ABWP Phase I Decommissioning

Navigational Risk Assessment

Volume 3, Appendix 7.1



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Author	Qualifications	Relevant Experience
		offshore wind projects, providing technical assurance.

Glossary

Term	Meaning
Arklow Bank Wind Park (ABWP) Phase I	Arklow Bank Wind Park (ABWP) Phase I comprises: • Offshore infrastructure seaward of High Water Mark (HWM), including: – Seven Wind Turbine Generators (WTG) with a combined capacity of 25.2 MW; – One meteorological (met) mast; – Inter-array cables connecting the WTGs and met mast; and – One offshore export cable connecting WTG T4 with landfall at HWM; • Onshore infrastructure landward of HWM including: – One onshore cable connecting landfall at HWM with the onshore substation; and – One onshore substation compound, where the onshore substation and ancillary infrastructure are located.
ABWP Phase II	ABWP Phase II comprises: • Offshore Infrastructure, including: – 53 or 47 WTGs and two Offshore Substation Platforms (OSPs) located within the "Array Area"; – Inter-array cables connecting WTGs with the OSPs; and – Two offshore export cables; • Onshore grid connection infrastructure, including a 220 kV substation at Shelton Abbey with an associated connection to the existing National Electricity Transmission Network; • Operations and Maintenance Facility (OMF) at South Dock, Arklow Harbour; and • EirGrid Upgrade Works.
Arklow Energy	Arklow Energy Limited, the entity seeking planning permission for the Proposed Works, i.e. the applicant.
Automatic Identification System (AIS)	A system by which vessels automatically broadcast their identity and key statistics including location, destination, length, speed and current status. Most commercial vessels and European Union fishing vessels over 15 metres (m) in length are required to carry AIS.
Baseline	A description of the relevant aspects of the current state of the environment (baseline scenario) (EIA Directive 2014/52/EU).
Bathymetry	Ocean's depth relative to sea level.
Commercial Fishing	Any form of fishing activity legally undertaken where the catch is sold for taxable profit.
Competent authority	Are those authorities that are entitled to give authorisation or consent to a plan or project. In the planning system, this means planning authorities and An Coimisiún Pleanála. There are, however, a wide range of other competent authorities in respect of other consent regimes e.g. EPA (environmental licencing), Minister for Agriculture, Food and the Marine (forestry, aquaculture and foreshore management), and various state bodies that have authority to undertake development under Part 9 of the Planning and Development Regulations (e.g. An Garda Síochána, defence forces, the courts service). The competent authority for this planning application is An Coimisiún Pleanála (ACP).
Consent	This shall include any licence, permission, permit, approval or other such authorisation granted by a public authority for any activity, or project where the authority is obliged to have regard to the requirements of the Environmental Impact Assessment (EIA) and/or Habitats Directive(s) (MDB, 2017).

Term	Meaning
Cumulative effect	The addition of many minor or insignificant effects, including effects of other projects, to create larger, more significant effects (EPA, 2022). Cumulative effects within this EIAR comprise those arising from the Proposed Works with other developments, i.e. plans and projects that are 'reasonably foreseeable' (Planning Inspectorate (PINS), 2024).
Decommissioning	The final closing down and putting into a state of safety of a development, project or process when it has come to the end of its useful life (EPA, 2022).
Draught	Vertical distance between the waterline and the lowest point of a vessel's hull (usually the keel). It essentially measures how deep a vessel sits in the water.
Dredged material	Seabed material arising from localised dredging potentially required to facilitate safe vessel access during Proposed Works Offshore, and / or extraction of seabed material located inside monopile (MP) foundations, as part of MP decommissioning.
Dumping	Any deliberate disposal in the maritime area (including side-cast dredging, plough dredging, water injection dredging and other such dredging techniques of a substance or material from or in conjunction with a vessel or aircraft or offshore installation (Dumping at Sea Act 1996 (as amended)).
Effect (for EIAR chapters and offshore-related appendices)	The consequence of an impact on a receptor. For example, in the offshore environment, vessel activity (activity) results in increased levels of underwater noise (impact), with the potential to disturb marine mammals (effect).
EIA Scoping	The scoping stage provides an opportunity for both developers and the Competent Authority to determine those key environmental impacts and issues of concern that are likely to be of the utmost importance to the Project proposal's decision-making and eliminates those that are less of a concern (European Commission (EC,) 2017).
EIA Scoping Presentation	Presentation scoping the likely environmental impacts of the Proposed Works to be further considered in the Environmental Impact Assessment Report (EIAR). The EIA Scoping Presentation is included in **Volume 3, Appendix 1.1** of the EIAR.
Environmental Impact Assessment (EIA)	Process of assessment of the effects of a project or development proposal on the environment. In the planning area, it is undertaken by a planning authority or An Coimisiún Pleanála during the consideration of applications for planning permission, taking account of an Environmental Impact Assessment Report (EIAR). The projects which require EIA are listed in Annex I and Annex II of the EIA Directive, as amended (Office of the Planning Regulator, n.d.).
Environmental Impact Assessment Report (EIAR)	A report or statement of the effects, if any, that Proposed Works, if carried out, would have on the environment. It is prepared by the developer to inform the EIA process (Office of the Planning Regulator, n.d.).
Exclusive Economic Zone (EEZ)	Area beyond and adjacent to the territorial sea, subject to the specific legal regime established in this Part (UNCLOS, 1982). The EEZ in Ireland extends up to 200 nautical miles (nm) from the outer edge of the territorial sea.
Fleet	A physical group of vessels sharing similar characteristics (e.g. nationality).
Foreshore	The bed and shore, below the line of high water of ordinary or medium tides, of the sea and of every tidal river and tidal estuary and of every channel, creek, and bay of the sea or of any such river or estuary. Its outer limit is coterminous with the seaward limit of the territorial sea (Foreshore Act 1933 (as amended)), which is at a distance of 12 nm from the nearest point of the baseline or otherwise prescribed (Maritime Jurisdiction Act 2021 (as amended)).
High Water Mark (HWM)	Level reached by the sea at high tide, measured as the mean of high tides.
Impact	A change brought about by the Proposed Works.
Inter-array cables	Subsea power lines that link individual wind turbine generators (WTGs) together in an offshore wind farm, forming an electrical network. In ABWP Phase I, inter-array cables connect WTGs and the met mast to each other and have an overall length of 7.4 km.
Landfall	The point where the offshore export cable transitions from the offshore marine environment to the onshore terrestrial environment.

Term	Meaning
Lowest Astronomical Tide (LAT)	Exact, lowest theoretical sea level that can be predicted to occur under average meteorological conditions.
Magnitude	A combination of the spatial extent, duration, frequency and reversibility of an impact.
Meteorological (Met) mast	A mast with a number of meteorological sensors located at different heights to record meteorological and sea condition data
Mitigation measures	Measures to avoid, prevent or reduce impacts (EPA, 2022), which comprise both embedded and additional mitigation, see separate definitions for these.
Monitoring	The periodic or continuous observation of biodiversity indicators and of other parameters that may affect biodiversity for any changes that may occur over time, so as to confirm predictions made with respect to likely effects and identify adverse changes that may require remedial action (Office of the Planning Regulator, n.d.).
Monopile (MP)	Hollow steel cylinder driven into the seabed typically used to anchor an offshore wind turbine generator (WTG). In ABWP Phase I, MPs support the seven WTGs as well as the meteorological (met) mast.
Nautical mile (nm)	Measurement used for distances at sea. 1 nm equates to 1.852 km.
Offshore export cable	Subsea power cable that transports the total generated power from an offshore wind farm to the onshore power grid. In ABWP Phase I, the offshore export cable connects the wind turbine generator (WTG) T4 to landfall with an approximate overall length of 15.6 km. At landfall, the offshore export cable transitions to the onshore cable connecting to the onshore substation.
Offshore Site	Part of the Site where Proposed Works Offshore are proposed to take place. In this application for planning permission, the Offshore Site comprises the Sub Lease Area, where the ABWP Phase I wind turbine generators (WTGs), met mast and inter-array cables are located, and the offshore export cable 10 m corridor connecting WTG T4 to the landfall at high water mark (HWM) near Arklow Harbour.
Onshore substation compound	Fenced compound that hosts the onshore substation building and ancillary facilities, including the 38 kV transformer.
Pathway	The route by which an effect is conveyed between a source and a receptor (EPA, 2022).
Planning permission	Formal, legal approval required from a local planning authority or An Coimisiún Pleanála (ACP) to carry out development. The Proposed Works require planning permission submitted from ACP under Section 291 of the Planning and Development Act 2000, as amended.
Proposed Works	The Proposed Works include decommissioning of ABWP Phase I offshore infrastructure (Proposed Works Offshore) and decommissioning of ABWP Phase I onshore infrastructure (Proposed Works Onshore).
Receptor	Any element in the environment which is subject to impacts (EPA, 2022).
Significance	The importance of the outcome of the impact (or the consequence of change) for the receiving environment (EPA, 2022).
NRA Study Area	Area covered in the characterisation of the baseline environment and considered in the assessment of potential environmental effects relevant to Navigational Risk Assessment, defined as 10 nautical mile (nm) buffer around ABWP Phase II array area (and less than 20 km from the Offshore Site), see **Section 3** and **Figure 1** in this document.
Sub Lease Area	Area where the ABWP Phase I WTGs, met mast and inter-array cables are located, as defined in the Sub Lease granted by Sure Partners Limited (SPL) to Arklow Energy Limited (Arklow Energy) to construct and operate ABWP Phase I.
Territorial sea	Belt of sea adjacent to a coastal State's land territory and internal waters, over which the State has sovereignty. A coastal State may claim up to 12 nautical miles from its baseline (usually the low-water line along the coast) (UNCLOS, 1982).
Transition Piece	The steel connection structure between the tower and the monopile (MP) foundation.

Term	Meaning
Wind Turbine Generator (WTG)	Structure that converts the kinetic energy of ocean winds into electrical energy. ABWP Phase I includes seven GE Energy 3.6s WTGs with a rated capacity of 3.6 megawatts (MW) per WTG.

Acronyms

Acronym	Meaning
ABWP	Arklow Bank Wind Park
AIS	Automatic Identification System
ALARP	As Low As Reasonably Practicable
AtoN	Aids to Navigation
BHD	Backhoe Dredger
CIL	Commissioners of Irish Lights
COLREGs	Convention on the International Regulations for Preventing Collisions at Sea, 1972
CSD	Cutter Suction Dredger
DaS	Dumping at Sea
DoT	Department of Transport
DP	Dynamic Positioning
EEZ	Exclusive Economic Zone
EIA	Environmental Impact Assessment
EIAR	Environmental Impact Assessment Report
FSA	Formal Safety Assessment
HAZID	Hazard Identification
HWM	High Water Mark
IALA	International Association of Marine Aids to Navigation (formerly the International Association of Lighthouse Authorities)
IMO	International Maritime Organization
IRCG	Irish Coast Guard
JUB	Jack Up Barge
LAT	Low Astronomical Tide
MBES	Multi-beam Echosounder
LMP	Lighting and Marking Plan
MCA	Maritime and Coastguard Agency
MGN	Marine Guidance Note
MP	Monopile
MSO	Marine Survey Office
nm	Nautical mile
NRA	Navigational Risk Assessment
NtM	Notice to Mariners
OMF	Operations and Maintenance Facility
OREI	Offshore Renewable Energy Installations
ORESS	Offshore Renewable Electricity Support Scheme
OSP	Offshore Substation Platform

Acronym	Meaning
RNLI	Royal National Lifeboat Institution
RoPax	Roll-on/Roll-off Passenger ferry
ROV	Remote Operating Vehicle
SAR	Search and Rescue
SBP	Sub-Bottom Profiler
SOP	Standard Operating Procedure
SOLAS	International Convention for the Safety of Life at Sea
SPL	Sure Partners Limited
SPRT	Soil Plug Removal Tool
SSS	Side Scan Sonar
TP	Transition Piece
TSS	Traffic Separation Scheme
UK	United Kingdom
USBL	Ultra-Short-Baseline
WTG	Wind Turbine Generators

Units

Unit	Meaning
m	Meter
nm	Nautical miles (1,852 m)

1 Introduction

1.1 Overview

1.1.1.1 Arklow Energy Limited (Arklow Energy) is seeking planning permission to decommission Arklow Bank Wind Park (ABWP) Phase I (referred to hereafter as 'the Proposed Works'). The Proposed Works include decommissioning of ABWP Phase I offshore infrastructure (Proposed Works Offshore) and decommissioning of ABWP Phase I onshore infrastructure (Proposed Works Onshore).

1.1.1.2 This Navigational Risk Assessment (NRA) aims to identify and analyse hazards to shipping associated with the Proposed Works Offshore and inform **Volume 2, Chapter 7: Shipping and Navigation** of the Environmental Impact Assessment Report (EIAR).

1.1.1.3 The Proposed Works Offshore will be undertaken within the Offshore Site (see **Volume 2, Chapter 3: Proposed Works Description**), which includes:

- The Sub Lease Area, located on the long narrow Arklow Bank sand bank, situated approximately 10 km off the coast of Arklow, south-east Ireland, where seven wind turbine generators (WTGs) and foundations, associated scour protection, 7.4 km of inter-array cables and one met mast are located; and
- A 10 m wide cable corridor along the 15.6 km offshore export cable route connecting WTG T4 to the landfall point at High Water Mark (HWM).

1.1.1.4 This NRA is in part based on the comprehensive NRA prepared in support of the planning application for the proposed ABWP Phase II (Anatec Limited, 2026) (see **Figure 1**, which also indicates the study area considered in the NRA, further described and justified in **Section 1.3)**, which includes the development of 47 or 53 offshore wind turbines in an area surrounding the Offshore Site.

1.1.1.5 This NRA is informed by:

- **Volume 2, Chapter 1: Introduction;**
- **Volume 2, Chapter 3;** and
- ABWP Phase II NRA (Anatec Limited, 2026).

1.1.1.6 The specific objective of this NRA is to document a risk assessment aligned with the new Irish guidance (Department of Transport (DoT), 2025a) covering the Proposed Works Offshore and any residual risks following these.

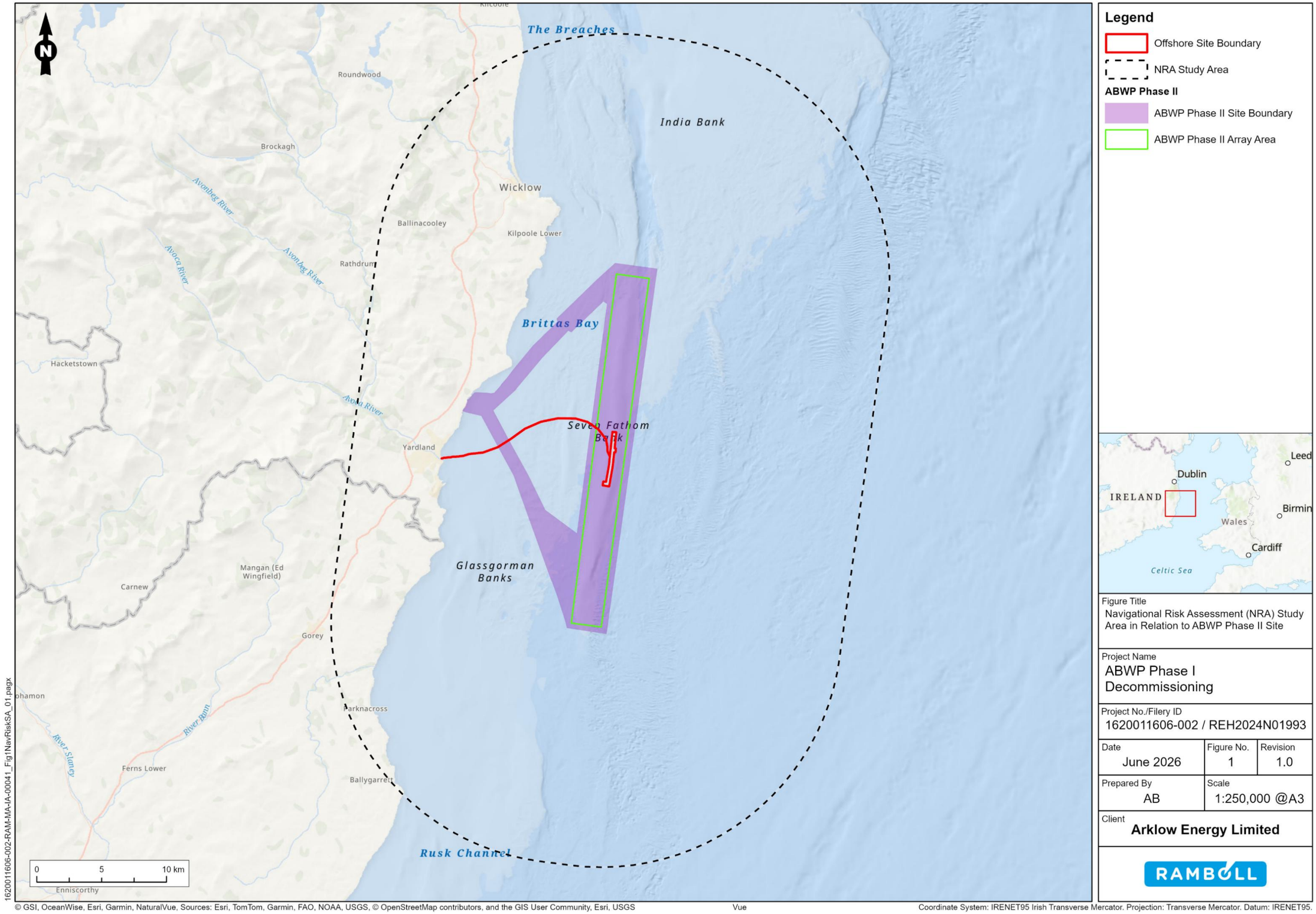


Figure 1: Proposed Works Offshore in relation to proposed ABWP Phase II and NRA Study Area

1.2 Consultation

1.2.1.1 The ABWP Phase I Decommissioning EIA scoping presentation (hereafter referred to as EIA Scoping Presentation) was issued to prescribed bodies in March 2026 (see **Volume 2, Appendix 1.1: EIA scoping presentation).**

1.2.1.2 Table sets out the key comments raised specific to the NRA for Proposed Works Offshore in response to this or during meetings with key stakeholders, with details of how these comments have been addressed.

Table 1.1: Summary of feedback relevant to the NRA

Comment	How and where considered in the NRA
Commissioners of Irish Lights (CIL), online meeting held on 11th March 2026	
No comments on the EIA Scoping Presentation. Please refer to the DoT for discussion and agreement on the proposed scope of the NRA and Shipping and Navigation EIAR Chapter.	Noted.
Irish Coast Guard (IRCG), online meeting held on 13th March 2026	
No comments on the EIA Scoping Presentation. Please refer to the DoT for discussion and agreement on the proposed scope of the NRA and Shipping and Navigation EIAR Chapter.	Noted.
Marine Survey Office (MSO), DoT, meeting held on 26th March 2026	
MSO strongly recommends following recent guidance issued by the DoT when preparing the NRA.	Noted. This has been considered in the preparation of **Volume 3, Appendix 7.1: Navigational Risk Assessment**.
MSO confirmed that baseline data collected as part of ABWP Phase II, which dates 2022 / 2023, is considered appropriate to inform the NRA / EIAR for Proposed Works Offshore, this should be properly justified.	Noted. **Section 1.3** of **Volume 3, Appendix 7.1: Navigational Risk Assessment** justifies the use of baseline information presented in ABWP Phase II NRA.
MSO confirmed that the NRA/ EIAR should focus on realistic worst-case scenarios as opposed to trying to model all potential scenarios.	Noted. **Volume 2, Chapter 7: Shipping and Navigation** of the EIAR and **Volume 3, Appendix 7.1: Navigational Risk Assessment** focus on realistic worst-case scenarios.

1.2.1.3 Consultation was also undertaken to inform the NRA for ABWP Phase II (Anatec Limited, 2026). Although the scale and nature of ABWP Phase II is different from Proposed Works Offshore, relevant stakeholder feedback has been considered in the preparation of this NRA:

- HAZID workshops formed the basis for the identification of navigation risks and input to the HAZID log;
- Analysis of ship traffic (automatic identification system (AIS) and other traffic) was used to understand sailing patterns and potential impacts;
- Input from search and rescue (SAR) and emergency services was included with a focus on emergency preparedness and response times;
- Historical maritime incidents were reviewed as part of the risk level assessment; and
- The assessment and validation of the final risk results.

1.3 Approach to the NRA

1.3.1.1 This NRA has been prepared in line with the DoT guidance on safety of navigation and emergency response for Offshore Renewable Energy Installations (OREI) (DoT, 2025a).

1.3.1.2 The IRCG, CIL and the MSO have been consulted with respect to the guidance that should be followed for shipping and navigation risk assessment within the NRA process. It was confirmed that since the publication of the first version of the NRA for ABWP Phase II (Anatec Limited, 2026), Irish guidance has since been published (DoT, 2025a) which follows Marine Guidance Note (MGN) 654 (Maritime and Coastguard Agency (MCA), 2021). This new guidance requires that "Offshore Renewable Electricity Support Scheme (ORESS) 1 projects shall rely on MGN

654", and although the Proposed Works do not fall within this category, due consideration has been given to the DoT guidance contents.

1.3.1.3 On this basis the primary guidance documents used to inform this NRA are as follows:

- DoT Guidance on Safety of Navigation & Emergency Response: Offshore Renewable Energy Installations (DoT, 2025a);
- SOP 07 2025 OREI Guidance and Operational Considerations for SAR and Emergency Response (DoT, 2025b);
- MGN 654 (Merchant and Fishing) Safety of Navigation: Offshore Renewable Energy Installations (OREIs) – Guidance on United Kingdom (UK) Navigational Practice, Safety and Emergency Response (MCA, 2021) including its annexes; and
- Revised Guidelines for Formal Safety Assessment (FSA) for Use in the Rule-Making Process (International Maritime Organization (IMO), 2018).

1.3.1.4 The MGN 654 approach is centred on risk management and requires that sufficient controls are, or will be, in place for the assessed risk to be judged as broadly acceptable, tolerable, or unacceptable.

1.3.1.5 However, it should be noted that the methodology in DoT (2025a):

- Is applicable to the construction of new OREIs, whereas this NRA focuses on the Proposed Works Offshore, i.e. decommissioning of an existing offshore wind farm (ABWP Phase I);
- Requires the assessment of the risk in a Baseline Scenario (before installation of OREIs), and assessment of the risk after installation, including after 10 and 20 years. The methodology prescribes a process adhering to the FSA (IMO, 2018) procedure covering the preparation of a hazards log and assessing the risk before and after installation of OREIs, including the effect of risk controls. In this NRA, the Baseline Scenario corresponds to the current operation of ABWP Phase I and additional scenarios are considered to represent Proposed Works Offshore and the post-decommissioning scenario; and
- Describes in "Annex I – Navigational Risk Assessment – Methodology" the methodology recommended to produce a NRA that is proportionate to the scale of the development and the magnitude of the risk.

1.3.1.6 As the DoT methodology is primarily designed for new offshore developments, it has been adapted proportionately to reflect the scope and risk profile of a decommissioning project. This includes focusing on relevant scenarios of the Proposed Works Offshore, considering temporary rather than permanent navigational impacts, and tailoring elements such as hazard identification, risk assessment scenarios (e.g. "with project" cases during decommissioning), and mitigation measures accordingly. Where certain sections typically expected in a full NRA (e.g. rerouting assessments or long-term operational impacts) are not included, this is on the basis that they are not applicable to the decommissioning context, particularly where existing navigation patterns already avoid the area (e.g. due to the presence of the Arklow Bank sand bank) or where impacts are short-term and managed through standard controls such as marking, lighting, and adherence to established maritime procedures.

1.3.1.7 In contrast with the installation of new OREIs, the baseline conditions relevant to decommissioning of existing OREIs are characterised by existing ship traffic routes and implemented navigational clearances, and decommissioning works primarily occur close to existing wind turbine generators (WTGs). Moreover, decommissioning results in removal of obstacles and not construction of new obstacles.

1.3.1.8 The risk assessment approach adopted in this NRA is therefore adapted to the scale of the Proposed Works Offshore, and in part builds on the comprehensive NRA prepared for ABWP Phase II (Anatec Limited, 2026) with respect to:

- Analysis of the ship traffic in the area around the Offshore Site;
- Emergency response and search and rescue of relevance to the Offshore Site; and
- Ship traffic routes and Baseline Scenario frequencies of relevance to the Offshore Site.

1.3.1.9 The use of the NRA prepared for ABWP Phase II (Anatec Limited, 2026) as the primary baseline source is considered appropriate in both spatial and temporal terms. The Proposed Works Offshore relate to the decommissioning and removal of existing turbines rather than the introduction of new infrastructure. The turbines are already located on a shallow bank where vessel traffic is limited due to navigational constraints and charted features, and therefore the baseline conditions captured in the NRA prepared for ABWP Phase II remain representative of current operations and the same study area has been used (see **Figure 1**).

1.3.1.10 In terms of temporal validity, Irish guidance recommends that NRAs are informed by vessel traffic data not older than 24 months and recognises that AIS data alone may not fully capture all vessel types, particularly smaller craft such as fishing and recreational vessels. While the acquisition of updated AIS data could supplement ABWP Phase II traffic analysis for larger vessels, this would not address these limitations. The NRA prepared for ABWP Phase II includes multiple survey periods with manual vessel observations across different seasons, providing a comprehensive representation of total vessel activity, including non-AIS traffic.

1.3.1.11 The MSO has confirmed that the baseline data collected as part of ABWP Phase II (Anatec Limited, 2026) is considered appropriate to inform this NRA and EIAR for the Proposed Works Offshore. On this basis, the NRA prepared for ABWP Phase II (Anatec Limited, 2026) is considered a robust and proportionate baseline for this assessment.

1.3.1.12 The methodological framework applied in the assessment of allisions between third-party vessel traffic and ABWP Phase I residual monopiles (MPs) (those retained below the seabed *in situ* post-decommissioning) and collision between vessels is described in more detail in **Section 6**, and is based on:

- Identification of worst-case hazards;
- Description of hazard scenarios related to the Proposed Works Offshore and post-decommissioning scenario;
- Estimation of collision frequencies for the scenarios; and
- Risk assessment and documentation.

1.3.1.13 In relation to the assessment of potential cumulative effects, the DoT guidance (2025a) requires the consideration of cumulative risks associated with other OREI developments in the strategic OREI area. **Volume 3, Appendix 1.2: Cumulative Screening** identifies OREI and non-OREI developments to be further considered in **Volume 2, Chapter 7: Shipping and Navigation** of the EIAR, using 25 nm (< 50 km) as a search area, which is considered adequate taking into account the geographical position of the Offshore Site and navigational features of the surrounding area within the Irish Sea. However, given that rerouting assessment is not considered applicable to the decommissioning context of Proposed Works Offshore, the consideration of potential cumulative effects in this NRA is limited to the consideration of a potential spatial and temporal overlap associated with the proposed ABWP Phase II. Accordingly, and given that ABWP Phase II surrounds the Offshore Site, it has been considered in detail as part of two of the scenarios covered in this NRA, i.e. potential for Proposed Works Offshore to temporarily overlap with ABWP Phase II construction, and implications of an operational ABWP Phase II on a post-decommissioning scenario.

1.3.1.14 **Volume 2, Chapter 7** further presents a qualitative assessment of potential cumulative effects with other relevant cumulative developments.

2 Description of the Proposed Works Offshore and How these Change the Marine Environment

2.1 Overview of Proposed Works Offshore

2.1.1.1 A summary of Proposed Works offshore and vessels / plant anticipated is presented in **Table 2.1**, additional information can be found in **Volume 2, Chapter 3**.

Table 2.1: Summary of Proposed Works Offshore

Activities	Anticipated approach / methods	Anticipated vessels required
Pre-decommissioning surveys	Geophysical / Remote Operating Vehicle (ROV) / diver surveys undertaken to confirm bathymetric conditions, identify any obstructions and hazards, and update the decommissioning methodology and programme.	Survey vessel equipped with: • Multi-beam Echosounder (MBES) • Side Scan Sonar (SSS) • Sub-Bottom Profilers (SBP) • Magnetometer • ROV • Dynamic Positioning (DP) • Ultra-Short-Baseline (USBL) acoustic positioning systems
Dredging (to facilitate safe vessel access, if required)	Subject to vessel requirements and bathymetric conditions found at the time of decommissioning: • Pre-dredging bathymetric surveys to confirm bathymetry conditions and refine dredging / disposal areas (if any required), volume estimates and methodologies (to be kept within limits / requirements of Dumping at Sea (DaS) permit; • Dredging within Sub Lease Area using: – a Cutter Suction Dredger (CSD), with disposal via pipeline / sidecasting within the Sub Lease Area; – a backhoe dredger (BHD), with disposal via sidecasting within the Sub Lease Area; – plough dredging, if required to maintain required depth within vessel access channels created following dredging with the above methods.	• Survey vessel equipped with MBES; • CSD supported by a single small tugboat and a shallow draught small survey vessel (equipped with MBES); • BHD supported by a single small tugboat and a single split hopper barge, and a shallow draught survey vessel; and/or • Plough dredger supported by a small survey vessel, equipped with MBES.
Decommissioning of WTGs	Reversal of the installation process: • Preparation works, including inspection, removal / securing loose items, etc; • Position of Jack Up Barge (JUB) for pre-load and jack up to working height; • Completion of safety checks and preparation of the WTG for lifting; • Full de-energising of the WTG, routing power supply from JUB if required for dismantling; • Permanent removal of rotor and blades; • Disconnection of power and signal cables between the nacelle and tower before removing nacelle; and • Disconnection of power and signal cables between the tower and the TP/ lift system before removing the tower.	JUB supported by two tugboats and transport barge, with potential use of: • DP • USBL acoustic positioning systems
Decommissioning of met mast	Dismantled in two separate sections. The triangular platform will subsequently be dismantled using the similar plant and lifting equipment used during WTG decommissioning.	JUB supported by two tugboats and transport barge, with potential use of: • DP • USBL acoustic positioning systems

Activities	Anticipated approach / methods	Anticipated vessels required
Decommissioning of TPs	• Position of JUB for pre-load and jack up to working height. Position of transport barge next to JUB and of gangway next to the TP to provide safe access; • General inspection of the TP before preparation activities for safety purposes; • Removal / securing of loose items inside and outside of the TP; • Installation and non-destructive testing of new lifting points, if required; • Securing of TP to crane for lifting before executing the cuts; and • Lifting of cutting equipment, as well as TP, transferred to the JUB or transport barge.	JUB supported by two tugboats and transport barge, with potential use of: • DP • USBL acoustic positioning systems
Decommissioning of foundations	• Following removal of the TP, then the seabed material inside MPs is extracted using a soil plug removal tool (SPRT). The target dredging depth will be 3 m below the target cutting depth to ensure cutting equipment can be safely operated. • Dredged material will be released via pipeline within 100 m from MP locations at the same time as being dredged; • Use of jetting, vibratory or any other friction removal equipment around the MP, if required; • Installation of the internal cutting equipment inside the MP at the required cutting elevation; • Securing of the MP to crane for lifting before cutting the MP at the target cutting depth; • Holding and then lifting the MP whist activating the equipment intended to remove potential shaft friction; and • Transfer of cutting equipment and MP onto the JUB and transport barge respectively.	JUB supported by two tugboats and transport barge, with potential use of: • DP • USBL acoustic positioning systems
Scour protection removal	• Position of support vessel equipped with MBES and grab dredger next to the MP; • Guiding of the grab dredger to grab the individual sandbags identified and mapped during MBES, and to lift them from the seabed to a skip located in a supporting barge; and • Recovering of sandbags and release of material back into the seabed via side casting.	• Grab dredger • Small barge equipped with MBES and a skip to temporarily store the content of sandbags
Inter-array cable removal	• Position of the multicat vessel at the designated location near the WTG where the cable needs to be recovered; • Unburial of cable using a running method, pulled out using clamps and a cable puller, towed slowly across the seafloor; and • Cutting of cables underwater or on vessel deck with shears into manageable sections, deposited in containers.	• Multicat vessel of shallow draught equipped with a running method
Offshore export cable removal	• Position of the multicat vessel at the designated location near the WTG where the cable needs to be recovered; • Unburial of cable with a running method, pulled out using clamps and a cable puller; • The offshore export cable will be severed by grapple and shears vicinity of the landfall, left exposed on the seabed until this is pulled from land; and • Cables will be cut underwater or on vessel deck with shears into manageable sections, deposited in containers for subsequent transfer to port.	• Multicat vessel of shallow draught equipped with a running method

Activities	Anticipated approach / methods	Anticipated vessels required
Post-decommissioning survey	Geophysical survey undertaken to verify the resulting seabed condition within the Offshore Site.	Survey vessel equipped with: • MBES • SSS • SBP • Magnetometer • DP • USBL acoustic positioning systems

2.1.2 Assumptions on Vessel Movements

2.1.2.1 The following assumptions about movements associated with decommissioning vessels are described and have been used as background for the risk assessment:

- It is assumed that the main decommissioning vessels will be mobilised from a European port, assuming a transit duration of up to 15 days;
- ABWP Phase I decommissioned components will be taken to an available Irish port (Rosslare, Waterford, Dublin and Greenore are potential ports being considered at this stage);
- Movements of decommissioning vessels, including JUBs, to and from the Offshore Site are assumed to follow established shipping routes and comply with the Convention on the International Regulations for Preventing Collisions at Sea, 1972 (COLREGs) when interacting with other vessels. These movements are therefore considered part of the general ship traffic in the area and are expected to result in a temporary increase in traffic intensity during periods of Proposed Works Offshore;
- All Proposed Works Offshore (e.g. dredging, lifting operations, and similar activities) are assumed to take place within a clearly defined work area marked with yellow buoys around the Sub Lease Area, as described in the Outline Lighting and Marking Plan (LMP) (see **Volume 3, Appendix 3.7**). When not in transit, decommissioning vessels are assumed to remain stationary within this work area and are therefore considered as potential obstacles to passing third-party vessel traffic; and
- Decommissioning vessel activities outside the defined work area are assumed to be limited in duration and confined to specific Proposed Works Offshore activities, such as removal of the offshore export cable. Consequently, any associated increase in ship traffic and the resulting reduction in return periods for ship-ship collisions are considered temporary and not representative of long-term conditions.

2.1.3 Programme

2.1.3.1 Proposed Works Offshore will be undertaken when seabed level conditions are favourable for safe vessel access and to minimise the extent of dredging works required or avoid them all together, which may result in the Proposed Works Offshore being staged in different years.

2.1.3.2 **Volume 2, Chapter 3** sets out an indicative programme for the Proposed Works Offshore to be undertaken in one season i.e. without staging, distinguishing between two main campaigns:

- First campaign, focused on the decommissioning of WTGs and met mast, of approximately 10 weeks; and
- Second campaign, focused on the decommissioning of TPs/MPs, scour protection removal and inter-array and offshore export cable removal; as well as post-decommissioning surveys, of approximately 16 weeks.

3 Analysis of Marine Traffic

3.1.1.1 This section describes the marine traffic in the study area covered in the NRA prepared for ABWP Phase II (Anatec Limited, 2026), which includes a 10 nautical mile (nm) buffer around ABWP Phase II array area (and less than 20 km from the Offshore Site), illustrated in **Figure 1**, and has been used as the study area in this NRA, as it captures both nearshore and offshore vessel movements relevant to the Offshore Site.

3.1.1.2 The Phase II NRA study area is considered representative for the present assessment, as it encompasses both the Offshore Site (Sub Lease Area and offshore export cable corridor) and a wider surrounding marine area. Accordingly, the Phase II baseline conditions are adopted as they provide full spatial coverage of both the Offshore Site and its broader navigational context, ensuring that all potential spatial interactions are adequately covered.

3.1.1.3 Arklow Bank is an offshore sand bank located off the east coast of Ireland in the Irish Sea, approximately 3.2 to 8.3 nm (6-15 km) from the coastline. The sand bank extends parallel to the coast and lies offshore of the towns of Arklow and Wicklow, with Dublin Port representing the nearest major commercial hub in the wider region. The sand bank has navigational compass markings at each end to support navigation outside the region of shallow water at the sand bank (Anatec Limited, 2026).

3.1.1.4 The wider region is influenced by International Maritime Organization (IMO) routeing measures, notably Traffic Separation Schemes (TSS) located to the south (Off Tuskar Rock and Off Smalls) and northeast (Off Skerries), illustrated in **Figure 2**, which structure vessel movements between the Irish Sea, the English Channel, and the North Atlantic (Anatec Limited, 2026).

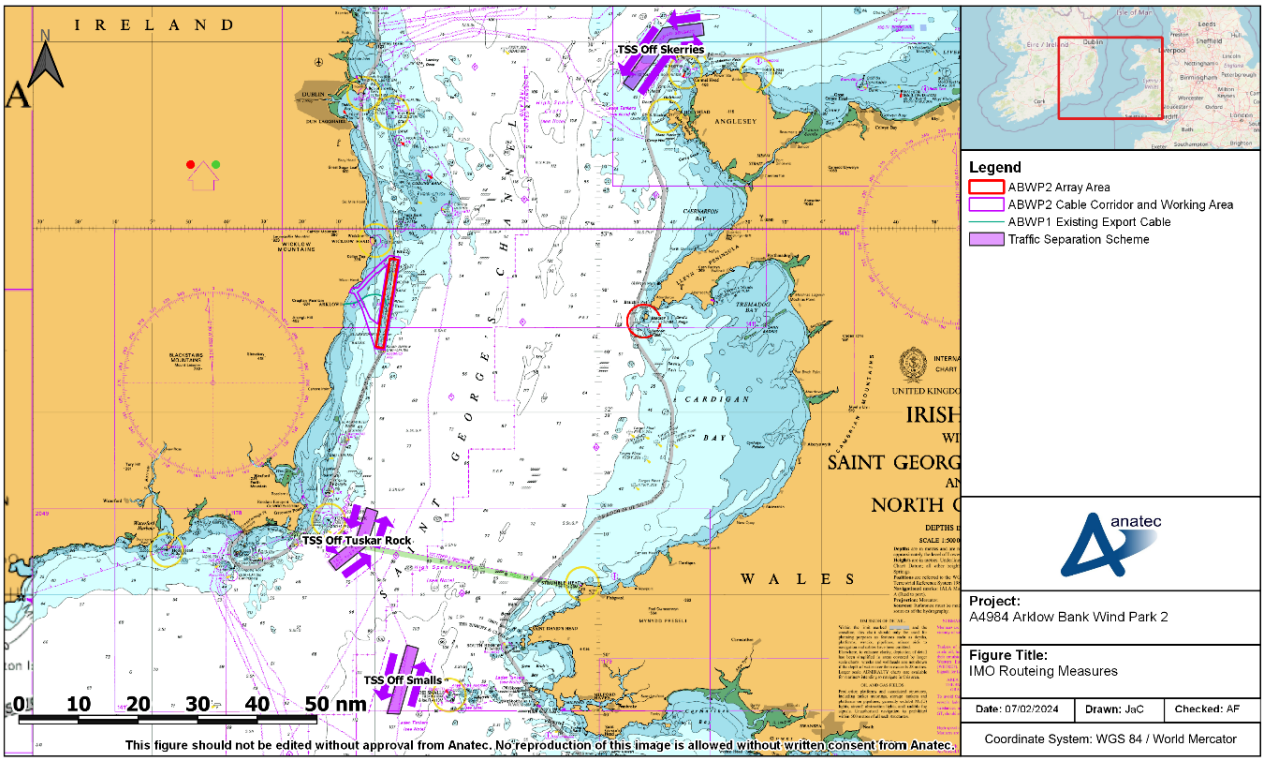


Figure 2: IMO Routeing Measures

Source: Anatec Limited, 2026

3.1.1.5 The vessel traffic environment around Arklow Bank is characterised by moderate activity levels with a clear spatial separation between offshore commercial traffic and inshore local traffic. Based on survey data, an average of approximately 36-37 vessels per day was recorded within the study area during summer periods, see **Figure 3** (Anatec Limited, 2026).

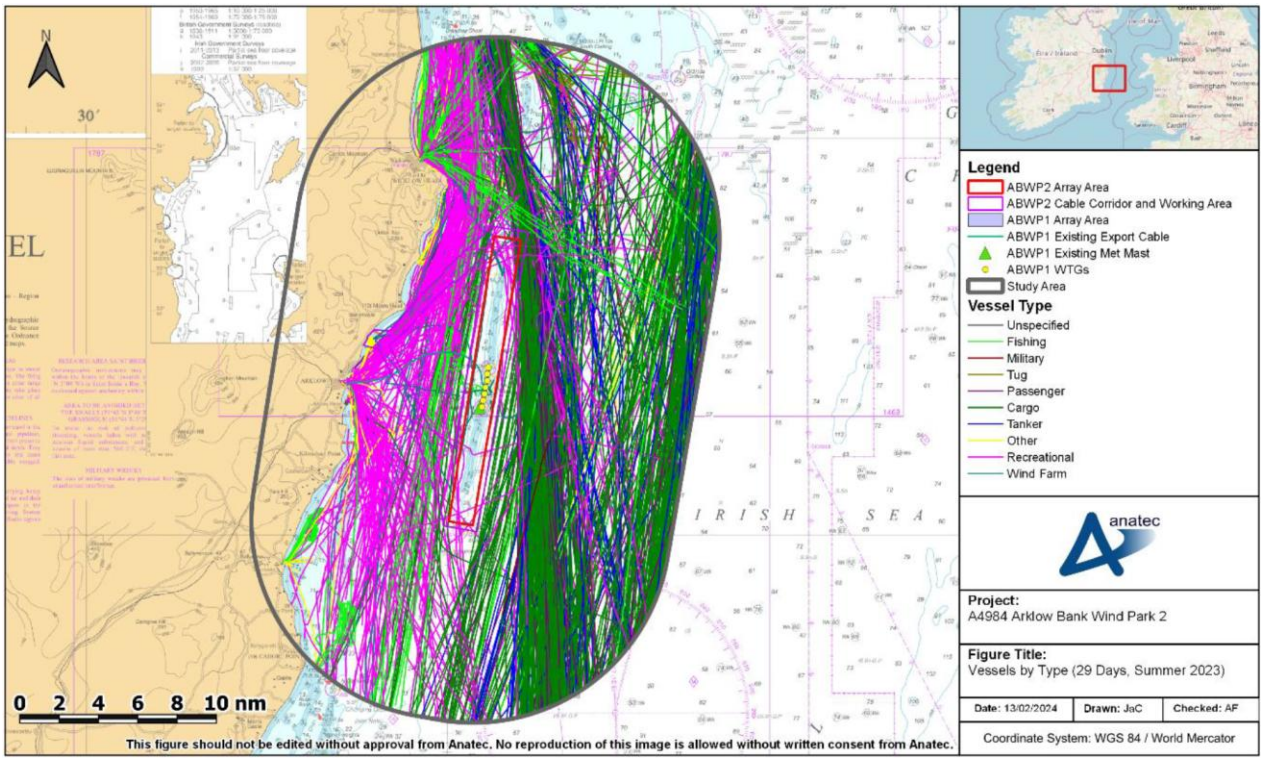


Figure 3: Vessel by Type (29 Days, Summer 2023)

Source: Anatec Limited, 2026

3.1.1.6 Automatic Identification System (AIS)-based vessel traffic analysis shows that the majority of commercial traffic is concentrated offshore of the ABWP Phase II Array Area, while fishing and recreational vessels are predominantly located inshore (Anatec Limited, 2026).

3.1.1.7 The composition of traffic is diverse. During the 2023 survey period, cargo vessels constituted the largest share (approximately 40%), followed by recreational vessels (31%), fishing vessels (10%), tankers (7%), and passenger vessels (5%). Other vessel categories, including tugs, military vessels, and offshore support vessels, were present in relatively small numbers (Anatec Limited, 2026).

3.1.1.8 The AIS analysis (Anatec Limited, 2026) confirms that different vessel types exhibit distinct spatial behaviours:

- Cargo vessels and tankers predominantly operate along offshore transit routes, maintaining safe distances from the shallow bank. Tankers, for example, follow southeast-northwest and north-south routes, often connecting Dublin with ports such as Pembroke;
- Passenger vessels, particularly RoPax ferries, follow regular offshore routes between Dublin and continental Europe, with very limited interaction with the ABWP Phase II Array Area;
- Fishing vessels are mainly active inshore or south of the ABWP Phase II Array Area, with limited activity offshore of the sand bank;
- Recreational vessels are concentrated in coastal waters, with activity peaking during summer months and during events such as the Round Ireland Yacht Race.

3.1.1.9 Importantly, vessel tracks demonstrate a consistent avoidance of the Arklow Bank sand bank itself, with minimal intersections through the ABWP Phase II Array Area. This behaviour is corroborated by long-term AIS data, which shows that traffic density is highest along routes offshore of the sand bank and in nearshore corridors, rather than across the sand bank (Anatec Limited, 2026), see **Figure 4**.

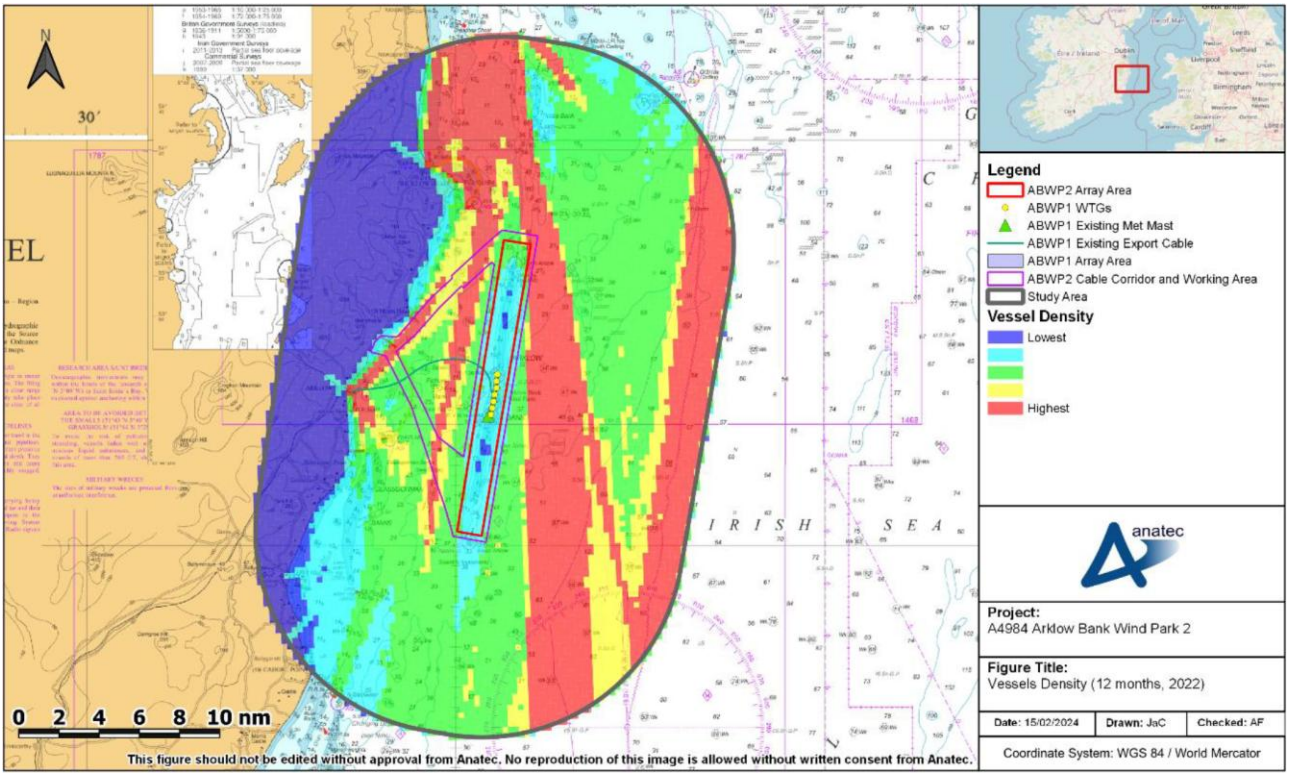


Figure 4: Vessel Density (12 months, 2022).

Source: Anatec Limited, 2026

3.1.1.10 High-density traffic corridors are primarily aligned along a northwest-southeast axis offshore of the Array Area and a north-south axis further east, representing key transit routes between Irish ports and international destinations (Anatec Limited, 2026).

3.1.1.11 A defining geographical feature of the area is Arklow Bank sand bank itself, a shallow sandbank that constitutes a natural navigational constraint. Due to grounding risk, vessels particularly commercial traffic generally avoid crossing the sand bank and instead route around it, even under favourable conditions (Anatec Limited, 2026). This results in relatively predictable traffic patterns, with a clear separation between offshore transit routes and inshore local traffic, and a general absence of significant crossing movements over the sand bank.

3.1.1.12 The broader navigational environment includes multiple interacting traffic streams, such as offshore commercial routes aligned with regional and international trade flows, coastal traffic associated with local ports, and seasonal recreational activity. Despite these interactions, the spatial separation of traffic types, combined with the natural constraint imposed by the sand bank, contributes to a structured and relatively low-complexity navigational environment within the ABWP Phase II Array Area.

3.1.1.13 Additionally, vessel routeing is influenced by external factors such as IMO routeing measures and port connectivity, which reinforce established traffic corridors and further reduce randomness in vessel movements (Anatec Limited, 2026).

3.1.1.14 It is noted that not all vessels are captured by AIS, particularly smaller fishing vessels and recreational craft. Radar and visual observations indicate that non-AIS traffic is relatively limited (approximately one vessel per day during survey periods), with the majority consisting of fishing and recreational vessels (Anatec Limited, 2026).

3.1.1.15 This limitation introduces some uncertainty in the baseline but is mitigated through combined AIS, radar, and visual survey methodologies.

3.1.1.16 A total of 12 main commercial routes have been identified within the study area based on long-term AIS data (Anatec Limited, 2026), illustrated in **Figure 5**. These routes reflect established transit corridors linking Irish ports such as Dublin, Drogheda, and Belfast with wider European destinations and TSS systems.

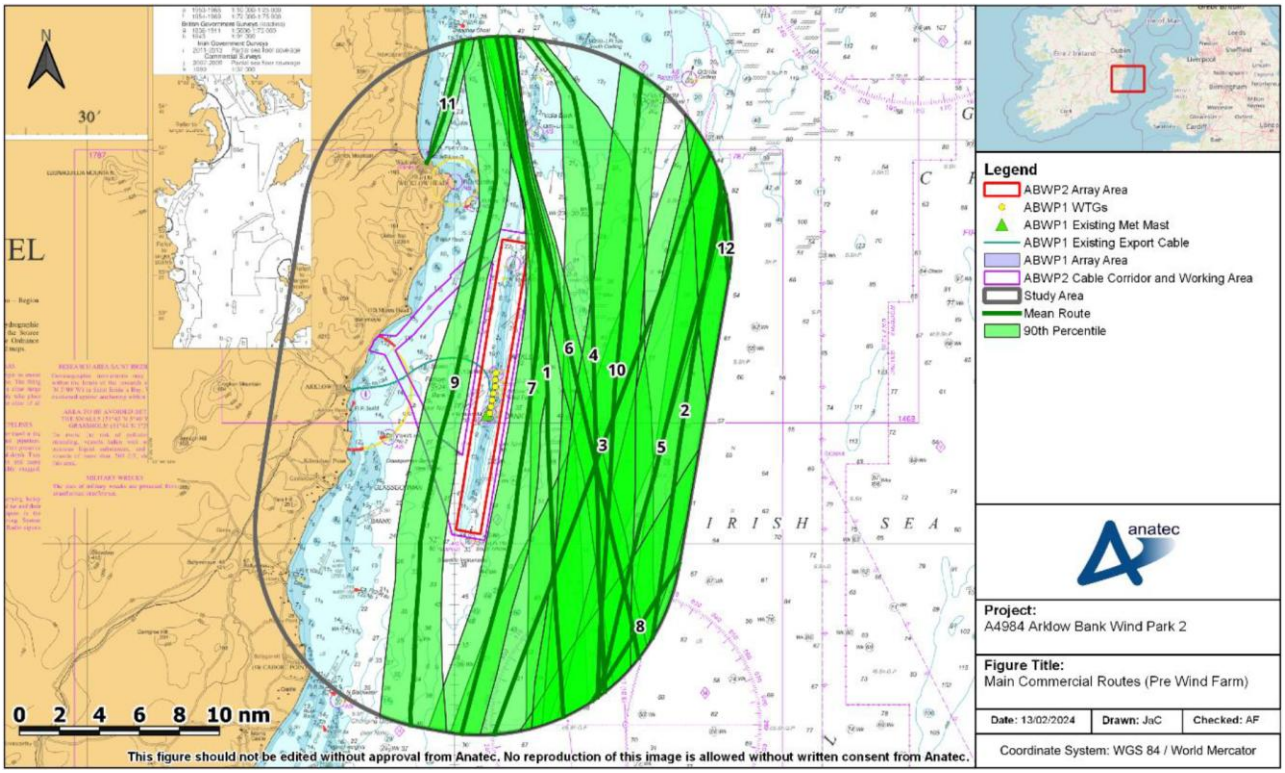


Figure 5: Main Commercial Routes

Source: Anatec Limited, 2026

3.1.1.17 The most significant route (Route 1) carries approximately 8-9 vessels per day and connects Dublin with the TSS Off Smalls, with traffic dominated by cargo vessels and RoPax ferries operating between Dublin and Cherbourg (Anatec Limited, 2026). Other routes show lower traffic densities but similar directional patterns, primarily oriented north-south or northwest-southeast. Across all routes, commercial vessels consistently remain offshore of the Arklow Bank sand bank, reflecting both safety considerations and established navigation practices.

3.1.1.18 Following the identification of the main commercial routes based on AIS analysis, a more detailed description of each route is provided in **Plate 1**, which outlines the characteristics of the 12 defined routes (as shown in **Figure 5**), including their directional alignment, typical vessel composition, and key origin-destination patterns.

Plate 1: Descriptions of Main Commercial Routes

Route Number	Average Vessels per Week	Average Vessels per Day	Description
1	58 – 59	8 – 9	**Dublin – TSS Off Smalls.** Mainly undertaken by cargo vessels (76%), followed by passenger vessels (14%) and tankers (9%). Approximately 94% of the passenger traffic is comprised of RoPax ferries, operated by Irish Ferries, undertaking regular routeing between Dublin and Cherbourg.
2	25 – 26	3 – 4	**Drogheda – TSS Off Smalls.** Mainly undertaken by cargo vessels (91%) followed by tankers (7%).
3	8 – 9	1	**Various – TSS Off Tuskar Rock.** Mainly undertaken by cargo vessels (79%) followed by tankers (10%).
4	8 – 9	1	**Dublin – TSS Off Smalls.** Mainly undertaken by cargo vessels (57%) followed by tankers (35%).
5	8	1	**Belfast – TSS Off Tuskar Rock.** Mainly undertaken by cargo vessels (85%) followed by tankers (11%).
6	6	1	**Dublin – Milford Haven.** Mainly undertaken by tankers (65%) followed by cargo vessels (31%).
7	5	< 1	**Dublin – TSS Off Tuskar Rock.** Mainly undertaken by cargo vessels (84%) followed by tankers (13%).
8	3 – 4	< 1	**Liverpool – Limerick.** Mainly undertaken by cargo vessels (64%) followed by tankers (21%).
9	3	< 1	**Dublin – TSS Off Tuskar Rock.** Mainly undertaken by cargo vessels (63%) followed by tankers (18%).
10	2	< 1	**Dublin – TSS Off Smalls.** Mainly undertaken by cargo vessels (79%) followed by tankers (14%).
11	2	< 1	**Wicklow – Various.** Mainly undertaken by cargo vessels (74%) and tugs (17%).
12	1 – 2	< 1	**Warrenpoint - Avonmouth.** Almost entirely undertaken by cargo vessels (98%).

Source: Anatec Limited, 2026

3.1.1.19 As shown in **Plate 1**, the primary routes are predominantly aligned along north-south and northwest-southeast axes, reflecting the broader structure of vessel movements within the Irish Sea. The most trafficked route connects Dublin Port with the TSS Off Smalls and is mainly used by cargo vessels and RoPax ferries operating between Ireland and continental Europe. Other routes serve regional connections between Irish ports and destinations in the UK and further afield, with generally lower traffic intensities.

3.1.1.20 The dataset includes a broad range of vessel sizes from large commercial vessels to small recreational craft. While detailed numerical distributions are presented in figures, the overall pattern indicates that larger vessels (cargo, tankers, ferries) operate at higher average speeds along defined routes. Smaller vessels (fishing and recreational) operate at lower speeds and exhibit more dispersed, localised movement patterns inshore.

3.1.1.21 To further characterise vessel behaviour within the study area, additional analyses of vessel draught and speed were undertaken in Anatec Limited, 2026. These parameters provide important insight into vessel size, operational patterns, and routing preferences, and help distinguish between offshore and nearshore traffic. The following sections present the spatial distribution of vessel draught and speed based on available AIS data.

3.1.1.22 One of the survey periods used in Phase II NRA comprises four discrete monitoring campaigns: 7-13 July 2023 (inclusive), 16-18 July 2023 (inclusive), 21 July-1 August 2023 (inclusive), and 8-14 August 2023 (inclusive). For the purposes of this study, these periods are collectively referred to as the "survey period".

3.1.1.23 **Figure 6** shows the vessels recorded within the study area during the survey period, colour-coded according to their draught. The information is based only on vessels transmitting a valid draught via AIS, representing approximately 54% of all recorded vessel tracks. Vessels without reported draught are excluded from the subsequent analysis, as these are primarily recreational and fishing vessels and are therefore assumed to have relatively shallow draughts.

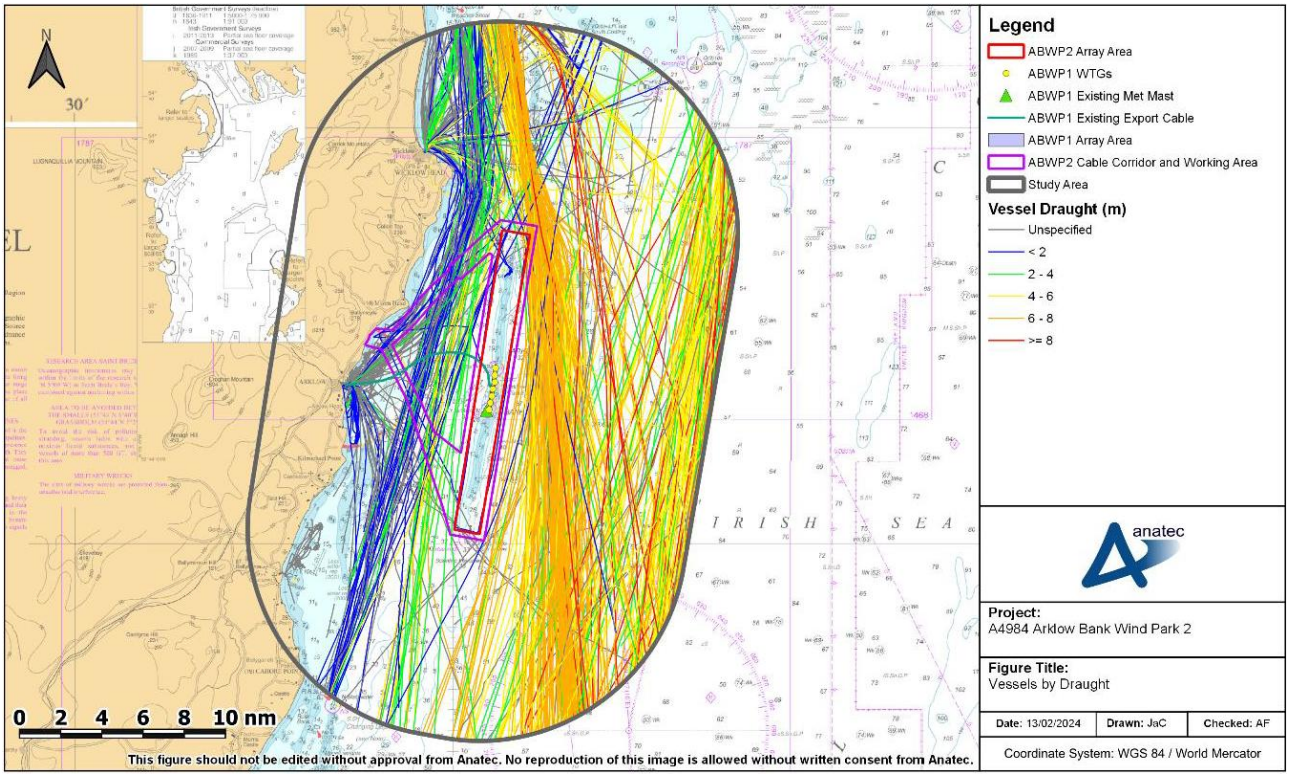


Figure 6: Vessel by Draught (29 Days, Summer 2023).

Source: Anatec Limited, 2026

3.1.1.24 **Figure 6** highlights a clear spatial pattern in vessel draught distribution across the area. Vessels with draughts greater than 6 m are predominantly observed to the east of the ABWP Phase II Array Area, indicating that deeper-draught vessels tend to follow offshore routes. In contrast, vessels located to the west of the ABWP Phase II Array Area generally have draughts less than 4 m, reflecting that shallower-draught vessels operate closer to shore. This distinction underlines a separation between larger, deeper-draught traffic offshore and smaller, shallow-draught traffic in nearshore waters.

3.1.1.25 **Figure 7** shows the vessels recorded within the study area during the survey period, colour-coded according to their speed. All vessel tracks are associated with a valid average speed.

3.1.1.26 **Figure 7** highlights a clear spatial pattern in vessel speeds across the area. Vessels with speeds greater than 9 knots are predominantly observed to the east of the ABWP phase II Array Area, indicating that higher-speed, typically commercial traffic mainly follows offshore routes. In contrast, vessels located to the west of the ABWP Phase II Array Area generally operate at speeds below 9 knots, reflecting slower-moving traffic closer to shore, often associated with fishing and recreational activities. This demonstrates a clear distinction between faster offshore traffic to the east and slower nearshore traffic to the west within the study area.

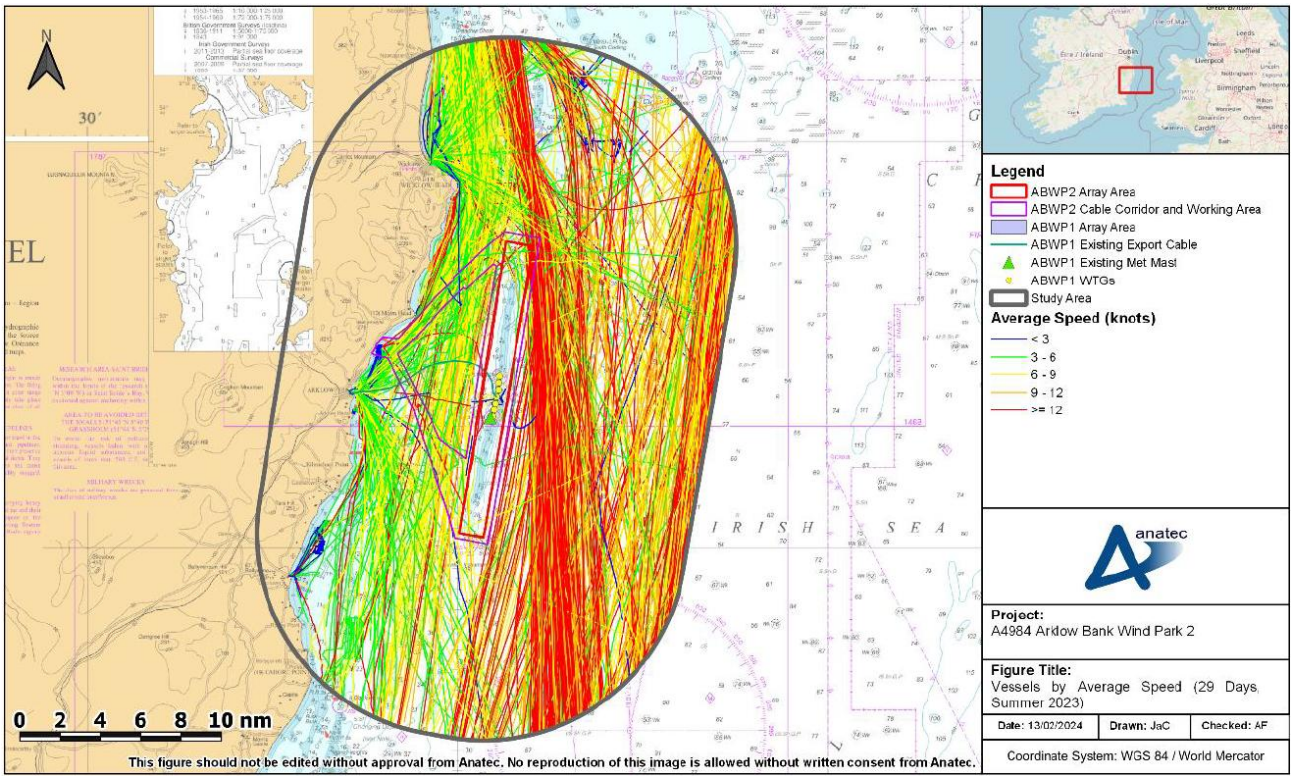


Figure 7: Vessels by Average Speed

Source: Anatec Limited, 2026

4 Emergency Response and Search and Rescue

4.1.1.1 This section describes the emergency response and search and rescue (SAR) arrangements in a larger area around the Offshore Site. The ABWP Phase II NRA (Anatec Limited, 2026) has been used as background for this section to give an overview of the capabilities available in the vicinity of the Offshore Site. It demonstrates that a well-established and layered emergency response system is in place, combining aerial, maritime, and auxiliary resources to ensure effective response to incidents in the area.

4.1.1.2 Search and rescue helicopter operations in Irish waters are coordinated by the Irish Coast Guard (IRCG), which is responsible for maritime SAR, counter-pollution, and ship casualty response. Under a contract awarded in 2023, these services are provided by Bristow Ireland Limited. The IRCG operates four helicopter bases located at Waterford, Sligo, Shannon, and Dublin Airport. Each base is equipped with a Sikorsky S-92 helicopter, with one additional aircraft rotated between bases. These helicopters have an operational airspeed of approximately 145 knots and an endurance exceeding four hours, allowing them to cover offshore locations efficiently. The spatial distribution of these helicopter bases, together with marine rescue coordination centres, is presented in **Figure 8**. The base at Dublin Airport is the closest to the Offshore Site, located approximately 33 nm to the northwest, and is therefore expected to provide the primary aerial response capability.

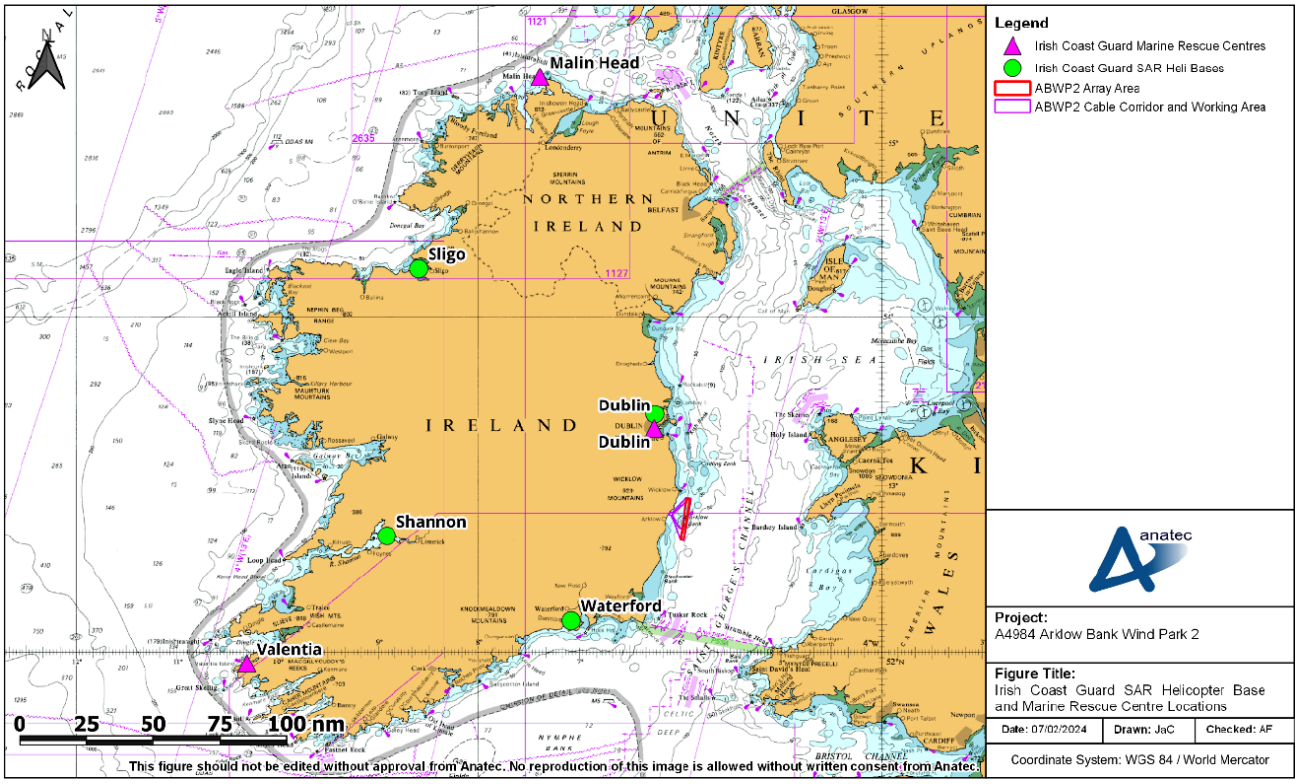


Figure 8: IRCG SAR helicopter base and marine rescue centre locations

Source: Anatec Limited, 2026

4.1.1.3 Marine-based SAR coordination is also managed by the IRCG through three Marine Rescue Coordination Centres located in Dublin, Malin Head, and Valentia Island, as shown in **Figure 8**. The Dublin centre, which functions as the National Maritime Operations Centre, is the closest to the Offshore Site at a distance of approximately 28 nm. This centre is responsible for coordinating SAR operations, managing marine casualty incidents, and overseeing activities within the Irish Exclusive Economic Zone (EEZ). In addition to these coordination centres, a network of 44 Coast Guard Units staffed by approximately 940 volunteers provides a distributed coastal response capability, supporting rapid intervention where required.

4.1.1.4 Further maritime emergency response is provided by the Royal National Lifeboat Institution (RNLI), which operates an extensive network of lifeboat stations across the UK and Ireland. The RNLI maintains more than 230 stations and over 440 lifeboats, with the relevant operational

division being Scotland and Ireland. The fleet includes both all-weather lifeboats capable of operating in offshore conditions and inshore lifeboats designed for nearshore environments. The locations of RNLI stations in proximity to the Offshore Site are shown in **Figure 9**, while detailed information on individual stations, including lifeboat type and distance to the ABWP Phase II Array Area, considered a proxy for the Offshore Site, is provided in **Plate 2**. The closest stations include Wicklow, Arklow, and Courtown, which provide rapid response capability, while additional stations such as Dun Laoghaire, Howth, Wexford, and Rosslare Harbour contribute to a scalable response for larger incidents.

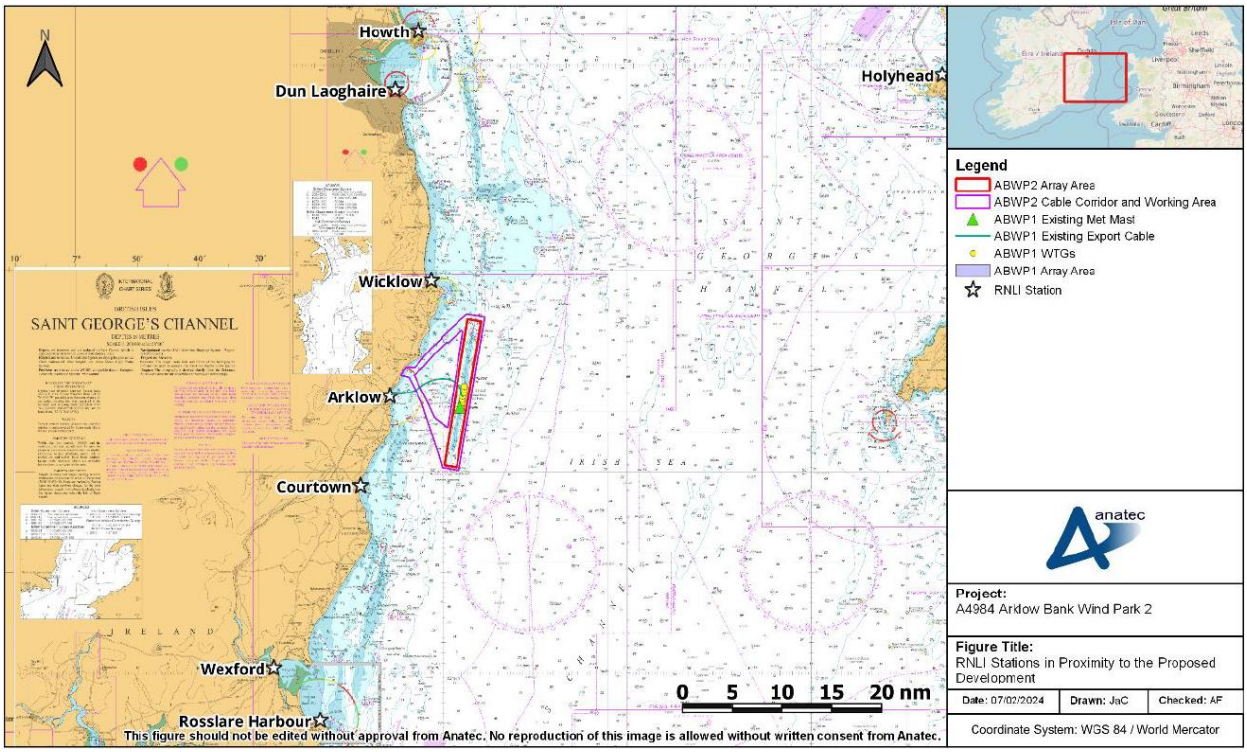


Figure 9: RNLI station locations in proximity to the Offshore Site

Source: Anatec Limited, 2026

Plate 2: Types of lifeboat held at RNLI stations in proximity to the Offshore Site. Note that distance is to the ABWP Phase II Array Area, which can be considered a proxy for distance to the Offshore Site.

Station	Lifeboat(s)	ALB Class	ILB Class	Minimum Distance to Array Area (nm)
Wicklow	ILB	–	D Class	5.0
Arklow	ALB	Trent	–	6.2
Courtown	ILB	–	D Class	8.4
Dun Laoghaire	ALB and ILB	Trent	D Class	24
Wexford	ILB (×2)	–	D Class (×2)	26
Howth	ALB and ILB	Trent	D Class	29
Rosslare Harbour	ALB	Severn	–	29

Source: Anatec Limited, 2026

4.1.1.5 In addition to dedicated SAR resources, third-party assistance represents an important supplementary component of the emergency response framework. Offshore operators typically have access to support vessels, helicopters, and operational equipment that can be mobilised in emergency situations. Furthermore, under the International Convention for the Safety of Life at Sea (SOLAS Convention), all vessels are required to render assistance to persons or vessels in

distress where it is safe to do so. This ensures that nearby commercial or operational vessels may act as first responders, providing an additional layer of redundancy to the overall emergency response system.

4.1.1.6 Overall, the emergency response infrastructure in the study area comprises a coordinated and multi-agency system integrating aerial assets, maritime coordination centres, lifeboat services, and third-party support. The combined availability of these resources ensures that incidents at the Offshore Site can be addressed effectively through a structured and responsive emergency management framework, supported by both dedicated services and wider maritime obligations.

5 Maritime Incidents

5.1.1.1 The historical record of maritime incidents in the study area indicates a generally low level of offshore risk, with only a few notable events identified. These include a collision in 2000 between a fishing vessel and a tanker under reduced visibility, and a fatal man overboard incident in 2016 involving a fishing vessel. This reflects that fishing vessels are among the primary vessel types involved in serious local incidents, typically linked to operational conditions rather than fixed infrastructure.

5.1.1.2 A broader perspective is provided by lifeboat response data from 2013 to 2022, as shown in **Figure 10** and **Figure 11**. A total of 404 incidents were recorded during this period, averaging around 40 per year. The figures show that incidents are concentrated in coastal waters near Wicklow, Arklow and Courtown, with very few occurring offshore within the ABWP Phase II Array Area, where only three minor incidents were recorded. The most common incident types are machinery failure and situations involving persons in danger, and the majority of incidents involve smaller vessels, particularly powered recreational vessels and fishing vessels.

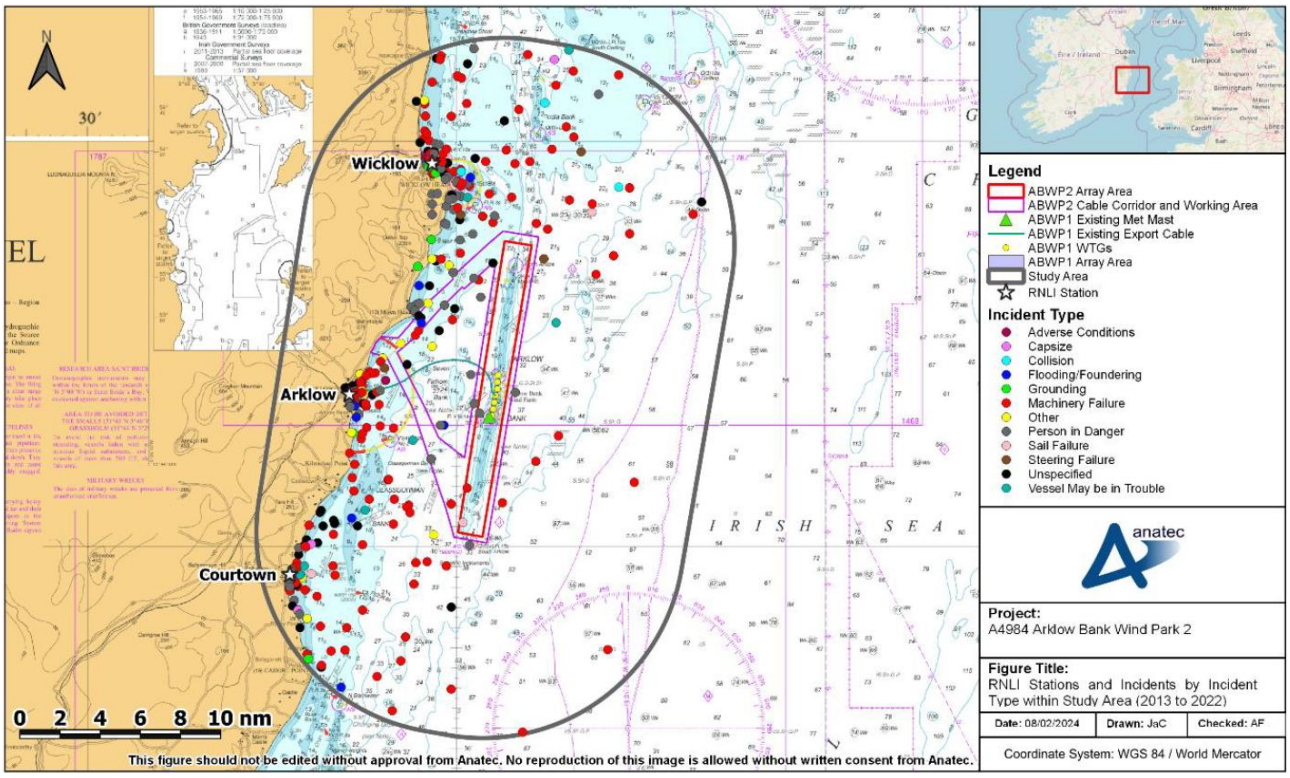


Figure 10: RNLI incident locations by incident type (2013 to 2022).

Source: Anatec Limited, 2026

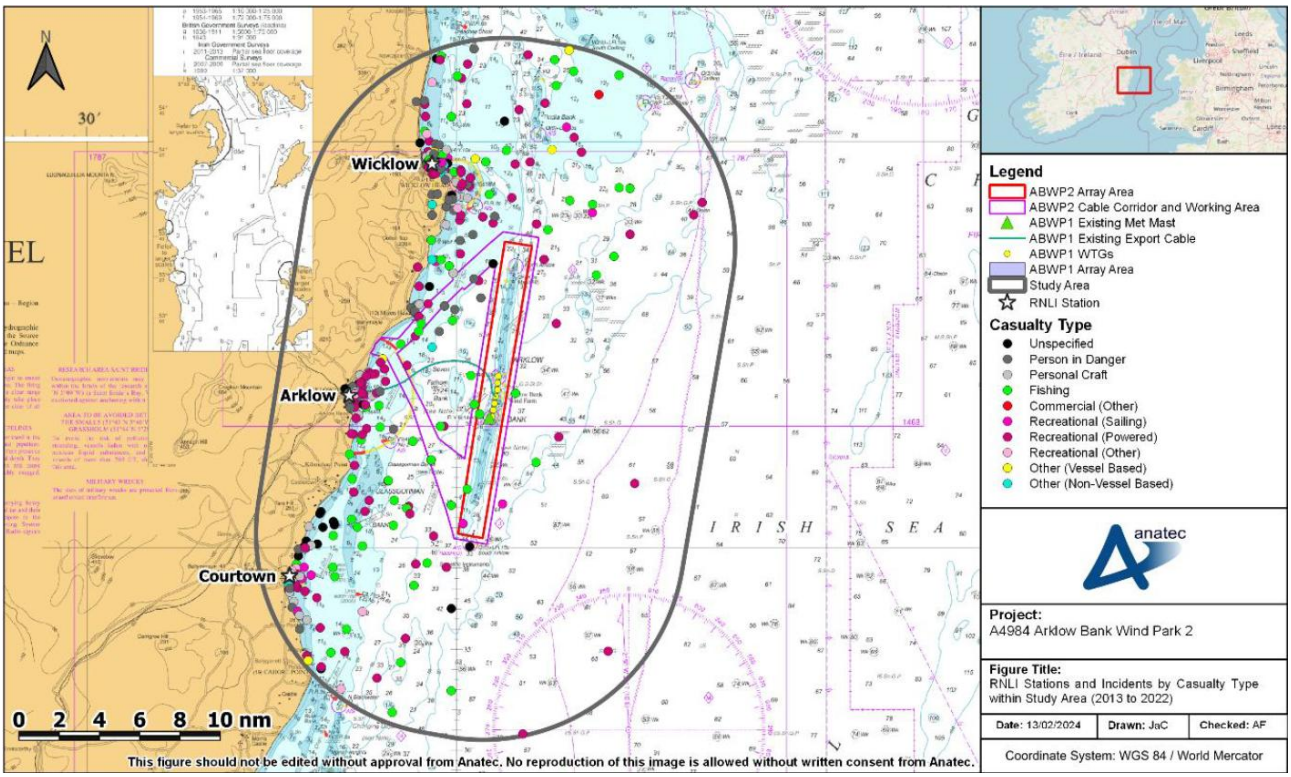


Figure 11: RNLI incident locations by casualty type (2013 to 2022).

Source: Anatec Limited, 2026

5.1.1.3 Experience from ABWP Phase I operation further supports the low risk profile. There are no reported incidents to vessels associated with the Offshore Site. The only recorded event is a lightning strike on a turbine in 2022, which did not involve vessels or result in injuries.

5.1.1.4 Overall, both local incident data and operational experience indicate that the area is characterised by low maritime incident risk, with incidents mainly occurring near the coast and involving smaller vessels, and no evidence that offshore wind turbines have contributed to vessel related incidents.

6 Methodology and Modelling

6.1 Overview

6.1.1.1 This section describes the methodological framework applied in the assessment of allisions between third-party vessel traffic and the WTGs within the Offshore Site and collision between vessels. Decommissioning vessels are also included in the assessment with respect to ship-ship collisions during transit and powered and drifting collisions while working within the designated work area.

6.1.1.2 The first step involved a qualitative hazard identification, conducted with the client based on expert judgment, project documentation, and relevant international guidelines for maritime risk assessment. The purpose of this step was to systematically identify all potential hazards that could lead to allisions and collisions.

6.1.1.3 Following the identification phase, a list of hazard scenarios is developed. These scenarios represent credible pathways through which hazardous events could occur. They include, for example, scenarios involving loss of propulsion, human errors, blackouts or technical malfunction.

6.1.1.4 The identification of hazards from Proposed Works Offshore lead to five main scenarios:

- Baseline scenario (without Proposed Works Offshore);
- First Campaign Scenario;
- Transitional Scenario (without WTGs);
- Second Campaign Scenario; and
- Post-decommissioning Scenario.

6.1.1.5 For each of these scenarios, allision and collision frequencies are estimated using a probabilistic method. Within each scenario, the main hazard scenarios are modelled as sequences of events potentially leading to allisions or collisions, and a systematic estimation of the frequency of such events is assessed.

6.1.1.6 The input parameters are derived from literature, previous studies, and available statistical data on similar maritime environments. These parameters include causation factors for various initiating events, such as human failures and machinery breakdowns.

6.1.1.7 Finally, impact frequencies are assessed for the five main scenarios. This includes calculating conditional probabilities for event progression and combining them to estimate the total frequency of a collision or allision for each hazard type. The outcomes of the modelling provide a quantitative basis for comparing risks across different scenario and for identifying which hazards contribute most significantly to the overall navigational risk.

6.1.1.8 In addition to the five main decommissioning scenarios, two additional scenarios related to possible overlaps between the ABWP Phase I and ABWP Phase II are considered:

- ABWP Phase II construction overlap Scenario; and
- Operational ABWP Phase II post-decommissioning Scenario.

6.2 Modelling Methodology

6.2.1.1 This section describes the methodology behind the estimates for the input parameters for the hazard scenarios related to the five main scenarios of the decommissioning phase.

6.2.1.2 The analysis focuses on identifying worst-case hazards related to ship-obstacle allisions, with primary attention given to allisions with the WTGs. Two distinct scenarios are considered:

- Powered allisions, where a vessel under propulsion accidentally impacts with any of the WTGs; and
- Drifting allisions, where a vessel is adrift due to loss of propulsion and subsequently impacts a WTG.

6.2.1.3 The estimation of powered and drifting vessel-to-structure allision are based on frequencies from Kirwan (1994), Rasmussen *et al.* (2012) and IWRAP Mk2 (2019) describing navigational errors. Navigation errors are studied and modelled in several ship allision models representing the probability for a navigator not to follow a planned route bend and hence continuing to a

grounding or an allision with an offshore structure (Kirwan (1994), Rasmussen *et al.* (2012) and IWRAP Mk2 (2019)). These probability factors are generally in the range of 1.0×10^{-4} to 5.0×10^{-4}, e.g., 1.6×10^{-4} IWRAP Mk2 (2019) and 2.0×10^{-4} Rasmussen *et al.* (2012). In the mentioned models, risks are not driven by route bends but rather by deviations from the route centreline. The lateral distribution of ship traffic may result in some vessels navigating closer to, or on, an allision course with the sand bank and potentially the turbines. Failure to correct such a course in time may lead to grounding or allision.

6.2.1.4 The ABWP Phase II NRA (Anatec Limited, 2026) provides vessel-to-vessel collision frequencies in the study area for a base case and a future case without construction of ABWP Phase II. The collision frequencies are 6.40×10^{-3} for the base case and 7.97×10^{-3} for the future case including a 10% vessel traffic increase (considered a conservative estimate during stakeholder discussions held as part of ABWP Phase II NRA preparation (Anatec Limited, 2026)).

6.2.1.5 The base case considered in the ABWP Phase II NRA is identical to the Baseline Scenario considered in this NRA, i.e. before commencement of Proposed Works Offshore, and results from Anatec Limited (2026) are used as background frequencies for "vessel-to-vessel collision in transit" during Proposed Works Offshore.

6.2.1.6 The future case with a 10% traffic increase is applied as a conservative assumption when decommissioning vessels are operating. Although decommissioning vessels will generate additional ship traffic throughout the limited duration of the two campaigns, it is assumed that the additional decommissioning vessel traffic is represented by a general 10% increase in traffic in the study area.

6.2.1.7 The presence of a pilot or additional navigators on the bridge can generally reduce the probability of navigation errors. This effect is not explicitly modelled in the present NRA. Instead, general causation factors are applied, and a conservative approach is adopted by not accounting for the potential risk-reducing influence of pilots or additional bridge personnel.

6.2.1.8 The marking of the work area around the Sub Lease Area is considered a temporary navigational condition during the Proposed Works Offshore, but it introduces a clearly defined and continuously communicated zone. Temporary conditions include increased navigational awareness requirements due to the presence of marked structures, updated chart information, and designated work areas. Mariners are informed through Notices to Mariners, updated nautical charts, and visible or charted warnings indicating the work area.

6.2.1.9 The WTGs within the Offshore Site are equipped with marine marking (see **Volume 3, Appendix 3.7**). In addition to visual marking (yellow lanterns and high-visibility markings), the outermost turbines (T1 and T7) are marked with Synthetic AIS Aids to Navigation (AtoN), providing electronic identification to vessels. The intermediate turbines (T2–T6) are not equipped with AIS AtoN but are marked with standard visual aids. This effect contributes to the awareness of the WTGs and work area during part of the Proposed Works Offshore.

6.2.1.10 This enhanced awareness significantly influences vessel behaviour. The combination of markings in navigational charts, expected operational knowledge, and recognition of residual MPs leads to a high compliance level among powered vessels. Based on Oliveira and Gusovsky (2012), the awareness factor can be represented by two consecutive reduction factors of 10%, resulting in an overall factor of $0.9 \times 0.9 = 0.81$. These reductions reflect a 90% probability that navigational charts are checked, and a 90% probability that the charts are up to date. It is therefore assumed that this combined effect results in an overall reduction of approximately 19% in the likelihood of a powered vessel unintentionally entering the work area during Proposed Works Offshore.

6.2.2 Powered Modelling Methodology

6.2.2.1 The vessel traffic intensity and routes are based on the vessel traffic data presented in Anatec Limited (2026). **Figure 5** shows the vessel traffic routes identified and a more detailed description of each route is provided in **Plate 1** with the daily and weekly vessel traffic for each of the 12 routes in study area.

6.2.2.2 As indicated in **Section 1.2**, the MSO confirmed that this NRA should focus on realistic worst-case scenarios as opposed to modelling all potential scenarios. The vessel traffic routes identified in Anatec Limited (2026) shows all routes are passing and without a direction towards the WTGs within the Sub Lease Area. A single route is passing west of the Sub Lease Area (Route 9), and the others are east of the Sub Lease Area. Many of the routes east of the Sub Lease Area are sailing further away and a vessel passing or drifting is therefore considered with

a lower contribution for a vessel allision. It is therefore only Route 1, Route 6, Route 7, and Route 9 that are included in the assessment with respect to estimation of powered and drifting vessel-to-structure allision.

6.2.2.3 **Figure 5** shows the vessel routes and the WTGs, where the distance from the route centreline to the WTGs, as well as the assumed route widths have been measured. These distances are relevant for assessing exposure and potential allision, as they define both the separation distance and the spatial distribution of vessel traffic relative to ABWP Phase I.

6.2.2.4 Given the considered four routes, Route 1 is with a distance from the Sub Lease Area, with a centreline distance of approximately 4,410 m. This is followed by Route 9 and Route 7, with distances of approximately 3,240 m and 2,880 m, respectively. Route 6 has the largest separation from the WTGs, with a centreline distance of approximately 6,210 m. In terms of route width, Route 9 and Route 1 are relatively wide corridors, with widths of approximately 3,850 m and 3,190 m, respectively, while Route 7 has a width of about 3,080 m. Route 6 is the narrowest of the considered routes, with an estimated width of approximately 2,200 m.

6.2.2.5 For the four considered routes, distances are measured between the Phase I WTGs and the routes centreline. In terms of the route width, Route 9 is relatively wide, with widths of approximately 3,850 m, while the remaining routes are close narrower. The distances are shown in **Table 6.1**.

Table 6.1 Distances from route centrelines to Phase I WTGs and corresponding corridor widths.

Route	Centreline distance to WTGs (m)	Route width (m)
Route 1	4,410	3,190
Route 6	6,210	2,200
Route 7	2,880	3,080
Route 9	3,240	3,850

6.2.2.6 For the purpose of the allision assessment, the vessel traffic distribution within each route is assumed to follow a normal distribution, where approximately 95% of the traffic is contained within the defined route width (green markings shown in **Figure 5**). This assumption implies that a small fraction of vessel traffic may occur outside the nominal route boundaries. Consequently, this provides a conservative basis for the analysis, as vessels deviating beyond the defined route width are still considered capable of contributing to an allision risk within the Sub Lease Area.

6.2.2.7 Based on the assumed lateral traffic distribution within each route, the annual ship traffic in proximity to the WTGs is estimated by multiplying the average annual traffic (**Plate 1**) with the probability of a vessel being located outside the nominal route width and thus within the turbine exposure area (assumed width of 100 meters).

6.2.2.8 The estimated annual vessel traffic in proximity to the WTGs is summarised in **Table 6.2**. Overall, the expected frequency is very low for all considered routes. Route 9 exhibits the highest contribution, followed by Route 7, while Routes 1 and 6 contribute negligibly. In particular, Route 6 shows effectively zero interaction due to its large distance from the WTGs.

Table 6.2 Estimated annual traffic near WTGs.

Route	Estimated traffic inside turbine exposure area (vessels/year)
Route 1	1.06×10^{-6}
Route 6	~0
Route 7	2.36×10^{-3}
Route 9	1.89×10^{-2}

6.2.3 Drifting Modelling Methodology

6.2.3.1 Loss of propulsion for conventional vessels is typically reported with a frequency of approximately 1.5E-4 per hour per ship (Rasmussen *et al*., 2012). This rate represents the probability of a general propulsion blackout, including mechanical engine failures. In the event of propulsion failure, the vessel has a 70% probability of successfully anchoring, assuming that

Offshore Site-specific water depths are suitable for emergency anchoring (Rasmussen *et al.*, 2012). This reflects situations where sufficient distance and time are available to deploy the anchor. Emergency anchoring is assumed to be attempted in all cases.

6.2.3.2 Depending on the vessel's position relative to the WTGs and the prevailing environmental conditions, an allision may be avoided if the vessel drifts past or passes between WTGs. Therefore, the geometric probability of allision is considered.

6.2.3.3 A basis for the assessment of environmental forcing is provided in **Figure 12**, which presents the wind rose (left) and current rose (right) at Arklow Bank sand bank. These roses have been combined into a single drift rose representing the overall direction in which vessels are expected to drift under the combined influence of wind and current.

6.2.3.4 Given that wind forcing generally has a greater influence on vessel drift than ocean currents, a weighted approach has been applied. The wind direction has been assigned a weight of 2/3, while the current direction has been assigned a weight of 1/3. This weighting reflects the fact that vessels typically have a larger exposed area above the waterline than below it, making them more susceptible to wind-driven forces than to hydrodynamic forces from currents.

6.2.3.5 The resulting drift directions applied in the modelling of drifting vessels are summarised in **Table 6.3**.

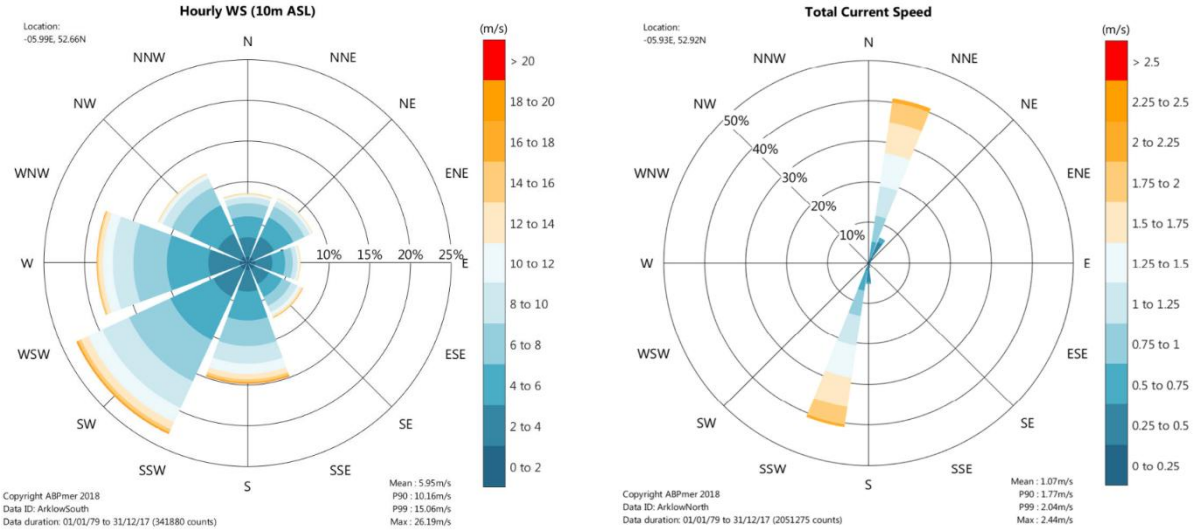


Figure 12: Wind rose (left) and current rose (right) at Arklow Bank.

Source: Arklow Offshore Wind Farm Preliminary Site Condition Report (ABP Marine Environmental Research Ltd, 2018).

Table 6.3: Resulting drift direction distribution based on combined wind (2/3) and current (1/3) forcing at Arklow.

Direction	N	NE	E	SE	S	SW	W	NW
Percentage	26%	17%	12%	8%	17%	10%	5%	5%

Source: Arklow Offshore Wind Farm Preliminary Site Condition Report (ABP Marine Environmental Research Ltd, 2018).

6.2.3.6 Based on **Table 6.3**, the combined drift conditions result in distinct dominant drift directions relevant for vessels transiting the area. In particular, vessels sailing along a north-south route may experience drift towards the Sub Lease Area depending on the prevailing environmental forces. The distribution indicates that 37% of the conditions lead to drifting in an easterly direction, while 20% result in drifting in a westerly direction. These directions are of particular importance, as they represent the scenarios where passing vessels have the potential to drift towards the wind turbines when navigating in a north-south alignment.

6.2.3.7 The distribution of vessel characteristics used in this analysis is based on Anatec Limited (2026), where values have been derived from visual interpretation of histograms representing the observed fleet composition. The extracted distributions for vessel length indicate a multi-modal structure, where discrete representative values have been assigned to each bin. The resulting length distribution shows that 23% of vessels have a length of 15 m, 10% are represented by 30 m, 19% by 90 m, and 22% by 140 m. For vessels exceeding 140 m, a representative assumed value of 200 m has been applied, accounting for 26% of the sample.

6.2.3.8 A similar approach has been applied to vessel speed, where the histogram-derived distribution indicates that 9% of vessels operate at 3 knots, 24% at 6 knots, 26% at 9 knots, and 18% at 12 knots. For speeds exceeding 12 knots, an assumed representative value of 15 knots has been assigned, covering the remaining 23% of observations. In addition, it is assumed that vessels west of the wind turbines operate at an average sailing speed of 6 knots when passing through the area, while vessels east of the area are assumed to sail at 12 knots. These estimates are based on Anatec Limited (2026) figures for sailing speed. These speed assumptions imply that it takes approximately 20 minutes to pass the western side of the turbines, reflecting smaller vessels and lower speeds, whereas it takes about 10 minutes on the eastern side due to larger vessels operating at higher speeds.

6.2.3.9 The frequency of loss of propulsion (Rasmussen *et al*., 2012) while passing the western and eastern sides of the WTGs is also considered. A loss of propulsion rate of 1.50×10^{-4} per hour per ship is applied and combined with the respective passage times. For vessels passing west of the turbines, the estimated transit time of approximately 20 minutes results in a loss of propulsion probability of 5.06×10^{-5} per passage. For vessels passing east of the turbines, the shorter transit time of approximately 10 minutes results in a corresponding probability of 2.53×10^{-5} per passage.

6.2.3.10 In addition to the loss of propulsion frequency, the probability that a vessel is unable to restart its main engine after a propulsion failure is also considered. Based on Rasmussen *et al.* (2012), it is assumed that a drifting vessel moves with a constant drift speed of 2 knots while drifting between the route centreline and the turbine area. Using this assumption together with the distance between the turbines and the route centreline, the corresponding drifting time can be estimated in hours.

6.2.3.11 For the considered routes, the distances between the turbines and the route centreline are 1.94 nm, 1.73 nm, 2.65 nm, and 3.73 nm, which correspond to drifting times of approximately 0.97 hours, 0.86 hours, 1.32 hours, and 1.86 hours, respectively. Based on Rasmussen *et al.* (2012) and IWRAP Mk2 (2019), the probability of not restarting the main engine is derived as a function of the drifting duration using a Weibull distribution approach, consistent with the methodology applied in IWRAP Mk2 (2019). Applying this approach results in an assumed probability of not restarting the engine of 15% for Route 9, 20% for Route 7, 10% for Route 1, and 5% for Route 6.

6.2.3.12 The analysis considers also the possibility of grounding on the Arklow Bank sand bank prior to a potential allision with the WTGs. A key assumption is that vessels with insufficient under-keel clearance in the western area of the Sub Lease Area are unable to reach the WTGs, as they will ground on the Arklow Bank sand bank before any impact occurs. In contrast, vessels approaching from the eastern side are generally larger and operate with greater draughts, making them more relevant for the allision risk assessment.

6.2.3.13 The draught distribution is discretised as follows: 9% of vessels have a draught of 2 m, 15% have 5 m, 28% have 6 m, and 41% have 8 m. For vessels exceeding 8 m draught, an assumed representative value of 12 m is applied, corresponding to 9% of the dataset. This discretisation provides a simplified but consistent representation of continuous operational parameters based on empirical histogram observations.

6.2.3.14 Under these assumptions, approximately 9% of vessels operating in the eastern traffic corridor have sufficient draught to ground on the Arlow Bank sand bank before potentially reaching the turbines. This implies that only this fraction of traffic is effectively "filtered out" by grounding prior to allision in the current configuration.

6.2.3.15 In the Post-decommissioning Scenario, the residual MPs are located between -6.59 m and -10.55 m Low Astronomical Tide (LAT), see **Volume 2, Chapter 3**. Under these conditions, it is estimated that approximately 71% of vessels would have sufficient draught to either pass over or ground on the Arklow Bank sand bank before reaching the residual MPs, and thus be prevented from colliding with the structures in a drifting scenario where propulsion is lost and vessels are carried towards the Sub Lease Area. This estimate is based on the discretised draught distribution, where vessels with draughts below 6 m (9% + 15% + 28%) and half of the vessels in the 6 - 8 m draught interval (0.5 × 41%) are assumed to either pass over or ground on the Arklow Bank sand bank before reaching the residual MPs.

6.2.4 Risk Classification Methodology

6.2.4.1 To quantify the risk of collisions and allisions, a framework is provided as basis for evaluating whether the predicted occurrence frequencies and consequences fall within acceptable limits. The approach is adopted from the ABWP Phase II NRA (Anatec Limited, 2026).

6.2.4.2 **Table 6.4** and **Table 6.5** show classification scales for frequency and consequence, **and Figure** 13 combines these into a risk ranking matrix that distinguishes between broadly acceptable, tolerable, and unacceptable risk levels:

- Unacceptable risks must be reduced or removed;
- Tolerable risks can be accepted if they are assessed to be As Low As Reasonably Practicable (ALARP) considering relevant and cost beneficial risk reducing measures; and
- Broadly Acceptable risks represent low risk hazards that are acceptable without further mitigation.

Table 6.4: Frequency of occurrence ranking definitions

Index	Description	Definition
1	Negligible	<1 occurrence per 10,000 years
2	Extremely unlikely	1 per 100 to 10,000 years
3	Remote	1 per 10 to 100 years
4	Reasonably probable	1 per 1 to 10 years
5	Frequent	Yearly

Source: Anatec Limited, 2026

Table 6.5: Severity of consequence classification ranking.

Index	Description	Definition			
		People	Property	Environment	Business
1	Negligible	No perceptible effect	No perceptible effect	No perceptible effect	No perceptible effect
2	Minor	Slight injury(s)	Minor damage to property, i.e., superficial damage	Tier 1 local assistance required	Minor reputational risks – limited to users
3	Moderate	Multiple minor or single serious injury	Damage not critical to operations	Tier 2 limited external assistance required	Local reputational risks
4	Serious	Multiple serious injuries or single fatality	Damage resulting in critical impact on operations	Tier 2 regional assistance required	National reputational risks
5	Major	More than one fatality	Total loss of property	Tier 3 national assistance required	International reputational risks

Source: Anatec Limited, 2026

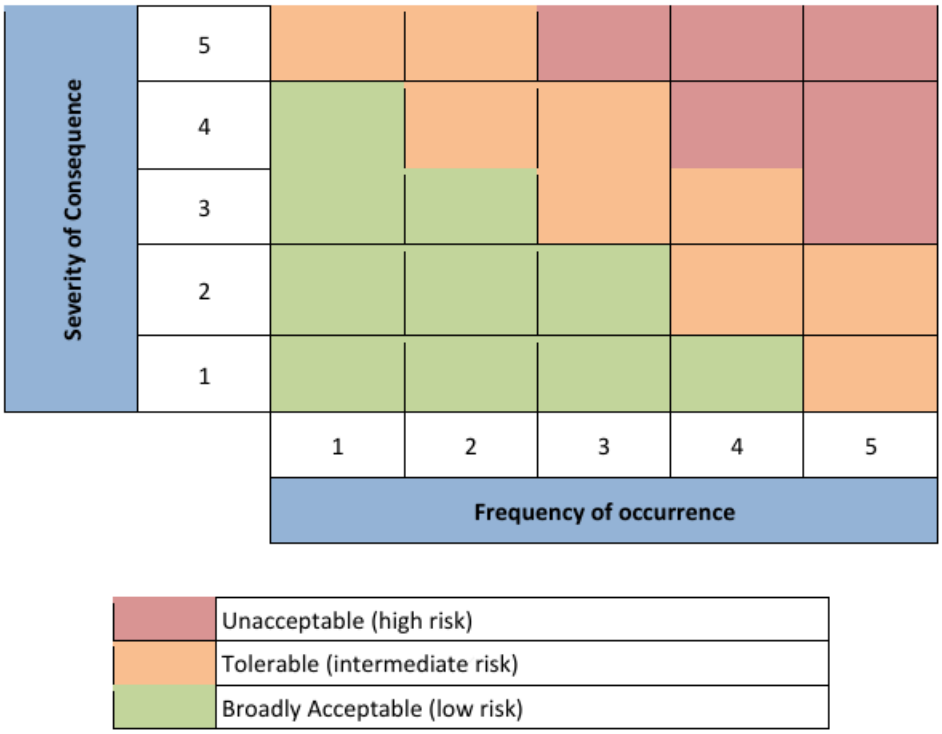


Figure 13: Risk ranking matrix and risk classification.

Source: Anatec Limited, 2026

6.2.4.3 The risk ranking matrix and risk classification is applied to each of the seven hazard scenarios (see **Section 6.1**) assessed considering two scenarios:

- Most likely scenario, based on the frequencies of occurrence obtained through modelling, which are considered to represent the most often experienced minor glancing scenarios involving relevant vessels. Consequences are then assessed considering the consequence classification ranking and applying professional judgement; and
- Worst-case scenario, which relates to scenarios with more severe consequences. In this scenario, the consequence rating obtained under the "most likely scenario" is revisited to capture the applicable worst-case consequence, and the frequency is adjusted using professional judgement to reflect the lower probability of such worst-case consequences to occur.

7 Hazards and Scenario Assessment

7.1 Overview

7.1.1.1 The following hazards have been identified and are used as basis for the assessment of navigational risk for Proposed Works Offshore:

- Vessel-to-vessel collision in transit: This hazard includes any collision between ships moving outside the defined work area around the Sub Lease Area including collisions between third-party vessels and decommissioning vessels;
- Powered collision with stationary work vessel: This hazard includes third-party vessels erroneously navigating into the work area to a powered collision with decommissioning vessels while decommissioning vessels are stationary working within the work area;
- Drifting collision with stationary work vessels: This hazard includes third-party vessels experiencing blackout and drifting into the work area to a collision with decommissioning vessels while the decommissioning vessels are stationary working within the work area.
- Powered vessel-to-structure allision: This hazard includes third-party vessels erroneously navigating to a powered allision with a WTG / met mast or to a grounding on a residual MP; and
- Drifting vessel-to-structure allision: This hazard includes third-party vessels experiencing blackout and drifting to an allision with a WTG / met mast or to a grounding on a residual MP.

7.1.1.2 The occurrence frequency and the risk are assessed for each of the hazards in relation to the five distinct scenarios with different operational conditions (see **Section 6.1**).

7.1.1.3 Each scenario is described below with respect to the five defined hazards. At the end of each section, the frequencies of occurrence are presented on an annual basis to enable comparison; however, it should be noted that the Proposed Works Offshore will only take place over a limited period, and the increased risk is therefore temporary except for the Post-decommissioning Scenario. The risk in the Post-decommissioning Scenario describes the post-decommissioning period until any changes to the circumstances occur, for example until the construction of turbines in Phase II.

7.1.1.4 The two additional scenarios considering possible overlapping with ABWP Phase II are considered separately:

- ABWP Phase II construction overlap Scenario; and
- Operational ABWP Phase II post-decommissioning Scenario.

7.2 Baseline scenario

7.2.1.1 The baseline scenario represents the current operational condition of the wind farm. In this scenario, all seven Wind Turbine Generators (WTGs) are standing and fully installed. No Proposed Works Offshore are ongoing, and vessel traffic is limited to normal operations. This scenario serves as a reference case for comparison with the other scenarios and an illustration image of this scenario is shown in **Figure 14**.



Figure 14: Illustration of the Sub Lease Area before Proposed Works Offshore commence.

7.2.1.2 The vessel traffic intensity and routes in this scenario are based on the vessel traffic data presented in the ABWP Phase II NRA (Anatec Limited, 2026). **Figure 5** shows the vessel traffic

routes. identified and a more detailed description of each route is provided in **Plate 1** with the daily and weekly vessel traffic for each of the 12 routes identified in study area.

7.2.1.3 Estimation of vessel-to-vessel collision in the ABWP Phase II NRA is based on AIS data for 2022. The risk results summary shows that the vessel-to-vessel collision frequency in the study area is 6.40×10^{-3} (one in 156 years) and if the vessel traffic increases by 10%, the resulting vessel-to-vessel collision frequency is 7.97×10^{-3} (one in 126 years). The Offshore Site lies entirely within the Phase II Array Area and therefore it is assumed that the analysis of the ship traffic is still valid and representative for the study area and can be used as background for the vessel-to-vessel collision estimation for this analysis. As mentioned in **Section 6.2**, these values are used as background frequencies for "vessel-to-vessel collision in transit" during the decommissioning scenarios. The estimated risk results from Anatec Limited (2026) are therefore assumed to cover the baseline scenario for vessel-to-vessel collision in the study area.

7.2.1.4 During the baseline scenario, powered and drifting allision between the WTGs and third-party vessels are also considered as potential hazard. For powered collisions, a human error is assumed to cause a ship to deviate from the normal traffic distribution (95%) and pass close to the turbines. Some vessels may ground on Arklow Bank sand bank, while others take avoiding action due to awareness of WTGs and updated navigational charts. For drifting allision, the annual ship traffic on each route is combined with probabilities of propulsion loss, wind direction, engine restart, and anchoring. Geometric factors are also included to account for vessels drifting into turbines rather than passing between them. All factors are considered jointly.

7.2.1.5 For this hazard scenario, the estimated collision and allision frequencies are as follows:

- Vessel-to-vessel collision in transit (with no future vessel traffic increase) occur at a frequency of 6.40×10^{-3} (one in 156 years, i.e. extremely unlikely);
- Powered vessel-to-structure allisions occur at 8.01×10^{-07} (one in 1.25 million years, i.e. negligible); and
- Drifting vessel-to-structure allisions occur at 9.68×10^{-05} (one in 10,330 years, i.e. negligible).

7.3 First Campaign Scenario

7.3.1.1 The First Campaign, includes the removal of the upper structural components of the WTGs and met mast. The main activities in this scenario are:

- Pre-decommissioning surveys;
- Dredging to ensure sufficient vessel access (if required); and
- Removal of the WTG and met mast components.

7.3.1.2 During this scenario, heavy-lift vessels and support vessels will be present in the work area.

7.3.1.3 The future case (the vessel traffic increases by 10%), is applied as a conservative assumption when decommissioning vessels are operating.

7.3.1.4 **Figure 15** gives and illustration of this scenario of the turbines after the tower is removed.



Figure 15: Illustration of the TP after the decommissioning of the tower, blades and nacelle.

7.3.1.5 The vessel traffic intensity and routes in this scenario are based on the same vessel traffic data presented in the ABWP Phase II NRA (Anatec Limited, 2026). However, during the First Campaign, additional decommissioning vessels are present within the study area next to the WTGs. The presence of vessels leads to increased local traffic density.

7.3.1.6 The estimation of vessel-to-vessel collision risk during this scenario is based on the background frequencies presented in Anatec Limited (2026), derived from AIS data for 2022. The collision frequency considered is the "future case" (the vessel traffic increases by 10%) with a frequency of 7.97×10^{-3} (one in 130 years). For the First Campaign, the future case assumption of a 10% increase in vessel traffic is applied to account for the additional decommissioning vessels operating in the work area. This frequency is therefore considered representative as background frequencies for "vessel-to-vessel collision in transit," covering also the decommissioning vessels transiting to and from the work area.

7.3.1.7 During Proposed Works Offshore, vessel-to-structure allision remains a relevant hazard, although the nature of the exposed structure changes. Following the removal of the nacelle, blades, and tower (or met mast), only the TP and substructure remain above sea level (as illustrated in **Figure 15**). This reduces the vertical extent of the structures but still represents a collision hazard to passing vessels.

7.3.1.8 For powered allision, human error may still cause vessels to deviate from planned routes and enter the work area. However, the presence of active operations, work vessels, and updated navigational warnings to mariners is expected to increase situational awareness.

7.3.1.9 Powered collisions with decommissioning vessels are assumed to have a risk similar to powered allision with WTGs / met mast. The size of the decommissioning vessels occupies a larger area, but the vessels are exposed for a shorter period and therefore less exposed Accordingly, the collision risk is assumed to be equivalent to powered allision with WTGs / met mast.

7.3.1.10 For drifting allision, the hazard persists due to the possibility of propulsion failure of passing vessels. The probability is assessed using the same approach as in the baseline, combining traffic intensity with probabilities of propulsion loss, wind and current, and the likelihood of successful anchoring or engine restart. The reduced structural height may slightly decrease the visual effect, but the TP still represents a fixed obstacle that drifting vessels may collide with.

7.3.1.11 Drifting collisions between third-party ships with decommissioning vessels are estimated with a lower frequency. The exposed area of which a ship can drift into a decommissioning vessel area compared to WTGs / met mast is with a lower probability.

7.3.1.12 For this hazard scenario, the estimated collision and allision frequencies are as follows:

- Vessel-to-vessel collision in transit occur at a frequency of 7.97×10^{-3} (1 in 130 years);
- Powered collisions with work vessels occur at 8.01×10^{-7} (1 in 1.2 million years);
- Drifting collisions with work vessels occur at 1.63×10^{-5} (1 in 61,000 years);
- Powered vessel-to-structure allisions occur at 8.01×10^{-7} (1 in 1.2 million years); and
- Drifting vessel-to-structure allisions occur at 9.68×10^{-5} (1 in 10,000 years).

7.4 Transitional Scenario (without WTGs)

7.4.1.1 The Transitional Scenario represents a temporary scenario between the First and Second Campaigns. In this scenario, the WTG tower / met mast and upper components have been removed, while the TPs remain in place for a certain period. The duration of this scenario is not yet determined, but may be weeks to a few years. For the risk assessment, the scenario is assessed as a permanent situation without marked work areas.

7.4.1.2 This condition potentially introduces an increased risk of allisions with exposed TPs due to:

- Reduced visibility and detectability of remaining structures; and
- Potential changes in marking or lighting conditions.

7.4.1.3 This scenario is time-limited but considered due to the elevated collision risk associated with partially removed structures.

7.4.1.4 This scenario between the First and Second Campaign is illustrated in **Figure 16**, where the turbines standing after the tower is removed and before the TPs and MPs are partly removed.



Figure 16: Illustration of the TPs in the temporary scenario under the decommissioning.

7.4.1.5 The temporary scenario is similar to the baseline scenario . The difference is that the WTGs / met mast no longer have their upper components installed. However, AIS signal and marking of the WTGs / met mast is still in effect as this is located in the TPs, as in the baseline scenario leading to similar awareness for other vessels even though the TPs are smaller and less visible compared to a full installed turbine. The estimation of collisions with these structures are therefore estimated identical to the baseline scenario.

7.4.1.6 During the temporary scenario, no decommissioning vessel activity is ongoing. The presence of decommissioning vessels as part of transit or near the structures are not planned. The estimation of collisions with decommissioning vessels are therefore left out.

7.4.1.7 For this hazard scenario, the estimated collision and allision frequencies are as follows:

- Vessel-to-vessel collision in transit occur at a frequency of 6.40×10^{-3};
- Powered vessel-to-structure allisions occur at 8.01×10^{-7}; and
- Drifting vessel-to-structure allisions occur at 9.68×10^{-5}.

7.5 Second Campaign Scenario

7.5.1.1 The decommissioning of the TP and MP is also referred to as the Second Campaign. It involves the removal of the remaining substructures and associated infrastructure. The main activities include:

- Pre-decommissioning surveys;
- Dredging for vessel access (if required);
- Removal of TPs;
- Removal of MPs (cut below seabed level between -6.59 m and -10.55 m LAT);
- Removal of scour protection;
- Removal of inter-array cables;
- Removal of export cables; and
- Post-decommissioning surveys.

7.5.1.2 With respect to navigational risk, the Second Campaign is considered comparable to the First Campaign. Although the removal activities differ, the main decommissioning vessel operations take place within the Sub Lease Area, with similar vessel types and sizes. Consequently, the exposure conditions are assumed to be equivalent, and the estimated vessel-to-vessel collision and vessel-to-structure allision frequencies are therefore considered similar to those applied for the First Campaign.

7.5.1.3 The removal of the offshore export cable, only activity outside the Sub Lease Area, is a moving operation, where the work area progresses along the cable route. A temporary moving work area with a radius of 500 m around the cable decommissioning vessel will be established and communicated through Notices to Mariners (NtM). In addition, a support vessel will accompany the operation to monitor nearby ship traffic and maintain proactive communication with approaching vessels to ensure safe passage. Since the activity takes place in an area with limited ship traffic and is managed through these control measures, it is not expected to significantly increase navigational risk and can be considered within the conservative assumptions applied for general traffic increases in the ship–ship collision assessment.

7.5.1.4 For this hazard scenario, the estimated collision and allision frequencies are as follows:

- Vessel-to-vessel collision in transit occur at a frequency of 7.97×10^{-3};
- Powered collisions with work vessels occur at 8.01×10^{-7};
- Drifting collisions with work vessels occur at 1.63×10^{-5};
- Powered vessel-to-structure allisions occur at 8.01×10^{-7}; and
- Drifting vessel-to-structure allisions occur at 9.68×10^{-5}.

7.6 Post-decommissioning Scenario

7.6.1.1 The Post-decommissioning Scenario represents the final state after completion of all Proposed Works Offshore

7.6.1.2 In this scenario:

- All above-seabed structures have been removed;
- MPs are cut below seabed level and only residual MPs remain; and
- No decommissioning activities are ongoing.

7.6.1.3 The Offshore Site is returned to a condition with minimal physical obstructions, and vessel traffic resumes normal patterns.

7.6.1.4 This Post-decommissioning Scenario is illustrated in **Figure 17**.

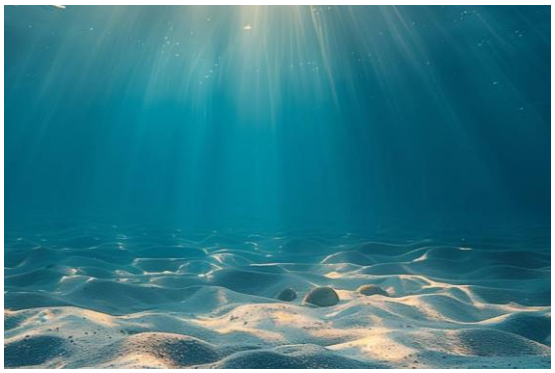


Figure 17: Illustration of the seabed in the Post-decommissioning Scenario after Proposed Works Offshore where MPs have been cut under the seabed.

7.6.1.5 The Post-decommissioning Scenario is similar to the baseline scenario with an exception. The difference is that the WTGs and met mast are no longer above the seabed, and collision is only possible if a vessel has draught large enough to plough through the seabed and hit the residual MPs, whether these are located below the seabed level or exposed.

7.6.1.6 For vessels navigating east of the Sub Lease Area, the draught distribution indicates that most vessels do not have sufficient draught to reach the residual MPs after decommissioning. In the post-decommissioning scenario, it is estimated that 71% of vessels would be unable to reach the residual MPs due to insufficient draught. This estimate is based on the discretised draught distribution, where vessels with draughts below 6 m (9% + 15% + 28%) and half of the vessels in the 6-8 m interval (0.5 × 41%) are assumed to either pass over or ground on the sand bank before reaching the residual MPs. Consequently, only vessels with draughts exceeding 6 - 8 m are considered capable of reaching and potentially impacting the residual MPs. Estimated collision and allision frequencies have conservatively assumed that vessels with draughts exceeding 6 m could potentially strike residual MPs, even those located at -10.55 m LAT, and have not taken into account the strong likelihood that some of these vessels would actually first ground on the sandbank before reaching residual MPs, whether these are located below the seabed level or exposed.

7.6.1.7 The draught of vessels sailing west of the Sub Lease Area indicates that these ships generally have draughts below 6 m. Consequently, they are not expected to contribute to the frequency of grounding events on the sand bank prior to potential impact with residual MPs located below seabed level, as they would not reach this depth. As a result, both drifting and powered allision scenarios involving these vessels can be considered negligible in the context of interaction with residual MP structures.

7.6.1.8 However, marking of the residual MPs is still in effect as described in **Volume 3, Appendix 3.7**, similar to marking of a rock in navigational charts. This is leading to similar awareness for other vessels. The estimation of collisions with residual MPs are therefore estimated identical to the baseline scenario but with a reduction factor that considers the vessel draughts.

7.6.1.9 During the Post-decommissioning Scenario, no decommissioning vessel activity is ongoing given the Proposed Works Offshore are finalised. The presence of decommissioning vessels as part of transit or near the Sub Lease Area with respect to the Proposed Works Offshore is not relevant anymore and therefore left out.

7.6.1.10 For this hazard scenario, the estimated collision and allision frequencies are as follows:

- Vessel-to-vessel collision in transit occur at a frequency of 6.40×10^{-3};
- Powered vessel-to-structure allisions occur at 2.34×10^{-7}; and
- Drifting vessel-to-structure allisions occur at 3.04×10^{-5}.

7.7 ABWP Phase II construction overlap Scenario

7.7.1.1 An additional aspect to be considered in the hazard assessment is the potential change in hazard frequencies arising if a temporal overlap with the ABWP Phase II construction activities is considered. During this period, the presence of construction vessels increases.

7.7.1.2 The potential temporal overlap with ABWP Phase II construction works is also addressed in the Outline LMP (**Volume 3, Appendix 3.7**). The plan defines specific principles for how proposed

work areas should be maintained or adjusted depending on the implementation of ABWP Phase II marking schemes.

7.7.1.3 In particular, the arrangement of work areas addressed in the Outline LMP (**Volume 3, Appendix 3.7**) is conditional on the marking strategy adopted for ABWP Phase II. If ABWP Phase II is marked using work areas that overlap or fully encompass the proposed works offshore, the proposed work area would be removed. If alternative non-overlapping marking schemes are used, the proposed work area may remain in place, potentially with adjustments agreed in consultation with CIL / MSO. If no work areas are implemented for ABWP Phase II, the proposed work area will remain unchanged.

7.7.1.4 The temporal overlap may lead to elevated interaction rates between vessels, particularly in constrained areas or in the vicinity of active work zones. This is primarily driven by the increased presence of construction vessels associated with concurrent Phase II construction and Phase I decommissioning activities. Such operations include towing, anchoring, and vessels with restricted manoeuvrability, all of which contribute to a higher potential for vessel interactions. At the same time, the expanded and more active work area may contribute to increased situational awareness among vessels.

7.7.1.5 This scenario is, to a large extent, addressed within the NRA for ABWP Phase II (Anatec Limited, 2026), which also have estimated the risk for elevated traffic densities and the associated risks. The overlapping operations are therefore considered to fall within the range of traffic and operational conditions assessed for Phase II.

7.8 Operational ABWP Phase II Post-decommissioning Scenario

7.8.1.1 In this scenario, the operational ABWP Phase II wind farm surrounds the former Phase I area. The wind farm constitutes a clearly defined and permanently marked zone, which is expected to influence vessel routing and navigational behaviour in the vicinity. All ABWP Phase I structures have been removed, with the possible exception of residual monopiles (MPs) remaining below the seabed.

7.8.1.2 ABWP Phase II effectively acts as a shielding mechanism for the Sub Lease Area, as vessel traffic is expected to avoid or route around the wind farm in accordance with established practices and regulatory requirements. This reduces the likelihood of vessels unintentionally transiting the Sub Lease Area. In addition, the situational awareness associated with operational wind farms due to charted structures, lighting, marking, and navigator familiarity further reduces the probability of hazardous interactions with any residual infrastructure.

7.8.1.3 Consequently, the probability of collision or allision with residual MPs is considered negligible. The residual risk is therefore related to ABWP Phase II operational turbines, and any additional risk associated with MPs remaining below the seabed is considered to be encompassed within the assessed risk in the NRA for ABWP Phase II, which concludes that risks during ABWP Phase II operation and maintenance phase is generally considered broadly acceptable (Anatec Limited, 2026).

8 Hazard Results

8.1 Overview

8.1.1.1 This section presents all the hazard frequencies and the assessed risk for the five scenarios and more brief for the two additional scenarios. The analysis covers both the Baseline condition as well as the Transitional and Post-decommissioning conditions associated with the Proposed Works Offshore.

8.1.1.2 The risk related to the hazards is assessed for each hazard and each of the five scenarios based on the risk classification scheme presented in **Section 6.2.4**.

8.2 Hazard Frequencies

8.2.1.1 A summary of the estimated hazard frequencies (as presented in **Section 7**) and the corresponding return periods for the five scenarios are summarised in **Table 8.1**.

Table 8.1: Summary of the frequencies and return periods for each hazard scenario and hazard. Note that frequency of occurrence represented per number of years is approximate.

Hazards / Scenarios	Baseline Scenario	First Campaign Scenario	Transitional Scenario	Second Campaign Scenario	Post-decommissioning Scenario
Vessel-to-vessel collision in transit	6.40×10^{-3} (1 per 160 years)	$7.97E\times10^{-3}$ (1 per 130 years)	6.40×10^{-3} (1 per 160 years)	7.97×10^{-3} (1 per 130 years)	$6.40E\times10^{-3}$ (1 per 160 years)
Powered collision with work vessel	-	8.01×10^{-7} (1 per 1,200,000 years)	-	8.01×10^{-7} (1 per 1,200,000 years)	-
Drifting collision with work vessel	-	1.63×10^{-5} (1 per 61,000 years)	-	1.63×10^{-5} (1 per 61,000 years)	-
Powered vessel-to-structure allision	8.01×10^{-7} (1 per 1,200,000 years)	8.01×10^{-7} (1 per 1,200,000 years)	8.01×10^{-7} (1 per 1,200,000 years)	8.01×10^{-7} (1 per 1,200,000 years)	2.34×10^{-7} (1 per 4,300,000 years)
Drifting vessel-to-structure allision	9.68×10^{-5} (1 per 10,000 years)	9.68×10^{-5} (1 per 10,000 years)	9.68×10^{-5} (1 per 10,000 years)	9.68×10^{-5} (1 per 10,000 years)	3.04×10^{-5} (1 per 33,000 years)
Total	6.50×10^{-3} (1 per 150 years)	8.08×10^{-3} (1 per 120 years)	6.50×10^{-3} (1 per 150 years)	8.08×10^{-3} (1 per 120 years)	6.43×10^{-3} (1 per 160 years)

8.2.1.2 **Table 8.1** summarises the calculated frequencies and corresponding return periods for each identified hazard across the different scenarios. The results highlight how the hazard frequencies vary between the baseline, transitional, and post-decommissioning conditions, with generally higher frequencies observed during the Proposed Works Offshore compared to both the baseline and the Post-decommissioning Scenario.

8.2.1.3 The hazard frequencies presented in **Table 8.1** are expressed as annual frequencies, representing the expected number of occurrences per year for each hazard type under the given scenario. These values are derived from probabilistic modelling of vessel traffic, failure mechanisms, and environmental conditions, as described in **Section 6**.

8.2.1.4 To support interpretation, the concept of return period is also used. The return period is the inverse of the annual frequency and represents the average time between occurrences of a given event. For example, a frequency of 1.0×10^{-3} corresponds to a return period of 1,000 years. It is important to note that return periods are statistical averages and do not imply that events occur regularly at fixed intervals.

8.2.1.5 To facilitate interpretation of the calculated ship collision and allision frequencies and corresponding return periods presented in **Table 8.1**, the results are evaluated using the frequency ranking definitions provided in **Table 6.4**. This classification translates quantitative frequency estimates into qualitative rankings on a scale from 1 to 5, where each rank represents a defined range of occurrence likelihood.

8.2.1.6 The resulting frequency rankings for each scenario and hazard are presented in **Table 8.2** below.

Table 8.2: Summary of the frequency of occurrence ranking definitions.

Scenarios	Baseline Scenario	First Campaign Scenario	Transitional Scenario	Second Campaign Scenario	Post-decommissioning Scenario
Vessel-to-vessel collision in transit	2 (Extremely unlikely)	2 (Extremely unlikely)	2 (Extremely unlikely)	2 (Extremely unlikely)	2 (Extremely unlikely)
Powered collision with work vessel	-	1 (Negligible)	-	1 (Negligible)	-
Drifting collision with work vessel	-	1 (Negligible)	-	1 (Negligible)	-
Powered vessel-to-structure allision	1 (Negligible)	1 (Negligible)	1 (Negligible)	1 (Negligible)	1 (Negligible)
Drifting vessel-to-structure allision	2 (Extremely unlikely)	2 (Extremely unlikely)	2 (Extremely unlikely)	2 (Extremely unlikely)	1 (Negligible)
Total	2 (Extremely unlikely)	2 (Extremely unlikely)	2 (Extremely unlikely)	2 (Extremely unlikely)	2 (Extremely unlikely)

8.3 Consequences

8.3.1.1 As noted in **Section 6.2.4**, consequences are assessed based on a description of most likely (assessed considering the consequence classification ranking and applying professional judgement in the interpretation of frequencies of occurrence obtained through modelling) and worst-case (which relate to scenarios with more severe consequences) scenarios.

8.3.1.2 The terminology used to describe hazards also reflects specific modelling assumptions:

- Collision refers to vessel-to-vessel collision, either in transit or involving stationary work vessels.
- Allision refers to contact between a vessel and a fixed or stationary object, such as a WTG, TP, or residual monopile.
- Powered events assume the vessel is under propulsion and deviates due to human or technical factors.
- Drifting events assume loss of propulsion followed by drift under environmental forcing.

8.4 Risk Mitigation

8.4.1.1 Results incorporate the effect of risk-reducing factors considered to be an integral part of the Proposed Works Offshore, such as navigational awareness, chart updates, marking of structures, and compliance with maritime regulations. These factors are reflected in the modelling through reduction coefficients and are implicitly included in the reported frequencies.

8.4.1.2 Certain conditions naturally result in mitigating impact with turbines. These conditions are factored into the assessment of the hazard frequencies and include:

- Turbines are located on a sand bank where ships do not naturally pass;
- Existing marking of the turbines;
- Water depths in the area limit access for vessels with larger draught, reducing exposure to turbine structures;
- Vessel traffic in the area is generally routed around the Offshore Site, limiting interaction with the turbines;
- The Offshore Site is clearly defined and identifiable on nautical charts, increasing awareness among mariners;

- Turbines are marked and lit in accordance with applicable requirements, making them visible under normal operating conditions;
- Mariners are expected to comply with COLREGs, contributing to safe navigation and avoidance of fixed structures; and
- The regular layout of turbines within the wind farm supports predictability and navigational awareness.

8.4.1.3 General risk mitigations applied are described in **Table 8.3**.

Table 8.3: Description of mitigations.

Mitigation	Description
Marking of WTGs	The turbines are currently marked with AIS. During decommissioning, the continuous marking of the WTG should be ensured.
Ensure compliance to COLREG	Work vessels comply with COLREGs when interacting with other vessels outside marked work area
Marking of work area	Work area marked according to the Outline LMP.
Moving work area around cable decommissioning vessel	According to the Outline LMP, a moving work area of 500 m from the cable decommissioning vessel shall be announced in NtM and a support vessel shall follow the cable decommissioning vessel
Procedures in place when work vessels departing or arriving to work area	Coordination of work vessels and movements into and out of work areas to ensure coordination with third-party traffic surrounding the work area
Cutting depths of MPs	The MPs are cut down to a level below the seabed, and to a level where only larger ships with a draught between 6-8 m will be able to impact.
Marking of residual MPs	According to the Outline LMP, residuals of MPs left *in situ* under the seabed will be charted in conjunction with MSO / UKHO.

8.5 Risk Assessment

8.5.1 General Description

8.5.1.1 This section presents the risk results for each hazard scenario, and distinguishing between most likely and worst-case scenarios for each using three key parameters, as described in **Section 6.2.4**:

- F (Frequency): This represents the likelihood of occurrence of a given hazard and is expressed using the frequency ranking scale defined in **Table 8.2**. The ranking converts the quantitative annual frequency into a qualitative category (e.g. "Remote", "Extremely unlikely") based on order-of-magnitude thresholds.
- C (Consequence): This represents the severity of the outcome should the hazard occur. The consequence ranking is based on the severity of consequence classification defined in **Section 6**, considering potential effects on people, property, environment, and business: and
- Risk: The overall risk level is determined by combining the frequency (F) and consequence (C) rankings using the risk matrix presented in **Section 6.2.4**. This results in a qualitative risk classification of Broadly Acceptable, Tolerable (ALARP), or Unacceptable.

8.5.2 Baseline Scenario

8.5.2.1 The risk for the Baseline Scenario is assessed in **Table 8.4**. The current situation is acceptable with the seven turbines already in place and marked, and considering the current traffic situation.

Table 8.4: Risk assessment - Baseline Scenario.

Hazard risk assessment – Baseline Scenarios									
Hazard	**Description**	**Consequence description**	**Mitigations**	**Most likely**			**Worst-case**		
				F	**C**	**Risk**	**F**	**C**	**Risk**
Vessel-to-vessel collision in transit	Vessel-vessel collision among ship traffic in the area.	Most likely: glancing or minor vessel-vessel impact. Worst-case: Serious injury, property damage or environmental damage due to frontal impact involving a larger vessel.	None.	2	3	Broadly acceptable	1	4	Broadly acceptable
Powered vessel-to-structure allision	Vessel diverting from route and impacting with one of the seven turbines.	Most likely: low-impact glancing allision. Worst-case: small vessel capsizing or larger vessel impact with possible pollution and serious damage to turbine.	Existing marking of turbines.	1	3	Broadly acceptable	1	4	Broadly acceptable
Drifting vessel-to-structure allision	Vessel with engine failure drifting to impact with one of the seven turbines.	Most likely: low-impact glancing allision. Worst-case: small vessel capsizing or larger vessel impact with possible pollution and serious damage to turbine.	Existing marking of turbines.	1	3	Broadly acceptable	1	4	Broadly acceptable

8.5.3 First Campaign Scenario

8.5.3.1 The risk for the First Campaign Scenario is assessed in **Table 8.5**.

8.5.3.2 The First Campaign includes decommissioning of the met mast and towers with activities within the Sub Lease Area as well as transports to/from the area generating additional decommissioning vessel traffic.

8.5.3.3 The scenario involves added risk of collisions with decommissioning vessels within the Sub Lease Area. The additional work vessel traffic also results in a slightly higher vessel-vessel collision frequency outside the Sub Lease Area due to the additional ship traffic generated by the decommissioning activities. However, the frequency is still assessed as extremely unlikely (index 2). Moreover, the duration of the Proposed Works is limited.

Table 8.5: Risk assessment – First Campaign Scenario.

Hazard risk assessment – First Campaign Scenario									
Hazard	**Description**	**Consequence description**	**Mitigations**	**Most likely**			**Worst-case**		
				F	**C**	**Risk**	**F**	**C**	**Risk**
Vessel-to-vessel collision in transit	Vessel-vessel collision among ship traffic in the area. Vessel-vessel collision between third-party vessel and work vessel outside the work area(s).	Most likely: glancing or minor vessel-vessel impact. Worst-case: Serious injury, property damage or environmental damage due to frontal impact involving a larger vessel.	Work vessels comply with COLREGs when interacting with other vessels outside marked work area.	2	3	Broadly acceptable	1	4	Broadly acceptable
Powered collision with work vessel	Third-party vessel navigating within work area to collision with work vessel.	Most likely: glancing or minor vessel-vessel impact. Worst-case: Serious injury, property damage or environmental damage due to frontal impact.	Work area marked according to the Outline LMP. Existing marking of turbines.	1	3	Broadly acceptable	1	4	Broadly acceptable
Drifting collision with work vessel	Third-party vessel with blackout drifting into work area to collision with work vessel.	Most likely: glancing or minor vessel-vessel impact. Worst-case: Serious injury, property damage or environmental damage due to frontal impact.	Work area marked according to the Outline LMP. Existing marking of turbines.	1	3	Broadly acceptable	1	4	Broadly acceptable
Powered vessel-to-structure allision	Vessel diverting from route and impacting with one of the seven turbines	Most likely: low-impact glancing allision. Worst-case: small vessel	Work area marked according to the Outline LMP.	1	3	Broadly acceptable	1	4	Broadly acceptable

Hazard risk assessment – First Campaign Scenario									
Hazard	Description	Consequence description	Mitigations	Most likely			Worst-case		
				F	C	Risk	F	C	Risk
	before or after removal of tower.	capsizing or larger vessel impact with possible pollution and serious damage to turbine	Existing marking of turbines.						
Drifting vessel-to-structure allision	Vessel with engine failure drifting to impact with one of the seven turbines before or after removal of tower.	Most likely: low-impact glancing allision. Worst-case: small vessel capsizing or larger vessel impact with possible pollution and serious damage to turbine.	Work area marked according to the Outline LMP. Existing marking of turbines.	2	3	Broadly acceptable	1	4	Broadly acceptable

8.5.4 Transitional Scenario

8.5.4.1 The risk for the Transitional Scenario is assessed in **Table 8.6**.

8.5.4.2 The Transitional Scenario may persist for some time, and the marking of the work area according to the Outline LMP (**Volume 3, Appendix 3.7**) may be removed.

8.5.4.3 There is no decommissioning vessel activity in this scenario.

8.5.4.4 According to **Volume 3, Appendix 3.7**, existing marking of the turbines shall be reinstalled on the TPs left in this scenario in case of a gap with removal of work area between campaigns. This includes flashing yellow marine lanterns, double high visibility yellow band markings, and synthetic AIS AtoN on the northern and southernmost TP.

Table 8.6: Risk assessment – Transitional Scenario.

Hazard risk assessment – Transitional Scenario									
Hazard	Description	Consequence description	Mitigations	Most likely			Worst-case		
				F	C	Risk	F	C	Risk
Vessel-to-vessel collision in transit	Vessel-vessel collision among ship traffic in the area.	Most likely: glancing or minor vessel-vessel impact. Worst-case: Serious injury, property damage or environmental damage due to frontal impact involving a larger vessel.	None.	2	3	Broadly acceptable	1	4	Broadly acceptable
Powered vessel-to-structure allision	Vessel diverting from route and impacting with one of the TPs left on the bank.	Most likely: low-impact glancing allision. Worst-case: small vessel capsizing or larger vessel impact	Existing marking of turbines is transferred to the TPs left for this scenario.	1	3	Broadly acceptable	1	4	Broadly acceptable

Hazard risk assessment – Transitional Scenario									
Hazard	Description	Consequence description	Mitigations	Most likely			Worst-case		
				F	C	Risk	F	C	Risk
		with possible pollution and serious damage to turbine.							
Drifting vessel-to-structure allision	Vessel diverting from route and impacting with one of the TPs left on the bank.	Most likely: low-impact glancing allision. Worst-case: small vessel capsizing or larger vessel impact with possible pollution and serious damage to turbine.	Existing marking of turbines is transferred to the TPs left for this scenario.	2	3	Broadly acceptable	1	4	Broadly acceptable

8.5.5 Second Campaign Scenario

8.5.5.1 The risk for the Second Campaign Scenario is assessed in **Table 8.7**.

8.5.5.2 This scenario includes decommissioning of the MPs and cutting these down to a level below seabed as described in **Volume 2, Chapter 3**, as well as removal of scour protection and inter-array cables within the Sub Lease Area. This results in decommissioning vessels present in the area at risk of impact from third-party vessels entering the area.

8.5.5.3 This scenario includes additional work vessel traffic outside the Sub Lease Area for transport of components as well as slow-moving vessels during decommissioning of the offshore export cable.

Table 8.7: Risk assessment – Second Campaign Scenario.

Hazard risk assessment – Second Campaign Scenario									
Hazard	Description	Consequence description	Mitigations	Most likely			Worst-case		
				F	C	Risk	F	C	Risk
Vessel-to-vessel collision in transit	Vessel-vessel collision among ship traffic in the area. Vessel-vessel collision between third-party vessel and work vessel outside work area(s). Collisions with slow-moving vessels during removal of export cable.	Most likely: glancing or minor vessel-vessel (west of Sub Lease Area) impact with slow-moving vessels during export cable removal. Worst-case: Serious injury, property damage or environmental damage due to frontal impact involving a larger vessel.	Work vessels comply with COLREGs outside marked work area. According to the Outline LMP, a moving work area of 500 m from the cable decommissioning vessel shall be announced in NtM and a support vessel shall follow the cable decommissioning vessel.	2	3	Broadly acceptable	1	4	Broadly acceptable

Hazard risk assessment – Second Campaign Scenario									
Hazard	**Description**	**Consequence description**	**Mitigations**	**Most likely**			**Worst-case**		
				F	**C**	**Risk**	**F**	**C**	**Risk**
Powered collision with work vessel	Third-party vessel navigating within work area to collision with work vessel.	Most likely: glancing or minor vessel-vessel impact. Worst-case: Serious injury, property damage or environmental damage due to frontal impact.	Turbines on sand bank. Generally avoided by ship traffic. Work area marked according to the Outline LMP. Existing marking of TPs persists until the MPs are cut down below seabed.	1	3	Broadly acceptable	1	4	Broadly acceptable
Drifting collision with work vessel	Third-party vessel with blackout drifting into work area to collision with work vessel.	Most likely: glancing or minor vessel-vessel impact. Worst-case: Serious injury, property damage or environmental damage due to frontal impact.	Turbines on sand bank. Generally avoided by ship traffic. Work area marked according to the Outline LMP. Existing marking of TPs persists until the MPs are cut down below seabed.	1	3	Broadly acceptable	1	4	Broadly acceptable
Powered vessel-to-structure allision	Vessel diverting from route and impacting with one of TPs before removal.	Most likely: low-impact glancing allision. Worst-case: small vessel capsizing or larger vessel impact with possible pollution and serious damage to turbine.	Turbines on sand bank. Generally avoided by ship traffic. Work area marked according to the Outline LMP. Existing marking of TPs persists until the MPs are cut down below seabed.	1	3	Broadly acceptable	1	4	Broadly acceptable
Drifting vessel-to-	Vessel with engine failure drifting to	Most likely: low-impact glancing allision.	Turbines on sand bank. Generally	2	3	Broadly acceptable	1	4	Broadly acceptable

Hazard risk assessment – Second Campaign Scenario									
Hazard	Description	Consequence description	Mitigations	Most likely			Worst-case		
				F	C	Risk	F	C	Risk
structure allision	impact with one of the TPs before removal.	Worst-case: small vessel capsizing or larger vessel impact with possible pollution and serious damage to turbine.	avoided by ship traffic. Work area marked according to the Outline LMP. Existing marking of TPs persists until the MPs are cut down below seabed.						

8.5.6 Post-decommissioning Scenario

8.5.6.1 The risk for the Post-decommissioning Scenario is assessed in **Table 8.8**.

8.5.6.2 There are no decommissioning vessels, and the vessel traffic situation around the area is as seen today.

8.5.6.3 The risk of impact with the residual MPs is related to larger ships with a draught above 6 m. These ships will likely impact with the sand bank before impacting with the residual MPs located under the seabed.

8.5.6.4 In summary, the risk of impact between third-party vessel and the residual MPs is assessed to be lower than the present risk of allisions with the WTGs.

Table 8.8: Risk assessment – Post-decommissioning Scenario.

Hazard risk assessment – Post-decommissioning Scenario									
Hazard	Description	Consequence description	Mitigations	Most likely			Worst-case		
				F	C	Risk	F	C	Risk
Vessel-to-vessel collision in transit	Vessel-vessel collision among ship traffic in the area.	Most likely: glancing or minor vessel-vessel impact. Worst-case: Serious injury, property damage or environmental damage due to frontal impact involving a larger vessel.	None.	2	3	Broadly acceptable	1	4	Broadly acceptable
Powered vessel-to-structure allision	Vessel diverting from route, grounding on the sand bank and hitting remains of the cut-down MPs.	Most likely: Most vessels will have a draught impeding impact. Most likely, an impact will be slowed by the sand bank and result	The MPs are cut down to a level below the seabed, and to a level where only larger ships with a draught between 6-8	1	1	Broadly acceptable	1	3	Broadly acceptable

Hazard risk assessment – Post-decommissioning Scenario									
Hazard	Description	Consequence description	Mitigations	Most likely			Worst-case		
				F	C	Risk	F	C	Risk
		in negligible impact. Worst-case: vessels with larger draught may experience slightly larger (moderate) damage in case of grounding on the sand bank and impacting with an MP left under the seabed.	m will be able to impact. According to the Outline LMP, sections of MPs left in situ under the seabed will be charted in conjunction with MSO / UKHO.						
Drifting vessel-to-structure allision	Vessel with engine failure drifting to grounding on the sand bank and hitting remains of the cut-down MPs.	Most likely: Most vessels will have a draught impeding impact. Most likely, an impact will be slowed by the sand bank and result in negligible impact. Worst-case: vessels with larger draught may experience only minor damage in case of grounding on the sand bank and impacting with an MP left under the seabed.	The MPs are cut down to a level below the seabed, and to a level where only larger ships with a draught above 8 m and half of the vessels with draughts in the interval 6-8 m will be able to impact. According to the Outline LMP, sections of MPs left in situ under the seabed will be charted in conjunction with MSO / UKHO.	1	1	Broadly acceptable	1	2	Broadly acceptable

8.5.7 ABWP Phase II Construction Overlap Scenario

8.5.7.1 The ABWP Phase II construction overlap Scenario considers a situation where construction activities for ABWP Phase I and Phase II are undertaken concurrently. This results in an increased number of construction and support vessels within and around the Offshore Site, including vessels with restricted manoeuvrability, leading to a temporary increase in vessel traffic density and interaction potential compared to the individual scenarios.

8.5.7.2 The hazards considered are consistent with those defined in **Section 7** and include vessel-to-vessel collision in transit, collision with stationary work vessels (both powered and drifting), and vessel-to-structure allision. The overlapping activities may lead to a minor increase in the frequency (F) of vessel-to-vessel collisions and interactions with work vessels due to the higher traffic density and more complex operations.

8.5.7.3 However, this increase is limited and temporary, as both Phase I and Phase II activities are subject to established control measures, including marking and lighting of work areas, communication through Notices to Mariners, compliance with COLREGs, and coordinated vessel

operations. These measures ensure that navigational awareness remains high despite the increased activity level.

8.5.7.4 The increase in frequency (F) is considered minor and temporary, while consequences (C) remain unchanged. The resulting risk levels for all hazards are therefore consistent with those assessed for the First and Second Campaign Scenarios, and all risks are assessed to remain Broadly Acceptable.

8.5.8 Operational ABWP Phase II Post-decommissioning Scenario

8.5.8.1 The Operational ABWP Phase II post-decommissioning Scenario considers the cumulative situation where ABWP Phase I has been decommissioned and ABWP Phase II is fully operational. In this scenario, all above-seabed structures from Phase I have been removed, while residual monopiles remain below seabed level, co-existing with the operational infrastructure of Phase II.

8.5.8.2 The operational wind farm associated with Phase II is permanently marked and charted and therefore defines the navigational conditions in the area. Vessel traffic is expected to route around the Offshore Site in accordance with established practices, thereby reducing exposure within the Sub Lease Area. The hazards considered include vessel-to-vessel collision in transit and vessel-to-structure allision, both powered and drifting.

8.5.8.3 Operational ABWP Phase II is expected to further reinforce existing route separation around Arklow Bank and thereby reduce the likelihood of third-party vessels operating in close proximity to the Sub Lease Area. This is consistent with the structured traffic patterns described in **paragraphs 3.1.1.9–3.1.1.13**. Due to the removal of above-seabed structures and the presence of the operational wind farm, the probability of collision or allision with residual MPs is considered negligible. The risk is primarily related to the operational turbines of ABWP Phase II, and any additional risk associated with residual MPs below the seabed is considered to be encompassed within the assessed risk in the NRA for ABWP Phase II (Anatec Limited, 2026).

8.5.8.4 The assessed risk in the NRA for ABWP Phase II (Anatec Limited, 2026) is generally considered Broadly Acceptable.

9 Conclusion

9.1.1.1 This NRA documents a risk assessment scaled to the size of the Proposed Works Offshore. The main hazards are assessed in relation to the main decommissioning scenarios as well as for the Post-decommissioning Scenario where residual MPs are left *in situ* under the seabed.

9.1.1.2 The hazards considered cover:

- Vessel-to-vessel collisions involving third-party ship traffic, including the risk of collisions between third-party vessels and decommissioning vessels outside the work area(s);
- Powered vessel-to-work vessel collisions within the Sub Lease Area;
- Drifting vessel-to-work vessel collisions within the Sub Lease Area;
- Powered vessel allisions with WTGs / met mast, TPs, and residual MPs left under the seabed; and
- Drifting vessel allisions with WTGs / met mast, TPs, and residual MPs left under the seabed

9.1.1.3 All hazards related to the current Baseline Scenario (the situation as-is today) are assessed to be Broadly Acceptable. In general, hazard frequencies related to hazards within the Sub Lease Area are low due to the existing ship traffic patterns where vessels naturally avoid crossing over the shallow waters at the Arklow Bank sand bank.

9.1.1.4 Proposed Works Offshore are temporary and show slightly higher collision and allision frequencies compared to the current situation with met mast / WTGs present in the Sub Lease Area. The risk related to all hazards identified for the Proposed Works Offshore are assessed as Broadly Acceptable while considering the work area marking as described in the Outline LMP (**Volume 3, Appendix 3.7**).

9.1.1.5 Hazards related to an intermediate scenario with TPs left between campaigns are assessed to Broadly Acceptable while considering that current marking is moved to the TPs left for the intermediate scenario.

9.1.1.6 For the Post-decommissioning Scenario, the hazard concerning vessel-vessel collisions in the area is identical to current situation as it has no changes to the current ship traffic routes. The risk related to allision with the WTGs / met mast is lower than today, as only ships with larger draughts will be able to impact the residual MPs to a level below the seabed, if not colliding with the sand bank first. All hazards for the Post-decommissioning Scenario are hence also assessed to be Broadly Acceptable.

10 References

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