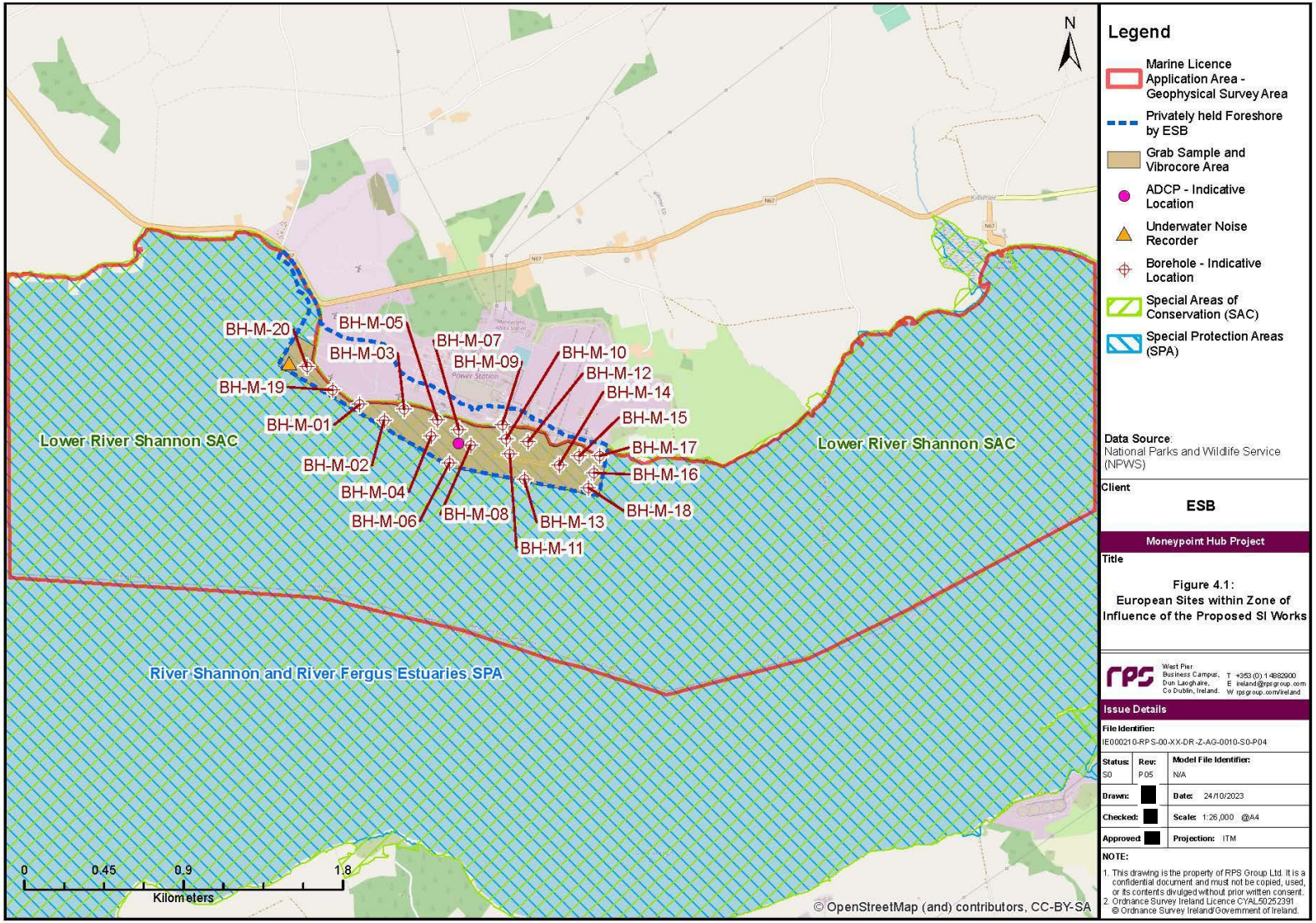

Figure 4.1 European Sites within Zone of Influence of the SI work

4.6 Conservation Objectives

The integrity of a European site (referred to in Article 6(3) of the EU Habitats Directive) is determined based on the conservation status of the qualifying interests of these sites.

European and national legislation places a collective obligation on Ireland and its citizens to maintain at favourable conservation status areas designated as SAC and SPA. The government and its agencies are responsible for the implementation and enforcement of regulations that will ensure the ecological integrity of these sites.

Favourable conservation status of a habitat is achieved when:

- Its natural range and area it covers within that range are stable or increasing; and
- The specific structure and functions which are necessary for its long-term maintenance exist and are likely to continue to exist for the foreseeable future; and
- The conservation status of its typical species is favourable.

The favourable conservation status of a species is achieved when:

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

The specific conservation objectives for each European site in Ireland are available on www.npws.ie. These have been accessed for the sites listed in Table 4.2 above on 17/10/2023.

Site specific and detailed conservation objectives documents were available for both sites:

- Lower River Shannon SAC (002165). Published 7 August 2012; and
- River Shannon and River Fergus Estuaries SPA (004077). Published 17 September 2012.

Management plans were not available for either site.

5 SUPPORTING INFORMATION FOR SCREENING FOR APPROPRIATE ASSESSMENT

5.1 Management of European Sites

The SI works are not directly connected with or necessary to the management of any European site(s).

5.2 Assessment of Likely Significant Effects

This section determines whether the impacts identified in Section 4.3 could have significant effects on the qualifying interests (QI) of the European sites identified in Section 4.4 in view of the conservation objectives of the sites. As described in Section 4.3, the potential impacts arising from the SI works are as follows:

- Noise, vibration, lighting, and human presence-related species disturbance.
- Surface water run-off/dust carrying suspended silt or contaminants to the marine environment.
- Habitat loss or disturbance (marine).
- Increased Suspended Sediment Concentrations (SSC) in the marine environment.
- Underwater noise (Injury and or displacement of Annex II marine mammals, otter, and fish from underwater noise and/or the presence of increased marine traffic (visual)).
- Accidental pollution event.
- Collision with survey vessels.

The assessment for likely significant effects will focus first on the Lower River Shannon SAC and then the River Shannon and River Fergus Estuaries SPA.

5.3 Lower River Shannon SAC (002165)

5.3.1 Noise, vibration, lighting, and human presence-related species disturbance

The SAC is selected for the protection of populations of the following aquatic, or in the case of otter semi-aquatic, species:

- Freshwater pearl mussel (*Margaritifera margaritifera*) [1029];
- Sea lamprey (*Petromyzon marinus*) [1095];
- Brook lamprey (*Lampetra planeri*) [1096];
- River lamprey (*Lampetra fluviatilis*) [1099];
- Atlantic salmon (*Salmo salar*) (only in fresh water) [1106];
- Bottlenose dolphin (*Tursiops trucatus*) [1349]; and
- Otter (*Lutra lutra)* [1355]

In relation to the land-based SI works, the only species that has the potential to be impacted is otter which, as noted in Table 4.1, may be impacted from noise, vibration, lighting, and human presence. Mapping carried out by NPWS (2012a) indicates that otter commute along the foreshore at Moneypoint, and this was confirmed during the otter survey undertaken in June 2022 and repeated in September 2023, where otter spraints were recorded along the rock armour on the shoreline at Moneypoint. All spraints found were recorded above the HWM. In the September 2023 two of the three couches identified in the 2022 otter survey were re-found and two possible holting sites also identified. One possible holt was identified within rock armour under the bridge to the jetty, and the second was located under the pier towards the east of the site. Multiple large accumulations of spraints were noted at these locations.

Moneypoint power station operates on a 24-hour, seven day a week schedule. There is therefore constant activity on-site including personnel, vehicle movements, deliveries, noise, artificial lighting, etc. It can be reasonably assumed that any otter activity on the site will be habituated to the existing site operations. It is considered highly unlikely that there will be any significant disturbance to otter as a result of the SI works. Therefore, this effect is screened out from further assessment.

There is no connectivity between disturbance from the land-based SI works and the remaining Annex II species listed above. While there is potential for visual disturbance to bottlenose dolphin and otter due to the presence of marine survey vessels during SI works, it is expected that a maximum of two vessels will be operating at any one time within the survey area.

The Lower Shannon Estuary is a busy shipping area, and Moneypoint is one of six of terminals within the Shannon Estuary. The estuary handles up to 1,000 ships carrying 12 million tons of cargo per annum (Clare County Council, 2023b) while Moneypoint accepts on average six to eight shipments per year. Bottlenose dolphins and otters are likely to be habituated to marine traffic, and the increase in vessel traffic as a result of the SI works is very low and temporary. It is considered highly unlikely that there will be any significant disturbance to marine species as a result of the presence of survey vessels. Therefore, further assessment of this impact is not considered necessary.

Underwater noise impacts on bottlenose dolphin, fish species and otter are considered in Section 5.3.5.

5.3.2 Surface water run-off/ dust carrying suspended silt or contaminants to the marine environment

The footprint of the land-based SI works will occur adjacent to the Shannon Estuary but on made/ disturbed-ground in and around the power station as shown in the drawings in Appendix A. Moneypoint power station operates 24 hours per day, 7 days a week with significant levels of activity. There are roads across the site with a number of carparks and other hardstanding areas. These are connected to the existing surface water management system on-site. There is a large coal storage area to the east of the power station and a Flue Gas Desulphurization (FGD) landfill. There are currently no significant environmental effects as a result of existing site operations leading to surface water run-off/dust carrying suspended silt or contaminants to the marine environment. When considered alongside the existing site operations, the SI works are insignificant. Material arisings from boreholes and trial pits will be stockpiled immediately adjacent to the investigation locations and backfilled immediately upon completion of the borehole/ trial pit. Any run-off from the works, e.g., due to rain, will be captured in the existing surface water management systems on-site. It is highly unlikely for there to be a direct pathway of suspended solids or contaminants from the land-based SI locations to the European site. It is considered highly unlikely that there will be any significant environmental effects from run-off, suspended silt or contaminants as a result of the SI works. Therefore, further assessment of this impact is not considered necessary.

5.3.3 Habitat loss, alteration, and fragmentation

In the vicinity of Moneypoint, and within the Marine Usage Licence area being applied for, the SAC boundary extends from the high water mark out into the marine area away from the land. Of the 14 Annex I habitat types selected for protection as part of the Lower River Shannon SAC (see Table 4.2), eleven are categorised as being 'Coastal and Halophytic'[3] in their distributions, while the remaining three habitats are categorised as freshwater, grasslands, and forests. The distribution of all annexed habitats within the SAC are presented in the conservation objectives document (NPWS, 2012a). The land-based SI works are not within the SAC boundary and will not impact on the annexed habitats. Therefore there will be no potential for habitat loss or alteration from the land-based activities. However, the marine based geotechnical works may impact on annexed habitats within the SAC. The distribution of the following habitats may occur within the area where the marine elements of the SI works will occur:

- Estuaries [1130][4]
- Reefs [1170][5]

[3] Marine in character

[4] Map 4: NPWS (2012a)

[5] Map 8: NPWS (2012a)

As identified in Table 4.1, there is the potential for loss and/or disturbance to these marine habitats as a result of Task 2: Metocean Surveys, Task 3: Marine Environment/ Ecological Surveys and Task 4: Marine Geotechnical Investigations.

Habitat fragmentation is the 'reduction and isolation of patches of natural environment' (Hall *et al.*, 1997 cited in Franklin *et al*., 2002) that alters the habitat and 'create[s] isolated or tenuously connected patches of the original habitat' (Wiens, 1989 cited in Franklin *et al*., 2002). This results in separation of habitat units which had previously been in a state of greater continuity. In effect, it reduces or eliminates connectivity which is an essential attribute of good conservation condition of any natural or semi-natural habitat - regardless of its legal status – and negatively affects biodiversity. Negative effects of habitat fragmentation can exert effects on species or populations increasing isolation of populations or species an effect which can detrimentally impact on the resilience or robustness of the populations, thereby, reducing overall species diversity and altering species abundance. While direct fragmentation impacts on motile species are less easy to discern the indirect impacts on them as a result of habitat fragmentation are undeniable.

The marine SI works will require the deployment of metocean equipment (e.g., ADCP) and underwater acoustic recorders which will be anchored/ weighted to the seafloor. Clump weights with acoustic releases are typically used. Buoys will mark the locations of these devices to warn vessels of their locations. The footprint of these devices and their interaction with the seafloor is extremely small. Only the ADCP will interact directly with the seabed with the underwater acoustic recorders being within the water column. The equipment will all be deployed for relatively short durations, i.e., weeks to months. Given the small footprint of these devices, the fact that they are only deployed for short-durations and will be removed once measurements are completed, it is considered that there will be no likely significant habitat loss, alteration, and fragmentation effects on Estuaries and/ or Reefs.

The marine SI works will require geotechnical investigations to allow for the characterisation of the sub-seabed strata and composition. It is anticipated that there will be 20 no. boreholes taken to a maximum depth of 30 m below the seabed. The samples sizes are typically 102 mm. Twenty-five vibrocores samples will also be performed at representative locations to a maximum of 3 m in depth with a sample size typically 150 mm, locations are shown in the drawings in Appendix A. As a result of intrusive marine survey works there is potential for loss and/or disturbance to Estuaries and/or Reefs within the development area as a result of the marine geotechnical works. In order to avoid this potential loss and/or disturbance, advance geophysical surveys can be undertaken to identify sensitive habitats with a view to avoiding them for the geotechnical investigations.

The marine environmental surveys will require the taking of grab samples from the seafloor. In order to extract grab-samples, there needs to be substrate that can be sampled, i.e., soft sediments. It is anticipated that there will be 20 no. stations at which grab samples will be taken as shown in the drawings in Appendix A and subject to suitable seafloor conditions. The samples sizes are typically 0.1m^2. Given the small footprint of this activity it is considered that there will be no likely significant habitat loss, alteration, and fragmentation effects on Estuaries and/ or Reefs as a result of the marine environmental surveys.

The assessment concludes that there is uncertainty as to whether or not significant habitat loss or alteration effects within the Estuaries [1130] and Reefs [1170] QIs are likely, without the implementation of mitigation measures. In light of this there is, similarly, uncertainty about habitat fragmentation impacts. In circumstances where there are any significant, potentially significant, or uncertain effects, further assessment of this impact is considered necessary.

5.3.4 Increased suspended sediment concentrations (SSC) in the marine environment

The deployment of metocean equipment to the seafloor will have an extremely small footprint and as a result there will be negligible amounts of sediments released into the water column. Given the water depth, tidal influence, the nature of the estuary and currents near Moneypoint, any sediment entering the water column from deployment and recovery of metocean equipment is expected to rapidly disperse. There will be no likely significant effects on the Annex I habitats Estuaries and Reef as a result of increased suspended sediment concentrations. Therefore, further assessment of this effect is not considered necessary.

The deposition arising from the drilling of the geotechnical marine boreholes has the potential to result in indirect effects of Annex I habitats associated with increased SSC and smothering may undermine the conservation objectives of benthic habitats. There is potential for limited SSC within the immediate footprint of the vibrocore while sampling but due to the small number of sites (25 vibrocores), relative footprint and limited duration of the surveys, SSC from vibrocores sampling is expected to be negligible. Increased SSC

and smothering may also occur from other activities such as use of anchors, positioning of equipment on the seabed (e.g., jack-up barge legs). The sediment type noted within the development area is noted as sand (fine to medium) with cobbles >9 cm mixed sediment (INFOMAR, 2023). This sediment type typically falls out of suspension quite rapidly and as the works will take place in the Lower Shannon Estuary this would aid in the rapid dispersal of any suspended sediments. As best practice methods to reduce sediment mobilisation to minimal levels during the SI works will be implemented, it is not anticipated that SSC will be in large enough quantities to significantly impact the Annex I habitats (e.g., estuaries and reef) in the area. Therefore, further assessment of this impact is not considered necessary.

The marine environmental surveys require that grab sampling be undertaken at locations in the foreshore. The location of grab samples is a small area at specific locations and as a result there will be negligible amounts of sediments released into the water column. Given the water depth, tidal influence, the nature of the estuary and currents near Moneypoint, any sediment from grab samplings entering the water column is expected to rapidly disperse. There will be no likely significant effects on the Annex I habitats Estuaries and Reef as a result of increased suspended sediment concentrations. Therefore, further assessment of this impact is not considered necessary.

5.3.5 Underwater noise (incl. Injury and/or displacement from increased marine traffic)

As identified in Table 4.1, there is potential for effects as a result of the underwater noise emitted by the following marine SI works: marine geophysical and geotechnical surveys, marine environmental works, deployment, and recovery of metocean equipment.

An underwater (subsea) noise assessment was carried out using indicative noise sources for the marine SI works. The assessment and results are presented in the Subsea Noise Technical Report in Appendix B. A summary of the equipment likely to be used in the SI Works and modelled for the Subsea Noise technical Report is provided in Section 2.2.6.

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 at Moneypoint ranges between 20-40m with a mixed substrate type, of muds, sands, coarse gravels, and exposed bedrock. 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 on this survey, operate by emitting extremely short pulses and are mostly directional or omni-directional (e.g., sparker) (Ruppell et al, 2022). While the range of the geophysical equipment will have a range limited principally by water depth and attenuation particularly of high frequency sources such as multi-beam and side scan sonar systems. Coupled with the narrow beam angle illustrated and short duty cycles (‘on’ for microseconds or milliseconds per second) means that surveying sonars have relatively low acoustic impact.

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 (Department of Arts, Heritage and the Gaeltacht (DAHG), 2014).

Should the noise levels from sources exceed the thresholds, there is the potential for underwater noise generated during the geophysical survey to result in injury and/or disturbance to bottlenose dolphin in the vicinity of the SI works.

Marine mammal species can be split into functional hearing groupings, according to their frequency-specific hearing sensitivity (Southall et al., 2019). Bottlenose dolphin is considered a high frequency cetacean (HF).

Continuous sources (i.e., survey vessels) are shown as almost 20 dB lower than the continuous noise threshold. Taking this and directionality into account there is no significant risk to marine mammals or fish from continuous noise.

From Table 6.1 and Table 6.2 of the Subsea Noise Technical Report (Appendix B), it can be seen that the greatest minimal starting range to avoid TTS for a fleeing animal is 3.1 km for VHF species (i.e., harbour porpoise). For HF species (i.e., bottlenose dolphin) the minimal starting range is 280m. As noted in Section 4.4.1, it is unlikely that harbour porpoise will be active within the estuary. However, as there is the potential for displacement of QI species of the Lower River Shannon SAC in the absence of mitigation measures, further assessment of this impact is considered necessary.

5.3.6 Accidental pollution event

The marine SI works will result in a slight increase in the number of vessels using the area for a temporary period. 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, which has the potential to result in toxic effects to Annex I benthic habitats and in turn on Annex II species that rely on these habitats for food.

The Lower Shannon Estuary is a busy shipping area in which a lot of commercial and recreational vessels operate. Given that the surveys would amount to, at most, two additional vessels operating in this area between Q1 of 2024 and Q1 of 2025 (See Table 2.2), the likelihood of a collision resulting in a pollution event is considered insignificant. As vessels are required by law to adhere to regulations governing accidental leakages and spillages similarly the likelihood of such an occurrence is considered very unlikely. 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. 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.

Given the nature of the SI works, their limited scale and duration, and the insignificant increase in vessel activity, it is considered highly unlikely that there will be a pollution incident, e.g., accidental spills of small quantities of fuel. Therefore, further assessment of this impact is not considered necessary.

5.3.7 Collision with survey vessels

Vessel strikes are a known cause of mortality in marine mammals (Laist *et al*., 2001). Non-lethal collisions have also been documented (Laist *et al*., 2001; Van Waerebeek *et al*., 2007). Injuries from such collisions can be divided into two broad categories: blunt trauma from impact and lacerations from propellers. Injuries may result in individuals becoming vulnerable to secondary infections or predation.

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 would be stationary, or travelling at low speeds.

The Lower Shannon Estuary is a busy shipping area, and Moneypoint is one of a number of terminals within the Shannon Estuary that handles up to 1,000 ships carrying 12 million tons of cargo per annum (Clare County Council, 2023b). Bottlenose dolphins are likely to be habituated to marine traffic, and the increase in vessel traffic as a result of the surveys is very low and temporary. On this basis it is predicted that collisions between survey vessels and bottlenose dolphins will be extremely unlikely. No likely significant effects are predicted as a result of collision with survey vessels.

It is considered highly unlikely that there would be any significant effects to marine species as a result of collision with survey vessels. Therefore, further assessment of this impact is not considered necessary.

5.4 River Shannon and River Fergus Estuaries SPA (004077)

5.4.1 Noise, vibration, lighting, and human presence-related species disturbance

This site is selected for the protection of 21 populations of seabirds and wildfowl, 20 of which are migratory, non-breeding overwintering populations[6]. These species vary considerably in aspects of their ecology due to adaptations and specialisations that influence their uses of different habitats, and the resulting behaviours affects how species are distributed across a site as a whole. Reliance on and use of alternative habitats varies between species, through time, from seasonally through to daily, and different habitats may be used by day and night (Shepherd *et al.* 2003, cited in NPWS, 2012b). Different waterbird species utilise habitats in different ways. When tidal flats are covered at high water, intertidally foraging waterbirds are unable to forage, and may move to nearby fields to feed. Some species are generalists, and make use of a range of habitats, for example the Black-tailed godwit do forage across intertidal mudflats but also readily use grassland habitats. Some species switch their habitat preference as food supplies become depleted, e.g., Light-bellied brent geese exploit grasslands when intertidal seagrass and algae become depleted. Table 5.1 below, summarises the characteristics, requirements, and specialities of the species for which this European site is selected.

Table 5.1 QI waterbird species – Ecological characteristics, requirements & specialities [adapted from NPWS, 2012b)

Species	Food/Prey[A] Requirements	Principal supporting habitat within site[B]	Ability to utilise other/alternative habitats[C]	Trophic Guild[D]
Cormorant	Highly specialised	Sheltered & shallow subtidal over sand and mud flats	1	3
Whooper swan	Wide	Lagoon and associated habitats, Intertidal mudflats and shallow subtidal	2	1,7
Light-bellied - brent goose	Highly Specialised	Intertidal mud and sand flats	2	1,5,7
Shelduck	Wide	Intertidal mud and sand flats Shallow subtidal	3	1,5
Wigeon	Narrower	Intertidal mud and sand flats and sheltered and shallow subtidal	2	1,5
Teal	Wide	Intertidal mud and sand flats and sheltered and shallow subtidal	3	1
Pintail	Wide	Shallow subtidal	2	1
Shoveler	Wide	Lagoon, brackish and freshwater lakes plus intertidal mud and sand flats	3	1
Scaup	Wide	Subtidal	1	2
Ringed plover	Wide	Intertidal mud and sand flats	3	4
Golden plover	Wide	Intertidal mud and sand flats	2	4
Grey plover	Wide	Intertidal mud and sand flats	3	4
Lapwing	Wide	Intertidal mud and sand flats	2	4
Knot	Narrower	Intertidal mud and sand flats	3	4
Dunlin	Wide	Intertidal mud and sand flats	3	4
Black-tailed Godwit	Wide	Intertidal mud and sand flats	2	4

[6] Site_specific_cons_obj (npws.ie)

Species	Food/Prey[A] Requirements	Principal supporting habitat within site[B]	Ability to utilise other/alternative habitats[C]	Trophic Guild[D]
Bar-tailed godwit	Wide	Intertidal mud and sand flats	2	4
Curlew	Wide	Intertidal mud and sand flats	2	4
Redshank	Wide	Intertidal mud and sand flats	2	4
Greenshank	Wide	Intertidal mud and sand flats	3	6
Black-headed gull	Wide	Intertidal flats and sheltered and shallow subtidal	2	1,2,4,6,7

A: *Food/prey requirements* – species with a **wide** prey/food range. Species with a **narrower** prey range (e.g., species that forage upon a few species/taxa only). Species with **highly specialised** foraging requirements.

B: *Principal supporting habitat within site* - Principal supporting habitat present within SPA. Note that this is the main habitat used when foraging.

C: *Ability to utilise alternative habitats* (refers to species ability to utilise other habitats adjacent to the site). **1** = wide ranging species with requirement to utilise the site as and when required. **2** = reliant onsite but highly likely to utilise alternative habitats at certain times (e.g., high tide). **3** = considered totally reliant on wetland habitats due to unsuitable surrounding habitats and/or species limited habitat requirements. Note a score of 1 for sea ducks and divers relates to propensity for within -season movements although the site is an important part of the species wintering range.

D: *Waterbird foraging guilds*: **1** = Surface swimmer, **2** = Water column diver (shallow), **3** = water column diver (deeper), **4/5** intertidal walker (out of water), **6** = intertidal walker (in water), **7** = terrestrial walker.

SUBTIDAL (The area that lies below mean low water). **INTERTIDAL** (The area between mean high water and mean low water).

As can be seen from Table 5.1, the specialised foraging strategies, and the limitations imposed by highly specific prey requirements, limit the capacities of the species populations, for which the European site is selected, to utilise alternative locations. The one exception is whooper swan that will forage on suitable grassland sites. The species populations rarely if ever move for sustained periods to areas not contiguous to the coastal mixed sediment habitats preferentially selected as foraging grounds. Two of the species are wide ranging with a tendency to utilise the European site as and when required; eleven species are reliant on the Natura site but are highly likely to utilise alternative habitats at certain times (e.g., high tide) and eight species are considered totally reliant on wetland habitats within the SPA due to unsuitable surrounding habitats and/or species' limited habitat requirements. Consequently, the populations are expected to continue to preferentially select the habitats of higher ecological value abundantly available within the European site designated for their protection over any of those within or in proximity to the SI works.

As can be seen from Table 5.1, above, the species for which this European site is selected are associated primarily with, and reliant to varying extents on, tidal, intertidal, and estuarine habitats unlike the habitats available at the SI works area, which are either entirely terrestrial, and disturbed above the high-water mark, or marine in character, below the high-water mark, and are not similar, or analogous in any way, to the habitats required by these species. As outlined in the preceding paragraph, behavioural constraints limit the capacities of the populations, for which the site is selected, to utilise alternative locations. It is expected that the populations of these species for which the European site is selected will continue to preferentially select the habitats of higher ecological value abundantly available within the European site designated for their protection over any of those within or in proximity to the location of the SI works.

It is concluded that none of the populations of these species for which the site is selected are expected to be present in the area of the SI works in numbers, or for sustained periods, and they will be unlikely to be exposed to significant disturbance or displacement effects. In light of the foregoing and considering the characteristics of the project described in Section 2 and the impacts identified in Section 4.3 it is considered that significant species disturbance or displacement impacts on the populations for which this European site is selected are not likely. Therefore, further assessment of this impact is not considered necessary.

5.4.2 Surface water run-off/dust carrying suspended silt or contaminants to the marine environment

As discussed in Section 5.3.2 the Moneypoint site is an active power station. There are currently no significant environmental effects as a result of existing site operations leading to surface water run-off/dust carrying suspended silt or contaminants to the marine environment. It is highly unlikely for there to be a

direct pathway of suspended solids or contaminants from the investigation locations to the European site. It is considered highly unlikely that there would be any significant environmental effects from run-off, suspended silt or contaminants as a result of the SI works. Therefore, further assessment of this impact is not considered necessary.

5.4.3 Habitat loss, alteration, and fragmentation

The SPA is selected for, inter alia, the non-annexed habitat type Wetlands defined in NPWS (2012b) as follows:

> [T]*he wetland habitat in the River Shannon and River Fergus Estuaries SPA* [which is] *a resource for the regularly occurring migratory waterbirds that utilise it.*

NPWS mapping of count sites and subsites and of roost sites (NPWS, 2012b), indicate that the area where the marine elements of the SI works will be carried out does not overlap with any of these sites. In addition, the mapping of waterbird distribution of low tide counts during low tide surveys (ibid.) indicates that, at low tide, the broad habitat types do not match those that encompass the location of the marine elements of the SI works. The aforementioned broad habitat types are:

- Subtidal (lying below the low tide mark but shallow and close to shore);
- Intertidal (of or denoting the area of a seashore which is covered at high tide and uncovered at low tide);
- Supratidal (that portion of a tidal flat which lies above the level of mean high water for spring tides);
- Lagoon and associated habitats; and
- Terrestrial.

Given that the existing berth at Moneypoint can service vessels up to 200,000 tonnes dwt, with depth alongside of 25 m, the area where the marine element of the SI works will occur is deep subtidal in nature and not ecologically analogous to the habitat types listed above. Therefore, it is considered that significant habitat loss or alteration impacts on the area of this non-annexed habitat type are not likely.

Habitat fragmentation is the 'reduction and isolation of patches of natural environment' (Hall *et al.*, 1997 cited in Franklin *et al*., 2002) that alters the habitat and 'create[s] isolated or tenuously connected patches of the original habitat' (Wiens, 1989 cited in Franklin *et al*., 2002). This results in separation of habitat units which had previously been in a state of greater continuity; in effect, it reduces or eliminates connectivity which is an essential attribute of good conservation condition of any natural or semi-natural habitat - regardless of its legal status – and negatively affects biodiversity. Negative effects of habitat fragmentation can exert effects on species or populations increasing isolation of populations or species an effect which can detrimentally impact on the resilience or robustness of the populations, thereby, reducing overall species diversity and altering species abundance. While direct fragmentation impacts on motile species are less easy to discern the indirect impacts on them as a result of habitat fragmentation are undeniable.

As concluded above (that habitat loss or alteration impacts on the area are not likely) it can also be concluded that significant habitat fragmentation impacts on this site are not likely. Similarly, it is concluded that significant species fragmentation impacts on the populations for which this site is selected are also not likely. Therefore, further assessment of this impact is not considered necessary.

5.4.4 Increased suspended sediment concentrations (SSC) in the marine environment

As outlined in Section 5.3.4, there is potential for increased SSC from the drilling of geotechnical boreholes and vibrocore sampling in the marine environment. There is potential for indirect effects to SPA QI birds due to smothering of fish prey species. However, due to the relatively limited extent of the works (maximum 20 boreholes and 25 vibrocores), and the wider availability of suitable habitat within the SPA, it is considered that significant prey availability impacts on the population will be extremely unlikely. Therefore, further assessment of this impact is not considered necessary.

5.4.5 Underwater noise (incl. Injury and/or displacement from increased marine traffic)

Little evidence exists of impacts to diving seabirds from acoustic survey activities. Given the limited extent of sound-producing activity and as the majority of QI bird species at this SPA are not divers (with the exception of cormorant and scaup) it is considered that there is a very low likelihood of interaction between underwater noise sources and diving birds. Therefore, further assessment of this impact is not considered necessary.

5.4.6 Accidental pollution event

Notwithstanding that water quality is not, in and of itself a qualifying interest, it is self-evident that high water quality is the vital and crucial component underpinning and supporting certain ecological structures and functions of the SPA.

As outlined in Section 5.3.6, given the nature of the SI works, their limited scale and duration, and the insignificant increase in vessel activity, it is considered highly unlikely that there will be a pollution incident, e.g., accidental spills of small quantities of fuel. Therefore, further assessment of this impact is not considered necessary.

5.5 In-combination effects

As part of the SISAA report, in addition to the SI works, other relevant projects and plans in the region must also be considered at this stage. The in-combination assessment is scoped with regard to the site-specific pressures and threats identified for the Lower River Shannon SAC and River Shannon and River Fergus Estuaries SPA.

5.5.1.1 Plans

The plans that are considered in-combination with the SI works at Moneypoint include:

- Shannon International River Basin Management Plan (2009-2015);
- Strategic Infrastructure Framework Plan for the Shannon Estuary (2013-2020);
- Clare County Development Plan (2023-2029);
- Kerry County Development Plan (2022-2028); and
- Draft National Biodiversity Action Plan (2023-2027)

There are no anticipated in-combination effects from plans and therefore in-combination effects are not considered for further assessment.

5.5.1.2 Projects

In January 2023, ESB applied to Clare County Council for planning permission for the onshore site investigation works at Moneypoint Generating Station. The land-based SI works comprise the drilling of boreholes and excavation of trial pits at various locations cross the site above the High-Water Mark. The investigation aims to determine the sub surface strata and composition of the ground and the level of rockhead (including follow on coring to confirm rock head).

It is proposed that approximately 26 no borehole stations and shallow exploratory investigations will be undertaken. The methods to be employed during the investigation works are borehole cable percussive, borehole rotary core and trial pits. It is anticipated that the maximum depth of the boreholes will be 20m. Trail pits are anticipated to be a maximum of 4.5m deep.

Planning permission for the onshore site investigation works was granted by Clare County Council on 18th April 2023. The expiry date of the grant is 17th April 2028.

Other marine projects could potentially give rise to either direct impacts on habitats or species (loss of habitat, disturbance to species) or indirect impacts (e.g., activities which could affect water quality or hydrology which could in turn affect the status/health of populations of water dependant habitats or species).

A search of planning authority applications and foreshore applications which could interact with the SI works was conducted using the planning authority websites (i.e., My Plan.ie, EIA planning portal which include applications from Clare Co. Co. planning website, Kerry Co. Co. planning website, An Bord Pleanála (ABP) website and Department of Housing and Local Government and Heritage (DHPLG) website.) A full list of each planning and foreshore application for the last 5 years was reviewed and is available in Appendix C.

The nature of the SI works is temporary and limited in scale. There will be no permanent land take and no continuous emissions or discharges arising from the SI works. Therefore, further assessment of in-combination effects is not considered necessary.

6 SUMMARY AND CONCLUSIONS

6.1 Summary

A summary of the findings of the preceding section is presented in Table 6.1.

Table 6.1 Summary of SISAA

Impact	Lower River Shannon SAC (002165) Further Assessment Required (Y/N)	River Shannon and River Fergus Estuaries SPA (004077) Further Assessment Required (Y/N)
Noise, vibration, lighting, and human presence-related species disturbance.	No	No
Surface water run-off/dust carrying suspended silt or contaminants to the marine environment.	No	No
Habitat loss, alteration, and fragmentation.	Yes	No
Increased Suspended Sediment Concentrations (SSC).	No	No
Underwater noise, Including injury and or displacement of Annex II marine mammals, otter, and fish from underwater noise and/or the presence of increased marine traffic (visual).	Yes	No
Accidental pollution event.	No	No
Collision with survey vessels	No	n/a
In-combination effects	No	No

6.2 Conclusions

RPS has prepared this report to provide a sufficient level of information to the MARA for them to complete a Screening for Appropriate Assessment of the potential for likely significant effects on European sites, in view of their conservation objectives, arising from the site investigation works either individually or in combination with other plans or projects. The potential impacts of the SI works have been considered in the context of the European sites potentially affected, their QIs and their conservation objectives, through the application of the S-P-R model, which considered the potential extent of effects from the SI works and the potential in-combination effects with other plans or projects. The overall findings are as follows.

The SI works are not connected with or necessary to the management of the nature conservation interest of any European site.

The SI works, in the absence of mitigation, have the potential to contribute to habitat loss, alteration, fragmentation in the Lower River Shannon SAC (002165). It should be noted that the geotechnical investigations will be informed by the geophysical survey outputs which is being undertaken as part of the current scope of SI works to mitigate habitat loss, alternation, and fragmentation effects on Estuaries and/or Reefs.

The geophysical survey will also introduce subsea noise that has the potential to impact on bottlenose dolphin that are a QI species of the Lower River Shannon SAC (002165). Mitigation measures such as those set out in the Guidance to Manage the Risk to Marine Mammals from Man-made Sound Sources in Irish Waters (DAHG, 2014) are required to avoid and/or reduce the potential for negative impacts on marine mammals.

It is our opinion, it cannot be excluded, on the basis of objective information, the SI works, individually or in combination with other plans or projects, will have a significant effect on a European site. It is recommended that a Natura Impact Statement (NIS) be prepared to assist the MARA in conducting an Appropriate Assessment should they agree with the findings of this SISAA.

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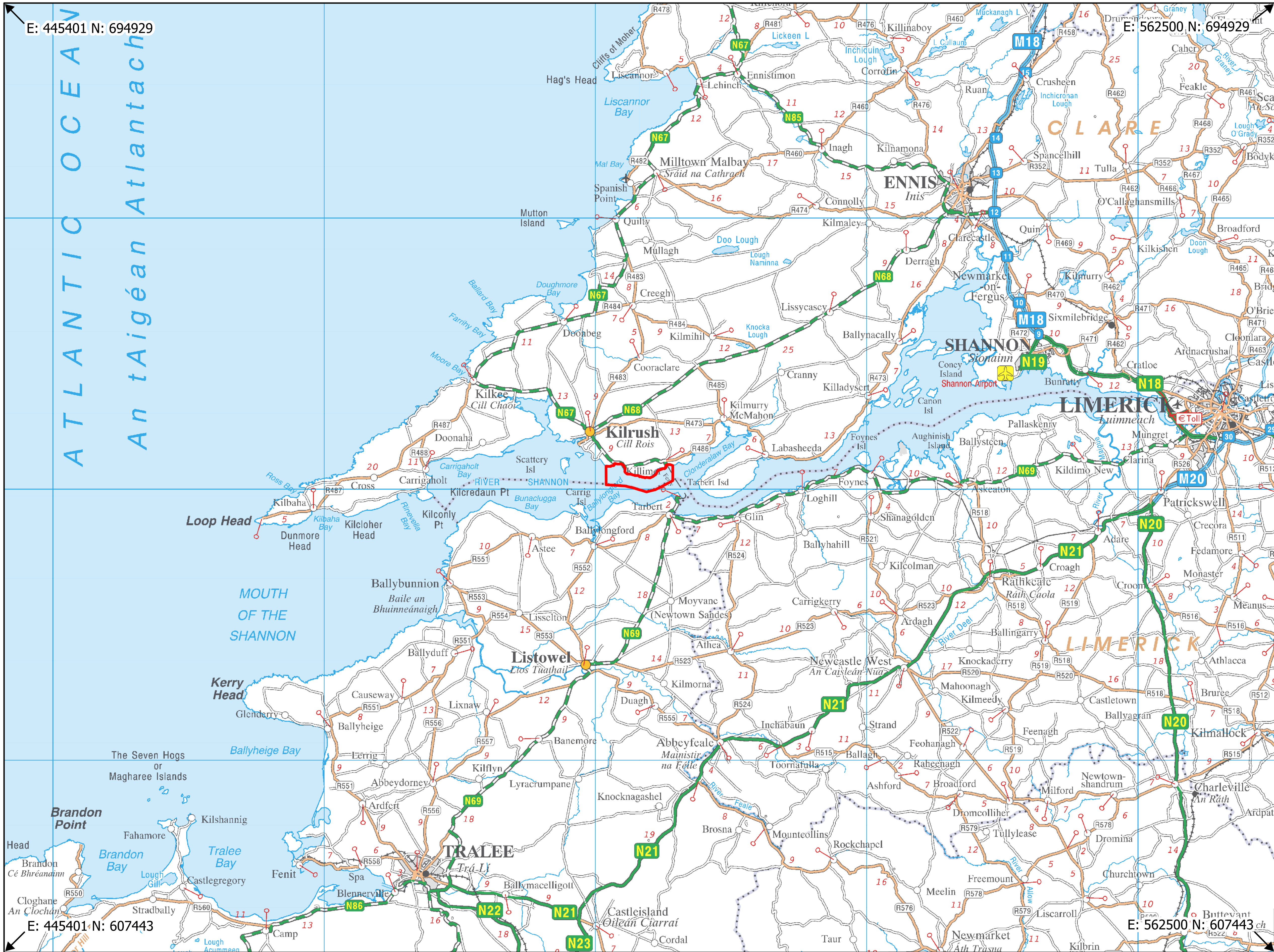
Appendix A
Drawings



Legend

Area A, 927.53ha

N

Prepared By:

[redacted]

BSc MSc CSci C.WEM M.CIWEM
ESB
One Dublin Airport Central,
Dublin Airport, Cloghran,
Co. Dublin, Ireland.
22/09/2023

Map Projection:
Irish Transverse Mercator (ITM)

Tailte Éireann Licence No. EN 0023719-24
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0 5 10 15 km

0	22/09/23	LICENCE APPLICATION	TO'R	D.H	M.H	D.H
REV	DATE	REVISION DESCRIPTION	DRN	PROD	VER	APP

PURPOSE OF ISSUE - PRELIMINARY UNLESS INDICATED

CLIENT APPROVAL ☐ PLANNING ☐ TENDER ☐ CONSTRUCTION ☐ AS-BUILT ☐

Engineering and Major Projects,
One Dublin Airport Central,
Dublin Airport, Cloghran,
Co. Dublin, K67 XF72, Ireland.
Tel: 353 1 703 8000 Web: www.esb.ie
Engineering and Major Projects is a division of ESB.

Energy for generations

CLIENT: ESB Generation & Trading

PROJECT: Moneypoint Hub Project Site Investigation

CONTRACT

PRODUCTION UNIT: Civil, Environmental & Renewable Engineering

DRAWING TITLE:
Map 1: Location Map
Maritime Area Regulatory Authority (MARA)

DRAWN	PRODUCED	VERIFIED	APPROVED	APPROVAL DATE
[redacted]	[redacted]	[redacted]	[redacted]	22/09/2023

CLIENT REF.	Revision	NO. OF SHEETS	SIZE	SCALE
00-00	0	00-00	A3	1:350,000

DRAWING NUMBER: QS-000339-01-D460-007-001-000

Legend

- Area A, 927.53ha
- Privately held Foreshore by ESB

N

NOTE:

Area A: 927.53ha Marine Licence Application Area

Area of privately held foreshore is 67.12ha as per Folio CE57420F & CE2029L

Area of privately held foreshore in the Marine environment: 40.59ha

Prepared By:

[redacted]

BSc MSc CSci C.WEM M.CIWEM.
ESB
One Dublin Airport Central,
Dublin Airport, Cloghran,
Co. Dublin, Ireland.
22/09/2023

Map Projection:
Irish Transverse Mercator (ITM)

0 250 500 750 1,000 m

REV	DATE	REVISION DESCRIPTION				
0	22/09/23	LICENCE APPLICATION	TO'R	D.H	M.H	D.H
			DRN	PROD	VER	APP

PURPOSE OF ISSUE - PRELIMINARY UNLESS INDICATED

CLIENT APPROVAL ☐ PLANNING ☐ TENDER ☐ CONSTRUCTION ☐ AS-BUILT ☐

Energy for generations

Engineering and Major Projects,
One Dublin Airport Central,
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Tel: 353 1 703 8000 **Web:** www.esb.ie

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CLIENT: **ESB Generation & Trading**

PROJECT: **Moneypoint Hub Project Site Investigation**

CONTRACT

PRODUCTION UNIT: **Civil, Environmental & Renewable Engineering**

DRAWING TITLE: **Map 2: Licence Map**
Maritime Area Regulatory Authority (MARA)

DRAWN	PRODUCED	VERIFIED	APPROVED	APPROVAL DATE
[redacted]	[redacted]	[redacted]	[redacted]	22/09/2023

CLIENT REF.	Revision	NO. OF SHEETS	SIZE	SCALE
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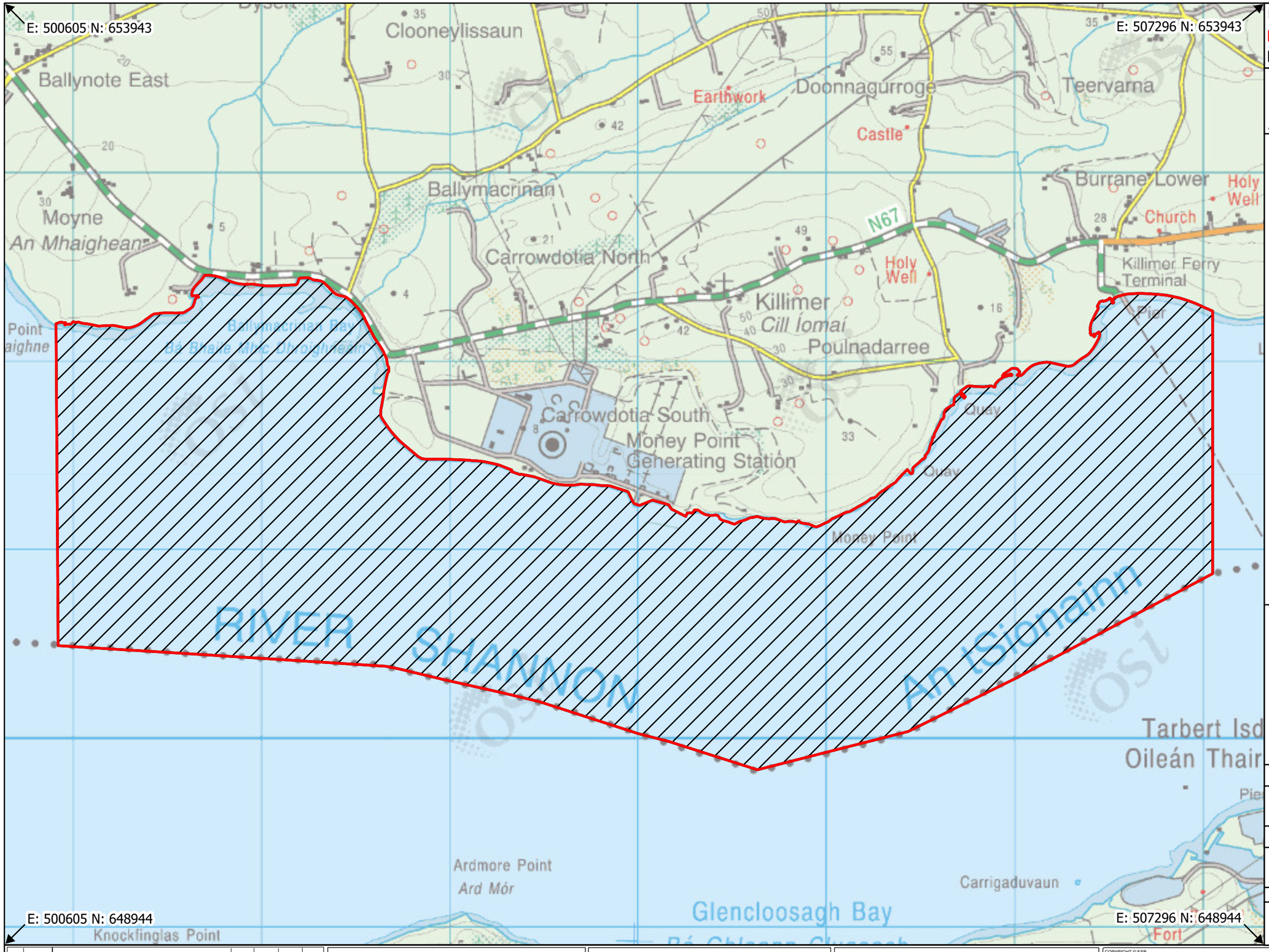
DRAWING NUMBER **QS-000339-01-D460-007-002-000**



Legend

- Area A, 927.53ha
- Geophysical Surveys - 927.53ha

N

Prepared By:

[redacted]

Daniel Hogan
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ESB
One Dublin Airport Central,
Dublin Airport, Cloghran,
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22/09/2023

Map Projection:
Irish Transverse Mercator (ITM)

0 250 500 750 1,000 m

REV	DATE	REVISION DESCRIPTION	TO'R	D.H	M.H	D.H
0	22/09/23	LICENCE APPLICATION	DRN	PROD	VER	APP

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DRAWING TITLE: **Map 3: Geophysical Survey Area Map Maritime Area Regulatory Authority (MARA)**

CONTRACT

DRAWN	PRODUCED	VERIFIED	APPROVED	APPROVAL DATE
[redacted]	[redacted]	[redacted]	[redacted]	22/09/2023

CLIENT REF.	Revision	NO. OF SHEETS	SIZE	SCALE
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DRAWING NUMBER **QS-000339-01-D460-007-003-000**

E: 502088 N: 652623

E: 504597 N: 652623

E: 502088 N: 650749

E: 504597 N: 650749

Legend

- Area A, 927.53ha
- Privately held Foreshore by ESB
- Grab Samples (20 in number) / Vibrocores (25 in number)
- ADCP - Indicative Location
- Underwater Noise Recorder - Indicative Location
- Borehole - Indicative Location (20 in number)

N

NOTE:

Points illustrated on map are are indicative only. The Marine Geophysical Surveys will be used to microsite the exact locations of geotechnical boreholes, environmental grab samples and vibrocores.

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22/09/2023

Map Projection:
Irish Transverse Mercator (ITM)

0 100 200 300 400 m

REV	DATE	REVISION DESCRIPTION	DRN	PROD	VER	APP
0	22/09/23	LICENCE APPLICATION	TO'R	D.H	M.H	D.H

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CONTRACT

PRODUCTION UNIT: **Civil, Environmental & Renewable Engineering**

DRAWING TITLE: **Map 4: Site Investigation Map Maritime Area Regulatory Authority (MARA)**

DRAWN	PRODUCED	VERIFIED	APPROVED	APPROVAL DATE
[redacted]	[redacted]	[redacted]	[redacted]	22/09/2023

CLIENT REF.	Revision	NO. OF SHEETS	SIZE	SCALE
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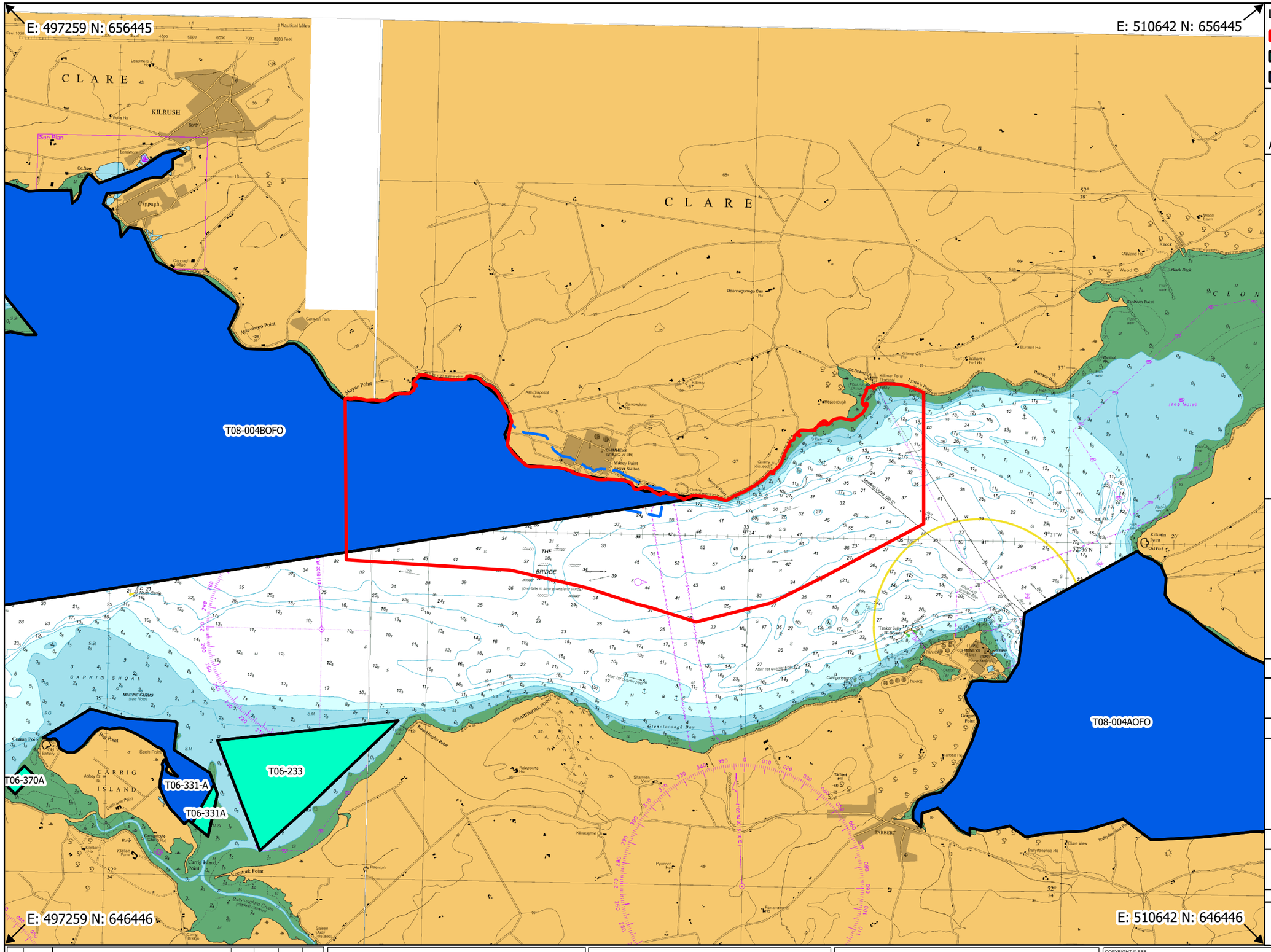
DRAWING NUMBER **QS-000339-01-D460-007-004-000**



Legend

- Area A, 927.53ha
- Aquaculture Site
- Fishery Order

N

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21/11/2023

Map Projection:
Irish Transverse Mercator (ITM)

0 0.5 1 1.5 2 km

REV	DATE	REVISION DESCRIPTION	TO'R	D.H	M.H	D.H
0	21/11/23	LICENCE APPLICATION	DRN	PROD	VER	APP

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CLIENT: **ESB Generation & Trading**

PROJECT: **Moneypoint Hub Project Site Investigation**

CONTRACT

PRODUCTION UNIT: **Civil, Environmental & Renewable Engineering**

DRAWING TITLE: **Map 5: Licenced Aquaculture Sites Map Maritime Area Regulatory Authority (MARA)**

DRAWN	PRODUCED	VERIFIED	APPROVED	APPROVAL DATE
[redacted]	[redacted]	[redacted]	[redacted]	21/11/2023

CLIENT REF.	Revision	NO. OF SHEETS	SIZE	SCALE
00-00	0	00-00	A3	1:40,000

DRAWING NUMBER **QS-000339-01-D460-007-005-000**

Appendix B
Subsea Noise Technical Report

ESB MONEYPOINT HUB PROJECT

SI Works – Subsea Noise Technical Report

IE000210RP0028
F01
23 November 2023

Document status

Version	Purpose of document	Authored by	Reviewed by	Approved by	Review date
D01	Internal Draft	[redacted]	[redacted]	[redacted]	03 November 2023
A01	Draft for Client Review	[redacted]	[redacted]	[redacted]	08 November 2023
F01	Final	[redacted]	[redacted]	[redacted]	23 November 2023

Approval for issue

GMcE	23 November 2023

Prepared by:	Prepared for:
RPS	ESB

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rpsgroup.com

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RPS Consulting Engineers Limited, registered in Ireland No. 161581
RPS Planning & Environment Limited, registered in Ireland No. 160191
RPS Engineering Services Limited, registered in Ireland No. 98795
The Registered office of each of the above companies is West Pier Business Campus, Dun Laoghaire, Co. Dublin, A96 N8T7

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GLOSSARY

Term	Meaning
Decibel (dB)	A customary scale most commonly used (in various ways) 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), and 20 micro-Pascals is the standard for airborne sound. The dB symbol is 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 (minutes to few hours) 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 (L_E)	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". Equal to the often seen "SEL" or "dB SEL" quantity. 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". Equal to the deprecated "RMS level", "dB_{rms}" and to L_{eq} if the period is equal to the whole duration of an event. 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 time 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". Defined in ISO 18405:2017, 3.2.2.1

ACRONYMS

Term	Meaning
ADD	Acoustic Deterrent Device
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*
NMFS	National Marine Fisheries Service
OW/OCW	Otariid pinnipeds/Other Carnivores in water (refers to the same weighting and animal groups)
PTS	Permanent Threshold Shift
PW/PCW	Phocid pinnipeds
RMS	Root Mean Square
L_E	Sound Exposure Level, [dB]
SPL	Sound Pressure Level, [dB]
L_P	Peak Pressure Level, [dB]
TTS	Temporary Threshold Shift
PTS	Permanent Threshold Shift

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)
µPa	Micro Pascal
Pa	Pascal (Pressure)
psu	Practical Salinity Units (parts per thousand of equivalent salt in seawater)
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

1.1 Overview

This Subsea Noise Technical Report presents the results of a desktop study considering the potential for Momentary, Brief and Temporary effects[1] of underwater noise on the marine environment from the site investigation works, which includes a geophysical survey to map the application area (hereafter referred to as "the Project"). The site forms a single contiguous area of approximately 9 km², or a ~1.3 km wide band of 6 km length along the north edge of the Shannon Estuary, centred on the Moneypoint power station, 5 km south-east of Kilrush, Co. Clare.

Sound is readily transmitted into the underwater environment and there is potential for the sound emissions from anthropogenic sources to adversely affect marine mammals and fish. At close ranges from a noise source with high noise levels, permanent or brief 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 Project on the surrounding marine environment based on the Southall et al. 2019 and Popper et al. 2014 framework for assessing impact from noise on marine mammals and fishes.

Consequently, the primary purpose of the subsea noise assessment is to predict the likely range of onset of injury as given in the relevant guidance (Temporary Threshold Shift) and ranges to potential behavioural effects due to anthropogenic noise as a result of the Project.

1.2 Statement of Authority

This report has been prepared by RPS on behalf of the ESB. The technical competence of the authors is outlined below:

Rasmus Sloth Pedersen is a Senior Project Scientist with RPS. He holds a master's degree in biology, biosonar and marine mammal hearing from University of Southern Denmark. Rasmus has over 10 years' experience as a marine biologist and over 8 years' experience with underwater noise modelling and marine noise impact assessments. Rasmus 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.

John Mahon 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. John has 19 years' experience in environmental projects including planning applications and environmental impact assessments for a wide range of strategic infrastructure projects.

Gareth McElhinney 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 Masters in Business Studies from the Irish Management Institute/ UCC. Gareth is also a Chartered Engineer. 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] Effects are defined in accordance with the EPA Guidelines on the information to be contained in Environmental Impact Assessment Reports (2022), Table 3.4 Description of Effects, pp.50-52.

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 1986; NIOSH 1998; ANSI 2005). This category includes sound sources such as seismic surveys, impact piling and underwater explosions. Also included are sounds under 1 second in duration with a weighted kurtosis over 40 (see note below*).
- Non-impulsive (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.

* 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 (section 2.2 of document). 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[2] of 40 (Martin, et al., 2020). 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 2019 framework limits are based on the narrower definition of impulsive as given above under “Impulse sounds”.

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.; Popper, et al., 2014).

2.2 Injury to Marine mammals

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. This assessment has added a fifth zone, the “zone of temporary hearing loss”. The five zones are as follows:

- **The zone of audibility**: this is the area within which the animal can detect the sound. Audibility itself does not implicitly mean that the sound will affect the marine mammal.
- **The zone of masking**: this is defined as the area within which noise 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 marine mammals detect sound in relation to masking levels (for example, humans can hear tones well below the numeric value of the overall noise level).
- **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 audibility does not necessarily evoke a reaction. For most species there is very little data on response, but for species like harbour porpoise there exist 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).

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

- **The zone of temporary hearing loss**: The area where the sound level is high enough to cause the auditory system to lose sensitivity for minutes to few hours, causing loss of "acoustic habitat": the volume of water that can be sensed acoustically by the animal. This effect is abbreviated "TTS".
- **The zone of injury / permanent hearing loss**: this is the area where the sound level is high enough to cause tissue damage in the ear. This is usually 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.

  Note that guidance from the Irish regulatory body classifies TTS (hearing loss persisting minutes to few hours) as causing injury, given the potential secondary effects of impacted hearing sensitivity.

For this study, it is the **zones of temporary hearing loss (area within range to TTS risk)**[3] 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.

The zone of injury in this study is classified as the distance over which a marine mammal will likely suffer TTS. Injury thresholds are based on a dual criteria approach using both un-weighted LP (maximal instantaneous SPL) and marine mammal hearing weighted LE. 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 truncates*) 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; air hearing 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 have therefore been used in this study and are shown in Figure 2.1. It should be noted that not all the above categories of marine mammal will be present in the Project area, but criteria are presented in this report for completeness.

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

Note that in Ireland the TTS limits are the main criteria, with PTS limits given for completeness.

[3] Department of Arts, Heritage and the Gaeltacht (2014) p. 11 establishes TTS as an injury.

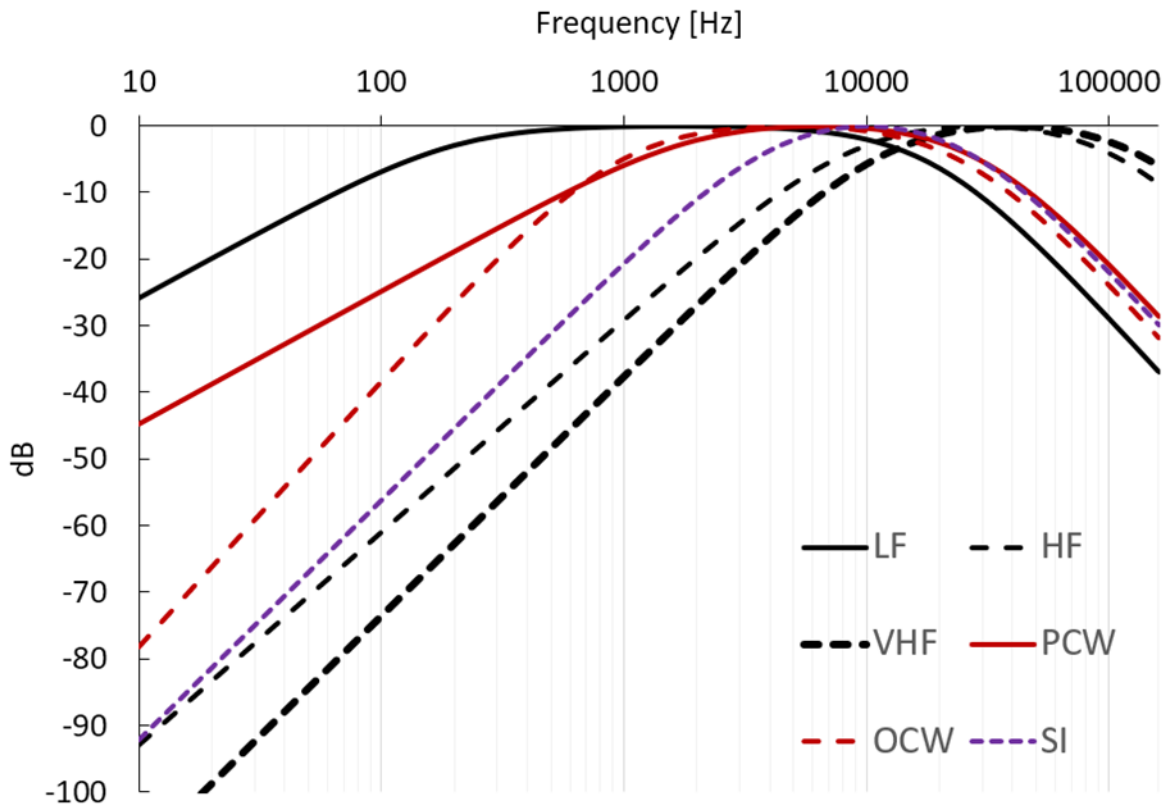

Figure 2.1 Hearing weighting functions for pinnipeds, cetaceans and sirenians (NMFS, 2018; Southall et al. 2019)

Table 2.1 PTS and TTS onset acoustic thresholds (Southall et al., 2019; Tables 6 and 7). TTS criteria in bold

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

These updated marine mammal injury criteria were published in March 2019 (Southall, et al.). 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 PTS and TTS onset acoustic thresholds (Southall et al., 2019; Tables 6 and 7). TTS criteria in bold

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

2.3 Disturbance to Marine Mammals

Disturbance thresholds for marine mammals are summarised in Table 2.3. These are based on "Level B harassment" of NMFS (National Marine Fisheries Service, 2005). 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.

Table 2.3 Disturbance Criteria for Marine Mammals

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

2.4 Injury and Disturbance to Fish and Sea Turtles

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. Peak pressure level (L_P) and exposure level (L_E) 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, 2011) 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:

1. The criteria presented in the Washington State Department of Transport Biological Assessment Preparation for Transport Projects Advanced Training Manual (WSDOT, 2011). 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 brief 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. Again, the threshold is implemented as either single impulse LE or 1 second LE, whichever is greater.
2. 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 LP, the 10th percentile level for behavioural response was 158 dB L_P, given the large variations in the data, this has been rounded to 160 dB L_P as the behavioural limit for fishes for impulsive noise, given the already considerable variation in the underlying data.

Table 2.4 Criteria for onset of injury to fish and sea turtles due to impulsive noise

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)	L_E	219[1]	216[1]	186[1]	150[3]
	L_P	213[1]	213[1]	193[2]	189[2]
Fish: where swim bladder is not involved in hearing (particle motion detection)	L_E	210[1]	203[1]	186[1]	150[3]
	L_P	207[1]	207[1]	193[2]	189[2]
Fish: where swim bladder is involved in hearing (primarily pressure detection)	L_E	207[1]	203[1]	186	150[3]
	L_P	207[1]	207[1]	193[2]	189[2]
Sea turtles	L_E	210[1]	(*Near*) High (*Intermediate*) Low (*Far*) Low	-	-
	L_P	207[1]		-	-
Eggs and larvae	L_E	210[1]	(*Near*) Moderate (*Intermediate*) Low (*Far*) Low	-	-
	L_P	207[1]		-	-

1 (Popper et al. 2014)

2 (Worcester, 2006)

3 (WSDOT, 2011)

Where Popper et al. 2014 present limits as ">" 207 or ">>" 186, the analysis ignores the "greater than" and uses the threshold level as given.

Relevant limits for fishes relating to PTS, TTS, and behaviour are given in the Table 2.5. Note that for the behaviour limit the impulsive limit has been used as the basis for the continuous noise limit, in the absence of better evidence.

Table 2.5 Criteria for fish from non-impulsive noise from Popper et al. 2014

Type of animal	Unit	Mortality and potential mortal injury	Recoverable injury (PTS) [dB]	TTS [dB]	Behavioural [dB]
All fishes	L_E	-	222	210	150 [SPL]*

*Based on the impulsive criteria.

3 SITE, SURVEY METHOD, AND ENVIRONMENT

3.1 Site Location

Moneypoint is located on the northern shore of the Shannon Estuary in Co. Clare, approximately 3 km west of Killimer and 6 km south-east of Kilrush (Figure 3.1). The site was acquired by ESB in the late-1970s to develop a coal fired power plant as part of its strategy to diversify from oil dependent electricity generation. It consists of both a terrestrial and marine area; along with the interface between the two.

The site investigation works form a single contiguous area of approximately 9 km², or a ~1.3 km wide band of 6 km length along the north edge of the Shannon Estuary, centred on the Moneypoint power station (see Figure 3.2).

The sediment is mainly sand to fine/medium gravel, and depths are <60 m (assuming high tide).

Figure 3.1 Location of Moneypoint Generating Station Site in the context of the Shannon Estuary, Co. Clare

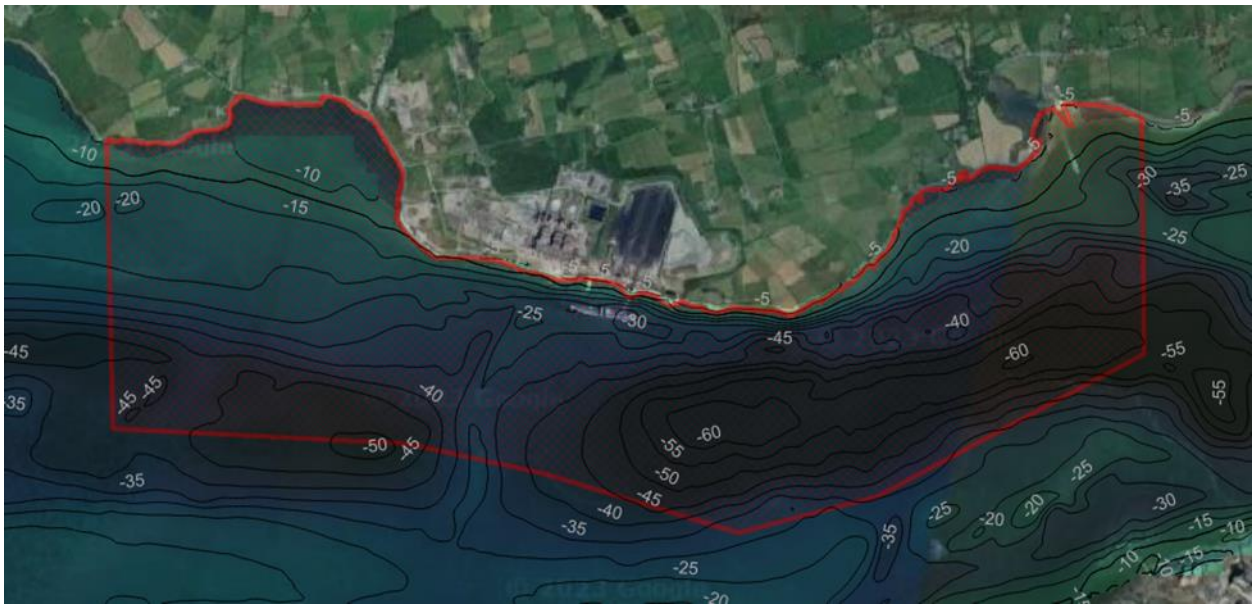

Figure 3.2 Site Investigation Survey Area

3.2 Survey Method

3.2.1 Overview

For a full description of the site investigation works (which includes both geophysical and geotechnical marine site investigations) please refer to Section 2 of the accompanying Assessment of Impact on the Maritime Usage (AIMU) Report.

In summary, the site will be surveyed by a small to medium vessel (15-80 m length, a 70 m vessel forming the basis of this assessment) with various geophysical survey equipment (see Table 4.1 in Section 4), with survey lines to cover the total area. The density of survey lines will depend on the local depth, as the "width of detection" (swath) is a constant angle, thus greater depths will mean that survey lines are spread further apart.

Details on the expected equipment to be used (or representative equipment) can be found in Section 4, Source Noise Levels.

The vessel is assumed to move at 4 knots during surveying (2 m/s). This speed affects the time a stationary receiver is exposed to the survey, and hence a slower speed is precautionary. The actual speed will likely be over 4 knots (> 2 m/s).

Survey line layouts as given in Section 3.2.2 are designed to be representative of the acoustic impact of the survey, not the actual survey layout. The acoustic impact is mainly affected by the survey speed and the total time spent in a given area, not the precise line layout.

3.2.2 Survey Layout Example

For the survey a line spacing of 25 m has been assumed as this is the largest line spacing for the magnetometer, and smaller than any required line spacing for the geophysical equipment. Even if the magnetometer is not equipped/active for all vessels, this spacing will be conservative as it is at least as dense as required for the remaining survey equipment. Where the magnetometer is not in use the actual line spacing will be 2-5 times the local depth, meaning that it is more practical to run survey lines along the shore (consistent depths means consistent swath width). See Figure 3.3 for example of this as well as the assumed 25 m survey grid.

At a speed of 4 knots (2 m/s) the longest transect will be approximately 50 minutes (6200 m / 2.06 m/s / 60 sec/min = 50 min).

Figure 3.3 Left: Example transects showing swath width (black areas) as an effect of depth. Right: Survey lines given 25 m spacing, and validation transects at 500 m spacing

3.3 Environment

3.3.1 Water Properties

Water properties were determined from historical data for the area. Where a range of values are expected, the value leading to the lowest transmission loss, highest received level, was used, resulting in a more conservative assessment. This use of values leading to lowest transmission loss (highest temperature, lowest salinity, highest tide) also covers seasonal variation at the site.

- Temperature: 20 degrees – Based on maximal temperature given by Met Eireann for Irish marine waters (16 degrees)[4] along with data from seatemperature.net for water temperatures near Shannon town. A higher temperature is more conservative.
- Salinity: Set at 30 psu - lowest, most conservative, value observed 2007-2011 (INFOMAR, 2012).
- Soundspeed profile: Assumed uniform given high mixing as a result of tidal flows. A uniform soundspeed profile is conservative compared to the likely downward refracting soundspeed profiles seen during summer months (higher temperature in the surface leads to higher soundspeeds). No significant halocline is expected, due to the relative proximity to the sea, and distance to the River Shannon outflow into the estuary.

3.3.2 Sediment Properties

Sediment properties are taken from EMODnet[5] "Folk 7-class Classification" and nautical charts[6]. A sediment model (Ainslie, 2010) was used to derive the acoustic properties of the sediments from the grain size. An "acoustically harder" sediment (higher density and soundspeed) will be conservative, in that it will improve sound propagation in the water column. Therefore, while it is expected to find finer, acoustically softer sediments present, these will have higher transmission losses, and will thus be covered by the more conservative assumption of the coarser sediment.

Table 3.1 Sediment properties

Sediment type (Folk 7)	Density [kg/m³]	Soundspeed [m/s]	Grain size [mm] (nominal)
Coarse substrate	2595	2034	3.5

[4] https://www.met.ie/climate/average-monthly-sea-temperature-at-malin-head/

[5] https://emodnet.ec.europa.eu/ sediment model "Folk 7-class" classification.

[6] https://fishing-app.gpsnauticalcharts.com/i-boating-fishing-web-app/fishing-marine-charts-navigation.html

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 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 this imagined acoustic centre point. Therefore, the stated sound pressure level at 1 m does not occur for large sources. For such large source, 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 the subsea noise assessment study are summarised in Table 4.1.

Source levels for the active equipment were combined to produce a “combined” source that represents the survey vessel’s sound signature while actively surveying during the survey (see Figure 4.1 and Figure 4.2).

Note that source levels vary depending on the location of the survey due to the ping rate, and therefore the SPL of the source, varies with the local depth.

Multibeam echosounders have been included in the assessment even though their main frequencies lie well above the hearing range of the VHF hearing group. This is because, given the way the signals are produced some spectral leakage (energy “leakage” into other frequencies due to the acoustic properties of the transducer) will occur, resulting in significant acoustic energy to frequencies audible to both dolphins and porpoises.

As sonars and echosounder have narrow beams and therefore “sweep” through the water body, they are harder to model for expected received level. For the assessment the energy in the beam has been converted to an equivalent spherical source (of lower spherical SPL than the in-beam level) to ensure that a randomly positioned receiver would receive the same energy. Note that while extremely narrow beams (0.1-1 degree) are often stated for sonars and echosounders, this is the width of the beam where the received level drops by a set amount, usually 3 dB (if stated at all). There is a significant amount of acoustic energy outside the beam, and this has been included in the assessment.

The parametric sub-bottom profilers have quite narrow beams directed vertically down, with levels attenuating rapidly as the angle away from vertical increases. For exposure modelling [dB L_E], the source level at an angle corresponding to the specular reflection of the sediment, 47 degrees from vertical[7], has been used for the assessment. This means that for the deeper sites (60 m) there will be a cone of diameter approximately 65 m radius at the sediment (depth of 60 m) which will underpredict the impact for animals. As this zone is a cone, the radius at half depth, is half as big, approximately 33 m at 30 m depth. Risk ranges tend to be larger than 65 m, and animals will be able to hear the vessel approaching with time to evade this cone.

Given that a parametric system introduces a significant increase in sound levels around the most sensitive region of the HF hearing group, compared with the remaining systems, it was chosen to split the assessment into two parts. This assessment presents (a) scenario with no parametric system active and (b) scenario with a parametric system active. This approach provides a better insight into the effect of including a parametric system, while also covering the scenario where no such system is used.

For peak pressure level [dB L_P] propagation modelling the actual directivity of common SBPs has been used to model the peak pressures at range.

[7] There is still reflection at steeper angles, but also a large loss to the sediment, meaning rapid attenuation, with increasing number of surface-bottom reflections.

Table 4.1 Summary of Noise Sources and Activities Included in the Subsea Noise Assessment

Equipment	Source level [SPL]	Primary frequencies (-20 dB width)	Source model details	Impulsive/non-impulsive
Survey vessel (based on "Fugro Discovery", IMO 9152882)	165 dB SPL	10-2,500 Hz	(Wittekind, 2014; Simard, et al., 2016; Heitmeyer, 2001)	Non-impulsive
Multibeam echosounder Based on: "Teledyne Reson Seabat T50-R", "Kongsberg GeoAcoustics GeoSwath Plus interferometric" & "R2 Sonic 2024"	182 dB SPL (ping rate dependent, equivalent spherical level)	200,000 Hz & 250,000 Hz	Source levels based on von Hann windowed FM or CW pulses at max SPL as given by manufacturer.	Impulsive
Side scan sonar Based on: "Kongsberg Geoacoustic 160", "Edgetech 4200", "C-Max CM2 system" & "Klein Hydro Scan"	170 dB SPL (ping rate dependent, equivalent spherical level)	300,000 – 445,000 Hz	Source levels based on von Hann windowed FM or CW pulses at max SPL as given by manufacturer.	Impulsive
Sub-bottom profiler 1 Based on: "Edgetech 3100, "Edgetech 3300, "Geopulse 5430A, "400 Joule Generic sparker", "350 Joule Generic Boomer"	188 dB SPL (ping rate dependent, off-axis level) 220 dB Lp (on-axis)	600 – 12,000 Hz	Source levels based on von Hann windowed FM or CW pulses at max SPL as given by manufacturer as well as generic models for Sparker and Boomer.	Impulsive
Sub-bottom profiler 2 Based on: "Sub-bottom profiler 1" & "Innomar Parametric (dual frequency)"	197 dB SPL (ping rate dependent, off-axis level) 247 dB Lp (on-axis)	1000 – 4,000 Hz & 85,000 – 115,000 Hz	Source levels based on von Hann windowed FM or CW pulses at max SPL as given by manufacturer.	Impulsive
Vibro-coring / drilling	195 dB SPL	10 – 3,000 Hz	(Bureau of Ocean Energy Management) (Center for Marine Acoustics, 2023)	Non-impulsive

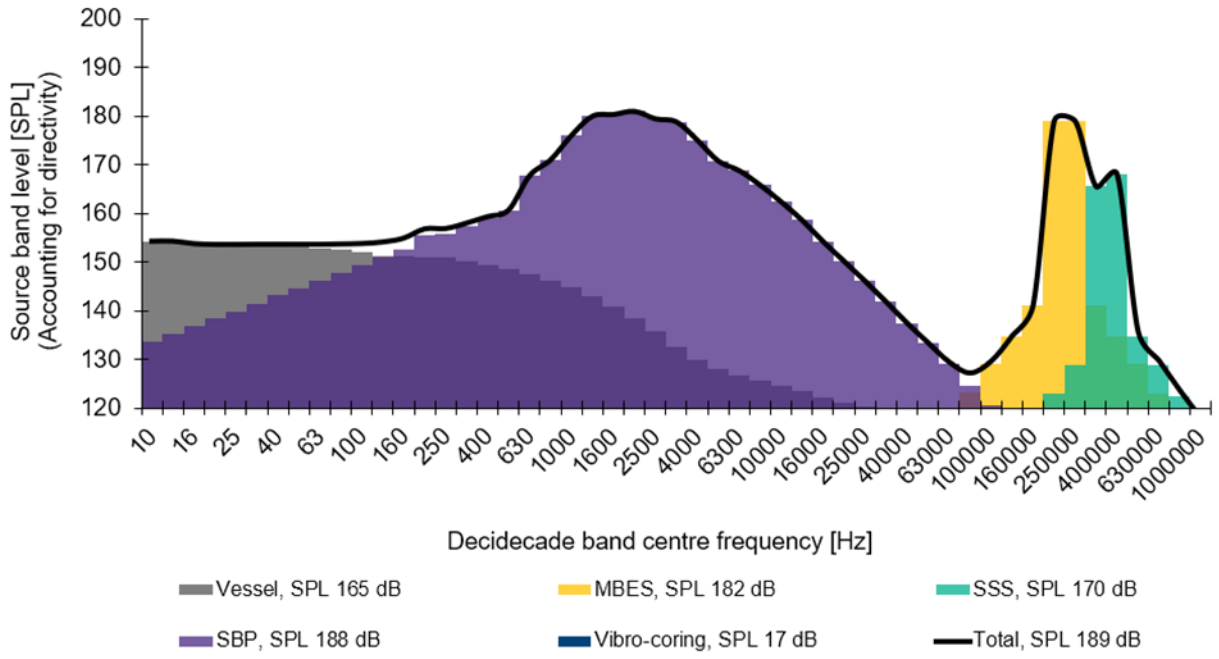

Figure 4.1 **Overview of sound sources as SPL at 1 m. Combined source (black solid line) represents source during survey without a parametric SBP (SBP 2 in Table 4.1)**

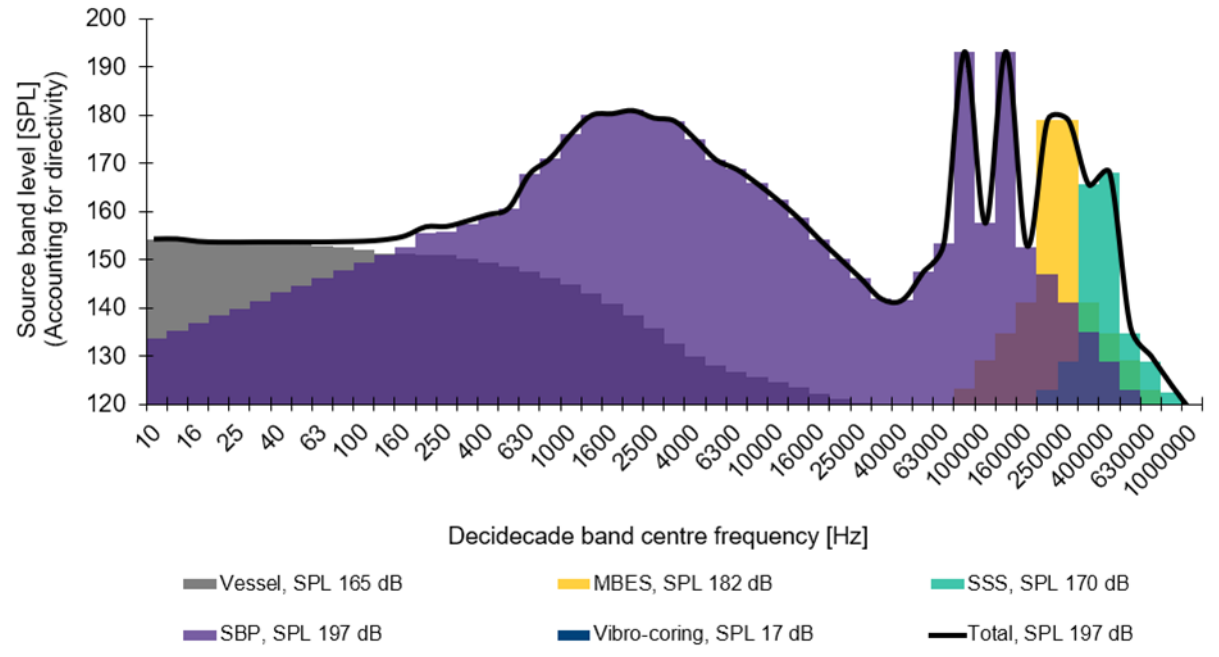

Figure 4.2 **Overview of sound sources as SPL at 1 m. Combined source (black solid line) represents source during survey with a parametric SBP (SBP 2 in Table 4.1)**

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 $10\times\log_{10}$(range) or $20\times\log_{10}$(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.

For this project a semi-empirical model ("Roger's" model) was used for calculating transmission losses of SPL and L_E, measures related to acoustic energy, where modelling of peak pressure levels (L_P) was done with full waveform propagation in dBSea's ray tracing algorithm (dBSeaRay).

5.1 Semi-empirical models

For simpler scenarios where the sediment is relatively uniform and mostly flat or where great detail in modelling is not warranted, due to uncertainty in model input or where the source level is relatively low compared to the receiver sensitivity, 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 the "Roger's" model (Rogers, 1981) has been used. This produces very similar output to the also regularly applied "Weston" model (Weston, 1971), but Roger's produces a smoother transition between spherical/cylindrical spreading, mode-stripping and single mode regions of the loss and would normally be preferred unless comparing to earlier work done using the Weston model. Both these models are compared to measurements in the papers describing them and are both capable of accurate modelling in acoustically simpler scenarios[8]. A comparison between Roger's and Weston's model has been included in this report for a 30 m deep scenario to show the similarities in the transmission losses they predict. The Roger's model is, however, preferred, as it is more conservative for lower frequencies, as it does not have "sharp" steps between different propagation regions.

These semi-empirical models will tend to underestimate the transmission losses (leading to estimated greater than actual impact) due primarily to the omission of surface roughness, wind effects and shear waves in the sediment.

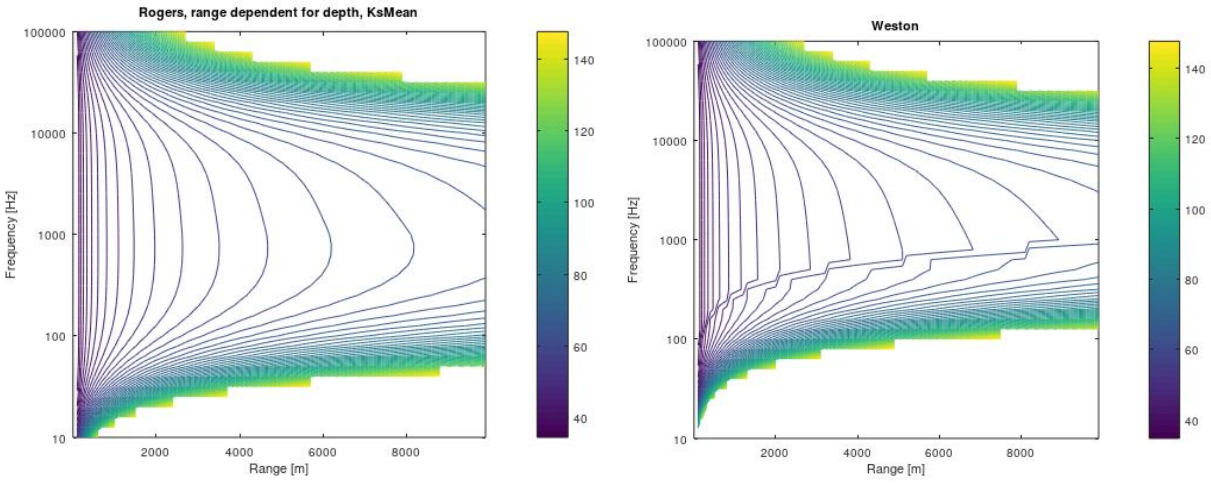

Figure 5.1 Comparison of two semi-empirical models over a sandy bottom at 30 m depth. Transmission loss in dB versus range and frequency

[8] Simpler meaning shallow in relation to the wavelengths and with no significant sound speed gradient in the water column.

5.2 Analytical models

For the impulsive sources dBSea software's ray tracing solver dBSeaRay has been used as this accounts for the full waveform propagation of the impulsive. This means including surface and bottom reflections as well as time-of-arrival in the calculations, as these are important to include to correctly estimate the effects of constructive and destructive interference. dBSea solvers are validated against a range of opensource solvers for so-called "standard scenarios" that have agreed solutions[9].

5.3 Exposure Calculations (dB L_E)

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, L_E, weighted for marine mammals, and unweighted for fish. For ease of implementation sources have generally been converted to an SPL source level. Converting to L_E from SPL or from a number of events is relatively simple:

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

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

Or where it is inappropriate to convert to SPL by relating to the number of events as:

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

As a marine mammal swims away from the sound source, the noise it experiences will become progressively more attenuated; the cumulative, fleeing L_E is derived by logarithmically adding the L_E to which the mammal is exposed as it travels away from the source. This calculation was used to estimate the approximate minimum start distance for a marine mammal in order for it to be exposed to sufficient sound energy to result in the onset of potential injury or 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 limit). 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 fairly constant relative speed. The real-world situation is more complex, and the animal is likely to move in a more complex manner.

Reported swim speeds are summarised in Table 5 1 along with the source papers for the assumptions.

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

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	Group 1 fish	1.0	Sims, 2000
All other fish groups	All fish groups	0.5	Popper *et al.,* 2014

[9] https://www.dbsea.co.uk/validation/

6 RESULTS AND ASSESSMENT

Tables of various risk measures are presented in this section. The values given represent a “reasonable worst-case scenario” where the upper 90th percentile value from the results is used, meaning 90% of the results have a smaller risk range than the stated.

Main assumptions for the validity of the results:

- Final equipment configuration is not louder at any decidecade band nor broadband than the presented equipment (Table 4.1, Figure 4.1 and Figure 4.2).
- All ranges are horizontal ranges. Therefore, at a risk range of 50 m, and a depth of 70 m an animal could be >50 m away (deep below the equipment) but be within the beam of a transducer thus experiencing more exposure than at 50 m horizontal range.

Six types of results are presented to inform this assessment:

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 momentary term risk and for comparison with other studies. This assumes a stationary animal (during the 1-second exposure).

2. **“10-minute exposure risk range”:**

   This is the risk range for a stationary animal. Over this duration the vessel will have moved 1200 m (at 4 knots). This represents a single survey line going in the north-south direction, the shortest survey line likely.

3. **“50-minute exposure risk range”:**

   This is the risk range for a stationary animal. Over this duration the vessel will have moved 6200 m (at 4 knots). This represents a single survey line running east-west, the longest likely single survey line.

4. **“Minimal starting range for a fleeing animal”:**

   The minimal range a fleeing animal needs to start fleeing from to avoid being exposed to noise exceeding its TTS limit. All these are for animals moving in a straight line away from the source at a constant speed of 1.5 m/s. This metric forms the main basis of the assessment.

5. **“Peak level risk range”:**

   The range of acute risk of impact from peak pressure levels associated with the impulsive sources. This measure is not included in tables as the range to the lowest TTS limit (fish 186 dB L_P) was <50 m (all other groups are shorter).

6. **“Behavioural response range”:**

   The range at which the behavioural limit for the marine mammals (160 dB SPL) or the fishes (150 dB SPL) behavioural limits for impulsive noise is exceeded.

6.1 TTS Risk Ranges

The following summarises risks from cumulative noise, split into hearing groups, exposure durations and stationary vs fleeing receiver and risk from peak pressure level.

The assessment is split into two “combined sources”:

- **Combined Source A:**

  Survey vessel, multi-beam echosounder, side-scan sonar, sub-bottom profiler excluding parametric models (Figure 4.1).

- **Combined Source B:**

  Same as “A” above, but with the addition of a parametric sub-bottom profiler (Figure 4.2).

6.2 Combined Source A, Without Parametric Sub-Bottom Profiler

This includes all sources given in Table 4.1 except the parametric sub-bottom profiler and the vibrocore. The results are presented in Table 6.1.

Table 6.1 Summary of risk ranges from noise exposure, L_E. All are risk ranges to TTS limits

Condition	LF	HF	VHF	PCW	OCW	Fish
1 second exposure TTS risk [m]	20	0	90	5	0	0
10-minute exposure TTS risk [m]	1700	200	2900	970	70	13
50-minute exposure TTS risk [m]	3900	580	5700	2400	210	50
Minimal starting range to avoid TTS [m] for fleeing animal	2000	41	3100	950	2.5	1
Peak [dB L_P] range [m]	<20	<20	<20	<20	<20	<50
Behavioural response range [m]	510	510	510	510	510	2000

6.3 Combined Source B, With Parametric Sub-Bottom Profiler

The parametric SBP introduces additional energy near the region of most sensitivity of the HF and VHF weighting (dolphins and porpoises). Risk ranges for porpoises are not affected as much by the additional energy at these higher frequencies as the risk ranges are too large already, but the HF group will see increased risk ranges. The results are presented in Table 6.2 with changes from Table 6.1 highlighted.

Table 6.2 Summary of risk ranges from noise exposure, L_E. All are risk ranges to TTS limits

Condition	LF	HF	VHF	PCW	OCW	Fish
1 second exposure TTS risk [m]	20	33	430	5	0	0
10-minute exposure TTS risk [m]	1700	500	2900	970	70	43
50-minute exposure TTS risk [m]	3900	770	5700	2400	210	100
Minimal starting range to avoid TTS [m] for fleeing animal	2000	280	3100	950	2.5	5
Peak [dB L_P] range [m]	<20	<20	<20	<20	<20	<50
Behavioural response range [m]	510	510	510	510	510	2000

6.4 Vibro-coring and Drilling

The results for the Vibro-coring and Drilling modelling are presented in Table 6.3.

Table 6.3 Summary of risk ranges from noise exposure, L_E. All are risk ranges to TTS limits

Condition	LF	HF	VHF	PCW	OCW	Fish
1 second exposure TTS risk [m]	0	0	0	0	0	0
10-minute exposure TTS risk [m]	830	20	510	270	10	0
50-minute exposure TTS risk [m]	2200	70	1400	790	50	20
Minimal starting range to avoid TTS [m] for fleeing animal	740	0	300	75	0	0
Behavioural response range [km]	15	15	15	15	15	1

7 SUMMARY AND CONCLUSIONS

At shorter ranges < 500-1000 m the inclusion of a parametric SBP in the combined source determines the risk ranges for TTS, while without a parametric SBP or at longer ranges the sparker determines the risk ranges for TTS.

Risk ranges for the Vibro-coring (covering drilling as well) are all at or below 300 m for species expected to be present (but >700 m for the LF hearing group).

The following focuses on the three hearing groups relating to Harbour porpoises (VHF), Seals (PCW) and Common and Bottlenose dolphins (HF). The remaining hearing groups are either assumed not present (LF) or have risk ranges that are considered too low to be significant (OCW and Fish). The focus is on minimal starting range for a fleeing animal to avoid TTS, with notes on what equipment determines this range (i.e., what equipment, if quieter, would reduce the range).

For porpoises (VHF hearing group) the minimal starting range to avoid TTS risk is 3100 m. This range is mainly determined by the sparker. If the sparker output is reduced, the range will be determined by the parametric SBP if used.

The HF hearing group (which includes bottlenose dolphins) has minimal starting ranges to avoid TTS at <50 m (or approximately 300 m if using parametric SBP). This range is determined by a sparker if no parametric SBP is used, otherwise the parametric SBP will determine the range.

The seals (hearing group PCW) have minimal starting ranges to avoid TTS at approximately 1 km. The sparker is driving this range.

For all hearing groups the TTS risk range for peak pressure is below 50 meters.

7.1 Mitigation and Limitations

7.1.1 Exclusion Zone – Marine Mammal Observer

The large risk ranges for the VHF and PCW groups mean that extra care must be taken in establishing presence of these animal groups prior to starting a survey line.

Assuming that the main species of concern is the bottlenose dolphin a pre-activity MMO search to 500 m to establish absence of this species will be sufficient to mitigate TTS risk from noise.

7.1.2 Equipment limitations

Any equipment used should not exceed the modelled equipment broadband levels (Table 4.1) or band-wise levels for overall levels (Figure 4.1 and Figure 4.2).

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Appendix C
List of Projects for In-combination Assessment

Appendix C List of Projects near to Moneypoint Hub Development Area for In-combination Assessment

Ref.	Applicant and project location	Brief description of development	Status	Distance from project (km)	Spatial overlap?	Temporal overlap?
Foreshore						
FS007083	The Electricity Supply Board Moneypoint Power Station, Co. Clare to Kilpaddoge, Co. Kerry	Foreshore application for the installation of submarine electricity cables across the Lower Shannon Estuary www.gov.ie	Determination 27/06/2023	0 km	Yes	Yes, licence granted on 13/06/2023, SI works completed but there may be temporal overlap with construction if works take place in 2024.
FS007141	ESB Ballymacrinon Bay, County Clare	Ecological survey in the form of 9 grab samples for infauna and granulometric analysis to help characterise subtidal habitat and benthic communities. www.gov.ie	Determination 10/13/2020	0 km	Yes	No, works carried out and completed in 2020.
FS006975	Shannon Foynes Port Company Foynes Port, County Limerick	Maintenance dredging at Limerick docks, the approach channel to Limerick docks and at Foynes Port. The Foreshore Licence application is in respect of proposed dredging on State-owned foreshore and dredging on foreshore owned by SFPC. www.gov.ie	Determination 09/06/2023	20.5 km	No	Yes, temporal overlap possible due to maintenance dredging of Foynes Port as licence was granted on 29/05/2023 for 8 years.
EIA planning portal						
18930	The Ballylongford Windfarm Group Aghanagran Middle Aghanagran Lower Ballyline West And Tullahennell South Ballylongford, Co Kerry	Construct a windfarm consisting of 8 wind turbines	Application Finalised	7.6	No, Distance from the proposed SI works means overlap in effects is unlikely.	No, permission refused therefore no in-combination effects.
2018053	TIGL Ireland Enterprises Ltd. Trump International Golf Links And Hotel, Doonbeg, Co. Clare	Construction of a ballroom / function room building; leisure facility building including restaurant; 53 no dwellings to be used for short term tourist accommodation; minor alterations to doughmore house; a gatehouse; enabling and ancillary works	Unknown	15.2	No, Distance from the proposed SI works means overlap in effects is unlikely.	Unknown
2018062	TIGL Ireland Enterprises Ltd. Trump International Golf Links And Hotel, Doonbeg, Co. Clare	Construction of a ballroom / function room building; leisure facility building including restaurant; 53 no dwellings to be used for short term tourist accommodation; minor alterations to doughmore house; a gatehouse; enabling and ancillary works	Application Finalised	14.9	No, Distance from the proposed SI works means overlap in effects is unlikely.	Yes, licence expires 08/11/2024

SI Works – Supporting Information for Screening for Appropriate Assessment

Ref.	Applicant and project location	Brief description of development	Status	Distance from project (km)	Spatial overlap?	Temporal overlap?
2021192 (5)	XMR Energy Limited. Development At The Permitted Crossmore Wind Farm Site, Co. Clare And North To The L6180/N68 Junction And To Booltiagh Substation In The Townland Of Booltiagh	Electrical grid connection (overhead line and underground cable) from the permitted crossmore wind farm to the booltiagh substation, including roads and access arrangements/works, alterations to the permitted wind farm infrastructure, forestry felling	Uploaded to portal 24/09/2021	Ranging from 10. 3 to 14 km	No, Distance from the proposed SI works means overlap in effects is unlikely.	Unknown
2023098 (2)	Ballykett Green Energy Limited. Ballykett, Tullabrack East And Tullabrack, Kilrush, Co. Clare.	The proposed development will consist of a 4-turbine wind farm, electrical substation, met mast, access tracks, internal cabling, and grid connection to Tullabrack 110kv ESB substation.	Unknown uploaded to portal 31/05/2023	Ranging from 5.9 to 6.5 km	No, Distance from the proposed SI works means overlap in effects is unlikely.	Yes, project could be constructed and operational during this projects lifetime
An Bord Pleanála						
314527	Harmony Solar Ireland Kerry Limited Within the townlands of Ballymacasey, Coolnagraigue, Ballyline East, Ballyline West, Leanamore and Dromlivaun, Co. Kerry.	110kv Substation.	Signed 03/04/2023	8. 06 km south	No Distance from the proposed SI works means overlap in effects is unlikely.	Potential however due to distance from works and scale of the works, no in-combination effects are likely.
315857	Tullamore Solar Farm Ltd. at Tullamore, Drombeg and Coolkeragh, Listowel, County Kerry	Alterations to the approved development of a 110kv 4-bay C-type electricity substation and associated loop-in infrastructure to tie into existing 110kv transmission line -ABP 305106-19	Signed 09/06/2023	10. 91 km south	No Distance from the proposed SI works means overlap in effects is unlikely.	Potential however due to distance from works and scale of the works, no in-combination effects are likely.
ABP-309156-21 (4)	Shronowen Windfarm Ltd. The Proposed Wind Farm Development Is Located In The Townlands Of Tullamore, Coolkeragh, Ballyline West And Dromalivaun, Co. Kerry. Approximately 4 Kilometres South Of Ballylongford And 6km North Of Listowel.	The proposed wind farm is comprised of 12 wind turbines with a maximum tip height of 150m, permanent met mast, new and upgraded roads, substation, underground grid connection and associated infrastructure	Granted with permissions	Ranging from 9.6 to 10.7 km	No, Distance from the proposed SI works means overlap in effects is unlikely.	Potential however due to distance from works and scale of the works, no in-combination effects are likely.

SI Works – Supporting Information for Screening for Appropriate Assessment

Ref.	Applicant and project location	Brief description of development	Status	Distance from project (km)	Spatial overlap?	Temporal overlap?
ABP-311233-21 (2)	Shannon LNG Limited. The Townlands Of Kilcolgan Lower And Ralappane, Ballylongford, Co. Kerry And On The Shannon Estuary	The proposed Shannon technology and energy park, to include a power plant; a battery energy storage system; a floating storage and regasification unit, jetty, onshore facilities; an agi	Refuse permission 13/9/2023	Ranging from 1 km to 1.8 km	No, Distance from the proposed SI works means overlap in effects is unlikely.	No, permission refused therefore no in-combination effects
My Plan Application (including Clare, Kerry, and Limerick Co. Co.)						
2332	The Electricity Supply Board (ESB) Moneypoint Generating Station, Carrowdotia & Carrowdotia South, Kilimer Co Clare (Eircode V15 R963)	For development within the Moneypoint Generating Station, Carrowdotia North and Carrowdotia South, Kilimer, County Clare (Eircode V15 R963) which is licenced by the Environmental Protection Agency (EPA) under an Industrial Emissions (IE) Licence (Ref P0605-04).	Conditional 18/04/2023; Valid until 17/04/2028	0 km	Yes	Yes
2360094	Spanish Point Homes Ltd. Beal An Inbhir, Shanakyle Road, Kilrush, Co. Clare	To construct 18 no. Social housing units together with all associated ancillary site works and services	Conditional. 31/08/2023; Expires 30/08/2028	5 .26 km north-west	No	Potential however due to distance from works and scale of the works, no in-combination effects are likely.
2360393	Prospect Flexpower Ltd. Ballygeery West	1 No. Enclosed battery energy storage system compound on a total of c. 6.2 hectare site, to include: 1 no. 220kv GIS electrical substation building and 1 no. Single storey customer substation building, control, and switch room, 220kv transformer and four no. Auxiliary transformers, up to 192 battery storage blocks on concrete support structures including heating, ventilation, and air conditioning unit (HVAC units), 16 transformer and 32 inverter units. Including access tracks and site entrance, associated electrical cabling and ducting, security gates, perimeter security fencing, CCTV system, landscaping works and all associated ancillary infrastructure. The proposed development will have a projected life span of 35 years. A Natura Impact Statement has been prepared to accompany this application.	New Application received 22/09/2023	11.4 km north-east	No	Potential however as this is a newly lodged application and works are yet to commence and due to distance from works, no in-combination effects are likely.

SI Works – Supporting Information for Screening for Appropriate Assessment

Ref.	Applicant and project location	Brief description of development	Status	Distance from project (km)	Spatial overlap?	Temporal overlap?
23518	Querrin Schoolhouse Company Limited. Querrin National School, Querrin, Kilkee, Co Clare	Change of use from a primary school to a community facility featuring a small business hub, community kitchen, and two community multi-purpose spaces along with provision for a storage/bicycle shed and car parking with all other necessary ancillary services.	NEW APPLICATION Received 05/10/2023	11.5 km west	No	Potential however due to distance from works, no in-combination effects are likely.
22872	Kearney's Home Baking. Tenekilla, Ballyhahill, Co. Limerick	The construction of a 243.m^2 Ground mounted Solar PV Array with all associated site works.	Conditional grant date 07/12/2022; Expiry 06/12/2027	13. 71 km	No	Potential however due to distance from works, no in-combination effects are likely.
221340	Terra Solar Ii Limited. Coolard, Coolkeragh And Glouria, Listowel, Co Kerry	Modify the approved grid connection for the Ballydonohoe solar farm as permitted under Kerry County Council reference 21457/An Bord Pleanála reference 312288. The modifications comprise of (1) the provision of a mv control building within the solar farm, (2) the laying of c. 1,747 metres of 33kv underground cabling with the solar farm site, l-1008 and adjacent public road to be installed in an excavated trench including underground ducting, joint bays, communication chambers and all associated site development and reinstatement works, and (3) minor relocation of pole sets and associated 33kv over-head wires within a c. 216 metres section of overhead lines on private lands.	Conditional Grant date 29/03/2023 Expiry 28/03/2028	15 km south	No	Potential however due to distance from works, no in-combination effects are likely.
23284	Harmony Solar Kerry Ltd. Ballymacasy, Coolnagraigue, Ballyline East, Ballyline West, Leanamore And Dromalivaun, Co Kerry	Apply for a 10 year permission and 40 year operation for a solar farm of 146.6 hectares, on 3 no. Land parcels consisting as described herin: west parcel (Ballymacasy, Ballyline east and Ballyline west townlands) c 58.48 hectares, central parcel (Coolnagraigue townland) c. 53.8 hectares and east parcel (Leanamore and Dromalivaun townlands) c 34.32 hectares, a route corridor for an underground internal electrical cable connecting the west and central parcels to the east parcel consisting of c 3772 meters in length. The total site	Conditional grant date 17/10/2023; Expiry 16/10/2028	7.89 km south	No	Potential however due to distance from works, no in-combination effects are likely.

SI Works – Supporting Information for Screening for Appropriate Assessment

Ref.	Applicant and project location	Brief description of development	Status	Distance from project (km)	Spatial overlap?	Temporal overlap?
		area for the proposed development is c. 146.6 hectares and consists of the following: 794,430 m^2 of solar photovoltaic panels on ground mounted steel frames, inverter/transformer stations, underground power and communication cables and ducts, boundary security fencing, 2 no. medium voltage (mv) control buildings, new internal access tracks and associated drainage infrastructure, upgrade of 1 no. Site entrance off the lio12 local road and 1 no. New site entrance off the l 6021 local road, CCTV/lighting posts, 5 no. Culvert crossings, biodiversity enhancement, landscaping and all associated site services and works. Installations of an internal network cable comprise trenching for an underground medium voltage electrical cable and associated joint bays and infrastructure, for a distance of approximately 35 metres in length along the l6021 and approximately 3,737 metres within the solar farm lands.as part of a separate strategic infrastructure development (SID) planning application , provision of a 110kv electrical substation with electrical control building, associated compound with palisade fence and 2 no. Overhead line masts, will be lodged with An Bord Pleanala in due course. The proposed substation is to be located in the east parcel in the townland of Dromalivaun with connection to the existing overhead lines in either the east parcel in the townland of Dromalivaun or the central parcel in the townland of Lenamore. A natura impact statement (nis) has been prepared in relation to the project and accompanies this planning application.				

SI Works – Supporting Information for Screening for Appropriate Assessment

Ref.	Applicant and project location	Brief description of development	Status	Distance from project (km)	Spatial overlap?	Temporal overlap?
23283	Virgin Media Ireland Limited. Urlee, Knockanore Mountain, Ballybunion, Co Kerry	To retain an existing telecommunications installation comprising of 29.5m lattice telecommunications support structure and attached antenna equipment, 6m stub tower and equipment, communication building together with associated ground equipment and container enclosed within a fenced compound.	Conditional Grant date 12/06/2023 expiry 11/06/2028	14.4 km south-west	No	Potential however due to distance from works, no in-combination effects are likely.
23350	EirGrid Plc. Tarbert 220kv Substation, Tarbert Generating Station, Tarbert Island (Townland), Co Kerry	The proposed development will comprise of the following on a site measuring approximately 6.9 hectares: (1) removal of existing cable joint, bay within Tarbert generating station, 220kv switchgear within the existing Tarbert substation compound and associated 220kv cabling; (2) two no. New lengths of 220kv underground cabling measuring approximately 340m each, running between two no. New underground cable joint base in Tarbert generating station and the connection point at Tarbert substation; (3) the new 220kv switchgear bay within the existing Tarbert substation compound comprising associated electrical equipment, including cable sealing ends, insulators, overhead conductors, surge arrestors, lightning masts and lighting poles; and (4) all ancillary site development works including temporary construction compound and layout areas, site preparation works and ground levelling as required to facilitate the works. Tarbert generating station is licensed by the environment protection agency (EPA) under the industrial emissions (ie) license (ref: p0607-02). The proposed development includes works located within the i.e., license boundary of Tarbert generating station which is an upper tier establishment to which the chemicals act (control of major accidents hazards involving dangerous substances) regulations 2015 (the COMAH regulations) apply. This planning is accompanied by a natura impact statement	New Application lodged 31/03/2023	3.44 km south-west	No	Potential however due to distance from works, no in-combination effects are likely.

SI Works – Supporting Information for Screening for Appropriate Assessment

Ref.	Applicant and project location	Brief description of development	Status	Distance from project (km)	Spatial overlap?	Temporal overlap?
		(nis). Amendments to the NIS have been made in response to the further information request.				
2360050	Gaofar Limited. Townlands Of Aghanagran Lower, Ballyline West, Kilgarvan, Coolkeragh, And Tullamore, Co. Kerry	A new grid connection route connecting the permitted Ballylongford windfarm (Kerry County Council planning ref 19/381) (An Bord Pleanala ref- PL08.304807) at Aghanagran Middle And Lower, Ballyline West And Tullahennel South, Ballylongford, to the proposed 38kvsubstation (Kerry County Council planning ref 23/431) at Tullamore, Listowel, Co Kerry. The route will entail the installation of approximately 7.3km of 38kv underground electric cable passing through townlands of Aghanagran Lower, Ballyline West, Kilgarvan, Coolkeragh, and Tullamore in County, Kerry The proposed grid route is proposed to be via underground cables located along the public roads: L10028, R552, and L-1009, and private property. The new grid route is a change a previously granted permission for a 12.1km grid connection route (Kerry County Council planning ref 20/438) (An Bord Pleanala ref- PL08308643) from the permitted wind farm to the 38kva /110kva substation at Kilpaddoge, Tarbert. The proposal includes alterations to the permitted windfarm (Kerry County Council planning ref 19/381) (An Bord Pleanala ref- PL08.304807), the permitted 38 kv substation at the wind farm is to be relocated and redesigned. The altered substation proposal will be located in a new substation compound that includes a control building, and all associated electrical plant and apparatus, fencing, and an access track within the townland of Aghanagran Lower. The proposed substation at the windfarm will be connected to the windfarm via underground cabling from Turbine T4. The project includes all ancillary and associated works necessary to facilitate the	Further information requested 13/09/2023	8 km south-west	No	Potential however due to distance from works, no in-combination effects are likely.

SI Works – Supporting Information for Screening for Appropriate Assessment

Ref.	Applicant and project location	Brief description of development	Status	Distance from project (km)	Spatial overlap?	Temporal overlap?
		development, including three temporary construction compounds.				
2360059	Vantage Towers Limited. Glouria, Lisselton, Listowel	To erect a 24m high lattice telecommunications support structure together with antennas, dishes and associated telecommunications equipment all enclosed in security fencing with an extension to an existing access track.	Conditional; 21/09/2023	13 km south-west	No	Potential however due to distance from works, no in-combination effects are likely.