Oriel Wind Farm Ltd

Foreshore Licence Application for Site Investigations for Oriel Wind Farm, off Co Louth

Non-statutory Environmental Report

Issue | 17 November 2021

This report takes into account the particular instructions and requirements of our client.

It is not intended for and will not be relied upon by any third party and no responsibility is undertaken to any third party.

Job number 282833-00

Ove Arup & Partners Ireland Ltd

Arup
One Albert Quay
Cork
T12 X8N6
Ireland
www.arup.com

ARUP

Document verification

ARUP

Job title		Foreshore Licence Application for Site Investigations for Oriel Wind Farm, off Co Louth		**Job number** 282833-00
Document title		Non-statutory Environmental Report		**File reference**
Document ref				
Revision	**Date**	**Filename**	Oriel Site Investigation Environmental Report Draft 1.docx	
Draft 1	10 Sept 2021	Description	First draft	
			Prepared by	Checked by	Approved by
		Name	[redacted]	[redacted]	
		Signature			
Draft 2	05 Oct 2021	**Filename**	Oriel Site Investigation Environmental Report Draft 1.docx	
		Description	Second Draft	
		Description	Prepared by	Checked by	Approved by
		Name	[redacted]		
		Signature			
Issue	17 Nov 2021	**Filename**	Oriel Site Investigation Environmental Report Issue.docx	
		Description	For Final Issue	
		Name	Prepared by	Checked by	Approved by
		Signature	[redacted]		
		Name			
		Filename			
		Description			
			Prepared by	Checked by	Approved by
		Name			
		Signature			
			Issue Document verification with document		✓

Contents

			Page
1	**Introduction**		**1**
2	**Background**		**2**
3	**Methodology**		**3**
4	**Description of the Proposed Project**		**4**
	4.1	Survey area	4
	4.2	Proposed Site Investigation	6
	4.3	Survey Summary	8
	4.4	Schedule	11
	4.5	Description of the Proposed Survey Works	11
5	**Baseline Environment**		**21**
	5.1	Population	21
	5.2	Biodiversity	30
	5.3	Marine processes	37
	5.4	Water, Air, Noise, Climate	43
	5.5	Marine Archaeology and Cultural Heritage	46
	5.6	Material Assets	49
	5.7	Seascape	51
6	**Potential Impacts of the Proposed project**		**55**
	6.1	Population	55
	6.2	Biodiversity	56
	6.3	Marine processes	60
	6.4	Water, Air, Noise, Climate	61
	6.5	Marine Archaeology and Cultural Heritage	63
	6.6	Material Assets	63
	6.7	Seascape	64
7	**Mitigation Measures**		**65**
	7.1	Population	65
	7.2	Biodiversity	69
	7.3	Marine processes	73
	7.4	Water, Air, Noise, Climate	73
	7.5	Marine Archaeology and Cultural Heritage	75
	7.6	Material Assets	77
	7.7	Seascape	77
8	**Environmental Appraisal**		**78**

8.1 Population 78
8.2 Biodiversity 80
8.3 Marine processes 81
8.4 Water, Air, Noise, Climate 82
8.5 Marine Archaeology and Cultural Heritage 83
8.6 Material Assets 83
8.7 Seascape 84
8.8 Other Projects in the Area 84
8.9 Conclusion of Non-statutory Environmental Appraisal 84

9 Environmental Impact Assessment Screening 85

9.1 Environmental Impact Assessment Directive Requirements 85
9.2 Approach to EIA Screening 86
9.3 Screening for Mandatory EIA 87
9.4 Conclusion of the EIA Screening 88

10 References 89

11 Glossary 90

Appendix A

Vessel and Equipment Data Sheets

1 Introduction

Arup has been appointed by Oriel Windfarm Ltd. (Oriel) to prepare an application for a foreshore licence for a site investigation for the Oriel offshore wind farm and the offshore cable corridor (hereafter referred to interchangeably as 'the proposed project' and the 'proposed survey works'). The offshore area for the wind farm is located off the coast of County Louth, approximately 22km east of Dundalk.

Arup's brief includes the preparation of an Environmental Impact Assessment (EIA) Screening Report and a non-statutory Environmental Report (ER).

This EIA screening report and non-statutory ER forms part of a Foreshore Licence Application to the Department of Housing, Local Government and Heritage seeking permission to undertake marine survey works within the proposed project site to support the Oriel Wind Farm project. These surveys will comprise a geotechnical investigation to determine the stability of the soil for design of foundations and cable routes and surveys to update baseline environmental data and to enable the preparation of an Environmental Impact Assessment Report (EIAR) and Natura Impact Statement (NIS) for the wind farm development. The scope and methodology of the works are described in **Section 4.2** of this report.

2 Background

Oriel Windfarm Ltd. (hereafter referred to as 'Oriel' and 'the applicant') is an Irish renewable energy company that has been developing the proposed Oriel Wind Farm, which is located offshore in the North West Irish Sea, 22km off the coast of Dundalk, County Louth.

Oriel Windfarm Limited is an Irish company established in 2005 to develop the Oriel offshore wind farm. In 2017, Parkwind NV, an established European offshore wind farm company became a strategic partner in the Oriel project. In 2019, ESB also joined the project, creating a partnership with the development, construction and operational experience and financial backing required to deliver an offshore wind farm.

The offshore elements of the Oriel Wind Farm development will include wind turbines mounted onto a foundation installed into the seabed, an offshore substation and interlinking cabling between the turbines and the substation and an export cable between the substation and the shore.

Oriel was granted a Foreshore Licence in October 2005 from the then Minister for Communications, Marine and Natural Resources, to carry out a technical work plan to investigate the suitability of an area to the east of Dundalk Bay for the construction of an offshore wind farm. The technical work plan included geotechnical site investigation, an engineering assessment and the completion of an Environmental Impact Statement.

Following the completion of this work, Oriel applied for a Foreshore Lease in February 2007, to construct an offshore wind farm of up to 330MW potential within the surveyed area. For a number of reasons, the development of the project was delayed.

In the interim, Oriel introduced Parkwind NV as a strategic shareholder.

In May 2019 Oriel obtained a Foreshore licence reference no. FS 006840 for additional site assessment surveys in the offshore wind farm area and the export cable corridor. Oriel undertook both onshore and offshore surveys to support further engineering design of the wind park, the cable routes and the preparation of an EIAR and an NIS for submission with an application for development consent.

Oriel now proposes to undertake a detailed geotechnical investigation and further site surveys. The purpose of the geotechnical investigation is to investigate the stability of the soil for the detailed design of foundations and the detailed design of the inter array and export cables.

3 Methodology

While the evaluation of effects is non-statutory, Arup considered the effects of the proposed survey on environmental aspects, such as population and human health, biodiversity, water, air, climate, cultural heritage and material assets, where relevant, and addressed these in this report. Where relevant, the non-statutory evaluation had regard to the EPA's Revised Guidelines on the Information to be contained in Environmental Impact Statements (Draft August 2017) and the Department of Housing, Planning, Community and Local Government (2018) Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment (August 2018).

The screening assessment for the requirement for an EIA had regard to the Office of the Planning Regulator's practice note on Environmental Impact Assessment screening for development proposals (Office of the Planning Regulator, 2021), and the Guidance on EIA Screening published by the European Commission, (EC, 2017).

4 Description of the Proposed Project

4.1 Survey area

The survey area comprises the Oriel offshore wind farm area, including thethe offshore cable corridor, and its vicinity. The survey area is located off the coast of County Louth to the east of Dundalk Bay, approximately 22km east of Dundalk, 18km east of Blackrock, 5km south of the Cooley Peninsula and 10km north east of Dunany Point, as outlined in **Figure 4.1**.

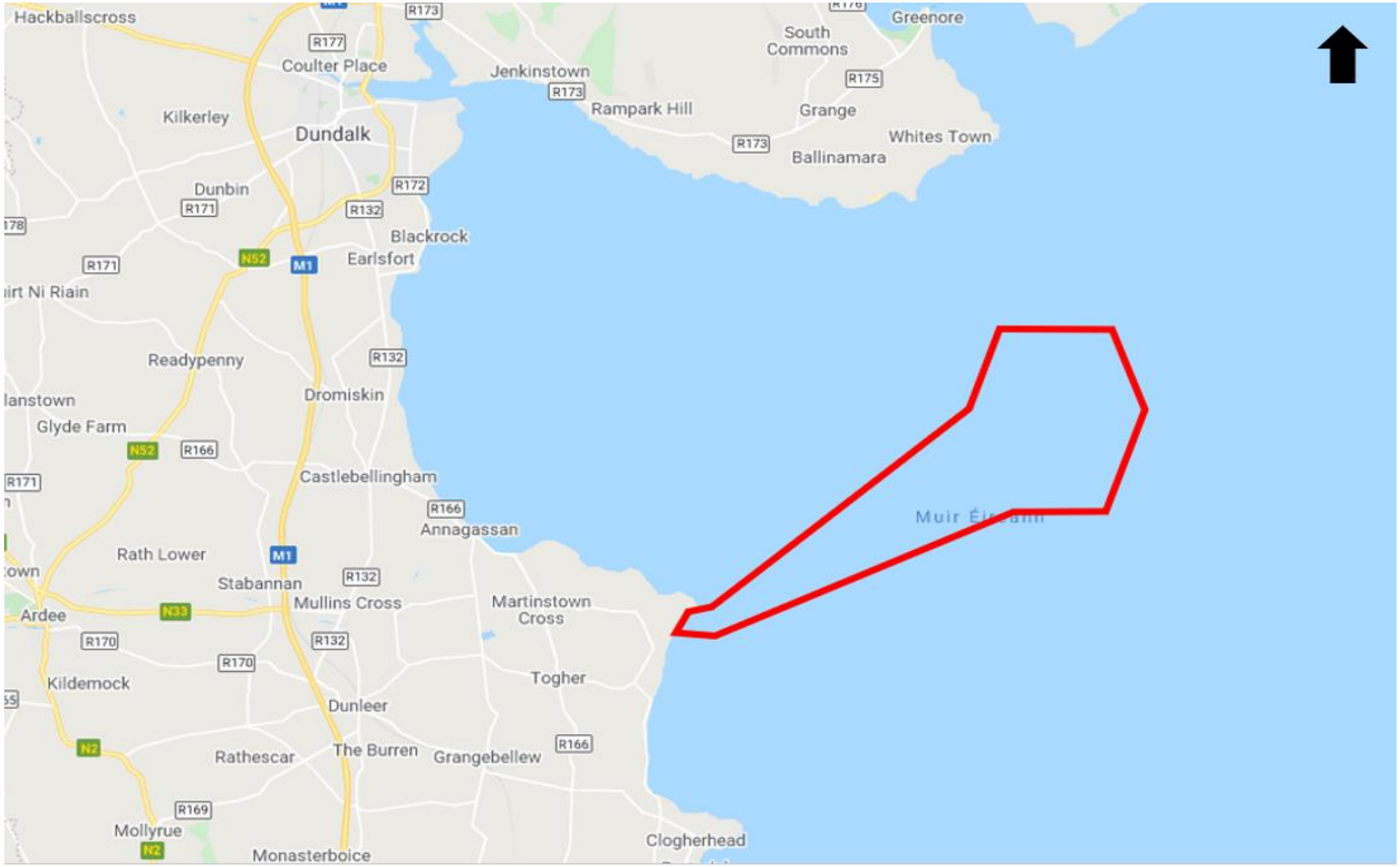

Figure 4.1: Location of the survey area (source:google maps)

The offshore wind farm area covers approximately 27.8km^2 and is broadly hexagonal in shape with a length of approximately 5.3km west to east and 6.7 km north to south.

The offshore cable corridor connects the offshore wind farm area to a landfall approximately 700m south of Dunany Point. The offshore cable corridor extends from the highwater mark (HWM) at the landfall to the south western boundary of the offshore wind farm area.

The offshore cable corridor is approximately 11km in length and covers an area of approximately 25km^2. The corridor is approximately 4km at its widest point, southwest of the offshore wind farm area, and narrows to approximately 1km at its narrowest point, just before landfall south of Dunany Point.

4.2 Proposed Site Investigation

The site investigations will include:

- Geophysical surveys;
- Geotechnical and sediment sampling;
- Environmental/Ecological surveys; *and*
- Metocean surveys.

Figure 4.2 presents an overview of the proposed survey works.

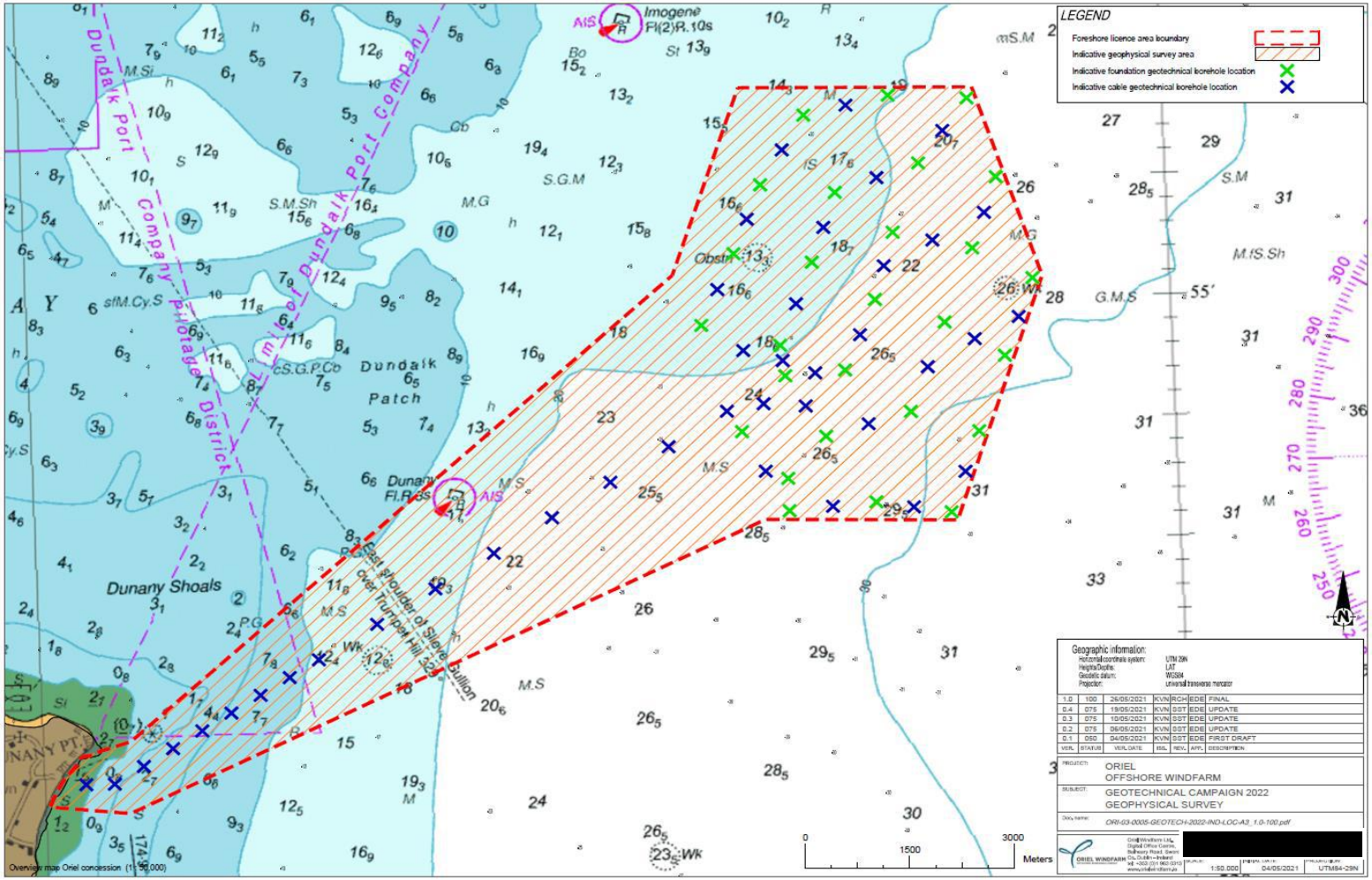

Figure 4.2: Overview of the proposed survey works

4.3 Survey Summary

Table 4. 1 provides information on each of the elements of the works and an indication of the survey duration. The survey locations are shown on the maps in the application but can be seen in **Figure 4.2**. These locations are indicative.

Table 4. 1: Summary of Surveys and Indicative Programme

Activity	Location	Proposed Sample Numbers
Geophysical Survey	Offshore windfarm area and offshore cable route	• Multibeam Echosounder (MBES) system for detailed bathymetric mapping • Side Scan Sonar (SSS) to achieve detailed seabed morphology and seafloor mapping • Magnetometer to detect geomorphological anomalies and ferrous obstructions • Sub-bottom Profiling (SBP), both single and multi-sourcings, to identify and characterise the layers of sediment/rock underneath the seafloor • Ultra-high-resolution multi-channel seismic (UHRS) to identify and characterise the layers of sediment/rock underneath the seafloor within the offshore site area. • Intertidal geophysical surveys including seismic, electrical resistivity and electromagnetic methods.
Geotechnical Survey and Sediment Sampling	Offshore windfarm area and offshore cable route	27 no. deep investigation locations at proposed structure locations (25 wind turbine locations and two options for the offshore substation location). Each deep investigation location will require up to 3 drilled boreholes with a target depth of 50 m below the seabed.
		41 no. shallow investigation locations along proposed inter-array and export cable routes. Each location will require one vibrocore or gravity core with a target depth of 3 m below the seabed.
		Up to 6 no. deep investigation locations in the intertidal area. Each location would be a drilled borehole with a target depth of up to 50m.
		Up to 12 no. shallow investigation locations in the intertidal area. Each location would be an excavated trial pit or borehole with a target depth of 3 m below the beach. Excavated locations to be backfilled immediately on completion of the investigation. Cores and CPTs may be taken from the boreholes or trial pits.
Environmental/ecological sampling	Offshore windfarm area and offshore cable route	<u>FPODs or CPODs</u> Environmental monitoring may include the deployment of up to 6 No. FPOD or CPOD devices for Static Acoustic Monitoring of Cetaceans. The devices will provide acoustic assessment of the presence/absence and species types of cetaceans (whales and dolphins) to i) allow for the recording species difficult to detect visually such as harbour porpoise, ii) provide data on other factors such as diel and tidal presence at the site and iii) to create a dataset with which to determine any effects of future construction or operation of a windfarm at a resolution which is relevant to managers. A FPOD or CPOD is a self-contained computer and hydrophone in a sealed sonde approximately 1m in length and can log the times and duration of click trains which resemble the echo-location clicks produced

Activity	Location	Proposed Sample Numbers
		by porpoises and dolphins. Static Acoustic Monitoring is independent of weather conditions once deployed and thus ensures high quality data is collected but only at a small spatial scale (typical detection distances of 250m (porpoises) to 800m (dolphins). Each FPOD or CPOD will require a robust, heavy weight mooring blocks of c. 250kg, clump chain and rope with either an acoustic release mechanism and benthic buoy or a robust mooring with a surface marker buoy. Batteries must be replaced and data downloaded every 3/4 months. Deployment and servicing will be undertaken from a survey vessel.
	Offshore windfarm area and offshore cable route	<u>Water Quality Sondes</u> Up to 6 No. sondes may be deployed for water quality monitoring through the water column – these will be used to monitor a range of parameters including turbidity, salinity, temperature, pH, DO, EC. Sondes will be either suspended from a surface marker buoy or a benthic buoy with acoustic release at a range of depths dependent on survey requirements. Each buoy will have a robust mooring on the seabed similar to the FPOD/CPOD mooring described above.
	Offshore windfarm area and offshore cable route	<u>Benthic and intertidal</u> Survey techniques may include drop down video (DDV) and deployment of a mini Hammond grab or Van Veen grab to obtain samples of 1-5kg in mass each. Manual digging will be used in the intertidal zone to collect the samples. Samples will be analysed to determine the benthic faunal community present and sediment geochemistry.
	Offshore windfarm area and offshore cable route	<u>Fish and shellfish GPS Tracking</u> Up to 6 sondes may be deployed for the tracking of fish or shellfish within the windfarm and export cable corridor. Similar to the FPOD/CPODs and water quality the sondes will deployed attached to a robust mooring with either a benthic buoy and acoustic release and/or a surface marker buoy.
Oceanographic and meteorological	Offshore windfarm area and offshore cable route	All metocean survey works will occur at one location within the marine survey area which will be determined following the appointment of a suitable contractor. The data will be collected via a floating weather station, which will include a wave rider and a wind measurement LiDAR current profiler. This equipment will be mounted on specifically designed floating bouys which are moored to the seabed using an anchor chain and clump weigths. All equipment including the moorings will be removed following completion of the survey. The wave rider will be used to collect wave height and current data across the site, while the LiDAR system will be used to measure the wind characteristics within the site.

4.4 Schedule

It is anticipated that the survey works will commence in Q2 of 2022 subject to approval of the Foreshore Licence Application, appointment of a suitable contractor, availability of vessels and suitable weather conditions. In order to allow for unforeseen delays we seek approval of a Foreshore Licence for a period of 3 years, to Q2 of 2025.

Table 4.2 outlines the approximate durations for the survey works required.

Table 4.2: Schedule of survey works

Survey	Time	Conditions
Geophysical Survey	4 weeks	Weather dependent
Geotechnical Survey	4 to 8 months	Weather dependent; will be extended if unforeseen ground conditions are discovered
Environmental/Ecological Survey	≤ 24 months	Weather dependent
Metocean Survey	≤ 24 months	May be greatly reduced if findings are in line with existing data collected from previous surveys

4.5 Description of the Proposed Survey Works

4.5.1 Survey Vessels

The marine survey works will be carried out by a dedicated marine vessels, suitable for the scope of work required, the water depth and the anticipated conditions of the survey area and the transit routes. The exact equipment to be used will be confirmed following a tender process to procure the site investigation contractor.

Separate survey vessels will be used for each activity. A larger vessel will be required to complete the offshore geotechnical works with smaller vessels for the geophysical, metocean and ecological surveys. A smaller RHIB type vessel may be used for geophysical works in shallow waters. Land based drilling and excavators may be used for the investigations and surveys within the intertidal zone. The types of vessels are described in the sections below.

These vessels will be comparable to those typically used in the industry for carrying out similar technical work and will possess all relevant classification certificates.

The vessels will conform to the following minimum requirements as appropriate:

1. Station-keeping and sea keeping capabilities required by the specified work at the proposed time of year; the appointed contractor will provide supplemental tug assistance if such assistance benefits the operation;

2. Endurance (e.g. fuel, water, stores, etc.) to undertake the required survey works;
3. Staffing to allow all planned work to be carried out as a continuous operation (on a 24 hour per day basis for the offshore activities and on a 12 hour per day basis for the inshore activities);
4. Equipment and spares with necessary tools for all specified works;
5. Appropriate accommodation and messing facilities on board; and
6. Adequate soil laboratory testing facility.

The vessels used for the surveys will be sound and capable of remaining safely at sea for a minimum of 30 days under weather conditions typically encountered in the marine survey area at the time of year that the operations are to take place. The appointed contractor will be responsible for all shipboard systems and equipment calibration and re-calibration, including spares. For every 30 days of operations the vessels will accrue one day of maintenance time.

Vessels will have breadth and draft of suitable proportions to provide adequate stability for the duration of the intended operation. The vessels will be capable of passage speeds in excess of 10 knots and extended survey operations at speeds 4 knots or less.

In addition to AIS-A and Active Radar Enhancing Systems, the vessels will have the following communications equipment as a minimum:

- Multi-channel VHF (very high frequency) and HF (high frequency) radio capable of working at all marine frequencies and with a dual watch facility.
- Mobile phone.
- Hand-held radios.
- Frame and winch for the deployment of equipment and sensors, sized for the required equipment/sensors loads and pulling force. The winch speed and size must be compatible with planned surveys.
- Gyrocompass.
- SATCOM (satellite communications) facilities (phone/fax and e-mail).
- 2 independent DGPS systems, a primary and secondary system (DGPS has a greater degree of accuracy than GPS).

All survey vessels and marine support vessels will conform to the relevant ISO and API technical specifications for drilling equipment and will maintain valid class with the recognised Classification Society.

4.5.1.1 Offshore Vessel

The survey vessel used for offshore works will be either a jack-up barge or a Dynamic Positioning (DP) vessel. Typical examples of the types of vessels used to undertake these works are provided in Appendix A.

Jack-up barges utilise a fixed anchoring system in order to maintain the required position within the site. The vessel consists of a self-elevating platform and several “legs”, that are deployed to the ocean floor mooring the vessel in place.

The survey works are carried out from the self-elevating platform, which is raised above the water’s surface. If used, the jack-up barge will meet with the following minimum requirements:

- The vessel will have at least four mooring points.
- The self-elevating platform must be permanently manned (i.e. off-shift personnel to stay onboard even if the accommodation is not a permanent equipment of the jack-up).
- The platform must be provided with a class certificate verifying the provision of adequate safety equipment for the type of vessel and the number of on-board personnel.
- The platform will be certified in compliance with the MODU Code and the BWEA guideline.

Unlike jack-up barges, DP vessels maintain station via propellors and thrusters with inputs from satellite DGPS signals, allowing the vessels to be positioned over any point on the seabed and maintain position without employing a fixed anchoring system. Using thrusters or propellers, a DP vessel can maintain position within a 2m to 0.5m window depending on the sea state/weather conditions and available power. The vessel will also transit under DP control along a given pre-determined path.

If used, a DP vessel will meet the following minimum requirements:

- The vessel must be fully equipped with a Class II DP system as a minimum.
- Two DP certified operators with the necessary experience must be members of the crew.
- The offshore works will be carried out on a 24-hour shift basis, with personnel working two 12-hour shifts. This will allow the works to be continuous.

4.5.1.2 Nearshore Vessel

The smaller, nearshore vessel will be used in locations where the water depth is too shallow for the larger, offshore vessel to carry out the works. This vessel does not need to have a dynamic positioning system. However it must have full DGPS capability. The vessel is usually held on station by joy-stick control and will deploy an anchor to assist in maintaining station (depending on sea state and weather conditions). The smaller vessel will use similar equipment to the larger vessel to carry out the required survey works.

The nearshore works will be carried out on a 12 hour per day basis, with the vessel returning to port at the end of each day.

4.5.1.3 Survey Navigation

All navigation equipment and instrumentation will be calibrated and used correctly. Calibration and/or verification will be repeated in the event of any equipment malfunction, which will nullify earlier calibrations and/or verifications.

Qualified surveyors will be used to operate the navigation and positioning equipment continuously throughout the survey while maintaining a continuous log of all navigation activities throughout the survey.

Sufficient survey and positioning spares and consumables will be provided to enable the survey to be completed without any degradation of navigation and positioning quality and effectiveness and without the need to return to port to acquire additional equipment.

4.5.2 Geophysical Survey

4.5.2.1 Scope of Work

The purpose of the geophysical survey is to determine the sediment conditions within the survey area in order to update the information gathered in previous survey works. This additional data will be used to better understand the sub-surface structure, in particular the sub-surface stratigraphy, and to confirm the bedrock elevation. The information will be used to assess the stability of the sub-surface soil for the design of foundations and the detailed routing of the inter array and export cables

The objectives of the geophysical survey are to:

- Produce detailed bathymetric mapping;
- Obtain detailed seabed morphology;
- Identify the nature of the seabed;
- Acquire both shallow and deep geological cross-sections of the wind farm site; *and*
- Confirm the export cable route within the cable route corridor.

The geophysical survey will include bathymetric, side scan sonar, magnetometry and seismic sounding of the proposed site. Details of the exact survey equipment will be determined prior to commencement of the works; however, it is envisaged that the geophysical data acquisition will involve the following acoustic-based techniques:

- Multibeam Echosounder (MBES) system for detailed bathymetric mapping.
- Side Scan Sonar for detailed seabed morphology and seafloor mapping.
- Magnetometer for detecting geomorphological anomalies and ferrous obstructions.

- Sub-bottom Profiling (SBP), both single and multi-sourcings, to identify and characterise the layers of sediment/rock underneath the seafloor along the cable route corridor.
- Ultra-high-resolution multi-channel seismic (UHRS) to identify and characterise the layers of sediment/rock underneath the seafloor within the windfarm site.

There may be the use of an ultra-short baseline (USBL) system to monitor the position of towed equipment. The USBL system consists of a multi-element transducer mounted on the hull of the vessel and a transponder attached to the towed equipment (e.g. side-scan sonar). USBL equipment is widely used by offshore commercial and research vessels where positional accuracy of towed survey equipment is critical. The emitted pulses will be short pulse width 'pings', approximately in the range of 20-35kHz and with a source level of up to ~200dB re 1µPa @1m (peak).

The geophysical surbey will comprise transects with a total length of circa 84km and a distance of 1km between each transect. The seismic source will detect the geological strata to a depth of 40m below the seabed (bsb).

4.5.2.2 Multibeam Echosounder (MBES)

The MBES system will be used to provide detailed bathymetric mapping throughout the survey area. An MBES is a type of sonar (acoustic surveying) used in seabed mapping wherein acoustic waves are used to indicate depth-to-seabed. The device is typically affixed to a vessel's hull or towed in its wake. The process is non-intrusive, and the device will not make contact with the seabed at any point. The Kongsberg EM710 may be taken as an indicative example of a MBES system to be used in the completion of these works. The equipment will operate within a frequency range of 70-100kHz with sound pressure levels in the range of 225-231dB re1µPa at 1 metre range[1].

4.5.2.3 Side Scan Sonar

The side scan sonar will be used to achieve detailed seabed morphology and seafloor mapping of the survey area. The survey is carried out using a sonar device attached to a vessel that emits fan-shaped pulse down towards the sea floor across a wide-angle perpendicular to the path of the sensor through the water. The intensity of the acoustic reflections from the seafloor of this fan shaped beam is recorded in a series of cross-track slices.

When stitched together along the direction of motion, these slices form an image of the sea bottom within the swath (coverage width) of the beam. The equipment will operate within a frequency range of 100kHz-500kHz with source levels at 235dB re 1µPa at 1 metre range.

[1] https://cdn1.shipserv.com/ShipServ/pages/profiles/54162/documents/EM-710-Product-Description.pdf

4.5.2.4 Magnetometer

A magnetometer detects ferrous objects and as such is used to locate and identify ferrous objects on or buried in the seabed within the range of the magnetometer. The device precisely measures the earth's magnetic field and detects any anomalies, which represent ferrous objects such as lost anchors, sunken ships and buried piped. The magnetometer is typically towed behind a survey vessel or affixed to a vessel's hull. The process is non-intrusive, and the device will not make any physical contact with the seabed at any point. The G-882 Marine Magnetometer will be taken as an indicative example and datasheet for this device in included in Appendix A.

4.5.2.5 Sub-Bottom Profiler (SBP)

The SBP will be used along the cable route corridor only. This device uses reflection seismology to give a 2D image of the sub-seabed geology. It is typically towed behind the vessel during survey works or affixed to the vessel's hull. The process is non-intrusive, and the device will not make any physical contact with the seabed at any point.

The Innomar SES-2000 Quattro Parametric SubBottom Profiler will be taken as an indicative example and the datasheet for this device is included in Appendix A. The shallow sub-bottom profiler system will be used within the cable route corridor and will have the following general specifications:

- Primary frequency of between 85 and 115kHz
- Secondary low frequencies between 2kHz and 20kHz;
- Source levels of 235-245dB re 1µPa at 1 metre range.
- A vertical resolution better than 0.2 metres;
- Penetration of 5 metres.

The profiler will be supplied with the following recorders and peripheral processing equipment:

- Fire control unit;
- Time varied gain;
- Swell filter;
- Bandpass or Time Varying Filters (TVF).

4.5.2.6 Ultra-high-resolution multi-channel seismic (UHRS)

The UHRS will be used within the windfarm site only, commonly used variants of this technology are known as Sparkers and Boomers. It will have the following characteristics as a minimum:

- repeatable source;
- frequency range between 1kHz and 3.5kHz;

- broadband width in excess of 2.5kHz at -10db;
- vertical resolution better than 0.5 metres;
- penetration 50 metres;
- variable energy levels 100-1000 Joules;
- record length suitable for the maximum depth required (250ms);
- sampling rate 0.25ms.

A multi-channel hydrophone streamer will be used. The streamer will be neutrally buoyant or controlled, well maintained and free of air bubbles. The hydrophone will have a response appropriate to the source used but will generally have a flat response between 500Hz and 10kHz. The streamer will have at least 16 channels and be 50m long. A tail buoy with a radar reflector will be used to mark the streamer.

4.5.3 Geotechnical Survey

4.5.3.1 Scope of Work

The purpose of the geotechnical survey is to to investigate the stability of the subsoil for foundation design by providing relevant information about the soil to a depth below which possible existence of weak formations will not influence the safety or performance of the wind turbine and its support structure.

The geotechnical survey will include 27 no. deep investigation locations and 41 no. shallow investigation locations.

Table 4.2 shows the indicative locations where these investigations will take place.

4.5.3.2 Boreholes

Some 27 No. deep investigations will be carried out at proposed structure locations (25 wind turbine locations and two options for the offshore substation location). Each deep investigation location may require up to 3 drilled boreholes with a target depth of 50 m below the seabed. Thus, up to 81 geotechnical boreholes may be drilled.

The equipment used to drill the boreholes will follow the ISO and API technical specifications for drilling equipment and at a minimum will have:

- A heave motion compensator system on board (seabed frame and/or drill string) with a minimum heave compensation of 1.5m.
- Capability of drilling lubricant ‘mud’ production to different densities (when mud production is required for the works). The mud will be water or bio-degradable organic polymer- refer to Appendix A for example data sheet.

A detailed description of the soil types, and the in situ geotechnical properties determined for the boreholes will be recorded in the boring log to characterise the strata.

Coring and sampling will be done in general accordance with EN ISO22475-1 Geotechnical Investigation and Testing. Rotary coring equipment, such as Geobor-S is expected to be utilised.

In situ testing will include the option of either down-hole wireline piezocone penetration testing (PCPT) associated with P-S wave logging or down-hole wireline seismic cone penetration testing (SCPT) over full length of borehole.

The boreholes are to be advanced by alternating PCPT/SCPT and push/core sampling; the methods will depend on the type of material type encountered. Within a granular deposit, the boreholes are to be advanced by alternating PCPT/SCPT and push sample. Where the sample recovery is poor using the push sampler, a hammer sampler will be used instead. Blow counts measured during hammer sampling will be recorded and presented on the Borehole Logs. Within the cohesive deposits, the boreholes are to be advanced by PCPT/SCPT followed by two push samples (repeat cycle). Rotary coring will be used instead of push sampling in suitable materials, in which case the CPT and cores will be alternated.

The samples/cores will be recovered in liners or in Shelby tubes for all soil types and the appropriate technique will be selected to minimise soil disturbance and maximize recovery.

SCPT tests will be executed at a minimum of four of the locations, which will be confirmed following the results of the geophysical survey. Two seismic measurements will be carried out during each SCPT stroke at a depth interval of 1m; the envisaged volume is 40-60 SCPT tests in total.

4.5.3.3 Vibrocoring/Gravity Coring

The contractor will carry out 41 No. shallow investigations along proposed inter-array and export cable routes. Each investigation will require one vibrocore or gravity core at each location with a target depth of 3 m below the seabed.

The cores will be carried out along the line of the cable route which is still to be defined, within the cable corridor.

Vibrocoring will be performed where cohesionless soil is expected. The rig will be fitted with a PVC liner, core catcher and cutting shoe. The vibrocorer will be lowered onto the seabed, position and depth will be noted, after which the vibrocoring process will start. Upon refusal or at the target depth, the stop condition will be recorded and the vibrocorer will be recovered on deck where the recovery rate will be measured. If required, a core catcher will be used to prevent the sample dropping out of the PVC liner.

All cores will be examined and tested offshore before any sealing of the sample. Soil found in the vibrocoring shoe will be stored in a bag.

Gravity coring (wireline self-weight penetration sampler) will be performed where cohesive soil is expected. The rig will be equipped with a PVC liner. The gravity

corer will be lowered on the seabed and penetrates in the seabed under its own weight. Upon refusal or at target depth, the gravity core will be recovered on deck where the recovery rate will be measured.

All cores will be examined and tested offshore before any sealing of samples.

4.5.4 Environmental/Ecological Survey

4.5.4.1 Scope of Work

The purpose of the ecological survey is to update the baseline environmental data collected from previous ecological surveys. This data will primarily be used to inform the preparation of the EIAR for the windfarm and export cables, by describing the environmental conditions within the site, and subsequently developing appropriate mitigation measures for any potential environmental impacts. The ecological scope of work will include the following:

FPOD or CPODs

It is proposed to deploy FPOD or CPOD devices for Static Acoustic Monitoring of Cetaceans. The devices will provide acoustic assessment of the presence/absence and species types of cetaceans (whales and dolphins) to i) allow for the recording species difficult to detect visually such as harbour porpoise and to ii) provide data on other factors such as diel and tidal presence at the site.

A CPOD is a self-contained computer and hydrophone in a sealed sonde approximately 1m in length. The CPOD can log the times and duration of click trains which resemble the echo-location clicks produced by porpoises and dolphins. Static Acoustic Monitoring is independent of weather conditions once deployed and thus ensures high quality data is collected. Data collection will be at a small spatial scale (typical detection distances of 250m (porpoises) to 800m (dolphins). Each FPOD or CPOD will have a robust, heavy weight mooring blocks of c. 250kg, clump chain and rope with either an acoustic release mechanism and benthic buoy or a robust mooring with a surface marker buoy. Batteries will be replaced and data downloaded every 3/4 months. Deployment and servicing will be undertaken from a survey vessel.

Water Quality Sondes

It is proposed to deploy sondes for water quality monitoring through the water column – these will be used to monitor a range of parameters including turbidity, salinity, temperature, pH, dissolved oxygen and electrical conductivity. Sondes will be either suspended from a surface marker buoy or a benthic buoy with acoustic release at a range of depths dependent on survey requirements. Each buoy will have a robust mooring on the seabed similar to the FPOD/CPOD mooring described above.

Benthic and intertidal

The survey will include drop down video and deployment of a mini Hammond grab or Van Veen grab to obtain samples of 1-5kg in mass each. Manual digging

will be used in the intertidal zone to collect the samples. Samples will be analysed to determine the benthic faunal community present and sediment geochemistry.

Fish and shellfish GPS Tracking

Up to 6 sondes will be deployed for the tracking of fish or shellfish within the windfarm and export cable corridor. Similar to the FPOD/CPODs and water quality sondes, these sondes for the tracking of fish or shellfish will deployed attached to a robust mooring with either a benthic buoy and acoustic release and/or a surface marker buoy.

4.5.5 Metocean Survey

4.5.5.1 Scope of Work

The purpose of the metocean survey is to obtain site specific atmospheric, wave and wind data over a minimum period of 12 months. All metocean survey works will occur at one location within the marine survey area. The location will be determined following the appointment of a contractor.

The data will be collected via a floating weather station, which will include a wave rider and a wind measurement LiDAR current profiler. The wave rider will be used to collect wave height and current data across the site, while the LiDAR system will be used to measure the wind characteristics within the site. This equipment will be mounted on specifically designed floating bouys which are moored to the seabed using an anchor chain and clump weigths. All equipment including the moorings will be removed following completion of the survey.

4.5.6 Access and Egress Arrangements

All offshore works will be carried out from a vessel. The offshore survey vessel may mobilise directly to site from its base or from a suitable port facility such as Dublin Port.

Access to the intertidal zone may be made from the landward side down an existing lane (Legg Lane) at the southern boundary of Dunany Demesne. This lane can be seen in the aerial photograph, **Figure 5.3**.

5 Baseline Environment

5.1 Population

5.1.1 Commercial Fishing

This section provides an overview of commercial fishing activity within the survey area.

5.1.1.1 Gear Type

The predominant gear types recorded in the survey area are bottom trawls (demersal otter trawl), dredging and pots. Other gear types recorded in the vicinity of the application area include pelagic trawls, seines and nets, although these were recorded less frequently than the demersal gear. Consultation with fishers active in the area identified pots as the main gear type across the application area and hook and line fishing as an additional gear used in the vicinity of the offshore wind farm area.

5.1.1.2 Traditional Fishing Grounds

Inshore fishing grounds overlapping with the survey area include a bivalve mollusc production area for cockles and razor clams (the “Dundalk Bay production area”), trammel and gill net fishing for mixed demersal species, dredge fishing for razor clam, scallops and mussels, and potting for shrimp, lobster, crab and whelk. No periwinkle grounds overlap with either the offshore wind farm area or offshore cable corridor. Four periwinkle harvesting sites are located within the survey area. Due to the high density of shellfish found within Dundalk Bay, the area is subject to a fisheries management plan.

Offshore fishing grounds in the survey area include the Irish Sea prawn grounds and areas fished by mobile bottom, mobile seine, mobile other and passive gear types. Automatic Identification System (AIS) data for 2019 suggest that vessels are steaming to and from offshore grounds, across the offshore wind farm area. The Irish Sea Prawn Grounds are largely located beyond the application area, covering most of the north west Irish Sea. Data for all gear types combined indicates that fishing effort within Dundalk Bay, to the west of the offshore wind farm area, is limited compared with that for the wider Irish Sea, east of the offshore wind farm area. Fishing effort recorded within and along the southern boundaries of the survey area is up to 50-200 hours per year. Adjacent areas show a greater density of fishing effort.

5.1.1.3 Commercially Important Species

Commercially important species within the survey area include the Dublin Bay prawn *Nephrops norvegicus* (also known as Nephrops or Norway lobster; hereafter referred to as "Nephrops"), brown crab *Cancer pagurus* and velvet crab *Necora puber*, sole *Solea solea*, witch *Glyptocephalus cynoglossus* and dogfish *Squalus acanthias*, often associated with muddy sediments. Communities found further offshore within sandier sediments include a variety of flatfish *Pleuronectiformes spp*., gurnard *Chelidonichthys cuculus*, whiting *Merlangius merlangus* and dogfish. Coarser sediments are dominated by lemon sole *Microstomus kitt*, angler fish *Lophius budegassa*, poor cod *Trisopterus minutus* and dogfish (Roden and Ludgate, 2003). The commercially fished species identified within the original 2007 Oriel Windfarm Environmental Statement included whiting, mackerel *Scombridae* spp., herring *Clupea harengus*, edible cockles *Cardiidae spp*., Nephrops and queen scallops *Aequipecten operculari*, with more recent catch data suggesting that razor clams *Siliqua patul*, brown crab and Nephrops are also caught.

Shellfish likely to be targeted in the survey area include Nephrops, cockles, razor clams, brown crab and European lobsters *Homarus Gammarus*. Crabs, lobsters and Nephrops are predominately caught using pots, with scallops targeted through dredging. Lobster and crabs are usually caught between March to September, with Nephrops pots set between September and December. Dredging for scallops occurs all year round.

Demersal species (e.g. plaice, cod, codling (juvenile cod), ling, European flounder, pollack Pollachius spp., whiting and gurnard) are predominantly caught using nets from March to September. Plaice, cod, ling and whiting are known to have spawning and nursery grounds that overlap with the area with plaice known to spawn in the region between January and March, cod in January through to April, ling from February through to May and whiting spawning between February and June.

Pelagic species, such as sprat and mackerel, are caught using a wide range of gear types. Mackerel is known to have spawning and nursery areas that overlap with the survey area, spawning from March to July.

Elasmobranchs (cartilaginous species), such as dogfish, tope and spurdog, are caught using a wide range of gear types. Tope and spurdog are known to have nursery grounds that overlap with the survey area and reproduce all year round.

Migratory species, such as Atlantic salmon, sea trout, European eel and sea lamprey, are known to transit the western Irish Sea and are caught using a wide range of gear types.

5.1.1.4 Fisheries Activity

Republic of Ireland

The majority of fishing effort by Republic of Ireland vessels of 12 m length or greater takes place within the Irish Exclusive Economic Zone (EEZ). However, most of the fishing effort inside the Irish EEZ is carried out by foreign vessels.

RoI is responsible for only 45% of effort from vessels ≥12 m inside the EEZ. The RoI effort consists mainly of demersal otter trawlers.

In 2020, the RoI fishing fleet registered 2,030 vessels, with a total of 16,430 people directly employed in the Irish seafood sector (BIM, 2020).

Northern Ireland

The Northern Ireland fishing fleet mostly target shellfish using static gears (i.e. pots and fixed nets), with an increasing number using single-rig *Nephrops* bottom trawls in traditional *Nephrops* grounds in the Irish Sea.

Based on consultation with the number of vessels operating in the Commercial Fisheries Survey area is more than 30, operating from a variety of ports including Clogherhead, Dundalk, Greenore and Donegal. The majority of fishing vessels are operated by 1 or 2 crew and are potters and creel vessels. Vessels operating in the area target prawn shrimp, lobster, crab, and mackerel and pollack using hand lines.

The closest RoI fishing port to the survey area, is Clogherhead. Consultation with the Dundalk Pilot advised that cockle day boats operate inside port limits, likely to be within Dundalk Bay, with up to three lobster boats operating out of Clogherhead. Furthermore, consultation with Clogherhead RNLI indicated that fishing activities within the Commercial Fisheries Survey area are likely to target *Nephrops*, razor clams, lobsters and crabs.

The closest Northern Ireland fishing ports to the survey area include Kilkeel, Ardglass and Portavogie. Kilkeel is the closest port to the survey area, however no Northern Ireland ports are located within the Commercial Fisheries Survey area although consultation has confirmed that Northern Ireland vessels will fish within the Commercial Fisheries Survey area targeting prawn, lobster and crab and occasionally mackerel and pollack using handlines.

5.1.2 Recreational Fishing

The east coast of Ireland is a renowned location for recreational angling, with both shore and boat-based angling carried out along this coastline. The species targeted include Pollack, wrasse, codling, ray and tope.

Section 5.1.2.1 and Section 5.1.2.2 provide an overview of recreational fishing activity within the survey area.

5.1.2.1 Boat Angling

Recreational sea angling locations can be found around the coast of County Louth, ranging from Carlingford Lough, south through Dundalk Bay and onwards towards Dublin. Inshore boat fishing is popular on Carlingford Lough from April through to September with tope and ray regularly caught. Along the coast south through Dundalk Bay, the inshore waters become very shallow, broken only by Dunany Point where there is shore fishing in summer.

Small boats can be launched from the slipway at Annagassan, Gyles Quay and Greenore. Anglers can expect to catch tope, ray, spurdog and dogfish between May to September.

5.1.2.2 Shore Angling

Shore angling is therefore likely to occur within the survey area. A shore angling mark at Dunany Point is located to the north of the offshore cable corridor at the landfall. The shallow beach extends for three miles broken up by rock patches and crossed by a stream from Dunany Point, south to Cruisetown. Bass and flounder are often caught via shore angling. Hacketts Cross, near Clogherhead and outside the survey area, can be found at the southern point of the beach where lugworm and ragworm can be found at low tide.

5.1.3 Shipping and Vessel Traffic and Navigation

There are no designated shipping lanes or traffic separation zones in the survey area. However, there is a marked and maintained shipping channel into Carlingford lough. The entrance to this channel is marked by the Hellyhunter navigation bouybuoy 6.6km from the survey area. There is also a marked and maintained shipping channel into Dundalk port, the entrance to this channel is marked by the pile light in Dundalk Bay, 12.9km from the survey area. The waters inshore of the survey area are used by commercial vessels, in addition to fishing boats and recreational craft. The waters to seaward of the survey area are used mainly by commercial vessels and fishing boats, with limited recreational craft.

To provide an accurate baseline of vessel traffic in the survey area, AIS information was utilised for January and July 2019 representative of winter and summer periods. AIS data has been supplemented by information provided during the consultation for shipping and navigation.

Table 5.3 summarises vessel traffic by type within the shipping and navigation survey area.

Table 5.3: Vessel traffic by type (AIS data)

Vessel type	Description
Cargo vessels	The majority of cargo vessel traffic passes clear of the offshore wind farm area. There is evidence of some commercial traffic transiting between Carlingford Lough to and from Drogheda Port.
Tankers	The level of tanker traffic transiting through the shipping and navigation survey area is minimal, with none passing through the offshore wind farm area.
Vessels bound to and from Dundalk	Most vessels pass outside the offshore wind farm area.
Fishing vessels	The data suggests that fishing activity is outside and to the south and south-east of the offshore wind farm area; however, several fishing vessels transit across the survey area to and from their fishing grounds.

Recreational craft	Recreational craft transit north and south to and from Carlingford Lough through the shipping and navigation survey area. This pattern corresponds with information available from the Irish Sailing Association.
Service vessels	Service craft primarily represents the Carlingford Lough and Dundalk Harbour respective pilot vessel movements. The other movements are attributed to general service vessels.
Other vessel types	Other vessel types are primarily associated with survey vessels engaged in survey work for the proposed offshore windfarm.

Vessel management measures within or close to the survey area are described below.

Pilotage

The principal ports employ their own licensed pilots. At minor ports where no official pilotage organisation exists, local fishermen or boatmen are usually available to act as pilots. The closest pilot station to the shipping and navigation survey area is situated at the entrance to Carlingford Lough, close to the Hellyhunter buoy. Pilotage is compulsory for all vessels entering the Lough, and Carlingford Lough Pilots Ltd. serve the ports of Warrenpoint and Greenore in Carlingford Lough.

Within the Dundalk pilotage district, if the Dundalk pilot boat is not operational the pilot will utilise Carlingford Lough pilot boat and generally board and land vessels bound to and from Dundalk close to the Hellyhunter buoy.

Vessel Traffic Services

There are no local port Vessel Traffic Service facilities close to the shipping and navigation survey area. The primary forms of communication between local ports and vessels are Very High Frequency (VHF) radio and AIS.

Radio Navigational Warnings

The waters within the shipping and navigation survey area lie within NAVAREA 1 which is coordinated by the United Kingdom. NAVAREA warnings are concerned with information which ocean-going mariners require for safe navigation including, in particular, failures of important Aids to Navigation as well as information which will necessitate changes to planned navigational routes.

Aids to Navigation

The Commissioner of Irish Lights (CIL) is the responsible authority for the principal lights and buoys on or around the coasts of Ireland. Some minor lights and buoys are the responsibility of local authorities.

The International Association of Marine Aids to Navigation and Lighthouse Authorities Maritime Buoyage System Region A (red to port) is in use on the coasts and in the harbours within the shipping and navigation survey area.

Search and Rescue

In Irish coastal waters and their approaches, Search and Rescue (SAR) operations are carried out by ships, aircraft, including helicopters, and by lifeboats. SAR operations are coordinated between the relevant responsible authorities and organisations in Ireland and Northern Ireland.

SAR in Ireland is the responsibility of the Department of Transport and is controlled in the Irish Maritime Search and Rescue Region (IMSRR) by the Irish Coast Guard (IRCG), a division of the Department. There is an IRCG station at Greenore Port.

In Northern Ireland, Her Majesty's Coast Guard (HMCG) is responsible for all civil maritime SAR operations in the United Kingdom Search and Rescue Region. The Ministry of Defence provides units to assist casualties on request from HMCG. The Royal Navy provides Explosive Ordnance Disposal Teams to deal with unexploded or suspect ordnance. The Aeronautical Rescue Coordination Centre at Kinloss, Scotland controls the operation of all military SAR air resources within the UK SRR.

The RNLI is a voluntary organisation incorporated by Royal Charter for the purpose of saving lives, promoting safety and providing relief from disaster, primarily at sea and secondly on the inland waters of Ireland, UK, Channel Islands and Isle of Man. The closest RNLI stations to the offshore wind farm area are at Kilkeel Harbour, Clogherhead and Newcastle Harbour.

5.1.4 Ports and Harbours

The commercial ports and harbours at Drogheda, Dundalk, and Greenore in Ireland, and Warrenpoint at the head of Carlingford Lough in Northern Ireland, are the main ports in the vicinity of the shipping and navigation survey area. In addition, there are several fishing harbours and inlets which are visited by coastal trading vessels and are suitable for small craft.

A brief synopsis of the principal ports and harbours is provided below in **Table 5.4**.

Table 5.4: Local ports and harbours

Port/Harbour	Description
Port of Warrenpoint	Situated at the mouth of the Newry River at the head of Carlingford Lough. The port has seven berths with a total quay length of 750 m. Principal trades are: Seatruck Ferries regular Roll on – Roll Off (Ro-Ro) service; Cardiff Container Line regular container service; and dry cargoes including timber and general building materials.
Port of Dundalk	Situated on the Castletown River at the head of Dundalk Bay. Ships of up to 3,500 deadweight tonnes (dwt) and 120 m length overall (LOA) can be handled. Main cargo inputs are plasterboard, feedstuff, oil, coal, timber and steel. Main exports are scrap metal and turf.
Greenore Port	Privately owned port at the eastern end of the Carlingford Peninsula. It has three berths and can handle vessels of up to

	40,000 gross tonnes. Plans to develop Ro-Ro and Load on - Load Off (Lo-Lo) facilities over the coming years.
Kilkeel Harbour	Fishing port lying 3.2 NM north-east of Cranfield Point. The harbour has facilities for fishing vessels and affords shelter for small craft. An inshore lifeboat is maintained.
Port of Drogheda	Situated 4.5 NM upstream from the mouth of the River Boyne. A commercial state port handling over 1 million tonnes of cargo annually. Imports include containers, paper, steel, timber, fertiliser, grains, petroleum, and liquefied petroleum gas. Exports include containers, magnesite, zinc concentrate and timber.

5.1.5 Recreational Sailing and Motor Cruising

This section provides an overview of recreational boating (including sailing and motor cruising) within the survey area.

In general, recreational boating is highly seasonal, with a greater density of vessels found throughout summer, as well as highly diurnal with boating occurring usually during the daytime. Boating areas include general sailing areas, racing areas, sailing schools and sailing clubs.

Carlingford Marina is on the west bank of Carlingford Lough. It has a total of 170 berths and is mainly used for recreational vessel and sailing. Sailing usually takes place within the immediate vicinity of the marina. Recreational vessels will exit Carlingford Lough however they quickly disperse and there are no defined routes of transit from Carlingford Marina into the Irish Sea.

Racing areas are generally used at weekends and during holiday periods by sailing and motor users. These areas are under the control of nearby sailing clubs and often contain temporary or permanent marker buoys. Racing routes are often determined on the day of the race. There are no racing areas in survey area. Racing areas are located within Carlingford Lough, 6.7 km to the north of the offshore wind farm area and off the coast of Dublin, 24 km to the south of the offshore wind farm area.

Sailing schools act as teaching institutions, with marina boat berths attached and are in constant use throughout the year. Sailing clubs are membership organisations with affiliation to Irish Sailing. They provide certain types of activities, ranging from racing and sail cruising to power-boating, all of which are open to members of the public. There are no sailing schools within the survey area.

There are number of sailing clubs which will use the survey area, with Carlingford Sailing Club (216 members) located 12 km north west of the offshore wind farm area. Others include the Carlingford Lough Yacht Club (15.3 km north west of the offshore wind farm area) and Skerries Sailing Club (33.8 km south of the offshore wind farm area). Carlingford Lough Yacht Club activities are generally restricted to within Carlingford Lough and usually involve 12 boats. Limited numbers of offshore races occur in the summer season only. Skerries Sailing Club has both dinghy and cruiser racing. It hosts an offshore race on the May bank holiday each

year from Skerries to Carlingford, a route which will pass through the survey area, depending on wind conditions. Additional sailing clubs can be found further south, with an increase in sailing clubs around Dublin.

There are light and medium traffic recreational boating routes that intersect with the survey area, with a number of offshore routes fanning out from the sailing clubs identified above. As noted further above, recreational boating generally does not involve point-to-point passage and therefore these routes are likely to be indicative. Light traffic routes are defined as known routes in common use and which are likely to be important to local users, with medium traffic routes defined as popular routes on which some recreational craft will be seen at most times during summer daylight hours. AIS data for recreational craft for the period January and July 2019 identifies vessels transiting north-south to/from Carlingford Lough, including through the survey area and less so through the offshore cable corridor, broadly corresponding with the indicative light and medium traffic routes.

5.1.6 Other Recreational Activities

Section 5.1.6.1 - 5.1.6.4 provides an overview of other recreational activity within the survey area. Activities include diving, boarding water sports, kayaking and canoeing, sea swimming and beach users.

5.1.6.1 Diving

There is one diving club in County Louth, known as Dundalk Sub Aqua Club, located 18 km from the offshore wind farm area. Dive sites frequented by the Dundalk Sub Aqua Club are unknown as no response to consultation was received. However, club members are likely to dive at wreck sites, reefs and geological areas of interest. Divers are likely to transit to a site via a small cruiser vessel, most likely following the light traffic routes.

5.1.6.2 Boarding water sports

Kite surfing, surfing and windsurfing occur almost entirely in coastal waters, generally within 1 km of the shore. Usually one shop/club will offer all three services to members of the public, provided that conditions are suitable for the sport. Additionally, members of the public are free to use their equipment wherever wind and wave conditions are suitable, all along the coast.

Celtic Adventures is located in the town of Dunleer, located approximately 8.5 km south west of the offshore cable corridor landfall, and provides stand up paddle boarding rentals, which can either be used on nearby rivers or at sea. Celtic Adventures operated out of Annagassan harbour, Annagassan Strand, Salterstown pier, Port Oriel and Clogherhead beach. In peak season they operate daily from April until October and can have up to 30 boards operating at one time.

There is a windsurfing club located approximately 14 km north of the offshore wind farm area, within Carlingford Lough. It is likely that windsurfing activity is largely confined to Carlingford Lough and therefore highly unlikely that this activity overlaps with the Survey area.

A surfing location has been identified within the survey area. The identified surfing location overlaps with the survey area at the landfall.

Surfing is dependent on swell conditions, with surfers moving up and down a beach to find the best waves and as such, the entire beach from Dunany Point south to Clogherhead will be surfed. Kite surfing, surfing and windsurfing all have the potential to occur within the nearshore and inshore sections of the offshore cable corridor.

5.1.6.3 Kayaking and Canoeing

There are no physical restrictions on the offshore range of kayaks and canoes, however, for logistical and safety reasons most will stay relatively close to the shore, undertaking coastal rather than seaward trips. Celtic Adventures, as mentioned above, also provides canoes and kayaks rentals, which can either be used on nearby rivers or at sea. The Strangford to Newry Canoe Trail is located approximately 11 km north east of the offshore wind farm area. Kayaking and canoeing have the potential to occur within the nearshore and inshore sections of the offshore cable corridor.

5.1.6.4 Beach Users

Dundalk Bay and associated beaches are likely to be used by members of the public for beach activities, hiking and dog walking. The popular beaches of Port Beach and Annagassan are located approximately 2.5 km south and 7 km west of the cable landfall, respectively.

The cable landfall is located at Dunany Bay Beach, which is located along a stretch of sandy shoreline extending soutwards from Dunany Point to Clogherhead. Members of the public are likely to use this beach for recreational activities. However, Dunany Bay Beach is not recognised as a popular tourism beach by the VisitLouth tourist information site (VisitLouth, 2017). To the south of Dunany Bay Beach is Port Beach, a Blue Flag beach with tourist facilities including lifeguard and swimming areas (with the bathing area up to 2,300 m in length), parking and toilets (Louth County Council, 2018).

Recommended coastal walks in the area include Blackrock Slí Na Sláinte, approximately 14 km north west from the cable landfall, Dundalk Slí na Sláinte, approximately 19 km north west, and The Táin Way, approximately 19.5 km north west (Tourism Ireland, Undated) none of which cross the Survey area.

5.2 Biodiversity

5.2.1 Benthic Subtidal and Intertidal Ecology

In April 2021 the Marine Institute provided benthic survey raw data taken in 2016 and 2019 from within Dundalk Bay. Survey data taken from the outer Dundalk Bay and North Irish Sea in 2016 recorded sediments of very fine sand and very coarse silt. Faunal communities were dominated by the echinoderms A. filiformis, the bivalves K. bidentata, F. fabula, Nucula hanleyi, the polychaetes Melinna palmata, Euclymene oerstedii and Galathowenia oculate. Survey data taken from the outer Dundalk Bay in 2019 recorded sand, muddy sand, gravelly muddy sand and sandy mud. As expected, the faunal communities were polychaete and bivalve dominated with high abundances of the same species as were recorded in the 2016 survey.

Site-specific surveys were undertaken for the Project in 2006 comprising 57 stations sampled with a modified van Veen grab for sediment and faunal analysis. The majority of the sediment samples taken were classified as silt-clay sediments. The 2019 benthic validation survey, which included collection of grab samples and video data recorded sediments in the north and east of the study area as dominated by mixed and coarse sediments, whereas sediments in the south west of the offshore wind farm area were dominated by sandy muds.

The species reported are all commonly found along the east coast of Ireland and no uncommon, rare or protected species were found. Faunal analysis was carried out on the 44 grab samples taken in 2006 within the offshore wind farm area. These samples were dominated by polychaetes (57 taxa), crustaceans (41 taxa), molluscs (30 taxa) and echinoderms (9 taxa). Other genus recorded included one genus of chelicerata (sea spiders) and two genera of phoronids (horseshoe worms).

As previously outlined, a further subtidal survey has been undertaken in 2019 to validate the results of the 2006 survey. Ten grab sample locations were selected from the original 44 within the offshore wind farm area to re-sample. Seven sample locations were selected along the offshore cable corridor to confirm the subtidal sediments and benthic fauna.

The results of the 2019 validation survey are broadly consistent with the results of the 2006 survey. In addition the results are consistent with the Marine Institute data from within Dundalk Bay recorded in 2016 and 2019.

Benthic subtidal and intertidal Important Ecological Features (IEFs) are identified in the study area are outlined in **Table 5.3.**

Table 5.3: IECs in the Study Area

IEF	Description and Representative biotopes	Protection status	Conservationinterest	Importance within the Study Area
Subtidal Sandy Mud Sediment	Subtidal sandy mud sediments with rich infaunal communities SS.SMu.CSaMu.AfilKurAnit SS.SMu.OMu.LevHet	None	Of local conservationinterest	Local
Subtidal Sand Sediment	Subtidal sandy sediments with moderately diverse infaunal communities SS.SSa.CFiSa.EpusOborApri SS.SSa.CFiSa.ApriBatPo SS.SSa.IMuSa.FfabMag	None	Of local conservationinterest	Local
Subtidal Coarse Sediment	Subtidal coarse sediments of sand and gravels with moderately diverse infaunal and epifaunal communities. SS.SCS.CCS.MedLumVen	None	Of local conservationinterest	Local
	SS.SCS.CCS.SpiB/ SS.SMx.CMx.FluHyd SS.SMx.CMx.Oph.Mx			
Subtidal Infralittoral Rock	Subtidal Rock with Kelp IR.MIR.KR	None	Of local conservationinterest	Local
Annex 1 Habitat Features of SACs				
Estuaries	A mosaic of subtidal and intertidal habitats, which are closely associated with surrounding terrestrial habitats. They are the downstream part of a rivervalley, subject to the tide and extendingfrom the limit of brackish water.	Annex I Habitats Directive	Qualifying feature of the Dundalk BaySAC and Dundalk BayRamsar	International – part of Europeandesignated site (Dundalk Bay SAC and Ramsar)

Mudflats and sandflats not coveredby seawaterat low tide	Intertidal mudflats and sandflats are submerged at high tide and exposed at low tide. They can occur on mobile, coarse-sand beaches on wave-exposedcoasts to stable, fine-sediment mudflatsin estuaries and other marine inlets.	Annex I Habitats Directive	Qualifying feature of the Dundalk BaySAC	International – part of Europeandesignated site (Dundalk Bay SAC)
Intertidal Habitats				
Littoral Sand	LS.LSa.MuSa.MacAre / LS.LSa.MuSa.Lan	None	Qualifies as anAnnex I habitat under the Habitats Directive although not within a SAC.	National
Eulittoral Rock	LR / LR.LLR.F.Fves / LR.FLR.Eph.EntPor	None	Local	Local

5.2.2 Marine Mammals

Cetaceans that could potentially occur in the survey area are described below.

The survey area was surveyed as part of the ObSERVE porgramme; a Government of Ireland funded initiative which aims to improve our knowledge and understanding of protected offshore species and their sensitive habitats.

The study area was surveyed a total of four times during the ObSERVE programme, in summer and winter 2015 and 2016. Harbour porpoise were observed throughout this area in all surveys. A single small group of bottlenose dolphins were recorded in one survey; waters to the south and west of Ireland are more important for this species. Small numbers of Risso's dolphins and minke whale were also observed in summer. Other cetacean species previously recorded in low numbers in the area include common dolphin, fin whale and humpback whale.

Site specific information on the cetaceans present in the area comes from monthly boat-based surveys completed between May 2018 to May 2020 (with the exception of February, March and April 2020 due to COVID restrictions). Monthly aerial surveys were commenced in April 2020 for 6 months and static acoustic monitoring (SAM) between November 2019 and November 2020.

Harbour porpoise were sighted in every month of the boat-based surveys within the study area. SAM results showed porpoises to be present on average 99% of days monitored with detection rates varying between 1-9 detections per hour across the four locations monitored within the survey area, with dolphins rarely detected.

During the aerial survey of the marine study area, 53 individual cetaceans were observed, of which 45 were recorded as dolphin/porpoise, 3 harbour porpoise and 3 dolphin species. One baleen whale and one minke whale were recorded in September. Very few dolphins were recorded by the boat-based surveys. Minke whale were sighted during the boat-based site-specific surveys between the months of June and October, although most sightings were outside the offshore wind farm area.

Marine mammal IEFs identified in the study area are outlined in **Table 5.4**.

Table 5.4: Marine mammal IEFs in the Study Area

IEF	Value	Justification
Harbour porpoise	International	*Annex II species protected under international legislation and designated feature of Rockabill to Dalkey Island SAC, North Channel SAC, North Anglesey Marine/Gogledd Môn Forol SAC* and *West Wales Marine/Gorllewin Cymru Forol SAC*. Regularly sited within the Regional Marine Megafauna Study Area.
Bottlenose dolphin	International	*Annex II species protected under international legislation and designated feature of Cardigan Bay/Bae Ceredigion SAC*
Short-beaked common dolphin	National	*Internationally protected species* and Ireland Protected Species *regularly sighted in the Regional Marine Megafauna Study Area.*
Minke whale	National	*Internationally protected species* and Ireland Protected Species *regularly sighted in the Regional Marine Megafauna Study Area.*
Grey seal	International	*Annex II species protected under international legislation and designated feature of Lambay Island SAC, Lleyn Peninsula and the Sarnau/Pen Llyn a`r Sarnau SAC* and *Pembrokeshire Marine/Sir Benfro Forol SAC,* and is a qualifying feature of *Cardigan Bay/Bae Ceredigion SAC*. Regularly recorded in the Regional Marine Megafauna Study Area, with large haul-outs at Carlingford Lough, Clogherhead, the Skerries, Dublin Bay and Lambay Island.
Harbour seal	International	*Annex II species protected under international legislation and designated feature of Lambay Island SAC* and is a qualifying feature of *Murlough SAC*. Regularly recorded in the Regional Marine Megafauna Study Area, with large haul-outs at Carlingford Lough, Dundalk Bay, Clogherhead and the Skerries.
Basking shark	National	*Internationally protected species/EPS listed on Ireland's Red List of Threatened Species (list No. 11) and UK* BAP Species. *Recorded migrating through Regional Marine Megafauna Study Area on an annual basis.*
Leatherback turtle	National	Internationally protected species, *listed on Ireland's Red List of Threatened Species (list No. 5)* and UK BAP Species, reported regularly (largely stranded) in the Regional Marine Megafauna Study Area.

5.2.3 Fish and Shellfish

This section provides a summary of each of the fish and shellfish receptors that have the potential to be impacted by the proposed survey works.

Fish and shellfish identified within the Study area include demersal, pelagic, elasmobranchs and migratory species. It is likely that surface seabed substrate is a determining factor in the fish and shellfish assemblage; with the study area mainly comprising of muddier sediments, with sands and gravels present further inshore along the offshore cable corridor. These muddy sediments have been found to support a large Nephrops fishery, associated predators and fish assemblages, such as gadoids, flatfish and elasmobranchs.

The western Irish Sea is also home to migratory fish species with Atlantic salmon and sea trout identified as the two most commercially important species in the region. The rivers Boyne and Blackwater, and the Slaney further south along the east coast of Ireland, have been designated for migratory fish species, while the rivers Dee, Fane, Glyde, Ballymascanlan, Flurry and Castletown, flowing into Dundalk Bay, are also known to host migratory fish species. The River Boyne and River Blackwater SAC is designated for the protection of the Annex II migratory fish river lamprey and Atlantic salmon, while the Slaney River Valley is a SAC designatedfor salmon, sea lamprey, river lamprey, brook lamprey and twaite shad.

Elasmobranchs found along the east coast of Ireland include sharks, rays, skates and the larger basking shark.

A large portion of the Irish Sea is considered important as a nursery and spawning area for several species of fish and shellfish. The study area overlaps with spawning and/or nursery grounds for pelagic, demersal and elasmobranch species, with Nephrops spawning and nursery grounds found to the east of the study area. Juveniles of many species often favour sheltered inshore waters.

The study area and the surrounding waters also support a diverse shellfish community, some of which are commercially exploited. Nephrops is the most commercially important shellfish with mussels identified as the second most important shellfish. The area inshore from the Project is considered to be particularly important for cockles and razor clams and for the settlement of larvae. Other shellfish noted in the region included cockles, scallop, edible crab, European lobster and velvet swimming crab.

5.2.4 Birds

Six aerial digital surveys were undertaken between April and September 2020 in the study area The abundance and distribution of birds within the survey area was estimated, and where possible, information on bird flight height and direction. The survey was designed to complement earlier boat-based ornithological surveys (Aquafact 2019) which were undertaken between May 2018 and January 2020.

Few waterbird species were recoded within the survey, and of those species identified to be relevant to this assessment, abundance was generally recorded to be low, for example unidentified duck species (three individuals recorded in April). Common scoter were recorded in relatively high abundance in April, however the birds were concentrated at the seaward edge of Dundalk Bay and to the north of the survey area relevant to this assessment. Peak counts of red-throated diver and great northern diver were also recorded with few or no birds recorded in the other survey months, indicating their wintering presence in the area. Similarly, cormorant were recorded in low numbers, with nine recorded in June 2020, declining to one in August and September.

With regard to seabirds, Auks were recorded widely across the ornithological survey area. Guillemot were particularly abundant across the survey area (peak count in September 2020 of 5,562), with puffin and razorbill still numerous (peak counts in September 2020 of 21 and 952 respectively). The next most abundant species recorded were northern gannet (peak count of 144 in July) and Manx shearwater (peak count of 1,245 in August), with relatively low numbers of black-legged kittiwake (peak count of 40 in April), and very low numbers of herring gull (peak count of 19 in July), lesser black-backed gull (peak count of two in May), common gull (peak count of three in April), black-headed gull (two, only recorded in April), and fulmar (one in April and August). Sandwich tern (peak count of three in April and September) and common tern (five, only recorded in September) were recorded but in relatively low numbers. The survey results are generally consistent with those of the ObSERVE programme (Rogan et al. 2018) in terms of the relative abundance of species which would be expected to frequent the survey area including gannet, Manx shearwater, auks and terns.

5.2.5 Invasive Species

Marine invasive species established in Ireland include carpet sea squirt *Didemnum vexillum* and the slipper limpet *Crepidula fornicata*, both of which are already found in the vicinity of the survey area (Invasive Species Ireland, 2019). There are several species which are of concern as potential marine invasive species for Ireland. These are the Asian rapa whelk *Rapana venosa*, oyster drill *Ceratostoma inornatum* and *Urosalpinx cinereal*, red king crab *Paralithodes camtschaticus* and striped eel catfish *Plotosus lineatus* (Invasive Species Ireland, 2019). Of these, the Asian rapa whelk is the only one thought to have a potential pathway to Ireland through ballast water (Invasive Species Ireland, 2019).

5.3 Marine processes

5.3.1 Bathymetry

Seabed levels across the survey area vary from 16 m chart datum (CD) in the north west deepening to 32 m CD in the south east, as illustrated in **Figure 5.1**. The seabed in the survey area is relatively flat with a terrace, characterised by a steeper sloping section which bisects the survey area.

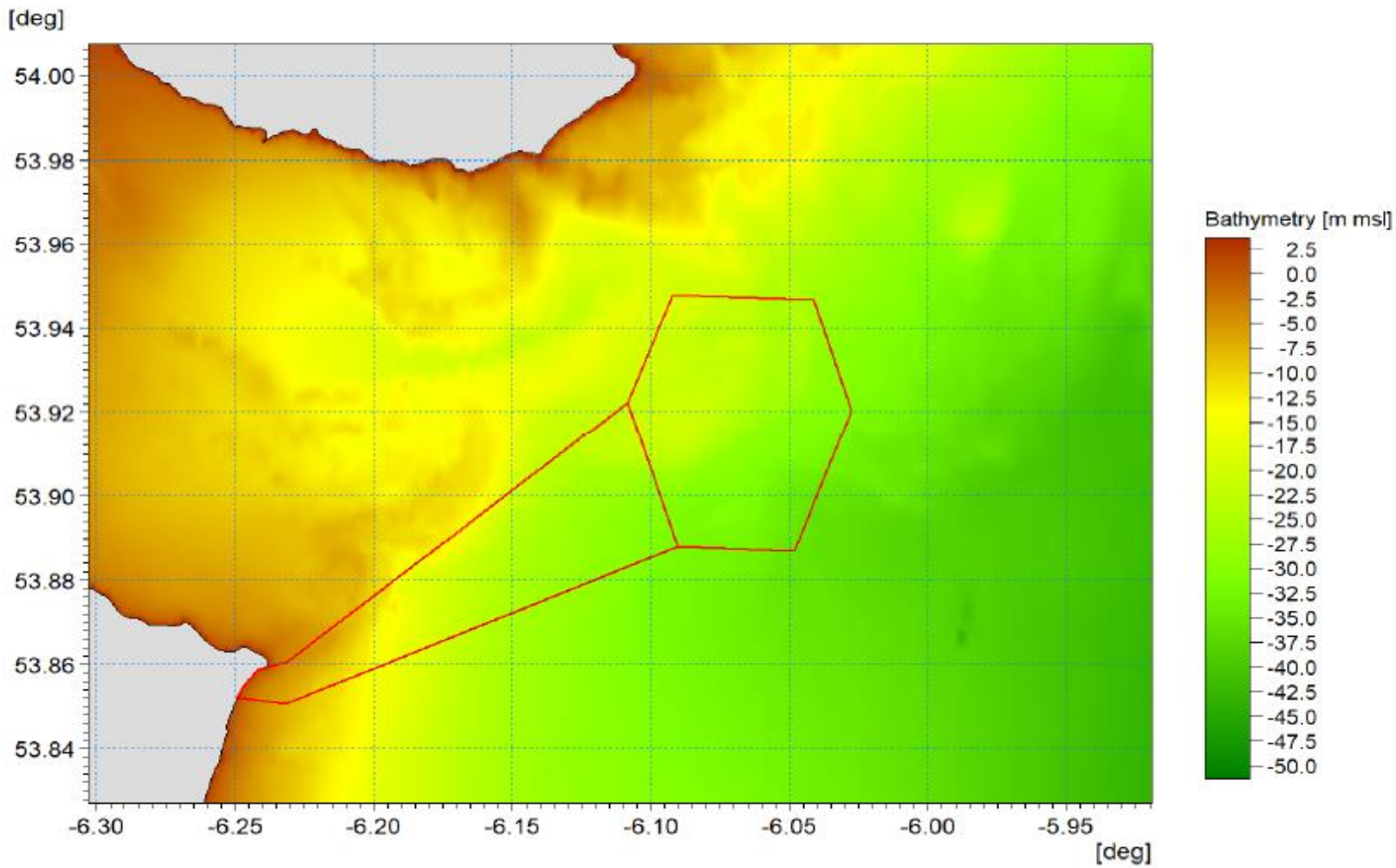

Figure 5.1: Seaed levels in survey area

5.3.2 Tidal Flow

The survey area has an average tidal range of 3.5 m as recorded by the OPW gauge at Giles Quay, east of Dundalk, Co Louth. This area is characterised by relatively weak tidal currents with a water depth of approximately 20 m. Across the survey area the tidal current floods to the north-west direction and ebbs to the south-east. The flows are relatively weak with tidal current speeds typically less than 0.2 m/s, with ebb and flood currents being of a similar magnitude. This was confirmed by the floating LiDAR data, collected specifically for the wind farm project, which showed current speeds were below 0.2m/s for 80% of the 12 months monitoring period giving rise to stable seabed sediment.

5.3.3 Waves

The survey area is sheltered from northerly winds and associated waves. However, larger waves will reach the survey area from the south due to a greater fetch. The modelling study demonstrated that during a 1 in 2-year return period storm, the significant wave height at the survey area varies from 2 to 3m depending on the direction of approach (i.e. larger waves approach from the south). This was confirmed by the floating LiDARdata, collected specifically for the project. For a more extreme 1 in 50-year event significant wave heights will reach towards 4m. The survey area is relatively sheltered during storms incoming from northerly directions.

5.3.4 Sediment and Sea Bed

Seabed sediments within the survey area range from muddy sand to coarse gravel, with exposed glacial till at some locations, as illustrated in **Figure 5.2**. It has been noted however that there is little evidence of significant sediment transport within this area as the limited tidal current will not be sufficient to mobilise and transport coarser sandy material. This is corroborated by the lack of sand wave features in the field data although some sand waves are visible to the south of the survey area. The offshore cable corridor seabed sediment is comprised of finer seabed material with some areas of muddy sand.

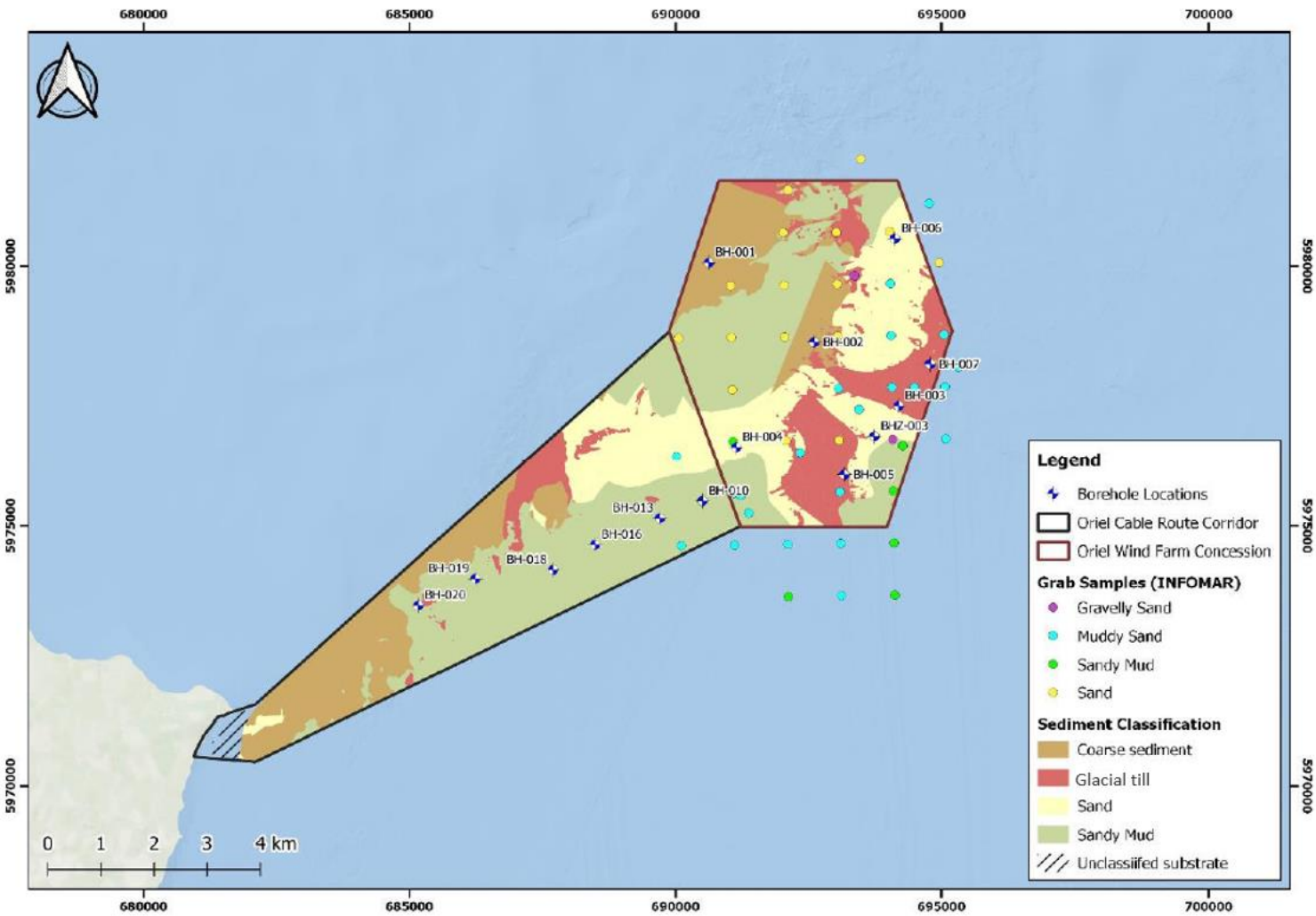

Figure 5.2: Sediment of the survey area

5.3.5 Shoreline/Nearshore

Dundalk Bay stretches some 16 km from Castletown River and the Cooley Peninsula in the north to Annagassan and Dunany Point in the south. The inner bay is shallow, sandy and large areas are uncovered at low tide. The rivers Dee, Glyde, Fane, Castletown (Dundalk), Flurry and Castletown (Cooley) flow into the Bay. The Bay is characterised by extensive saltmarshes and intertidal sand/mudflats with a beach located at Blackrock, southeast of Dundalk. This area is exposed to waves. The sandy material within the bay means that the Dundalk Harbour navigation channel is prone to siltation and is dredged by the Dundalk Harbour Commissioners with sand waves forming post completion of the dredging campaigns.

5.3.6 Cable Route Landfall

The cable route landfall is subject to limited longshore transport due to the sheltering effect of Dunany Point to the north and Clogher Head to the south, giving rise to lesser residual currents. The landfall location is exposed to storm events approaching from the south east. The landfall has no specific coastal features such as dunes or berms.

The cable route landfall is illustrated in **Figure 5.3**

Figure 5.3: Cable route landfall

5.4 Water, Air, Noise, Climate

5.4.1 Water

5.4.1.1 Water Quality

Coastal Water Quality

The Water Framework Directive 2000/60/EC (WFD) Coastal Waterbody Status dataset contains all the Coastal Waterbody Status results recorded in accordance with European Communities (Water Policy) Regulations 2003 (SI No. 722/2003).

The regulation objectives include the attainment of good status in waterbodies that are of lesser status at present and retaining good status or better where good status exists.

The WFD Coastal Waterbody Status at Outer Dundalk Bay was recorded as 'Good' in 2018, which was the most recent assessment.

In addition to recording the current status of a water body, a WFD risk status is assigned to it. The WFD Risk Status of a waterbody represents the risk of that water body failing to meet their Water Framework Directive (WFD) objectives by 2027. The risk of not meeting WFD objectives is determined by an assessment of the monitoring data, data on the pressureson the water body and the measures that have been implemented to lessen or improve the pressures. Waterbodies that are 'At Risk' are prioritised for implementation of measures to lessen or remove the pressures. Waterbodies that are 'Not at Risk' are meeting their WFD objectives. These require maintenance of existing measures to protect the satisfactory status of the water bodies.

The Risk Status applied to Outer Dundalk Bay was recorded as 'Not at Risk' under the WFD 3rd Risk Cycle (2020).

Bathing Water Quality

The overall quality of Ireland's bathing waters is considered to be very high. Most of designated bathing waters consistently meet the minimum standards of the Bathing Water Directive, Directive 2006/7/EC of the European Parliament and of the Council of 15 February 2006 concerning the management of bathing water quality and repealing Directive 76/160/EEC. In 2018, 94% of designated bathing waters met these standards, indicating a low risk to human health from microbial contamination.

The closest Bathing Water monitoring station to the survey area is at Lurganboy Port which, in 2020, was recorded as having 'Excellent' bathing water quality.

5.4.2 Air

5.4.2.1 Terrestrial Air Quality

For terrestrial air quality, the EPA 2019 air quality report states that over air quality was generally good in 2019 with the exception of one exceedance of the EU annual average legal limit values at one urban traffic station in Dublin due to pollution from transport. Ireland was above World Health Organization (WHO) air quality guideline value levels at 33 monitoring sites – mostly due to the burning of solid fuel in our cities, towns and villages. Ireland was above the European Environment Agency reference level for polycyclic aromatic hydrocarbons at four monitoring sites due to the burning of solid fuel.

The nearest air monitoring station to the survey area- particularly to the onshore element at Dunany Point, is Station 84 in North Drogheda. The air quality recorded at this air monitoring station on 20 August 2021 is reported as being of ‘Good’ status.

5.4.2.2 Maritime Air Quality

Air pollution from ships is currently regulated by the MARPOL Convention, specifically Annex VI which limits the main air pollutants from ships, namely SOX, NOx, PM prohibits the of deliberate release of ozone-depleting substances. Incineration on ships and emissions of VOCs are also regulated. The objectives are for progressive reductions in air pollution from shipping.

Since the establishment of the Annex VI standards, there has been significant global reductions of NOx, SOx and PM emissions. The regulations also allow for emission control areas (ECA) to be established for which more stringent stands will apply. There is an ECA applied to the North Sea and English Channel for NOx and SOx,. However there is currently none in place for the North-east Atlantic/Celtic Sea/Irish Sea.

Monitoring of air quality in the offshore area is not undertaken. The nearest air monitoring station to the offshore windfarm area is the terrestrial Station 84 in North Drogheda. Refer to Section 5.4.2.1 for the air quality recorded at this air monitoring station.

5.4.3 Noise

Underwater noise is increasing as human activities in the marine environment continue to expand. Activities such as vessel movement (e.g. shipping, fishing, and leisure crafts), seismic surveys, drilling, use of sonar, pile-driving, underwater explosions and dredging all contribute to levels of noise in the marine environment.

The knowledge base regarding sources of noise in the marine environment is relatively recent. Research currently being undertaken is intended to support the development of 'risk-based' noise monitoring programmes for Irish waters, incorporating the establishment of baselines and the determination of trends. DCCAE's ObSERVE report on acoustic surveys for instance, represents a good knowledge base on the noise in the marine environment and the distribution of cetaceans. The main sources relate to shipping, resource extraction (including use of seismic surveys) and military/defence activities; data from OSPAR indicates that background levels of underwater noise in the Celtic Sea for instance are thought to be high due to the intensity and diversity of human activities which take place. Exposure of the majority of populations to marine sources of noise is thought to be negligible, given that most activities which generate underwater noise are located some distance from land and generally only affect ship crews or operational staff on offshore structures (platforms, rigs etc.).

Noise levels from offshore or nearshore activities will become a nuisance where populations are located close to ports and harbours.

5.4.4 Climate

5.4.4.1 Irelands Greenhouse Gas Emissions Overview

According to the EPA (2020), Ireland's 2019 GHG emissions are estimated to be 59.78 million tonnes carbon dioxide equivalent (Mt CO2eq), which is 4.4% lower (or 2.75 Mt CO2 eq) than emissions in 2018 (62.53 Mt CO2 eq).

Ireland's greenhouse gas (GHG) emissions increased in the period from 1990 to 2001 when it peaked at 70.46 Mt CO2 equivalent, before displaying a downward trend to 2014. Emissions increased by 4.1% and 3.4%, respectively in the years, 2015 and 2016 and remained relatively stable in 2017 and 2018. In 2019 final estimates of total national GHG emissions amounted to 59.78Mt CO2 equivalent, which is 4.4 per cent lower than 2018 emissions. Ireland's GHG emissions have increased by 9.9 per cent from 1990-2019.

The EPA estimated that between 1990-2019, carbon dioxide (CO2) accounted for 62.4% of the total, with methane (CH4) and nitrous oxide (N2O) contributing 24.6% and 11.45% as CO2 equivalent, respectively and fluorinated gases contributing 1.5 per cent of the total as CO2 equivalent.

In 2019, the energy industries, transport and agriculture sectors accounted for 71.4% of total GHG emissions. Agriculture is the single largest contributor to the overall emissions, at 35.4 per cent. Transport, Energy Industries and the Residential sector are the next largest contributors, at 20.4 per cent, 15.8 per cent and 10.9 per cent, respectively.

5.4.4.2 Emissions from Maritime Activity

Shipping is the key activity responsible for GHG emissions in the maritime environment. Under the Kyoto Protocol, shipping represents a complex global activity, emissions from which are not easily attributable to any one country, however the International Maritime Organisation (IMO) is pursuing emissions reduction from the shipping. In 2021, shipping emits approximately 940 Mt CO2 annually and at a global scale, this accounts for just 2.5% of total GHG emissions. However emissions are predicted to grow by between 50% and 250% by 2050, which is not in accordance with international agreements to limit GHG emissions under the Paris Agreement.

5.5 Marine Archaeology and Cultural Heritage

5.5.1 Submerged prehistoric archaeological potential

During the Pleistocene epoch (from approx. 2.58 million to 11,700 years ago), the Irish Sea most likely either formed dry land (in inter-glacial periods) as part of the land mass that connected Ireland with Britain and mainland Europe or was covered in an ice sheet (in glaciation periods). During periods of glaciation the seabed of the Irish Sea will have been uninhabitable but during inter-glacial periods there is a potential for periglacial occupation during periods when the seabed will have formed dry land. However, the effects of repeated glaciations, marine transgressions and associated fluvial activity mean that the potential for the survival of any archaeology from this period within the Survey area is unlikely.

Close to the shoreline, if peat and organic muds are present, there is a potential for geoarchaeological/ palaeoenvironmental evidence along the western extent of the Survey area. In addition, where these sediments are present there a good potential for organic preservation of Mesolithic (from approx. 10,000 to 6500 years ago) coastal activity such as fish traps. However, none of the recent borehole investigations, undertaken under the previous Foreshore Lience, reported the observation of anthropogenic features such as timber, metal or ceramic, and none record peat or related organic strata that might indicate the presence of submerged palaeo-landscapes (ADCO 2021).

5.5.2 Protected and recorded wrecks

Data for known shipwrecks and recorded shipping losses within the Survey area were obtained as appropriate from the NMS Wreck Inventory of Ireland Database (WIID) and the baseline studies undertaken in 2007 and 2021 for the preparation of the EIS and EIAR for the offshore wind farm. These datasets provide a general picture of maritime casualties in the Survey area in the last 150 to 200 years but may not indicate all potential maritime archaeological remains in the area.

Wrecks of historical, archaeological or artistic importance are preserved by the designation of an Underwater Heritage Order in accordance with the National Monuments Act (1930-2004). No wreck sites that have been placed with an Underwater Heritage Order are located within the offshore wind farm area or offshore cable corridor.

A known wreck over 100 years old (the Topaz (W00248) a Glasgow registered iron steamship lost in 1891) is located within the offshore cable corridor. An unidentified wreck (W00276) has also been identified to the south of this site. These two wreck sites are protected under the National Monuments Act. In addition, a possible wreck (W00529) was identified during the Irish National Seabed Survey, located 860 m south east of the offshore wind farm area.

A number of geophysical anomalies were identified during the 2007 survey within the offshore wind farm area, which have since been classified as Wreck Sites on the WIID (W111145-W11157 and W11435). However, the report that identified those features concluded that they are 'probably not archaeological in nature' (ADCO 2007). This comprises 14 sites, 11 of which lie within the offshore wind farm area and three of which lie outside the wind farm area boundary and within the survey area. The recent 2019 survey only overlapped with geophysical anomalies identified in the 2007 data set (W11148 and W11153) so the further investigations have not confirmed whether these anomalies are wreck sites or anomalies of natural origin.

A map of the known wreck sites and anomalies (as identified from geophysical surveys to date) within the Survey area is provided in **Figure 5.4**. A total of 18 sites have been recorded in the Survey area. The 2007 and 2019 assessments confirm that the incidence of wrecking is high along the east Coast of Ireland and also seaward of the coast.

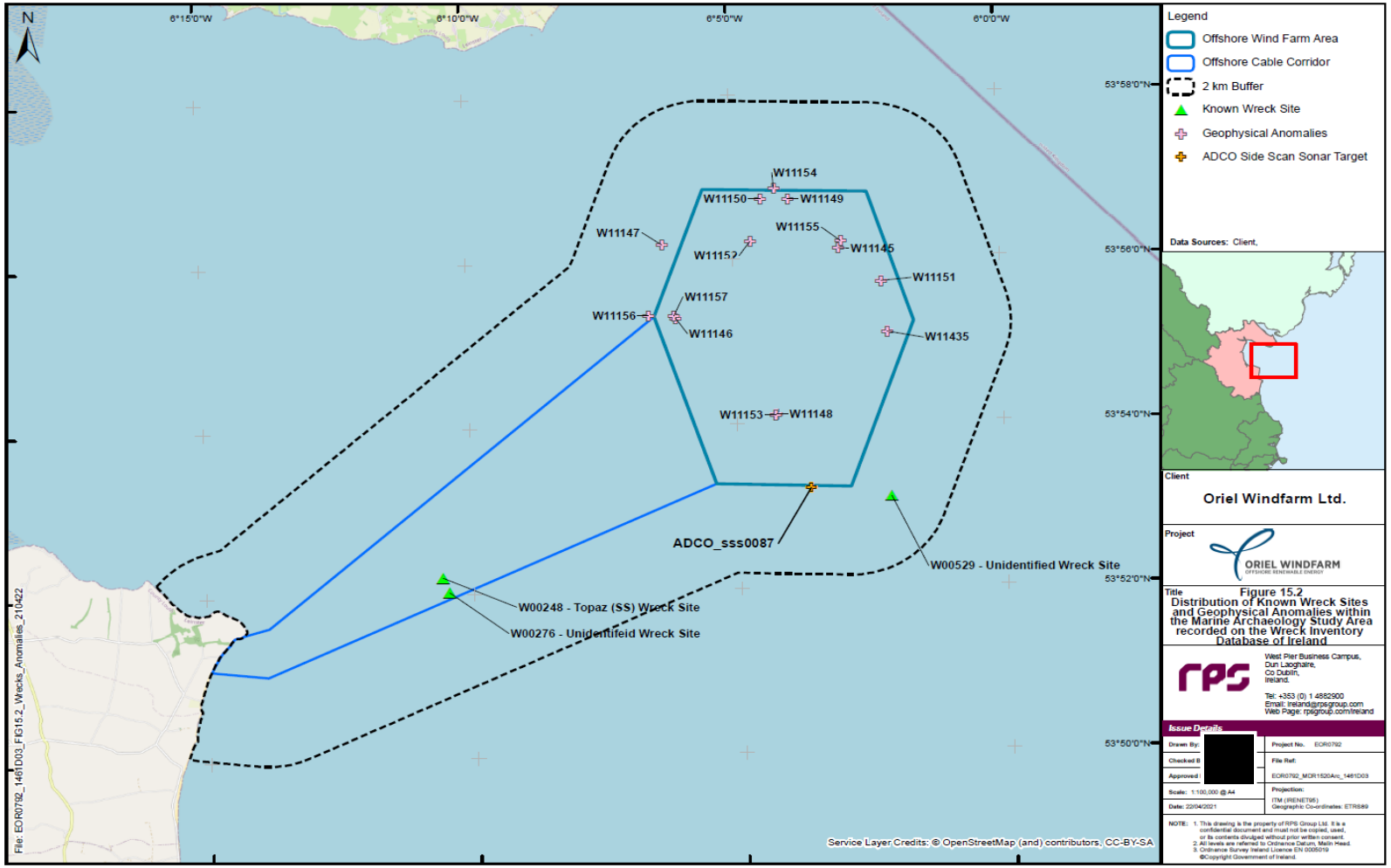

Figure 5.4: Location of recorded wrecks

5.6 Material Assets

This section provides an overview of the baseline environment relating to material assets.

5.6.1.1 Offshore Cables

There are no active cables within the Survey area. There is one historic (out of service) submarine power cable, which partially extends from the north of Dundalk Bay towards the centre of the bay, however this cable does not overlap with the survey area.

5.6.1.2 Carbon Capture and Storage, Natural Gas Storage and Underground Coal Gasification

There are no active or proposed Carbon Capture and Storage, natural gas storage or Underground Coal Gasification sites within the survey area.

5.6.1.3 Coal Deposits

There are no known coal deposits located off Dundalk Bay and therefore within the survey area.

5.6.1.4 Aquaculture

According to the current register of Licenced Aquaculture sites in Ireland, on the data.gov.ie website Aquaculture Sites - Datasets - data.gov.ie (accessed in August 2021), there are no aquaculture sites with the survey area of the proposed project. The nearest licensed aquaculture sites are in Carlingford Lough.

5.6.1.5 Marine Aggregate Extraction and Disposal Sites

This section provides an overview of aggregate extraction sites and disposal sites within the survey area.

Sand and Gravel

There are currently no aggregate extraction sites within the survey area. The nearest marine aggregate extraction point is Kish Bank, located 84 km south of the offshore wind farm area.

Areas of high potential marine aggregate resource have been identified within the survey area. This includes fragmented patches of sand within the survey area. Wider areas of high potential marine aggregate resource have been identified further south along the east and south east coasts of Ireland, and offshore of the south west coast of Ireland.

Heavy Mineral Deposits

Sandy deposits can contain valuable heavy minerals such as gold, diamonds, platinum and tin. Such deposits are found on continental shelves worldwide from the beach to the outer shelf.

During the 1980's Geological Survey Ireland carried out a series of joint industry reconnaissance surveys which identified several potentially viable deposits, however, none are located within or close to the Survey area.

Disposal Sites

The nearest dredge material disposal sites, currently in use, are the Warren Point B site, located 7.5 km to the north east of the offshore wind farm area and Kilkeel, located 12.5 km to the north east of the offshore wind farm area. No disposal sites have been identified that overlap with the Survey area.

5.6.1.6 Oil and Gas Infrastructure

Licences for the exploration and extraction of oil and gas are awarded by the Petroleum Affairs Division of the Department of the Environment, Climate and Communications. These licences are granted for identified geographical licence option areas (blocks and sub-blocks) in rounds. The survey area is located within the Celtic Sea/ Irish Sea open-door licensing area and under frontier exploration licence option area.

There are currently no licenced acreage that is within or adjacent to the Survey area. There are no hydrocarbon fields, wells or gas platforms within the Survey area.

There are no pipelines located within the survey area. A gas pipeline from Scotland comes ashore 2.3km (1.25 nautical miles (NM)) north-west of Braymore Point and passes about 15km (8 NM) to the south-east of the offshore wind farm area, at its closest point.

A natural gas pipeline from Scotland comes ashore in the vicinity of Loughshinny, which is well to the south of the offshore wind farm area.

5.6.1.7 Offshore Renewable Energy Installations

There are no existing offshore renewable energy installations in or close to the Survey area.

5.6.1.8 Charted Anchorages

Other than anchorages for emergency situations there are no charted anchorages within the offshore wind farm area or the offshore cable corridor, although vessels will on occasion anchor in the bays and inlets along the coast.

5.6.1.9 Defence and National Security

The Naval Service is the State's principal sea-going agency. A flotilla consisting of eight ships is maintained at Haulbowline Naval Base in Cork.

The Air Corps operates from Casement Aerodrome Baldonnel County Dublin. Within the Air Corps. The Air Corps supports the Naval Service in the Maritime environment and currently provides air surveillance capacity through two maritime patrol aircraft.

The location of the survey area is not considered significant with regards either Haulbowline Naval Base or the Air Corps base.

British Admiralty Practice and Exercise Area (PEXA) chart Q6403 gives details of exercise areas in the vicinity of the survey area. Submarines exercise frequently both underwater and on the surface, 8 NM to the north-east of the offshore wind farm area.

There is a firing practice area in Dundrum Bay, approximately 20 NM north-east of the Survey area.

Gormanston Military Firing Range operates from the site of the Gormanston aerodrome, which is located 16 NM south west of the offshore wind farm area.

5.7 Seascape

This section describes the key components, features and characteristics that make up the seascape type(s) within the survey area.

A seascape can be described as a discreet area containing a seaward component, a coastline component and a landward component. It can be defined as '*the coastal landscape and adjoining areas of open water, including views from land to sea, from sea to land and along the coastline*'.

Seascape is recognised more and more as being a key element of the coastal and marine environment. Seascape can form an important element of employment, tourism, recreation and visual amenity.

In the absence of national or regional guidance and assessments, local authorities currently conserve and protect scenic value as areas of high amenity, high sensitivity, areas of outstanding natural beauty, protected views and similar designations,. Each local authority is responsible for the designation of these within their individual jurisdictions, with each development plan providing objectives to protect such scenic values.

According to the SEA Environmental Report for the National Marine Planning Framework (RPS, 2019), the Offshore Renewable Energy Development Plan (OREDP) (Department for Communications, Energy and Natural Resources, 2014) outlined a high-level methodology for seascape character assessment as part of a desktop study. It described the key characteristics of strategic seascapes Ireland, and outlined which areas are likely to be least sensitive to offshore renewable energy development.

The approach was adapted from DTI Guidance on Seascape and Visual Impact Assessment of Offshore Wind Farms (DTI, 2015) and the good practice outlined in the Guidelines for Landscape and Visual Impact Assessment published by the Landscape Institute and the Institute of Environmental Management and Assessment in 2002. While representing a good first step, to date no further work has been undertaken towards progressing national and regional-level landscape assessment.

As part of the seascape character assessment of the OREDP, nine Seascape character types were established. The survey area, which is located in Dundalk Bay is classified as seascape type 8, 'Large Bay' which maintains the characteristics described in **Table 5.3**.

Table 5.3: Seascape Character Types

Seascape Type	Location	Physical Characteristics	Quality of Experience
8. Large Bay	Donegal Bay (Donegal, Leitrim and Sligo), Ballyheigue, Tralee and Brandon Bay (Kerry), Cork Harbour to Loop Head (Cork and Waterford), Dublin bay (Dun Laoghaire) and Dundalk Bay (Louth).	Very large long sweeping bays often with sand dunes, expansive sands and tidal flats and rocky headlands. The scale of the seascape varies from medium to large with very long open views framed by landmass, both across the bay and out to the wide horizon of the open sea.	The effects of scale, light, and water in long uninterrupted vistas framed by landmass are important components of the seascape character within the bay area. The open and expansive long views from the inner shore are contained by views to headlands and distant shorelines creating a foreshortening effect looking across the bay, with long views out to the wide horizon of the open sea.

According to the Draft Louth County Development Plan 2021-2027 (the Draft CDP), there are a number of protected views and prospects in the County. Of these protected views and prospects, two are of relevance to the proposed surveys- VP18 and VP19, as illustracted in **Figure 5.5**.

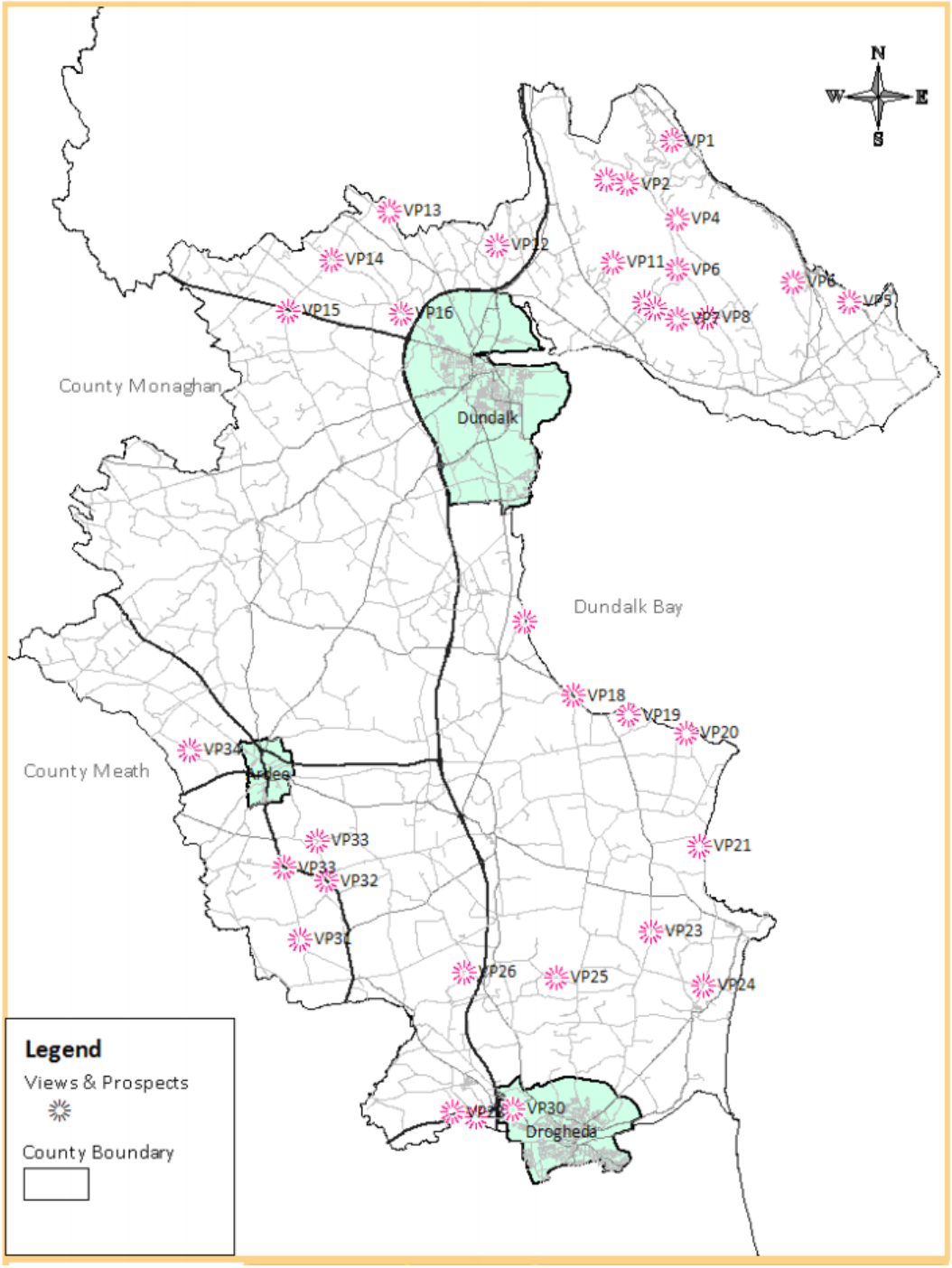

Figure 5.5: Protected Views and Prospects in County Louth (Source: Draft Louth County Development Plan 2021-2027, Louth County Council)

VP 20 represents a protected view/propsect at Salterstown, from the northernmost end of local secondary road L6220. It is described in the Draft CDP as a "*beach strip, providing uninterrupted sea view looking north across Dundalk Bay towards the Cooley and Mourne Mountains.*"

VP 21 represents a protected view/prospect at Draghanstown, Corstown- from the northernmost end of local secondary road L6220. It is described in the Draft CDP as an '*uninterrupted sea view looking north across Dundalk Bay towards the Cooley Mountains and the Mourne Mountains*.'

6 Potential Impacts of the Proposed project

6.1 Population

6.1.1 Commercial Fishing

The survey vessels will be capable of passage speeds in excess of 10 knots. During survey operations the vessels' speed will be less than 4 knots and, for some of the duration, the vessels will be towing an array. All other vessels will be required to remain at a distance of at least 500m from vessels engaged in the survey operations. This exclusion zone will move with the survey vessel.

Fishermen with static gear such as whelk/lobster/crab pots will be asked to remove the gear from the survey area for the duration of the geophsyical survey, which is expected to be approximately 1 month).

For the geotechnical investigations, the vessel will static at one location, for a period of up to a week before moving to the next static location. Other vessels will be required to remain at a distance of 500m from the geotechnical vessl. The duration of the geotechnical investigations is expected to be up to eight months. The presence of survey vessels and static equipment, and the exclusion zones around them, will cause temporary loss or restricted access to fishing grounds and will temporarily displace fishing activity to other areas. The static survey equipment will have a very small footprint, it will be necessary for the fishermen to avoid the static survey equipment also.

There is therefore potential for negative effects on commercial fishing, in the absence of mitigation. Refer to **Section 7**.

6.1.2 Recreational Fishing

The survey activities will result in the same temporary disruption or displacement to boat-based recreational angling as to commercial fishing. There will be a very small temporary exclusion area around any onshore site investigation works, to ensure public safety.

Thus, there is also potential for negative effects on recreational fishing, in the absence of mitigation. Refer to **Section 7**.

6.1.3 Shipping and Vessel Traffic and Navigation

As described in **Section 5.1.3**, the waters inshore of the survey area are used by commercial vessels, in addition to fishing boats and recreational craft.

The potential effect on commercial and recreational shipping and fishing boats, from a navigational perspective, is an increased risk of collision with the static survey equipment and with the slow-moving survey vessels.

Thus, in the absence of mitigation there is potential for negative effects on shipping vessel traffic and navigation. Refer to **Section 7**.

6.1.4 Ports and Harbours

Shipping routes to the Ports of Warrenpoint, Dundalk, Greenore, Drogheda and to Kilkeel Harbour of will be impacted for the duration of the survey activities in the immediate vicinity of the survey vessels.

Thus, there is potential for negative effects on ports and harbours in proximity to the survey area, in the absence of mitigation. Refer to **Section 7**.

6.1.5 Recreational Sailing and Motor Cruising

As described in **Section 5.1.6**, the waters inshore of the survey area are used by recreational craft.

The presence of survey vessels and static equipment, and the exclusion zones around them, will temporarily displace recreational craft to other areas. It will be necessary for these boat users to avoid the static survey equipment, which will have very small footprints.

There is therefore potential for negative effects on recreational sailing and motor cruising, in the absence of mitigation. Refer to **Section 7**.

6.1.6 Other Recreational Activities

As described in **Section 5.1.6**, the shore at the potential onshore cable route landfall is used by the public for recreation in the form of beach use at Dunany Bay Beach, and associated water sports in the nearshore area.

As illustrated in **Figure 4.2**, there are proposed borehole locations in the nearshore area of Dunany Bay Beach and as such, there is a potential that the survey works will interfere with other recreational activities, Thus, in the absence of mitigation, there is potential for negative effects on other recreational activities. Refer to **Section 7**.

6.2 Biodiversity

6.2.1 Benthic Subtidal and Intertidal Ecology

The use of a jack-up barge has the potential to cause physical disturbance of the seabed from the placement of the barge's legs with terminal spud cans on the

seabed. In locations with an uneven or soft seabed, material such as grout bags or rocks may be placed on the seabed to stabilise the rig feet, and recoverable mud mats may be used in soft sediment. The placement of benthic mooring blocks, if used to hold underwater survey equipment (e.g. FPOD/CPODs, sondes), could also cause physical disturbance.

Other activities including the collection of vibrocores, boreholes and grab samples may result in a small loss of seabed sediments and the release of relatively small and transient sediment plumes into the water column.

Benthic invertebrates do not have auditory structures and will not be impacted by noise from survey activities. Benthic invertebrates do react to vibrations. The high frequency of seismic acoustics will not generate any vibration effects on the sediment and the invertebrates will therefore not react. Vibro-coring will produce vibration effects on the seabed and this may disturb benthic fauna.

6.2.2 Marine Mammals

The primary source of potential physical effect from vessels in relation to marine mammals is collision. However, the risk of injury or mortality to marine mammals as a result of the proposed survey works is considered low as:

- marine mammals in the immediate vicinity are likely to be short term and highly mobile as no critical habitats were identified within the proposed wind farm area;
- any marine mammals, if present in the area, are exposed to small vessels on a regular basis and would be aware of their presence. The survey vessels during the survey will be slow moving and thus any animals in the area would have sufficient time to avoid any collisions and thus injury and mortality;
- coring and drilling will be very local and of short duration in any one place.

The multi-beam and single beam echosounders, side-scan sonar and sub-bottom profiler are noise emitting technologies. The sound levels and frequencies of the sources are at higher frequency than the frequencies which the most sensitive cetacean are capable of hearing.

Acoustic disturbance could occur during the site investigations due to the use of a wide range of frequencies during the geophysical surveys and the localised noise during geotechnical operations.

Noise generated from vibro-coring, drilling and downhole sesmic testing will be of low intensity, very localized and although occurring over a 4 to 5-month period will move around the site causing, at worse, short-term displacement.

There will be a number of vessels associated with the survey works, which will contribute to ocean noise. Shipping produces low broadband and “tonal” narrowband sounds. Marine mammals are often seen in close proximity to human

activity and exhibit some tolerance to anthropogenic noise and other stimuli. Baleen whales use shipping lanes and feed in rich fishing grounds occupied by large fishing vessels. Fin whales are thought to avoid ships by slight changes in heading or increasing the speed and duration of underwater travel but continue to call in the presence of vessel noise.

Odontocetes such as dolphins and harbour porpoise are often more tolerant of shipping noise, being repeatedly exposed to many vessels, small and large. Harbour porpoise are frequently observed near vessels but tend to change behaviour or move away. Seals show considerable tolerance to vessel activity but this does not exclude the possibility that it has an effect.

The risk of disrupting the life cycle of marine mammals is considered to be extremely low. Harbour porpoises, dolphins and seals are primarily using the area for foraging throughout the year, minke whales during summer months and humpback whales very occasionally in winter. Marine mammals range over a wide area when foraging and there is no evidence, such as high sighting rates, that the survey area is an important foraging area. The geophysical and geotechnical surveys could cause temporary displacement from the immediate area. It is unlikely that this effect is long-term and, if it occurs at all, it would only occur during relatively short periods (medium term), and could be constrained by weather conditions resulting in less than continuous exposure. Any effect is likely to be quite localized and of relatively short duration. Most sightings are outside the proposed windfarm area and along the coast.

6.2.3 Fish and Shellfish

Atlantic salmon are functionally deaf above 0.38kHz. Salmon are not sensitive to the very high frequencies associated with the multi-beam and single beam surveys and they will not be impacted by them. The poor hearing of salmon also means that they will not be impacted by the lower frequency sub-bottom profiling. Salmon will hear vessel noise. However, noise from an additional vessel will not significantly impact on salmon passing through the area. Salmon will also hear borehole drilling. However, as this will occur at one stationary location at a time over a short duration, disturbance caused to salmon will be minimal. The same is true for vibro-coring.

Lamprey are not sensitive to and will not be impacted by the very high frequencies associated with multi-beam and single beam echosounders. Lamprey have poor hearing meaning they will not be impacted by sub-bottom profiling. Lamprey will hear vessel noise. However, noise from an additional vessel will not significantly impact lamprey passing through the area. Lamprey will also hear borehole drilling. However, as this will occur at one stationary location at a time over a short duration, disturbance caused to lamprey will be minimal. The same is true for vibro-coring.

Shad are not sensitive to the very high frequencies associated with multibeam and single beam surveys and they will not be impacted by them. Shad will hear the low frequency noise from sub-bottom profiling, particularly ultra-high-resolution sonar if it is required at the site. Shad will hear vessel noise. However, noise from an additional vessel will not significantly impact shad passing through the area. Shad will also hear borehole drilling.

However, as this will occur at one stationary location at a time over a short duration, disturbance caused to shad will be minimal. The same is true for vibro-coring.

Atlantic salmon, lamprey and Twaite shad will hear vessel noise. However, noise from an additional vessel will not significantly impact these species passing through the area.

Studies of fish mortality or behavioural response to noise have tended to focus on geological seismic survey using airgun arrays, and while the proposed survey will generate significantly less noise than these, these studies have relevance to the consideration of potential noise effects on fish and are therefore summarised here.

Studies investigating fish mortality and organ damage from noise generated during seismic surveys are limited and results are highly variable, from no effect to long-term auditory damage. Behavioural responses and effects on fishing success ("catchability") have been reported following seismic surveys, although a similar number of studies have reported no effects on catches or abundance, or conflicting results. Existing studies do not yield completely coherent results but show that short-term startle responses are common at high exposure levels, and that fish can stop foraging and move down in the water column. Such temporary displacement and/or altered feeding behaviour are likely to be responsible for the reduced catches reported in some circumstances.

6.2.4 Birds

The physical presence of the survey vessel may temporarily disturb birds present in the survey area. However, as the works are short-term and temporary in nature and, given the alternative feeding grounds in the area, any disturbance caused by an additional survey vessel will be insignificant. The survey vessels will not pose a collision risk to seabirds foraging in the area.

Information on the underwater hearing abilities of diving birds and evidence of the effects of underwater anthropogenic noise is very limited. Direct effects from underwater acoustic surveys on diving birds could potentially occur through physical damage, given exposure to sufficiently high amplitudes, or through behavioural disturbance. Deeper-diving species which spend longer periods of time underwater (e.g. auks) may be most at risk of exposure, but all species which routinely submerge in pursuit of prey and benthic feeding opportunities in marine and estuarine habitats may be exposed to anthropogenic noise. Very high

amplitude low frequency underwater noise has the potential to result in acute trauma to diving seabirds, with several studies reporting mortality of diving birds in close proximity (i.e. tens of metres) to underwater explosions. However, mortality of seabirds has not been reported during extensive seismic operations in the North Sea and elsewhere.

While seabird responses to approaching vessels are highly variable, flushing disturbance would be expected to displace most diving seabirds from close proximity to the survey vessel and any towed equipment, thereby limiting their exposure to the highest sound pressures generated.

6.2.5 Invasive Species

Use of vessels and equipment during the site investigation works carry the risk of introduction and spread of invasive species, should appropriate biosecurity measures are not taken to clean the plant and equipment being used at the site on completion of works. Thus, there is potential for negative effects, in the absence of mitigation. Refer to **Section 7.**

6.3 Marine processes

6.3.1 Bathymetry, Tidal Flow and Waves

Due to the nature of the survey works described in **Section 4.2**, and the temporary duration of the same, no likely effects on bathymetry, tidal flow or waves are anticipated.

6.3.2 Sediment and Seabed

The geotechnical survey, the benthic grab sampling in the area of the offshore wind farm, the ecological sampling, and the anchoring of the static survey equipment will potentially cause an increased in the suspended sediment concentration in the water column.

However, given the large area over which the survey operations will be carried out and the type of equipment to be deployed, the relative area of the seabed which will be disturbed will be very small and the increase in the suspended sediment concentration in the water column will be negligible.

No likely potential significant negative effects on sediments are therefore identified.

The static survey equipment will be deployed using heavy weight mooring blocks of c. 250kg, clump chain and rope with either an acoustic release mechanism and benthic buoy or a robust mooring with a surface marker buoy. If robust mooring with a surface marker buoy are used, the buoy and mooring of each device will be

recovered on completion of the survey. However, if an acoustic release mechanism and benthic buoy are used, only the rope and benthic buoy will be recovered and the mooring blocks of c. 250kg and clump chain will remain on the seabed. As previously described, up to 6 No. FPOD or CPODS will be in position for 24 months and will need to be serviced every three to four months. The 6 No. sondes will also be in position for 24 months and will need to be serviced every three to four months. Consequently, if anchored using an acoustic release mechanism, the mooring blocks will remain in place, once the survey has been completed.

6.3.3 Shoreline/Nearshore and Cable Route Landfall

One indicative deep investigation location is identified at Dunany Bay Beach, as indicated in **Figure 4.2**. As noted in **Section 4.2**, each deep investigation location will require up to 3 drilled boreholes to a target depth of 50 m below the seabed.

Geotechnical boreholes are localised in nature and not likely to result in any significant impacts to marine processes at the shoreline/nearshore area of Dunany Bay Beach. Borehole diameter is usually ~200mm.

No likely potential significant negative effects on marine processes at the shoreline/ nearshore area therefore identified.

6.4 Water, Air, Noise, Climate

6.4.1 Water

6.4.1.1 Water Quality

As outlined in Section 5.4.2.1, the quality of both the coastal and bathing water in the survey area is currently good.

The proposed survey activities will mainly be undertaken at sea. Drilling the boreholes will use water or biodegradable polymer-based drill muds. There will be no planned release of potentially harmful substances from the survey vessels.

The geotechnical survey, the benthic grab sampling, the ecological sampling and the anchoring of the static survey equipment will potentially cause an increased in the suspended sediment concentration in the water column. The vessels conducting the surveys will use fuels and carry lubricants etc which have the potential to be harmful to the environment, if released.

With the two survey vessels in the area, there is a slightly increased risk of collision, which could result in leaks or spills of fuel or other substances, would have a potential impact on water quality.

Given the large area over which the survey operations will be carried out and the type of equipment to be deployed, the relative area of the seabed, which will be disturbed, will be very small and an increase in the suspended sediment concentration in the water column will be negligible.

Mitigation measures will be employed to ensure that no harmful pollutants are released to sea.

6.4.2 Air

6.4.2.1 Terrestrial Air Quality

There will be no releases to air, other than routine equipment exhausts. Air quality standards will not be exceeded.

Thus, no likely effects on terrestrial air quality are identified.

6.4.2.2 Maritime Air Quality

There will be no releases to air, other than routine vessels exhausts. Air Quality standards will not be exceeded.

Thus, no likely effects on maritime air quality are identified.

6.4.3 Noise

The multi-beam and single beam echosounders, side-scan sonar and sub-bottom profiler are noise emitting technologies. The sound levels and frequencies of the sources are very high. The geotechnical survey drilling equipment will emit sound at low frequencies and sound intensities. The in-situ geotechnical testing will include down-hole wireline seismic cone testing (SCPT) over the full length of borehole. This technique will emit noise, which will be audible underwater but not at the surface. In addition, there will be a number of vessels associated with the survey works, which will contribute to ocean noise.

Thus, in the absence of mitigation, the proposed surveys have the potential to give rise to likely effects on the baseline noise environment underwater.

The likely effect of this underwater noise on marine species is described in **Section 6.2**. Refer to **Section 7.2** for mitigation measures for underwater noise.

6.4.4 Climate

The survey vessels and plant undertaking the surveys will use fossil fuels and will emit greenhouse gases. However, given the small scale of the operation, the emission of greenhouse gases is not expected to be significant in the context of the overall emission of greenhouse gases in Ireland.

No likely potential effects on climate are therefore identified as a result of the proposed survey works.

6.5 Marine Archaeology and Cultural Heritage

6.5.1 Submerged prehistoric archaeological potential

As outlined in **Section 5.1.1**, if peat and organic muds are present, there is a potential for geoarchaeological/ palaeo-environmental evidence along the western extent of the survey area. In addition, where these sediments are present there a good potential for organic preservation of Mesolithic coastal activity such as fish traps. However, none of the previous borehole investigations in the area report the observation of anthropogenic features such as timber, metal or ceramic, and none record peat or related organic strata that might indicate the presence of submerged palaeo-landscapes. Thus, the likelihood that the proposed survey works will impact submerged prehistoric archaeological features is low.

Nevertheless, will one of the proposed borehole investigations uncover a feature of geoarchaeological/ palaeo-environmental significance, there is a risk of the find being damaged in the process.

While the geophysical survey will identify the location of any wrecks or other potential archaeological or cultural heritage features in the survey area, the increased presence of survey vessels and equipment in the survey area has the potential to give rise to effects on shipwrecks.

Thus, in the absence of mitigation, there is potential for negative effects on submerged archaeological features. Refer to **Section 7**.

6.5.2 Protected and recorded wrecks

The increased presence of survey vessels and equipment in the survey area have the potential to give rise to effects on ship wrecks, in the absence of mitigation. Refer to **Section 7**.

6.6 Material Assets

6.6.1 Overview

As outlined in **Section 5.6**, there are limited material assets in the survey area. Thus, the material assets which have been considered in this assessment have been limited to oil and gas infrastructure, and defence and national security.

6.6.1.1 Oil and Gas Infrastructure

As outlined in **Section 5.6**, a gas pipeline from Scotland comes ashore 2.3km (1.25 NM) north-west of Braymore Point and passes about 15km (8 NM) to the south-east of the survey area, at its closest point.

A natural gas pipeline from Scotland comes ashore in the vicinity of Loughshinny which is well to the south of the survey area.

Given the location of the gas pipelines and the nature of the proposed survey work, no likely significant effects on the material assets are predicted.

6.6.1.2 Defence and National Security

As outlined in **Section 5.6**, the location of the survey area is not considered significant with regards either the operations of Haulbowline Naval Base or the Air Corps base. However, submarines exercise frequently 15km (8 NM) to the north-east of the survey area, both underwater and on the surface. No likely effects on this material asset are identified.

Given the location of the firing areas in the wider area, and the restrictions on firing to those times when the sea areas are clear of shipping, no likely effects on these material assets are identified.

6.7 Seascape

As outlined in **Section 5.7**, the survey area, which is located in Dundalk Bay is classified as a 'Large Bay.' The effects of scale, light, and water in long uninterrupted vistas framed by landmass are important components of the seascape character within the bay area.

As further outlined in **Section 5.7**, there are two proected views/prospects identified in the Draft CDP which are of relevance to the proposed surveys- VP 20 and VP 21. These views/prospects are both desginated for their uninterrupted sea views across Dundalk Bay.

The proposed survey works will involve the presence of survey vessels and static equipment in the Bay area for a period of time. Thus, there is potential for the proposed survey works to give rise on potential effects on the seascape.

However, there will be at most two survey vessels and small scale static equipment in the Bay area. Further, as described in **Section 5.1**, the survey area is currently used by a lot of marine traffic. Thus, when considered against the existing baseline, the survey vessels and static equipment will not be a noticeable visual intrusion on the seascape.

No likely effects on the seascape are therefore identified.

7 Mitigation Measures

7.1 Population

7.1.1 Commercial Fishing

As outlined in **Section 6.1.1**, the presence of survey vessels and static equipment, and the exclusion zones around them, will cause temporary loss or restricted access to fishing grounds and will temporarily displace fishing activity to other areas.

However, if a Foreshore Licence is granted, the applicant will implement measures to ensure this displacement is kept to a minimum and that the effects on commercial fishing is not significant.

Oriel has appointed a fisheries liaison officer, who engages with all relevant fishing organisations and holds meetings with the local fishing community to provide details of planned surveys, gather information on existing fishing activity in the area and determine the potential for interaction.

Appropriate actions will be taken to avoid or minimise interactions with ongoing fishing activities in the area during the course of the surveys.

In addition, the Sea Fisheries Protection Authority (SFPA) will be notified in advance of works so that small local fishing vessels can be informed of the works.

The survey works will be carried out in compliance with Convention on the International Regulations for Preventing Collisions at Sea, 1972 ('COLREGS') (IMO, 1972) and International Convention for the Safety of Life at Sea ('SOLAS') regulations.

Information regarding survey works will be communicated via Marine Notices, Radio Navigational Warnings, NAVTEX, and/or broadcast warnings in advance of and during survey works. Information will also be circulated to local ports, harbours and marinas in the area. The notices will include a description of the work being carried out. The mitigation measures set out in **Section 7.1.3** for 'Shipping and Vessel Traffic and Navigation' will also reduce the effects on commercial fishing.

7.1.2 Recreational Fishing

As outlined in **Section 6.1.2**, the presence of survey vessels and static equipment, and the exclusion zones around them, will cause the same temporary loss or restricted access to recreational fishing in the survey area.

However, if a Foreshore Licence is granted, Oriel will implement measures to ensure this displacement is kept to a minimum and ensure that the effects on recreational fishing is not significant.

The mitigation measures proposed in **Section 7.1.1**. 'Commercial Fishing' will also apply to recreational fishing/angling. Similarly, the mitigation measures set out in **Section 7.1.3** 'Shipping and Vessel Traffic and Navigation' will also reduce the effects on recreational fishing and are thus also applicable.

7.1.3 Shipping and Vessel Traffic and Navigation

As described in **Section 6.1.3**, the presence of survey vessels and equipment has the potential to negatively affect commercial and recreational shipping and fishing boats. There will be an increased risk of collision with the static survey equipment and with the survey vessels.

However, if a Foreshore Licence is granted, Oriel will implement measures to ensure this risk of collision is kept to a minimum and that the effects on vessel traffic and navigation is not significant.

All vessels shall comply with the latest International Maritime Organization (IMO) and Safety of Life at Sea (SOLAS) and environmental requirements for their classification and with any national requirement of the territorial or continental / EEZ waters to be operated in. All vessels will follow Parkwind's Vessel Management System.

Standard industry practices including aids to navigation will be adhered to throughout the duration of the survey works. The survey contractor and vessels will be similar to those that are currently used in the market for similar surveys and be responsible for complying with international and national statute as appropriate.

Commissioners of Irish Lights (CIL) standard navigational safety requirements will be adhered to with regard to lighting, positioning and mooring of all relevant static equipment.

Key mitigation measures for the reduction of navigational risk associated with the proposed surveys and deployment of static survey equipment are as follows:

- Arrangements will be made for the publication of a formal Marine Notices through the Marine Survey Office of the Department of Transport and the notice will provide vessel and contact details together with a general description of operations and approximate dates of marine survey commencement and completion, deployment timing and location of fixed monitoring equipment.
- During the survey operations and deployment and recovery of static survey equipment, other vessels will be requested to maintain a safe distance from

survey vessels due to the restricted manoeuvrability and the layback of survey equipment towed behind the survey vessels.

- Survey Vessel speed will be of the order of 2-4 knots during surveys.
- Lights, shapes and other internationally recognised identification or warning signals will be displayed on survey vessels and any static survey equipment deployed to the surface.
- The vessels will comply fully with all requirements of the International Regulations for Preventing Collisions at Sea.
- Local Harbour Masters/Harbour Authorities be informed of the Plan of Work and of the planned start and estimated completion dates for the operations. Regular updates will be provided.
- Approval for deployment of static survey equipment will be obtained from Commissioners of Irish Lights. The approval process will be informed by a more detailed Navigational Risk Assessment (NRA), once final locations of activities are known (as informed by geophysical surveys where appropriate). Mitigation measures identified as part of the NRA process will be agreed with Commissioner of Irish Lights.
- All deployed static survey equipment will be marked and lit appropriately to comply with navigation safety requirements and the requirements of the Commissioner of Irish Lights prior to commence of the surveys and deployment of static survey equipment,
- Charting requirements will be agreed with Department of Transport Marine Survey Office.
- Oriel will arrange with the Maritime Safety Directorate for the publication of a Marine Notice. The marine notice will give a general description of operations, including locations.

All survey works will be carried out in compliance with the relevant regulations and standards, including S.I. No. 507/2012 - Merchant Shipping (Collision Regulations) (Ships and Watercraft on the Water) Order 2012.

7.1.4 Ports and Harbours

As outlined in **Section 6.1.4**, access to the Ports of Warrenpoint, Dundalk, Greenore, and Drogheda and Kilkeel Harbour will be reduced for the duration of the survey activities.

However, if a Foreshore Licence is granted, Oriel will implement measures to ensure this reduced access is kept to a minimum and that the effects on ports and harbours is not significant.

Throughout the duration of the survey works, Oriel will liaise with the local Harbour Masters and Harbour Authorities, who will be informed of the Plan of

Work and of the planned start and estimated completion dates for the operations. Regular updates will be provided. This will ensure any impacts on the use of local ports are minimised or avoided.

The mitigation measures set out in **Section 7.1.3** for Shipping and Vessel Traffic and Navigation will also seek to reduce the effects on port and harbour access and are thus also applicable.

7.1.5 Recreational Sailing and Motor Cruising

As described in **Section 6.1.5**, the presence of survey vessels and static equipment, and the exclusion zones around them, will temporarily displace recreational craft to other areas.

However, if a Foreshore Licence is granted, Oriel will implement measures to ensure this potential displacement is kept to a minimum and that the effects on recreational sailing and motor cruising is not significant.

The mitigation measures set out in **Section 7.1.3** for Shipping and Vessel Traffic and Navigation will reduce the effects on recreational sailing and motor cruising and are thus applicable here.

7.1.6 Other Recreational Activities

As described in **Section 6.1.6**, the shore at the potential landfall site is used by the public for recreation- in the form of beach use at Dunany Bay Beach, and associated water sports in the nearshore area. As illustrated in **Figure 4.2**, there is one proposed borehole location in the nearshore area of Dunany Bay Beach. Consequently, there is a potential that the survey works will interfere with other recreational activities.

However, if a Foreshore Licence is granted, Oriel will implement measures to ensure this interference is kept to a minimum and that the effects on other recreational activities- such as beach use and water sports, is not significant.

Any works undertaken on the Dunany Bay Beach will only be undertaken following the completion of a risk assessment and appropriate safety precautions provided. In advance of any survey works in the nearshore area, or indeed any survey vehicle or equipment presence on Dunany Bay Beach, Oriel will ensure that all survey locations are fenced off from access by the public and that the works are carried out in compliance with all relevant health and safety guidance and legislation. In addition, prior notification will be given to all relevant local water sports groups as well as Louth County Council to ensure that the public are informed of any potential disturbance in advance.

Oriel will also ensure that existing public access arrangements to the general foreshore area will not be impeded by any vessels, plant or materials used in

connection with the site investigations/surveys. Where relevant, this access will be made safe and guaranteed by the provision of appropriate signage/notices/barriers.

7.2 Biodiversity

7.2.1 Benthic Subtidal and Intertidal Ecology

As outlined in **Section 6.2.1**, the presence of survey equipment has the potential to disturb the seabed and associated benthic subtidal and intertidal ecology.

However, if a Foreshore Licence is granted, Oriel will implement measures to ensure this displacement is kept to a minimum and ensure that the effects on benthic subtidal and intertidal ecology is not significant.

Mitigation proposed in order to minimise effects on benthic and intertidal habitats (including Annex I habitats) includes:

- Geophysical surveys will identify any area which can be considered reef, and these will be avoided where possible by intrusive survey / sampling techniques (benthic grab / epibenthic beam trawl / geotechnical studies / metocean or POD) or sampled by DDV for benthic surveys.
- Ensure all jacks associated with geotechnical survey works, or placement of metocean devices are positioned to avoid any known reef features (identified from the geophysical survey).
- All borehole operations will use water or biodegradable polymer-based drilling muds only and will have a system in place to return drill cuttings to the vessel for appropriate disposal.
- All work undertaken in the intertidal by tracked vehicles will avoid the *Zostera* dominated community, the boundary of which will be delineated through an intertidal survey of the area prior to such work commencing.
- Movement of tracked vehicles in the intertidal will be restricted to the minimum number of access tracks necessary to achieve the sampling. This will reduce areas of compaction allowing rapid recovery of the small area affected after the cessation of the work, ensuring the natural condition of the feature is maintained.
- Works on the intertidal using a tracked vehicle will be overseen by an Ecological Clerk of Works.

7.2.2 Marine Mammals

As outlined in **Section 6.2.2**, the presence of survey vessels and equipment could give rise to potential effects on marine mammals in the form of collision risk, acoustic disturbance and potential for contamination events.

However, if a Foreshore Licence is granted, Oriel will implement measures to ensure this displacement is kept to a minimum and ensure that the effects on marine mammals is not significant.

The best practice guidelines, "Guidance to manage the risk to marine mammals from man-made sound sources in Irish waters" (DAHG 2014), will be implemented for the geophysical surveys and a qualified and experienced marine mammal observer (MMO) will be employed aboard the survey vessels during all multibeam, single beam, side-scan sonar and sub-bottom profiling. MMO monitoring will include pre-start monitoring, 'soft-start' ramp-up procedures, line change procedures and procedure for a break in sound output.

As the proposed surveys are to be conducted in waters of less than 200 m deep, the pre-start survey will commence a minimum of 30 minutes prior to the scheduled start time. For all pre-start surveys, a monitored zone of 500 m will be employed, i.e. if a marine mammal is observed within 500 m of the sound source in the 30 minutes prior to the scheduled start, works will be delayed until no marine mammals have been observed in the monitored zone for 30 minutes. If the marine mammals do not leave the area, the survey vessel may alter its course to ensure that the animals are outside the monitored zone when the soft start commences. The Marine Mammal Observer (MMO) will use a distance measuring stick or reticule binoculars to ascertain distances to marine mammals.

A qualified and experienced MMO will be appointed to monitor for marine mammals and to log all relevant events using standardised data forms provided by the DAHG. In order to allow 24-hour working, or for work to commence when visual observation is not possible due to weather conditions or sea state, a proven Passive Acoustic Monitoring (PAM) system and experienced operator(s) will be employed to undertake pre-start surveys during these times.

A soft start is the gradual ramping of power over a set period of time. The UHRS and check-shot logging equipment is assumed to have this capability inbuilt.

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 mammals enter the monitored zone (500 m radial distance of the sound source).

The following ramp up procedure will be undertaken in line with the DAHG (2014) guidance:

1. 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 up to 40 minutes.
2. This controlled build-up of energy output will occur in consistent stages to provide a steady and gradual increase over the ramp-up period.

3. 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.

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 may 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).

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/station change) then all pre-survey monitoring measures and ramp-up (soft start) will recommence prior to re-starting.

For drilling operations, in order to allow 24- hour working, or for work to commence when visual observation is not possible due to weather conditions or sea state, a proven Passive Acoustic Monitoring (PAM) system and experienced operator(s) will be employed to undertake pre-start surveys during these times.

Geophysical site surveys are of medium duration but any displacement will be relatively short term. Pre, during and post survey monitoring would allow for an assessment of any disruption and if it is evident, then the level can be quantified. Post-survey monitoring would also provide a means to establish if disruption occurred and how long it takes for animals to return to an area and resume site usage.

If surveys are carried out during summer months the species most likely to be exposed to temporary disturbance include harbour porpoise, common and bottlenose dolphin and, to a lesser extent, minke whale. The breeding and pupping seasons for grey seals are between August to November. Given the proximity of the SAC for grey seals, surveys outside of the seal breeding season would result in less exposure of marine mammals to potential impacts.

All vessels will be compliant with the International Convention for the Prevention of Pollution from Ships (MAROL), as per standard good practice, which will reduce the risk of contamination incidents and accidents.

The mitigation measures set out in **Section 7.4.1** ‘Water’ will also reduce the effects on marine mammals and are thus also applicable.

7.2.3 Fish and Shellfish

As outlined in **Section 6.2.3**, the presence of survey vessels and equipment could give rise to potential effects on fish and shelfish in the form of acoustic disturbance and potential for contamination events.

However, if a Foreshore Licence is granted, Oriel will implement measures to ensure this displacement is kept to a minimum and ensure that the effects on fish and shelfish is not significant.

The mitigation measures proposed in **Section 7.2.2** for 'Marine Mammals' will also apply to fish and shelfish. Similarly, the mitigation measures set out in **Section 7.4.1** 'Water' will also reduce the effects on fish and shelfish and are thus also applicable

Procedural controls, stemming from industry-standard guidelines and best practice procedures will limit the possibility of accidental events. In the unlikely event of a spill occurring, BIM, as well as all other relevant statutory bodies, will be notified as soon as possible.

7.2.4 Birds

As outlined in **Section 6.2.4**, the proposed survey works could give rise to potential effects on diving birds in the form of acoustic disturbance,

However, if a Foreshore Licence is granted, Oriel will implement measures to ensure this displacement is kept to a minimum and ensure that the effects on birds is not significant.

The mitigation measures set out in **Section 7.2.2** for 'Marine Mammals' will reduce the effects on diving birds and are thus applicable here.

7.2.5 Invasive Species

An Invasive Species Management Plan will be prepared to avoid the potential for the introduction and spread of marine alien invasive species. This will include systems to ensure:

- Vessels will be compliant with the International Convention for the Control and Management of Ship's Ballast Water and Sediments and will hold the relevant certificate of compliance in this regard. This compliance covers the measures for the control and management of the vessel's biofouling to minimise the transfer of invasive aquatic species.
- Boats, barges and marine equipment will be free of fouling by the use of appropriate application of antifouling paints and/ or washdowns for smaller boats and plant.

- A record of all antifouling procedures implemented will be kept for the duration of the project.
- All machines entering the intertidal and subtidal area will be washed down at a designated location prior to mobilising to site.
- Any visible organisms will be removed from any tracked plant and equipment entering the intertidal area.

7.3 Marine processes

7.3.1 Bathymetry, Tidal Flow and Waves

As no likely potential significant impacts on bathymetry, tidal flow or waves are predicted as a result of the proposed survey works, no mitigation measures are proposed.

7.3.2 Sediments and Seabed

As no likely potential significant impacts on sediments are predicted as a result of the proposed survey works, no mitigation measures are proposed.

The mooring for any static equipment, not moored using acoustic releases, will be recovered.

7.3.3 Shoreline/Nearshore and Cable Route Landfall

As no likely potential significant impacts on the shoreline/nearshore or the cable route landfall are predicted as a result of the proposed survey works, no mitigation measures are proposed.

7.4 Water, Air, Noise, Climate

7.4.1 Water

7.4.1.1 Water Quality

As outlined in **Section 6.4.1.1**, there will be no planned release of potentially harmful substances from the survey vessels. However any accidental release of potentially harmful substances has the potential to negatively impact water quality in the survey area.

However, if a Foreshore Licence is granted, Oriel will implement measures to ensure that the risk of accidental release of potentially harmful substances is kept to a minimum and that the effects on water quality is not significant.

All vessels will comply with the International Convention for the Prevention of Marine Pollution from Ships (MAROL73/78), as per standard good practice, which will reduce the risk of contamination incidents and accidents.

The appointed contractor will take particular care when handling or storing hazardous materials, radiation sources and chemicals. All storage and handling must be carried out in accordance to accepted guidelines; appropriate safety precautions must be taken, and safety clothing must be worn as necessary. Liquid or non-liquid pollutants or waste material will not be dumped, thrown or otherwise disposed of into the sea. All refuse and materials shall be kept onboard the vessel and safely disposed of onshore according to the MARPOL convention. All substances handled and/or used whilst undertaking the works will be handled, used, stored and documented in accordance with assessments and recommendations of the Control of Substances Hazardous to Health (COSHH) Regulations 1994. Where Fuels, Oils and Lubes are required to bestowed on boats, suitable containers will be used and stowed to allow ventilation and safe dissipation of any accidental leaked gas and retention of any leaked liquid. No liquid will be discharged into the water at any stage of the work on site. No smoking will be permitted in the vicinity of fuel in storage or when in use.

All survey works will be carried out in compliance with the regulations and standards, including but not limited to:

- S.I. No. 507/2012 - Merchant Shipping (Collision Regulations) (Ships and Watercraft on the Water) Order 2012;
- Sea Pollution Act 1991 which transposes into Irish statute the requirements of MARPOL;
- Sea Pollution (Amendment) Act, 1999 - which gives effect to the International Convention on on Oil Pollution Preparedness, Response and Co-operation, 1990 (OPRC);
- 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.

Refuelling of equipment, machinery or plant will normally not take place on the foreshore. However, if a jack up barge is used, offshore refuelling may be necessary. In this eventuality, ever practical precaution will be taken to avoid a spill or leak of fuel into the sea.

7.4.2 Air

As no likely potential significant effects on terrestrial or marine air quality are identified no specific mitigation measures are proposed.

However, all survey vessels will be MAROL compliant, as per standard good practice, which will reduce the risk of pollutant emissions.

7.4.3 Noise

The NPWS 2014 Guidance to Manage the Risk to Marine Mammals from Man-made Sound Sources in Irish Waters is the standard mitigation considered sufficient by the competent authorities to mitigate the risk to marine mammals from marine surveys. This Guidance will be complied with throughout the duration of the surveys. Refer to **Section 7.2** above for mitigation measures for underwater noise.

7.4.4 Climate

As no likely potential significant effects on climate are identified no specific mitigation measures are proposed.

However, all survey vessels will be MAROL compliant, as per standard good practice, which will reduce the emissions greenhouse gases.

7.5 Marine Archaeology and Cultural Heritage

7.5.1 Protected and Recorded Wrecks

If a Foreshore Licence is granted, Oriel will implement measures to ensure that the risk of impact to any protected and recorded wrecks is kept to a minimum.

The following measures will be implemented:

- Where cultural heritage assets will potentially be subject to direct or indirect impacts, archaeological exclusion zones (AEZ) will be implemented to prevent potential impacts from anchoring of survey vessels, sample retrieval and mooring of static equipment;
- Exclusion zones of at least 100 m will be established around sites identified as being of high vulnerability, while an exclusion zone of a minimum 50 m will be established around those of medium vulnerability;
- Geophysical survey data will be subject to archaeological analysis and submission to the UAU. This will be used to refine and finalise any mitigation measures required;
- Will further survey or investigation confirm the nature and characteristics of an identified asset then an AEZ can be maintained or removed as appropriate and in consultation and agreement with National Monuments Service;
- The implementation and monitoring (where appropriate and agreed) of the AEZs will be undertaken.

Will it not be possible to avoid sites of cultural heritage interest, a full programme of archaeological investigation, which will include diver survey or Remotely Operated Vehicle investigation, will be undertaken to identify the nature and

extent of these sites. Subject to these investigations an appropriate mitigation strategy will be agreed with NMS.

7.5.2 Unknown Submerged Archaeological Features

As outlined in **Section 6.5.1**, the likelihood that the proposed survey works will impact unknown submerged archaeological features is low. Nevertheless, will one of the proposed borehole investigations uncover a feature of geoarchaeological/ palaeo-environmental significance, there is a risk of the find being damaged in the process.

If a Foreshore Licence is granted, Oriel will implement measures to ensure that the risk of impact to any finds of geoarchaeological/ palaeo-environmental significance is kept to a minimum.

All geophysical survey data sets available from previous work in the survey area, including bathymetry, side scan sonar, magnetometry and archaeological assessment, will be assessed by a suitably qualified archaeologist to ensure that the proposed survey does not negatively impact on locations where there is known or potential archaeology and to ensure no samples or cores are taken from an area where a wreck site is located. Refer also to **Section 7.5.2** below.

A report summarising the assessment of the geophysical data will be forwarded to Underwater Archaeology Unit (UAU) of the National Monuments Service of the Department of Housing, Local Government and Heritage for review prior to the geotechnical investigations commencing. Oriel will consult the UAU and comply with its recommendations, if any, in carrying out the geotechnical investigations

The results of the geotechnical investigations will be assessed by a suitably qualified archaeologist and this assessment will form part of the overall archaeological assessment of any proposed wind farm development.

Oriel will enforce a Protocol for Archaeological Discoveries to mitigate impacts in the event of any unexpected archaeological discoveries during the surveys. This protocol will also include appropriate archaeological briefings for all personnel involved in the activities associated with the proposed surveys.

7.5.3 Dive Surveys

Will it not be possible to avoid sites of cultural heritage interest, a full programme of archaeological investigation, which will include diver survey or Remotely Operated Vehicle (ROV) investigation, will be undertaken to identify the nature and extent of these sites. Subject to these investigations an appropriate mitigation strategy will be agreed with NMS.

7.6 Material Assets

7.6.1.1 Oil and Gas Infrastructure

As outlined in **Section 6.6.1.1**, given the location of the gas pipelines and the nature of the proposed survey work, no likely potential significant effects on the material assets are predicted. Consequently, no specific mitigation measures are proposed.

7.6.1.2 Defence and National Security

As outlined in **Section 6.6.1.2**, given the location of the firing areas and the restrictions on firing to those times when the areas are clear of shipping, no likely potential significant effects on this material asset are identified. Consequently, no specific mitigation measures are proposed.

7.7 Seascape

As outlined in **Section 6.7,** the nature and scale of the proposed survey works are such that there will be a limited survey vessel and equipment presence in the Dundalk Bay area. Further, the survey area is used by a lot of marine traffic. Thus, when considered against the existing baseline, the survey vessels and static equipment will not be a noticeable visual intrusion on the seascape. No likely potential significant effects on the seascape are therefore identified.Consequently, no specific mitigation measures are proposed.

8 Environmental Appraisal

The description of impacts and effects in this appraisal generally follows the guidance provided in Table 3.3 Descrption of Effectsin the EPA draft Guidance (EPA, 2017).

8.1 Population

8.1.1 Commercial Fishing

As outlined in **Section 6.1.1**, the presence of survey vessels and static equipment, and the exclusion zones around them, will cause temporary loss or restricted access to fishing grounds and will temporarily displace fishing activity to other areas.

The mitigation measures outlined in **Section 7.1.1** will reduce the likelihood of, or avoid, these potential effects occurring, and lessen the impact, will they occur.

Following implementation of the mitigation measures proposed and given the scale and duration of the proposed survey works, as well as presence of extensive alternative fishing grounds available in the wider area, the effect on commercial fisheries will be confined to a small portion of the survey area at any one time and is expected to be negative, temporary, in the case of the survey vessels, short term in the case of the static equipment, and not significant.

8.1.2 Recreational Fishing

As outlined in **Section 6.1.2**, the presence of survey vessels and static equipment, and the exclusion zones around them, will cause the same temporary loss or restricted access to recreational fishing in the survey area.

The mitigation measures outlined in **Section 7.1.2** will reduce the likelihood of, or avoid, these potential effects occurring.

Following implementation of the mitigation measures proposed and given the scale and duration of the proposed survey works, as well as presence of extensive alternative fishing grounds available in the wider area, the effect on recreational fisheries will be confined to a small portion of the survey area at any one time, and is expected to be negative, temporary and not significant.

8.1.3 Shipping and Vessel Traffic and Navigation

As described in **Section 6.1.3**, the presence of survey vessels and static survey equipment has the potential to negatively affect commercial and recreational shipping and fishing boats, from a navigational perspective, by increasing the risk of collision.

The mitigation measures outlined in **Section 7.1.3** will reduce the likelihood of, or avoid, these potential effects occurring.

Following implementation of the mitigation measures proposed, the effect on vessel traffic and navigation will be confined to a small portion of the survey area at any one time, and is expected to be negative, temporary and not significant.

8.1.4 Ports and Harbours

As outlined in **Section 6.1.4**, access to the Ports of Warrenpoint, Dundalk, Greenore, and Drogheda and Kilkeel Harbour will be reduced for the duration of the survey activities in the immediate vicinity of the potential landfalls.

The mitigation measures outlined in **Section 7.1.4** will reduce the likelihood of, or avoid, these potential effects occurring.

Following implementation of the mitigation measures proposed, the effect on vessel ports and harbours will be confined to a small portion of the survey area at any one time, and is expected to be negative, temporary and imperceptible.

8.1.5 Recreational Sailing and Motor Cruising

As outlined in **Section 6.1.5**, the presence of survey vessels and static equipment, and the exclusion zones around them, will temporarily displace recreational craft to other areas.

The mitigation measures outlined in **Section 7.1.4** will reduce the likelihood of, or avoid, these potential effects occurring.

Following implementation of the mitigation measures proposed, the effect on recreational sailing and motor cruising will be confined to a small portion of the survey area at any one time, and is expected to be negative, temporary and not significant.

8.1.6 Other Recreational Activities

As described in **Section 6.1.6**, the shore at the potential landfall site is used by the public for recreation- in the form of beach use at Dunany Bay Beach, and associated water sports in the nearshore area.

As illustrated in **Figure 4.2**, there is one proposed borehole location in the nearshore area of Dunany Bay Beach and as such, there is a potential that the survey works will interfere with other recreational activities.

The mitigation measures outlined in **Section 7.1.6** will reduce the likelihood of, or avoid, these potential effects occurring.

Following implementation of the mitigation measures proposed, the effect on other recreational activities will be confined to a small portion of the survey area at any one time, and is expected to be negative, temporary and not significant.

8.2 Biodiversity

8.2.1 Benthic Subtidal and Intertidal Ecology

As outlined in **Section 6.2.1**, the proposed survey works have the potential to give rise to effects on the seabed and associated benthic subtidal and intertidal ecology.

The mitigation measures outlined in **Section 7.2.1** will reduce or avoid the likelihood of these potential effects occurring.

Following implementation of the mitigation measures proposed and given the scale and duration of the proposed survey works, the effect on benthic subtidal and intertidal ecology fisheries is expected to be negative, temporary and not significant.

8.2.2 Marine Mammals

As outlined in **Section 6.2**, the potential disruption and adverse impact of the surveys and investigations on habitats and species will be very small scale, temporary and short term.

The mitigation measures outlined in **Section 7.2.2** will reduce or avoid the likelihood of these potential effects occurring.

Following implementation of the mitigation measures proposed, no likely significant effects on marine mammals are expected. Refer to the Report for the purposes of Appropriate Assessment Screening which accompanies this application for further information.

8.2.3 Fish and Shelfish

As outlined in **Section 6.2**, the potential disruption and adverse impact of the surveys and investigations on habitats and species will be very small scale, temporary and short term.

The mitigation measures outlined in **Section 7.2.2** and **Section 7.2.3** will reduce or avoid the likelihood of these potential effects occurring.

Following implementation of the mitigation measures proposed, no likely significant effects on fish and shellfish are expected. Refer to the Report for the purposes of Appropriate Assessment Screening which accompanies this application for further information.

8.2.4 Birds

As outlined in **Section 6.2**, the potential disruption and adverse impact of the surveys and investigations on habitats and species will be very small scale, temporary and short term.

The mitigation measures outlined in **Section 7.2.2** and **Section 7.2.3** will reduce or avoid the likelihood of these potential effects occurring.

Following implementation of the mitigation measures proposed, no likely significant effects on birds are expected. Refer to the Report for the purposes of Appropriate Assessment Screening which accompanies this application for further information.

8.2.5 Invasive Species

As outlined in **Section 6.2.5**, there is potential risk of introduction of invasive species as a result of the us of vessels and equipment. The mitigation measures outlined in **Section 7.2.5** will reduce or avoid the likihood of these potential effects occurring.

Following implementation of the mitigation measures proposed, no likely introduction of invasive species is expected.

8.3 Marine processes

8.3.1 Bathymetry, Tidal Flow and Waves

No likely significant negative effects on bathymetry, tidal flow or waves are predicted as a result of the proposed survey works.

8.3.2 Sediments and Seabed

No likely significant negative effects on sediments or waves are predicted as a result of the proposed survey works.

As described in **Section 6.3.2** above, if the static survey equipment is moored using acoustic release devices, the mooring blocks made of either concrete or steel and chains made of galvanised steel will remain on the seabed. The moorings and chains will occupy a very small part of seabed. The effect on the seabed will

be confined to an very small part of the seabed in the survey area, and is expected to be neutral, long term and imperceptible.

8.3.3 Shoreline/Nearshore and Cable Route Landfall

No likely significant effects on marine processes at the shoreline/nearshore and cable route landfall are predicted as a result of the proposed survey works.

8.4 Water, Air, Noise, Climate

8.4.1 Water

8.4.1.1 Water Quality

As outlined in **Section 6.4.1.1**, there will be no planned release of potentially harmful substances from the survey vessels, however any accidental release of potentially harmful substances has the potential to negatively impact water quality in the survey area.

The mitigation measures outlined in **Section 7.4.1.1** will reduce or avoid the likelihood of these potential effects occurring.

Following implementation of the mitigation measures proposed and given the short-term duration and scale of the proposed survey works, as well as the localised extent of the survey area, the effect on water quality is expected to be neutral, temporary and imperceptible.

8.4.2 Air

No likely significant effects on terrestrial or marine air quality are identified as a result of the proposed survey works.

8.4.3 Noise

Refer to **Section 8.2**.

8.4.4 Climate

No likely significant effects on climate are identified as a result of the proposed survey works.

8.5 Marine Archaeology and Cultural Heritage

8.5.1 Submerged prehistoric archaeological potential

As outlined in **Section 6.5.1**, the likelihood that the proposed survey works will impact submerged prehistoric archaeological features is low. Nevertheless, will one of the proposed borehole investigations uncover a feature of geoarchaeological/ palaeo-environmental significance, there is a risk of the find being damaged in the process.

The mitigation measures outlined in **Section 7.5.1** will reduce or avoid the likelihood of these potential effects occurring.

Following implementation of the mitigation measures proposed, and considering that previous borehole investigations did not uncover any features of significance, no likely significant effects on submerged prehistoric archaeological features are expected.

8.5.2 Protected and recorded wrecks

As outlined in **Section 6.5.2**, the increased presence of survey vessels and equipment in the survey area has the potential to give rise to effects on shipwrecks.

The mitigation measures outlined in **Section 7.5.2** will reduce or avoid the likelihood of these potential effects occurring.

Following implementation of the mitigation measures proposed and given that the geophysical survey will identify the location of any wrecks or other potential archaeological or cultural heritage features in the survey area, no likely significant effects on submerged prehistoric archaeological features are expected.

8.6 Material Assets

8.6.1 Oil and Gas Infrastructure

No likely significant effects on oil and gas infrastructure are identified as a result of the proposed survey works.

8.6.2 Defence and National Security

No likely significant effects on defence and national security are identified as a result of the proposed survey works.

8.7 Seascape

No likely significant effects on defence and national security are identified as a result of the proposed survey works.

8.8 Other Projects in the Area

A number of early concept offshore wind farm areas are located close to the proposed Oriel survey area. None of these have received consent and their progression through the development process will be subject to the implementation of the Marine Area Planning Bill once enacted. The timing of any potential works for these is uncertain and is highly likely to be outside of the proposed Oriel survey schedule. All of these areas and related cable corridor areas of search have been, or are being, subject to foreshore licence applications for investigative works of a similar nature to that proposed for this application.

There is the potential for works associated with site investigations at Cooley Point, Braymore Point, Clogher Head and the North Irish Sea Array to take place within the schedule of works for this application, for example, as the licences granted provide a five year period within which to complete the works. In view of the similarity of the nature of the works between these applications, and the potential for in-combination effects, particular in relation to underwater noise, Oriel will maintain awareness of the scheduling associated with these other licences, and engage with the licence holders, as required, to ensure that in-combination effects will not be generated.

Shipping activity in the area is dominated by fishing, particularly in the offshore area, with vessels in transit to or actively fishing the West Irish Sea Mudbelt, which is primarily targeted for Nephrops. Cargo vessels in transit to Dundalk, Warrenpoint and Drogheda are also present in the area, with lower densities of recreational, passenger and other vessels. In view of the level of existing shipping in the area, the temporary presence of the survey vessels will not result in likely significant effects.

8.9 Conclusion of Non-statutory Environmental Appraisal

The nature, scale and location of the proposed survey is such that there is no real likelihood of significant effects on the environment arising from the proposed project.

9 Environmental Impact Assessment Screening

9.1 Environmental Impact Assessment Directive Requirements

Article 4 of Environmental Impact Assessment (EIA) Directive (Council Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment, as amended by Directive 2014/52/EU), imposes the requirement for an EIA for the projects, to which the Article applies. These projects are listed in Annex I and II of the Directive. For Annex I projects, an EIA is mandatory. Member States must determine if an EIA is mandatory for Annex II projects. Member States must make the determination through (a) a case-by-case assessment or (b) thresholds or criteria set by the member state.

The Foreshore Acts, nos. 12 of 1933, 17 of 1992, 54 of 1998 and 11 of 2011 ("Foreshore Acts"), transpose this requirement into Irish law. The Foreshore Acts section 13A, as inserted by the European Union Foreshore Regulations 2009, SI 404 of 2009 is as follows:

"13A.— *(1)(a) The appropriate Minister will, as part of his consideration of a relevant application, in accordance with paragraph (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.*

(b) (i) An environmental impact assessment will be carried out by the appropriate Minister in respect of a relevant application for consent where the proposed project will be of a class specified in—

(I) Part 1 of Schedule 5 of the Planning and Development Regulations 2001,
and either—

(A) such development will 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 will 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.

(ii) An environmental impact assessment will be carried out by the appropriate Minister in respect of a proposed project where such development—

(I) will be of a class specified in Part 2 of Schedule 5 of the Planning and Development Regulations 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 project will be likely to have significant effects on the environment."

The projects, for which an EIA is mandatory, are listed in Part 1 of Schedule 5 of the Planning and Development Regulations, SI 600 of 2001, as amended. Annex II projects are addressed in Part 2 of Schedule 5. For most project classes, a threshold is specified. There are a number of classes which require a case-by-case assessment. An EIA is also required for projects, which do not exceed the threshold, but where the Minister determines that the proposed project will be likely to have significant effects on the environment.

9.2 Approach to EIA Screening

The Office of the Planning Regulator issued a practice note on *Environmental Impact Assessment (EIA) screening for development proposals* (Office of the Planning Regulator, 2021). While the Practice Note is written to provide guidance for compliance with the planning legislation, it provides useful guidance for EIA screening for other consent legislation.

The Practice Note advocates a step-by-step approach. The first step considers:

- Is the proposed project a project as per the EIA Directive? If not, then the proposed project does not require an EIA.
- Is the project listed in Part 1 of Schedule 5 or does it meet or exceed a threshold in part 2 of Schedule 5 of the Planning and Development Regulations, SI 600 of 2001, as amended? If it does, an EIA is mandatory.
- Is the project sub threshold? If it is, preliminary examination is required.

Step 2 is a preliminary examination of the nature, size, and location of the development, including proximity to ecologically sensitive sites, and the potential to affect other environmental sensitivities in the area. Step 2 will have one of three outcomes:

- There is no real likelihood of a significant effect on the environment and an EIA is not required. The reasons and conclusions will be recorded.
- There is significant doubt as to the effects on the environment and a formal screening determination is required.
- There is a real likelihood of a significant effect on the environment and an EIA is required.

Step 3 is a formal screening determination.

9.3 Screening for Mandatory EIA

Part 1 of Schedule 5

The proposed project is not a project type or class listed in Part 1 of Schedule 5 on the Regulations.

Part 2 of Schedule 5

One class listed in Part 2 of Schedule 5 on the Regulations was considered.

"Class 2 Extractive Industry

2 (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 will be carried out—

(IV) it is decided, in accordance with section 13A of the Foreshore Act 1933 (No. 12 of 1933) (in this subparagraph referred to as the "Act of 1933"), by the appropriate Minister (within the meaning of the Act of 1933) that the drilling concerned will not have a significant effect on the environment,"

The proposed project includes a geotechnical investigation, comprising the drilling of a total of 27 no. deep investigation locations at proposed structure locations. Each deep investigation location will require up to three drilled boreholes, each with a target depth of 50 m below the seabed. The proposed project also includes 41 no. shallow investigation locations along proposed inter-array and export cable routes. Each location will require one vibrocore or gravity core with a target depth of 3 m below the seabed.

The purpose of the drilling of the boreholes and core holes is to investigate the stability of the soil at the potential turbine foundation locations and on the export cable route.

As deep drilling for investigating the stability of the soil is excluded from Class 2(e),, the project is not of a class listed in Part 2 of Schedule 5 of the Regulations. An EIA is not required.

9.4 Conclusion of the EIA Screening

The conclusion of the EIA screening is that the project is not of a class listed in Part 1 or Part 2 of Schedule 5 of the Planning and Development Regulations, SI 600 of 2001, as amended. It is Arup's view that an EIA is not required. The determination as to whether a EIA is required will be made by the Department of Housing, Local Government and Heritage.

10 References

ADCO (2007) Archaeological Assessment for Oriel Offshore Windfarm Development North-Western Irish Sea, Appendix VII, Archaeological Assessment within Oriel Windfarm Ltd, Offshore Wind Farm, Environmental Impact Statement, Appendices, Volume 3 of 3, Available at: *https://www.housing.gov.ie/planning/foreshore/applications/oriel-windfarm-ltd* [Accessed 15 August 2021]

ADCO (2021) Underwater Archaeological Impact Assessment Oriel Wind Farm, Dundalk Bay off Dunany, Co. Louth Offshore Wind Farm Area and Cable Routes

Department of Arts, Heritage and the Gaeltacht *Guidance to Manage the Risk to Marine Mammals from Man-made Sound Sources in Irish Waters* (2014)

Department of Communications, Climate Action and Environment *Guidance on EIS and NIS Preparation for Offshore Renewable Energy Projects* (2017)

Department of Housing, Planning, Community and Local Government (2018) *Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment (August 2018)*

Environmental Protection Agency *Revised Guidelines on the Information to be contained in Environmental Impact Statements* (Draft August 2017)

European Commission *Directive 2014/52/EU of the European Parliament and of the Council of 16 April 2014 amending Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment (2014)*

Invasive Species Ireland (2019), Species Accounts. Available: http://invasivespeciesireland.com/species-accounts Accessed: 12/11/2021

Office of the Planning Regulator issued a practice note on *Environmental Impact Assessment (EIA) screening for development proposals* (Office of the Planning Regulator, 2021).

Planning and Development Regulations SI 600 of 2001, as amended by *S.I. 404 of 2018 European Union (Planning and Development) (Environmental Impact Assessment) (no 2) Regulations of 2018*

BIM (2020) BIM. Aavailable at: https://bim.ie/fisheries/ (Accessed 14 August 2021)

EPA (2020) EPA. Available at: https://www.epa.ie/our-services/monitoring--assessment/climate-change/ghg/latest-emissions-data/ (Accessed 15 August 2021)

RPS (2019) SEA Environmental Report for the National Marine Planning Framework

Department for Communications, Energy and Natural Resources (2014) Offshore Renewable Energy Development Plan.

DTI (2005) Guidance on the Assessment of the Impact of Offshore Wind Farms. Seascape and Visual Impact Report.

11 Glossary

µPa- micro pascals a unit of energy.

AEZ -Archaeological Exclusion Zones

AIS- Automatic Identification System

API- Application Programmaing Interface. Provides a way for developers to programmatically interact with ocean-related data and software.

Bsb- below the seabed

BWEA- British Wind Energy Association

CD- chart datum

CH_4- methane

CIL- Commissioner of Irish Lights

CO_2- carbon dioxide

COLREGS- Convention on the International Regulations for Preventing Collisions at Sea, 1972

CPOD device for static acoustic monitoring of cetaceans

dB- decibels DGPS- Differential Global Positioning System (DGPS). An enhancement to the Global Positioning System (GPS) which provides improved location accuracy

DO- Dissolved Oxygen

DP- Dynamic Positioning

EC- Electrical Conductivity

ECA- Emission Control Areas

EEZ- Exclusive Economic Zone

EIA- Environmental Impact Assessment

EIAR- Environmental Impact Assessment Report

EPA- Environmental Protection Agency

ER- Environmental Report

FLO- Fisheries Liaison Officer

GHG- Greenhouse Gas

GPS- Global Positioning System- a satellite-based radionavigation system

HF- High Frequency

HMCG- Her Majesty's Coast Guard

HWM- highwater mark

IMO- International Maritime Organisation

IMSRR- Irish Maritime Search and Rescue Region

IRCG- Irish Coast Guard

ISO International Organisation for Standardisation

kHz- kilohertz

LiDAR- Light Detection and Ranging. A remote sensing method that uses light in the form of a pulsed laser to measure ranges (variable distances) to the Earth.

MARPOL- International Convention for the Prevention of Pollution from Ships

MBES- Multibeam Echosounder

MODU- Mobile Offshore Drilling Units

Mt- million tonnes

Ms- Milli seconds

NAVAREAs- are the maritime geographic areas in which various governments are responsible for navigation and weather warnings.

NAVTEX- NAVigational TEleX

NIS- Natura Impact Statement

NM- Nautical Miles

NMS- National Monuments Service

NOx- Nitrogen Oxides

NPWS- National Parks and Wildlife Services

NRA-Navigational Risk Assessment

PCPT-piezocone penetration testing

PEXA- Practice and Exercise Area

pH- potential of hydrogen. A measure of how acidic/basic water is

PM- Particulate Matter

PVC liner- Polyvinyl Chloride liner.

RHIB- Rigid-hull inflatable boat

RoI- Republic of Ireland

ROV- Remotely Operated Vehicle

SAR- Search and Rescue

SATCOM- satellite communications

SBP- Sub-Bottom Profiling

SCPT-Seismiccone Penetration Testing

SFPA- Sea Fisheries Protection Authority

Sox- Sulphur Oxides

SRR- Search and Rescue Region

SSS- Side Scan Sonar

TVF- Time Varying Filters

UAU- Underwater Archaeology Unit

UHRS- Ultra-High-Resolution Multi-Channel Seismic

USBL- ultra-short baseline (position monitoring equipment)

VHF- Very High Frequency

VOC- Volatile Organic Compounds

WFD Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy (Water Framework Directive)

WFD- Water Framework Directive

WIID- Wreck Inventory of Ireland Database