ESB MONEYPOINT HUB PROJECT

SI Works – Natura Impact Statement

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EXECUTIVE SUMMARY

This Natura Impact Statement (NIS) has been prepared by RPS, on behalf of the ESB, to provide information for the Appropriate Assessment (AA) of the marine site investigation (SI) works within the Lower Shannon Estuary adjacent to Moneypoint Generating Station site in County Clare. The SI works are required in order to inform future development at the ESB Moneypoint site.

The SI works include geophysical, geotechnical and environmental investigations in both the terrestrial (land-based) and the 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).

A Supporting Information for Screening for Appropriate Assessment (SISAA) report was prepared for the SI works and identified the presence of European sites within the potential Zone of Influence (ZoI) of the SI works. The SISAA concluded that the marine geotechnical investigations have the potential to contribute to habitat loss, alteration, fragmentation in the Lower River Shannon Special Area of Conservation (SAC) (002165). The SISAA also concluded that the geophysical survey will 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 to avoid adverse impacts are therefore required. Therefore, the SISAA concludes that a Natura Impact Statement (NIS) be prepared to assist the Maritime Area Regulatory Authority (MARA), the competent authority, in conducting an Appropriate Assessment (AA) should they agree with the findings of the SISAA.

The purpose of this NIS is to provide MARA with information for the purposes of Article 6 of the Habitats Directive on the implications of the SI works, on its own or in combination with other plans or projects, for one or more than one European site, in view of the conservation objectives of the site or sites. This NIS will assist MARA in determining whether or not the SI works will adversely affect the integrity of the site(s) concerned.

Within this NIS, best practice construction and mitigation measures have been proposed for the avoidance of adverse effects to the European sites within the project ZoI. The implementation of best practice construction design measures and site-specific mitigation during the SI works will ensure that the SI works do not adversely affect the integrity of the site(s) concerned. The mitigations measures include:

- Undertaking the geophysical survey in Phase 1 in order to identify areas of sensitive habitat(s) in advance of the geotechnical investigations. This will ensure that the geotechnical investigations only target suitable substrate and seafloor areas and do not lead to significant habitat loss, alternation, and fragmentation effects on Estuaries and/or Reefs.
- Implementation of the Guidance to Manage the Risk to Marine Mammals from Man-made Sound Sources in Irish Waters (DAHG, 2014) including the use of a Marine Mammal Observer (MMO) on the vessels undertaking the geophysical surveys.

Through the implementation of best practice and the recommended mitigation measures there will be no potential for direct, indirect, ex-situ or cumulative impacts arising from the SI works. Similarly, there will be no significant risk of negative impact, either alone or in combination with other plans or projects, to the integrity of the Natura 2000 network. Therefore, it is concluded that the SI works will not adversely affect the integrity of the Lower River Shannon SAC or the overall European site network. No reasonable scientific doubt remains as to the absence of such adverse effects.

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 port to act as a staging point and sufficient land availability to facilitate the construction of the floating platform structures.

The 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.

The ESB intends to undertake marine site investigation (SI) work 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

A Supporting Information for Screening for Appropriate Assessment (SISAA) report was prepared for the SI works and identified the presence of European sites within the potential Zone of Influence (ZoI) of the SI works. The SISAA concluded that the marine geotechnical investigations have the potential to contribute to habitat loss, alteration, fragmentation in the Lower River Shannon Special Area of Conservation (SAC) (002165). The SISAA also concluded that the geophysical survey will 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 to avoid adverse impacts are therefore required. Therefore, the SISAA concludes that a Natura Impact Statement (NIS) be prepared to assist the Maritime Area Regulatory Authority (MARA), the competent authority, in conducting an Appropriate Assessment (AA) should they agree with the findings of the SISAA

The purpose of this NIS is to provide MARA with information for the purposes of Article 6 of the Habitats Directive on the implications of the SI works, on its own or in combination with other plans or projects, for one or more than one European site, in view of the conservation objectives of the site or sites. This NIS will assist MARA in determining whether or not the SI works will adversely affect the integrity of the site(s) concerned. This NIS provides an overview of the marine SI 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 Natura Impact Statement (NIS) and Environmental Impact Assessment Report (EIAR) 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 Senior Project Scientist in the Environmental Services Business Unit in RPS. She has over 10 years' experience. She holds an honours degree in marine science from NUI. Galway and a Master's of Science in Marine Biology from UCC. She is experienced in the preparation of ecological impact assessments, biodiversity chapters for EIAR, Annex IV species reports and Appropriate Assessment (Screening and NIS).

[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 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 NIS has been prepared in compliance with the legislative and policy requirements described in Section1.4 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 or European 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 1.4.2 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 In for Appropriate Assessment

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 Part 5, 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.

1.4.2.4 Appropriate Assessment

In accordance with Section 117(6)(a), MARA requires that the applicant prepare and submit a Natura Impact Statement (NIS) as defined in Regulation 2 of the European Communities (Birds and Natural Habitats) Regulations, 2011 (as amended), where:

> *"Natura Impact Statement" means a report comprising the scientific examination of a plan or project and the relevant European Site or European Sites, to identify and characterise any possible implications of the plan or project individually or in combination with other plans or projects in view of the conservation objectives of the site or sites, and any further information including, but not limited to, any plans, maps or drawings, scientific information or data required to enable the carrying out of an Appropriate Assessment.!*

Following receipt of the NIS, MARA will, in accordance with Section 117(6)(b), satisfy itself as to the adequacy of the NIS and then write to the applicant to require them to give notice to the public that the application and supporting information has been provided to MARA. Following a consultation period of not less than 30 days, MARA will then carry out an AA in accordance with Section 117(7)(a).

Under Section 177V (2) of the Planning and Development Act 2000 (as amended), the competent authority shall take into account each of the following matters in their AA determination:

- The NIS;
- Any supplemental information furnished in relation to the NIS;
- If appropriate, any additional information sought by the planning authority and furnished by the applicant in relation to a Natura impact statement;
- Any information or advice obtained by the competent authority;
- If appropriate, any written submissions or observations made to the competent authority in relation to the application for consent for proposed development; and
- Any other relevant information.

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 the 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. The Shannon Estuary that handles up to 1,000 ships carrying 12 million tons of cargo per annum (Clare County Council, 2023b). Moneypoint is one of six terminals within the Shannon Estuary which receives 6-8 deliveries per annum.

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

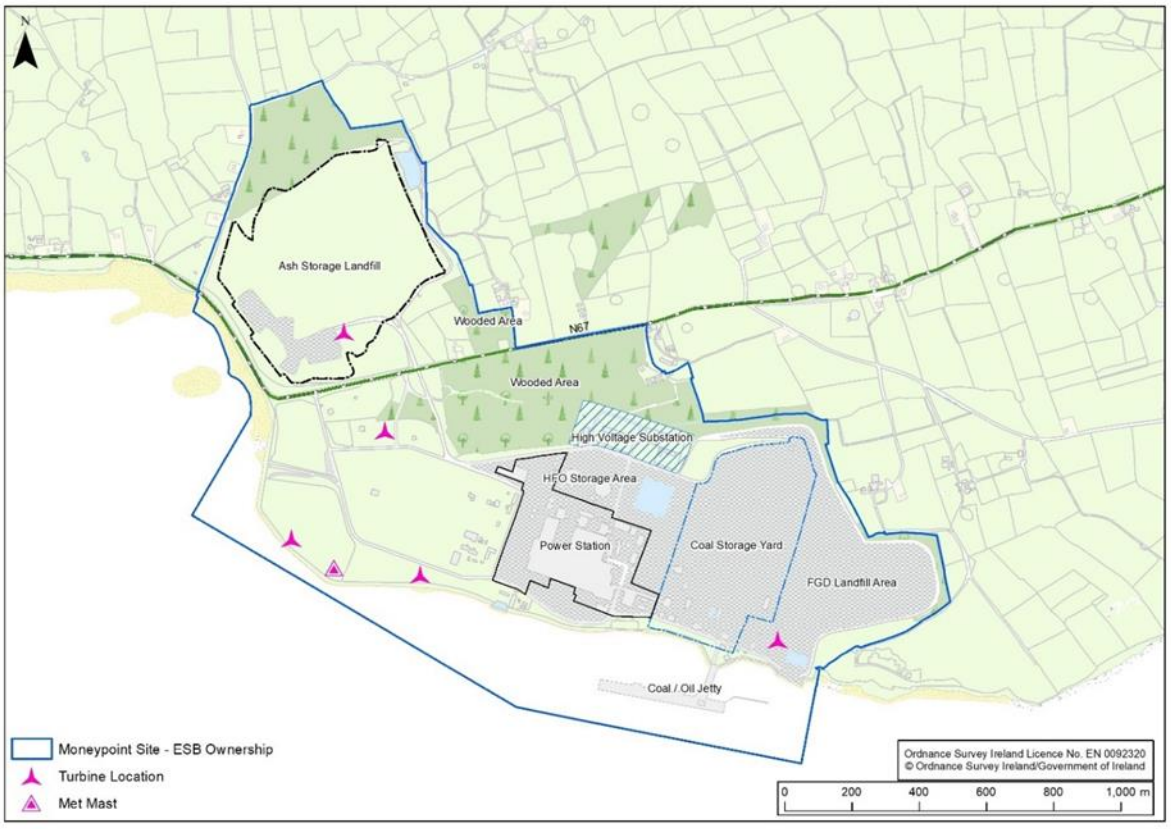


Figure 2.2 Moneypoint Generating Station Site, Co. Clare

2.2 Description of the Proposed 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 investigation 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 only 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)
- 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's); 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 later 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 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 needed. Surveys shall identify the level, nature, and detailed coverage of the seabed to ensure identification of features on the seabed within the area shown, any 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 needed 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 echo sounder,
- Teledyne Reson SeaBat T50-R,
- R2Sonic 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)

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.

Figure 2.5 Counting pulley for winch-towed C-Max CM2 SSS

Swath width: The swath width will be based on the water depth encountered. It is expected 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 - Seatronics 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 supply 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 method 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.

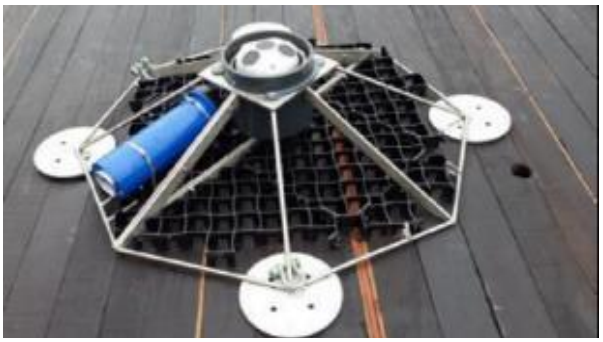


Figure 2.9 Typical seabed frame with ADCP (Ocean Scientific International Ltd)

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 include 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 utilising 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 be undertaken as part of either the geophysical or geotechnical surveys or may be a standalone survey.

Indicative Quantity: It is expected 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 -15m CD and -25m CD. 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 the ESB - Refer to Dwg Ref: QS-000339-01-D460-007-004-000 (Appendix A). The final sampling locations will be decided 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 expected 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 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 expected 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 proposed surveys, which will be undertaken by a suitable qualified archaeologist are to collect baseline data which will be used to inform the EIAR. Surveys will be undertaken in advance of any intrusive survey work and 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 proposed surveys, which will be undertaken by a suitable qualified marine ecologist, are to collect baseline habitat data which will be used to inform the EIAR and Appropriate Assessment. Surveys will be undertaken in advance of any geotechnical survey work and coordinated with the geophysical survey proposed herein. Surveys will involve 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 micro siting 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, RoyCédric, & Giard, 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, the 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

The 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. The 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
	Terrestrial 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 potential 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.

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

3 NEED AND ALTERNATIVES

A review of all available site investigation data at Moneypoint between 1979 and 2022 has been conducted as part of the Moneypoint Hub project development. The majority of available marine ground investigation data and borehole logs were collected at the site in the 1970s/1980s during geotechnical surveys that were undertaken prior to the construction of the Moneypoint Generating Station. The majority of marine logs are focused in the area surrounding the existing coal jetty only.

Given the limited amount of data that is currently available in the potential development areas, further site investigation (SI) information is required to progress the Moneypoint Hub design options to the next stage.

With regards to alternative considered, there are no alternatives to undertaking site investigations. Site investigation information is critical to the assessment of ground conditions and for civil engineering design. The use of the historic data that is available at Moneypoint may result in inadequate and unsafe design that could have significant life and economic consequences for the project.

4 APPROPRIATE ASSESSMENT METHODOLOGY

4.1 Guidance

This NIS has been completed in consideration of the EU and national guidance documents that pertain 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 NIS 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.

4.2 Stages

Appropriate Assessment (AA) is a four-stage process with tests at each stage. The four stages are summarised diagrammatically in Figure 4.1 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).

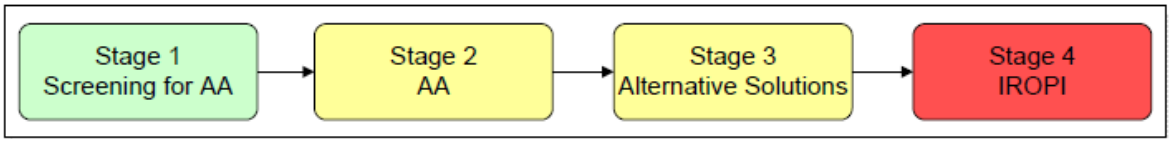


Figure 4.1 Four Stages of Appropriate Assessment

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 COs. In this case, a 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).

4.3 Identification of Relevant European sites

4.3.1 Source-Pathway-Receptor Model

Relevant European sites were identified in the Supporting Information for Screening for Appropriate Assessment (SISAA) report (RPS report ref: IE000210RP0026), based on the identification of a 'zone of influence' (ZoI) of the SI works using a Source-Pathway-Receptor (S-P-R) model (OPR, 2021) 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 linked. These are termed as 'relevant' sites/QIs throughout this report.

4.3.2 Adverse effects on the integrity of European sites

The European Commission's 2018 Notice (EC, 2019) advises that the purpose of the appropriate assessment is to assess the implications of the plan or project in respect of the site's COs, either individually or in-combination with other plans or projects. The conclusions should enable the competent authorities to ascertain whether the plan or project will adversely affect the integrity of the site concerned. The focus of the AA is therefore specifically on the species and/or the habitats for which the European site is designated.

EC (2019) also emphasises the importance of using the best scientific knowledge when carrying out the AA in order to enable the competent authority to conclude with certainty that there will be no adverse effects on the integrity of the site. This guidance notes that it is at the time of adoption of the decision authorising implementation of the project that there must be no reasonable scientific doubt remaining as to the absence of adverse effects on the integrity of the site in question.

As regards the meaning of 'integrity,' this relates to ecological integrity. This can be considered as a quality or condition of being whole or complete. In a dynamic ecological context, it can also be considered as having the sense of resilience and ability to evolve in ways that are favourable to conservation.

The 'integrity of the site' can be usefully defined as (EC, 2019):

"The coherent sum of the site's ecological structure, function and ecological processes, across its whole area, which enables it to sustain the habitats, complex of habitats and/or populations of species for which the site is designated."

EC (2019) notes that if the competent authority considers the mitigation measures are sufficient to avoid the adverse effects on site integrity identified in the AA, they will become an integral part of the specification of the final plan or project or may be listed as a condition for project approval.

EC (2020) advises that it is for the competent authority, in the light of the conclusions made in the appropriate assessment on the implications of a plan or project for the European site concerned, to approve the plan or project. This decision can only be taken after they have made certain that the plan or project will not adversely affect the integrity of the site. That is the case where no reasonable scientific doubt remains as to the absence of such effects.

EC (2020) also reaffirms that the authorisation criterion laid down in the second sentence of Article 6(3) of the Habitats Directive integrates the precautionary principle and makes it possible effectively to prevent the protected sites from suffering adverse effects on their integrity as the result of the plans or projects. A less stringent authorisation criterion could not as effectively ensure the fulfilment of the objective of site protection intended under that provision. The onus is therefore on demonstrating the absence of adverse effects rather than their presence, reflecting the precautionary principle. It follows that the appropriate assessment must be sufficiently detailed and reasoned to demonstrate the absence of adverse effects, in light of the best scientific knowledge in the field.

4.3.3 Consideration of ex-situ effects

EC (2019) advises that Member States, both in their legislation and in their practice, allow for the Article 6(3) safeguards to be applied to any development pressures, including those which are external to European sites, but which are likely to have significant effects on any of them.

The Court of Justice of the European Union (CJEU) developed this point when it issued a ruling in case C-461/17 ("Brian Holohan and Others v An Bord Pleanála") that determined *inter alia* that Article 6(3) of Directive 92/43/EEC must be interpreted as meaning that an appropriate assessment must on the one hand, catalogue the entirety of habitat types and species for which a site is protected, and, on the other, identify and examine both the implications of the Project for the species present on that site, and for which that site has not been listed, and the implications for habitat types and species to be found outside the boundaries of that site, provided that those implications are liable to affect the COs of the site.

In that regard, consideration has been given in this NIS to inform AA to implications for habitats and species located both inside and outside of the European sites considered in the SISAA with reference to those sites' COs where effects upon those habitats and/or species are liable to affect the COs of the sites concerned.

4.3.4 Conservation objectives

The COs for each European site are to maintain or restore the favourable conservation condition of the Annex I habitat(s) and/or the Annex II species for which the site has been selected.

The favourable conservation status of a habitat is achieved when:

- Its natural range, and area it covers within that range, are stable or increasing;
- 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 (or condition, at a site level) 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;
- 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 COs of European sites published by the National Parks and Wildlife Service (NPWS) note that an AA based on the most up to date COs (which are defined by a list of attributes and targets) will remain valid even if the targets are subsequently updated, providing they were the most recent objectives available when the assessment was carried out.

The most up-to-date COs for the European sites being considered have been used in this NIS. Details in relation to the QIs of SACs is based on publicly available data sourced from the NPWS.

4.3.5 In-combination effects

Article 6(3) of the Habitats Directive requires that in-combination effects with other plans or projects are also considered. As set out in EC (2018), significance will vary depending on factors such as magnitude of impact, type, extent, duration, intensity, timing, probability, cumulative effects and the vulnerability of the habitats and species concerned.

EC (2021) notes that cumulative environmental effects can be defined as effects on the environment caused by the combined action of past, current, and future activities. Although the effects of one development may not be significant, the combined effects of several developments together can be significant.

EC (p.14, 2021) also notes that "in-combination provision concerns other plans or projects that have been already completed, approved but uncompleted, or proposed (i.e., for which an application for approval or consent has been submitted)." And furthermore (p.31, ibid): "In addition to the effects of the plans or projects that are the main subject of the assessment, it may be appropriate to consider the effects of already completed plans and projects, including those preceding the date of transposition of the directive or the date of designation of the site. The effects of such completed plans and projects would typically form part of the site's baseline conditions which are considered at this stage."

Plans and projects that have been approved in the past but have not yet been implemented or completed should be included in the in-combination provision. As regards other proposed plans or projects, on grounds of legal certainty it would seem appropriate to restrict the 'in combination' provision to plans that have been proposed, (i.e., for which an application for approval or consent has been submitted) (EC, 2021).

This mirrors the advice contained in EC (2018) which advises that other plans or projects which are completed, approved but uncompleted, or proposed should be considered. EC (2018) specifically advises that "as regards other proposed plans or projects (i.e., other projects not proposed by the Applicant), on grounds of legal certainty it would seem appropriate to restrict the in-combination provision to those which have been actually proposed, i.e., for which an application for approval or consent has been introduced".

The ability for impacts arising from the proposed project to overlap with those from other projects, plans and activities to result in adverse effects are considered. This means that, in most examples, an overlap of the physical extents of the impacts arising from the two (or more) projects, plans or activities must be established for an in-combination effect to arise. For example, for a cumulative sedimentation effect to be established between the proposed project and another project, it must be established that the extent of sediment release from both projects has the potential to overlap and may affect a receptor at the same location.

Exceptions to this exist for certain mobile receptors that may move between, and be subject to, two or more separate physical extents of impact from two or more projects. For example, species such as otter may be affected by water quality impacts from the project, as well as those from other projects where the extent of another area affecting water quality does not directly overlap with that of the project. Where relevant, mitigation is proposed as necessary to prevent adverse in-combination.

4.4 Ecological Data

4.4.1 Desk Study

A desk study was completed to assess the potential for QIs of European sites within the ZoI of the SI works to occur and the potential for relevant QIs to be adversely affected. The desktop study had particular regard for the following sources:

- Mapping of European Site boundaries and COs for relevant sites, available online from the NPWS included site synopsis, European Data form and Conservation Objective Supporting Documents where available (https://www.npws.ie/protected-sites);
- 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;
- Inland Fisheries Ireland mapping http://wfdfish.ie/;
- Irish Whale and Dolphin Group Sightings Log https://iwdg.ie/browsers/sightings.php/;
- BirdWatch Ireland (https://birdwatchireland.ie/);

- MERC Consultants (2022) Moneypoint Hub Dropdown Video Survey;
- Distribution records for QI of Natura 2000 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);
- NPWS (2013) Ireland's Summary Report for the period 2008 – 2012 under Article 12 of the Birds Directive. National Parks and Wildlife Services. Department of Arts, Heritage and the Gaeltacht, Dublin, Ireland;
- NPWS (2019a) The Status of Protected EU Habitats and Species in Ireland. Volume 1: Summary Overview. Unpublished Report, National Parks & Wildlife Services. Department of Culture, Heritage and the Gaeltacht, Dublin;
- NPWS (2019b) The Status of EU Protected Habitats and Species in Ireland. Volume 2: Habitat Assessments. Unpublished Report, National Parks, and Wildlife Service. Department of Culture, Heritage and the Gaeltacht, Dublin; and
- NPWS (2019c) The Status of EU Protected Habitats and Species in Ireland. Volume 3: Species Assessments. Unpublished Report, National Parks, and Wildlife Service. Department of Culture, Heritage and the Gaeltacht, Dublin.

4.4.1.1 Cetaceans

Twenty-five species of cetacean have been recorded in the waters around Ireland. The Irish Whale and Dolphin Group (IWDG) holds 117 records of cetacean sightings off the coast of County Clare for the period November 2022 to November 2023 (IWDG, 2023). Species identified include bottlenose dolphin (*Tursiops truncatus*), common dolphin (*Delphinus delphis*), harbour porpoise (*Phocoena phocoena*), minke whale (*Balaenoptera acutorostrata*), and humpback whale (*Megaptera novaeangliae*). Within the Shannon Estuary bottlenose dolphin were noted as the most frequently recorded species (34 sightings recorded between November 2022 to November 2023) with just one sighting of harbour porpoise in the outer reaches of the estuary at Loop Head over the same time period (IWDG, 2023). No other cetacean species was recorded in the Shannon Estuary between November 2022 to November 2023.

The Shannon Estuary is one of the most important areas for bottlenose dolphins in Ireland, and the species are a qualifying interest of the Lower River Shannon SAC. The potential for adverse effects arising from the SI works on bottlenose dolphins is assessed against the COs of the SAC in the separate report Supporting Information for Screening for Appropriate Assessment (SISAA) (RPS ref: IE000210RP0026).

MERC Consultants carried out a preliminary overview of marine ecological data for the Moneypoint Hub project (MERC, 2021). This review identified that 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.

MERC (2021) described the results of static acoustic monitoring (SAM) in the vicinity of Moneypoint, with respect to bottlenose dolphins. The longest SAM dataset at Moneypoint is used as the reference point for acoustic detections elsewhere in the estuary. Dolphin detections at Moneypoint typically range from 50-93% of days monitored and are affected by season as well tidal and diel cycles. Seasonal variation in foraging suggested that Moneypoint is an important feeding site during winter and spring (Carmen et al. 2021 in MERC, 2021).

A cetacean desktop literature review was conducted by Inis Environmental Consultants Ltd. in 2010 to inform the Moneypoint Windfarm development planning application. This review noted that neonatal calves were recorded from July to September 2010 highlighting that the area is an important nursery area. Large groups of bottlenose dolphins were frequently observed in the narrow waters at Kilcredaun and in the mouth of the estuary. This area has been identified as a 'Critical Area' for bottlenose dolphin within the Shannon Estuary (Ingram and Rogan, 2002). A second critical area was identified further east into the estuary around Moneypoint and Tarbert/ Killimer. Both of these areas are located in deep parts of the estuary within fast tidal currents (Ingram and Rogan, 2002).

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, it is considered unlikely for harbour porpoise to be encountered within the SI works area during operations.

4.4.1.2 Otter

Otter (Lutra lutra) occurs throughout Ireland, including along the coasts in County Clare (NPWS, 2019) with populations also found along rivers, lakes, and coasts, where fish and other prey are abundant, and where the bank-side habitat offers plenty of cover. The otter is an opportunistic predator with a broad and varied diet. They have diverse habitat preferences: lakes, canals, riverine (streams up to major river systems) marshland and estuaries. Otters that live nearer to the coast tend to require access to freshwater for bathing purposes, while any aquatic environment which has nearby vegetation or rock cover will be used by otters (NPWS, 2019).

Although otters are a mobile species, they have defined territories. Females have territories of 7.5 ± 1.5km in length along a riverine environment and 6.5 ± 1.0km in coastal environments, while male otter territory along rivers is approximately 13.2 ± 5.3km in length with a high degree of variability (Reid et al., 2013).

The main threats to otter include pollution, particularly organic pollution resulting in fish kills; and accidental deaths, e.g. road traffic and fishing gear (NPWS, 2019). The most recent Article 17 conservation assessment for otters in Ireland deemed the species as being in favourable conservation status (NPWS, 2019).

Otters are a QI of the Lower River Shannon Estuary SAC, which the SI works is within. The CO for otter is to restore the favourable conservation condition of otter in the Lower River Shannon SAC, which is defined through the attributes and targets in the NPWS (2012d) Conservation Objectives document.

Based on a survey completed in 2010 to inform other works within the Moneypoint site, evidence of otter activity was found to the east of the coal-loading jetty within the industrial site. Evidence was also found along the rocks above the HWM at Ballymacrinan Bay. Otter spraints were found on the rock armour to the front of the site to the east of the site jetty. Fresh spraints were also identified to the east of the power station. During a 2013 otter survey within the Moneypoint site, no holts or other tracks/signs were identified within the site (Inis, 2013). Mapping carried out by NPWS (2012) indicates that otter commute along the foreshore at Moneypoint.

4.4.1.3 Marine Habitats

In August 2021, MERC Consultants carried out a drop-down video survey designed to supplement available NPWS data on the subtidal and intertidal habitats adjacent to the Moneypoint site (MERC, 2022). Where relevant, the results of this survey have been used to inform this NIS.

4.4.2 Field surveys

To inform the future environmental assessment of the Moneypoint OWF Hub project, terrestrial ecological surveys have been undertaken in 2022 and 2023. The ecological study area was defined based on the ESB's land ownership boundary and refined based on the areas within which physical works are required for the construction and operation of the project. This area is to the south and east of the N67 road, excludes

the power station, HFO area and substations, but includes the coal yard and FGD landfill to the east of the site. The study area for the terrestrial ecological surveys is shown in Figure 4.2.

Figure 4.2 Ecological Survey Area for Moneypoint OWF Hub Project

4.4.2.1 Bats

Bat surveys were undertaken across the Moneypoint site in June through October 2023 to inform the proposed development of the Moneypoint Offshore Windfarm (OWF) Hub Project. The bat surveys comprised:

- Static detector (activity) surveys;
- Potential bat roost (PBR) surveys;
- Dawn/ dusk surveys including transects; and
- Emergence/ re-entry surveys of structure.

Bat numbers on-site were moderate with the activity mainly confined to foraging and commuting along scrub and wooded areas within the site. The following bat species were recorded on the static detectors:

- Myotis spp.
- Pipistrellus spp.
- *Pipistrellus pipistrellus* (Common pipistrelle)
- *Pipistrellus pygmaeus* (Soprano pipistrelle)
- *Nyctalus leisleri* (Leisler's bat)
- *Plecotus auritus* (Brown long eared bat)
- *Rhinolophus hipposideros* (Lesser horseshoe bat)

The preliminary ground level roost assessments identified 14 trees with features suitable for roosting bats. Of these 14 trees, the visual assessment categorised all 14 trees as having 'Low' bat roosting suitability. No trees with 'Moderate' or 'High' roosting suitability were identified.

The preliminary ground level roost assessments identified six buildings suitable for roosting bats. Of these, the visual assessment categorised five buildings as having 'Low' bat roosting suitability and one building as having 'Moderate' bat roosting suitability. No buildings with 'High' roosting suitability were identified.

Bat emergence and re-entry surveys for two derelict structures and four actively used buildings were carried out. During the emergence survey of the derelict structure BS4 (shown on Figure 4.2) a lesser horseshoe bat call was picked up on the Elekon M2 batlogger in proximity to the structure. A roost inspection of structure BS4 was undertaken on 31st October 2023, under licence from the NPWS, to determine if Lesser horseshoe bats are present or if the roost is in use by other bat species. No Lesser horseshoe bats were encountered during the visit but evidence of bat activity was clear. Further surveys of BS4 are planned to confirm its use as a roost.

4.4.2.2 Otter

For the proposed future development, an otter activity survey was conducted within the Moneypoint site in June 2022 which confirmed that otters are using the foreshore and rock armour to the south. Similar evidence has been confirmed from surveys conducted in September 2023. Further discussion on these surveys is included in Section 5.2.1.5.

5 STAGE 2 NATURA IMPACT STATEMENT

5.1 Relevant European Site(s)

As outlined in section 4.3, potential connectivity between European sites and the SI works was identified in the SISAA using the S-P-R model. In the SISAA, RPS concluded that 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). The geophysical survey will also introduce subsea noise that has the potential to impact on bottlenose dolphin that are a Qualifying Interests (QI) species of the Lower River Shannon SAC (002165). Therefore, 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 was determined that further assessment is required to determine whether the SI works are likely to adversely affect the integrity of the Lower River Shannon SAC with or without mitigation measures.

The following sections identify, through a scientific examination of ecological data and evidence, the QIs of each relevant European site. Each of these QIs will be assessed to determine whether or not the SI works, alone or in combination with other plans or projects, will have an adverse effect on the integrity of the European site in view of their Conservation Objectives (COs).

5.1.1 Lower River Shannon SAC

Table 5.1 lists the QIs for the Lower River Shannon SAC and identifies whether or not there is an ecological pathway for impact between the SI works and each QI.

Table 5.1 Lower River Shannon SAC (002165)

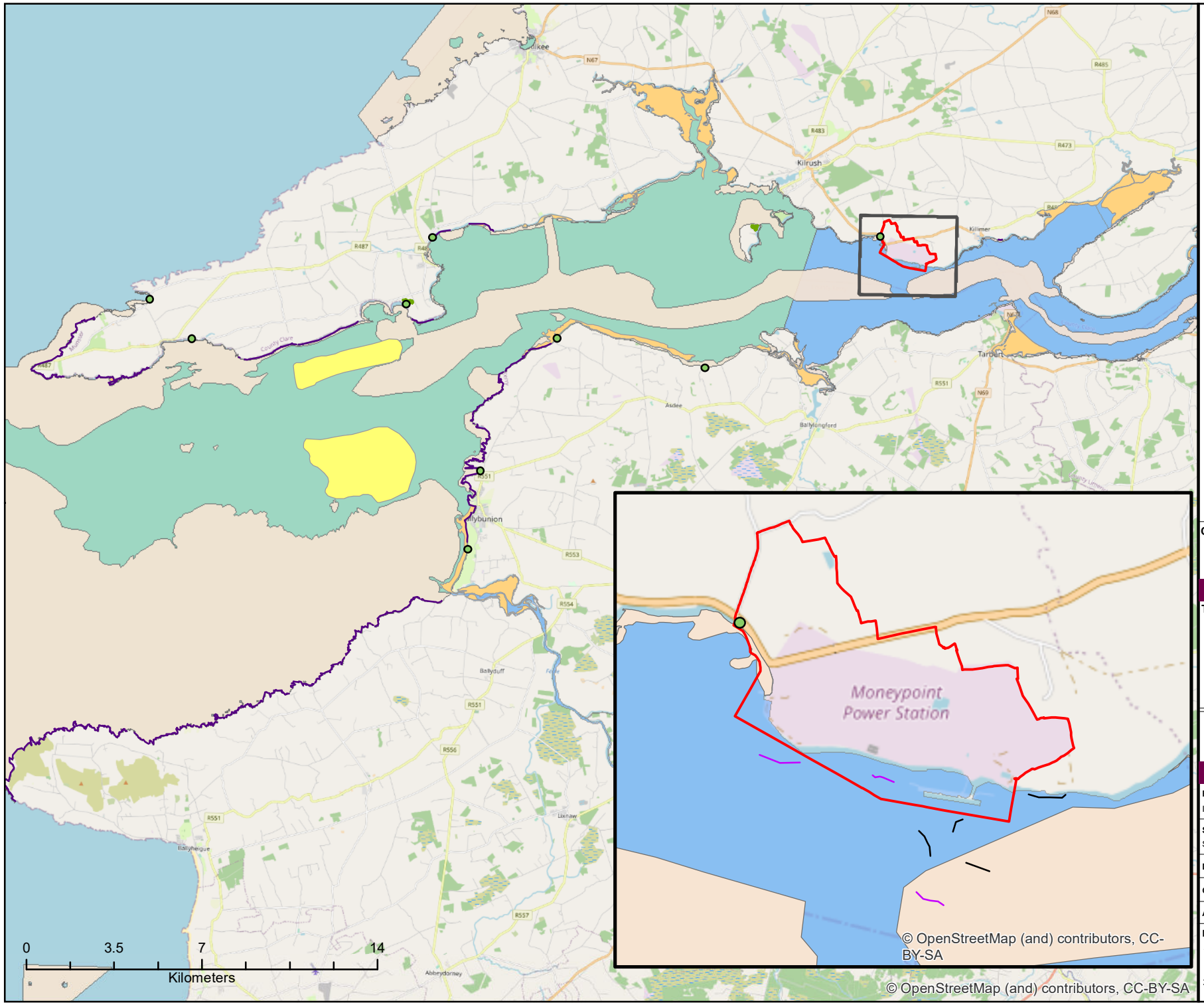
Feature	Relevant Qualifying Interest (QI)	Pathway for impact (Yes/No)?	Rationale
Habitat	Sandbanks which are slightly covered by sea water all the time [1110]	No	This habitat is sufficiently removed from the works area at the mouth of the Shannon Estuary (see Figure 5.1) and will not be directly disturbed during the SI works. The limited extent of the extractive works (borehole and benthic grab) during the SI will not have an adverse effect on this feature.
	Estuaries [1130]	Yes	This habitat is mapped within and adjacent to the marine SI works area. There is potential for estuary habitats and communities to be affected by direct habitat loss/damage, and deterioration due to deposition of increased suspended sediments and accidental pollution as a result of the marine SI works.
	Mudflats and sandflats not covered by seawater at low tide [1140]	No	The closest area of this habitat is c. 5 km southwest of Moneypoint on the Co. Kerry side of the estuary (see Figure 5.1). The marine SI works will not directly disturb this habitat and due to the intervening distance and directional flow of the estuary it is considered that there is no connectivity with this habitat.
	Coastal Lagoons* [1150]	No	There are two coastal lagoon features in the Lower Shannon Estuary (NPWS, 2012a). The Scattery Lagoon is c. 5. km west of Moneypoint, and the Cloonconeen Pool is c. 20 km west of Moneypoint. There is no pathway for direct or indirect impacts from the SI works due to the intervening distance, and due to the presence of physical barriers separating the lagoons from the marine environment (NPWS, 2012b).
	Large shallow inlets and bays [1160]	Yes	This habitat is mapped by NPWS within the outer Shannon Estuary (see Figure 5.1), downstream of the SI works and is hydrologically linked to the marine SI works area. There is potential for the habitat to be indirectly affected through increased suspended sediments and accidental pollution during the marine SI works.
	Reefs [1170]	Yes	This habitat has been observed within and adjacent to the marine SI works area (MERC, 2022; see Figure 5.1). There is potential for reefs to be affected by direct habitat loss/damage, and deterioration

Feature	Relevant Qualifying Interest (QI)	Pathway for impact (Yes/No)?	Rationale
			due to deposition of increased suspended sediments and accidental pollution as a result of the marine SI works.
	Perennial vegetation of stony banks [1220]	Yes	While this habitat is within the ESB foreshore area at Ballymacrinan Bay, it is removed from the indicative locations of the land-based and marine SI works and is unlikely to be disturbed during the SI work. However, there is the potential for indirect impact from heavy duty machinery should access be required via Ballymacrinan Bay.
	Vegetated sea cliffs of the Atlantic and Baltic coasts [1230]	No	This habitat is sufficiently removed from the works area (see Figure 5.1) and will not be affected during the SI works.
	Salicornia and other annuals colonizing mud and sand [1310]	No	The closest area of habitat is located c.10km west of Moneypoint. There is a lack of intertidal mudflats available within the ESB ownership boundary which could be colonised by *Salicornia*, owing to the rocky nature of the shoreline in this location, and to the historic reclamation of the intertidal mudflats.
	Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) [1330]	No	The closest area of habitat is located c.5km west of Moneypoint. There is a lack of intertidal mudflats available within the ESB ownership boundary which could be colonised by saltmarsh habitats, owing to the rocky nature of the shoreline in this location, and to the historic reclamation of the intertidal mudflats.
	Mediterranean salt meadows (*Juncetalia maritimi*) [1410]	No	The closest area of habitat is located c.7km west of Moneypoint. There is a lack of intertidal mudflats available within the ESB ownership boundary which could be colonised by saltmarsh habitats, owing to the rocky nature of the shoreline in this location, and to the historic reclamation of the intertidal mudflats.
	Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation [3260]	No	This habitat is located a significant distance upstream of the works area and is not hydrologically linked to the SI works area.
	Molinia meadows on calcareous, peaty, or clayey-silt-laden soils (*Molinion caeruleae*) [6410]	No	This terrestrial habitat is not present within the works area and is not linked to the works area through any ecological impact pathway. Moneypoint is an active industrial site with largely ephemeral dry grassland habitats and disturbed areas.
	*Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion, Alnion incanae, Salicion albae*) [91E0]	No	This habitat is sufficiently upstream of Moneypoint in the mouth of the Shannon River and is removed from the works area. It is not linked to the works area through any hydrological or ecological impact pathway.
Species	Freshwater pearl mussel *Margaritifera* [1029]	No	The Cloon River is the only watercourse designated as a *Margaritifera* catchment within the Lower River Shannon SAC. However, it is located c. 11km upstream of the works area and therefore no direct hydrological pathway exists between the works area and this QI species. Freshwater pearl mussel larvae infest the gills of salmon or brown trout, which function as host species for this life stage. Host specificity has been recorded in freshwater pearl mussel populations (Wacker *et al*., 2019) and the Cloon freshwater pearl mussel population appears to favour native brown trout (NPWS, 2012d). It is therefore considered that any potential effects to the Atlantic salmon population of the SAC are unlikely to lead to indirect effects on the freshwater pearl mussel population. In addition, the COs for the Lower River Shannon SAC (NPWS, 2012d) state that habitat for freshwater pearl mussel is currently unsuitable for the survival of adult mussels or the recruitment of juveniles due to the inferior quality of the river substrate. Therefore, it is unlikely that any potential effects on host species would affect freshwater pearl mussel recruitment, which is already deteriorated in the Cloon.

Feature	Relevant Qualifying Interest (QI)	Pathway for impact (Yes/No)?	Rationale
			As a result, it is considered that there is no pathway for effects to freshwater pearl mussel.
	Sea Lamprey *Petromyzon marinus* [1095]	Yes	The River Shannon is one of the key sites for sea lamprey in Ireland. While the SI works do not overlap spatially with spawning or juvenile habitats of sea lamprey, individuals could pass through the area during their migrations to/from the sea. Therefore, this species may be affected during the marine SI works.
	Brook Lamprey *Lampetra planeri* [1096]	No	Brook lampreys live exclusively in freshwater and are more typically found in smaller river channels. As the SI works are located within the lower Shannon Estuary, downstream of spawning and nursery habitat, this species will not be disturbed during the marine SI works.
	River Lamprey *Lampetra fluviatilis* [1099]	Yes	River lampreys occur in transitional waters of major river estuaries as adults, where they feed on estuarine fish before moving to freshwater rivers to spawn. While the SI works do not overlap spatially with spawning or juvenile habitats of river lamprey, individuals could pass through the area during their migrations to/from the sea. Therefore, there is potential for species to be affected during the marine SI works.
	Atlantic Salmon *Salmo salar* [1106]	Yes	While the SI works do not overlap spatially with spawning or juvenile habitats of Atlantic salmon, individuals could pass through the area during their migrations to/from the sea. Therefore, this species may be directly disturbed during the marine SI works.
	Bottlenose Dolphin *Tursiops truncatus* [1349]	Yes	The ESB-owned foreshore is directly within a critical habitat area for bottlenose dolphin within the Lower River Shannon SAC (NPWS, 2012c). There is a resident bottlenose dolphin population in the Shannon Estuary which may be directly affected as a result of underwater noise, collision risk and accidental pollution.
	Otter *Lutra lutra* [1355]	Yes	Otter's commute, forage, and rest along the Shannon Estuary. Otter activity was confirmed at the Moneypoint site during the June 2022 and September 2023 otter surveys (see Figure 5.2). Therefore, an ecological pathway for impact exists between the works area and this QI species.

In summary, the following QIs of the Lower River Shannon SAC will be considered in this NIS:

- Estuaries [1130];
- Large shallow inlets and bays [1160];
- Reefs [1170];
- Perennial vegetation of stony banks [1220];
- Sea lamprey *Petromyzon marinus* [1095];
- River Lamprey *Lampetra fluviatilis* [1099];
- Atlantic Salmon *Salmo salar* [1106];
- Bottlenose Dolphin *Tursiops truncatus* [1349]; and
- Otter *Lutra lutra* [1355]



Legend Main Map

- Perennial vegetation of stony banks
- Vegetated sea cliffs of the Atlantic and Baltic coasts
- Sandbanks
- Estuaries
- Tidal Mudflats and Sandflats
- Coastal Lagoons
- Large Shallow Inlets and Bays
- Reefs
- ESB Ownership Moneypoint

Legend Inset Map

- Perennial vegetation of stony banks
- Reefs
- Estuaries
- Reef Identified (MERC, 2021)
- No Reef Identified (MERC, 2021)
- ESB Ownership Moneypoint

Data Sources: NPWS, April 2022

Client

ESB

Moneypoint Hub Project

Title

Figure 5.1:
Habitat Map of Lower River Shannon SAC Qualifying Interests

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Issue Details

File Identifier: IE000210-RPS-00-XX-DR-Z-AG-0005-S0-P03		
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5.2 Baseline Description of Relevant Qualifying Interests

5.2.1 Lower River Shannon SAC

5.2.1.1 Estuaries [1130], Reefs [1170] and Large shallow inlets and bays [1160]

The Shannon and Fergus Estuaries form the largest estuarine complex in Ireland. The area within which the marine SI works will take place has been mapped by NPWS as Estuaries, a large physiographic feature that may wholly or partly incorporate other Annex I habitats including reefs, sandbanks, or mudflats within its area. The Lower River Shannon SAC Estuaries QI habitat extent is estimated to be c. 24, 273ha.

A previous review carried out by MERC (2021) identified that benthic data for the area immediately surrounding Moneypoint were limited. The MERC report noted that the reef mapped by NPWS in the centre channel of the Shannon Estuary is based on interpolated information, and without concentrated survey effort, the exact habitat and community types could not be determined. The available data for the area immediately surrounding Moneypoint is described by NPWS (2012c) as a soft sediment community "Subtidal sand to mixed sediment with Nucula nucleus community type", however, MERC identified that the nearest NPWS sediment monitoring stations are 5 km east and west of Moneypoint and therefore this mapping is also based on interpolated information. A drop-down video survey (MERC, 2022) identified a mosaic of coarse sediment and cobble reef surrounding the jetty at Moneypoint (inset on Figure 5.1). As a result of the uncertainty around Annex I habitat types at Moneypoint, and in the absence of more accurate habitat mapping, it is assumed that the area could consist of all habitat and community types under the Estuaries QI, i.e., muddy to mixed sediment and reefs. Reefs are also a QI of the Lower River Shannon SAC in their own right and will be assessed both as part of the Estuaries QI and on their own.

Another large physiographic feature occurs at the mouth of the Shannon Estuary and is designated as the QI 'Large shallow inlets and bays'. Within the Lower River Shannon SAC, large shallow inlets and bays are estimated to encompass c. 35,282ha (NPWS, 2012d). Similar to the Estuaries QI, this habitat encompasses the Annex I habitats mudflats and sandflats not covered by water at low tide, sandbanks which are slightly covered by sea water at all times and reefs. This habitat has been mapped by NPWS approximately 3 km from the proposed Moneypoint SI works and while there is no pathway for direct impact, i.e., through removal or destruction of constituent habitats or communities, there is potential for indirect effects to habitats, e.g., effects associated with increased suspended sediment or accidental pollution.

The CO for estuaries, reefs and large shallow inlets and bays is to maintain the favourable conservation condition of these QIs, as defined through the attributes and targets in the NPWS (2012d) Conservation Objectives document (see Table 6.3 for an assessment of effects against the COs).

5.2.1.2 Perennial vegetation of stony banks [1220]

Perennial vegetation of stony banks occurs along coastlines where shingle (cobbles, pebbles, and gravel ≥2mm) has accumulated to form elevated ridges or banks above the high tide mark. This habitat is shown on Map 10 of the Conservation Objectives to occur at Ballymacrinan Bay to the west of the main Moneypoint site (NPWS, 2012d). Ecology surveys undertaken in May and June 2022 confirmed that this habitat is present at Ballymacrinan Bay within the ESB ownership boundary. The vegetation is dominated by sea sandwort (*Honckenya peploides*), curled dock (*Rumex crispus*), sea beet (*Beta vulgaris* ssp. maritima), orache (*Atriplex* spp.) and sea mayweed (*Tripleurospermum maritimum*). There are no SI works proposed for Ballymacrinan Bay. The CO for perennial vegetation of stony banks is to maintain the favourable conservation condition of this QI, as defined through the attributes and targets in the NPWS (2012d) Conservation Objectives document (see Table 6.3 for an assessment of effects against the CO).

5.2.1.3 Sea Lamprey, *Petromyzon marinus* [1095], River Lamprey, *Lampetra fluviatilis* [1099] and Atlantic Salmon, *Salmo salar* (only in fresh water) [1106]

Sea (*Petromyzon marinus*) and river (*Lampetra fluviatilis*) lamprey typically spawn in the lower reaches of rivers but may also migrate upstream to spawn (IFI, 2022a; IFI, 2022b; Kurz and Costello, 1999). Lamprey build nests called redds which they evacuate from the riverbed using their suckers. Sea lampreys prefer sediments made of small cobbles and pebbles for spawning, whereas river lampreys prefer sand or gravelly

sediments (Kurz and Costello, 1999). Sea lampreys usually spawn during the months of June and July, while river lamprey typically spawn in mid- to late- spring (IFI, 2022a; IFI, 2022b). After hatching, larval lampreys move downstream until they find a suitable muddy or silty part of the riverbed to burrow into. According to Inland Fisheries Ireland (IFI, 2022a; IFI, 2022b) both species of lamprey then spend several years (four years for river lamprey, six to eight years for sea lamprey) in a blind, worm-like juvenile form known as ammocoetes, filter feeding on microscopic organisms. Once transformation to adults is complete river and sea lamprey being their migration to sea. River lampreys remain relatively close to the coast for about 18 months before migrating back up into the river to spawn. Sea lampreys spend up to three years at sea before returning back up into the river to spawn (IFI, 2022a; IFI, 2022b).

Salmon (*Salmo salar*) typically returns to rivers in the spring or early summer (IFI, 2022c) and spawn in gravelly, well-oxygenated rivers between November and March. Juvenile salmon usually stay in the river for two to three years, migrating to feeding ground thousands of kilometres away (IFI, 2022c). The conservation status of Atlantic salmon in Ireland is inadequate (NPWS, 2019) and the overall CO for salmon in the Lower River Shannon SAC is to restore the favourable conservation condition. Its conservation status is due to a decline in abundance caused by mortality at sea, habitat loss, barriers to migration, poor water quality, overfishing and sea lice (IFI website).

As outlined above, river lampreys typically spawn in mid- to late-spring, sea lamprey during June and July and salmon return to their rivers during spring or early summer, waiting until winter to spawn. As the SI works are expected to take place during the autumn months, it is highly unlikely that fish migrating upstream will be present in the estuary. Therefore, the only potential overlap between the works will be for adult lamprey and salmon smolts migrating downstream through the estuary to the marine environment.

The CO for sea lamprey and Atlantic salmon is to restore the favourable conservation condition of these QIs, as defined through the attributes and targets in the NPWS (2012d) Conservation Objectives document. The CO for river lamprey is to maintain the favourable conservation condition of this QI, as defined through the attributes and targets in the NPWS (2012d) Conservation Objectives document (see Table 6.3 for an assessment of effects against the CO).

5.2.1.4 Bottlenose dolphin, *Tursiops truncatus* [1349]

The Shannon Estuary is one of the most important habitats for bottlenose dolphins (*Tursiops truncatus*) in Ireland. The population is resident within the Lower River Shannon SAC, and bottlenose dolphins are present throughout the year (Berrow *et al*, 2010) and genetically discrete compared to bottlenose dolphins found elsewhere in Irish waters and that the estuary is an important calving area (Mirimin *et al*. 2011). 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) and the area is identified as a critical habitat area in the CO supporting document (NPWS, 2012c).

MERC (2021) described the results of Static Acoustic Monitoring (SAM) in the vicinity of Moneypoint, with respect to bottlenose dolphins. The longest SAM dataset at Moneypoint is used as the reference point for acoustic detections elsewhere in the estuary. Dolphin detections at Moneypoint typically range from 50-93% of days monitored and are affected by season as well as tidal and diel cycles. Seasonal variation in foraging suggested that Moneypoint is an important feeding site during winter and spring (Carmen *et al*. 2021 in MERC, 2021).

The CO for bottlenose dolphin is to maintain the favourable conservation condition of this QI, as defined through the attributes and targets in the NPWS (2012d) Conservation Objectives document (see Table 6.3 for an assessment of effects against the CO).

5.2.1.5 Otter, *Lutra lutra* [1355]

Otters (*Lutra lutra*) have diverse habitat preferences: lakes, canals, riverine (streams up to major river systems) marshland and estuaries. Otters that live nearer to the coast tend to require access to freshwater for bathing purposes, while any aquatic environment which has nearby vegetation or rock cover will be used by otters. The otter is an opportunistic predator with a broad and varied diet. In coastal areas fish, crabs and molluscs are known to be eaten.

Based on a survey completed in 2010 to inform other works within the Moneypoint site, evidence of otter activity was found to the east of the coal-loading jetty within the industrial site. Evidence was also found along the rocks above the HWM at Ballymacrinan Bay. Otter spraints were found on the rock armour to the front of the site to the east of the site jetty. Fresh spraints were also identified to the east of the power station. During a 2013 otter survey within the Moneypoint site, no holts or other tracks/signs were identified within the site (Inis, 2013). Mapping carried out by NPWS (2012) indicates that otter commute along the foreshore at Moneypoint.

For the proposed future development, an otter activity survey was conducted within the Moneypoint site on 16th June 2022 which confirmed that otters are using the foreshore and rock armour to the south. Three couch/seat areas were found on the grassland/rock armour interface close to freshwater outfalls. Similar evidence has been confirmed from surveys conducted in September 2023. Old and fresh spraints were recorded all along the rock armour. No otter holts were recorded in June 2022, but two possible holts were located by surveys in 2023 at the bridge to the jetty and at a pier just west of the jetty, which indicates that otters are quite active in the area, using the site for resting, cleaning, and feeding, but breeding may also occur within the Moneypoint Generating Station. Otter activity recorded in the 2022 and 2023 surveys is presented in Figure 5.2 .

It is expected that otters move regularly along the shoreline of the Moneypoint site. There was no evidence of otter within the terrestrial habitats north of the rock armour. The CO for otter is to restore the favourable conservation condition of otter in the Lower River Shannon SAC, which is defined through the attributes and targets in the NPWS (2012d) Conservation Objectives document (see Table 6.3 for an assessment of effects against the CO).

Legend

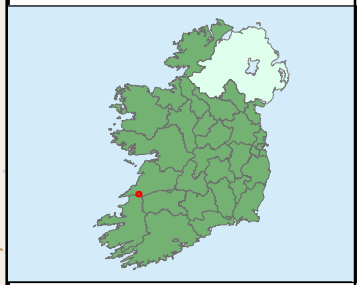
Otter Survey 2023

- Couch
- Crab remains
- Spraint

Otter Survey 2022

- Couch
- Spraint
- ESB Ownership Moneypoint

Data Sources: OSi



Client

ESB

Moneypoint Hub Project

Title

Figure 5.2: Evidence of otter recorded in 2022 and 2023

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6 ASSESSMENT OF ADVERSE EFFECTS

6.1 Lower River Shannon SAC

6.1.1 Habitat Loss or Disturbance

As outlined in Section 5.2.1, the SI works area overlaps with an area of the SAC mapped by NPWS as Estuaries, which can be characterised by a range of benthic community and substrate types, including muddy sand to mixed sediment and reefs. Due to the uncertainty associated with the available interpolated habitat mapping and the results of a drop-down video survey (MERC, 2022) which observed reef habitat in the vicinity of the existing Moneypoint jetty, it must be assumed that there is potential for a range of community types and Annex I habitat types, including reefs, within the SI works area.

There is therefore potential for direct habitat loss and/or disturbance of subtidal Annex I habitats as a result of the following intrusive survey types: geotechnical surveys (boreholes and CPT, including disturbance from placement of jack-up barge legs), benthic grabs, mooring of ADCPs and underwater noise recorders, and vessel anchoring.

With respect to sedimentary communities and habitats (i.e., muddy sand, mixed sediment), sediment removal and disturbance from intrusive techniques will affect relatively small areas in the context of the wider SAC. For example, the area of the Estuaries QI was estimated as 24,273 ha (NPWS, 2012d), while the marine area to be surveyed during the SI works extends to just 43 ha. A maximum of 18 boreholes (diameter c. 10 cm each) and 25 grab samples (area 0.1 m^2 each) will be removed, while anchoring and jack-up barge footprints have the potential to disturb habitats. It is considered that sediment removal and disturbance will not represent an adverse effect on integrity of sedimentary Annex I habitats due to the small-scale of the intrusive SI works in the context of the extent of sedimentary habitats within the SAC.

As outlined in Section 5.2.1, the full extent of Annex I reef within and adjacent to the Moneypoint SI works area is currently unknown. Preliminary drop-down video footage (MERC, 2022) suggests that the area comprises a mosaic of coarse/mixed sediment and cobble reef. Therefore, in the absence of control measures, the proposed intrusive SI works have the potential to cause adverse effects on Annex I reef habitat through physical disturbance. Mitigation measures are therefore required to avoid adverse effects to Annex I reef. These are described in Section 7. With these measures in place, there will be no adverse effect on the integrity of the Estuaries or Reefs QI of the Lower River Shannon SAC.

Although the perennial vegetation of stony banks is above the high-water mark this QI is within the Moneypoint site boundary. Access to the marine waters will be from pier/ port/ jetty/ slipway facilities and not from the shoreline along Ballymacrinan Bay. Therefore there is no potential for habitat loss or disturbance effects.

There is potential for there to be some disturbance of habitats used by otter as a result of the SI works. For example, personnel accessing the shoreline or nearshore and onshore works. However, the SI works (both terrestrial and marine) will result in only limited activity around the shore of Moneypoint power station. The 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 is considered highly unlikely that there would be any significant disturbance to otter habitats as a result of the SI works.

Table 6.3 assesses the impacts of the project against the attributes and targets defined by NPWS (2012d) to maintain/restore the conservation status of the relevant QIs of the Lower River Shannon SAC and determines whether mitigation is required to avoid adverse effects on the integrity of the site in view of its conservation objectives.

6.1.2 Underwater Noise

Geophysical and geotechnical surveys, as well as survey vessels, have the potential to introduce underwater noise to the marine environment, with the potential to impact upon bottlenose dolphin, migratory fish species and otter.

6.1.2.1 Underwater Noise Sources

A Subsea Noise Technical Report was carried out using indicative noise sources for the SI works. The results of this assessment are presented in full in Appendix B and summarised here.

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). The range of the geophysical equipment will be limited principally by water depth and attenuation particularly of high frequency sources such as multi-beam and side scan sonar systems.

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.

6.1.2.2 Underwater Noise Effects to Annex II Migratory Fish Species

As outlined in Section 5.2.1 above, there is potential for outward migrating sea lamprey, river lamprey and salmon to overlap with the SI works. There is therefore potential for these migratory fish species to be injured or disturbed by underwater noise emitted by the proposed marine surveys.

The thresholds for harm to fish species have been based on the sound exposure guidelines for fish proposed by the ANSI-Accredited Standards Committee S3/SC 1, Animal Bioacoustics Working Group (Popper *et al*. 2014). The guidelines represent the Working Group's consensus efforts to establish broadly applicable guidelines for fish and sea turtles, with specific criteria relating to mortality and potential mortal injury, recoverable injury, and TTS. The Working Group defines the criteria for injury and TTS as follows:

- mortality and mortal injury – immediate or delayed death;
- recoverable injury – injuries, including hair cell damage, minor internal or external hematoma, etc. None of these injuries is likely to result in mortality;
- TTS – short or long-term changes in hearing sensitivity that may or may not reduce fitness (defined as any persistent change in hearing of 6 dB or greater).

At sound levels lower than those that may cause physical injury or mortality, noise may also cause behavioural effects on a species, for example, avoidance of an area or changes in swimming speed (Mueller-Blenkle, 2010). This may be significant if it causes, for example, a migratory species to be delayed or diverted from their course.

Most fish species are capable of hearing within a frequency range of 50 Hz up to 500 to 1,500 Hz. A smaller number of species (notably clupeids) can detect sounds to over 3 kHz while a few species can detect sounds to well over 100 kHz (Popper and Hastings, 2009). Fish can be grouped into the following categories based on the presence or absence of a swim bladder and on the potential for that swim bladder to improve the hearing sensitivity and range of hearing (Popper *et al*., 2014):

- Group 1 fish: fish with no swim bladder or other gas chamber. With respect to migratory fish, this includes sea lamprey and river lamprey. These species are less susceptible to barotrauma and only detect particle motion, not sound pressure.

- Group 2 fish: fish with swim bladders in which hearing does not involve the swim bladder or other gas volume. With respect to migratory fish, this category includes Atlantic salmon. These species are susceptible to barotrauma although hearing only involves particle motion, not sound pressure.
- Group 3 fish: fish in which hearing involves a swim bladder or other gas volume. These species are susceptible to barotrauma and detect sound pressure as well as particle motion. There are no Group 3 fish designated as QI for the Lower River Shannon SAC.
- Fish eggs and larvae. The spawning and nursery grounds for sea and river lamprey and salmon are out with the Lower Shannon Estuary, therefore the effect of noise on eggs, larvae and juveniles is not of concern in this assessment.

As outlined in Tables 6.1 to Table 6.3 in Appendix B, fish are at low risk of mortality and impairment (recoverable injury and TTS) when exposed to shipping and other continuous noise. In the near to intermediate fields (i.e., tens to hundreds of metres) there may be moderate risk of a behavioural response. Given that the Shannon Estuary is a busy shipping lane handling c. 1,000 ships a year, it is considered highly unlikely that the addition of a small number of survey vessels over a temporary period would lead to any long-term behavioural effects, above the existing baseline.

For impulsive noise sources, thresholds are taken from Popper *et al.* (2014) which does not have an impulsive noise category, however, on a precautionary basis, the thresholds for 'explosive' noise sources have been applied in this assessment. The results of the underwater noise modelling show that this threshold is only likely to be exceeded out to a range of approximately 5 m from the noise source. The risk of recoverable injury and TTS for lamprey species and salmon is high in the near field (within tens of metres). This reduces with distance from the noise source. There is high risk of a behavioural response in the near field for all species, reducing with distance from the noise source.

Sound from survey equipment is targeted towards the seabed, meaning that effects to fish are only expected if they are within the immediate zone of ensonification below the survey vessel. The typical behavioural response to sounds by fish might range from no change in behaviour, to a mild awareness (startle response) to larger movements of displacement for the duration of the sound (Popper *et al*., 2014)

The results of the underwater noise assessment show that lamprey and salmon have the potential to experience effects only if they are within metres of the sound source. It is important to understand that exposure to sound levels in excess of the thresholds does not necessarily imply that the sound will result in significant disturbance. It is also necessary to assess the likelihood that the sensitive receptors will be exposed to that sound and whether the numbers exposed are likely to be significant at the population level. Due to survey timings, there will likely only be a potential overlap between the SI works and outward migrating salmon, the marine SI works will be of temporary duration and underwater noise effects considered to be perceptible above background levels will be limited to within metres of the sound source. Therefore, it is considered highly unlikely that mortality or impairment of river lamprey, sea lamprey or Atlantic salmon will occur at a level that is likely to be significant at a population level.

6.1.2.3 Underwater Noise Effects to Annex II Bottlenose Dolphin

Auditory injury in marine mammals can be defined as a permanent threshold shift (PTS) leading to non-reversible auditory injury, or as a temporary threshold shift (TTS) in hearing sensitivity, which can have negative effects on the ability to use natural sounds (e.g., to communicate, navigate, locate prey) for a period of minutes, hours, or days. With increasing distance from the sound source, where it is audible to the animal, the effect is expected to diminish through identifiable stages (i.e., PTS or TTS in hearing, avoidance, masking, reduced vocalisation) to a point where no significant response occurs. Factors such as local propagation and individual hearing ability can influence the actual effect (DAHG, 2014).

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 proposed works. A desk-based assessment of underwater sound changes associated with indicative survey equipment and predicted effects on a range of species was carried out and is presented in Appendix B.

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). See Table 6.1 below for a list of species contained within each functional hearing group.

Table 6.1 Functional marine mammal hearing groups for marine mammal species

Southall *et al.* (2019) hearing group name	Species included in group
Low-frequency cetaceans (LF)	Baleen whales (minke, fin and humpback whale)
High-frequency cetaceans (HF)	Most toothed whales and dolphins (bottlenose, common and Risso's dolphin, killer, and pilot whales)
Very high-frequency cetaceans (VHF)	Certain toothed whales and porpoises (harbour porpoise)
Other marine carnivores in water (OCW)	Includes sea lions, walrus, otters
Phocid carnivores in water (PCW)	Earless seals (including harbour and grey seal)

Indicative underwater noise sources are provided in Appendix B. The underwater noise assessment considers noise from continuous noise sources (i.e., survey vessel) and impulsive noise sources (ADCP, MBES, SSS, SBP). Southall *et al*. (2019) provides impact thresholds for both PTS and TTS, addressing both peak sound pressure levels (SPL) and sound exposure levels (SEL) and these are provided in Table 6.2 below for bottlenose dolphin. SEL is recommended for assessing the impacts of non-impulsive (continuous) noise, while a dual approach using SEL and SPL is recommended for impulsive noise. Although the DAHG (2014) guidance refers to Southall *et al*. (2007), the more recent Southall *et al*. (2019) outlines more precautionary thresholds than those outlined in 2007 for PTS and TTS.

Table 6.2 Summary of PTS and TTS onset thresholds (Southall *et al.*, 2019)

Hearing Group	Parameter	Impulsive		Non-impulsive	
		TTS	PTS	TTS	PTS
High-frequency (HF) cetaceans (e.g., bottlenose dolphin)	L_P (unweighted)	224	230	-	-
	L_E (HF weighted)	170	185	178	198

The underwater noise assessment TTS can also be triggered by SEL, but these are frequency-weighted and as shown in Figure 1-2 in Appendix B, the sensitivity decreases significantly at higher frequencies, particularly over 100 kHz. In combination with the narrow beam widths of the noise, the risk of any significant exposure under the SEL metric is minimal. Similarly, the potential disturbance due to noise levels is reduced by the duty cycle and source level of the noise sources. It is unlikely that there will be any disturbance due to underwater noise levels. See Appendix B for more information on the subsea noise assessment.

The most likely response of a marine mammal to noise levels that could induce TTS is to flee from the ensonified area (Southall *et al*., 2007) and subsequently the onset of TTS can be referred to as the fleeing response. This is therefore a behavioural response that overlaps with disturbance ranges and animals exposed to these noise levels are likely to actively avoid hearing damage by moving away from the area. However, as there is potential for TTS within c. <50 m (or approximately 300 m if using parametric SBP), respectively, mitigation measures are required to avoid adverse effects to bottlenose dolphin during the SI works and these are outlined in Section 7.1.2 below. Mitigation is required to prevent PTS and TTS to bottlenose dolphin and to prevent auditory injury to bottlenose dolphin. As described in the subsea noise technical report, the sound emitted during the geotechnical surveys is not predicted to exceed the thresholds for permanent injury to bottlenose dolphin and therefore mitigation measures are not required during these surveys.

6.1.2.4 Underwater Noise Effects to Annex II Otter

The assessment concluded that underwater noise may affect otter within less than 5 m of the Multibeam Echosounder (MBES). For all other geophysical and geotechnical survey equipment, thresholds for injury and disturbance were not exceeded. While otters are known to forage within estuaries, they are likely to be disturbed by the presence of the vessels and or anthropogenic works and avoid the area. Sound emitted from the survey vessels and equipment will be directional and can only cause acoustic trauma when an animal is directly below or within 5m of the source, as shown in the results in Appendix B. Owing to the

relatively shallow (25-30m deep) nature of the survey area, the assimilative capacity of the mixed sediment substrate and likelihood that otter will avoid foraging in close proximity to the vessels, it is anticipated there will be a low acoustic impact. Adverse effects to otters foraging in the marine environment are highly unlikely.

Table 6.3 assesses the impacts of the project against the attributes and targets defined by NPWS (2012d) to maintain/restore the conservation status of the relevant QIs of the Lower River Shannon SAC and determines whether mitigation is required to avoid adverse effects on the integrity of the site in view of its COs.

6.1.3 Summary of Effects on Conservation Objectives

Table 6.3 Summary of Assessment of Adverse Effects and Mitigation in light of Conservation Objectives

Qualifying Interest	Attribute	Target	Potential effect	Mitigation required to achieve target
[1130] Estuaries	Habitat area	The permanent habitat area is stable or increasing, subject to natural processes. Habitat area was estimated as 24,273 ha using OSi data and the Transitional Water Body area as defined under the Water Framework Directive.	This habitat forms part of the area within the footprint of the SI works. There is potential for limited removal of sedimentary habitat during geotechnical and benthic grab surveys, however, this will not represent an adverse effect as the works will be temporary and limited in scale, and estuarine sedimentary habitats will recover in the medium to long term. There is potential for habitat loss and destruction to reefs as a constituent habitat of estuaries, therefore mitigation is required to avoid adverse effects on reef habitat area.	Yes See Section 7.1.1 for measures aimed at avoiding reef habitat.
	Community distribution	Conserve the following community types in a natural condition: Intertidal sand to mixed sediment with polychaetes, molluscs and crustaceans community complex; Estuarine subtidal muddy sand to mixed sediment with gammarids community complex; Subtidal sand to mixed sediment with *Nucula nucleus* community complex; Subtidal sand to mixed sediment with Nephtys spp. community complex; Fucoid-dominated intertidal reef community complex; Faunal turf-dominated subtidal reef community; and Anemone-dominated subtidal reef community. The likely area of these communities was derived from intertidal and subtidal surveys undertaken in 2010 (Aquafact, 2011a and c).	While there is potential for very localised temporary increases in suspended sediment/smothering as a result of benthic grab and geotechnical activity, this will not represent an adverse effect on community distribution or condition. There is potential for effects to community types as a result of pollution. However, with the application of standard/ best practice measures, this risk is reduced to as low as reasonably practicable.	No
[1160] Large shallow inlets and bays	Habitat area	The permanent habitat area is stable or increasing, subject to natural processes. Habitat area was estimated as 35,282 ha using OSi data and the Transitional Water Body area as defined under the Water Framework Directive.	No direct removal of large shallow inlets and bays habitat will occur, therefore no adverse effects to habitat area are predicted.	No

Qualifying Interest	Attribute	Target	Potential effect	Mitigation required to achieve target
	Community distribution	Conserve the following community types in a natural condition: Intertidal sand with *Scolelepis squamata* and Pontocrates spp. community; Intertidal sand to mixed sediment with polychaetes, molluscs and crustaceans community complex; Subtidal sand to mixed sediment with *Nucula nucleus* community complex; Subtidal sand to mixed sediment with Nephtys spp. community complex; Fucoid-dominated intertidal reef community complex; Mixed subtidal reef community complex; Faunal turf-dominated subtidal reef community; Anemone- dominated subtidal reef community; and Laminaria- dominated community complex. The likely area of these communities was derived from intertidal and subtidal surveys in 2010 (Aquafact, 2011a and c). See marine supporting document for further details.	The SI works will take place approximately 3 km from this habitat. While sediments will be disturbed the known coarse nature of the sediment type will result in rapid settlement of the suspended sediments and therefore it is unlikely that suspended sediments will travel as far as the large shallow inlets and bays habitat. There is potential for effects to community types as a result of pollution. However, with the application of standard/ best practice measures, this risk is reduced to as low as reasonably practicable.	Yes
[1170] Reefs	Habitat distribution	The distribution of Reefs is stable, subject to natural processes. Distribution is established from intertidal and subtidal reef surveys in 2010 (Aquafact, 2011b and c).	There is potential for effects to community types as a result of pollution. However, with the application of standard/ best practice measures, this risk is reduced to as low as reasonably practicable. There is potential for habitat loss and destruction to reefs as a constituent habitat of estuaries, therefore mitigation is required to avoid adverse effects on reef habitat area. While there is potential for very localised temporary increases in suspended sediment/smothering as a result of benthic grab and geotechnical activity, this will not represent an adverse effect on community distribution or condition.	Yes See section 7.1.1 for measures aimed at avoiding reef habitat;
	Habitat area	The permanent habitat area is stable, subject to natural processes. Habitat area was estimated as 21,421ha from the 2010 intertidal and subtidal reef survey (Aquafact 2011b and c).		
	Community distribution	Conserve the following reef community types in a natural condition: Fucoid-dominated intertidal reef community complex; Mixed subtidal reef community complex; Faunal turf-dominated subtidal reef community; Anemone- dominated subtidal reef community; and Laminaria- dominated community complex. Based on the 2010 intertidal and subtidal reef survey (Aquafact, 2011b and c). See marine supporting document for further details.		

Qualifying Interest	Attribute	Target	Potential effect	Mitigation required to achieve target
1220 Perennial vegetation of stony banks	Habitat area	Area stable or increasing, subject to natural processes, including erosion and succession.	This feature while above the high water mark it is sensitive to anthropogenic disturbance. Access to the marine waters will be from pier/ port/ jetty/ slipway facilities and not from Ballymacrinan Bay. Therefore there is no potential for habitat loss or disturbance effects.	No
	Habitat distribution	No decline, or change in habitat distribution, subject to natural processes. See map 10 for recorded locations.		
	Physical structure: functionality and sediment supply	Maintain the natural circulation of sediment and organic matter, without any physical obstructions.		
	Vegetation structure: zonation	Maintain the range of coastal habitats including transitional zones, subject to natural processes including erosion and succession.		
	Vegetation composition: typical species and sub-communities	Maintain the typical vegetated shingle flora including the range of sub- communities within the different zones.		
	Vegetation composition: negative indicator species	Negative indicator species (including non-natives) to represent less than 5% cover.		
1095] Sea lamprey (*Petromyzon marinus*)	Distribution: extent of anadromy	Greater than 75% of main stem length of rivers accessible from estuary.	The SI works will not block or limit sea lamprey's migration up or downstream within the Shannon estuary.	No
	Population structure of juveniles	At least three age/size groups present.	As juvenile sea lampreys burrow in silty riverbeds, there is no spatial overlap between the SI works and juvenile habitat. While there is potential for underwater noise effects on sea lamprey as a result of the geophysical survey, the impact range will be limited to metres of the sound source and therefore it is highly unlikely that any mortality or impairment would lead to population level effects.	No
	Juvenile density in fine sediment	Juvenile density at least 1/m².	As above, there is no overlap between the SI works and juvenile habitat and any underwater noise effects would be extremely limited in scale, with no potential for population level effects.	No

Qualifying Interest	Attribute	Target	Potential effect	Mitigation required to achieve target
	Extent and distribution of spawning habitat	No decline in extent and distribution of spawning beds.	Sea lamprey spawn in in pebbly or cobbly sediments in the lower reaches of rivers. There is no spatial overlap between the SI works and sea lamprey spawning habitat.	No
	Availability of juvenile habitat	More than 50% of sample sites positive.	As juvenile sea lampreys burrow in silty riverbeds, there is no spatial overlap between the SI works and juvenile habitat.	No
[1099] River lamprey (*Lampetra fluviatilis*)	Distribution	Access to all water courses down to first order streams.	The SI works will not block or limit river lamprey's migration up or downstream within the Shannon estuary.	No
	Population structure of juveniles	At least three age/size groups of river/brook lamprey present.	As juvenile river lampreys burrow in silty riverbeds, there is no spatial overlap between the SI works and juvenile habitat. While there is potential for underwater noise effects on river lamprey as a result of the geophysical survey, the impact range will be limited to metres of the sound source and therefore it is highly unlikely that any mortality or impairment would lead to population level effects.	No
	Juvenile density in fine sediment	Mean catchment juvenile density of river/brook lamprey at least 2/m².	As above, there is no overlap between the SI works and juvenile habitat and any underwater noise effects would be extremely limited in scale, with no potential for population level effects.	No
	Extent and distribution of spawning habitat	No decline in extent and distribution of spawning beds.	River lamprey spawn in in sandy or gravelly sediments in the lower reaches of rivers. There is no spatial overlap between the SI works and river lamprey spawning habitat.	No
	Availability of juvenile habitat	More than 50% of sample sites positive.	As juvenile river lampreys burrow in silty riverbeds, there is no spatial overlap between the SI works and juvenile habitat.	No
[1106] Atlantic salmon (*Salmo salar*)	Distribution: extent of anadromy	100% of river channels down to second order accessible from estuary.	No pathway for effects were found. The SI works will not interact with river channels. There will be no barriers to migration as a result of the SI works.	No
	Adult spawning fish	Conservation Limit (CL) for each system consistently exceeded.	While there is potential for underwater noise effects on salmon as a result of the geophysical survey, the impact range will be limited to metres of the sound source and therefore it is highly unlikely that any mortality or impairment would lead to population level effects. It is considered the mortality or injury of	No

Qualifying Interest	Attribute	Target	Potential effect	Mitigation required to achieve target
			any salmon individuals would be insignificant against the CL or stock levels/recruitment.	
	Salmon fry abundance	Maintain or exceed 0+ fry mean catchment-wide abundance threshold value. Currently set at 17 salmon fry/5 min sampling.	There is no spatial overlap between salmon fry habitat (rivers) and SI works. As above, although there is potential for limited effects on salmon due to underwater noise, it is highly unlikely that this would lead to population level effects or significantly affect the CL for the river.	No
	Out-migrating smolt abundance	No significant decline.	Out-migrating smolt may be affected by impacts such as estuarine pollution. Potential water quality impacts arising from the SI works could lead to an adverse effect, in the absence of pollution control measures. As above, although there is potential for limited effects on salmon due to underwater noise, it is highly unlikely that this would lead to a significant decline in outward migrating smolt abundance.	No
	Number and distribution of redds	No decline in number and distribution of spawning redds due to anthropogenic causes.	Salmon spawn in clean gravels upstream. There is no spatial overlap with salmon spawning grounds and there will be no barriers to migration as a result of the SI works.	No
	Water quality	At least Q4 at all sites sampled by EPA.	Water quality target refers to freshwater Q-values for macroinvertebrates. It is not possible for the SI works to have an effect on water quality upstream.	No
[1349] Bottlenose Dolphin *Tursiops truncatus*	Access to suitable habitat	Species range within the site should not be restricted by artificial barriers to site use. See map 16 for suitable habitat.	In the absence of mitigation, there is potential for PTS and TTS to bottlenose dolphin within the impact range of the geophysical surveys, which may result in potential avoidance behaviour. Access to suitable habitat for bottlenose dolphin will however be preserved in the long term. The surveys will be temporary and intermittent with the geophysical and geotechnical surveys mobilising as separate campaigns. The surveys will not result in the permanent exclusion of bottlenose dolphin from part of its range within the site nor will permanently prevent access for the species to suitable habitat. Within regards to collision risk, there is an existing high level of vessel activity in the Shannon Estuary and in proximity of Moneypoint and a hotspot for bottlenose occurs along the estuary at Moneypoint,	Yes Mitigation for cetaceans will follow DAHG (2014) guidelines on underwater noise and is outlined in Section 7.1.2.
	Habitat use critical areas	Critical areas, representing habitat used preferentially by bottlenose dolphin, should be maintained in a natural condition.		
	Disturbance	Human activities should occur at levels that do not adversely affect the bottlenose dolphin population at the site.		

Qualifying Interest	Attribute	Target	Potential effect	Mitigation required to achieve target
			therefore it is highly likely that the species has habituated to the baseline marine traffic situation. The addition of up to two survey vessels is considered of negligible significance in the context of the wider vessel activity. In the unlikely occurrence of a pollution event, bottlenose dolphin could be adversely affected by water quality impacts and impacts to prey. However, with the application of standard/ best practice measures, this risk is reduced to as low as reasonably practicable	
Otter	Distribution	No significant decline.	The SI works (both terrestrial and marine) will result in limited activity around the shore of Moneypoint power station. The 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 and/or avoid the areas where there are on-going operations. It is considered highly unlikely that there would be any significant disturbance to otter as a result of the SI works.	No
	Extent of terrestrial habitat	No significant decline. Area mapped and calculated as 596.8 ha above high-water mark (HWM); 958.9 ha along riverbanks/ around ponds. No field surveys. Areas mapped to include 10m terrestrial buffer along shoreline (above HWM and along riverbanks) identified as critical for otters.		
	Extent of marine habitat	No significant decline. Area mapped and calculated as 4,461.6ha. No field surveys. Area mapped based on evidence that otters tend to forage within 80m of the shoreline (HWM).	Otters forage in the intertidal and marine area adjacent to Moneypoint. The SI works will not permanently remove any marine habitat. However, there will be temporary disturbance during the SI works. It is expected that otters will avoid the area of works temporarily.	No
	Extent of freshwater (river) habitat	No significant decline. Length mapped and calculated as 500.1km. No field surveys. River length calculated on the basis that otters will utilise freshwater habitats from estuary to headwaters.	There are no freshwater (river) habitats in the Moneypoint SI site impacted by the SI works.	No
	Extent of freshwater (lake/lagoon) habitat	No significant decline. Area mapped and calculated as 125.6ha. No field surveys. Area mapped based on evidence that otters tend to forage within 80m of the shoreline.	Artificial lagoons occur within the Moneypoint site. These are successional habitats that primarily function as settlement ponds and reservoirs. Though possible that otters may utilise these lagoons, these	No

Qualifying Interest	Attribute	Target	Potential effect	Mitigation required to achieve target
			are not functionally or structurally linked to the COs of the SAC.	
	Couching sites and holts	No significant decline. Otters need lying up areas throughout their territory where they are secure from disturbance.	Otter resting sites were identified along the shoreline at Moneypoint. The SI works will not permanently remove any terrestrial habitat.	No
	Fish biomass available	No significant decline. Broad diet that varies locally and seasonally, but dominated by fish, in particular salmonids, eels and sticklebacks in freshwater and wrasse and rockling in coastal waters.	There is potential for effects to prey biomass as a result of pollution. However, with the application of standard/ best practice measures, this risk is reduced to as low as reasonably practicable.	No
	Barriers to connectivity	No significant increase. Otters will regularly commute across stretches of open water up to 500m. E.g., between the mainland and an island; between two islands; across an estuary. It is important that such commuting routes are not obstructed.	There may be temporary disturbance during SI works, however, the SI works will not cause barriers to connectivity between the coast and the terrestrial habitats at Moneypoint or the marine habitats adjacent to it.	No

6.2 In-combination effects

6.2.1 Identification of other plans or projects

A key requirement of the Habitats Directive is that the effects of any project on the Natura 2000 site network should be considered in combination with other plans or projects. The impacts of the project have the potential to interact in combination, both spatially and or temporally, with other plans and projects as described in the following sections.

6.2.1.1 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 (2017-2023)
- Clare County Development Plan (as varied) (2017-2023)
- Kerry County Development Plan (2022-2028)
- National Biodiversity Action Plan (2017-2021)

6.2.1.2 Projects

In January 2023, the 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.

7 MITIGATION MEASURES

7.1 Mitigation of Adverse Effects

7.1.1 Avoidance of impacts to Annex I Reef

In order to avoid direct impact to Annex I reef habitat within the Lower River Shannon SAC, the following measures will be implemented:

- The outputs of the geophysical surveys will be reviewed to identify any areas which may correspond with reef habitats.
- Any areas of reef identified will be avoided by micro siting intrusive sample locations (e.g., benthic grabs, geotechnical sampling, ADCP deployments) away from these areas;
- Prior to geotechnical and benthic surveys, a visual survey (i.e., undertaken by divers, autonomous underwater vehicle (UAV) or remotely operated vehicle (ROV)) will be undertaken prior to sampling at each location, and if reef habitats are present, geotechnical sampling locations will be micro sited away from the reef and benthic sampling locations will be sampled by video survey only; and,
- All jack-up operations associated with geotechnical surveys, or placement of moorings for metocean devices (ADCPs) will be positioned to avoid any known reef features (identified from the geophysical survey and visual survey).

7.1.2 Avoidance of underwater noise impacts

The Guidance to Manage the Risk to Marine Mammals from Man-made Sound Sources in Irish Waters (DAHG, 2014) will be followed for the duration of the SI works. Sound producing activities shall only commence in daylight hours where effective visual monitoring, as performed and determined by the MMO, has been achieved. Should there be a break in sound-producing activity for a period greater than 30 minutes sound-producing activity shall not recommence until at least 30 minutes have elapsed with no marine mammals detected within the Monitored Zone by the MMO. If a break of greater than 30 minutes occurs during hours of darkness then sound-producing activities shall not re-start until daylight hours and only after the MMO has completed the effective visual monitoring in accordance with the DAHG Guidance (2014.). It is proposed that impacts on marine mammals will be reduced to the lowest possible risk to ensure there is no significant risk to marine mammals from impulsive noise.

Standard risk avoidance and/or risk reduction measures will be in place on survey vessels, as required under Section 4.3.4 of the Guidance to Manage the Risk to Marine Mammals from Man-made Sound Sources in Irish Waters (DAHG, 2014). The measures include the requirement to have an MMO on-board at all times during geophysical surveys. As required by the DAHG Guidelines (2014), survey activity will be planned to commence at the innermost part of the estuary to be surveyed and thereafter work outwards, to ensure that marine mammals are not driven into or artificially confined within an enclosed comparatively shallow area.

The following is an extract from Section 4.3.4(ii) of the DAHG Guidelines (2014) of the measures to protect marine mammals.

Multibeam, single beam, side-scan sonar & sub-bottom profiler surveys (sound producing activities): applicable additional measures extracted from DAHG Guidelines (2014).

1. A qualified and experienced marine mammal observer (MMO) shall be appointed to monitor for marine mammals and to log all relevant events using standardised data forms.
2. Sound producing activities shall not commence if marine mammals are detected within a 500m radial distance of the sound source intended for use, i.e., within the Monitored Zone.

Pre-Start Monitoring

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

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

Ramp-Up Procedure

7. In commencing sound producing activities using the above equipment, the following Ramp-up Procedure (i.e., “soft-start”) must be used, including during any testing of acoustic sources, where the output peak sound pressure level from any source exceeds 170 dB L_P:
    a. A controlled build-up of acoustic energy output shall occur in consistent stages to provide a steady and gradual increase over the ramp-up period.
    b. Where the acoustic output measures outlined in steps (a) and (b) are not possible according to the operational parameters of any such equipment, the device shall be switched “on” and “off” in a consistent sequential manner over a period of 20 minutes prior to commencement of the full necessary output.
8. In all cases where a Ramp-Up Procedure is employed the delay between the end of ramp-up and the necessary full output must be minimised to prevent unnecessary high-level sound introduction into the environment.
9. Once the Ramp-Up Procedure commences, there is no requirement to halt or discontinue the procedure at night-time, nor if weather or visibility conditions deteriorate nor if marine mammals occur within a 500m radial distance, of the sound source, i.e., within the Monitored Zone.

Breaks in sound output

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

Reporting

11. Full reporting on MMO operations and mitigation undertaken must be provided to the Regulatory Authority.

8 CONCLUSION

This NIS was prepared to inform an Appropriate Assessment of the implications of the SI works on European sites, namely:

- Lower River Shannon SAC (002165)

The provisions of Article 6 of the 'Habitats' Directive 92/43/EC (2000) defines 'integrity' as the 'coherence of the site's ecological structure and function, across its whole area, or the habitats, complex of habitats and/or population of species for which the site is or will be classified'.

This appraisal considered the introduction of measures intended to avoid or reduce the adverse effects of the SI works on the integrity of Natura 2000 sites with reference to their Conservation Objectives. These measures will ensure that the SI works individually or in combination with other plans and projects will not undermine the conservation objectives of the sites concerned, and as such will not adversely affect the integrity of any Natura 2000 site.

It is concluded that the SI works, subject to the implementation of the proposed mitigation measures and conditions outlined and considered in this report, will not result in direct, indirect, or in-combination effects which would adversely affect the integrity of the Lower River Shannon SAC.

REFERENCES

Ainslie, M. (2010) Principles of Sonar Performance Modelling, Praxis Publishing.

Berrow, S., O'Brien J., Groth L., Foley A., and Voigt K. (2010) Bottlenose Dolphin SAC Survey 2010. Report to the National Parks and Wildlife Service. Shannon Dolphin and Wildlife Foundation. pp.24.

CIEEM (2022) Guidelines for Ecological Impact Assessment in the UK and Ireland. Chartered Institute of Ecology and Environmental Management

Chapman, P.J. and Chapman, L.L. (1982). Otter survey of Ireland Unpublished Report to Vincent Wildlife Trust.

Chanin P. (2003). Ecology of the European Otter. Conserving Natura 2000. Rivers Ecology Series No. 10. English Nature, Peterborough.

Clare County Council (2023a). Clare County Development Plan 2023-2029. https://clarecdp2023-2029.clarecoco.ie/ Accessed 25/10/2023.

Clare County Council (2023b). Strategic Integrated Framework Plan (SIFP) for the Shannon Estuary, Volume 9, Clare County Development Plan 2023-2029. https://clarecdp2023-2029.clarecoco.ie/ Accessed 25/10/2023.

Department of Arts, Heritage and the Gaeltacht (DAHG) (2014) Guidance to Manage the Risk to Marine Mammals from Man-made Sound Sources in Irish Waters . Dublin, Ireland, Department of Arts, Heritage and the Gaeltacht, 58pp.

Department of the Environment, Heritage and Local Government (DoEHLG) (2009, rev. 2010). Appropriate Assessment of Plans and Projects in Ireland Guidance for Planning Authorities. Government of Ireland.

EC (2000) Communication from the Commission on the Precautionary Principle. Office for Official Publications of the European Communities, Luxembourg;

EC (2006) Nature and biodiversity cases: Ruling of the European Court of Justice;

EC (2007a) Guidance document on Article 6(4) of the 'Habitats Directive' 92/43/EEC – Clarification of the concepts of: alternative solutions, imperative reasons of overriding public interest, compensatory measures, overall coherence, opinion of the Commission;

EC (2007b) Guidance document on the strict protection of animal species of Community interest under the Habitats Directive 92/43/EEC. European Commission, Luxembourg;

EC (2014) Article 6 of the Habitats Directive: Rulings of the European Court of Justice;

EC (2018) 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. European Commission;

EC (2021) Commission Notice. Assessment of plans and projects in relation to Natura 2000 sites – Methodological guidance on the provisions of Article 6(3) and (4) of the Habitats Directive 92/43/EEC. European Commission.

Erbe, C., and McPherson, C. (2017). Underwater noise from geotechnical drilling and standard penetration testing, J. Acoust. Soc. Am. 142(3).

Franklin, A.B., Noon, B.R. and George, T.L. (2002). What is Habitat Fragmentation? Studies in Avian Biology. No 25 pp 20-29.

Gilbert, G., Stanbury, A. and Lewis, L. (2021). Bird of Conservation Concern in Ireland 4: 2020-2026. *Irish Birds* **43**: 1–22.

Inland Fisheries Ireland (IFI) (2016) Guidelines on Protection of Fisheries during Construction Works in and Adjacent to Waters. Inland Fisheries Ireland, 3044 Lake Drive, Citywest Business Campus Co. Dublin. IFI/2016/1- 4298.

IFI (2022a) Sea lamprey (*Petromyzon marinus*) https://www.fisheriesireland.ie/species/sea-lamprey-petromyzon-marinus

IFI (2022b) River lamprey (*Lampetra fluviatilis*) https://www.fisheriesireland.ie/species/river-lamprey-lampetra-fluviatilis

IFI (2022c) Atlantic salmon (*Salmo salar*) https://www.fisheriesireland.ie/species/atlantic-salmon-salmo-salar

Kurz, 1. and Costello, M.J. (1999). An outline of the biology, distribution, and conservation of lampreys in Ireland. Irish Wildlife Manuals No. 5. Dúchas, The Heritage Service. Department of Arts, Heritage, Gaeltacht, and the Islands.

Laist, D.W., Knowlton, A.R., Mead, J.G., Collet, A.S. and Podesta, M. (2001) Collisions between ships and whales. Marine Mammal Science 17(1): 35-75.

Martin, J.R., Daly, O.H. and Devaney F.M. (2017) Survey and assessment of vegetated shingle and associated habitats at 30 coastal sites in Ireland. Irish Wildlife Manuals, No. 98. National Parks and Wildlife Service, Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs, Ireland.

Masters-Williams, H., Heap, A., Kitts, H., Greenshaw, L., Davis, S., Fisher, P., Hendrie, M., Owens, D. (2001) Control of water pollution from construction sites. Guidance for consultants and contractors. DETR/CIRIA. London.

MERC (2021) Moneypoint Hub: Preliminary overview of marine ecological data. Report prepared by MERC Consultants Ltd for ESB. 18 pp.

MERC (2022) Moneypoint Hub: Dropdown Video Survey. Report prepared by MERC Consultants Ltd for ESB. 13 pp.

Mirimin, L., Miller, R., Dillane, E., Berrow, S. D., Ingram, S., Cross, T. F., and Rogan, E. (2011) Fine-scale population genetic structuring of bottlenose dolphins in Irish coastal waters. Animal Conservation, 14(4), 342-353.

Mueller-Blenkle, C, McGregor, P.K., Gill, A.B., Andersson, M.H., Metcalfe, J., Bendall, V., Sigray, P., Wood, D.T. & Thomsen, F. (2010) Effects of Pile-driving Noise on the Behaviour of Marine Fish. COWRIE Ref: Fish 06-08, Technical Report. 31st March 2010

NPWS (2012a) Lower River Shannon SAC (site code 2165). Conservation objectives supporting document – Lagoons. Version 1.0. National Parks and Wildlife Service, Department of Arts, Heritage, and the Gaeltacht.

NPWS (2012b) Lower River Shannon SAC (site code 2165). Conservation objectives supporting document – coastal habitats. Version 1.0. National Parks and Wildlife Service, Department of Arts, Heritage, and the Gaeltacht.

NPWS (2012c) Lower River Shannon SAC (site code 2165). Conservation objectives supporting document – marine habitats and species. Version 1.0. National Parks and Wildlife Service, Department of Arts, Heritage, and the Gaeltacht.

NPWS (2012d) Conservation Objectives: Lower River Shannon SAC 002165. Version 1.0. National Parks and Wildlife Service, Department of Arts, Heritage, and the Gaeltacht.

NPWS (2012e) Conservation Objectives Series. River Shannon and River Fergus Estuaries SPA 004077. Version 1.0. Department of Arts, Heritage, and the Gaeltacht.

NPWS (2019). The Status of EU Protected Habitats and Species in Ireland. Volume 3: Species Assessments. Unpublished NPWS report. Edited by: Deirdre Lynn and Fionnuala O'Neill

NRA (2008) Guidelines for the Treatment of Otters prior to the Construction of National Road Schemes. National Roads Authority, St Martin's House, Waterloo Road, Dublin 4.

NRA (2010) 'Guidelines on the Management of Noxious Weeds and Non-Native Invasive Plant Species on National Roads' Revision 1. National Roads Authority, St Martin's House, Waterloo Road, Dublin 4

OPR (2021). Practice Note PN01: Appropriate Assessment Screening for Development Management. Office of the Planning Regulator, Dublin Ireland.

Popper, A.N. and Hastings, M.C. (2009) The effects of anthropogenic sources of sound on fishes. Journal of Fish Biology Vol 75, Issue 3.

Popper, A., Hawkins, A., Fay, R., Mann, D., Bartol, S., Carlson, T., Coombs, S., Ellison, W., Gentry, R., Halvorsen, M., Løkkeborg, S., Rogers, P., Southall, B., Zeddies, D., Tavolga, W., (2014), Sound Exposure Guidelines for Fishes and Sea Turtles: A Technical Report prepared by ANSI-Accredited Standards Committee S3/SC1 and registered with ANSI, ASA S3/SC1.4 TR-2014;

Reid, N., Hayden, B., Lundy, M.G., Pietravalle, S., McDonald, R.A. & Montgomery, W.I. (2013) National Otter Survey of Ireland 2010/12. Irish Wildlife Manuals No. 76. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht, Dublin, Ireland.

Roycroft, D., Cronin, M., Mackey, M., Ingram, S., O'Cadhla, O. (2007). Risk assessment for marine mammal and seabird populations in southwestern Irish waters (RAMSII). Coastal & Marine Resources Centre, UCC.

Simon Berrow, Joanne O'Brien, Lisa Groth, Aoife Foley, and Kerstin Voigt (2010) Bottlenose Dolphin SAC Survey 2010. Report to the National Parks and Wildlife Service. Shannon Dolphin and Wildlife Foundation. pp.24

Southall, Brandon L., Ann E. Bowles, William T. Ellison, James J. Finneran, Roger L. Gentry, Charles R. Greene Jr, David Kastak, *et al*., (2007). "Marine Mammal Noise-Exposure Criteria: Initial Scientific Recommendations." Aquatic Mammals 33 (4): 411–521.

Southall, Brandon L., James J. Finneran, Colleen Reichmuth, Paul E. Nachtigall, Darlene R. Ketten, Ann E. Bowles, William T. Ellison, Douglas P. Nowacek, and Peter L. Tyack. 2019. "Marine Mammal Noise Exposure Criteria: Updated Scientific Recommendations for Residual Hearing Effects." Aquatic Mammals 45 (2): 125–232.

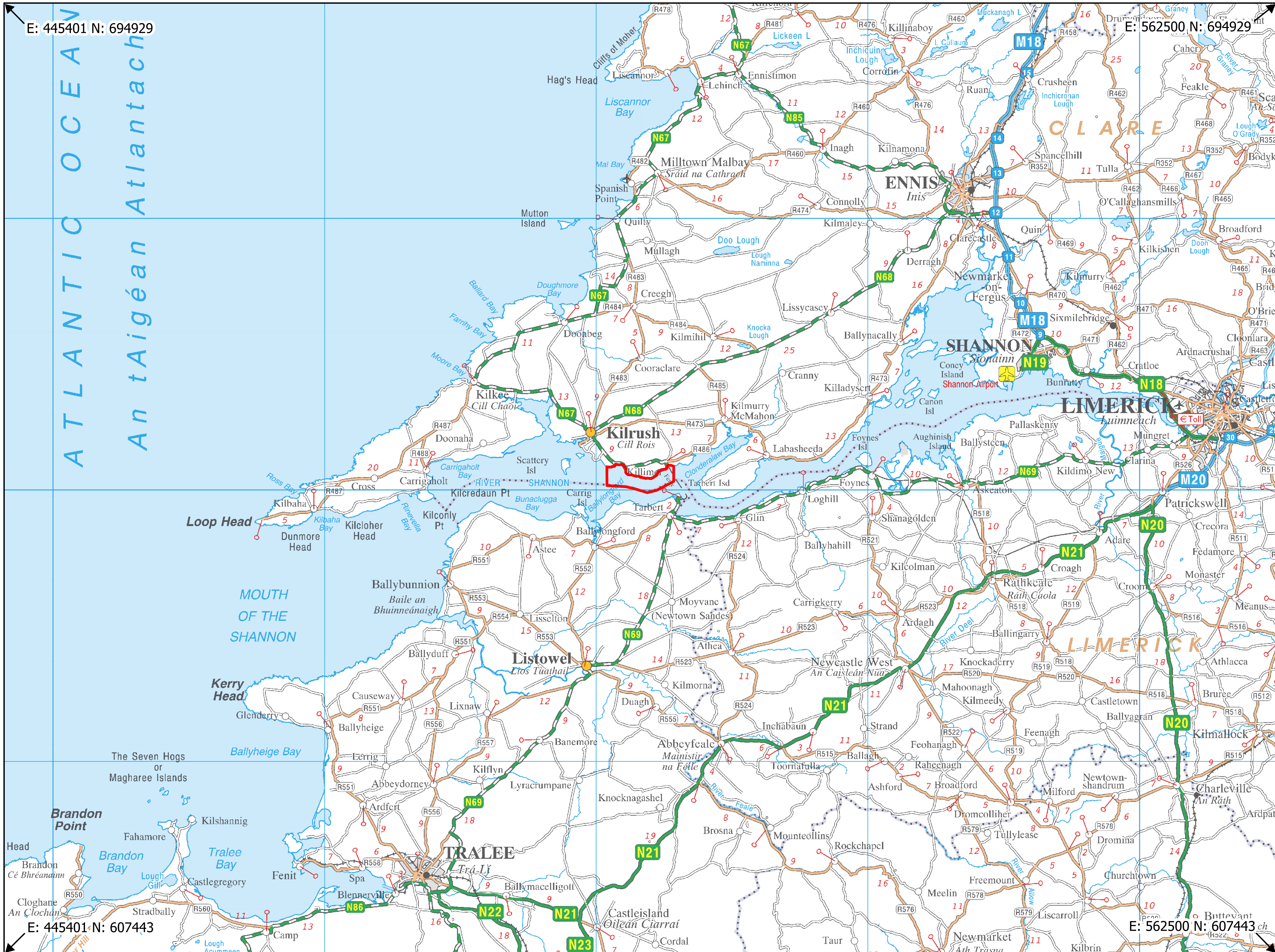
Strategic Integrated Framework Plan for the Shannon Estuary (SIFP), 2013-2020, An inter-jurisdictional land and marine based framework to guide the future development and management of the Shannon Estuary.

Van Waerebeek, K., Baker, A. N., Félix, F., Gedamke, J., I-iguez, M., and Sanino, G. P. (2007) Vessel collisions with small cetaceans worldwide and with large whales in the Southern Hemisphere, an initial assessment. Lat. Am. J. Aquat. Mammals 6, 43–69. doi: 10.5597/lajam00109.

Wacker, S., Larsen, B.M., Karlsson, S. and Hindar, K. (2019) Host specificity drives genetic structure in a freshwater mussel. *Sci Rep* **9,** 10409 (2019). https://doi.org/10.1038/s41598-019-46802-8

Walsh, P., Halley, D.J., Harris, M.P., del Nevo, A.; Sim, I.M.W. and Tasker, M.L. (1995). Seabird monitoring handbook for Britain and Ireland: a compilation of methods for survey and monitoring of breeding seabirds. JNCC, Peterborough.

Appendix A
Drawings



Legend

Area A, 927.53ha

N

Prepared By:

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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)

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0 5 10 15 km

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

PURPOSE OF ISSUE - PRELIMINARY UNLESS INDICATED

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

Energy for generations

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.

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

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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

PURPOSE OF ISSUE - PRELIMINARY UNLESS INDICATED

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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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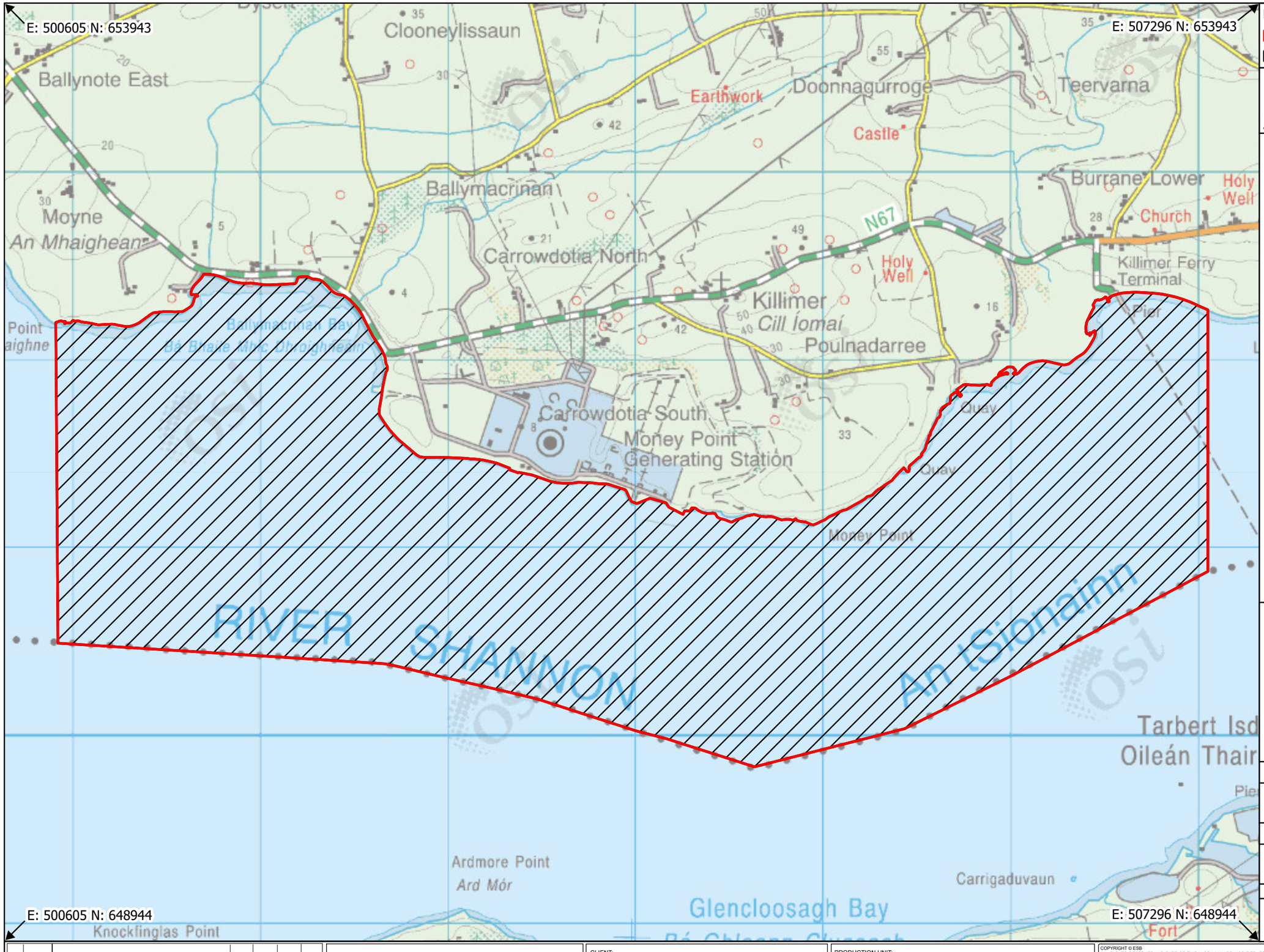
DRAWING NUMBER **QS-000339-01-D460-007-002-000**



Legend

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

N

Prepared By:

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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

PURPOSE OF ISSUE - PRELIMINARY UNLESS INDICATED

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

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Engineering and Major Projects is a division of ESB.

CLIENT: **ESB Generation & Trading**

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

PROJECT: **Moneypoint Hub Project Site Investigation**

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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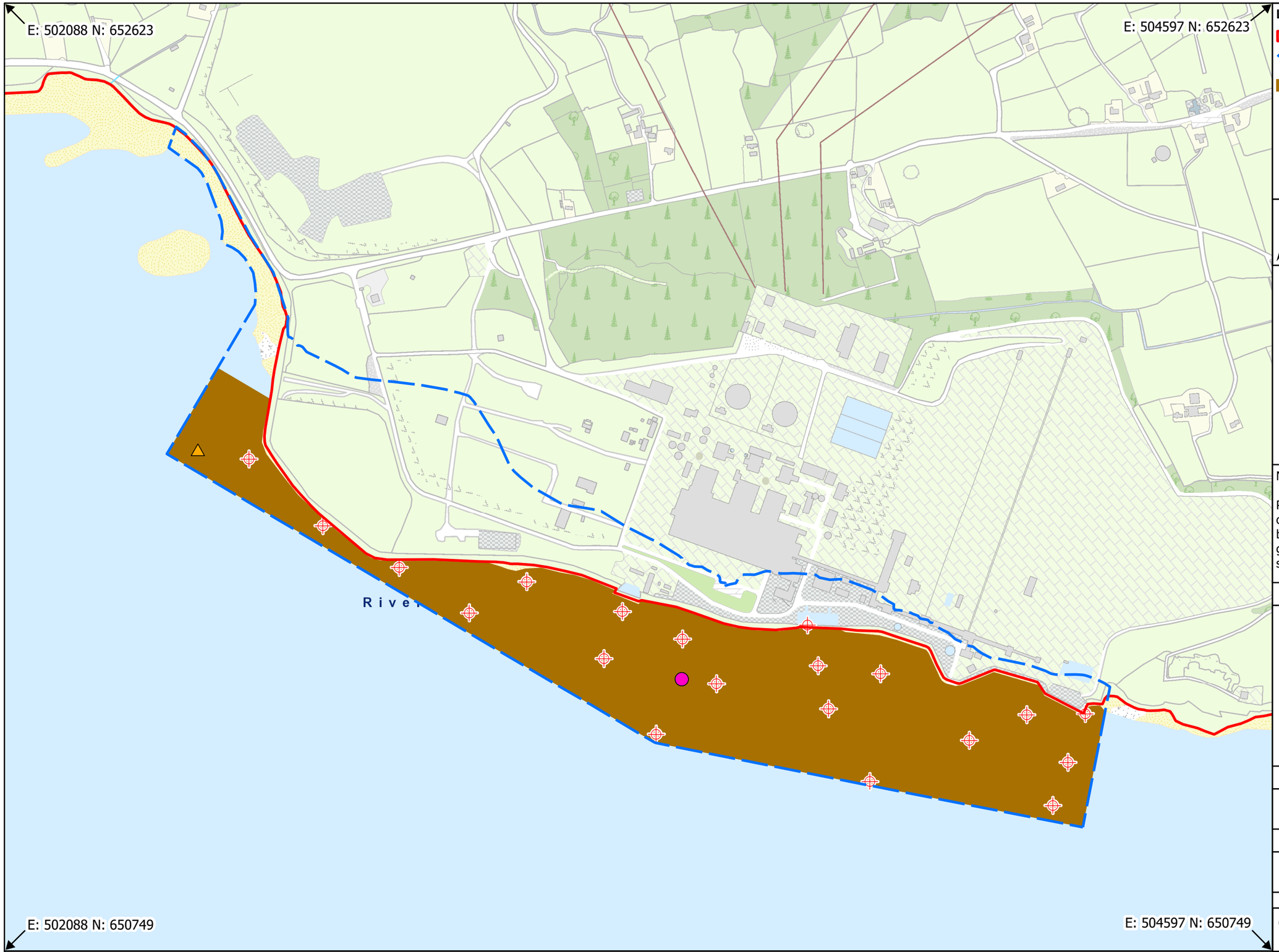
DRAWING NUMBER **QS-000339-01-D460-007-003-000**



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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[redacted]

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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

PURPOSE OF ISSUE - PRELIMINARY UNLESS INDICATED

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CLIENT: **ESB Generation & Trading**

PROJECT: **Moneypoint Hub Project Site Investigation**

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

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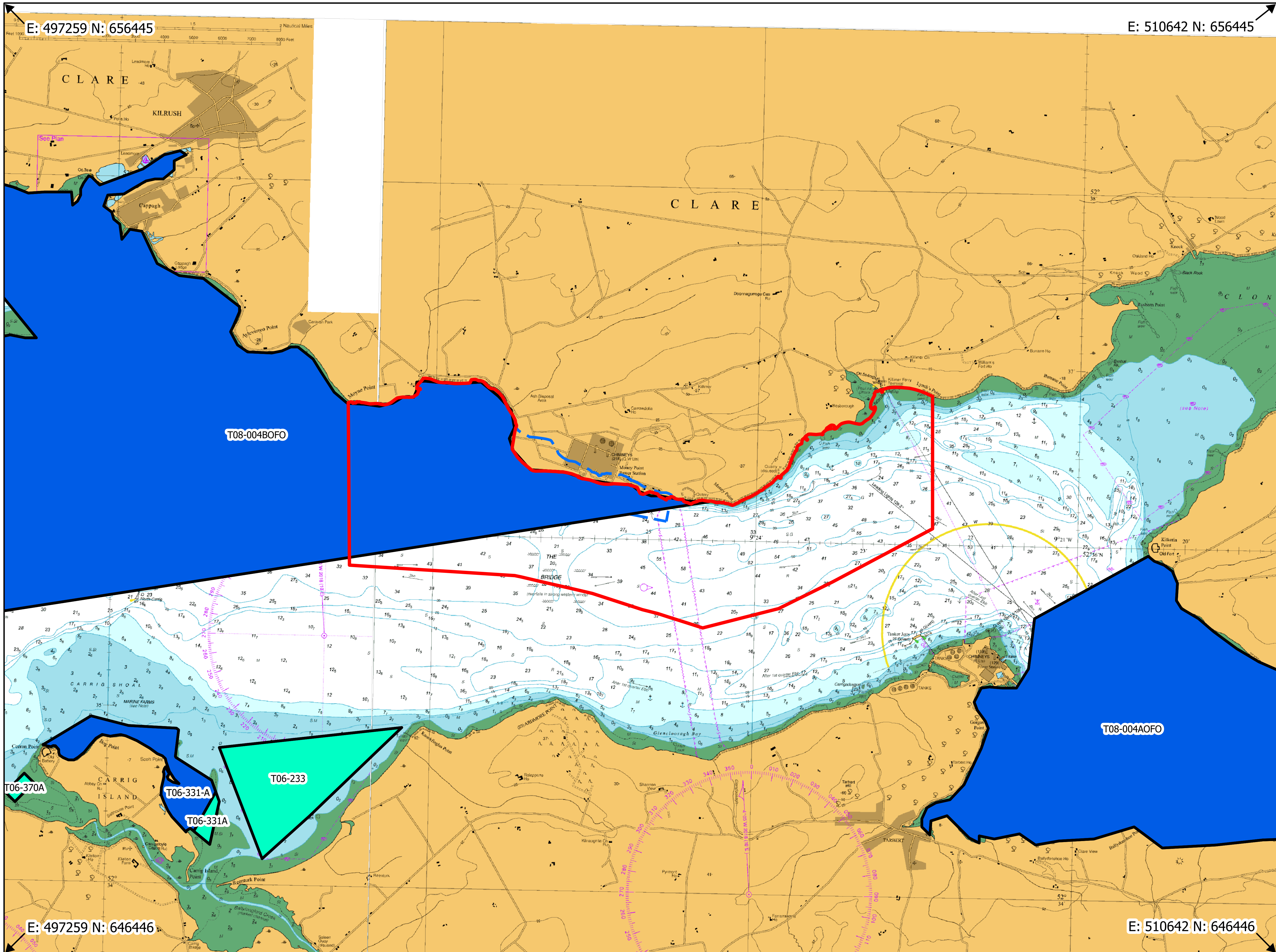
DRAWING NUMBER **QS-000339-01-D460-007-004-000**



Legend

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

N

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21/11/2023

Map Projection:
Irish Transverse Mercator (ITM)

Not to be used for Navigation

0 0.5 1 1.5 2 km

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

PURPOSE OF ISSUE - PRELIMINARY UNLESS INDICATED

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

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Engineering and Major Projects is a division of ESB.

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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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:

[redacted] 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. [redacted] has co-developed commercially available underwater noise modelling software, as well developed multiple source models for e.g. impact piling, seismic airgun arrays and sonars.

[redacted] s an Associate in Acoustics with RPS. He holds a BA BAI in Mechanical Engineering from Trinity College Dublin (2004) and a PhD in Acoustics and Vibration from Trinity College Dublin (2008). He is a Chartered Engineer with Engineers Ireland. [redacted] has 19 years' experience in environmental projects including planning applications and environmental impact assessments for a wide range of strategic infrastructure projects.

[redacted] is Technical Director in the Environmental Services Business Unit in RPS. He has over 24 years' experience. He holds an honours degree in Civil Engineering (B.E.) from NUI, Galway, a postgraduate diploma in Environmental Sustainability from NUI, Galway, and a Masters 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.

[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.

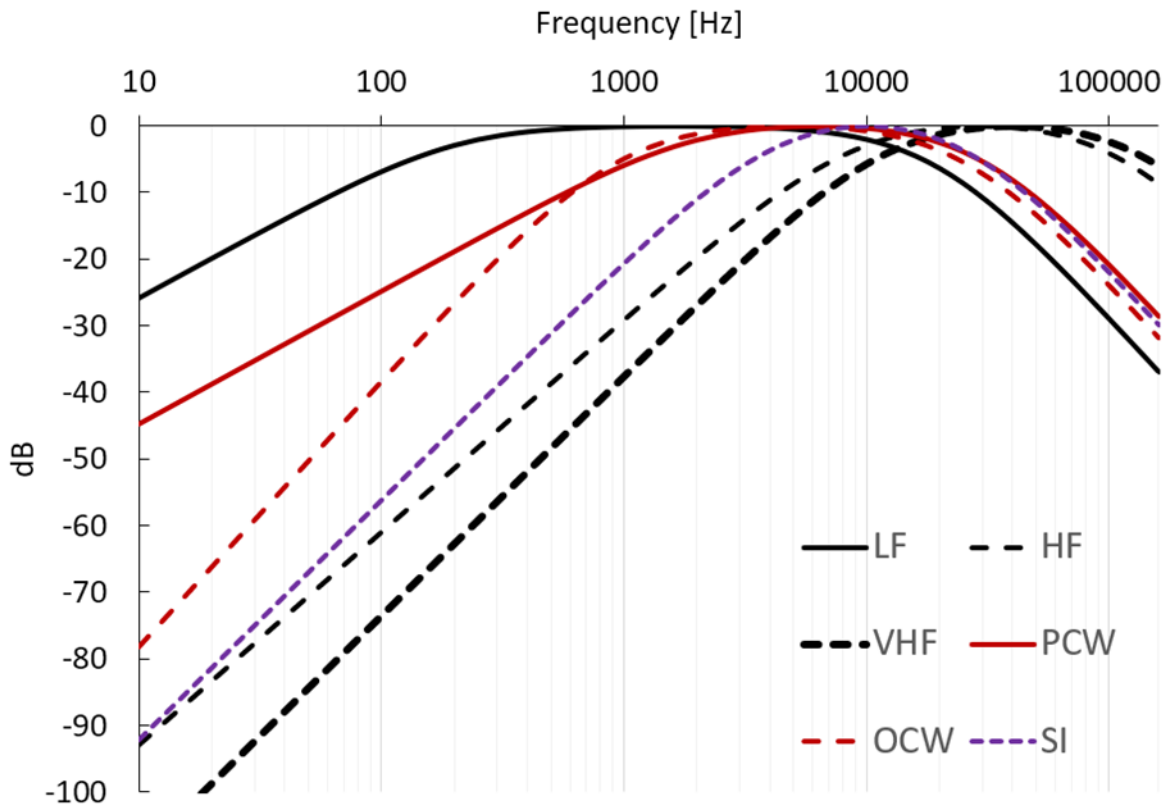

Figure 2.1 Hearing weighting functions for pinnipeds, cetaceans and sirenians (NMFS, 2018; Southall et al. 2019)

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

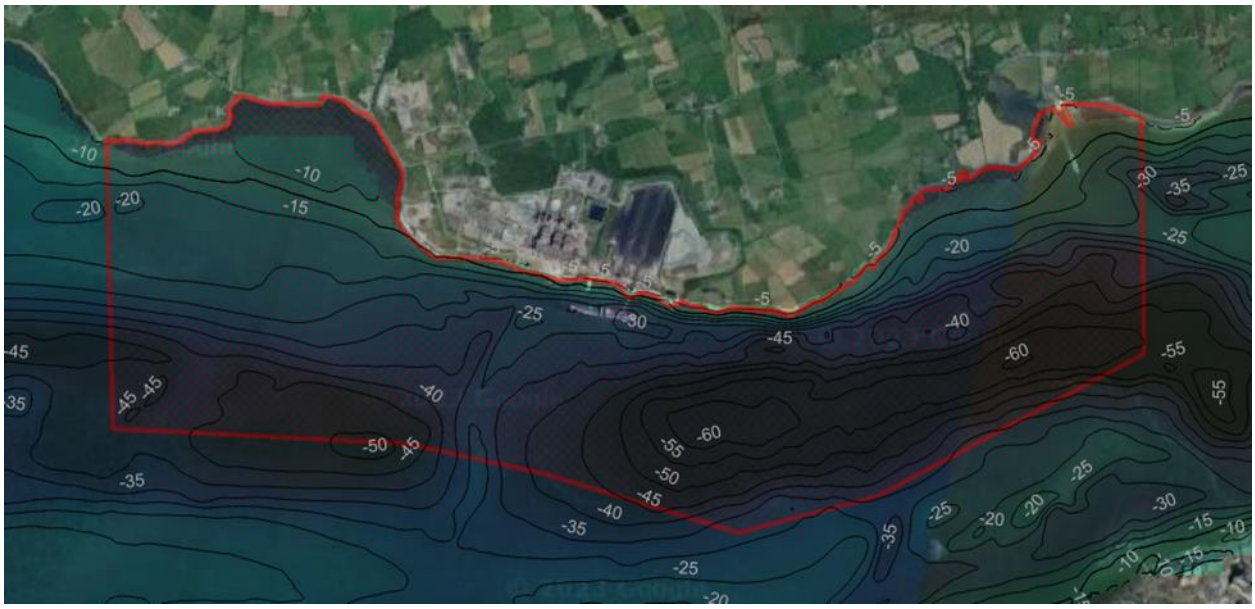

Figure 3.2 Site Investigation Survey Area

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

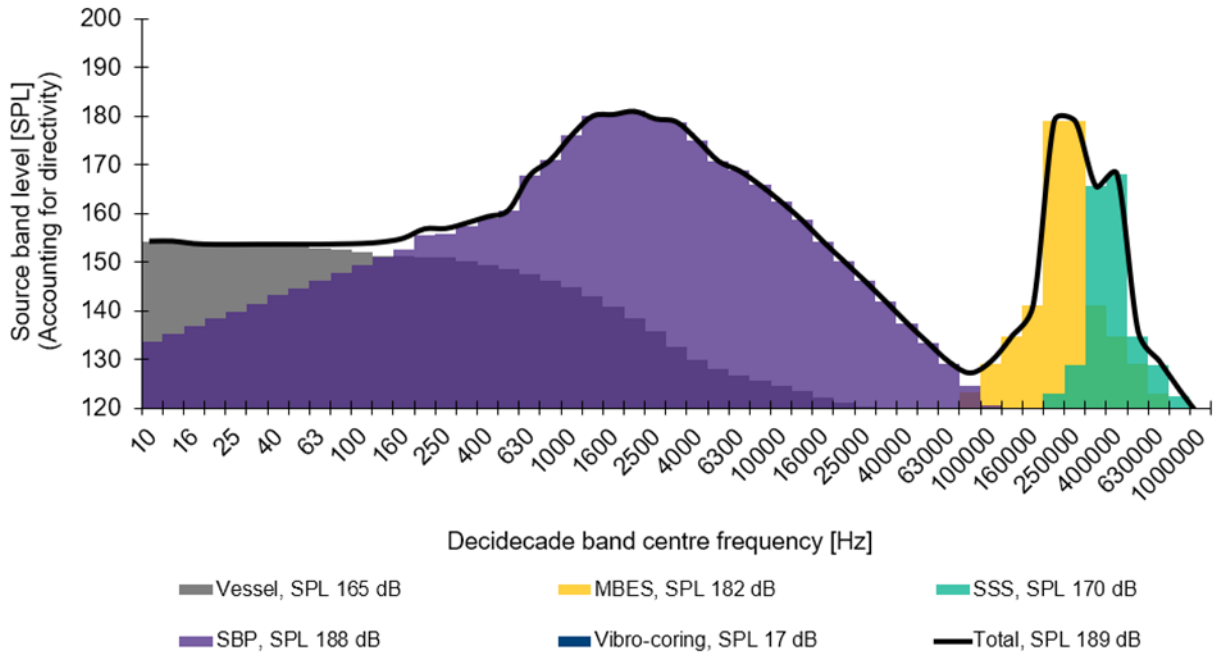

Figure 4.1 **Overview of sound sources as SPL at 1 m. Combined source (black solid line) represents source during survey without a parametric SBP (SBP 2 in Table 4.1)**

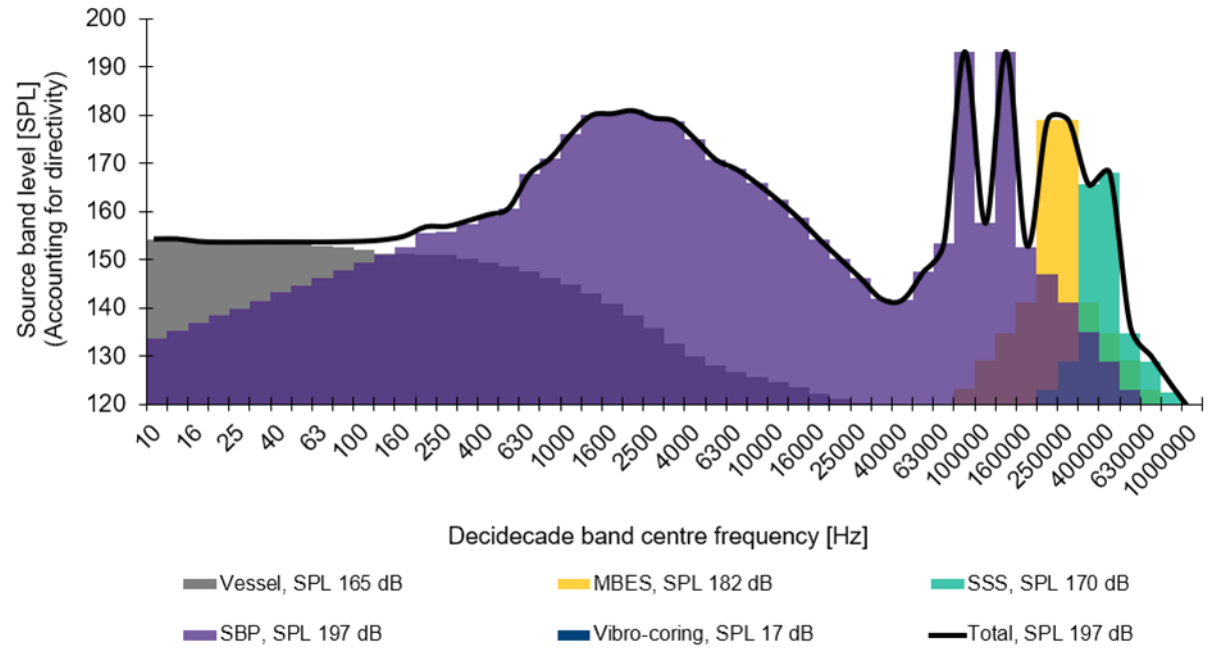

Figure 4.2 **Overview of sound sources as SPL at 1 m. Combined source (black solid line) represents source during survey with a parametric SBP (SBP 2 in Table 4.1)**

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.

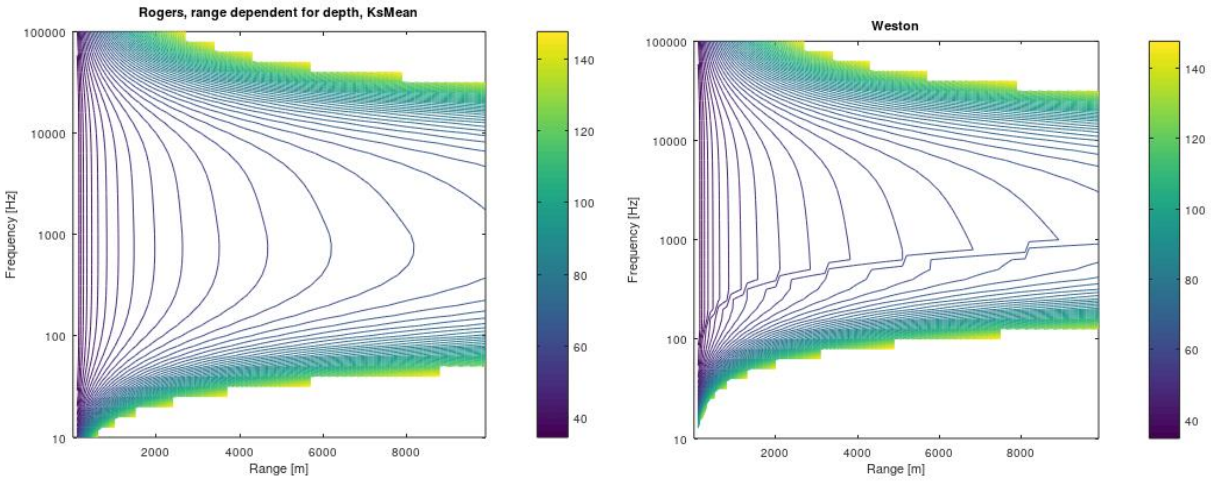

Figure 5.1 Comparison of two semi-empirical models over a sandy bottom at 30 m depth. Transmission loss in dB versus range and frequency

[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).

8 REFERENCES

Ainslie Michael A. Principles of Sonar Performance Modeling [Book]. - Heidelberg : Springer, 2010.

Benhemma-Le Gall A Graham IM, Merchant ND and Thompson PM Broad-Scale Responses of Harbor Porpoises to Pile-Driving and Vessel Activities During Offshore Windfarm Construction [Journal]. - [s.l.] : Frontiers in Marine Science, 2021. - 664724 : Vol. 8.

BOOTH C.G., HARWOOD, J., PLUNKETT, R, MENDES, S, & WALKER, R. Using the Interim PCoD framework to assess the potential impacts of offshore wind developments in Eastern English Waters on harbour porpoises in the North Sea [Report]. - [s.l.] : Natural England, 2017.

British Geological Survey Geology Viewer [Online] // British Geological Survey. - 11 05 2023. - 11 05 2023. - https://geologyviewer.bgs.ac.uk.

Bureau of Ocean Energy Management Appendix A: Description of Equipment. - [s.l.] : Bureau of Ocean Energy Management.

Center for Marine Acoustics Sound Source List. A description of sounds commonly produced during ocean exploration activity. [Report]. - [s.l.] : Bureau of Ocean Energy Management, 2023.

Department of Arts, heritage and the Gealtacht Guidance to Manage the Risk to Marine Mammals from Man-made Sound in Irish Waters [Report]. - [s.l.] : Department of Arts, heritage and the Gealtacht, 2014.

Frisk George V. Noiseonomics: The relationship between ambient noise levels in the sea and global economic trends [Journal]. - [s.l.] : nature, 2012. - 437 : Vol. 2.

Graham IM Merchant ND, Farcas A, Barton TR, Cheney B, Bono S, Thompson PM. Harbour porpoise responses to pile-driving diminish over time [Journal]. - [s.l.] : Royal Society Open Science, 2019. - 190335 : Vol. 6.

Heitmeyer Stephen C. Wales and Richard M. An ensemble source spectra model for merchant ship-radiated noise [Journal]. - Washington : Naval Research Laboratory, 2001.

INFOMAR Sea surface alkalinity across the Irish shelf from underway temperature and salinity data collected during the INFOMAR project [Report]. - Galway : NUI Galway, 2012.

Jakob Tougaard Line Hermannsen, Peter T. madsen How loud is the underwater noise from operating offshore wind turbines? [Report]. - [s.l.] : The Journal of the Acoustical Society of America, 2020.

Jensen Finn B. [et al.] Computational Ocean Acoustics [Book]. - [s.l.] : Springer, 2011.

JNCC JNCC guidelines for minimising the risk of injury to marine mammals from geophysical surveys [Report]. - [s.l.] : Joint Nature Conservation Committee, 2017.

JNCC Statutory nature conservation agency protocol for minimising the risk of injury to marine mammals from piling noise [Report]. - [s.l.] : Joint Nature Conservation Committee, 2010.

Martin S. Bruce and Klaus Lucke David R. Barclay Techniques for distinguishing between impulsive and non-impulsive sound in the context of regulating sound exposure for marine mammals [Journal]. - [s.l.] : Journal of the Acoustical Society of America, 2020. - 4 : Vol. 147.

MSFD Technical Subgroup on Underwater Noise Monitoring Guidance for Underwater Noise in European Seas, Part II: Monitoring Guidance Specifications [Report]. - [s.l.] : European commision, 2014.

National Marine Fisheries Service Scoping report for NMFS EIS for the National Acoustic Guidelines on Marine Mammals [Report]. - [s.l.] : National Marine Fisheries Service, 2005.

Popper A. N. [et al.] Sound Exposure Guidelines for Fishes and Sea Turtles [Report]. - [s.l.] : Springer, 2014.

Rogers P. H. Onboard Prediction of Propagation Loss in Shallow Water [Report]. - Washington DC : Naval Research Laboratory, 1981.

Rogers P. H. Onboard Prediction of Propagation Loss in Shallow Water [Report]. - Washington DC : Naval Research Laboratory, 1981.

Sarnoci´nska J Teilmann J, Balle JD, van Beest FM, Delefosse M and Tougaard J Harbor Porpoise (Phocoena phocoena) Reaction to a 3D Seismic Airgun Survey in the North Sea [Journal]. - [s.l.] : Frontiers in Marine Science, 2020. - 824 : Vol. 6.

Simard Yvan, RoyCédric Nathalie and Giard Gervaise Samuel Analysis and modeling of 255 source levels of merchant ships from an acoustic observatory along St. Lawrence Seaway [Journal]. - [s.l.] : journal of the Acoustical Society of America, 2016. - 2002 : Vol. 140.

Southall Brandon L. [et al.] Marine Mammal Noise Exposure Criteria: Updated Scientific Recommendations for Residual Hearing Effects [Journal]. - [s.l.] : Aquatic Mammals. - 2 : Vol. 45.

Weston D. E. Intensity-Range Relations in Oceanographic Acoustics [Report]. - Teddington : Admiralty Research Laboratory, 1971.

Wittekind Dietrich Kurt A Simple Model for the Underwater Noise Source Level of Ships [Journal]. - Schwentinental : DW-ShipConsult GmbH, 2014.

Worcester T. Effects of Seismic Energy on Fish; A Literature Review [Report]. - Dartmouth, Canada : Department of Fisheries and Oceans, Bedford Institute of Oceanography, 2006.

Appendix C
List of Other Projects

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, There may be temporal overlap with the project as there is potential for an additional Geophysical Survey in Q1 of 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

Ref.	Applicant and project location	Brief description of development	Status	Distance from project (km)	Spatial overlap?	Temporal overlap?
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
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 the 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.

Ref.	Applicant and project location	Brief description of development	Status	Distance from project (km)	Spatial overlap?	Temporal overlap?
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.
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.

Ref.	Applicant and project location	Brief description of development	Status	Distance from project (km)	Spatial overlap?	Temporal overlap?
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.
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.

Ref.	Applicant and project location	Brief description of development	Status	Distance from project (km)	Spatial overlap?	Temporal overlap?
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 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	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.

Ref.	Applicant and project location	Brief description of development	Status	Distance from project (km)	Spatial overlap?	Temporal overlap?
		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.				
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,	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	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.

Ref.	Applicant and project location	Brief description of development	Status	Distance from project (km)	Spatial overlap?	Temporal overlap?
	Tarbert Island (Townland), Co Kerry	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 (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	Further information requested 13/09/2023	8 km south-west	No	Potential however due to distance from works, no in-combination effects are likely.

Ref.	Applicant and project location	Brief description of development	Status	Distance from project (km)	Spatial overlap?	Temporal overlap?
		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 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.