Environmental Impact Assessment Report

NISA

North Irish Sea Array

Volume 9: Appendices (Offshore)

Appendix 17.1

Navigational Risk Assessment

Statkraft

CIP Copenhagen Infrastructure Partners

GoBe APEM Group

ARUP

North Irish Sea Array Offshore Wind Farm Navigational Risk Assessment

Prepared by	Anatec Limited
Presented to	North Irish Sea Array Windfarm Ltd.
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00	21 August 2023	Initial Draft
01	28 February 2024	Updated following Project Design changes
02	07 May 2024	Final
03	14 May 2024	Final for Submission

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Glossary of Terms

Term	Definition
Allision	The act or process of a moving object striking a stationary object.
Array Area	Area that encompasses all planned surface infrastructure associated with the offshore development area at the submission of the EIA.
Automatic Identification System (AIS)	A system by which vessels automatically broadcast their identity, key statistics including location, destination, length, speed, and current status. Most commercial vessels and European Union (EU) fishing vessels over 15m length overall (LOA) are required to carry AIS.

Term	Definition
Baseline	The existing conditions as represented by the latest available survey and other data which is used as a benchmark for making comparisons to assess the impact of development.
Cable Burial Risk Assessment	Risk assessment undertaken post consent to determine suitable trench depths for cables, based on hazards such as anchor strike, fishing gear interaction and seabed mobility.
Collision	The act or process of one moving object striking another moving object.
Cumulative risk	Additional changes caused by a development in conjunction with other similar developments or as a combined risk of a set of developments.
Electromagnetic Field (EMF)	An electric and magnetic force field that surrounds a moving electrical charge.
Embedded mitigation measures	Measures to avoid or reduce risks to shipping and navigational safety that are directly incorporated into the preferred masterplan for a development.
Environmental Impact Assessment (EIA)	A process which identifies the environmental effects of a proposed development, both negative and positive.
European Union (EU)	The political and economic union of 27 European member states.
Export Cable Corridor (ECC)	Area within the offshore development area which encompasses all export cables.
Formal Safety Assessment (FSA)	A structured and systematic process for assessing the risks and costs (if applicable) associated with shipping activity.
Future case	The assessment of risk based on the predicted growth in future shipping densities and traffic types as well as foreseeable changes in the marine environment.
Geographical Information System (GIS)	A system that captures, stores, analyses, manages, and presents data linked to location. It links spatial information to a digital database.
Geophysical	The physical processes and properties of the Earth.
Impact	The changes resulting from an action.
Inshore Traffic Zone (ITZ)	An International Maritime Organization (IMO) routeing measure designed to protect local traffic including small craft.
International Maritime Organization (IMO) routeing measure	Predetermined shipping routes and areas established by the IMO to improve the safety of shipping at sea.
Maritime Area Consent (MAC) boundary	The boundary for surface infrastructure granted by the Minister for the Environment, Climate and Communications in December 2022.
Main commercial route	Defined transit route (mean position) of commercial vessels identified within the specified study area.
Marine aggregate	Marine dredged sand and/or gravel.
Marine Guidance Note (MGN)	A system of guidance notes issued by the United Kingdom (UK) Maritime and Coastguard Agency (MCA) which provide significant advice relating to the improvement of the safety of shipping at sea, and to prevent or minimise pollution from shipping.

Term	Definition
Navigational Risk Assessment (NRA)	A document which assesses the overall impact to shipping and navigation of a proposed Offshore Renewable Energy Installation (OREI) based on Formal Safety Assessment (FSA).
Offshore development area	The proposed development boundary below the HWM, consisting of the array area and the ECC.
Offshore Renewable Energy Installation (OREI)	In the context of offshore wind development, offshore Wind Turbine Generators (WTG) and the associated electrical infrastructure such as offshore substations.
Radio Detection and Ranging (Radar)	An object-detection system which uses radio waves to determine the range, altitude, direction, or speed of objects.
User	A recipient of a hazard.
Regular Operator	A commercial operator whose vessel(s) are observed to transit through a particular region on a regular basis.
Rockabill gap	The sea room between the Rockabill islands and the array area.
Scoping Report	A report defining the scope and level of detail of information to be provided in the Environmental Impact Assessment Report (EIAR) for a development.
Scoping Opinion	The written responses of the Stakeholders to the Scoping Report.
Significance of risk	A measure of the importance of a hazard, defined by the Formal Safety Assessment (FSA) methodology.
Stakeholder	A person or organisation with a specific interest (commercial, professional, or personal) in a particular issue.
Structure Exclusion Zone	An area within the array area which excludes all surface infrastructure (inclusive of blade overfly) and enables a 3 nautical miles (nm) separation between surface infrastructure and the Rockabill Islands to be maintained.
Study area	A buffer of 10nm applied around the array area, defined in order to provide local context to the analysis of risks by capturing the relevant routes and vessel traffic movements within and in proximity to the array area.
Traffic Separation Scheme (TSS)	A traffic management route system defined by the International Maritime Organization (IMO). The traffic lanes (or clearways) indicate the general direction of transit which apply of the vessels in that zone; vessels navigating within a TSS all sail in the same direction, or they cross the lane at an angle as close to 90 degrees (°) as possible.
The Developer	North Irish Sea Array (NISA) Windfarm Limited, a Joint Venture between Statkraft Ireland and Copenhagen Infrastructure Partners (CIP).
The proposed development	The onshore and offshore infrastructure associated with the North Irish Sea Array (NISA) Offshore Wind Farm development.
Unique vessel	An individual vessel identified on any particular calendar day, irrespective of how many tracks were recorded for that vessel on that day. This prevents vessels being over counted. Individual vessels are identified using their Maritime Mobile Service Identity (MMSI) which is unique to each vessel.

Term	Definition
Vessel Traffic Service (VTS)	A service implemented by a Competent Authority designed to improve the safety and efficiency of vessel traffic and to protect the environment. The service should have the capability to interact with the traffic and to respond to traffic situations developing in the VTS area.

Abbreviations Table

Abbreviation	Definition
AC	Alternating Current
AIS	Automatic Identification System
ALARP	As Low As Reasonably Practicable
ALB	All-Weather Lifeboat
ARPA	Automatic Radar Plotting Aid
ATBA	Area to Be Avoided
AtoN	Aid to Navigation
BBC	British Broadcasting Corporation
BWEA	British Wind Energy Association
CBA	Cost Benefit Analysis
CCTV	Closed Circuit Television
CD	Chart Datum
CHIRP	Confidential Human Factors Incident Reporting Programme
CIP	Copenhagen Infrastructure Partners
COLREGs	Convention on International Regulations for Preventing Collisions at Sea
CTV	Crew Transfer Vessel
DCCAE	Department of the Environment, Climate and Communications
DF	Direction Finding
DHLGH	Department of Housing, Local Government and Heritage
DoD	Department of Defence
DoT	Department of Transport
DSC	Digital Selective Calling
DWT	Dead Weight Tonnage
ECC	Export Cable Corridor
EEZ	Exclusive Economic Zone
EIA	Environmental Impact Assessment
EIAR	Environmental Impact Assessment Report
EIS	Environmental Impact Statement

Abbreviation	Definition
EMF	Electromagnetic Field
ERCoP	Emergency Response Cooperation Plan
ESRI	Environmental Systems Research Institute
ERP	Emergency Response Plan
ETRS89	European Terrestrial Reference System 1989
EU	European Union
FRB	Fast Rescue Boat
FSA	Formal Safety Assessment
GIS	Geographical Information System
GLA	General Lighthouse Authority
GMDSS	Global Maritime Distress and Safety System
GPS	Global Positioning System
GRP	Glass Reinforced Plastic
GT	Gross Tonnage
HAT	Highest Astronomical Tide
HMCG	His Majesty's Coastguard
HWM	High Water Mark
IAA	Irish Aviation Authority
IALA	International Association of Marine Aids to Navigation and Lighthouse Authorities
ILB	Inshore Lifeboat
IMCA	International Marine Contractors Association
IMO	International Maritime Organization
IRCG	Irish Coast Guard
ITZ	Inshore Traffic Zone
JUV	Jack-Up Vessel
kHz	Kilohertz
km	Kilometre
kt	Knot
LAT	Lowest Astronomical Tide
LiDAR	Light Detection and Ranging
LMP	Lighting and Marking Plan
LNG	Liquified Natural Gas
LOA	Length Overall
LoD	Limit of Deviation

Abbreviation	Definition
LoLo	Lift-On/ Lift-Off Cargo
LPG	Liquid Petroleum Gas
m	Metre
MAC	Maritime Area Consent
MAIB	Marine Accident Investigation Branch
MCA	Maritime and Coastguard Agency
MCIB	Marine Casualty Investigation Board
MEPC	Marine Environment Protection Committee
MGN	Marine Guidance Note
MRCC	Marine Rescue Coordination Centre
MSC	Maritime Safety Council
MSI	Maritime Safety Information
MSO	Marine Survey Office
N	North
NAVTEX	Navigational Telex
NIS	Natura Impact Statements
NISA	North Irish Sea Array
nm	Nautical Mile
nm^2	Square Nautical Mile
NMOC	National Maritime Operations Centre
NRA	Navigational Risk Assessment
NUC	Not Under Control
ODAS	Ocean Data Acquisition System
OREI	Offshore Renewable Energy Installation
OSP	Offshore Substation Platform
OSPAR	Convention for the Protection of the Marine Environment of the North-East Atlantic
PLL	Potential Loss of Life
Radar	Radio Detection and Ranging
RIB	Rigid Inflatable Boat
RNLI	Royal National Lifeboat Institution
RoPax	Roll-On/ Roll-Off Passenger
RoRo	Roll-On/ Roll-Off Cargo
RYA	Royal Yachting Association
SAR	Search and Rescue

Abbreviation	Definition
SLoO	Single Line of Orientation
SOLAS	International Convention for the Safety of Life at Sea
SONAR	Sound Navigation Ranging
SOV	Service Operation Vessel
TSS	Traffic Separation Scheme
UK	United Kingdom
UKHO	United Kingdom Hydrographic Office
US	United States
UTC	Coordinated Universal Time
VHF	Very High Frequency
VTS	Vessel Traffic Service
W	West
WGS84	World Geodetic System 1984
WTG	Wind Turbine Generator

1 Introduction

1.1 Background

1. Anatec was commissioned by North Irish Sea Array (NISA) Windfarm Limited, a Joint Venture between Statkraft Ireland and Copenhagen Infrastructure Partners (CIP), (hereafter 'the Developer') to undertake a Navigational Risk Assessment (NRA) for the proposed NISA Offshore Wind Farm development (hereafter 'the proposed development'), which consists of the array area and offshore export cable corridor (ECC) within the proposed development boundary below the High Water Mark (HWM), collectively referred to as the 'offshore development area' hereafter.

2. This NRA presents information on the proposed development relative to the existing and estimated future navigational activity and forms the technical appendix to **Volume 3, Chapter 17: Shipping and Navigation**.

1.2 Navigational Risk Assessment

3. An Environmental Impact Assessment (EIA) is a process which identifies the environmental effects of a project, both positive and negative, in accordance with the European Union (EU) Directive 2011/92/EU (as amended by Directive 2014/52/EU) and as transposed into Irish law. An important component of the EIA for offshore projects is the NRA, given impacts to shipping and navigation users must be properly considered and assessed.

4. The Marine Survey Office (MSO), Irish Lights and Irish Coast Guard (IRCG) have been consulted with respect to appropriate guidance for undertaking an NRA. At that time, comprehensive Irish guidance was not in place and therefore use of the United Kingdom's (UK) Marine Guidance Note (MGN) 654 (Maritime and Coastguard Agency (MCA), 2021) was agreed, with upcoming Irish guidance expected to closely resemble MGN 654. MGN 654 requires the use of the IMO FSA (IMO, 2018) and therefore the FSA has been used to assess impacts to shipping and navigation users.

5. The draft Irish guidance was published by the Department of Transport (DoT) for consultation in January 2024 consisting of the main document – Marine Navigational Safety & Emergency Response Risk of Offshore Renewable Energy Installations (OREI) (DoT, 2024) – and annexes covering the NRA methodology and Search and Rescue (SAR). The draft Irish guidance is based on the principles of MGN 654, with the introduction stating that the MCA gave permission for MGN 654 to be used when compiling the draft Irish guidance. Therefore, it remains appropriate to apply the principles of MGN 654 in the assessment of shipping and navigation.

6. In line with this approach, the NRA includes the following:

- Outline of methodology applied in the NRA;

- Summary of consultation undertaken with shipping and navigation stakeholders to date;
- Lessons learnt from previous offshore wind farm developments;
- Summary of the project description relevant to shipping and navigation;
- Baseline characterisation of the existing environment;
- Discussion of potential impacts on navigation, communication and position fixing equipment;
- Cumulative project screening overview;
- Future case vessel traffic characterisation;
- Collision and allision risk modelling; and
- Outline of embedded mitigation measures.

7. Potential hazards are considered for each phase of development as follows:

- Construction;
- Operational; and
- Decommissioning.

8. Assessment parameters assumed within the NRA for the proposed development are detailed in Section 7. Further details on the overarching project design and approach are provided in **Volume 2, Chapter 6: Description of the Proposed Development – Offshore**.

9. The shipping and navigation baseline and risk assessment has been undertaken based upon the information available and responses received at the time of preparation, including the assessment parameters assumed as discussed above.

2 Guidance and Legislation

10. This section sets out the primary and secondary guidance considered for the purposes of informing the NRA and **Volume 3, Chapter 17: Shipping and Navigation**.

2.1 Primary Guidance

11. At the time of preparing this NRA no specific guidance for shipping and navigation assessment in Ireland has been finalised by the MSO. However, as outlined in Section 1.2, draft guidance for undertaking an NRA has been published and closely resembles the UK MCA's MGN 654 (MCA, 2021) which is the primary guidance used for equivalent assessment for UK Offshore Renewable Energy Installations (OREIs). The MSO and Irish Lights (see Section 5) have previously indicated prior to the draft guidance being published that in the absence of this guidance, developers should apply the principles of MGN 654. Therefore, MGN 654 (MCA, 2021) has been used as the primary guidance document to inform the approach to shipping and navigation assessment, noting that, given the commonality between the draft guidance and MGN 654, it remains appropriate to apply the principles of MGN 654.

12. In particular, MGN 654 (MCA, 2021) requires the use of the International Maritime Organization (IMO) Formal Safety Assessment (FSA) (IMO, 2018). Therefore, the FSA has been used to assess hazards to shipping and navigation users, and the NRA applies the associated terminology. Further details are provided in Section 3.

2.2 Other Guidance

13. In addition to the primary guidance as per Section 2.1, other key guidance documents considered are as follows (noting this includes certain UK guidance where directed by MGN 654 as above):

- *Guidance on Environmental Impact Statements (EISs) and Natura Impact Statements (NISs) Preparation for Offshore Renewable Energy Projects* (Department of the Environment, Climate and Communications (DCCAE), 2017);
- *MGN 372 Amendment 1 (Merchant and Fishing) OREIs: Guidance to Mariners Operating in the Vicinity of UK OREIs* (MCA, 2022;
- *International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA) Recommendation O-139 and Guidance G1162 on the Marking of Man-Made Offshore Structures* (IALA, 2021); and
- *The Royal Yachting Association's (RYA's) Position on Offshore Renewable Energy Developments: Paper 1 (of 4) – Wind Energy* (RYA, 2019).

2.3 Lessons Learnt

14. There is considerable benefit to developers in the sharing of lessons learnt within the offshore renewables industry. The NRA includes general consideration for lessons learnt and expert opinion from previous offshore wind farm developments, with

particular focus on UK developments given the operational experience of offshore wind to date in the UK relative to the equivalent Irish industry.

3 Navigational Risk Assessment Methodology

3.1 Assumptions

15. The shipping and navigation baseline and risk assessment has been undertaken based upon the information (including information regarding the description of the proposed development) available and responses received at the time of preparation. Details of data limitations are provided in Section 5.4.

3.2 Formal Safety Assessment Methodology

16. A shipping and navigation user can only be affected by a hazard if there is a pathway through which the hazard can be transmitted between the source activity (cause) and the user. In cases where a user is exposed to a hazard, the overall severity of consequence to the user is determined. This process incorporates a degree of subjectivity. Therefore, the assessments presented herein for shipping and navigation users have considered various criteria including the following:

- Baseline data and assessment;
- Expert opinion;
- Outputs of the Hazard Workshop for the proposed development (Section 4.3);
- Level of stakeholder concern;
- Time and/ or distance of any deviation;
- Number of transits of specific vessel and/ or vessel type; and
- Lessons learnt from existing offshore developments.

17. It is noted that, with regards to commercial fishing vessels, the methodology and assessment has been applied to hazards considering commercial fishing vessels in transit. A separate methodology and assessment has been applied in **Volume 3, Chapter 16: Commercial Fisheries** to consider hazards on commercial fishing vessels directly related to commercial fishing activity (rather than fishing vessels in transit), whether safety related or of a commercial nature.

3.3 Formal Safety Assessment Process

18. The IMO FSA process (IMO, 2018) as amended by the IMO in 2018 under Maritime Safety Council (MSC) Marine Environment Protection Committee (MEPC).2/Circ. 2/Rev2 was applied within the Hazard Workshop by using the five steps outlined below, and subsequently within the matrices used to assess impacts in **Volume 3, Chapter 17: Shipping and Navigation**.

19. The FSA is a structured and systematic methodology based upon risk analysis and Cost Benefit Analysis (CBA) (if applicable) to reduce risks to As Low As Reasonably Practicable (ALARP). There are five basic steps within this process as illustrated in Figure 3.1 and summarised in the following list:

- Step 1 – identification of hazards (a list is produced of hazards prioritised by risk level specific to the problem under review);
- Step 2 – risk analysis (investigation of the causes and initiating events and consequences of the more important hazards identified in step 1);
- Step 3 – risk control options (identification of measures to control and reduce the identified hazards);
- Step 4 – CBA (identification and comparison of the benefits and costs associated with the risk control options identified in step 3); and
- Step 5 – recommendations for decision-making (defining of recommendations based upon the outputs of steps 1 to 4).

Figure 3.1 Flow Chart of the FSA Methodology

3.3.1 Hazard Workshop Methodology

20. A key tool used in the NRA process is the Hazard Workshop, which ensures that all hazards are identified, and corresponding risks qualified in discussion with stakeholders prior to assessment within **Volume 3, Chapter 17: Shipping and Navigation**. Table 3.1 and Table 3.2 identify how the severity of consequence and the frequency of occurrence respectively have been defined within the Hazard Log, which is the output of the Hazard Workshop.

Table 3.1 Severity of Consequence Ranking Definitions

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

Table 3.2 Frequency of Occurrence Ranking Definitions

Rank	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

21. The severity of consequence and frequency of occurrence are then considered collectively using a tolerability matrix to provide the significance of risk for each hazard. The tolerability matrix is presented in Table 3.3, with the significance of risk of a hazard defined as **Broadly Acceptable** (low risk), **Tolerable** (intermediate risk), or **Unacceptable** (high risk).

Table 3.3 Tolerability Matrix and Risk Rankings

Severity of Consequence	5					
	4					
	3					
	2					
	1					
		1	2	3	4	5
		Frequency of Occurrence				

	Unacceptable (high risk)
	Tolerable (intermediate risk)
	Broadly Acceptable (low risk)

22. Once identified, the significance of risk of a hazard is assessed with the inclusion of risk control measures (embedded mitigation measures) to ensure it is ALARP. Further risk control measures (additional mitigation measures) may be required to further mitigate a hazard in accordance with the ALARP principle. Unacceptable risks are not considered to be ALARP (significant). Broadly Acceptable or Tolerable with Mitigation risks are considered to be ALARP (not significant).

23. The Hazard Log has been used as evidence to support and refine the risk assessment contained within **Volume 3, Chapter 17: Shipping and Navigation**.

3.4 Methodology for Cumulative Risk Assessment

24. The hazards identified in the FSA are also assessed for cumulative risks with the inclusion of other projects. Given the international nature of shipping, other projects up to 50 nautical miles (nm) from the array area are considered and screened as part of the NRA process. The maximum distance within which other projects are considered is dependent upon the type of project:

- Offshore wind farms – up to 50nm from the array area and up to 5nm from ECC;
- Wave/ tidal developments – up to 25nm from the array area and up to 5nm from ECC;
- Subsea cables/ pipelines – up to 2nm from the array area and ECC; and
- Port/ harbour developments – up to 50nm from the array area and up to 5nm from the ECC.

25. Given the varying distances, types and statuses of other projects, a tiered approach to cumulative risk assessment has been applied, with screened in projects assigned to tiers depending on the following factors:

- Project status;
- Distance to the array area and ECC;
- Level of interaction with baseline traffic relevant to the proposed development;
- Level of concern raised during consultation; and
- Data confidence.

26. An aggregate of the criteria is used to determine the tier of each project. This differs from the standard EIA approach to tiering and assessment but ensures the NRA follows the FSA preferred by MGN 654.

27. The tiers are summarised in Table 3.4, with the level of assessment undertaken for each tier included.

28. Other projects meeting the assessment criteria are detailed in Section 15.

Table 3.4 Cumulative Risk Assessment Screening Summary

Tier	Development Status	Distance from Proposed Development	Interaction with Baseline Traffic	Consultation Responses	Data Confidence	Level of Cumulative Risk Assessment
N/A	Operational (or under construction for offshore wind farms and wave/tidal developments)	N/A	N/A	N/A	N/A	None – considered as part of the baseline assessment
1	Consented	*Offshore wind farms:* ▪ Up to 10nm from the array area; or ▪ Up to 2nm from the ECC. *Wave/ tidal developments:* ▪ Up to 10nm from the array area; or ▪ Up to 2nm from the ECC. *Subsea cables/ pipelines:* ▪ Up to 2nm from the array area; or ▪ Up to 2nm from the ECC. *Port/ harbour developments:* ▪ Up to 10nm from the array area; or ▪ Up to 2nm from the ECC.	▪ May impact a main commercial route passing within 1nm of the array area or ECC; and/or ▪ Interacts with traffic which may be directly displaced by the array area or ECC.	Raised as having a potential cumulative effect.	High	Detailed qualitative and quantitative assessment of displacement of main commercial vessels.

Tier	Development Status	Distance from Proposed Development	Interaction with Baseline Traffic	Consultation Responses	Data Confidence	Level of Cumulative Risk Assessment
2	Scoped	*Offshore wind farms:* ▪ Between 10 and 25nm from the array area; or ▪ Between 2 and 5nm from the ECC. *Wave /tidal developments:* ▪ Between 10 and 25nm from the array area; or ▪ Between 2 and 5nm from the ECC. *Port/ harbour developments:* ▪ Between 10 and 25nm from the array area; or ▪ Between 2 and 5nm from the ECC.	▪ May impact a main commercial route passing within 1nm of the array area or ECC; and/ or ▪ Interacts with traffic which may be directly displaced by the array area or ECC.	Raised as having a potential cumulative effect.	Medium	Detailed qualitative and quantitative assessment of displacement of main commercial vessels.
3	Pre scoping or early development	*Offshore wind farms:* ▪ Between 25 and 50nm from the array area; or ▪ Between 25 and 50nm from the array area.	▪ Does not impact a main commercial route passing within 1nm of the array area; and ▪ Does not interact with traffic which may be directly displaced by the array area.	No concerns raised.	Low	High level qualitative assumptions of displacement of main commercial vessels only.

3.5 Study Area

29. A buffer of a minimum of 10nm has been applied around the array area as the study area for shipping and navigation (hereafter the 'study area'). The array area has been used as The Developer has committed to not develop out with the development boundary itself and so all surface piercing infrastructure will be located within the array area (see Section 6.1.1). It is noted that the ECC is fully encompassed within the 10nm study area.

30. The radius of 10nm is standard for shipping and navigation assessment and has been used in the majority of publicly available offshore wind farm NRAs and within the shipping and navigation assessment in the Scoping Report undertaken for the proposed development.

31. This study area has been defined in order to provide local context to the analysis of risks by capturing the relevant routes, vessel traffic movements and historical incident data within and in proximity to the proposed development. Navigational features wholly or partially outside the study area are considered where appropriate e.g., IMO routeing measures.

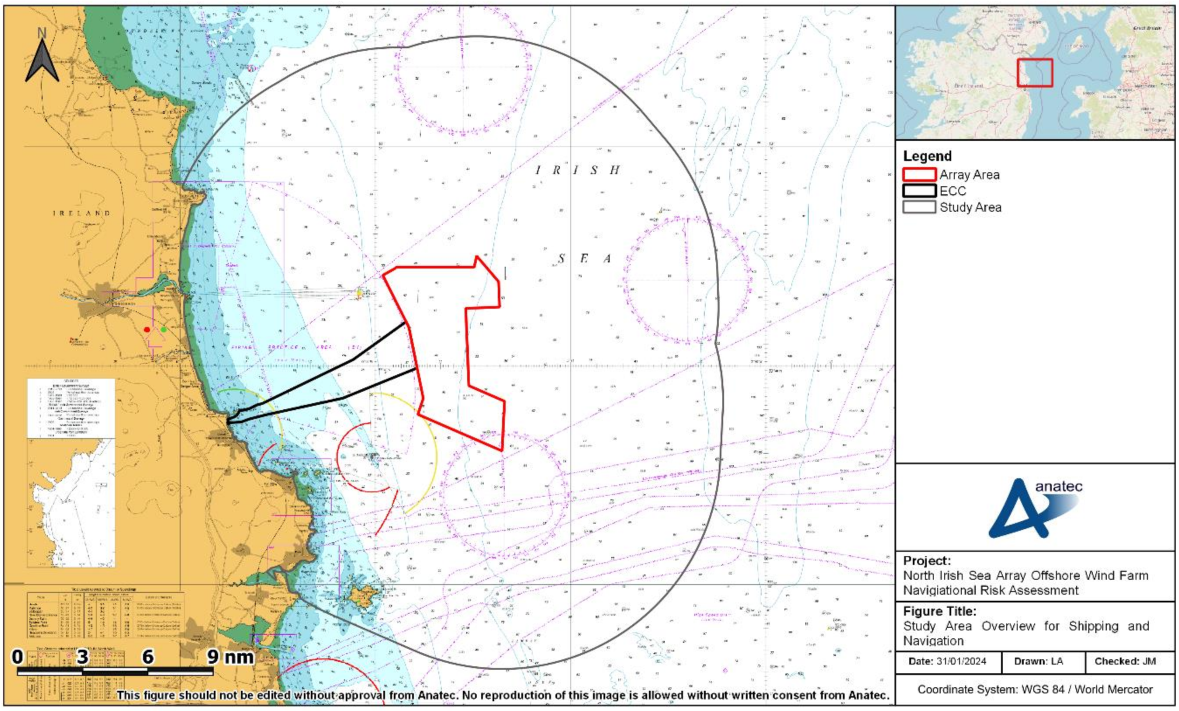

Figure 3.2 Overview of Study Area for Shipping and Navigation

4 Consultation

4.1 Key Stakeholder Meetings

32. Key shipping and navigation stakeholders have been consulted in the NRA process. The following stakeholders have been consulted via dedicated meetings (noting the Hazard Workshop is considered separately in Section 4.3):

- MSO;
- Irish Lights;
- The Irish Coast Guard (IRCG);
- Drogheda Port Company; and
- Dublin Port Company.

33. Table 4.1 summarises the key outputs of the consultation meetings that have been undertaken for the proposed development during the NRA process. References to where each point raised has been addressed are included and it has been noted where consultation related to the full Maritime Area Consent (MAC) boundary[1] rather than the reduced array area (see Section 6.1.1).

[1] The MAC is a State consent which allows the Developer the right to occupy a part of the maritime area and the ability to subsequently apply for development consent within that maritime area.

Table 4.1 Summary of Key Points Raised During Consultation

Stakeholder(s)	Date and Form of Correspondence	Summary Points	Response or Where Addressed within NRA
Dublin Port Company	30 June 2021 Scoping response	The Dublin Port Masterplan 2040 (Reviewed 2018) envisages the capacity of Dublin Port being increased to its ultimate level of 77 million gross tonnes (GT) per annum over the next 20 years.	The Dublin Port Masterplan 2040 (Dublin Port, 2018) is described in Section 15.4.2.
		The proposal must take account of Dublin Port's strategy objectives in continuing to develop port capacity to meet Ireland's growth needs by 2040.	The Dublin Port Masterplan 2040 has been screened in to the cumulative risk assessment (see Section 15.4.2).
		Supportive of the guidance documents listed in the Scoping Report as good practice.	The guidance documents considered at the scoping stage have been considered including MGN 654 (the most up-to-date equivalent guidance which superseded MGN 543 in 2021) and are outlined in Section 2.
		Should liaise with local fishery and leisure clubs to ensure an accurate description of the activity of non Automatic Identification System (AIS) vessels is attained.	Non AIS related vessel traffic based on the vessel traffic surveys (which includes Radar and visual observation data in addition to AIS) is described in Section 10. Additionally, fishing and recreational stakeholders were invited to attend the Hazard Workshop (see Section 4.3.1).
		The traffic separation scheme (TSS) at the northern entrance to Dublin Bay is of high relevance with regard to traffic density and direction.	IMO routeing measures and TSSs are described in Section 7.2 and main commercial routes, which include routes using IMO routeing measures, are detailed in Section 215.

Stakeholder(s)	Date and Form of Correspondence	Summary Points	Response or Where Addressed within NRA
		Sailing activities from clubs includes offshore racing for which consultation will be required.	Recreational vessel traffic based on the vessel traffic surveys (which includes Radar and visual observation data in addition to AIS) was assessed in Section 10. Additionally, recreational stakeholders including various local sailing clubs were invited to attend the Hazard Workshop (see Section 4.3.1).
		Recommend that cables are buried to withstand vessel anchors being dropped - the impact of an emergency anchoring manoeuvre by a vessel could be catastrophic to the cable.	The NRA has assessed baseline vessel draughts and anchored vessels (Section 10.3.2 and 10.2.6, respectively), with hazards associated with underkeel clearance assessed within Section 19. Cable burial will be informed by a Cable Burial Risk Assessment post consent which is included as an embedded mitigation measure (see Section 20).
		Dublin Port has recorded an increase in the number of cargo vessels anchoring off the north coast of Dublin due to the increase in shipping to and from the port.	Anchored vessels from the vessel traffic surveys and long-term vessel traffic data were assessed in Section 10.2.6 and Appendix E, respectively. Additionally, waiting behaviour associated with adverse weather and berth availability at Dublin Port has been identified (see Section 12.2).
		The array area [at scoping] does not represent a negative outcome for the vast majority of vessels to/ from Dublin Port but vessels carrying cargoes up and down the east coast to Drogheda and Dundalk will require alternative routeing.	Deviations due to the presence of the proposed development have been assessed in Section 16.5.2 noting that the array area represents 36% of the MAC boundary (see Section 6.1.1).
Irish Lights	1 July 2021 Scoping response	Content with broad approach to the Environmental Impact Assessment Report (EIAR) including for shipping and navigation.	Noted.

Stakeholder(s)	Date and Form of Correspondence	Summary Points	Response or Where Addressed within NRA
		Preference would be not to have any outlying Wind Turbine Generators (WTGs) within a group. The grouping of WTGs clearly defines edges and boundaries are clearer for marking and lighting, promoting situational awareness for the mariner.	Groups of WTGs in 'clusters' are no longer under consideration.
		Recommend that the limitation on safe navigation water for vessels due to proximity to Lambay Island is considered in the NRA. Passage of vessels to the west of Lambay Island is limited due to a number of shallow patches, meaning deeper draught vessels need to pass east and could be displaced or squeezed for sea room depending on the development of the south-west corner.	The array area represents 36% of the MAC boundary (see Section 6.1.1) resulting in the issue of proximity to Lambay Island being removed. The distance between the array area and Lambay Island is approximately 8.3nm.
		Agree with the use of MGN 654 as the primary guidance document to support the development of the NRA in conjunction with the overarching Department of the Environment, Climate and Communications (DCCAE) 2017 Guidance.	MGN 654 (the most up-to-date equivalent guidance which superseded MGN 543 in 2021) and the DCCAE guidance have been applied as per Section 2, noting that the draft guidance published by the DoT in January 2024 is based on the principles of MGN 654.
		Recommend inclusion of data sources other than AIS such as visual and Radio Detection and Ranging (Radar) traffic surveys to capture non AIS traffic and provide a more complete picture of traffic.	Dedicated vessel traffic surveys which formed the baseline data analysis includes Radar and visual observation data (in addition to AIS) as outlined in Section 5.2.
		Additional impacts which should be included are vessel to structure contact risk (particularly given the influence of tidal streams in the area) and reduction of under keel clearance as a result of sediment transport.	Hazards associated with vessel to structure allision risk and underkeel clearance are assessed in Section 19. Sediment displacement is considered in **Volume 3, Chapter 10: Marine Geology, Oceanography and Physical Processes**

Stakeholder(s)	Date and Form of Correspondence	Summary Points	Response or Where Addressed within NRA
		A key factor for cumulative effects will be the potential impact of other OREIs in the area which could affect routeing with potential safety of navigation considerations. Should be considered in the NRA.	Displacement of existing routes at a cumulative level is considered in Section 16.6 with consideration of other cumulative offshore wind farms given (see Section 15.1).
		Consider including the Royal National Lifeboat Institution (RNLI) as a consultee.	The RNLI were included as a stakeholder and attended the Hazard Workshop (see Section 4.3).
Irish Lights	8 July 2021 Post scoping consultation meeting	The pod layout concept may be challenging for vessel traffic as mariners prefer clean lines around obstacles. Outlying turbines disturb such clean lines and may present navigational risk and additional complications with navigational marking including how to mark outlying structures.	A layout for shipping and navigation is provided in Section 6.2.1. The pod design is no longer under consideration following refinement of the array area within the MAC boundary (see Section 6.1.1).
		Lambay Island is located only 2km from the proposed site boundary and this may affect vessel passage. It should be considered in the NRA.	The array area within the MAC boundary has since been refined (Section 6.1.1) and more available sea room to the south is present. There is now approximately 8.3nm between Lambay Island and the array area
		Agree that use of MGN 654 guidance is the preferred approach.	MGN 654 (the most up-to-date equivalent guidance which superseded MGN 543 in 2021) has been applied as per Section 2, noting that the draft guidance published by the DoT in January 2024 is based on the principles of MGN 654.
		The vessel traffic survey approach is in line with expectations noting there may be a significant volume of traffic not carrying AIS in the area.	Dedicated vessel traffic surveys which formed the baseline data analysis includes Radar and visual observation data (in addition to AIS) and is described in Section 10.
		As the decision maker for the topic of shipping and navigation, consultation with MSO is required.	The MSO are considered a key stakeholder and have been consulted throughout the NRA process (see Section 4).

Stakeholder(s)	Date and Form of Correspondence	Summary Points	Response or Where Addressed within NRA
		Consultation is suggested with ports (including Drogheda, Dundalk, and Bremore), the Department of Defence, RNLI, and UK stakeholders.	All stakeholders noted have been approached to engage with the proposed development and Drogheda/Bremore and the RNLI have been consulted including through the Hazard Workshop (see Section 4.3)
		Cumulative effects of other offshore wind farms should be considered in the overall routeing and impacts on vessel traffic.	Displacement of existing routes at a cumulative level is considered in Section 16.6 with consideration of other cumulative offshore wind farms given (see Section 15.1).
MSO	19 July 2021 Post scoping consultation meeting	The Bremore Port development may present some challenges to the proposed development.	Extensive consultation has been undertaken with the Drogheda Port Company as the developer of the proposed Bremore Port development (see Section 4). The Bremore Port development has been screened in to the cumulative risk assessment (see Section 15.4.1).
		Navigation channels between the pods will need to be assessed as part of the NRA.	The pod design is no longer under consideration following refinement of the array area within the MAC boundary (see Section 6.1.1).
		Agree that use of MGN 654 guidance is the preferred approach before any guidance is developed by MSO and Irish Lights for Ireland.	MGN 654 (the most up-to-date equivalent guidance which superseded MGN 543 in 2021) has been applied as per Section 2, noting that the draft guidance published by the DoT in January 2024 is based on the principles of MGN 654.
		There is an intention to develop guidance, but it is unlikely to be too different from MGN 654 and therefore should guidance be released prior to submission of the proposed development application no changes to that application would be expected.	MGN 654 (the most up-to-date equivalent guidance which superseded MGN 543 in 2021) has been applied as per Section 2, noting that the draft guidance published by the DoT in January 2024 is based on the principles of MGN 654..

Stakeholder(s)	Date and Form of Correspondence	Summary Points	Response or Where Addressed within NRA
		Any irregularities in commercial vessel traffic caused by Brexit appear to have now dissipated.	Acknowledged in Section 5.4.1.
		There is no expectation of any major issues with commercial vessel navigation occurring as a result of the project.	Noted.
MSO	4 November 2021 Email correspondence	No issues with the proposed dates for vessel traffic surveys or with it being land based.	The winter vessel traffic survey was undertaken between 2 and 16 December 2021 and the summer vessel traffic survey undertaken between 11 and 25 July 2022 (see Section 5.2). It is noted that the 2021 winter vessel traffic survey was superseded by the 2023 winter vessel traffic survey.
MSO	19 April 2023 Consultation meeting	Need to be aware of the military firing area and liaise with defence infrastructure.	Military Practice and Exercise Areas (PEXAs) are described in Section 7.8 and the DoD have been consulted as part of **Volume 3, Chapter 20: Infrastructure and Other Users**.
		Main concern on layout was obscuring the view of vessels i.e., could non alignment of turbines obscure vessels from each other	Limitations regarding visual identification of other third-party vessels is assessed in Section 19.1.1.2.
		MSO noted the sensitivity of wrecks in the area.	Charted wrecks are described in Section 7.9 with non-charted wrecks (which are not considered a danger to safe navigation) considered in **Volume 5, Chapter 18: Offshore Archaeology and Cultural Heritage.**
		May be an effect on the south-west corner of the array area from vessel traffic i.e., increased vessel numbers.	A detailed review of the potential users of the Rockabill gap has been undertaken in Appendix E. Where relevant, reference has been included within the risk assessment (see Section 19).

Stakeholder(s)	Date and Form of Correspondence	Summary Points	Response or Where Addressed within NRA
		Consider consultation with Drogheda Port.	Extensive consultation has been undertaken with the Drogheda Port Company (see Section 4).
		Consider consultation with vessel operators.	Regular Operators based on analysis of the vessel traffic survey data were contacted during the NRA process and invited to attend the Hazard Workshop (see Section 4.2 and Appendix C).
IRCG	21 April 2023 Consultation meeting	Compliance with UK guidance (MGN 654) is the best way forward. Irish guidance is still being worked on.	MGN 654 (the most up-to-date equivalent guidance which superseded MGN 543 in 2021) has been applied as per Section 2, noting that the draft guidance published by the DoT in January 2024 is based on the principles of MGN 654.
		Vessels drifting, colliding and alliding (and follow up actions) will need to be considered within the NRA	Collision and allision risk (including drifting allision) have been quantitatively modelled in Section 17 and scoped into the risk assessment (see Section 18).
		Consultation should be carried out with Irish Lights regarding lighting and marking.	Consultation has been undertaken with Irish Lights (see Section 4) and agreement with Irish Lights of lighting and marking of the array is included as an embedded mitigation measure (see Section 20).
Drogheda Port Company	27 April 2023 Consultation meeting	Bremore Port confirmed planning application for 2026 and noted that Bremore associated traffic will not be included in the vessel traffic surveys.	The Bremore Port development has been screened in to the cumulative risk assessment (see Section 15.4.1) rather than accounted for specifically through the future case scenarios given that little reliable quantitative information is available in relation to the volume, type, and size of related traffic (see Section 16.3.1).
		There are no emergency tow vessels on the east coast, and this should be factored into the assessment.	Acknowledged in the assessment of drifting allision risk in Section 19.7

Stakeholder(s)	Date and Form of Correspondence	Summary Points	Response or Where Addressed within NRA
		No concerns over the leading light associated with Drogheda which would remain unaltered.	Acknowledged in the assessment of port access in Section 19.5.
		Traffic running east-west through the site was a concern. Depending on the eastern port these may be 12-hour passages which rely upon specific tidal windows at both ends.	Displacement of existing routes and activity as well as reduced access to local ports is scoped into the risk assessment undertaken in Section 18, noting that a Structure Exclusion Zone within the array area has been committed to by the Developer to assist the continued passage of east-west traffic to the south of the array area. (see Section 6.1.1.1).
		With present spacing values (noting no safety zones/ exclusions) vessels would not transit through the array.	Acknowledged in the assessment of vessel displacement in Section 19.1.
		Drogheda noted 2021/ 2022 not representative due to COVID, Brexit and Ukraine. Estimated in normal circumstances Drogheda traffic volume is 15-20% greater	The effects of COVID-19 and Brexit have been acknowledged (see Section 5.4.1) and the potential for increases in vessel traffic volumes are considered in the establishment of the future case scenarios (see Section 16). It is noted that the 2021 winter vessel traffic data was superseded by 2023 winter vessel traffic data, thus COVID is not expected to have a large impact.
		Bremore is anticipated to have similar traffic volumes to Dublin when fully operational and around a third for the first phase	A detailed assessment of the proposed Bremore Port development has been carried out in Section 15.4.1 as well as cumulative effects of Bremore Port and the proposed development highlighted for each hazard outlined in Section 19.
Irish Lights	27 April 2023 Consultation meeting	Irish Lights noted international preference for array is for a standard geometrical shape from a mariners and navigational perspective, avoiding outlying turbines.	The layout for Project Option 1 is provided in Section 6.2.1, noting that for shipping and navigation this layout is deemed to have the greater severity of consequence.

Stakeholder(s)	Date and Form of Correspondence	Summary Points	Response or Where Addressed within NRA
		From a Search and Rescue (SAR) point of view inclusion of a line of orientation is preferable. From a mariner's perspective, a single geometrical shape would be beneficial for layout. Overall shape is the biggest priority.	The layout for Project Option 1 includes a Single Line of Orientation (SLoO) (see Section 6.2.1).
		Current guidance will stand and will discuss further with reference to mariners' ease of routeing, especially to the east side where there are no turbines.	Guidance and legislation has been applied and is outlined in Section 2.
		Irish Lights indicated that the leading lights for Drogheda are local aids to navigation and more a concern for Drogheda Port and the riverbed is what determines vessel approach with most vessels approaching from the south. Need Irish Lights permission to change aids to navigation.	The Drogheda Port Company have confirmed that there are no concerns with the leading lights (see previous 27 April 2023 entry).
		Noting north south traffic routes including out of Carlingford and between Belfast Lough and Dublin, a cardinal mark may be needed to move the traffic to the east.	Lighting and marking of the array in agreement with Irish Lights and in line with IALA G1162 is included as an embedded mitigation measure (see Section 20) with a separate Lighting and Marking Plan (LMP) provided in Appendix 17.3. The use of a permanent cardinal mark as indicated by Irish Lights is not included in the LMP but will be further discussed with Irish Lights as required, noting that precise buoyage locations will be directed by Irish Lights.
		Irish Lights have not yet had sight of the Irish guidance but confirmed application of IALA G1162 will continue.	IALA G1162 has been applied as per Section 2 and is considered as part of the embedded mitigation measure for lighting and marking (see Section 20).

Stakeholder(s)	Date and Form of Correspondence	Summary Points	Response or Where Addressed within NRA
Irish Chamber of Shipping	7 June 2023 Hazard Workshop	Certain vessels may not have up-to-date nautical charts and questioned the procedure for lighting during construction.	Agreement with Irish Lights of lighting and marking of the array is included as an embedded mitigation measure (see Section 20). Promulgation of information relating to the proposed development is included as an embedded mitigation measure (see Section 20).
		Queried whether the use of two discrete survey periods in winter and summer may miss adverse weather transits especially vessels close to the coast during period of strong winds from the west.	Adverse weather routeing is explored within Section 12 based on the vessel traffic survey data but also additional long-term data (see Appendix F).
		The biggest risk for which mitigation should be considered is the concentration of traffic that would be diverted around the extreme points of the array as well as regular routeing traffic north-south.	Higher vessel traffic concentration around the array is considered within the collision risk modelling (Section 17).
		Advise that the 2.8nm space between Rockabill and the array would be tight for commercial vessels passing each other on opposite routes, and that vessels over 10,000 DWT would transit offshore around the array area instead.	Rockabill sea room has been explored in Section 13 and a Structure Exclusion Zone within the array area to ensure a 3nm gap has been committed to by the Developer (see Section 6.1.1.1) following agreement with Drogheda Port Company. A route deviated offshore of the array area has been included in the collision risk modelling (see Section 17) to split larger vessels from smaller ones, assuming they would prefer to deviate around rather than navigate between the array area and Rockabill.
		Additional charted anchorage areas may be required if the cables are interfering with common anchoring locations.	The Developer will carry out a cable burial risk assessment post consent following detailed site investigation surveys to identify areas of concern.

Stakeholder(s)	Date and Form of Correspondence	Summary Points	Response or Where Addressed within NRA
CLdN	7 June 2023 Hazard Workshop	CLdN noted north-south waiting behaviour within the 28-day data, stating they usually occur in winter when waiting for berth availability at Dublin Port. And noted that although there are no specific routes for these vessels to take while waiting, introduction of the array area reduces the north-south space available and is not ideal for larger vessels to turn, especially in bad weather.	Adverse weather routeing is considered within Section 12, and vessel waiting behaviour is explored with regards to the array area.
Warrenpoint Harbour Authority	7 June 2023 Hazard Workshop	It is unclear where larger vessels would wait/anchor whilst wating to berth. Irish Chamber of Shipping added that Drogheda Port would be sensitive due to the bank upon entrance and vessels regularly drift around waiting to enter.	Vessel waiting behaviour and vessels at anchor are considered in Sections 10 and 12.
Drogheda Port Company	28 June 2023 Consultation meeting	Roll-On/ Roll-Off Passenger (RoPax) activity is planned for phase one of Bremore Port, and that it is likely to accommodate larger vessels than what is currently seen at Drogheda Port, with vessels up to 300m	Bremore Port development has been considered within future shipping scenarios (see Section 16)
		Preference of 3nm between Rockabill and the array area, to allow a safe passing distance of 1nm between project structure and other hazards.	A structure exclusion zone has been agreed by the Developer, increasing overall sea room to 3nm (see Section 13)
Drogheda Port Company	4 August 2023 Consultation meeting/ Email correspondence	Happy with of the Structure Exclusion Zone and confirmed that their advice of having a mile either side and a mile in the middle has been taken on by the Developer and noted that smaller vessels within the area can still go closer to land if they wish.	The Structure Exclusion Zone is detailed in Section 6.1.1.1 and supported by a review of the Rockabill gap in Appendix E.

Stakeholder(s)	Date and Form of Correspondence	Summary Points	Response or Where Addressed within NRA
IRCG	12 December 2023 Consultation meeting	IRCG noted that technical equipment such as VHF should be in place on the offshore substations and that the project would be expected to have adequate self-help capabilities.	The Emergency Response Plan (ERP) will consider necessary emergency response equipment.
Marine Survey Office (MSO)	12 December 2023 Consultation meeting	MSO had no concerns over the layout approach.	Noted.
Irish Lights	13 December 2023 Consultation meeting	Irish Lights noted from fisheries that vessels will not transit within the array so may well use the gap between Rockabill and the array area.	The potential for small craft movements in proximity to the Rockabill gap is considered in in Appendix E.
		Irish Lights queried if SPS and IPS requirements had been considered and requested indicative SPS and IPS locations.	Agreement with Irish Lights of lighting and marking of the array is included as an embedded mitigation measure (see Section 20).
IRCG	25 January 2024 Email correspondence	IRCG cannot provide comment on the array layout until the Irish OREI guidance is published, and suggested to use MGN 654 (2021) as guidance.	MGN 654 (the most up-to-date equivalent guidance which superseded MGN 543 in 2021) has been applied as per Section 2, noting that the draft guidance published by the DoT in January 2024 is based on the principles of MGN 654.

4.2 Regular Operator Outreach

34. As well as consulting with the organisations outlined above, 14 Regular Operators, identified from the vessel traffic survey data studied (see Section 10), were subsequently contacted and were provided with an overview of the Proposed Development and offered the opportunity to provide comment (the full Regular Operator letter is presented in Appendix C). The full list of Regular Operators identified is provided below:

- Amasus Shipping;
- Arklow Shipping;
- ASL Shipping Line;
- Boskalis;
- BRISE;
- CLdN;
- Dublin Bay Cruises;
- EemsWerken;
- Irish Ferries;
- P&O Ferries;
- Seatruck Ferries;
- Stena Line;
- Wessels Reederei; and
- Wilson ASA.

35. CLdN, Dublin Bay Cruises, Irish Ferries, and Seatruck Ferries all responded stating they had no concerns regarding their operations and the proposed development during the Regular Operator outreach.

4.3 Hazard Workshop

36. A key element of the consultation phase was the Hazard Workshop, a meeting of local and national marine stakeholders to identify and discuss potential shipping and navigation hazards. Using the information gathered from the Hazard Workshop, a Hazard Log was produced for use as input into the risk assessment undertaken in **Volume 3, Chapter 17: Shipping and Navigation**. This ensured that expert opinion and local knowledge was incorporated into the risk assessment and that the Hazard Log was site-specific.

4.3.1 Hazard Workshop Attendance

37. The Hazard Workshop was held virtually on Microsoft Teams on 7 June 2023. Organisations were invited to attend representing various sectors relevant to shipping and navigation including regulators, commercial bodies, port operators, recreational clubs and bodies, and SAR responders.

38. The Hazard Workshop was attended by:

- Irish Chamber of Shipping;
- Irish Lights;
- Drogheda Port Company;
- Warrenpoint Harbour Authority;
- Royal National Lifeboat Institution (RNLI);
- CLdN; and
- Dublin Bay Sailing Club.

4.3.2 Hazard Workshop Process and Log

39. During the Hazard Workshop, key maritime hazards associated with the construction, operational and decommissioning of the proposed development were identified and discussed. Where appropriate, hazards were considered by vessel type to ensure risk control options could be identified on a type-specific basis.

40. Following the Hazard Workshop, the risks associated with the identified hazards were ranked in the Hazard Log based upon the discussions during the workshop, with appropriate embedded mitigation measures identified, including any additional measures required to reduce the risks to ALARP. The Hazard Log was then provided to the Hazard Workshop attendees for comment and their feedback incorporated into the NRA. The Hazard Log is provided in full in Appendix D.

4.3.3 Stakeholder Update Regarding the Structure Exclusion Zone

41. A Structure Exclusion Zone was introduced following feedback received in the Hazard Workshop (see Section 6.1.1.1) and incorporated as an embedded mitigation measure in the Hazard Log provided to attendees for comment.

5 Data Sources

42. This section summarises the main data sources used to characterise the shipping and navigation baseline relative to the proposed development.

5.1 Summary of Data Sources

43. The main site-specific data sources used to characterise the shipping and navigation baseline relative to the proposed development are outlined in Table 5.1.

Table 5.1 Data Sources Used to Inform Shipping and Navigation Baseline

Data	Source(s)	Purpose
Vessel traffic survey data	Winter 2023 shore based traffic survey data consisting of AIS, Radar, and visual observations for the study area (14 days, 4 to 18 December 2023) recorded from the survey site in Skerries.	Characterising vessel traffic movements within and in proximity to the array area and ECC.
	Summer 2022 shore based traffic survey data consisting of AIS, Radar, and visual observations for the study area (14 days, 11 to 25 July 2022) recorded from the survey site in Skerries.	
	AIS data for the study area (12 months 2022 (hereafter the 'long-term vessel traffic data'), alongside 14 days of winter 2021 AIS data to provide data validation.	Validation of the vessel traffic surveys and characterising seasonal variations.
	Winter 2021 shore based traffic survey data consisting of AIS, Radar, and visual observations for the study area (14 days, 2 to 16 December 2021) recorded from the survey site in Skerries.	Validation of the winter 2023 vessel traffic survey.
Maritime incidents	RNLI incident data for the study area (2012 to 2021).	Review of maritime incidents within and in proximity to the array area and ECC.
	Marine Casualty Investigation Board (MCIB) database for the region (1992 to 2022).	
Other navigational features	Admiralty Charts 44-0, 1121-0, 1411-0, 1415-0, and 1431-0 (United Kingdom Hydrographic Office (UKHO), 2022/ 23).	Characterising other navigational features in proximity to the array area and ECC.
	Admiralty Sailing Directions Irish Coast Pilot NP40 (UKHO, 2019)	
Weather	Data collected from Light Detection and Ranging (LiDAR) buoys at two locations within the proposed development's Maritime Area Consent (MAC) boundary	Characterising weather conditions in proximity to the array area for use as input to the collision and allision risk modelling.

Data	Source(s)	Purpose
	over a three-year period between October 2019 and September 2022.	
	Visibility data provided in Admiralty Sailing Directions Irish Coast Pilot NP40 (UKHO, 2019).	
	Tidal data provided by Admiralty Chart 44-0 and 1141-0 (UKHO, 2022/ 23).	

5.2 Vessel Traffic Surveys

44. The site-specific vessel traffic surveys for the proposed development were undertaken from Skerries on the east coast of Ireland. The data was collected using a combination of Automatic Identification System (AIS), Radio Detection and Ranging (Radar), and visual observations. The survey site was estimated to be approximately 5 to 10 metres (m) above sea level although Radar activity and visual observations very close to the coastline south of Skerries may have been slightly obscured by rocky terrain; however, this is unlikely to have had any notable effect on coverage of the array area.

45. Several visual observations were recorded which had no corresponding AIS or Radar tracks. These sighting are included in the analysis where relevant and the full visual observations log is provided in Appendix G.

46. Several vessel tracks recorded during the survey period were classified as temporary (non-routine), such as the tracks from an offshore support vessel involved in cable survey works during the winter 2023 survey period to the south of the array area and several vessels involved in geophysical surveys associated with the Lir and Clogher Head Offshore Wind Farms during the summer survey period. These vessels have therefore been excluded from the analysis. Temporary traffic that was removed for the combined latest 28-days of seasonal vessel traffic data equated to approximately 5% of all data. For the latest 28-day data that was included in the vessel traffic analysis, 85% of tracks were recorded via AIS and the other 15% via Radar.

47. The primary dataset is assessed in full in Section 10.

5.3 Long-Term Vessel Traffic Data

48. The long-term vessel traffic data consists of AIS covering 12 months in 2022. Taking into account the distance offshore of the proposed development, the long-term AIS vessel traffic data is considered to be comprehensive for the study area. The assessment of this dataset allowed for seasonal variations in vessel traffic within the area to be captured.

49. The dataset is assessed in full in Appendix E.

5.4 Data Limitations

5.4.1 Automatic Identification System Data

50. The carriage of AIS is required on board all vessels of greater than 300 Gross Tonnage (GT) engaged on international voyages, cargo vessels of more than 500GT not engaged on international voyages, passenger vessels irrespective of size built on or after 1 July 2002, and fishing vessels over 15m length overall (LOA).

51. Therefore, for the vessel traffic surveys larger vessels were recorded on AIS, while smaller vessels without AIS installed (including fishing vessels under 15m LOA and recreational craft) were recorded, where possible, on the automatic Radar plotting aid (ARPA). A proportion of smaller vessels also carry AIS voluntarily, typically utilising a Class B AIS device which are smaller and require less power compared to Class A AIS devices.

52. Throughout the winter 2023 survey, 83% of vessel tracks were recorded via AIS with the remaining 17% recorded via Radar. Throughout the summer 2022 survey, approximately 90% of vessel tracks were recorded via AIS with the remaining 10% recorded via Radar.

53. The COVID pandemic was observed to have a tangible effect on worldwide vessel traffic volumes and behaviours during 2020. On this basis, there may still be effects of COVID present within the 2021 vessel traffic survey dataset and this was highlighted by the Drogheda Port Company during consultation (see Section 4). Brexit may also have had an effect on traffic volumes and behaviours in the area. However, the MSO have confirmed during consultation that the approach to vessel traffic survey data collection is suitable. Furthermore, the addition of the 2023 winter survey data ensures there is not over-reliance on the 2021 winter survey data.

54. The long-term vessel traffic data – an AIS only dataset – assumes that vessels under a legal obligation to broadcast via AIS will do so. Both the long-term vessel traffic data and the AIS component of the vessel traffic survey data assume that the details broadcast via AIS is accurate (such as vessel type and dimensions) unless there is clear evidence to the contrary.

5.4.2 Historical Incident Data

55. The RNLI incident data cannot be considered comprehensive of all incidents in the study area. Although hoaxes and false alarms are excluded, any incident to which an RNLI resource was not mobilised has not been accounted for in this dataset.

56. Similarly, the Marine Casualty Investigation Board (MCIB) incident data only accounts for completed investigations. Any incident that has not been investigated or whose

investigation was ongoing at the time of writing was not accounted for. In addition, precise location data is not available for all incidents within the dataset.

5.4.3 United Kingdom Hydrographic Office Admiralty Charts

57. The United Kingdom Hydrographic Office (UKHO) admiralty charts are updated periodically and therefore the information shown may not reflect the real time features within the region with total accuracy. However, during consultation, input has been sought from relevant stakeholders regarding the navigational features baseline.

6 Project Description Relevant to Shipping and Navigation

58. The NRA reflects the project description which is detailed in full in **Volume 2, Chapter 6: Description of the Proposed Development - Offshore**. The following subsections outline the proposed development boundary for which any shipping and navigation hazards are assessed.

6.1 Proposed Development

6.1.1 Array Area

59. The array area is located within the Irish Sea and at its closest point, from the south-west corner, is approximately 6.1nm from Skerries on the coast of County Dublin. The entire array area covers an area of 26 square nautical miles (nm^2) with charted water depths between 30m and 60m below Chart Datum (CD). The array area spans 8.9nm north-south and 5.1nm east-west at its widest point.

60. The key coordinates defining the array area are illustrated in Figure 6.1 and provided in Table 6.1 using longitude and latitude values under World Geodetic System 1984 (WGS84).

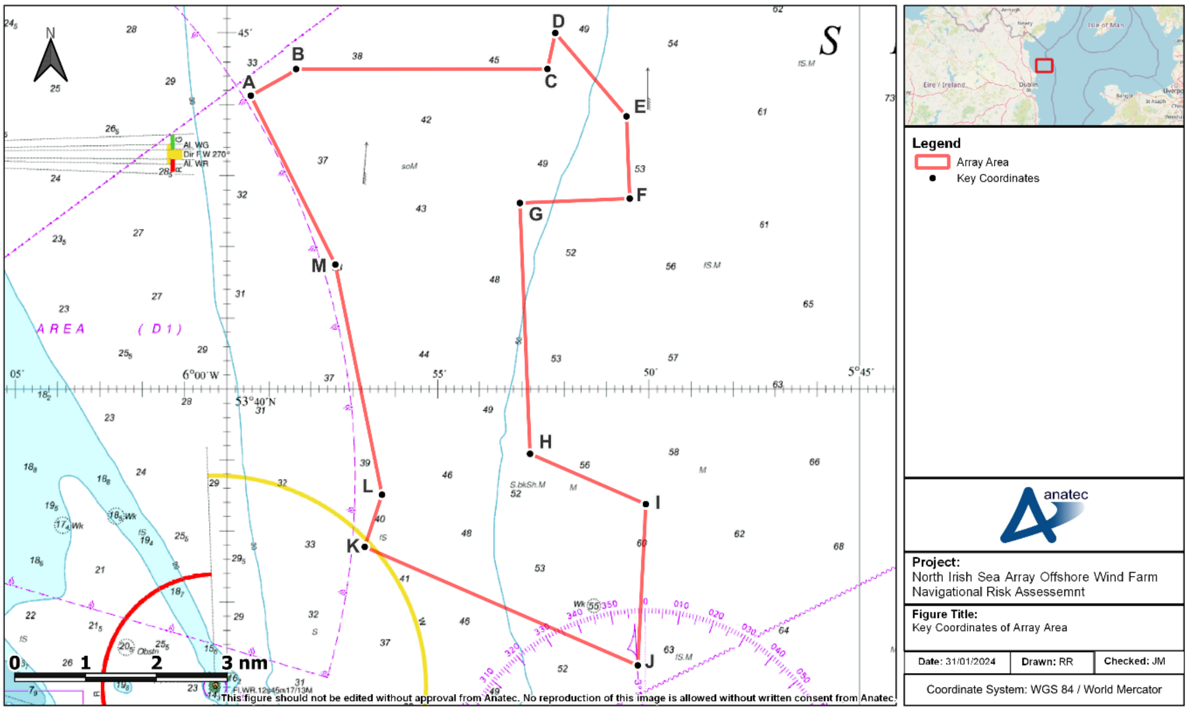

Figure 6.1 Key Coordinates of Array Area

Table 6.1 Key Coordinates of Array Area

Point	Latitude	Longitude	Point	Latitude	Longitude
A	53° 44' 07.09" North (N)	005° 59' 25.32" West (W)	H	53° 39' 04.93" N	005° 52' 48.34" W
B	53° 44' 29.45" N	005° 58' 21.00" W	I	53° 38' 22.39" N	005° 50' 03.80" W
C	53° 44' 29.52" N	005° 52' 23.60" W	J	53° 36' 06.17" N	005° 50' 15.27" W
D	53° 44' 59.84" N	005° 52' 12.50" W	K	53° 37' 46.32" N	005° 56' 43.36" W
E	53° 43' 49.60" N	005° 50' 31.32" W	L	53° 38' 30.37" N	005° 56' 18.83" W
F	53° 42' 40.33" N	005° 50' 26.65" W	M	53° 41' 44.66" N	005° 57' 25.16" W
G	53° 42' 36.59" N	005° 53' 02.80" W			

61. The array area represents 36% of the area covered by the full MAC boundary. This array area will contain all surface infrastructure (see Section 6.2) and has been defined from the MAC boundary on the basis of the results of geophysical surveys and early feedback from stakeholders across various EIA topics, including shipping and navigation. For shipping and navigation, this change eliminates concerns relating to the squeeze of vessel traffic in proximity to Lambay Island and reduces the extent of vessel displacement around the array.

6.1.1.1 Structure Exclusion Zone

62. During consultation (see Section 13), it was raised by multiple stakeholders that the distance between the array area and the Rockabill islands could potentially create difficulty for vessels transiting through the area, especially when routes may need deviated to this area due to the presence of the proposed development (see Section 11.2 for pre-wind farm routeing).

63. The Drogheda Port Company raised concerns that the development of Bremore Port (Section 16.3.1) will also increase traffic volumes in the area as well as attracting larger LOA vessels. The Drogheda Port Company requested a 3nm gap which would allow 1nm of sea room for vessels to transit with 1nm either side, from both Rockabill and the array area. The Developer has undertaken a review of the gap to inform the risk assessment (see Appendix E) whilst also accepting the Drogheda Port Company's request and committed to a 3nm gap. Subsequently, a Structures Exclusion Zone has been established within the array area to ensure this distance is maintained and is presented in Figure 6.2.

64. This Structure Exclusion Zone is a commitment from the Developer (and is captured as an embedded mitigation measure in Section 20). Although still part of the array area, no surface piercing infrastructure will be located within the area inclusive of blade overfly. Cables may be installed in the area but will be dependent on final layout and will be subject to the Cable Burial Risk Assessment post consent.

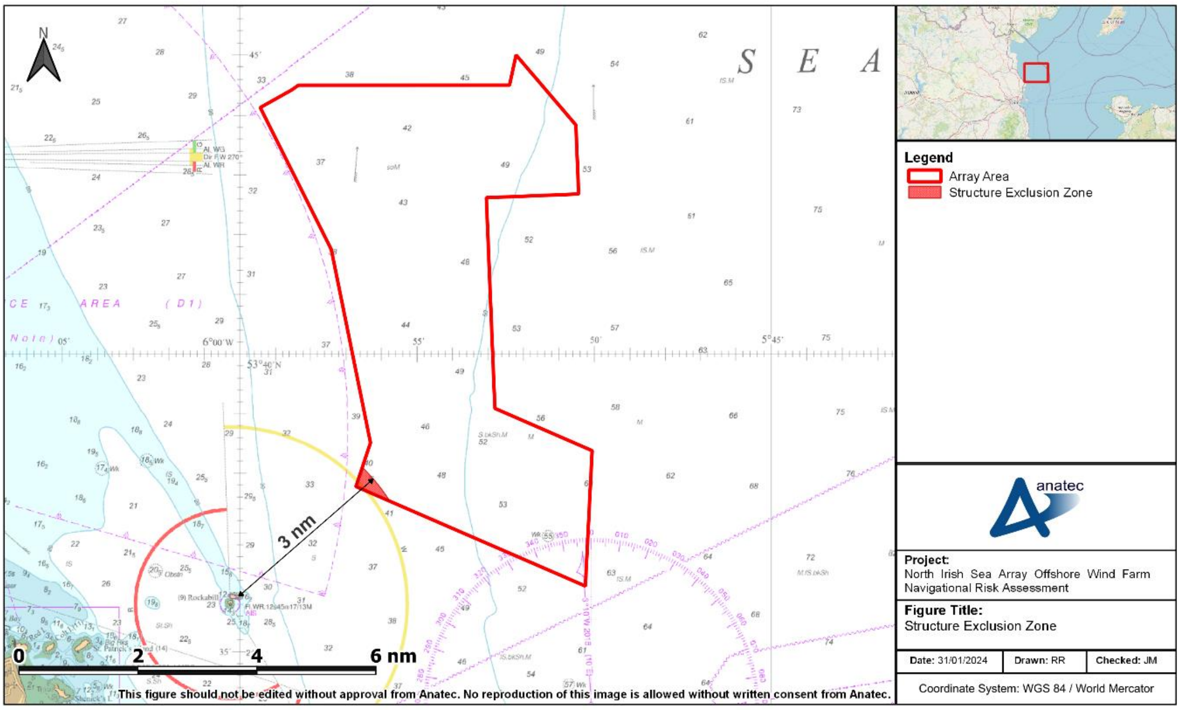

Figure 6.2 Array Area Structure Exclusion Zone

6.1.2 Offshore Export Cable Corridor

65. The ECC is presented in Figure 6.3. The total area covered by the ECC is approximately 10.7nm^2 with charted water depths ranging between zero (at landfall nearshore) and 39m below CD. The ECC makes landfall immediately south of Braymore Point and Cardy Rocks, the most northernly coastal point of County Dublin.

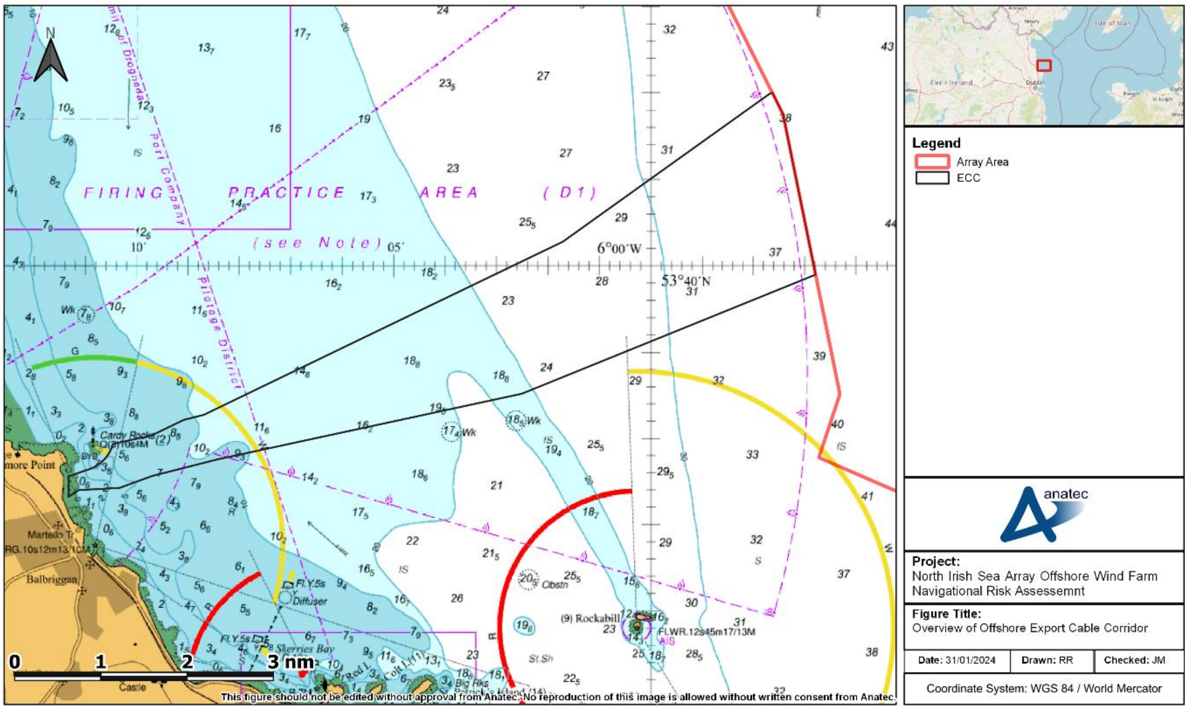

Figure 6.3 Overview of ECC

6.2 Surface Infrastructure

6.2.1 Array Layouts

66. To enable flexibility, the Developer is seeking consent for two project options, only one of which will be progressed to construction. This includes:

- **Project Option 1**: The smallest WTG option comprising of 49 WTGs with a rotor diameter of 250m; and
- **Project Option 2**: The largest WTG option comprising of 35 WTGs with a rotor diameter of 276m.

67. Both project options and associated components are described in detail within **Volume 2, Chapter 6: Description of the Proposed Development – Offshore**. Both project options will conform to the Structure Exclusion Zone at the south-west of the array area (Section 6.1.1.1). The Developer is limiting the request for flexibility to the two defined project options above.

68. For the purposes of the NRA, the project option with the greatest significance of risk from a shipping and navigation perspective is deemed to be Project Option 1, which is shown in Figure 6.4. This is due to Project Option 1 including the greatest number of structures, thus maximising vessel exposure to allision risk. Within this NRA, only the parameters for Project Option 1 are shown and applied given this represents the option with the greatest significance of risk from a shipping and navigation perspective. The significance of risk for hazards associated with Project Option 2 are

anticipated to be no greater than that assessed for Project Option 1. **Volume 3, Chapter 17: Shipping and Navigation** provides assessment for both project options.

69. The minimum spacing between structures (measured centre-to-centre) is 910m (subject to a 500m Limit of Deviation (LoD)) and the layout includes a SLoO. The layout is considered to be compliant with the requirements of MGN 654 (MCA, 2021).

70. As described in Section 1.2, the proposed development (including the layout options) have been subject to a comprehensive NRA as required by the methodology agreed with shipping regulators, notably the MSO, prior to the NRA process commencing. No specific national guidance on NRA currently exists, but the assessment undertaken has taken account of international best practice and precedent in respect of offshore wind developments in the UK. The Developer is aware that draft specific national guidance is currently under review and that engagement with the IRCG, if required, upon publication of the final guidance documents (which is not expected to be published until later this year) may result in the requirement for a safety justification for the array layout to be undertaken. This would be specifically for the IRCG's own access assessment and to ensure requirements within the guidance are complied with.

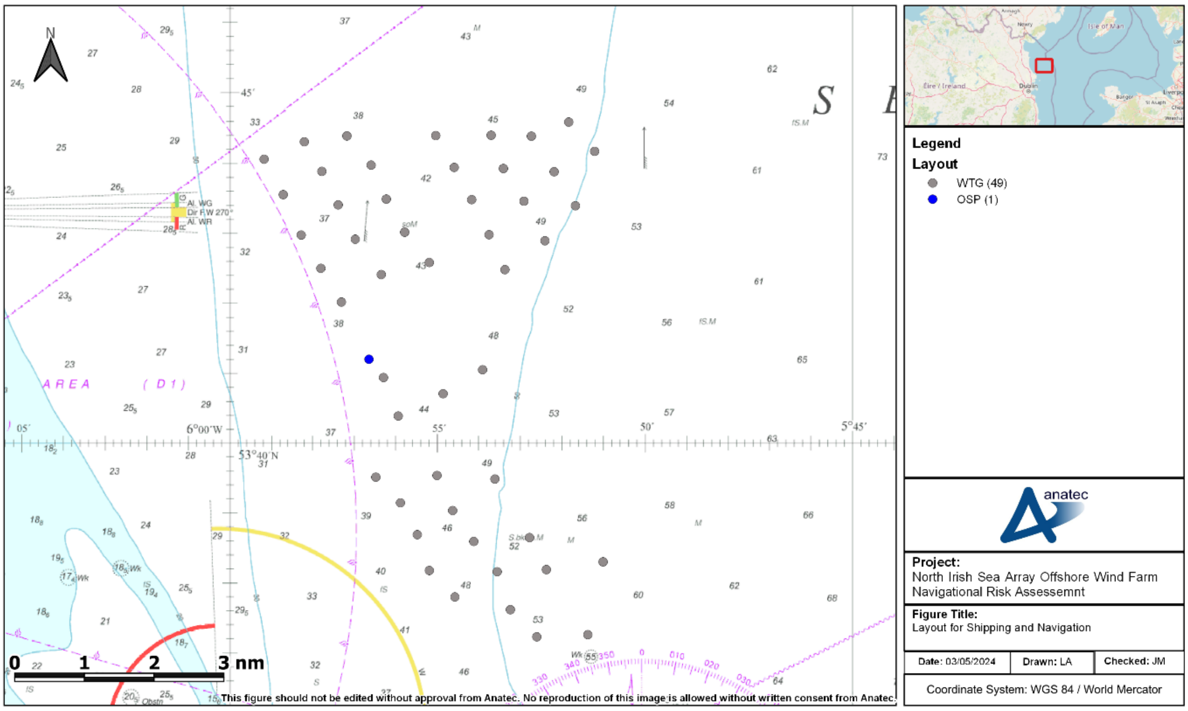

Figure 6.4 Layout for Shipping and Navigation (Project Option 1)

6.2.2 Wind Turbine Generators (WTGs)

71. The WTGs within the layout each have a maximum rotor diameter of 250m and maximum upper blade tip height (above Lowest Astronomical Tide (LAT)) of 290m.

72. Key parameters for the WTGs associated with Project Option 1 are given in Table 6.2.

Table 6.2 Key Parameters for Shipping and Navigation – WTGs

Parameter	Project Option 1
Maximum number of WTGs	49
Foundation type	Monopile
Dimensions at sea surface	12.5m
Maximum blade tip height (above LAT)	290m
Minimum air gap (above HWM)	40m (35m for Project Option 2)
Maximum rotor diameter	250m
Minimum spacing from other structures (excluding LoD)	910m

6.2.3 Offshore Substations

73. The OSP structure will be installed on either jacket foundations with pin piles or on one/ two monopiles but in both cases will have maximum topside dimensions of 45×45m and a minimum spacing (excluding LoD) of 910m from other structures.

6.3 Subsea Cables

74. Two types of cables will be installed and can be categorised as inter-array cables and export cables. Each of these is summarised in the following subsections.

6.3.1.1 Inter-array Cables

75. The array cables will connect individual WTGs to the OSP. A total of 60nm of inter-array cables will be required. All inter-array cables will be installed within the array area of the proposed development. Five potential cable or pipeline crossings are considered.

6.3.1.2 Export Cables

76. The export cables will carry the energy generated by the WTGs from the array area to shore. Two export cables circuits will be required with an individual length of 9.7nm will be installed within the ECC component of the proposed development. The export cables will lie within the ECC. There are no anticipated cable crossings. The export cables will make landfall south of Braymore Point, County Dublin.

6.3.1.3 Cable Burial

77. Where available, the primary means of cable protection will be by seabed burial. The extent and method by which the subsea cables will be buried will depend on the results of a detailed seabed survey of the final cable routes and associated cable burial risk assessment post consent. For the inter-array cables and export cables, the trench depth is 1 to 3m.

78. Where cable burial is not possible, alternative cable protection methods may be deployed such as mattressing and/ or loose rock. It is assumed that 20% of cables will need additional cable protection but will be determined within the cable burial risk assessment post consent.

79. Cable burial and protection is captured in the embedded mitigation measures (see Section 20).

6.4 Construction Phase

80. The offshore construction phase is expected to begin in 2027, with completion expected in 2029. Table 6.3 outlines a construction programme for the proposed development which indicates the maximum duration of construction for each element.

Table 6.3 Construction Timeline

Activity Name	Year 1 – 2027				Year 2 – 2028				Year 3 - 2029			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Pre construction activities												
Landfall												
Offshore Export Cables Installation Period												
Foundation Piling (WTG and OSP) (monopile)												
Foundation pre-piling (WTG and OSP) (jackets)												
Substructure Installation (WTG and OSP) (jackets)												
Offshore Substation Topside Installation												
Array Cable Installation Period												
WTG Installation period												

6.5 Vessel and Helicopter Numbers

6.5.1 Construction Vessels

81. There will be a maximum of 49 construction vessels on-site simultaneously during the construction phase with 3,008 return trips to port.

6.5.2 Helicopters during Construction

82. During construction it is to be assumed that one helicopter trip per week for six months will be carried out with a maximum number of 10 return trips per helicopter.

6.5.3 Operation and Maintenance Vessels

83. There will be a maximum of 12 operation and maintenance vessels on-site simultaneously during the operation and maintenance phase with 1,261 annual return trips to port. Helicopters are not being considered as a method for transferring technicians offshore to perform asset maintenance.

6.6 Decommissioning Phase

84. The decommissioning sequence will generally be the reverse of the construction sequence and involve similar types and numbers of vessels. The decommissioning duration of the offshore infrastructure may take the same amount of time as construction of the proposed development, approximately three years, although this indicative timing may reduce.

7 Navigational Features

85. A plot of the navigational features within, and in proximity to, the proposed development is presented in Figure 7.1. Following this, a more detailed overview of the navigational figures in proximity to the array area is presented in Figure 7.2. Each of the features shown are discussed in the following subsections and have been identified using the most detailed UKHO Admiralty charts available.

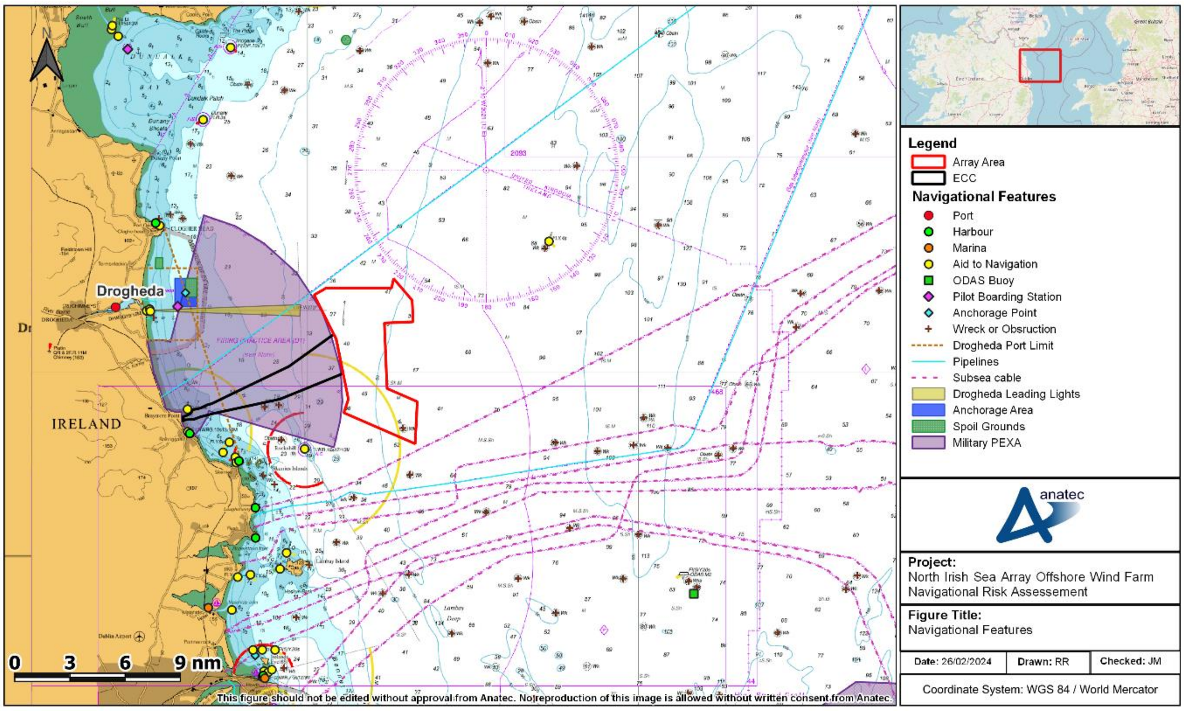

Figure 7.1 Navigational Features

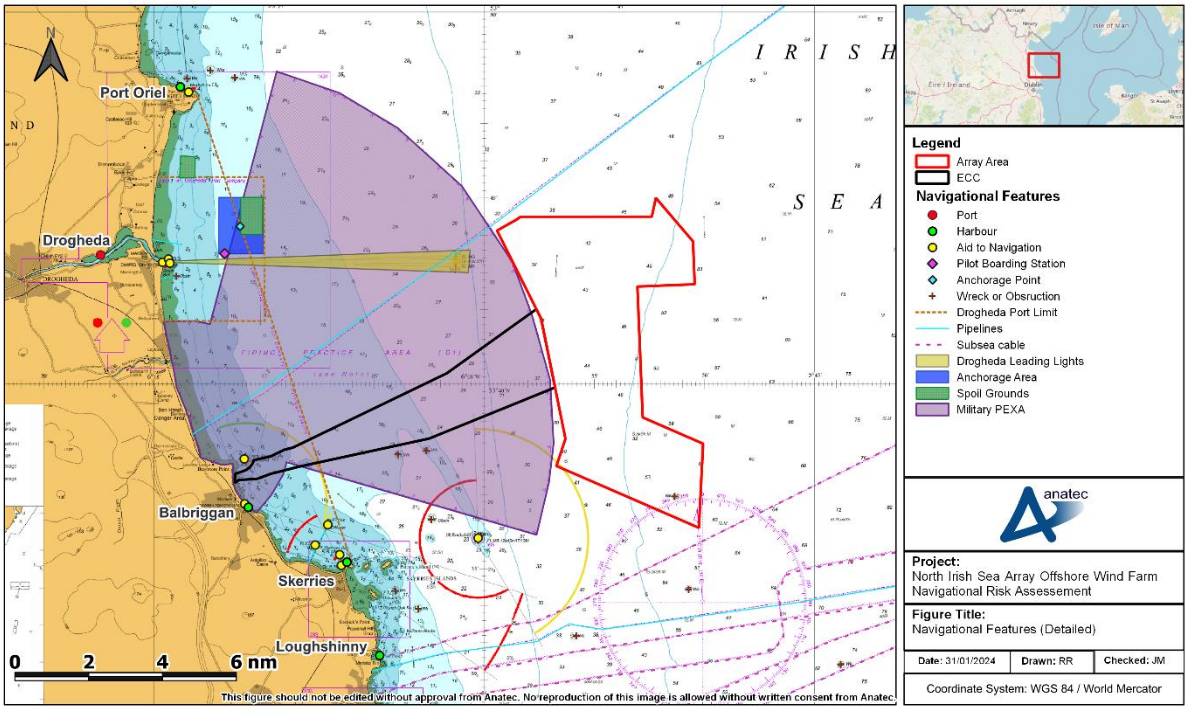

Figure 7.2 Navigational Features (Detailed)

7.1 Ports, Harbours, and Related Facilities

86. Several ports, harbours, and marinas are located along the east Irish coast in proximity to the proposed development, as illustrated in Figure 7.1. The closest port or harbour to the array area is Drogheda Port, entrance via the Rive Boyne is approximately 9nm west, and Port Oriel Harbour (Clogher Head), approximately 9nm north-west. Also, of importance to vessel traffic movements within the surrounding area is Dublin Port, situated 20nm to the south-west.

87. The closest port or harbour to the ECC is Balbriggan Harbour at approximately 0.6nm south. Various other harbours are situated south-west of the proposed development including Skerries Harbour and Loughshinny Harbour. Malahide Marina and Howth Harbour are also located further south on the east Irish coast, just north of Dublin Bay.

88. The following subsections provide further details on the main ports and harbours in proximity to the proposed development.

7.1.1 Drogheda Port

89. Drogheda Port is located approximately 11.5nm west of the array area on the River Boyne, approximately 2.5nm from the river mouth which enters the Irish Sea. The Admiralty Sailing Directions state that Drogheda Port "*is a commercial port catering for regional industry and agriculture and also acts as a relief port for Dublin*" (UKHO, 2019). The port has many varied exports and imports including principal exports of

magnesite, animal feed, clinker, cement, and municipal waste. As for principal imports, paper, chipboard timber, steel, fertiliser, and Liquid Petroleum Gas (LPG) are the most common. Although the River Boyne provides complete protection to vessels, maintained depths within the river are limiting at certain stretches but depths at the entrance to the river are liable to change depending on the weather.

90. Anchorage can be obtained at the Drogheda outer anchorage area, approximately 1nm from the mouth and breakwaters of the River Boyne in the Irish Sea. This outer anchorage area is situated between the 10 to 20m depth contours and is approximately 6nm to the west of the array area.

91. A pilot boarding station for Drogheda Port is charted directly south of the recommended Drogheda outer anchorage area, east of the river breakwater. Pilotage is compulsory for all vessels entering the River Boyne and any vessels awaiting pilot should not approach further than the pilot station. It is noted that any vessel awaiting pilot should not approach closer than 1.5nm to the Aleria Light, particularly in times of wind blowing onshore.

7.1.2 Dublin Port

92. Dublin Port is located approximately 20nm south-west of the array area within Dublin Bay, south of the Ben of Howth. The port is situated on the banks of the River Liffey through the city of Dublin. The Admiralty Sailing Directions state that Dublin Port is "*the principal commercial and industrial port in Ireland and is equipped with all modern cargo handling facilities for break bulk, Lift-On/ Lift-Off (LoLo), Roll-On/ Roll-Off (RoRo) and bulk liquid cargoes. It is also the Irish terminus for vehicle and passenger ferries form certain UK ports and maintains regular container services to the UK, continental Europe, South Europe, and Mediterranean Ports"* (UKHO, 2019). Dublin port handles almost 50% of all trade in the Republic of Ireland (Dublin Port Company, 2022) and has principal exports of ores, agricultural products, food preparations, peat moss, whiskey, and industrial products. Principal imports include oil, coal, grain, machinery, capital goods, chemicals, paper, animal feed, iron, and steel.

93. Anchorage can be obtained in the charted outer anchorage area situated within Dublin Bay. This anchorage is split into four designated areas arranged into a circle with depth contours of 10 to 20m.

94. A vessel traffic service (VTS) is present within Dublin Bay at the head of the eastern breakwater and maintains a 24-hour watch on Very High Frequency (VHF) and Radar. Two pilot boarding stations are located within the VTS, one in each of the traffic routes. Pilotage is compulsory for all vessels except:

- Pleasure craft and sail training vessels;
- Vessels with a Passenger Certificate no more than 24m LOA; and
- Vessels not more than 95m LOA departing to sea.

95. All vessels carrying hazardous cargo in bulk or such vessels that are not gas-free are also required to board a pilot.

7.1.3 Port Oriel Harbour

96. Port Oriel Harbour, otherwise known as Clogher Head, is located approximately 9nm to the north-west of the array area, on the north side of Clogher Head. The Admiralty Sailing Directions state that Port Oriel Harbour "*is a small fishing port consisting of a basin enclosed by an L-shaped mole which provides 175m of berthing, part of which has alongside depths of 4m*" (UKHO, 2019). The harbour also allows for shelter of small craft but is weather dependant and the basin can be closed with a boom in bad weather, especially when winds form the north-west and north-east. Anchorage may also be obtained west of the mole in 2 to 3m and to the north of the slip but can be exposed to the swell of the bay.

7.1.4 Skerries Harbour

97. Skerries Harbour is approximately 6.2nm from the array area and 2.5nm from the south of the ECC. The Admiralty Sailing Directions state that Skerries Harbour "*is little frequented but formed by a pier extending 150m from the west side of Red Island… The pier dries alongside except for the outer 60m where there is a depth of 1m. It is usually occupied by fishing vessels but small craft may berth alongside temporarily*" (UKHO, 2019).

98. Anchorage may be obtained within Skerries Bay to the west, it affords well sheltered anchorage with a good holding in offshore winds.

99. As per the Admiralty Sailing Directions, local fishermen will act as pilots in the area (UKHO, 2019).

7.1.5 Balbriggan Harbour

100. Balbriggan Harbour is approximately 8.4nm from the array area and is situated approximately 0.6nm south of the ECC landfall. The Admiralty Sailing Directions state that Balbriggan Harbour "*is a small artificial harbour which dries. It is principally a fishing harbour but is also used by with small craft*" (UKHO, 2019).

7.2 IMO Routeing Measures

101. The only IMO routeing measure within the wider area is at the entrance to Dublin Bay and consists of the North and South Burford TSS. The TSS has lanes and separation zones north and south of the Burford Bank converging at a traffic circle around the Dublin Bay Light Buoy. This TSS gives access to Dublin Bay and all vessels entering or leaving the bay are required to do so by way of this buoy. The closest point of the North Burford TSS to the array area is approximately 16nm to the south-west.

102. An Inshore Traffic Zone (ITZ) is also present between the outer lane of the North Burford TSS and Baily Lighthouse and also between the outer South Burford TSS Lane and Dalkey Island. The ITZ is designed to protect local traffic including small craft.

103. Whilst not within or in proximity to the proposed development and hence not detailed in Figure 7.1, the TSSs that are associated with the Irish Sea are still considered relevant navigational features given that vessel passages are highly dictated by the lanes of the TSSs. On this basis, the TSSs which influence vessel routeing in the area most prominently are illustrated in Figure 7.3 and are considered to be:

- Off Skerries TSS – 34nm south-east;
- Liverpool Bay TSS – 76nm east;
- Off Tuskar Rock TSS – 82nm south; and
- Off Smalls TSS – 104nm south.

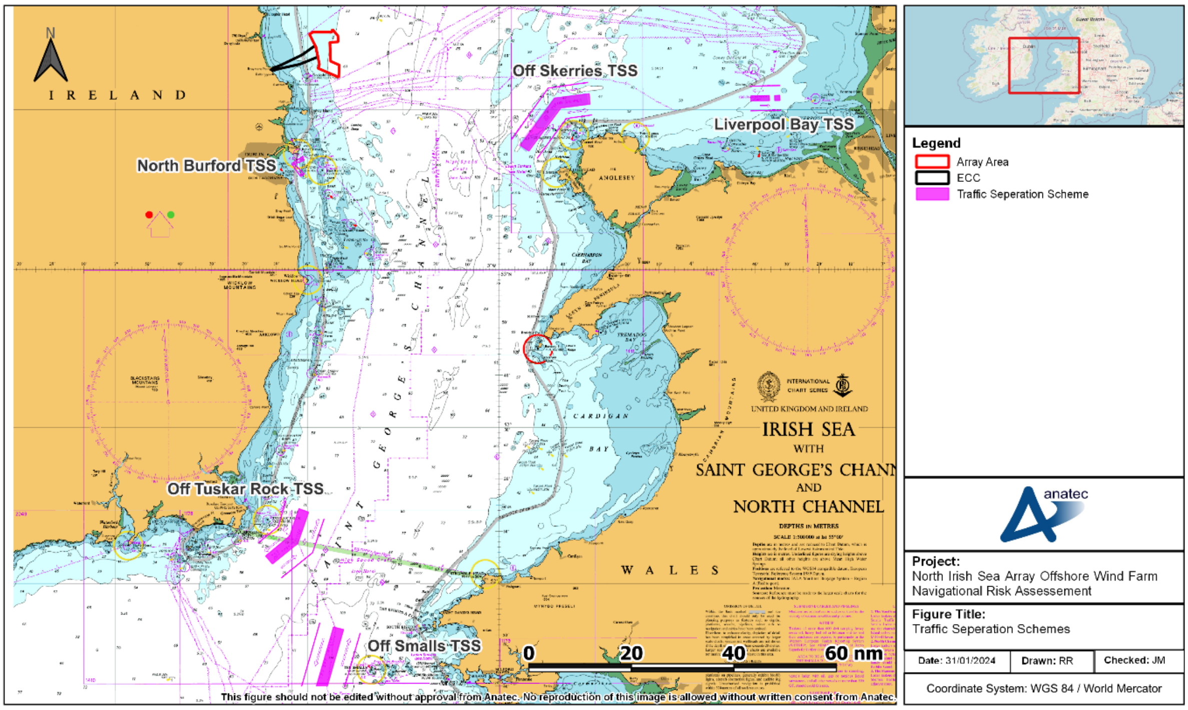

Figure 7.3 Traffic Separation Schemes

7.3 Aids to Navigation

104. Various aids to navigation (AtoN) are located in proximity to the proposed development including on the shoreline and at the entrance to ports, harbours, and marinas. The closest AtoN to the array area is the Rockabill Lighthouse located approximately 2.9nm to the south-west, situated on the larger of the two islands that form Rockabill which at its closest distance is 2.7nm from the array area, 3.0nm when accounting for the Structures Exclusion Zone. Two AtoN are located within 1nm of the ECC, both at the coast close to the landfall location. One of these AtoN is a lit

east cardinal mark situated on Cardy Rocks, 0.3nm from Braymore Point and 0.2nm from the ECC. The other is Balbriggan Lighthouse 0.5nm south of the ECC landfall location.

105. Other AtoN of importance that are not related to the entrance and routeing of ports/ harbours include the lit cylindrical buoy offshore of Skerries Bay which marks the nearby diffuser for an outfall pipeline. There is also a lit pillar buoy, likely marking a wreck, approximately 8nm to the east of the array area.

7.4 Charted Anchorage Areas

106. Charted anchorage areas in proximity to the proposed development are associated with Drogheda and Dublin ports and are considered within Section 7.1.

107. The only other anchorage in proximity to the proposed development is a reported anchorage located north-east of Ireland's Eye Island, in Carrigeen Bay, approximately 14nm south-west of the array area. This anchorage offers a secluded area with a minimum depth of 2m and is only serviceable in settled conditions. It is used predominantly for vessels landing on Ireland's Eye.

108. Although not charted and so not displayed in Figure 7.1, anchorage points present in Malahide Inlet, Lambay Bay, Rogerstown Inlet, Rush, Loughshinny, and Skerries Bay are also noted in the Admiralty Sailing Directions.

7.5 Spoil Grounds

109. A spoil ground is located within the designated Drogheda Anchorage Area and another also to the north-west of the anchorage area, approximately 0.5nm form the coast. These spoil grounds are associated with dredging activity which occurs within Drogheda Port and the entrance to the River Boyne (see Section 11.3.1).

110. Two spoil grounds are charted to the north of the array area, with the closest approximately 13nm. These spoil grounds are positioned south of the Dunnaval, to the east of the entrance to Carlingford Lough.

7.6 Subsea Cables

111. There are a number of subsea cables that pass in proximity to the proposed development with the closest cable 0.4nm to the south of the array area. This cable is the Celtix-Connect 2 subsea fibre optic cable connecting land points between Ireland, the Isle of Man, and mainland UK. Many other similar cables are also present to the immediate south of the array area but no subsea cables passing through the array area or the ECC.

7.7 Subsea Pipelines

112. There are two pipelines in proximity to the proposed development, both of which are gas interconnector pipelines connecting land points from Ireland to mainland UK. One of these pipelines passes approximately 0.2nm (400m) to the north-west of the array area while the other passes approximately 2.3nm to the south. No pipelines intersect the array area or the ECC.

7.8 Military Practice and Exercise Areas

113. A Department of Defence (DoD) firing practice area is located to the immediate west of the array area. The area is charted as the Ben Head Danger Area but known as the Gormanston Danger Area D1. No restrictions are placed on the right to transit the firing practice range at any time with the firing practice range operating a clear range procedure – exercises only take place when the area is considered to be clear of all shipping.

7.9 Charted Wrecks

114. There are a number of charted[2] wrecks in proximity to the proposed development including one within the south-east of the array area and two approximately 400m south the ECC.

115. Non-charted wrecks (which are not considered a danger to safe navigation) are considered in **Volume 5, Chapter 18: Offshore Archaeology and Cultural Heritage.**

7.10 Other Navigational Features

7.10.1 Ocean Data Acquisition System (ODAS) Buoy

116. Approximately 17nm south-east of the array area is an Ocean Data Acquisition System (ODAS) buoy which is lit but not considered to be an AtoN. The ODAS buoy is owned by the Irish Department of Transport (DoT) but is managed by the Marine Institute in collaboration with Met Éireann and the UK Met Office and is used to collect meteorological and oceanographic data from the Irish Sea.

[2] It is noted that not all wrecks are charted, although all those considered a danger to the safety of navigation (and therefore relevant to shipping and navigation) are charted.

8 Meteorological Ocean Data

117. This section presents meteorological and oceanographic statistics local to the proposed development, primarily based on the combined significant wave height data collected from Light Detection and Ranging (LiDAR) buoys at two locations within the proposed development array area over a three-year period between October 2019 and September 2022 (further referenced as Location A and Location B), Admiralty Sailing Directions and UKHO Admiralty charts. The data presented in this section is used as input to the collision and allision risk modelling (see Section 17).

8.1 Wind Direction

118. The distribution of wind direction data is presented in presented in Figure 8.1 in the form of a wind rose.

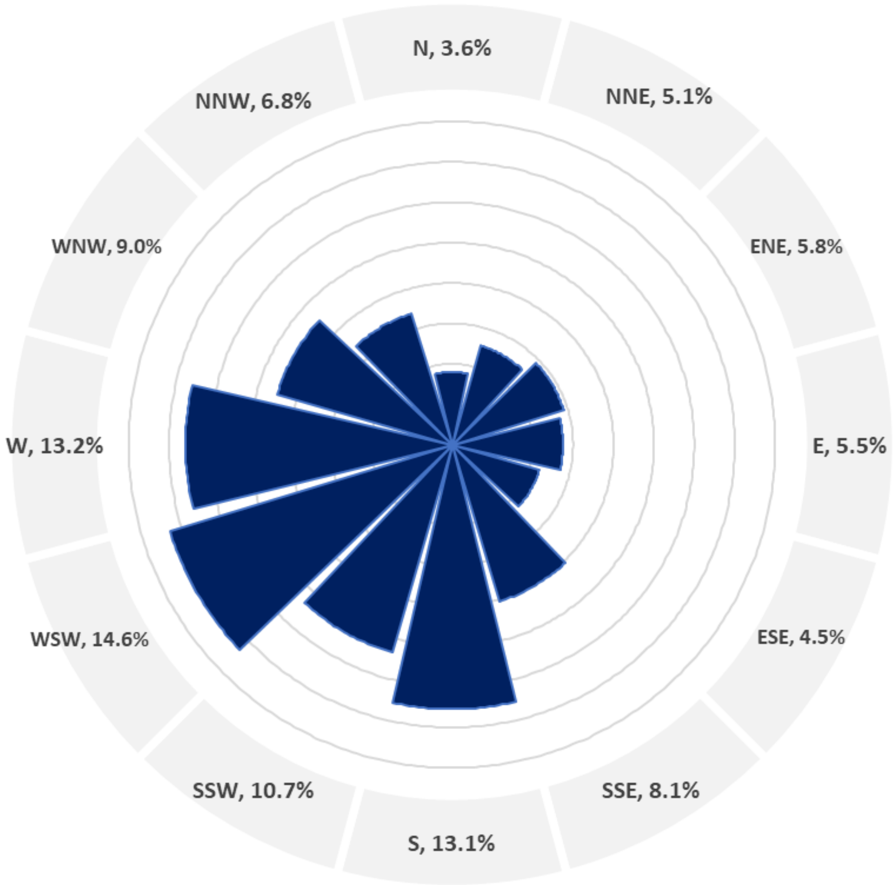

Figure 8.1 Wind Direction Distribution in Proximity to the Array Area

119. Winds are most predominant from the west south-west (14.6%), west (13.2%), and the south (13.1%).

8.2 Significant Wave Height

120. Significant wave height data has been analysed from the LiDAR buoys at Location A and Location B. Table 8.1 presents the proportion of the significant wave height within each of three defined ranges which are categorised as calm, moderate and severe sea states.

Table 8.1 Sea State Distribution in Proximity to the Array Area

Significant Wave Height (m)	Sea State	Location A Proportion (%)	Location B Proportion (%)
< 1	Calm	62.7	63.9
1 to 5	Moderate	37.3	36.1
≥ 5	Severe	0	0

8.3 Visibility

121. It is assumed that the proportion of poor visibility (defined as the proportion of a year where the visibility can be expected to be less than 1 kilometre (km)) is 2%. This is based upon information available within *Admiralty Sailing Directions Irish Coast Pilot NP40* (UKHO, 2019).

8.4 Tidal Speed and Direction

122. Tidal data to be used as an input to the allision modelling is based upon the information available from UKHO Admiralty Charts 1411 and 44. Table 8.2 presents the peak flood and ebb direction and speed values for the charted tidal diamonds within proximity of the array area.

Table 8.2 Peak Flood and Ebb Speeds and Directions

Tidal Diamond	UKHO Admiralty Chart	Flood		Ebb	
		Direction (°)	Speed (knots)	Direction (°)	Speed (knots)
P	1411	350	2.2	171	2.2
L	1411	33	1.8	219	1.7
B	44	353	1	175	1

123. Based upon the available data, no impacts are expected at high water that would not also be expected at low water, and vice versa. The wind farm structures are not expected to have any additional impact on the existing tidal streams in relation to their effect on existing shipping and navigation users.

9 Emergency Response and Incident Overview

124. This section summarises the existing emergency response resources (including SAR) and reviews historical maritime incident data to assess baseline incident rates in proximity to the proposed development.

9.1 Search and Rescue Helicopters

125. The IRCG is responsible for the response to, and coordination of, maritime accidents which require SAR, counter-pollution operations, and ship casualty operations. SAR helicopter operations are contracted by the IRCG to CHC Helicopter, the world's largest operator of the Sikorsky S-92 helicopter. The current contract runs for 10 years and was due for expiration in 2022, however one year of extension was applied, expiring in 2023. As announced in May 2023, Bristow Group was the preferred bidder for the new SAR helicopter operations contract and will receive a contract of service for 10 years with options to extend out to 13 years. The current contract with CHC can be further extended for periods up to 2025 depending on procurement process and the transition period required between the existing and a new contract but at the time of writing (August 2023), a decision on the new contract start date has yet to be made.

126. The IRCG has four SAR helicopter bases around the country located at Dublin, Waterford, Sligo, and Shannon. Each site has one Sikorsky S-92 helicopter with an additional helicopter being rotated between bases. The locations of these bases are presented in Figure 9.1.

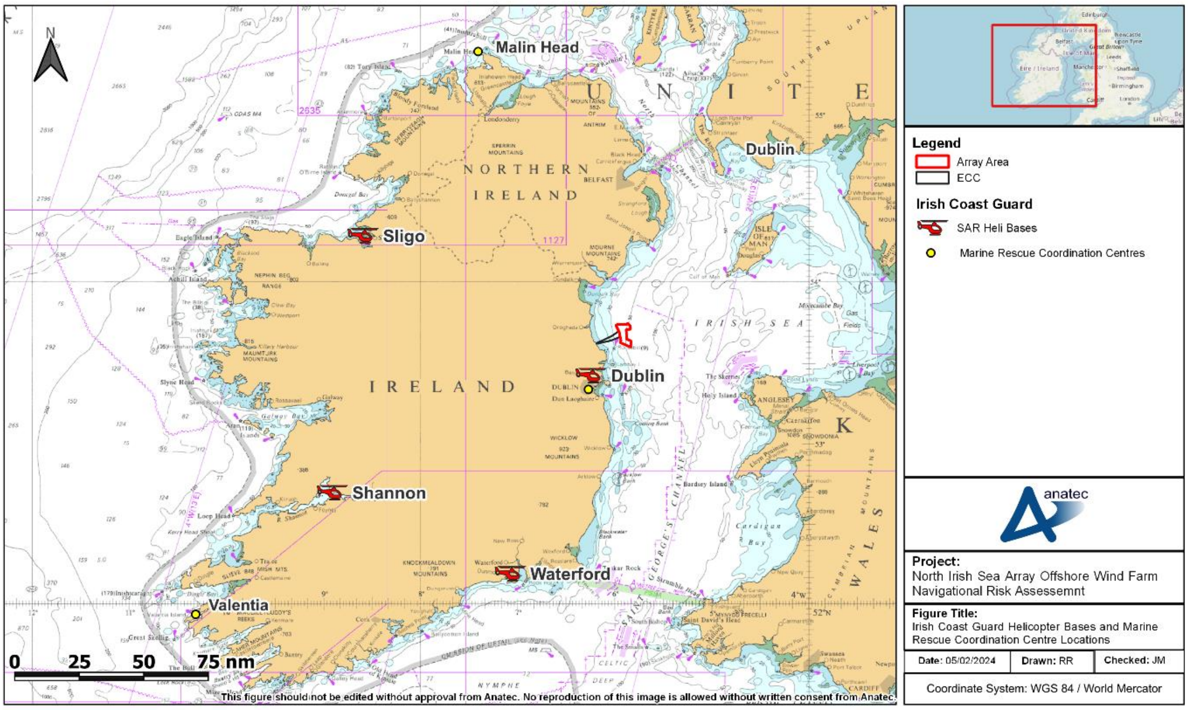

Figure 9.1 IRCG Helicopter Bases and Marine Rescue Coordination Centres

127. The closest IRGC SAR base to the array area, and the base most likely to respond to an incident requiring helicopter assistance near the proposed development, is located at Dublin Airport, approximately 16nm of the south of the array area.

9.2 Maritime Rescue Coordination Centres

128. The IRCG operates three Marine Rescue Coordination Centres (MRCC) around Irish waters, based in Dublin, Malin Head, and Valentia Island. The locations of these bases are presented in Figure 9.1. The closest of these centres to the array area is Dublin (a National Maritime Operations Centre (NMOC)) which provides marine SAR response services and co-ordinates the response to marine casualty incidents within the Irish Exclusive Economic Zone (EEZ).

9.3 Royal National Lifeboat Institution

129. The RNLI is organised into six divisions, with the relevant region for the proposed development being the ‘Ireland’ division. Based out of 238 stations across the UK and Ireland, there are over 430 active lifeboats across the RNLI fleet, including both All-Weather Lifeboats (ALBs) and Inshore Lifeboats (ILBs).

130. The closest RNLI station the proposed development is the Skerries RNLI Station at approximately 6nm from the array area. Skerries RNLI station utilises a B-class ILB. Clogherhead RNLI station is situated approximately 9nm from the proposed development and utilises a Tamar ALB. No other RNLI stations are within 10nm.

131. Figure 9.2 presents the locations of RNLI stations in the vicinity of the proposed development along with incidents reported by the RNLI that occurred within the study area during the 10 year period 2012 to 2021, colour-coded by incident type. Following this, Figure 9.3 presents the same incidents reported, colour-coded by casualty type.

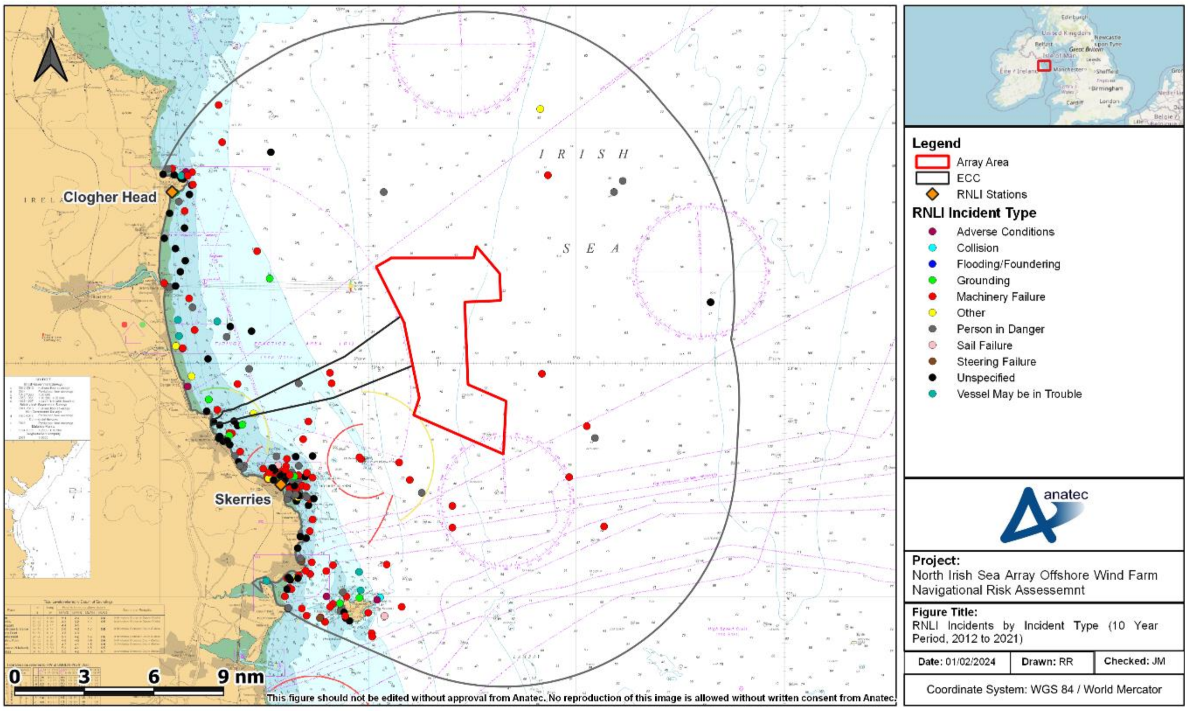

Figure 9.2 RNLI Stations and Incidents by Incident Type (10 Year Period, 2012 to 2021)

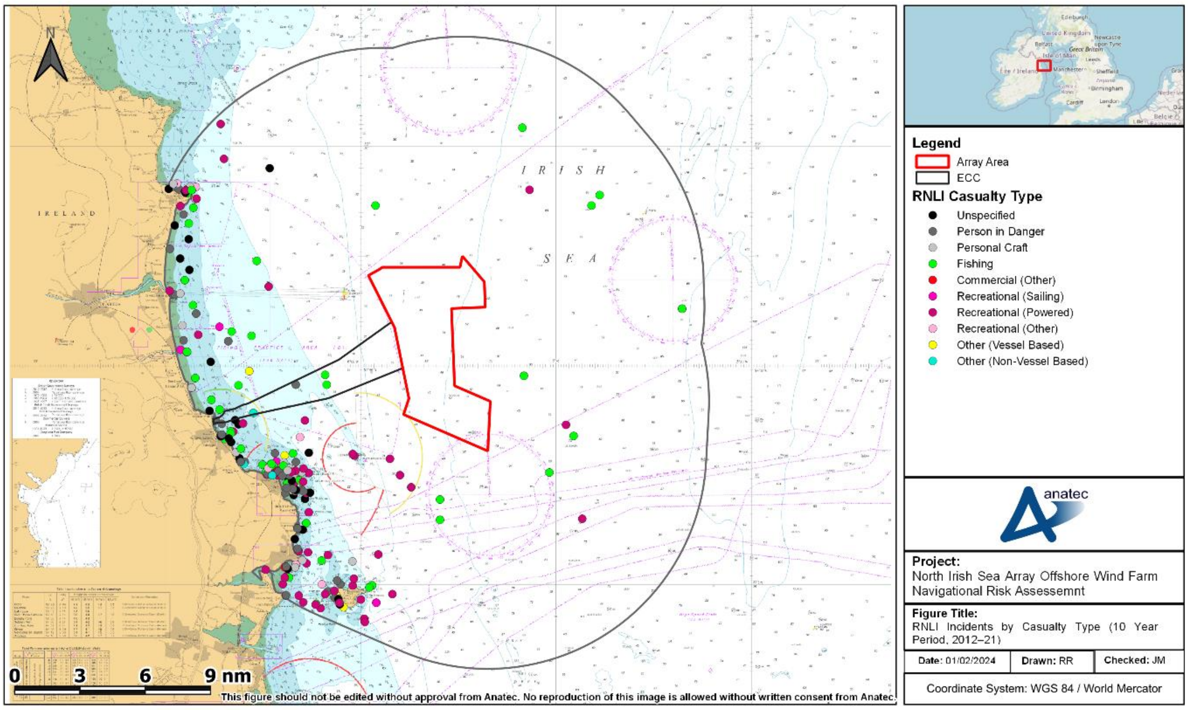

Figure 9.3 RNLI Incidents by Casualty Type (10 Year Period, 2012 to 2021)

132. A total of 251 RNLI lifeboat responses to 241 unique incidents were recorded within the study area during the 10 year period, equating to 24 unique incidents per year. Most incidents recorded were coastal and clustered around the Skerries, as well as several at Clogher Head and surrounding Lambay Island. Of all incidents recorded, approximately 82% occurred within 2nm of the east Irish coast.

133. No incidents were recorded within the array area and six unique incidents recorded within the ECC; two cases of 'Machinery Failure' both with a casualty type 'Fishing', two cases of 'Unspecified' casualty types 'Unspecified' and 'Person in Danger', one incident of 'Person in Danger' with a casualty type 'Person in Danger', and one incident classed as 'Other' with a casualty type 'Other (Non-Vessel Based).

134. Overall, the most common incident types recorded for the study area include 'Machinery Failure' (36%), 'Unspecified' (27%), 'Person in Danger' (20%), and 'Grounding' (5%). No other incident type equated to more than 5% of the total incidents recorded.

135. The most common casualty type was powered recreational vessels (26%), followed by fishing vessels (23%), 'Person in Danger' (22%), unspecified (13%), and personal craft (10%). No other casualty type equated to more than 5% of the total incidents recorded.

136. The RNLI station which responded to the most incidents was Skerries which responded to 62% of all incidents within the study area over the 10–year period. Clogher Head (20%) and Howth (16%) RNLI stations were also noted.

9.4 Marine Casualty Investigation Board

137. The MCIB is the Irish government agency for investigating maritime accidents and incidents and was established in 2002 under Section 7(1) of the Merchant Shipping (Investigation of Marine Casualties) Act, 2000. The MCIB head office is in Dublin and functions to examine and if necessary, carry out investigations into all types of marine casualties to, or on board, Irish registered vessels worldwide and other vessels in Irish territorial waters and inland waterways.

138. Although the MCIB do not publish comprehensive incident data in the public domain, they do publish investigation reports online (MCIB, 2023) and details on each incident are provided.

139. It is noted that not all incidents will be documented and not all documented incidents have accurate coordinates available (see Section 5.4.2).

140. Below, Table 9.1 presents the details of the incidents recorded within the study area over the 20-year period 2002 to 2021.

Table 9.1 Summary of MCIB Incidents within the Study Area

Incident Type	Data	Summary
Machinery Failure	18 April 2003	Engine failure of a Rigid Inflatable Boat (RIB) off Lambay Island leading to vessel flooding. No injuries were reported, and the RIB was towed to Howth by the RNLI.
Man Overboard	18 April 2006	A fatal incident occurred from the fishing vessel in fishing grounds east of Clogher Head. A man overboard was reported when the vessel went to retrieve nets and noticed a crew member was missing.
Grounding	16 November 2010	A general cargo vessel grounded on the river bar when on route, out of Drogheda Port, on the River Boyne. There were no injuries, and the vessel refloated three days later from tug assistance before it was towed to Dublin for rudder repairs.
Capsize	1 April 2011	A double fatality occurred when a small fishing vessel capsized off Skerries Harbour on the way to collect lobster pots from Colt Islands and St Patrick's Island.
Capsize	26May 2011	A group of eight kayaks capsized in rough conditions off the coast of Clogher Head. All persons were rescued by the RNLI and one made it safely to shore without any help. There were no injuries, fatalities, or pollution associated with this incident.
Flooding/ Foundering	20 March 2016	A fishing vessel departed from Kilkeel and the following day, while the vessel was engaged in fishing activities east of Clogher Head, the vessel suffered a sudden ingress of water in the fish hold before quickly sinking. All crew made it to the life raft and no fatalities occurred. The wreck was not recovered.

Incident Type	Data	Summary
Capsize	26 May 2017	A fishing vessel experienced malfunction in equipment when its dredge partially filled with rocks and fell starboard before fully capsizing the vessel and quickly sinking. The incident occurred inshore, within 100m of Skerries Harbour and resulted in one fatality and pollution in the form of a slight oil slick. The wreck was not recovered.

9.5 Third-party Assistance

141. Companies operating offshore typically have resources including vessels, helicopters, and other equipment available for normal operations that can assist with emergencies offshore. All vessels under IMO obligations set out in the International Convention for the Safety of Life at Sea (SOLAS) (IMO, 1974) as amended, are required to render assistance to any person or vessel in distress if safely able to do so.

142. Emergency response and cooperation procedures between the proposed development and the IRCG will be agreed prior to construction as per Section 19.

9.6 Global Maritime Distress and Safety System

143. The Global Maritime Distress and Safety System (GMDSS) is a maritime communications system used for emergency and distress messages, vessel to vessel routeing communications, and vessel to shore routine communications. It is implemented globally, and vessels engaged in international voyages are obliged to carry GMDSS certified equipment.

144. There are four GMDSS sea areas, and in Ireland it is the responsibility of the IRCG to ensure VHF coverage from coastal stations within sea area A1. The Proposed Development is located within sea area A1, as shown in Figure 9.4, and therefore in the event of an emergency any vessel located in proximity to the Proposed Development would be able to contact IRCG via VHF.

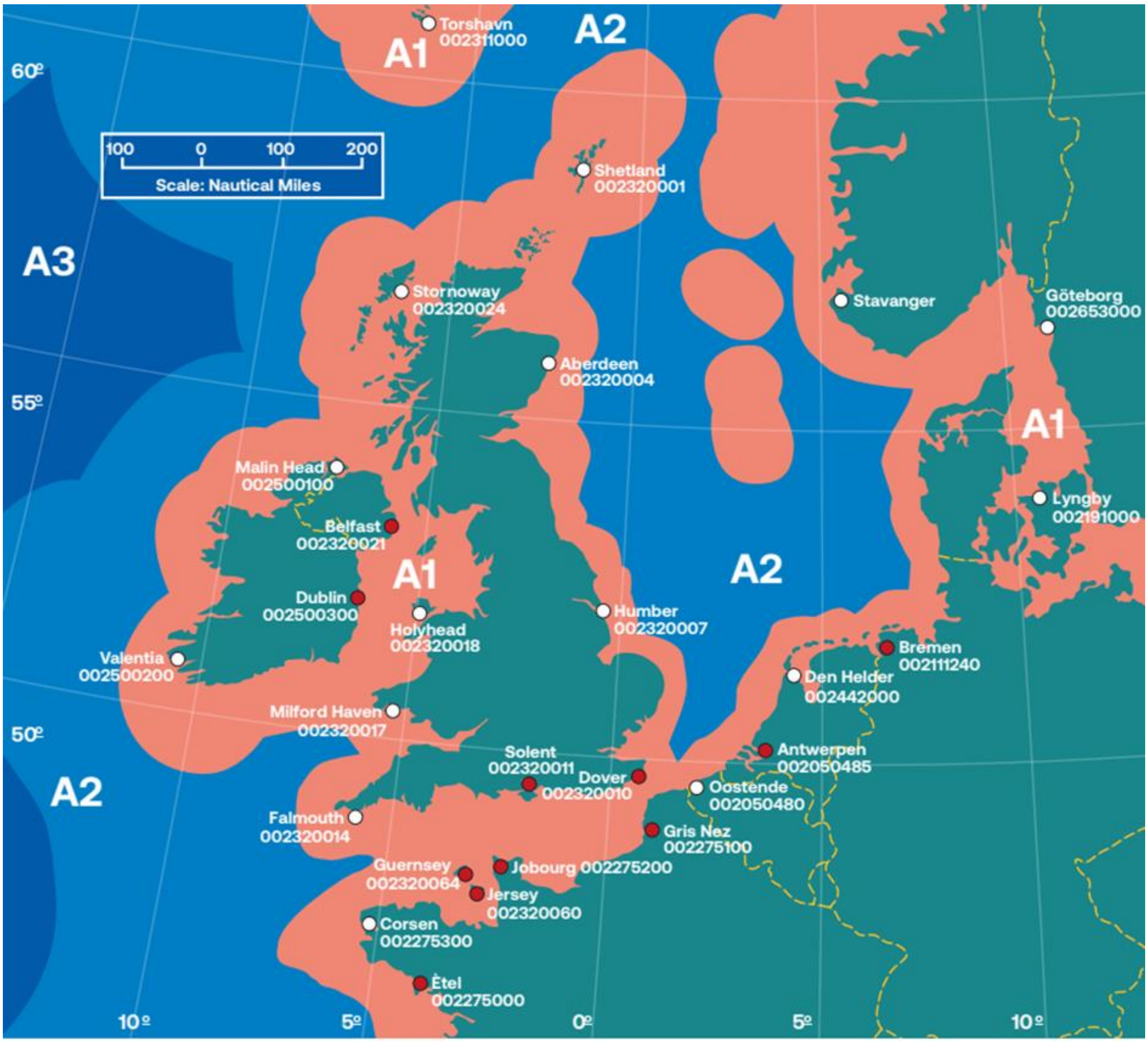

Figure 9.4 GMDSS Sea Areas (MCA, 2021)

9.7 Historical Offshore Wind Farm Incidents

145. Given the early stage of offshore wind farm development in Ireland, there is no historical incident data available in terms of incidents arising from or caused by the presence of offshore wind farm structures noting that there have been no reported incidents to vessels associated with the existing Arklow Bank Wind Park 1.

146. Therefore, UK experience has been considered in this section given that incidents relating to offshore wind farm development in a similar regulatory framework can be considered over a long-term period.

9.7.1 Incidents Involving UK Offshore Wind Farm Developments

147. As of February 2024, there are 42 operational offshore wind farms in the UK, ranging from the North Hoyle Offshore Wind Farm (fully commissioned in 2003) to the

Hornsea Project Two Offshore Wind Farm (fully commissioned in 2022). Between them these developments encompass approximately 22,758 fully operational wind turbine years.

148. Various sources have been used to collate a list of historical collision and allision incidents involving UK offshore wind farm developments including the Marine Accident Investigation Branch (MAIB) incident database. The list of historical collision and allision incidents involving UK offshore wind farm developments is presented in Table 9.2.

Table 9.2 Summary of Historical Collision and Allision Incidents Involving UK Offshore Wind Farm Developments

Incident Vessel	Incident Type	Date	Description of Incident	Vessel Damage	Harm to Persons	Source
Project	Allision	7 August 2005	Wind turbine installation vessel allision with wind turbine base whilst manoeuvring alongside it. Minor damage sustained to a gangway on the vessel, the wind turbine tower, and a wind turbine blade.	Minor damage to gangway on the vessel	None	MAIB
Project	Allision	29 September 2006	Offshore services vessel allision with rotating wind turbine blade.	None	None	MAIB
Project	Allision	8 February 2010	Work boat allision with disused pile following human error with throttle controls whilst in proximity. Passenger later diagnosed with injuries and no serious damage sustained by vessel.	Minor	Injury	MAIB
Project / third-party	Collision	23 April 2011	Third-party catamaran collision with project guard vessel within harbour.	Moderate	None	MAIB
Project	Allision	18 November 2011	Cable-laying vessel allision with wind turbine foundation following watchkeeping failure. Two hull breaches to vessel.	Major	None	MAIB
Project / project	Collision	2 June 2012	CTV allision with flotel. Nine persons safely evacuated and transferred to nearby vessel before being brought back in to port.	Moderate	None	UK Confidential Human Factors Incident Reporting Programme (CHIRP)

Incident Vessel	Incident Type	Date	Description of Incident	Vessel Damage	Harm to Persons	Source
Project	Allision	20 October 2012	Project vessel allision with wind turbine monopile following human error (misjudgement of distance). Minor damage sustained by vessel.	Minor	None	MAIB
Project	Allision	21 November 2012	Passenger transfer catamaran allision with buoy following navigational error. Vessel abandoned by crew of 12 having been holed, causing extensive flooding but no injuries sustained.	Major	None	MAIB
Project	Allision	21 November 2012	Work boat allision with unlit WTG transition piece at moderate speed following navigational error. Vessel able to proceed to port unassisted with no water ingress but some structural damage sustained.	Moderate	None	MAIB
Project	Allision	1 July 2013	Service vessel allision with wind turbine foundation following machinery failure. Minor damage sustained by vessel.	Minor	None	International Marine Contractors Association (IMCA) Safety Flash
Project	Allision	14 August 2014	Standby safety vessel allision with wind turbine pile. Oil leaked by vessel which moved away from environmentally sensitive areas until leak was stopped.	Minor with pollution	None	UK CHIRP
Third-party	Allision	26 May 2016	Third-party fishing vessel allision with wind turbine following human error (autopilot). Lifeboat attended the incident.	Moderate	Injury	Web search (RNLI, 2016)
Project	Allision	14 February 2019	Survey vessel contacted with wind turbine jacket whilst autopilot was engaged.	Minor	None	MAIB
Project	Allision	17 January 2020	Project vessel allision with wind turbine. Injury sustained by crew member but vessel able to proceed to port unassisted.	None	Injury	Web search (Vessel Tracker, 2020)
Project	Allision	27 January 2020	Project vessel allision with wind turbine. Minor damage to vessel and wind turbine sustained, with no personal injuries.	Minor	None	Marine Safety Forum

Incident Vessel	Incident Type	Date	Description of Incident	Vessel Damage	Harm to Persons	Source
Third-party	Allision	9 June 2022	Fishing vessel allision with wind turbine resulting in damage to vessel and two minor injuries for crew members. RNLI lifeboat escorted vessel under its own power to port.	Minor	Injury	Web search (RNLI, 2022)

(*) As per incident reports.

149. The worst consequences reported for vessels involved in a collision or allision incident involving a UK offshore wind farm development has been flooding, with no life-threatening injuries to persons reported.

150. As of February 2024, there have been no third-party collisions directly as a result of the presence of an offshore wind farm in the UK. The only reported collision incident in relation to a UK offshore wind farm involved a project vessel hitting a third-party vessel whilst in harbour.

151. As of February 2024, there have been 13 reported cases of an allision between a vessel and a wind turbine (under construction, operational or disused) in the UK, with all but one involving a support vessel for the development and the errant vessel in each case under power rather than drifting. Therefore, there has been an average of 1,751 wind turbine years per allision incident in the UK, noting that this is a conservative calculation given that only operational wind turbine hours have been included (whereas allision incidents counted include non-operational wind turbines).

9.7.2 Incidents Involving Non-UK Offshore Wind Farms

152. It is acknowledged that collision and allision incidents involving non-UK offshore wind farm developments have also occurred. However, it is not possible to maintain a comprehensive list of such incidents. Some non-UK countries also have more stringent regulations restricting access to arrays and so a direct comparison to UK incidents is not feasible.

153. One high profile non-UK incident which is noted is that involving a bulk carrier in January 2022 which dragged anchor during a storm in Dutch waters and collided with another anchored vessel. The vessel began to take on water, leading to all crew members being evacuated by helicopter. Having broken free from its anchor, the vessel then continued to drift towards shore including through an under-construction offshore wind farm where it allided with a wind turbine foundation and a platform foundation before being taken under tow.

9.7.3 Incidents Responded to by Vessels Associated with UK Offshore Wind Farms

154. From news reports, basic web searches and experience at working with existing offshore wind farm developments, a list has been collated of historical incidents

responded to by vessels associated with UK offshore wind farm developments, which is summarised in Table 9.3. The initial cause of these incidents is not related to the offshore wind farm in question.

155. Table 9.3 comprises known incidents that were responded to by a UK wind farm vessel. Additional incidents associated with the construction or operation of offshore wind farms are also known to have occurred. These incidents typically involve an accident to person which requires medical attention (including emergency response) but does not affect the operation of the vessel involved.

Table 9.3 Historical Incidents Responded to By Vessels Associated with UK Offshore Wind Farm Developments

Incident Type	Date	Related Development	Description of Incident	Source
Capsize	21 June 2018	Walney	His Majesty's Coastguard (HMCG) issued mayday relay broadcast following trimaran capsize. Support vessel for Walney arrived and recovered two persons from the water who were then winched onboard a Coastguard helicopter.	Web search (4C Offshore, 2018)
Capsize	5 November 2018	Race Bank	Fishing vessel capsized resulting in two persons in the water. Vessel operating at the nearby Race Bank reported to have assisted with the rescue which also involved a Belgian military helicopter and the RNLI.	Web search (British Broadcasting Corporation (BBC), 2018)
Vessel in distress	15 May 2019	London Array	Yacht in difficulty sought shelter by tying up to a wind turbine but suffered damage and a person in the water. Support vessel for London Array identified and secured the casualty vessel and recovered the person in the water. The support vessel raised the alarm to the Coastguard. The Coastguard later instructed the support vessel to return to port and seek medical assistance for the casualty vessel's occupant.	Web search (The Isle of Thanet News, 2019)
Drifting	7 July 2019	Gwynt y Môr	Speedboat suffered mechanical failure stranding four persons. Support vessel for Gwynt y Môr responded to an 'all-ships' broadcast from the Coastguard and prevented the casualty vessel drifting into the Gwynt y Môr array. The support vessel later towed the casualty vessel back towards port.	Web search (Renews, 2019)
Machinery failure	28 September 2019	Race Bank	Fishing vessel suffered mechanical failure and launched flares. Guard vessel and SOV for Race Bank both immediately offered assistance until the MCA's arrival on-scene.	Internal daily progress report received by Anatec

Incident Type	Date	Related Development	Description of Incident	Source
Vessel in distress	13 December 2019	Race Bank	Passing vessel got into difficulty and guard vessel for Race Bank was requested to assist. The Coastguard later requested that the guard vessel tow the casualty vessel into port.	Internal daily progress report received by Anatec
Search	21 May 2020	Walney	Coastguard contacted guard vessel for Walney reporting red flare sighting at the wind farm. Guard vessel proceeded to undertake search but did not find anything to report.	Internal daily progress report received by Anatec
Aircraft crash	15 June 2020	Hornsea Project One	United States (US) jet crashed into sea during routine flight. CTV and SOV for Hornsea Project One joined the search for the missing pilot.	Web search (4C Offshore, 2020)
Fire / explosion	15 December 2020	Dudgeon	Fishing vessel experienced explosions on board with crew injured. SOV for Dudgeon deployed its Fast Rescue Boat (FRB) and evacuated the casualty vessel.	Web search (Offshore WIND, 2020)
Vessel in distress	3 July 2021	Robin Rigg	Wind farm CTV fire alarm sounded, with the engine then shut down. A support vessel for Robin Rigg was able to assist in escorting the vessel to port.	Web search (Vessel Tracker, 2021)
Drifting	17 July 2021	Neart na Gaoithe	Small dinghy with two children aboard drifted offshore due to strong winds. A guard vessel associated with Neart na Gaoithe was able to retrieve the children.	Web search (Edinburgh Evening News, 2021)
Allision	9 June 2022	Westermost Rough	Fishing vessel allided with a wind turbine at Westermost Rough. A supply vessel was among the responders as an RNLI lifeboat escorted the vessel under its own power to port.	Web search (Vessel Tracker, 2022)

10 Vessel Traffic Movements

156. This section presents an overview of vessel traffic movements within the study area, based upon the findings of the site-specific summer and winter vessel traffic surveys undertaken in July 2022 and December 2023, respectively (see Section 5.2).

157. A plot of the vessel tracks recorded during the 14-day summer survey period within the study area, colour-coded by vessel type and excluding any temporary traffic, is presented in Figure 10.1. Following this, Figure 10.2 presents the same data converted to a density heat map.

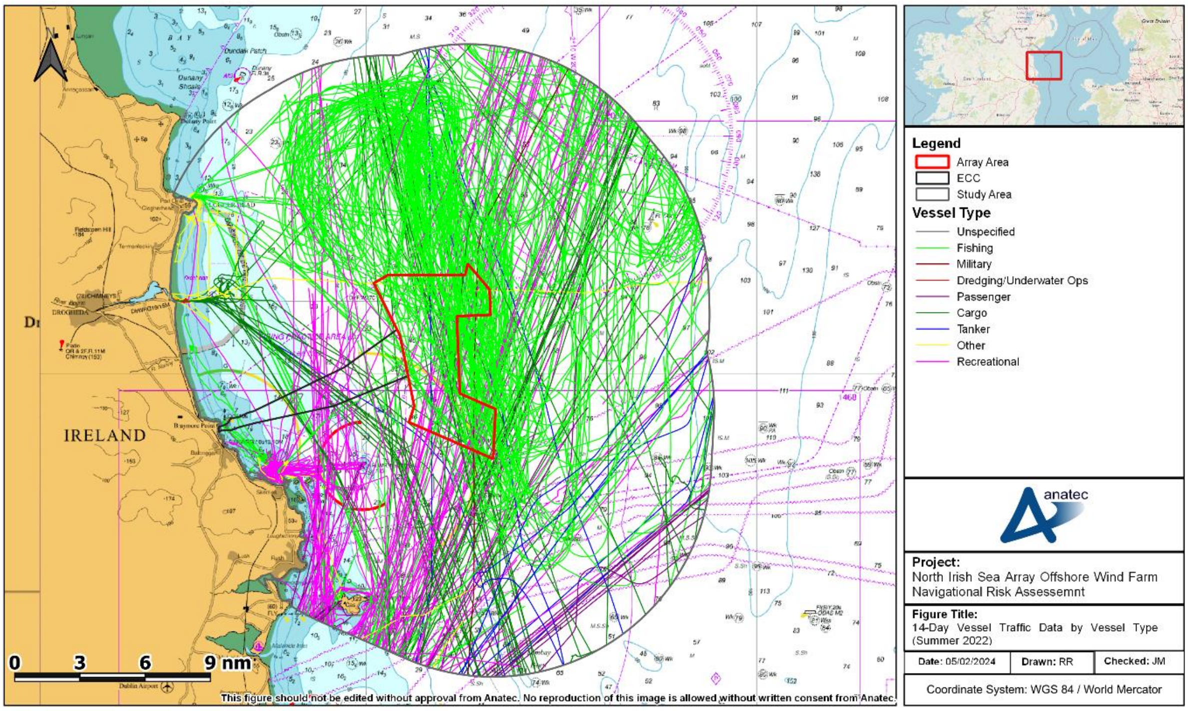

Figure 10.1 14-Day Vessel Traffic Data by Vessel Type (Summer 2022)

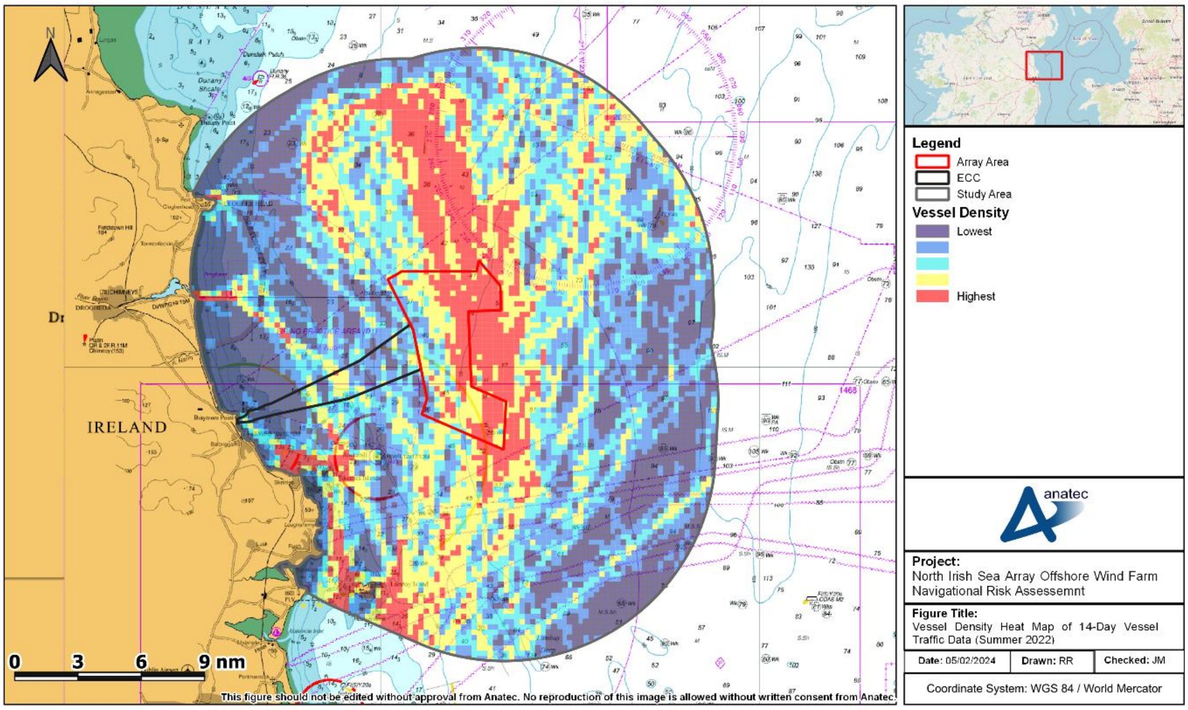

Figure 10.2 Vessel Density Heat Map of 14-Day Vessel Traffic (Summer 2022)

158. During the summer survey period, vessel traffic was mainly fishing vessels and recreational vessels, both of which are described in more detail in Section 10.2.2 and Section 10.2.5, respectively. Both vessel types resulted in areas of high density (Figure 10.2) throughout the study area especially to the north and east of the array area and also around Skerries Harbour and Lambay Island.

159. A plot of the vessel tracks recorded during the 14-day winter survey period within the study area, colour-coded by vessel type and excluding any temporary traffic, is presented in Figure 10.3. Following this, Figure 10.4 presents the same data converted to a density heat map. It is noted that the same density bins were used as per the summer survey period to allow for direct comparison.

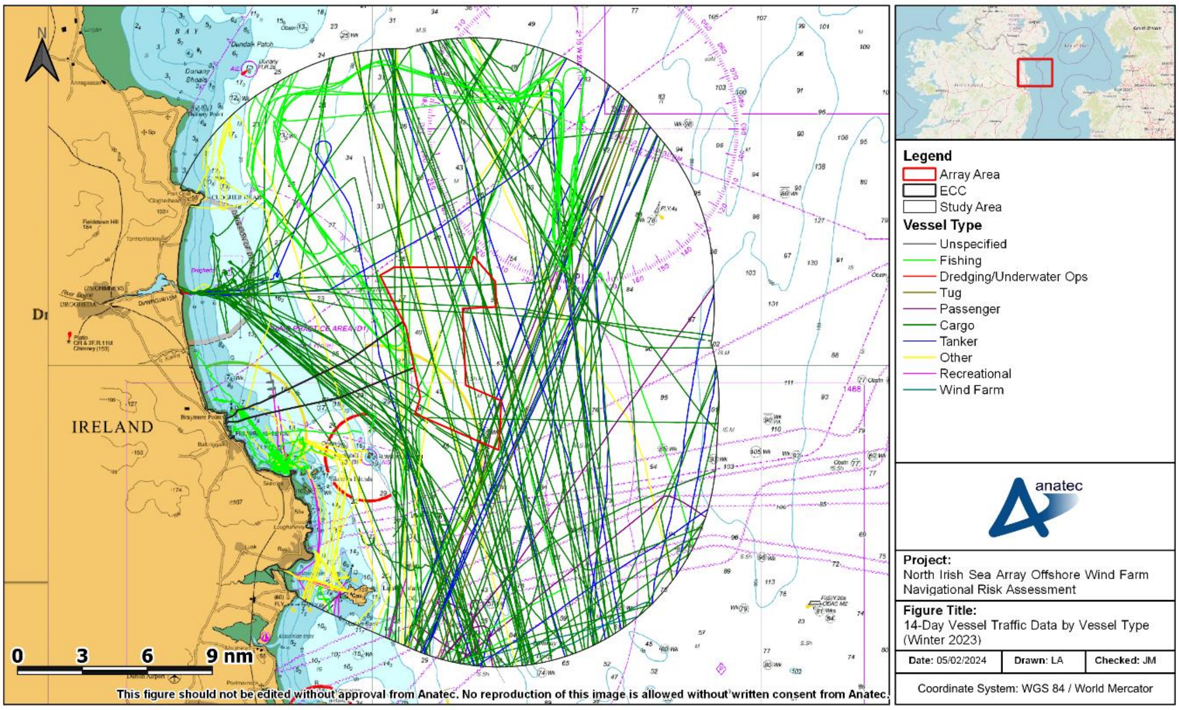

Figure 10.3 14-Day Vessel Traffic Data by Vessel Type (Winter 2023)

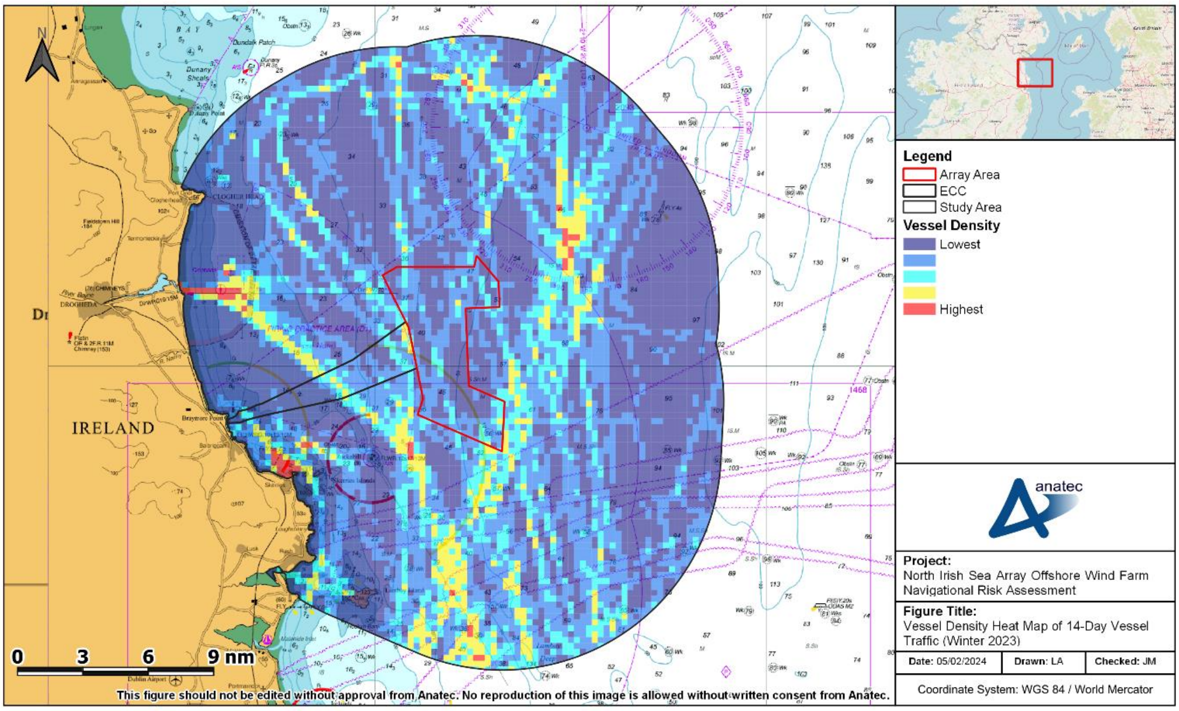

Figure 10.4 Vessel Density Heat Map of 14-Day Vessel Traffic (Winter 2023)

160. During the winter survey period, vessel traffic was mainly cargo. Fishing vessels were also common within the study area, with several vessels noted to operate out of Skerries. The main vessel types are explored in detail in Section 10.2. The greatest

areas of vessel density (Figure 10.4) highlight commercial routeing within the study area (see Section 11.2) with marine aggregate dredging activity, and pilotage activity at the entrance to the River Boyne showing the greatest density. The dredging activity is described in greater detail in Section 11.3.1. Additionally, high density is noted around Skerries Harbour which is primarily attributed to small fishing vessels.

10.1 Vessel Counts

161. Figure 10.5 illustrates the daily number of unique vessels recorded within the study area, as well as intersecting the array area and ECC, during the summer survey period. It should be noted that the first and last days, 11 and 25 July 2022, were partial survey days.

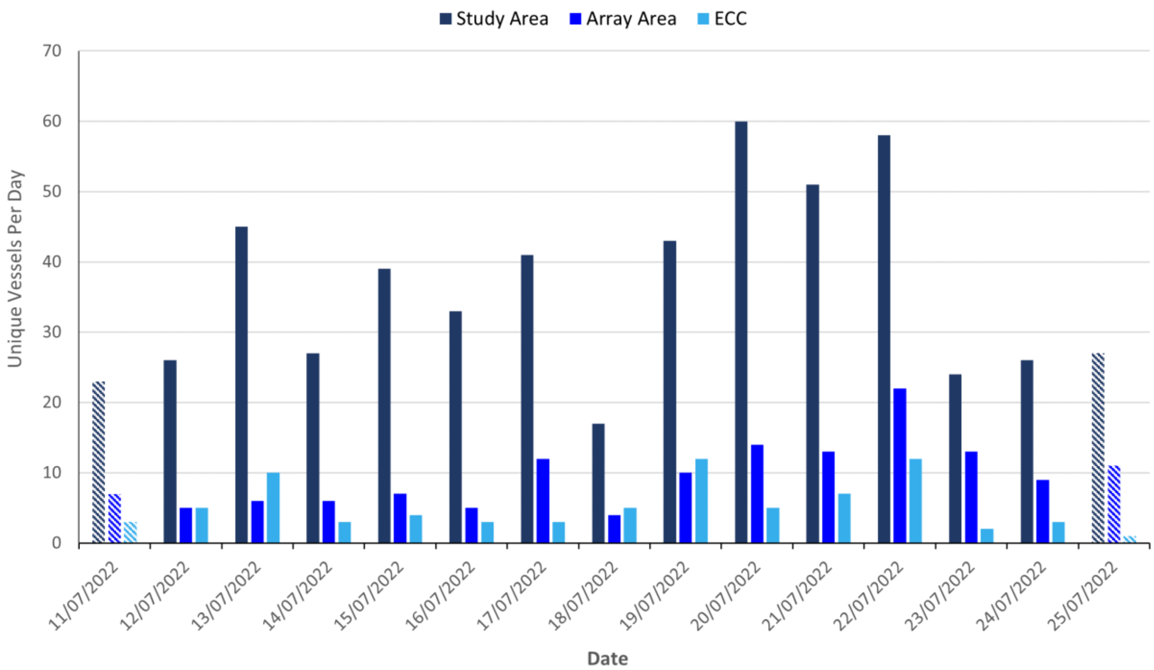

Figure 10.5 Daily Unique Vessel Counts within Study Area, Array Area, and ECC (Summer 2022)

162. For the 14-days analysis in summer, there was an average of 39 unique vessels recorded per day within the study area. An average of 10 unique vessels per day were recorded intersecting the array area, and an average of six unique vessels per day were recorded intersecting the ECC. Throughout the summer survey period, approximately 27% of vessel traffic recorded within the study area intersected the array area, and 14% intersected the ECC.

163. The busiest full day recorded within the study area throughout the summer survey period was 20 July 2022, when 60 unique vessels were recorded. The busiest full day within the array area was the 22 July 2022, when 22 unique vessels were recorded.

The busiest full day within the ECC was 19 and 22 July 2022, when 12 unique vessels were recorded each day.

164. The quietest full day recorded within the study area throughout the summer survey period was the 18 July 2022, when 17 unique vessels were recorded. The quietest full day within the array area was also the 18 July 2022, when four unique vessels were recorded. The quietest full day within the ECC was 23 July 2022, when two unique vessels were recorded.

165. Figure 10.6 illustrates the daily number of unique vessels recorded within the study area, as well as intersecting the array area and ECC, during the winter survey period. It should be noted that the first and last days, 4 and 18 December, were partial survey days.

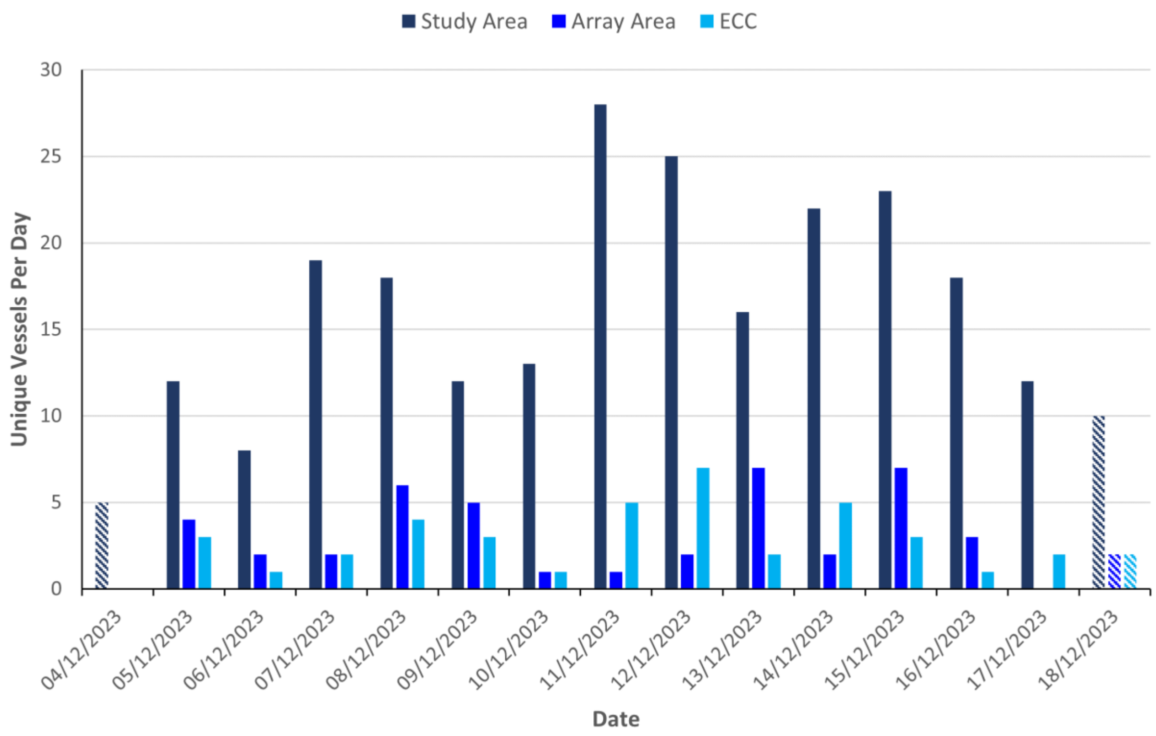

Figure 10.6 Daily Unique Vessel Counts within Study Area, Array Area, and ECC (Winter 2023)

166. For the 14-day analysis in winter, there was an average of 17 unique vessels recorded per day within the study area. An average of three unique vessels per day were recorded intersecting the array area, as well as the ECC. Throughout the winter survey period approximately 18% of vessel tracks recorded within the study area intersected the array area, and 17% intersected the ECC.

167. The busiest full day recorded within the study area throughout the winter survey period was 11 December 2023, when 28 unique vessels were recorded. The busiest

full days within the array area were 13 and 15 December 2023, when seven unique vessels were recorded. The busiest full days within the ECC was 12 December 2023, when seven unique vessels were recorded.

168. The quietest full days recorded within the study area throughout the winter survey period was 6 December 2023, when 8 unique vessels were recorded. The quietest full day within the array area was 17 December 2023, when no vessels were recorded. The quietest full days within the ECC was 6, 10 and 16 December 2023, when one unique vessel were recorded per day.

10.2 Vessel Type

169. The percentage distribution of the main vessel types recorded passing within the study area, as well as intersecting the array area and ECC, during the summer survey period is presented in Figure 10.7. The same distribution for the winter survey period is presented in Figure 10.8.

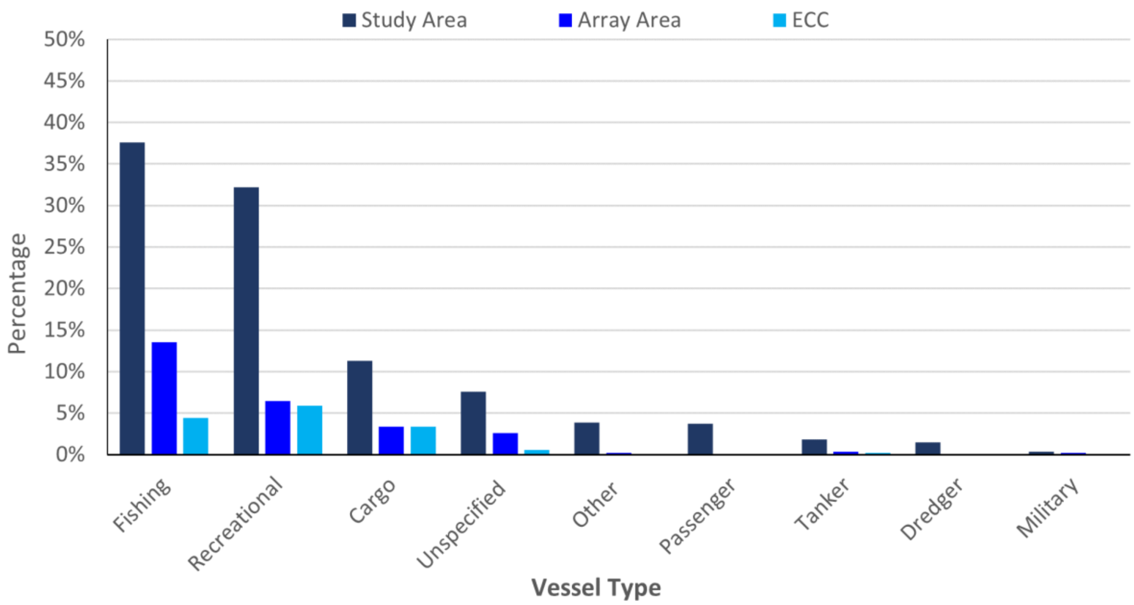

Figure 10.7 Main Vessel Type Distributions (Summer 2022)

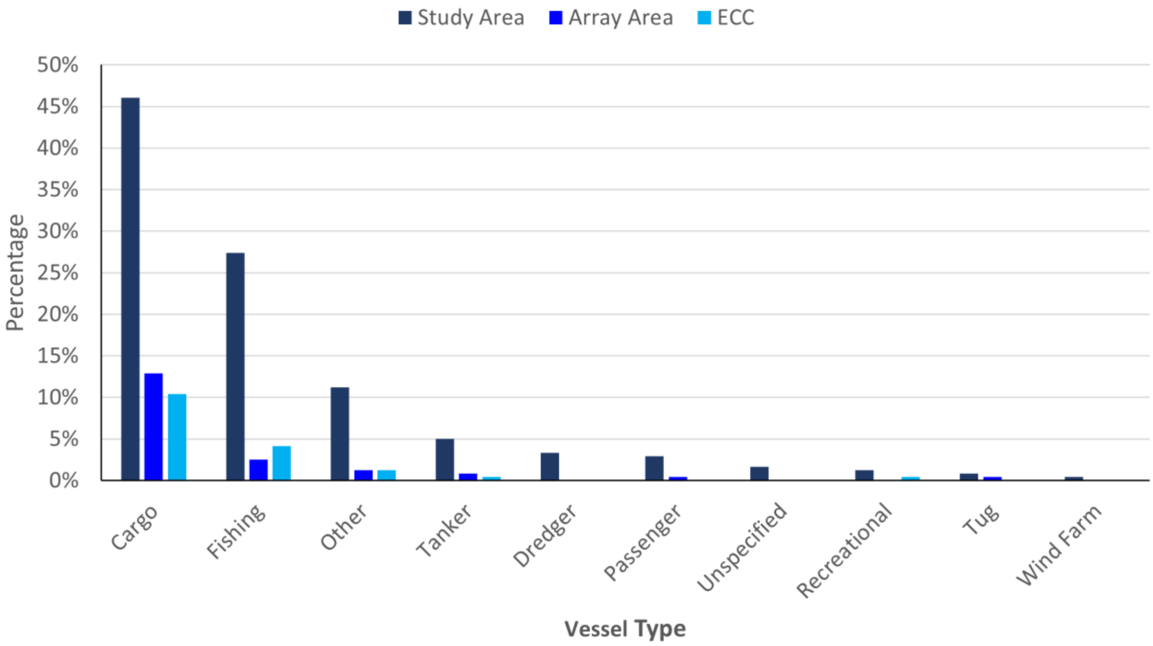

Figure 10.8 Main Vessel Type Distributions (Winter 2023)

170. Throughout the summer survey period, the main vessel types were fishing vessels (38%), recreational vessels (32%), and cargo vessels (11%).

171. Throughout the winter survey period, the main vessel types within the study area were cargo vessels (46%), fishing vessels (27%), and other vessels (11%) which were mainly pilot vessels associated with Drogheda Port, RNLI lifeboats, and a buoy-laying vessel.

172. The following subsections consider each of the main vessel types individually.

10.2.1 Cargo Vessels

173. Figure 10.9 presents a plot of cargo vessels, including RoRos, recorded within the study area during the two 14-day survey periods.

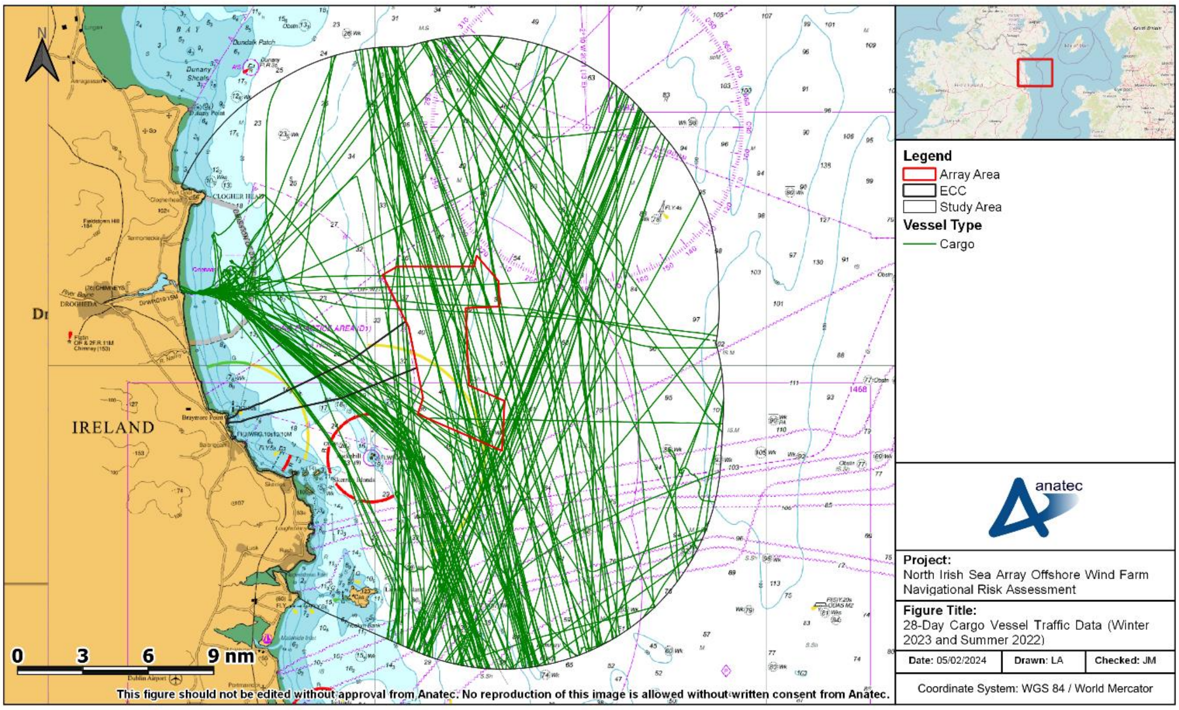

Figure 10.9 28-Day Cargo Vessel Traffic Data (Summer 2022 and Winter 2023)

174. Throughout the summer survey period an average of four unique cargo vessels per day was recorded within the array area, and an average of one unique cargo vessel per day was recorded within the ECC.

175. Throughout the winter survey period an average of eight unique cargo vessels per day were recorded within the study area. An average of two to three unique cargo vessels per day were recorded within the array area, and an average of one to two unique cargo vessels per day were recorded within the ECC.

176. Vessels were observed across the study area with greater numbers recorded transiting through the centre routeing to/ from ports including Drogheda (Ireland), Warrenpoint (UK) and Belfast (UK). Many vessels transiting to Dublin (Ireland) were observed routeing north-east/south-west through the study area. From Anatec's ShipRoutes database, it is known there is substantial volumes of cargo vessel routeing immediately south of the study area.

177. The main cargo vessel sub-types recorded during the two 14-day survey periods were general cargo (38%), part-containerised (33%), container carrier (12%), and RoRo (7%). RoRo cargo vessels are described in more detail in Section 10.2.1.1.

10.2.1.1 RoRo Vessels

178. Figure 10.10 presents a plot of RoRo vessels recorded within the study area during the two 14-day periods, colour-coded by operator.

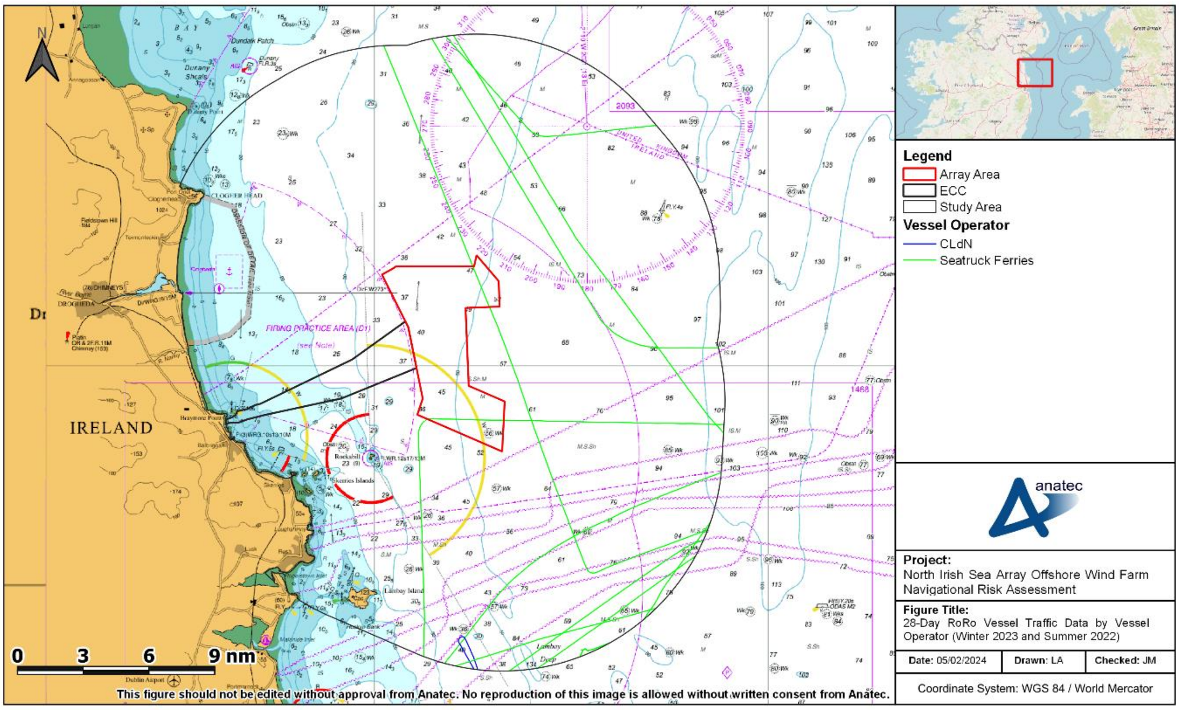

Figure 10.10 28-Day RoRo Vessel Traffic Data by Vessel Operator (Summer 2022 and Winter 2023)

179. Seatruck Ferries, owned by CLdN, was the main operator recorded within the study area during both survey periods, operating all but one vessel. One vessel operated by CLdN was recorded during the winter survey period displaying waiting behaviour prior to entering Dublin Port, to the south of the study area. Such behaviour by commercial ferries was also noted in the 12 months dataset (see Appendix F) and extended further north than identified in the 2023 winter survey data. These RoRos operate on timetabled routes which are generally to the south of the study area and no route regularly passes within the array area.

180. Routes for each operator include:

- Seatruck Ferries routeing between Dublin – Liverpool (UK) and Dublin – Heysham (UK).
- CLdN routeing between Dublin and various destinations along northern and western Europe, including Zeebrugge (Belgium) and Santander (Spain).

181. Two RoRo vessels were noted to intersect the array area, both operated by Seatruck Ferries. One vessel intersected from west to east on route from Dublin to Liverpool on 9 December 2023, the other intersected northwest through southeast on a route from Warrenpoint to Heysham during 16 December 2023. Vessels on the Dublin – Liverpool route do not regularly intersect the array area. This track may be an instance where adverse weather caused the vessel to deviate from its regular route. This is therefore not representative of the vessel's normal movements.

10.2.2 Fishing Vessels

182. Figure 10.11 presents a plot of fishing vessel activity recorded within the study area throughout the two 14-day survey periods, colour-coded by survey period.

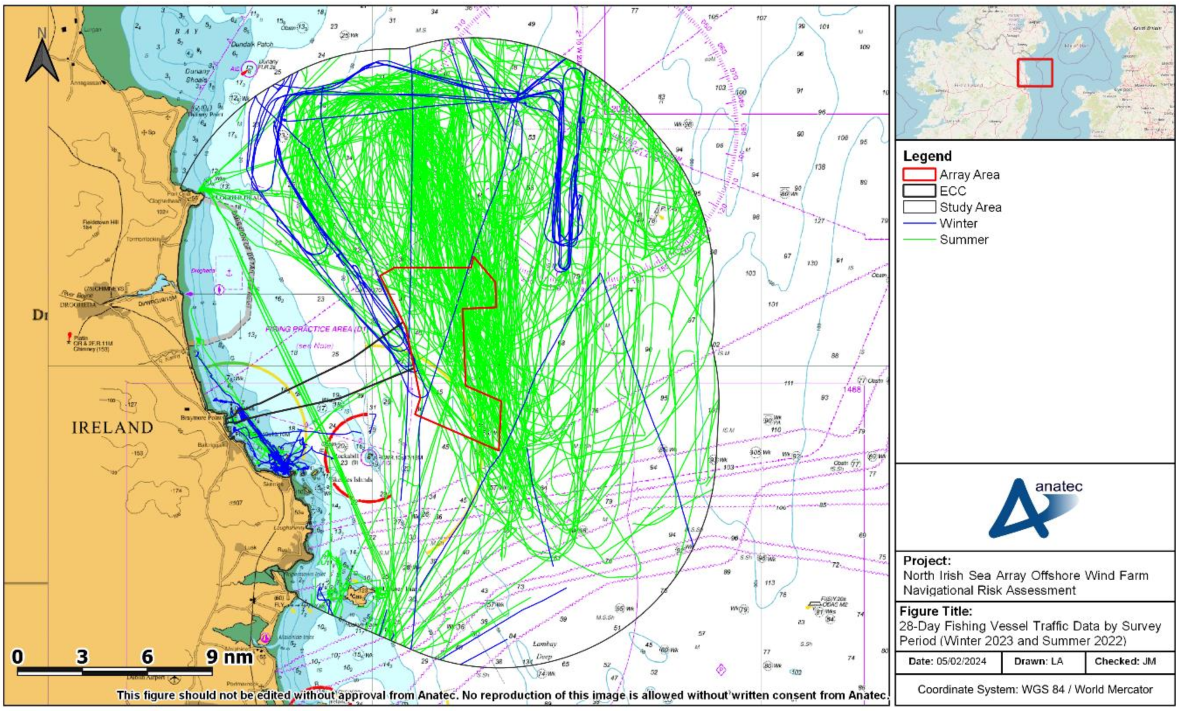

Figure 10.11 28-Day Fishing Vessel Traffic Data by Survey Period (Summer 2022 and Winter 2023)

183. Throughout the summer survey period an average of 15 unique fishing vessels per day were recorded within the study area. An average of five unique vessels per day were recorded within the array area, and an average of two unique fishing vessels per day were recorded within the ECC.

184. Throughout the winter survey period, an average of five unique fishing vessels per day were recorded within the study area. One unique fishing vessel per day was recorded every two to three days within the array area and one unique fishing vessel every one to two days was recorded within the ECC.

185. As noted by vessel counts and as illustrated in Figure 10.11 there is considerable seasonality in fishing vessel movements with greater volumes of fishing across the summer survey period (75% of all fishing tracks recorded). Most fishing vessels recorded in winter were seen transiting through the study area or close to the coast off Skerries, one vessel was recorded to be engaged in likely fishing activities to the north of the array area over multiple days. As for summer, fishing vessels were recorded on transit throughout the study area as well as engaged in likely fishing activities, most notably to the north and centre of the study area. Vessels on transit

were primarily observed transiting between fishing grounds and Skerries Harbour or Port Oriel Harbour.

186. As considered within **Volume 3, Chapter 16: Commercial Fisheries**, the main fishing grounds to the east and north of the array area are nephrops fishing areas and constitute the majority of the fishing activity in the area.

187. Of all fishing tracks recorded, 72% could be associated with a fishing gear type and country of registration. The main gear types recorded were single (otter) demersal trawlers (69%) and pelagic trawlers (15%). The main country of registration was Ireland (66%) and Great Britain (32%).

188. Approximately 74% of fishing vessels throughout the two 14-day survey periods were recorded on AIS, and the remaining 26% on Radar. There were also some visual observations of fishing vessels – these are detailed in Appendix G.

10.2.3 Tankers

189. Figure 10.12 presents a plot of tankers within the study area during the two 14-day survey periods.

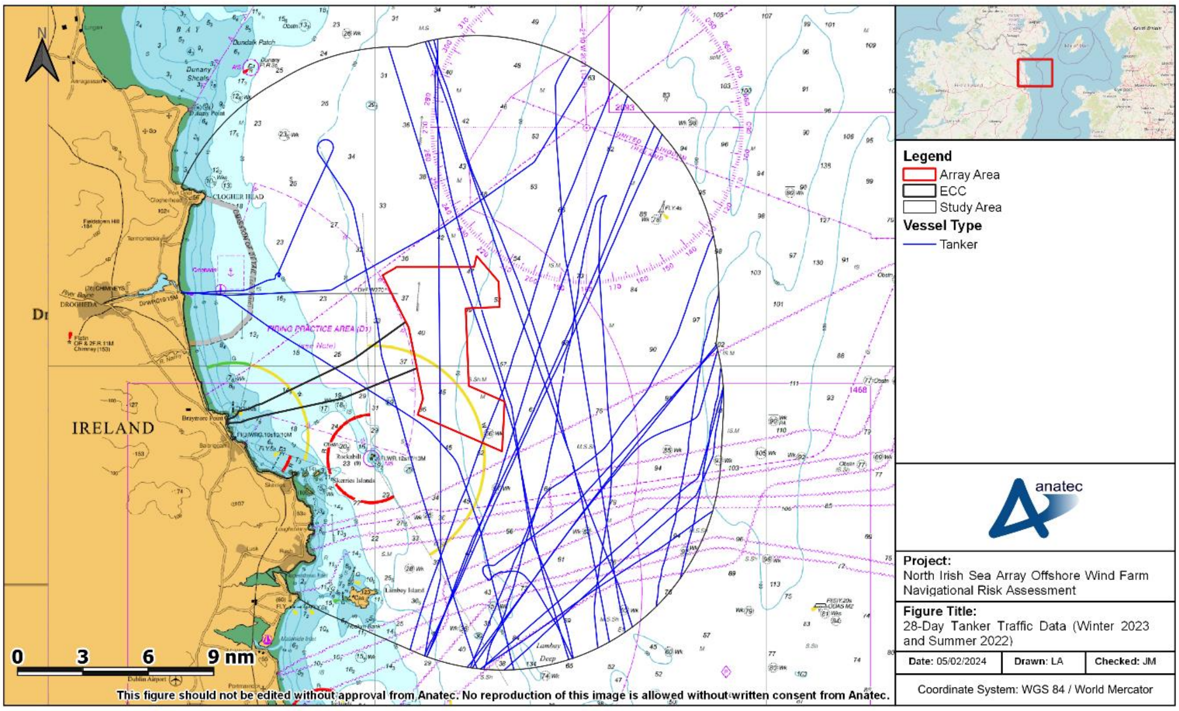

Figure 10.12 28-Day Tanker Traffic Data (Summer 2022 and Winter 2023)

190. An average of one unique tanker per day was recorded within the study area throughout both the winter and the summer survey periods.

191. Similarly, during both summer and winter survey periods, two unique tankers were recorded within the array area, or one unique vessel every seven days, and only one unique tanker was recorded within the ECC.

192. Tankers were observed transiting across the study area with a higher volume southeast of the array area. Several vessels transited through the array area on routes to/ from Warrenpoint, Rosslare, and Dublin.

193. The most common tanker sub-type within the study area was combined oil/ chemical tankers (44%). Liquid Petroleum Gas (LPG) carriers (22%), and product tankers (22%) were also commonly recorded.

10.2.4 Passenger Vessels

194. Figure 10.13 presents a plot of passenger vessels recorded within the study area during the two 14-day survey periods.

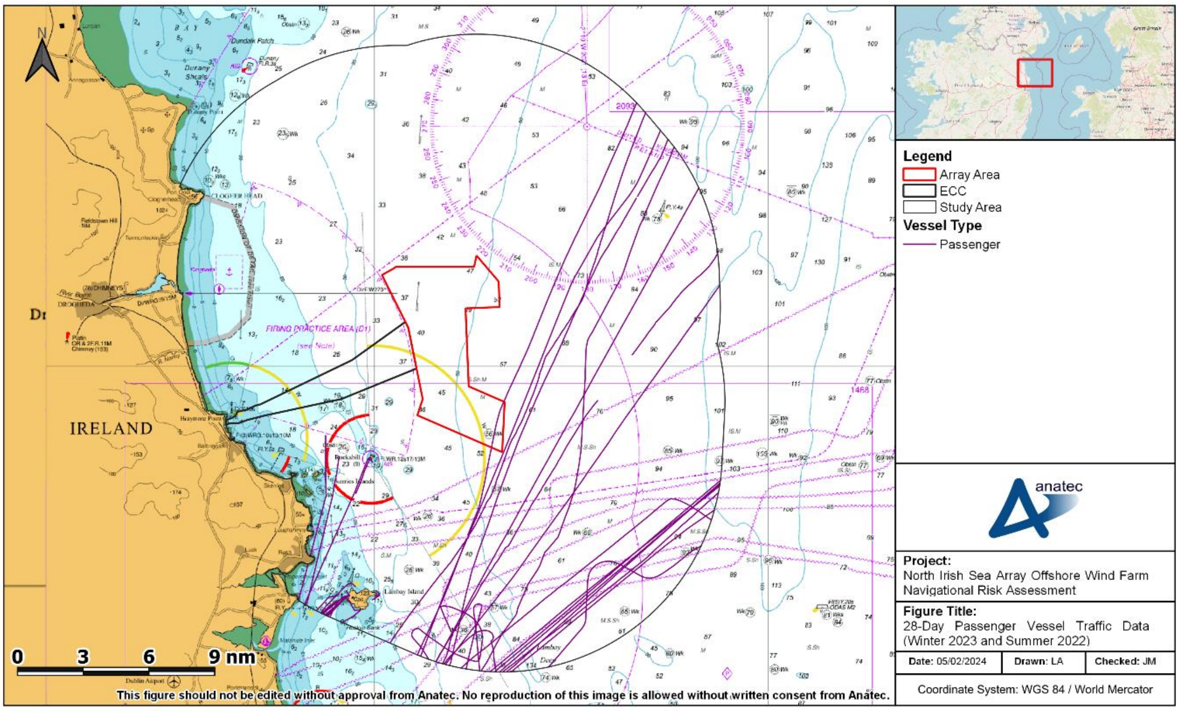

Figure 10.13 28-Day Passenger Vessel Traffic Data (Summer 2022 and Winter 2023)

195. Throughout the summer survey period an average of between one and two unique passenger vessels per day were recorded within the study area. No passenger vessels were recorded within the array area or ECC during the summer survey period.

196. Throughout the winter survey period an average of one unique passenger vessel was recorded within the study area every two days. One unique passenger vessel was recorded within the array area and none were recorded within the ECC across the survey period.

197. Roll-On/ Roll-Off Passenger (RoPax) vessels (33% of all passenger vessels recorded) were noted to were routeing between:

- Dublin– Liverpool and operated by P&O Ferries;
- Dublin– Douglas and operated by Isle of Man Steam Packet Company; and
- Dublin– Cherbourg and operated by Irish Ferries.

198. Only the Dublin – Douglas route regularly passes within the study area at the south-east extent. Vessels routeing to Dublin from Liverpool are observed intersecting the southeast of the study area, straying from their standard route which – based on Anatec's ShipRoutes database – passes south of the study area. One RoPax vessel was also noted routeing to Belfast from Dublin during the winter survey period, intersecting the array area. It is noted that this is not a regular route and was due to an exchange in ownership of the vessel.

199. As with RoRo vessels (see Section 10.2.1.1), one RoPax operated by Irish Ferries on the Dublin – Cherbourg (France) route south of the study area, was noted to display waiting behaviour in the south of the study area from 7 December 2023 until 8 December 2023 prior to arriving at Dublin. This transit is therefore not representative of the vessel's normal movements and may be due to adverse weather and berth availability at Dublin Port, adverse weather routeing is detailed further in Section 12.

200. Two cruise liners were noted transiting north-east from Dublin during the summer survey period. One vessel was routeing to Belfast and the other to Greenock (UK).

201. Other passenger vessels recorded during the survey periods consisted of seasonal daytrip/ tour ferries around the coast and Lambay Island and to Rockabill Lighthouse (vessels with ability to carry more than 12 passengers are classified as passenger rather than recreational vessels). One sailing vessel and one yacht were also recorded routeing north-east south-west to/ from Dublin (greater than 24m length and therefore categorised as passenger vessels rather than recreational vessels).

10.2.5 Recreational Vessels

202. Figure 10.14 presents a plot of recreational vessel activity within the study area throughout the two 14-day survey periods.

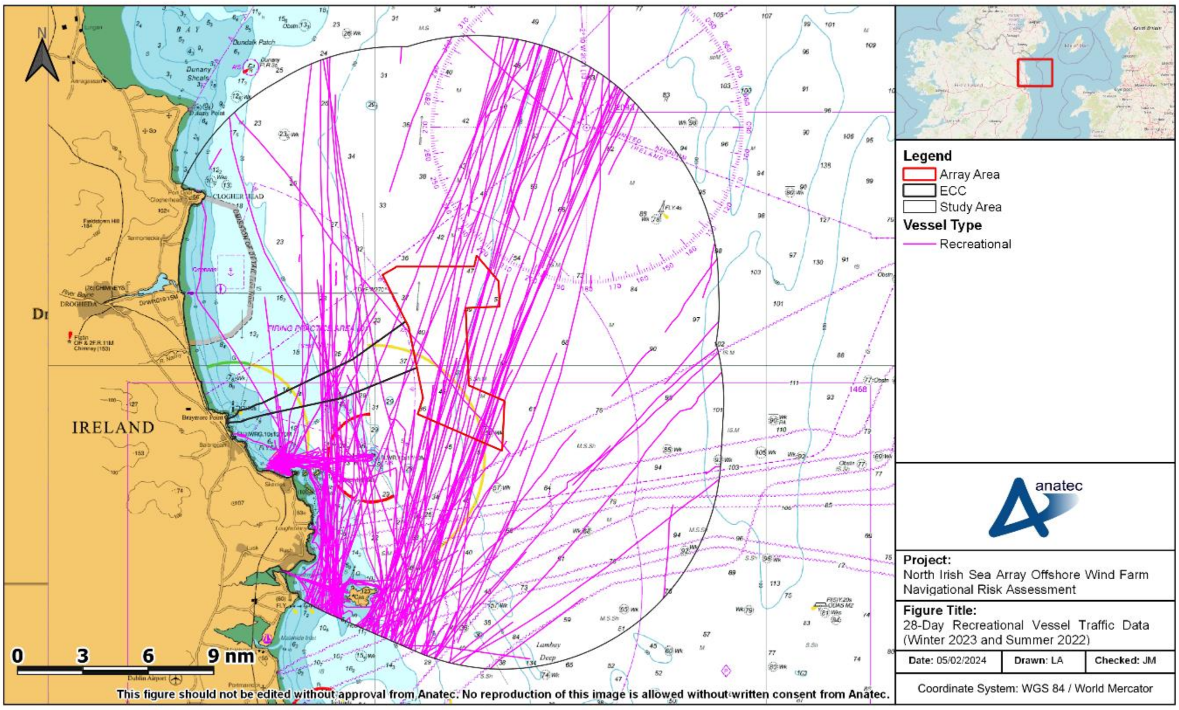

Figure 10.14 28-Day Recreational Vessel Traffic Data (Summer 2022 and Winter 2023)

203. Throughout the summer survey period an average of 12 unique recreational vessels per day were recorded in the study area, between two and three unique recreational vessels per day were recorded per day within the array area, and an average of two unique vessels per day were recorded within the ECC.

204. Throughout the winter survey period an average of one unique recreational vessel was recorded every four to five days within the study area. No recreational vessels were recorded within the array area, and only one was recorded within the ECC.

205. Recreational vessels were predominantly observed transiting in nearshore areas with most traffic transiting through the centre and to the west of the array area. Vessels were noted utilising harbours and marinas on the coast with Skerries Harbour being the most common. Vessels transiting through the study area were on a transit north-south to the west of the array area to/ from the Carlingford Lough or north-east south-west through the array area, likely on route to/ from Howth and Dublin Bay. The greatest proportion of recreational vessels were observed to the south-west of the study area transiting between the mainland and around Lambay Island. Overall, most of the recreational traffic was seasonal and observed during the summer survey period with only three unique transits being present in the south-west during the winter period.

206. Approximately 90% of recreational vessels throughout the 28-day survey periods were recorded via AIS, and the remaining 10% via Radar. There were also some visual observations of recreational vessels – these are detailed in Appendix G. Additionally,

Anatec has reviewed the data contained in the RYA Coastal Atlas which indicates good agreement with the data collected during the vessel traffic surveys, including the distinctive routes north-south to the west of the array area to/ from Carlingford Lough and north east south-west through the array area to/ from Dublin Bay.

10.2.6 Anchored Vessels

207. Anchored vessels can be identified based upon the AIS navigational status which is programmed on the AIS transmitter on board a vessel. However, information is manually entered into the AIS, and therefore it is common for vessels not to update their navigational status if only at anchor for a short period of time.

208. For this reason, those vessels which travelled at a speed of less than one knot (kt) for more than 30 minutes had their corresponding vessel tracks individually checked for patterns characteristic of anchoring activity.

209. After applying these criteria, 44 anchored vessels were identified within the study area, corresponding to an average of one anchored vessel per day. Of the anchored vessels identified, 66% broadcast an AIS navigational status of “at anchor”. Figure 10.15 presents a plot of anchored vessels recorded within the study area throughout the two 14-day survey periods. A high number of vessels (52%) utilised the Drogheda outer anchorage area to the west of the array area (see Section 7.1.1). No vessels were at anchor within the array area, nor the ECC.

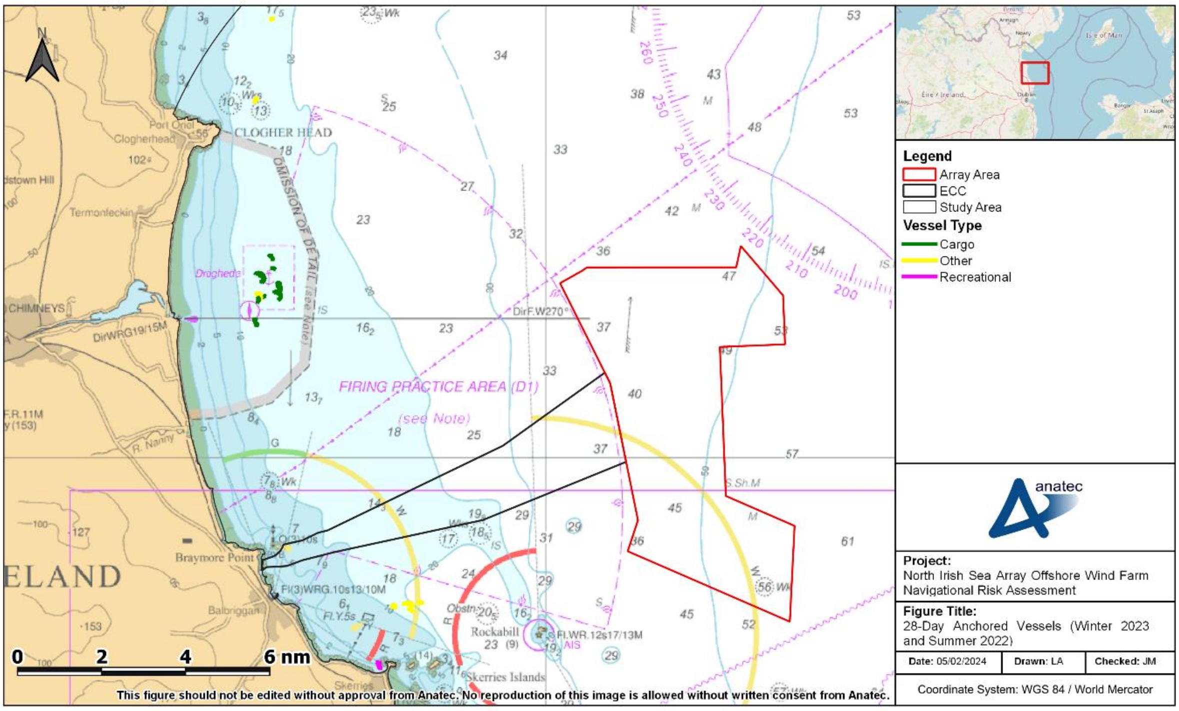

Figure 10.15 28-Day Anchored Vessels (Summer 2022 and Winter 2023)

10.3 Vessel Size

10.3.1 Vessel Length

210. A plot of all vessel tracks (excluding temporary traffic) recorded within the study area throughout the survey periods, colour-coded by LOA, is presented in Figure 10.16. Following this, the distribution of these LOA classes by survey period is presented in Figure 10.17.

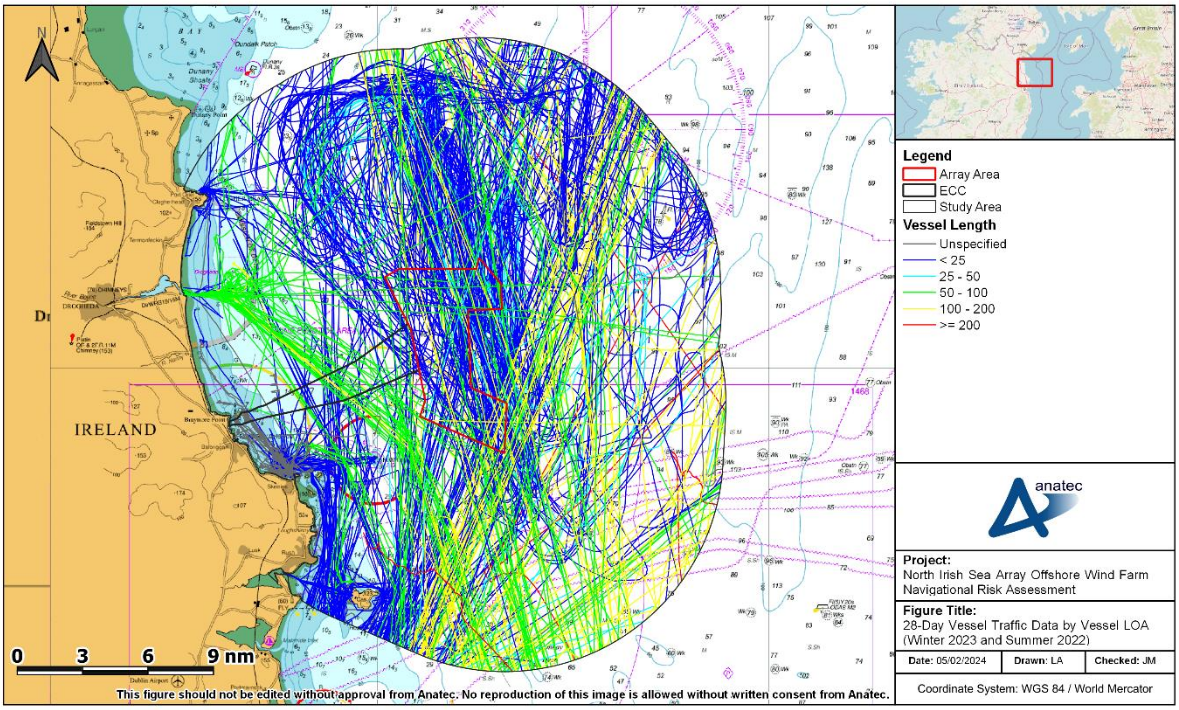

Figure 10.16 28-Day Vessel Traffic Data by Vessel LOA Within the Study Area (Summer 2022 and Winter 2023)

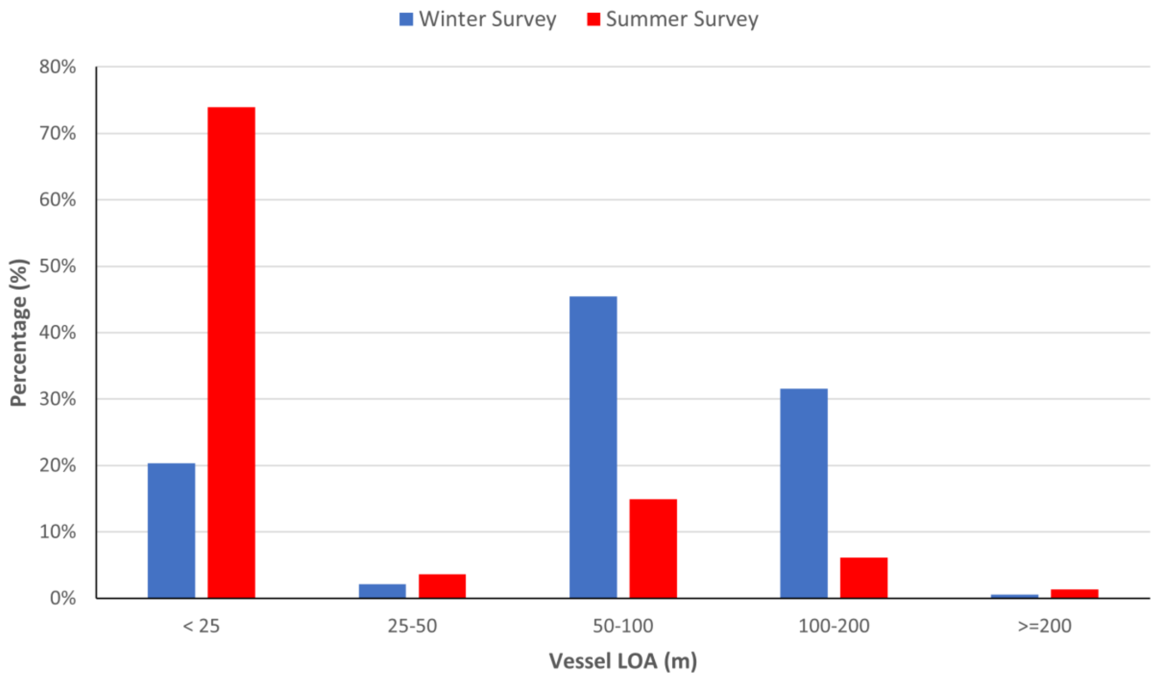

Figure 10.17 28-Day Vessel Length Distribution by Survey Period (Summer 2022 and Winter 2023)

211. Vessel LOA was available for 81% of vessels recorded throughout the two 14-day survey periods and ranged from 7m recreational vessels to a 291m Liquified Natural Gas (LNG) tanker.

212. Excluding the proportion of vessels for which a length was not available the average length of vessels within the study area throughout the summer and winter survey periods was 37m and 89m, respectively. The difference in average vessel length between the two survey periods may be attributed to the greater presence of small recreational vessels in the summer period. This is also highlighted by the majority of vessels in the summer period (74%) having a LOA of less than 25m whereas in the winter period higher LOAs were more prevalent.

10.3.2 Vessel Draught

213. A plot of all vessel tracks (excluding temporary traffic) recorded within the study area throughout the survey periods, colour-coded by vessel draught is presented in Figure 10.18. Following this, the distribution of these draught classes is presented in Figure 10.19.

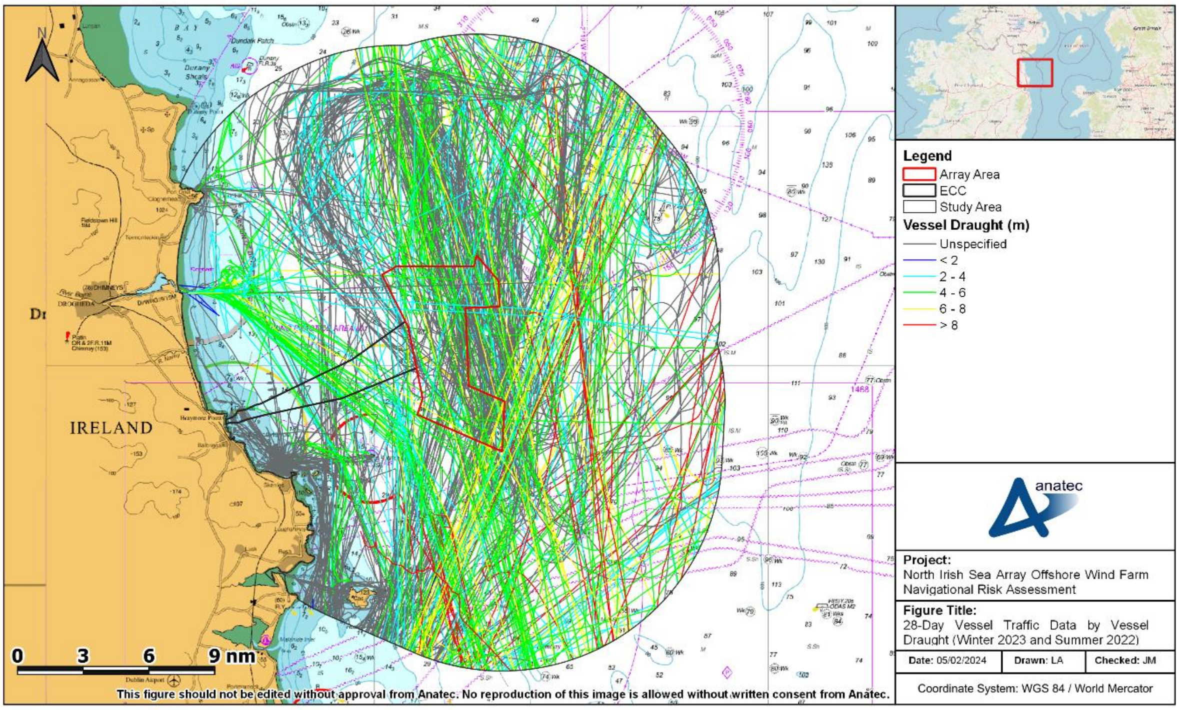

Figure 10.18 28-Day Vessel Traffic Data by Vessel Draught Within the Study Area (Summer 2022 and Winter 2023)

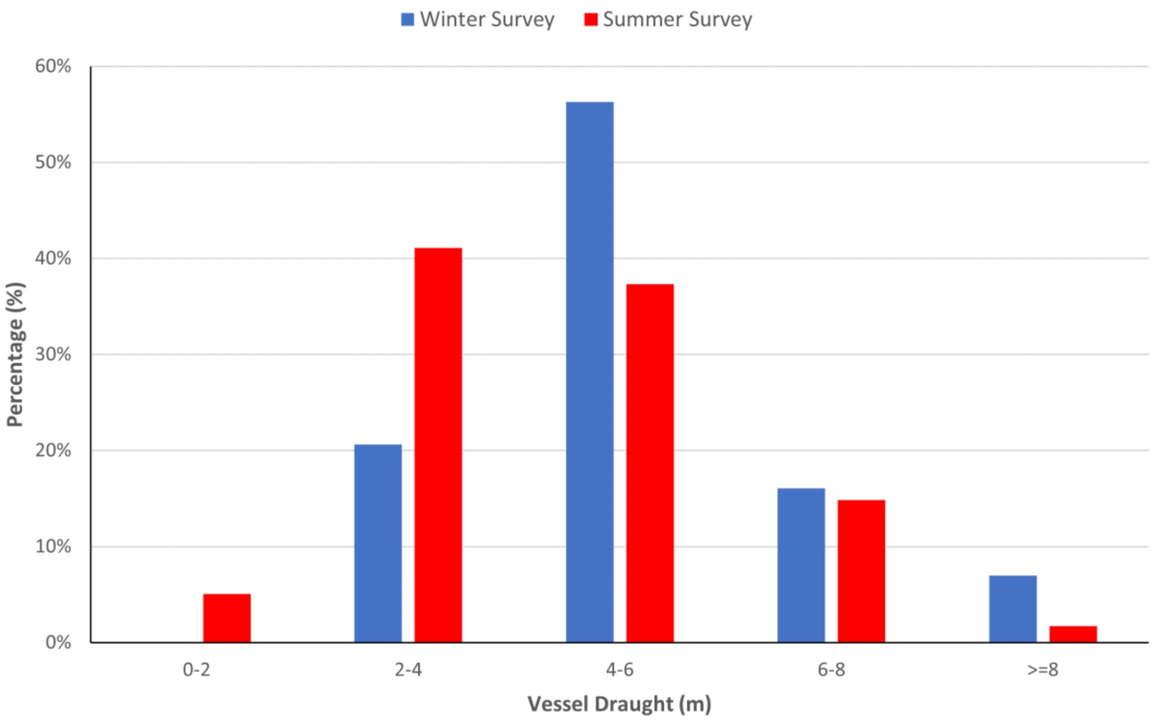

Figure 10.19 28-Day Vessel Draught Distribution by Survey Period (Summer 2022 and Winter 2023)

214. Vessel draught was available for approximately 39% of vessels recorded throughout the two 14-day survey periods and ranged from 1m for a pilot vessel to 11.6m for a LNG tanker, the same LNG tanker with the greatest LOA (see Section 1).

215. Excluding the proportion of vessels for which a length was not available the average draught of vessels within the study area throughout the summer and winter survey periods was 4.3m and 5.2m, respectively. Of those vessels with unspecified vessel draughts, most of these vessels were either recreational or fishing vessels and data limitations are expected with these vessel types (Section 5.4.1).

11 Base Case Vessel Routeing

11.1 Definition of a Main Commercial Route

216. Main commercial routes have been identified using the principles set out in MGN 654 (MCA, 2021). Vessel traffic data are assessed and vessels transiting at similar headings and locations are identified as a main route. To help identify main routes, vessel traffic data can also be interrogated to show vessels (by name and/ or operator) that frequently transit those routes. The route width is then calculated using the 90th percentile rule from the median line of the potential shipping route as shown in Figure 11.1.

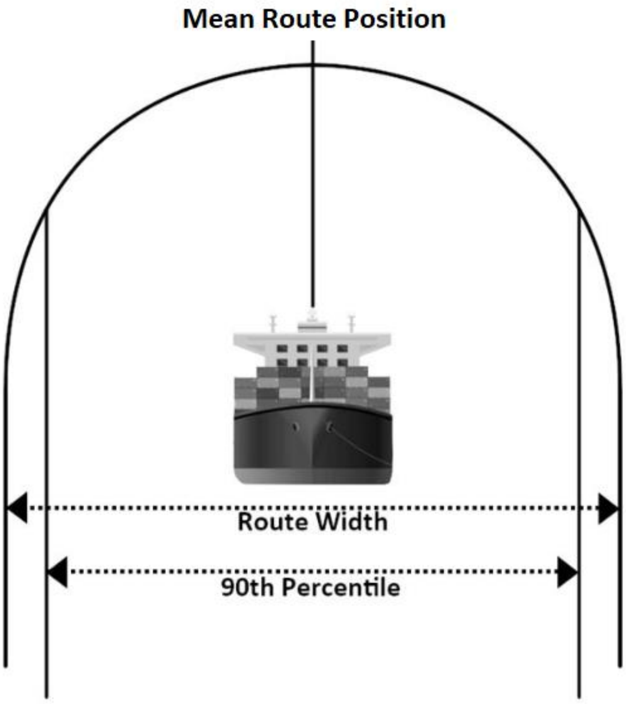

Figure 11.1 Illustration of Main Route Calculation (MCA, 2021)

11.2 Pre Wind Farm Main Commercial Routes

217. A total of 10 main commercial routes were identified from the vessel traffic survey data. These main commercial routes and corresponding 90th percentiles within the study area are shown relative to the array area in Figure 11.2. Following this, a description of each route is provided in Table 11.1, including the average number of vessels per day, start and end locations, main vessel types and details of commercial ferry routeing (where applicable). It is noted that the start and end locations are based on the most common destinations transmitted via AIS by vessels on those routes. Vessels on some routes have a wide variety of potential destinations, and therefore determining an overall route length (to/ from a specific port) beyond the

Irish Sea is not feasible, and the start/ end destination used (usually a TSS) is the shared and fixed location for all vessels on these routes.

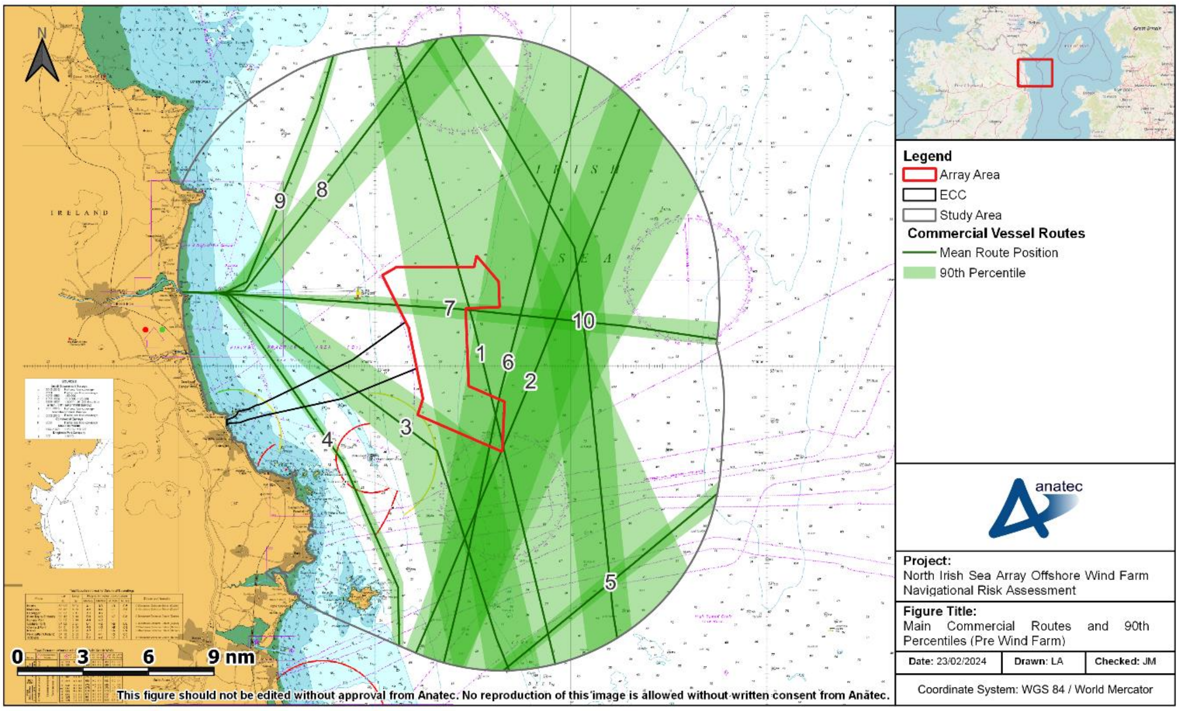

Figure 11.2 Main Commercial Routes and 90th Percentiles within Study Area (Pre Wind Farm)

Table 11.1 Details of Main Commercial Routes

Route number	Average vessels per week	Description
1	10 to 11	**Warrenpoint to ports within Bristol Channel.** Generally used by cargo vessels (83%).
2	9 to 10	**Dublin to Belfast.** Generally used by cargo vessels (59%), passenger vessels (21%), and tankers (15%).
3	6 to 7	**Drogheda to Off Smalls TSS.** Used by cargo vessels (100%).
4	1	**Drogheda to Off Smalls TSS.** Used by cargo vessels (100%).
5	1 to 2	**Dublin to Douglas.** Generally used by passenger vessels (60%) and tankers (40%).
6	1	**Belfast to Wicklow.** Used by cargo vessels (100%).
7	1	**Drogheda to Mersey.** Used by cargo vessels (100%).
8	1	**Drogheda to Belfast.** Used by cargo vessels (100%).
9	1	**Drogheda to Warrenpoint.** Used by cargo vessels (100%).
10	3 to 4	**Warrenpoint to Off Smalls TSS.** Mainly used by cargo vessels (87%).

11.3 Local Port Related Traffic

218. As noted in Section 7.1, there are several ports and harbours located along the coast close to the proposed development. Although some vessel traffic associated with these ports (both entering and exiting) is characterised in the main commercial routes, there is additional commercial traffic which did not constitute a main commercial route (due to volume) and non-commercial traffic.

219. The following subsection considers each of the main ports within the study area and their associated vessel traffic.

11.3.1 Drogheda Port

220. A plot of the vessel tracks associated with Drogheda Port within the study area throughout the two 14-day survey periods is presented in Figure 11.3.

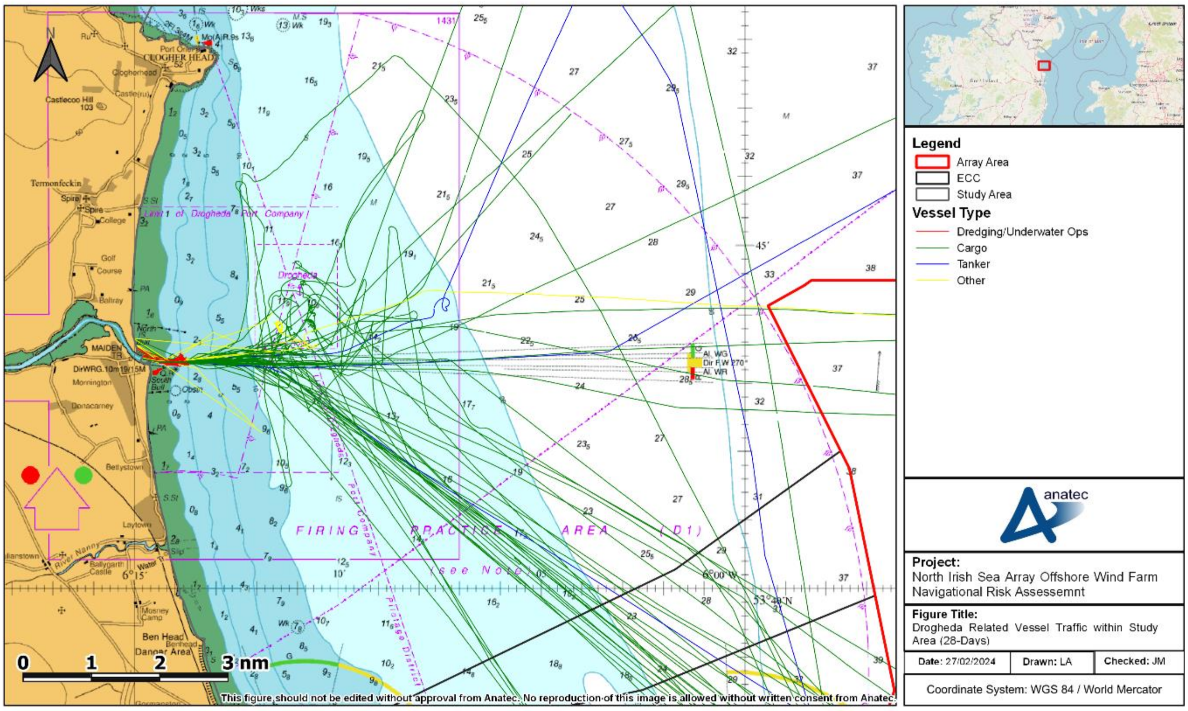

Figure 11.3 Drogheda Related Vessel Traffic within Study Area (28-Days)

221. As indicated in Section 1, cargo vessels are prominent out of Drogheda, with the majority transiting to the south-east and through the ECC with vessels also transiting east through the array area. Due to the proximity of the Drogheda outer anchorage area, various commercial vessels were anchored or waiting for a berth at Drogheda Port within the surrounding area.

222. Marine aggregate dredgers were also recorded across both survey periods. These marine aggregate dredgers were undertaking dredging activity for Drogheda Port at the entrance to the River Boyne and estuary, and within the Drogheda outer

anchorage area, likely maintaining safe navigation depths for entrance to the port. Although maintenance dredging is temporary, the seaward entrance to the estuary and port approach is particularly vulnerable to high levels of silt deposition caused by high river water exit velocity, storm events, and periods of bad weather (Department of Housing, Local Government and Heritage (DHLGH), 2022). This makes it difficult to pre-plan or forecast maintenance dredging activity but will more than likely occur periodically within the area.

223. Pilotage activity was also observed at the pilot boarding station situated on the southern boundary of the charted anchorage area with two Drogheda pilot vessels recorded taking multiple trips to and from the pilot boarding station on the southern boundary of the designated anchorage, located approximately 1.6nm from the port entrance.

11.3.2 Skerries Harbour

224. A plot of the vessel tracks associated with Skerries Harbour within the study area throughout the two 14-day survey periods is presented in Figure 11.4.

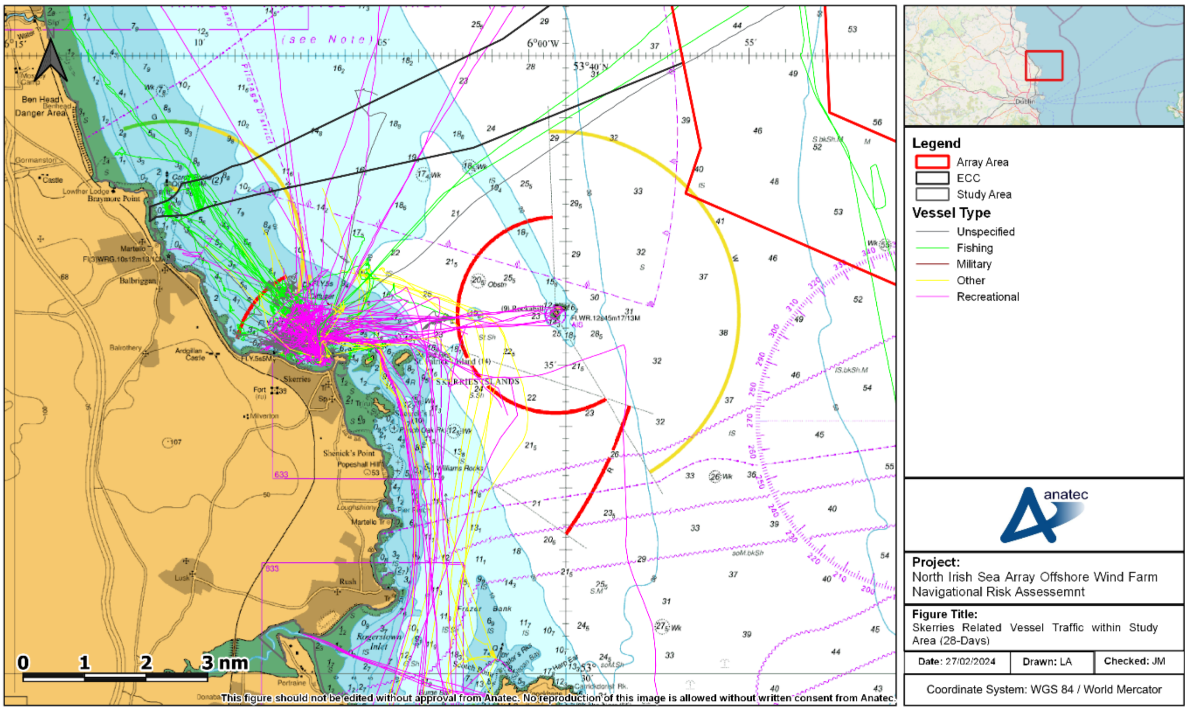

Figure 11.4 Skerries Related Vessel Traffic within Study Area (28-Days)

225. The most prominent vessel traffic out of Skerries Harbour is recreational and fishing vessels. The majority of recreational vessels were seasonal and only present during the summer whilst a number of fishing vessels were recorded during winter, as presented in Section 10.2.2. Recreational vessels were mostly recorded transiting to/from Rockabill and to the south towards Howth Head, with cases of navigation further offshore in proximity to the array area limited. Of all fishing vessels recorded

utilising Skerries Harbour, only one vessel track was recorded via AIS while the rest were recorded via Radar. Approximately 83% of all recreational tracks recorded were via AIS with the remaining 17% via Radar.

226. No commercial traffic was recorded utilising Skerries Harbour which is expected with the harbour only having availability for berthing fishing and small craft vessels due to tidal depths (see Section 7.1.4). Multiple RNLI lifeboats were recorded making trips to and from the Skerries RNLI station located within the harbour.

11.3.3 Port Oriel Harbour

227. A plot of the vessel tracks associated with Port Oriel Harbour, and the area surrounding Clogher Head, within the study area throughout the two 14-day survey periods is presented in Figure 11.5.

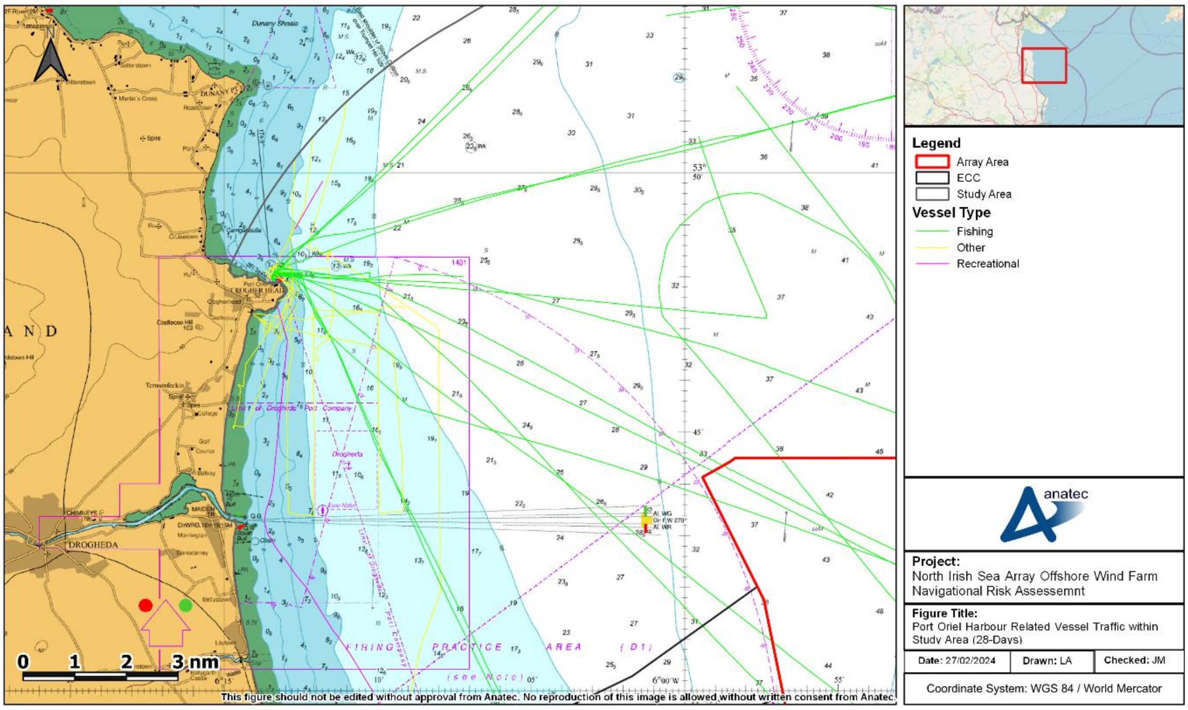

Figure 11.5 Port Oriel Harbour Related Vessel Traffic within Study Area (28-Days)

228. Port Oriel Harbour was mainly used by fishing vessels which is expected as the harbour is described as a small fishing port (Section 7.1.3). Fishing vessels were recorded during summer and were most notable recorded transiting to the east to fishing grounds both immediately north and east of the array area. Some vessels were also recorded transiting south to fishing grounds. All fishing vessels utilising Port Oriel Harbour were recorded via AIS.

229. One recreational vessel was recorded entering Port Oriel Harbour briefly from the south before continuing to transit north on the same day and was recorded via AIS.

230. RNLI lifeboats were noted transiting in proximity to Clogher Head and transiting to and from the Clogher Head RNLI station to Port Oriel Harbour.

12 Adverse Weather Routeing

231. Some vessels and vessel operators may operate alternative routes during periods of adverse weather. This section focuses on vessel movements in adverse weather given the implications can be significant if a commercial vessel is unable to make passage or a small craft is unable to access safe havens in adverse weather due to the presence of the development or activities associated with the development.

232. Adverse weather includes wind, wave, and tidal conditions as well as reduced visibility due to fog that can hinder a vessel's standard route, speed of navigation and/ or ability to enter the destination port. Adverse weather routes are assessed to be significant course adjustments to mitigate vessel motion in adverse weather conditions. When transiting in adverse weather conditions, a vessel is likely to encounter various types of weather and tidal phenomena, which may lead to severe roll motions, potentially causing damage to cargo, equipment and/ or discomfort and danger to persons on board. The sensitivity of a vessel to these phenomena will depend upon the actual stability parameters, hull geometry, vessel type, vessel size and speed.

12.1 Identification of Periods of Adverse Weather

233. Historical weather information provided by the Met Éireann (DHLGH, 2023) and information from The Irish Times (The Irish Times, 2023) have been used to identify periods of adverse weather during the vessel traffic surveys and the long-term data set, when routes in proximity to the proposed development could be considered most likely to be altered or cancelled. The key weather events identified are detailed in Table 12.1.

Table 12.1 Key Weather Events During Vessel Traffic Surveys Relevant to the Proposed Development (Met Éireann)

Weather event	Date(s)	Details
Storm Arwen	26 November 2021	A powerful extratropical cyclone that brought severe winds and snow to Ireland and the UK. Wind gusts in Ireland reached 70kt with waves reaching 13.3m.
Storm Barra	7 to 8 December 2021	Severe and damaging winds across Ireland accompanied by widespread heavy rain and snow. Wind gusts reaching 73kt and waves reaching 19.9m.
Storm Malik	28 January 2022	An extratropical cyclone that caused damage throughout northern Europe. Wind gusts of 58kt and waves reaching 14.4m.
Storm Corrie	29 to 30 January 2022	Severe and damaging winds and rain across Ireland and the UK. Wind gusts of 53kt and waves reaching 12m.
Storm Dudley	16 to 17 February 2022	European windstorm bringing severe flooding, high winds, and snow. Wind gusts of 68kt and waves reaching 13.8m.

Weather event	Date(s)	Details
Storm Eunice	18 February 2022	An intense extratropical cyclone. Wind gusts reaching 74kt and waves reaching 16.2m. Storm was recorded as one of the worst weather events in Ireland history with sever disruptions to power and critical services.
Storm Franklin	20 to 21 February 2022	Severe widespread winds and flooding which caused major disruption to power and critical services. Wind gust reached 75kt and waves reaching 29.5m
Storm Elin	9 December 2023	Irish Sea coasts were warned they could see gusts of up to 61kt.
Storm Fergus	10 December 2023	Strong winds and heavy rain starting in County Galway and then tracking eastwards across Ireland.

12.2 Commercial Routeing Changes

234. Vessel traffic survey data and consultation has been used to identify potential commercial routeing activity related to adverse weather conditions in proximity to the proposed development, with the periods outlined in Table 12.1 and commercial ferries (which can be seen to make similar transits on a very regular basis) studied most closely. Additionally, as part of the Regular Operator consultation, Regular Operators identified from the vessel traffic data were asked "*whether the presence of the proposed development poses any safety concerns to your vessels, including in relation to adverse weather routeing*" (see Appendix E).

235. No feedback was received in relation to adverse weather routeing during the Regular Operator consultation. However, during the Hazard Workshop, CLdN noted that north-south waiting behaviour associated with commercial vessels, including RoRo vessels, identified in the winter 2021 vessel traffic survey data is characteristic of vessels awaiting safe access to Dublin Port, particularly in winter. This period also coincides with the timing of Storm Barra which was reported as preventing vessels entering Dublin Port (AFLOAT, 2021).

236. The long-term vessel traffic data was analysed to further establish this activity. Figure 12.1 presents the tracks of vessels observed undertaking north-south transits characteristic of waiting for safe access to Dublin Port.

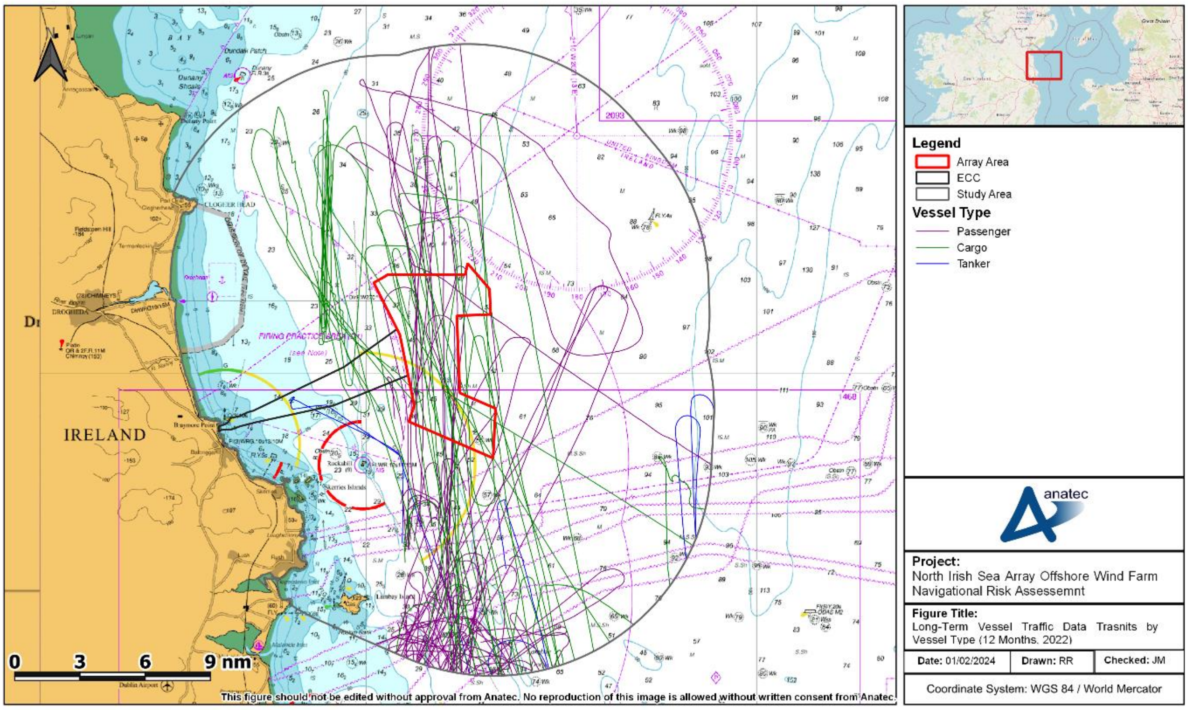

Figure 12.1 Long-Term Vessel Traffic Data Transits by Vessel Type (12 Months, 2022)

237. Generally, these tracks turn to the south of the array area, minimising potential interaction with the array, with only 20% of vessel tracks displaying this behaviour intersecting the array area itself. Vessels intersecting the array area were either cargo vessels or passenger vessels and only 12 unique instances occurred. Some of these instances comprised of multiple transits over the same day through the array area and several vessels only intersected the array area once on route to/ from their area of waiting. However, for instances of vessels turning further north, the presence of the array it would no longer be possible to undertake this activity. However, the overall majority of vessels displaying waiting behaviour were out with the array area.

238. Commercial ferries were also noted, with two unique RoRo vessels intersecting the array area. Both vessels were Stena Line vessels on the Dublin–Holyhead route, with one of these vessels only in the area temporarily due to a brief route change in April 2022 (AFLOAT, 2022).

239. Additionally, alternative routeing potentially for adverse weather featuring the Seatruck Ferries sister vessels on the Warrenpoint–Heysham route was observed in the long-term vessel traffic data (see Appendix E). This routeing occurs north-west south-east at the north-eastern extent of the study area, well clear of the array area.

12.3 Small Craft Use of Safe Havens

240. The 28-day vessel traffic survey data has been used to identify potential small craft use of safe havens related to adverse weather conditions in proximity to the proposed development, with the periods outlined in Table 12.1 and fishing vessels

and recreational vessels studied most closely. No substantial sheltering using safe havens was observed from the vessel traffic data considered.

13 Rockabill Gap

241. This section provides a summary of the key points raised in relation to the available sea room between Rockabill and the array area (hereafter the "Rockabill gap").

242. Key points raised during consultation included:

- From the vessel traffic survey data, it is assumed that vessels are currently using Rockabill as a clearance and transiting directly through the array area.
- With the wind farm in situ, vessels may pass around the array rather than through the Rockabill gap since mariners will select the most straightforward transit.
- The 2.7nm distance should be reviewed as it leaves tight sea room for vessels, including out of the proposed Bremore Port with less than 1nm between hazards and inbound/ outbound vessels. This is particularly relevant for larger vessels – smaller vessels (under 90m) would likely remain on the original transit.
- Preference is for a 1nm distance between passing vessels and from Rockabill and project infrastructure, i.e., a 3nm gap. The concern also extends to other vessels, i.e., fishing and recreational vessels.
- Tankers currently passing through the Rockabill gap closer to Rockabill than the array area may pass around the array but will be subject to Master preference.

243. As a result of the concerns raised during consultation, the Developer has agreed to the commitment of the Structure Exclusion Zone at the south-west of the array area (described fully in Section 6.1.1.1). The Structure Exclusion Zone designates 3nm of open sea room for vessels on transit through the Rockabill gap.

244. Additionally, a focused review of vessel traffic in the area from the long-term dataset is included in Appendix E to further inform the risk assessment (Section 19). Also, the main commercial route deviations have accounted for the potential of commercial vessels deviating around the array (see Route 3A in Section 16.5.2), noting that the likelihood of this occurring may be reduced due to the commitment to the Structure Exclusion Zone.

14 Navigation, Communication, and Position Fixing Equipment

245. This section discusses the potential effects on the use of navigation, communication and position fixing equipment of vessels that may arise due to the infrastructure associated with the proposed development.

246. Note that due to the more advanced stage of offshore wind in the UK, the majority of the studies relating to communication and position fixing equipment have been performed within UK offshore wind farms; however, this guidance and research is considered directly applicable to vessel operation in proximity to offshore wind farms in Irish waters.

14.1 Very High Frequency Communications (Including Digital Selective Calling)

247. In 2004, trials were undertaken at the North Hoyle Offshore Wind Farm, located off the coast of North Wales. As part of these trials, tests were undertaken to evaluate the operational use of typical small vessel VHF transceivers (including Digital Selective Calling (DSC)) when operated close to WTGs.

248. The WTGs had no noticeable effect on voice communications within the array or ashore. It was noted that if small craft vessel to vessel and vessel to shore communications were not affected significantly by the presence of WTGs, then it is reasonable to assume that larger vessels with higher powered and more efficient systems would also be unaffected.

249. During this trial, a number of telephone calls were made from ashore, both within and offshore of the array area. No effects were recorded using any system provider (MCA and QinetiQ, 2004).

250. Furthermore, as part of SAR trials carried out at the North Hoyle Offshore Wind Farm in 2005, radio checks were undertaken between the Sea King helicopter and both Holyhead and Liverpool coastguards. The aircraft was positioned to offshore of the array area and communications were reported as very clear, with no apparent degradation of performance. Communications with the service vessel located within the array were also fully satisfactory throughout the trial (MCA, 2005).

251. In addition to the North Hoyle trials, a desk-based study was undertaken for the Horns Rev 3 Offshore Wind Farm in Denmark in 2014 and it was concluded that there were not expected to be any conflicts between point-to-point radio communications networks and no interference upon VHF communications (Energinet, 2014).

252. Following consideration of these reports and noting that since the trials detailed above there have been no significant issues with regards to VHF observed or reported, the presence of the proposed development is anticipated to have no significant impact upon VHF communications.

14.2 Very High Frequency Direction Finding

253. During the North Hoyle Offshore Wind Farm trials in 2004, the VHF Direction Finding (DF) equipment carried in the trial boats did not function correctly when very close to WTGs (within approximately 50m). This is deemed to be a relatively small-scale impact due to the limited use of VHF direction finding equipment and will not impact operational or SAR activities (MCA and QinetiQ, 2004).

254. Throughout the 2005 SAR trials carried out at North Hoyle, the Sea King radio homer system was tested. The Sea King radio homer system utilises the lateral displacement of a vertical bar on an instrument to indicate the sense of a target relative to the aircraft heading. With the aircraft and the target vessel within the array, at a range of approximately 1nm, the homer system operated as expected with no apparent degradation.

255. Since the trials detailed above, no significant issues with regards to VHF DF have been observed or reported, and therefore the presence of the proposed development is anticipated to have no significant impact upon VHF DF equipment.

14.3 Automatic Identification System

256. No significant issues with interference to AIS transmission from operational offshore wind farms have been observed or reported to date. Such interference was also absent in the trials carried out at the North Hoyle Offshore Wind Farm (MCA and QinetiQ, 2004).

257. In theory there could be interference when there is a structure located between the transmitting and receiving antennas (i.e., blocking line of sight) of the AIS. However, given no issues have been reported to date at operational developments or during trials, no significant impact is anticipated due to the presence of the proposed development.

14.4 Navigational Telex System

258. The Navigational Telex (NAVTEX) system is used for the automatic broadcast of localised Maritime Safety Information (MSI) and either prints it out in hard copy or displays it on a screen, depending upon the model.

259. There are two NAVTEX frequencies. All transmissions on NAVTEX 518 kilohertz (kHz), the international channel, are in English. NAVTEX 518 kHz provides the mariner (both recreational and commercial) with weather forecasts, severe weather warnings and navigation warnings such as obstructions or buoys off station. Depending on the user's location, other information options may be available such as ice warnings for high latitude sailing.

260. The 490 kHz national NAVTEX service may be transmitted in the local language. In the UK full use is made of this secondary frequency including useful information for

smaller craft, such as the inshore waters forecast and actual weather observations from weather stations around the coast.

261. Although no specific trials have been undertaken, no significant effect on NAVTEX has been reported to date at operational developments, and therefore no significant impact is anticipated due to the presence of the proposed development.

14.5 Global Positioning System

262. Global Positioning System (GPS) is a satellite based navigational system. GPS trials were also undertaken throughout the 2004 trials at North Hoyle Offshore Wind Farm, and it was stated that "*no problems with basic GPS reception or positional accuracy were reported during the trials*".

263. The additional tests showed that "even with a very close proximity of a wind turbine to the GPS antenna, there were always enough satellites elsewhere in the sky to cover for any that might be shadowed by the wind turbine tower" (MCA and QinetiQ, 2004).

264. Therefore, there are not expected to be any significant impacts associated with the use of GPS systems within or in proximity to the proposed development, noting that there have been no reported issues relating to GPS within or in proximity to any operational UK offshore wind farms to date.

14.6 Electromagnetic Interference

265. A compass, magnetic compass or mariner's compass is a navigational instrument for determining direction relative to the earth's magnetic poles. It consists of a magnetised pointer (usually marked on the north end) free to align itself with the Earth's magnetic field. A compass can be used to calculate heading, used with a sextant to calculate latitude, and with a marine chronometer to calculate longitude.

266. Like any magnetic device, compasses are affected by nearby ferrous materials as well as by strong local electromagnetic forces, such as magnetic fields emitted from power cables. As the compass still serves as an essential means of navigation in the event of power loss or as a secondary source, it is important that potential impacts from Electromagnetic Field (EMF) are minimised to ensure continued safe navigation.

267. The vast majority of commercial traffic uses non-magnetic gyrocompasses as the primary means of navigation, which are unaffected by EMF. Therefore, it is considered highly unlikely that any interference from EMF as a result of the presence of the proposed development will have a significant impact on vessel navigation. However, some smaller craft (fishing or leisure) may rely on it as their sole means of navigation.

14.6.1 Subsea Cables

268. The subsea cables for the proposed development will be Alternating Current (AC), with studies indicating that AC does not emit an EMF significant enough to impact marine magnetic compasses (Convention for the Protection of the Marine Environment of the North-East Atlantic (OSPAR), 2008). Therefore, electromagnetic interference due to cables associated with the proposed development are not considered any further.

14.6.2 Wind Turbine Generators

269. MGN 654 (MCA, 2021) notes that small vessels with simple magnetic steering and hand bearing compasses should be wary of using these close to WTGs as with any structure in which there is a large amount of ferrous material (MCA and QinetiQ, 2004). Potential effects are deemed to be within acceptable levels when considered alongside other mitigation such as the mariner being able to make visual observations (not wholly reliant on the magnetic compass), lighting, sound signals and identification marking in line with MGN 654.

14.6.3 Experience at Operational Offshore Wind Farms

270. No issues with respect to magnetic compasses have been reported to date in any of the trials (MCA and QinetiQ, 2004) undertaken (inclusive of SAR helicopters) nor in any published reports from operational offshore wind farms. Considering this and the information outlined above, limited impact is therefore anticipated in relation to the presence of the proposed development.

14.7 Marine Radar

271. This section summarises the results of trials and studies undertaken in relation to Radar effects from offshore wind farms in the UK. It is important to note that since the time of the trials and studies discussed, WTG technology has advanced significantly, most notably in terms of the size of WTGs available to be installed and utilised. The use of these larger WTGs allows for a greater spacing between WTGs than was achievable at the time of the studies being undertaken, which is beneficial in terms of Radar interference effects (and surface navigation in general) as detailed below.

14.7.1 Trials

272. During the early years of offshore renewables within the UK, maritime regulators undertook a number of trials (both shore-based and vessel-based) into the effects of WTGs on the use and effectiveness of marine Radar.

273. In 2004 trials undertaken at the North Hoyle Offshore Wind Farm (MCA and QinetiQ, 2004) identified areas of concern regarding the potential impact on marine- and shore-based Radar systems due to the large vertical extents of the WTGs (based on

the technology at that time). This resulted in Radar responses strong enough to produce interfering side lobes and reflected echoes (often referred to as false targets or ghosts).

274. Side lobe patterns are produced by small amounts of energy from the transmitted pulses that are radiated outside of the narrow main beam. The effects of side lobes are most noticeable within targets at short range (below 1.5nm) and with large objects. Side lobe echoes form either an arc on the Radar screen similar to range rings, or a series of echoes forming a broken arc, as illustrated in Figure 14.1.

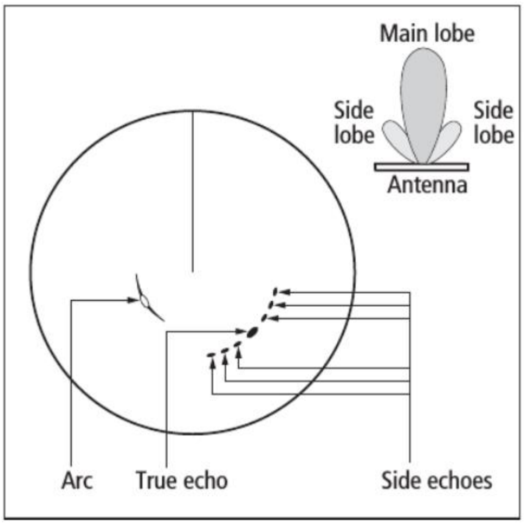

Figure 14.1 Illustration of side lobes on Radar screen

275. Multiple reflected echoes are returned from a real target by reflection from some object in the Radar beam. Indirect echoes or 'ghost' images have the appearance of true echoes but are usually intermittent or poorly defined; such echoes appear at a false bearing and false range, as illustrated in Figure 14.2.

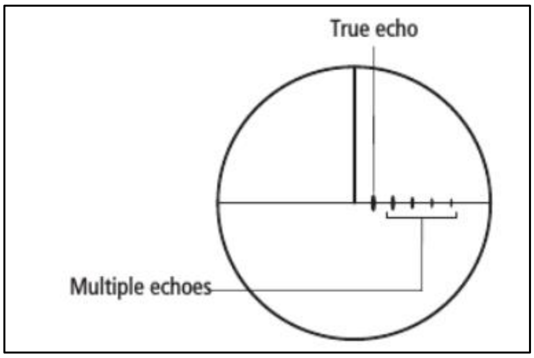

Figure 14.2 Illustration of multiple reflected echoes on Radar screen

276. Based on the results of the North Hoyle trials, the MCA produced a Shipping Route Template designed to give guidance to mariners on the distances which should be established between shipping routes and offshore wind farms. However, as

experience of effects associated with use of marine Radar in proximity to offshore wind farms grew, the MCA refined their guidance, offering more flexibility within the most recent Shipping Route Template contained within MGN 654 (MCA, 2021).

277. A second set of trials conducted at Kentish Flats Offshore Wind Farm in 2006 on behalf of the British Wind Energy Association (BWEA) – now called RenewableUK (BWEA, 2007) – also found that Radar antennas which are sited unfavourably with respect to components of the vessel's structure can exacerbate effects such as side lobes and reflected echoes. Careful adjustment of Radar controls suppressed these spurious Radar returns but mariners were warned that there is a consequent risk of losing targets with a small Radar cross section, which may include buoys or small craft, particularly yachts or Glass Reinforced Plastic (GRP) constructed craft; therefore, due care should be taken in making such adjustments.

278. Theoretical modelling of the effects of the development of the proposed Atlantic Array Offshore Wind Farm, which was to be located off the south coast of Wales, on marine Radar systems was undertaken by the Atlantic Array project (Atlantic Array, 2012) and considered a wider spacing of WTGs than that considered within the early trials[3]. The main outcomes of the modelling were the following:

- Multiple and indirect echoes were detected under all modelled parameters;
- The main effects noticed were stretching of targets in azimuth (horizontal) and appearance of ghost targets;
- There was a significant amount of clear space amongst the returns to ensure recognition of vessels moving amongst the WTGs and safe navigation;
- Even in the worst case with Radar operator settings artificially set to be poor, there is significant clear space around each WTG that does not contain any multipath or side lobe ambiguities to ensure safe navigation and allow differentiation between false and real (both static and moving) targets;
- Overall it was concluded that the amount of shadowing observed was very little (noting that the model considered lattice-type foundations which are sufficiently sparse to allow Radar energy to pass through);
- The lower the density of WTGs the easier it is to interpret the Radar returns and fewer multipath ambiguities are present;
- In dense, target rich environments S-Band Radar scanners suffer more severely from multipath effects in comparison to X-Band Radar scanners;
- It is important for passing vessels to keep a reasonable separation distance between the WTGs in order to minimise the effect of multipath and other ambiguities;
- The Atlantic Array study undertaken in 2012 noted that the potential for Radar interference was mainly a problem during periods of reduced visibility when mariners may not be able to visually confirm the presence of other vessels in proximity (those without AIS installed which are usually fishing and recreational

[3] It is acknowledged that other theoretical analysis has been undertaken.

craft). It is noted that this situation would arise with or without WTGs in place; and
- There is potential for the performance of a vessel's ARPA to be affected when tracking targets in or near the array area. Although greater vigilance is required, during the Kentish Flats trials it was shown that false targets were quickly identified as such by the mariners and then by the equipment itself.

279. In summary, experience in UK waters has shown that mariners have become increasingly aware of any Radar effects as more offshore wind farms become operational. Based on this experience, the mariner can interpret the effects correctly, noting that effects are the same as those experienced by mariners in other environments such as in close proximity to other vessels or structures. Effects can be effectively mitigated by "*careful adjustment of Radar controls*".

280. The MCA has also produced guidance to mariners operating in proximity to OREIs in the UK which highlights Radar issues amongst others to be taken into account when planning and undertaking voyages in proximity to OREIs (MCA, 2008). The interference buffers presented in Table 14.1 are based on MGN 654 (MCA, 2021), MGN 371 (MCA, 2008), MGN 543 (MCA, 2016) and MGN 372 Amendment 1 (MCA, 2022).

Table 14.1 Distances at which Impacts on Marine Radar Occur

Distance at Which Effect Occurs (nm)	Identified Effects
0.5	▪ Intolerable impacts can be experienced. ▪ X-Band Radar interference is intolerable under 0.25nm. ▪ Vessels may generate multiple echoes on shore-based Radars under 0.45nm.
1.5	▪ Under MGN 654, impacts on Radar are considered to be tolerable with mitigation between 0.5 and 3.5nm. ▪ S-band Radar interference starts at 1.5nm. ▪ Echoes develop at approximately 1.5nm, with progressive deterioration in the Radar display as the range closes. Where a main vessel route passes within this range considerable interference may be expected along a line of WTGs. ▪ The WTGs produce strong Radar echoes giving early warning of their presence. ▪ Target size of the WTG echo increases close to the WTG with a consequent degradation on both X and S-Band Radars.

281. As noted in Table 14.1, the onset range from the WTGs of false returns is approximately 1.5nm, with progressive deterioration in the Radar display as the range closes. If interfering echoes develop, the requirements of the Convention on International Regulations for Preventing Collisions at Sea (COLREGs) *Rule 6 Safe*

Speed are particularly applicable and must be observed with due regard to the prevailing circumstances (IMO, 1972/77). In restricted visibility, *Rule 19 Conduct of Vessels in Restricted Visibility* applies and compliance with *Rule 6* becomes especially relevant. In such conditions mariners are required, under *Rule 5 Look-out* to take into account information from other sources which may include sound signals and VHF information, for example from a VTS or AIS (MCA, 2016).

14.7.2 Experience from Operational Developments

282. The evidence from mariners operating in proximity to existing offshore wind farms is that they quickly learn to adapt to any effects. Figure 14.3 presents the example of the Galloper and Greater Gabbard Offshore Wind Farms in the UK, which are located in proximity to IMO routeing measures. Despite this proximity to heavily trafficked TSS lanes, there have been no reported incidents or issues raised by mariners who operate within the vicinity. The interference buffers presented in Figure 14.3 are as per Table 14.1.

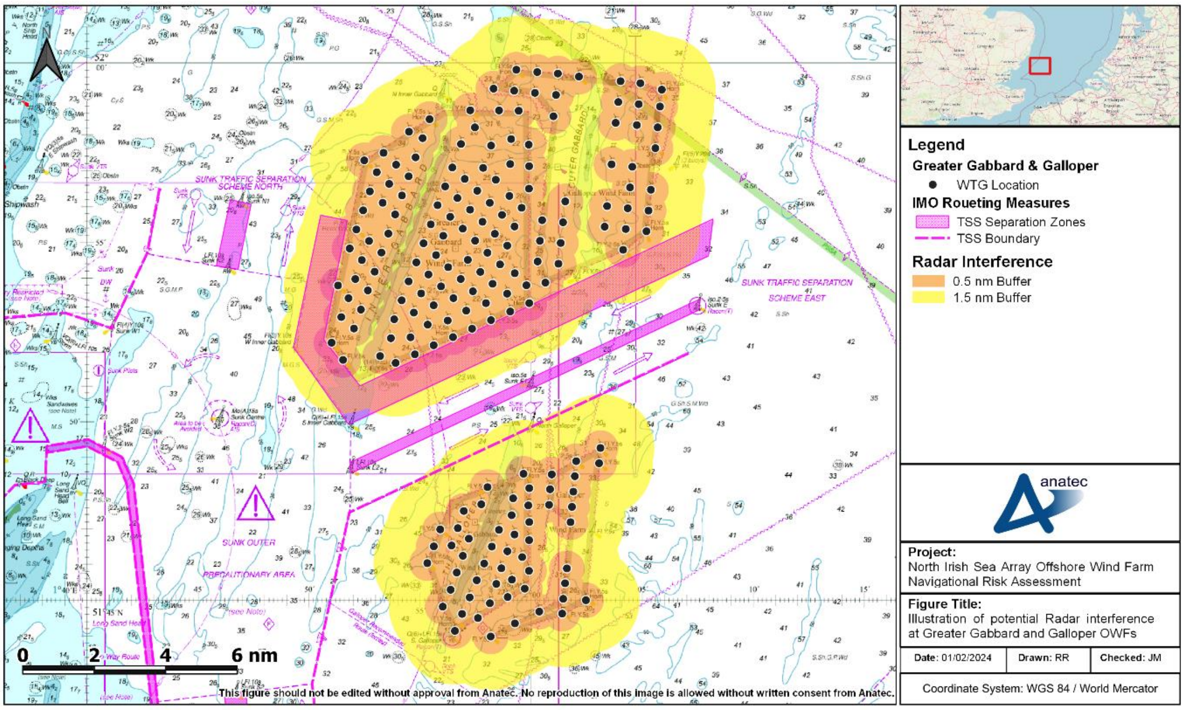

Figure 14.3 Illustration of potential Radar interference at Greater Gabbard and Galloper Offshore Wind Farms

283. As indicated by Figure 14.3, vessels utilising these TSS lanes will experience some Radar interference based on the available guidance. Both developments are operational, and each of the lanes is used by a minimum of five vessels per day on average. However, to date, there have been no incidents recorded (including any related to Radar use) or concerns raised by the users.

284. AIS information can also be used to verify the targets of larger vessels (generally vessels over 15m LOA – the minimum threshold for fishing vessel AIS carriage requirements).

285. For any smaller vessels, particularly fishing vessels and recreational vessels, AIS Class B devices are becoming increasingly popular and allow the position of these small craft to be verified when in proximity to an offshore wind farm.

14.7.3 Increased Radar Returns

286. Beam width is the angular width, horizontal or vertical, of the path taken by the Radar pulse. Horizontal beam width ranges from 0.75° to 5°, and vertical beam width from 20° to 25°. How well an object reflects energy back towards the Radar depends upon its size, shape, and aspect angle.

287. Larger WTGs (either in height or width) will return greater target sizes and/ or stronger false targets. However, there is a limit to which the vertical beam width would be affected (20° to 25°) dependent upon the distance from the target. Therefore, increased WTG height in the array area will not create any effects in addition to those already identified from existing offshore wind farms (interfering side lobes, multiple and reflected echoes).

288. Again, when taking into consideration the potential options available to marine users (such as reducing gain to remove false returns) and feedback from operational experience, this shows that the effects of increased returns can be managed effectively.

14.7.4 Fixed Radar Antenna Use in Proximity to an Operational Wind Farm

289. It is noted that there are multiple operational offshore wind farms including Galloper in the UK (see Section 14.7.2) that successfully operate fixed Radar antenna from locations on the periphery of the array. These antennas are able to provide accurate and useful information to onshore coordination centres.

14.7.5 Application to the Proposed Development

290. Upon development of the proposed development, some commercial vessels may pass within 1.5nm of the wind farm structures and therefore may be subject to a minor level of Radar interference. Trials, modelling, and experience from existing developments note that any impact can be mitigated by adjustment of Radar controls.

291. Figure 14.4 presents an illustration of potential Radar interference due to the proposed development relative to the post wind farm routeing illustrated in Section 16.5.2. The Radar effects have been applied to the layout introduced in Section 6.2.1.

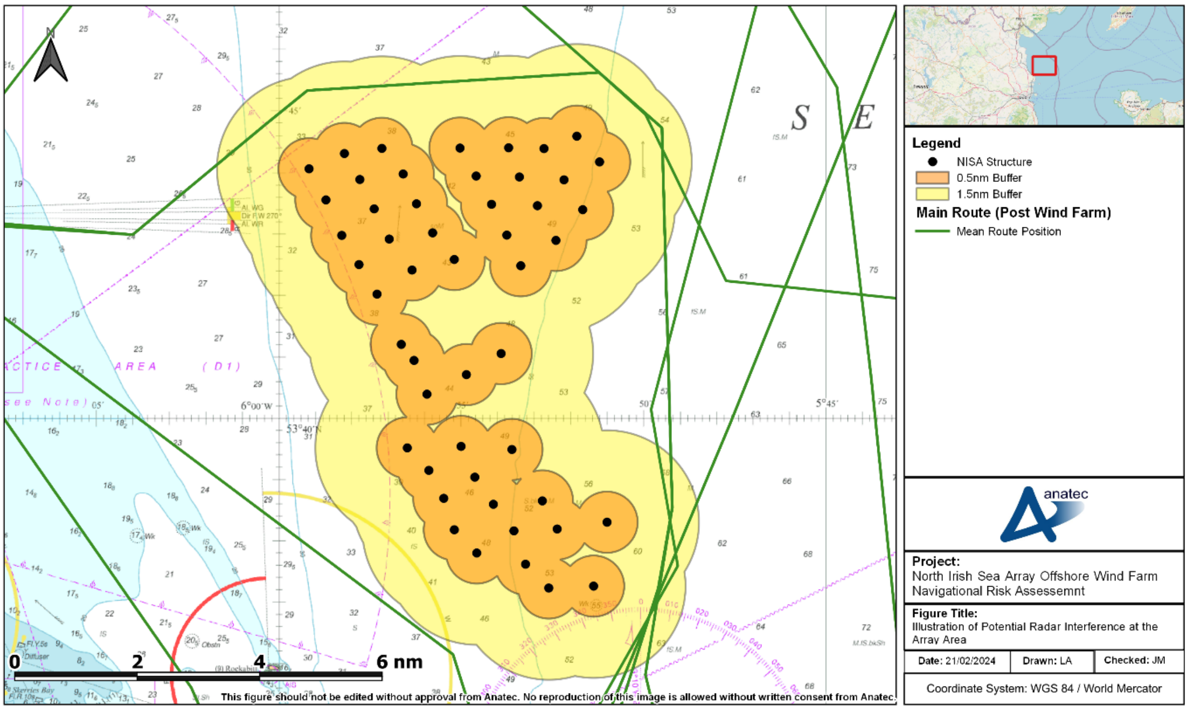

Figure 14.4 Illustration of Potential Radar Interference at the Array Area

292. Vessels passing within the array area will be subject to a greater level of interference with impacts becoming more substantial in close proximity to WTGs. This will require additional mitigation by any vessels including consideration of the navigational conditions (visibility) when passage planning and compliance with the COLREGs (IMO, 1972/77) will be essential.

293. Overall, the impact on marine Radar is expected to be low and no further impact upon navigational safety is anticipated outside the parameters which can be mitigated by operational controls.

14.8 Sound Navigation and Ranging System

294. No evidence has been found to date with regard to existing offshore wind farms to suggest that Sound Navigation Ranging (SONAR) systems produce any kind of SONAR interference which is detrimental to the fishing industry, or to military systems. Limited impact is therefore anticipated in relation to the presence of the proposed development.

14.9 Noise

295. No evidence has been found to date with regard to existing offshore wind farms to suggest that prescribed sound signals are in any way impacted by acoustic noise produced by the wind farm. Limited impact is therefore anticipated in relation to the presence of the proposed development.

14.10 Summary of Potential Effects on Use

296. Based on the detailed technical assessment of the effects due to the presence of the proposed development on navigation, communication and position fixing equipment in the previous subsections, Table 14.2 summarises the assessment of frequency and consequence and the resulting risk for each component of this impact.

Table 14.2 Summary of Risk to Navigation, Communication and Position Fixing Equipment

Topic	Frequency	Consequence	Significance of Risk
VHF	Negligible	Minor	Broadly Acceptable
VHF direction finding	Extremely Unlikely	Minor	Broadly Acceptable
AIS	Negligible	Minor	Broadly Acceptable
NAVTEX	Negligible	Minor	Broadly Acceptable
GPS	Negligible	Minor	Broadly Acceptable
EMF	Extremely Unlikely	Negligible	Broadly Acceptable
Marine Radar	Remote	Minor	Broadly Acceptable
SONAR	Negligible	Minor	Broadly Acceptable
Noise	Negligible	Minor	Broadly Acceptable

297. On the basis of these findings, associated risks are screened out of the risk assessment undertaken in **Volume 3, Chapter 17: Shipping and Navigation**.

15 Cumulative Project Screening Exercise

298. Shipping and navigation hazards associated with the proposed development are considered on a cumulative basis alongside other projects. To determine which other projects should be screened in to the cumulative risk assessment and the extent of their consideration, the methodology outlined in Section 3.4 has been applied.

299. It should be noted that the methodology applied differs from that used in **Volume 3, Chapter 17: Shipping and Navigation** which applies the standard EIA approach to cumulative assessment. This departure from the standard EIA approach ensures the NRA continues to follow the FSA preferred by MGN 654.

300. The following subsections provide details of the results of the screening exercise for each type of project considered, with the screened in projects presented in Figure 15.1 and detailed in Table 15.1.

15.1 Offshore Wind Farms

301. In addition to the proposed development, there are various other proposed offshore wind farm projects located on the east Irish coast. During consultation, various stakeholders have expressed an interest in the cumulative build out of offshore wind farm projects.

302. Only Phase 1 Projects have a high level of data confidence, with each having produced a Scoping Report. Those located on the Irish east coast are screened in to the cumulative risk assessment. Other offshore wind farm projects are considered to have low data confidence including uncertainty regarding their build out location and thus are screened out of the cumulative risk assessment.

303. The closest Phase 1 Project to the proposed development is the Oriel Wind Park, located approximately 9.1nm north west of the array area. Other Phase 1 Projects within 50nm of the array area include Dublin Array Offshore Wind Farm, Codling Wind Park, and Arklow Bank Wind Park 2, as illustrated in Figure 15.1.

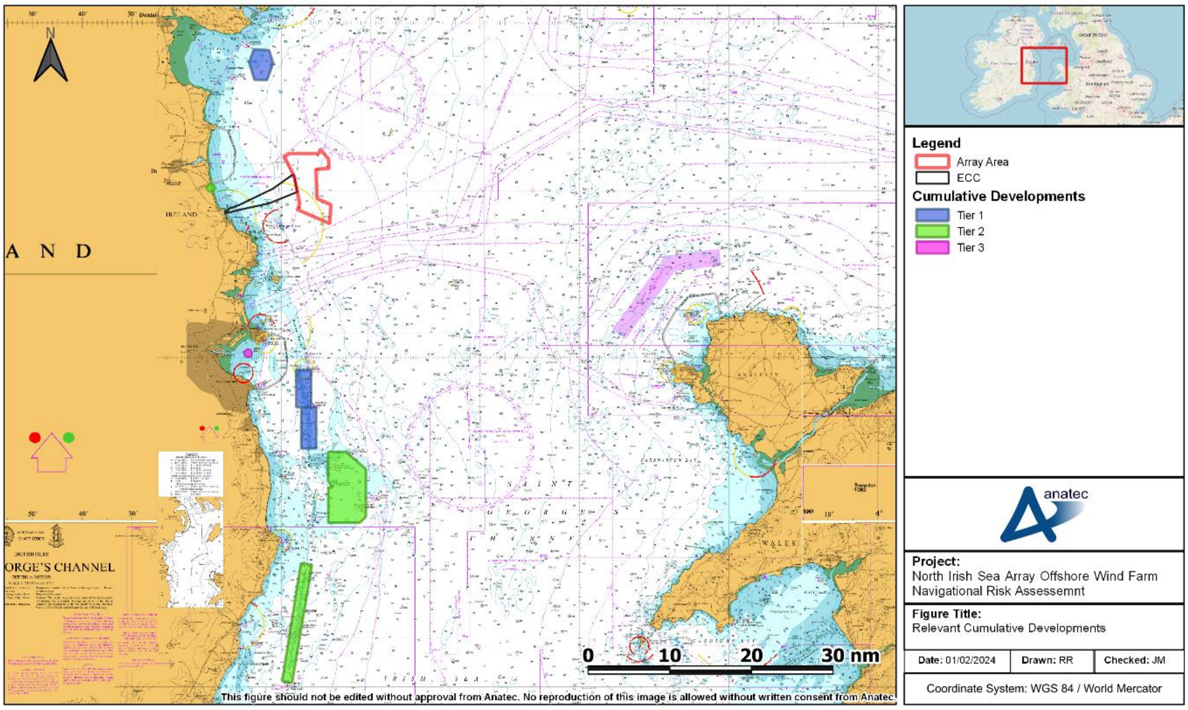

Figure 15.1 Relevant Cumulative Developments

304. Of these Phase 1 Projects, Oriel Wind Park and Dublin Array Offshore Wind Farm may interact with main commercial routes passing within 1nm of the array area, in particular Routes 1 and 6 (see Section 11.2) which pass east of Oriel Wind Park and west of Dublin Array Offshore Wind Farm, respectively.

15.2 Wave/ Tidal Developments

305. The closest proposed wave or tidal development to the proposed development is the Holyhead Deep (Minesto) tidal site, located approximately 41nm south east of the array area off the Anglesey coast.

306. There are no wave or tidal developments located within 25nm of the array area and therefore no direct hazard pathway to shipping and navigation users is identified between such projects and the proposed development. Therefore, no wave/ tidal developments are screened in to the cumulative risk assessment.

15.3 Subsea Cables/Pipelines

307. The closest proposed subsea cable or pipeline to the proposed development is the MaresConnect Interconnector, located approximately 18nm south of the array area, passing east-west between Ireland and the UK.

308. There are no subsea cable/ pipeline projects located within 2nm of the array area and ECC and therefore no direct hazard pathway to shipping and navigation users is

identified between such projects and the proposed development. Therefore, no subsea cable/ pipeline projects are screened in to the cumulative risk assessment.

15.4 Port/Harbour Developments

15.4.1 Bremore Port

309. The Bremore Port development is proposed on the east Irish coast near Balbriggan, and is located approximately 8.7nm from the array area and 0.2nm from the ECC (measured from Braymore Point). During consultation, the Drogheda Port Company – the developer of Bremore Port – have indicated that Bremore Port should be considered as part of the future case scenario, noting that this will include the establishment of new commercial routes and vessel traffic in the region.

310. Although various consultation meetings have been held with the Drogheda Port Company (see Section 4), there remains limited publicly available information associated with Bremore Port as a planning application has not yet been submitted, and so only medium data confidence can be assumed.

311. Additional commercial routeing associated with the proposed Bremore Port should it be developed may interact with existing commercial routeing and may be affected by the presence of the proposed development. Therefore, Bremore Port is screened in to the cumulative risk assessment.

15.4.2 Dublin Port Masterplan 2040

312. Dublin Port is located approximately 16nm south of the array area (measured from the extent of the Dublin Pilotage District). The Dublin Port Masterplan 2040 (Dublin Port, 2018) outlines plans to increase the volume and size of vessel traffic which can be accommodated at Dublin Port.

313. The Masterplan's main conclusions included that "*Dublin Port should be developed to provide capacity based on an increased average annual growth rate of 3.3% from 2010 to 2040*".

314. Unlike for Bremore Port, the establishment of new commercial routes in the region is not anticipated; however, there are main commercial routes passing within 1nm of the array area which are headed to/ from Dublin Port, in particular Routes 2 and 6 (see Section 11.2) which pass towards the eastern extent of the array area enroute to Dublin Bay.

315. Therefore, although there is only medium data confidence associated with the Dublin Port Masterplan 2040 (which is subject to change), there is a clear hazard pathway and so this port development is screened in to the cumulative risk assessment.

Table 15.1 Screened In Cumulative Projects

Project	Project Type	Status	Closest Distance (nm)		Data Confidence	Cumulative Tier
			Array Area	ECC		
Arklow Bank Wind Park 2	Offshore wind farm	Scoped	41	43	High	2
Bremore Port	Port development	Early development	8.8	0.1	Medium	2
Codling Wind Park	Offshore wind farm	Scoped	27	31	High	2
Dublin Array Offshore Wind Farm	Offshore wind farm	Scoped	18	20	High	1
Dublin Port Masterplan 2040	Port development	Early development	19	16	Medium	3
Oriel Wind Park	Offshore wind farm	Scoped	9.1	12	High	1

16 Future Case Vessel Traffic

316. The vessel traffic baseline established (see Section 10 to 12) is used as input to the risk assessment (see Section 19). However, it is also necessary to consider potential future case vessel traffic, in terms of general volume and size changes, port developments which may influence movements, and with the presence of the proposed development (the post wind farm scenario).

317. The following subsections outline the future case scenario which has been used to inform the risk assessment.

16.1 Increases in Commercial Vessel Activity

318. As with any NRA process there is uncertainty associated with long-term predictions of vessel traffic growth particularly in relation to the potential for any other new developments in Ireland or transboundary ports and the long-term effects of Brexit.

319. It is noted that the RoRo service operated by CLdN between Santander, Liverpool and Dublin was expanded from January 2023, with a twice weekly schedule from Santander to Dublin and an additional vessel deployed between Dublin and Liverpool (CLdN, 2022). This is not reflected in the vessel traffic data; however, the leg of this route relevant to the proposed development (Dublin-Liverpool) generally passes south of the study area and therefore the increased service is not expected to markedly alter the findings of the baseline assessment.

320. Noting that port developments (which may be associated with commercial vessels) are discussed separately in Section 16.3, two independent scenarios of potential growth in commercial vessel movements of 10% and 20% have been estimated throughout the lifetime of the proposed development with this growth also accounting for any COVID effects from the baseline traffic levels.

16.2 Increase in Commercial Fishing Vessel and Recreational Vessel Activity

321. There is similar uncertainty associated with long-term predictions for commercial fishing vessel and recreational vessel transits given the limited reliable information on future trends upon which any firm assumption could be made. There are no known major developments which would increase commercial fishing or recreational vessel activity in the region.

322. Therefore, a conservative potential growth in commercial fishing vessel and recreational vessel movements of 10% and 20% have been estimated throughout the lifetime of the proposed development. Changes in fishing activity are considered further in **Volume 3, Chapter 16: Commercial Fisheries**.

16.3 Bremore Port Development and Dublin Port Masterplan 2040

16.3.1 Bremore Port Development

323. The proposed Bremore Port development was identified during consultation, as described in Section 15.4.1. It has been incorporated as a cumulative project in the cumulative risk assessment, noting that the port development is not consented, and a planning application is not anticipated until 2026 – this medium level of data confidence is reflected in Section 15.4.1.

324. The Drogheda Port Company has been consulted throughout the NRA process, including via dedicated meetings and the Hazard Workshop. Based on discussions, four indicative main commercial routes in/ out of the proposed Bremore Port have been identified, as shown in Figure 16.1.

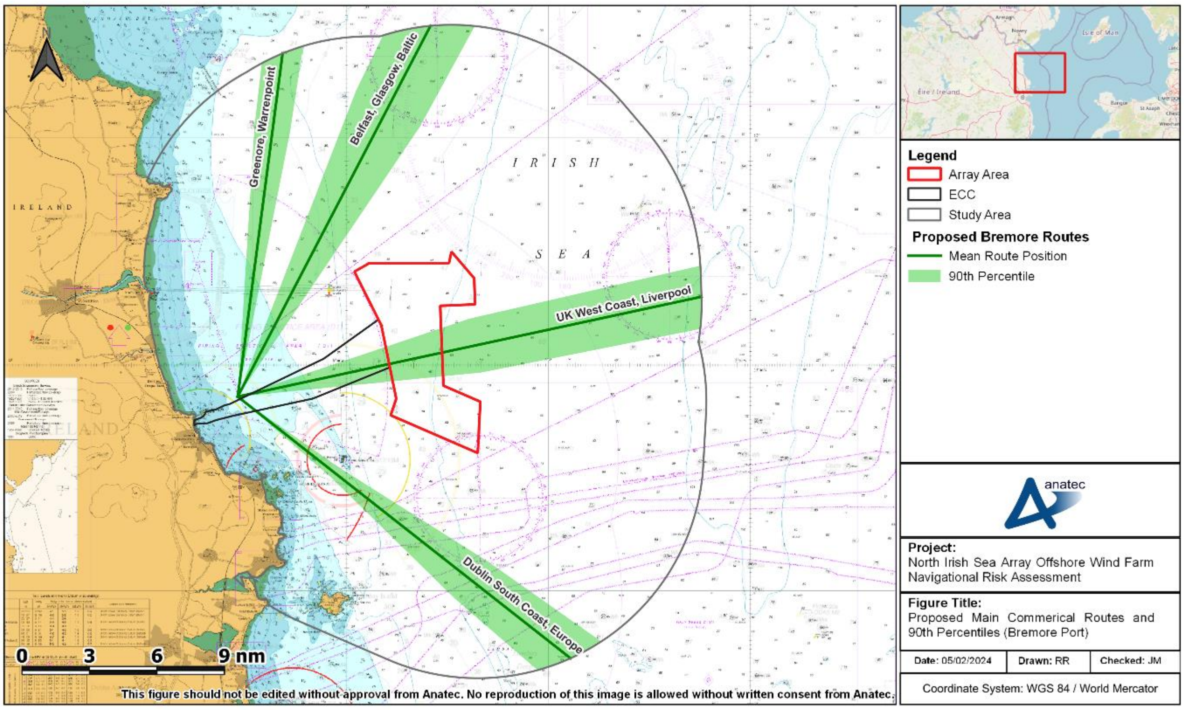

Figure 16.1 Proposed Bremore Port Routes and 90th Percentiles

325. Of these indicative routes, those headed to/ from the UK and Europe are anticipated to carry the greater volumes of vessel traffic once the port is established. However, there is significant uncertainty regarding the specific volumes which may feature on these indicative routes and the specific vessel types and sizes which may feature on all the routes.

326. From consultation, the Drogheda Port Company have indicated that the proposed Bremore Port will likely be developed in phases, with up to 1.9km of berth length for the first phase and 3.5km of berth length for the full build out of the development. It is possible that the proposed Bremore Port could be fully built out within the

operational lifetime of the proposed development (35 years) with operations commencing in 2030. However, as noted, a planning application has not yet been submitted and therefore a full build out, particularly during the operational lifetime of the proposed development, may not be realistic and the commencement of operations may be affected by various factors including the planning consent process and the economic markets.

327. In terms of volumes, Drogheda Port Company have indicated that there is currently a capacity issue on the east Irish coast and that there is sufficient demand to support the first phase of the proposed Bremore Port without displacing traffic from Dublin Port or affecting the net volume at Drogheda Port when also accounting for general traffic growth (see Section 16.1). Longer term, volumes in/ out of Bremore Port – if developed fully – could match that currently at Dublin Port.

328. In terms of vessel types, the Drogheda Port Company noted that the proposed Bremore Port may feature a range of commercial vessels including RoPax vessels operating scheduled services, with work ongoing as part of the planning application process in relation to associated onshore facilities. There may also be capacity for wind farm vessels, although given the infancy of the offshore wind industry in Ireland it is difficult to provide details.

329. If developed, the proposed Bremore Port would likely take larger vessels than currently observed at Drogheda (where the average vessel length from the vessel traffic survey data is 52m and the maximum is 291m), with deeper waters resulting in better access than is available at Dublin Port.

330. Given that the proposed Bremore Port development has the potential to create new commercial routeing but little reliable quantitative information is available in relation to the volume, type, and size of this traffic, the development has been accounted for as part of the cumulative risk assessment including main commercial route deviations (see Section 16.5.2) rather than specifically through the future case scenarios. This allows Bremore Port to be assessed in the NRA based on the level of information available. During consultation, the Drogheda Port Company noted they were satisfied with the future case scenarios being carried out for the Bremore Port development (Section 4.1).

16.3.1.1 Rockabill Gap

331. Should the proposed Bremore Port be developed, the volume of potential users for the Rockabill gap is expected to increase. In particular, the main commercial route anticipated between Bremore, and the UK is expected to be displaced due to the presence of the array, resulting in vessels either passing north or south of the array. Those vessels passing south of the array are potential users of the Rockabill gap.

332. It is not possible to accurately quantify future traffic volumes in/out of the proposed Bremore Port. However, it is anticipated that the number of potential users may

increase substantially, particularly should multiple phases of development be realised. The Drogheda Port Company noted during consultation that once fully developed, tonnage at Bremore Port may be comparable with Dublin Port. However, data confidence for this forecast is relatively low.

333. Some of the larger vessels anticipated to utilise Bremore Port may be potential users of the Rockabill gap, although it is also feasible that some vessels may pass north of the array, particularly those which are larger. For any commercial ferries operating out of Bremore Port, there is potential that schedules may be defined so as to minimise the likelihood of these passing whilst within the Rockabill gap.

334. As aforementioned, with the Structure Exclusion Zone being implemented and with the development of Bremore Port in regard to the 3nm Rockabill gap, the Drogheda Port Company are satisfied with the future case scenarios being carried out for the Bremore Port development and have agreed that the Structure Exclusion Zone satisfies their concerns regarding the Rockabill gap.

16.3.2 Dublin Port Masterplan 2040

335. The Dublin Port Masterplan 2040 was identified during consultation and is described in Section 15.4.2.

336. Although increases to volumes associated with Dublin Port are proposed through infrastructure development, the masterplan acknowledges that the development options "*are not a prescriptive menu*" and if projected growth is not realised then "*individual projects can be deferred or even cancelled*" (Dublin Port Company, 2018).

337. Nevertheless, there are main commercial routes in/ out of Dublin Port which interact with the proposed development, and it is therefore considered prudent to incorporate the future development into the future case scenarios.

338. The masterplan provides best estimates for the growth of various cargo types in terms of gross tonnage but does not offer analysis of growth for numbers of vessels which is the parameter of relevance to navigational risk. The potential growth of 20% in commercial vessel movements throughout the lifetime of the proposed development is considered a conservative approach, noting that only a fraction of the total traffic associated with Dublin Port is considered relevant to the proposed development.

16.4 Increases in Traffic Associated with the Proposed Development Operations

339. During the construction phase a maximum of 3,008 return trips to port will be made by vessels involved in the installation of the proposed development (see Section 6.5.1). During the operational phase, a maximum of 1,261 annual return trips to port will be made by vessels involved in the operational of the proposed development (see Section 6.5.3).

16.5 Commercial Traffic Routeing (Proposed Development in Isolation)

16.5.1 Methodology

340. It is not possible to consider all potential alternative routeing options for commercial traffic and therefore alternatives have been considered where possible in consultation with local users. Assumptions for re-routeing include:

- All alternative routes maintain a minimum mean distance of 1nm from offshore installations in line with industry experience. This distance is considered for shipping and navigation from a safety perspective as explained below; and
- All mean routes take into account sandbanks, aids to navigation and known routeing preferences.

341. Annex 1 of MGN 654 defines a methodology for assessing passing distance from offshore wind farm boundaries but states that it is "*not a prescriptive tool but needs intelligent application*" (MCA, 2021).

342. To date, internal and external studies undertaken by Anatec on behalf of offshore wind farm developers show that vessels do pass consistently and safely within 1nm of established offshore wind farms and these distances vary depending upon the sea room available as well as the prevailing conditions. This evidence also demonstrates that the mariner defines their own safe passing distance based upon the conditions and the nature of the traffic at the time, but they are shown to frequently pass 1nm off established developments. Evidence also demonstrates that commercial vessels do not transit through offshore wind farm arrays and this has been supported by Irish Chamber of Shipping and CLdN during consultation.

343. The NRA also aims to establish the worst case for deviations based on navigational safety parameters, and when considering this the most conservative realistic scenario for vessel routeing is when main commercial routes pass 1nm off developments, Evidence collected during numerous assessments at an industry level confirms that this is a safe and reasonable distance for vessels to pass; however, it is likely that a large number of vessels would instead choose to pass at a greater distance depending upon their own passage plan and the current conditions.

344. Additionally, this approach maximises the length and duration by altering course close to the development and passing at the 1nm distance rather than making an earlier alteration of course prior to arriving in proximity. It is recognised that this is a conservative approach, with various stakeholders confirming during consultation that mariners will passage plan accordingly to minimise the extent of the deviation.

16.5.2 Main Commercial Route Deviations

345. An illustration of the anticipated project option with the worst case shift in the mean positions of the main commercial routes within the study area following the

development of the proposed development is presented in Figure 16.2. Following this, the deviated routes area presented in Figure 16.3.

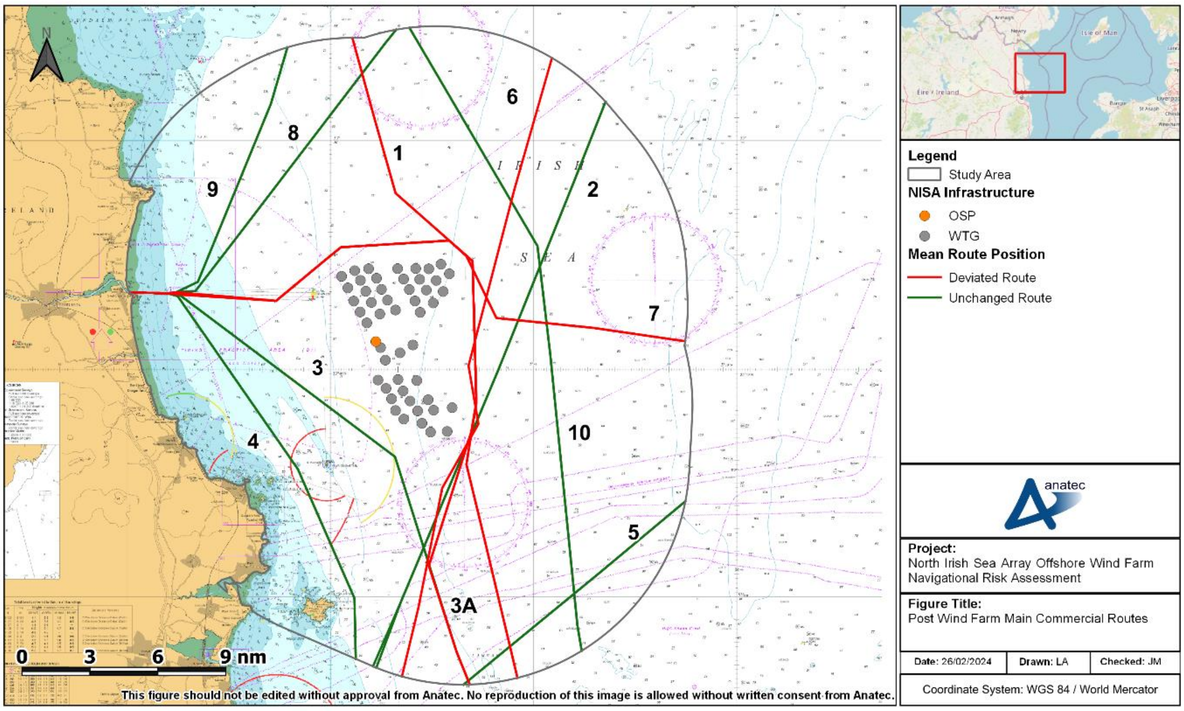

Figure 16.2 Post Wind Farm Main Commercial Routes

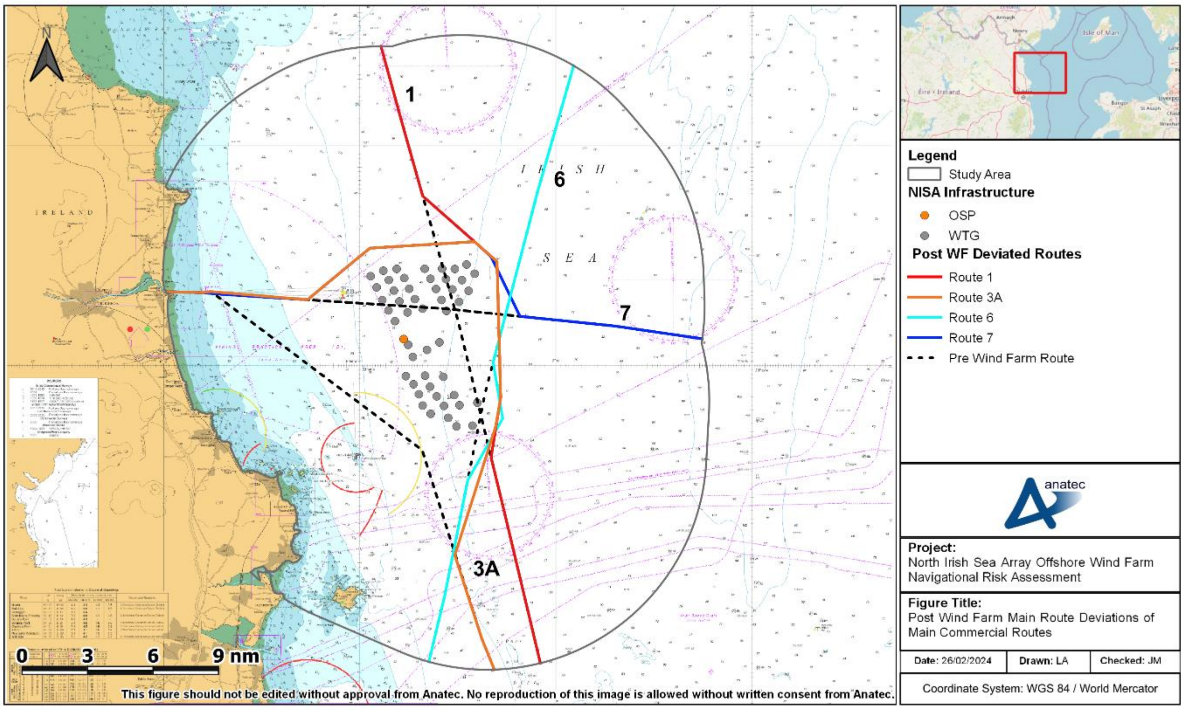

Figure 16.3 Post Wind Farm Route Deviations of Main Commercial Routes

346. Deviations from the pre wind farm scenario would be required for four out of the 10 main commercial routes identified, with the level of deviation varying between a 0.3% increase for Route 6, and an 8.0% increase for Route 3A. For the displaced routes, the increase from the pre wind farm scenario is presented in Table 16.1.

Table 16.1 Summary of Post Wind Farm Main Commercial Route Deviations within the Study Area

Route Number	Increase in Route Length (nm)	Percentage Change in Total Route Length (%)	Nature of Deviation
1	1.1	0.5	Passing (slightly) east of the array.
3A	11	8.0	Passing north and east of the array – associated with larger vessels and tankers following consultation feedback.
6	0.4	0.3	Passing (slightly) east of the array.
7	2.8	2.3	Passing north of the array.

347. In the case of Route 3, smaller vessels are not expected to require a deviation since the route passes with a mean position of 2nm. However, from consultation feedback it is anticipated that larger vessels and tankers (around two to three vessels per month) may choose to pass north and east of the array (Route 3A) to avoid navigating the sea room between the south western corner of the array and the Rockabill islands. This sensitivity is considered in further detail in Appendix E.

16.6 Commercial Traffic Routeing (Cumulative)

348. An illustration of the anticipated worst case shift in the mean positions of the main commercial routes within the study area following the development of the proposed development and Tier 1 and 2 cumulative projects (see Section 15) is presented in Figure 16.4. These deviations follow the same methodology outlined for deviations due to the proposed development in isolation (see Section 16.5.1).

349. Deviations from the pre wind farm scenario would be required for six out of the ten main commercial routes identified, with the level of deviation varying between a 0.3nm increase for Route 4, and a 14nm increase for Route 3A. For the displaced routes, the increase from the pre wind farm scenario is presented in Table 16.1.

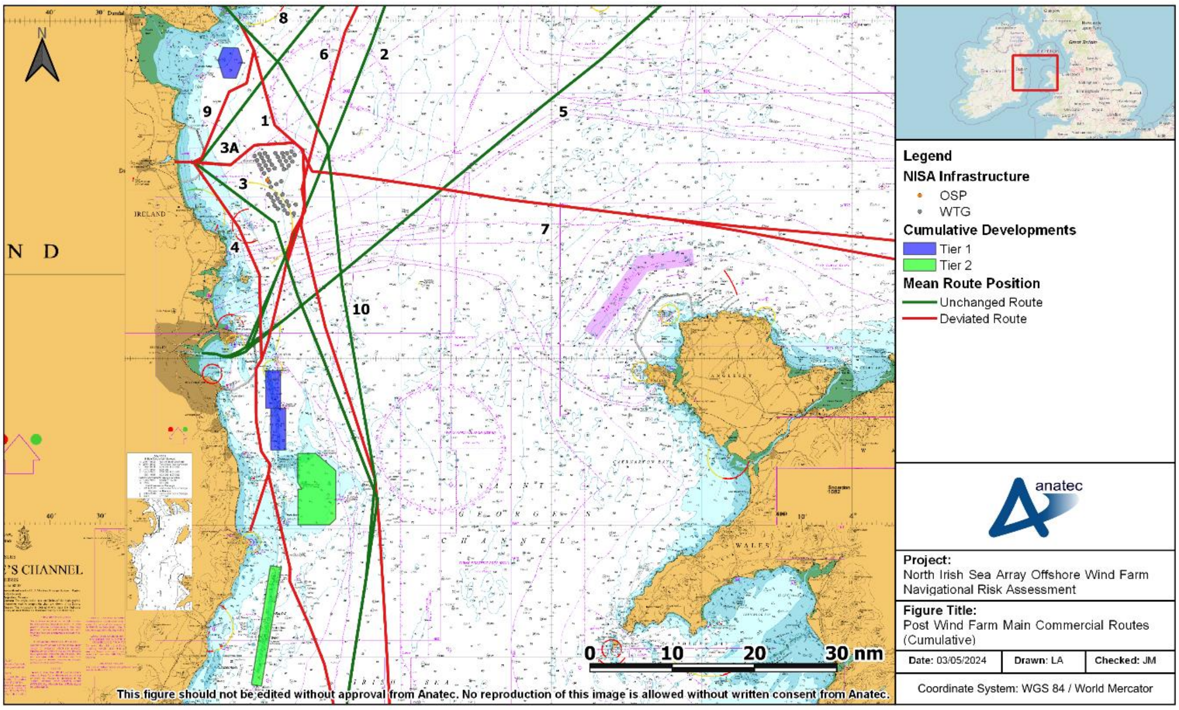

Figure 16.4 Post Wind Farm Main Commercial Routes (Cumulative)

Table 16.2 Summary of Post Wind Farm Main Commercial Route Deviations within the Study Area

Route Number	Increase in Route Length (nm)	Percentage Change in Total Route Length (%)	Nature of Deviation
1	1.1	0.5	As per the in isolation scenario.
4	0.6	0.4	Passing west of Dublin Array Offshore Wind Farm and north of Arklow Bank Wind Park 2.
3A	11	8	As per the in isolation scenario.
6	1	0.8	Passing west of Dublin Array Offshore Wind Farm.
7	2.8	2.3	As per the in isolation scenario.
9	1.6	6.2	Passing east of Oriel.

17 Collision and Allision Risk Modelling

350. To inform the risk assessment, a quantitative assessment of some of the major hazards associated with the proposed development has been undertaken. The following subsections outline the inputs and methodology used for the collision and allision risk modelling.

17.1 Hazards Under Consideration

351. Hazards considered in the quantitative assessment are as follows:

- increased vessel to vessel collision risk;
- increased powered vessel to structure allision risk;
- increased drifting vessel to structure allision risk; and
- increased fishing vessel to structure allision risk.

352. The pre wind farm assessment has been informed by the vessel traffic survey data (see Section 10) in combination with the outputs of consultation (see Section 4) and other baseline data sources (see Section 5). Conservative assumptions have been made with regard to route deviations and future shipping growth over the lifetime of the proposed development.

353. Where return periods are reported, these relate to the expected number of years between occurrences[4], noting that annual frequency (i.e., the number of expected occurrences per year; the inverse of the return period) is referenced, where appropriate.

17.2 Scenarios Under Consideration

354. For each element of the quantitative assessment both a pre and post wind farm scenario with base and future case vessel traffic levels (as per Section 16) have been considered. As a result, six distinct scenarios have been modelled:

- Pre wind farm with the base case vessel traffic level;
- Pre wind farm with a future case vessel traffic level defined by a:
  - 10% increase in traffic; and
  - 20% increase in traffic.
- Post wind farm with the base case traffic level; and
- Post wind farm with a future case vessel traffic level defined by a:
  - 10% increase in traffic; and
  - 20% increase in traffic.

[4] For example, a return period of one in 100 years indicates that over a 100-year period the expected number of occurrences is one. This differs from the notion that it will take 100 years for one instance to occur.

355. The results of the base case scenarios are detailed in full in the following subsections with the equivalent results for the future case scenarios provided in Section 17.6.

17.3 Post Wind Farm Routeing

356. The methodology for determining the post wind farm routeing is outlined in Section 16.

17.4 Pre Wind Farm Routeing

17.4.1 Vessel to Vessel Encounters

357. An assessment of current vessel to vessel encounters has been undertaken by replaying at high speed the vessel traffic data collected as part of the summer 2022 and winter 2023 vessel traffic surveys (see Section 5.1). The model defines an encounter as two vessels passing within 1nm of each other within the same minute. This helps to illustrate where existing shipping congestion is highest and therefore where offshore developments, such as an offshore wind farm, could potentially increase congestion and therefore also increase the risk of encounters and collisions. No account of whether encounters are head on or stern to head are given; only close proximity is accounted for.

358. The identified encounters were manually checked to determine whether there were any clear cases of non-genuine encounters (e.g., towing operations). Any such instances have been removed.

359. Figure 17.1 presents a heat map based upon the geographical distribution of vessel encounter tracks within a density grid.

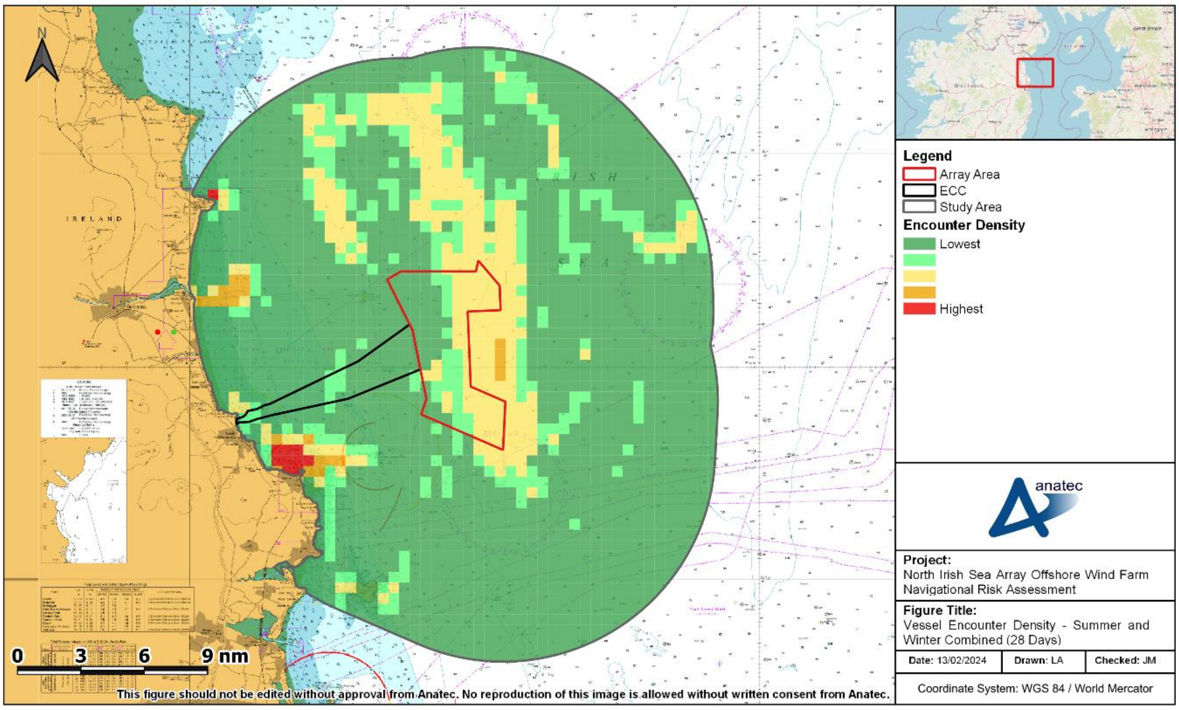

Figure 17.1 Vessel Encounter Density – Summer and Winter Combined (28–Days)

360. There was an average of 35 encounters per day within the study area throughout the survey periods. The greatest number of encounters recorded on one day was 141, on 20 July 2022, on which a high number of recreational vessels were involved, especially around Skerries Harbour. Approximately 57% of all encounters were recorded across the approach and surrounding areas of Drogheda Port, Skerries Harbour, and Port Oriel Harbour.

361. The most frequent vessel types involved in the encounters during the survey period were fishing vessels (51%), recreational vessels (26%), and cargo vessels (9%).

17.4.2 Vessel to Vessel Collisions

362. Using the pre wind farm vessel routeing as input, Anatec's COLLRISK model has been run to estimate the existing vessel to vessel collision risk in proximity to the proposed development. The route positions and widths are based on the vessel traffic survey data and was validated with the long-term vessel traffic data and consultation with local stakeholders.

363. A heat map based upon the geographical distribution of collision risk within a 0.5×0.5nm grid for the base case is presented in Figure 17.2.

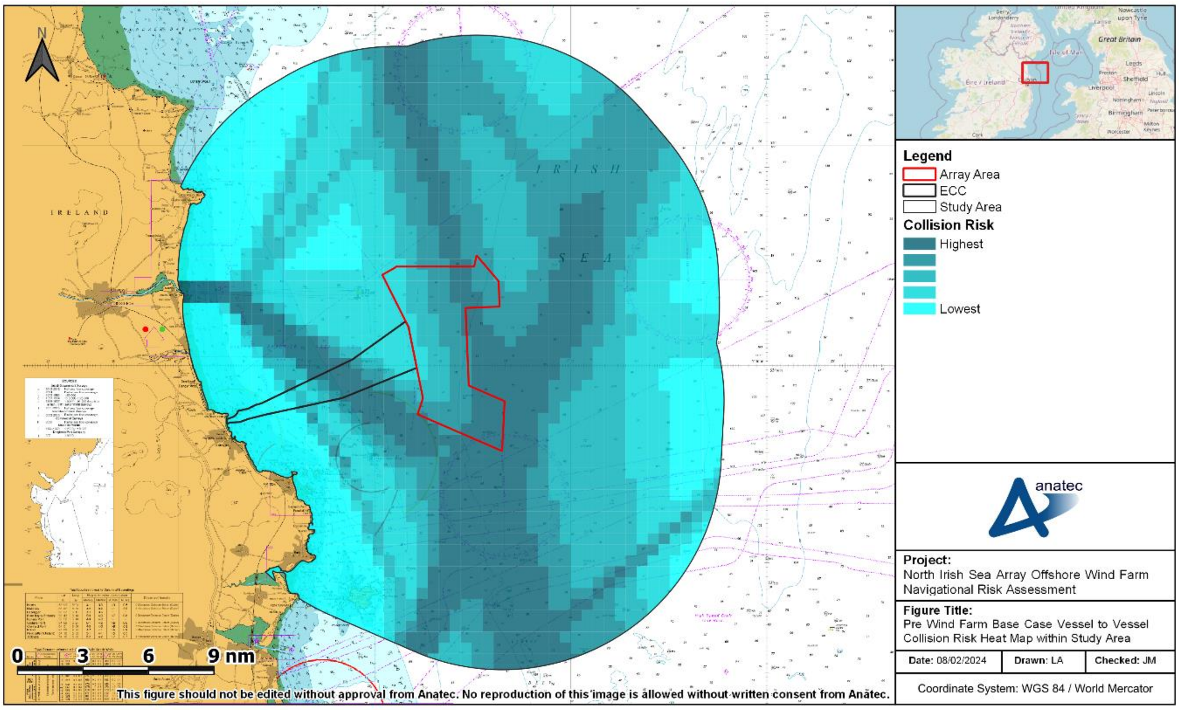

Figure 17.2 Pre Wind Farm Base Case Vessel to Vessel Collision Risk Heat Map within Study Area

364. Assuming base case vessel traffic levels, the annual collision frequency pre wind farm was estimated to be 2.6×10^{-4}, corresponding to a return period of approximately one in 3,919 years. This is a relatively low return period compared to that estimated in the pre wind farm scenario for other UK and Ireland offshore wind farm developments and is reflective of the low volume of vessel traffic in the area.

365. It is noted that the model is calibrated based upon major incident data at sea which allows for benchmarking but does not cover all incidents, such as minor impacts. Other incident data, which includes minor incidents, is presented in Section 9.

17.5 Post Wind Farm

17.5.1 Simulated Automatic Identification System

366. Anatec's AIS Simulator software was used to gain insight into the potential re-routed commercial traffic following the installation of the wind farm structures within the array area. The AIS Simulator uses the mean positions of the main commercial routes identified within the study area and the anticipated shift post wind farm, together with the standard deviations and average number of vessels on each main commercial route.

367. A plot of 28-days of simulated AIS (matching the total durations of the vessel traffic surveys) within the study area, based on the deviated main commercial routes, is presented in Figure 17.3.

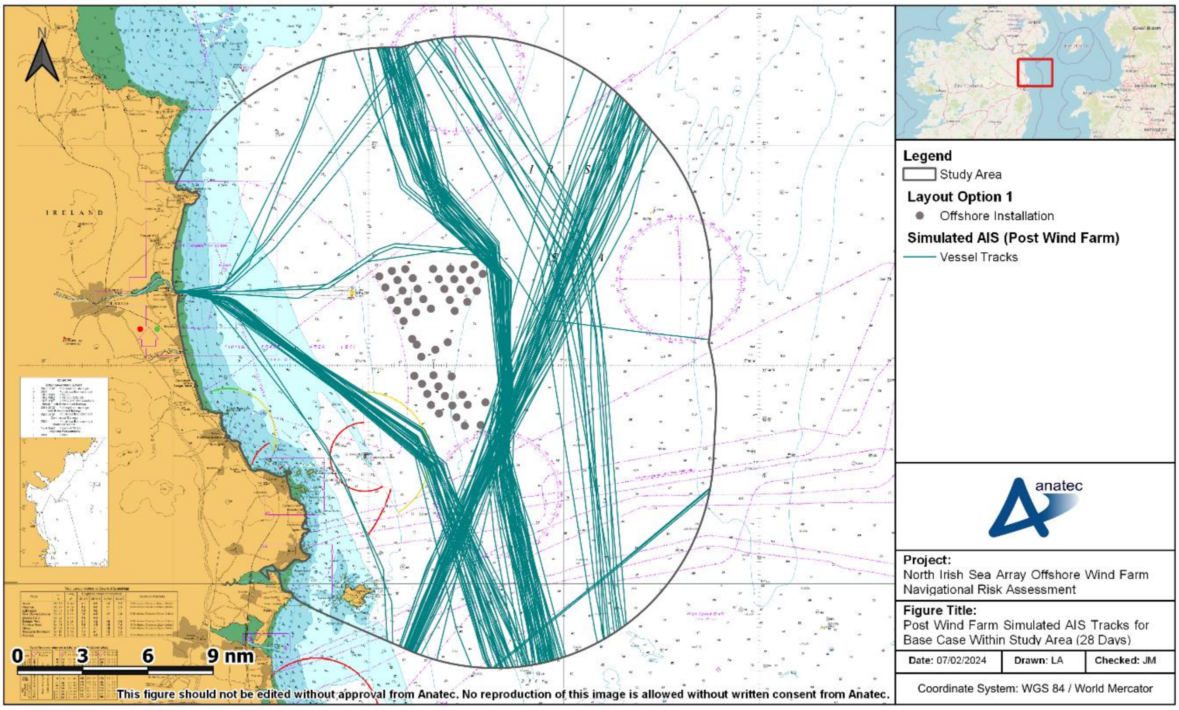

Figure 17.3 Post Wind Farm Simulated AIS Tracks for Base Case Within Study Area (28-Days)

17.5.2 Vessel to Vessel Collisions

368. Using the post wind farm routeing as input, Anatec’s COLLRISK model has been run to estimate the anticipated vessel to vessel collision risk in proximity to the proposed development.

369. A heat map based upon the geographical distribution of collision risk within a 0.5×0.5nm grid for the base case is presented in Figure 17.4.

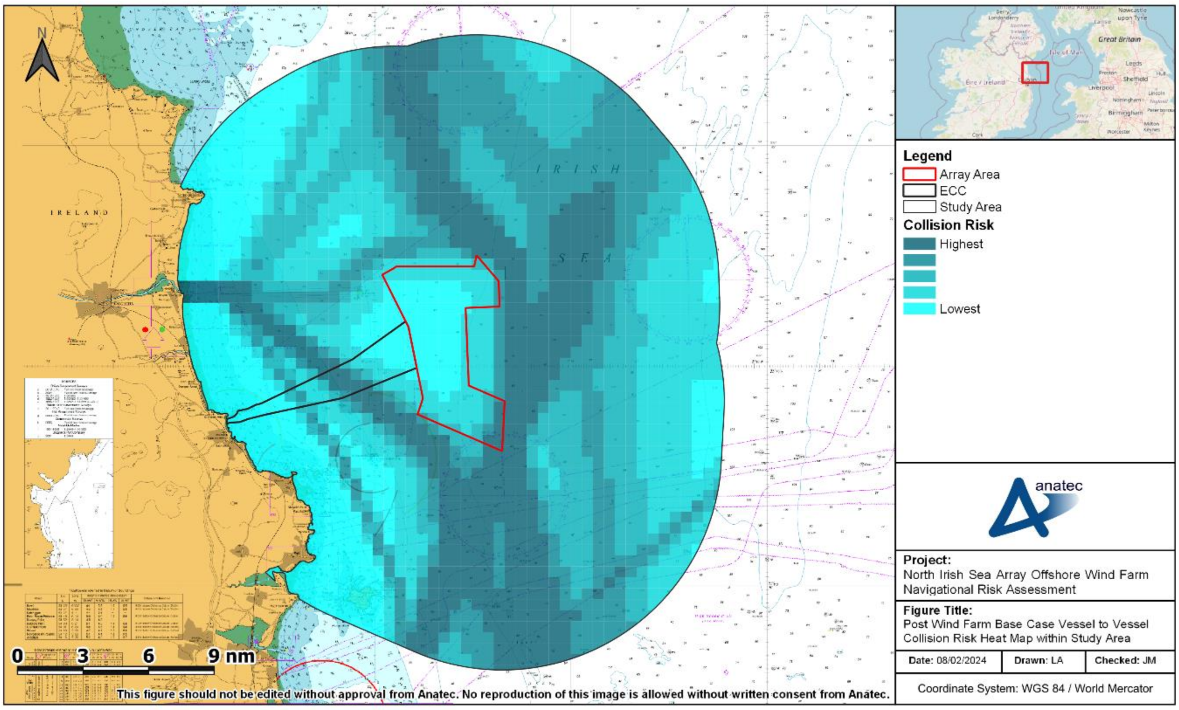

Figure 17.4 Post Wind Farm Base Case Vessel to Vessel Collision Risk Heat Map within Study Area

370. Assuming base case vessel traffic levels, the annual collision frequency post wind farm was estimated to be 3.6×10^{-4}, corresponding to a return period of approximately one in 2,814 years. This represents a 39.2% increase in collision frequency compared to the pre wind farm base case result.

371. The change in vessel to vessel collision risk between the base case pre wind fam and post wind farm scenarios is presented in a heat map in Figure 17.5. Generally, there is an increase in collision risk where routeing traffic has been displaced to, this was noted mostly to the east of the array area. A decrease in collision risk was noted mainly where routeing traffic has been displaced from, this was seen mostly within the array area and directly surrounding.

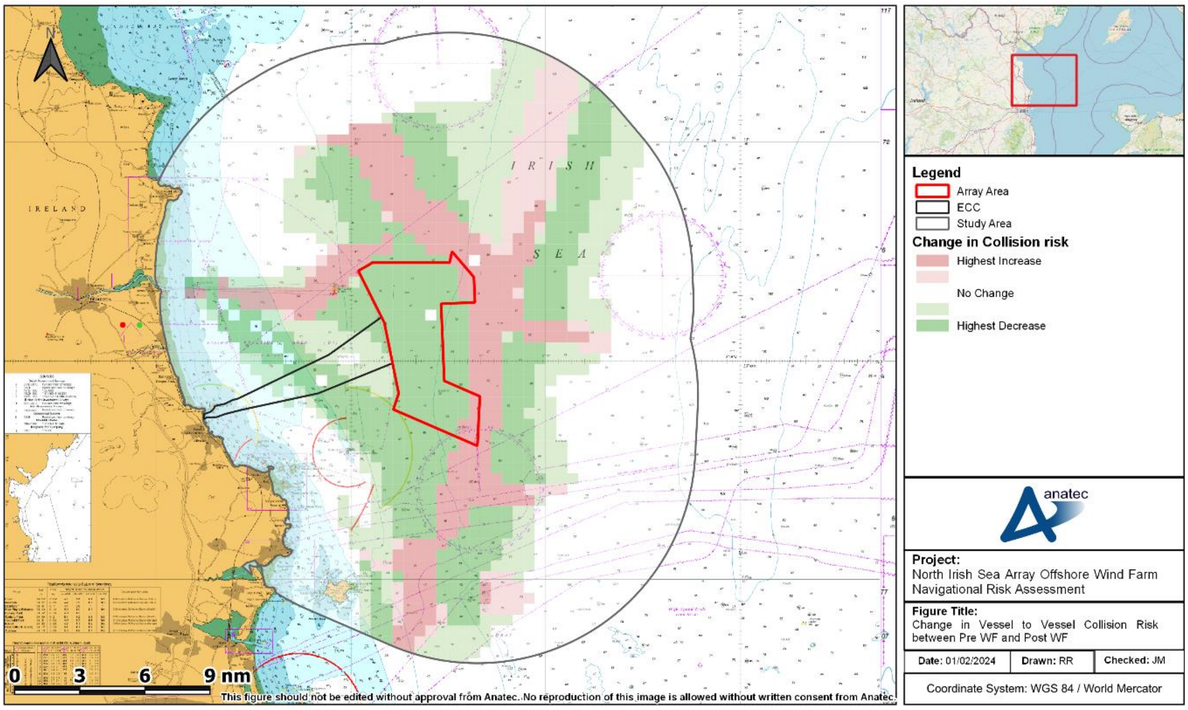

Figure 17.5 Change in Vessel to Vessel Collision Risk

17.5.3 Powered Vessel to Structure Allision

372. Based upon the vessel routeing identified in the study area, the anticipated re-routeing as a result of the presence of the proposed development, and assumptions that relevant embedded mitigation measures are in place (see Section 19), the frequency of an errant vessel under power deviating from its route to the extent that it came into proximity with a wind farm structure associated with the proposed development is considered to be low.

373. From consultation with the shipping industry, it is also assumed that commercial vessels would be highly unlikely to navigate between wind farm structures due to the restricted sea room and will instead be directed by the aids to navigation located in the region and those present at the proposed development. During the construction and decommissioning phases this will primarily consist of the buoyed construction area whilst during the operational phase this will primarily consist of the lighting and marking of the wind farm structures themselves.

374. Using the post wind farm routeing as input, together with the layout and local meteorological ocean data, Anatec’s COLLRISK model was run to estimate the likelihood of a commercial vessel alliding with one of the wind farm structures within the array area whilst under power. In order to maintain a worst case the model did not consider one structure shielding another.

375. A plot of the annual powered allision frequency per structure for the base case is presented in Figure 17.6, with the chart background removed to increase the visibility of those structures with lower allision frequencies.

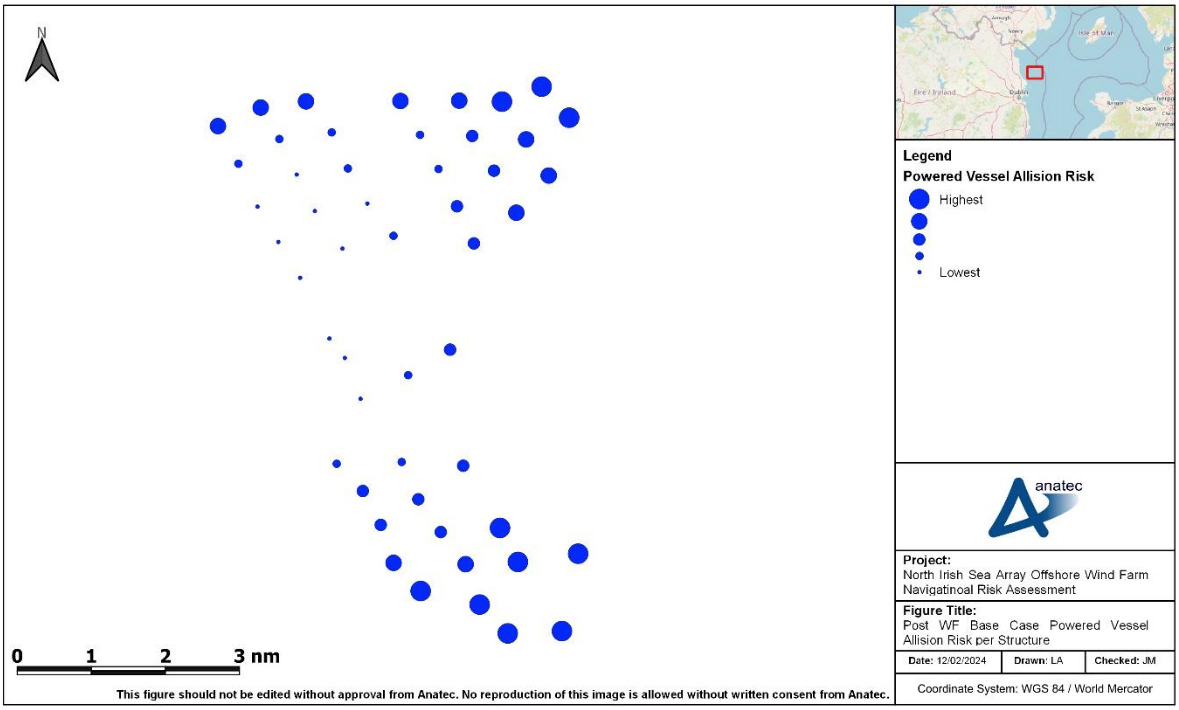

Figure 17.6 Base Case Powered Allision Risk per Structure

376. Assuming base case vessel traffic levels, the annual powered allision frequency was estimated to be 9.53×10^{-4}, corresponding to a return period of approximately one in 1,049 years.

377. The greatest powered vessel to structure allision risk was associated with structures at the eastern corners of layout, specifically the south-east, where a high volume of traffic from multiple main commercial routes between Warrenpoint and the Bristol Channel, Belfast and Wicklow, and Drogheda and Mersey all pass within close proximity (1nm). The greatest individual allision risk was associated with the WTG on the south-east corner (approximately 3.95×10^{-4} or one in 2,533 years).

17.5.4 Drifting Vessel to Structure Allision

378. Using the post wind farm routeing as input, together with the layout and local meteorological ocean data, Anatec's COLLRISK model was run to estimate the likelihood of a commercial vessel alliding with one of the wind farm structures within the array area. The model is based on the premise that propulsion on a vessel must fail before drifting will occur. The model takes account of the type and size of the vessel, the number of engines and the average time required to repair but does not consider navigational errors caused by human actions.

379. The exposure times for a drifting scenario are based upon the vessel hours spent in proximity to the array area (up to 10nm from the array area). These have been estimated based on the vessel traffic levels, speeds, and revised routeing patterns. The exposure is divided by vessel type and size to ensure that these specific factors, which based upon analysis of historical incident data have been shown to influence incident rates, are taken into account for the modelling.

380. Using this information, the overall rate of mechanical failure in proximity to the array area was estimated. The probability of a vessel drifting towards a wind farm structure and the drift speed are dependent on the prevailing wind, wave, and tidal conditions at the time of the incident. Therefore, three drift scenarios were modelled, each using the meteorological ocean data provided in Section 8:

- Wind;
- Peak spring flood tide; and
- Peak spring ebb tide.

381. The probability of vessel recovery from drift is estimated based upon the speed of the drift and hence the time available before arriving at a wind farm structure. Vessels which do not recover within this time are assumed to allide. Conservatively, no account is made for another vessel (including a proposed development vessel) rendering assistance.

382. After modelling the three drifting scenarios, it was established that the wind dominated scenario produced the worst case results. A plot of the annual powered allision frequency per structure for the base case is presented in Figure 17.7, with the chart background removed to increase the visibility of those structures with a low allision frequency.

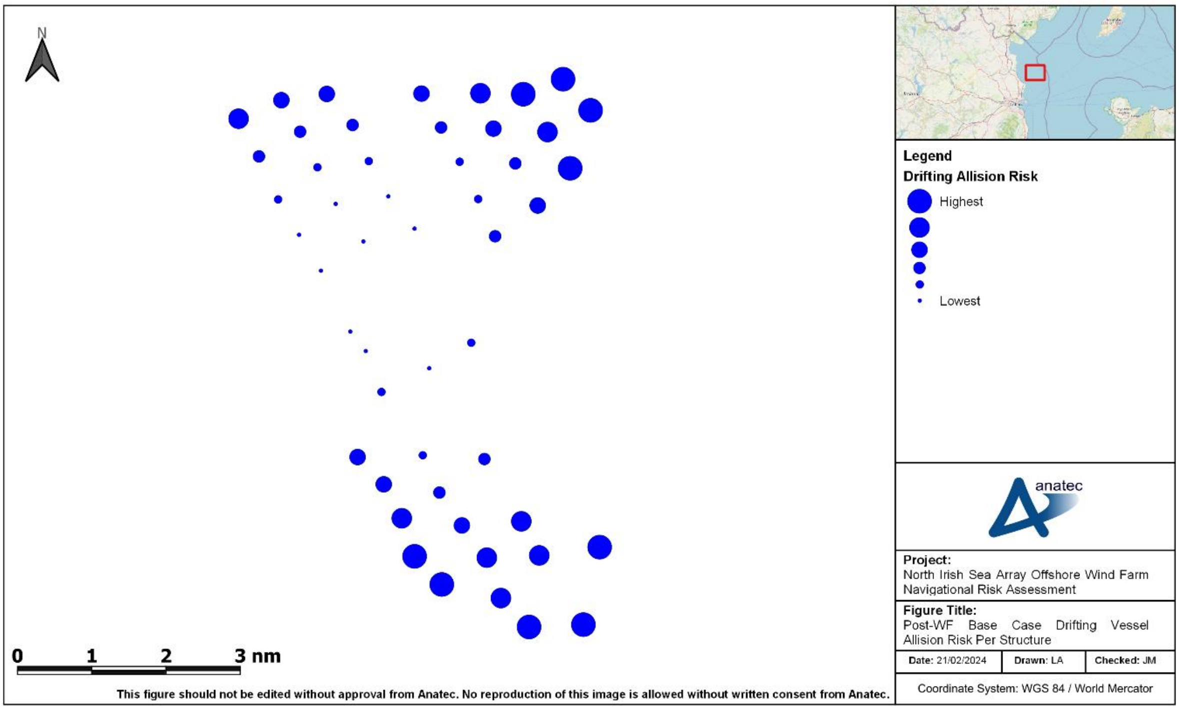

Figure 17.7 Base Case Drifting Allision Risk per Structure

383. Assuming base case vessel traffic levels, the annual drifting allision frequency was estimated to be 5.94×10^{-5}, corresponding to a return period of approximately one in 16,835 years.

384. The greatest drifting vessel to structure allision risk was again associated with structures at the south-eastern extent where multiple main commercial routes pass at the minimum mean distance from the layout (1nm). The greatest individual allision risk was associated with a WTG on the south-east corner of the layout (approximately 1.03×10^{-5} or one in 97,378 years).

385. It is noted that historically there have been no reported drifting allision incidents with wind farm structures in the UK. Whilst drifting vessels do occur every year in UK waters, in most cases the vessel has been recovered prior to any allision incident occurring (such as by anchoring, restarting engines, or being taken in tow).

17.5.5 Fishing Vessel to Structure Allision

386. Using the vessel traffic survey data as input, Anatec's COLLRISK model was run to estimate the likelihood of a fishing vessel alliding with one of the wind farm structures within the array area.

387. A fishing vessel allision is classified separately from other allisions since, unlike in the case of the commercial traffic characterised using the main commercial routes, fishing vessels may be either in transit or actively fishing within the study area. Moreover, fishing vessels could be observed internally within the array area in

addition to externally. Anatec's COLLRISK model uses vessel numbers, sizes (length and beam), array area layout and structure dimensions. The likelihood of a major allision incident has been calibrated against historical maritime incident data and historical AIS vessel traffic data within operational offshore wind farm arrays. Given that not all fishing vessels broadcast on AIS, the vessel density observed is scaled up to account for non-AIS fishing vessels, with the scaling factor dependent on the distance of the array offshore.

388. A plot of the annual fishing vessel allision frequency per structure for the base case is presented in Figure 17.8.

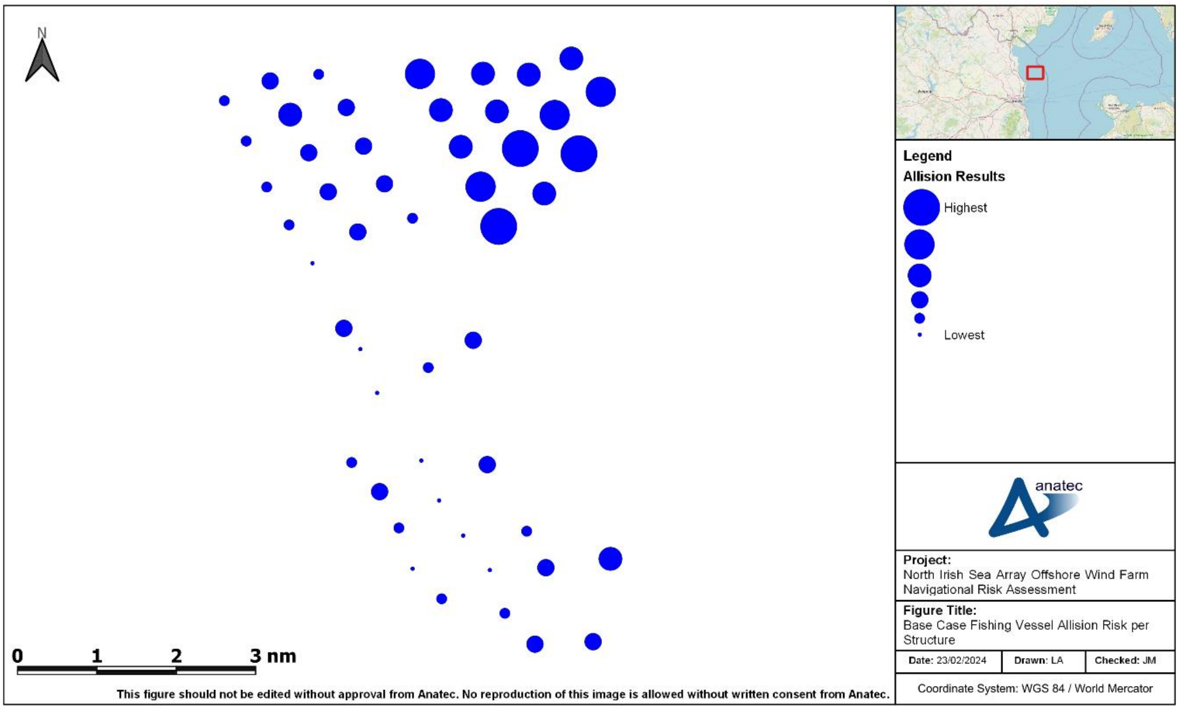

Figure 17.8 Base Case Fishing Vessel Allision Risk per Structure

389. Assuming base case vessel traffic levels, the annual fishing vessel to structure allision frequency was estimated to be 3.33×10^{-1}, corresponding to a return period of approximately one in 3.00 years.

390. The greatest fishing vessel to structure allision risk was associated with structures at the north and eastern extent of the array area where active fishing activity was observed. The greatest individual allision risk was associated with a WTG to the northeast of the array area (approximately 1.6×10^{-2} or one in 62 years).

17.6 Risk Results Summary

391. The previous sections modelled two scenarios, namely the pre and post wind farm scenarios with base case traffic levels. In order to incorporate the potential for future traffic growth, pre and post wind farm scenarios have also been modelled for future

case traffic levels (both 10% and 20% increases). Table 17.1 summarises the results of all six scenarios.

Table 17.1 Summary of Annual Collision and Allision Risk Results

Risk	Scenario	Annual Frequency (Return Period)		
		Pre Wind Farm	Post Wind Farm	Change
Vessel to vessel collision	Base case	2.55×10^{-4} (1 in 3,919 years)	3.55×10^{-4} (1 in 2,814 years)	1×10^{-4} (1 in 9,988 years)
	Future case (10%)	3.17×10^{-4} (1 in 3,150 years)	4.42×10^{-4} (1 in 2,263 years)	1.24×10^{-4} (1 in 8,035 years)
	Future case (20%)	3.76×10^{-4} (1 in 2,659 years)	5.24×10^{-4} (1 in 1,910 years)	1.48×10^{-4} (1 in 6,776 years)
Powered vessel to structure allision	Base case	N/A	9.53×10^{-4} (1 in 1,049 years)	9.53×10^{-4} (1 in 1,049 years)
	Future case (10%)	N/A	1.1×10^{-3} (1 in 940 years)	1.1×10^{-3} (1 in 940 years)
	Future case (20%)	N/A	1.2×10^{-3} (1 in 862 years)	1.2×10^{-3} (1 in 862 years)
Drifting vessel to structure allision	Base case	N/A	5.94×10^{-5} (1 in 16,835 years)	5.94×10^{-5} (1 in 16,835 years)
	Future case (10%)	N/A	6.62×10^{-5} (1 in 15,110 years)	6.62×10^{-5} (1 in 15,110 years)
	Future case (20%)	N/A	7.21×10^{-5} (1 in 13,877 years)	7.21×10^{-5} (1 in 13,877 years)
Fishing vessel to structure allision	Base case	N/A	3.33×10^{-1} (1 in 3.00 years)	3.33×10^{-1} (1 in 3.00 years)
	Future case (10%)	N/A	3.67×10^{-1} (1 in 2.72 years)	3.67×10^{-1} (1 in 2.72 years)
	Future case (20%)	N/A	4.00×10^{-1} (1 in 2.50 years)	4.00×10^{-1} (1 in 2.50 years)
Total	**Base case**	2.55×10^{-4} (1 in 3,919 years)	3.35×10^{-1} (1 in 3.00 years)	3.34×10^{-1} (1 in 3.00 years)
	Future case (10%)	3.17×10^{-4} (1 in 3,150 years)	3.68×10^{-1} (1 in 2.72 years)	3.68×10^{-1} (1 in 2.72 years)
	Future case (20%)	3.76×10^{-4} (1 in 2,659 years)	4.02×10^{-1} (1 in 2.49 years)	4.01×10^{-1} (1 in 2.49 years)

18 Introduction to Risk Assessment

392. Section 19 provides a qualitative and quantitative risk assessment (using FSA) for the hazards identified due to the proposed development, based on baseline data, expert opinion, outputs of the Hazard Workshop, stakeholder concerns and lessons learnt from existing offshore developments. The hazards assessed are as follows:

- Vessel displacement and increased third-party vessel to vessel collision risk;
- Third-party to proposed development vessel collision risk;
- Reduced access to local ports;
- Creation of vessel to structure allision risk;
- Reduction in under keel clearance;
- Anchor interaction with subsea cables; and
- Reduction of emergency response provision including SAR capability.

393. The shipping and navigation users considered are as follows:

- Commercial vessels;
- Recreational vessels;
- Commercial fishing vessels in transit;
- Military vessels;
- Anchored vessels;
- Emergency responders; and
- Local ports and services including pilot vessels.

394. For each hazard, the full description of the hazard is provided in *italicised* text. This is followed by various subsections as appropriate to consider each component of the hazard, both qualitative and quantitatively including in isolations scenario (proposed development only) and the cumulative scenario (the proposed development alongside those cumulative developments screened in Section 15). The cumulative scenario is considered on a tiered basis to ensure all realistic build out scenarios are accounted for. Each hazard covers the array area and the ECC.

395. Within each component of an overarching hazard, embedded mitigation measures which have been identified as relevant to reducing risk are listed, with full descriptions provided in Section 20.

396. At the end of the assessment of each hazard, the potential significance of risk has been determined based on the frequency of occurrence and severity of consequence and is summarised in tabular form, based on the methodology defined in Section 3.3.

397. A concluding risk statement is provided (see Section 21.7).

19 Risk Assessment

19.1 Vessel Displacement and Increased Vessel to Vessel Collision Risk (Array Area)

398. *Activities associated with the installation, maintenance and decommissioning of structures and cables as well as the presence of surface structures within the array area may displace third-party vessels from their existing routes or activity. This displacement may result in increased collision risk with other third-party vessels.*

19.1.1 In Isolation Scenario – All Users

399. The subject of vessel displacement and its potential consequences was raised by multiple stakeholders during consultation including at the Hazard Workshop and by IRCG, Irish Chamber of Shipping, Warrenpoint Harbour Authority, and Drogheda Port Company.

400. The elements of this hazard which are considered include:

- Vessel displacement from main commercial routes;
- Increased third-party to third-party vessel collision risk;
- Adverse weather routeing; and
- Small craft displacement and collision risk.

19.1.1.1 Vessel Displacement from Main Commercial Routes

401. During the construction and decommissioning phases, a buoyed construction/ decommissioning area will be deployed around the array within the array area. No restrictions on vessel entry will be enforced for the buoyed construction/ decommissioning area or during the operations and maintenance phase. However, based on experience at previously under construction and existing operational offshore wind farms, it is anticipated that commercial vessels will choose not to navigate internally within the buoyed construction/ decommissioning area or the operational array. These assumptions have been supported during consultation with stakeholders and Regular Operators including the Irish Chamber of Shipping, CLdN, and the Drogheda Port Company. Given the reduction in navigable sea room there will be some displacement of main commercial routes expected during all phases.

402. The volume of vessel traffic passing within or in proximity to the array area has been established using vessel traffic data collected during dedicated surveys (28 days over winter 2023 and summer 2022) and from coastal receivers (12 months in 2022) as well as Anatec's ShipRoutes database, noting that the vessel traffic data has been agreed as appropriate by the MSO. The combination of datasets used addresses the concerns raised during the Hazard Workshop by the Irish Chamber of Shipping and Warrenpoint Harbour Authority, with the long-term vessel traffic data ensuring that any periods of adverse weather and associated vessel movements are detected.

403. As part of the future case considerations, increases of 10% and 20% for all commercial traffic identified in the baseline is assumed.

404. These datasets were interrogated to identify main routes using the principles set out in MGN 654 (MCA, 2021). The full methodology for main route deviations is provided in Section 16.5.1. A deviation will be required for four of the ten main routes identified within the study area for all phases of the proposed development. The level of deviation ranging from 0.4nm increase for Route 6 (Belfast to Wicklow) to an 11nm increase for Route 3 (Drogheda to Off Smalls TSS), noting that vessel traffic levels on Route 3 (identified as Route 3A passing around the north and east of the array) are very low as only a small proportion of vessels on the route are anticipated to require the deviation. Route 3A sees the maximum percentage change in total route length at 8%, again noting this route has very low traffic levels and the route start/ end point is calculated for this assessment as the Off Smalls TSS. However, the destinations of vessels on this route will be located at a greater distance and therefore any displacement will be a smaller overall percentage change [5]. Stakeholders agreed that in practical terms the route deviations taken by vessels would have fewer waypoints applied earlier in the approach to the array resulting in shorter overall routes than what is conservatively identified within the assessment.

405. The deviation associated with Route 3A has been considered for assessment due to consultation feedback from Drogheda Port Company, Warrenpoint Harbour Authority and Irish Chamber of Shipping regarding sensitive cargos, i.e., tankers and larger DWT cargo vessels for which passing between Rockabill and the array area may be considered unfavourable due to less manoeuvrability in restricted sea room. Consultation with the Drogheda Port Company following inclusion of the Structure Exclusion Zone indicated that deviated routes provide safe and viable options for base case and future case shipping inclusive of any routes passing between the array area and Rockabill.

406. The most likely consequence of vessel displacement will be increased journey times and distances for affected third-party vessels, as indicated by the Drogheda Port Company during consultation. The hazard will occur over a regional spatial extent given that the buoyed construction/ decommissioning areas will be deployed around the maximum extent of the array. Vessels are expected to comply with international and flag state regulations (including the COLREGs and SOLAS) and will be able to passage plan in advance given the promulgation of information relating to the proposed development and relevant nautical charts, as well as the operational lighting and marking of the array as per the LMP provided in Appendix 17.3. This high level of awareness will assist with ensuring that vessels make safe and effective deviations which minimise journey increases.

[5] Vessels on some routes have a wide variety of potential destinations, and therefore determining an overall route length (to/ from a specific port) beyond the Irish Sea is not feasible, and the start/ end destination used (usually a TSS) is the shared and fixed location for all vessels on these routes.

407. There could be disruption to schedules, particularly for commercial ferry operators. However, given that no deviations are anticipated for these routes, and the international nature of routeing in the region alongside the ability to passage plan, disruptions to schedule are expected to be minimal. Moreover, the MSO have acknowledged during consultation that there are no expectations of major issues for commercial vessel navigation due to the proposed development.

19.1.1.2 Increased Third-Party to Third-Party Vessel Collision Risk

408. Post wind farm modelling using the main commercial route deviations as input gives an estimated collision return period of one in 2,814 years for base case traffic levels, rising to one in 1,910 years for the higher tier of future case traffic levels (20%). The higher level of collision risk is due to the high volume of vessel traffic in concentrated areas, particularly to the east and south-east of the array. The base case collision result represents a 39% increase compared to the pre wind farm base case result indicating that the influence of the array on the overall collision risk for commercial traffic is moderate. However, the collision risk return period of one in 2,814 years post wind farm is still considered to be very low relative to the results associated with NRAs for many UK offshore wind farms. This reflects historical incident data which indicates that no collision incidents between third-party vessels have occurred directly as a result of an offshore wind farm (in the UK).

409. Stakeholders including the Drogheda Port Company, Warrenpoint Harbour Authority, CLdN, and the Irish Chamber of Shipping, raised concerns over the sea room available at the Rockabill gap and how vessels on passage may be at an increased risk of collision due to the limited sea room for passing. Following a review and in response to this, the Developer has agreed to a Structure Exclusion Zone within the array area which increases sea room to 3nm between the array and Rockabill Island, and this forms part of the proposed development design (see Section 6.1.1.1).

410. Limited active fishing occurs in proximity to the Rockabill gap as most fishing occurs in the nephrop fishing grounds to the north-east. Recreational vessel activity is most prominent east of the Rockabill gap and consists of transits to and from Dublin Bay. Accounting for the lower temporal exposure and sea room available, it is again anticipated that potential users of the Rockabill gap will be able to safely navigate in the presence of any recreational and fishing activity.

411. In poor visibility, third-party vessels may experience limitations regarding visual identification of other third-party vessels due to the presence of surface infrastructure. During consultation the MSO noted the potential for the array to obscure the view of vessels approaching each other from differing sides of the array, giving rise to additional collision risk.

412. As part of the project option with the greatest significance of risk, consideration is given to the WTG surface dimensions (12.5m diameter) and OSP topside dimensions

(45x45m) alongside the minimum vessel dimensions based on vessel traffic survey data (around 8x2m). Should the WTG surface dimensions be reduced, or the size of vessel involved in such a scenario be greater, it is expected that the potential for visual interference would be reduced. This will also be mitigated by the application of the COLREGs (reduced speeds) in adverse weather conditions.

413. Situations where the passing vessels may be visually obscured from each other by a structure are limited given the considerable spacing between WTGs (910m subject to LoD) which maintains large open areas of sea room where there are no visual obtrusions.

414. Additionally, given the size of the structures, the duration for which any visual obtrusion may occur would be very low and most sizes of vessel would not be fully obscured at any point. The effect would be heightened when the obscuring structure is the OSP given its greater size, but would remain negligible. Therefore, increased collision risk due to visual interference is expected to be minimal.

415. There is also potential for multiple structures together to create more prolonged visual interference (due to the optical illusion of the multiple structures being one continuous entity). However, given the minimum spacing between structures this would require a very specific alignment of the two vessels involved and would only occur where the vessels are far apart, e.g., at opposite ends of a row of structures. Subsequently, collision risk associated with the vessels would be minimal given the need for close proximity for an encounter and collision event to develop.

416. The most likely consequences in the event of an encounter between two or more third-party vessels is the implementation of collision avoidance action in line with the COLREGs, with the vessels involved able to resume their respective passages with no long-term consequences.

417. Should an encounter develop into a collision incident, it is most likely to involve minor contact resulting in minor damage to the vessels with no harm to people and no substantial reputational risks. As part of the scenario deemed to have the greatest significance of risk, with very low frequency of occurrence one of the vessels could receive substantial damage or founder with Potential Loss of Life (PLL) and pollution, with this outcome more likely where one of the vessels is a small craft (e.g., fishing vessel, recreational vessel or crew transfer vessel (CTV)). However, the likelihood of such an event occurring is very low with the mitigation in place.

19.1.1.3 Adverse Weather Routeing

418. The need to consider adverse weather routeing was highlighted by the Irish Chamber of Shipping and Warrenpoint Harbour Authority during consultation in the Hazard Workshop.

419. From the vessel traffic data and the 12 month long-term vessel traffic data it was identified that various commercial vessels, including commercial ferries, were

exhibiting waiting behaviour. These were north-south transits and turning within the array area while waiting for berth availability at Dublin Port, as confirmed by CLdN during consultation. CLdN also noted that this activity occurs periodically, usually in winter, and a reduction in sea room from the presence of the array may make it harder for vessels to turn in bad weather. From the most recent vessel traffic survey data and the long-term vessel traffic data this activity does not routinely occur in proximity to the array area, noting that the standard routeing it is associated with is located south of the study area. The refinement of the array area within the MAC boundary has assisted with minimising the interaction by increasing the sea room available to the south, such that it is anticipated that this routeing may safely continue during all phases. No other adverse weather routeing was identified for the main commercial routes within the study area.

420. The most likely consequences of displacement of adverse weather routeing are similar to that of displacement of standard weather routeing, i.e., increased journey times and distances for affected third-party vessels with the hazard occurring over a regional spatial extent given that the buoyed construction/ decommissioning areas and infrastructure will be deployed around the maximum extent of the array area.

421. As part of the project option with the greatest significance of risk, the passage undertaken by a deviated vessel may be considered unsafe for navigation in adverse weather conditions resulting in the vessel being unable to make the transit. It is considered highly unlikely that the vessel would undertake an unsafe transit and therefore risk to the vessel or crew are negligible due to the very low frequency of occurrence.

19.1.1.4 Promulgation of Information and Passage Planning

422. All vessels operating in the area are expected to comply with international flag state regulations (including COLREGs and SOLAS) and will have a raised level of awareness of construction and decommissioning activities given the promulgation of information relating to the proposed development including the charting of the construction/ decommissioning areas on relevant nautical charts prior to the commencement of construction works, as well as the publication of Notices to Mariners, which may be issued as Marine Notices if deemed appropriate by the MSO. The buoyed construction/ decommissioning areas will also serve to maximise awareness, allowing vessels to passage plan effectively. Likewise, during the operational phase infrastructure will be appropriately marked on relevant nautical charts and awareness of the operational array will be very high and continue to increase with the longevity of the proposed development.

423. SOLAS Chapter V states that "*the voyage plan shall identify a route which… anticipates all known navigational hazards and adverse weather conditions*" (IMO, 1974). The promulgation of information relating to the proposed development will assist such passage planning.

19.1.1.5 Small Craft Displacement and Collision

424. From the vessel traffic survey data (which incorporates Radar and visual observations in addition to AIS) regular transits by commercial fishing vessels and recreational vessels through the array area are common but are highly seasonal, with higher levels recorded for both vessel types during the summer months. Active fishing occurs within the array area and recreational vessels are noted on transit north-east south-west to/ from Dublin.

425. Limited consultation has been provided by commercial fisheries and recreational operators via the Hazard Workshop. Based on Anatec's experience at previously under construction offshore wind farms, it is anticipated that fishing vessels and recreational vessels will also choose not to routinely navigate internally within the buoyed construction/ decommissioning area. Therefore, some displacement of transits by small craft will be required during the construction and decommissioning phases. Displacement of active commercial fishing is assessed separately in **Volume 5, Chapter 16: Commercial Fisheries**.

426. For regular transits through the array area, there is sufficient sea room available for deviations to the east and west, and due to the refinement of the array area within the MAC boundary, this gives more sea room to the south.

427. For the operational phase, based on experience at existing operational offshore wind farms, it is anticipated that commercial fishing vessels and recreational vessels may choose to navigate internally within the operational array, particularly in favourable weather conditions and as awareness of the array increases throughout the operational phase. In situations where small craft do navigate internally, the level of displacement is considered negligible.

428. It has been raised by the Irish Chamber of Shipping and CLdN during consultation that vessels on passage through the Rockabill gap are of greater concern when small craft vessels are involved. From the datasets, fishing vessels and recreational vessels do transit over the area on occasion but is highly seasonal and limited. Recreational vessels are most prominent seasonally east of the Rockabill gap transiting to/ from Dublin Bay. These transits may be displaced further east by the array – particularly when the construction/ decommissioning area is present – thus providing additional sea room for maintaining safe passing distances between vessels. Where this is not the case, the temporal exposure will be minimal given that the users of the Rockabill gap and recreational vessels will be passing perpendicular and thus the likelihood of an encounter is very low.

19.1.2 Cumulative Scenario – All Users

19.1.2.1 Tier 1

429. One of the main commercial routes identified from the in isolation scenario may potentially interact with Oriel Wind Park with slight deviations required (Route 9).

430. Route 9 is not displaced by the array area and the sea room between the array area and Oriel Wind Park (approximately 9.1nm) is sufficient to ensure a deviation around the east of Oriel Wind Park will not result in a passing distance from the array area which compromises navigational safety.

431. Two of the main commercial routes identified from the in isolation scenario may potentially interact with Dublin Array Offshore Wind Farm with slight deviations required (Route 4 and Route 6).

432. In both instances the increase in route length is low (equal to or less than 1nm) and corresponds to a maximum 0.8% increase in total route length. Therefore, disruption to journey times and distances and effects on collision risk are anticipated to be negligible.

19.1.2.2 Tier 2

433. One of the main commercial routes identified from the in isolation scenario may potentially interact with Arklow Bank Wind Park 2 with a slight deviation required (Route 4). The increase in route length for the cumulative scenario is very small relative to the in isolation scenario (a further increase of 0.6nm), and so further increases in journey times and distances and effects on collision risk are anticipated to be negligible.

434. If taken forward, the proposed Bremore Port development would increase the overall vessel traffic volumes and may introduce larger vessels not currently present in the area to routes in proximity to the array area. This may include increased volumes on Route 3 which – in the case of larger vessels or vessels carrying sensitive cargoes – may result in a large deviation around the array (Route 3A).

435. The presence of Bremore Port may also introduce new routes as illustrated in Section 16.3.1. These include an indicative route headed to/ from the UK which would need to pass north or south of the array resulting in a longer passage. Given that Drogheda Port Company stated during consultation that, if taken forward, vessels utilising the proposed Bremore Port are currently expected to approach from the north-east, a passage to the north is more likely.

436. Bremore Port and its potential increase in vessels may also increase collision risk, especially at the Rockabill gap if some vessels choose to transit to the south of the proposed development, including from the indicative new route to/ from the UK. However, given the low likelihood of a collision in the Rockabill gap for the base case (as analysed in Appendix E), the additional risk with Bremore Port related traffic is expected to remain within tolerable levels.

19.1.2.3 Tier 3

437. It is noted that the Dublin Masterplan 2040 may reduce traffic levels in the area from local ports, i.e., traffic previously navigating to and from other local ports relocates

to Dublin Port. However, there is also potential for those main commercial routes out of Dublin to feature increased traffic volumes (with Route 2 of particularly note). There is adequate sea room offshore of the array area to accommodate future case increases in traffic volume, limiting the creation of additional hotspots for collision risk, particularly in relation to the area at the south-eastern corner of the array area where crossing interaction may occur with potential Bremore Port related traffic.

19.1.3 Embedded Mitigation Measures

438. Embedded mitigation measures identified as relevant to reducing the significance of risk area as follows (full list in Section 20):

- Advisory safe passing distances, as outlined in the VMP in Appendix 17.2;
- Buoyed construction/ decommissioning area;
- Compliance with relevant regulator guidance;
- Guard vessel(s) as required, as outlined in the VMP in Appendix 17.2;
- Liaison with IRCG in relation to SAR resources;
- Lighting and marking as outlined in the LMP in Appendix 17.3;
- Marking on nautical charts;
- Promulgation of information, as outlined in the VMP in Appendix 17.2; and
- Structure Exclusion Zone.

19.1.4 Potential Significance of Risk

439. The frequency of occurrence and severity of consequence due to vessel displacement and increased collision risk associated with the array area for each phase of the proposed development is presented in Table 19.1 alongside the resulting significance risk.

Table 19.1 Significance of Risk for Vessel Displacement and Increased Collision Risk (Array Area)

Scenario	Phase	Potential Consequences	Frequency of Occurrence	Severity of Consequence	Significance of Risk
In Isolation	Construction	Displacement including to navigation in adverse weather resulting in increased encounters and impacts on compliance	Extremely Unlikely	Moderate	**Broadly Acceptable (ALARP)**
	Operational		Remote	Moderate	**Tolerable with Mitigation (ALARP)**
	Decommissioning		Extremely Unlikely	Moderate	**Broadly Acceptable (ALARP)**

Scenario	Phase	Potential Consequences	Frequency of Occurrence	Severity of Consequence	Significance of Risk
Cumulative	Construction	with COLREGs, resulting in a collision event with vessel damage, PLL and/or pollution.	Remote	Moderate	**Tolerable with Mitigation (ALARP)**
	Operational		Reasonably Probable	Moderate	**Tolerable with Mitigation (ALARP)**
	Decommissioning		Remote	Moderate	**Tolerable with Mitigation (ALARP)**

19.2 Vessel Displacement and Increased Vessel to Vessel Collision Risk (Offshore Export Cable Corridor)

440. *Activities associated with the installation, maintenance and decommissioning of cables within the ECC may displace third-party vessels from their existing routes or activity. This displacement may result in increased collision risk with other third-party vessels.*

19.2.1 In Isolation Scenario – All Users

441. Two export cables each with a length of 9.7nm will be installed within the ECC. Once installed the presence of the export cables will not directly result in vessel displacement (noting that hazards associated with port/ harbour access and under keel clearance are assessed separately). Therefore, this hazard is considered only in relation to export cable installation/ removal and maintenance activities.

442. It is anticipated that only one main vessel will be involved in the cable laying activities, only one main vessel involved in the cable burial and only one main support vessel – an overall maximum of three main vessels on-site at any one time. During the operational phase, export cables will be inspected annually for the first three years, then every three years by survey vessels or unmanned surface vessels.

443. The spatial extent of the hazard will be limited to where installation/ removal or maintenance activities are ongoing, with routeing vessels required to make deviations to pass around installation/ removal or maintenance works. These deviations will only be small and will be short-term. Disruption to vessel traffic is anticipated to be minimal given the length of the ECC and the small volume of traffic that routinely transit over the area of the ECC. Only two main commercial routes are expected to cross the ECC (Route 3 and Route 4) and both of these routes feature

low vessel volumes. For the areas in which these routes pass the ECC, there is sufficient sea room available for the temporary minor deviations that may need to occur. This is also relevant to small craft that transit north-south across the ECC which are low volume and highly seasonal with ample sea room available for minor deviations as required.

444. Mariners navigating in proximity to the ECC will have a raised level of awareness of the area given the proximity to the coast and this will be heightened by the promulgation of information relating to the proposed development including the publication of Notices to Mariners as export cable installation/ removal progresses and maintenance activities are required.

445. The most likely and project option with the greatest significance of risk consequences of vessel displacement due to installation/ removal or maintenance activities for the ECC are generally analogous to those outlined for the array area, although the likelihood of disruption to vessel schedules is likely to be considerably lower given the low frequency of vessel traffic in the area and the extent of the ECC. However, as part of the project option with the greatest significance of risk there is also potential for increased encounters and congestion at areas of the ECC where there is less available sea room (i.e., near landfall and in the path of traffic on passage to/ from the Rockabill gap) and subsequently a risk of collision with PLL, pollution and vessel damage.

19.2.2 Cumulative Scenario – All Users

19.2.2.1 Tier 1

446. For this hazard, no Tier 1 developments are anticipated to intersect the ECC as the closest development, Oriel Wind Park, is proposing a landfall location close to Dunany Point which is approximately 14nm north of the closest point of the ECC. Therefore, there is no direct link between the ECC and Tier 1 developments and so no additional assessments of risk have been undertaken.

19.2.2.2 Tier 2

447. For this hazard there is no direct link between the ECC and any Tier 2 offshore wind farm developments and therefore no additional assessment of effects has been undertaken in regard to the offshore wind farms.

448. Similar to the array area, if taken forward the Bremore Port development would increase the overall vessel traffic volumes in the area. The development is proposed to be located in conjunction with the landfall of the ECC putting its vessels and associated routes in direct line with the ECC resulting in the increased likelihood of deviations during operational and decommissioning activities (no temporal overlap with the construction phase is anticipated).

449. The presence of operational and decommissioning activities within the ECC may also reduce the available sea room available west of the Rockabill gap leading to increased encounters and congestion resulting in an increased collision risk. However, Drogheda Port Company stated during consultation that, if taken forward, vessels utilising the proposed Bremore Port are currently expected to approach from the north-east and this may reduce the vessel numbers to the south of the ECC. Additionally, there is sea room between the Rockabill gap and the ECC for vessels to adjust course for small deviations which are what may be required for operational and decommissioning activities within the ECC.

19.2.2.3 Tier 3

450. For this hazard, no Tier 3 developments are anticipated to intersect the ECC. Therefore, there is no direct link between the ECC and Tier 3 developments and so no additional assessments of risk have been undertaken.

19.2.3 Embedded Mitigation Measures

451. Embedded mitigation measures identified as relevant to reducing the significance of risk area as follows (full list in Section 20):

- Advisory safe passing distances, as outlined in the VMP in Appendix 17.2;
- Compliance with relevant regulator guidance;
- Guard vessel(s) as required, as outlined in the VMP in Appendix 17.2;
- Liaison with IRCG in relation to SAR resources;
- Lighting and marking as outlined in the LMP in Appendix 17.3;
- Marking on nautical charts; and
- Promulgation of information, as outlined in the VMP in Appendix 17.2.

19.2.4 Potential Significance of Risk

452. The frequency of occurrence and severity of consequence due to vessel displacement and increased collision risk associated with the ECC for each phase of the proposed development is presented in Table 19.2 alongside the resulting significance risk.

Table 19.2 Significance of Risk for Vessel Displacement and Increased Collision Risk (ECC)

Scenario	Phase	Potential Consequences	Frequency of Occurrence	Severity of Consequence	Significance of Risk
In Isolation	Construction	Displacement including to navigation in	Extremely Unlikely	Tolerable	**Broadly Acceptable (ALARP)**

Scenario	Phase	Potential Consequences	Frequency of Occurrence	Severity of Consequence	Significance of Risk
	Operational	adverse weather resulting in increased encounters and impacts on compliance with COLREGs, resulting in a collision event with vessel damage, PLL and/or pollution.	Extremely Unlikely	Tolerable	**Broadly Acceptable (ALARP)**
	Decommissioning		Extremely Unlikely	Tolerable	**Broadly Acceptable (ALARP)**
Cumulative	Construction		Remote	Tolerable	**Broadly Acceptable (ALARP)**
	Operational		Remote	Tolerable	**Broadly Acceptable (ALARP)**
	Decommissioning		Remote	Tolerable	**Broadly Acceptable (ALARP)**

19.3 Third-Party to Proposed Development Vessel Collision Risk (Array Area)

453. *Proposed development vessels associated with construction, operational, and decommissioning activities may increase encounters and collision risk for other third-party vessels already in the area.*

19.3.1 In Isolation Scenario – All Users

454. The construction and decommissioning phases may each last for approximately three years. For both phases 49 construction/ decommissioning vessels may be located on site simultaneously, in turn making a maximum of 3,008 return trips to port. The operational phase may last for 35 years with a maximum of 12 operational vessels located on-site simultaneously, in turn making a maximum of 1,261 annual return trips to port. Some proposed development vessels may be RAM and it is anticipated that proposed development vessels will generally undertake construction/ decommissioning or operational works associated with the array area within the buoyed construction/ decommissioning areas or operational array, both of which third-party vessels are generally expected to avoid.

455. From historical incident data, there has been one instance of a third-party vessel colliding with a proposed development vessel associated with a UK offshore wind farm. In this incident, occurring in 2011, moderate vessel damage was reported with no harm to persons. Since then, awareness of offshore wind farm developments and

the application of the measures outlined below has improved or been refined considerably, with no further collision incidents reported since.

456. Proposed development vessel movements will be managed by the Developer's marine coordination and any associated procedures implemented will account for those areas where collision risk is assessed as greatest (where regular commercial routeing passes close to the array). Additionally, proposed development vessels will carry AIS and be compliant with Flag State regulations including IMO conventions such as the COLREGs, and information for fishing vessels will be promulgated through ongoing liaison with fishing fleets via an appointed Fisheries Liaison Officer (FLO). A guard vessel may also be deployed based on a risk assessment.

457. Although there are no current offshore wind farms at any stage of construction or operation in Ireland, shipping is international and the majority of vessels present within the datasets are on routes to/from areas where offshore wind farms are present, including the east Irish Sea. Therefore, mariners will likely be experienced in working around offshore wind farm activities. This will be less common for local fishing and recreational users. The majority of commercial fishing vessels present within the datasets were of Irish Flag registration and so may only be used to navigating within Irish coastal waters. To help aid local and international mariner knowledge, details of authorised minimum advisory safe passing distances, as defined by a risk assessment, may be applied, with advanced warning and accurate locations of any minimum advisory passing distances provided by Notices to Mariners and Kingfisher Bulletins. These will be particularly effective in the event of smaller craft such as commercial fishing vessels and recreational vessels choosing to navigate internally within the operational array, where a proposed development vessel may be undertaking major maintenance at a structure. This information promulgated alongside the details of any ongoing activity will maximise awareness for all third-party users, including in both day and night conditions. There was no concern for proposed development vessel collision with any vessel type during consultation.

458. In poor visibility, third-party vessels may experience limitations regarding visual identification of proposed development vessels entering and exiting the buoyed construction/ decommissioning areas and the operational array; however, this hazard will be mitigated by the application of the COLREGs (reduced speeds) in adverse weather conditions and AIS carriage by proposed development vessels.

459. Should an encounter occur between a third-party vessel and a proposed development vessel, it is likely to be very localised and occur for only a short duration and so the most likely consequence (during any phase) would be collision avoidance action implemented in line with the COLREGs. The vessels involved will likely be able to resume their respective passages and/ or activities with no long-term consequences.

460. Should an encounter develop into a collision incident, the most likely consequences will be similar to that outlined for the case of a collision between two third-party vessels. As part of the scenario deemed to have the greatest significance of risk, one of the vessels could founder resulting in PLL and pollution, with this outcome more likely where one of the vessels is a small craft (e.g., fishing vessel, recreational vessel, or CTV) with comparatively weaker structural integrity given hull materials. However, the likelihood of such an event occurring is very low given the mitigation in place.

19.3.2 Cumulative Scenario – All Users

19.3.2.1 Tier 1

461. On-site project vessel activities associated with Tier 1 developments are not expected to create a cumulative effect with the array area. However, at the time of writing, the base ports for the proposed development and Tier 1 developments (for construction/ decommissioning and operational) are not known. If the developments have a common base port, there may be an increased collision risk when vessels are entering/ exiting the port and enroute to/ from the array. However, the marine coordination facility will take account of this, and it is assumed that a similar facility will be in place for Tier 1 developments.

19.3.2.2 Tier 2

462. Again, on-site activities associated with Tier 2 offshore wind farm developments are not expected to create a cumulative effect with the array area. However, at the time of writing, the base ports for the proposed development and Tier 2 offshore wind farm developments (for construction/ decommissioning and operational) are not known.

463. If taken forward, the proposed Bremore Port development would increase the overall vessel traffic volumes in proximity to the array area as well as introducing vessels which will be entering/ exiting the new port, including on new routes. These vessels may increase collision risk from new and existing third-party vessels and proposed development vessels in the area.

464. For this hazard, the same points raised for Tier 1 developments are again applicable for all Tier 2 developments.

19.3.2.3 Tier 3

465. Again, on-site activities associated with Tier 3 developments are not expected to create a cumulative effect with the array area. However, Dublin Masterplan 2040 is expected to create an increase in traffic volumes entering/exiting Dublin Port and so there may be an increase in collision risk. The mitigation measures that have been highlighted as part of this hazard will ensure this risk is ALARP.

19.3.3 Embedded Mitigation Measures

466. Embedded mitigation measures identified as relevant to reducing the significance of risk area as follows (full list in Section 20):

- Advisory safe passing distances, as outlined in the VMP in Appendix 17.2;
- Buoyed construction/decommissioning area;
- Guard vessel(s) as required, as outlined in the VMP in Appendix 17.2;
- Liaison with IRCG in relation to SAR resources;
- Lighting and marking as outlined in the LMP in Appendix 17.3;
- Marking on nautical charts;
- Marine coordination for proposed development vessels as outlined in the VMP in Appendix 17.2; and
- Promulgation of information, as outlined in the VMP in Appendix 17.2.

19.3.4 Potential Significance of Risk

467. The frequency of occurrence and severity of consequence due to third-party with proposed development vessel collision risk associated with the array area for each phase of the proposed development is presented in Table 19.3 alongside the resulting significance risk.

Table 19.3 Significance of Risk for Third-Party to Proposed Development Vessel Collision Risk (Array Area)

Scenario	Phase	Potential Consequences	Frequency of Occurrence	Severity of Consequence	Significance of Risk
In Isolation	Construction	Increased encounters and impacts on compliance with COLREGs, resulting in a collision event with vessel damage, PLL and/ or pollution.	Extremely Unlikely	Moderate	**Broadly Acceptable (ALARP)**
	Operational		Negligible	Moderate	**Broadly Acceptable (ALARP)**
	Decommissioning		Extremely Unlikely	Moderate	**Broadly Acceptable (ALARP)**
Cumulative	Construction		Remote	Moderate	**Tolerable with Mitigation (ALARP)**
	Operational		Extremely Unlikely	Moderate	**Broadly Acceptable (ALARP)**

Scenario	Phase	Potential Consequences	Frequency of Occurrence	Severity of Consequence	Significance of Risk
	Decommissioning		Remote	Moderate	**Tolerable with Mitigation (ALARP)**

19.4 Third-Party to Proposed Development Vessel Collision Risk (Offshore Export Cable Corridor)

468. *Proposed development vessels associated with construction, operational, and decommissioning activities may increase encounters and collision risk for other third-party vessels already in the area.*

19.4.1 In Isolation Scenario – All Users

469. Two export cables each with a maximum length of 9.7nm will be installed within the ECC. Once installed the presence of the export cables will not directly result in third-party with project vessel collision risk. Therefore, this hazard is considered only in relation to export cable installation/ removal and maintenance activities.

470. It is anticipated that only one vessel will be involved in the cable laying activities, only one vessel involved in the cable burial and only one support vessel – an overall maximum of three vessels on-site at any one time. During the operational phase, export cables will be inspected annually for the first three years, then every three years by survey vessels or unmanned surface vessels. The spatial extent of the hazard will be limited to where installation/ removal or maintenance activities are ongoing, and the temporal extent will be limited to the duration of these activities. Although this hazard is more likely to occur than a third-party to third-party collision (given that there need only be one passing third-party vessel present), the overall risk is still low.

471. The level of exposure to this hazard for third-party vessels will depend upon the location of export cable installation/ removal or maintenance at any given time. The portions of the ECC that are considered to have higher exposure are those areas in which these routes passing on either side of Rockabill (Route 3 and Route 4) intersect. Both of these routes feature low vessel volumes and the ECC is far enough away from Rockabill for vessels on each route to have sufficient sea room to amend their passage as required, noting that such deviations will be relatively small. This is also relevant to small craft that transits north-south across the ECC; this is again low volume and highly seasonal with sea room available. The majority of these vessels are passing perpendicular across the ECC, and this will also reduce exposure time in periods of proposed development vessel activity.

472. Mariners navigating in proximity to the ECC will have a raised level of awareness of the area and this will be further heightened by the promulgation of information relating to the proposed development including the publication of Notices to Mariners as export cable installation/ removal progresses and maintenance activities are required.

473. Details of ongoing installation/ removal and maintenance activities will be promulgated, thus maximising awareness for third-party users, including in both day and night conditions. A guard vessel may also be deployed based on a risk assessment, particularly during the operational phase where there is a cable exposure requiring reburial.

474. The consequences of vessel displacement due to installation/ removal or maintenance activities for the ECC are generally analogous to those outlined for the array area.

19.4.2 Cumulative Scenario – All Users

19.4.2.1 Tier 1

475. For this hazard, no Tier 1 developments are anticipated to intersect the ECC as the closest development, Oriel Wind Park, is proposing a landfall location close to Dunany Point which is approximately 14nm north of the closest point of the ECC. Should installation/ removal or maintenance activities for Oriel Wind Park and the proposed development occur at the same time the spatial extent of the hazard may be increased but the base ports for the proposed development and Tier 1 developments (for construction/ decommissioning and operational) are not currently known. If the developments have a common base port, there may be an increased collision risk when vessels are entering/ exiting the port and enroute to/ from the ECCs. However, the marine coordination facility will take account of this, and it is assumed that a similar facility will be in place for Tier 1 developments.

19.4.2.2 Tier 2

476. Again, on-site activities associated with Tier 2 offshore wind farm developments are not expected to create a cumulative effect with the array area. However, at the time of writing, the base ports for the proposed development and Tier 2 offshore wind farm developments (for construction/ decommissioning and operational) are not known.

477. If taken forward, the proposed Bremore Port development would increase the overall vessel traffic volumes in proximity to the array area as well as introducing vessels which will be entering/ exiting the new port, including on new routes. These vessels may increase collision risk from new and existing third-party vessels and proposed development vessels in the area. This is of limited concern during the construction phase and as previously mentioned, the base ports are not currently known for proposed development vessels for the proposed development. It is

anticipated that any operational or decommissioning activities associated with the ECC would be undertaken in communication and coordination with the Drogheda Port Company as the future operator for Bremore Port.

478. For this hazard, the same points raised for Tier 1 developments are again applicable for all Tier 2 developments.

19.4.2.3 Tier 3

479. Again, on-site activities associated with Tier 3 developments are not expected to create a cumulative effect with the ECC. However, Dublin Masterplan 2040 is expected to create an increase in traffic volumes entering/exiting Dublin Port and so there may be an increase in collision risk between third-party vessels and proposed development vessels. This may be dependent upon the location of the base ports for proposed development vessels which are not currently known. The mitigation measures that have been highlighted as part of this hazard will ensure this risk is ALARP.

19.4.3 Embedded Mitigation Measures

480. Embedded mitigation measures identified as relevant to reducing the significance of risk area as follows (full list in Section 20):

- Advisory safe passing distances, as outlined in the VMP in Appendix 17.2;
- Guard vessel(s) as required, as outlined in the VMP in Appendix 17.2;
- Liaison with IRCG in relation to SAR resources;
- Lighting and marking as outlined in the LMP in Appendix 17.3;
- Marking on nautical charts;
- Marine coordination for proposed development vessels as outlined in the VMP in Appendix 17.2; and
- Promulgation of information, as outlined in the VMP in Appendix 17.2.

19.4.4 Potential Significance of Risk

481. The frequency of occurrence and severity of consequence due to third-party with proposed development vessel collision risk associated with the ECC for each phase of the proposed development is presented in Table 19.4 alongside the resulting significance risk.

Table 19.4 Significance of Risk for Third-Party to Proposed Development Vessel Collision Risk (ECC)

Scenario	Phase	Potential Consequences	Frequency of Occurrence	Severity of Consequence	Significance of Risk
In Isolation	Construction	Increased encounters and impacts on	Extremely Unlikely	Moderate	**Broadly Acceptable (ALARP)**

Scenario	Phase	Potential Consequences	Frequency of Occurrence	Severity of Consequence	Significance of Risk
	Operational	compliance with COLREGs, resulting in a collision event with vessel damage, PLL and/or pollution.	Negligible	Moderate	**Broadly Acceptable (ALARP)**
	Decommissioning		Extremely Unlikely	Moderate	**Broadly Acceptable (ALARP)**
Cumulative	Construction		Extremely Unlikely	Moderate	**Broadly Acceptable (ALARP)**
	Operational		Negligible	Moderate	**Broadly Acceptable (ALARP)**
	Decommissioning		Extremely Unlikely	Moderate	**Broadly Acceptable (ALARP)**

19.5 Reduced Access to Local Ports (Array Area)

482. *Construction/ decommissioning activities and the presence of surface structures within the array area may result in reduced access to local ports and harbours for vessels.*

19.5.1 In Isolation Scenario – All Users

483. There are numerous ports and harbours located on the east Irish coast in proximity to the array area. This includes Drogheda Port which is located directly west of the array area. The presence of the buoyed construction/ decommissioning areas and operational array may affect the preferred approach to both Drogheda and Warrenpoint Harbour for vessels on some of the main commercial routes.

484. Given the size of main commercial route deviations due to the presence of the buoyed construction/ decommissioning areas and operational array (as outlined in Section 19.1), and the volume of vessels on each of these routes, the effects on any port/ pilot arrivals times are expected to be limited and therefore schedules will not be affected.

485. Access to Drogheda Port, in particular for larger vessels, was raised as a concern by multiple stakeholders during consultation including Drogheda Port Company, Warrenpoint Harbour Authority, the MSO, and the Irish Chamber of Shipping. Concerns were raised regarding vessels entering the port as the entrance to the River Boyne is time sensitive due to tidal windows. In the instance a vessel has to wait for

ideal conditions, a vessel may wait/ drift in the surrounding area until it can proceed on entering the river. The Irish Chamber of Shipping noted specifically that it may become unclear on where vessels in this instance wait/ anchor as there is a bank upon entrance to the River Boyne.

486. Anchored vessels in the area were assessed across all datasets and it was found that all anchored vessels associated with Drogheda Port were located within the designated outer anchorage area, within 0.5nm of the outer anchorage area boundary or at anchor between the outer anchorage area and the coast. No vessels were deemed to be exhibiting waiting behaviour in proximity to the array area while waiting for entrance to Drogheda Port.

487. The Drogheda Port Company highlighted that traffic on an east-west route to/from the port are at the biggest risk of missing tidal windows but the effect was not a concern when accounting for the levels of increased time and distance. The inclusion of the Structure Exclusion Zone also mitigates the effect in the case of east-west routeing displaced south of the array area.

488. For the pilot boarding station on the southern boundary of the outer anchorage area, pilot vessel movements were only recorded in proximity to the boarding station and to the west. Likewise, marine aggregate dredging activity associated with Drogheda Port occurs only in proximity to the River Boyne and the outer anchorage area. Therefore, no interactions with the pilotage or dredging of the port would be affected by the presence of the array. The Drogheda Port Company have also noted in consultation that the presence of the buoyed construction/ decommissioning areas and operational array will have no impact on the Drogheda Port leading lights and there was no concerns raised.

489. Given its location within Dublin Bay, access to Dublin Port is not directly affected by the presence of the buoyed construction/ decommissioning areas and operational array. The only interaction that could cause any affect to the access of the port may be the waiting behaviour displayed by commercial vessels in periods of bad weather or when waiting to berth. These behaviours were discussed with CLdN in the Hazard Workshop and although the presence of the buoyed construction/ decommissioning areas and operational array will reduce the sea room available for such routeing, this behaviour is minimal and from the analysis of long-term vessel traffic data (as requested by stakeholders), most waiting vessels utilise sea room to the south of the array area. This again is aided by the refinement of the array area within the MAC boundary with more sea room available to the south.

490. Skerries Harbour located to the south-west of the array area was identified to mostly be used by small craft vessels (i.e., fishing and recreational). Vessels may have to alter their approach to the harbour due to the buoyed construction/ decommissioning areas and operational array as it is anticipated that small craft will not enter or choose to transit through these areas but any deviations (as outlined for the vessel displacement hazard) are minimal and the presence of the proposed

development at all phases will not affect the overall harbour access, noting there is sufficient distance between the harbour and array area to allow vessels to choose a safe approach.

491. The most likely consequences of reduced port access in relation to the array area will be limited effects on port schedules. As part of the scenario deemed to have the greatest significance of risk, there could be disruption to port schedules and a vessel may have to enter port (specifically Dublin Bay) in unreasonable weather conditions.

19.5.2 Cumulative Scenario – All Users

19.5.2.1 Tier 1

492. The presence of the Tier 1 developments in addition to the proposed development may interfere with mariners planning their preferred approach to local ports and harbours. The presence of Oriel Wind Park will reduce the sea room available for navigation to the north of the proposed development and may impact port schedules for commercial vessels routeing to/from numerous ports and harbours on the east Irish coast including Drogheda and Warrenpoint/Greenore. The presence of Dublin Array Offshore Wind Farm may impact routes to/from the south of the proposed development.

493. However, of those commercial routes that may be impacted, all routes feature low traffic volumes and there is ample sea room between developments providing access to local ports and harbours. Therefore, with adequate passage planning the overall effects on port schedules and navigational safety will be minimal.

19.5.2.2 Tier 2

494. The presence of Tier 2 offshore wind farm developments are not expected to create a cumulative effect with the array area due their distance from the proposed development.

495. If taken forward, the presence of the proposed Bremore Port may impact the approach of commercial vessels on routes to/from local ports on the east Irish coast. The existing commercial routes that would be impacted by the presence of Bremore Port are of low vessel volume. As previously mentioned, during consultation, concerns over the time sensitive window upon the entrance to the River Boyne were noted but no additional concerns were raised regarding the presence of Bremore Port, with Drogheda Port Company stating that although vessels may be on time sensitive routes, as long as there are deviation options (as outlined in Section 19.1) for mariners to passage plan, there should be limited impact on port schedules.

496. For this hazard, the same points raised for Tier 1 developments are again applicable for all Tier 2 developments.

19.5.2.3 Tier 3

497. For this hazard, there is no direct link between Tier 3 developments and the array area and therefore no additional assessment of effect has been undertaken and the same points raised for Tier 1 and Tier 2 developments are again applicable for Tier 3 developments.

19.5.3 Embedded Mitigation Measures

498. Embedded mitigation measures identified as relevant to reducing the significance of risk area as follows (full list in Section 20):

- Advisory safe passing distances, as outlined in the VMP in Appendix 17.2;
- Buoyed construction/decommissioning area;
- Compliance with relevant regulator guidance;
- Marine coordination for proposed development vessels as outlined in the VMP in Appendix 17.2;
- Promulgation of information, as outlined in the VMP in Appendix 17.2; and
- Structure Exclusion Zone.

19.5.4 Potential Significance of Risk

499. The frequency of occurrence and severity of consequence due to reduced access to local ports associated with the array area for each phase of the proposed development is presented in Table 19.5 alongside the resulting significance risk.

Table 19.5 Significance of Risk for Reduced Access to Local Ports (Array Area)

Scenario	Phase	Potential Consequences	Frequency of Occurrence	Severity of Consequence	Significance of Risk
In Isolation	Construction	Increased journey time/ distance impacting on schedules, berth times, and/ or compliance with COLREGs	Extremely Unlikely	Minor	**Broadly Acceptable (ALARP)**
	Operational		Extremely Unlikely	Minor	**Broadly Acceptable (ALARP)**
	Decommissioning		Extremely Unlikely	Minor	**Broadly Acceptable (ALARP)**
Cumulative	Construction		Remote	Minor	**Broadly Acceptable (ALARP)**

Scenario	Phase	Potential Consequences	Frequency of Occurrence	Severity of Consequence	Significance of Risk
	Operational		Remote	Minor	**Broadly Acceptable (ALARP)**
	Decommissioning		Remote	Minor	**Broadly Acceptable (ALARP)**

19.6 Reduced Access to Local Ports (Offshore Export Cable Corridor)

500. *Installation, maintenance, and decommissioning activities associated with the ECC may result in reduced access to local ports and harbours for vessels.*

19.6.1 In Isolation Scenario – All Users

501. Ports and harbours in proximity to the ECC include Drogheda Port and Skerries Harbour, as the majority of vessels transiting over the ECC are on routes to/ from these destinations.

502. As there is no buoyed construction/ decommissioning area or surface piercing structures associated with the ECC, disruption to port access will be limited to where installation/ removal or maintenance activities are ongoing, and the temporal extent will be limited to the duration of these activities. Reduced access to these locations will be limited at all phases of the development in relation to the ECC as it is anticipated (as mentioned for the collision hazards) that an overall maximum of three vessels will be on-site at any one time for the ECC and deviations around works will be small and short-term. Therefore, limited effects on port arrival and berth times are anticipated.

503. Additionally, mariners navigating in proximity to the ECC will have a raised level of awareness of the area and this will be heightened by the promulgation of information relating to the proposed development including the publication of Notices to Mariners as export cable installation/ removal progresses and maintenance activities as required, allowing for reviewed passaging planning if needed.

504. This is also relevant to small craft that transit north-south across the ECC to/ from Skerries Harbour, this is again low volume and highly seasonal. It is anticipated – noting available sea room – that such vessels will be able to adjust course to avoid activities associated with the ECC without any effect on access to the harbour.

505. The consequences of reduced port access due to installation/ removal or maintenance activities for the ECC are generally analogous to those outlines for the array area.

19.6.2 Cumulative Scenario – All Users

19.6.2.1 Tier 1

506. For this hazard, no Tier 1 developments are anticipated to intersect the ECC as the closest development, Oriel Wind Park, is proposing a landfall location close to Dunany Point which is approximately 14nm north of the closest point of the ECC. Should installation/ removal or maintenance activities for Oriel Wind Park and the proposed development occur at the same time the spatial extent of the hazard may be increased but the base ports for the proposed development and Tier 1 developments (for construction/ decommissioning and operational) are not currently known. If the developments have a common base port, there may be an increase in disruption to mariners planning their preferred approach to local ports and harbours.

19.6.2.2 Tier 2

507. The presence of Tier 2 offshore wind farm developments are not expected to create a cumulative effect with the ECC due to their distance from the proposed development.

508. If taken forward, the presence of the proposed Bremore Port may impact the approach of commercial vessels on routes to/from local ports on the east Irish coast. The existing commercial routes that would be impacted by the presence of Bremore Port are of low vessel volume and as there is no buoyed construction/ decommissioning areas or surface structures associated with the ECC, risks will only be relevant during periods of installation/ removal or maintenance activities and limited to the area of these ongoing activities. The Drogheda Port Company have not raised concerns during consultation in relation to these activities, with concerns centred on the presence of the array.

19.6.2.3 Tier 3

509. For this hazard, there is no direct link between Tier 3 developments and the ECC and therefore no additional assessment of effect has been undertaken and the same points raised for Tier 1 and Tier 2 developments are again applicable for Tier 3 developments.

19.6.3 Embedded Mitigation Measures

510. Embedded mitigation measures identified as relevant to reducing the significance of risk area as follows (full list in Section 20):

- Advisory safe passing distances, as outlined in the VMP in Appendix 17.2;
- Compliance with relevant regulator guidance;
- Marine coordination for proposed development vessels as outlined in the VMP in Appendix 17.2; and

- Promulgation of information, as outlined in the VMP in Appendix 17.2.

19.6.4 Potential Significance of Risk

511. The frequency of occurrence and severity of consequence due to reduced access to local ports associated with the ECC for each phase of the proposed development is presented in Table 19.6 alongside the resulting significance risk.

Table 19.6 Significance of Risk for Reduced Access to Local Ports (ECC)

Scenario	Phase	Potential Consequences	Frequency of Occurrence	Severity of Consequence	Significance of Risk
In Isolation	Construction	Increased journey time/ distance impacting on schedules, berth times, and/ or compliance with COLREGs	Negligible	Negligible	**Broadly Acceptable (ALARP)**
	Operational		Negligible	Negligible	**Broadly Acceptable (ALARP)**
	Decommissioning		Negligible	Negligible	**Broadly Acceptable (ALARP)**
Cumulative	Construction		Extremely Unlikely	Minor	**Broadly Acceptable (ALARP)**
	Operational		Extremely Unlikely	Minor	**Broadly Acceptable (ALARP)**
	Decommissioning		Extremely Unlikely	Minor	**Broadly Acceptable (ALARP)**

19.7 Creation of Vessel to Structure Allision Risk (Array Area)

512. *The presence of surface structures within the array area may result in the creation of a risk of allision for vessels.*

513. This hazard is considered only in relation to the array area since there are no surface structures associated with the ECC (underwater allision risk due to reduction in under keel clearance is considered separately in Section 19.8 and Section 19.9).

19.7.1 In Isolation Scenario – All Users

514. The main commercial route deviations and future case considerations described for the vessel displacement hazard have also been assumed for this hazard, noting that internal navigation by commercial vessels is not anticipated. However, commercial fishing vessels and recreational vessels may choose to navigate internally within the array, particularly in favourable weather conditions.

515. Although there is limited experience of operational offshore wind farms in Ireland, shipping is international in nature and the majority of vessels present within the datasets are on routes to/from areas where offshore wind farms are present, including the east Irish Sea. Therefore, mariners will likely be experienced in working around offshore wind farm installations. This will be less common for local fishing and recreational users. The majority of the fishing vessels present within the datasets were of Irish Flag registration and so may only be used to navigating within Irish coastal waters. To help aid local and international mariner knowledge, details of authorised minimum advisory safe passing distances, as defined by a risk assessment, may be applied, with advanced warning and accurate locations of any minimum advisory passing distances provided by Notices to Mariners and Kingfisher Bulletins. These will be particularly effective in the event of smaller craft such as commercial fishing vessels and recreational vessels choosing to navigate internally within the operational array. This information promulgated alongside the details of any ongoing activity will maximise awareness for all third-party users, including in both day and night conditions. There was limited concern for structure allision with any vessel type during consultation.

516. However, it is acknowledged that the presence of new surface structures does introduce new allision risk which can be considered across three forms, all of which are localised in nature given that a vessel must be in close proximity to a structure for an allision incident to occur:

- Powered allision risk;
- Drifting allision risk; and
- Internal allision risk.

19.7.1.1 Powered Allision Risk

517. Post wind farm modelling using the main commercial route deviations as input gives an estimated powered allision return period of one in 1,049 years for base case traffic levels, rising to one in 862 years for future case traffic levels (20%). The extent of the array area avoids busier routes to/from Dublin to the south; surrounding routes carry relatively low traffic volumes. The greatest allision risk was associated with structures on the east, particularly the south-eastern extent of the array, where a higher volume of traffic from multiple main commercial routes including those associated with vessel deviations pass in the closest proximity to the array (minimum mean distance of 1nm from the array) when compared to other routes.

518. From historical incident data, there have been three instances of a third-party vessel alliding with an operational wind farm structure in the UK, with one of these instances occurring in the Irish Sea. These incidents all involved a fishing vessel, with a RNLI lifeboat attending on each occasion and a helicopter deployed in one case. Given the volume of vessel traffic in the area and subsequent heightened mariner alertness, it is unlikely that such an incident will occur at the offshore development area.

519. Additionally, vessels are expected to comply with international flag state regulations (including COLREGs and SOLAS) and will be able to effectively passage plan a route which minimises effects given the promulgation of information relating to the proposed development including the charting of infrastructure on relevant nautical charts. On approach, the operational lighting and marking of the array (as outlined in the LMP in Appendix 17.3) will also assist in maximising marine awareness.

520. During consultation, Irish Lights indicated that an additional cardinal mark may be necessary to the east of the array to mitigate effects and keep vessel traffic passing at a safe distance on the eastern boundary; this is conservatively not included in the LMP provided in Appendix 17.3 but will be further discussed with Irish Lights when finalising lighting and marking plans, noting that precise buoyage locations will be directed by Irish Lights. It is not anticipated that the presence of a cardinal mark would substantially affect the likelihood of an allision incident given that, based on the main commercial route deviations, vessels passing at the east of the array would primarily be doing so in a north-south direction and thus unlikely to navigate within the sea space formed by the concave shape of the eastern boundary.

521. Should a powered allision incident occur, the consequences will depend on multiple factors including the energy of the contact, structural integrity of the vessel involved, type of structure contacted, and the sea state at the time of the contact. Small craft including commercial fishing vessels and recreational vessels are considered most vulnerable to the hazard given the potential for a non-steel construction and possible internal navigation within the array. In such cases the most likely consequences will be minor damage with the vessel able to resume passage and undertake a full inspection at the next port. As part of the scenario deemed to have the greatest significance of risk, the vessel could allide with the OSP, resulting in the vessel foundering with PLL and pollution.

19.7.1.2 Drifting Allision Risk

522. A vessel adrift may only develop into an allision situation where the vessel is in proximity to a structure and the direction of the wind and/ or tide is such as to direct the vessel towards the structure.

523. With the main commercial route deviations associated with the presence of the proposed development in place, an estimated powered allision return period of one in 16,835 years for base case traffic levels, rising to one in 13,877 for future case

traffic levels (20%). This is a very low return period and is reflective of the low volume of vessel traffic in the area. The greatest allision risk was again associated with structures on the east, particularly the south-eastern extent of the array. The return period is lower than that for powered allision risk, reflecting the need for a vessel to become adrift in the first instance before an allision situation can develop.

524. From historical incident data, there have been no instances of a third-party vessel alliding with an operational wind farm structure whilst Not Under Command (NUC). However, there is some potential for a vessel to be adrift; this is reflected in the number of machinery failure incidents[6] reported by the RNLI in proximity to the proposed development which indicates that machinery failure is the most common incident type (approximately 36%). It is noted that no incidents, and so no machinery failure incidents, occurred within the array area. Two machinery failure incidents occurred within the ECC but the majority of incidents recorded within the study area occurred within 2nm of the coast (82% of all incidents) and were not in proximity to the array area.

525. In circumstances where a vessel drifts towards a structure, there are actions which may be taken to prevent the incident developing into an allision situation. For a powered vessel, the ideal and likely solution would be regaining power prior to reaching the array (by rectifying any fault). Failing this, the vessel's emergency response procedures would be implemented – this may include an emergency anchoring event following a check of the relevant nautical charts to ensure the deployment of the anchor will not lead to other effects (such as the anchor snagging on a subsea cable).

526. Where the deployment of the anchor is not possible (such as for small craft) then proposed development vessels, if on-site, may be able to render assistance including under SOLAS obligations (IMO, 1974) and this response will be managed via marine coordination and depends on the type and capability of vessels on site. This would be particularly relevant for sailing vessels whose propulsion is dictated solely by the metocean conditions, although if the vessel becomes adrift in proximity to a structure there may be limited time to render assistance. It was raised during consultation by Drogheda Port Company that there is no standard emergency tow vessel on the east Irish coast that would be able to assist during an incident.

527. Should a drifting allision incident occur, the consequences will be similar to those outlined for a powered allision incident, including the determining factors. However, the speed at which the contact occurs will likely be lower than for a powered allision, resulting in the contact energy being lower.

528. It is acknowledged that as per the assessment of powered allision risk, an allision with an OSP is likely to create higher consequence given the size of the structure

[6] An incident reported as a 'machinery failure' may not be so severe as to result in the vessel losing power and becoming NUC.

although this is highly unlikely given the lack of main commercial routes passing in proximity to the OSP.

19.7.1.3 Internal Allision Risk

529. As described for the vessel displacement hazard, commercial vessels are not anticipated to navigate internally within the operational array and therefore the likelihood of an internal allision risk for such vessels is negligible. It is anticipated that commercial fishing and recreational vessels may choose to navigate internally within the operational array, particularly in summer months.

530. Post wind farm modelling using the vessel traffic survey data as input gives an estimated commercial fishing allision return period of one in 3.00 years for base case traffic levels, rising to one in 2.50 years for future case traffic levels (20%)[7]. This is a high return period and is reflective of the high volume of commercial fishing vessel activity within the region and within the array area during the summer months, noting that this is largely characteristic of fishing vessels engaged in fishing rather than in transit.

531. The minimum spacing between structures (910m subject LoD) is sufficient for safe internal navigation and is greater than that associated with many UK offshore wind farms, some of which are navigated by commercial fishing vessels in favourable conditions. The layout is compliant with the requirements of MGN 654 (MCA, 2021). The proposed development (including the layout options) has been subject to a comprehensive NRA as required by the methodology agreed with shipping regulators, notably the MSO, prior to the NRA process commencing. No specific national guidance on NRA currently exists, but the assessment undertaken has taken account of international best practice and precedent in respect of offshore wind developments in the UK. The Developer is aware that draft specific national guidance is currently under review and that engagement with the IRCG, if required, upon publication of the final guidance documents (which is not expected to be published until later this year) may result in the requirement for a safety justification to be undertaken for the layout. This would be specifically for the IRCG's own access assessment and to ensure requirements within the guidance are complied with.

532. As with any passage, a vessel navigation internally within the array is expected to passage plan in accordance with SOLAS Chapter V (IMO, 1974). The lighting and marking of the array and MGN 654 compliant unique identification marking of structures in an easily identifiable pattern will assist with minimising the likelihood of a mariner becoming disoriented whilst navigation internally within the array.

533. For recreational vessels under sail navigating internally within the array there is also potential for effects such as a wind shear, masking, and turbulence to occur. From

[7] These return periods are very conservative since the model cannot account in detail for how fishing vessels will adapt to the presence of the array.

previous studies of offshore wind developments, it has been concluded that WTGs do reduce wind velocity downwind of a WTG (MCA, 2022) but that no negative effects on recreational craft have been reported on the basis of the limited spatial extent of the effect and its similarity to that experienced when passing a large vessel or close to other large structures (such as bridges) or the coastline. In addition, no practical issues have been raised by recreational users to date when operating in proximity to existing offshore wind developments.

534. An additional allision risk associated with the WTG blades applies for recreational vessels with a mast when navigating internally within the array. However, the minimum air gap will be 35m above LAT which is greater than the minimum clearance the RYA recommend for minimising allision risk (RYA, 2019) and which is also noted in MGN 654.

535. Should an internal allision occur, the consequences will be similar to those outlined for a powered allision incident, including the determining factors. However, as with a drifting allision incident, the speed at which the contact occurs will likely be lower than for an external allision, resulting in the contact energy being lower.

19.7.2 Cumulative Scenario – All Users

19.7.2.1 Tier 1

536. For this hazard there is no direct link between the array area and any Tier 1 developments given the lack of close proximity between developments and therefore no additional assessment of effects has been undertaken.

19.7.2.2 Tier 2

537. Although allision risk is localised in nature, there remains a cumulative effect associated with routeing through the Rockabill gap (Route 3), which with the presence of Bremore Port may feature additional routeing vessels. This increases exposure to allision risk with perimeter structures on the south-western extent of the array. However, the Drogheda Port Company confirmed during consultation that concerns relating to the Rockabill gap were limited to collision risk rather than allision risk. Nevertheless, with the implementation of the Structure Exclusion Zone, the risk of an allision with an isolated structure on the south-west of the array area has been minimised.

538. There may also be increased exposure to allision risk with perimeter structures on the northern extent of the array depending on the chosen passage for an indicative new route between the proposed Bremore Port and the UK. Accounting for the mitigation measures highlighted in the in isolation scenario, this further risk is considered to be ALARP.

19.7.2.3 Tier 3

539. For this hazard there is no direct link between the array area and any Tier 3 developments and therefore no additional assessment of effects has been undertaken.

19.7.3 Embedded Mitigation Measures

540. Embedded mitigation measures identified as relevant to reducing the significance of risk area as follows (full list in Section 20):

- Compliance with relevant regulator guidance;
- Guard vessel(s) as required, as outlined in the VMP in Appendix 17.2;
- Liaison with IRCG in relation to SAR resources;
- Lighting and marking as outlined in the LMP in Appendix 17.3;
- Marking on nautical charts;
- Minimum blade clearance;
- Promulgation of information, as outlined in the VMP in Appendix 17.2;
- Structure Exclusion Zone; and
- WTG layout and design.

19.7.4 Potential Significance of Risk

541. The frequency of occurrence and severity of consequence due to a vessel to structure allision risk associated with the array area for each phase of the proposed development is presented in Table 19.7 alongside the resulting significance risk.

Table 19.7 Significance of Risk for Vessel to Structure Allision (Array Area)

Scenario	Phase	Potential Consequences	Frequency of Occurrence	Severity of Consequence	Significance of Risk
In Isolation	Operational	Allision event occurs involving vessel damage, PLL and/ or pollution.	Remote	Moderate	**Tolerable with Mitigation (ALARP)**
Cumulative	Operational		Remote	Moderate	**Tolerable with Mitigation (ALARP)**

19.8 Reduction in Under Keel Clearance (Array Area)

542. *The presence of cable protection associated with the inter-array cables may result in reductions to water depth and the creation of an under keel clearance risk for vessels.*

19.8.1 In Isolation Scenario – All Users

543. For the inter-array cables the trench depth is 1 to 3m. Seabed burial will be the primary means of cable burial and the trench depth plus any external cable protection will be determined by the Cable Burial Risk Assessment post consent which will be conducted post consent following detailed site investigation surveys and detailed design.

544. It is anticipated that 20% of inter-array cables may require alternative cable protection. It is noted that five potential cable crossings are anticipated for the inter-array cables.

545. Relevant regulator guidance (closely aligned with MGN 654) will be considered, including discussion with MSO and Irish Lights, where the reduction in under keel clearance due to cable protection will be greater than 5% referenced to CD.

546. Charted water depths within the array area are between 30m and 60m and with the anticipated water depth reduction along with deep draught vessels not anticipated to transit within the array, as indicated during consultation, this limits the risk of an underwater allision occurring.

547. Should a vessel navigate over an area with reduced water depth, the most likely consequence is that no contact occurs and the vessel's passage is able to continue unaffected. As part of the scenario deemed to have the greatest significance of risk, the vessel could experience an underwater allision, grounding on the cable protection with pollution and vessel damage as potential outcomes.

19.8.2 Cumulative Scenario – All Users

548. For this hazard there is no direct link between the array area and any cumulative developments (across all tiers) given that inter-array cables will be contained entirely within the array area and therefore no additional assessment of effects has been undertaken.

19.8.3 Embedded Mitigation Measures

549. Embedded mitigation measures identified as relevant to reducing the significance of risk area as follows (full list in Section 20):

- Cable protection;
- Compliance with relevant regulator guidance;
- Guard vessel(s) if required, as outlined in the VMP in Appendix 17.2;
- Liaison with IRCG in relation to SAR resources; and
- Promulgation of information, as outlined in the VMP in Appendix 17.2.

19.8.4 Potential Significance of Risk

550. The frequency of occurrence and severity of consequence due to a reduction in under keel clearance associated with the array area for the operational phase of the proposed development is presented in Table 19.8 alongside the resulting significance risk.

Table 19.8 Significance of Risk for a Reduction in Under Keel Clearance (Array Area)

Scenario	Phase	Potential Consequences	Frequency of Occurrence	Severity of Consequence	Significance of Risk
In Isolation	Operational	Grounding on cable protection resulting in vessel damage and/ or pollution.	Negligible	Moderate	**Broadly Acceptable (ALARP)**
Cumulative	Operational		Negligible	Moderate	**Broadly Acceptable (ALARP)**

19.9 Reduction in Under Keel Clearance (Offshore Export Cable Corridor)

551. *The presence of cable protection associated with the export cables may result in reductions to water depth and the creation of an under keel clearance risk for vessels.*

19.9.1 In Isolation Scenario – All Users

552. Two export cables each with a maximum length of 9.7nm will be installed within the ECC. The cable protection methodology for inter-array cables is again applicable, and there are no cable crossings anticipated for the export cables.

553. Again, the Cable Burial Risk Assessment will determine the cable trench depth and any external cable protection. Relevant regulator guidance (closely aligned with MGN 654) will be considered, including discussion with MSO and Irish Lights, where the reduction in under keel clearance due to cable protection will be greater than 5% referenced to CD.

554. There is a higher risk of an under keel clearance risk with the export cables when compared to the inter-array cables. This is due to both the cables being more exposed to shallower water depths and increased crossing traffic volumes.

555. Charted water depths within the ECC range between zero (at landfall nearshore) and 39m below CD. The charted 10m contour in the ECC is approximately 2nm from the coast with the charted 20m contour approximately 5nm from the coast. Vessels at transit within the lower depths are more at risk of an underwater allision. From the vessel traffic data, vessels on transit in these lower depths were primarily

commercial fishing vessels on route to/ from Skerries with shallower draughts and thus minimal exposure to under keel clearance risks. Larger draught vessels were noted further offshore with draughts not exceeding 6.3m within the ECC. No vessel with a draught greater than 6m was on transit in waters at a charted depth of less that 20m crossing the ECC, with the frequency of these vessels low.

556. Overall, vessel traffic on transit through the ECC was low and the majority of vessels cross the ECC perpendicularly thus minimising the overall exposure to any underwater allision risk, noting this will be managed through the Cable Burial Risk Assessment process post consent. This includes routeing traffic which is constrained by the Rockabill gap.

557. Should a vessel navigate over an area with reduced water depth, the consequences are analogous to those outlined for the array area.

19.9.2 Cumulative Scenario – All Users

19.9.2.1 Tier 1

558. For this hazard, no Tier 1 developments are anticipated to intersect the ECC as the closest development, Oriel Wind Park, is proposing a landfall location close to Dunany Point which is approximately 14nm north of the closest point of the ECC. The spatial extent of the hazard may increase, but the base ports for the proposed development and Tier 1 developments (for construction/ decommissioning and operational) are not currently known. Vessels involved with Tier 1 developments may route frequently over the ECC, although these are generally not anticipated to have deeper draughts.

19.9.2.2 Tier 2

559. Tier 2 offshore wind farm developments are not expected to create a cumulative effect with the ECC noting their distance from the proposed development.

560. If taken forward, the proposed Bremore Port development is anticipated to be located at the same location as the ECC will make landfall. The presence of this development will increase the overall vessel traffic volumes in proximity to the ECC as well as introducing vessels which will be entering/ exiting the new port, including the larger vessels that the port is anticipated to attract to the region as highlighted by the Drogheda Port Company during consultation. These vessels may be at a higher risk of an underwater allision although the embedded mitigation measures noted for the in isolation scenario are again applicable and the Drogheda Port Company have not raised relevant concerns during consultation.

19.9.2.3 Tier 3

561. For this hazard, there is no direct link between Tier 3 developments and the ECC and therefore no additional assessment of effect has been undertaken and the same

points raised for Tier 1 and Tier 2 developments are again applicable for Tier 3 developments.

19.9.3 Embedded Mitigation Measures

562. Embedded mitigation measures identified as relevant to reducing the significance of risk area as follows (full list in Section 20):

- Cable protection;
- Compliance with relevant regulator guidance;
- Guard vessel(s) if required, as outlined in the VMP in Appendix 17.2;
- Liaison with IRCG in relation to SAR resources; and
- Promulgation of information, as outlined in the VMP in Appendix 17.2.

19.9.4 Potential Significance of Risk

563. The frequency of occurrence and severity of consequence due to a reduction in under keel clearance associated with the ECC for the operational phase of the proposed development is presented in Table 19.9 alongside the resulting significance risk.

Table 19.9 Significance of Risk for a Reduction in Under Keel Clearance (ECC)

Scenario	Phase	Potential Consequences	Frequency of Occurrence	Severity of Consequence	Significance of Risk
In Isolation	Operational	Grounding on cable protection resulting in vessel damage and/ or pollution.	Extremely Unlikely	Moderate	**Tolerable with Mitigation (ALARP)**
Cumulative	Operational		Extremely Unlikely	Moderate	**Tolerable with Mitigation (ALARP)**

19.10 Anchor Interaction with Subsea Cables (Array Area)

564. *The presence of inter-array cables may result in the creation of a risk of a vessel anchor making contact with an inter-array cable.*

19.10.1 In Isolation Scenario – All Users

565. A total of 60m of inter-array cables will be located within the array area. Where available, the primary means of cable protection will be by seabed burial, with a trench depth of 1 to 3m. It is anticipated that 20% of inter-array cables may require alternative cable protection but this will be determined within the Cable Burial Risk

Assessment post consent. It is noted that there are five potential cable crossings anticipated for the inter-array cables.

566. There are three anchoring scenarios which are considered for this hazard:

- Planned anchoring – most likely as a vessel awaits a berth to enter port but may also result from adverse weather conditions, machinery failure or subsea operations;
- Unplanned anchoring – generally resulting from an emergency situation where the vessel has experienced steering failure; and
- Anchor dragging – caused by anchor failure.

567. Although the second of these scenarios may involve limited decision-making time if drifting towards a hazard, in all three scenarios it is anticipated that the charting of infrastructure including the subsea cables will inform the decision to anchor, as per Regulation 34 of SOLAS (IMO, 1974).

568. Since the inter-array cables will be fully contained within the array area it is considered unlikely that a vessel will choose to anchor in close proximity to an inter-array cable. Moreover, from the site-specific surveys, anchoring activity within and in proximity to the array area is limited, with vessels instead choosing to use the designated anchorage area at Drogheda Port. During the Hazard Workshop, the Irish Chamber of Shipping indicated that additional anchorage area may be required if any cables associated with the proposed development interfere with common anchoring locations. From the baseline assessment, including the additional long-term vessel traffic data, no cable is intended to be placed in an area of common anchoring activity, but this will be assessed further in the Cable Burial Risk Assessment post consent.

569. The likelihood of anchor interaction with an inter-array cable is further minimised by the burial of the cables and use of external cable protection where required, which will be informed by the Cable Burial Risk Assessment post consent.

570. The most likely consequences in the event of a vessel anchoring over an inter-array cable is that no interaction occurs given the protection applied to the cable (by burial or other means). Should an interaction occur, historical incident data suggests that the consequences would be negligible, with no damage cause to the vessel or cable. As part of the scenario deemed to have the greatest significance of risk, a snagging incident could occur to a commercial fishing vessel with damage cause to the anchor and/ or cable, comprising the stability of the vessel.

19.10.2 Cumulative Scenario – All Users

571. For this hazard there is no direct link between the array area and any cumulative developments (across all tiers) given that inter-array cables will be contained entirely within the array area and therefore no additional assessment of effects has been undertaken.

19.10.3 Embedded Mitigation Measures

572. Embedded mitigation measures identified as relevant to reducing the significance of risk area as follows (full list in Section 20):

- Cable protection;
- Compliance with relevant regulator guidance;
- Marking on nautical charts; and
- Promulgation of information, as outlined in the VMP in Appendix 17.2 as outlined in the VMP in Appendix 17.2.

19.10.4 Potential Significance of Risk

573. The frequency of occurrence and severity of consequence due to a vessel to structure allision risk associated with the array area for the operational phase of the proposed development is presented in Table 19.10 alongside the resulting significance risk.

Table 19.10 Significance of Risk for Anchor Interaction with Subsea Cable (Array Area)

Scenario	Phase	Potential Consequences	Frequency of Occurrence	Severity of Consequence	Significance of Risk
In Isolation	Operational	Anchor snagging incident occurs with anchor and/ or cable damage and compromised vessel stability.	Extremely Unlikely	Minor	**Broadly Acceptable (ALARP)**
Cumulative	Operational		Extremely Unlikely	Minor	**Broadly Acceptable (ALARP)**

19.11 Anchor Interaction with Cables (ECC)

574. *The presence of export cables may result in the creation of a risk of a vessel anchor making contact with an array cable.*

19.11.1 In Isolation Scenario – All Users

575. Two export cables each with a maximum length of 9.7nm may be installed within the ECC. The cable protection methodology for inter-array cables is again applicable, and there are no cable crossings anticipated for the export cables.

576. The three anchoring scenarios outlined for the array cables are again applicable.

577. The ECC avoids and does not overlap with any designated anchorage area. The Drogheda outer anchorage area is located directly north of the ECC at approximately 5nm at its closest point. From the site-specific surveys, anchoring activity in proximity to the ECC is limited with no vessels at anchor within the ECC during the vessel traffic

surveys and only one vessel, a tanker, at anchor within the ECC during the 12 month long-term dataset.

578. Several vessels also anchored off Skerries with single instances of anchoring occurring at undesignated locations within the study area. Given the undesignated nature of these anchoring events and the available sea room, it is anticipated that such anchoring will be able to move if required following installation of the export cables.

579. It is anticipated that mariners will check relevant nautical charts to ensure the deployment of the anchor will not lead to any interaction with subsea cables and it is therefore considered unlikely that planned anchoring will occur within the ECC.

580. With suitable metocean conditions, an anchor dragging event could cause an interaction incident. As for unplanned anchoring, specific locations cannot be pinpointed within the ECC given the nature of this activity. However, the likelihood of anchor interaction with an export cable is further minimised by the burial of the cables and use of external cable protection where required, which will be informed by the Cable Burial Risk Assessment post consent.

581. If an interaction does occur with an anchor and the export cables, the consequences are analogous to those outlined for the array area.

19.11.2 Cumulative Scenario – All Users

19.11.2.1 Tier 1

582. For this hazard there is no direct link between the array area and any Tier 1 developments and therefore no additional assessment of effects has been undertaken.

19.11.2.2 Tier 2

583. For this hazard there is no direct link between the ECC and any Tier 2 offshore wind farm developments and therefore no additional assessment of effects has been undertaken in regard to the offshore wind farms.

584. The Bremore Port development is proposed to be located in conjunction with the landfall of the ECC and therefore if taken forward may create exposure for associated vessels and routes to an anchor interaction risk.

585. However, the application of good seamanship is anticipated, with mariners checking the relevant nautical charts prior to making the decision to drop the anchor. Dropping the anchor over a cable would only occur as a last resort to prevent an incident with potentially greater consequences such as a collision or allision. Additionally, the likelihood of a vessel requiring to drop anchor at a location where the export cables and other cable developments are in close proximity is very low,

with the assessment of vessel traffic data provided for the in isolation scenario again applicable.

586. If taken forward, anchorage areas associated with the proposed Bremore Port may be designated and it is expected that these would account for the export cables accordingly to minimise exposure to anchor interaction risk.

19.11.2.3 Tier 3

587. For this hazard there is no direct link between the array area and any Tier 3 developments and therefore no additional assessment of effects has been undertaken.

19.11.3 Embedded Mitigation Measures

588. Embedded mitigation measures identified as relevant to reducing the significance of risk area as follows (full list in Section 20):

- Cable protection;
- Compliance with relevant regulator guidance;
- Marking on nautical charts; and
- Promulgation of information, as outlined in the VMP in Appendix 17.2.

19.11.4 Potential Significance of Risk

589. The frequency of occurrence and severity of consequence due to a vessel to structure allision risk associated with the ECC for the operational phase of the proposed development is presented in Table 19.11 alongside the resulting significance risk.

Table 19.11 Significance of Risk for Anchor Interaction with Cable (ECC)

Scenario	Phase	Potential Consequences	Frequency of Occurrence	Severity of Consequence	Significance of Risk
In Isolation	Operational	Anchor snagging incident occurs with anchor and/ or cable damage and compromised vessel stability.	Extremely Unlikely	Minor	**Broadly Acceptable (ALARP)**
Cumulative	Operational		Remote	Minor	**Broadly Acceptable (ALARP)**

19.12 Reduction of Emergency Response Capability

590. *The presence of surface structures within the array area and operational activities associated with the array area and ECC may result in an increased likelihood of an*

incident occurring which requires an emergency response and may reduce access for surface air responders, including SAR assets.

591. The array area and ECC are considered collectively for this hazard since the assessment undertaken is considered relevant to the proposed development as a whole.

19.12.1 In Isolation Scenario – All Users

19.12.1.1 Emergency Response Resources

592. The operational phase may last for 35 years with a maximum of 12 operational vessels located on-site simultaneously and making 1,261 annual return trips. With the array area, these vessels will increase the likelihood of an incident requiring an emergency response and subsequently increase the likelihood of multiple incidents occurring simultaneously, diminishing emergency response capability.

593. Given the distances that may be covered by air-based SAR support (the SAR helicopter base at Dublin is located approximately 16nm from the proposed development), but also the national nature of this resource, the spatial extent of this hazard is considered reasonably large. Additionally, the array area covers approximately 26nm^2 which represents a large area to search. However, it is unlikely that a SAR operation will require the entire array area to be searched; it is much more likely that a search could be restricted to a smaller area within which a casualty is known to be located (inclusive of any assumptions on the drift of the casualty). Though unlikely, as part of the scenario deemed to have the greatest significance of risk, the consequences of such a situation could include a failure of emergency response to an incident, resulting in a PLL and pollution.

594. There are other emergency response resources in the regions with multiple RNLI stations in proximity to the offshore development area, and with the distance from the coast, response times will be much shorter when compared to existing offshore wind farms located further offshore. It was noted in the baseline assessment that each of the RNLI stations in proximity to the offshore development area all responded to a proportion of incidents recorded within the study area, which reduces the risk of resource capability being compromised in the event of an emergency response being required.

595. From historical incident data, there is a moderate rate of incidents in the region, although over a 10 year period (2012 to 2021) 82% of incidents recorded by the RNLI occurred within 2nm of the coast with no incidents occurring within the array area. Six incidents occurred within the ECC with the closest of these incidents approximately 4nm from the array area and all relatively close to the coast. Incidents were recorded further offshore, but these were less common, and the majority were instances of machinery failure and the likelihood of an incident related to the proposed development occurring at the same time is low. Additionally, based on the

number of collision and allision incidents[8] associated with UK offshore wind farms reported to date, there is an average of one incident per 1,751 operational WTG years (as of February 2024). Therefore, the proposed development itself is not expected to result in a marked increase in the frequency of incidents requiring an emergency response.

596. With proposed development vessels to be managed through marine coordination and compliance with Flag State regulations, the likelihood of an incident is minimised. Additionally, should an incident occur, proposed development vessels will be well equipped to assist, either through self-help capability or – for an incident involving a nearby third-party vessel – through SOLAS obligations (IMO, 1974), all in liaison with the IRCG. This is reflected in past UK experience, with 12 known instances of a vessel (or persons on a vessel) being assisted by an industry vessel for a nearby UK offshore wind farm.

597. The most likely consequences in the event of an incident in the region requiring an emergency response is that emergency responders are able to assist without any limitations on capability. As part of the scenario deemed to have the greatest significance of risk, there could be a delay to a response request due to a simultaneous incident associated with the proposed development leading to PLL, pollution, and vessel damage. However, this scenario is highly unlikely.

19.12.1.2 Search and Rescue Access

598. With the array area, its physical presence may restrict access for SAR responders, either due to the incident in question occurring within the array or the array obstructing the most effective path to each incident (likely further offshore). This is more likely to be an issue in adverse weather conditions. The Developer is committed to working within the parameters of MGN 654, including ID marking as well as lighting and marking in liaison with the IRCG, to minimise hazards.

599. The total area covered by the array area is 26nm^2 which is moderate in comparison to UK offshore wind farms. The minimum spacing between structures is 910m (subject to 500m LoD), which is greater than most existing UK offshore wind farms. The layout is compliant with the requirements of MGN 654 (MCA, 2021). The proposed development (including the layout options) has been subject to a comprehensive NRA as required by the methodology agreed with shipping regulators, notably the MSO, prior to the NRA process commencing. No specific national guidance on NRA currently exists, but the assessment undertaken has taken account of international best practice and precedent in respect of offshore wind developments in the UK. The Developer is aware that draft specific national guidance is currently under review and that engagement with the IRCG, if required, upon

[8] Although other types of incident are acknowledged, collision and allision incidents have the potential to be among the most serious and give a reasonable indication of the rate of incidents requiring an emergency response.

publication of the final guidance documents (which is not expected to be published until later this year) may result in the requirement for a safety justification to be undertaken for the layout. This would be specifically for the IRCG's own access assessment and to ensure requirements within the guidance are complied with.

600. The most likely consequences in the event of a SAR operation is that SAR assets are able to fulfil their objectives without any limitations on capability. As part of the scenario deemed to have the greatest significance of risk, it may not be possible to undertake an effective search. However, given compliance with MGN 654 for the final layout, this is considered highly unlikely.

19.12.2 Cumulative Scenario – All Users

19.12.2.1 Tier 1

601. The presence and activities associated with Tier 1 developments may further increase the likelihood of incidents requiring an emergency response and could subsequently increase the likelihood of multiple incidents occurring simultaneously, adding additional stress on emergency responders. However, given the locations of the developments and additional emergency response resources in proximity to each, the accessibility of resources is not expected to be compromised. It is likely that differing emergency response resources (i.e., different RNLI stations) may respond to an incident associated with Tier 1 developments compared to those used for the proposed development depending on proximity.

602. As with the proposed development, it is assumed that Tier 1 developments will have suitable embedded mitigations measures in place to reduce the likelihood of a reduction in emergency response capability including marine coordination for project vessels. Furthermore, SOLAS obligations (IMO, 1974) are applicable to all developments and may have a positive effect on a cumulative level, e.g., a project vessel for Oriel Wind Park may be able to assist with an incident associated with the proposed development and vice-versa.

603. Given that there are no immediately adjacent screened cumulative developments, and the relative distance between the proposed development and Tier 1 projects, there is not considered to be any cumulative effect associated with SAR access.

19.12.2.2 Tier 2

604. If taken forward, the activities associated with the development of the proposed Bremore Port will increase the likelihood of an incident requiring an emergency response and subsequently increase the likelihood of multiple incidents occurring simultaneously, adding additional stress on emergency responders.

605. SOLAS obligations (IMO, 1974) are again applicable and may have a positive effect on a cumulative level as a project vessel for the proposed Bremore Port may be able to assist with an incident associated with the proposed development. Bremore Port

may also, in time, incorporate an emergency response base out of the port and so increase the availability of emergency responders in proximity to the proposed development and in the region as a whole.

606. The Tier 2 offshore wind farm developments are not expected to create a cumulative effect development due their distance from the proposed development.

19.12.2.3 Tier 3

607. The increase in vessel volumes associated with the development of the Dublin Port Masterplan 2040 will increase the likelihood of an incident requiring an emergency response and subsequently increase the likelihood of multiple incidents occurring simultaneously, adding additional stress on emergency responders. However, the effects may not be as prominent as they would be for the proposed Bremore Port (Tier 2) due to its location further south (approximately 20nm).

608. However, given the distance from the proposed development, it is unlikely that SOLAS obligations would be as relevant for the proposed development in the event of an incident. Moreover, it is likely that differing emergency response resources (i.e., different RNLI stations) may respond to an incident associated with the Dublin Port Masterplan 2040 due to some bases being closer in proximity. Therefore, the likelihood of this hazard arising is not substantially higher than with the Tier 2 developments in situ.

19.12.3 Embedded Mitigation Measures

609. Embedded mitigation measures identified as relevant to reducing the significance of risk area as follows (full list in Section 20):

- Compliance with relevant regulator guidance;
- Liaison with IRCG in relation to SAR resources;
- Lighting and marking as outlined in the LMP in Appendix 17.3;
- Marine coordination for proposed development vessels as outlined in the LMP in Appendix 17.3;
- Proposed development vessel compliance with international marine regulations as outlined in the VMP in Appendix 17.2; and
- WTG design and layout.

19.12.4 Potential Significance of Risk

610. The frequency of occurrence and severity of consequence due to reduction of emergency response capabilities associated with the operational phase of the proposed development is presented in Table 19.12 alongside the resulting significance risk.

Table 19.12 Significance of Risk for Reduction of Emergency Response Capability

Scenario	Phase	Potential Consequences	Frequency of Occurrence	Severity of Consequence	Significance of Risk
In isolation	Operational	Delay to a response request and inability to undertake an effective search leading to vessel damage, PLL, and pollution.	Extremely Unlikely	Serious	**Tolerable with Mitigation (ALARP)**
Cumulative	Operational		Remote	Serious	**Tolerable with Mitigation (ALARP)**

20 Embedded Mitigation Measures

611. As part of the design process for the proposed development, various embedded mitigation measures have been adopted to reduce the risk of hazards identified, including those relevant to shipping and navigation. These measures typically include those identified as good or standard practice and include actions that will be undertaken to meeting legislation requirements. As there is a commitment to implementing these measures, and also to various standard sectoral practices and procedures, they are considered inherently part of the design of the proposed development.

612. The embedded mitigation measures relevant to shipping and navigation are outlined in Table 20.1.

Table 20.1 Embedded Mitigation Measures Relevant to Shipping and Navigation

Embedded Mitigation Measure	Details
Advisory safe passing distances	Advisory safe passing distances may be deployed around ongoing work being undertaken by a construction or maintenance vessel with notice of these promulgated through Notices to Mariners and Marine Notices (where deemed appropriate).
Buoyed construction area	A buoyed construction (or decommissioning) area around the array area will be implemented during the appropriate phases in agreement with Irish Lights and as outlined in the LMP in Appendix 17.3.
Cable protection	Cable protection (burial or external protection) will be implemented and monitored, as determined by a cable burial risk assessment post consent.
Compliance with relevant regulator guidance	The proposed development will be compliant with the relevant regulator guidance noting that the draft version published by DoT is generally aligned with UK MGN 654.
Guard vessel(s)	Where appropriate, guard vessels will be used to ensure adherence with advisory passing distances.
Liaison with IRCG in relation to SAR resources	The Developer will liaise with the IRCG in relation to SAR resources to ensure the Emergency Response Cooperation Plan (ERCoP) is in place post consent.
Lighting and marking	Lighting and marking of the array in agreement with Irish Lights and in line with International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA) G1162. A separate LMP is provided in Appendix 17.3.
Marine coordination for proposed development vessels	Marine coordination will be implemented to manage proposed development vessels. A separate VMP is provided in Appendix 17.2.
Marking on nautical charts	There will be appropriate marking of all offshore infrastructure associated with the proposed development on UKHO Admiralty charts.
Minimum blade clearance	There will be a minimum blade clearance of more than 22 m above highest Astronomical Tide (HAT) in line with industry good practice and MGN 654. The

Embedded Mitigation Measure	Details
	lowest minimum blade clearance associated with the proposed development is 35m above LAT associated with selected WTGs for Project Option 2.
Proposed development vessel compliance with international marine regulations	All proposed development vessels will comply with international marine regulations as adopted by the Flag State including COLREGs and International Convention for the Safety of Life at Sea (SOLAS). A separate VMP is provided in Appendix 17.2.
Promulgation of information	Information relating to the proposed development will be circulated via Notices to Mariners and other appropriate media including via the project FLO and Marine Notices (where deemed appropriate).
Structure Exclusion Zone	An area within the array area within which no surface piercing structure will be located inclusive of blade overfly. This area will ensure that a minimum 3nm gap between the Rockabill islands and the array is maintained.
WTG design and layouts	Consideration will be given to navigational safety and SAR with respect to WTG and layout design (with respect to the 500m LoD), including acceptable levels of SCADA systems.

21 Summary

613. From a baseline assessment, collision and allision risk modelling, and consultation with relevant stakeholders including a Hazard Workshop, hazards relating to shipping and navigation have been identified and assessed for the proposed development for all phases of development (construction, operational and decommissioning).

614. The following subsections summarise the key elements of the NRA.

21.1 Consultation

615. Consultation has been undertaken throughout the NRA process, including key shipping and navigation stakeholders including:

- MSO;
- Irish Lights;
- IRCG;
- Irish Chamber of Shipping;
- Local ports/ harbours including Drogheda Port Company, Dublin Port Company, and Warrenpoint Harbour Authority;
- Regular Operators including Irish Ferries and CLdN;
- Recreational stakeholders including Dublin Bay Sailing Club; and
- RNLI.

616. Key consultation aspects included a Regular Operator outreach based on the vessel traffic data, a Hazard Workshop, and responses to the Scoping Report. Further details on consultation can be found in Section 4.

21.2 Navigational Features

617. The existing navigational features in proximity to the proposed development have been presented in Section 7.

618. Several ports and harbours are located along the east Irish coast close to the array area with the closest being Drogheda Port to the west (9nm) and Port Oriel Harbour to the north-west (9nm). The closest to the offshore cable corridor is Skerries Harbour (2.5nm south). Drogheda Port has associated pilotage services located at the boundary of the Drogheda outer anchorage area approximately 6nm west of the array area.

619. The only IMO routeing measure within the wider area is at the entrance to Dublin Bay and consists of the North and South Burford TSS which is approximately 16nm south-west of the array area.

620. The closest AtoN to the array area is the Rockabill Lighthouse located approximately 2.9nm to the south-west.

621. Two spoil grounds are located to the west of the array area, one within the Drogheda outer anchorage area and one parallel to the west between the coast and the anchorage. Both spoil grounds are utilised by regular dredging associated with Drogheda Port and the River Boyne.

622. The Gormanston Danger Area D1 firing practice area is located immediately west of the array area.

21.3 Maritime incidents

623. From RNLI incident data recorded between 2012 and 2021 within the study area, there was an average of 24 incidents per year, with the majority (82%) occurring within 2nm of the coast. No incidents were recorded within the array area and six within the ECC. The most common incident types recorded were 'Machinery Failure' (36%), 'Unspecified' (27%), 'Person in Danger' (20%), and 'Grounding' (5%). The most common casualty types recorded were powered recreational vessels (26%), followed by fishing vessels (23%). The RNLI station which responded to the most incidents was Skerries which responded to 62% of all incidents.

624. Two incidents were recorded within the study area by the MCIB between 2012 and 2021. One incident was as flooding/ foundering of fishing vessel with no fatalities and the other was a capsized fishing vessel which resulted in one fatality and slight pollution. There were also five recorded incidents between 2002 and 2011.

21.4 Vessel Traffic Movements

625. From 14 days of vessel traffic survey data recorded in July 2022 (summer) within the study area, there was an average of 39 unique vessels per day. An average of 10 unique vessels per day was recorded intersecting the array area and six unique vessels per day intersecting the ECC.

626. Throughout the summer survey period, the main vessel types recorded within the study area were fishing vessels (38%), recreational vessels (32%), and cargo vessels (11%).

627. From 14 days of vessel traffic survey data recorded in December 2023 (winter) within the study area, there was an average of 17 unique vessels per day. An average of three unique vessels per day was recorded intersecting the array area as well as the ECC.

628. Throughout the winter survey period, the main vessel types recorded within the study area were cargo vessels (46%), fishing vessels (27%), and other vessels (11%) which were mainly pilot vessels associated with Drogheda Port, RNLI lifeboats, and a buoy-laying vessel.

629. A total of ten main commercial routes were identified from the vessel traffic survey data. The highest use main commercial route was between Warrenpoint and the Bristol Channel with an average of 10 to 11 unique vessels per week.

21.5 Future Case Vessel Traffic

630. Indicative 10% and 20% increases in vessel traffic associated with commercial vessels, commercial fishing vessels, and recreational vessels has been considered for the future case scenario. Additionally, transits made by proposed development vessels have been considered.

631. Deviations due to the presence of the proposed development could be required for four out of the ten main commercial routes identified, with the level of deviation varying between 0.4nm increase for a route between Belfast and Wicklow and a 11nm increase for a route between Drogheda and the Off Smalls TSS, with the latter limited to larger vessels and tankers on the route.

21.6 Collision and Allision Risk Modelling

632. The annual vessel to vessel collision risk in proximity to the proposed development was estimated to be 3.55×10^{-4}, corresponding to a return period of approximately one in 2,814 years. This represents a 39% increase in collision frequency compared to the pre wind farm result.

633. The annual powered vessel to structure allision risk following installation of the proposed development was estimated to be 9.53×10^{-4}, corresponding to a return period of approximately one in 1,049 years.

634. After modelling three drift scenarios it was established that the wind dominated scenario produced the project option with the worst case results. The annual drifting vessel to structure allision risk following installation of the proposed development was estimated to be 5.94×10^{-5}, corresponding to a return period of approximately one in 16,835 years.

635. The annual fishing vessel to structure allision risk following installation of the proposed development was estimated to be 3.33×10^{-1}, corresponding to a return period of approximately one in 3 years.

21.7 Risk Statement

636. Using the baseline data, expert opinion, outputs of the Hazard Workshop, stakeholder concerns and lessons learnt from existing offshore developments, various shipping and navigation hazards have been risk assessed in line with the FSA approach in Section 19.

637. The significance of risk has been determined as either **Broadly Acceptable** or **Tolerable with Mitigation** (and ALARP) for all hazards assessed and no additional

mitigation measures beyond those embedded into the proposed development are proposed. This conclusion applies to both Project Option 1 and Project Option 2.

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Appendix A Marine Guidance Note 654 Checklist

638. The MGN 654 Checklist can be divided into two distinct checklists, one considering the main MGN 654 guidance document and one considering the Methodology for Assessing Marine Navigational Safety and Emergency Response Risks of OREIs (MCA, 2021) which serves as Annex 1 to MGN 654.

639. The checklist for the main MGN 654 guidance document is presented in Table A.1. Following this, the checklist for the MCA's methodology annex is presented in Table A.2. For both checklists, references to where the relevant information and/ or assessment is provided in the NRA is given.

Table A.1 MGN 654 Checklist for main document

Issue	Compliance	Comments
Site and Installation Coordinates. Developers are responsible for ensuring that formally agreed coordinates and subsequent variations of site perimeters and individual OREI structures are made available, on request, to interested parties at relevant project stages, including application for consent, development, array variation, operation, and decommissioning. This should be supplied as authoritative Geographical Information System (GIS) data, preferably in Environmental Systems Research Institute (ESRI) format. Metadata should facilitate the identification of the data creator, its date and purpose, and the geodetic datum used. For mariners' use, appropriate data should also be provided with latitude and longitude coordinates in WGS84 (European Terrestrial Reference System 1989 (ETRS89)) datum.		
Traffic Survey. Includes:		
All vessel types.	✓	**Section 10: Vessel Traffic Movements** All vessel types are considered with specific breakdowns by vessel type given within the study area.
At least 28 days duration, within either 12 or 24 months prior to submission of the ES.	✓	**Section 5: Data Sources** A total of 28 full days of vessel traffic survey data from December 2021 and July 2022 has been assessed within the study area.
Multiple data sources.	✓	**Section 5: Data Sources** The vessel traffic survey data includes AIS, Radar, and visual observations to maximise coverage of vessels not broadcasting on AIS. Long-term vessel traffic data recorded on AIS have also been considered.
Seasonal variations.	✓	**Section 5: Data Sources** A total of 28 full days of vessel traffic survey data from December 2021 and July 2022 has been assessed within the study area. **Appendix F: Long-Term Vessel Traffic Movements** To assist with the assessment of seasonal variation a long-term AIS dataset covering 12 months in 2022 has also been assessed.

Issue	Compliance	Comments
MCA consultation.	✓	**Section 4: Consultation** The Irish equivalent of MCA include MSO and IRCG and both have been consulted as part of the NRA process including through the Hazard Workshop.
General Lighthouse Authority (GLA) consultation.	✓	**Section 4: Consultation** Irish Lights and have been consulted as part of the NRA process including through the Hazard Workshop.
UK Chamber of Shipping consultation.	✓	**Section 4: Consultation** The Irish Chamber of Shipping is not a statutory consultee but has been invited to take part in the consultation process of the NRA process including through the Hazard Workshop.
Recreational and fishing vessel organisations consultation.	✓	**Section 4: Consultation** Dublin Bay Cruises responded to the Regular Operator outreach and various recreational organisations were invited to the Hazard Workshop with Dublin Bay Sailing Club attending.
Port and navigation authorities consultation, as appropriate.	✓	**Section 4: Consultation** Drogheda Port Company, Dublin Port Company and Warrenpoint Harbour Authority have been consulted as part of the NRA process including through the Hazard Workshop.
Assessment of the cumulative and individual effects of (as appropriate):		
i. Proposed OREI site relative to areas used by any type of marine craft.	✓	**Section 10: Vessel Traffic Movements** Vessel traffic data in proximity to the proposed development has been analysed. **Section 18: Introduction to Risk Assessment** The hazards due to the proposed development have been assessed for each phase in isolation and for cumulative scenarios – Sections 19.
ii. Numbers, types and sizes of vessels presently using such areas.	✓	**Section 10: Vessel Traffic Movements** Vessel traffic data in proximity to the proposed development has been analysed and includes breakdowns of daily vessel count, vessel type and vessel size.
iii. Non-transit uses of the areas, e.g., fishing, day cruising of leisure craft, racing, aggregate dredging, personal watercraft, etc.	✓	**Section 7: Navigational Features** Non-transit uses of the areas in proximity to the proposed development have been identified, including marine aggregate dredging, pilotage, and anchoring. **Section 10: Vessel Traffic Movements** Non-transit users were identified in the vessel traffic survey data and included fishing vessels engaged in fishing activities, marine aggregate dredgers engaged in dredging activities, recreational activities, and anchoring activities.

Issue	Compliance	Comments
iv. Whether these areas contain transit routes used by coastal or deep-draught vessels on passage.	✓	**Section 11: Base Case Vessel Routeing** Main commercial routes have been identified using the principles set out in MGN 654 in proximity to the proposed development, with these routes taking into account coastal, deep-draught and internationally scheduled vessels.
v. Alignment and proximity of the site relative to adjacent shipping lanes.	✓	**Section 7: Navigational Features** Section 7.2 identifies IMO routeing measures in proximity to the Proposed Development.
vi. Whether the nearby area contains prescribed routeing schemes or precautionary areas.	✓	**Section 7: Navigational Features** Section 7.2 identifies the IMO routeing measures in proximity to the proposed development and Section 7.8 identifies military PEXAs in proximity to the proposed development.
vii. Proximity of the site to areas used for anchorage (charted or uncharted), safe haven, port approaches and pilot boarding or landing areas.	✓	**Section 7: Navigational Features** Section 7.1 identifies port approaches and pilot boarding stations in proximity to the proposed development and Section 7.4 identifies anchorage areas in proximity to the Proposed Development. **Section 12: Adverse Weather Routeing** Section 12.3 identifies safe havens in proximity to the proposed development.
viii. Whether the site lies within the jurisdiction of a port and/ or navigation authority.	✓	**Section 7: Navigational Features** Section 7.1 identifies the locations of ports in proximity to the proposed development.
ix. Proximity of the site to existing fishing grounds, or to routes used by fishing vessels to such grounds.	✓	**Section 10: Vessel Traffic Movements** Fishing vessel movements are considered within the study area. Detailed analysis of dedicated fishing vessel activities is undertaken in **Volume 3, Chapter 16: Commercial fisheries**.
x. Proximity of the site to offshore firing/ bombing ranges and areas used for any marine military purposes.	✓	**Section 7: Navigational Features** Section 7.8 identifies military PEXAs in proximity to the proposed development.
xi. Proximity of the site to existing or proposed submarine cables or pipelines, offshore oil/ gas platforms, marine aggregate dredging, marine archaeological sites or wrecks, Marine Protected Areas, or other exploration/ exploitation sites.	✓	**Section 7: Navigational Features** Section 7.6 identifies the submarine cables in proximity to the proposed development, Section 7.7 identifies the pipelines in proximity to the proposed development and Section 7.9 identifies the charted wrecks in proximity to the Proposed Development. **Section 15: Cumulative Project Screening Exercise** Considers exploration/ exploitation sites in proximity to the proposed development cumulatively

Issue	Compliance	Comments
xii. Proximity of the site to existing or proposed OREI developments, in cooperation with other relevant developers, within each round of lease awards.	✓	**Section 7: Navigational Features** Identifies there are no other offshore wind farm developments in proximity to the proposed development. **Section 15: Cumulative Project Screening Exercise** Considers exploration/ exploitation sites in proximity to the proposed development cumulatively
xiii. Proximity of the site relative to any designated areas for the disposal of dredging spoil or other dumping ground.	✓	**Section 7: Navigational Features** Section 7.5 identifies spoil and dumping rounds in proximity to the proposed development.
xiv. Proximity of the site to aids to navigation and/ or VTS in or adjacent to the area and any impact thereon.	✓	**Section 7: Navigational Features** Section 7.2 identifies VTS areas in proximity to the proposed development and Section 7.3 identifies aids to navigation in proximity to the proposed development.
xv. Researched opinion using computer simulation techniques with respect to the displacement of traffic and, in particular, the creation of 'choke points' in areas of high traffic density and nearby or consented OREI sites not yet constructed.	✓	**Section 17: Collision and Allision Risk Modelling** Provides quantification of collision and allision risk resulting from the proposed development including pinch (or choke) points in proximity to the proposed development.
xvi. With reference to xv. above, the number and type of incidents to vessels which have taken place in or near to the proposed site of the OREI to assess the likelihood of such events in the future and the potential impact of such a situation.	✓	**Section 9: Emergency Response and Incident Overview** Historical vessel incident data published RNLI (Section 9.3) and MCIB (Section 9.4) in proximity to the proposed development has been considered alongside historical offshore wind farm incident data throughout the UK (Section 9.7).
xvii. Proximity of the site to areas used for recreation which depend on specific features of the area.	✓	**Section 10: Vessel Traffic Movements** Non-transit users were identified in the vessel traffic survey data and included recreational activities.
Predicted effect of OREI on traffic and interactive boundaries. Where appropriate, the following should be determined:		
a. The safe distance between a shipping route and OREI boundaries.	✓	**Section 16: Future Case Vessel Traffic** A methodology for post wind farm routeing is outlined and includes a minimum distance of 1nm from offshore installations and existing offshore wind farm boundaries.
b. The width of a corridor between sites or OREIs to allow safe passage of shipping.	✓	A navigational corridor is not required for the proposed development.
OREI Structures. The following should be determined:		

Issue	Compliance	Comments
a. Whether any feature of the OREI, including auxiliary platforms outside the main generator site, mooring and anchoring systems, inter-device and export cabling could pose any type of difficulty or danger to vessels underway, performing normal operations, including fishing, anchoring and emergency response.	✓	**Section 17: Collision and Allision Risk Modelling** Provides quantification of collision and allision risk resulting from the Proposed Development. **Section 18: Introduction to Risk Assessment** The hazards due to the proposed development have been assessed for each phase and include consideration of users such as commercial vessels, commercial fishing vessels in transit, recreational vessels, anchored vessels, and emergency responders – Section 19.
b. Clearances of fixed or floating WTG blades above the sea surface are not less than 22 m (above HWM for fixed). Floating turbines allow for degrees of motion.	✓	**Section 6: Project Description Relevant to Shipping and Navigation** Section 6.2.2 outlines the shipping and navigation project option with the greatest significance of risk for WTGs including the minimum air gap above HWM.
c. Underwater devices: i. Changes to charted depth; ii. Maximum height above seabed; and iii. Under keel clearance.	✓	**Section 6: Project Description Relevant to Shipping and Navigation** Section 6.3 outlines the shipping and navigation project option with the greatest significance of risk for subsea cables including the cable burial specifications.
d. Whether structures block or hinder the view of other vessels or other navigational features.	✓	**Section 18: Introduction to Risk Assessment** The hazards due to the proposed development have been assessed for each phase and include consideration of the potential for vessels navigating in proximity to structures to be visually obscured or inhibit the use of existing aids to navigation – Section 19.
The effect of tides, tidal streams, and weather. It should be determined whether:		
a. Current maritime traffic flows and operations in the general area are affected by the depth of water in which the proposed installation is situated at various states of the tide, i.e. whether the installation could pose problems at high water which do not exist at low water conditions, and vice versa.	✓	**Section 6: Project Description Relevant to Shipping and Navigation** Section 6.1 outlines the shipping and navigation for the array area and includes the range of existing water depths. **Section 8: Meteorological Ocean Data** Section 8.4 provides data relating to various states of the tide. **Section 10: Vessel Traffic Movements** Vessel traffic data in proximity to the proposed development has been analysed including vessel draught. **Section 17: Collision and Allision Risk Modelling** Provides quantification of collision and allision risk resulting from the proposed development including accounting for tidal conditions.

<table>
<tr><th>Issue</th><th>Compliance</th><th>Comments</th></tr>
<tr><td>b. The set and rate of the tidal stream, at any state of the tide, has a significant effect on vessels in the area of the OREI site.</td><td>✓</td><td rowspan="3">Section 8: Meteorological Ocean Data
Section 8.4 provides meteorological data in proximity to the proposed development relating to various states of the tide.

Section 17: Collision and Allision Risk Modelling
Provides quantification of collision and allision risk resulting from the proposed development including accounting for tidal conditions.</td></tr>
<tr><td>c. The maximum rate tidal stream runs parallel to the major axis of the proposed site layout, and, if so, its effect.</td><td>✓</td></tr>
<tr><td>d. The set is across the major axis of the layout at any time, and, if so, at what rate.</td><td>✓</td></tr>
<tr><td>e. In general, whether engine failure or other circumstance could cause vessels to be set into danger by the tidal stream, including unpowered vessels and small, low speed craft.</td><td>✓</td><td>Section 8: Meteorological Ocean Data
Section 8.4 provides meteorological data in proximity to the proposed development relating to various states of the tide.

Section 17: Collision and Allision Risk Modelling
Provides quantification of collision and allision risk resulting from the proposed development including accounting for tidal conditions and assessment of whether machinery failure could cause vessels to be set into danger.</td></tr>
<tr><td>f. The structures themselves could cause changes in the set and rate of the tidal stream.</td><td>✓</td><td>Section 8: Meteorological Ocean Data
Section 8.4 provides meteorological data in proximity to the proposed development relating to various states of the tide and notes that no effects are anticipated.</td></tr>
<tr><td>g. The structures in the tidal stream could be such as to produce siltation, deposition of sediment or scouring, affecting navigable water depths in the wind farm area or adjacent to the area.</td><td>✓</td><td>Section 8: Meteorological Ocean Data
Section 8.4 provides meteorological data in proximity to the proposed development relating to various states of the tide.

Section 18: Introduction to Risk Assessment
The hazards due to the proposed development have been assessed for each phase and include consideration of the potential for reduction in under keel clearance – Section 19.</td></tr>
</table>

Issue	Compliance	Comments
h. The site, in normal, bad weather, or restricted visibility conditions, could present difficulties or dangers to craft, including sailing vessels, which might pass in close proximity to it.	✓	**Section 8: Meteorological Ocean Data** Provides meteorological data in proximity to the proposed development relating to weather and visibility. **Section 10: Vessel Traffic Movements** Vessel traffic data in proximity to the proposed development has been analysed including recreational vessels. **Section 12: Adverse Weather Routeing** Section 12.2 identifies alternative vessel routeing in proximity to the proposed development in adverse weather. **Section 18: Introduction to Risk Assessment** The hazards due to the Proposed Development have been assessed for each phase and include consideration of adverse weather routeing – Section 19.
i. The structures could create problems in the area for vessels under sail, such as wind masking, turbulence or sheer.	✓	**Section 18: Introduction to Risk Assessment** The hazards due to the Proposed Development have been assessed for each phase and include consideration of internal allision risk for vessels under sail – Section 19.
j. In general, taking into account the prevailing winds for the area, whether engine failure or other circumstances could cause vessels to drift into danger, particularly if in conjunction with a tidal set such as referred to above.	✓	**Section 8: Meteorological Ocean Data** Provides meteorological data in proximity to the proposed development relating to wind direction and various states of the tide. **Section 17: Collision and Allision Risk Modelling** Provides quantification of collision and allision risk resulting from the proposed development including accounting for weather conditions and assessment of whether machinery failure could cause vessels to be set into danger. **Section 18: Introduction to Risk Assessment** The hazards due to the Proposed Development have been assessed for each phase and include consideration of drifting allision risk – Section 19.
Assessment of access to and navigation within, or close to, an OREI. To determine the extent to which navigation would be feasible within the OREI site itself by assessing whether:		
a. Navigation within or close to the site would be safe:		
i. For all vessels.	✓	**Section 4: Consultation** Section 4.2 outlines Regular Operator consultation undertaken following the vessel traffic surveys. **Section 12: Adverse Weather Routeing** Section 12.2 identifies alternative vessel routeing in proximity to the proposed development in adverse weather.
ii. For specified vessel types, operations and/ or sizes.		

Issue	Compliance	Comments
iii. In all directions or areas.		**Section 17: Collision and Allision Risk Modelling** Provides quantification of collision and allision risk resulting from the proposed development including accounting for weather and tidal conditions. **Section 18: Introduction to Risk Assessment** The hazards due to the Proposed Development have been assessed for each phase and include consideration of internal allision risk – Section 19.
iv. In specified directions or areas.		
v. In specified tidal, weather, or other conditions.		
b. Navigation in and/or near the site should be prohibited or restricted:		
i. For specified vessel types, operations and/ or sizes.	✓	**Section 13: Navigation, Communication and Position Fixing Equipment** Assesses potential hazards on navigation of the different communications and position fixing devices used in and around offshore wind farms. **Section 16: Future Case Vessel Traffic** A methodology for post wind farm routeing is outlined and includes a minimum distance of 1nm from offshore installations and existing offshore wind farm boundaries, i.e., it is assumed that commercial vessels will avoid the array area. **Section 18: Introduction to Risk Assessment** The hazards due to the proposed development have been assessed for each phase and include consideration of vessel displacement – Section 19.
ii. In respect of specific activities.	✓	
iii. In all areas or directions.	✓	
iv. In specified areas or directions.	✓	
v. In specified tidal or weather conditions.	✓	
c. Where it is not feasible for vessels to access or navigate through the site it could cause navigational, safety or routeing problems for vessels operating in the area, e.g., by preventing vessels from responding to calls for assistance from persons in distress.	✓	**Section 18: Introduction to Risk Assessment** The hazards due to the proposed development have been assessed for each phase and include consideration of vessel displacement and emergency response capability – Section 19.
d. Guidance on the calculation of safe distance of OREI boundaries from shipping routes has been considered.		**Section 16: Future Case Vessel Traffic** A methodology for post wind farm routeing is outlined and includes consideration of the Shipping Route Template.
SAR, maritime assistance service, counter pollution, and salvage incident response.		
The MCA, through HM Coastguard, is required to provide SAR and emergency response within the sea area occupied by all OREIs in UK waters. To ensure that such operations can be safely and effectively conducted, certain requirements must be met by developers and operators.		

Issue	Compliance	Comments
a. An ERCoP will be developed for the construction, operation, and decommissioning phases of the OREI.	✓	**Section 20: Embedded Mitigation Measures** Outlines the embedded mitigation measures to be implemented to reduce the significance of risk of shipping and navigation hazards including compliance with MGN 654 which includes the provision of an ERCoP.
b. The MCA's guidance document *Offshore Renewable Energy Installations: Requirements, Guidance and Operational Considerations for Search and Rescue and Emergency Response* (MCA, 2021) for the design, equipment and operation requirements will be followed.	✓	**Section 2: Guidance and Legislation** Outlines the guidance and legislation used within the NRA including Annex 5 of MGN 654. **Section 20: Embedded Mitigation Measures** Outlines the embedded mitigation measures to be implemented to reduce the significance of risk of shipping and navigation hazards including compliance with MGN 654 and its annexes.
c. A SAR checklist will be completed to record discussions regarding the requirements, recommendations and considerations outlined in Annex 5 (to be agreed with MCA).	✓	**Section 20: Embedded Mitigation Measures** Outlines the embedded mitigation measures to be implemented to reduce the significance of risk of shipping and navigation hazards including compliance with MGN 654 which includes the completion of the SAR checklist.
6. Hydrography. In order to establish a baseline, confirm the safe navigable depth, monitor seabed mobility and to identify underwater hazards, detailed and accurate hydrographic surveys are included or acknowledged for the following stages and to MCA specifications:		
i. Pre-construction: The proposed generating assets area and proposed cable route.	✓	**Section 20: Embedded Mitigation Measures** Outlines the embedded mitigation measures to be implemented including compliance with MGN 654 which includes the hydrographic surveys stated.
ii. On a pre-established periodicity during the life of the development.	✓	
iii. Post construction: Cable route(s).	✓	
iv. Post decommissioning of all or part of the development: the installed generating assets area and cable route.	✓	
Communications, Radar, and positioning systems. To provide researched opinion of a generic and, where appropriate, site specific nature concerning whether:		
a. The structures could produce radio interference such as shadowing, reflections or phase changes, and emissions with respect to any frequencies used for marine positioning, navigation, and timing (PNT) or communications, including GMDSS and AIS, whether ship borne, ashore or fitted to any of the proposed structures, to:		
i. Vessels operating at a safe navigational distance.	✓	**Section 13: Navigation, Communication and Position Fixing Equipment**

Issue	Compliance	Comments
ii. Vessels by the nature of their work necessarily operating at less than the safe navigational distance to the OREI, e.g., support vessels, survey vessels, SAR assets.	✓	Assesses the potential risks associated with the use of navigation, communication and position fixing equipment due to the proposed development including in relation to radio interference.
iii. Vessels by the nature of their work necessarily operating within the OREI.	✓	
b. The structures could produce Radar reflections, blind spots, shadow areas or other adverse effects:		
i. Vessel to vessel.	✓	**Section 13: Navigation, Communication and Position Fixing Equipment** Assesses the potential risks associated with the use of navigation, communication and position fixing equipment due to the proposed development including in relation to marine Radar.
ii. Vessel to shore.	✓	
iii. VTS Radar to vessel.	✓	
iv. Racon to/ from vessel.	✓	
c. The structures and generators might produce SONAR interference affecting fishing, industrial or military systems used in the area.	✓	**Section 13: Navigation, Communication and Position Fixing Equipment** Assesses the potential risks associated with the use of navigation, communication and position fixing equipment due to the proposed development including in relation to SONAR.
d. The site might produce acoustic noise which could mask prescribed sound signals.	✓	**Section 13: Navigation, Communication and Position Fixing Equipment** Assesses the potential risks associated with the use of navigation, communication and position fixing equipment due to the proposed development including in relation to noise.
e. Generators and the seabed cabling within the site and onshore might produce EMFs affecting compasses and other navigation systems.	✓	**Section 13: Navigation, Communication and Position Fixing Equipment** Assesses the potential risks associated with the use of navigation, communication and position fixing equipment due to the proposed development including in relation to electromagnetic interference.
Risk mitigation measures recommended for OREI during construction, operation, and decommissioning.		
Mitigation and safety measures will be applied to the OREI development appropriate to the level and type of risk determined during the EIA. The specific measures to be employed will be selected in consultation with the MCA and will be listed in the developer's ES. These will be consistent with international standards contained in, for example, SOLAS Chapter V (IMO, 1974), and could include any or all of the following:		
i. Promulgation of information and warnings through notices to mariners and other appropriate MSI dissemination methods.	✓	**Section 20: Embedded Mitigation Measures** Outlines the embedded mitigation measures to be implemented to reduce the significance of risk of shipping and navigation hazards including promulgation of information.
ii. Continuous watch by multi-channel VHF, including DSC.	✓	**Section 20: Embedded Mitigation Measures** Outlines the embedded mitigation measures to be implemented to reduce the significance of risk of shipping and navigation hazards including marine coordination.

Issue	Compliance	Comments
iii. Safety zones of appropriate configuration, extent, and application to specified vessels.	✓	**Section 20: Embedded Mitigation Measures** Outlines the embedded mitigation measures to be implemented to reduce the significance of risk of shipping and navigation hazards including advisory safe passing distances (noting that safety zones are not applicable in Ireland).
iv. Designation of the site as an Area to be Avoided (ATBA).	✓	There are no plans to designate the proposed development as an ATBA.
v. Provision of aids to navigation as determined by the GLA.	✓	**Section 20: Embedded Mitigation Measures** Outlines the embedded mitigation measures to be implemented to reduce the significance of risk of shipping and navigation hazards including lighting and marking in accordance with Trinity House and MCA requirements.
vi. Implementation of routeing measures within or near to the development.	✓	There are no plans to implement any new routeing measures in proximity to the proposed development.
vii. Monitoring by Radar, AIS, Closed Circuit Television (CCTV) or other agreed means.	✓	**Section 20: Embedded Mitigation Measures** Outlines the embedded mitigation measures to be implemented to reduce the significance of risk of shipping and navigation hazards including traffic monitoring.
viii. Appropriate means for OREI operators to notify, and provide evidence of, the infringement of Safety Zones.	**N/A**	Safety zones are not applicable in Ireland.
ix. Creation of an ERCoP with the MCA's SAR Branch for the construction phase onwards.	✓	**Section 20: Embedded Mitigation Measures** Outlines the embedded mitigation measures to be implemented to reduce the significance of risk of shipping and navigation hazards including compliance with MGN 654 which include the provision of an ERCoP.
x. Use of guard vessels, where appropriate.	✓	**Section 20: Embedded Mitigation Measures** Outlines the embedded mitigation measures to be implemented to reduce the significance of risk of shipping and navigation hazards including the use of guard vessels.
xi. Update NRAs every two years, e.g. at testing sites.	**N/A**	Not applicable to the proposed development.
xii. Device-specific or array-specific NRAs.	✓	**Section 6: Project Description Relevant to Shipping and Navigation** All offshore elements of the proposed development have been considered in this NRA including all infrastructure (surface and subsea) within the array area and offshore export cable corridor.
xiii. Design of OREI structures to minimise risk to contacting vessels or craft.	✓	There is no additional risk posed to craft compared to previous offshore wind farms and so no additional measures are identified.

Issue	Compliance	Comments
xiv. Any other measures and procedures considered appropriate in consultation with other stakeholders.	✓	**Section 20: Embedded Mitigation Measures** Outlines the embedded mitigation measures to be implemented to reduce the significance of risk of shipping and navigation hazards.

Table A.2 MGN 654 Annex 1 checklist

Item	Compliance	Comments
A risk claim is included that is supported by a reasoned argument and evidence.	✓	**Section 18: Introduction to Risk Assessment** The risk assessment provides a risk claim for a range of hazards based on a number of inputs including (but not limited to) baseline data, expert opinion, outputs of the Hazard Workshop, stakeholder concerns and lessons learnt from existing offshore developments – Section 19
Description of the marine environment.	✓	**Section 7: Navigational Features** Relevant navigational features in proximity to the proposed development have been described including (but not limited to) IMO routeing measures, ports, harbours and related facilities, charted anchorage areas, aids to navigation, subsea cables, and pipelines, military PEXAs and charted wrecks. **Section 15: Cumulative Project Screening Exercise** Potential future developments have been screened in to the cumulative risk assessment where a cumulative or in combination activity has been identified based upon the location and distance from the proposed development.
SAR overview and assessment.	✓	**Section 9: Emergency Response and Incident Overview** Existing SAR resources in proximity to the proposed development are summarised including the RNLI stations and assets and IRCG stations which respond to incidents requiring SAR. **Section 18: Introduction to Risk Assessment** The risk assessment includes an assessment of how activities associated with the Proposed Development may restrict emergency response capability of existing resources – Section 19.
Description of the OREI development and how it changes the marine environment.	✓	**Section 6: Project Description Relevant to Shipping and Navigation** The proposed development boundary for which any shipping and navigation hazards are assessed is provided including a description of the array area and ECC infrastructure, construction phase programme and indicative vessel and helicopter numbers during the construction and operational phases. **Section 16: Future Case Vessel Traffic**

Item	Compliance	Comments
		Alternative routeing for commercial traffic has been considered for the project option with the greatest significance of risk.
Analysis of the vessel traffic, including base case and future traffic densities and types.	✓	**Section 16: Future Case Vessel Traffic** Vessel traffic data in proximity to the proposed development has been analysed and includes vessel density and breakdowns of vessel type. **Section 16: Future Case Vessel Traffic** Future vessel traffic levels have been considered, broken down as increases in commercial vessel activity, commercial fishing vessel and recreational vessel activity, increases in traffic associated with project operations and changes in marine aggregate dredging activities. Additionally, worst case alternative routeing for commercial traffic has been considered.
Status of the Hazard Log: ▪ Hazard identification; ▪ Risk assessment; ▪ Influences on level of risk; ▪ Tolerability of risk; and ▪ Risk matrix.	✓	**Section 3: Navigational Risk Assessment Methodology** A tolerability matrix has been defined to determine the tolerability (significance) of risks. **Appendix D: Hazard Log** The complete Hazard Log is presented and includes a description of the hazards considered, possible causes, consequences (most likely and worst case) and relevant embedded mitigation measures. Using this information, each hazard is then ranked in terms of frequency of occurrence and severity of consequence to give a tolerability (significance) level.
NRA: ▪ Appropriate risk assessment; ▪ MCA acceptance for assessment techniques and tools; ▪ Demonstration of results; and ▪ Limitations.	✓	**Section 2: Guidance and Legislation** MGN 654 and the IMO's FSA guidelines are the primary guidance documents used for the assessment alongside MGN 372 Amendment 1. **Section 17: Collision and Allision Risk Modelling** Provides quantification of collision and allision risk resulting from the with the results outlined numerically and graphically, where appropriate.
Risk control log	✓	**Appendix D: Hazard Log** The complete Hazard Log is presented and includes a description of the hazards considered, possible causes, consequences (most likely and worst case) and relevant embedded mitigation measures. Using this information, each hazard is then ranked in terms of frequency of occurrence and severity of consequence to give a tolerability (significance) level.

Appendix B Consequences Assessment

B.1 Introduction

640. This appendix presents an assessment of the consequences of collision and allision incidents, in terms of people and the environment, due to the presence of the proposed development.

641. The significance of the impact due to the presence of the proposed development is also assessed based on risk evaluation criteria and comparison with historical incident data in UK waters[9]. UK data has been used due to the extensive availability (particularly MAIB data) noting that, given the proximity of UK and Irish waters and international nature of shipping, analysis based on MAIB data is considered applicable to the proposed development.

B.2 Risk Evaluation Criteria

B.2.1 Risk to People

642. Regarding the assessment of risk to people two measures are considered, namely:

- Individual risk; and
- Societal risk.

B.2.2 Individual Risk

643. Individual risk considers whether the risk from an incident to a particular individual changes significantly due to the presence of the proposed development. Individual risk considers not only the frequency of the incident and the consequences (e.g., likelihood of death), but also the individual's fractional exposure to that risk, i.e. the probability of the individual being in the given location at the time of the incident.

644. The purpose of estimating the individual risk is to ensure that individuals who may be affected by the presence of the proposed development are not exposed to excessive risks. This is achieved by considering the significance of the change in individual risk resulting from the presence of the proposed development relative to the UK background individual risk levels.

645. Annual risk levels to crew (the annual risk to an average crew member) for different vessel types are presented in Figure B.1, which also includes the upper and lower bounds for risk acceptance criteria as suggested in IMO Maritime Safety Committee 72/ 16 (IMO, 2001). The annual individual risk level to crew falls within the ALARP region for each of the vessel types presented.

[9] For the purposes of this assessment, UK waters is defined as the UK EEZ and UK territorial waters refers to the 12 nm limit from the British Isles, excluding the Republic of Ireland.

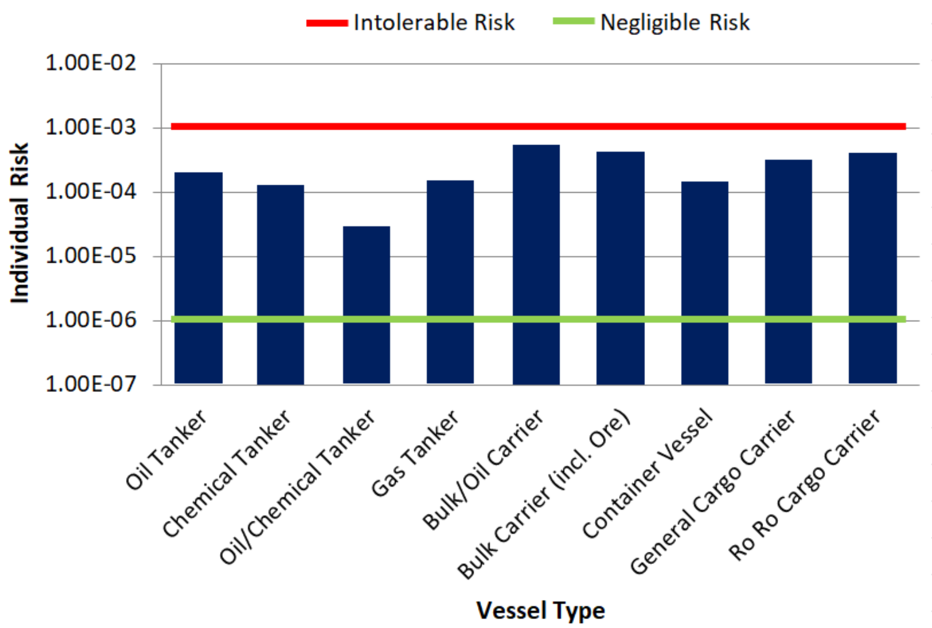

Figure B.1 Individual Risk Levels and Acceptance Criteria per Vessel Type

646. The typical bounds defining the ALARP regions for decision making within shipping are presented in Table B.1. For a new vessel, the target upper bound for ALARP is set lower since new vessels are expected to benefit (in terms of design) from changes in legislation and improved maritime safety.

Table B.1 Individual Risk ALARP Criteria

Individual	Lower Bound for ALARP	Upper Bound for ALARP
To crew member	10^{-6}	10^{-3}
To passenger	10^{-6}	10^{-4}
Third-party	10^{-6}	10^{-4}
New vessel target	10^{-6}	Above values reduced by one order of magnitude

647. On a UK basis, the MCA have presented individual risks for various UK industries based on HSE data from 1987 to 1991. The risks for different industries are presented in Figure B.2.

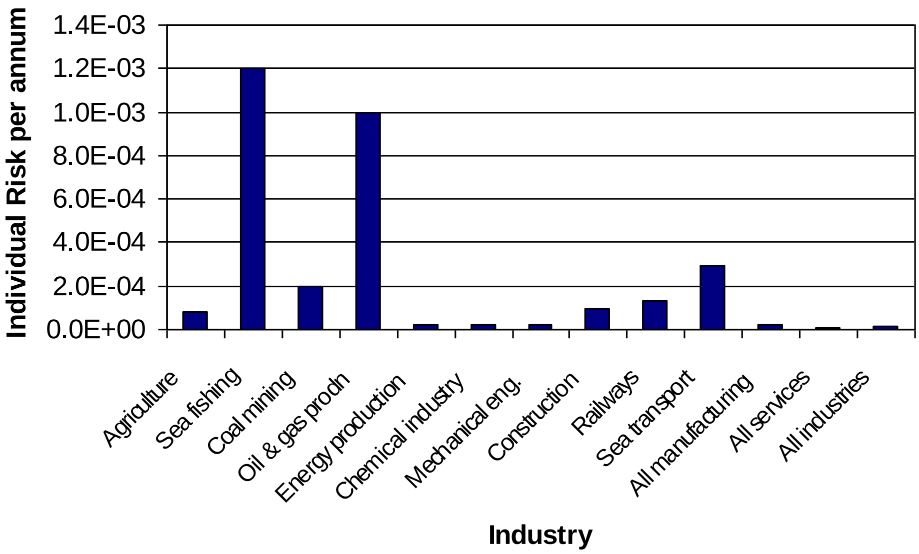

Figure B.2 Individual Risk per Year for Various UK Industries

648. The individual risk for sea transport of 2.9×10^{-4} per year is consistent with the worldwide data presented in Figure B.1, whilst the individual risk for sea fishing of 1.2×10^{-3} per year is the highest across all of the industries included.

B.2.3 Societal Risk

649. Societal risk is used to estimate risks of incidents affecting many persons (catastrophes) and acknowledging risk adverse or neutral attitudes. Societal risk includes the risk to every person, even if a person is only exposed to risk on one brief occasion. For assessing the risk to a large number of affected people, societal risk is desirable because individual risk is insufficient in evaluating risks imposed on large numbers of people.

650. Within this assessment, societal (navigation based) risk can be assessed for the proposed development, giving account to the change in risk associated with each incident scenario cause by the introduction of the WTGs. Societal risk may be expressed as:

- Annual fatality rate where frequency and fatality are combined into a convenient one-dimensional measure of societal risk (also known as PLL); and
- F-N diagrams showing explicitly the relationship between the cumulative frequency of an accident and the number of fatalities in a multi-dimensional diagram.

651. When assessing societal risk this study focuses on PLL, which accounts for the number of people likely to be involved in an incident (which is higher for certain vessel types) and assesses the significance of the change in risk compared to the UK background risk levels.

B.2.4 Risk to Environment

652. For risk to the environment the key criteria considered in terms of the risk due to the proposed development is the potential quantity of oil spilled from a vessel involved in an incident.

653. It is recognised that there will be other potential pollution, e.g., hazardous containerised cargoes; however, oil is considered the most likely pollutant and the extent of predicted oil spills will provide an indication of the significance of pollution risk due to the proposed development compared to UK background pollution risk levels.

B.3 Marine Accident Investigation Branch Incident Data

B.3.1 All Incidents in UK Waters

654. All British flagged commercial vessels are required to report incidents to the MAIB. Non-British flagged vessels do not have to report an incident to the MAIB unless located at a UK port or within 12nm territorial waters and carrying passengers to a UK port. There are no requirements for non-commercial recreational craft to report incidents to the MAIB; however, a significant proportion of such incidents are reported to and investigated by the MAIB.

655. The MCA, harbour authorities and inland waterway authorities also have a duty to report incidents to the MAIB. Therefore, whilst there may be a degree of underreporting of incidents with minor consequences, those resulting in more serious consequences, such as fatalities, are likely to be reported.

656. Only incidents occurring in UK waters have been considered within this assessment for which the MAIB data is most comprehensive. It is also noted that incidents occurring in ports/ harbours and rivers/ canals have been excluded since the causes and consequences may differ considerably from an incident occurring offshore, which is the location of most relevance to the proposed development.

657. Accounting for these criteria, a total of 11,774 accidents, injuries and hazardous incidents were reported to the MAIB in the 20-year period between 2002 and 2021 involving 13,415 vessels (some incidents, such as collisions, involved more than one vessel).

658. The location of all incidents in proximity to the UK are presented in Figure B.3, colour-coded by incident type[10]. The majority of incidents occur in coastal waters.

[10] The MAIB aim for 97% accuracy in reporting the location of incidents.

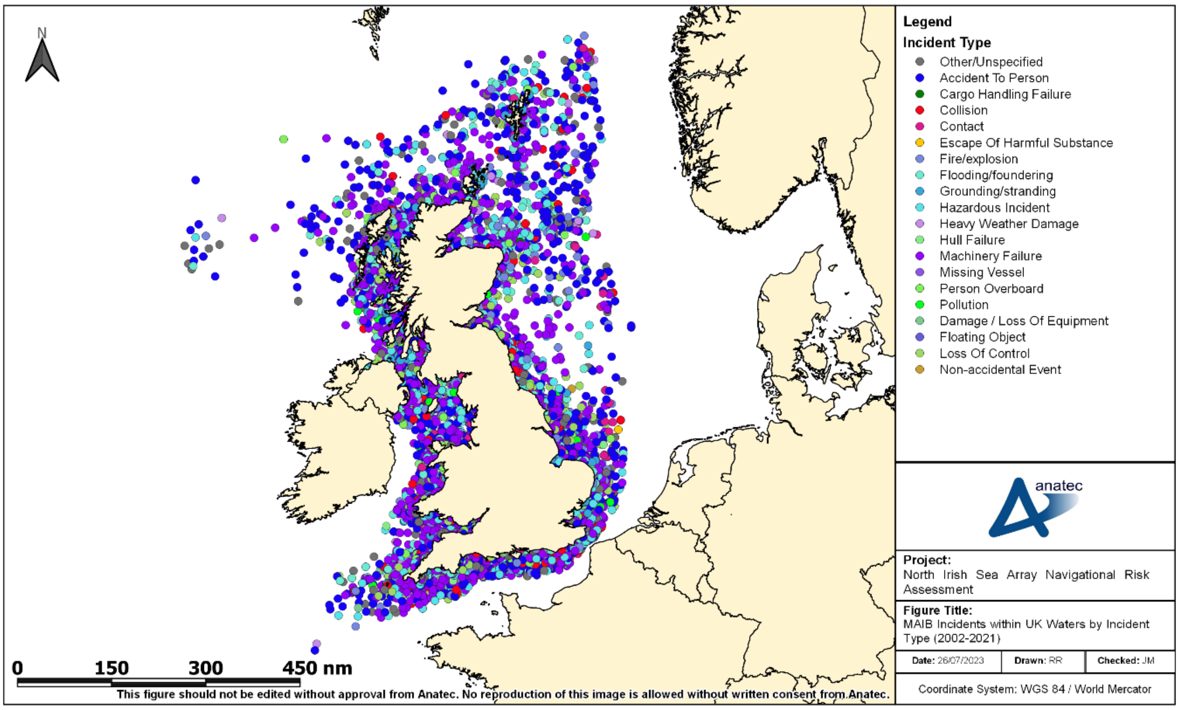

Figure B.3 MAIB Incident Locations by Incident Type within UK Waters (2002 to 2021)

659. The distribution of incidents by year in UK waters is presented in Figure B.4.

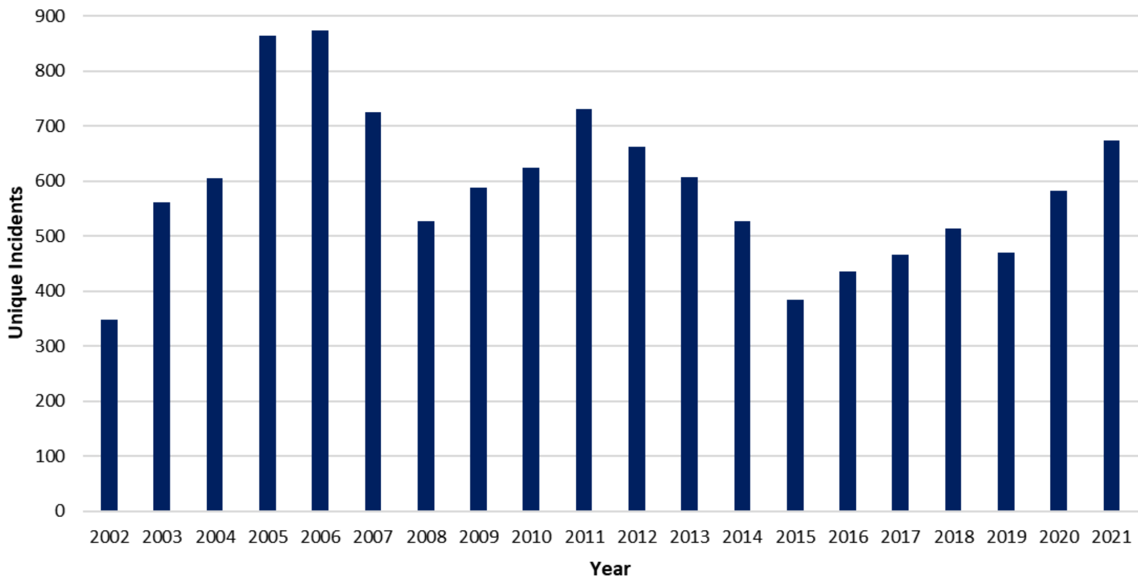

Figure B.4 MAIB Unique Incidents per Year within UK Waters (2002 to 2021)

660. The average number of unique incidents per year was 589. There has generally been a fluctuating trend in incidents over the 20-year period.

661. The distribution of incidents in UK waters by incident type is presented in Figure B.5.

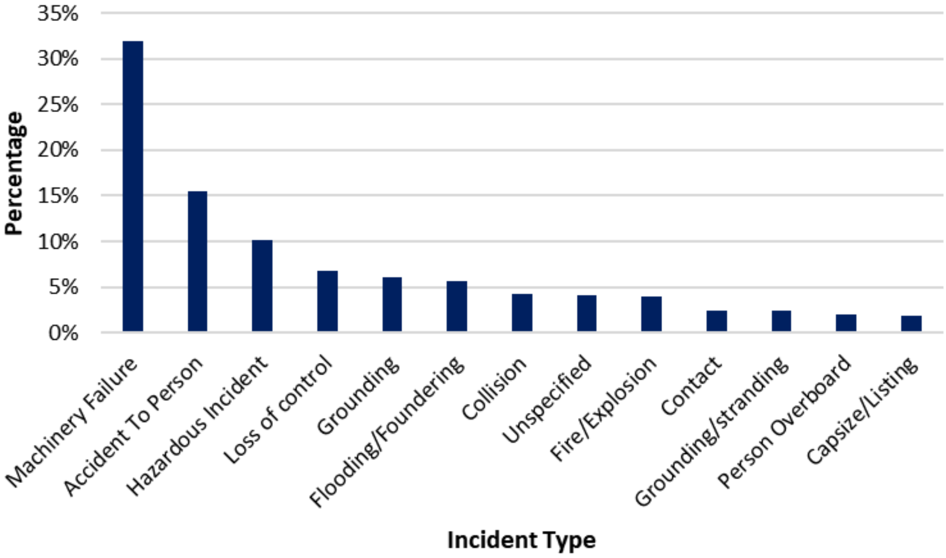

Figure B.5 MAIB Incident Types Breakdown within UK Waters (2002 to 2021)

662. The most frequent incident types were "*machinery failure*" (32%), "*accident to person*" (16%) and "*hazardous incident*" (10%). "*Collision*" and "*contact*" incidents represented 4% and 2% of total incidents, respectively.

663. The distribution of incidents in UK waters by vessel type is presented in Figure B.6.

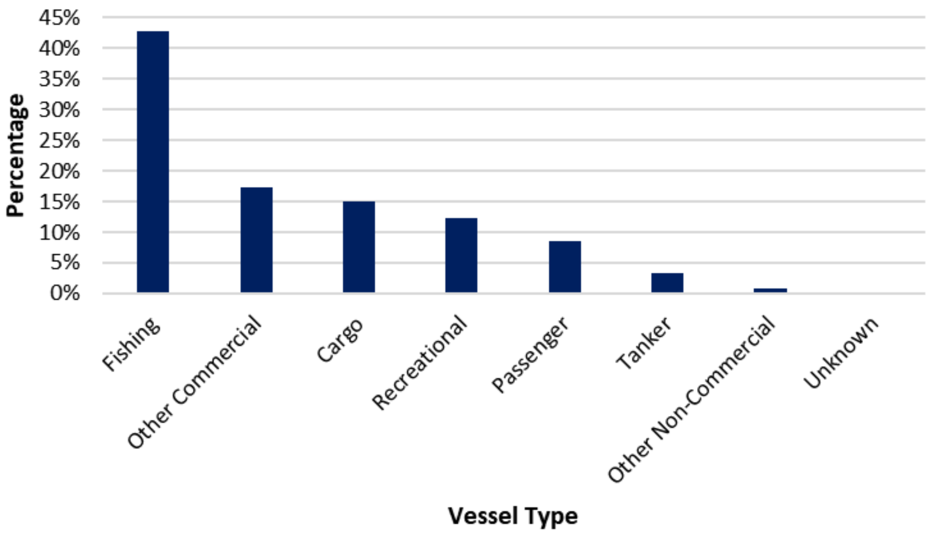

Figure B.6 MAIB Incident Types Breakdown within UK Waters (2002 to 2021)

664. The most frequent vessel types involved in incidents were fishing vessels (43%), other commercial vessels (17%) (including offshore industry vessels, tugs, workboats, and pilot vessels) and cargo vessels (15%).

665. A total of 414 fatalities were reported in the MAIB incidents within UK waters between 2002 and 2021, corresponding to an average of 21 fatalities per year.

666. The distribution of fatalities in UK waters by vessel type and person category (crew, passenger and other) is presented in Figure B.7.

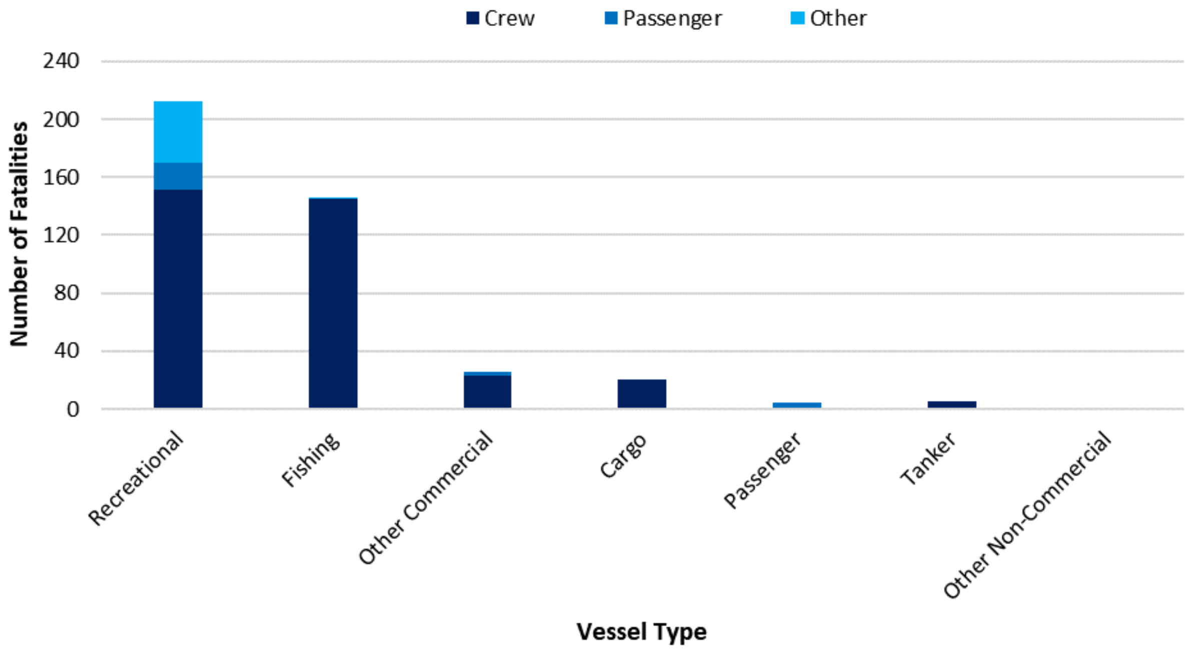

Figure B.7 MAIB Fatalities by Vessel Type within UK Waters (2002 to 2021)

667. The majority of fatalities occurred to recreational vessels (51%) and fishing vessels (35%), with crew members the main people involved (83%).

B.3.2 Collision Incidents

668. The MAIB define a collision incident as "*ships striking or being struck by another ship, regardless of whether the ships are underway, anchored or moored*" (MAIB, 2013).

669. A total of 504 collision incidents were reported to the MAIB in UK waters between 2002 and 2021 involving 1,068 vessels (in a small number of cases the other vessel involved was not logged).

670. The locations of collision incidents reported in proximity to the UK are presented in Figure B.8.

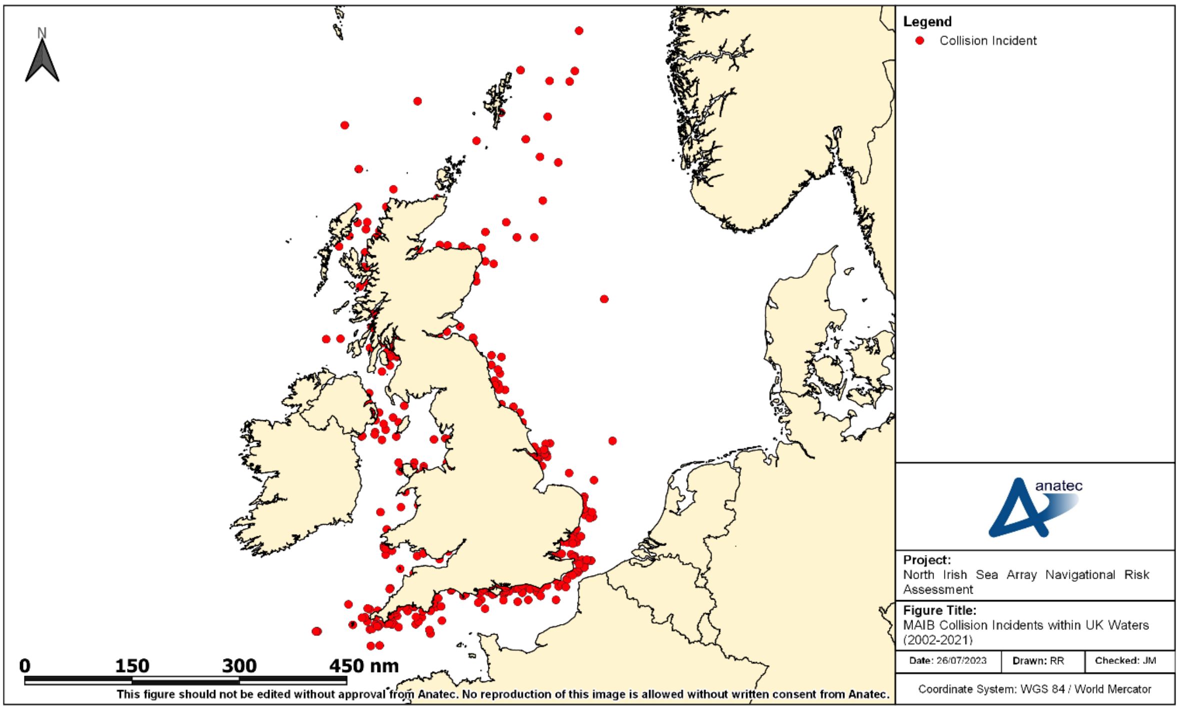

Figure B.8 MAIB Collision Incident Locations within UK Waters (2002 to 2021)

671. The distribution of collision incidents per year is presented in Figure B.9.

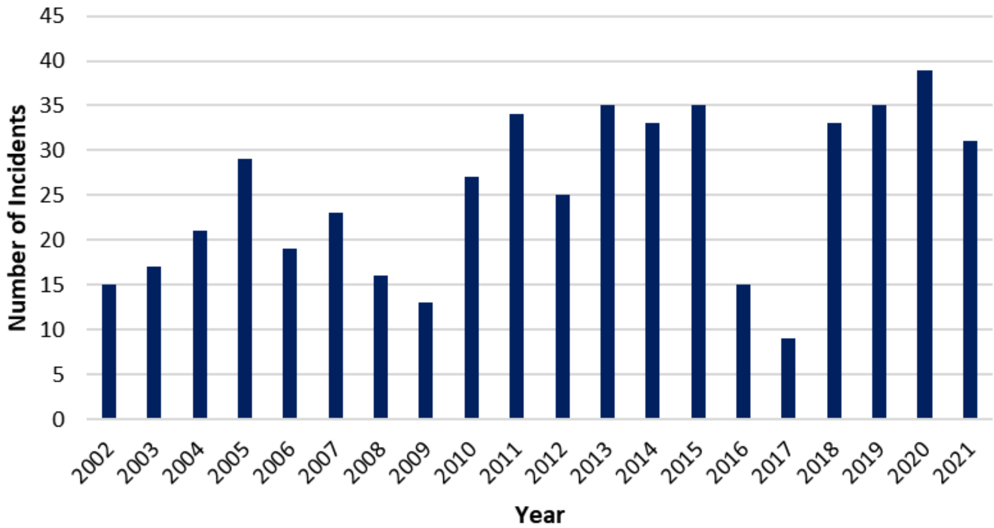

Figure B.9 MAIB Annual Collision Incidents within UK Waters (2002 to 2021)

672. The average number of collision incidents per year was 25. There has been an overall slight increasing trend in collision incidents over the 20-year period, which may be due to better reporting of less serious incidents in recent years.

673. The distribution of vessel types involved in collision incidents is presented in Figure B.10

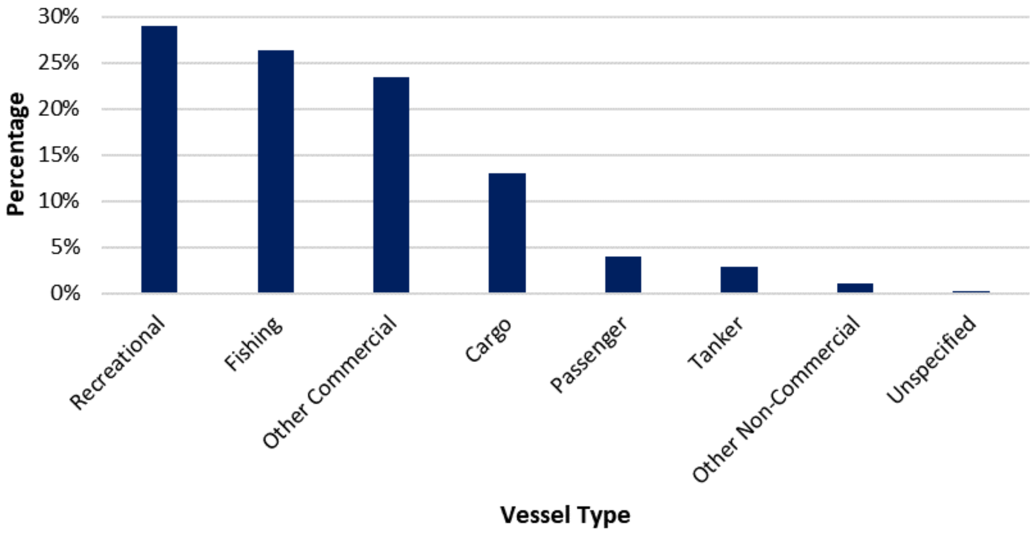

Figure B.10 MAIB Collision Incidents by Vessel Type within UK Waters (2002 to 2021)

674. The most frequent vessel types involved in collision incidents were recreational vessels (29%), fishing vessels (26%), other commercial vessels (24%) and cargo vessels (13%).

675. A total of five fatalities were reported in MAIB collision incidents within UK waters between 2002 and 2021. Details of each of these fatal incidents reported by the MAIB are presented in Table B.2.

Table B.2 Description of Fatal MAIB Collision Incidents (2002 to 2021)

Date	Description	Fatalities
July 2005	Collision between two powerboats at night. Both vessels were unlit and both helmsmen had consumed alcohol. One of the helmsmen died.	1
October 2007	Collision between fishing vessel and coastal general cargo vessel following failure to keep an effective lookout. Fishing vessel sank with three of the four crew members abandoning ship into a life raft but the fourth crew member was not recovered.	1
August 2010	Collision between passenger ferry and fishing vessel. Fishing vessel sank with one of the two crew members recovered from the sea but the other member was not recovered despite an extensive search.	1

Date	Description	Fatalities
June 2015	Collision between Rigid-hulled Inflatable Boat (RIB) and yacht. Believed that around a dozen persons were onboard the motorboat with the majority taken ashore by lifeboat. One person seriously injured and airlifted to hospital before being pronounced dead later.	1
June 2018	Collision between power boats during a race. One of the vessels overturned with the pilot pronounced dead at the scene.	1

B.3.3 Contact Incidents

676. The MAIB define a contact incident as "*ships striking or being struck by an external object. The objects can be: floating object (cargo, ice, other or unknown); fixed object, but not the sea bottom; or flying object*" (MAIB, 2013).

677. A total of 288 contact incidents were reported to the MAIB within UK waters between 2002 and 2021 involving 324 vessels (in a small number of cases the contact involved a moving vessel and a stationary vessel).

678. The locations of contact incidents reported in proximity to the UK are presented in Figure B.11.

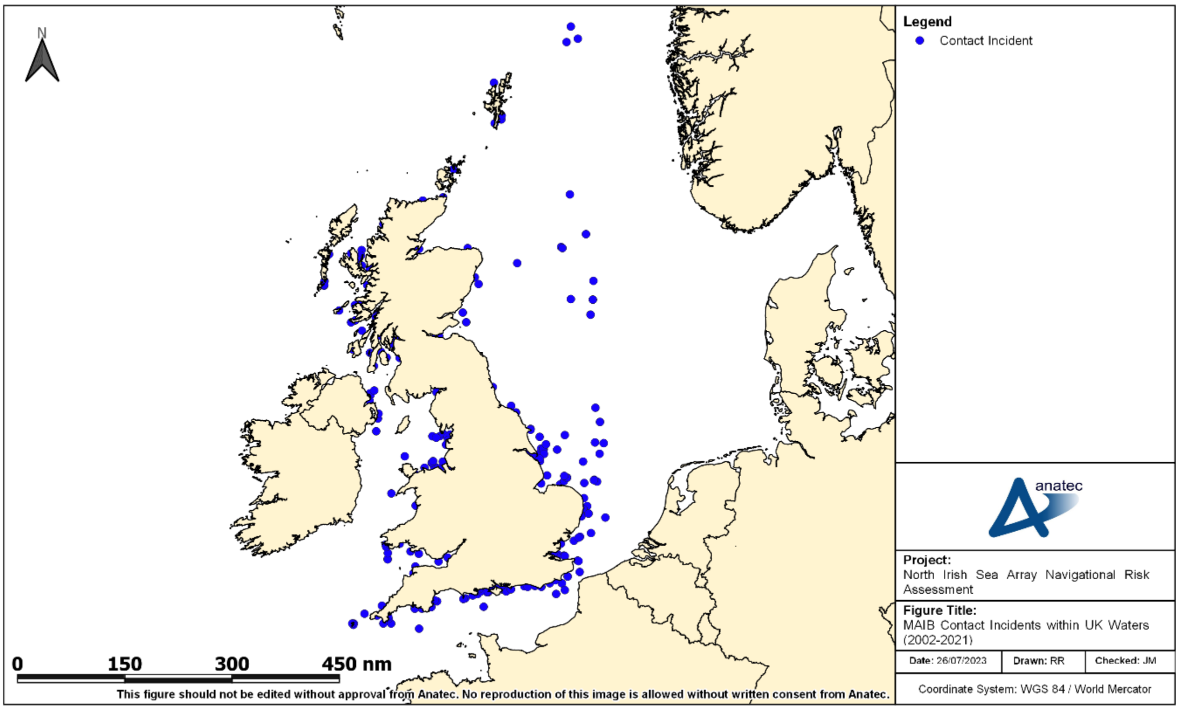

Figure B.11 MAIB Contact Incident Locations within UK waters (2002 to 2021)

679. The distribution of contact incidents per year is presented in Figure B.12.

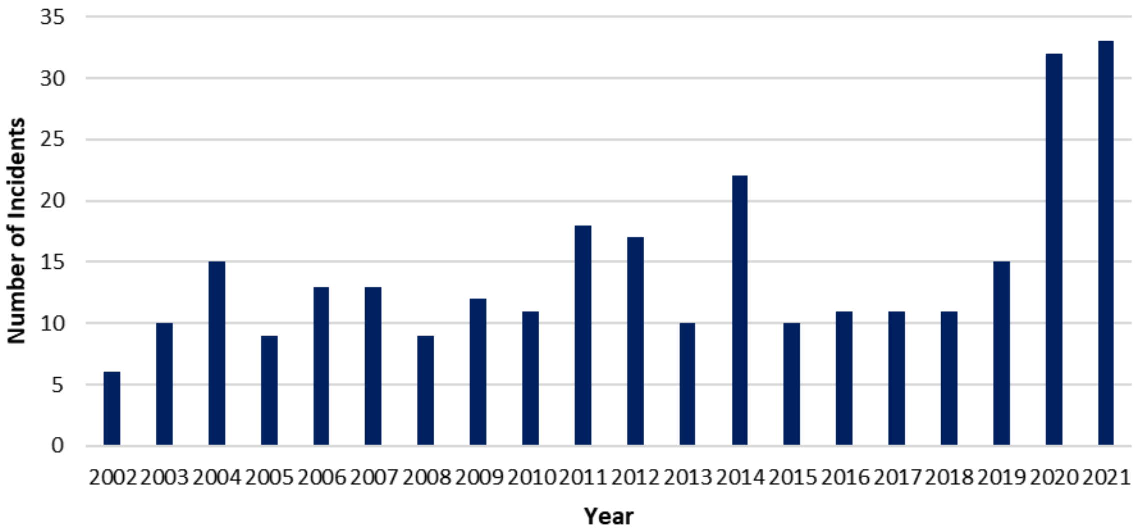

Figure B.12 MAIB Contact Incidents per Year within UK Waters (2002 to 2021)

680. The average number of contact incidents per year was 14. As with collision incidents, there has been an overall slight increasing trend over the 20-year period, which may be due to better reporting of less serious incidents in recent years. The spike in contact incidents in 2020 and 2021 may be a result of changes to reporting method and criteria.

681. The distribution of vessel types involved in contact incidents is presented in Figure B.13.

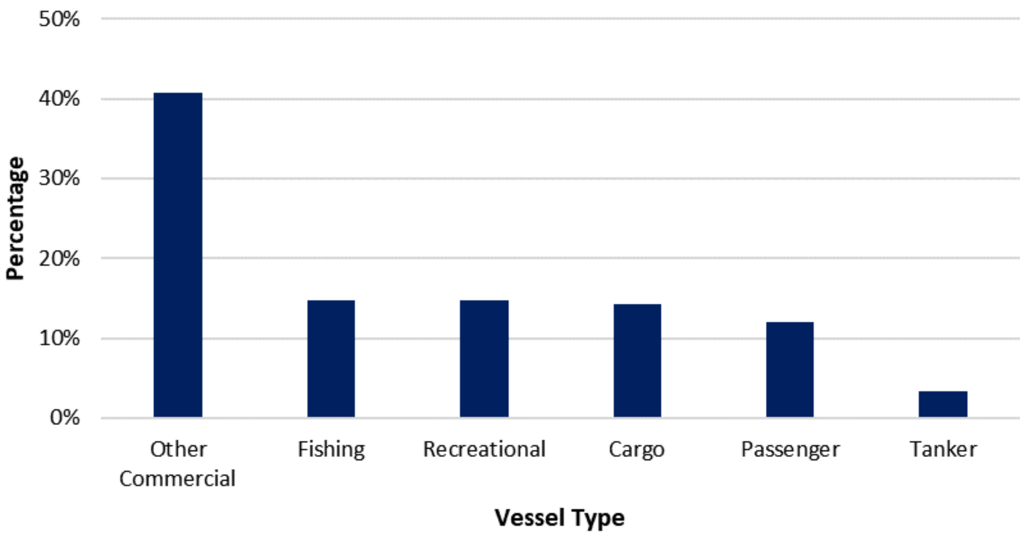

Figure B.13 MAIB Contact Incidents by Vessel Type within UK Waters (2002 to 2021)

682. The most frequent vessel types involved in contact incidents were other commercial vessels (41%), fishing vessels (15%) and recreational vessels (15%).

683. A total of two fatalities was reported in MAIB contact incidents within UK waters between 2002 and 2021. Details of this fatal incident reported by the MAIB are presented in Table B.3.

Table B.3 Description of Fatal MAIB Contact Incidents (2002 to 2021)

Date	Description	Fatalities
June 2012	Contact between RIB and jetty. RIB badly damaged around the bow and fenders on the jetty also damaged. The RIB owner had consumed alcohol and suffered fatal injuries following the impact.	1
August 2020	Contact between RIB and buoy.	1

B.4 Fatality Risk

B.4.1 Incident Data

684. This section uses the MAIB incident data along with information on average manning levels per vessel type to estimate the probability of a fatality in a maritime incident associated with the proposed development.

685. The proposed development is assessed to have the potential to affect the following incidents:

- Vessel to vessel collision;
- Powered vessel to structure allision;
- Drifting vessel to structure allision; and
- Fishing vessel to structure allision.

686. Of these incident types, only vessel to vessel collisions match the MAIB definition of collisions and hence the fatality analysis presented in Section B.3.2 is considered directly applicable to these types of incidents.

687. The other scenarios of powered vessel to structure allision, drifting vessel to structure allision and fishing vessel to structure allision are technically contacts since they would involve a vessel striking an immobile object in the form of a WTG or OSP. From Section B.4.3, only two of the 288 contact incidents reported by the MAIB between 2002 and 2021 resulted in a fatality, with both contacts involving a RIB in coastal waters.

688. As the mechanics involved in a vessel contacting a WTG may differ in severity from striking, for example, a buoy, quayside or moored vessel, the MAIB collision fatality risk rate has also been conservatively applied for the allision incident types.

B.4.2 Fatality Probability

689. Five of the 504 collision incidents reported by the MAIB within UK waters between 2002 and 2021 resulted in one or more fatalities. This gives a 1.0% probability that a collision incident will lead to a fatal accident.

690. To assess the fatality risk for personnel onboard a vessel (crew, passenger or other) the number of persons involved in the incidents needs to be estimated. Table B.4 presents the average number of POB estimated for each category of vessel navigating in proximity to the proposed development. For passenger vessels this is based upon information available for the specific vessels recorded in the vessel traffic survey data. For other vessel categories, this is based upon information available from the MAIB incident data.

Table B.4 Estimated Average POB by Vessel Category

Vessel Category	Sub Categories	Source of Estimated Average POB	Estimated Average POB
Cargo/ freight	Dry cargo, other commercial, service ship, etc.	MAIB incident data	15
Tanker	Tanker/ combination carrier	MAIB incident data	23
Passenger	RoRo passenger, cruise liner, etc.	Vessel traffic survey data / online information	368
Fishing	Trawler, potter, dredger, etc.	MAIB incident data	3.3
Recreational	Yacht, small commercial motor yacht, etc.	MAIB incident data	3.3

691. It is recognised that these average POB numbers can be substantially higher or lower on an individual vessel basis depending upon the size, subtype, etc. but applying reasonable averages is considered sufficient for this analysis, particularly when noting that the average POB for the dominant vessel category (passenger) is based upon the vessel traffic survey data where possible.

692. Using the average POB, along with the vessel type information involved in collision incidents reported by the MAIB (see Section B.4.2), there was an estimated 20,199 POB the vessels involved in the collision incidents.

693. Based upon five fatalities, the overall fatality probability in a collision for any individual onboard is approximately 2.5×10^{-4} per collision.

694. It is considered inappropriate to apply this rate uniformly as the statistics indicate that the fatality probability associated with smaller craft, such as fishing vessels and recreational vessels, is higher. Therefore, the fatality probability has been subdivided into three categories of vessel as presented in Table B.5. In addition, due to zero fatalities resulting from commercial vessel collisions during the period 2002 to 2021, the time period used to assess the fatality probability for commercial vessels has been extended by five years to ensure a meaningful probability is captured.

Table B.5 Collision Incident Fatality Probability by Vessel Category

Vessel Category	Sub Categories	Fatalities	People Involved	Fatality Probability	Time Period
Commercial	Dry cargo, passenger, tanker, etc.	1	18,249	5.5×10^{-5}	1997 to 2021 (25 years)
Fishing	Trawler, potter, dredger, etc.	2	927	2.2×10^{-3}	2002 to 2021 (20 years)
Recreational	Yacht, small commercial motor yacht, etc.	3	1,023	2.9×10^{-3}	2002 to 2021 (20 years)

B.4.3 Fatality Risk due to the Proposed Development

695. The base case and future case annual collision frequency levels pre and post wind farm for the proposed development are summarised in Table B.6.

Table B.6 Summary of Annual Collision and Allision Risk Results

Collision/Allision Scenario	Base Case			Future Case (20%)		
	Pre Wind Farm	Post Wind Farm	Change	Pre Wind Farm	Post Wind Farm	Change
Vessel to vessel collision	2.55×10^{-4} (1 in 3,919 years)	3.55×10^{-4} (1 in 2,814 years)	1×10^{-4} (1 in 9,988 years)	3.76×10^{-4} (1 in 2,659 years)	5.24×10^{-4} (1 in 1,910 years)	1.48×10^{-4} (1 in 6,776 years)
Powered vessel to structure allision	N/A	9.53×10^{-4} (1 in 1,049 years)	9.53×10^{-4} (1 in 1,049 years)	N/A	1.2×10^{-3} (1 in 862 years)	1.2×10^{-3} (1 in 862 years)
Drifting vessel to structure allision	N/A	5.94×10^{-5} (1 in 16,835 years)	5.94×10^{-5} (1 in 16,835 years)	N/A	7.21×10^{-5} (1 in 13,877 years)	7.21×10^{-5} (1 in 13,877 years)
Fishing vessel to structure allision	N/A	3.33×10^{-1} (1 in 3.00 years)	3.33×10^{-1} (1 in 3.00 years)	N/A	4.00×10^{-1} (1 in 2.50 years)	4.00×10^{-1} (1 in 2.50 years)
Total	2.55×10^{-4} (1 in 3,919 years)	3.35×10^{-1} (1 in 3.00 years)	3.34×10^{-1} (1 in 3.00 years)	3.76×10^{-4} (1 in 2,659 years)	4.02×10^{-1} (1 in 2.49 years)	4.01×10^{-1} (1 in 2.49 years

696. From the detailed results of the collision and allision risk modelling, the distribution of the predicted change in annual collision and allision frequency by vessel type due to the proposed development for the base case and future case are presented in Figure B.14.

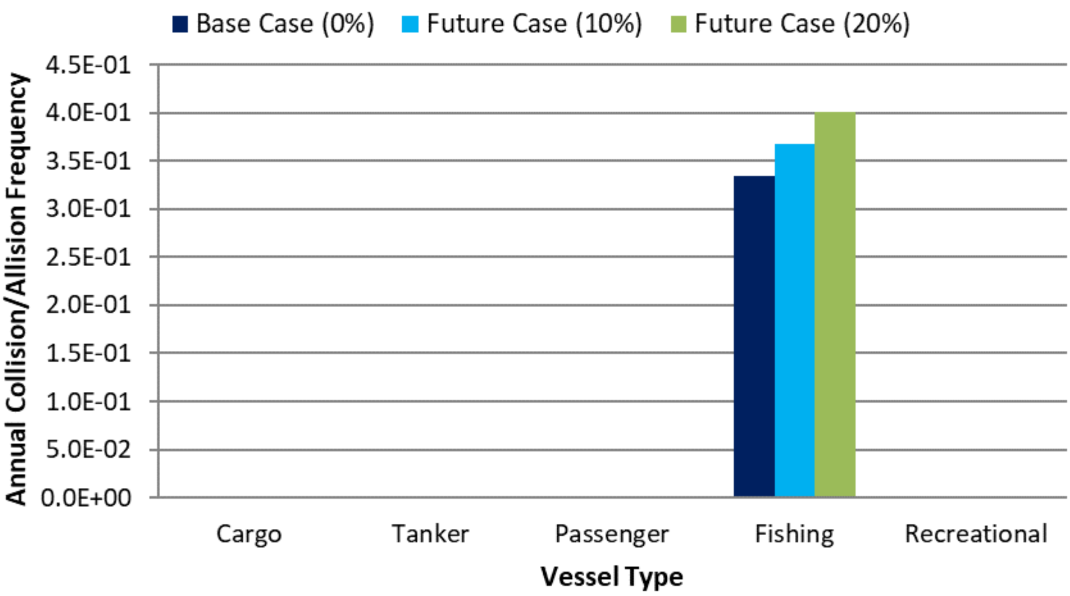

Figure B.14 Estimated Change in Annual Collision and Allision Frequency by Vessel Type

697. The change in collision and allision frequency is dominated by fishing vessels due to their prevalence within the study area in comparison to other vessel types, particularly from activity by vessels engaged in fishing activities and the high allision risk associated with fishing vessels navigating internally within the array area. The distribution of the predicted change in annual collision and allision frequency by vessel type, excluding fishing, is presented in Figure B.15.

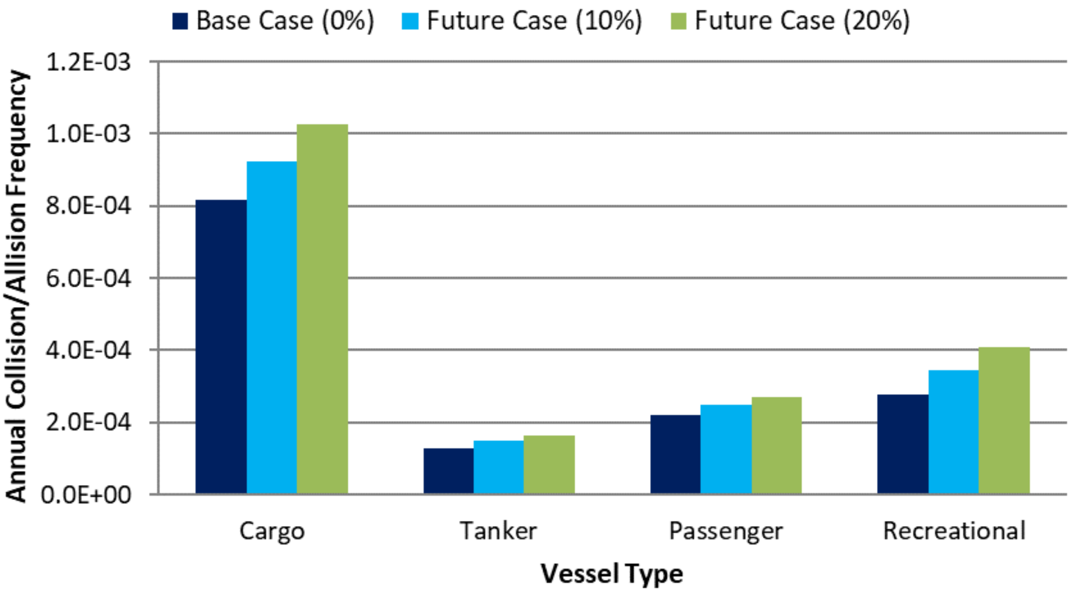

Figure B.15 Estimated Change in Annual Collision and Allision Frequency by Vessel Type [Excluding Fishing Vessels]

698. The second greatest collision and allision frequency change was associated with cargo vessels, which was significantly lower than for fishing vessels.

699. Combining the annual collision and allision frequency (see Table B.6), estimated number of POB for each vessel type (see Table B.4) and the estimated fatality probability for each vessel type category (see Table B.5), the annual increase in PLL due to the presence of the proposed development for the base case is estimated to be 2.38×10^{-3}, equating to one additional fatality every 420 years.

700. The estimated incremental increases in PLL due to the proposed development distributed by vessel type and for the base case and future case, are presented in Figure B.16. As with the change in collision and allision frequency, the same data is presented in Figure B.17, excluding fishing vessels.

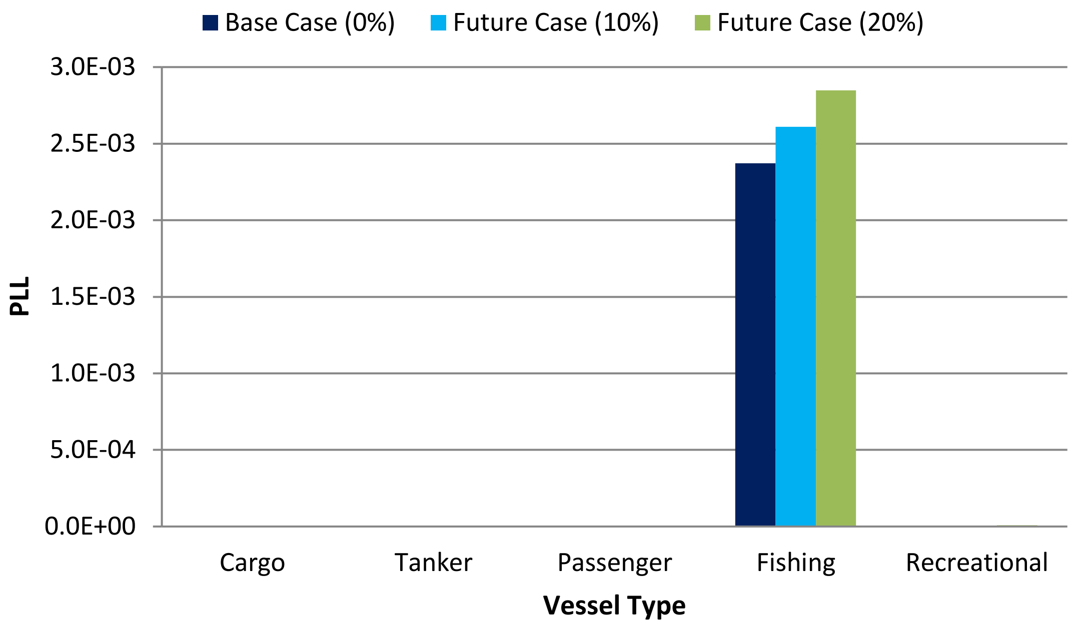

Figure B.16 Estimated Change in Annual PLL by Vessel Type

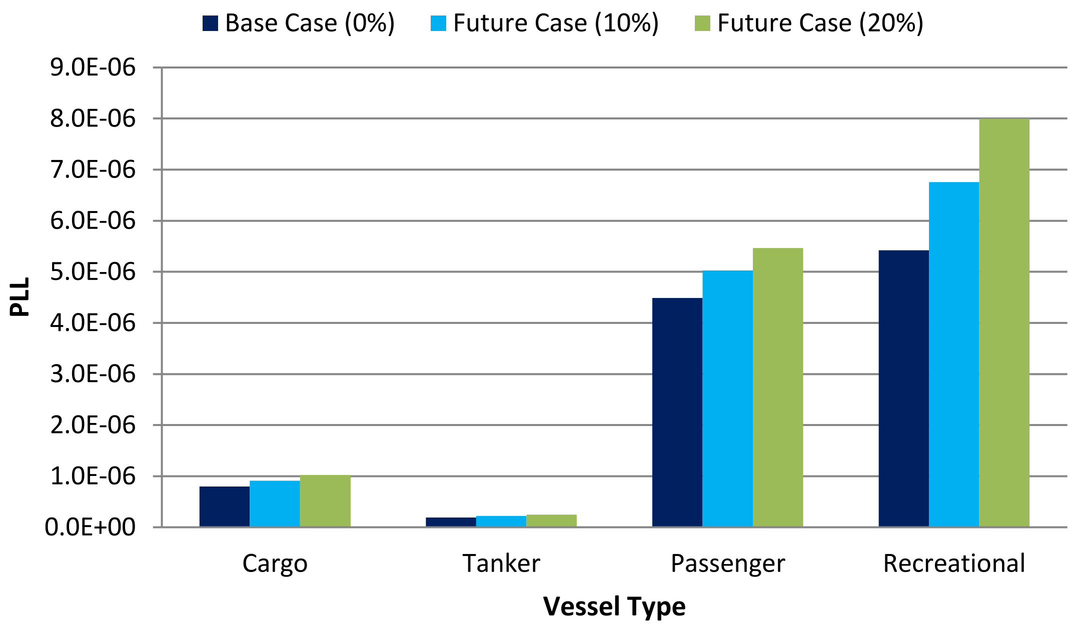

Figure B.17 Estimated Change in Annual PLL by Vessel Type [Excluding Fishing Vessels]

701. As with the change in collision and allision frequency, the change in annual PLL is dominated by fishing vessels which historically have a higher fatality probability than commercial vessels.

702. Converting the PLL to individual risk based upon the average number of people exposed by vessel type, the results are presented in Figure B.18. Again, following this, the same data is presented in Figure B.19, excluding fishing vessels.

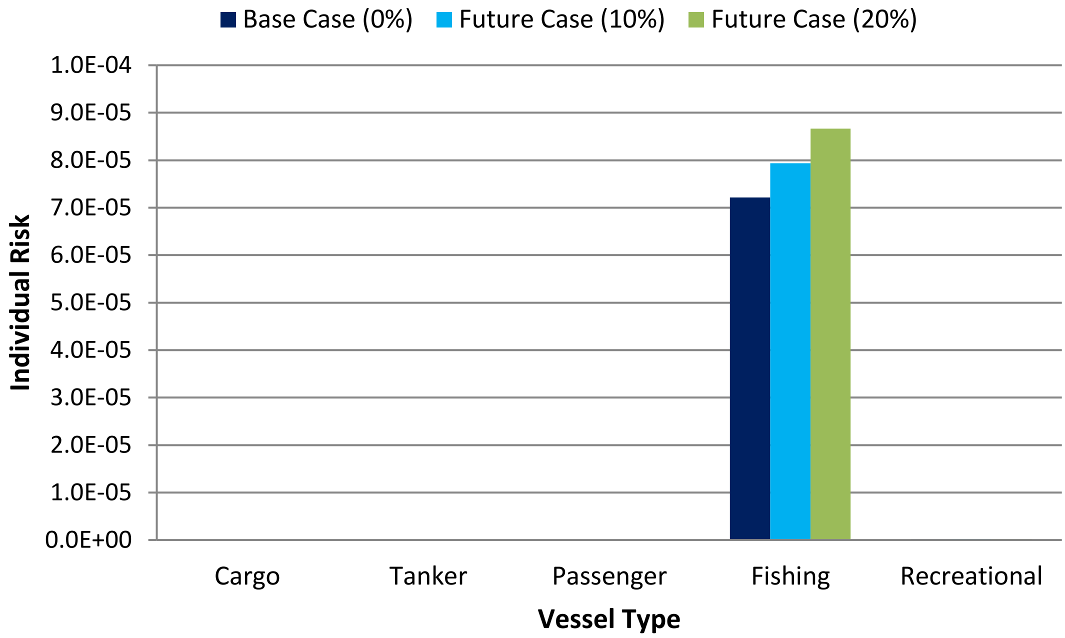

Figure B.18 Estimated Change in Individual Risk by Vessel Type

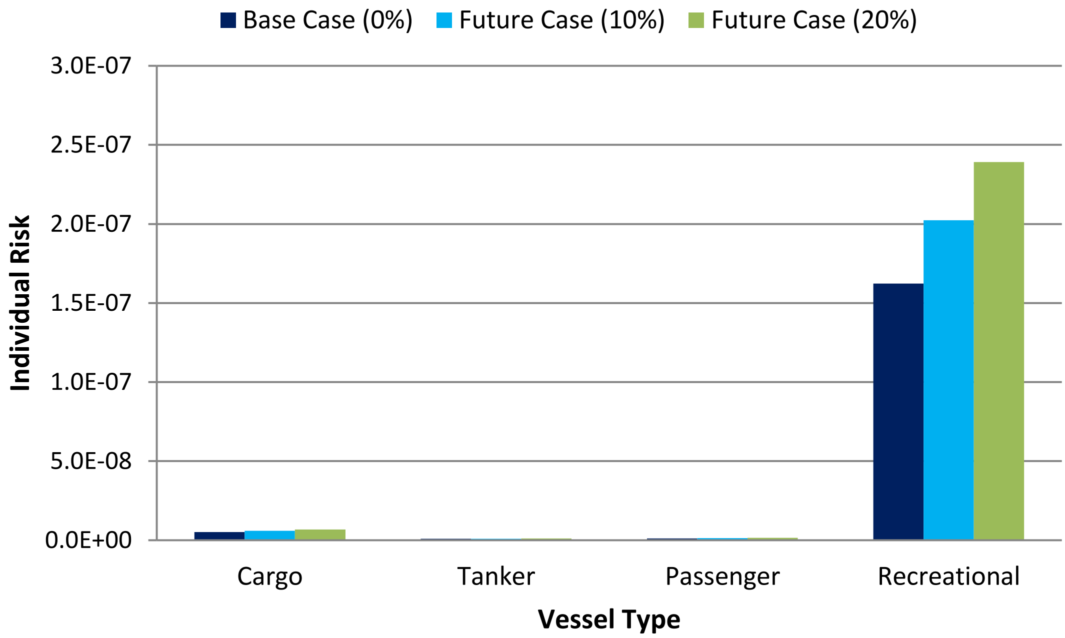

Figure B.19 Estimated Change in Individual Risk by Vessel Type [Excluding Fishing Vessels]

703. It can be seen that the individual risk to people is dominated by fishing vessels, reflecting the higher probability of a fatality occurring in the event of an incident involving a fishing vessel in comparison to other vessel types.

B.4.4 Significance of Increase in Fatality Risk

704. In comparison to MAIB statistics, which indicate an average of 18 to 19 fatalities per year in UK territorial waters during the 20-year period between 2002 and 2021, the overall increase for the base case in PLL of one additional fatality per 420 years represents a negligible change.

705. In terms of individual risk to people, the change for commercial vessels attributed to the proposed development (approximately 7.25×10^{-9} for the base case) is negligible compared to the background risk level for the UK sea transport industry of 2.9×10^{-4} per year.

706. For fishing vessels, the change in individual risk attributed to the proposed development (approximately 7.21×10^{-5} for the base case) is low compared to the background risk level for the UK sea fishing industry of 1.2×10^{-3} per year.

B.5 Pollution Risk

B.5.1 Historical Analysis

707. The pollution consequences of a collision in terms of oil spill depend upon the following criteria:

- Spill probability (i.e., the likelihood of outflow following an incident); and
- Spill size (quantity of oil).

708. Two types of oil spill are considered in this assessment:

- Fuel oil spills from bunkers (all vessel types); and
- Cargo oil spills (laden tankers).

709. The research undertaken as part of the DfT's MEHRAs project (DfT, 2001) has been used as it was comprehensive and based upon worldwide marine oil spill data analysis. From this research, the overall probability of a spill per incident was calculated based upon historical incident data for each incident type as presented in Figure B.20.

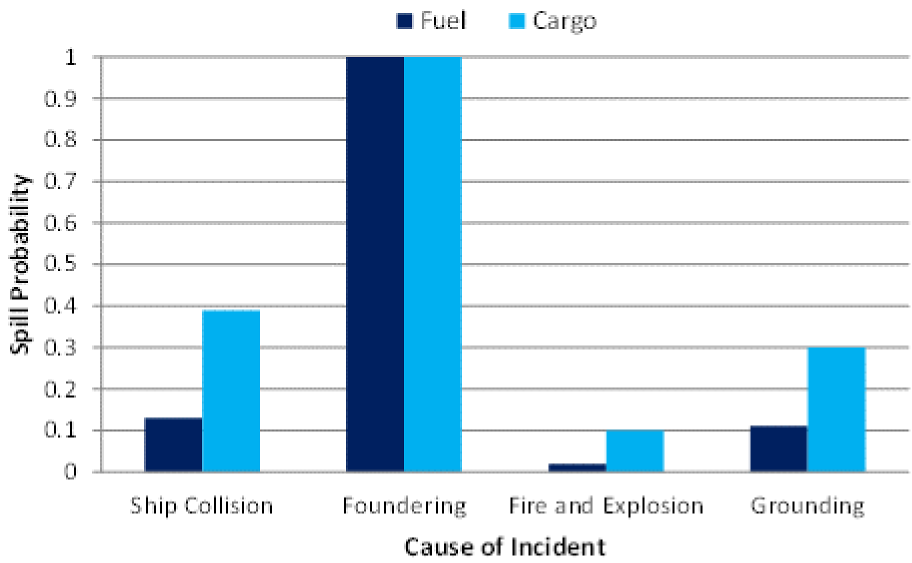

Figure B.20 Probability of an Oil Spill Resulting from an Accident

710. Therefore, it was estimated that 13% of vessel collisions result in a fuel oil spill and 39% of collisions involving a laden tanker result in a cargo oil spill.

711. In the event of a bunker spill, the potential outflow of oil depends upon the bunker capacity of the vessel. Historical bunker spills from vessels have generally been limited to a size below 50% of bunker capacity, and in most incidents much lower.

712. For the types and sizes of vessels exposed to the proposed development, an average spill size of 100 tonnes of fuel oil is considered a conservative assumption.

713. For cargo spills from laden tankers, the spill size can vary significantly. The ITOPF reported the following spill size distribution for tanker collisions between 1974 and 2004:

- 31% of spills below seven tonnes;
- 52% of spills between seven and 700 tonnes; and
- 17% of spills greater than 700 tonnes.

714. Based upon this data and the tankers transiting in proximity to the proposed development, an average spill size of 400 tonnes is considered a conservative assumption.

715. For fishing vessel collisions, comprehensive statistical data is not available. Consequently, it is conservatively assumed that 50% of all collisions involving fishing vessels will lead to oil spill with the quantity spilled being on average five tonnes. Similarly for recreational vessels, due to a lack of data 50% of collisions are conservatively assumed to lead to a spill with an average size of one tonne.

B.5.2 Pollution Risk due to the Proposed Development

716. Applying the above probabilities to the annual collision and allision frequency by vessel type presented in Table B.6 and the average spill size per vessel, the amount of oil spilled per year due to the impact of the proposed development is estimated to be 0.87 per year for the base case and 1.04 per year for the future case (20%).

717. The estimated increase in tonnes of oil spilled, distributed by vessel type, for the base case and future case are presented in Figure B.21. Again, following this, the same data is presented in Figure B.22, excluding fishing vessels.

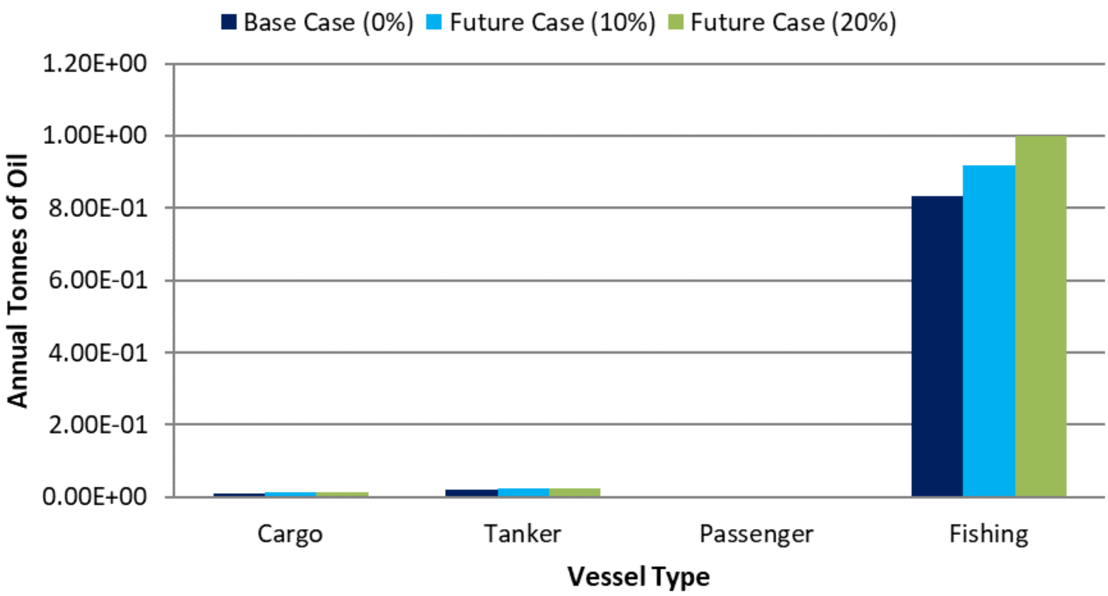

Figure B.21 Estimated Change in Pollution by Vessel Type

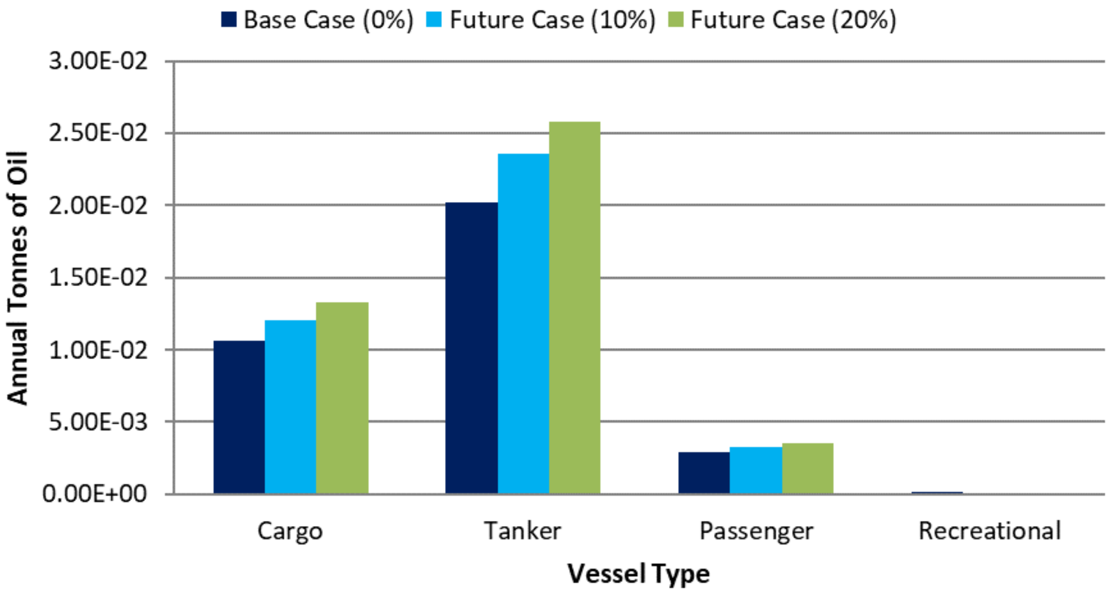

Figure B.22 Estimated Change in Pollution by Vessel Type [Excluding Fishing Vessels]

718. The annual oil spill results are dominated by fishing vessels due to their high associated annual collision and allision frequency. Tankers, cargo vessels, and then passenger vessels also contribute to the annual oil spill estimate, but at a low volume. Tankers are the greatest contributor of the three vessel types which reflects the greater volume of oil spillage anticipated per incident involving tankers.

B.5.3 Significance of Increase in Pollution Risk

719. To assess the significance of the increased pollution risk from vessels caused by the proposed development, historical oil spill data for the UK has been used as a benchmark (owing to the lack of equivalent data being available for Ireland but noting the international nature of shipping and proximity of UK and Irish waters).

720. From the MEHRAs research, the annual average tonnes of oil spilled in UK waters due to maritime incidents in the 10-year period from 1989 to 1998 was 16,111. This is based upon a total of 146 reported oil pollution incidents of greater than one tonne (smaller spills are excluded as are incidents which occurred within port or harbour areas or resulting from operational errors or equipment failure). Commercial vessel spills accounted for approximately 99% of the total while fishing vessel incidents accounted for less than 1%.

721. The overall increase in pollution estimated due to the proposed development of 0.87 tonnes for the base case represents a 0.005% increase compared to the historical average pollution quantities from maritime incidents in UK waters.

B.6 Conclusion

722. This appendix has quantitively assessed the fatality and pollution risk associated with the proposed development in the event of a collision or allision incident occurring. The assessment indicates that the fatality and pollution risk associated with fishing vessels is greatest.

723. Overall, the impact of the proposed development on people and the environment is relatively low compared to the existing background risk levels in UK waters. However, this is the localised impact of a single offshore wind farm development and there will be additional maritime risks associated with other offshore wind farm developments in the Irish Sea and the Ireland as a whole.

724. Discussion of relevant mitigation measures and monitoring is provided in Section 20 of the NRA.

Appendix C Regular Operator Consultation

725. As part of the consultation process for the proposed development, Regular Operators identified (from the vessel traffic survey data) in proximity to the array area were consulted via email. An example of the correspondence sent to the Regular Operators is presented below.

Anatec Ltd.
Cain House
10 Exchange Street
Aberdeen AB11 6PH
Tel: 01224 253700
Email: aberdeen@anatec.com
Web: www.anatec.com

Date: 28th March 2023

Opportunity to Participate in Consultation Relating to Shipping and Navigation for the Proposed North Irish Sea Array (NISA) Offshore Wind Farm

Dear Sir/Madam,

As you may be aware, North Irish Sea Array (NISA) Windfarm Limited, a Joint Venture between Statkraft Ireland and Copenhagen Infrastructure Partners (CIP), is the Developer of NISA, a proposed offshore wind farm development on the east coast of Ireland. Following a Scoping Report published in May 2021 (see here), a Navigational Risk Assessment (NRA) is being undertaken to inform the Environmental Impact Assessment (EIA).

An overview of NISA is provided in Figure 1. The wind farm array is located approximately 6.1 nautical miles (nm) off the Irish east coast, west of Drogheda Port and north of Dublin Port. The wind farm array includes an infrastructure boundary covering an area of approximately 26nm^2 within which up to 46 wind turbine generators (WTG) and one offshore substation platform (OSP) will be installed. An offshore export cable corridor (ECC) runs between the wind farm array and a landfall location at Braymore Point. The offshore ECC covers an area of approximately 20nm^2.

Figure 1 Overview of NISA

Further information about NISA can be found here.

Anatec has been contracted by NISA Windfarm Ltd. to provide technical support on shipping and navigation during the EIA process, and to coordinate consultation with relevant stakeholders. As part of this support, Anatec has undertaken an assessment of 28 days of Automatic Identification System (AIS), Radar and visual observations data (14 days in December 2021 and 14 days in July 2022) to identify regular commercial operators. This exercise has identified your organisation as a regular operator within or in proximity to the wind farm array.

We therefore invite your feedback on NISA, including any impact it may have upon the navigation of vessels. Whilst we welcome all feedback we are particularly interested in any comments or feedback relating to the following:

1. Whether the presence of NISA is likely to impact the routeing of any specific vessels and/or routes, including the nature of any change in regular passage.
2. Whether the presence of NISA poses any safety concerns to your vessels, including in relation to adverse weather routeing.
3. Whether you would choose to make passage internally through the wind farm array.
4. Whether you wish to be retained on our list of marine stakeholders and consulted throughout the NRA process.

Additionally, we would like to invite you to attend a Hazard Workshop scheduled to take place in May 2023 (further details to follow).

We would appreciate that any responses are provided via email to [redacted] by Friday 21st April, as well as an indication of whether you are interested in attending the Hazard Workshop noted above.

Yours sincerely,

[redacted]
Risk Analyst
Anatec Ltd.

Appendix D Hazard Log

726. The complete hazard log, produced following the Hazard Workshop in June 2023 is presented in Table D.1. The Hazard Workshop methodology, including the approach to the hazard log, is provided in Section 3.3.1.

Table D.1 Hazard Log

User	Isolation / Cumulative	Project Component(s)	Phase (C/O/D)	Embedded Mitigation Measures (Full Descriptions Provided in Section 20)	Possible Causes	Most Likely Consequences	Realistic Most Likely Consequences								Worst Case Consequences	Realistic Worst Case Consequences							Further Mitigation Required and Additional Comments
							Frequency	Consequences					Risk			Frequency	Consequences					Risk	
								People	Environment	Property	Business	Average Consequence					People	Environment	Property	Business	Average Consequence		
Increased Vessel to Vessel Collision Risk Between Third-Party Vessels Resulting from Displacement (Including Adverse Weather)																							
Commercial vessels	Isolation	Array area	C/D	Advisory safe passing distances Buoyed construction area Compliance with relevant regulator guidance Guard vessel(s) Liaison with Irish Coast Guard (IRCG) in relation to Search and rescue (SAR) resources Lighting and marking Marking on nautical charts Promulgation of information Structure Exclusion Zone	Presence of buoyed construction area Adverse weather Reduced sea room between the Infrastructure Boundary and Rockabill Construction vessels which are restricted in their ability to manoeuvre (RAM)	Increased journey time/distance but does not impact on schedules Increased encounters but does not impact compliance with Convention on the International Regulations for Preventing Collisions at Sea, 1972 (COLREGs)	5	1	1	1	2	1.3	**Tolerable**		Displacement including to navigation in adverse weather resulting in increased encounters and impacts on compliance with COLREGs, resulting in a collision event with vessel damage, potential loss of life (PLL), and/or pollution	2	4	4	4	4	4.0	**Tolerable**	Multiple stakeholders raised concern over available sea room between the Infrastructure Boundary and Rockabill for encountering vessels - depending on Master preference some sensitive vessels may choose to pass around the array resulting in increased journey distances - Structure Exclusion Zone added as an embedded mitigation measure. Irish Chamber of Shipping noted that deviations will be more direct than presented.

			O	Advisory safe passing distances Compliance with relevant regulator guidance Guard vessel(s) Liaison with IRCG in relation to SAR resources Lighting and marking Marking on nautical charts Promulgation of information Structure Exclusion Zone	Adverse weather Reduced sea room between the Infrastructure Boundary and Rockabill Maintenance vessels which are RAM Visual interference associated with a third-party vessel exiting the array	Increased journey time/distance but does not impact on schedules Increased encounters but does not impact compliance with COLREGs	5	1	1	1	2	1.3	**Tolerable**	Displacement including to navigation in adverse weather resulting in increased encounters and impacts on compliance with COLREGs, resulting in a collision event with vessel damage, PLL, and/or pollution	3	4	4	4	4	4.0	**Tolerable**	Multiple stakeholders raised concern over available sea room between the Infrastructure Boundary and Rockabill for encountering vessels - depending on Master preference some sensitive vessels may choose to pass around the array resulting in increased journey distances - Structure Exclusion Zone added as an embedded mitigation measure. Irish Chamber of Shipping noted that deviations will be more direct than presented. Worst case frequency increased during operational phase due to no buoyed construction area.
		ECC	C/D	Advisory safe passing distances Compliance with relevant regulator guidance Guard vessel(s)	Adverse weather Construction vessels which are RAM	Increased journey time/distance but does not impact on schedules Increased encounters but does not impact	4	1	1	1	1	1.0	**Broadly Acceptable**	Displacement including to navigation in adverse weather resulting in increased encounters and impacts on	1	4	4	4	4	4.0	**Tolerable**	

User	Isolation / Cumulative	Project Component(s)	Phase (C/O/D)	Embedded Mitigation Measures (Full Descriptions Provided in Section 20)	Possible Causes	Most Likely Consequences	Realistic Most Likely Consequences							Worst Case Consequences	Realistic Worst Case Consequences							Further Mitigation Required and Additional Comments
							Frequency	Consequences: People	Consequences: Environment	Consequences: Property	Consequences: Business	Consequences: Average Consequence	Risk		Frequency	Consequences: People	Consequences: Environment	Consequences: Property	Consequences: Business	Consequences: Average Consequence	Risk	
				Liaison with IRCG in relation to SAR resources Marking on nautical charts Promulgation of information		compliance with COLREGs								compliance with COLREGs, resulting in a collision event with vessel damage, PLL, and/or pollution								
			O	Advisory safe passing distances Compliance with relevant regulator guidance Guard vessel(s) Liaison with IRCG in relation to SAR resources Marking on nautical charts Promulgation of information	Adverse weather Maintenance vessels which are RAM	Increased journey time/distance but does not impact on schedules Increased encounters but does not impact compliance with COLREGs	4	1	1	1	1	1.0	**Broadly Acceptable**	Displacement including to navigation in adverse weather resulting in increased encounters and impacts on compliance with COLREGs, resulting in a collision event with vessel damage, PLL, and/or pollution	1	4	4	4	4	4.0	**Tolerable**	

	Cumulative	Array area	C/D	Advisory safe passing distances Buoyed construction area Compliance with relevant regulator guidance Guard vessel(s) Liaison with IRCG in relation to SAR resources Lighting and marking Marking on nautical charts Promulgation of information Structure Exclusion Zone	Presence of buoyed construction areas Adverse weather Reduced sea room between the Infrastructure Boundary and Rockabill Construction vessels which are RAM	Increased journey time/distance but does not impact on schedules Increased encounters but does not impact compliance with COLREGs	5	1	1	1	2	1.3	**Tolerable**	Displacement including to navigation in adverse weather resulting in increased encounters and impacts on compliance with COLREGs, resulting in a collision event with vessel damage, PLL, and/or pollution	2	4	4	4	5	4.3	**Tolerable**	Includes consideration of the Relevant Projects, Bremore Port development and Dublin Port development. Multiple stakeholders raised concern over available sea room between the Infrastructure Boundary and Rockabill for encountering vessels - depending on Master preference some sensitive vessels may choose to pass around the array resulting in increased journey distances - Structure Exclusion Zone added as an embedded mitigation measure. Irish Chamber of Shipping noted that deviations will be more direct than presented. Worst case frequency increased from in isolation scenario given the potential for vessels

User	Isolation / Cumulative	Project Component(s)	Phase (C/O/D)	Embedded Mitigation Measures (Full Descriptions Provided in Section 20)	Possible Causes	Most Likely Consequences	Realistic Most Likely Consequences							Worst Case Consequences	Realistic Worst Case Consequences							Further Mitigation Required and Additional Comments
							Frequency	Consequences: People	Consequences: Environment	Consequences: Property	Consequences: Business	Consequences: Average Consequence	Risk		Frequency	Consequences: People	Consequences: Environment	Consequences: Property	Consequences: Business	Consequences: Average Consequence	Risk	
																						associated with Bremore Port navigating the sea room between Infrastructure Boundary and Rockabill.

			O	Advisory safe passing distances Compliance with relevant regulator guidance Guard vessel(s) Liaison with IRCG in relation to SAR resources Lighting and marking Marking on nautical charts Promulgation of information Structure Exclusion Zone	Presence of other Relevant Projects Adverse weather Reduced sea room between the Infrastructure Boundary and Rockabill Maintenance vessels which are RAM Visual interference associated with a third-party vessel exiting the array	Increased journey time/distance but does not impact on schedules Increased encounters but does not impact compliance with COLREGs	5	1	1	1	2	1.3	**Tolerable**	Displacement including to navigation in adverse weather resulting in increased encounters and impacts on compliance with COLREGs, resulting in a collision event with vessel damage, PLL, and/or pollution	3	4	4	4	5	4.3	**Tolerable**	Includes consideration of the Relevant Projects, Bremore Port development and Dublin Port development. Multiple stakeholders raised concern over available sea room between the Infrastructure Boundary and Rockabill for encountering vessels - depending on Master preference some sensitive vessels may choose to pass around the array resulting in increased journey distances - Structure Exclusion Zone added as an embedded mitigation measure. Irish Chamber of Shipping noted that deviations will be more direct than presented. Worst case frequency increased during operational phase due to no buoyed

User	Isolation / Cumulative	Project Component(s)	Phase (C/O/D)	Embedded Mitigation Measures (Full Descriptions Provided in Section 20)	Possible Causes	Most Likely Consequences	Realistic Most Likely Consequences								Worst Case Consequences	Realistic Worst Case Consequences								Further Mitigation Required and Additional Comments
							Frequency	Consequences					Risk		Frequency	Consequences					Risk	
								People	Environment	Property	Business	Average Consequence				People	Environment	Property	Business	Average Consequence		
																						construction area.
		ECC	C/D	Advisory safe passing distances Compliance with relevant regulator guidance Guard vessel(s) Liaison with IRCG in relation to SAR resources Marking on nautical charts Promulgation of information	Adverse weather Construction vessels which are RAM	Increased journey time/distance but does not impact on schedules Increased encounters but does not impact compliance with COLREGs	4	1	1	1	1	1.0	**Broadly Acceptable**	Displacement including to navigation in adverse weather resulting in increased encounters and impacts on compliance with COLREGs, resulting in a collision event with vessel damage, PLL, and/or pollution	2	4	4	4	4	4.0	**Tolerable**	Includes consideration of the Bremore Port development.
			O	Advisory safe passing distances Compliance with relevant regulator guidance Guard vessel(s) Liaison with IRCG in relation to SAR resources Marking on nautical charts Promulgation of information	Adverse weather Maintenance vessels which are RAM	Increased journey time/distance but does not impact on schedules Increased encounters but does not impact compliance with COLREGs	4	1	1	1	1	1.0	**Broadly Acceptable**	Displacement including to navigation in adverse weather resulting in increased encounters and impacts on compliance with COLREGs, resulting in a collision event with vessel damage, PLL, and/or pollution	2	4	4	4	4	4.0	**Tolerable**	Includes consideration of the Bremore Port development.

User	Isolation / Cumulative	Project Component(s)	Phase (C/O/D)	Embedded Mitigation Measures (Full Descriptions Provided in Section 20)	Possible Causes	Most Likely Consequences	Realistic Most Likely Consequences							Worst Case Consequences	Realistic Worst Case Consequences							Further Mitigation Required and Additional Comments
							Frequency	Consequences: People	Environment	Property	Business	Average Consequence	Risk		Frequency	Consequences: People	Environment	Property	Business	Average Consequence	Risk	
Commercial fishing vessels in transit	Isolation	Array area	C/D	Advisory safe passing distances Buoyed construction area Compliance with relevant regulator guidance Guard vessel(s) Liaison with IRCG in relation to SAR resources Lighting and marking Marking on nautical charts Promulgation of information	Presence of buoyed construction area Adverse weather Reduced sea room between the Infrastructure Boundary and Rockabill Construction vessels which are RAM	Increased journey time/distance but does not impact on transits Increased encounters but does not impact compliance with COLREGs	5	1	1	1	1	1.0	Tolerable	Displacement including to navigation in adverse weather resulting in increased encounters and impacts on compliance with COLREGs, resulting in a collision event with vessel damage, PLL, and/or pollution	2	4	2	4	3	3.3	Broadly Acceptable	
			O	Advisory safe passing distances Compliance with relevant regulator guidance Guard vessel(s) Liaison with IRCG in relation to SAR resources Lighting and marking Marking on nautical charts Promulgation of information	Adverse weather Reduced sea room between the Infrastructure Boundary and Rockabill Maintenance vessels which are RAM Visual interference associated with a third-party vessel exiting the array	Increased journey time/distance but does not impact on transits Increased encounters but does not impact compliance with COLREGs	5	1	1	1	1	1.0	Tolerable	Displacement including to navigation in adverse weather resulting in increased encounters and impacts on compliance with COLREGs, resulting in a collision event with vessel damage, PLL, and/or pollution	3	4	2	4	3	3.3	Tolerable	Worst case frequency increased during operational phase due to no buoyed construction area.

User	Isolation / Cumulative	Project Component(s)	Phase (C/O/D)	Embedded Mitigation Measures (Full Descriptions Provided in Section 20)	Possible Causes	Most Likely Consequences	Realistic Most Likely Consequences								Worst Case Consequences	Realistic Worst Case Consequences								Further Mitigation Required and Additional Comments
							Frequency	Consequences: People	Environment	Property	Business	Average Consequence	Risk			Frequency	Consequences: People	Environment	Property	Business	Average Consequence	Risk		
		ECC	C/D	Advisory safe passing distances Compliance with relevant regulator guidance Guard vessel(s) Liaison with IRCG in relation to SAR resources Marking on nautical charts Promulgation of information	Adverse weather Construction vessels which are RAM	Increased journey time/distance but does not impact on transits Increased encounters but does not impact compliance with COLREGs	5	1	1	1	1	1.0	**Tolerable**		Displacement including to navigation in adverse weather resulting in increased encounters and impacts on compliance with COLREGs, resulting in a collision event with vessel damage, PLL, and/or pollution	2	4	2	4	3	3.3	**Broadly Acceptable**		
		ECC	O	Advisory safe passing distances Compliance with relevant regulator guidance Guard vessel(s) Liaison with IRCG in relation to SAR resources Marking on nautical charts Promulgation of information	Adverse weather Maintenance vessels which are RAM	Increased journey time/distance but does not impact on transits Increased encounters but does not impact compliance with COLREGs	5	1	1	1	1	1.0	**Tolerable**		Displacement including to navigation in adverse weather resulting in increased encounters and impacts on compliance with COLREGs, resulting in a collision event with vessel damage, PLL, and/or pollution	2	4	2	4	3	3.3	**Broadly Acceptable**		

User	Isolation / Cumulative	Project Component(s)	Phase (C/O/D)	Embedded Mitigation Measures (Full Descriptions Provided in Section 20)	Possible Causes	Most Likely Consequences	Realistic Most Likely Consequences								Worst Case Consequences	Realistic Worst Case Consequences								Further Mitigation Required and Additional Comments
							Frequency	Consequences					Risk			Frequency	Consequences					Risk		
								People	Environment	Property	Business	Average Consequence					People	Environment	Property	Business	Average Consequence			
	Cumulative	Array area	C/D	Advisory safe passing distances Buoyed construction area Compliance with relevant regulator guidance Guard vessel(s) Liaison with IRCG in relation to SAR resources Lighting and marking Marking on nautical charts Promulgation of information	Presence of buoyed construction area Adverse weather Reduced sea room between the Infrastructure Boundary and Rockabill Construction vessels which are RAM	Increased journey time/distance but does not impact on transits Increased encounters but does not impact compliance with COLREGs	5	1	1	1	1	1.0	**Tolerable**		Displacement including to navigation in adverse weather resulting in increased encounters and impacts on compliance with COLREGs, resulting in a collision event with vessel damage, PLL, and/or pollution	2	4	2	4	3	3.3	**Broadly Acceptable**		Includes consideration of the Relevant Projects.
	Cumulative	Array area	O	Advisory safe passing distances Compliance with relevant regulator guidance Guard vessel(s) Liaison with IRCG in relation to SAR resources Lighting and marking Marking on nautical charts Promulgation of information	Adverse weather Reduced sea room between the Infrastructure Boundary and Rockabill Maintenance vessels which are RAM Visual interference associated with a third-party vessel exiting the array	Increased journey time/distance but does not impact on transits Increased encounters but does not impact compliance with COLREGs	5	1	1	1	1	1.0	**Tolerable**		Displacement including to navigation in adverse weather resulting in increased encounters and impacts on compliance with COLREGs, resulting in a collision event with vessel damage, PLL, and/or pollution	3	4	2	4	3	3.3	**Tolerable**		Includes consideration of the Relevant Projects. Worst case frequency increased during operational phase due to no buoyed construction area.

User	Isolation / Cumulative	Project Component(s)	Phase (C/O/D)	Embedded Mitigation Measures (Full Descriptions Provided in Section 20)	Possible Causes	Most Likely Consequences	Realistic Most Likely Consequences							Worst Case Consequences	Realistic Worst Case Consequences							Further Mitigation Required and Additional Comments
							Frequency	People	Environment	Property	Business	Average Consequence	Risk		Frequency	People	Environment	Property	Business	Average Consequence	Risk	
		ECC	C/D	Advisory safe passing distances Compliance with relevant regulator guidance Guard vessel(s) Liaison with IRCG in relation to SAR resources Marking on nautical charts Promulgation of information	Adverse weather Construction vessels which are RAM	Increased journey time/distance but does not impact on transits Increased encounters but does not impact compliance with COLREGs	5	1	1	1	1	1.0	**Tolerable**	Displacement including to navigation in adverse weather resulting in increased encounters and impacts on compliance with COLREGs, resulting in a collision event with vessel damage, PLL, and/or pollution	2	4	2	4	3	3.3	**Broadly Acceptable**	Includes consideration of the Relevant Projects.
			O	Advisory safe passing distances Compliance with relevant regulator guidance Guard vessel(s) Liaison with IRCG in relation to SAR resources Marking on nautical charts Promulgation of information	Adverse weather Maintenance vessels which are RAM	Increased journey time/distance but does not impact on transits Increased encounters but does not impact compliance with COLREGs	5	1	1	1	1	1.0	**Tolerable**	Displacement including to navigation in adverse weather resulting in increased encounters and impacts on compliance with COLREGs, resulting in a collision event with vessel damage, PLL, and/or pollution	2	4	2	4	3	3.3	**Broadly Acceptable**	Includes consideration of the Relevant Projects.

User	Isolation / Cumulative	Project Component(s)	Phase (C/O/D)	Embedded Mitigation Measures (Full Descriptions Provided in Section 20)	Possible Causes	Most Likely Consequences	Realistic Most Likely Consequences							Worst Case Consequences	Realistic Worst Case Consequences							Further Mitigation Required and Additional Comments
							Frequency	Consequences					Risk		Frequency	Consequences					Risk	
								People	Environment	Property	Business	Average Consequence				People	Environment	Property	Business	Average Consequence		
Recreational vessels (2.5 to 24m length)	Isolation	Array area	C/D	Advisory safe passing distances Buoyed construction area Compliance with relevant regulator guidance Guard vessel(s) Liaison with IRCG in relation to SAR resources Lighting and marking Marking on nautical charts Promulgation of information	Presence of buoyed construction area Adverse weather Reduced sea room between the Infrastructure Boundary and Rockabill Construction vessels which are RAM	Increased journey time/distance but does not impact on transits Increased encounters but does not impact compliance with COLREGs	5	1	1	1	1	1.0	**Tolerable**	Displacement including to navigation in adverse weather resulting in increased encounters and impacts on compliance with COLREGs, resulting in a collision event with vessel damage, PLL, and/or pollution	2	4	2	4	2	3.0	**Broadly Acceptable**	
			O	Advisory safe passing distances Compliance with relevant regulator guidance Guard vessel(s) Liaison with IRCG in relation to SAR resources Lighting and marking Marking on nautical charts Promulgation of information	Adverse weather Reduced sea room between the Infrastructure Boundary and Rockabill Maintenance vessels which are RAM Visual interference associated with a third-party vessel exiting the array	Increased journey time/distance but does not impact on transits Increased encounters but does not impact compliance with COLREGs	5	1	1	1	1	1.0	**Tolerable**	Displacement including to navigation in adverse weather resulting in increased encounters and impacts on compliance with COLREGs, resulting in a collision event with vessel damage, PLL, and/or pollution	3	4	2	4	2	3.0	**Tolerable**	Worst case frequency increased during operational phase due to no buoyed construction area.

User	Isolation / Cumulative	Project Component(s)	Phase (C/O/D)	Embedded Mitigation Measures (Full Descriptions Provided in Section 20)	Possible Causes	Most Likely Consequences	Realistic Most Likely Consequences							Worst Case Consequences	Realistic Worst Case Consequences							Further Mitigation Required and Additional Comments
							Frequency	Consequences: People	Environment	Property	Business	Average Consequence	Risk		Frequency	Consequences: People	Environment	Property	Business	Average Consequence	Risk	
		ECC	C/D	Advisory safe passing distances Compliance with relevant regulator guidance Guard vessel(s) Liaison with IRCG in relation to SAR resources Marking on nautical charts Promulgation of information	Adverse weather Construction vessels which are RAM	Increased journey time/distance but does not impact on transits Increased encounters but does not impact compliance with COLREGs	5	1	1	1	1	1.0	**Tolerable**	Displacement including to navigation in adverse weather resulting in increased encounters and impacts on compliance with COLREGs, resulting in a collision event with vessel damage, PLL, and/or pollution	3	4	2	4	2	3.0	**Tolerable**	
			O	Advisory safe passing distances Compliance with relevant regulator guidance Guard vessel(s) Liaison with IRCG in relation to SAR resources Marking on nautical charts Promulgation of information	Adverse weather Maintenance vessels which are RAM	Increased journey time/distance but does not impact on transits Increased encounters but does not impact compliance with COLREGs	5	1	1	1	1	1.0	**Tolerable**	Displacement including to navigation in adverse weather resulting in increased encounters and impacts on compliance with COLREGs, resulting in a collision event with vessel damage, PLL, and/or pollution	3	4	2	4	2	3.0	**Tolerable**	

User	Isolation / Cumulative	Project Component(s)	Phase (C/O/D)	Embedded Mitigation Measures (Full Descriptions Provided in Section 20)	Possible Causes	Most Likely Consequences	Realistic Most Likely Consequences							Worst Case Consequences	Realistic Worst Case Consequences							Further Mitigation Required and Additional Comments
							Frequency	Consequences					Risk		Frequency	Consequences					Risk	
								People	Environment	Property	Business	Average Consequence				People	Environment	Property	Business	Average Consequence		
	Cumulative	Array area	C/D	Advisory safe passing distances Buoyed construction area Compliance with relevant regulator guidance Guard vessel(s) Liaison with IRCG in relation to SAR resources Lighting and marking Marking on nautical charts Promulgation of information	Presence of buoyed construction area Adverse weather Reduced sea room between the Infrastructure Boundary and Rockabill Construction vessels which are RAM	Increased journey time/distance but does not impact on transits Increased encounters but does not impact compliance with COLREGs	5	1	1	1	1	1.0	Tolerable	Displacement including to navigation in adverse weather resulting in increased encounters and impacts on compliance with COLREGs, resulting in a collision event with vessel damage, PLL, and/or pollution	2	4	2	4	2	3.0	Broadly Acceptable	Includes consideration of the Relevant Projects.
			O	Advisory safe passing distances Compliance with relevant regulator guidance Guard vessel(s) Liaison with IRCG in relation to SAR resources Lighting and marking Marking on nautical charts Promulgation of information	Adverse weather Reduced sea room between the Infrastructure Boundary and Rockabill Maintenance vessels which are RAM Visual interference associated with a third-party vessel exiting the array	Increased journey time/distance but does not impact on transits Increased encounters but does not impact compliance with COLREGs	5	1	1	1	1	1.0	Tolerable	Displacement including to navigation in adverse weather resulting in increased encounters and impacts on compliance with COLREGs, resulting in a collision event with vessel damage, PLL, and/or pollution	3	4	2	4	2	3.0	Tolerable	Includes consideration of the Relevant Projects. Worst case frequency increased during operational phase due to no buoyed construction area.

User	Isolation / Cumulative	Project Component(s)	Phase (C/O/D)	Embedded Mitigation Measures (Full Descriptions Provided in Section 20)	Possible Causes	Most Likely Consequences	Realistic Most Likely Consequences							Worst Case Consequences	Realistic Worst Case Consequences							Further Mitigation Required and Additional Comments
							Frequency	Consequences: People	Environment	Property	Business	Average Consequence	Risk		Frequency	Consequences: People	Environment	Property	Business	Average Consequence	Risk	
		ECC	C/D	Advisory safe passing distances Compliance with relevant regulator guidance Guard vessel(s) Liaison with IRCG in relation to SAR resources Marking on nautical charts Promulgation of information	Adverse weather Construction vessels which are RAM	Increased journey time/distance but does not impact on transits Increased encounters but does not impact compliance with COLREGs	5	1	1	1	1	1.0	Tolerable	Displacement including to navigation in adverse weather resulting in increased encounters and impacts on compliance with COLREGs, resulting in a collision event with vessel damage, PLL, and/or pollution	3	4	2	4	2	3.0	Tolerable	Includes consideration of the Relevant Projects.
		ECC	O	Advisory safe passing distances Compliance with relevant regulator guidance Guard vessel(s) Liaison with IRCG in relation to SAR resources Marking on nautical charts Promulgation of information	Adverse weather Maintenance vessels which are RAM	Increased journey time/distance but does not impact on transits Increased encounters but does not impact compliance with COLREGs	5	1	1	1	1	1.0	Tolerable	Displacement including to navigation in adverse weather resulting in increased encounters and impacts on compliance with COLREGs, resulting in a collision event with vessel damage, PLL, and/or pollution	3	4	2	4	2	3.0	Tolerable	Includes consideration of the Relevant Projects.

User	Isolation / Cumulative	Project Component(s)	Phase (C/O/D)	Embedded Mitigation Measures (Full Descriptions Provided in Section 20)	Possible Causes	Most Likely Consequences	Realistic Most Likely Consequences							Worst Case Consequences	Realistic Worst Case Consequences							Further Mitigation Required and Additional Comments
							Frequency	Consequences					Risk		Frequency	Consequences					Risk	
								People	Environment	Property	Business	Average Consequence				People	Environment	Property	Business	Average Consequence		
Increased Vessel to Vessel Collision Risk Between a Third-Party Vessel and a Proposed Development Vessel																						
Commercial vessels	Isolation	Array area	C/D	Advisory safe passing distances Buoyed construction area Guard vessel(s) Liaison with IRCG in relation to SAR resources Marine coordination for project vessels Marking on nautical charts Project vessel compliance with international marine regulations Promulgation of information	Project vessels in transit Lack of third-party awareness Construction vessels which are RAM	Increased encounters resulting in increased alertness but no safety risks including compliance with COLREGs	4	1	1	1	1	1.0	**Broadly Acceptable**	Increased encounters and impacts on compliance with COLREGs, resulting in a collision event with vessel damage, PLL, and/or pollution	2	4	4	4	4	4.0	**Tolerable**	
			O	Advisory safe passing distances Guard vessel(s) Liaison with IRCG in relation to SAR resources Marine coordination for project vessels Marking on nautical charts Project vessel compliance with international marine regulations Promulgation of information	Project vessels in transit Lack of third-party awareness Maintenance vessels which are RAM	Increased encounters resulting in increased alertness but no safety risks including compliance with COLREGs	3	1	1	1	1	1.0	**Broadly Acceptable**	Increased encounters and impacts on compliance with COLREGs, resulting in a collision event with vessel damage, PLL, and/or pollution	1	4	4	4	4	4.0	**Tolerable**	Frequency decreased during operational phase due to fewer project vessels on-site.

User	Isolation / Cumulative	Project Component(s)	Phase (C/O/D)	Embedded Mitigation Measures (Full Descriptions Provided in Section 20)	Possible Causes	Most Likely Consequences	Realistic Most Likely Consequences: Frequency	Consequences: People	Consequences: Environment	Consequences: Property	Consequences: Business	Consequences: Average Consequence	Risk	Worst Case Consequences	Realistic Worst Case Consequences: Frequency	Consequences: People	Consequences: Environment	Consequences: Property	Consequences: Business	Consequences: Average Consequence	Risk	Further Mitigation Required and Additional Comments
		ECC	C/D	Advisory safe passing distances Guard vessel(s) Liaison with IRCG in relation to SAR resources Marine coordination for project vessels Marking on nautical charts Project vessel compliance with international marine regulations Promulgation of information	Project vessels in transit Lack of third-party awareness Construction vessels which are RAM	Increased encounters resulting in increased alertness but no safety risks including compliance with COLREGs	3	1	1	1	1	1.0	**Broadly Acceptable**	Increased encounters and impacts on compliance with COLREGs, resulting in a collision event with vessel damage, PLL, and/or pollution	2	4	4	4	4	4.0	**Tolerable**	
			O	Advisory safe passing distances Guard vessel(s) Liaison with IRCG in relation to SAR resources Marine coordination for project vessels Marking on nautical charts Project vessel compliance with international marine regulations Promulgation of information	Project vessels in transit Lack of third-party awareness Maintenance vessels which are RAM	Increased encounters resulting in increased alertness but no safety risks including compliance with COLREGs	2	1	1	1	1	1.0	**Broadly Acceptable**	Increased encounters and impacts on compliance with COLREGs, resulting in a collision event with vessel damage, PLL, and/or pollution	1	4	4	4	4	4.0	**Tolerable**	Frequency decreased during operational phase due to fewer project vessels on-site.

User	Isolation / Cumulative	Project Component(s)	Phase (C/O/D)	Embedded Mitigation Measures (Full Descriptions Provided in Section 20)	Possible Causes	Most Likely Consequences	Realistic Most Likely Consequences								Worst Case Consequences	Realistic Worst Case Consequences								Further Mitigation Required and Additional Comments
							Frequency	Consequences					Risk			Frequency	Consequences					Risk	
								People	Environment	Property	Business	Average Consequence					People	Environment	Property	Business	Average Consequence		
	Cumulative	Array area	C/D	Advisory safe passing distances Buoyed construction area Guard vessel(s) Liaison with IRCG in relation to SAR resources Marine coordination for project vessels Marking on nautical charts Project vessel compliance with international marine regulations Promulgation of information	Project vessels in transit Lack of third-party awareness Construction vessels which are RAM	Increased encounters resulting in increased alertness but no safety risks including compliance with COLREGs	4	1	1	1	1	1.0	**Broadly Acceptable**		Increased encounters and impacts on compliance with COLREGs, resulting in a collision event with vessel damage, PLL, and/or pollution	3	4	4	4	4	4.0	**Tolerable**	Includes consideration of the Relevant Projects, Bremore Port development and Dublin Port development.
	Cumulative	Array area	O	Advisory safe passing distances Guard vessel(s) Liaison with IRCG in relation to SAR resources Marine coordination for project vessels Marking on nautical charts Project vessel compliance with international marine regulations Promulgation of information	Project vessels in transit Lack of third-party awareness Maintenance vessels which are RAM	Increased encounters resulting in increased alertness but no safety risks including compliance with COLREGs	3	1	1	1	1	1.0	**Broadly Acceptable**		Increased encounters and impacts on compliance with COLREGs, resulting in a collision event with vessel damage, PLL, and/or pollution	2	4	4	4	4	4.0	**Tolerable**	Includes consideration of the Relevant Projects, Bremore Port development and Dublin Port development. Frequency decreased during operational phase due to fewer project vessels on-site.

User	Isolation / Cumulative	Project Component(s)	Phase (C/O/D)	Embedded Mitigation Measures (Full Descriptions Provided in Section 20)	Possible Causes	Most Likely Consequences	Realistic Most Likely Consequences								Worst Case Consequences	Realistic Worst Case Consequences								Further Mitigation Required and Additional Comments
							Frequency	Consequences					Risk			Frequency	Consequences					Risk		
								People	Environment	Property	Business	Average Consequence					People	Environment	Property	Business	Average Consequence			
		ECC	C/D	Advisory safe passing distances Guard vessel(s) Liaison with IRCG in relation to SAR resources Marine coordination for project vessels Marking on nautical charts Project vessel compliance with international marine regulations Promulgation of information	Project vessels in transit Lack of third-party awareness Construction vessels which are RAM	Increased encounters resulting in increased alertness but no safety risks including compliance with COLREGs	3	1	1	1	1	1.0	**Broadly Acceptable**		Increased encounters and impacts on compliance with COLREGs, resulting in a collision event with vessel damage, PLL, and/or pollution	2	4	4	4	4	4.0	**Tolerable**		Includes consideration of the Relevant Projects and Bremore Port development.
			O	Advisory safe passing distances Guard vessel(s) Liaison with IRCG in relation to SAR resources Marine coordination for project vessels Marking on nautical charts Project vessel compliance with international marine regulations Promulgation of information	Project vessels in transit Lack of third-party awareness Maintenance vessels which are RAM	Increased encounters resulting in increased alertness but no safety risks including compliance with COLREGs	2	1	1	1	1	1.0	**Broadly Acceptable**		Increased encounters and impacts on compliance with COLREGs, resulting in a collision event with vessel damage, PLL, and/or pollution	1	4	4	4	4	4.0	**Tolerable**		Includes consideration of the Relevant Projects and Bremore Port development. Frequency decreased during operational phase due to fewer project vessels on-site.

User	Isolation / Cumulative	Project Component(s)	Phase (C/O/D)	Embedded Mitigation Measures (Full Descriptions Provided in Section 20)	Possible Causes	Most Likely Consequences	Realistic Most Likely Consequences: Frequency	Consequences: People	Consequences: Environment	Consequences: Property	Consequences: Business	Consequences: Average Consequence	Risk	Worst Case Consequences	Realistic Worst Case Consequences: Frequency	Consequences: People	Consequences: Environment	Consequences: Property	Consequences: Business	Consequences: Average Consequence	Risk	Further Mitigation Required and Additional Comments
Commercial fishing vessels in transit	Isolation	Array area	C/D	Advisory safe passing distances Buoyed construction area Guard vessel(s) Liaison with IRCG in relation to SAR resources Marine coordination for project vessels Marking on nautical charts Project vessel compliance with international marine regulations Promulgation of information	Project vessels in transit Lack of third-party awareness Construction vessels which are RAM	Increased encounters resulting in increased alertness but no safety risks including compliance with COLREGs	4	1	1	1	1	1.0	**Broadly Acceptable**	Increased encounters and impacts on compliance with COLREGs, resulting in a collision event with vessel damage, PLL, and/or pollution	3	4	2	4	3	3.3	**Tolerable**	
			O	Advisory safe passing distances Guard vessel(s) Liaison with IRCG in relation to SAR resources Marine coordination for project vessels Marking on nautical charts Project vessel compliance with international marine regulations Promulgation of information	Project vessels in transit or within array Lack of third-party awareness Maintenance vessels which are RAM	Increased encounters resulting in increased alertness but no safety risks including compliance with COLREGs	4	1	1	1	1	1.0	**Broadly Acceptable**	Increased encounters and impacts on compliance with COLREGs, resulting in a collision event with vessel damage, PLL, and/or pollution	3	4	2	4	3	3.3	**Tolerable**	Frequency remains the same during operational phase due to fewer project vessels on-site but potential for internal navigation.

User	Isolation / Cumulative	Project Component(s)	Phase (C/O/D)	Embedded Mitigation Measures (Full Descriptions Provided in Section 20)	Possible Causes	Most Likely Consequences	Realistic Most Likely Consequences								Worst Case Consequences	Realistic Worst Case Consequences								Further Mitigation Required and Additional Comments
							Frequency	Consequences: People	Environment	Property	Business	Average Consequence	Risk		Frequency	Consequences: People	Environment	Property	Business	Average Consequence	Risk	
		ECC	C/D	Advisory safe passing distances Guard vessel(s) Liaison with IRCG in relation to SAR resources Marine coordination for project vessels Marking on nautical charts Project vessel compliance with international marine regulations Promulgation of information	Project vessels in transit Lack of third-party awareness Construction vessels which are RAM	Increased encounters resulting in increased alertness but no safety risks including compliance with COLREGs	3	1	1	1	1	1.0	**Broadly Acceptable**	Increased encounters and impacts on compliance with COLREGs, resulting in a collision event with vessel damage, PLL, and/or pollution	2	4	2	4	3	3.3	**Broadly Acceptable**	
			O	Advisory safe passing distances Guard vessel(s) Liaison with IRCG in relation to SAR resources Marine coordination for project vessels Marking on nautical charts Project vessel compliance with international marine regulations Promulgation of information	Project vessels in transit Lack of third-party awareness Maintenance vessels which are RAM	Increased encounters resulting in increased alertness but no safety risks including compliance with COLREGs	2	1	1	1	1	1.0	**Broadly Acceptable**	Increased encounters and impacts on compliance with COLREGs, resulting in a collision event with vessel damage, PLL, and/or pollution	1	4	2	4	3	3.3	**Broadly Acceptable**	Frequency decreased during operational phase due to fewer project vessels on-site.

User	Isolation / Cumulative	Project Component(s)	Phase (C/O/D)	Embedded Mitigation Measures (Full Descriptions Provided in Section 20)	Possible Causes	Most Likely Consequences	Realistic Most Likely Consequences								Worst Case Consequences	Realistic Worst Case Consequences								Further Mitigation Required and Additional Comments
							Frequency	Consequences					Risk			Frequency	Consequences					Risk		
								People	Environment	Property	Business	Average Consequence					People	Environment	Property	Business	Average Consequence			
	Cumulative	Array area	C/D	Advisory safe passing distances Buoyed construction area Guard vessel(s) Liaison with IRCG in relation to SAR resources Marine coordination for project vessels Marking on nautical charts Project vessel compliance with international marine regulations Promulgation of information	Project vessels in transit Lack of third-party awareness Construction vessels which are RAM	Increased encounters resulting in increased alertness but no safety risks including compliance with COLREGs	4	1	1	1	1	1.0	**Broadly Acceptable**		Increased encounters and impacts on compliance with COLREGs, resulting in a collision event with vessel damage, PLL, and/or pollution	3	4	2	4	3	3.3	**Tolerable**		Includes consideration of the Relevant Projects.
			O	Advisory safe passing distances Guard vessel(s) Liaison with IRCG in relation to SAR resources Marine coordination for project vessels Marking on nautical charts Project vessel compliance with international marine regulations Promulgation of information	Project vessels in transit or within array Lack of third-party awareness Maintenance vessels which are RAM	Increased encounters resulting in increased alertness but no safety risks including compliance with COLREGs	4	1	1	1	1	1.0	**Broadly Acceptable**		Increased encounters and impacts on compliance with COLREGs, resulting in a collision event with vessel damage, PLL, and/or pollution	3	4	2	4	3	3.3	**Tolerable**		Includes consideration of the Relevant Projects. Frequency remains the same during operational phase due to fewer project vessels on-site but potential for internal navigation.

User	Isolation / Cumulative	Project Component(s)	Phase (C/O/D)	Embedded Mitigation Measures (Full Descriptions Provided in Section 20)	Possible Causes	Most Likely Consequences	Realistic Most Likely Consequences: Frequency	Consequences: People	Consequences: Environment	Consequences: Property	Consequences: Business	Consequences: Average Consequence	Risk	Worst Case Consequences	Realistic Worst Case Consequences: Frequency	Consequences: People	Consequences: Environment	Consequences: Property	Consequences: Business	Consequences: Average Consequence	Risk	Further Mitigation Required and Additional Comments
		ECC	C/D	Advisory safe passing distances Guard vessel(s) Liaison with IRCG in relation to SAR resources Marine coordination for project vessels Marking on nautical charts Project vessel compliance with international marine regulations Promulgation of information	Project vessels in transit Lack of third-party awareness Construction vessels which are RAM	Increased encounters resulting in increased alertness but no safety risks including compliance with COLREGs	3	1	1	1	1	1.0	**Broadly Acceptable**	Increased encounters and impacts on compliance with COLREGs, resulting in a collision event with vessel damage, PLL, and/or pollution	2	4	2	4	3	3.3	**Broadly Acceptable**	Includes consideration of the Relevant Projects.
			O	Advisory safe passing distances Guard vessel(s) Liaison with IRCG in relation to SAR resources Marine coordination for project vessels Marking on nautical charts Project vessel compliance with international marine regulations Promulgation of information	Project vessels in transit Lack of third-party awareness Maintenance vessels which are RAM	Increased encounters resulting in increased alertness but no safety risks including compliance with COLREGs	2	1	1	1	1	1.0	**Broadly Acceptable**	Increased encounters and impacts on compliance with COLREGs, resulting in a collision event with vessel damage, PLL, and/or pollution	1	4	2	4	3	3.3	**Broadly Acceptable**	Includes consideration of the Relevant Projects.

User	Isolation / Cumulative	Project Component(s)	Phase (C/O/D)	Embedded Mitigation Measures (Full Descriptions Provided in Section 20)	Possible Causes	Most Likely Consequences	Realistic Most Likely Consequences							Worst Case Consequences	Realistic Worst Case Consequences							Further Mitigation Required and Additional Comments
							Frequency	Consequences					Risk		Frequency	Consequences					Risk	
								People	Environment	Property	Business	Average Consequence				People	Environment	Property	Business	Average Consequence		
Recreational vessels (2.5 to 24m length)	Isolation	Array area	C/D	Advisory safe passing distances Buoyed construction area Guard vessel(s) Liaison with IRCG in relation to SAR resources Marine coordination for project vessels Marking on nautical charts Project vessel compliance with international marine regulations Promulgation of information	Project vessels in transit Lack of third-party awareness Construction vessels which are RAM	Increased encounters resulting in increased alertness but no safety risks including compliance with COLREGs	4	1	1	1	1	1.0	**Broadly Acceptable**	Increased encounters and impacts on compliance with COLREGs, resulting in a collision event with vessel damage, PLL, and/or pollution	3	4	2	4	3	3.3	**Tolerable**	
			O	Advisory safe passing distances Guard vessel(s) Liaison with IRCG in relation to SAR resources Marine coordination for project vessels Marking on nautical charts Project vessel compliance with international marine regulations Promulgation of information	Project vessels in transit or within array Lack of third-party awareness Maintenance vessels which are RAM	Increased encounters resulting in increased alertness but no safety risks including compliance with COLREGs	4	1	1	1	1	1.0	**Broadly Acceptable**	Increased encounters and impacts on compliance with COLREGs, resulting in a collision event with vessel damage, PLL, and/or pollution	3	4	2	4	3	3.3	**Tolerable**	Frequency remains the same during operational phase due to fewer project vessels on-site but potential for internal navigation.

User	Isolation / Cumulative	Project Component(s)	Phase (C/O/D)	Embedded Mitigation Measures (Full Descriptions Provided in Section 20)	Possible Causes	Most Likely Consequences	Realistic Most Likely Consequences							Worst Case Consequences	Realistic Worst Case Consequences							Further Mitigation Required and Additional Comments
							Frequency	Consequences: People	Environment	Property	Business	Average Consequence	Risk		Frequency	Consequences: People	Environment	Property	Business	Average Consequence	Risk	
		ECC	C/D	Advisory safe passing distances Guard vessel(s) Liaison with IRCG in relation to SAR resources Marine coordination for project vessels Marking on nautical charts Project vessel compliance with international marine regulations Promulgation of information	Project vessels in transit Lack of third-party awareness Construction vessels which are RAM	Increased encounters resulting in increased alertness but no safety risks including compliance with COLREGs	3	1	1	1	1	1.0	**Broadly Acceptable**	Increased encounters and impacts on compliance with COLREGs, resulting in a collision event with vessel damage, PLL, and/or pollution	2	4	2	4	3	3.3	**Broadly Acceptable**	
			O	Advisory safe passing distances Guard vessel(s) Liaison with IRCG in relation to SAR resources Marine coordination for project vessels Marking on nautical charts Project vessel compliance with international marine regulations Promulgation of information	Project vessels in transit Lack of third-party awareness Maintenance vessels which are RAM	Increased encounters resulting in increased alertness but no safety risks including compliance with COLREGs	2	1	1	1	1	1.0	**Broadly Acceptable**	Increased encounters and impacts on compliance with COLREGs, resulting in a collision event with vessel damage, PLL, and/or pollution	1	4	2	4	3	3.3	**Broadly Acceptable**	

User	Isolation / Cumulative	Project Component(s)	Phase (C/O/D)	Embedded Mitigation Measures (Full Descriptions Provided in Section 20)	Possible Causes	Most Likely Consequences	Realistic Most Likely Consequences: Frequency	Consequences: People	Consequences: Environment	Consequences: Property	Consequences: Business	Consequences: Average Consequence	Risk	Worst Case Consequences	Realistic Worst Case Consequences: Frequency	Consequences: People	Consequences: Environment	Consequences: Property	Consequences: Business	Consequences: Average Consequence	Risk	Further Mitigation Required and Additional Comments
	Cumulative	Array area	C/D	Advisory safe passing distances Buoyed construction area Guard vessel(s) Liaison with IRCG in relation to SAR resources Marine coordination for project vessels Marking on nautical charts Project vessel compliance with international marine regulations Promulgation of information	Project vessels in transit Lack of third-party awareness Construction vessels which are RAM	Increased encounters resulting in increased alertness but no safety risks including compliance with COLREGs	4	1	1	1	1	1.0	**Broadly Acceptable**	Increased encounters and impacts on compliance with COLREGs, resulting in a collision event with vessel damage, PLL, and/or pollution	3	4	2	4	3	3.3	**Tolerable**	Includes consideration of the Relevant Projects.
			O	Advisory safe passing distances Guard vessel(s) Liaison with IRCG in relation to SAR resources Marine coordination for project vessels Marking on nautical charts Project vessel compliance with international marine regulations Promulgation of information	Project vessels in transit or within array Lack of third-party awareness Maintenance vessels which are RAM	Increased encounters resulting in increased alertness but no safety risks including compliance with COLREGs	4	1	1	1	1	1.0	**Broadly Acceptable**	Increased encounters and impacts on compliance with COLREGs, resulting in a collision event with vessel damage, PLL, and/or pollution	3	4	2	4	3	3.3	**Tolerable**	Includes consideration of the Relevant Projects. Frequency remains the same during operational phase due to fewer project vessels on-site but potential for internal navigation.

User	Isolation / Cumulative	Project Component(s)	Phase (C/O/D)	Embedded Mitigation Measures (Full Descriptions Provided in Section 20)	Possible Causes	Most Likely Consequences	Realistic Most Likely Consequences								Worst Case Consequences	Realistic Worst Case Consequences								Further Mitigation Required and Additional Comments
							Frequency	Consequences: People	Environment	Property	Business	Average Consequence	Risk		Frequency	Consequences: People	Environment	Property	Business	Average Consequence	Risk	
		ECC	C/D	Advisory safe passing distances Guard vessel(s) Liaison with IRCG in relation to SAR resources Marine coordination for project vessels Marking on nautical charts Project vessel compliance with international marine regulations Promulgation of information	Project vessels in transit Lack of third-party awareness Construction vessels which are RAM	Increased encounters resulting in increased alertness but no safety risks including compliance with COLREGs	3	1	1	1	1	1.0	**Broadly Acceptable**	Increased encounters and impacts on compliance with COLREGs, resulting in a collision event with vessel damage, PLL, and/or pollution	2	4	2	4	3	3.3	**Broadly Acceptable**	Includes consideration of the Relevant Projects.
		ECC	O	Advisory safe passing distances Guard vessel(s) Liaison with IRCG in relation to SAR resources Marine coordination for project vessels Marking on nautical charts Project vessel compliance with international marine regulations Promulgation of information	Project vessels in transit Lack of third-party awareness Maintenance vessels which are RAM	Increased encounters resulting in increased alertness but no safety risks including compliance with COLREGs	2	1	1	1	1	1.0	**Broadly Acceptable**	Increased encounters and impacts on compliance with COLREGs, resulting in a collision event with vessel damage, PLL, and/or pollution	1	4	2	4	3	3.3	**Broadly Acceptable**	Includes consideration of the Relevant Projects.

User	Isolation / Cumulative	Project Component(s)	Phase (C/O/D)	Embedded Mitigation Measures (Full Descriptions Provided in Section 20)	Possible Causes	Most Likely Consequences	Realistic Most Likely Consequences								Worst Case Consequences	Realistic Worst Case Consequences								Further Mitigation Required and Additional Comments
							Frequency	Consequences					Risk			Frequency	Consequences					Risk		
								People	Environment	Property	Business	Average Consequence					People	Environment	Property	Business	Average Consequence			
Reduced Access to Local Ports, Harbours, and Marinas																								
Commercial vessels	Isolation	Array area	C/D	Advisory safe passing distances Buoyed construction area Marine coordination for project vessels Project vessel compliance with international marine regulations Promulgation of information	Presence of buoyed construction area Construction vessels which are RAM	Increased journey time/distance but does not impact on schedules, berth times, or compliance with COLREGs	4	1	1	1	2	1.3	**Broadly Acceptable**		Increased journey time/distance impacting on schedules, berth times, and/or compliance with COLREGs	3	1	2	1	2	1.5	**Broadly Acceptable**		Irish Chamber of Shipping and Warrenpoint Harbour Authority noted that vessels arriving at Drogheda Port are already sensitive to tidal conditions affecting berth accessibility. Frequently vessels wait at anchor for access. Multiple stakeholders raised concern relating to potential for some sensitive vessels choosing to pass around the array resulting in increased journey distances.

User	Isolation / Cumulative	Project Component(s)	Phase (C/O/D)	Embedded Mitigation Measures (Full Descriptions Provided in Section 20)	Possible Causes	Most Likely Consequences	Realistic Most Likely Consequences								Worst Case Consequences	Realistic Worst Case Consequences								Further Mitigation Required and Additional Comments
							Frequency	Consequences					Risk			Frequency	Consequences					Risk	
								People	Environment	Property	Business	Average Consequence					People	Environment	Property	Business	Average Consequence		
			O	Advisory safe passing distances Marine coordination for project vessels Project vessel compliance with international marine regulations Promulgation of information	Presence of surface structures Maintenance vessels which are RAM	Increased journey time/distance but does not impact on schedules, berth times, or compliance with COLREGs	4	1	1	1	2	1.3	**Broadly Acceptable**		Increased journey time/distance impacting on schedules, berth times, and/or compliance with COLREGs	3	1	2	1	2	1.5	**Broadly Acceptable**	Irish Chamber of Shipping and Warrenpoint Harbour Authority noted that vessels arriving at Drogheda Port are already sensitive to tidal conditions affecting berth accessibility. Frequently vessels wait at anchor for access. Multiple stakeholders raised concern relating to potential for some sensitive vessels choosing to pass around the array resulting in increased journey distances.

User	Isolation / Cumulative	Project Component(s)	Phase (C/O/D)	Embedded Mitigation Measures (Full Descriptions Provided in Section 20)	Possible Causes	Most Likely Consequences	Realistic Most Likely Consequences								Worst Case Consequences	Realistic Worst Case Consequences								Further Mitigation Required and Additional Comments
							Frequency	Consequences					Risk			Frequency	Consequences					Risk	
								People	Environment	Property	Business	Average Consequence					People	Environment	Property	Business	Average Consequence		
		ECC	C/D	Advisory safe passing distances Marine coordination for project vessels Project vessel compliance with international marine regulations Promulgation of information	Construction vessels which are RAM	Increased journey time/distance but does not impact on schedules, berth times, or compliance with COLREGs	3	1	1	1	1	1.0	**Broadly Acceptable**	Increased journey time/distance impacting on schedules, berth times, and/or compliance with COLREGs	2	1	1	1	1	1.0	**Broadly Acceptable**	Irish Chamber of Shipping and Warrenpoint Harbour Authority noted that vessels arriving at Drogheda Port are already sensitive to tidal conditions affecting berth accessibility. Frequently vessels wait at anchor for access.
			O	Advisory safe passing distances Marine coordination for project vessels Project vessel compliance with international marine regulations Promulgation of information	Maintenance vessels which are RAM	Increased journey time/distance but does not impact on schedules, berth times, or compliance with COLREGs	3	1	1	1	1	1.0	**Broadly Acceptable**	Increased journey time/distance impacting on schedules, berth times, and/or compliance with COLREGs	2	1	1	1	1	1.0	**Broadly Acceptable**	Irish Chamber of Shipping and Warrenpoint Harbour Authority noted that vessels arriving at Drogheda Port are already sensitive to tidal conditions affecting berth accessibility. Frequently vessels wait at anchor for access.

	Cumulative	Array area	C/D	Advisory safe passing distances Buoyed construction area Marine coordination for project vessels Project vessel compliance with international marine regulations Promulgation of information	Presence of buoyed construction area Construction vessels which are RAM	Increased journey time/distance but does not impact on schedules, berth times, or compliance with COLREGs	4	1	1	1	2	1.3	**Broadly Acceptable**	Increased journey time/distance impacting on schedules, berth times, and/or compliance with COLREGs	3	1	2	1	3	1.8	**Broadly Acceptable**	Includes consideration of the Relevant Projects and Bremore Port development. Irish Chamber of Shipping and Warrenpoint Harbour Authority noted that vessels arriving at Drogheda Port are already sensitive to tidal conditions affecting berth accessibility. Frequently vessels wait at anchor for access. Multiple stakeholders raised concern relating to potential for some sensitive vessels choosing to pass around the array resulting in increased journey distances.
			O	Advisory safe passing distances Marine coordination for project vessels Project vessel compliance with international marine regulations Promulgation of information	Presence of surface structures Maintenance vessels which are RAM	Increased journey time/distance but does not impact on schedules, berth times, or compliance with COLREGs	4	1	1	1	2	1.3	**Broadly Acceptable**	Increased journey time/distance impacting on schedules, berth times, and/or compliance with COLREGs	3	1	2	1	3	1.8	**Broadly Acceptable**	Includes consideration of the Relevant Projects and Bremore Port development. Irish Chamber of Shipping and Warrenpoint Harbour Authority

User	Isolation / Cumulative	Project Component(s)	Phase (C/O/D)	Embedded Mitigation Measures (Full Descriptions Provided in Section 20)	Possible Causes	Most Likely Consequences	Realistic Most Likely Consequences							Worst Case Consequences	Realistic Worst Case Consequences							Further Mitigation Required and Additional Comments
								Consequences					Risk			Consequences					Risk	
							Frequency	People	Environment	Property	Business	Average Consequence			Frequency	People	Environment	Property	Business	Average Consequence		
																						noted that vessels arriving at Drogheda Port are already sensitive to tidal conditions affecting berth accessibility. Frequently vessels wait at anchor for access. Multiple stakeholders raised concern relating to potential for some sensitive vessels choosing to pass around the array resulting in increased journey distances.

User	Isolation / Cumulative	Project Component(s)	Phase (C/O/D)	Embedded Mitigation Measures (Full Descriptions Provided in Section 20)	Possible Causes	Most Likely Consequences	Realistic Most Likely Consequences							Worst Case Consequences	Realistic Worst Case Consequences							Further Mitigation Required and Additional Comments
							Frequency	Consequences					Risk		Frequency	Consequences					Risk	
								People	Environment	Property	Business	Average Consequence				People	Environment	Property	Business	Average Consequence		
		ECC	C/D	Advisory safe passing distances Marine coordination for project vessels Project vessel compliance with international marine regulations Promulgation of information	Construction vessels which are RAM	Increased journey time/distance but does not impact on schedules, berth times, or compliance with COLREGs	3	1	1	1	1	1.0	**Broadly Acceptable**	Increased journey time/distance impacting on schedules, berth times, and/or compliance with COLREGs	2	1	1	1	2	1.3	**Broadly Acceptable**	Includes consideration of the Relevant Projects and Bremore Port development. Irish Chamber of Shipping and Warrenpoint Harbour Authority noted that vessels arriving at Drogheda Port are already sensitive to tidal conditions affecting berth accessibility. Frequently vessels wait at anchor for access.

User	Isolation / Cumulative	Project Component(s)	Phase (C/O/D)	Embedded Mitigation Measures (Full Descriptions Provided in Section 20)	Possible Causes	Most Likely Consequences	Realistic Most Likely Consequences							Worst Case Consequences	Realistic Worst Case Consequences							Further Mitigation Required and Additional Comments
							Frequency	Consequences: People	Environment	Property	Business	Average Consequence	Risk		Frequency	Consequences: People	Environment	Property	Business	Average Consequence	Risk	
			O	Advisory safe passing distances Marine coordination for project vessels Project vessel compliance with international marine regulations Promulgation of information	Maintenance vessels which are RAM	Increased journey time/distance but does not impact on schedules, berth times, or compliance with COLREGs	3	1	1	1	1	1.0	**Broadly Acceptable**	Increased journey time/distance impacting on schedules, berth times, and/or compliance with COLREGs	2	1	1	1	2	1.3	**Broadly Acceptable**	Includes consideration of the Relevant Projects and Bremore Port development. Irish Chamber of Shipping and Warrenpoint Harbour Authority noted that vessels arriving at Drogheda Port are already sensitive to tidal conditions affecting berth accessibility. Frequently vessels wait at anchor for access.
Commercial fishing vessels in transit	Isolation	Array area	C/D	Advisory safe passing distances Buoyed construction area Marine coordination for project vessels Project vessel compliance with international marine regulations Promulgation of information	Presence of buoyed construction area Construction vessels which are RAM	Increased journey time/distance but does not impact on transits or compliance with COLREGs	4	1	1	1	1	1.0	**Broadly Acceptable**	Increased journey time/distance impacting on transits and/or compliance with COLREGs	2	1	1	1	1	1.0	**Broadly Acceptable**	

User	Isolation / Cumulative	Project Component(s)	Phase (C/O/D)	Embedded Mitigation Measures (Full Descriptions Provided in Section 20)	Possible Causes	Most Likely Consequences	Realistic Most Likely Consequences								Worst Case Consequences	Realistic Worst Case Consequences								Further Mitigation Required and Additional Comments
							Frequency	Consequences					Risk			Frequency	Consequences					Risk		
								People	Environment	Property	Business	Average Consequence					People	Environment	Property	Business	Average Consequence			
			O	Advisory safe passing distances Marine coordination for project vessels Project vessel compliance with international marine regulations Promulgation of information	Presence of surface structures Maintenance vessels which are RAM	Increased journey time/distance but does not impact on transits or compliance with COLREGs	4	1	1	1	1	1.0	**Broadly Acceptable**		Increased journey time/distance impacting on transits and/or compliance with COLREGs	2	1	1	1	1	1.0	**Broadly Acceptable**		
		ECC	C/D	Advisory safe passing distances Marine coordination for project vessels Project vessel compliance with international marine regulations Promulgation of information	Construction vessels which are RAM	Increased journey time/distance but does not impact on transits or compliance with COLREGs	4	1	1	1	1	1.0	**Broadly Acceptable**		Increased journey time/distance impacting on transits and/or compliance with COLREGs	1	1	1	1	1	1.0	**Broadly Acceptable**		
		ECC	O	Advisory safe passing distances Marine coordination for project vessels Project vessel compliance with international marine regulations Promulgation of information	Maintenance vessels which are RAM	Increased journey time/distance but does not impact on transits or compliance with COLREGs	4	1	1	1	1	1.0	**Broadly Acceptable**		Increased journey time/distance impacting on transits and/or compliance with COLREGs	1	1	1	1	1	1.0	**Broadly Acceptable**		

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User	Isolation / Cumulative	Project Component(s)	Phase (C/O/D)	Embedded Mitigation Measures (Full Descriptions Provided in Section 20)	Possible Causes	Most Likely Consequences	Realistic Most Likely Consequences: Frequency	Consequences: People	Consequences: Environment	Consequences: Property	Consequences: Business	Average Consequence	Risk	Worst Case Consequences	Realistic Worst Case Consequences: Frequency	Consequences: People	Consequences: Environment	Consequences: Property	Consequences: Business	Average Consequence	Risk	Further Mitigation Required and Additional Comments
	Cumulative	Array area	C/D	Advisory safe passing distances Buoyed construction area Marine coordination for project vessels Project vessel compliance with international marine regulations Promulgation of information	Presence of buoyed construction area Construction vessels which are RAM	Increased journey time/distance but does not impact on transits or compliance with COLREGs	4	1	1	1	1	1.0	**Broadly Acceptable**	Increased journey time/distance impacting on transits and/or compliance with COLREGs	2	1	1	1	2	1.3	**Broadly Acceptable**	Includes consideration of the Relevant Projects.
			O	Advisory safe passing distances Marine coordination for project vessels Project vessel compliance with international marine regulations Promulgation of information	Presence of surface structures Maintenance vessels which are RAM	Increased journey time/distance but does not impact on transits or compliance with COLREGs	4	1	1	1	1	1.0	**Broadly Acceptable**	Increased journey time/distance impacting on transits and/or compliance with COLREGs	2	1	1	1	2	1.3	**Broadly Acceptable**	Includes consideration of the Relevant Projects.
		ECC	C/D	Advisory safe passing distances Marine coordination for project vessels Project vessel compliance with international marine regulations Promulgation of information	Construction vessels which are RAM	Increased journey time/distance but does not impact on transits or compliance with COLREGs	4	1	1	1	1	1.0	**Broadly Acceptable**	Increased journey time/distance impacting on transits and/or compliance with COLREGs	1	1	1	1	1	1.0	**Broadly Acceptable**	Includes consideration of the Relevant Projects.

User	Isolation / Cumulative	Project Component(s)	Phase (C/O/D)	Embedded Mitigation Measures (Full Descriptions Provided in Section 20)	Possible Causes	Most Likely Consequences	Realistic Most Likely Consequences								Worst Case Consequences	Realistic Worst Case Consequences								Further Mitigation Required and Additional Comments
							Frequency	Consequences: People	Environment	Property	Business	Average Consequence	Risk			Frequency	Consequences: People	Environment	Property	Business	Average Consequence	Risk		
			O	Advisory safe passing distances Marine coordination for project vessels Project vessel compliance with international marine regulations Promulgation of information	Maintenance vessels which are RAM	Increased journey time/distance but does not impact on transits or compliance with COLREGs	4	1	1	1	1	1.0	**Broadly Acceptable**		Increased journey time/distance impacting on transits and/or compliance with COLREGs	1	1	1	1	1	1.0	**Broadly Acceptable**		Includes consideration of the Relevant Projects.
Recreational vessels (2.5 to 24m length)	Isolation	Array area	C/D	Advisory safe passing distances Buoyed construction area Marine coordination for project vessels Project vessel compliance with international marine regulations Promulgation of information	Presence of buoyed construction area Construction vessels which are RAM	Increased journey time/distance but does not impact on transits or compliance with COLREGs	4	1	1	1	1	1.0	**Broadly Acceptable**		Increased journey time/distance impacting on transits and/or compliance with COLREGs	2	1	1	1	1	1.0	**Broadly Acceptable**		
			O	Advisory safe passing distances Marine coordination for project vessels Project vessel compliance with international marine regulations Promulgation of information	Presence of surface structures Maintenance vessels which are RAM	Increased journey time/distance but does not impact on transits or compliance with COLREGs	4	1	1	1	1	1.0	**Broadly Acceptable**		Increased journey time/distance impacting on transits and/or compliance with COLREGs	2	1	1	1	1	1.0	**Broadly Acceptable**		

User	Isolation / Cumulative	Project Component(s)	Phase (C/O/D)	Embedded Mitigation Measures (Full Descriptions Provided in Section 20)	Possible Causes	Most Likely Consequences	Realistic Most Likely Consequences							Worst Case Consequences	Realistic Worst Case Consequences							Further Mitigation Required and Additional Comments
							Frequency	Consequences: People	Environment	Property	Business	Average Consequence	Risk		Frequency	Consequences: People	Environment	Property	Business	Average Consequence	Risk	
		ECC	C/D	Advisory safe passing distances Marine coordination for project vessels Project vessel compliance with international marine regulations Promulgation of information	Construction vessels which are RAM	Increased journey time/distance but does not impact on transits or compliance with COLREGs	4	1	1	1	1	1.0	**Broadly Acceptable**	Increased journey time/distance impacting on transits and/or compliance with COLREGs	1	1	1	1	1	1.0	**Broadly Acceptable**	
			O	Advisory safe passing distances Marine coordination for project vessels Project vessel compliance with international marine regulations Promulgation of information	Maintenance vessels which are RAM	Increased journey time/distance but does not impact on transits or compliance with COLREGs	4	1	1	1	1	1.0	**Broadly Acceptable**	Increased journey time/distance impacting on transits and/or compliance with COLREGs	1	1	1	1	1	1.0	**Broadly Acceptable**	
	Cumulative	Array area	C/D	Advisory safe passing distances Buoyed construction area Marine coordination for project vessels Project vessel compliance with international marine regulations Promulgation of information	Presence of buoyed construction area Construction vessels which are RAM	Increased journey time/distance but does not impact on transits or compliance with COLREGs	4	1	1	1	1	1.0	**Broadly Acceptable**	Increased journey time/distance impacting on transits and/or compliance with COLREGs	2	1	1	1	2	1.3	**Broadly Acceptable**	Includes consideration of the Relevant Projects.

User	Isolation / Cumulative	Project Component(s)	Phase (C/O/D)	Embedded Mitigation Measures (Full Descriptions Provided in Section 20)	Possible Causes	Most Likely Consequences	Realistic Most Likely Consequences								Worst Case Consequences	Realistic Worst Case Consequences								Further Mitigation Required and Additional Comments
							Frequency	Consequences					Risk		Frequency	Consequences					Risk	
								People	Environment	Property	Business	Average Consequence				People	Environment	Property	Business	Average Consequence		
			O	Advisory safe passing distances Marine coordination for project vessels Project vessel compliance with international marine regulations Promulgation of information	Presence of surface structures Maintenance vessels which are RAM	Increased journey time/distance but does not impact on transits or compliance with COLREGs	4	1	1	1	1	1.0	Broadly Acceptable	Increased journey time/distance impacting on transits and/or compliance with COLREGs	2	1	1	1	2	1.3	Broadly Acceptable	Includes consideration of the Relevant Projects.
		ECC	C/D	Advisory safe passing distances Marine coordination for project vessels Project vessel compliance with international marine regulations Promulgation of information	Construction vessels which are RAM	Increased journey time/distance but does not impact on transits or compliance with COLREGs	4	1	1	1	1	1.0	Broadly Acceptable	Increased journey time/distance impacting on transits and/or compliance with COLREGs	1	1	1	1	1	1.0	Broadly Acceptable	Includes consideration of the Relevant Projects.
			O	Advisory safe passing distances Marine coordination for project vessels Project vessel compliance with international marine regulations Promulgation of information	Maintenance vessels which are RAM	Increased journey time/distance but does not impact on transits or compliance with COLREGs	4	1	1	1	1	1.0	Broadly Acceptable	Increased journey time/distance impacting on transits and/or compliance with COLREGs	1	1	1	1	1	1.0	Broadly Acceptable	Includes consideration of the Relevant Projects.

User	Isolation / Cumulative	Project Component(s)	Phase (C/O/D)	Embedded Mitigation Measures (Full Descriptions Provided in Section 20)	Possible Causes	Most Likely Consequences	Realistic Most Likely Consequences							Worst Case Consequences	Realistic Worst Case Consequences							Further Mitigation Required and Additional Comments
							Frequency	Consequences					Risk		Frequency	Consequences					Risk	
								People	Environment	Property	Business	Average Consequence				People	Environment	Property	Business	Average Consequence		
Creation of Vessel to Structure Allision Risk (Including Powered, Drifting, and Internal)																						
Commercial vessels	Isolation	Array area	O	Compliance with relevant regulator guidance Guard vessel(s) Liaison with IRCG in relation to SAR resources Lighting and marking Marking on nautical charts Promulgation of information Structure Exclusion Zone Wind Turbine Generator (WTG) design and layouts	Presence of surface structures Human/navigational error Mechanical/technical failure Adverse weather Aid to navigation failure	Vessel passes at an unsafe distance resulting in a need to make a late adjustment to course/speed	3	1	1	1	1	1.0	**Broadly Acceptable**	Allision event occurs involving vessel damage, PLL and/or pollution	2	4	4	4	4	4.0	**Tolerable**	Multiple stakeholders raised concern over available sea room between the Infrastructure Boundary and Rockabill - depending on Master preference some sensitive vessels may choose to pass around the array resulting in increased exposure to perimeter structures - Structure Exclusion Zone added as an embedded mitigation measure.

User	Isolation / Cumulative	Project Component(s)	Phase (C/O/D)	Embedded Mitigation Measures (Full Descriptions Provided in Section 20)	Possible Causes	Most Likely Consequences	Realistic Most Likely Consequences							Worst Case Consequences	Realistic Worst Case Consequences							Further Mitigation Required and Additional Comments
							Frequency	Consequences: People	Environment	Property	Business	Average Consequence	Risk		Frequency	Consequences: People	Environment	Property	Business	Average Consequence	Risk	
	Cumulative	Array area	O	Compliance with relevant regulator guidance Guard vessel(s) Liaison with IRCG in relation to SAR resources Lighting and marking Marking on nautical charts Promulgation of information Structure Exclusion Zone WTG design and layouts	Presence of surface structures Human/navigational error Mechanical/technical failure Adverse weather Aid to navigation failure	Vessel passes at an unsafe distance resulting in a need to make a late adjustment to course/speed	3	1	1	1	1	1.0	**Broadly Acceptable**	Allision event occurs involving vessel damage, PLL and/or pollution	2	4	4	4	4	4.0	**Tolerable**	Includes consideration of the Relevant Projects. Multiple stakeholders raised concern over available sea room between the Infrastructure Boundary and Rockabill - depending on Master preference some sensitive vessels may choose to pass around the array resulting in increased exposure to perimeter structures - Structure Exclusion Zone added as an embedded mitigation measure.

User	Isolation / Cumulative	Project Component(s)	Phase (C/O/D)	Embedded Mitigation Measures (Full Descriptions Provided in Section 20)	Possible Causes	Most Likely Consequences	Realistic Most Likely Consequences							Worst Case Consequences	Realistic Worst Case Consequences							Further Mitigation Required and Additional Comments
							Frequency	Consequences					Risk		Frequency	Consequences					Risk	
								People	Environment	Property	Business	Average Consequence				People	Environment	Property	Business	Average Consequence		
Commercial fishing vessels in transit	Isolation	Array area	O	Compliance with relevant regulator guidance Guard vessel(s) Liaison with IRCG in relation to SAR resources Lighting and marking Marking on nautical charts Promulgation of information WTG design and layouts	Presence of surface structures Human/navigational error Mechanical/technical failure Adverse weather Aid to navigation failure	Vessel passes at an unsafe distance resulting in a need to make a late adjustment to course/speed	4	1	1	1	1	1.0	**Broadly Acceptable**	Allision event occurs involving vessel damage, PLL and/or pollution	3	4	3	4	3	3.5	**Tolerable**	Frequency increased relative to commercial vessels due to potential for internal navigation.
	Cumulative	Array area	O	Compliance with relevant regulator guidance Guard vessel(s) Liaison with IRCG in relation to SAR resources Lighting and marking Marking on nautical charts Promulgation of information WTG design and layouts	Presence of surface structures Human/navigational error Mechanical/technical failure Adverse weather Aid to navigation failure	Vessel passes at an unsafe distance resulting in a need to make a late adjustment to course/speed	4	1	1	1	1	1.0	**Broadly Acceptable**	Allision event occurs involving vessel damage, PLL and/or pollution	3	4	3	4	3	3.5	**Tolerable**	Includes consideration of the Relevant Projects. Frequency increased relative to commercial vessels due to potential for internal navigation.

User	Isolation / Cumulative	Project Component(s)	Phase (C/O/D)	Embedded Mitigation Measures (Full Descriptions Provided in Section 20)	Possible Causes	Most Likely Consequences	Realistic Most Likely Consequences							Worst Case Consequences	Realistic Worst Case Consequences							Further Mitigation Required and Additional Comments
							Frequency	Consequences					Risk		Frequency	Consequences					Risk	
								People	Environment	Property	Business	Average Consequence				People	Environment	Property	Business	Average Consequence		
Recreational vessels (2.5 to 24m length)	Isolation	Array area	O	Compliance with relevant regulator guidance Guard vessel(s) Liaison with IRCG in relation to SAR resources Lighting and marking Marking on nautical charts Promulgation of information WTG design and layouts	Presence of surface structures Human/navigational error Mechanical/technical failure Adverse weather Aid to navigation failure	Vessel passes at an unsafe distance resulting in a need to make a late adjustment to course/speed	4	1	1	1	1	1.0	**Broadly Acceptable**	Allision event occurs involving vessel damage, PLL and/or pollution	3	4	3	4	2	3.3	**Tolerable**	Frequency increased relative to commercial vessels due to potential for internal navigation.
	Cumulative	Array area	O	Compliance with relevant regulator guidance Guard vessel(s) Liaison with IRCG in relation to SAR resources Lighting and marking Marking on nautical charts Promulgation of information WTG design and layouts	Presence of surface structures Human/navigational error Mechanical/technical failure Adverse weather Aid to navigation failure	Vessel passes at an unsafe distance resulting in a need to make a late adjustment to course/speed	4	1	1	1	1	1.0	**Broadly Acceptable**	Allision event occurs involving vessel damage, PLL and/or pollution	3	4	3	4	2	3.3	**Tolerable**	Includes consideration of the Relevant Projects. Frequency increased relative to commercial vessels due to potential for internal navigation.

User	Isolation / Cumulative	Project Component(s)	Phase (C/O/D)	Embedded Mitigation Measures (Full Descriptions Provided in Section 20)	Possible Causes	Most Likely Consequences	Realistic Most Likely Consequences							Worst Case Consequences	Realistic Worst Case Consequences							Further Mitigation Required and Additional Comments
							Frequency	Consequences					Risk		Frequency	Consequences					Risk	
								People	Environment	Property	Business	Average Consequence				People	Environment	Property	Business	Average Consequence		
Reduction of Under Keel Clearance as a Result of Cable Protection																						
All vessels	Isolation	All subsea cables	O	Cable protection Compliance with relevant regulator guidance Guard vessel(s) Liaison with IRCG in relation to SAR resources Promulgation of information	Presence of cable protection reduces water depth Human/navigational error	Vessel transits over an area of reduced clearance but does not make contact	3	1	1	1	1	1.0	**Broadly Acceptable**	Grounding on cable protection resulting in vessel damage and/or pollution	2	2	2	4	4	3.0	**Broadly Acceptable**	
All vessels	Cumulative	All subsea cables	O	Cable protection Compliance with relevant regulator guidance Guard vessel(s) Liaison with IRCG in relation to SAR resources Promulgation of information	Presence of cable protection reduces water depth Human/navigational error	Vessel transits over an area of reduced clearance but does not make contact	4	1	1	1	1	1.0	**Broadly Acceptable**	Grounding on cable protection resulting in vessel damage and/or pollution	3	2	2	4	4	3.0	**Tolerable**	Includes consideration of the Bremore Port development. Frequency increased relative to in isolation scenario due to potential proximity of vessels associated with Bremore Port.

User	Isolation / Cumulative	Project Component(s)	Phase (C/O/D)	Embedded Mitigation Measures (Full Descriptions Provided in Section 20)	Possible Causes	Most Likely Consequences	Realistic Most Likely Consequences							Worst Case Consequences	Realistic Worst Case Consequences							Further Mitigation Required and Additional Comments
								Consequences					Risk			Consequences					Risk	
							Frequency	People	Environment	Property	Business	Average Consequence			Frequency	People	Environment	Property	Business	Average Consequence		
Anchor Interaction with Subsea Cables																						
All vessels	Isolation	All subsea cables	O	Cable protection Compliance with relevant regulator guidance Marking on nautical charts Promulgation of information	Presence of subsea cables Insufficient cable burial/protection Human/navigational error Mechanical/technical failure	Vessel anchors on or drags anchor over a subsea cable/protection but no interaction occurs	3	1	1	1	1	1.0	**Broadly Acceptable**	Vessel anchors on or drags anchor over a subsea cable/protection with interaction occurring resulting in damage to the cable, protection, and/or anchor	2	1	2	2	2	1.8	**Broadly Acceptable**	Irish Chamber of Shipping noted that further designated anchorage areas may be required if cables interfere with frequent anchoring locations.
Interference with Communications and Position Fixing Equipment from the Proposed Development																						
All vessels	Isolation	Array area	O	Lighting and marking Marking on nautical charts Promulgation of information WTG design and layouts	Human error relating to adjustment of Radar controls Presence of surface structures	Structures have no effect upon the Radar, communication and position fixing equipment on a vessel	4	1	1	1	1	1.0	**Broadly Acceptable**	Structures have minor but manageable levels of Radar interference on a vessel	3	1	1	1	1	1.0	**Broadly Acceptable**	Irish Chamber of Shipping indicated that Radar interference should be considered.
Electromagnetic Interference with Magnetic Compasses from Subsea Cables																						
All vessels	Isolation	Array area	O	Marking on nautical charts Promulgation of information WTG design and layouts	Presence of subsea cables Human/navigational error	Inter array cables have no effect upon the magnetic compass on a vessel	4	1	1	1	1	1.0	**Broadly Acceptable**	Inter array cables have minor but manageable level of effect on compass deviation on a vessel	2	1	1	1	1	1.0	**Broadly Acceptable**	
		ECC	O	Marking on nautical charts Promulgation of information	Presence of subsea cables Human/navigational error	Export cables have no effect upon the magnetic compass on a vessel	4	1	1	1	1	1.0	**Broadly Acceptable**	Export cables have minor but manageable level of effect on compass deviation on a vessel	2	1	1	1	1	1.0	**Broadly Acceptable**	

User	Isolation / Cumulative	Project Component(s)	Phase (C/O/D)	Embedded Mitigation Measures (Full Descriptions Provided in Section 20)	Possible Causes	Most Likely Consequences	Realistic Most Likely Consequences								Worst Case Consequences	Realistic Worst Case Consequences								Further Mitigation Required and Additional Comments
							Frequency	Consequences					Risk			Frequency	Consequences					Risk	
								People	Environment	Property	Business	Average Consequence					People	Environment	Property	Business	Average Consequence		
Reduction of SAR Capability due to Increased Incident Rates																							
Emergency responders	Isolation	Array area	O	Compliance with relevant regulator guidance Liaison with IRCG in relation to SAR resources Lighting and marking Marine coordination for project vessels Project vessel compliance with international marine regulations WTG design and layouts	Array does not facilitate emergency responder access Adverse weather Limited resource capability	Delay to emergency response request	3	2	1	1	1	1.3	**Broadly Acceptable**	Delay to emergency response request leading to vessel damage, PLL and/or pollution	2	5	4	5	5	4.8	**Tolerable**	
		ECC	O	Compliance with relevant regulator guidance Liaison with IRCG in relation to SAR resources Marine coordination for project vessels Project vessel compliance with international marine regulations	Adverse weather Limited resource capability	Delay to emergency response request	2	2	1	1	1	1.3	**Broadly Acceptable**	Delay to emergency response request leading to vessel damage, PLL and/or pollution	1	5	4	5	5	4.8	**Tolerable**	

User	Isolation / Cumulative	Project Component(s)	Phase (C/O/D)	Embedded Mitigation Measures (Full Descriptions Provided in Section 20)	Possible Causes	Most Likely Consequences	Realistic Most Likely Consequences							Worst Case Consequences	Realistic Worst Case Consequences							Further Mitigation Required and Additional Comments
							Frequency	Consequences					Risk		Frequency	Consequences					Risk	
								People	Environment	Property	Business	Average Consequence				People	Environment	Property	Business	Average Consequence		
	Cumulative	Array area	O	Compliance with relevant regulator guidance Liaison with IRCG in relation to SAR resources Lighting and marking Marine coordination for project vessels Project vessel compliance with international marine regulations WTG design and layouts	Array does not facilitate emergency responder access Adverse weather Limited resource capability	Delay to emergency response request	4	2	1	1	1	1.3	**Broadly Acceptable**	Delay to emergency response request leading to vessel damage, PLL and/or pollution	3	5	4	5	5	4.8	**Tolerable**	Includes consideration of the Relevant Projects, Bremore Port development and Dublin Port development.
		ECC	O	Compliance with relevant regulator guidance Liaison with IRCG in relation to SAR resources Marine coordination for project vessels Project vessel compliance with international marine regulations	Adverse weather Limited resource capability	Delay to emergency response request	3	2	1	1	1	1.3	**Broadly Acceptable**	Delay to emergency response request leading to vessel damage, PLL and/or pollution	2	5	4	5	5	4.8	**Tolerable**	Includes consideration of the Relevant Projects, Bremore Port development and Dublin Port development.

Appendix E Rockabill Gap Review

727. This appendix provides a review of potential users of the Rockabill gap as defined in Section 13 to further inform the risk assessment, noting that the Drogheda Port Company have confirmed that the Rockabill gap, inclusive of a Structure Exclusion Zone, is suitable for the safety of navigation.

E.1 Potential Users

728. To ensure all relevant vessels from the base case are considered, the long-term AIS data (see Section 5.3 and Appendix F) has been used. Commercial vessel tracks deemed to be potential users of the Rockabill gap have been identified using a gate analysis, i.e., those vessel tracks passing through a gate which has been conservatively positioned to cover both the Rockabill gap and sea room within the array area where commercial vessels may be displaced from[11]. It was assumed that vessels passing inshore of Rockabill in the base case will continue to do so with the array in situ. The gate is presented in Figure E.1.

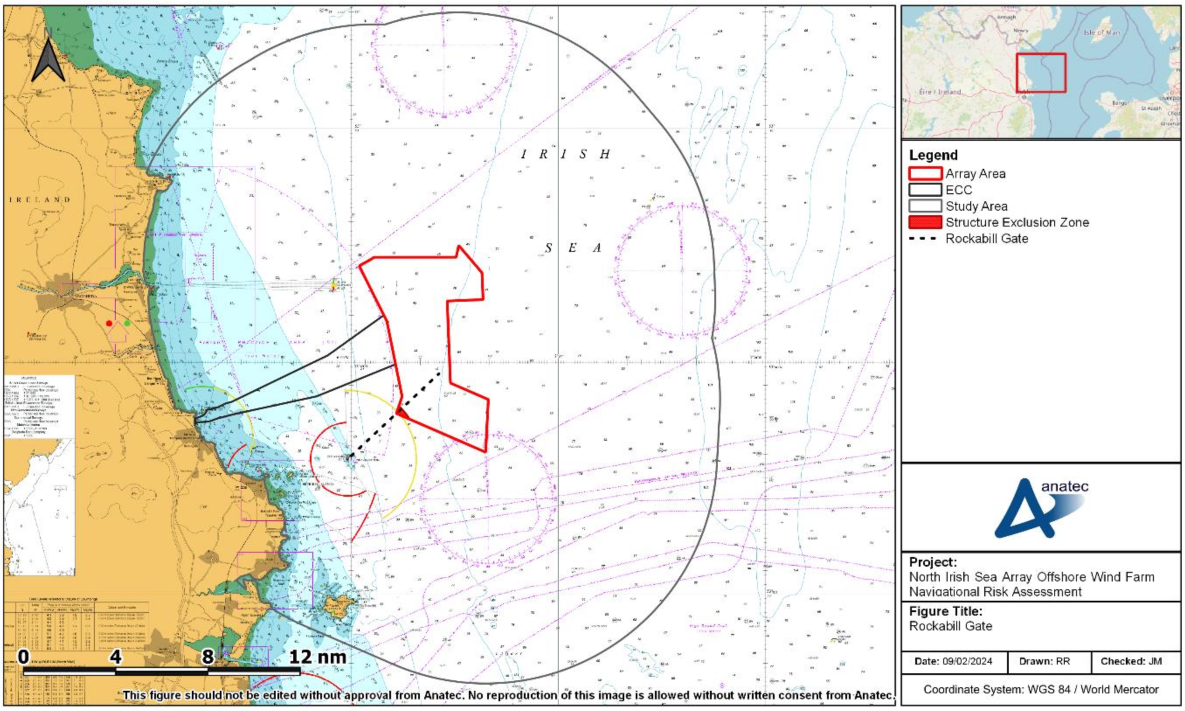

Figure E.1 Rockabill Gate

[11] Vessel tracks which have a clear and preferable alternative routeing option, i.e., users of Route 1 which are expected to deviate east of the array, have not been included.

E.1.2 Vessel Volume

729. On average there was one unique potential user per day across the 12-month period. The average daily numbers of potential users throughout each month is presented in Figure E.2.

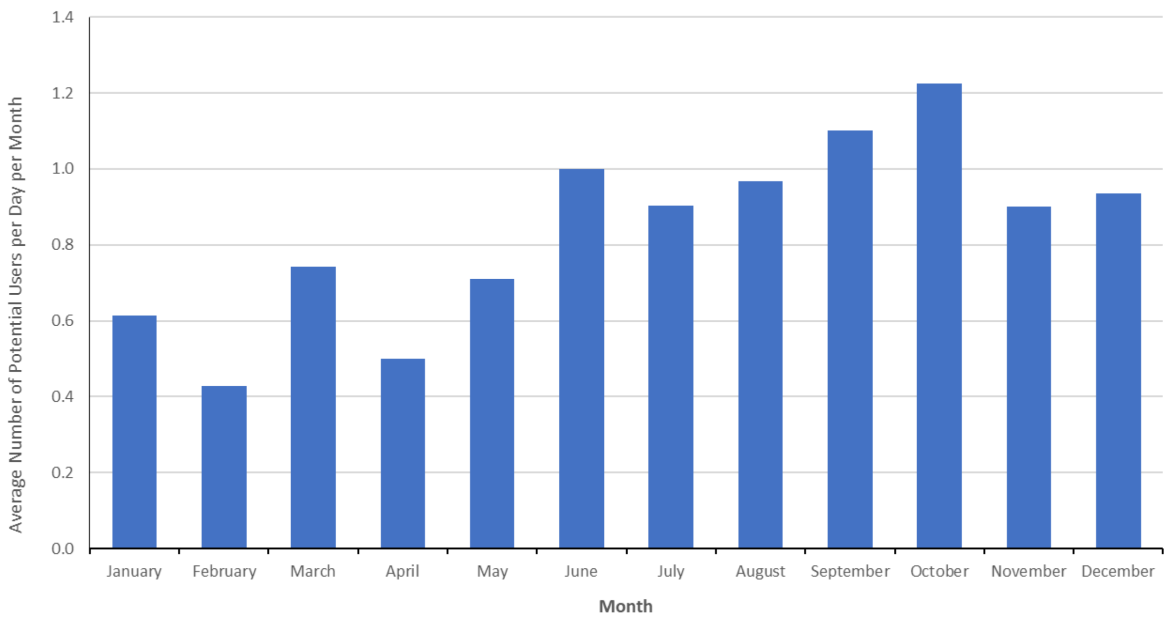

Figure E.2 Average Number of Potential Users Per Day Per Month (2022)

730. The maximum number of potential users recorded on transit through on any one day was four. This was recorded on five separate occasions across January, June, August, and December. There were 165 days (45% of the 12-month period) where no potential users were recorded.

E.1.3 Vessel Type

731. A plot of the potential users recorded within the study area during the 12-month period, colour-coded by vessel type, is presented in Figure E.3. Following this, the distribution of the main commercial vessel types is presented in Figure E.4.

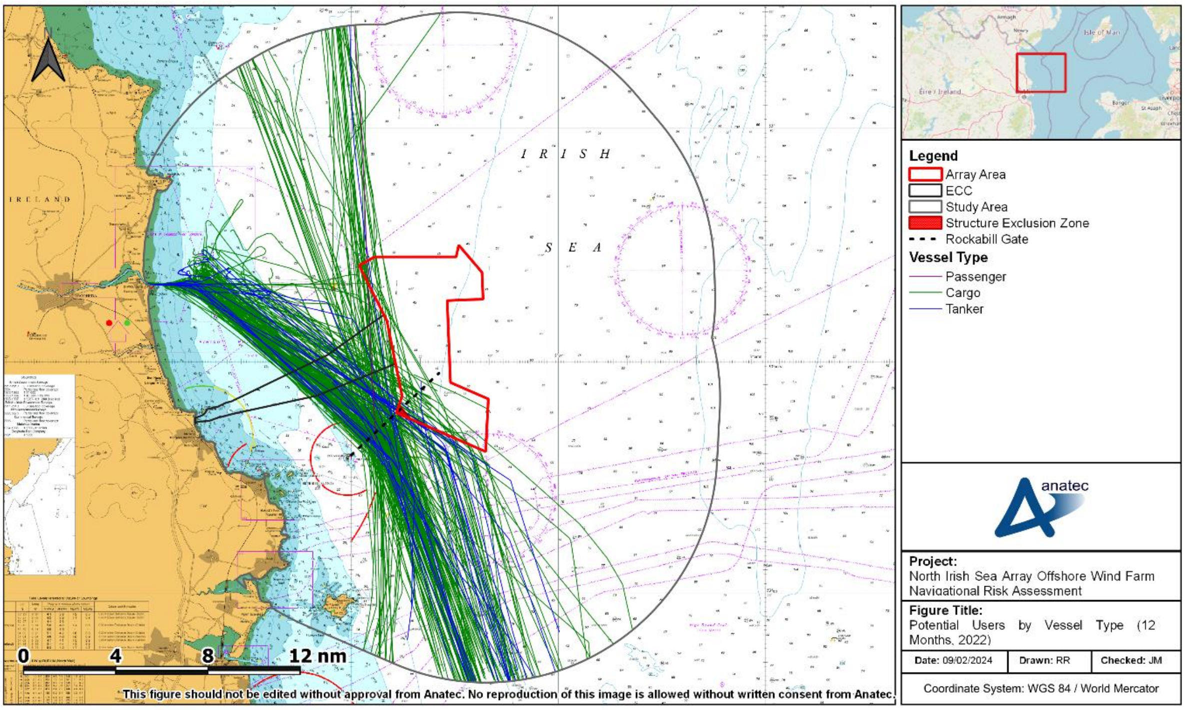

Figure E.3 Potential Users by Vessel Type (12 Months, 2022)

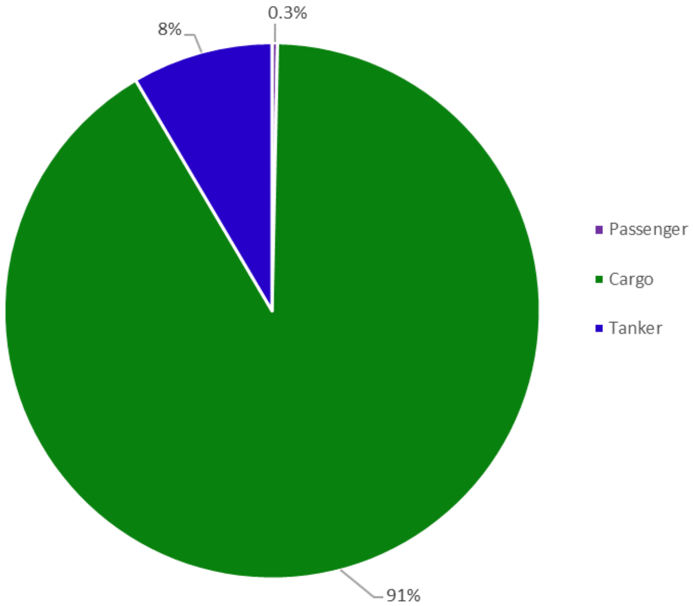

Figure E.4 Main Vessel Type Distribution for Potential Users (12 Months, 2022)

732. The most common vessel type recorded was cargo vessels, accounting for the majority (91%) of all traffic recorded. Other vessel types included tankers (8%) and passenger vessels (<1%). It is noted that only one passenger vessel, a small passenger cruise vessel, was recorded passing through the Rockabill gap.

E.1.4 Vessel Size

733. A plot of the potential users recorded within the study area during the 12-month period, colour-coded by LOA, is presented in Figure E.5. Following this, the distribution of these LOA classes is presented in Figure E.6.

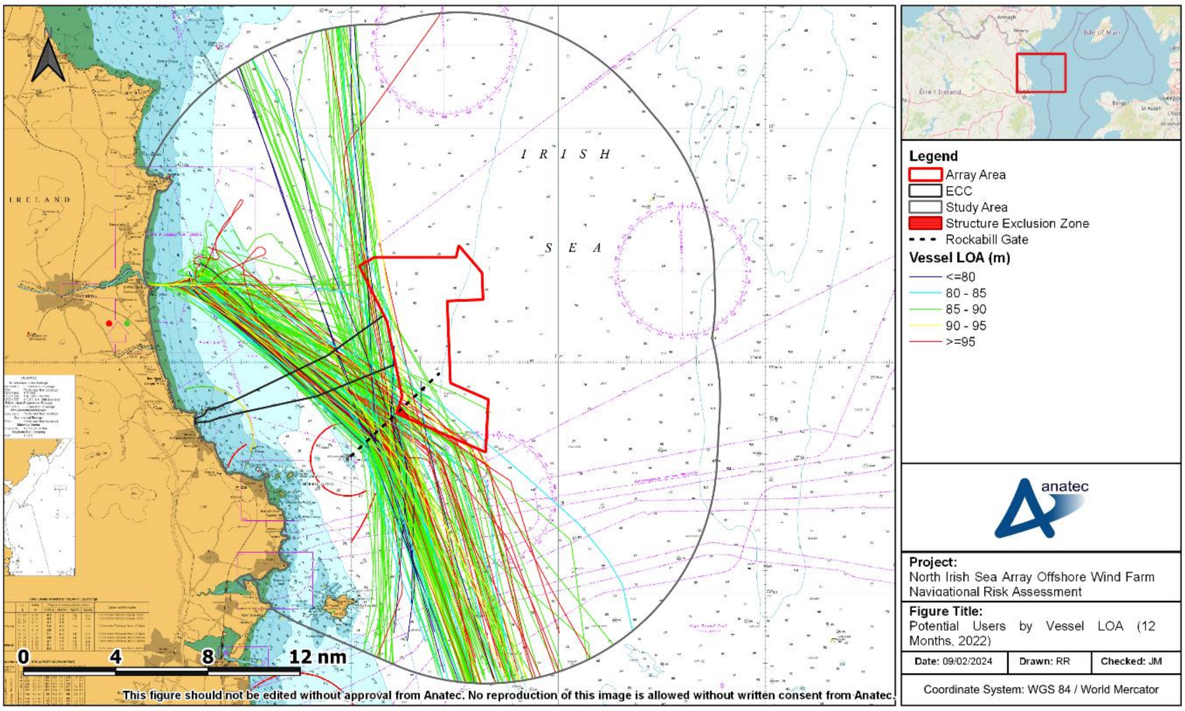

Figure E.5 Potential Users by Vessel LOA (12 Months, 2022)

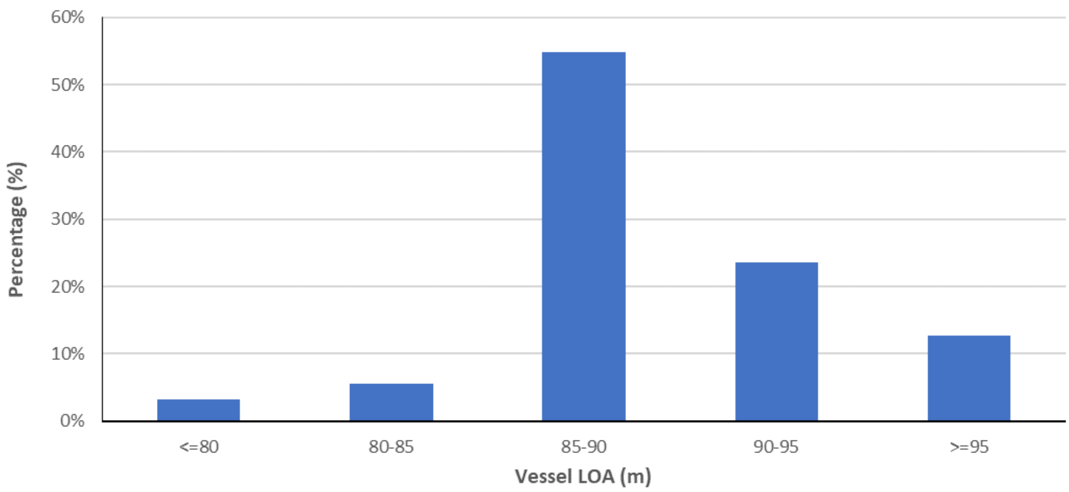

Figure E.6 Potential Users LOA Distribution (12 Months, 2022)

734. Vessel LOA ranged from a 59m general cargo vessel to a 142m RoRo; however, over half of vessels (55%) had an LOA of between 85 and 90m. The average LOA for potential users was 90m.

735. Vessels with greater LOA were primarily cargo vessels including RoRo, general cargo, and part containerised vessels. Vessels with smaller LOA were general cargo vessels, the one passenger vessel, and product tankers.

736. A plot of the potential users recorded within the study area during the 12-month period, colour-coded by DWT, is presented in Figure E.7. Following this, the distribution of these DWT classes is presented in Figure E.8.

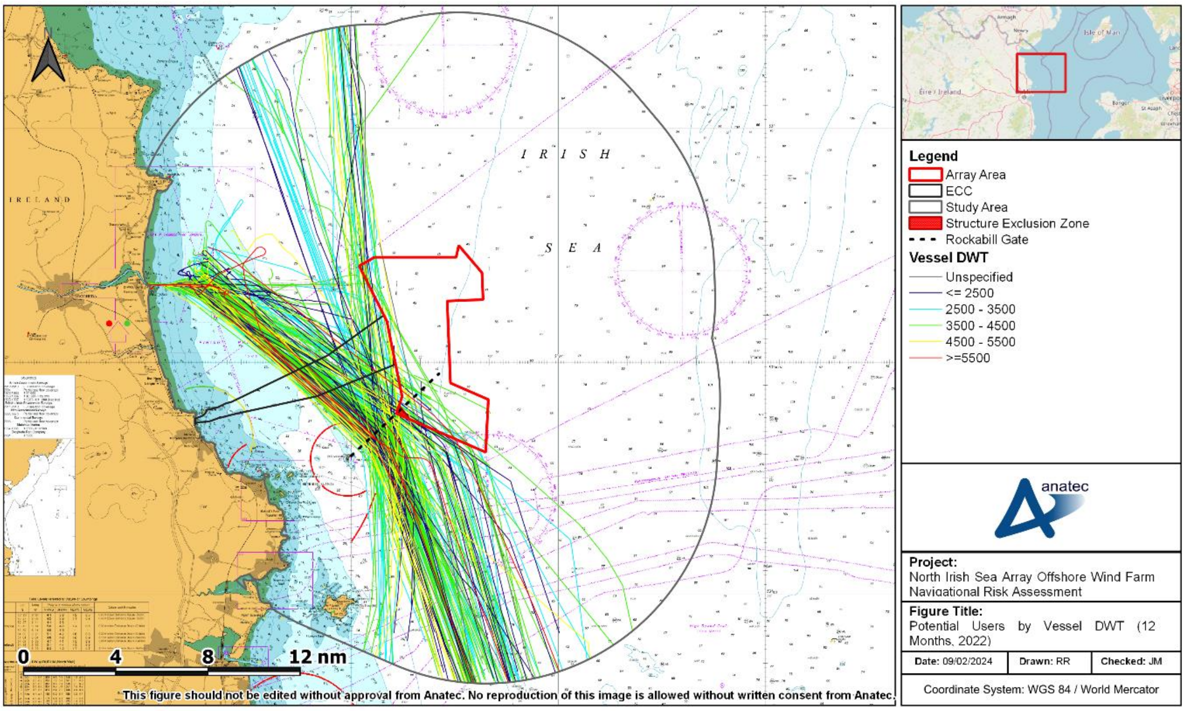

Figure E.7 Potential Users by DWT (12 Months, 2022)

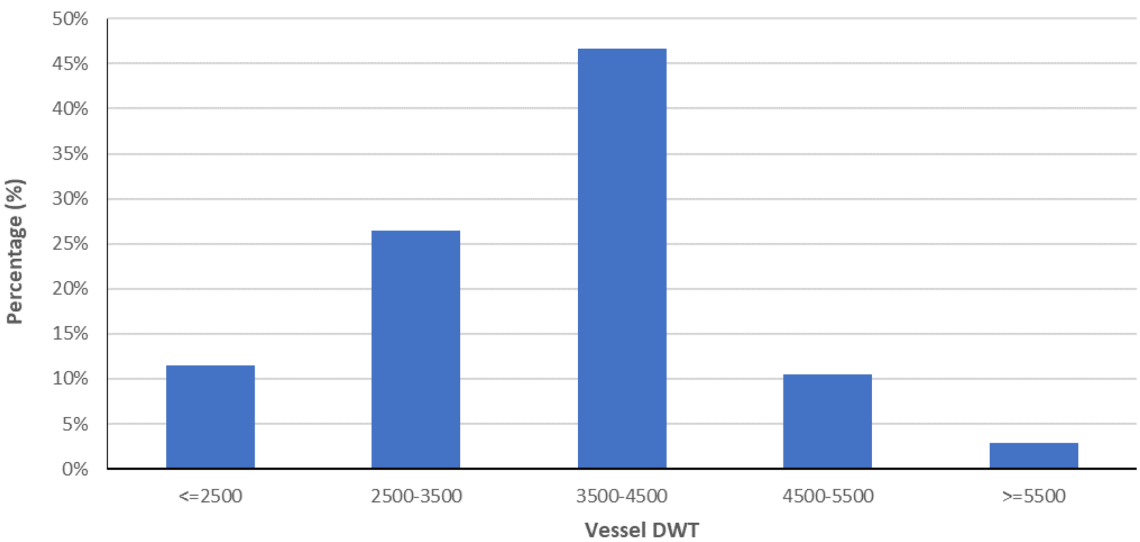

Figure E.8 Potential Users DWT Distribution (12 Months, 2022)

737. Vessel DWT was available for 98% of all vessels recorded. Of those available, DWT ranged from 125 DWT for a passenger cruise vessel to 7,984 DWT for a general cargo vessel. The average DWT for potential users was 3,660 DWT. Nearly half of all vessels (47%) had a DWT of between 3,500 and 4,500.

738. Vessels with greater DWT were primarily general cargo vessels and part containerised cargo vessels. Those vessels with smaller DWT were the one passenger vessel, LPG tankers, and small LOA general cargo vessels.

E.1.5 Average Vessel Speed

739. A plot of the potential users recorded within the study area during the 12-month period, colour-coded by average speed, is presented in Figure E.9. Following this, the distribution of these average speed classes is presented in Figure E.10.

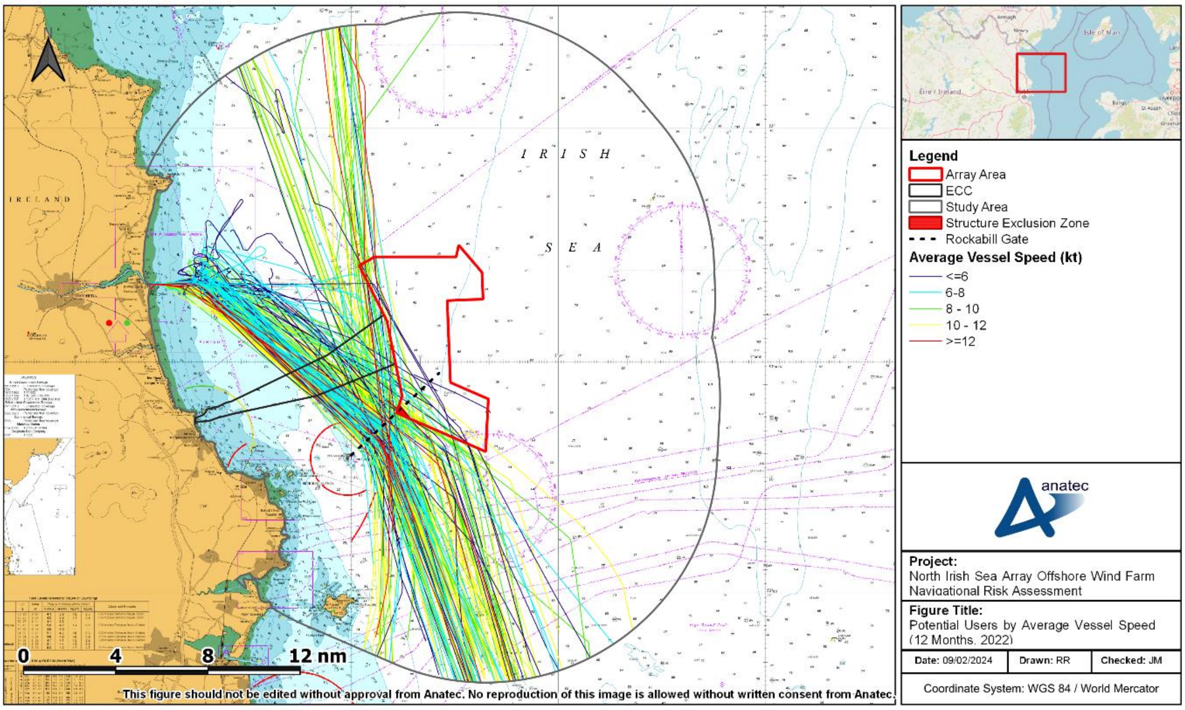

Figure E.9 Potential Users by Average Vessel Speed (12 Months, 2022)

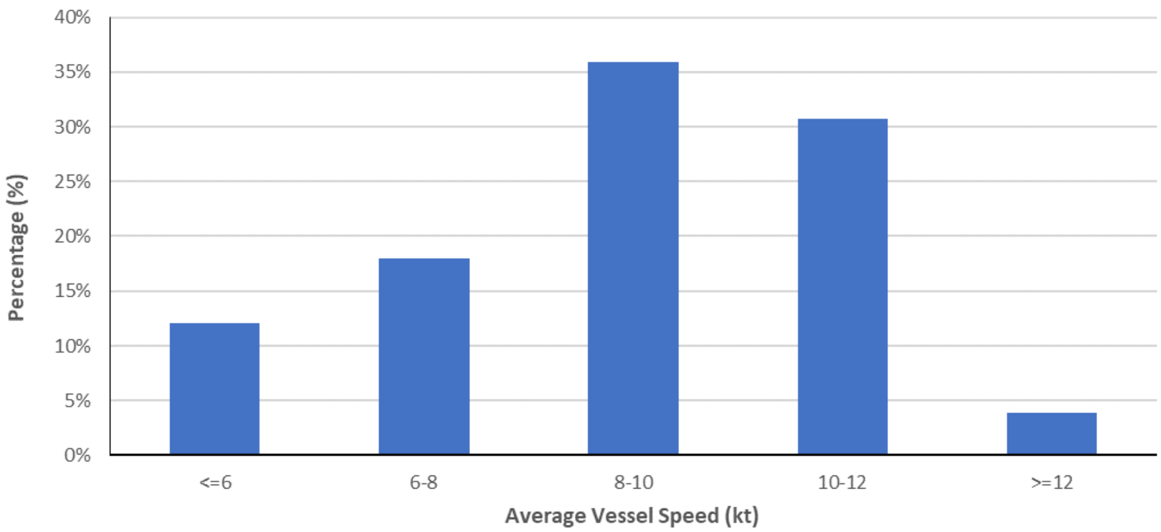

Figure E.10 Potential Users Average Vessel Speed Distribution (12 Months, 2022)

740. Average vessel speed ranged from 1.9kt for a general cargo vessel headed to Drogheda to 13.1kt for a general cargo vessel headed to Dublin. The average vessel speed for vessels on transit through the Rockabill gap was 8.9kt with the majority of vessels (67%) at an average vessel speed between 8 and 12kt.

741. Vessels with greater average speeds were primarily general cargo vessels. Vessels with lower average speeds were also general cargo vessels but also LPG tankers. All vessels at lower average speeds were routeing to/ from Drogheda.

E.2 Encounters

E.2.1 Likelihood of Encounters

742. Anatec's *Time Analyser* program has been used to identify the time at which each potential user identified in Section 727 passed through the gate. This data has been used to compute the number of transiting vessels within the Rockabill gap within each 30 minute interval throughout the 12-month period, where the 30 minute intervals are rolled minute-by-minute. Therefore, a total of 1,440 intervals are considered per day, or 525,571 intervals for the full year[12].

743. The breakdown of the number of transits for each 30 minute interval is presented in Table E.1.

[12] The last day (31st December 2022) includes 29 fewer 30 minute intervals since the final interval starts at 23:31 and ends at 00:00, i.e., there is no data to account for intervals ending after 00:00 on the 1st January 2023.

Table E.1 Breakdown of Number of Transits within Same 30 Minute Interval within the Rockabill Gap (12 Months, 2022)

Number of Transits within Same 30 Minute Period	Count	Percentage (%)
0	516,546	98.28%
1	8,870	1.69%
2	155	0.03%

744. The analysis indicates that over 98% of the 30 minute intervals featured no vessels passing the gate. In around 1.7% of the 30 minute intervals there was one vessel passing the gate. Finally, in 0.03% of the 30 minute intervals there were two vessels passing the gate. At no point did more than two vessels pass through the gate within the same 30 minute period.

E.2.2 Closest Passing Distance from Rockabill

745. An analysis has been undertaken of the closest passing distance from Rockabill for potential users throughout the 12-month period. A breakdown of closest passing distances for potential users from Rockabill is presented in Figure E.11.

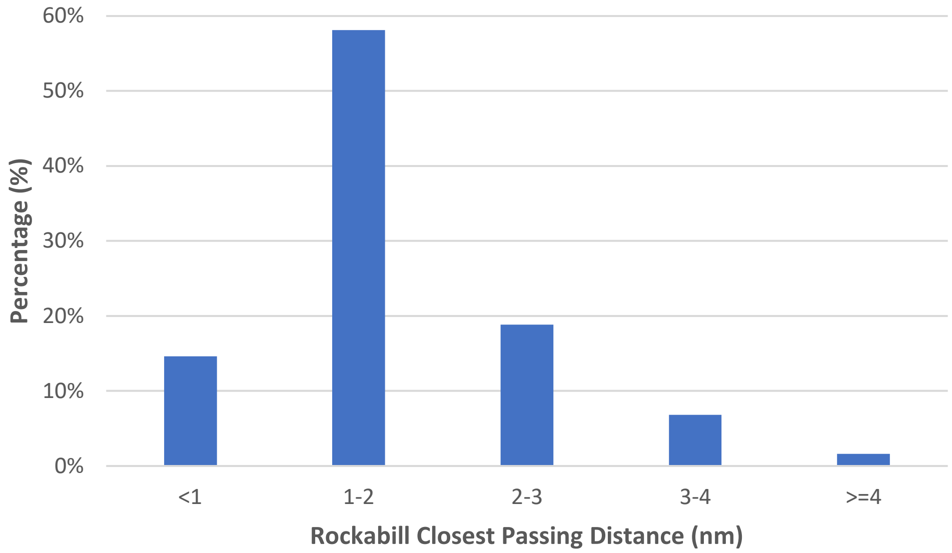

Figure E.11 Breakdown of Closest Passing Distances for Potential Users from Rockabill (12 Months, 2022)

746. The majority of potential users (58%) passed between 1 and 2nm from Rockabill, with approximately 15% passing within 1nm. The distribution of vessel types and sizes for potential users by closest passing distance from Rockabill is provided in Table E.2.

Table E.2 Distribution of Vessel Types and Sizes for Potential Users by Closest Passing Distance from Rockabill (12 Months, 2022)

Closest Passing Distance from Rockabill	Vessel Type			Vessel Length	
	Cargo	Tanker	Passenger	<90m	≥90m
<1	15%	7%	0%	14%	16%
1-2	60%	41%	100%	63%	49%
2-3	17%	41%	0%	17%	23%
3-4	7%	7%	0%	5%	10%
>=4	1%	4%	0%	1%	3%

747. In terms of vessel type, cargo vessels are more likely to pass closer to Rockabill than tankers, with a considerable portion of tankers maintaining a passing distance of at least 2nm.

748. In terms of vessel size, smaller vessels (less than 90m) are more likely to pass closer to Rockabill than larger vessels (at least 90m) although the distribution is less skewed than that for vessel type.

E.2.3 Effect of Non Users

749. From the vessel traffic survey data (see Section 10) and long-term traffic data (see Appendix E) there are vessel movements which would not be considered potential users of the Rockabill gap but which are relevant since they pass in proximity to the Rockabill gap.

750. Recreational vessels are highly seasonal, with much higher volumes recorded during the summer months. One of the prominent recreational vessel movements is north-east south-west transits through the array area on route to/from Howth and Dublin Bay. These transits pass directly east of the Rockabill gap, perpendicular to the direction of transit for a vessel navigating through the Rockabill gap.

751. Fishing vessels are less prominent in proximity to the Rockabill gap, with only occasional transits at the point where vessels may navigate through the Rockabill gap. However, active fishing occurs off the south-eastern corner of the array area and may interact with users of the Rockabill gap. Further baseline data relating to active fishing is provided in **Volume 3, Chapter 16: Commercial Fisheries** and Appendix 16.1.

752. No vessels were identified at anchor in proximity to the Rockabill gap.

Appendix F Long-Term Vessel Traffic Movements

753. This appendix assesses additional long-term vessel traffic data for the proposed development. As required under MGN 654 (MCA, 2021), the NRA and **Volume 3, Chapter 17: Shipping and Navigation** consider 28 days of AIS, Radar, and visual observation data as the primary vessel traffic data source. However, it should be considered that studying a 28-day period in isolation may exclude certain activities or periods of pertinence to shipping and navigation. Therefore, in line with good practice assessment procedures, this NRA has also considered a longer term dataset covering all of 2022 to ensure a comprehensive characterisation of vessel traffic movements can be established, including the capture of any seasonal variation.

754. This approach (i.e., the use of both short- and long-term data) was requested by multiple stakeholders at the Hazard Workshop.

755. The key aims of this appendix are to identify seasonal variations and any other movements or activities not represented by the vessel traffic survey data.

F.1 Methodology

F.1.1 Study Area

756. This appendix has assessed the long-term vessel traffic data within the same study area introduced in Section 3.5.

F.1.2 Data Period and Temporary Vessel Traffic

757. The long-term vessel traffic data was collected from coastal AIS receivers for the entirety of 2022 (1 January to 31 December). Overall, there was good coverage of the study area during the data period.

758. As per the vessel traffic surveys, a number of vessel tracks recorded during the data period were classified as temporary (non-routine) and have been excluded from the characterisation of the vessel traffic baseline.

F.1.3 AIS Carriage

759. General limitations associated with the use of AIS data (for example, carriage requirements) are discussed in full within Section 5.4.1.

F.2 Long-Term Vessel Traffic Movements

760. A plot of the vessel tracks recorded within the study area during the data period, colour-coded by vessel type and excluding temporary traffic, is presented in Figure F.1. Following this, the same data illustrated in a density heat map in Figure F.2.

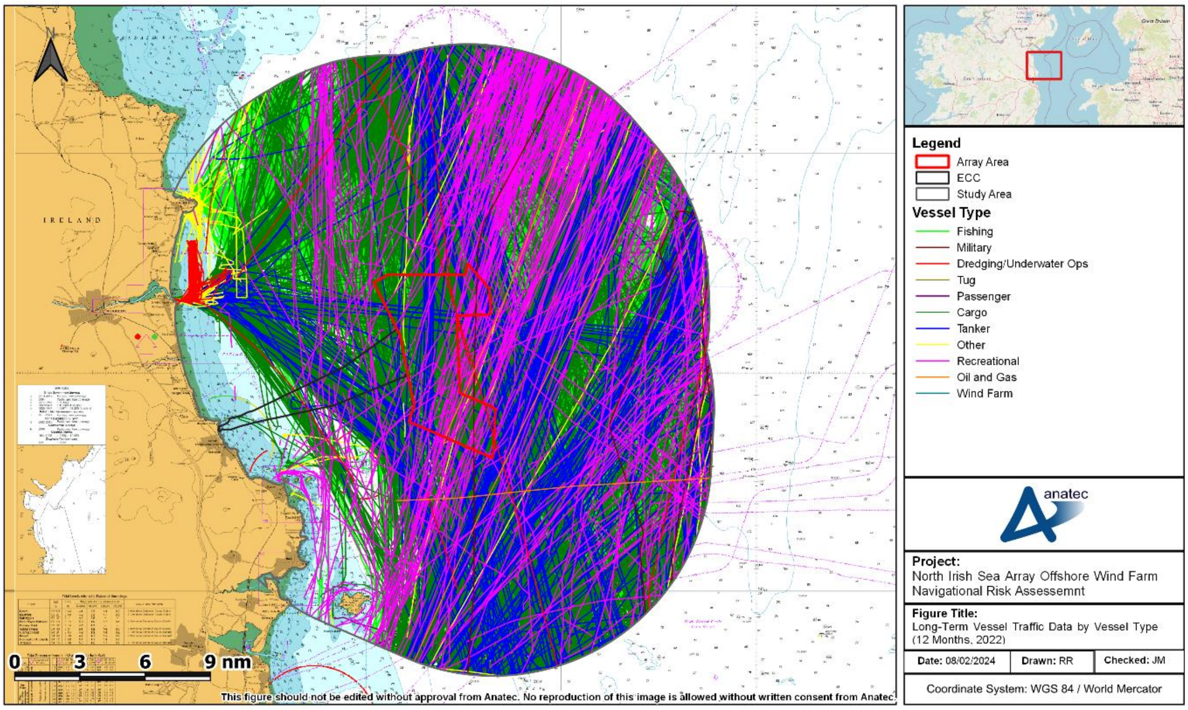

Figure F.1 Long-Term Vessel Traffic Data by Vessel Type (12 Months, 2022)

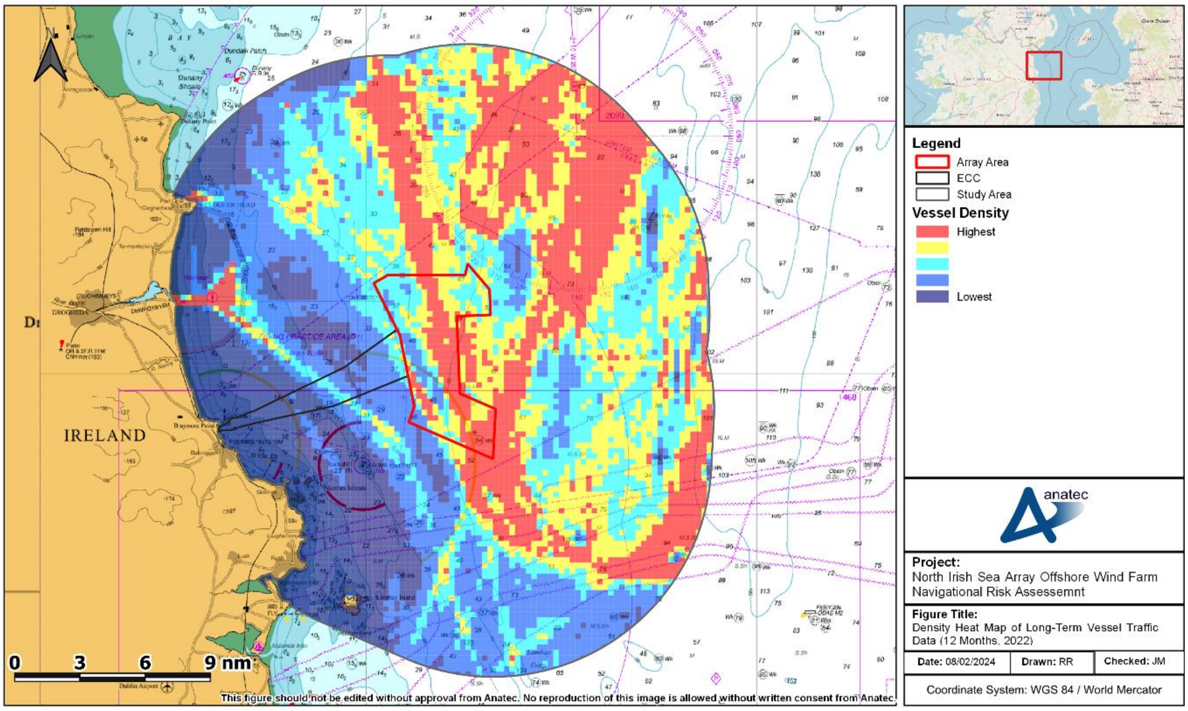

Figure F.2 Density Heat Map of Long-Term Vessel Traffic Data (12 Months, 2022)

F.2.2 Vessel Count

761. The average daily numbers of vessels within the study area, array area, and ECC throughout each month of 2022 are presented in Figure F.3.

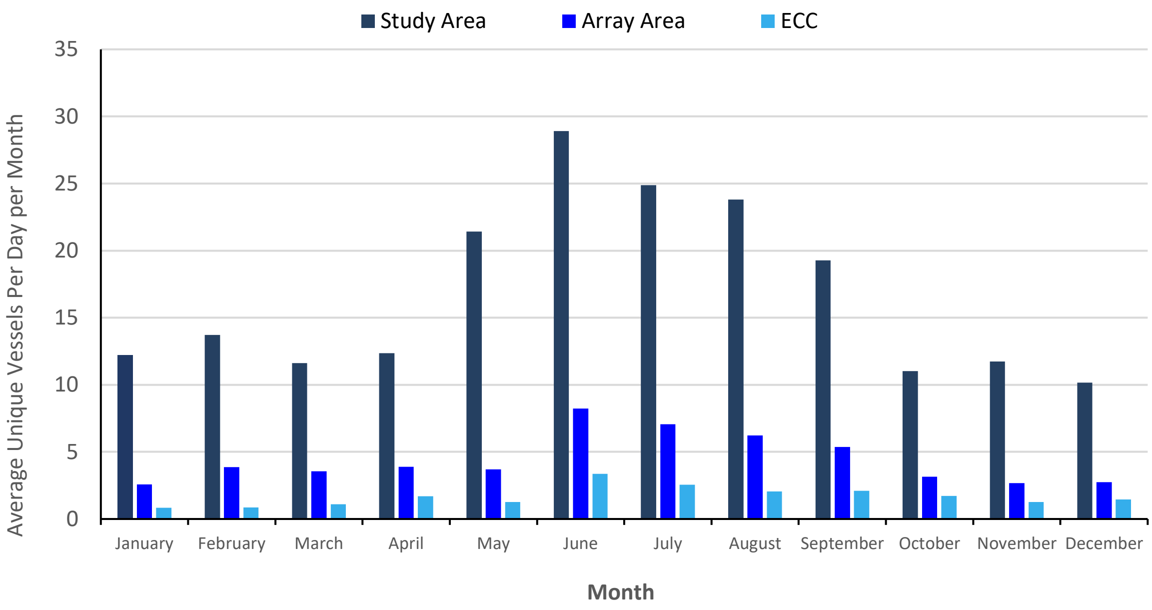

Figure F.3 Long-Term Average Daily Counts by Month within Study Area, Array Area, and ECC (2022)

762. The busiest month during the long-term vessel traffic dataset was June with approximately 29 unique vessels per day recorded within the study area. June was also the busiest month for the array area and the ECC with an average of eight unique vessel per day recorded within the array area and an average of three to four unique vessels per day recorded within the ECC.

763. The quietest month during the long-term vessel traffic data set was December with approximately 10 unique vessels per day recorded within the study area. January was the quietest month for the array area and the ECC with an average of two to three unique vessel per day recorded within the array area and an average of one unique vessel per day recorded within the ECC.

764. Overall, higher levels of vessel traffic were observed during the summer months, likely due to greater recreational and fishing activity given more favourable weather conditions.

F.2.3 Vessel Type

765. The distribution of the main vessel types recorded during the long-term vessel traffic data set are presented in Figure F.4. Vessel types accounting for less than 1% of the overall vessel tracks recorded during the data period (including military, tug, oil and

gas, and wind farm) have been incorporated into the 'all others' category. It is noted that the other vessel type category consists of mainly RNLI lifeboats and pilot vessels.

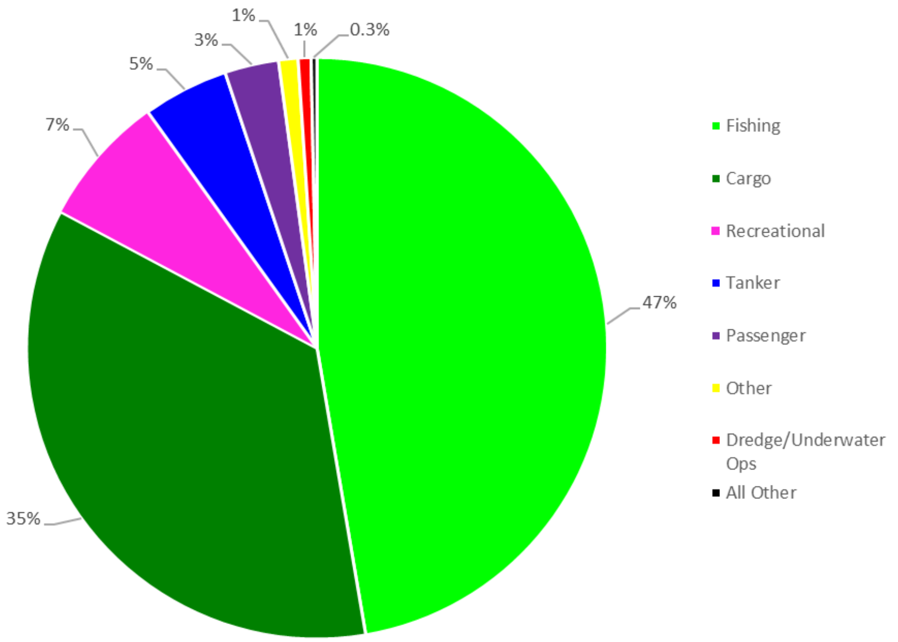

Figure F.4 Main Vessel Type Distribution (12 Months, 2022)

766. The most common vessel type recorded within the study area during the data period was fishing vessels, accounting for nearly half (47%) of all traffic recorded. Other common vessel types included cargo vessels (35%), recreational (7%), and tankers (5%). No other vessel type equating to more than 5% of all vessel types recorded.

Commercial Vessels

767. Figure F.5 presents the commercial vessels recorded within the study area during the data period, colour-coded by vessel type.

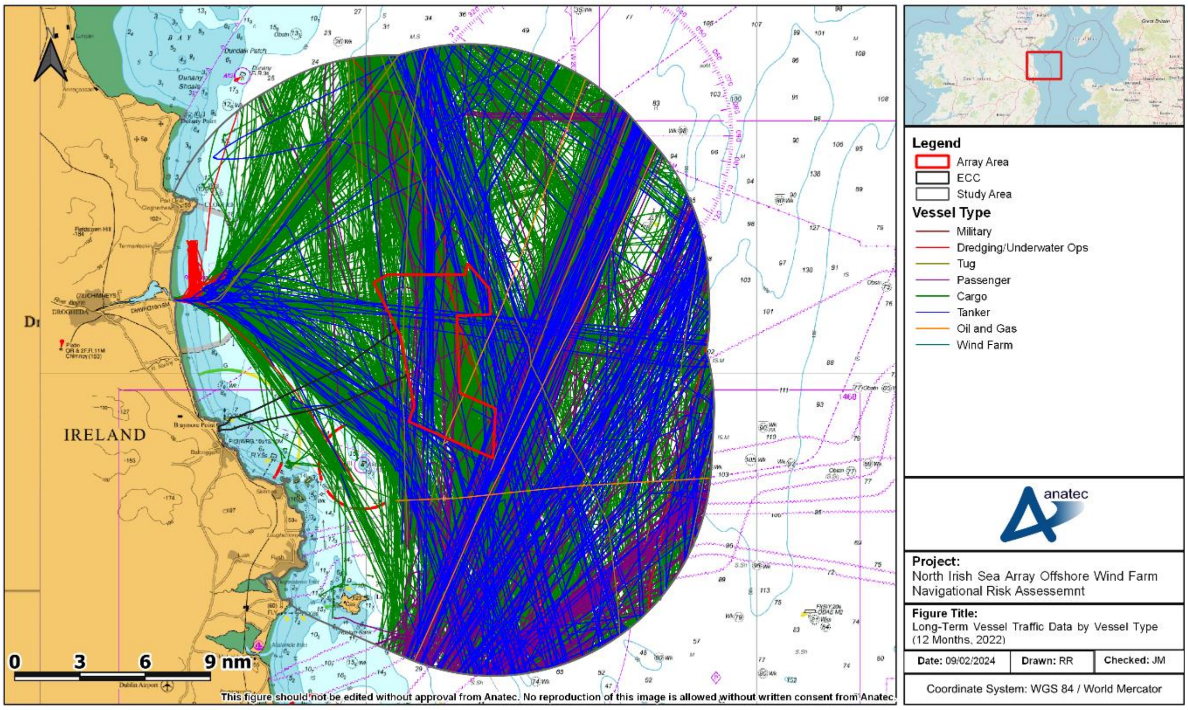

Figure F.5 Commercial Vessel Traffic Data by Vessel Type (12 Months, 2022)

768. The majority of the commercial traffic within the study area is on well-defined routes with these primarily comprising the main commercial routes that have been identified from the vessel traffic survey data (see Section 11.2). Notably there was significant north-south transits comprising cargo vessels and tankers.

769. Marine aggregate dredging activity was recorded at the entrance to the River Boyne as well as north-south between the coast and the Drogheda anchorage area that was not noted in the vessel traffic survey data.

770. A breakdown of the average number of unique vessels per day for each commercial vessel type recorded within the study area, as well as intersecting the array area and ECC, is presented in Figure F.6. Accounting for the distribution of vessel types, only cargo vessels, tankers, passenger vessels, and dredging/ subsea operation vessels are included. No other commercial vessels equated to more than 1% of all vessel traffic recorded (Section F.2.3).

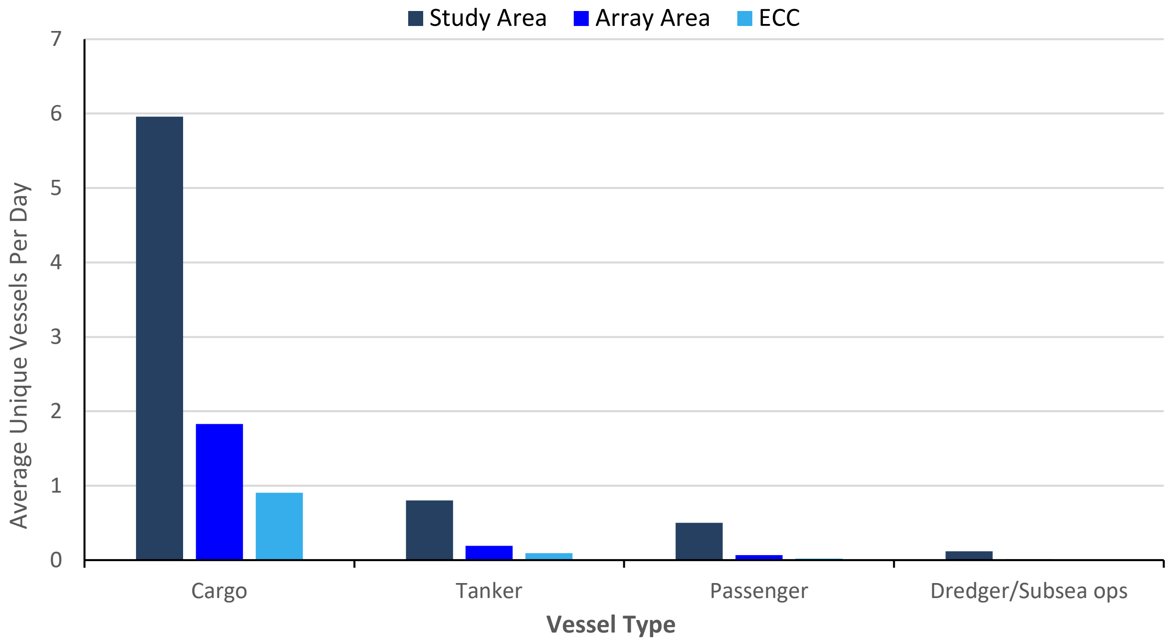

Figure F.6 Commercial Vessel Average Daily Counts per Vessel Type (12 Months, 2022)

771. On average throughout the data period, there was an average of six unique cargo vessels and one unique tanker vessel recorded per day within the study area. For passenger vessels, one unique passenger vessel was recorded on average every two days within the study area and one unique dredger/ subsea operation vessel every eight days. Approximately 29% of all commercial vessels were recorded intersecting the array area, the majority being cargo vessels. Approximately 14% of all commercial vessels were recorded intersecting the ECC, the majority also being cargo vessels.

772. Figure F.7, Figure F.8, and Figure F.9 present the daily average number of unique commercial vessels for each vessel type for the study area, array area and ECC, respectively.

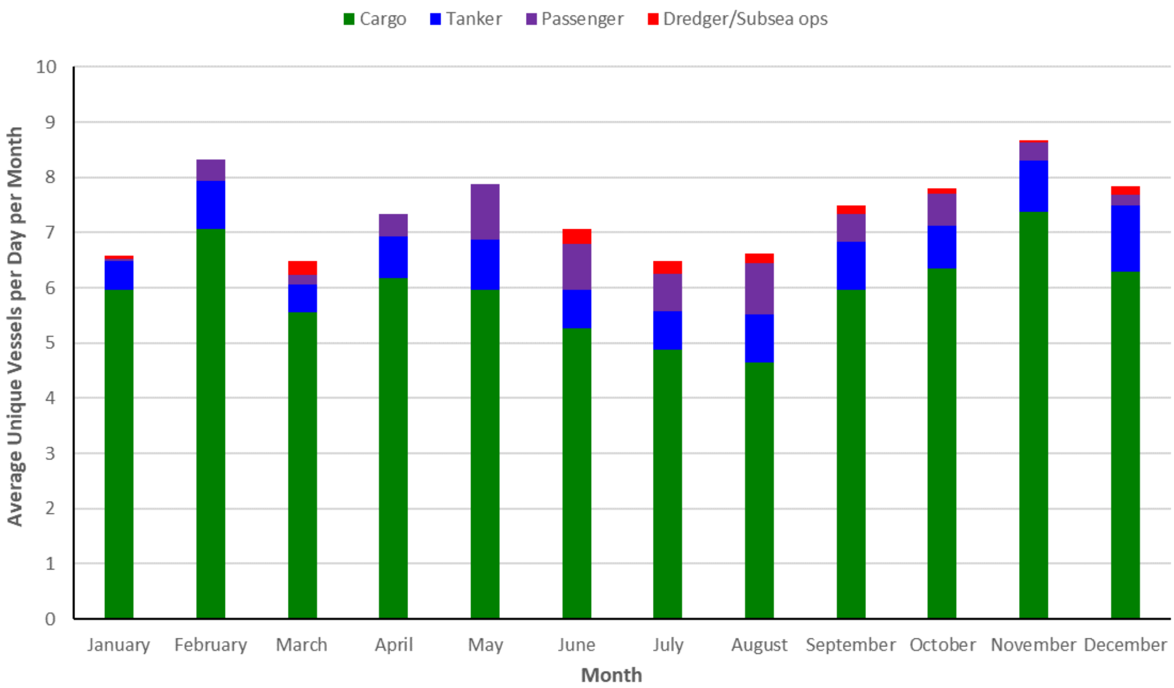

Figure F.7 Commercial Vessel Average Daily Counts by Month per Vessel Type within Study Area (2022)

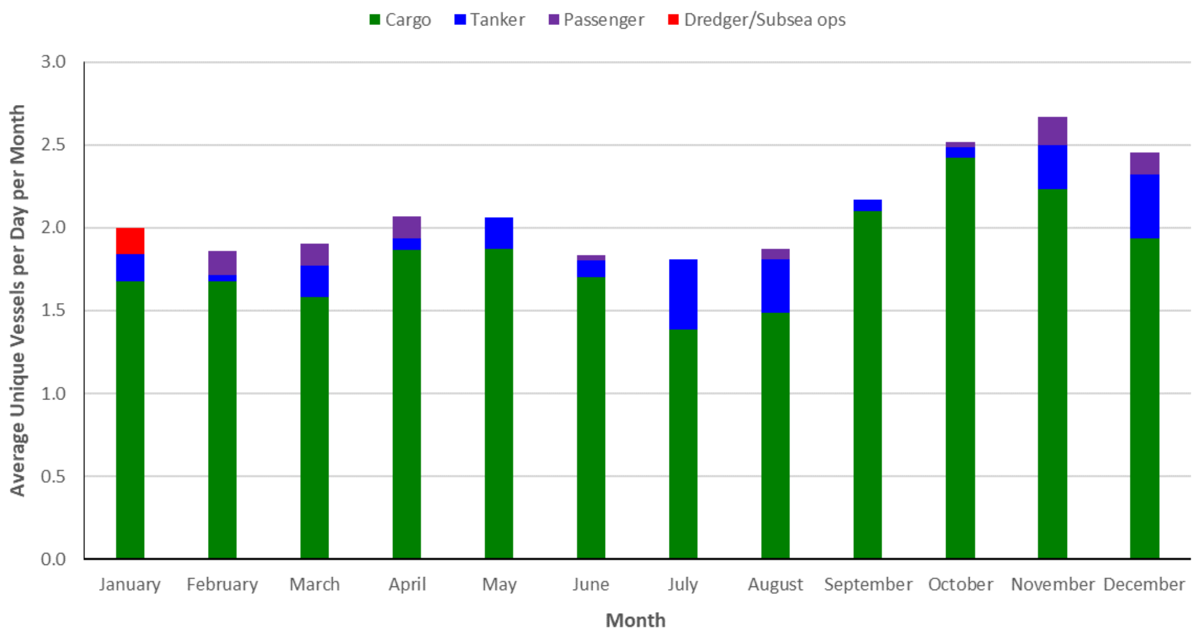

Figure F.8 Commercial Vessel Average Daily Counts by Month per Vessel Type within Array Area (2022)

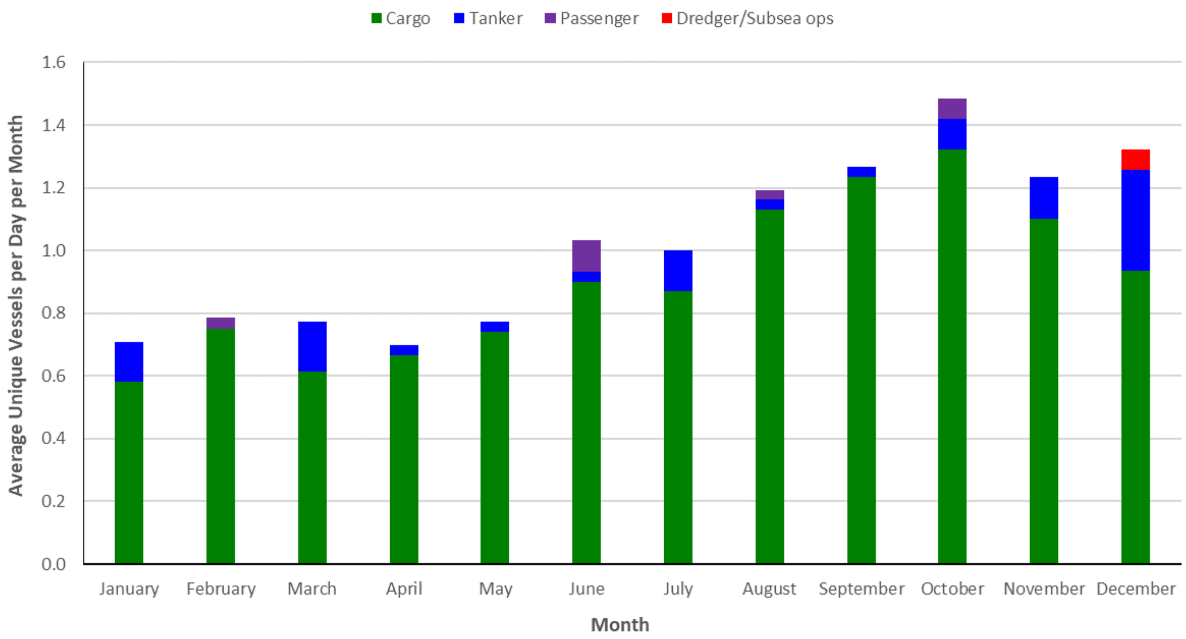

Figure F.9 Commercial Vessel Average Daily Counts by Month per Vessel Type within ECC (2022)

773. Cargo vessels showed minimal seasonal variation within the study area with only a slight decrease in vessel numbers over the summer months. The busiest month within the study area for cargo vessels was November with an average of seven to eight unique cargo vessels per day. The quietest month for cargo vessels was August with an average of four to five unique cargo vessels per day.

774. Tankers similarly showed minimal seasonal variation within the study area with the busiest month being December with an average of one unique tanker every day. The quietest months for tankers were January and March with an average of one unique tanker recorded every two days in the study area during each month.

775. Passenger vessels showed some seasonal variation with a greater daily average recorded during the summer months than the winter months. The busiest month within the study area for passenger vessels was May with an average of one unique passenger vessel per day. The quietest month for passenger vessels was January when one passenger vessel was recorded within the study area the entire month.

776. Dredging/ subsea operation vessels showed minimal seasonal variation with the busiest month for dredging/ subsea operations vessels in the study area being June where one unique vessel was recorded every three to four days. The quietest months within the study area were February and May where no dredging/ subsea operation vessels were recorded at all.

777. Table F.1 presents a summary of the average number of vessels per week within the study area during the busiest month, quietest month, and average throughout the full data period.

Table F.1 Quietest Month, Busiest Month, and Overall Average Weekly Count for Commercial Vessels within the Study Area (2022)

Vessel type	Quietest month (Unique Vessels per Week)	Busiest Month (Unique Vessels per Week)	Average (Unique Vessels per Week)
Cargo	32	52	42
Tanker	3-4	8-9	5-6
Passenger	0-1	7	3-4
Dredging/ Subsea Operation	None	2	0-1

778. In summary, the most common type of commercial vessel recorded withing the study area was cargo vessels. Cargo vessels, tankers, and dredging/ subsea operation vessels showed little, if any, seasonal variation whilst passenger vessel activity was greater in the summer months.

Commercial Ferries

779. Figure F.10 presents the commercial ferries (RoRo and RoPax vessels) recorded within the study area during the data period, colour-coded by operator.

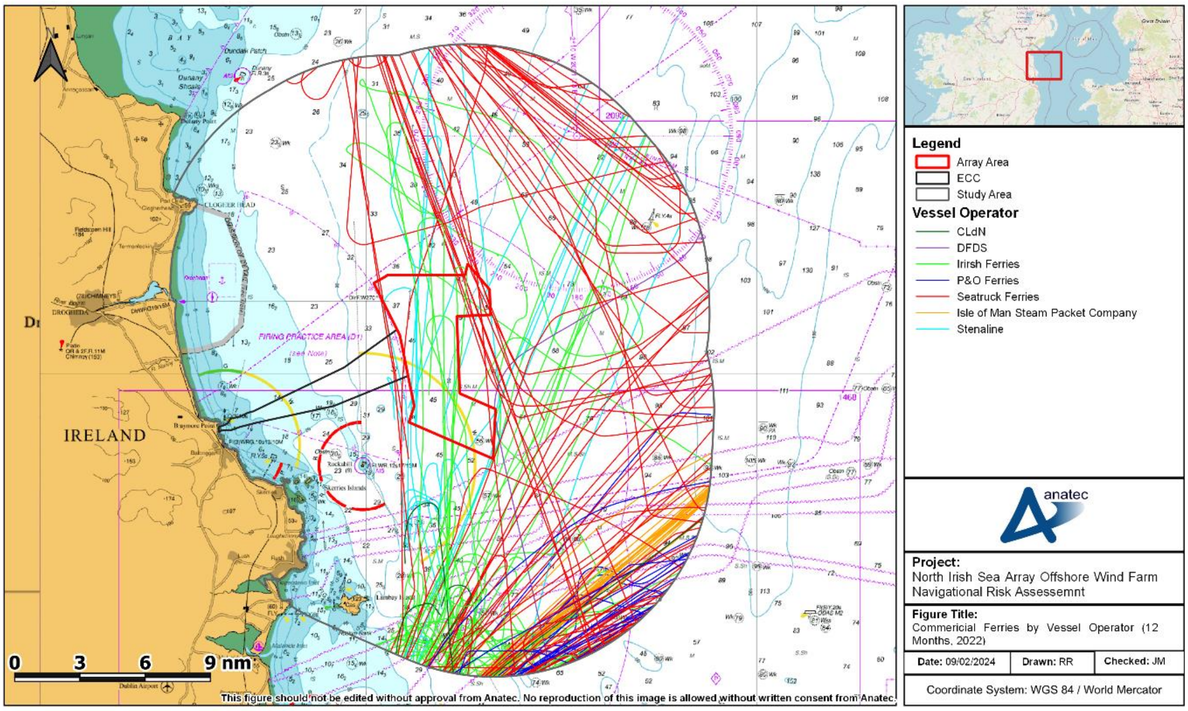

Figure F.10 Commercial Ferries within the Study Area by Vessel Operator (12 Months, 2022)

780. RoRo (53%) and RoPax (47%) vessels were both frequently recorded within the study area during the data period. The most frequently recorded commercial ferry within the study area was the *W.B. Yeats,* a RoPax operated by Irish Ferries on a route between Dublin and Cherbourg (France). This route does not pass within the study area as standard; however, on occasion the vessel exhibited waiting behaviour south of the array area which may be due to berth availability at Dublin and adverse weather conditions as described in Section 12.

781. For vessels which did route within the study area, the most frequent were the Seatruck Ferries sister vessels on the Warrenpoint–Heysham route transiting north-west south-east. These tracks are indicative of alternative routeing in adverse weather, although continue to pass well clear of the array area to the north-east.

782. The most commonly recorded operator was Seatruck Ferries, followed by Irish Ferries, and P&O Ferries.

783. The commercial ferry operators and their relative prominence within the study area is comparable with that observed during the vessel traffic surveys.

Fishing Vessels

784. The average daily unique vessel counts for fishing vessels recorded within the study area during the data period are presented in Figure F.11, as well as unique daily counts for fishing vessels within the array area and the ECC.

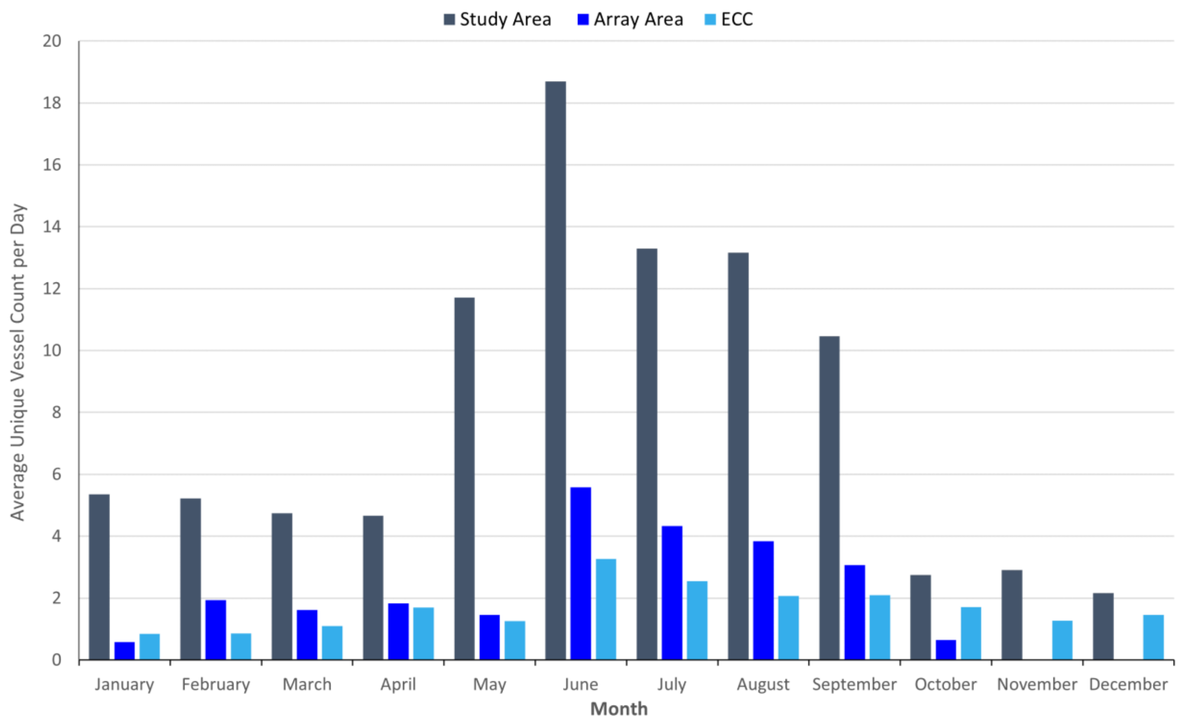

Figure F.11 Average Unique Daily Fishing Vessel Counts per Month within the Study Area, Array Area, and ECC (2022)

785. The presence of fishing vessels in the study area is highly seasonal with vessel prominence increasing in the summer months from May until September as opposed to the winter months. Fishing vessels peaked in June with an average of 19 unique vessels recorded per day within the study area. The quietest month recorded for fishing vessels within the study area was December with an average of two unique vessel per day.

786. Throughout all of 2022, an average of eight unique fishing vessels per day were recorded within the study area. Approximately 27% of fishing vessels were recorded intersecting the array area and approximately 22% of fishing vessels were recorded intersecting the ECC.

787. Fishing vessel data was distributed across two seasonal periods: six months from April to September for the summer period and six months from January to March and October to November for the winter period. Fishing vessel transits for each of these data periods are presented in a density heat map in Figure F.12 and Figure F.13 for the summer and winter periods, respectively. It is noted that the same density bins were used for each of the data periods for a direct comparison.

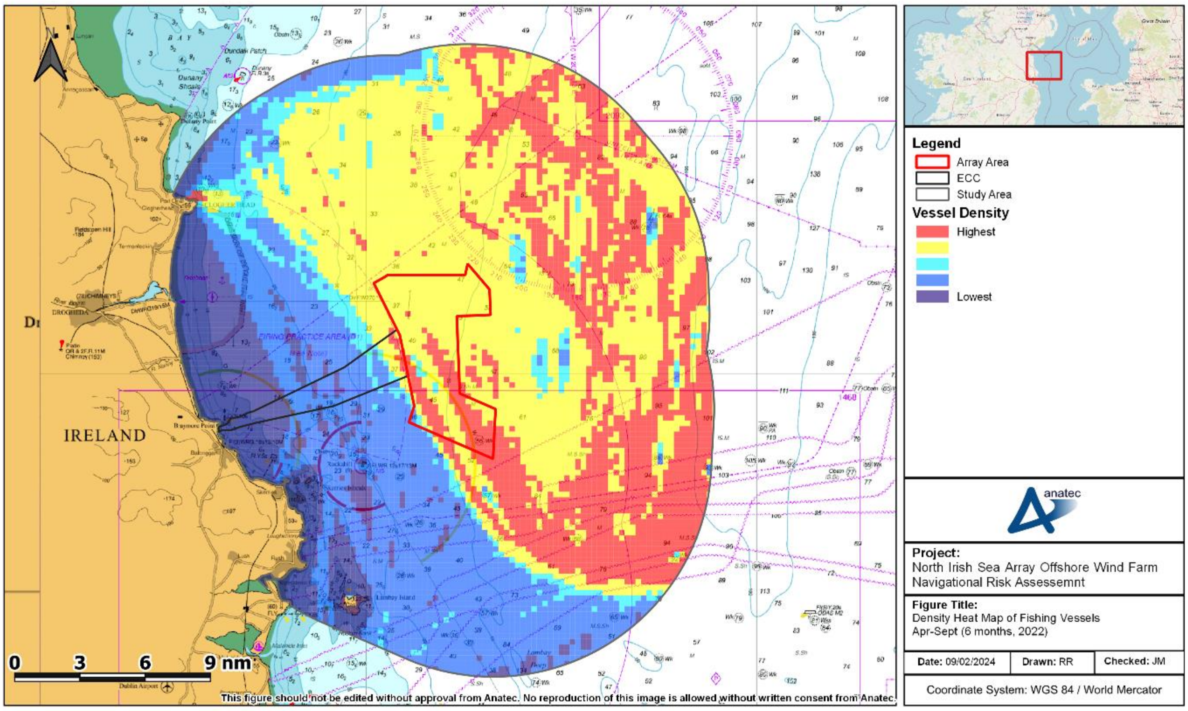

Figure F.12 Density Heat Map of Fishing Vessel Traffic Data April to September (6 Months, 2022)

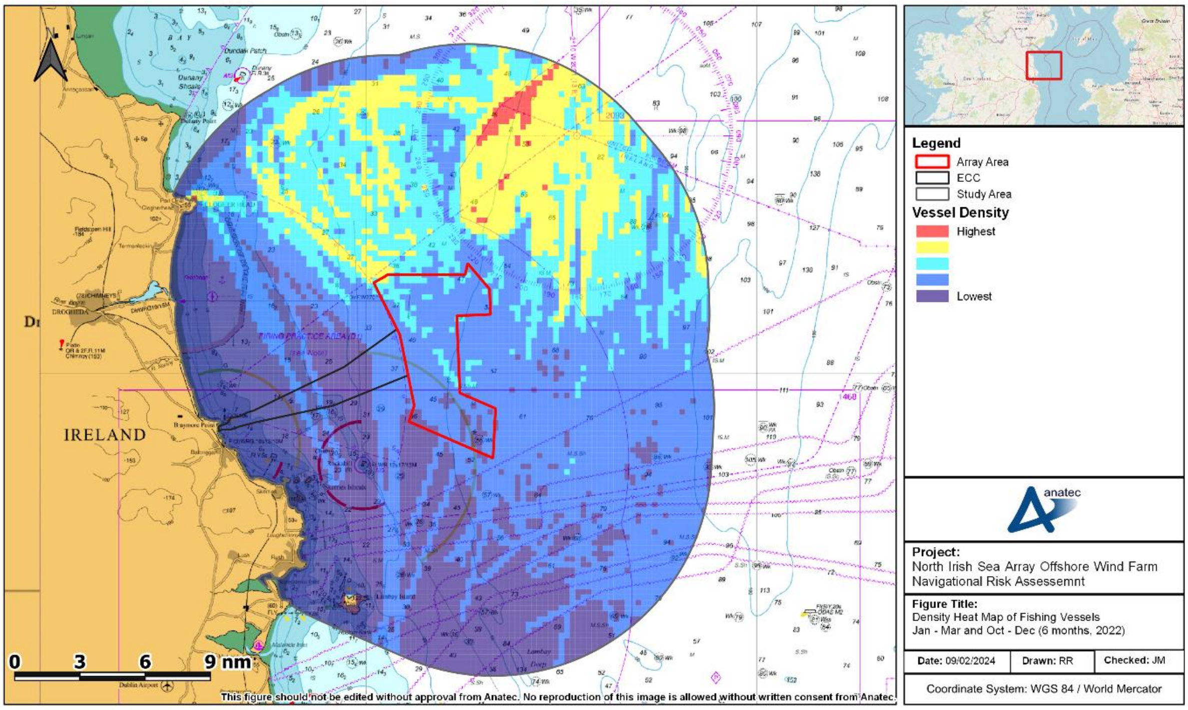

Figure F.13 Density Heat Map of Fishing Vessel Traffic Data January to March and October to December (6 Months, 2022)

788. Seasonality in fishing vessels is highlighted again by vessel density with summer periods showing greater areas of density, particularly to the east of the study area and within the array area. Fishing vessels were noted mostly to the north of the study area during the winter with only low patches of vessel density within the array area.

789. Based on the behaviour of tracks, a significant number of vessels were actively engaged in fishing with the majority of fishing activity taking place on the east and north-east of the study area. Notable levels of vessels transits were also noted inshore of the array area.

Recreational Vessels

790. The average daily unique vessel counts for recreational vessels recorded within the study area during the data period are presented in Figure F.14, as well as unique daily counts for recreational vessels within the array area and the ECC.

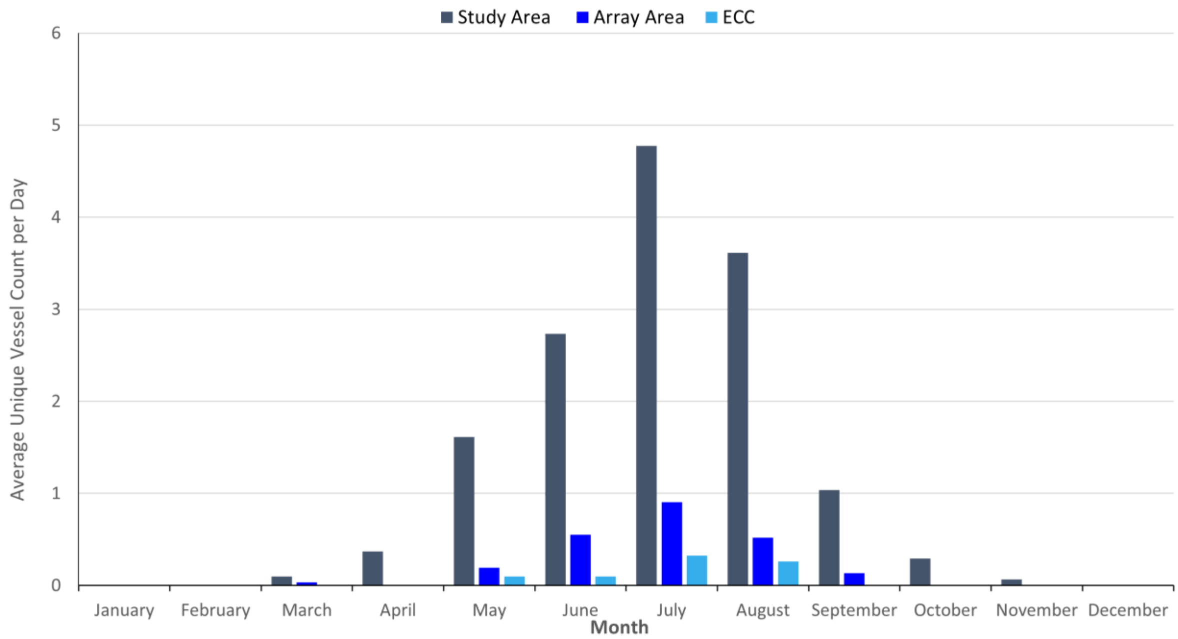

Figure F.14 Average Unique Daily Recreational Vessel Counts per Month within the Study Area, Array Area, and ECC (2022)

791. The presence of recreational vessels in the study area is highly seasonal with vessels only being recorded between March and November with peak summer months showing the greatest of vessels recorded. This is largely due to the favourable sailing conditions that the summer weather brings.

792. The busiest month for recreational vessels was July with an average of five unique vessels recorded per day within the study area. The quietest months recorded for recreational vessels within the study area were January, February, and December when no recreational vessels were recorded within the study area. During the months of March and November, only three and two unique vessels were recorded within the study area across each month, respectively.

793. Throughout all of 2022, an average of one unique recreational vessel per day was recorded within the study area. Approximately 16% of recreational vessels were recorded intersecting the array area and approximately 5% of recreational vessels were recorded intersecting the ECC.

794. Figure F.15 presents a density heat map of the recreational vessel tracks recorded within the study area during the data period.

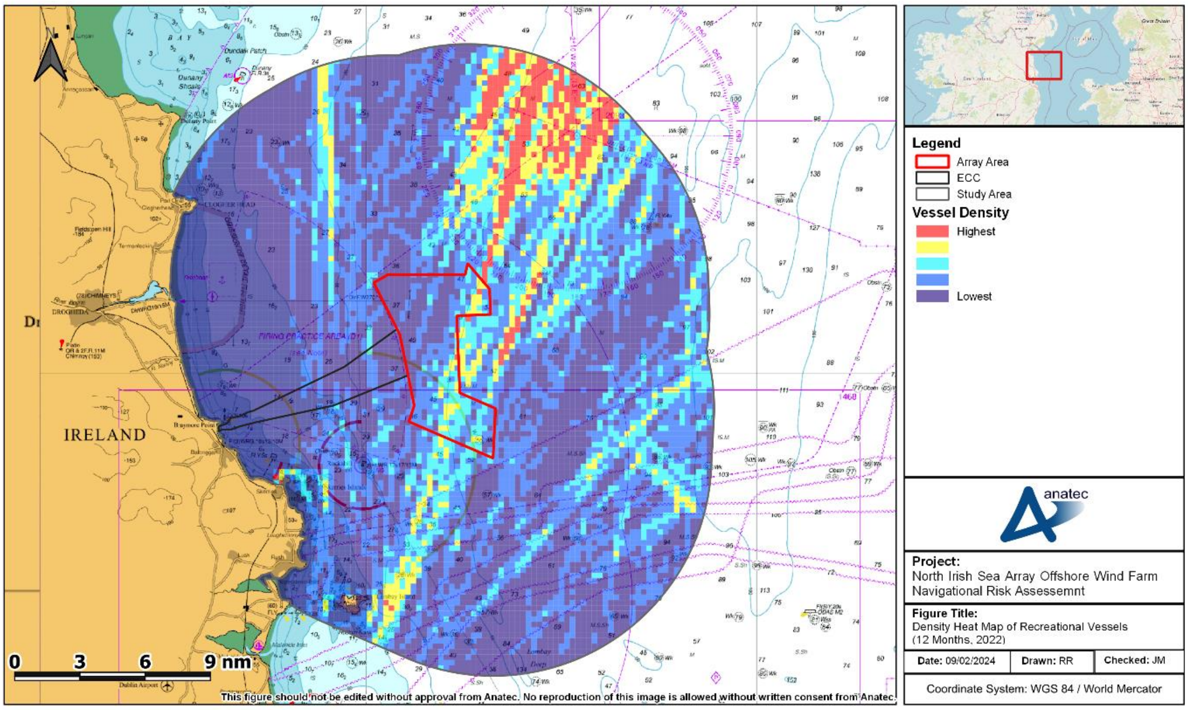

Figure F.15 Density Heat Map of Recreational Vessel Traffic Data (12 Months, 2022)

795. Recreational transits mostly follow a north-east south-west transit directly through the array area out of Dublin Bay. The highest density is noted at the north-eastern extent of the study area. Vessels were also noted transiting north-south at the west of the array area staying closer to the coast.

796. Overall, recreational traffic noted during the 12-month data period is comparable to that recorded during the 28-day vessel traffic surveys.

Anchored Vessels

797. Anchored vessels were identified during the long-term data period using the same criteria that was used for the 28-day vessel traffic survey data (Section 10).

798. After applying these criteria, 179 unique anchored vessels were identified within the study area, corresponding to an average of one anchored vessel every two days across the data period. Of the anchored vessels identified, 80% broadcast an AIS navigational status of "at anchor". Figure F.16 presents a plot of anchored vessels recorded within the study area throughout the data period. A high number of vessels (76%) utilised the Drogheda outer anchorage area to the west of the array area (see Section 7.1.1), with three unique instances of anchoring occurring within 0.5nm of the outer anchorage area boundary. No vessels were at anchor within the array area and one tanker was at anchor within the ECC for approximately 39 hours over two consecutive days December 2022.

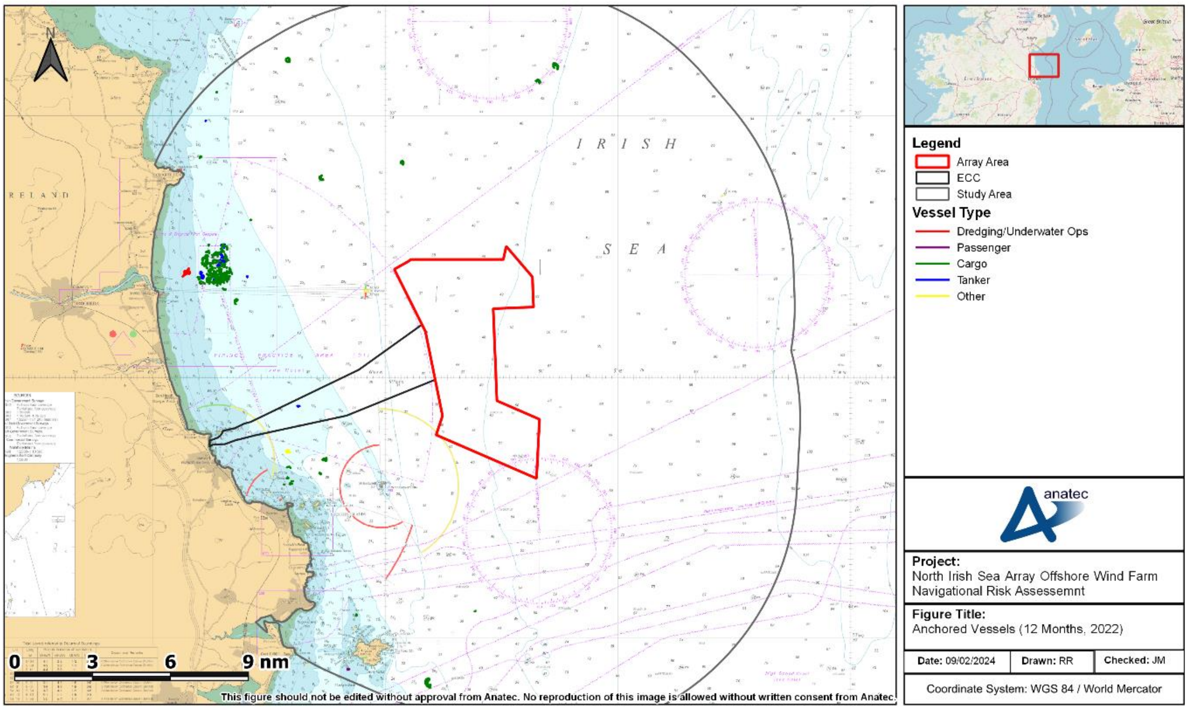

Figure F.16 Anchored Vessels (12 Months, 2022)

F.3 Survey Data Comparison

799. The routeing of vessels during the site-specific vessel traffic surveys was similar overall to the long-term vessel traffic data and comparable to the routes defined in the NRA (see Section 11.2). Table F.2 compares traffic volumes by vessel type between the long-term vessel traffic data and vessel traffic survey data.

Table F.2 Comparison of Vessel Type Counts Between Long-Term Vessel Traffic Data and Vessel Traffic Survey Data

Vessel Type	Long-Term AIS Data			Summer Survey (Jul 2022)	Winter Survey (Dec 2023)
	Busiest Month	Quietest Month	Average Vessels per Week	Average Vessels per Week	Average Vessels per Week
Cargo vessels	Nov	Aug	42	34	56
Tankers	Dec	Jan, Mar	6	5	6
Passenger vessels	May	Jan	3-4	10	4
Dredgers/ subsea ops	Jun	April, May	1	4	4
Recreational vessels	Jul	Jan, Feb, Dec	7	87	2

Vessel Type	Long-Term AIS Data			Summer Survey (Jul 2022)	Winter Survey (Dec 2023)
	Busiest Month	Quietest Month	Average Vessels per Week	Average Vessels per Week	Average Vessels per Week
Fishing vessels	Jun	Dec	56	102	33

800. The weekly average of commercial vessels was lower during the summer survey period, with the exception of passenger vessels. Whilst recreational and fishing vessel activity was higher in the summer survey, this is to be expected as July provides favourable sailing and weather conditions in comparison with the winter months. This is reflected in the long-term vessel traffic data since July was the busiest month for recreational activity during 2022 and was the second busiest month for fishing vessels after June.

F.4 Conclusion

801. A year of 2022 AIS data has been analysed to validate the 2023/ 2022 vessel traffic survey data recorded within the study area.

802. The main type of vessels detected within the study area during 2022 were fishing vessels (47%), cargo vessels (35%), and recreational vessels (7%). The main type of vessels detected during the 2023 winter survey within the study area were cargo vessels (46%), fishing vessels (27%) and during the 2022 summer survey within the study area were fishing vessels (38%), recreational vessels (32%), and cargo vessels (11%). Smaller but significant numbers of passenger vessels and tankers were also detected during both periods.

803. Overall, the vessel types detected within the study area were similar between the vessel traffic survey data and long-term vessel traffic data after considering typical seasonality associated with smaller vessels.

Appendix G Visual Observation Log of Vessel Traffic Movements

804. During both the winter and summer vessel traffic surveys undertaken for the study area in July 2022 and December 2023, several visual observations of vessels not broadcasting on AIS and located within or in proximity to the array area and ECC were collected.

805. The data collected consisted primarily of recreational and fishing vessels and this appendix provides full details of the visual observation logs recorded throughout the vessel traffic surveys.

806. The visual observation log is provided in Table G.1, with all times shown in Coordinated Universal Time (UTC).

Table G.1 Visual Observation Log

Date	Time (UTC)	Vessel description	Length (m)	Speed (kt)	Course (°)	Comments
11 Jul 2022	17:20	Fishing trawler	10	5	330	
11 Jul 2022	17:25	Fishing trawler	10	5	330	
11 Jul 2022	17:30	Fishing trawler	10	5	330	
11 Jul 2022	17:44	Fishing trawler	10	5	330	
12 Jul 2022	07:00	Fishing trawler	10	5	180	Enroute to Skerries Harbour.
12 Jul 2022	07:20	Fishing trawler	10	5	180	Enroute to Skerries Harbour.
12 Jul 2022	09:35	Sailing yacht	9	4	100	Yacht under power heading for Rockabill
12 Jul 2022	09:45	Sailing yacht	9	4	100	Yacht under power heading for Rockabill
16 Jul 2022	09:00	Fishing, pot hauler	10	6	50	
16 Jul 2022	09:10	Fishing, pot hauler	10	6	330	
17 Jul 2022	10:00	Fishing, lobster boat	10	4	175	

Date	Time (UTC)	Vessel description	Length (m)	Speed (kt)	Course (°)	Comments
17 Jul 2022	14:35	Sailing yacht	12	4.5	180	Under power
17 Jul 2022	14:50	Sailing yacht	12	4.5	180	Under power
18 Jul 2022	14:10	Sailing yacht	10	5	180	Under sail
18 Jul 2022	14:20	Sailing yacht	10	5	180	Under sail
11 Dec 2023	09:00	Fishing vessel	N/A	N/A	355	
11 Dec 2023	09:15	Fishing vessel	N/A	N/A	352	
11 Dec 2023	09:30	Fishing vessel	N/A	N/A	352	
11 Dec 2023	09:35	Fishing vessel	N/A	N/A	356	
11 Dec 2023	09:40	Fishing vessel	N/A	N/A	355	
12 Dec 2023	06:50	No visual	N/A	N/A	350	Target heading towards Drogheda
12 Dec 2023	07:00	No visual	N/A	N/A	347	Target heading towards Drogheda
12 Dec 2023	07:10	No visual	N/A	N/A	345	Target heading towards Drogheda

Date	Time (UTC)	Vessel description	Length (m)	Speed (kt)	Course (°)	Comments
12 Dec 2023	07:20	No visual	N/A	N/A	343	Target heading towards Drogheda
12 Dec 2023	07:30	No visual	N/A	N/A	341	Target heading towards Drogheda