Fuinneamh Sceirde Teoranta

Sceirde Rocks Offshore Wind Farm Foreshore Licence Application

Environmental Assessment and Environmental Impact Assessment Screening Report

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REVISIONS & APPROVALS

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1 INTRODUCTION

Green Investment Group Ltd (GIG) are the new owners of Fuinneamh Sceirde Teoranta (FST) and are progressing the development of the Sceirde Rocks Offshore Wind Farm off the west coast of County Galway.

Xodus Group Ltd (Xodus) has prepared this report on behalf of FST in support of an application for a Foreshore Licence under Section 3 of the Foreshore Act 1933, as amended, to carry out a site investigation campaign within the Foreshore Licence Area, which is set out and described below. The objective of the campaign is to gather geotechnical, geophysical, metocean, wind resource and environmental data to inform the development of the Sceirde Rocks Offshore Wind Farm.

1.1 Aim of this Report

This Environmental Assessment and Environmental Impact Assessment (EIA) Screening report is part of the Foreshore Licence Application to the Foreshore Section of the Department of Housing, Local Government and Heritage (DHLGH).

This report has been prepared to support an application to the Minister for Housing, Local Government and Heritage (the "Minister") under Section 13of the Foreshore Act 1933 as amended (the "Foreshore Acts") . It is submitted to the DHLGH to provide the Minister with environmental information to examine the possibility that the site investigation activities, either individually or in combination with other plans and projects, may result in significant negative environmental impacts. It also provides the Minister with the information required to inform the screening determination on whether the proposed site investigation activities should be subject to an EIA.

The requirement for EIA Screening under the EIA Directive 2011/92/EC, as amended, the Foreshore Acts and the Planning and Development Regulations 2001, as amended, is discussed in detail in Section 1.4 below. In summary, statutory EIA, and screening for EIA, are required only in relation to:

- Project types defined in Article 4 and listed in Annex I or Annex II of Council Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment, as revised by Directive 2014/52/EU (EIA Directive); and/or
- The corresponding classes of project which are transposed by the Foreshore Acts 1933, as amended, and listed in Schedule 5, Parts 1 and 2, of the Planning and Development Regulations 2001, as amended (Planning Regulations).

Part 1 of Schedule 5 of the Planning Regulations lists the project types for which EIA is mandatory, transposing Annex I of the EIA Directive. Part 2 lists project types for which EIA is mandatory if a specified threshold is exceeded. For all other project types listed in Part 2, corresponding to Annex II, which do not exceed a threshold or for which no threshold is set, a screening analysis and determination are required. If a proposed development is not of a project class listed in Annex I or II of the EIA Directive, or Schedule 5 of the Planning Regulations, the EIA Directive is not applicable.

The proposed site investigation activities considered in this document, comprising a geotechnical investigation, a geophysical survey, metocean and wind resource data gathering and a benthic ecology survey, do not constitute a project or development as listed in Part 1 or Part 2 of the Planning Regulations. Part 2 of Schedule 5 of the Regulations, under Class 2 Extractive Industry, mentions "deep drilling". The proposed geotechnical investigation involves shallow borehole drilling to a maximum of 70 m below the seabed and is not related to an extractive industry. Moreover, Class 2 specifically excludes drilling for investigating the stability of soil. The shallow boreholes proposed by FST are intended to investigate the stability and characteristics of the seabed and underlying shallow geology to inform the design of safe and effective turbine foundations, and cable installation, for a wind farm at the site.

This document also includes an Annex IV species statement, which addresses the Article 12 obligations of the European Community Habitats Directive 92/43/EEC, transposed into Irish law in Regulation 29 (1)(e)(i) of the European Communities (Birds and Natural Habitats) Regulations 2011. Information is submitted to assist the Minister in determining whether the Sceirde Rocks Offshore Wind Farm site investigations (the subject of this foreshore licence application), either individually or in combination with other activities, plans or projects, will have an adverse effect on the conservation status of animal species listed in Annex IV(a) to the Habitats Directive in their natural range.

This report should be read in conjunction with the following documents that make the complete Foreshore Licence Application package:

- Application Form - Investigative Foreshore Licence Application (Offshore Renewable Energy);
- Schedule of Activities (Document Reference L100725-S00-A-REPT-004);
- Report to Inform Appropriate Assessment Screening (Document Reference L100725-S00-A-REPT-005); and
- Natura Impact Statement (Document Reference L100725-S00-A-REPT-007)

1.2 Foreshore Licence Area

This Foreshore Licence Application seeks consent to conduct site investigation activities to inform the development of the Sceirde Rocks Offshore Wind Farm approximately 5 km off the coast of County Galway. Following completion of the site investigations, it is the intention of FST that an application to construct the Sceirde Rocks Offshore Wind Farm will be submitted under the Maritime Area Planning Act 2021.

This Foreshore Licence Application covers only the wind farm array area of the Sceirde Rocks Offshore Wind Farm. The Investigative Foreshore Licence Area is shown on Figure 1 and Figure 2 measures 141 km^2.

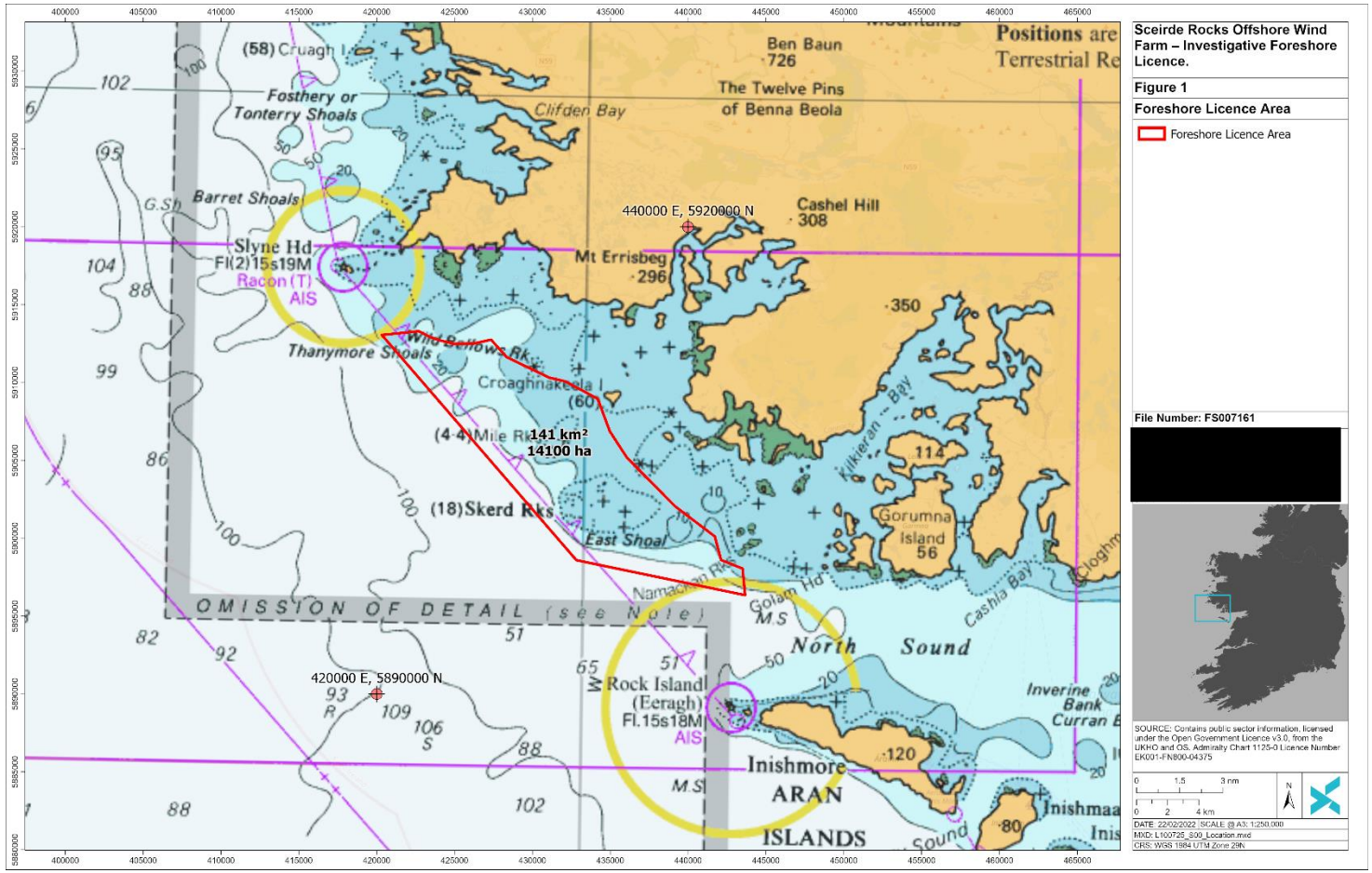

Figure 1 Foreshore Licence Area

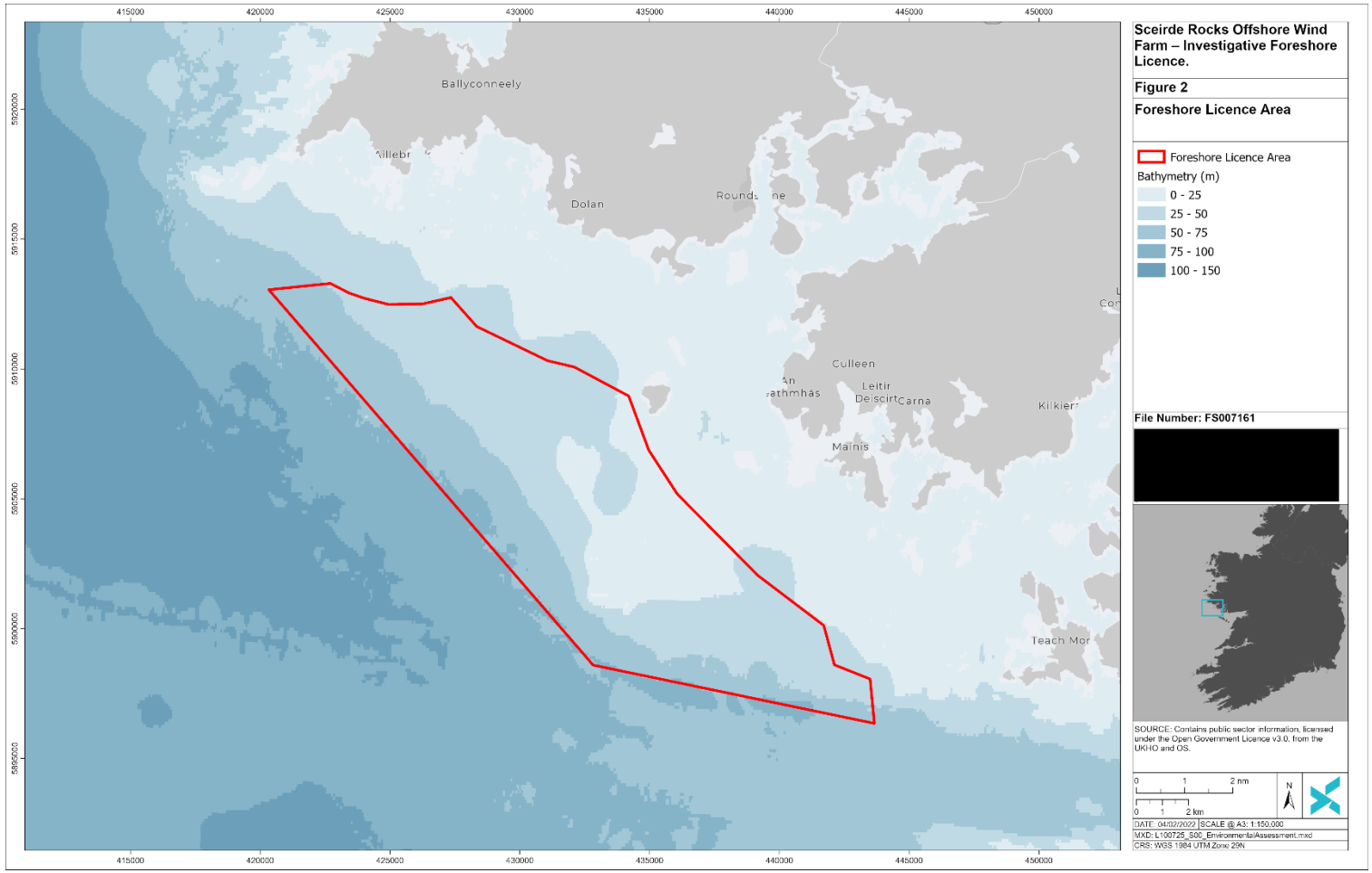

Figure 2 Foreshore Licence Area

1.3 Overview of Site Investigation Activities

The objective of the proposed Sceirde Rocks Offshore Wind Farm site investigations is to determine geotechnical, geophysical, metocean, wind resource and benthic characteristics within the Foreshore Licence Area. The data obtained and subsequent analyses will provide a greater and more detailed understanding of the existing seabed and sub-seabed conditions within the Foreshore Licence Area. The findings will be used to engage further with stakeholders, inform the design of Sceirde Rocks Offshore Wind Farm and begin the process of preparing the EIA Report and the Natura Impact Statement for the Project.

Full details of the scope and methodologies for each activity can be found in Section 2. A summary of the proposed surveys is given below in Table 1-1. Following a decision to grant the foreshore licence, it is the intention that surveys will commence as soon as practicably possible with a staged programme of site investigations taking account of suitable weather conditions. It is currently anticipated that surveys will begin in late 2022 or early 2023. It is possible that the investigations may be undertaken simultaneously and this is considered in the assessments provided in Sections 4 and 5.

The information provided in this report is based on all types of equipment that may be used, and activities that may be undertaken, during the proposed site investigations. Where there is uncertainty as to as the number of sampling locations or the duration or timing of activities, all options/scenarios have been taken into account in the context of the assessment and the potential impacts have been considered.

Table 1-1 Summary of proposed site investigations

Survey	Methods	Purpose and scope
Geotechnical	Borehole Sampling	Provide geotechnical data to aid with preliminary engineering, foundation design and array layout. Up to 60No. boreholes will be required using Cable Percussive Sampling and/or Rotary Coring techniques (depth of borehole will not exceed 70m).
	Down-hole Acoustic Imaging	Imaging of rock structure within boreholes to determine the nature, orientation and spacing of rock discontinuities and assess zones of core loss.
	Shallow sampling	Shallow sampling (60No. locations) may be used to determine the near surface sediment properties. This could utilise a combination of grab samples, Vibrocores, and gravity cores. These techniques would range from 0.5 to 6m penetration and would extract a shallow sample for further lab testing and visual descriptions.
	Cone Penetration Tests (CPT)	CPTs are used to derive in-situ geotechnical parameters. CPTs will be targeting Quaternary and pre-Quaternary sediments, where present. Up to 60No. CPT locations using Seafloor CPT methodology.
Preliminary bathymetric	Contiguous acquisitions	Multi-sensor survey to include some of the following: multibeam echosounder (MBES), side scan sonar (SSS), magnetometer, sub-

Survey	Methods	Purpose and scope
and geophysical		bottom profiler (SBP) and a seismic survey using Ultra High Resolution Seismic (Boomer/Sparker).
Metocean	Metocean measurement devices (e.g. Wave buoys)	Up to three metocean measurement devices (for example, wave buoys may be deployed at three different locations covering an extreme case and a site representative case to define wave height and direction).
Wind resource	Floating LiDAR Buoy	Floating LiDAR used to measure the wind resource within the Foreshore Licence Area. Up to two measurement locations considered due to the size of the area.
Benthic Ecology	Drop Down Video/Camera	Drop down video surveys provide visual data on environment epibiota and sediment type, this will be used to provide an overview of the seabed habitat. In addition, dive surveys may be required where a potential reef environment is identified.
	Water Sampling	Used to provide data on suspended sediment concentrations within the water column. This information will be used to inform decisions regarding coastal processes and sediment dynamics assessment. Data will be collected throughout the water column and over different tidal cycles
	Grab Sampling	Used to investigate sediment habitat types and determine physico-chemical characteristics (such as organic content and particle size) and macro-faunal analysis. Grab sampling conducted using 0.1 m^2 day grabs. Up to 40 grab sample stations (using day grab or van Veen grab) will be acquired across the site

1.4 Requirement for EIA Screening

1.4.1 The EIA Directive

EU Council Directive 2011/92/EU of 13 December 2011, as amended by Directive 2014/52/EU ("EIA Directive") establishes the framework for Member States to legislate on the assessment of the effects of certain projects on the environment.

Article 2(1) of the EIA Directive provides as follows:

> *"Member States shall adopt all measures necessary to ensure that, before development consent is given, projects likely to have significant effects on the environment by virtue, inter alia, of their nature, size or location are made subject to a requirement for development consent and an assessment with regard to their effects on the environment (an environmental impact assessment). Those projects are defined in Article 4". (Emphasis added)*

Article 4 provides as follows:

> *"1. Subject to Article 2(4), projects listed in Annex I shall be made subject to an assessment in accordance with Articles 5 to 10. [an environmental impact assessment]*
>
> *2. Subject to Article 2(4), for projects listed in Annex II, Member States shall determine whether the project shall be made subject to an assessment in accordance with Articles 5 to 10. Member States shall make that determination through:*
>
> *(a) a case-by-case examination; or*
>
> *(b) thresholds or criteria set by the Member State.*
>
> *Member States may decide to apply both procedures referred to in points (a) and (b)". (Emphasis added)*

Article 4(3) provides that, when a case-by-case examination is carried out or thresholds or criteria are set for the purpose of Article 4(2), the criteria set out in Annex III shall be taken into account.

As stated above, Annex I describes the categories of projects in respect of which an environmental impact assessment (EIA) is mandatory in all cases. It refers to such projects as crude oil refineries, thermal power stations, nuclear power installations, smelting of cast iron and steel, extraction and processing of asbestos, chemical installations, certain transport infrastructures, certain waste disposal installations, damns, pipelines, and a range of other industrial plants and installations.

Annex II lists the categories of projects in respect of which an EIA is required only where Member States so decide by reference to criteria set out in Annex III. They are listed under categories such as agriculture, silviculture and aquaculture, energy, metal production and processing, the mineral industry, chemical industry, food industry, textiles, leather, wood and paper industry, certain infrastructure projects not mentioned in Annex 1, tourism and leisure, and certain other projects.

Annex I and Annex II projects, in so far as they have been implemented into Irish law, and as they arise pursuant to the Foreshore Act, are set out and considered in further detail in Section 1.4.2 below.

The selection criteria in Annex III include characteristics of projects, location of projects and characteristics of the potential impact. Under the heading "Characteristics of projects", Annex III stipulates that regard must be had to:

> *"(a) the size of the project;*
>
> *(b) the cumulation with other projects; (emphasis added)*
>
> *(c) the use of natural resource;*
>
> *(d) the production of waste;*
>
> *(e) pollution and nuisances;*
>
> *(f) the risk of accidents having regard in particular to substances or technologies used".*

1.4.2 The Foreshore Act and the Planning and Development Regulations

Section 13A(1)(a) of the Foreshore Act 1933, as amended, provides as follows:

> *"The appropriate Minister shall as part of his consideration of a relevant application, in accordance with para. (b) ensure that, before a decision on the application is given, projects likely to have significant effects on the environment by virtue, inter alia, of their nature, size or location, are made subject to an environmental impact assessment".*

Section 13A(1)(b)(i) provides: -

> *"An environmental impact assessment shall be carried out by the appropriate Minister in respect of a relevant application for consent, where the proposed development would be of a class specified".*

In describing the "*class specified*", the section continues by referring to Parts 1 and 2 of Schedule 5 to the Planning and Development Regulations 2001. These Parts broadly correspond to Annex I and Annex II to the EIA Directive (described in Section 1.4.1 above).

Section 13A(1)(b)(i) of the Foreshore Act provides that:

> *"An environmental impact assessment shall be carried out by the appropriate Minister in respect of a relevant application for consent where the proposed development would be of a class specified in:*
>
> *(I) Part 1 of Schedule 5 of the Planning and Development Regulations 2001, and either —*
>
> *(A) such development would exceed any relevant quantity, area or other limit specified in that Part, or*
>
> *(B) no quantity, area or other limit is specified in that Part in respect of the development concerned,*
>
> *or*
>
> *(II) Part 2 of Schedule 5 of the Planning and Development Regulations 2001 and either —*
>
> *(A) such development would exceed any relevant quantity, area or other limit specified in that Part, or*
>
> *(B) no quantity, area or other limit is specified in that Part in respect of the development concerned."*

Regarding Annex II development or Part 2 of Schedule 5 of the Planning and Development Regulations 2001 (S.I. No. 600 of 2001) as amended -

> *"(ii) An environmental impact assessment shall be carried out by the appropriate Minister in respect of a proposed development where:*
>
> > *(I) such development would be of a class specified in Part 2 of Schedule 5 to the Planning and Development Regulations 2001 (S.I. No. 600 of 2001) but does not exceed the relevant quantity, area or other limit specified in that Part, **and***
> >
> > *(II) the appropriate Minister determines that the proposed development would be likely to have significant effects on the environment."*

If the proposed Sceirde Rocks Offshore Wind Farm site investigation activities do not fall under Annex I or Annex II of the EIA Directive, or Schedule 5 of the Planning Regulations 2001, as amended, the EIA Directive does not apply to the proposed site investigations.

However, if the proposed site investigation activities are a project type under Part 2 of Schedule 5 where there is no quantity, area or other limit specified in that part in respect of the type of development, the wording pursuant to Section 13A(1)(b)(i)(II)(B) states that an EIA shall be carried out if the Minister determines that the proposed development would be likely to have significant effects on the environment. The Planning Regulations 2001 requires an EIA screening determination as a first step.

1.4.3 Relevance to the proposed site investigations

Part I and Part 2 of Schedule 5 of the Planning Regulations have been reviewed in detail. The proposed site investigation activities applied for in this foreshore licence application are not a project type or class listed in Part 1 of Schedule 5 of the Planning Regulations. The only class of project type listed in Part 2 of the Planning Regulations that could arguably be relevant to the site investigation activities is that listed under Class 2 Extractive Industry. Class 2 mentions various extractive industries including peat, aggregates, minerals, coal, oil and gas and lists under Class 2(e) several types of "deep" drilling which are undertaken by certain extractive industries and which involve the construction of wells.

The proposed site investigation activities are not an extractive industry project and therefore do not fall into Class 2. Nonetheless, consideration has been given to Class 2(e) since the geotechnical part of the site investigation activities includes shallow drilling and rotary coring methods to obtain samples from boreholes, as described in Section 2.1.1. Up to 70 borehole samples might be obtained from within the Foreshore Licence Area and will be used to establish the ground conditions and any hazards, to inform engineering design and layout for a future offshore windfarm. Boreholes for geotechnical investigations are different in many respects from wells drilled by the extractive industries such as oil and gas. For example:

- A well is a proper construction, with various cement linings inside the wellbore, special completion structures installed at the bottom and a wellhead installed on the seabed above it, whereas a borehole is a narrow hole in the seabed;
- A well is considerably deeper (several 100s-1000s of metres) and wider (over a metre diameter at the top) than a borehole (the SI boreholes will be a maximum of 70 m deep and up to 100 mm diameter).

- A well takes a few months to drill and complete whereas each borehole sample is expected to be obtained in a matter of hours to a few days.
- A hydrocarbon well may extend into oil-bearing reservoirs with corresponding risk of spillage to the environment, while boreholes carry no such risk.

Class 2 Extractive Industry as it relates to drilling states as follows:

> *(e)"**With the exception of drilling for investigating the stability of the soil,** deep drilling, consisting of— ..... (iv) any other deep drilling, except where, in considering whether or not an environmental impact assessment should be carried out—*
>
> *(IV) it is decided, in accordance with section 13A of the Foreshore Act 1933 ..., by the appropriate Minister ... that the drilling concerned would not have a significant effect on the environment,"* [Emphasis added]

Even if the shallow borehole drilling which forms part of the proposed site investigation activities and this foreshore licence application are considered as part of an extractive industry (which it is not), it falls within "drilling for investigating the stability of the soil" and does not fall within a project type under Class 2(e).

Even if Class 2(e) did apply (which it does not), it is our opinion, that and having regard to the relevant criteria in Annex III (Schedule 7 of the Planning Regulations 2001, as amended), that the proposed site investigation activities are not likely to have a significant effect on the environment as presented in this report (particularly Section 4).

However, it is a matter for the Minister ultimately to determine whether the proposed site investigation activities are likely to have a significant effect on the environment, having regard the requirements of the EIA Directive, Section 13A of the Foreshore Act, and Schedules 5 and 7 of the Planning Regulations, prior to the grant of a foreshore licence. This report has been prepared to inform any such determination and inform any EIA screening assessment.

1.5 Structure of the Report

This Environmental Assessment and EIA Screening Report is presented in the following sections:

Section 1	*Introduction* – provides a background to the Sceirde Rocks Offshore Wind Farm Foreshore Licence Application and the purpose of this report
Section 2	*Proposed Site Investigations* – describes the activities of the proposed site investigations.
Section 3	*Overview of the Existing Environment* – describes the baseline environment in and around the Foreshore Licence Area based on currently available information.
Section 4	*Assessment of Environmental Effects* – Assesses the environmental effects of the proposed site investigation activities alone and cumulatively with other projects and provides the information required to support EIA Screening.
Section 5	*Risk Assessment for Annex IV Species* – identifies the Annex IV species requiring assessment under Article 12 obligations and assesses the potential for adverse effects on their conservation status from the site investigations alone and in combination with other activities, plans and projects.
Section 6	*Overall Conclusions*

Section 7 *References*

2 PROPOSED SITE INVESTIGATIONS

2.1 Geotechnical Site Investigations

It is currently proposed that geotechnical surveys are phased to account for uncertainty and to allow the preliminary investigation to inform future surveys. Phasing will consist of:

- A preliminary investigation for general ground conditions and potential hazard assessment;
- A main investigation for specific ground conditions; and
- An infill survey covering additional locations or to investigate newly identified hazards.

A foreshore license with a timeline of 5 years is being requested to allow phases of survey activity. This phasing is the industry accepted approach to obtaining geotechnical data. It is likely that the main investigation and infill survey phases will be undertaken over several years as the data requirements for the project evolves.

The primary objectives of the geotechnical investigations are to inform the project engineering, consenting requirements and generally reduce project uncertainty with respect to site characterisation. The data collected through these surveys will facilitate decision making on engineering, foundation design and array layout optioneering.

During the geotechnical investigations, included in this foreshore licence application, the following methods (described below in Section 2.1.1, Section 2.1.2 and Section 2.1.4) will be used in collaboration to ensure that a comprehensive understanding of the subsurface environment of the Foreshore Licence Area is obtained.

The preliminary geotechnical sampling may comprise:

- Up to 60No. boreholes, which may include cable percussive or rotary coring techniques, for example. The borehole depths will not exceed 70m;
- Up to 60No. seafloor CPTs undertaken across the site; and
- Shallow sampling (potentially using Vibrocore techniques at up to 60 locations).

At this stage, exact borehole locations within the Foreshore Licence Area will be confirmed following appointment of a suitable qualified survey contractor. Borehole locations will be chosen to obtain site-wide coverage and will be determined based on the best locations to help define geological boundaries and obtain samples in all the anticipated geological units. Final borehole locations and CPT locations can be provided to the Department of Housing, Local Government and Heritage prior to survey mobilisation if requested.

2.1.1 Borehole Sampling

The geotechnical surveys will be performed at various water depths by either a Dynamic Positioning (DP) controlled and heave-compensated drillship, a Jack-up vessel, or by means of seabed drilling equipment.

Vessels will be fully equipped with ultra-short baseline (USBL) system for accurate positioning of boreholes. Vessel selection will depend on the water depth, environmental conditions and seabed soils. At this stage, the potential for challenging seabed conditions means that a jack up vessel may be required. The survey methodology will comprise a combination of drilling techniques, such as cable percussive drilling, with follow-on rotary coring techniques. The boreholes will provide in-situ information on sediment and rock type and distribution and provide samples for laboratory testing. The data collection will support decision making on engineering, foundation design and array layout optioneering.

Cable Percussive Drilling

Cable percussive drilling is one drilling technique to target seabed and sub-seabed sediments which overlie rock. This includes coarse-grained sediments such as sand and gravel, and fine-grained sediments such as clay and silt. Casing will be utilised to stabilise the borehole walls through the superficial sediments.

Within coarse-grained sediments, percussive sampling, such as hammer samples, will be undertaken at regular intervals. In-situ standard penetration testing (SPT) will also be undertaken, generally alternating with percussive sampling. Bulk-disturbed and small-disturbed samples will be undertaken, where appropriate.

Within fine-grained sediments, hammer or push samples will be undertaken at regular intervals, alternating with SPT testing. Undisturbed, bulk disturbed and small disturbed samples are anticipated to be taken to enable a range of laboratory tests.

Samples will be appropriately preserved and stored prior to transportation to onshore laboratories for geotechnical testing. An offshore laboratory will also be provided on the vessel to enable classification and index testing to be undertaken, along with preliminary core and sample logging.

Rotary Coring Techniques

Rotary coring is anticipated to comprise double or triple-tubed coring depending on the nature of the rock. The drilling operations typically utilise a drilling fluid to help flush drill cuttings from the bore, cool the drill bit and generally aid drilling performance; drilling fluids are typically certified for offshore use and may comprise biodegradable, miscible guar gum, or similar, and seawater.

The retrieved core is anticipated to be approximately 100mm in diameter but may potentially be reduced to 70mm. The majority of the underlying rocks are anticipated to be high-strength granitoid rocks, with minor zones of limestone around the southern margin.

The extracted rock core will be photographed, logged and sub-sampled offshore. Samples will be appropriately preserved and stored prior to transportation to onshore laboratories for geotechnical testing. Classification and index testing of the rock to be undertaken in the offshore laboratory.

2.1.2 Down-hole Testing including Acoustic Imaging

It is anticipated that some level of down-hole testing may be undertaken which could include video imaging, acoustic imaging, dilatometer testing, etc... For example, the purpose of down-hole acoustic imaging is to provide an image of the rock structure to determine the nature, orientation and spacing of any rock discontinuities within the Foreshore Licence Application Site.

The process involves sending an acoustic imaging camera down the borehole, which takes a 360° image of the rock face. This can show features such as voids or fractures and can also give an indication of the orientation of discontinuities. This is important for understanding the in-situ fracture spacing and orientation of beds, which can then be used to develop three-dimensional models of the rock. The images can also be used to assess zones of core loss and adjust borehole logs accordingly.

Acoustic imaging requires a stable borehole and therefore requires casing through unstable surficial sediments and extension of casing to support deeper unstable zones. Acoustic imaging cannot be undertaken through the cased section of a borehole and therefore the strategy for performing the survey may require modification based on the general nature of the rock encountered.

2.1.3 Shallow Sampling (eg. Vibrocores)

Shallow sampling may be used to determine the near surface sediment properties. This could utilise a combination of grab samples, Vibrocores, and gravity cores for example. These techniques would range from 0.5 to 6m penetration and would extract a shallow sample for further lab testing and visual descriptions.

2.1.4 Cone Penetration Tests (CPT)

Seabed CPTs consist of a self-contained and automated CPT test unit, housed within a seabed frame and connected to the DP vessel via a lift wire and data transfer umbilical. The frame is kept on deck of the DP vessel and deployed over the side using a dedicated Launch Recovery System (LARS) or through a moonpool. Once positioned on the seafloor, the cone is pushed at a constant rate into the seabed until either target penetration is achieved or refusal reached. Refusal may be due to maximum thrust reached, excessive load experience on the tip or the sleeve, or excessive cone inclination.

The configuration of the CPT unit used for the preliminary survey will be defined by the target penetration depth. The maximum penetration depth anticipated for this Foreshore Licence Area is circa 50m, however final selection of the CPT unit will be determined on the basis of sediment thicknesses estimated from the geophysical survey data. This preliminary depth places this CPT site investigation within the category of deep seabed CPT testing, which would require a 20 to 25 tonne CPT unit. CPT testing to this sort of depth takes a few hours from unit deployment to recovery back on deck. Where the technical requirements are not met at a location, the CPT unit may be lifted a small distance from the seabed and repositioned horizontally so that another test can be attempted.

2.1.5 USBL Specification and Use

USBL systems are used to determine the position of subsea survey items, including Remotely Operated Vehicles (ROVs), towed devices, grab samplers, etc. This involves the emission of sound from a vessel-mounted transducer to a subsea transponder, thereby introducing sound into the marine environment. A USBL system consists of a transducer, which is mounted on the vessel and a transponder attached to the ROV. The transducer transmits acoustics through the water and the transponder sends a response which is detected by the transducer. The USBL calculates the bearing and time taken for the transmissions to be completed and thus the position of the subsea unit / sampling equipment is determined. These systems can either be used continuously or intermittently through the operation they are supporting.

The survey vessel will visit each individual borehole location in turn. Accurate positioning of the boreholes will be achieved using an ultra-short baseline (USBL) system. These systems include a transceiver which is mounted on the hull of the survey vessel and a transponder or beacon which will be mounted on the seabed frame during deployment. Transponders emit pulses of medium frequency sound. The peak sound pressure level (SPL) was estimated as 207 dB re 1 µPa at 1 m for the Kongsberg HiPap 500 (Austin *et al.*, 2012).

Transmissions are not continuous but consist of short 'chirps' with a duration that ranges from 3 to 40 milliseconds. Transponders will not emit any sound when on standby. For general positioning and when lowering the seabed frame, they will emit one chirp every five seconds. When required for precise positioning, they will emit one chirp every second. Use of the USBL and beacon is expected to take from a few minutes to 1.5 hours per station depending on the water depth. Once the seabed frame is on the seabed, stationary and a final fix has been recorded, the USBL will be turned off.

2.1.6 Coring Fluids and Discharges

Borehole coring may be conducted with seawater only, with no added chemicals. It is possible that coring fluids may be used when required. The most likely fluid in this case would be an organic, biodegradable, high performance water-based mud (HPWBM). Bentonite will also be carried onboard in case it is needed and this may sometimes be mixed with soda ash. All proposed coring fluid products are rated as PLONOR (posing little or no risk to the environment) and contain only OCNS Gold/Silver, E or D rated chemicals. Final details of the coring fluids to be used will be known upon appointment of the survey contractor.

Only minimal amounts of cuttings will be discharged because 80 - 90% of the core is recovered for analysis. Cuttings are discharged and will settle close to the seabed and are estimated to amount to <0.25 m^3 per borehole.

2.1.7 Summary

Activity	Activity time	Total number of SI locations	Total SI duration	Footprint per SI location [m^2]	Total SI footprint [m^2]	Affected area as a % of the foreshore license area
Borehole	48 – 96 hours per location	60	1 – 2 months over several phases over a 5 year window	1 – 2	60 – 120	8.5e-5%
Jack up vessel	-	60	-	20	1200	8.5e-4%
CPT	2 – 6 hours per location	60	1 – 2 months over several phases over a 5 year window	4-8	240-480	3.4e-4%
Shallow sampling	3 hours per location	60	1 – 2 months over several phases over a 5 year window	0.1	6	4.3e-6%

2.2 Geophysical Survey Investigations

The proposed geophysical survey programme involves a multi-disciplinary approach that is designed to acquire a full suite of data which includes a multibeam echosounder, side scan sonar, magnetometer, sub-bottom profiler and a seismic survey using a slightly higher energy source (only if sufficient depth data cannot be obtained using the sub-bottom profiler). The collected data will be used to better understand the water depths, topography and relief structure of the seabed and the subsurface structure, in particular the sub-surface stratigraphy, determining sediment strata and the elevation of competent bedrock. To inform the suitability of a cable corridor area, understanding the top ~5m is crucial. The process is non-intrusive and at no point will the equipment used make contact with the seafloor. The exact equipment to be used will be confirmed following a tender process to procure the site investigation contractor however the operating frequencies outlined in Table 2-3 represent the operating frequencies employed in site investigations for offshore wind.

The objectives of the geophysical survey shall be:

- To obtain up to date high-resolution water depth measurements across the site;
- To obtain information on the seabed surface (type, texture, variability, etc.) and in particular, to identify any seabed features that may be of interest to the overall project;
- Identify any shallow geohazards and man-made hazards (including but not limited to outcropping rock, boulders, shallow gas, wrecks, debris etc.);
- Determine the stratigraphy across the site and quantify the variability in the lateral and vertical extents to depths greater than foundation depth, if necessary;
- Identify the presence of bedrock within the site boundary and the thickness of the overburden deposits;
- Identify any magnetic anomalies;
- Identify marine habitat areas as the basis for a benthic survey to be carried out;
- Identify sensitive marine habitats which will need to be avoided during geotechnical and environmental sampling.
- Provide information for identification of archaeological targets.

During the geophysical investigations, included in this foreshore licence application, the following methods (described below in Sections 2.2.1, 2.2.2, 2.2.3, 2.2.4 and 2.2.5) will be used in collaboration to ensure that a comprehensive understanding of the subsurface environment of the Foreshore Licence Area is obtained.

2.2.1 Multibeam Echosounder (MBES)

A Multibeam Echosounder (MBES) system will be used to provide detailed bathymetric mapping throughout the survey area.

MBES dual head system will be hull mounted. The exact equipment used will be confirmed following the appointment of a survey contractor. The R2 Sonic 2024 or the Kongsberg EM2040 may be taken as an example (Plate 1). Operating frequencies for offshore wind are in the regions of 200kHz (minimum) and can be up to 700kHz.

MBES is non-intrusive therefore does not interact with the sea floor. MBES may be undertaken across the site to a suitable percentage coverage.

Plate 1 Multibeam Echosounder (EM2040)

2.2.2 Side Scan Sonar (SSS)

Side Scan Sonar (SSS) is a towed sensor which is towed behind the vessel on an armoured tow cable, although some models can be pole mounted on the side of the vessel. SSS will be a dual frequency hydrographic sonar used to produce seabed imagery. A Side Scan Sonar (SSS) system will be used to provide detailed imagery of the seabed throughout the survey area which will aid with seafloor sediment/bedrock and geomorphology mapping as well as for identifying any shallow geohazards.

Side scan systems are available from a number of manufacturers. These units vary in size, working and technical characteristics and acquisition configuration (towed or vessel mounted). Presently, dual frequency digital systems are available in the market which allows more survey flexibility; some systems can acquire and record both frequencies swaths independently and simultaneously. Using these systems, operator may use a higher frequency to produce sharper images and narrow swath or use the lower frequencies to obtain wider seabed coverage at lower resolutions. The exact equipment used will be confirmed following the appointment of a survey contractor. The operating frequency range for offshore wind purposes is between 300 to 900 kHz.

The system will be adequate to the depth range of the study area and the seabed discrimination level required. The design of transects will consider the geographic and depth extent of the study area, seabed coverage ratio, overlap coverage desired, priority areas to survey, prevailing winds and currents, etc. Often, the complete coverage of the seabed is the ultimate goal of an acoustic survey design, to enable the creation of full mosaics. In these cases, theoretically, parallel transects should be run to produce up to 100% ensonification of the seafloor. When complete coverage is not necessary to define seabed boundaries, consecutive swaths may not overlap can be adequate. However, in some cases, transect spacing of is less than the swath width can provide reasonable overlapping to compensate any loss in data quality at the outer range limits. This is very dependable on metocean conditions and the survey will be planned accordingly by an experienced survey team.

SSS is non-intrusive therefore does not interact with the seafloor. SSS may be undertaken across the site to a suitable percentage coverage.

Plate 2 Example of a Towable Side Scan Sonar Data Device (EdgeTech)

2.2.3 Magnetometer

A magnetometer is a passive device that is towed behind a survey vessel. It is used to detect ferrous objects on the surface or in the subsurface. Magnetometer surveys are widely used prior to intrusive works to highlight any obstruction or potential risk such as existing infrastructure, shipwrecks and unexploded ordnance.

The vessel will tow a submerged pod (Magnetometer) piggy-backed to the side scan sonar. The exact equipment used will be confirmed following the appointment of a survey contractor. The marine magnetometer will be of the Caesium Vapour type and capable of recording variations in magnetic field strength during survey to an accuracy of ±0.5nT.

A Magnetometer is non-intrusive therefore does not interact with the sea floor. It may be undertaken across the site to a suitable percentage coverage and the parameters of the survey may be determined by the requirements of the Underwater Archaeology Unit of the National Monuments Service. Their requirements are set out in Table 2-1

Table 2-1 Underwater Archaeology Unit Requirements for Magnetometer Survey

ACTIVITY	REQUIREMENTS FOR ARCHAEOLOGICAL PURPOSES
Side Scan Sonar	1. Operational frequency of 200 to 700kHz. 2. 50m survey line spacing 3. 100% site coverage (overlap of areas may be required)
Magnetometer	4. Caesium or proton magnetometer 5. 50m side spacing

Plate 3 Magnetometer Example (Geometrics)

2.2.4 Sub-Bottom Profiling (SBP)

Shallow Sub-Bottom Profiling aims to create a 2-D image of the subsurface up to potential depths of approximately 10-50 m below seabed, depending on the geological conditions encountered and the choice of system used greater penetration can be achieved. Different types of SBP are available including chirp, pinger and parametric chirp systems. The most appropriate system will be decided depending on the seabed, anticipated geological environment and the objectives of the survey.

A Sub-Bottom Profiling (SBP) system may be used to determine the stratigraphy across the site and quantify the variability in the lateral and vertical extents to a depth of at least 50m below seabed.

The Seatronics Edgetech 3300 may be taken as an indicative example of a hull-mounted pinger system and would have an expected operating frequency range of approximately 2-16 kHz with sound pressure levels of 200dB re1µPa at 1 metre range. This survey is non-intrusive therefore does not interact with the sea floor. It may be undertaken across the site to a suitable percentage coverage.

Plate 4 Example of Boomer Sub-Bottom Profiler

Plate 5 Example of Pinger Sub-Bottom Profiler

2.2.5 Ultra High Resolution Seismic (UHRS)

Higher energy seismic sources (boomer and sparker) may be used to determine the stratigraphy across the site and quantify the variability in the lateral and vertical extents to a depth of at least 50m below seabed, depending on the geological conditions encountered and the choice of system used greater penetration can be achieved.

The Applied Acoustics may be taken as an indicative example of a boomer source and would have an expected operating frequency of approximately 2.5 kHz with sound pressure levels in the range of 208-215dB re1µPa at 1 metre range. The Geo-Source 200 or the Applied Acoustics Squid 500 may be taken as an indicative example of a towed sparker system, with sound pressure levels in the range of 204-216dB.

Multi-channel acoustic surveys using higher energy sources are used to image the subsurface and categorise sediment strata. These surveys can create ultra-high resolution 2D or 3D images of the subsurface whilst achieving greater depths than sub-bottom profiling systems. The intensity of the source can vary depending on the requirements of the survey. These surveys will only be used if sufficient depth data is not achieved with the use of the SBP method in Section 2.2.4.

This survey is non-intrusive therefore does not interact with the seafloor. It may be undertaken across the site to a suitable percentage coverage.

Plate 6 Example of Sparker sub-bottom profiler

2.2.6 Summary

ACTIVITY	ACTIVITY TIME	COVERAGE	TOTAL SI DURATION
Bathymetric and Geophysical surveys	2-3 months	100%	2-3 months of activity in different phases over the 5 year licence period

2.3 Metocean Site Investigations

Metocean site investigations are necessary to evaluate the wave and current conditions across the Foreshore Licence Area. The data will be used to help define the design parameters of the Sceirde Rocks Offshore Wind Farm foundations, as well as the conditions to be expected during the installation and maintenance of the project. The site investigations will require the use of two wave buoys with a minimum 12 month but possibly up to 24 month measuring campaign to reduce the uncertainty of the final metocean assessment.

2.3.1 Metocean Measurement Devices (e.g. Wave Buoys)

Metocean site investigation will require the installation of up to three metocean devices, such as wave buoys. Wave buoys are designed to follow movement at the water surface and gather the relevant wave data. Each wave buoy is anchored to the sea floor using a length of highly elastic rubber chord and suitably sized anchor structure. The elasticity of this chord allows the buoy to ride and follow the movement of the water surface. A real time data feed with a GSM and satellite communication system transmits the collected data from the buoy to a receiver station onshore. The wave buoy specifications include: an LED light for detection, an integrated datalogger for backup data storage, GPS position, a solar powered battery and an internal backup battery pack.

At this stage, exact locations of the metocean devices within the Foreshore Licence Area will be confirmed following appointment of a suitable qualified survey contractor. Final device locations can be provided to the Department of Housing, Local Government and Heritage prior to survey mobilisation if requested.

The data to be collected from the metocean site investigations of the Foreshore Licence Area include:

- Location (latitude, longitude)
- Significant wave height (Hs)
- Maximum wave height (Hmax)
- Peak wave period (Tp)
- Mean wave period (Tz)
- Wave direction
- Directional spreading
- Sea temperature

2.3.2 Survey Summary

ACTIVITY	ACTIVITY TIME	TOTAL NUMBER OF SI LOCATIONS	TOTAL SI DURATION	SI AFFECTED FOOTPRINT [M^2]	TOTAL FOOTPRINT [M^2]	AFFECTED AREA AS PROPORTION OF THE FORESHORE LICENSE AREA
Metocean Measurement Devices	12 – 24 months per location	3	12 – 24 months	10	20	1.4e-5%

2.4 Wind Resource Site Investigations

Wind resource measurements are required to accurately estimate the wind conditions across the Sceirde Rocks Offshore Wind Farm site. The data collected will be used to assess the energy production from the wind farm including daily and seasonal patterns. The wind data is also used as one of the inputs for the engineering design of the wind turbine, turbine layout and foundation structures.

The wind resource measurement campaign will last a minimum of 12 months but could last more than 24 months (depending on project development programme) in order to gather more data to reduce uncertainty of the future wind resource and energy yield estimates, as well as to provide contingency for any unforeseen issues with data measurements.

2.4.1 Proposed wind resource measurement campaign locations

It is expected that up to two wind measurement locations (using floating LiDAR) will be situated within the Foreshore Licence Area. At this stage, exact deployment locations of the floating LiDAR devices within the Foreshore Licence Area will be confirmed following appointment of a suitable qualified survey contractor. Final device locations can be provided to the DHLGH prior to survey mobilisation if requested

2.4.2 Floating LiDAR systems

A floating LiDAR system (FLS) is usually a small (2 m to 3 m across) buoy moored using a gravity anchor. It houses a LiDAR (Light Detection And Ranging) device which uses laser to measure wind speed and direction at a range of heights, up to 100 m to 200 m above the device. The buoy also houses all the necessary processing equipment, power supply systems (solar panels, small scale wind turbine generators, and batteries), additional measurement systems required for the data monitoring (such as key metocean and atmospheric characteristics), as well as auxiliary systems for marine navigation safety. The data is stored on the device, as well as uploaded to a remote storage via a GSM or satellite link.

There are several FLS providers, and the final design used for the measurement campaign at Sceirde Rocks Offshore Wind Farm will be known following appointment of the survey contractor. FLS would be deployed, serviced, and decommissioned using an installation vessel.

Two FLS buoys will be deployed in the Foreshore Licence Area in order to improve the accuracy of the wind resource estimates, as well as provide additional contingency should one of the devices experience any issues.

2.4.3 Summary

ACTIVITY	ACTIVITY TIME	TOTAL NUMBER OF SI LOCATIONS	TOTAL SI DURATION	SI AFFECTED FOOTPRINT [M^2]	TOTAL FOOTPRINT [M^2]	AFFECTED AREA AS PROPORTION OF THE FORESHORE LICENSE AREA
Floating LiDAR system	12 – 24 months per location	2	12 – 24 months	10	20	1.4e-5%

2.5 Benthic Ecology Site Investigations

The purpose of the benthic ecology site investigations is to identify the extent and distribution of marine benthic communities and habitats within the Foreshore Licence Area.

At this stage, exact benthic sample locations within the Foreshore Licence Area will be confirmed following appointment of a suitable qualified survey contractor. The sample locations will be selected to ensure that samples are collected from different habitats to generate a representative overview of the Foreshore Licence Area benthic habitat. Final benthic sample locations can be provided to the Department of Housing, Local Government and Heritage prior to survey mobilisation if requested.

The survey data acquisition for assessing benthic ecology and sediment dynamics will include drop down camera/Remotely Operated Vehicle (ROV), water column sampling and grab sampling.

An indicative overview of the habitats encountered across the proposed project site can be determined from the offshore component of the adjacent Kilkieran Bay and Islands SAC. The expected habitats may include:

- Sediment dominated communities.
- Subtidal reef communities of varying exposures; and
- Intertidal reef communities (associated with rocky outcrops within the project site).

Of these, it is the sediment dominated communities present within the Foreshore Licence Area that will be subject to the benthic grab sampling regime. While there is expected to be subtidal rocky/stony substrata across the area, the exact positions of these will be confirmed from analysis of geophysical data prior to final selection of the benthic sampling locations. Where a benthic grab sample station is confirmed to be rocky substrata, only drop down camera/ROV visual data will be acquired for habitat assessment (possibly supplemented by diver survey in littoral zone).

It is proposed that up to 40 grab sample stations (using day grab or van Veen grab) will be acquired across the site. The proposed benthic grab sample stations will coincide with the proposed geotechnical borehole locations outlined in Section 2.1, with additional benthic stations selected to fill in gaps to ensure a comprehensive coverage

of the habitats present, which will capture the range of depths and exposures. It is expected that the seabed will be comprised of mixed sediments which may range from pebbles, gravels to finer sands which will be determined by the acoustic data acquisition. A stratified random sampling regime across the Foreshore Licence Area has been adopted to determine the baseline environment.

The number of sample stations has been selected in order to ensure that sampling is representative and sufficient and that any species that occur in low densities or are locally rare are identified.

The benthic sampling acquisition will include up to 4 replicate grabs at each station. Three replicates will be used for macro-faunal analysis, and the fourth will be sub-sampled for physico-chemical analysis (i.e. Particle size analysis (PSA) and organic content). The replication of samples is proposed to provide a statistically robust macro-faunal data set to inform the environmental baseline and future monitoring.

Assuming all grab stations are acquired, a total of up to 160 grabs would be taken, each disturbing an area of 0.1 m^2. Therefore, the total area of seabed that would be directly affected by the gab sampling regime will be 16 m^2.

In any case where benthic sampling is not possible, drop down video/camera analysis would be sufficient to establish the benthic ecology present.

2.5.1 Summary

ACTIVITY	ACTIVITY TIME	TOTAL NUMBER OF SI LOCATIONS	TOTAL SI DURATION	SI AFFECTED FOOTPRINT [M^2]	TOTAL FOOTPRINT [M^2]	AFFECTED AREA AS PROPORTION OF THE FORESHORE LICENSE AREA
Benthic grab sample	3 hours per location	40 (x 4 grabs at each location = 160 grabs)	2-3 weeks	0.1	16	1.1e-5%

2.6 Survey Vessels

Each of the proposed site investigation surveys included in this foreshore licence application will require the use of a small number of vessels for the efficient deployment, execution and recovery of the site investigation activities. Given the nature of the survey activities, all vessels will be slow moving.

The survey contractor vessels will comply with international and national statute as appropriate including but not limited to:

- Sea Pollution Act 1991 and International Convention for the Prevention of Marine Pollution from Ships (MARPOL 73/78);

- Sea Pollution (Amendment) Act 1999 and International Convention on Oil Pollution Preparedness, Response and Co-operation 1990;
- S.I No. 372/2012 Sea Pollution (Prevention of Pollution by Garbage from Ships) Regulations 2012;
- S.I. No. 492/2012 Sea Pollution (Prevention of Pollution by Sewage from Ships) (Amendment) Regulations 2012; and
- SI. No. 507/2012 Merchant Shipping (Collision Regulations) (Ships and Water-Craft on the Water) Order 2012

The largest vessel to be used is the geotechnical survey vessel. Indicative parameters are provided in Table 2-2.

Table 2-2 Geotechnical investigation vessel indicative parameters

PARAMETER	VALUE
Registered tonnage	5,400 – 7,000 tonnes
Length	80-110m
Breadth	20-25m
Draft	6-8m

2.7 Noise Sources from Survey Works

The range of likely noise frequency and sound pressure associated with the survey methodologies identified in this document is summarised in Table 2-3 below.

Noise emissions associated with the survey vessels are continuous in nature. Use of a DP system constitutes the greatest noise source for this type of vessel. Hartkin *et al.* (2011) found that source pressure levels reached a maximum of 170 dB within 1 m of the thrustors, whilst the vessel was on DP.

Source noise levels for rotary coring of 165dB re 1µpa @1 m (Subacoustech Environmental Ltd, 2018) and source noise levels for percussive drilling of 185dB re 1µpa @1 m (Subacoustech Environmental Ltd, 2018).

Details of the exact equipment to be used will not be known until completion of survey contractor procurement, however the ranges provided below in Table 2-3 are considered a worst case not to be exceeded by chosen equipment and are applicable for consideration of potential impacts on the environment which is presented in the following documents also submitted with this foreshore licence application:

- Report to inform Appropriate Assessment Screening;
- EIA Screening and Environmental Assessment Report (including Annex IV species risk assessment); and
- Natura Impact Statement.

Table 2-3 Summary of Indicative Survey Methodology Operating Sound Pressures

NOISE SOURCE	FREQUENCY	SOUND PRESSURE LEVEL (DB RE 1µPA @1 M)
USBL	19.5 – 33.5 kHz	207
Geotechnical Drilling	2 Hz – 50 kHz	160-185
Shipping Noise	<1kHz	160 – 185
Multi-beam echo sounder	200 – 700 kHz	200 – 228
Side scan sonar	300 – 900 kHz	228
SBP (Pinger, Chirp, Parametric)	2-16 kHz	200-226
UHRS (Sparker/Boomer)	2.5 kHz	204-216 / 208-215

Further detail on the equipment specifications used in underwater noise modelling to inform the assessment of potential impacts is provided in Section 4.4.4.

2.8 Timeline For Site Investigations and Summary

Following grant of the foreshore licence, it is the intention that surveys will commence as soon as practicably possible with a stage programme of site investigations taking account of suitable weather conditions. It is currently anticipated that surveys will begin in late 2022 or early 2023. A foreshore license with a timeline of 5 years is being requested to allow surveys to be undertaken in phases across the licence period

3 OVERVIEW OF THE EXISTING ENVIRONMENT

This section provides an overview of the existing environment in and around the proposed Foreshore Licence Area to inform this environmental assessment. The focus is on those features and activities that could potentially interact with the proposed site investigations.

It should be noted that one of the objectives of the proposed site investigations is to obtain relevant data to inform a future EIA Report and Natura Impact Statement of any future Sceirde Rocks Offshore Wind Farm project consent application. Available existing data (and data gaps) have informed both the design of the surveys and this assessment.

Information has been drawn from a variety of sources including published papers on scientific research in the area and industry-wide information at a strategic or regional level, including but not limited to:

- Ireland's Marine Atlas: Marine Strategy Framework Directive Predominant Habitat Type (Marine Institute, 2021a);
- Reports generated from the ObSERVE programme (Berrow et al, 2018; Rogan et al, 2018; Jessop et al, 2018);
- The Atlas of Cetacean Distribution in North-West European Waters (Reid et al, 2003);
- Data on the spawning and nursery grounds of commercially important species (Marine Institute, 2021b);
- The Atlas of Commercial Fisheries around Ireland (Marine Institute, 2019); and
- Fisheries sensitivity maps in British and Irish waters (Coull et al., 1998) in conjunction with spawning and nursery maps of selected fish species in Irish waters (Ellis et al., 2012).

3.1 Physical Environment

The Foreshore Licence Area lies in coastal waters on the Irish Shelf, approximately 5 km off the southwest coast of county Galway, in water depths ranging from approximately 20 m to 70 m (see Figure 2).

Winds throughout the west coast of Ireland are extremely variable in both direction and speed, owing to the frequent passage of Atlantic depressions into the area from the mid North Atlantic and due to the North Atlantic Oscillation (NAO). Most frequently, winds blow from the west to south-west. However, when a stationary anti-cyclone develops over or west of Ireland and Britain (often during spring and/or autumn), an easterly to north-easterly wind may persist for up to several weeks. The annual average wave height increases from the southeast to the northwest of the site, ranging overall from <1 m to approximately 3 m (Marine Institute, 2005). The deployment of wave buoys and floating LiDAR during the stie investigations will provide site-specific metocean data to inform the wind farm design and EIA.

The area is influenced by water currents moving predominantly south to north around the western coast of Ireland (Marine Institute, 2021a).

3.2 Benthic Habitats and Communities

The only existing site-specific information is from a diver survey carried out in a very small and relatively shallow of the current Foreshore Licence Area in 2005. This showed that the seabed in that area was predominantly rock with

a thin veneer of rippled sands. The seabed was mostly flat with some bedrock outcrops. Exposed rock was seen to support kelp forests with algal understories and encrusting epifauna such as echinoderms and sponges.

Seabed sediments on the Irish shelf are highly varied. Sediments in the vicinity of the current Foreshore Licence Area are a mix of low to moderate energy muds, sands and coarse sediment with a high density of rocky areas towards the coast. Publicly available information on the seabed habitat types in and around the Foreshore Licence Area is shown in Figure 3. Under the EUNIS habitat classification system, the Foreshore Licence Area is predicted to be predominantly "shallow circalittoral", with areas of "deep circalittoral" along the western and southern boundaries and a shallower area of "infralittoral" habitat in the southern part as shown on the first map in Figure 3 (EUSeamap, 2019). Although the INFOMAR marine substrate data shown in the central map in Figure 3 do not cover the present area of interest within the Foreshore Licence Area, these data confirm that the shallow circalittoral and infralittoral seabed in adjacent areas at similar water depths includes mixed sediments as well as areas of rocky reef. Data from the National Parks and Wildlife Service (NPWS, 2019) suggest the possible presence of reefs throughout the Foreshore Licence Area.

In terms of features of conservation interest, rocky areas potentially qualifying as Annex I reef habitat may be present along much of this coastline including within the Foreshore Licence Area. To the southeast, the inshore waters of Kilkieran Bay fall within the category of 'large shallow inlets and bays' and support a wide range of habitats. The OSPAR-listed threatened or declining marine habitats 'Maerl beds' (OSPAR, 2010a) and 'Seapens and burrowing megafauna' (OSPAR, 2010b) are present inland of the array area but not within the Foreshore Licence Area (third map in Figure 3).

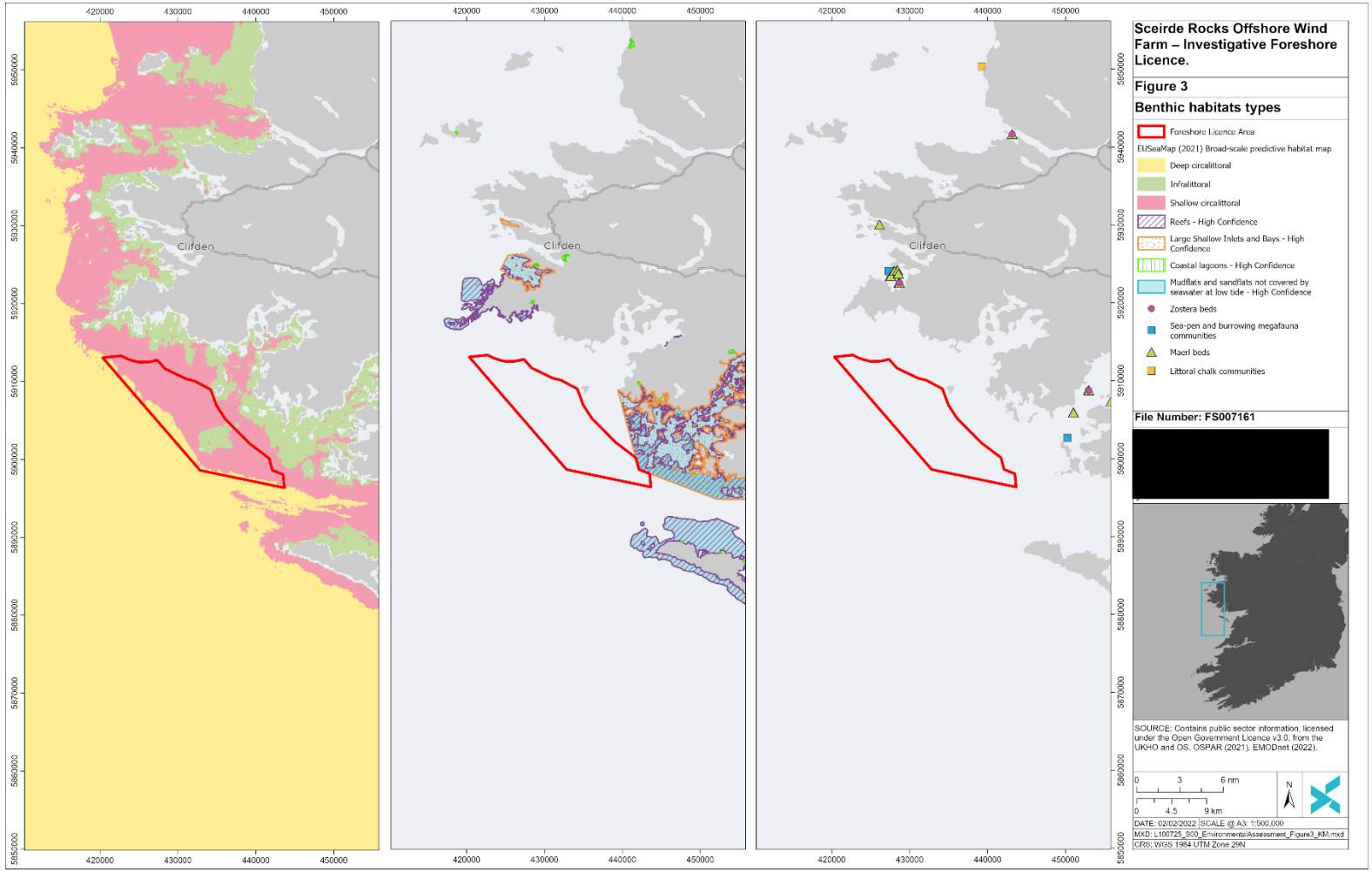

Figure 3 Benthic habitat types

The term benthos describes the organisms that live within and on the seabed. Those benthic species that live on the surface of the seabed are termed epifauna, and those that live within the seabed sediments are referred to as infauna. Factors which affect benthic faunal communities include sediment type, water depth, water temperature, and water currents. Two community types have been broadly identified over the coastal and continental shelf seabed (50-200 m water depth) west of Ireland in sands and muddy sands: an *Amphiura* community and a *Chamelea gallina* community. The *Amphiura* community includes the brittlestars *Amphiura filiformis* and/or *Amphiura chiajei* while the *Chamelea gallina* community may be characterised by the bivalve mollusc *Chamelea gallina*, together with other bivalves such as *Fabulina* spp., *Mactra* spp., various polychaetes and the brittle star *Amphiura brachiata*. However, this benthic assemblage is typically associated with coastal sands (DCENR, 2015). The proposed benthic survey will provide detailed information on the benthic communities present in the Foreshore Licence Area.

3.3 Fish and Shellfish

Waters to the west of Ireland support a variety of fish and shellfish species. Fish species distribution in shelf and coastal waters is generally determined by sediment type, water temperature and water depth. Many of the shelf-water species (adult fish typically found in the vicinity of the continental shelves at water depths of up to around 250 m) which are of commercial importance are pelagic (ICES, 2018). The following species are noted to occur at these water depths in the extensive ICES Celtic Sea Ecoregion (but may not all be present in the inshore waters of the Foreshore Licence Area; ICES, 2019):

- Pelagic fish species include herring *Clupea harengus*, boarfish *Capros aper*, blue whiting *Micromesistius poutassou*, mackerel *Scomber scombrus*, and horse mackerel *Trachurus trachurus*.
- The most abundant demersal shelf-water fish species in the ICES Celtic Sea ecoregion are haddock *Melanogramus aeglefinus*, whiting *Merlangius merlangus*, and pout *Trisopterus* spp. Also commonly found are dab *Limanda limanda*, plaice *Pleuronectes platessa*, anglerfish *Lophius piscatorius*European hake *Merluccius merluccius*, and several species of sole and megrim.
- Regarding commercially important shellfish species, soft sediments host *Nephrops* (the Norway lobster *Nephrops norvegicus*) which create and reside in burrows, emerging only to feed. In addition, scallop (Pectinidae sp.) are known to inhabit this region.
- Other species of note which are recorded in the shelf areas include species of elasmobranchs, cod *Gadus morhua*, and gurnard Triglidae sp. Cod, haddock and whiting are of conservation concern (ICES, 2019).

The extent of spawning grounds and nursery grounds of fish and shellfish species which potentially use the habitats in or near the Foreshore Licence Area are shown in Figure 4 and Figure 5 respectively, according to Coull *et al* (1998) and Ellis *et al (*2012), which corresponds to the information provided by the Marine Institute (2021b). It should be noted that the spawning areas which have been mapped by Coull *et al* (1998) and Ellis et al (2012) represent the widest known distribution of spawning and nursery grounds based on current knowledge and survey data and should not be taken as rigid unchanging descriptions of presence or absence (Coull *et al.*, 1998).

Species potentially spawning within the area are mackerel, sprat and *Nephrops*, while spawning grounds for haddock, hake and horse mackerel lie some distance offshore to the west. Mackerel spawn between March and July, while sprat spawn between May and August and *Nephrops* spawn year-round. The most intense spawning activity for all of these species is likely to be in the spring and early summer. The area of potential mackerel and

sprat spawning ground which overlaps with the Foreshore Licence Area is a very small proportion of the overall spawning grounds for these species. Mackerel and sprat are pelagic spawners (i.e. do not use the seabed), and as such are thought to be less vulnerable to disturbance than species which spawn on the seabed. *Nephrops* spawn on the seabed and therefore may be more vulnerable to disturbance than pelagic spawning species. Spawning for Nephrops is highly dependent on sediment type, with a preference for sediments composed of fine cohesive mud. Based on available information (see Section 3.2), the Foreshore Licence Area may not provide much suitable spawning habitat for this species.

Several species may use this area as a nursery ground at any time of year, including anglerfish, blue whiting, common skate, hake, ling, mackerel, saithe, spurdog, whiting and Nephrops, while herring may use the shallowest part or waters inshore of the licence area (Figure 5). The Foreshore Licence Area occupies a small proportion of the available nursery habitat for all species concerned.

Figure 4 Potential fish and shellfish spawning grounds (Coull et al, 1998; Ellis et al, 2012)

Figure 5 *Potential fish and shellfish nursery grounds (Coull et al, 1998; Ellis et al, 2012)*

3.4 Marine Turtles

Five species of marine turtle have been recorded in Irish and UK waters, but little information is available on their distribution patterns in these areas. The leatherback turtle *Dermochelys coriacea* is the only species reported annually and considered as a regular user of Irish waters. Sightings suggest that they move into Irish waters from the south and west before migrating north, around the west coast of Ireland or through the Irish Sea (Pierpoint, 2000). It is likely that they follow swarms of jellyfish, their main prey species, into Irish waters (Reeds, 2004). Rogan *et al.* (2018) recorded three leatherback turtles over a two-year period, all in the summer and all over the continental shelf.

Loggerhead turtles *Caretta caretta* and Kemp's Ridley turtles *Lepidochelys kempii* occur less frequently, typically thought to be carried north by adverse weather conditions. Most records of this species are from strandings data. The hawksbill turtle *Eretmochelys imbricata* and the green turtle *Chelonia mydas* have been sighted rarely or found stranded in Ireland.

3.5 Marine Mammals

3.5.1 Cetaceans

This section includes data drawn from the ObSERVE programme aerial survey report (Rogan *et al.*, 2018), see Figure 6, as well as older sources (DCENR, 2015; Hammond *et al.*, 2004; Reid *et al.*, 2003; Wall *et al.*, 2013; Berrow *et al.*, 2010 and O'Cadhla *et al.*, 2004).

Twenty-four species of cetaceans have been recorded in Irish waters, covering shallow coastal waters to deeper open ocean, but only a few of these are likely to be encountered in the Foreshore Licence Area, particularly harbour porpoise *Phocoena phocoena*, common dolphin *Delphinus delphis* and bottlenose dolphin *Tursiops truncatus* (Table 3-1). Table 3-1 also shows the densities in each study area, where data are available. Densities are for the summer months for the most relevant strata used by Rogan *et al* (2018) (see Figure 7).

Table 3-1 Cetacean species most likely to be encountered in the Foreshore Licence Area

SPECIES	DISTRIBUTION	SEASONALITY
Bottlenose dolphin *Tursiops truncatus*	Bottlenose dolphins are the third most frequently recorded species in Irish waters (Berrow *et al.*, 2010). There is increasing evidence to suggest that an offshore ecotype of bottlenose dolphin exists in Irish waters (Wall *et al.*, 2013), and was sited during spring/summer months (April-August), and again in high numbers in November by O'Cadhla *et al.* (2004). This species has been recorded in the wider region all year round, predominantly in the shelf break, and waters to the south and south-west of Ireland and further offshore in deep North Atlantic waters. Off the west coast of Ireland, the Shannon Estuary is also home to at least one resident bottlenose dolphin population year-round. Special areas for conservation (SACs) have	Present all year, with peaks of sightings in May.

SPECIES	DISTRIBUTION	SEASONALITY
	been designated for bottlenose dolphin in Irish waters, including the Slyne Head Islands SAC, Slyne Head Peninsula SAC and West Connacht Coast SAC which lie north of the Foreshore Licence application Area (see Section 3.5). Densities relevant to the Foreshore Licence Area are 0.157 to 1.161 individuals/km^2 (Rogan *et al.*, 2018).	
Common dolphin *Delphinus delphinus*	Common dolphin, also known as the short beaked common dolphin, are the second most frequently recorded cetaceans in Irish waters (Reid *et al.*, 2003). They have been observed over deeper waters across the continental shelf but rarely in water depths exceeding 200 m (Reid *et al.*, 2003). Although the biggest concentrations in Ireland are over the continental shelf and in deeper waters, individuals are frequently observed in shallow inshore waters off the south and south-west coasts and around the Aran Islands (IWDG, 2015). There is evidence of a strong inshore winter peak in numbers along the south coast, possibly associated with movements of sprat (IWDG, 2015). They have been reported in high abundances around the edges of the Porcupine Basin and in the wider region year-round, with sightings being made in coastal waters, along the continental slope, as well as over deeper areas. Densities relevant to the Foreshore Licence Area are 0 to 0.257 individuals/km2 (Rogan *et al,* 2018).	Most sightings occur in summer (Rogan *et al.* (2018).
Harbour porpoise *Phocoena phocoena*	The harbour porpoise is a predominantly coastal species. They typically occur in the European continental shelf in waters up to 200 km from the coast (DCENR, 2015). Although these are the smallest cetaceans in Irish waters, they are abundant and widespread. The majority of sightings in the area occur over the continental shelf. SACs have been designated for bottlenose dolphin in Irish waters, including the Blasket Islands SAC and Roaringwater Bay and Islands SAC, which lie approximately 125 km and 186 km respectively from the Foreshore Licence Area. Densities relevant to the Foreshore Licence Area are 0.009 to 0.208 individuals/km2 (Rogan *et al.*, 2018)	Most sightings occur in summer (Rogan *et al.* (2018).
Minke whale *Balaenoptera acutorostrata*	Minke whales are the smallest and most frequently sighted and stranded baleen whale in Irish waters (Berrow et al., 2010). Rogan et al. (2018) reports that minke whales' favour the coastal waters off the southwest of Ireland during summer. They appear to move away from the coast during winter and increase their use of the continental shelf and shelf edge to the east of the proposed well location. Densities relevant to the Foreshore Licence Area are 0 to 0.236 individuals/km2 (Rogan *et al.*, 2018)	Favour southwestern Irish coastal waters during summer, dispersing offshore during winter (Rogan *et al.*, 2018).
Risso's dolphin *Grampus griseus*	Records from Rogan *et al.* (2018) indicate this species is more common away from the coast but over the continental shelf rather than in very deep water. Some reports indicate this species is present year-round in the wider Porcupine Basin (DCENR, 2007), however Rogan et al., (2018) only recorded sightings within the	Data from Rogan *et al.* (2018) suggests sightings may be more common

SPECIES	DISTRIBUTION	SEASONALITY
	Porcupine seabight during the winter 2015-2016 survey. No sightings were made over the Goban Spur. Densities relevant to the Foreshore Licence Area are 0 to 0.057 individuals/km2 (Rogan *et al.*, 2018)	during the winter months.
Striped dolphin *Stenella coeruleoalba*	Striped dolphin tend to reside beyond the continental shelf in depths of greater than 1,000 m. However, specimens occasionally occur over the shelf into waters with depths of less than 60 m. O'Cadhla *et al.* (2004) recorded sightings of this species along the Irish Atlantic Margin in summer and early autumn. Rogan *et al.* (2018) only recorded two confirmed sightings of striped dolphin, both of which were off the continental shelf to the west of the Porcupine Bank. Rogan *et al.* (2018) acknowledged difficulties in differentiating striped and common dolphins. Densities relevant to the Foreshore Licence Application are 0 to 0.257 individuals/km^2 (Rogan et al., 2018)	Both records in Rogan *et al.* (2018) were from the winter 2015-2016 survey.

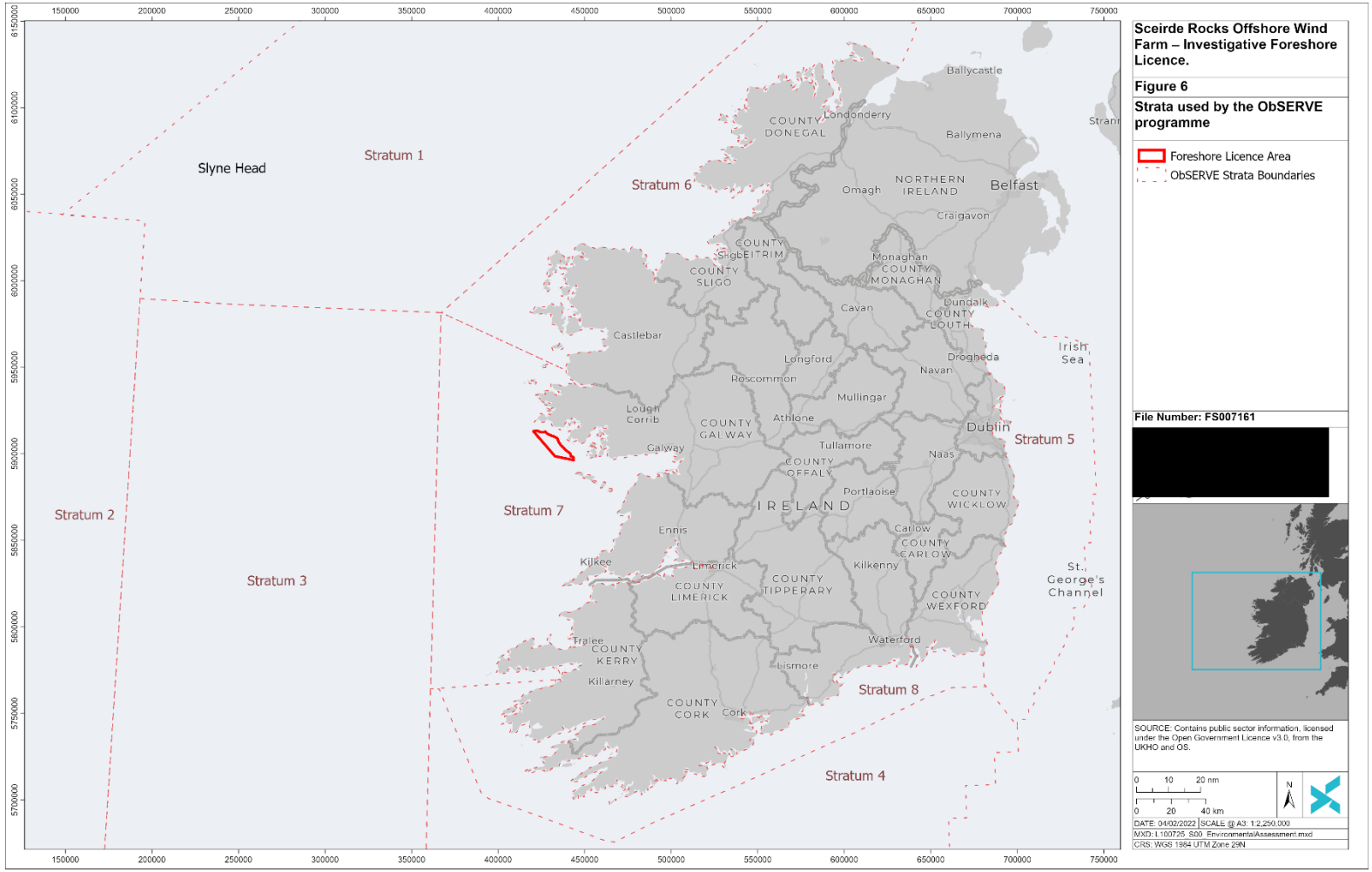

Figure 6 Strata used by the ObSERVE programme

3.5.2 Pinnipeds (seals)

Harbour seals *Phoca vitulina* and grey seals *Halichoerus grypus* are common in Irish waters and tend to be concentrated in coastal and nearshore waters. Both species have established terrestrial haul-out sites along all coastlines of Ireland, which they leave when foraging and to which they return to rest during the moulting and breeding season. Outwith the breeding and moulting periods, studies in the UK have shown that both harbour and grey seals will travel significant distances from their colonies. Sightings of pinnipeds reported in Rogan et al. (2018) are mostly either coastal or over the continental shelf within 100 km from the coast. Harbour seal and grey seal are Annex II species under the Habitats Directive and sites for their protection have been designated in Ireland, including at sights within foraging range of the Foreshore Licence Area (see Section 3.6).

3.5.3 Eurasian otter

The Eurasian otter *Lutra lutra* is listed in Habitats Directive Annexes II (requiring designation of SACs) and IV (species requiring strict protection). Ireland has long been considered to hold one of the most important remaining populations of Eurasian otter in Western Europe and surveys carried out in the early 1980s and again in the early 1990s confirmed the species to be widespread throughout the country. Populations in coastal areas utilise shallow, inshore marine areas for feeding but also require fresh water for bathing and terrestrial areas for resting and breeding holts.

During 2010 and 2011 a national survey of otter populations was undertaken by National Parks and Wildlife Service (NPWS) and reported by Reid et al. (2013). The outcomes of this national survey indicate that otters occur throughout Ireland, including west and south coasts. The assessment of the diets of coastal otters in Ireland indicate that those individuals which inhabit the coastal marine waters of Ireland feed predominantly on marine species such as rocklings (Gadidae), wrasse (Labridae), Crustacea, Mollusca, Atlantic eel, goby (Gobiidae), sea scorpions (Cottidae) and blennies, but they also travel inland to estuaries to feed on brackish or freshwater food resources (Reid et al., 2013).

3.6 Protected Sites

An extensive network of coastal Special Areas of Conservation (SACs) and Special Protection Areas (SPAs) is located along the western coast of Ireland (see Figure 7). SACs are designated for the presence of habitats and species of significant ecological importance listed under Annexes I and II respectively of the Habitats Directive. Irish coastal SACs protect a variety of coastal and marine Annex I habitats and Annex II species and include reefs, caves, cliffs, offshore islands, sand dunes, salt marshes, intertidal bays, beaches and rivers. SPAs are designated for the protection of rare and vulnerable birds listed under the Annex I of the Birds Directive.

The Foreshore Licence Area does not lie within a SAC, although a small length of its boundary is adjacent to the Kilkieran Bay and Islands SAC. Details of the four closest coastal SACs with connectivity to the Foreshore Licence Area (through potential underwater noise impacts on harbour porpoise, bottlenose dolphin, harbour seal or grey seal) are shown in Table 3-2 and Figure 8.

Full details of the proposed site investigation activities potential for likely significant effect on SACs or SPAs can be found in the 'Report to Inform Appropriate Assessment Screening' and 'Natura Impact Statement' that accompanies this foreshore licence application.

Table 3-2 Closest SACs to the Foreshore Licence Area

SITE NAME [SITE CODE]	QUALIFYING FEATURES	DISTANCE FROM SITE BOUNDARY
Kilkieran Bay and Islands [002111]	- Reefs - Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) - Mediterranean salt meadows (*Juncetalia maritime*) - Machairs - Oligotrophic to mesotrophic standing waters with vegetation of *Littorelletea uniflorae* and/or Isoeto-Nanojuncetea - Lowland hay meadows (*Alopecurus pratensis, Sanguisorba officinalis*) - Otter (*Lutra lutra*) - Harbour seal (*Phoca vitulina*) - Slender Naiad (*Najas flexilis*)	<1 km
Slyne Head Islands [000328]	- Reefs - Common bottlenose dolphin (*Tursiops truncatus*) - Grey seal (*Halichoerus grypus*)	3.82 km
Slyne Head Peninsula [002074]	- Coastal lagoons - Large shallow inlets and bays - Reefs - Annual vegetation of drift lines - Perennial vegetation of stony banks - Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) - Mediterranean salt meadows (*Juncetalia maritime*) - Embryonic shifting dunes - Shifting dunes along the shoreline with white dunes - Machairs - Oligotrophic water containing very few minerals of sandy plains - Oligotrophic to mesotrophic standing waters with vegetation of the *Littorelletea uniflorae* and/or *Isoeto-Nanojuncetea* - Hard oligo-mesotrophic water with benthic vegetation of *Chara* spp. - European dry heaths - Juniperus communis formations on heaths or calcareous grasslands	4.84 km

SITE NAME [SITE CODE]	QUALIFYING FEATURES	DISTANCE FROM SITE BOUNDARY
	- Semi-natural dry grasslands and scrubland facies on calcareous substrates - Molinia meadows on calcareous, peaty or clayey-silt-laden soils - Lowland hay meadows - Alkaline fens - Common bottlenose dolphin (*Tursiops truncatus*) - Petalwort (*Petalophyllum ralfsii*) - Slender Naiad (*Najas flexilis*)	
West Connacht Coast [002998]	- Common bottlenose dolphin (*Tursiops truncatus*)	9.84 km

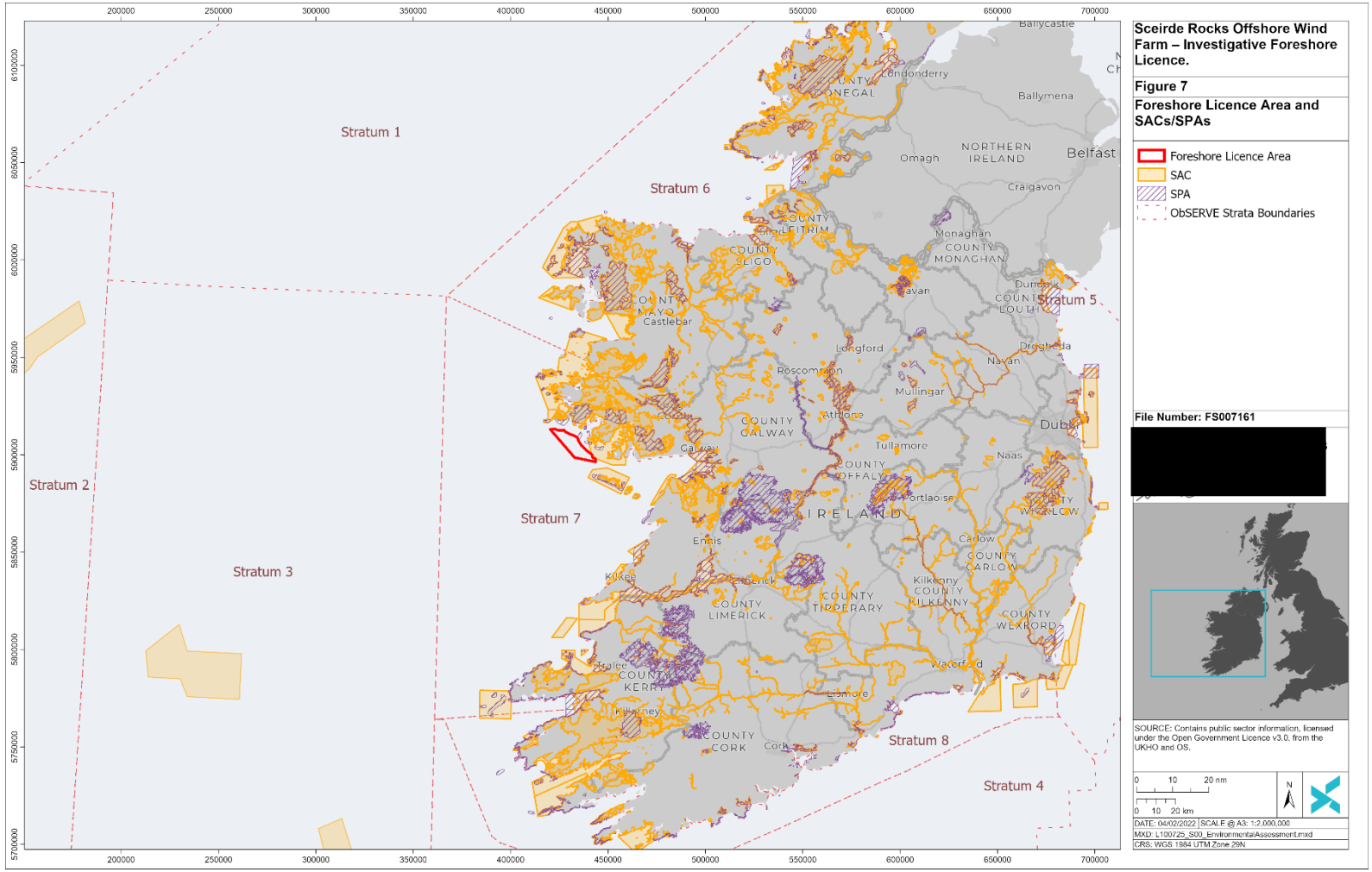

Figure 7 SACs and SPAs and the Foreshore Licence Area

Figure 8 SACs in the immediate vicinity and with connectivity to the Foreshore Licence Area

3.7 Commercial Fisheries

The waters around Ireland support a range of national and international commercial fishing fleets. A variety of vessels operating demersal and pelagic trawls are active in waters of up to 500 m in depth. The Foreshore Licence Area does not lie within any fishing grounds, but one fishing ground lies immediately adjacent to the site. The Aran Islands fishing ground for *Nephrops* lies over 9 km to the south. Inshore waters east of the site are designated shellfish waters, and fish and shellfish are landed at several ports in this area, including Rossaveal and Galway (Figure 9). The nearby port of Rossaveal (see Figure 11 for location) is the main fishing port in the west of Ireland and receives a mix of pelagic, demersal and shellfish species, the shellfish being almost exclusively *Nephrops*.

The following types of inshore fisheries are known to take place within the Foreshore Licence Area, as shown on Figure 9:

- Line fishing;
- Net fishing for crayfish; and
- Pot fishing (various crab species and lobster).

The Foreshore Licence Area is located within ICES rectangles 35D9 and 35E0. It also lies within the Biologically Sensitive Area (BSA) located off most of the south and west coasts of Ireland, within which specific fishing effort restrictions apply for demersal fishing vessels as well as scallop and crab fisheries. The distribution of commercial fishing activity for relevant fishing methods for the site is shown in Figure 10, based on vessel monitoring system (VMS) data from 2014-2018. As the figure illustrates, there are no records of fishing in the Foreshore Licence Area; however, VMS data are not available for vessels of under 12 m in length and so may not be representative of the activity for this fleet. Smaller vessels <12 m (without VMS) account for a significant proportion of the Irish potting effort, for which crabs dominate the landings (Marine Institute, 2019).

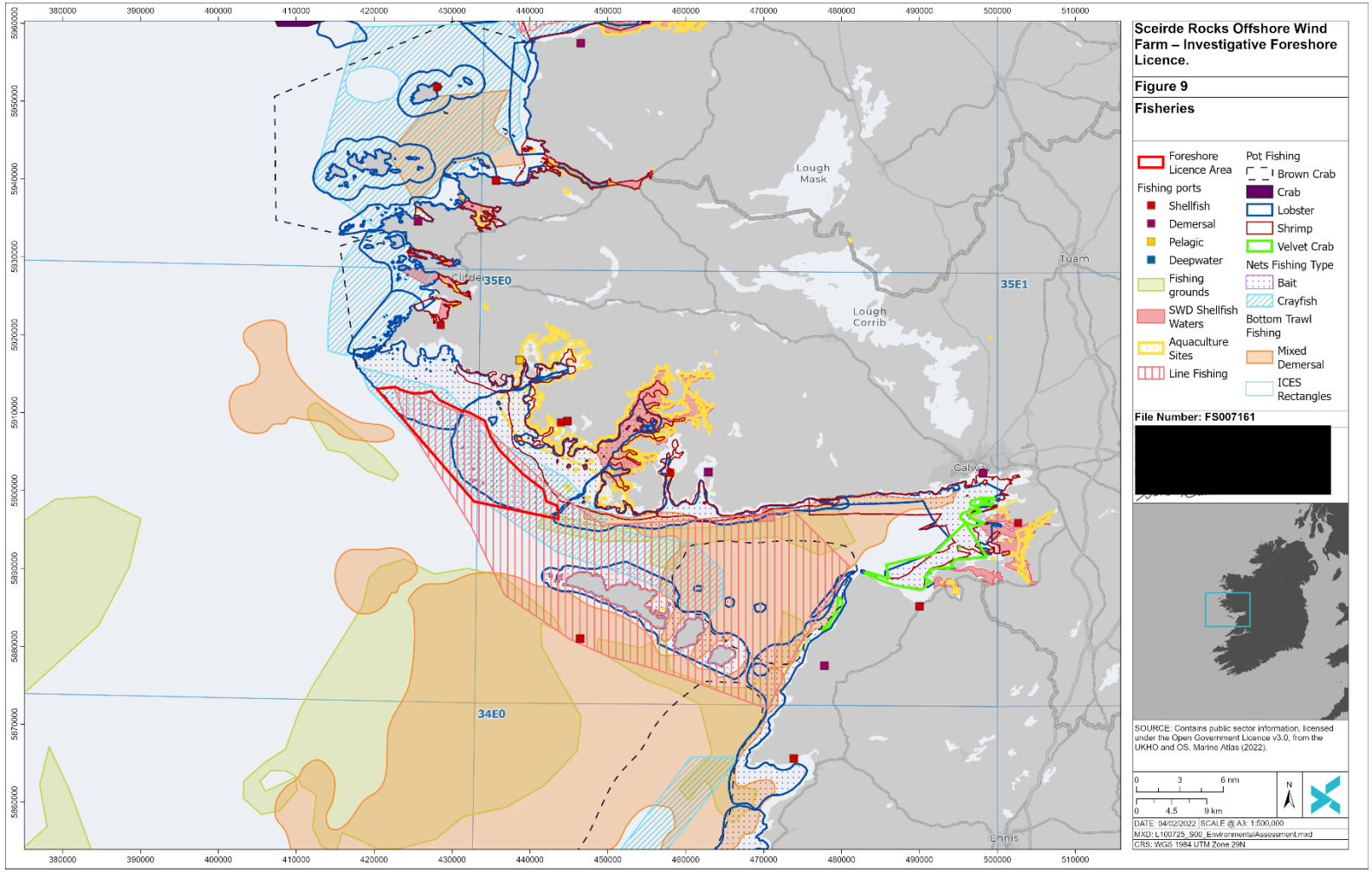

Figure 9 *Fishing grounds and aquaculture sites*

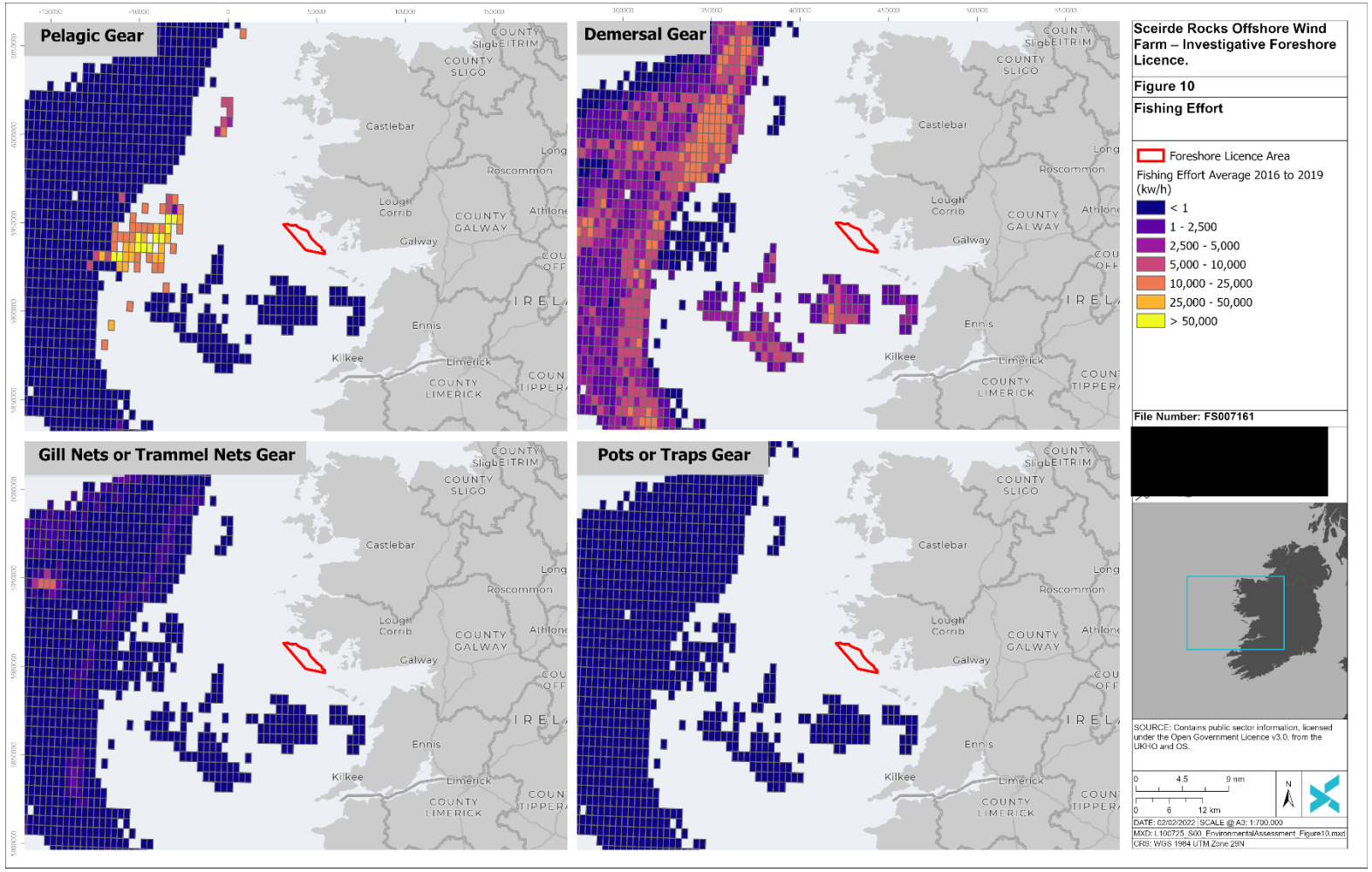

Figure 10 Fishing effort (hr/km/year) (Marine Institute, 2019)

3.8 Shipping

The majority of the shipping routes on the Irish Shelf consist of cargo and tanker routes running north-south in direction Figure 11.

The Foreshore Licence Area lies in an area of relatively low shipping activity (Figure 11) . Most vessels of all types, including passenger, cargo and fishing vessels, pass to the south of the site. Somewhat higher vessel density is associated with the approaches to the ports on the adjacent coastline and with the local ferry routes (shown on Figure 12). Due south of the site at a distance of approximately 9 km, the activity of Nephrops fishing vessels can be seen over the Aran Islands Nephrops fishing ground.

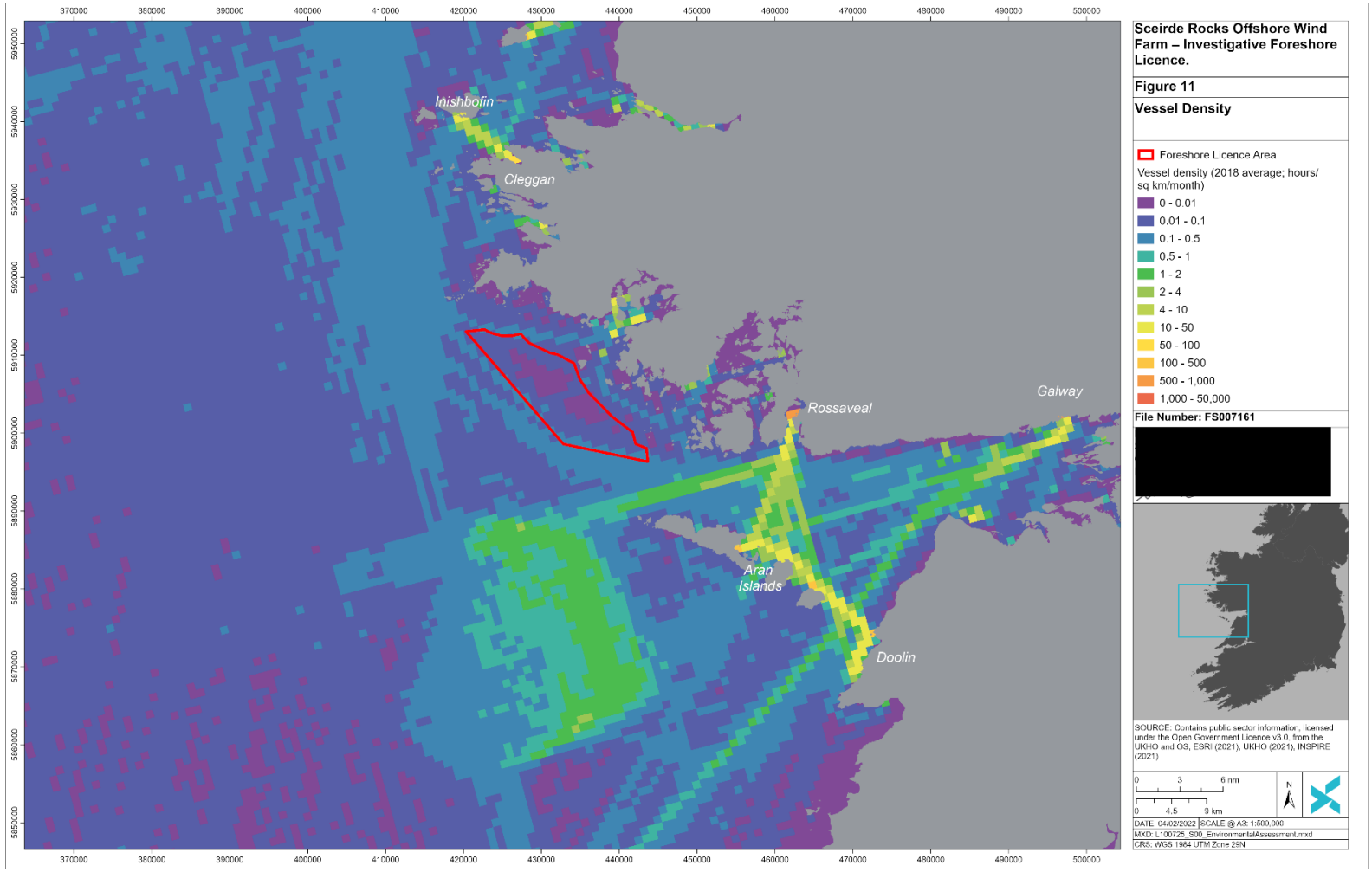

Figure 11 Vessel traffic in the vicinity of the Foreshore Licence Area

3.9 Other Sea Users and wrecks

Extensive coastal areas immediately inshore of the site support aquaculture as shown in Figure 12. Aquaculture is an important sector in Ireland and mainly marine-based, with a value of 180 million euros in 2018. The northwest coast of Ireland (including the Galway area) is the most valuable area for aquaculture production, contributing 25% of Ireland's total aquaculture output (4,067 tonnes with a value of just under 44 million euros) in 2018. The aquaculture industry in this area is dominated by caged Atlantic salmon, with some farmed oyster and limited rope mussel production (BIM, 2019).

The nearest telecommunications cable and military practice area lie several kilometres to the north and are not considered to have any connectivity with the proposed site investigations in the Foreshore Licence Area. There is no known oil and gas industry activity in the vicinity.

A single wreck has been recorded from within the site (Figure 12).

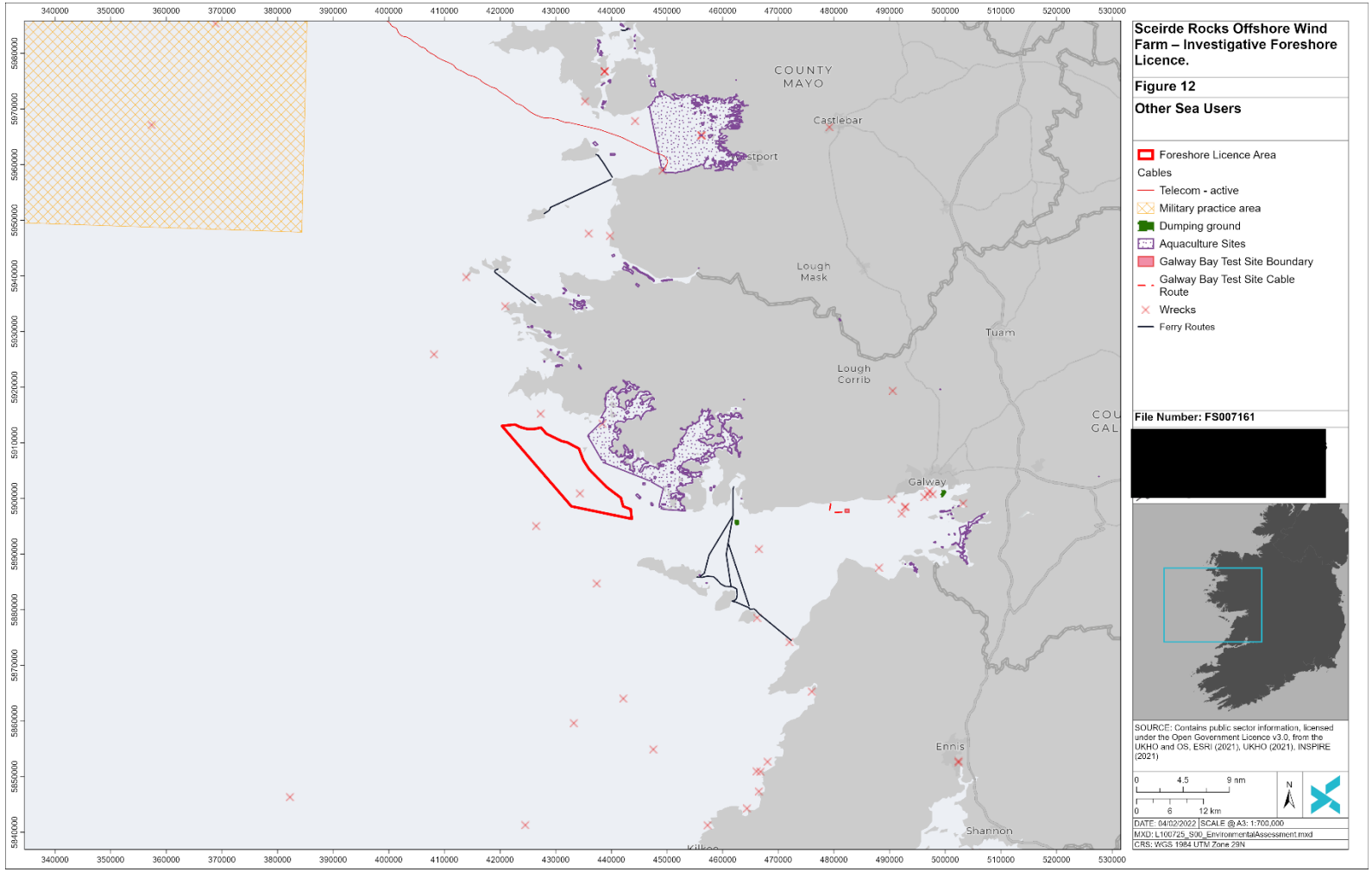

Figure 12 *Other sea users and wrecks*

4 Assessment of Environmental Effects

4.1 Approach to Environmental Assessment and EIA Screening

Where a case-by-case screening is required in determining if the proposed site investigations will have significant environmental effects, Schedule 7A of the Planning Regulations sets out the information an applicant should provide for the purposes of screening (and mirrors Annex IIA of the EIA Directive). The compilation of the information shall take into account, where relevant, the criteria set out in Schedule 7 of the Planning Regulations. Schedule 7 lists the criteria that should be taken into account by the competent authority in the EIA screening and determination, mirroring Annex III of the EIA Directive. Table 4-1 sets out the relevant information to be provided by the applicant and describes how the requirements have been met in this document.

The environmental assessment which follows in Sections 4.1 to 4.5 (drawing on the description of site investigation activities in Section 2 and the sensitivities of the receiving environment described in Section 3) has been conducted to determine whether or not the site investigation activities, alone or cumulatively with other projects, are likely to have any significant environmental effects, thereby informing EIA Screening.

Table 4-1 Information required to be provided by the applicant under Schedule 7 and 7A of the Planning Regulations, and how these requirements have been met

Information to be provided by the applicant under Schedule 7A and Schedule 7 requirements	Information provided in this document
Schedule 7A *1. A description of the proposed development, including in particular—* *(a) a description of the physical characteristics of the whole proposed development and, where relevant, of demolition works, and* *(b) a description of the location of the proposed development, with particular regard to the environmental sensitivity of geographical areas likely to be affected.* ***Schedule 7*** *The only additional criteria from Schedule 7 Item 1 that could possibly considered relevant are:* *(g) the risk of major accidents, and/or disasters which are relevant to the project concerned, including those caused by climate change, in accordance with scientific knowledge, and*	7A(1)(a) A description of the proposed site investigation activities is provided in Section 2. These do not include development activities or demolitions works. Where further details are required for the purposes of assessing the potential for significant effects, these are provided in Section 4.3. 7A(1)(b) A description of the location is provided in Section 3. The focus is on the sensitivity of those areas and receptors potentially affected by the site investigations. These have been identified systematically using an environmental impact identification exercise based on the specific proposed site investigation activities, the environmental and socioeconomic sensitivities and consideration of wider stakeholder interests as described in Section 4.2 (see Table 4-2). 7(1)(g) A major accident or disaster is extremely unlikely due to the nature of the site investigation activities, as described in Section 4.2.

Information to be provided by the applicant under Schedule 7A and Schedule 7 requirements	Information provided in this document
(h) the risks to human health (for example, due to water contamination or air pollution).	7(1)(h) Due to nature of the site investigation activities, the measures described to manage discharges to sea, the lack of risk of a major accidental spill to sea, and the low level of atmospheric emissions from the survey vessels, there will be no risks to human health.
Schedule 7A *2. A description of the aspects of the environment likely to be significantly affected by the proposed development.* ***Schedule 7*** *The criteria from Schedule 7 Item **2** that could possibly considered relevant are:* *The environmental sensitivity of geographical areas likely to be affected by the proposed development, with particular regard to—* *(b) the relative abundance, availability, quality and regenerative capacity of natural resources (including soil, land, water and biodiversity) in the area and its underground,* *(c) the absorption capacity of the natural environment, paying particular attention to the following areas:* *(ii) coastal zones and the marine environment;* *(v) areas classified or protected under legislation, including Natura 2000 areas designated pursuant to the Habitats Directive and the Birds Directive and;* *(viii) landscapes and sites of historical, cultural or archaeological significance.*	7A(2) Section 3 describes the elements of the environment potentially affected by the site investigations. Section 4.2 identifies those elements, Sections 4.3 and 3.4 provide an environmental assessment to determine the likelihood of any significant effects from the site investigations alone and Section 4.5 considers the likelihood of any significant effects in combination with other plans and projects. 7(2)(b) The relevant natural resources are described in Section 3. The assessments in Sections 4.1-4.5 take into account the regenerative capacity of the relevant natural resources to the potential environmental effects. 7(2)(c)(ii) The assessments in Sections 4.1-4.5 take into account the absorption capacity of the natural environment, focussed on the marine environment and coastal zones. 7(2)(c)(v) Section 3 identifies the relevant areas protected under legislation, including Natura 2000 areas, as well as the potential presence of Annex I habitat within the zone of influence. Any potential environmental effects on the qualifying features, taking account of the absorption capacity of the natural environment, are assessed in Sections 4.1-4.5 and in the Report to Inform AA Screening. Further information on the presence of Annex 1 and other sensitive benthic habitats will be obtained during the site investigations for the purpose of informing future EIAR and NIS for the planned offshore windfarm. 7(2)(c)(viii) Section 3.9 identifies the potential presence of features of archaeological interest in the Foreshore Licence Area and Section 4.3 assesses the potential for any significant effects on any such features.
Schedule 7A *3. A description of any likely significant effects, to the extent of the information available on such effects, of the proposed development on the environment resulting from—*	7A(3)(a) The expected emissions to air are limited to routine vessel emissions from the vessels used to conduct the site investigations. These are described and the likelihood of significant effects assessed in Section 4.3.

Information to be provided by the applicant under Schedule 7A and Schedule 7 requirements	Information provided in this document
(a) the expected residues and emissions and the production of waste, where relevant, and *(b) the use of natural resources, in particular soil, land, water and biodiversity.* ***Schedule 7*** *The likely significant effects on the environment of proposed development in relation to criteria set out under paragraphs 1 and 2, with regard to the impact of the project on the factors specified in paragraph (b)(i)(I) to (V) of the definition of 'environmental impact assessment report' in section 171A of the Act, taking into account—* *(a) the magnitude and spatial extent of the impact (for example, geographical area and size of the population likely to be affected),* *(b) the nature of the impact,* *(c) the transboundary nature of the impact,* *(d) the intensity and complexity of the impact,* *(e) the probability of the impact,* *(f) the expected onset, duration, frequency and reversibility of the impact,* *(g) the cumulation of the impact with the impact of other existing and/or development the subject of a consent for proposed development for the purposes of section 172(1A)(b) of the Act and/or development the subject of any development consent for the purposes of the Environmental Impact Assessment Directive by or under any other enactment, and* *(h) the possibility of effectively reducing the impact.*	The expected discharges to sea include: • Routine vessel discharges; and • Minor operational discharges of coring fluids and cuttings. Descriptions of these discharges and their management are provided in Sections 2.1.6 and 2.6 and the likelihood of significant effects is assessed in Section 4.3. The only wastes are those generated onboard the survey vessels and will be managed according to international and national statute as appropriate. There are not expected to be any significant effects on the marine environment. Waste brought ashore will be disposed of in accredited facilities and will not have any significant effects. The assessments in Sections 4.1-4.5 have also given particular consideration (in Section 4.4.) to the potential effects of underwater noise generated by the site investigation activities, particularly by the geophysical surveys. 7A(3)(b) The site investigations will not involve the use of natural resources. Small samples of the seabed will be obtained by grab sampling to provide necessary data on benthic ecology as described in Section 2.5. The potential effects are assessed in Sections 4.2-4.5. The wind resource site investigations described in Section 2.4 have the objective of measuring the wind resource that may be available for the offshore wind farm. 7(3)(a-h) The assessments of environmental effects presented in Sections 4.3 and 4.4 have been conducted in proportion to the nature of the proposed activities (temporary site investigations rather than any construction, operation or decommissioning of a development) and the limited nature of potential environmental effects. In conducting the assessments, consideration has been given to the items listed in items (a) to (h). Transboundary impacts have not been discussed since no such impacts are regarded as feasible. The cumulation of the impact is addressed in Section 4.5. The embedded control measures relating to each type of impact are detailed in Section 4.3. Particular attention has been given to the potential for effects from underwater noise, and the relevant mitigation measures based on NPWS guidance that will be applied (Section 4.4).

4.2 Identification of potential environmental effects

An impact identification exercise was undertaken to identify the possible interactions between the proposed site investigation activities and the environmental and socioeconomic receptors, the impact mechanisms and the potential impacts or risks requiring assessment. This environmental impact identification exercise was based on the specific proposed site investigation activities, the environmental and socioeconomic sensitivities and consideration of wider stakeholder interests.

Table 4-2 shows the matrix of potential interactions between the proposed site investigation activities and the environmental and social receptors.

In addition to the planned activities considered in Table 4-2, consideration was also given to the risk of an accidental release of fuel or coring fluids to sea. The risk from releases of fuel during bunkering is removed as there will be no offshore bunkering. A hydrocarbon spill due to loss of fuel inventory following a vessel collision would require the following sequence of events:

- A cause of vessel interaction must result in a collision;
- The collision must have enough force to penetrate the vessel hull;
- The collision must be in the exact location of the fuel tank; and
- The fuel tank must be full, or at least of volume whereby the fuel level is higher than the point of penetration.

The probability of this chain of events aligning to result in a breach of fuel tanks resulting in a spill that could potentially affect the marine environment is considered remote and therefore such a release is not considered a credible scenario.

The only credible type of accidental release from the site investigations is the spillage of hydrocarbons (diesel fuel, hydraulic oil and lubricants) or chemicals (coring fluids) from vessel decks during storage or handling. Only very small amounts of fuel or chemicals could be released in this way, and measures will be in place to prevent or respond to any such releases. Given the short duration of the site investigation activities and the low risks to the environment from accidental releases, it is concluded that significant environmental effects associated with hydrocarbon or chemical spills can be discounted and are not considered further in this assessment.

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Table 4-2 Impact identification matrix

Proposed Site Investigation Activities	AIR QUALITY & GHG EMISSIONS	MARINE WATER QUALITY	BENTHIC HABITATS/ COMMUNITIES	FISH	MARINE MAMMALS	PROTECTED SITES *	COMMERCIAL FISHERIES	SHIPPING & NAVIGATION/ OTHER SEA USERS	MARINE ARCHAEOLOGY
Atmospheric emissions - routine vessel emissions	1								
Discharges (aqueous) to sea – routine vessel discharges		2		5					
Discharges (particulate) to sea – coring fluids & cuttings		3	4	5					
Physical presence of vessels, buoys and mooring lines					6		7	7	
Physical presence and seabed disturbance – equipment deployed on the seabed; coring/sampling operations			4	5			7	7	8
Underwater noise – DP, geophysical survey equipment (MBES, SSS, sub-bottom profiler (SBP) and UHRS), borehole coring, USBL				5	6	*			

* Although some consideration of protected sites is included in this document, full assessment of the qualifying features of European sites is provided in the accompanying 'Report to Inform Appropriate Assessment Screening'.

KEY	
An interaction is not reasonably expected	
An interaction is reasonably possible	

4.3 Assessment of potential environmental effects

Based on the interactions identified, Table 4-3 considers the impact mechanisms, identifies the relevant control measures and provides an assessment of the potential likely significant effects.

Table 4-3 Potential Effects on Environmental Receptors

Item No.	RECEPTOR	POTENTIAL EFFECTS ON RECEPTOR	Conclusion
1	Air quality Contribution to greenhouse gases	Atmospheric emissions: Emissions to air from fuel use of survey vessels The only atmospheric emissions associated with the site investigations are related to fuel consumption by the vessels to be used, which will result in the emission of various combustion gases including carbon dioxide, methane, nitrous oxide, sulphur oxides, nitrogen oxides, carbon monoxide and non-methane volatile organic compounds. The maximum vessel activity associated with the site investigations is anticipated to be: • Various geotechnical survey vessels – 3-6 months in total in different phases over a 5-year period; • Geophysical survey vessel – 2-3 months in different phases over a 5-year period; • Benthic survey vessel – 2-3 weeks within the 5-year period; and • General purpose vessel for the deployment and recovery of wave buoys and floating LiDAR systems. This represents a negligible increase to shipping activity in the area. Air quality: Given the low levels of emissions, the short duration of the activities and the dispersive nature of the exposed offshore environment, any locally elevated concentrations of emitted gases will be short-lived and there will be no likely significant effect on local or regional air quality. Greenhouse gas (GHG) emissions: On a global scale, concern about atmospheric emissions is now increasingly focused on global warming and climate change. GHG includes water vapour, carbon dioxide, methane, N_2O, ozone and chlorofluorocarbons. The most abundant GHG is water vapour followed by CO_2. Greenhouse gas emissions are, by their nature, cumulative. The emissions from the survey vessels are not significant in the context of shipping activity in Ireland and worldwide, and of other global GHG sources. However, FST recognises the importance of reducing vessel emissions. Control measures	No likely significant effect

Item No.	RECEPTOR	POTENTIAL EFFECTS ON RECEPTOR	Conclusion
		The following measures will be used to minimise the atmospheric emissions resulting from the proposed activities: - Advanced survey planning to allow for efficient operations and fuel utilisation. - The vessels will comply with the MARPOL Convention 73/78 Appendix VI on atmospheric emissions: no emissions of ozone depleting substances, content of sulphur in fuel oil not exceeding 0.5% m/m, and no incineration of garbage containing more than traces of heavy metals. - The vessels will comply with the Merchant Shipping (Prevention of Air Pollution from Ships) (Amendment) Regulations 2014. - FST will verify that survey vessel contractor procedures align with the relevant FST marine requirements. Emissions of CO_2 will contribute to global warming and ocean acidification, whilst emissions of SO_2 and NOx can result in acidifying effects and the formation of ground-level ozone. However, there will be no direct, demonstrable effect of the emissions arising from the proposed activities since they will be negligible in a national or global context. Through practical steps to limit the release of atmospheric emissions, FST will minimise the environmental risks associated with atmospheric emissions from the site investigations. Therefore, given the dispersive nature of the exposed offshore environment, the overall consequence of adverse environmental impact through atmospheric emissions associated with the site investigations is **negligible and there will be no likely significant effect**.	
2	Marine water quality	Discharges (aqueous) to sea • Routine discharge of ballast water, blackwater, grey water and food waste from the vessels Discharges associated with vessel operations (waste water (sewage and grey water), food waste, oily bilge water, drainage, ballast waters) are typically well-controlled activities that are managed as per the International Maritime Organisation standards and are considered to have a minor environmental impact. The site investigations will involve the following vessel use, representing a negligible increase to existing shipping activity in the area: • Geotechnical survey vessel for 1-2 months for borehole drilling and 1-2 months for CPT;	No likely significant effect

Item No.	RECEPTOR	POTENTIAL EFFECTS ON RECEPTOR	Conclusion
		• Jack-up vessel as needed for a limited number of borehole locations; • Benthic survey vessel for 2-3 weeks; and • General purpose vessel for the deployment and recovery of wave buoys and floating LiDAR systems. Control measures: The following measures will apply to all vessels involved in the proposed activities: - The vessels will have a Vessel Waste Management Plan (for managing solid and hazardous waste) which requires dedicated waste segregation bins, records of all waste to be disposed (treated or recycled) and waste streams to be handled and managed according to their hazard and recyclability class. - Vessel discharges (sewage, drainage, food waste and bilge water) will be controlled in line with MARPOL 73/78 requirements and no discharges will be made within 12 nm of the coastline (i.e., within the foreshore area). - The vessels will have an IMO Approved oil in water separator (oil in water < 15 ppm); - The vessels will adhere to the Ballast Water Management (BWM) Convention requirements. Considering the above, there will be no likely significant effect on marine water quality or biological receptors from routine vessel discharges.	
3	Marine water quality	Discharges (particulate) to sea – coring fluids & cuttings There will be minimal discharges associated with borehole coring, which may include coring fluids and associated borehole cuttings. Coring fluids will only be used if necessary, and only minimal amounts of cuttings will be discharged, as discussed in Section 2.1.5. These discharges could potentially affect the water quality in terms of highly localise increases in turbidity and chemical impacts (toxicity) at the borehole locations. Control measures • Should chemicals and coring fluids be required, they will be selected to be the least environmentally harmful.	No likely significant effect

Item No.	RECEPTOR	POTENTIAL EFFECTS ON RECEPTOR	Conclusion
		• As detailed in Section 2.1.5, FST intends to select products that contain only PLONOR and OCNS rated gold, silver, E or D chemicals. Given the small size of the boreholes (up to 70 m depth and 100 mm diameter), the very low toxicity of the fluids and the very small quantities of cuttings discharged at the seabed (estimated at <0.25 m3 per borehole), there will be **no likely significant effect** on marine water quality from cuttings or coring fluid discharges.	
4	Benthic habitats and communities (including shellfish)	Discharges (particulate) to sea – coring fluids & cuttings As discussed under Item No.3 above, there will be minimal particulate discharges associated with borehole coring, which may include borehole cuttings and any particulate components of coring fluids. These discharges could potentially affect the water column, seabed habitats and associated benthic fauna and flora through physical impacts (direct displacement of seabed, and increased turbidity affecting feeding and respiration). Increased suspended solids may also result in direct irritation to certain types of marine benthic organisms, abrading protective mucous coatings and increasing their susceptibility to parasites and infections, as well as affecting growth, reproduction and feeding. The coring fluids, if needed, contain OCNS rated chemicals and are non-toxic. As such, there is no expected potential for bioaccumulation of toxins through the food chain. Control measures • As listed above for Item 3 Potential seabed impacts from the coring of each borehole are likely to be minor and localised. Given the highly dynamic marine environment in the Foreshore Licence Area, it is expected that any chemicals from coring fluid and suspended particles will be quickly dispersed in the water column to negligible concentrations. Given the small size of the boreholes (up to 70 m depth and 100 mm diameter), the very low toxicity of the fluids and the very small quantities of cuttings discharged at the seabed (estimated at <0.25 m^3), there will be **no likely significant effect** on benthic species and habitats from cuttings or coring fluid discharges.	No likely significant effect

Item No.	RECEPTOR	POTENTIAL EFFECTS ON RECEPTOR	Conclusion
		Physical presence and seabed disturbance from equipment deployed on the seabed and from coring/sampling operations and anchoring of buoys) The geotechnical investigation and benthic survey will involve the temporary placement of equipment on the seabed at each location, as well as the removal of geotechnical cores from the boreholes and of small samples of surficial sediment by the grab sampler. In addition, the wave buoy and LiDAR will be securely moored to the seabed for the duration of their deployment. Seabed habitats and the biota may be impacted by: • Direct loss of benthic species and seabed habitat within the physical footprint of the activities; and • Wider indirect disturbance to the benthic environment through the suspension and re-settlement of sediments. As discussed in Sections 3.2, the seabed in the Foreshore Licence Area is expected to consist of mixed sediments with significant areas of exposed bedrock. None of the survey locations are situated protected areas designated for seabed habitats and there are no records of sensitive habitats within the area. The area directly affected will be highly localised within the footprint of the equipment deployed. Any sessile epifauna on which equipment is placed may be damaged or lost. In soft sediments, the equipment may penetrate a few centimetres into the sediment which may cause displacement or loss of individual infaunal animals. The geotechnical sampling equipment will remain in position for up to four days at each location, after which it will be recovered, and nothing will be left on the seabed. In very soft sediments, small depressions may be left in the seabed. Recovery from the minor disturbance is expected to begin immediately due to natural processes. The biota in the Foreshore Licence Area are naturally habituated to sediment transport processes and are therefore less susceptible to the impacts of temporarily increased sedimentation rates. Control measures	

Item No.	RECEPTOR	POTENTIAL EFFECTS ON RECEPTOR	Conclusion

The following measures will be taken to avoid or reduce any potential impacts on the seabed:

- The geotechnical boring and CPT equipment will be accurately positioned on the seabed at each pre-determined location where safe and practicable to do so, reducing any seabed impacts where possible. All deployment and recovery activities will be undertaken as per pre-determined procedures.
- A drop-down underwater camera or ROV will be used at each benthic sampling station and the grab will only be deployed if soft sediments are present, thereby avoiding unnecessary damage to potential rocky reef habitats. The photographic equipment itself will not contact the seabed.

Each site investigation activity (boreholes including possible use of jack-up rig, CPT, benthic grab sampling, floating LiDAR and wave buoy moorings) will have a limited footprint of interaction with the seabed. Based on the information provided in Section 2, the maximum area of seabed potentially affected directly by the proposed activities is as follows, based on the maximum number of locations:

SITE INVESTIGATION	NO. OF LOCATIONS	FOOTPRINT PER LOCATION (M^2)	TOTAL FOOTPRINT (M^2)
Geotechnical investigation (borehole)	60	1-2	60-120
Jack-up vessel for boreholes	60	20	1,200
Geotechnical investigation (CPT)	60	4-8	240-480
Benthic grab sampling	40 (x 4 grabs at each location = 160 grabs)[1]	0.1	16[1]
Wind buoy moorings	2	10	20
Metocean moorings	3	10	20

[1] Note that grab sampling will only be undertaken at those sampling stations where there is suitable soft sediment. Areas of bedrock, boulders or very coarse sediment will be investigated using drop-down photography and will not experience any seabed impact.

Item No.	RECEPTOR	POTENTIAL EFFECTS ON RECEPTOR	Conclusion
		The overall maximum area of direct disturbance will therefore be 1,856 m^2. Given the dynamic nature of the seabed in the Foreshore Licence Area, potential sediment suspension and re-settlement around those activities causing seabed disturbance is only likely to have a temporary effect and to occur in close proximity to the areas directly impacted. Considering the relatively small scale and temporary nature of the seabed impact and the potential for rapid recovery once the short-term activities are competed, there will be **no likely significant effect**.	
5	Fish	Discharges (aqueous) to sea • Routine discharge of ballast water, blackwater, grey water and food waste from the vessels The vessel discharges are described above under Item 2. Control measures: As for Item 2 Given that vessel discharges are well-regulated and there will be **no likely significant effect** on marine water quality, such discharges are also not likely to affect marine biota including fish species and their food sources. Discharges (particulate) to sea – coring fluids & cuttings These discharges are described above under Item 3. Control measures: As for Item 3. Given the very small quantities and temporary nature of these particulate discharges, their low toxicity and the limited area that could be affected, there will be **no likely significant effect** on marine biota, including fish species, from cuttings or coring fluid discharges. Physical presence and seabed disturbance – equipment deployed on the seabed; coring/sampling operations	No likely significant effect

Item No.	RECEPTOR	POTENTIAL EFFECTS ON RECEPTOR	Conclusion
		As described above for Item 4, the geotechnical investigation and benthic survey will involve the temporary placement of equipment on the seabed at each location, as well as the removal of small quantities of seabed material from the boreholes and grab samples. In addition, the wave buoy and LiDAR will be securely moored to the seabed for the duration of their deployment and will provide additional hard substrate in these small areas during this period. These activities have the potential for very localised direct impacts on the seabed and associated communities, which may include demersal fish species, spawning grounds and nursery areas. In addition, any sediment plumes raised during activities may lead to temporary increases in suspended sediment particles in the water column. Control measures: As for Item 4 The equipment will be in place for 1.5 to 4 days at each location, after which recovery of the seabed from any disturbance is expected to be rapid. There will be no likely significant effect on fish from seabed disturbance. The biota in the Foreshore Licence Area, including fish and shellfish species and their prey species, are habituated to sediment transport processes and the presence of hard substrata. Underwater noise – DP, geophysical survey equipment (MBES, SSS, sub-bottom profiler, UHRS), borehole coring, USBL Site investigation activities will not take place within any areas protected for marine fauna. Underwater noise generation is limited to vessels, coring noise and use of geophysical survey equipment. Control measures: Section 4.4.7 provides details of mitigation measures that will be used to remove the impact of underwater noise on marine mammals, but they are equally applicable in removing impact to fish species.	

Item No.	RECEPTOR	POTENTIAL EFFECTS ON RECEPTOR	Conclusion
		Considering the additional underwater noise sources associated with the proposed site investigations, and the control measures, there will be **no likely significant effect** on fish from underwater noise generated by the site investigations. Note that the potential for impacts on Annex IV fish species is addressed in Section 5 of this document. The potential for impacts on fish species associated with protected sites is addressed in the 'Report to Inform Appropriate Assessment Screening' that accompanies this foreshore licence application.	
6	Marine mammals	Physical presence of the survey vessels (in transit and on location). The maximum vessel activity associated with the site investigations is anticipated to be: • Various geotechnical survey vessels – 3-6 months in total in different phases over a 5-year period; • Geophysical survey vessel – 2-3 months in different phases over a 5-year period; and • Benthic survey vessel – 2-3 weeks within the 5-year period. In addition, general purpose vessels will be used for the deployment and recovery of the floating LiDAR systems and wave buoys. This represents a negligible increase to shipping activity in the area. Control measures: • Vessel use will be minimised through efficient survey planning and management. Site investigation activities will not take place within any areas protected for marine fauna, although several marine mammal species, especially harbour porpoise, common dolphin, bottlenose dolphin, grey seal and harbour seal are known to frequent the Foreshore Licence Area. Considering the relatively short-term and low level of vessel use described above, there will be **no likely significant effect** on marine fauna from the physical presence of the vessels. Underwater noise – DP, geophysical survey equipment (MBES, SSS, sub-bottom profiler, UHRS), borehole coring, USBL	No likely significant effect

Item No.	RECEPTOR	POTENTIAL EFFECTS ON RECEPTOR	Conclusion
		Section 4.4 provides a detailed assessment of the potential for underwater noise impacts on marine mammals from the site investigation activities. A summary is provided here below. In addition to responding to natural sounds, marine species may also respond to man-made noise. For example, bottlenose dolphins have been shown to modify their acoustic activity in areas of heavy marine traffic by reducing their call rate during the passage of operating vessels (Luís et al., 2014). Whilst there is a lack of species-specific information on behavioural response collected under controlled or well-documented conditions, enough evidence exists to suggest that sound may elicit potentially biologically-important impacts to marine mammals and that noise from man-made sources may affect animals to varying degrees depending on the sound source, its characteristics and the susceptibility of the species present (e.g., Nowacek et al., 2007). In addition to potential behavioural impacts of noise, marine mammals exposed to an adequately high sound source may experience a temporary shift in hearing ability (termed a temporary threshold shift; TTS) (e.g., Finneran et al., 2005). In some cases, the source level may be sufficiently high such that the animal exposed to the sound level might experience physical damage to their hearing apparatus and the shift in hearing ability may become irreversible (termed a permanent threshold shift; PTS) (Southall et al., 2007; Southall et al., 2019). Underwater noise sources associated with the site investigations which have the potential to illicit marine mammal response include the geophysical survey equipment (MBES, SSS, sub-bottom profiler, UHRS), use of survey vessels (including the geotechnical survey vessel utilising DP and borehole coring equipment) and USBL. Control measures: Section 4.4.7 provides details of the mitigation measures that will be used to remove the impact of underwater noise on marine mammals. Mitigation measures follow the guidance set out in 'Guidance to Manage the Risk to Marine Mammals from Man-made Sound Sources in Irish Waters' (Department of Arts, Heritage and the Gaeltacht (DAHG), 2014.	

Item No.	RECEPTOR	POTENTIAL EFFECTS ON RECEPTOR	Conclusion
		As detailed in Section 3.4, site investigation activities will not take place within any areas protected for marine fauna, although several marine mammal species, especially harbour porpoise, common dolphin, bottlenose dolphin, grey seal and harbour seal are known to frequent the Foreshore Licence Area. A detailed assessment, including underwater noise propagation modelling, has been undertaken of potential impacts on marine mammals from the underwater noise associated with the site investigations. The focus is on those species that could occur in the vicinity of the site investigation activities, including those associated with coastal SACs. Details of the assessment and the mitigation measures to be taken to reduce the potential for impact are provided in Section 4.4. This assessment has demonstrated that, with the mitigation measures in place, there will be no impact on marine mammals from the underwater noise generated by the site investigations and therefore there is no likely significant effects to any species.	
7	Commercial fisheries; shipping and navigation; other sea users	Physical presence of vessels, buoys and mooring lines The presence of the various vessels to be used in the site investigations has the potential to impact other shipping, navigation and fishing activities that may occur in the area during the different investigation activities as described below. The vessels will not have any towed equipment. Increased vessel traffic and collision risk: The temporary physical presence of the survey vessels has the potential to interfere with other sea users that may be present in the area, including increasing the risk of vessel collisions. Temporary exclusion: In advance of survey mobilisation, a notice to mariners will be issued by FST in line with accepted maritime safety practice requesting that whilst the geotechnical survey vessel is on location, a temporary 500 m radius safety zone should be maintained around it at each borehole location. The purpose of the safety zone is to ensure the safety of all personnel involved and to minimise the risk of collisions between the survey vessel and other vessels in the area. As such, the 500 m safety zone (with an area of approximately 0.8 km2 around each borehole location) will exclude other sea users, including fisheries, at each borehole location in turn. The safety zone will not be maintained once each borehole is complete. The geotechnical survey is expected to take place for 1 – 2 months over several phases over a 5 year window.	No likely significant effect

Item No.	RECEPTOR	POTENTIAL EFFECTS ON RECEPTOR	Conclusion
		The geophysical survey vessel will not be moored on a single location; however, it will undertake survey activities along set lines in order to obtain the data required and will therefore have limited ability to manouevre from the paths of other vessels. For this reason, a safety zone of 500 m radius will be requested (via notice to mariners) around the geophysical survey vessel while it is operational (2-3 months of activity in different phases over the 5 year licence period). Snagging risk: All seabed equipment is expected to be within the 500 m safety zone around the survey vessel when it is on location, and therefore there are unlikely be any issues with snagging of fishing gear. Control measures: A number of measures will be employed to minimise the impact of increased vessel traffic and collision: - FST will consult with relevant local fishery organisations in advance of the commencement of site investigations. - Dissemination of information to fishery stakeholders to commence as early as possible by way of providing a stakeholder consultation information sheet to the relevant fishers. - A Marine Notice will be published by the Department of Transport, Tourism and Sport (DTTAS) before the site investigations commence. - Daily Radio Navigation Warnings will be broadcast during survey operations. - Notification of the geotechnical investigation will be given in detail in a Notice to Fishermen which will be published in the relevant fishing journals and online portals (e.g. The Marine Times, The Irish Skipper, Kingfisher Fortnightly Bulletin). - A safety zone will be maintained around the survey vessel whilst on location, when it is restricted in its ability to manoeuvre. - A dedicated Fisheries Liaison Officer (FLO) will be on board the survey vessel for the duration of the investigation with onshore support available. - The survey vessels will issue Sécurité messages over VHF radio as required. - The survey vessel contractor will ensure that the survey vessels will follow the rules set out in IMO Convention on the International Regulations for Preventing Collisions at Sea, 1973 (COLREGs).	

Item No.	RECEPTOR	POTENTIAL EFFECTS ON RECEPTOR	Conclusion
		- Where possible, and in order to avoid potential confusion, coordinates which are shared with the fishing industry will be provided in WGS84 Latitude - Longitude format. - The survey vessels will display SOLAS compliant lights and shapes and noise signals to alert other seafarers in the area. Although there will be an increase in the number of vessels in the area during the site investigations, these activities will only be of a relatively limited duration. As noted in the control measures above, standard communication and notification procedures will be in place to ensure that all vessels operating in the area are aware of the activities, including the presence of the survey vessel. With the limited vessel requirements and the mitigation measures to be employed, there is little increase in the risk of vessel collision as a consequence of increased vessel activities from the site investigations. In addition, the investigations are over a relatively small area and temporary. No likely significant effect are expected. Physical presence and seabed disturbance – equipment deployed on the seabed; coring/sampling operations The seabed equipment is expected to be within the temporary 500 m safety zone around the vessel and therefore there are unlikely to be any issues with snagging of fishing gear. Relevant control measures including consultations with fishery organisations are listed above.	
8	Underwater archaeology	Physical presence and seabed disturbance – equipment deployed on the seabed; coring/sampling operations There is the potential for the site investigations to disturb and features of archaeological interest within the Foreshore Licence Area. As shown in Section 3.8, there is one known wreck within the Foreshore Licence Area. In advance of the site investigations, geophysical survey data will be examined for any other potential features of archaeological interest in proximity to survey locations. Control measures: - Avoidance of the known wreck location - Review of geophysical survey data	No likely significant effect

Item No.	RECEPTOR	POTENTIAL EFFECTS ON RECEPTOR	Conclusion
		- Final position of survey locations to be microsited away from potential archaeology features - Consultation with relevant stakeholders - A drop-down underwater video of each borehole location and benthic grab station will be undertaken prior to deployment on the seabed, to check the proposed location is free of hazards including any wrecks; should any wrecks or artifacts of potential archaeological interest be encountered, FST will notify the relevant authorities, cease work at that location and assist in providing information to the authorities. - The equipment will be accurately positioned on the seabed at each pre-determined surveylocation where safe and practicable to do so. With the above measures in place, there will be **no likely significant effect** on features of archaeological interest.	

4.4 Assessment of the potential for impacts of underwater noise on marine mammals

4.4.1 Noise impact mechanisms

Noise emissions from the proposed activities constitute the greatest potential risk of injury or disturbance to cetaceans in the vicinity of the survey area. Injury and disturbance from underwater noise may impact cetaceans in the following ways:

- Injury – physiological damage to auditory or other internal organs; and
- Disturbance (temporary or continuous) – disruptions to behavioural patterns, including, but not limited to migration, breathing, nursing, breeding, foraging, socialising and / or sheltering.

Physiological responses (injury) are generated when noise emissions fall within the hearing frequency-range of an individual. At the very base level, introduced sounds may impact marine mammals by causing auditory fatigue from the repeated focusing of the hearing apparatus on frequencies occurring at the limits of the individual's 'normal' hearing range. Such fatigue may cause a temporary reduction in hearing ability known as a Temporary Threshold Shift (TTS) (Finneran *et al.*, 2005; Popov *et al.*, 2013; Southall *et al.*, 2019). When anthropogenic sounds are sufficiently loud (i.e. at a large enough amplitude to generate intense pressure waves), they have the potential to cause permanent injury to hearing apparatus, through Permanent Threshold Shift (PTS) (Southall *et al.*, 2007, Southall *et al.*, 2019; NOAA, 2018).

Behavioural changes (disturbance) may include changes to movement, such as altering direction or dive pattern, whilst acoustic responses may take the form of changing vocalisation patterns or communication with conspecifics. Both of these impact mechanisms are considered "disturbance responses" to anthropogenic sounds, and they may have population-level consequences if they preclude the use of important habitat for prolonged periods or impact upon their foraging or breeding success (Lusseau and Bejder, 2007; Williams *et al.*, 2006).

To determine the potential for noise impacts to marine mammals, predicted emission levels are compared to available empirically estimated thresholds for injury and disturbance. Several threshold criteria and methods for determining how sound levels are perceived by marine mammals are available (e.g. the decibel hearing threshold (dBht) method and other hearing weighted and linear measures) and each has its own advantages and disadvantages. The DAHG Guidance to Manage the Risk to Marine Mammals from Man-made Sound Sources in Irish Waters (NPWS, 2014), alongside other guidance such as that from Marine Scotland (2014), recommend using injury and disturbance criteria proposed by Southall et al. (2007), which is based on a combination of linear (un-weighted) peak sound pressure levels (SPL) and weighted sound exposure levels (SEL). Since the publication of this seminal paper, there has been mounting evidence of marine mammal auditory abilities in novel species which has led to amendments to the auditory thresholds for injury (NOAA, 2018; Southall et al.; 2019). In accordance with recent regulator feedback, these amended hearing groups and thresholds for acoustic injury have been adopted herein; they are detailed in Table 4-4.

If a noise emission is composed of frequencies which lie outwith the estimated auditory bandwidth for a given species, then disturbance or injury is extremely unlikely. To understand the potential for noise-related impacts, the

likely hearing sensitivities of different cetacean hearing groups has been summarised in Table 4-4, which is the basis for screening out MBES and SSS (Table 4-5) from further noise modelling assessment. The hearing groups relevant to the proposed site investigations are:

- High-frequency cetaceans (HF)
- Very high frequency cetaceans (VHF); and
- Phocid carnivores in water (PW).

Table 4-4 Auditory bandwidths estimated for cetaceans (NOAA, 2018; Southall et al., 2019)

HEARING GROUP	ESTIMATED AUDITORY BANDWIDTH
Low-frequency cetaceans (LF): (e.g. baleen whales, such as humpback whales, minke whales, fin whales, etc.)	7 Hz to 35 kHz
High-frequency cetaceans (HF): (e.g. dolphins, toothed whales, beaked whales and bottlenose whales)	150 Hz to 160 kHz
Very high-frequency cetaceans (VHF): (e.g. harbour porpoises and other 'true' porpoises)	275 Hz to 160 kHz
Phocid carnivores in water (PW): (e.g. earless or 'true' seals, such as grey and harbour seals)	50 Hz to 86 kHz

4.4.2 Underwater noise sources from the site investigations

An overview of survey activities and their potential impacts to harbour porpoise, bottlenose dolphin and grey and harbour seal is provided in Table 4-5. While some survey techniques and activities may introduce noise to the marine environment, other activities do not operate in relevant frequency ranges or generate sufficient levels of noise to be considered as potential sources of noise-related injury or disturbance to harbour porpoise, bottlenose dolphin and grey and harbour seal, and have been screened out of further consideration.

Based on the information provided in Table 4-5, the potential noise sources associated with the Sceirde Rocks Offshore Wind Farm site investigations that are considered relevant to marine mammals are:

- Ultra Low Baseline Positioning System (USBL);
- Sub-bottom profiling SBP; and
- Ultra High Resolution Seismic (UHRS).

Table 4-5 Overview of potential impacts of marine survey equipment

ACTIVITY / EQUIPMENT	EXAMPLE EQUIPMENT	POTENTIAL IMPACTS	FREQUENCY RANGES (KHZ)	INDICATIVE SPL_{PEAK} (DB RE 1 1µPA)	INDICATIVE SPL_{RMS} (DB RE 1 1µPA)	CONSIDERED FURTHER IN THIS ASSESSMENT?
Vessels and Vehicles						
Survey vessels	Various	Propellers, engines, and propulsion activities form the primary noise sources of survey vessels. Vessel noise is generally continuous and comes in both narrowband and broadband emissions. Potential impacts depend on the duration of the survey activities, location of the survey routes and species of cetacean potentially present in the vicinity of the Foreshore Licence Area.	Acoustic energy from vessels is strongest at frequencies <1 kHz	N/A	<50 m length vessel = 160 – 175 >50 m length vessel = 165 – 185	No –The noise source levels associated with vessels are likely to be too low to result in injury, and the presence of a small number of survey vessels in the region does not constitute a change from baseline conditions.
Remotely Operated Vehicle (ROV)	Various	Potential impacts include disturbance from noise emissions associated with movements underwater. However, these are anticipated to be limited in scale, given the small size of the submerged vehicles. Collision risk is considered an unlikely impact, given the high level of manoeuvrability and slow movement associated with ROVs.	N/A	N/A	N/A	No – the predominant noise source during such activities is the USBL, and other geophysical survey sensors deployed on the vehicle, which is expected to mask any sound generated by the vehicle itself. Noise generated by geophysical survey devices has been considered separately (see below).
Marine Survey Equipment (noise emitting)						
Ultra-Low Baseline (USBL) positioning	HIPAP 501	USBL systems involve the emission of impulsive sound from a hull-mounted transducer to a subsea transponder, thereby introducing sound into the marine environment. The potential impacts of this sound on harbour porpoise, bottlenose dolphin and grey and harbour seal depends upon the	19.5 – 33.5	170 – 207	165 – 190	Yes – The pressure levels and frequencies at which the USBL operate are not of a level where injury is expected but have the

ACTIVITY / EQUIPMENT	EXAMPLE EQUIPMENT	POTENTIAL IMPACTS	FREQUENCY RANGES (KHZ)	INDICATIVE SPL_{PEAK} (DB RE 1 1µPA)	INDICATIVE SPL_{RMS} (DB RE 1 1µPA)	CONSIDERED FURTHER IN THIS ASSESSMENT?
system		abundance, distribution and sensitivity of the species, and the duration of the operations.				potential to cause disturbance to harbour porpoise, bottlenose dolphin and grey and harbour seal.
Side Scan Sonar (SSS)	Edge Tech 4200/4205	Side-scan sonar equipment produces impulsive sound emissions through high frequency pulses used to image the seabed habitat. Potential impacts to harbour porpoise, bottlenose dolphin and grey and harbour seal depend upon the frequency, location, and duration of the pulses.	300 – 900	190 - 230	187 – 227	No – The SSS used for the proposed survey operations will operate at frequencies above 300 kHz. This is above the hearing threshold of all marine mammals which may be present in the area (as detailed in Table 4-4. Hence no potential for injury or disturbance exists (NOAA, 2018).
Multibeam echosounder (MBES)	R2Sonic 2024; EM 2040	High frequency noise pulses created by multi-beam echo sounder equipment generate sound waves which produce impulsive underwater noise. Depending on the frequency of the pulses, location and duration of the operations, and the species present, there could be potential impacts on harbour porpoise, bottlenose dolphin and grey and harbour seal.	200 – 700	180 – 240	177 – 227	No – The MBES used for the proposed survey operations will operate at frequencies above 200 kHz. This is above the hearing threshold of all marine mammals which may be present in the area, as detailed Table 4-4 Hence no potential for injury or disturbance exists (NOAA, 2018).
Sub-bottom profiling (SBP)	EdgeTech 2000 series (Chirp)	Sub-bottom profiling involves the vertical emission of sound pulses (impulsive noise) to characterise the layers of sediment comprising the seabed. Such activities introduce noise emissions into the marine environment. The	0.5 – 12 (chirp)	200 – 230 (chirp) 200 – 235	197 – 227 (chirp) 197 – 232	Yes – The frequencies of the noise emissions are within marine mammal hearing ranges and the

ACTIVITY / EQUIPMENT	EXAMPLE EQUIPMENT	POTENTIAL IMPACTS	FREQUENCY RANGES (KHZ)	INDICATIVE SPL_{PEAK} (DB RE 1 1µPA)	INDICATIVE SPL_{RMS} (DB RE 1 1µPA)	CONSIDERED FURTHER IN THIS ASSESSMENT?
	Innomar SBP 2000 series (Pinger)	potential impacts of this sound depend upon the type of profiler technology used, as well as the abundance, distribution and sensitivity of the species, and the duration of the operations. There are numerous SBP technologies may be deployed during the survey operations including; pingers, chirpers and parametrics.	4 (pinger) 100 (pinger)	(pingers)	(pingers)	source pressure levels may pose a risk of injury and disturbance to harbour porpoise, bottlenose dolphin and grey and harbour seal.
Ultra-High-Resolution Seismic (UHRS) System	The Dura-Spark; The Dura-Spark UHD 240/400	An Ultra-High Resolution Seismic (UHRS) system is optimised to achieve a sub-bed penetration depth focusing on the depth range of 10–1000 m below seafloor. This technology requires a controlled seismic source of energy connected by high voltage cable to a sound source (boomer or sparker) that transfers the energy through the water to penetrate the seabed. The energy reflected back from the solid seabed layers is received by hydrophones on the sea surface, recorded and processed by a data acquisition system aboard a vessel, so that visual profile of the seabed can be created.	0.1 – 6 (sparker/ boomer)	216 – 250 (sparker/ boomer)	213 – 247	Yes – The frequency of the noise emissions is within marine mammal hearing ranges and the source pressure level may pose a risk of injury and disturbance to harbour porpoise, bottlenose dolphin and grey and harbour seal.

4.4.3 Impact thresholds

Injury

The DAHG Guidance to Manage the Risk to Marine Mammals from Man-made Sound Sources in Irish Waters (NPWS, 2014), alongside other guidance such as that from Marine Scotland (2014) recommend using injury criteria proposed by Southall et al. (2007), which is based on a combination of linear (un-weighted) peak sound pressure levels (SPL) and weighted sound exposure levels (SEL). Since the publication of this seminal paper, there has been mounting evidence of marine mammal auditory abilities in novel species which has led to amendments to the auditory thresholds for injury (NOAA, 2018; Southall et al.; 2019). In accordance with recent regulator feedback, these amended hearing groups and thresholds for acoustic injury have been adopted herein.

Injury criteria proposed by NOAA (2018) are devised for two different types of sound:

- Impulsive: sounds which are short in duration (i.e. less than 1 second long) and temporary, occupy a broadband bandwidth, and have rapid rise and decay times with a high peak pressure level; and
- Non-impulsive: sounds which may occupy a broadband, narrowband or tonal bandwidth, can be brief, prolonged, continuous or intermittent in nature, and are not characterised by rapid rise and decay times or a high peak pressure level.

The geophysical, benthic and geotechnical surveys will comprise acoustic equipment which emits multiple pulsed sound, as detailed within Table 4-5.

The noise emitted from the equipment listed in Table 4-5 will disperse through the water column, with sound pressure reducing as distance from the noise source increases, hence marine mammals will be exposed to a lower source pressure further from the noise source. Therefore, for the survey equipment with potential to cause injury or disturbance to marine mammals, the dispersion of noise through the water column has been modelled to assess the appropriate mitigation zone in which the source pressure levels received by marine mammals are reduced below potentially injurious levels.

A duel-metric approach has been adopted which identifies the range of potential injury to marine mammals which have been derived from the source level including the peak pressure and cumulative SELs experienced for each equipment type identified to require consideration for noise-related injury (see Table 4-5). The thresholds above which each marine mammal and pinniped hearing group may experience noise-related injury are presented in Table 4-6. These thresholds are derived from measurements of marine mammal hearing using weighting functions which account for peak hearing abilities for each hearing group (NOAA, 2018).

Table 4-6 Criteria considered in this assessment for the onset of injury in marine mammals from impulsive noise (NOAA, 2018; Southall et al., 2019)

MARINE MAMMAL HEARING GROUP[1]	IMPULSIVE NOISE		NON-IMPULSIVE NOISE
	Peak Pressure (dB re 1 µPa)	Cumulative SEL (dB re 1 µPa^{2}s)	Cumulative SEL (dB re 1 µPa^{2}s)
Low-frequency (LF) cetaceans	219	183	199
High-frequency (HF) cetaceans	230	185	198
Very high-frequency (VHF) cetaceans	202	155	173
Phocid pinnipeds (underwater)	218	185	201

Disturbance

Significant disturbance may occur when there is a risk of a considerable proportion of animals from a population incurring sustained or chronic disruption of behaviour or becoming displaced from an area, with subsequent redistribution being substantially different from that occurring due to natural variation.

To consider the possibility of disturbance resulting from the proposed site investigations, it is necessary to consider both the likelihood that the sound could cause disturbance and the likelihood that sensitive receptors (marine mammals) will be exposed to that sound. Southall *et al.* (2007) recommended that the only currently feasible way to assess whether a specific sound could cause disturbance is to compare the circumstances of the situation with empirical studies.

Auditory thresholds for disturbance, as defined by the National Marine Fisheries Service (NMFS, 2014), coupled with behavioural response criteria detailed in Southall et al. (2007) have been adopted for the assessment of potential marine mammal disturbance from both non-impulsive and impulsive noise sources. These thresholds (provided in in SPLrms) and behavioural response severity ratings are detailed in Table 4-7.

Table 4-7 Disturbance threshold criteria for impulsive sounds (Southall et al., 2007; NMFS, 2014).

BEHAVIOURAL EFFECT	THRESHOLD CRITERIA SPL_{RMS} (DB RE 1 MPA)
Potential strong behavioural reaction (6 or more on the severity scale)	160

[1] *Hearing groups have been defined using the naming conventions provided in Southall et al. (2019), which are based on accepted frequency ranges commonly used in acoustics; however, the groupings and their respective criteria do not differ from NOAA (2018).*

4.4.4 Underwater noise modelling approach

Underwater modelling has been undertaking using Xodus' SubsoniX noise model which was developed specifically for assessing environmental impacts due to underwater noise. The SubsoniX model approach is based on an extended version of the semi-empirical model developed by Marsh-Schulkin (Marsh and Schulkin, 1962). The sound propagation model uses several concepts including:

- Refractive cycle, or skip distance;
- Geometric divergence;
- Deflection of energy into the bottom at high angles by scattering from the sea surface;
- A simplified Rayleigh two-fluid model of the bottom for sand or mud sediments; and
- Absorption of sound energy by molecules in the water.

The following inputs are required to the model:

- Third-octave band source sound level data;
- Discreet range (distance from source to receiver);
- Water column depth and sediment layer depth;
- Sediment type (sand/mud);
- Sea state; and
- Source directivity characteristics.

The model is based on a combination of acoustic theory and empirical data from around 100,000 measurements and has been found to provide good predictions.

The duel-metric assessment approach disseminated in National Oceanic and Atmospheric Administration (NOAA, 2018) has been used to estimate injury impact range from: (1) the peak SPL; and (2) the weighted cumulative SEL criteria. The SEL represents the total energy produced by a noise-generating activity standardised to a one-second interval. This enables comparison of the total energy attributed to different activities with different inter-pulse intervals. As detailed in Table 4-4, empirically-based weighting functions (NOAA, 2018; Southall et al., 2019) have been applied to the modelling outputs to account for peak hearing sensitivity for the respective marine mammal hearing groups.

The following assumptions have been applied to the models:

- Maximum reported SPLs for all equipment have been used;
- Maximum pulse length and minimum turn around has been used where provided;
- Where data is unavailable, the time between pulses has been calculated as 1.5 times the ping length;
- Vessels are moving at slow speeds; and
- Survey equipment likely to be used in the shallow water environment (i.e. <10 m) will be very high frequency to provide better resolution and will have a lower SPL, and so does not constitute a worst-case scenario.

The directivity characteristics of the sound sources are also an important factor affecting the received sound pressure levels from noise-generating activities. In geophysical surveys, source arrays are designed so that the majority of acoustic energy is directed downwards towards the ocean floor for data collection purposes. As such,

the amount of energy emitted across the horizontal plane is significantly less (20 dB +) than that emitted directly downwards (Richardson et al, 1995). Due to the frequency-dependent nature of sound, the loss of pressure on the horizontal plane is more pronounced at higher frequencies than at lower frequencies. Directivity corrections can be applied to the model outputs, which provide broadband normalised amplitudes at varying angles of azimuth[2] and dip angle[3]. Directivity corrections have been applied to the modelling outputs under the assumption that the animal is directly in-line with the vessel.

As detailed in above in Table 4-7, the disturbance threshold uses the SPLrms metric, and hence needs to be evaluated against equipment source levels in SPLrms. It is important to note that the rms value associated with the SPLrms depends upon the length of the integration window used. Using a longer duration integration window results in a lower rms than produced by a shorter integration window.

An acoustic phenomenon results from the elongation of the waveform with distance from the source due to a combination of dispersion and multiple reflections. Measurements presented by Breitzke et al. (2008) indicate elongation of the T90 window up to approximately 800 m at 1 km. This temporal "smearing" reduces the rms amplitude with distance by elongating the rms window and has been included within the disturbance modelling scenarios. Since the auditory organs of most marine mammals integrate low frequency sounds over an acoustic window of around 200 ms (Madsen et al., 2006 and references therein), this duration was used as a maximum integration window for the received SPLrms.

4.4.5 Injury impacts

For the proposed site investigations, the expected frequency range of noise emissions from the SBP, UHRS and USBL operations overlap with the hearing range of all cetacean hearing groups (Table 4-4 and Table 4-5). Potential injury to cetaceans (i.e. injury which results from a permanent threshold shift in hearing abilities) is limited to impulsive noise sources which exceed the injury thresholds defined in Table 4-6.

Modelling of ranges at which injury impacts are likely to result from deployment of survey equipment has been undertaken, as described in above. Example equipment has been selected to exemplify the realistic worst-case scenario for each survey technique, including the maximum SPLs across source frequencies meant to encapsulate the hearing abilities of all representative hearing groups.

The hearing groups relevant to the proposed site investigations are:

- High-frequency cetaceans (HF)
- Very high frequency cetaceans (VHF); and
- Phocid carnivores in water (PW).

[2] The azimuth is taken as the angle of circumference around the boat which lies parallel to the surface of the water, progressing around the boat from port to starboard.

[3] The dip angle is taken as the angle under the boat, progressing from prow to stern.

Table 4-8 Noise modelling results for injury impacts from impulsive noise sources (N/E = no exceedance of thresholds)

ACTIVITY	FREQUENCY (KHZ)	PEAK SPL (DB RE 1µPA)	DEPTH (M)[4]	INJURY RANGE (M)											
				Weighted Cumulative SEL (Static Mammals)				Weighted Cumulative SEL (Moving Mammals)				Unweighted Peak SPL			
				VHF	HF	LF	PW	VHF	HF	LF	PW	VHF	HF	LF	PW
SBP	0.5 - 12	230	100	40	38	38	38	38	38	38	38	61	3	8	9
			10	5	4	4	4	5	4	4	4	73	4	13	15
	4	235	100	9	5	9	9	9	5	6	5	255	28	68	73
			10	N/E	N/E	N/E	N/E	N/E	N/E	N/E	N/E	445	98	178	188
	100	235	100	28	17	17	17	19	17	16	17	30	12	17	18
			10	N/E	N/E	N/E	N/E	N/E	N/E	N/E	N/E	29	11	16	17
USBL	19.5 – 33.5	207	100	43	8	4	5	38	2	1	1	3	N/E	N/E	N/E

[4] *These depths have been identified as representative of the nearshore and offshore depths in which surveys are likely to occur across the survey area, based on available bathymetry data.*

ACTIVITY	FREQUENCY (KHZ)	PEAK SPL (DB RE 1µPA)	DEPTH (M)[4]	INJURY RANGE (M)											
				Weighted Cumulative SEL (Static Mammals)				Weighted Cumulative SEL (Moving Mammals)				Unweighted Peak SPL			
				VHF	HF	LF	PW	VHF	HF	LF	PW	VHF	HF	LF	PW
			10	4	4	2	3	4	2	N/E	N/E	3	N/E	N/E	N/E
UHRS[5]	0.1	250	100	10	N/E	44	41	2	N/E	44	13	511	17	63	70
			10	3	N/E	4	4	2	NE	4	4	559	19	71	80
	6	250	100	44	44	44	44	44	44	44	44	381	14	49	54
			10	4	4	4	4	4	4	4	4	412	15	55	62

[5] *Noise modelling for UHRS undertaken based on a ping range of 0.0003 – 0.0015 second ping length, with 0.0015s results presented to represent the realistic worst-case scenario.*

Across modelling scenarios and metrics, the injury ranges were generally highest for the VHF hearing group which is represented by harbour porpoise. Conversely, HF cetaceans seemed to constitute the hearing group with the lowest potential impact ranges for the peak SPL. Additionally, for both the SBP and USBL equipment, LF cetaceans largely displayed the lowest impact ranges for the cumulative SEL metrics, whereas HF cetaceans demonstrated the lowest impact ranges for both SEL metrics when considering use of the low frequency UHRS system.

Higher frequency sounds attenuate more quickly than lower frequency sounds such that an animal would need to be much closer to the sound source for it to cause injury. For this reason, injury ranges were of the order of metres to tens of metres for the SBP operating at 100 kHz.

The deployment of USBL in 100 m depths elevated the potential range of impact to a maximum of 43 m for VHFs, when considering cumulative SEL metric. However, in order for the cumulative SEL threshold to be exceeded, an animal would have to remain within 43 m of the source for a sustained period. The likelihood of a cetacean remaining this close to operational equipment is extremely low when considering that the source is deployed from a moving vessel travelling at more than 2ms 1 (i.e. 4 knots) and, in some cases, is being towed at depth (e.g. a USBL may be mounted on a an ROV within a few metres of the seabed). Whilst USBL may be deployed from a stationary vessel during particular activities (e.g. seabed sampling), these are anticipated to be limited in duration. As such, a realistic risk of injury is not expected from the use of USBL, and no marine mammal mitigation is proposed for USBL operations.

The greatest injury ranges to marine mammals during shallow water operations (i.e. 10m) came from both the UHRS operating at 0.1 kHz, and SBP operating at 4 kHz, wherein refraction off the seabed causes nearly immediate cylindrical spreading of noise emissions, causing the sound to travel farther along the horizontal plane of the water column more quickly. The deployment of the UHRS survey equipment in 10 m depths elevated the potential range of impact to a maximum of 559 m for VHF cetaceans. Whereby, the SBP operating at 4 kHz in shallow waters demonstrated a maximum impact range of 445 m for VHF cetaceans.

Whilst deployment of a very low frequency UHRS system and a low frequency SBP in nearshore waters constitutes a worst-case situation of the potential injury range attributable to the survey techniques, these scenarios are highly unlikely. Geophysical survey technologies generally employ higher frequency sounds in shallow waters where sound loss to absorption and transmission are much lower. As such, sound penetration below the seabed is achievable at lower powers and higher frequencies, which offer higher resolution imagery to the surveyor. Furthermore, when considering the directionality of the equipment, the impact ranges are further reduced. This is because the beam of sound generated by the equipment is directed downward towards the seabed, so the vast majority of power is contained within a roughly 40° angle from the source (the slant height of the conical noise source) to maximise penetration and the resultant imagery. Animals would need to be at the seabed below the noise source to experience the full sound levels behind the modelled impact ranges.

The majority of injury ranges were at least slightly reduced when considering animal movement during cumulative SEL estimation. Swim speeds of the species most likely to be observed in the area have been shown to be several ms- 1 (e.g. harbour porpoise may swim up to 4.3 ms-1) (Blix and Folkow, 1995; Otani et al., 2000). Furthermore, SNH (2016) has provided standard values for mean swimming speeds of various marine mammal species likely to occur in the project area, including harbour porpoise (1.4 ms-1; Westgate et al., 1995) and harbour / grey seal (1.8 ms-1; Thompson, 2015). To offer a representative model of the predicted noise exposure ranges of marine

mammals moving away from the sound source, a mean swim speed of 1.5 ms-1 has been used in the calculations. Considering that the surveys themselves will take place while the vessel is moving, the cumulative SELs of all equipment types are expected to be even lower based on the premise that animals are likely to move away from the mobile noise source at some angle opposing the direction of vessel travel

It should also be noted that the modelling scenarios are meant to define the worst-case injury ranges associated with the deployment of the project's survey equipment. The in-situ deployment of the noise-generating survey equipment will most frequently occur in waters of intermediate depths (i.e. somewhere between 10-100 m). Moreover, the frequency ranges depicted constitute the lowest and highest reasonably practicable settings for the survey activities modelled, meaning that the spread of sound in the marine environment is also likely to fall somewhere between the modelled extremes. The injury ranges anticipated to result from equipment use are thus likely to fall within the spectrum of those defined by the model outputs, thereby reducing the impact ranges associated with the low frequency survey equipment.

4.4.6 Disturbance impacts

In addition to physical injury, noise emissions have the potential to affect the behaviour of cetaceans and pinnipeds in the vicinity of the noise source. Significant or strong disturbance (see Table 4-7; Southall *et al.*, 2007) may occur when an animal is at risk of a sustained or chronic disruption of behaviour or habitat use resulting in population-level effects. An assessment of potential disturbance impacts from the SBP, USBL and UHRS operations is provided below. The outputs of the noise modelling assessment against the disturbance thresholds relative to SPL_{rms} values for the survey equipment are provided in Table 4-9.

Table 4-9 Noise modelling results for disturbance impacts from impulsive noise sources

ACTIVITY	FREQUENCY (KHZ)	SPL_{RMS} (DB RE 1µPA)	DEPTH (M)	RANGE OF BEHAVIOURAL CHANGE (M)
SBP	0.5 - 12	227	100	3,250
			10	2,750
	4	232	100	4,220
			10	3,120
	100	232	100	125
			10	120
USBL	19.5 – 33.5	190	100	9.0
			10	9.1
UHRS	0.1	247	100	2,100
			10	2,300
	6	247	100	1,450

ACTIVITY	FREQUENCY (KHZ)	SPL_{RMS} (DB RE 1µPA)	DEPTH (M)	RANGE OF BEHAVIOURAL CHANGE (M)
			10	1,700

SBP, USBL and UHRS survey activities have the potential to generate a strong disturbance event. The potential for a disturbance impact to result from these types of technology varies between activity type, though, the predicted disturbance range is much greater for the low frequency noise sources which travel further within the marine environment. The sounds emitted by the SBP (operating at 0.5 – 12 kHz or at 4 kHz) and UHRS (operating between 0.1 – 6 kHz) form the lower frequency sounds and have the potential to generate disturbance impacts on the order of several km, whilst those from the USBL and higher frequency (i.e. 100 kHz) SBP are on the order of tens to a hundred metres (Table 4-9).

As the survey vessel will not be stationary for prolonged periods during these activities, animals within a particular area will not be exposed to extended periods of underwater noise. Rather, individuals would have to follow the moving equipment to be subjected to lasting or prolonged periods of noise which may have detrimental effects at the individual or population level (i.e. a significant disturbance), which is highly unlikely.

The survey activities are anticipated to be completed in periods of 2-3 months, and within this time there will be periods of inactivity during weather downtime. Given the transient and short-term nature of the survey and vessel activities, it is highly unlikely that any disturbance impacts from use of the UHRS, USBL or SBP would have any negative impact on marine mammals. This is on the basis that the modelled level of disturbance is unlikely to affect the ability of any individual animal to survive or reproduce.

4.4.7 Mitigation Measures

Due to the potential for injury to marine mammals seal resulting from the site investigations, marine mammal mitigation will be implemented. Available mitigation measures specifically designed for geophysical surveys have been incorporated into the mitigation measures described below and the protocol 'Guidance to Manage the Risk to Marine Mammals from Man-made Sound Sources in Irish Waters' (Department of Arts, Heritage and the Gaeltacht (DAHG), 2014) will be followed at all times for all site investigation activities. Section 4.3.4 of the DAHG 2014 guidance specifically relates to geophysical survey activities. These best practice guidelines are now incorporated as standard operating procedures for all noise emitting surveys in Irish Waters and are considered sufficient by the competent authority (National Parks and Wildlife Service (NPWS)) to mitigate for disturbance to marine mammal species.

Marine Mammal Monitoring

There will be a qualified Marine Mammal Observer (MMO) appointed to monitor for marine mammals and to log all relevant events using the required data forms provided by DAHG. Particular attention will be given during the commencement of the SBP and UHRS activities. The MMO will be located at a suitable vantage point, providing good all-round visibility. During daylight hours the MMO(s) will carry out visual observations to monitor for the presence of marine mammals before the soft-start commences and will recommend delays in the commencement of the site investigations should any species be detected within the relevant monitored zone.

Pre-Start Monitoring

Visual (MMO) will be conducted for a pre-soft start search of 30 minutes i.e. prior to the commencement of SBP and UHRS operations. This will involve a visual observation (during daylight hours) to determine if any marine mammals are within the relevant zone of the activities as per the DAHG 2014 guidance.

Monitored Zone

The DAHG 2014 guidance defines the monitored zone as a 1,000m radial distance around the UHRS noise source and a 500m radial distance around the SBP noise source. Should any marine mammal species be detected within the monitored zone, commencement of the site investigation activities (SBP and UHRS operations) will be delayed until their passage, or the transit of the survey vessel, results in the marine mammals being of sufficient distance from the vessel. There will be a 30-minute delay from the time of the last sighting within the monitored zone to the commencement/recommencement of the SBP and UHRS operations. The MMO will use a distance measuring stick or reticule binoculars to ascertain distances to marine mammals. It should be noted that once started site investigations will not cease should marine mammals approach the survey vessel.

Soft-start / 'Ramp Up' procedure

A soft start is the gradual ramping of power over a set period of time, to give any marine mammals adequate time to leave the area. Once the soft start commences, there is no requirement to halt or discontinue the procedure at night time, if weather or visibility conditions deteriorate, or if marine mammal species enter the monitored zone (as per the DAHG 2014 guidance for monitored zones activity dependent).

In commencing a geophysical survey operation, including any testing of seismic sound sources, where the output peak sound pressure level exceeds 170 dB re: 1µPa @1m, the following ramp up procedure will be undertaken in line with the DAHG (2014) guidance:

- Energy output will commence from a low energy start-up and be allowed to gradually build up to the necessary maximum output over a period of 20-40 minutes (the exact time period will be dependent on survey parameters and equipment and will be designed in consultation with an experienced marine ecologist).
- This controlled build-up of energy output will occur in consistent stages to provide a steady and gradual increase over the ramp-up period.
- If marine mammals enter or are detected within the monitored zone while the ramp-up procedure is under way but incomplete, the energy output will not be increased until the marine mammals are no longer within the monitored zone.

Line Changes

In line with DAHG 2014 guidance, where the duration of a survey line or station change is greater than 40 minutes, the activity will, on completion of the line/station being surveyed, either cease (i.e., shut down) or preferably undergo a reduction in energy output to a lower state where the peak sound pressure level from any operating source is =<170 dB re 1 µPa @ 1 m. Prior to the start of the next line/station, if the power was shut down, all pre-survey monitoring measures and soft start procedures will be followed as for start-up. If there has been a reduction in power, a soft start will be undertaken gradually from the lower output level. The latter sound reduction measure will be applied to line changes at night-time or in daytime conditions of poor visibility. Where the duration of a survey line/station change is less than 40 minutes the activity will continue as normal (i.e. under full output).

Breaks in sound output

In line with DAHG 2014 guidance, if there is a break in sound output for a period of 5-10 minutes (e.g., due to equipment failure, shut-down, survey line or station change), MMO monitoring must be undertaken to check that no marine mammals are observed within the Monitored Zone prior to recommencement of the sound source at full power.

Where a marine mammal is observed within the Monitored Zone during such a break of 5-10 minutes, then all Pre-Start Monitoring and a subsequent Ramp-up Procedure (where appropriate following Pre-Start Monitoring) shall recommence as in a normal start-up operation.

If there is a break in sound output for a period greater than 10 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

The MMO will submit a report to the relevant Regulatory Authority within 30 days of completion of any geophysical survey activity. The report will follow the guidance and standardized template provided in Appendix 6 of the DAHG 2014 guidance (*'Operator and marine mammal observer (MMO) reporting and standard (JIP) data forms for Geophysical Acoustic Surveys'*).

Survey vessel speed and course

The project survey vessels will be moving at a maximum speed of approximately 5 knots during surveys to allow marine mammal species to move away from the vessel should they be disturbed by the vessel presence or noise emissions. During transit times, the survey vessels will be travelling at speeds greater than 5 knots. However, these movements are not considered to deviate from normal vessel traffic in the region of the Foreshore Licence Area (particularly in and out of Galway harbour). Should a marine mammal species be found to be in the direct path of a survey vessel, during or outside of survey times, the survey vessel will slow down or, if possible, alter course to avoid collision.

4.4.8 Residual impacts

Injury

The soft-start procedure included in the protocol 'Guidance to Manage the Risk to Marine Mammals from Man-made Sound Sources in Irish Waters' (DAHG, 2014) is considered sufficient by NPWS, the competent authority for marine environmental protection to ensure that even the most sensitive of marine mammal species is protected from injury impacts from site investigation underwater noise sources. In consideration of the relevant mitigation measures being applied, no marine mammal would be within the monitored zone and therefore no injury impact will occur. For these reasons, it is highly unlikely that any injury impacts from use of the geophysical survey equipment would impair the ability of any individual marine mammal to survive or reproduce. Therefore, there are no likely significant effects on any populations of marine mammals.

Disturbance

As the survey vessel will not be stationary for prolonged periods during the site investigation activities, animals within a particular area will not be exposed to extended periods of underwater noise. Rather, individuals would have to follow the moving equipment to be subjected to lasting or prolonged periods of noise which may have detrimental effects at the individual or population level (i.e. a significant disturbance), which is highly unlikely.

The geophysical survey activities are anticipated to be completed in periods of 2-3 months, and within this time there will be periods of inactivity during weather downtime. Given the transient and short-term nature of the survey and vessel activities, and through strict adherence to the DAHG 2014 guidance (mitigation measures outlined in Section 4.4.7) it is highly unlikely that any disturbance impacts from use of the geophysical survey equipment would have a significant effect on marine mammals. This is on the basis that the level of disturbance is highly unlikely to affect the ability of any individual marine mammal to survive or reproduce. Therefore, there are no likely significant effects on any populations of marine mammals.

4.5 Potential cumulative effects

An assessment has been made of the potential impacts of the proposed activities on the receiving environment cumulatively with other projects in the area. As shown in Assessment of potential environmental effects

Based on the interactions identified, Table 4-3 considers the impact mechanisms, identifies the relevant control measures and provides an assessment of the potential likely significant effects.

Table 4-3, any impacts on air quality, marine water quality, benthic habitats and communities, fish, shipping and navigation and marine archaeology are expected to be localised, temporary and not significant, and therefore it is concluded that there will be no potential significant cumulative effects on these receptors from the site investigation with other projects or activities.

Further consideration has been given to the potential for marine mammal species, with sensitivity to underwater noise, and commercial fisheries to be affected by the site investigation activities cumulatively with other projects. Potential cumulative effects are anticipated to arise due to other offshore survey campaigns including those for other marine renewable energy projects, offshore cable installation projects or future surveys conducted by other marine or coastal developments. Any such survey campaigns may share common pathways of impact in terms of underwater noise from vessels, coring, and geophysical survey equipment (SBP, UHRS) and USBL, and in terms of the temporary exclusion or interference with commercial fisheries.

A review of the DHLGH Foreshore Licence Applications and Determinations search tool (Department of Housing, Local Government and Heritage (DHLGH), January 2022), was undertaken for foreshore licence applications for projects in 'County Galway' and 'County Clare'. This is considered a conservative approach in this instance, taking into account the very temporary and localised nature of the Sceirde Rocks Offshore Wind Farm site investigation activities proposed under this application.

Details of these projects and activities, their interaction with the site investigation activities proposed under this Foreshore Licence Application and the potential for cumulative effects, is set out in Table 4-10.

Table 4-10 Projects for consideration of cumulative effects

APPLICANT	FSL APPLICATION NUMBER	FORESHORE LICENCE STATUS	ACTIVITY	DISTANCE FROM SCEIRDE ROCKS FSL AREA	POTENTIAL FOR CUMUALTIVE EFFECTS	
					UNDERWATER NOISE	INTERFERENCE WITH COMMERCIAL FISHERIES
Connemara Organic Seaweed	FS006002	Consultation	Seaweed harvesting	25km	**NO** No spatial overlap and no pathway for in-combination underwater noise impacts from the site investigation activities	**NO** No spatial overlap and no pathway for cumulative effects impacts from the site investigation activities
Deep Sea Fibre Networks	FS007016	Consultation	Cable route survey and site investigations for subsea fibre optic cable	<5km	**YES** No spatial overlap but due to the site investigation activities under both applications there is a pathway for in-combination underwater noise impacts should they be undertaken in the same time period.	**YES** No spatial overlap but due to the site investigation activities under both applications there is a pathway for cumulative effects from interference with commercial fisheries, should they be undertaken in the same time period.

APPLICANT	FSL APPLICATION NUMBER	FORESHORE LICENCE STATUS	ACTIVITY	DISTANCE FROM SCEIRDE ROCKS FSL AREA	POTENTIAL FOR CUMUALTIVE EFFECTS	
					UNDERWATER NOISE	INTERFERENCE WITH COMMERCIAL FISHERIES
Galway County Council	FS007056	Consultation	Emergency repairs and fortification of coastal protection works	>50km	**NO** No spatial overlap and no pathway for in-combination underwater noise impacts from the site investigation activities.	**NO** No spatial overlap and no pathway for cumulative effects impacts from the site investigation activities
Galway County Council	FS005977	Consultation	Re-alignment of N59	>50km	**NO** No spatial overlap and no pathway for in-combination underwater noise impacts from the site investigation activities.	**NO** No spatial overlap and no pathway for cumulative effects impacts from the site investigation activities
Irish Water	FS007085	Consultation	Borehole site investigations to inform design of Roundstone	10km	**NO** No spatial overlap and no pathway for in-combination underwater noise impacts	**NO** No spatial overlap and no pathway for cumulative effects impacts from the site investigation activities

APPLICANT	FSL APPLICATION NUMBER	FORESHORE LICENCE STATUS	ACTIVITY	DISTANCE FROM SCEIRDE ROCKS FSL AREA	POTENTIAL FOR CUMUALTIVE EFFECTS	
					UNDERWATER NOISE	INTERFERENCE WITH COMMERCIAL FISHERIES
			Sewerage Scheme		from the site investigation activities.	
Marine Institute – Spiddal	FS006566	Consultation	Testing of prototype wind, wave and tidal energy devices	35km	**YES** No spatial overlap but due to the site investigation activities under both applications there is a pathway for in-combination underwater noise impacts should they be undertaken in the same time period.	**YES** No spatial overlap but due to the site investigation activities under both applications there is a pathway for cumulative effects from interference with commercial fisheries, should they be undertaken in the same time period.
Clare County Council	FS006666	Consultation	Coastal protection works and repair of seawall	>50km	**NO** No spatial overlap and no pathway for in-combination underwater noise impacts from the site investigation activities.	**NO** No spatial overlap and no pathway for cumulative effects impacts from the site investigation activities

APPLICANT	FSL APPLICATION NUMBER	FORESHORE LICENCE STATUS	ACTIVITY	DISTANCE FROM SCEIRDE ROCKS FSL AREA	POTENTIAL FOR CUMUALTIVE EFFECTS	
					UNDERWATER NOISE	INTERFERENCE WITH COMMERCIAL FISHERIES
DesignPro Cahiracon Quay	FS007081	Consultation	Testing of tidal power generating devices	>100km	No spatial overlap and due to the significant distance between application areas there is no pathway for in-combination underwater noise impacts from the site investigation activities.	No spatial overlap and no pathway for cumulative effects impacts from the site investigation activities
ESB Moneypoint	FS007141	Consultation	Ecology surveys in the form of 9 grab samples	85km	No spatial overlap and due to the significant distance between application areas there is no pathway for in-combination underwater noise impacts from the site investigation activities.	No spatial overlap and no pathway for cumulative effects impacts from the site investigation activities
Shannon Airport Authority	FS007036	Applied	Refurbishment of flood defences	>100km	No spatial overlap and due to the significant distance between application areas there is no pathway for in-	No spatial overlap and no pathway for cumulative effects impacts from the site investigation activities

APPLICANT	FSL APPLICATION NUMBER	FORESHORE LICENCE STATUS	ACTIVITY	DISTANCE FROM SCEIRDE ROCKS FSL AREA	POTENTIAL FOR CUMUALTIVE EFFECTS	
					UNDERWATER NOISE	INTERFERENCE WITH COMMERCIAL FISHERIES
					combination underwater noise impacts from the site investigation activities.	

In addition, from a review of 4C offshore website (https://map.4coffshore.com/offshorewind/, visited January 2022), the following offshore wind farm projects are located with 100km of the Foreshore Licence Area but do not have foreshore licence applications available on the DHLGH website:

- Ilen Offshore Wind Farm (approx. 45km);
- Inis West 2 Offshore Wind Farm (approx. 50km);
- Clarus Offshore Wind Farm (approx. 55km);
- Moneypoint Offshore Two (approx. 85km);
- Moneypoint Offshore One (approx. 90km); and
- Inis West 1 Offshore Wind Farm (approx. 95km).

In the absence of further information of any planned survey activities for these projects, a precautionary approach has been taken which assumes that there may be periods of geophysical survey activity involving underwater noise generation, and that some small, temporary safety exclusion zones will be requested (via a notice to mariners) during the course of the surveys. However, given the distances of these other projects from the Foreshore Licence Area, there will be no spatial overlap and no pathway for cumulative impacts from the site investigation activities. There are no other known projects or activities of relevance which are capable of combining with the Sceirde Rocks Offshore Wind Farm site investigation activities to give rise to likely significant cumulative effects.

There is a pathway for cumulative effects on marine mammals from underwater noise where other site investigation activities are conducted close to the Sceirde Rocks Offshore Windfarm site investigations, as shown on Table 4-10, if there is an overlap in timing of survey execution. However, all projects are required to undertake their marine surveys in accordance with the mitigation and guidelines provided in the 'Guidance to Manage the Risk to Marine Mammals from Man-made Sound Sources in Irish Waters' (DAHG, 2014), and therefore there will be no likely significant cumulative effect from injury or disturbance impacts from use of the geophysical survey equipment would have significant effects on marine mammal species in the area. This is on the basis that the site investigation activities cumulatively will not impair the ability of any individual marine mammal to survive or reproduce.

There is a pathway for cumulative effects on commercial fisheries, particularly inshore commercial fisheries, where other site investigation activities are conducted close to the Sceirde Rocks Offshore Windfarm Foreshore Licence Area. As described in Section 3.7, the Foreshore Licence Area lies within areas where line fishing, net fishing for crayfish and pot fishing for lobster and crab may take place at times. Such fishing activities also take place in coastal waters to the north and south of the Foreshore Licence Area, as shown on Figure 9. Therefore, depending on the timings of the various site investigations, there may be a cumulative impact arising from temporary displacement within parts of the fishing grounds. However, all of the site investigation activities will be of relatively short duration and the sizes of safety zones small. Given the short duration and small scale of the safety zones around each borehole and geophysical survey vessel, and the short duration of the benthic ecology survey, together with the control measures in place (Table 4-3, Item 7), there will be no likely significant cumulative effects on inshore fisheries from the presence of vessels and buoys associated with the Sceirde Rocks Offshore Wind Farm site investigation activities.

4.6 Conclusions of the Environmental Assessment

An assessment has been undertaken of the potential effects of the Sceirde Rocks Offshore Windfarm site investigations on the marine environment to demonstrate whether the proposed activities would be likely to have a significant effect on the environment by virtue, *inter alia*, of its nature, size and location.

Through a description of the proposed site investigations (Section 2 of this report) and the baseline environment across the Foreshore Licence Area and surrounding marine environment (Section 3), an assessment of the potential effects of the site investigations (Section 4) has been conducted for the relevant environmental receptors of:

- Air Quality;
- Benthic habitat;
- Fish;
- Marine Mammals;
- Protected Sites;
- Commercial Fisheries;
- Shipping and Navigation;
- Other sea users; and
- Marine Archaeology.

The site investigation has also been assessed cumulatively with other projects in the region to identify any potential for cumulative impacts.

Although there are expected to be some temporary, localised, minor environmental effects during the site investigations, through the implementation of best practice, adherence to industry guidance and implementation of marine mammal mitigation measures, the assessment has demonstrated that the proposed Sceirde Rocks Offshore Wind Farm site investigations will have no likely significant effects on the identified environmental receptors.

4.7 Conclusions of EIA Screening

Information in this report is submitted to the Minister to inform the screening determination on whether the site investigations of the Sceirde Rocks Offshore Windfarm should be subject to EIA.

The Sceirde Rocks Offshore Windfarm site investigations can be screened out for EIA on the following grounds:

- The site investigations do not fall under the description of activities included within Annex I or Annex II of the Directive, as discussed in Section 1.4; and
- The results of the environmental assessment presented above conclude that the proposed site investigations will have no likely significant effect on the environment;

The conclusion of the EIA Screening is based on the information provided as required in Schedule 7A of the Planning and Development Regulations 2001, and the relevant criteria set out in Schedule 7, together with additional relevant information used to conduct the environmental assessment.

The nature, scale and location of the site investigations is such that there are no foreseeable significant effects on the environment arising from the proposed surveys, and therefore it is the conclusion of this EIA screening exercise that an EIA is not required.

5 RISK ASSESSMENT FOR ANNEX IV SPECIES

This section addresses the Article 12 obligations of the Habitats Directive, which are transposed into Irish law in Regulation 29(1)(e)(i) of the European Communities (Birds and Natural Habitats) Regulations 2011. Information is submitted to assist the Minister in determining whether the site investigation activities, either individually or in combination with other activities, plans or projects, will have an adverse effect on the conservation status of animal species listed in Annex IV(a) to the Habitats Directive in their natural range.

Article 12(1) of the Habitats Directive states that:

> *1 . Member States shall take the requisite measures to establish a system of strict protection for the animal species listed in Annex IV(a) in their natural range, prohibiting: (a) all forms of deliberate capture or killing of specimens of these species in the wild; (b) deliberate disturbance of these species, particularly during the period of breeding, rearing, hibernation and migration; (c) deliberate destruction or taking of eggs from the wild; (d) deterioration or destruction of breeding sites or resting places.*

Regulation 29(1) of the European Communities (Birds and Natural Habitats) Regulations states:

> *29. (1) Where the Minister has reason to believe that any activity, either individually or in combination with other activities, plans or projects, is of a type that may—*
>
> *(e) have an adverse effect on the conservation status of— (i) animal species listed in Annex IV(a) to the Habitats Directive in their natural range pursuant to Article 12 of the Habitats Directive,*
>
> *the Minister shall, by notice, subject to paragraph (2), where he or she considers appropriate, direct that the activity shall not be carried out, caused or permitted to be carried out or continue to be carried out by any person in the European Site or part thereof or at any other specified land or may restrict or regulate the activity in the European Site or part thereof or at any other specified land, and each such notice shall be accompanied by a statement of the Minister's reasons for making the decision.*

This section has also been produced in accordance with Commission notice (2021) "Guidance document on the strict protection of animal species of Community Interest under the Habitats Directive".

5.1 Relevant Protected Species and Sources of Potential Impact

Annex IVa of the Habitats Directive lists the animal species of community interest that are in need of strict protection as described above. This protection must be applied across their entire natural range within the EU, both within and outside European sites. The list has been reviewed to identify the Annex IV species that could be present in Irish waters and within the foreshore area potentially affected by the proposed site investigations; this list is presented below.

5.1.1 Cetaceans

Annex IV of the Habitats directive includes all cetacean species. Twenty-four cetacean species have been identified within Irish waters. Through a desk-based baseline study, it was concluded that six of these species were identified by Rogan *et al* (2018) within the waters of the Irish Shelf and could potentially occur in or near the Foreshore Licence Area: bottlenose dolphin *Tursiops truncatus*, common dolphin *Delphinus delphis*, harbour porpoise *Phocoena phocoena*, minke whale *Balaenoptera acutorostrata*, Risso's dolphin *Grampus griseus* and striped dolphin *Stenella coeruleoalba* (see Section 3.5.1). The harbour porpoise, common dolphin and bottlenose dolphin are the most likely cetacean species to occur in the Foreshore Licence Area. SACs have been designated in Irish waters for bottlenose dolphin (including the Slyne Head Islands SAC, Slyne Head Peninsula SAC and West Connacht Coast SAC which lie north of the Foreshore Licence Area) and for harbour porpoise (including the Blasket Islands SAC and Roaringwater Bay and Islands SAC which lie approximately 125 km and 186 km respectively from the Foreshore Licence Area. As described in Section 4, although there is a possibility of interaction between these species and the proposed site investigation activities through the physical presence of the survey vessels and underwater noise, the only impact mechanism with a potentially significant effect is underwater noise. Further assessment is provided in Section 5.2.

5.1.2 Fish

While the European Sea Sturgeon *Acipenser sturio* is listed on Annex IV of the Habitats Directive and may possibly occur in Irish waters, OSPAR (2009) suggests that the Foreshore Licence Area will lie outwith the known range of this species. Therefore, it has been concluded that the proposed site investigation activities will have no likely significant effect on this species and no further assessment is required.

5.1.3 Mammals

The majority of other mammals identified by Annex IV of the Habitats Directive are terrestrial, and therefore will not be impacted by the site investigation activities. However, the Eurasian otter *Lutra lutra* (although listed as a terrestrial mammal on Annex IV of the Habitats Directive) has marine habits and uses the nearshore coastal waters in some parts of Ireland as described in Section 3.4.3. As presented in Section 3.5, there are several SACs along the west Ireland coast designated for the Eurasian otter. Otter populations in coastal areas utilise shallow, inshore marine areas for feeding. Therefore, the zone of influence for otters around the coastal European sites is expected to be the same as the site boundaries themselves. The boundary of the Kilkieran Bay and Islands SAC, which includes Eurasian otter as a feature of site designation, lies adjacent to the southern boundary of the Foreshore Licence Area and therefore it is possible that otters may occasionally be present within it. However, given that the hearing capacity of otters is less sensitive than the marine mammals species assessed (see Section 5.2 below), it has been concluded that the proposed site investigation activities will have no likely significant effect upon the population status of otters and no further assessment is required.

5.1.4 Reptiles

Marine turtles are the only reptiles that occur in Irish waters, where five species have been recorded as discussed in Section 3.4. While all five species are listed on Annex IV, the leatherback turtle *Dermochelys coriacea* is the only

species observed with enough regularity to be considered native to Irish waters (DCENR, 2015) and sightings are rare.

There is the potential for interaction between the site investigation activities and marine turtles through the physical presence of the survey vessels and underwater noise generation. Marine turtles have the potential to experience TTS and PTS as discussed for marine mammals; however, almost no data are available on the effects of intense sounds on marine turtles, with the only published studies focussing on seismic airguns (which are not part of these site investigation activities). Weir (2007) argues that an assessment of turtle behaviour in relation to such seismic surveys is hindered by the apparent reaction of individuals to the vessel rather than specifically to airgun sounds. These reactions occurred at close ranges (usually <10 m) to approaching objects and appeared to be based principally on visual detections.

The mitigation measures that will be in place for protection of marine mammals from noise sources (described in Section 4.4.7) will also serve to provide protection to any marine turtles that may occur in the area at the time. The survey vessels will be moving at slow speed or will be stationary Given the short duration and temporary nature of the site investigation activities, and that the geophysical surveys do not involve the use of towed equipment (streamers) behind the vessel, it is extremely unlikely that any turtles will encounter the site investigation activities. There are no likely significant effects upon the population status of any marine turtle species and no further assessment is required.

5.2 Assessment of Potential Impacts from Underwater Noise on Cetaceans

5.2.1 Noise impact mechanisms

Underwater noise emissions from the proposed site investigation activities constitute the greatest potential risk of injury or disturbance to cetaceans in the vicinity of the survey area and therefore these have been the subject of a detailed impact assessment involving underwater noise propagation modelling and the specification of strict mitigation measures as presented in Section 4.4.7 of this report. The key elements of the assessment are presented below.

Injury and disturbance from underwater noise may impact cetaceans in the following ways:

- Injury – physiological damage to auditory or other internal organs; and
- Disturbance (temporary or continuous) – disruptions to behavioural patterns, including, but not limited to migration, breathing, nursing, breeding, foraging, socialising and / or sheltering.

Physiological responses (injury) are generated when noise emissions fall within the hearing frequency-range of an individual. At the very base level, introduced sounds may impact cetaceans by causing auditory fatigue from the repeated focusing of the hearing apparatus on frequencies occurring at the limits of the individual's 'normal' hearing range. Such fatigue may cause a temporary reduction in hearing ability known as a Temporary Threshold Shift (TTS) (Finneran *et al.*, 2005; Popov *et al.*, 2013; Southall *et al.*, 2019). When anthropogenic sounds are sufficiently loud (i.e. at a large enough amplitude to generate intense pressure waves), they have the potential to

cause permanent injury to hearing apparatus, through Permanent Threshold Shift (PTS) (Southall *et al.*, 2007, Southall *et al.*, 2019; NOAA, 2018).

Behavioural changes (disturbance) may include changes to movement, such as altering direction or dive pattern, whilst acoustic responses may take the form of changing vocalisation patterns or communication with conspecifics. Both of these impact mechanisms are considered "disturbance responses" to anthropogenic sounds, and they may have population-level consequences if they preclude the use of important habitat for prolonged periods or impact upon their foraging or breeding success (Lusseau and Bejder, 2007; Williams *et al.*, 2006).

To determine the potential for noise impacts to cetaceans, predicted emission levels are compared to available empirically estimated thresholds for injury and disturbance. Several threshold criteria and methods for determining how sound levels are perceived by marine mammals are available (e.g. the decibel hearing threshold (dBht) method and other hearing weighted and linear measures) and each has its own advantages and disadvantages. The DAHG Guidance to Manage the Risk to Marine Mammals from Man-made Sound Sources in Irish Waters (NPWS, 2014), alongside other guidance such as that from Marine Scotland (2014), recommend using injury and disturbance criteria proposed by Southall et al. (2007), which is based on a combination of linear (un-weighted) peak sound pressure levels (SPL) and weighted sound exposure levels (SEL). Since the publication of this seminal paper, there has been mounting evidence of marine mammal auditory abilities in novel species which has led to amendments to the auditory thresholds for injury (NOAA, 2018; Southall et al.; 2019). In accordance with recent regulator feedback, these amended hearing groups and thresholds for acoustic injury were adopted for the assessment so that the best scientific evidence is used in the assessment. The thresholds used are detailed above in Table 4-4.

If a noise emission is composed of frequencies which lie outwith the estimated auditory bandwidth for a given species, then disturbance or injury is extremely unlikely. On the basis of these hearing sensitivities, it has been possible to screen out MBES and SSS (Table 5-1) from further noise modelling assessment. The hearing groups relevant to the risk assessment for Annex IV species are:

- Low-frequency cetaceans (LF) = minke whale (estimated auditory bandwidth of 7 Hz to 35 kHz);
- High-frequency cetaceans (HF) = bottlenose dolphin, common dolphin, Risso's dolphin and striped dolphin (estimated auditory bandwidth of 150 Hz to 160 kHz); and
- Very high frequency cetaceans (VHF) = harbour porpoise (estimated auditory bandwidth of 275 Hz to 160 kHz.

5.2.2 Underwater noise sources from the site investigations

An overview of survey activities and their potential impacts to cetaceans is provided in Table 5-1. While some survey techniques and activities may introduce noise to the marine environment, other activities do not operate in relevant frequency ranges or generate sufficient levels of noise to be considered as potential sources of noise-related injury or disturbance to cetaceans, and have been screened out of further consideration, as indicated in Table 5-1. Based on the information provided in Table 5-1, the potential noise sources associated with the Sceirde Rocks Offshore Wind Farm site investigations that are considered relevant to the cetaceans that may be present in or near the Foreshore Licence Area are:

- Ultra Low Baseline Positioning System (USBL);

- Sub-bottom profiling SBP; and
- Ultra High Resolution Seismic (UHRS

Table 5-1 Overview of potential impacts of marine survey equipment

ACTIVITY / EQUIPMENT	EXAMPLE EQUIPMENT	POTENTIAL IMPACTS	FREQUENCY RANGES (KHZ)	INDICATIVE SPL_{PEAK} (DB RE 1 1µPA)	INDICATIVE SPL_{RMS} (DB RE 1 1µPA)	CONSIDERED FURTHER IN THIS ASSESSMENT?
Vessels and Vehicles						
Survey vessels	Various	Propellers, engines, and propulsion activities form the primary noise sources of survey vessels. Vessel noise is generally continuous and comes in both narrowband and broadband emissions. Potential impacts depend on the duration of the survey activities, location of the survey routes and species of cetacean potentially present in the vicinity of the Foreshore Licence Area.	Acoustic energy from vessels is strongest at frequencies <1 kHz	N/A	<50 m length vessel = 160 – 175 >50 m length vessel = 165 – 185	No –The noise source levels associated with vessels are likely to be too low to result in injury, and the presence of a small number of survey vessels in the region does not constitute a change from baseline conditions.
Remotely Operated Vehicle (ROV)	Various	Potential impacts include disturbance from noise emissions associated with movements underwater. However, these are anticipated to be limited in scale, given the small size of the submerged vehicles. Collision risk is considered an unlikely impact, given the high level of manoeuvrability and slow movement associated with ROVs.	N/A	N/A	N/A	No – the predominant noise source during such activities is the USBL, and other geophysical survey sensors deployed on the vehicle, which is expected to mask any sound generated by the vehicle itself. Noise generated by geophysical survey devices has been considered separately (see below).
Marine Survey Equipment (noise emitting)						
Ultra-Low Baseline (USBL) positioning	HIPAP 501	USBL systems involve the emission of impulsive sound from a hull-mounted transducer to a subsea transponder, thereby introducing sound into the marine environment. The potential impacts of this sound on harbour porpoise, bottlenose dolphin and grey and harbour seal depends upon the	19.5 – 33.5	170 – 207	165 – 190	Yes – The pressure levels and frequencies at which the USBL operate are not of a level where injury is expected but have the

ACTIVITY / EQUIPMENT	EXAMPLE EQUIPMENT	POTENTIAL IMPACTS	FREQUENCY RANGES (KHZ)	INDICATIVE SPL_{PEAK} (DB RE 1 1µPA)	INDICATIVE SPL_{RMS} (DB RE 1 1µPA)	CONSIDERED FURTHER IN THIS ASSESSMENT?
system		abundance, distribution and sensitivity of the species, and the duration of the operations.				potential to cause disturbance to the six cetacean species that may occur in or near the Foreshore Licence Areal.
Side Scan Sonar (SSS)	Edge Tech 4200/4205	Side-scan sonar equipment produces impulsive sound emissions through high frequency pulses used to image the seabed habitat. Potential impacts to harbour porpoise, bottlenose dolphin and grey and harbour seal depend upon the frequency, location, and duration of the pulses.	300 – 900	190 - 230	187 – 227	No – The SSS used for the proposed survey operations will operate at frequencies above 300 kHz. This is above the hearing threshold of all marine mammals which may be present in the area. Hence no potential for injury or disturbance exists (NOAA, 2018).
Multibeam echosounder (MBES)	R2Sonic 2024; EM 2040	High frequency noise pulses created by multi-beam echo sounder equipment generate sound waves which produce impulsive underwater noise. Depending on the frequency of the pulses, location and duration of the operations, and the species present, there could be potential impacts on harbour porpoise, bottlenose dolphin and grey and harbour seal.	200 – 700	180 – 240	177 – 227	No – The MBES used for the proposed survey operations will operate at frequencies above 200 kHz. This is above the hearing threshold of all marine mammals which may be present in the area, as detailed, hence no potential for injury or disturbance exists (NOAA, 2018).
Sub-bottom profiling (SBP)	EdgeTech 2000 series (Chirp) Innomar SBP	Sub-bottom profiling involves the vertical emission of sound pulses (impulsive noise) to characterise the layers of sediment comprising the seabed. Such activities introduce noise emissions into the marine environment. The potential impacts of this sound depend upon the type of profiler technology	0.5 – 12 (chirp) 4 (pinger)	200 – 230 (chirp) 200 – 235 (pingers)	197 – 227 (chirp) 197 – 232 (pingers)	Yes – The frequencies of the noise emissions are within marine mammal hearing ranges and the source pressure levels may pose a

ACTIVITY / EQUIPMENT	EXAMPLE EQUIPMENT	POTENTIAL IMPACTS	FREQUENCY RANGES (KHZ)	INDICATIVE SPL_{PEAK} (DB RE 1 1µPA)	INDICATIVE SPL_{RMS} (DB RE 1 1µPA)	CONSIDERED FURTHER IN THIS ASSESSMENT?
	2000 series (Pinger)	used, as well as the abundance, distribution and sensitivity of the species, and the duration of the operations. There are numerous SBP technologies may be deployed during the survey operations including; pingers, chirpers and parametrics.	100 (pinger)			risk of injury and disturbance to all cetacean species that may occur in or near the Foreshore Licence Area.
Ultra-High-Resolution Seismic (UHRS) System	The Dura-Spark; The Dura-Spark UHD 240/400	An Ultra-High Resolution Seismic (UHRS) system is optimised to achieve a sub-bed penetration depth focusing on the depth range of 10–1000 m below seafloor. This technology requires a controlled seismic source of energy connected by high voltage cable to a sound source (boomer or sparker) that transfers the energy through the water to penetrate the seabed. The energy reflected back from the solid seabed layers is received by hydrophones on the sea surface, recorded and processed by a data acquisition system aboard a vessel, so that visual profile of the seabed can be created.	0.1 – 6 (sparker/ boomer)	216 – 250 (sparker/ boomer)	213 – 247	**Yes** – The frequency of the noise emissions is within marine mammal hearing ranges and the source pressure level may pose a risk of injury and disturbance to all of the cetacean species that may occur in or near the Foreshore Licence Area. .

5.2.3 Impact thresholds

Injury

Injury criteria proposed by NOAA (2018) are devised for two different types of sound:

- Impulsive: sounds which are short in duration (i.e. less than 1 second long) and temporary, occupy a broadband bandwidth, and have rapid rise and decay times with a high peak pressure level; and
- Non-impulsive: sounds which may occupy a broadband, narrowband or tonal bandwidth, can be brief, prolonged, continuous or intermittent in nature, and are not characterised by rapid rise and decay times or a high peak pressure level.

The geophysical, benthic and geotechnical surveys will comprise acoustic equipment which emits multiple pulsed sound, as detailed within Table 5-2. The noise emitted from the equipment listed in Table 5-2 will disperse through the water column, with sound pressure reducing as distance from the noise source increases, hence marine mammals will be exposed to a lower source pressure further from the noise source. Therefore, for the survey equipment with potential to cause injury or disturbance to cetaceans, the dispersion of noise through the water column has been modelled to assess the appropriate mitigation zone in which the source pressure levels received by cetaceans are reduced below potentially injurious levels.

A duel-metric approach has been adopted which identifies the range of potential injury to marine mammals which have been derived from the source level including the peak pressure and cumulative SELs experienced for each equipment type identified to require consideration for noise-related injury. The thresholds above which each marine mammal and pinniped hearing group may experience noise-related injury are presented in Table 5-2 These thresholds are derived from measurements of marine mammal hearing using weighting functions which account for peak hearing abilities for each hearing group (NOAA, 2018).

Table 5-2 Criteria considered in this assessment for the onset of injury in cetaceans from impulsive noise (NOAA, 2018; Southall et al, 2019)

MARINE MAMMAL HEARING GROUP[6]	IMPULSIVE NOISE		NON-IMPULSIVE NOISE
	Peak Pressure (dB re 1 µPa)	Cumulative SEL (dB re 1 µPa^{2}s)	Cumulative SEL (dB re 1 µPa^{2}s)
Low-frequency (LF) cetaceans	219	183	199
High-frequency (HF) cetaceans	230	185	198
Very high-frequency (VHF) cetaceans	202	155	173

[6] *Hearing groups have been defined using the naming conventions provided in Southall et al. (2019), which are based on accepted frequency ranges commonly used in acoustics; however, the groupings and their respective criteria do not differ from NOAA (2018).*

Disturbance

Significant disturbance may occur when there is a risk of a considerable proportion of animals from a population incurring sustained or chronic disruption of behaviour or becoming displaced from an area, with subsequent redistribution being substantially different from that occurring due to natural variation.

To consider the possibility of disturbance resulting from the proposed site investigations, it is necessary to consider both the likelihood that the sound could cause disturbance and the likelihood that sensitive receptors (cetaceans) will be exposed to that sound. Southall *et al.* (2007) recommended that the only currently feasible way to assess whether a specific sound could cause disturbance is to compare the circumstances of the situation with empirical studies.

Auditory thresholds for disturbance, as defined by the National Marine Fisheries Service (NMFS, 2014), coupled with behavioural response criteria detailed in Southall et al. (2007) have been adopted for the assessment of potential marine mammal disturbance from both non-impulsive and impulsive noise sources. These thresholds (provided in in SPLrms) and behavioural response severity ratings are detailed in Table 5-3.

Table 5-3 Disturbance threshold criteria for impulsive sounds (Southall et al, 2007; NMFS, 2014)

BEHAVIOURAL EFFECT	THRESHOLD CRITERIA SPL_{RMS} (DB RE 1 MPA)
Potential strong behavioural reaction (6 or more on the severity scale)	160

5.2.4 Underwater noise modelling approach

Underwater modelling has been undertaking using Xodus' SubsoniX noise model which was developed specifically for assessing environmental impacts due to underwater noise. The SubsoniX model approach is based on an extended version of the semi-empirical model developed by Marsh-Schulkin (Marsh and Schulkin, 1962). The sound propagation model uses several concepts including:

- Refractive cycle, or skip distance;
- Geometric divergence;
- Deflection of energy into the bottom at high angles by scattering from the sea surface;
- A simplified Rayleigh two-fluid model of the bottom for sand or mud sediments; and
- Absorption of sound energy by molecules in the water.

The following inputs are required to the model:

- Third-octave band source sound level data;
- Discreet range (distance from source to receiver);
- Water column depth and sediment layer depth;
- Sediment type (sand/mud);

- Sea state; and
- Source directivity characteristics.

The model is based on a combination of acoustic theory and empirical data from around 100,000 measurements and has been found to provide good predictions. Full technical details of the model are provided in Section 4.4.1 of this report and are not duplicated here in full.

5.2.5 Injury impacts

As discussed above, for the proposed site investigations, the expected frequency range of noise emissions from the SBP, UHRS and USBL operations overlap with the hearing range of all cetacean hearing groups. Potential injury to cetaceans (i.e. injury which results from a permanent threshold shift in hearing abilities) is limited to impulsive noise sources which exceed the injury thresholds.

Modelling of ranges at which injury impacts are likely to result from deployment of survey equipment has been undertaken. Example equipment has been selected to exemplify the realistic worst-case scenario for each survey technique, including the maximum SPLs across source frequencies meant to encapsulate the hearing abilities of all representative hearing groups. The noise modelling results are presented in Table 5-4.

Table 5-4 Noise modelling results for injury impacts from impulsive noise sources (N/E = no exceedance of thresholds)

ACTIVITY	FREQUENCY (KHZ)	PEAK SPL (DB RE 1µPA)	DEPTH (M)[7]	INJURY RANGE (M)											
				Weighted Cumulative SEL (Static Mammals)				Weighted Cumulative SEL (Moving Mammals)				Unweighted Peak SPL			
				VHF	HF	LF	PW	VHF	HF	LF	PW	VHF	HF	LF	PW
SBP	0.5 - 12	230	100	40	38	38	38	38	38	38	38	61	3	8	9
			10	5	4	4	4	5	4	4	4	73	4	13	15
	4	235	100	9	5	9	9	9	5	6	5	255	28	68	73
			10	N/E	N/E	N/E	N/E	N/E	N/E	N/E	N/E	445	98	178	188
	100	235	100	28	17	17	17	19	17	16	17	30	12	17	18
			10	N/E	N/E	N/E	N/E	N/E	N/E	N/E	N/E	29	11	16	17
USBL	19.5 – 33.5	207	100	43	8	4	5	38	2	1	1	3	N/E	N/E	N/E

[7] *These depths have been identified as representative of the nearshore and offshore depths in which surveys are likely to occur across the survey area, based on available bathymetry data.*

ACTIVITY	FREQUENCY (KHZ)	PEAK SPL (DB RE 1µPA)	DEPTH (M)[7]	INJURY RANGE (M)											
				Weighted Cumulative SEL (Static Mammals)				Weighted Cumulative SEL (Moving Mammals)				Unweighted Peak SPL			
				VHF	HF	LF	PW	VHF	HF	LF	PW	VHF	HF	LF	PW
			10	4	4	2	3	4	2	N/E	N/E	3	N/E	N/E	N/E
UHRS[8]	0.1	250	100	10	N/E	44	41	2	N/E	44	13	511	17	63	70
			10	3	N/E	4	4	2	NE	4	4	559	19	71	80
	6	250	100	44	44	44	44	44	44	44	44	381	14	49	54
			10	4	4	4	4	4	4	4	4	412	15	55	62

[8] *Noise modelling for UHRS undertaken based on a ping range of 0.0003 – 0.0015 second ping length, with 0.0015s results presented to represent the realistic worst-case scenario.*

Across modelling scenarios and metrics, the injury ranges were generally highest for the VHF hearing group which is represented by harbour porpoise. Conversely, HF cetaceans seemed to constitute the hearing group with the lowest potential impact ranges for the peak SPL. Additionally, for both the SBP and USBL equipment, LF cetaceans largely displayed the lowest impact ranges for the cumulative SEL metrics, whereas HF cetaceans demonstrated the lowest impact ranges for both SEL metrics when considering use of the low frequency UHRS system.

Higher frequency sounds attenuate more quickly than lower frequency sounds such that an animal would need to be much closer to the sound source for it to cause injury. For this reason, injury ranges were of the order of metres to tens of metres for the SBP operating at 100 kHz.

The deployment of USBL in 100 m depths elevated the potential range of impact to a maximum of 43 m for VHFs, when considering cumulative SEL metric. However, in order for the cumulative SEL threshold to be exceeded, an animal would have to remain within 43 m of the source for a sustained period. The likelihood of a cetacean remaining this close to operational equipment is extremely low when considering that the source is deployed from a moving vessel travelling at more than 2ms 1 (i.e. 4 knots) and, in some cases, is being towed at depth (e.g. a USBL may be mounted on a an ROV within a few metres of the seabed). Whilst USBL may be deployed from a stationary vessel during particular activities (e.g. seabed sampling), these are anticipated to be limited in duration. As such, a realistic risk of injury is not expected from the use of USBL, and no mitigation is proposed for USBL operations.

The greatest injury ranges to cetaceans during shallow water operations (i.e. 10m) came from both the UHRS operating at 0.1 kHz, and SBP operating at 4 kHz, wherein refraction off the seabed causes nearly immediate cylindrical spreading of noise emissions, causing the sound to travel farther along the horizontal plane of the water column more quickly. The deployment of the UHRS survey equipment in 10 m depths elevated the potential range of impact to a maximum of 559 m for VHF cetaceans. Whereby, the SBP operating at 4 kHz in shallow waters demonstrated a maximum impact range of 445 m for VHF cetaceans.

Whilst deployment of a very low frequency UHRS system and a low frequency SBP in nearshore waters constitutes a worst-case situation of the potential injury range attributable to the survey techniques, these scenarios are highly unlikely. Geophysical survey technologies generally employ higher frequency sounds in shallow waters where sound loss to absorption and transmission are much lower. As such, sound penetration below the seabed is achievable at lower powers and higher frequencies, which offer higher resolution imagery to the surveyor. Furthermore, when considering the directionality of the equipment, the impact ranges are further reduced. This is because the beam of sound generated by the equipment is directed downward towards the seabed, so the vast majority of power is contained within a roughly 40° angle from the source (the slant height of the conical noise source) to maximise penetration and the resultant imagery. Animals would need to be at the seabed below the noise source to experience the full sound levels behind the modelled impact ranges.

The majority of injury ranges were at least slightly reduced when considering animal movement during cumulative SEL estimation. Swim speeds of the species most likely to be observed in the area have been shown to be several ms- 1 (e.g. harbour porpoise may swim up to 4.3 ms-1) (Blix and Folkow, 1995; Otani et al., 2000). Furthermore, SNH (2016) has provided standard values for mean swimming speeds of various marine mammal species likely to occur in the project area, including harbour porpoise (1.4 ms-1; Westgate et al., 1995). To offer a representative model of the predicted noise exposure ranges of marine mammals moving away from the sound source, a mean swim speed of 1.5 ms-1 has been used in the calculations. Considering that the surveys themselves will take place

while the vessel is moving, the cumulative SELs of all equipment types are expected to be even lower based on the premise that animals are likely to move away from the mobile noise source at some angle opposing the direction of vessel travel

It should also be noted that the modelling scenarios are meant to define the worst-case injury ranges associated with the deployment of the project's survey equipment. The in-situ deployment of the noise-generating survey equipment will most frequently occur in waters of intermediate depths (i.e. somewhere between 10-100 m). Moreover, the frequency ranges depicted constitute the lowest and highest reasonably practicable settings for the survey activities modelled, meaning that the spread of sound in the marine environment is also likely to fall somewhere between the modelled extremes. The injury ranges anticipated to result from equipment use are thus likely to fall within the spectrum of those defined by the model outputs, thereby reducing the impact ranges associated with the low frequency survey equipment.

5.2.6 Disturbance impacts

An assessment of potential disturbance impacts from the SBP, USBL and UHRS operations is provided below. The outputs of the noise modelling assessment against the disturbance thresholds relative to SPL_{rms} values for the survey equipment are provided in Table 5-5.

Table 5-5 Noise modelling results for disturbance impacts from impulsive noise sources

ACTIVITY	FREQUENCY (KHZ)	SPL_{RMS} (DB RE 1µPA)	DEPTH (M)	RANGE OF BEHAVIOURAL CHANGE (M)
SBP	0.5 - 12	227	100	3,250
			10	2,750
	4	232	100	4,220
			10	3,120
	100	232	100	125
			10	120
USBL	19.5 – 33.5	190	100	9.0
			10	9.1
UHRS	0.1	247	100	2,100
			10	2,300
	6	247	100	1,450
			10	1,700

SBP, USBL and UHRS survey activities have the potential to generate a strong disturbance event. The potential for a disturbance impact to result from these types of technology varies between activity type, though, the predicted disturbance range is much greater for the low frequency noise sources which travel further within the marine environment. The sounds emitted by the SBP (operating at 0.5 – 12 kHz or at 4 kHz) and UHRS (operating between 0.1 – 6 kHz) form the lower frequency sounds and have the potential to generate disturbance impacts on the order of several km, whilst those from the USBL and higher frequency (i.e. 100 kHz) SBP are on the order of tens to a hundred metres.

As the survey vessel will not be stationary for prolonged periods during these activities, animals within a particular area will not be exposed to extended periods of underwater noise. Rather, individuals would have to follow the moving equipment to be subjected to lasting or prolonged periods of noise which may have detrimental effects at the individual or population level (i.e. a significant disturbance), which is highly unlikely.

The survey activities are anticipated to be completed in periods of 2-3 months, and within this time there will be periods of inactivity during weather downtime. Given the transient and short-term nature of the survey and vessel activities, it is highly unlikely that any disturbance impacts from use of the UHRS, USBL or SBP would negatively impact upon conservation objective of those cetacean species that may occur in or near the Foreshore Licence Area. This is on the basis that the modelled level of disturbance is unlikely to affect the ability of any individual animal to survive or reproduce.

5.2.7 Mitigation measures

Due to the potential for injury to cetacean species resulting from the site investigations, marine mammal mitigation will be implemented. Available mitigation measures specifically designed for geophysical surveys have been incorporated into the mitigation measures described below and the protocol 'Guidance to Manage the Risk to Marine Mammals from Man-made Sound Sources in Irish Waters' (Department of Arts, Heritage and the Gaeltacht (DAHG), 2014) will be followed at all times for all site investigation activities. Section 4.3.4 of the DAHG 2014 guidance specifically relates to geophysical survey activities. These best practice guidelines are now incorporated as standard operating procedures for all noise emitting surveys in Irish Waters and are considered sufficient by the competent authority (National Parks and Wildlife Service (NPWS)) to mitigate for disturbance to marine mammal species.

Full details of the mitigation measures that will be followed during the site investigations are set out in Section 4.4.7 of this report.

5.2.8 Residual Impacts

Injury

The soft-start procedure included in the protocol 'Guidance to Manage the Risk to Marine Mammals from Man-made Sound Sources in Irish Waters' (DAHG, 2014) is considered sufficient by NPWS, the competent authority for marine environmental protection to ensure that even the most sensitive of cetacean species is protected from injury impacts from site investigation underwater noise sources. In consideration of the relevant mitigation measures being applied, no cetacean would be within the monitored zone and therefore no injury impact will occur. For

these reasons, it is highly unlikely that any injury impacts from use of the geophysical survey equipment would impair the ability of any individual cetacean to survive or reproduce. Therefore, there are no likely significant effects on any populations of cetaceans.

Given the above, mortality or injury of the Annex IV cetacean species that may be present in the area (including during breeding and migration) or deterioration or destruction of breeding sites or resting places is not likely. Thus, the proposed site investigations are unlikely to adversely affect the favourable conservation status of any of the Annex IV species that may be present.

Disturbance

As the survey vessel will not be stationary for prolonged periods during the site investigation activities, animals within a particular area will not be exposed to extended periods of underwater noise. Rather, individuals would have to follow the moving equipment to be subjected to lasting or prolonged periods of noise which may have detrimental effects at the individual or population level (i.e. a significant disturbance), which is highly unlikely.

The geophysical survey activities are anticipated to be completed in periods of 2-3 months, and within this time there will be periods of inactivity during weather downtime. Given the transient and short-term nature of the survey and vessel activities, and through strict adherence to the DAHG 2014 guidance, it is highly unlikely that any disturbance impacts from use of the geophysical survey equipment would have a significant effect on cetaceans. This is on the basis that the level of disturbance is highly unlikely to affect the ability of any individual to survive or reproduce. Therefore, there are no likely significant effects on any populations of cetaceans.

Given the above, significant disturbance of the Annex IV cetacean species that may be present in the area (including during breeding and migration) or deterioration or destruction of breeding sites or resting places is not likely. Thus, the proposed site investigations are unlikely to adversely affect the favourable conservation status of any of the Annex IV species that may be present.

5.3 In-combination effects

An assessment has been made of the potential in-combination effects on cetaceans of underwater noise from the proposed site investigation activities together with other activities and projects in the area. Potential in-combination effects are anticipated to arise due to other offshore survey campaigns including those for other marine renewable energy projects, offshore cable installation projects or future surveys conducted by other marine or coastal developments. Any such survey campaigns may share common pathways of impact in terms of underwater noise from vessels, coring, and geophysical survey equipment (SBP, UHRS) and USBL.

A review of the DHLGH Foreshore Licence Applications and Determinations search tool (Department of Housing, Local Government and Heritage (DHLGH), January 2022), was undertaken for foreshore licence applications for projects in County Galway and County Clare. This is considered a conservative approach in this instance, taking into account the very temporary and localised nature of the Sceirde Rocks Offshore Wind Farm site investigation activities proposed under this application.

Details of these projects and activities, their interaction with the site investigation activities proposed under this Foreshore Licence Application and the potential for likely in-combination effects, is set out in Table 4-10 in Section

4.5 of this document. From this exercise, it was determined that, despite there being no spatial overlap, there is a potential pathway for cumulative underwater noise impacts with the site investigations for two other projects, should they be undertaken in the same time period:

- Deep Sea Fibre Network cable route survey and site investigations; and
- Marine Institute – Spiddal testing of prototype wind, wave and tidal energy devices.

However, it can be confidently assumed that all projects will undertake their marine surveys in accordance with the mitigation and guidelines provided in the 'Guidance to Manage the Risk to Marine Mammals from Man-made Sound Sources in Irish Waters' (DAHG, 2014), and therefore it is highly unlikely that any in-combination injury or disturbance impacts from use of the geophysical survey equipment would have significant effects on cetacean species in the area. This is on the basis that the site investigation activities in-combination will not impair the ability of any individual cetacean to survive or reproduce.

5.4 Conclusion of the Annex IV species risk assessment

From the above desk-based study, significant effects, mortality or deterioration of the Annex IV species identified within Section 5.1 that may be present within or in proximity to the Foreshore Licence Area is highly unlikely and therefore, the proposed site investigation activities will leave the conservation of the identified Annex IV species in a favourable condition.

6 Overall Conclusions

The environmental assessment section of this report (Section 4) provides the Minister with information on the potential environmental effects of the Sceirde Rocks Offshore Windfarm site investigations and concludes that the proposed activities will have no likely significant effects on the identified environmental receptors.

Information provided in this report, including that required under Schedules 7A and 7 of the Planning and Development Regulations 2001, is submitted to the Minister to inform the screening determination on whether the Sceirde Rocks Offshore Windfarm site investigations should be subject to EIA. The site investigations can be screened out for EIA on the following grounds:

- They do not fall under the description of activities included within Annex I or Annex II of the Directive; and
- The nature, scale and location of the site investigations is such that there are no foreseeable significant effects on the environment arising from the proposed activities.

The Annex IV Species Statement section of this report (Section 5) is provided is to assist the Minister in the determination of whether the proposed site investigations, individually or in combination with other activities, plans or projects, will have an adverse effect on the conservation status of animal species listed in Annex IV(a) to the Habitats Directive in their natural range. This assessment carried out demonstrates that the Sceirde Rocks Offshore Wind Farm site investigations will have no likely significant effects on any Annex IV species or their conservation objectives .

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