APPENDIX 14-1

NAVIGATIONAL RISK ASSESSMENT (NRA)

Sceirde Rocks Windfarm
Appendix 14-1: Navigational Risk Assessment

Prepared by	Anatec Limited
Presented to	Fuinneamh Sceirde Teoranta
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03	4th December 2024	Updated following client feedback
04	10th December 2024	Final

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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
AW189	AgustaWestland 189
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
COLREGs	Convention on the International Regulations for Preventing Collisions at Sea
CSV	Construction Support Vessel
DF	Direction Finding
DMAP	Designated Maritime Area Plan
DoT	Department of Transport
DSC	Digital Selective Calling
ERCoP	Emergency Response Cooperation Plan
ETRS89	European Terrestrial Reference System 1989
GRP	Glass Reinforced Plastic
EEZ	Exclusive Economic Zone
EIA	Environmental Impact Assessment
EIAR	Environmental Impact Assessment Report
EMF	Electromagnetic Field
EU	European Union
FSA	Formal Safety Assessment
GMDSS	Global Maritime Distress and Safety System

Abbreviation	Definition
GPS	Global Positioning System
GT	Gross Tonnage
HAT	Highest Astronomical Tide
HRA	Helicopter Refuge Area
HTV	Heavy Transport Vessel
HVAC	High Voltage Alternating Current
IAA	Irish Aviation Authority
ILB	Inshore Lifeboat
IMO	International Maritime Organization
IRCG	Irish Coastguard
kHz	Kilohertz
kt	Knot
LAT	Lowest Astronomical Tide
LMP	Lighting and Marking Plan
MAC	Maritime Area Consent
MAIB	Marine Accident Investigation Branch
MARPOL	International Convention for the Prevention of Pollution from Ships
MCA	Maritime and Coastguard Agency
MCIB	Marine Casualty Investigation Board
MEPC	Marine Environment Protection Committee
MGN	Marine Guidance Note
MRCC	Maritime Rescue Coordination Centre
MPCP	Marine Pollution Contingency Plan
MSC	Maritime Safety Council
MSI	Maritime Safety Information
NAVTEX	Navigational Text
NMOC	National Maritime Operations Centre
NRA	Navigational Risk Assessment
OAA	Offshore Array Area
OECC	Offshore Export Cable Corridor

Abbreviation	Definition
OREI	Offshore Renewable Energy Installation
ORESS	Offshore Renewable Electricity Support Scheme
OSPAR	Convention for the Protection of the Marine Environment of the North-East Atlantic
OSS	Offshore Substation
PLB	Personal Location Beacon
PLL	Potential Loss of Life
RAM	Restricted in Ability to Manoeuvre
RNLI	Royal National Lifeboat Institution
RoPax	Roll-on/Roll-off Passenger
RoRo	Roll-on/Roll-off Cargo
SAR	Search and Rescue
SOLAS	International Convention for the Safety of Life at Sea
SONAR	Sound Navigation and Ranging
UK	United Kingdom
UKHO	United Kingdom Hydrographic Office
VHF	Very High Frequency
WGS84	World Geodetic System 1984
WTG	Wind Turbine Generator

1 Introduction

1.1 Background

1. Anatec was commissioned by Fuinneamh Sceirde Teoranta (hereafter 'the Applicant') to undertake a Navigational Risk Assessment (NRA) for the proposed Sceirde Rocks Offshore Wind Farm (hereafter 'the Project') – in particular the Offshore Site, which comprises the Offshore Array Area (OAA) and Offshore Export Cable Corridor (OECC).

2. The NRA presents information regarding baseline features and activity of relevance to the Offshore Site and considers potential effects of the Offshore Site on Shipping and Navigation users. The NRA serves as the technical appendix to, and is used to inform, the impact assessment undertaken in **Chapter 14: Shipping and Navigation** of the Environmental Impact Assessment Report (EIAR).

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 European Union (EU) directives (Directive 2011/92/EU, as amended by Directive 2014/52/EU) and as transposed into Irish law[1]. 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. No guidance for the undertaking of NRAs in Irish waters has been formally published at the time of writing. However, draft 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).

5. This draft guidance is heavily influenced by the equivalent guidance for the United Kingdom (UK) – Marine Guidance Note (MGN) 654 (Maritime and Coastguard Agency (MCA), 2021), with some notable differences. Therefore, this NRA has applied the principles of MGN 654 for the assessment of hazards to Shipping and Navigation users.

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;

[1] European Union (Planning and Development) (Environmental Impact Assessment) Regulations 2018 (S.I. No 296 of 2018) of (hereafter referred to as the EIA Regulations 2018).

- 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 and transboundary overview;
- Vessel to vessel collision modelling;
- Assessment of navigational risk (following the Formal Safety Assessment (FSA) process);
- Outline of embedded mitigation measures; and
- Completion of MGN 654 Checklist.

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

- Construction;
- Operation and maintenance; and
- Decommissioning.

8. Assessment parameters assumed within the NRA for the Offshore Site are summarised in Section 5.2, with further details on the overarching project design approach are provided in **Chapter 5: Project Description**.

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 **Chapter 14: Shipping and Navigation**.

2.1 Primary Guidance

11. Formal guidance for undertaking an NRA in Irish waters has not been published at the time of writing. However, as outlined in Section 1.2, draft guidance has been published and closely resembles the UK MCA's MGN 654 (MCA, 2021) which is the equivalent guidance used for assessment of offshore renewable developments in the UK.

12. Therefore, MGN 654 has been used to inform the approach to the NRA. In particular, MGN 654 requires the use of the International Maritime Organization (IMO) Formal Safety Assessment (FSA) (IMO, 2018). The FSA has been used to assess hazards to Shipping and Navigation users, and the NRA utilises 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):

- *National Marine Planning Framework* (Department of Housing, Local Government and Heritage, 2021);
- *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) 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 Navigation Risk Assessment Methodology

15. This section sets out the methodology by which this NRA and **Chapter 14: Shipping and Navigation** have been undertaken. In summary, the NRA provides the technical assessment for Shipping and Navigation, whereby hazards to Shipping and Navigation users are identified and assessed.

3.1 Assumptions

16. The Shipping and Navigation baseline and impact identification has been undertaken based upon the information (including project description information) available and responses received at the time of preparation in autumn 2024. Details of data limitations are provided in Section 5.3.

3.2 Formal Safety Assessment Methodology

17. 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;
- 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.

18. 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 have been applied in Chapter 13: Commercial Fisheries to consider hazards associated with active fishing.

3.3 Formal Safety Assessment Process

19. 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 hazards in Section 16.

20. 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

21. A key tool used in the NRA process is the Hazard Workshop, which ensures that risks are identified and qualified in agreement with stakeholders prior to assessment within Section 16. 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.

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

22. The severity of consequence and frequency of occurrence are then considered collectively using the ranking system to provide the level 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 with Mitigation** (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 with Mitigation (intermediate risk)
	Broadly Acceptable (low risk)

23. Once identified, the significance of risk of a hazard is assessed with the inclusion of embedded mitigation measures to ensure it is ALARP. 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 in EIA terms) while Broadly Acceptable or Tolerable with Mitigation risks are considered to be ALARP (not significant in EIA terms).

24. Outputs of the Hazard Log have been used as evidence to support and refine the risk assessment contained within Section 16.

3.4 Methodology for Cumulative Risk Assessment

25. The hazards identified in the FSA are also assessed for cumulative effects with the inclusion of other planned projects. For Shipping and Navigation, given the international nature of shipping, other planned projects within 50 nautical miles (NM) are considered and screened as part of the NRA process.

26. The 50 NM radius is considered to be best practice based on consultation and experience with previously consented offshore wind developments and allows consideration of vessels as they approach and depart the OAA to identify where there may be multiple deviations associated with different (cumulative) planned projects. Any deviations associated with planned projects that are further than 50 NM are considered to be mitigated by the length of the transit/journey.

27. For other planned projects, an exercise is undertaken to determine which should be incorporated into the risk assessment. Factors considered in addition to the distance from the Offshore Site include development status, level of interaction with Shipping

and Navigation users associated with the Offshore Site, consultation feedback, and data confidence.

3.5 Study Areas

28. A buffer of 10 NM has been applied around the OAA as the study area for Shipping and Navigation (hereafter the 'study area'). This buffer is standard for Shipping and Navigation assessment and has been used in the majority of Irish and UK offshore wind farm NRAs and within the Shipping and Navigation assessment in the Scoping Report undertaken for the Project. Additionally, in line with best practice, a buffer of 2 NM has been applied around the OECC (hereafter the 'OECC study area'). These study areas are presented in Figure 3.2.

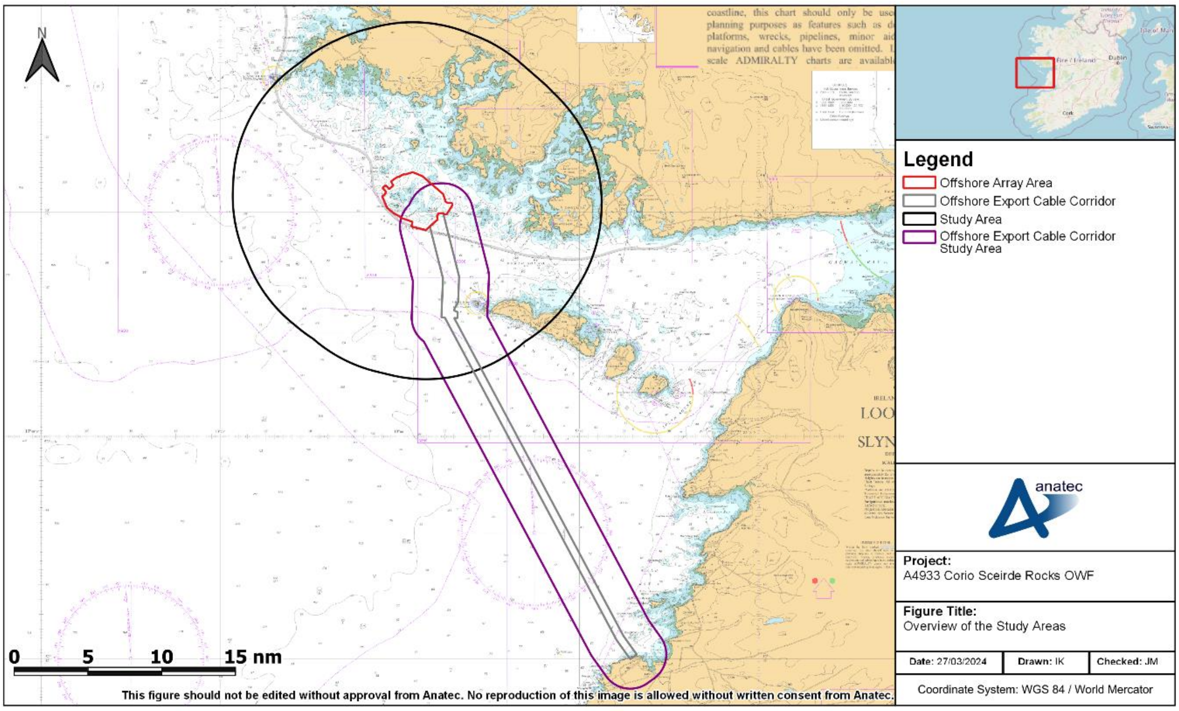


Figure 3.2 Overview of the Study Areas

29. These study areas have 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 OAA and OECC. Navigational features wholly or partially outside the study area are considered where appropriate (i.e., where they are of relevance to vessel routeing within the study area).

4 Consultation

4.1 Scoping Report

30. The Scoping Report was submitted to key stakeholders in August 2023. Comments on the Scoping report which are considered relevant to the assessment of Shipping and Navigation hazards are summarised in Table 4.1. A high-level response on how and where these comments have been addressed within the NRA or the wider EIAR are also provided.

Table 4.1 Scoping Report Comments Related to Shipping and Navigation

Consultee	Point Raised	Where Addressed in the EIAR
Irish Lights	Requested a meeting regarding the Project.	Consultation meetings were held with Irish Lights (see Section 4.5).
Irish Aviation Authority (IAA)	Recommended that consultation be undertaken with the Irish Coast Guard (IRCG).	IRCG have been consulted (see Section 4.6).
	Request that, in the event of planning consent being granted, the applicant should be conditioned to contact the IAA to agree an aeronautical obstacle warning light scheme for the Project.	**Appendix 5-9: Lighting and Marking Plan (LMP)** considers the appropriate IAA guidance.
IRCG	The Scoping Report does not take into account the contents of the National Maritime Oil/HNS Spill Contingency Plan and the National SAR plan. Suggest that the EIAR includes and takes into account the contents of the plans.	The national Maritime Oil/HNS Spill Contingency Plan and the National SAR plan are considered within the mitigation laid out in Section 17.
Irish Sailing Association	No objections to the Project and it will not be located within any sailing race zones.	Noted.
	Recommended that the Applicant contact local sailing clubs in the area.	Recreational stakeholders were invited to attend the Hazard Workshop (see Section 4.3).

4.2 Regular Operators

31. Using the vessel traffic survey data, Regular Operators were identified and subsequently provided with an overview of the Project, with the opportunity to provide comment and participate in the Hazard Workshop (see Section 4.3).

32. Given the low levels of commercial traffic in the region, all commercial operators identified were contacted. The full list of Regular Operators is provided below:

- Arklow Shipping;
- Azamara Cruises;
- Fred Olsen Cruises;
- Hansa Shipping;
- Hartel Shipping;
- HAV Shipping;
- Ponant Cruises;
- Royal Wagenborg; and
- The World Cruises.

33. No Regular Operators provided feedback.

4.3 Hazard Workshop

34. The Hazard Workshop is a key element of consultation for the NRA. This workshop gathers local and national marine stakeholders to identify and discuss potential Shipping and Navigation hazards. The hazard log is produced based on the discussions and is used as input to the risk assessment.

35. The following stakeholders were invited to attend the Hazard Workshop on 1st May 2024 noting that despite the lack of feedback the Regular Operators were included as part of a proactive approach:

- Arklow Shipping;
- Azamara Cruises;
- Fred Olsen Cruises;
- Galway Bay Sailing Club;
- Galway City Sailing Club;
- IRCG;
- Irish Chamber of Shipping;
- Irish Lights;
- Hansa Shipping;
- Hartel Shipping;
- HAV Shipping;
- MSO;
- Ponant Cruises;
- Port of Galway;

- Royal National Lifeboat Institution (RNLI);
- Royal Irish Yacht Club;
- Royal Wagenborg; and
- The World Cruises.

36. There was limited interest in the Hazard Workshop, with only the Port of Galway attending. Nevertheless, Shipping and Navigation hazards across the phases of the Project were identified and discussed, including by vessel type where appropriate.

37. Key points raised by Port of Galway are summarised below:

- The planning application for the Port of Galway expansion will result in changes to vessel numbers and sizes should the permission be granted and development proceed. The current timeline has the completion of construction in 2030. After construction, cruise vessels will be able to moor at Galway, rather than anchoring further offshore, with the pilot boarding station moved further west.
- The application was submitted in January 2014 with an An Bord Pleanála hearing in 2015. The application remains undecided in the planning system.
- Several subsea cables should be considered including the operational IRIS cable (from Iceland), and the PISCES (from Portugal) and Far North Fibre (from Canada/Japan) cables, both in the planning stage.
- Imports of alternative fuels to Galway have begun, with a potential supply from Nordic countries which would change the traffic patterns for tankers, i.e., transits through the North Sound similar to those currently recorded for cargo vessels.
- During installation works for the subsea cables there may be navigational safety risk for fishing vessels but this would no longer be the case post installation. Previous experience of cable laying in the region was positive given the level of consultation with local fishermen.
- Recreational traffic is very weather dependent and will likely increase in the future due to the marina in Rossaveel and new leisure craft facilities constructed at Kilronan.

38. Following the Hazard Workshop, the risks associated with the identified hazards were ranked in the hazard log with appropriate embedded mitigation measures identified. The hazard log has been incorporated into the NRA and is provided in full in Appendix D.

4.4 Meeting with Rossaveel Harbour

39. A consultation meeting was held with the Harbour Master for Rossaveel Harbour on 15th May 2024. Although not part of the Hazard Workshop, feedback received was fed into the hazard log process in agreement with the Harbour Master.

40. Key points raised by Rossaveel Harbour are summarised below:

- There is a preference for a guard vessel to be located on-site while construction is ongoing.

- Content that the continued navigation of fishing vessels internally within the OAA can be managed through marine coordination.
- No impact on pilotage operations associated with Rossaveel is expected as a result of the Offshore Site.
- The periods for the vessel traffic survey data cover the busy fishing periods in the winter, which run October to April, and the ferry season in the summer.
- Recreational traffic is very limited in the summer and not expected in the winter – the vessel traffic survey data is representative.
- Active fishing is present near the Landfall and is represented by the Automatic Identification System (AIS) data.
- There is a small level of cargo which is transported out of Rossaveel in the summer, headed to the Aran Islands.

4.5 Meetings with Irish Lights

41. A consultation meeting was held with Irish Lights on 22nd November 2023 in which a general overview of the Project was provided and any significant concerns discussed. Irish Lights were comfortable with the Project and mitigations proposed to manage lighting and marking during each phase. A further consultation meeting was held on 17th October 2024 in which Irish Lights noted that an operational buoy may be required to assist nearby routeing vessels maintain a suitable distance from the OAA.

4.6 Meeting with Irish Coast Guard

42. The Applicant met with IRCG in Dublin on 11th April 2024. The meeting focused on discussion around the project layout (see Section 6.2.1) and SAR access internally within the array. A further meeting was held on 19th July 2024 to discuss IRCG next step requirements. Further discussions are anticipated on an ongoing basis.

4.7 Meeting with Marine Survey Office

43. A consultation meeting was held with the MSO on 27th September 2024. The meeting included an overview of the planned NRA process and high-level review of the baseline conditions.

5 Data Sources

44. This section summarises the main data sources used to characterise the Shipping and Navigation baseline relative to the Offshore Site.

5.1 Summary of Data Sources

45. The main data sources used to characterise the Shipping and Navigation baseline relative to the Offshore Site are outlined in Table 5.1.

Table 5.1 Data Sources Used to Inform Shipping and Navigation Baseline

Data	Source(s)	Purpose
Vessel traffic	AIS, Radio Detection and Ranging (Radar), and visual observation summer survey data for the study area (14 days, August/September 2022).	Characterising vessel traffic movements within and in proximity to the OAA.
	AIS, Radar, and visual observation winter survey data for the study area (14 days, November 2022).	
	AIS summer data for the OECC study area (14 days, August/September 2022).	Characterising vessel traffic movements within and in proximity to the OECC.
	AIS winter data for the OECC study area (14 days, November 2022).	
	Anatec's ShipRoutes database (2024).	Validation of survey data.
Maritime incidents	Marine Casualty Investigation Board (MCIB) incident reports (1993 to 2023 – latest available at time of assessment)	Review of maritime incidents within, and in proximity to, the Offshore Site.
	RNLI incident data (2013 to 2022 – latest available at time of assessment)	
	Marine Accident Investigation Branch (MAIB) incident reports	
Navigational features	*Admiralty Sailing Directions Irish Coast Pilot NP40* (United Kingdom Hydrographic Office (UKHO), 2019)	Characterising navigational features in proximity to the Offshore Site.
	UK Admiralty charts 1125, 2709, 2173, and 2420 (UKHO, 2023)	
Weather data	Wind, wave, and tidal stream data provided by the *Skerd Rocks Offshore Wind Farm MetOcean Study* (Deltares, 2022)	Characterising weather conditions in proximity to the Offshore Site for use as input to the collision and allision risk modelling.
	Visibility data taken from *Admiralty Sailing Directions Irish Coast Pilot NP40* (UKHO, 2019)	

5.2 Vessel Traffic Surveys

46. The vessel traffic surveys were undertaken in line with MGN 654 requirements. In particular, two 14-day periods of AIS, Radar, and visual observations data were

sought to ensure the baseline characterisation of vessel traffic movements considered seasonality and vessels not broadcasting on AIS:

- 25th August to 8th September 2022 (14 days, summer); and
- 16th to 30th November 2022 (14 days, winter).

47. The vessel traffic surveys were undertaken from a shore-based location on Mweenish Island with line-of-sight to the OAA. The survey location is shown relative to the OAA in Figure 5.1.

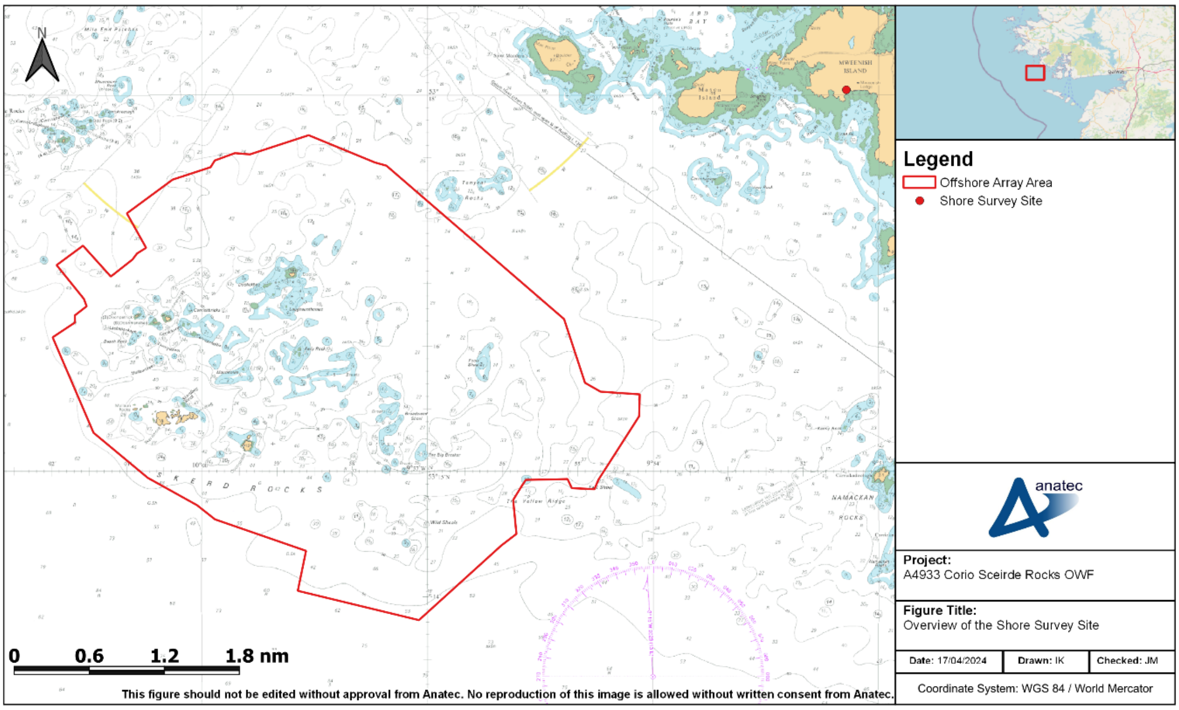


Figure 5.1 Overview of the Shore Survey Site

48. A number of vessel tracks recorded during the survey periods were classified as temporary (non-routine), such as non-routine survey vessels. These have therefore been excluded from the analysis.

49. The dataset is assessed in full in Section 10.

5.3 Data Limitations

5.3.1 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 500 GT not engaged on international voyages, passenger vessels irrespective of size built on or after 1st July 2002, and fishing vessels over 15 metres (m) in length.

51. Therefore, for the vessel traffic surveys larger vessels were recorded on AIS, while smaller vessels without AIS installed (including fishing vessels under 15 m in length 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.

52. Throughout the summer 2022 survey, approximately 46% of vessel tracks were recorded via AIS with 53% recorded via Radar and one visual observation tracked. Throughout the winter 2022 survey, approximately 96% of vessel tracks were recorded via AIS with the remaining 4% recorded via Radar. The summer 2022 survey partially overlapped with the Project's geophysical survey; during this time some small fishing vessels which would typically operate in the Offshore Array were subsequently absent. However, results of the vessel traffic surveys were discussed with stakeholders including local ports to ensure baseline data was suitable to inform the risk assessment and future case vessel traffic growth has considered any effects on fishing vessel volumes (see Section 14.2).

53. As the vessel traffic data for the OECC includes vessels transmitting over AIS only, fishing and recreational vessels under 15 m in length may be underrepresented. However, Rossaveel Harbour confirmed during consultation that AIS data for fishing vessels near the Landfall is representative.

5.3.2 Historical Incident Data

54. 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.

55. Similarly, the MCIB incident data only accounts for completed investigations. Any incident that has not been investigated or whose investigation is ongoing was not accounted for. In addition, precise location data is not available for all incidents within the dataset.

56. Incident data relating to IRCG is not publicly available for analysis.

5.3.3 United Kingdom Hydrographic Office Admiralty Charts

57. The UKHO Admiralty charts are updated periodically, and therefore the information shown may not reflect the real-time features within the region with total accuracy. Additionally, not all navigational features may be charted, e.g., certain aids to navigation and wrecks. However, during consultation, input has been sought from relevant stakeholders regarding the navigational features baseline.

6 Project Description Relevant to Shipping and Navigation

58. This section provides an overview of the key parameters of the design scenarios under consideration deemed of relevance to the NRA. Full details of the assumptions made around assessment parameters are provided in Chapter 5: Project Description.

6.1 OAA

59. The OAA is located approximately 2.6 NM west of the Galway coast and covers an area of approximately 10.9 NM^2. Charted water depths within the site range from zero (Skerd Rocks) to 55 m below Chart Datum (CD). Key coordinates of the OAA are presented in Figure 6.1, the positions of which are provided in Table 6.1.

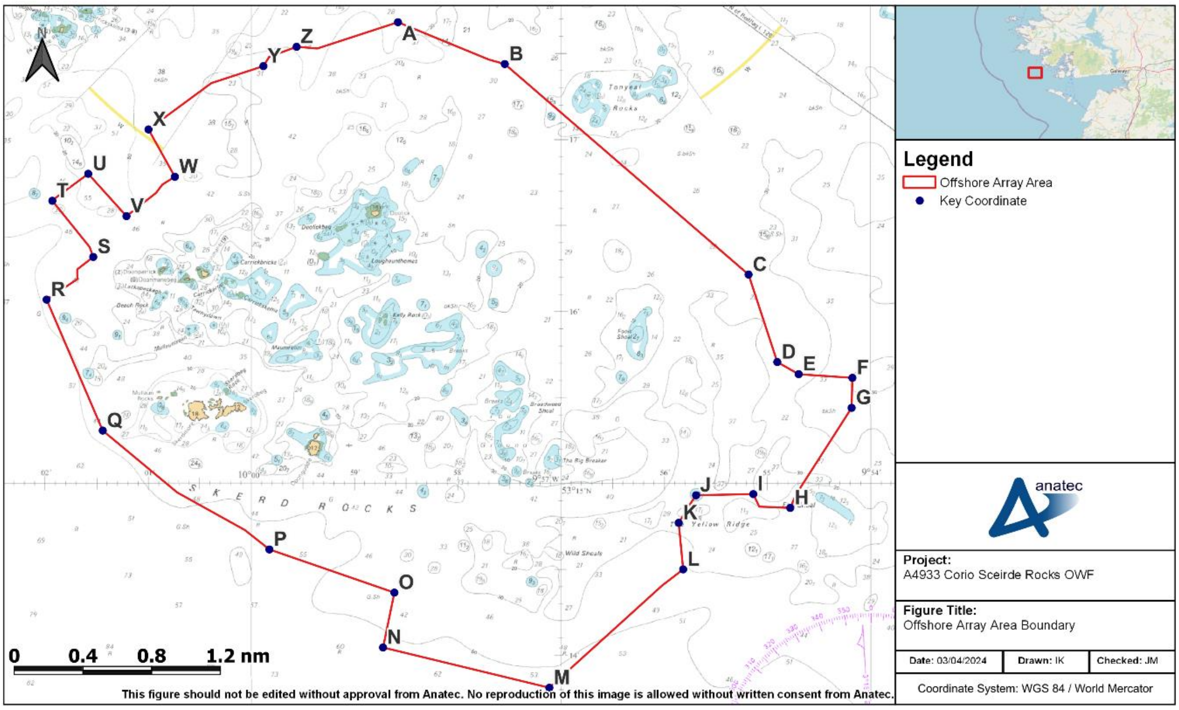


Figure 6.1 OAA Boundary

Table 6.1 OAA Key Coordinates (World Geodetic System 1984 (WGS84))

Point	Latitude	Longitude	Point	Latitude	Longitude
A	53° 17′ 41.03″ N	009° 58′ 34.67″ W	N	53° 14′ 02.88″ N	009° 58′ 43.35″ W
B	53° 17′ 26.45″ N	009° 57′ 32.59″ W	O	53° 14′ 22.03″ N	009° 58′ 36.76″ W
C	53° 16′ 13.03″ N	009° 55′ 10.84″ W	P	53° 14′ 37.11″ N	009° 59′ 49.44″ W
D	53° 15′ 42.50″ N	009° 54′ 54.13″ W	Q	53° 15′ 18.59″ N	010° 01′ 26.35″ W
E	53° 15′ 38.26″ N	009° 54′ 41.70″ W	R	53° 16′ 04.29″ N	010° 01′ 58.99″ W
F	53° 15′ 36.99″ N	009° 54′ 10.45″ W	S	53° 16′ 19.16″ N	010° 01′ 31.86″ W
G	53° 15′ 26.51″ N	009° 54′ 10.93″ W	T	53° 16′ 38.76″ N	010° 01′ 55.65″ W
H	53° 14′ 51.59″ N	009° 54′ 46.59″ W	U	53° 16′ 48.16″ N	010° 01′ 34.77″ W
I	53° 14′ 56.42″ N	009° 55′ 08.08″ W	V	53° 16′ 33.39″ N	010° 01′ 12.56″ W
J	53° 14′ 56.02″ N	009° 55′ 41.36″ W	W	53° 16′ 47.14″ N	010° 00′ 44.41″ W
K	53° 14′ 46.40″ N	009° 55′ 51.47″ W	X	53° 17′ 03.64″ N	010° 00′ 59.75″ W
L	53° 14′ 30.15″ N	009° 55′ 48.84″ W	Y	53° 17′ 25.72″ N	009° 59′ 52.93″ W
M	53° 13′ 48.82″ N	009° 57′ 06.66″ W	Z	53° 17′ 32.46″ N	009° 59′ 33.59″ W

6.2 Surface Infrastructure

6.2.1 Indicative Layout

60. A total of 31 surface structures will be installed within the OAA, consisting of 30 Wind Turbine Generators (WTG) and one Offshore Substation (OSS).

61. The layout is presented in Figure 6.2.

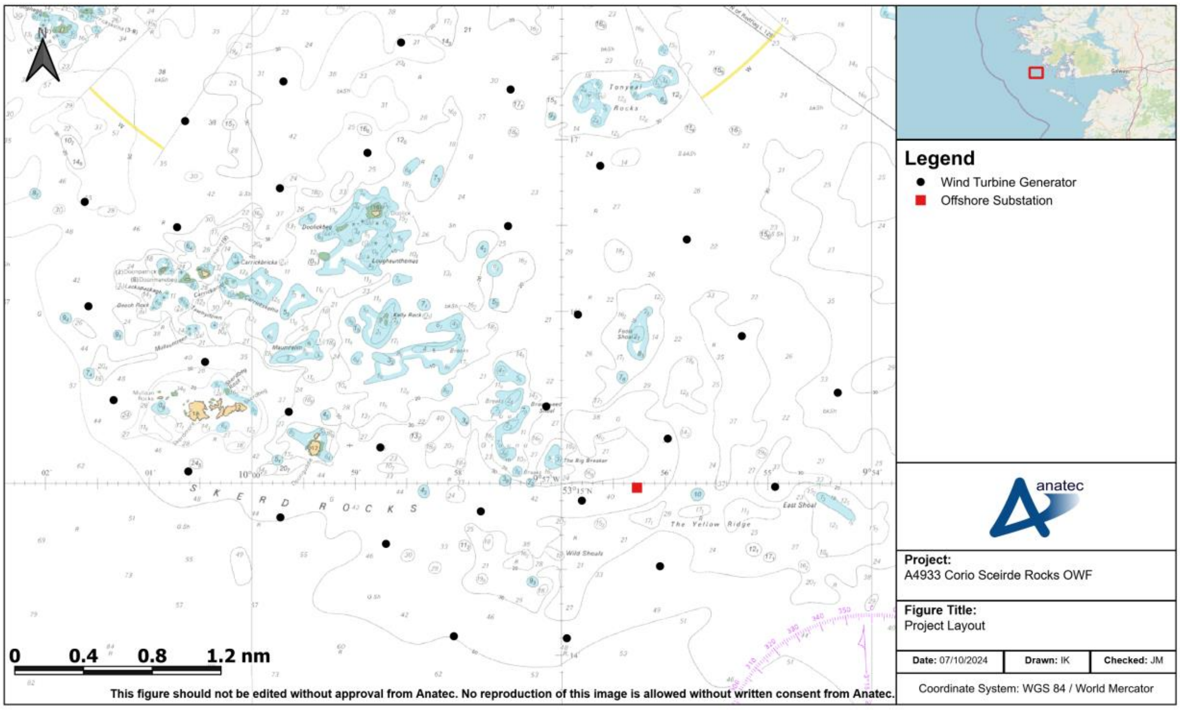


Figure 6.2 Project Layout

62. The layout consists of a full build out of the OAA periphery, thus maximising the spatial extent of vessel deviations. The minimum spacing between WTGs is 1,017 m (measured centre-to-centre) and the minimum spacing between WTGs and the OSS is 610 m.

6.2.2 Wind Turbine Generators

63. The WTGs within the indicative layout will have a rotor diameter of 292 m and maximum blade tip height (above Lowest Astronomical Tide (LAT)) of 324.9 m.

64. Relevant specifications for the NRA in relation to the WTGs are presented in Table 6.2.

Table 6.2 WTG Specifications for Shipping and Navigation

Parameter	Value
Foundation type	Gravity Base
Dimensions at sea surface	13 m diameter
Minimum blade clearance above Highest Astronomical Tide (HAT)	27.5 m
Maximum blade tip height above LAT	324.9 m
Maximum rotor diameter	292 m

6.2.3 Offshore Substation

65. The OSS will also be installed on gravity base foundations (of the same dimensions as the foundations required for the WTGs), utilising High Voltage Alternating Current (HVAC). The maximum topside dimensions are 58.5×42.5 m.

6.3 Subsea Infrastructure

6.3.1 Array Cables

66. The array cables will be fully installed within the OAA to connect individual WTGs to each other and to the OSS. Approximately 39 NM of array cables will be required with no cable crossings.

6.3.2 Offshore Export Cable

67. The offshore export cable will be installed within the OECC to carry the electricity generated by the WTGs to Landfall. Approximately 34 NM of export cable will be required with one cable crossing. The maximum height of this cable crossing will be 1.2 m.

6.3.3 Cable Burial and Protection

68. Where possible, 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 subsea cable routes and associated cable burial risk assessment. However, a minimum burial depth of 1.0 m for all subsea cables associated with the Offshore Site is assumed.

69. Where cable burial is not possible, alternative cable protection methods will be deployed which will again be determined within the cable burial risk assessment. These methods may include a combination of rock placement and trenching. For the array cables and offshore export cables, the proportion of indicative cable protection heights is presented in Table 6.3.

Table 6.3 Proportion of Cable Protection to be Implemented

Cable Protection Height	Array Cables	Offshore Export Cable
0.9 m	0%	73.5%
1.6 m	86%	22.2%
3.4 m	14%	4.3%

70. The areas in which the 3.4 m height will be used for the offshore export cables are in shallow waters close to the Landfall.

6.4 Construction Phase

71. The construction phase will last up to four years.

72. The types and numbers of vessels required for each element of the offshore construction is provided in Table 6.4, noting that vessels may be used for multiple operations. Overall, a total of 23 separate project vessels will be utilised across 10 activities, with a maximum of 11 project vessels on site on any one day. It is noted that the construction port(s) has not yet been determined.

Table 6.4 Breakdown of Construction Vessel Numbers

Activity	Vessel Type	Number
Seabed preparation	Rock dumper	1
Mooring preparation	Construction Support Vessel (CSV)	1
Foundation transportation	Semi-sub Heavy Transport Vessel (HTV)	2
OSS transportation	Tug	1
	Barge	1
Foundation installation	Tug	4
	Support vessel	1
WTG installation	Jackup vessel	2
	WTG installation vessel	1
	WTG commissioning CTV/SOV	1
OSS installation	Heavy Lift Vessel (HLV)	1
	Tug	1
Inter-array cable installation	Cable lay vessel	1
	Service operation vessel	1
Export cable installation	Cable lay vessel	1
	Service operation vessel	1
Trenching/rock dumping	Trenching operations vessel	1
	Rock dumper	1

6.5 Operation and Maintenance Phase

73. The operation and maintenance phase will last for up to 38 years.

74. The types and numbers of vessels required for operation and maintenance activities is provided in Table 6.5, with an average of two project vessels on site on any one day. It is assumed that Rossaveel Harbour will be the primary operation and maintenance base.

Table 6.5 Breakdown of Operation and Maintenance Vessel Numbers

Vessel Type	Return Trips per Year
Crew transfer vessel	730
Service operation vessel	365
Jackup vessel	2
Cable survey vessel	1
Total	**1,098**

75. Helicopters may form part of the operations and maintenance strategy, with an estimated one return trip required annually.

6.6 Decommissioning Phase

76. The decommissioning phase will generally be the reverse of the construction phase in terms of duration, vessel types and vessel numbers. However, it is intended that subsea cables will be left in situ post decommissioning, with routine monitoring undertaken to ensure exposure does not increase over time. This will be detailed in the Decommissioning Plan (see Section 17.1).

6.7 Temporary Anchorage

77. It is acknowledged that should temporary anchorage be used this will be subject to a separate licencing and consenting procedure and is therefore not considered in detail in this NRA. However, any such activity would occur within the Shannon Estuary and therefore within an area over which the Shannon Foynes Port Company would have jurisdiction as the Statutory Harbour Authority. With appropriate marine coordination between the Project and the Statutory Harbour Authority – noting that marine coordination for project vessels is captured as an embedded mitigation measure in Section 17.1 – it is expected that any temporary anchorage will not give rise to significant navigational risk.

7 Navigational Features

78. The navigational features within, and in proximity to, the OAA and OECC are presented in Figure 7.1.

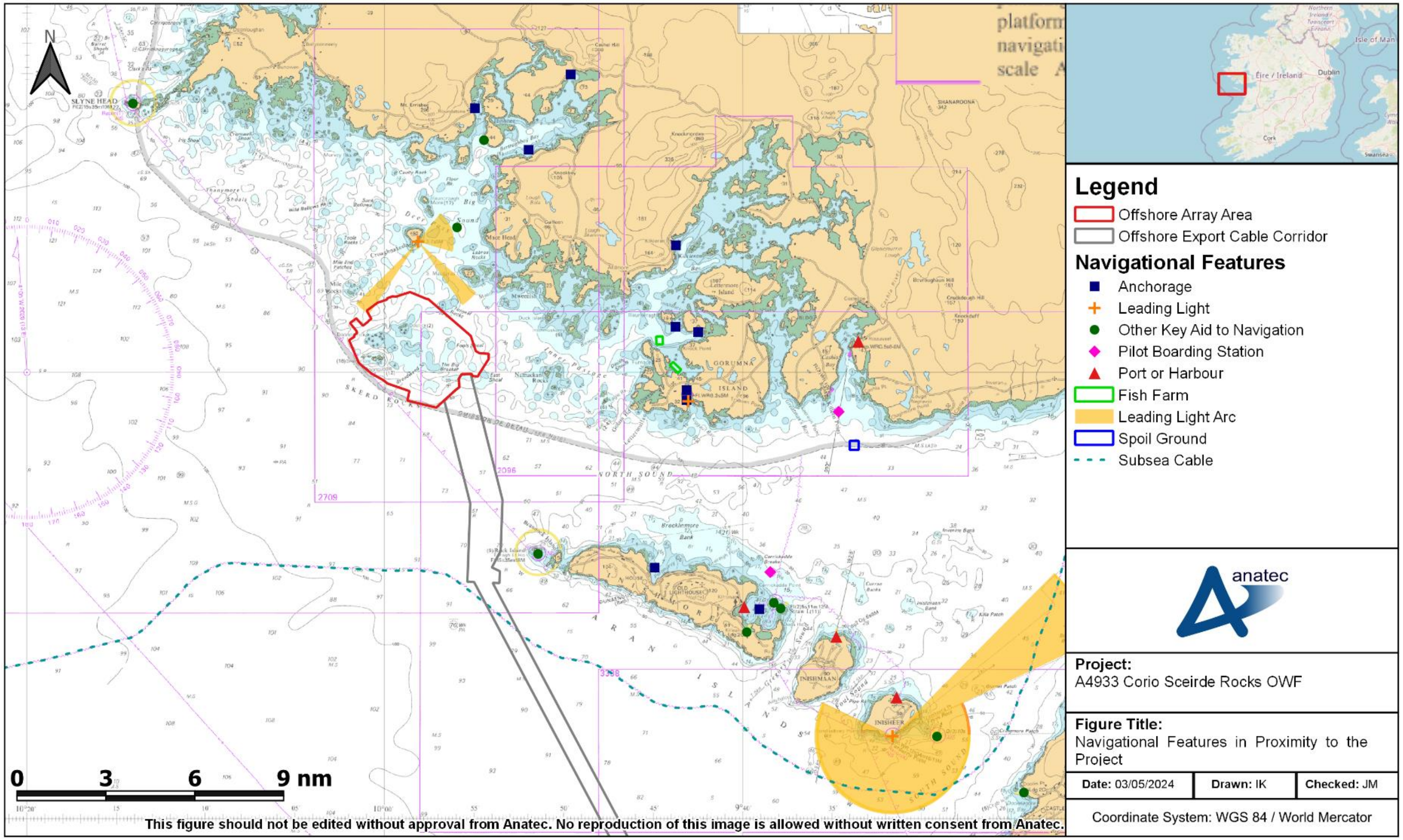


Figure 7.1 Navigational Features in Proximity to the Offshore Site

7.1 Aids to Navigation

79. The closest key aid to navigation to the OAA is a flashing beacon at Croaghnakeela Island, approximately 1.7 NM north of the OAA. The charted sectors for the leadings lights associated with this aid to navigation are presented in Figure 7.2.

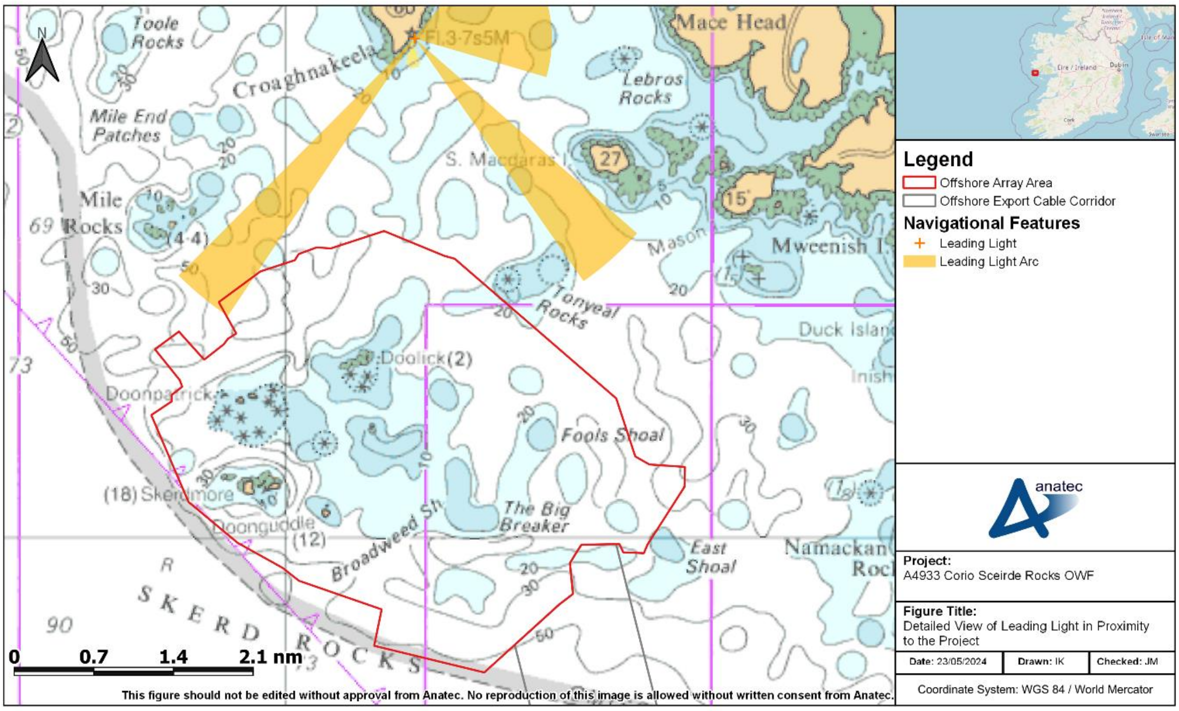


Figure 7.2 Detailed View of Leading Light in Proximity to the Offshore Site

80. Consisting of a 4 m tall white concrete tower, this aid to navigation includes several leading lights with 5 NM range[2], one of which provides assistance to vessels transiting between Mile Rocks and Skerd Rocks from the southwest. The westernmost WTG position intersects this leading light, while another WTG position is located approximately 20 m from the extremity of the leading light sector.

81. A lighthouse is located on Rock Island, approximately 1.3 NM east of the OECC, denoting the western extent of the Aran Islands.

7.2 Ports and Harbours

82. The closest port or harbour to the Offshore Site is Kilronan, a pier on the largest of the three Aran Islands, Inishmore, 11.9 NM southeast of the OAA and 7.7 NM east of the OECC. This is situated in the village of Kilronan, on the west of Killeany Bay, and which upon its breakwater stands a light beacon. According to the Admiralty Sailing

[2] It is noted that the charted sectors for this aid to navigation to not replicate this range; for the leading light between Mile Rocks and Skerd Rocks, the range shown on charts is 2.9 NM.

Directions (UKHO, 2019), the pier is usually occupied by fishing vessels and mainland ferries.

83. The fishing harbour of Rossaveel is located 12.4 NM east of the OAA, in the northeast of Cashla Bay. This harbour also serves as the mainland terminal for a passenger ferry and cargo service to the Aran Islands.

84. The OECC is situated across the entrance to Galway Bay, with the Port of Galway at the far eastern extent approximately 31 NM east of the OAA. The Port of Galway is, according to the Admiralty Sailing Directions (UKHO, 2019), a commercial port and minor fishing harbour, with a small marina also within the docks. Dock gates are typically opened to allow entry/exit of vessels only during the two hours preceding high waters.

7.3 Pilot Boarding Stations

85. Pilot boarding stations for the Aran Islands and Rossaveel are each located 11.8 NM east of the OAA. Pilotage is not compulsory for smaller vessels in either instance (and not compulsory for the Aran Islands harbours at all), but pilots are available from Galway if a vessel requests.

7.4 Subsea Cables

86. The IRIS subsea cable - which was raised by the Port of Galway during consultation – runs between Iceland and Galway. The OECC south of the Aran Islands intersects this subsea cable. There are no other existing subsea cables in the region.

7.5 Anchorages

87. Charted anchorages are situated throughout the coast, although none are located within either the OAA or OECC.

8 Meteorological Ocean Data

88. This section presents meteorological and oceanographic statistics collected for the area. The data presented in this section has been used as input into the risk assessment within this NRA, and in particular is used within the collision and allision risk modelling (see Section 15).

8.1 Wind

89. Based on wind direction data provided by Fuinneamh Sceirde Teoranta, Figure 8.1 presents the proportion of the wind direction within each 30-degree interval in the form of a wind rose.

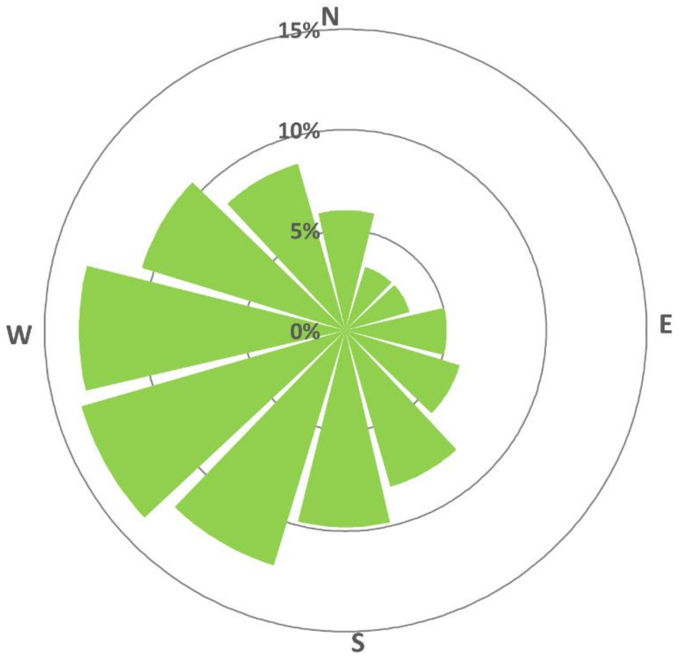


Figure 8.1 Wind Direction Distribution

8.2 Wave

90. Based on significant wave height data described within the *Sceirde Rocks Offshore Wind Farm MetOcean Study* (Deltares, 2022), Table 8.1 presents the proportion of the sea state within each of three defined ranges which will be used as input to the collision and allision risk modelling. Values were provided for three separate WTG locations within the OAA, with the location of highest proportion of severe sea state (in the south of the OAA) chosen as a worst-case.

Table 8.1 Sea State Data

Sea State	Proportion (%)
Calm (<1 m)	10.39
Moderate (1–5 m)	85.52
Severe (>5 m)	4.09

8.3 Visibility

91. 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 1km) is 4%. This is based upon information available within *Admiralty Sailing Directions NP40 Irish Coast Pilot* (UKHO, 2019). This correlates well with an assessment undertaken by Deltares, which indicates that the proportion of a year in which visibility can be expected to be less than 1km around the OAA is approximately 3%.

8.4 Tide

92. Tidal data to be used as input to the collision and allision modelling is based upon the peak tidal current information available from the *Sceirde Rocks Offshore Wind Farm MetOcean Study* (Deltares, 2022). Table 8.2 presents the peak flood and ebb direction and speed values for each of the three measured WTG locations, which will be used as input to the collision and allision risk modelling.

Table 8.2 Tidal Data

Location in OAA	Flood		Ebb	
	Direction (°)	Speed (knots)	Direction (°)	Speed (knots)
Southwest	90	0.58	300	0.49
South	120	0.78	330	0.87
East	120	1.17	300	0.97

93. 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 Resources

94. 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 Offshore Site.

9.1 Search and Rescue Helicopters

95. The IRCG is responsible for the response to, and coordination of, maritime accidents which require SAR, counter-pollution operations, and ship casualty operations. The DoT signed a 10-year contract (with optional extension to 13 years) with Bristow Group in August 2023 to provide the IRCG with SAR services (Bristow Group, 2023).

96. The IRCG has four SAR helicopter bases around the country located at Dublin, Waterford, Sligo, and Shannon. Each site currently 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 alongside the two marine rescue centres at Malin Head and Valentia.

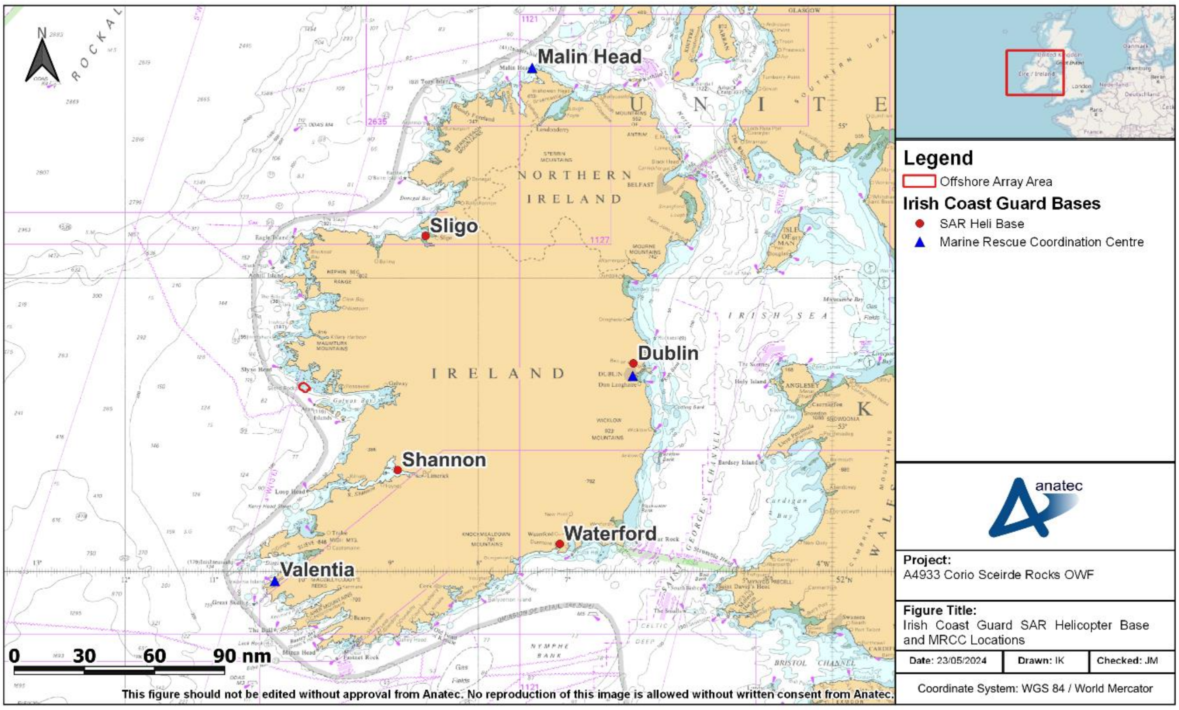


Figure 9.1 Irish Coast Guard SAR Helicopter Base and Maritime Rescue Coordination Centre (MRCC) Locations

97. As part of the new SAR contract with Bristow, six SAR-configured AgustaWestland 189 (AW189) helicopters will be operated across the four SAR helicopter bases. The AW189 has a maximum cruise speed of 159 knots (kt), maximum range of 563 NM, and endurance time of over four hours. Additionally, two specialised King Air fixed-

wing aircraft will provide operational support from Shannon for SAR and environmental monitoring.

98. The closest base to the OAA, and most likely to respond to an incident requiring helicopter assistance, is the Shannon base, approximately 49 NM southeast of the site.

9.2 Marine Rescue Coordination Centres

99. The Irish Coast Guard operates three MRCCs 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 OAA is Valentia, 79 NM south (a National Maritime Operations Centre (NMOC)) which provides marine SAR response services and coordinates the response to marine casualty incidents within the Irish Exclusive Economic Zone (EEZ).

9.3 Irish Coast Guard Stations

100. The IRCG stations located in proximity to the OAA and OECC are presented in Figure 9.2.

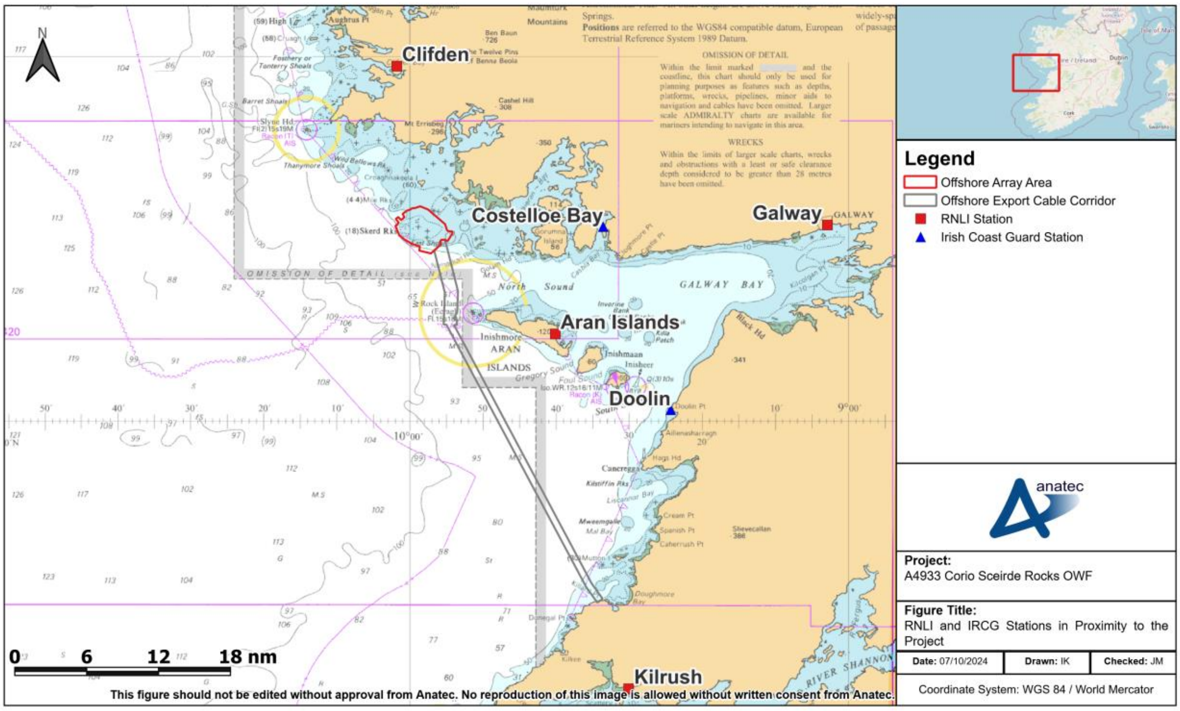


Figure 9.2 RNLI and IRCG Stations in Proximity to the Offshore Site

101. The closest IRCG stations to the Offshore Site are the Costelloe Bay and Doolin stations, which are approximately 12 NM east and 23 NM southeast of the OAA respectively.

9.4 Royal National Lifeboat Institution

102. The RNLI stations located in proximity to the OAA and OECC are presented in Figure 9.2.

103. The Clifden and Aran Islands RNLI stations lie approximately 12 NM north and southeast of the OAA respectively and are the closest RNLI stations. The Clifden station operates a Shannon class All-Weather Lifeboat (ALB) and a B class Atlantic 85 Inshore Lifeboat (ILB), while the Aran Islands station operates a Severn class ALB. The RNLI have a strategic performance standard of reaching casualties up to a maximum of 100 NM offshore. The closest RNLI station to the OECC is the Aran Islands station, approximately 7 NM to the east. The Galway and Kilrush stations are also in the region and located 31 NM to the east, and 40 NM to the south, respectively.

104. Figure 9.3 presents the incidents documented by the RNLI that occurred within the study areas, colour-coded by incident type. Figure 9.4 presents the same data, colour-coded by vessel type. It is noted that incidents which were deemed hoaxes or false alarms have been excluded from the analysis.

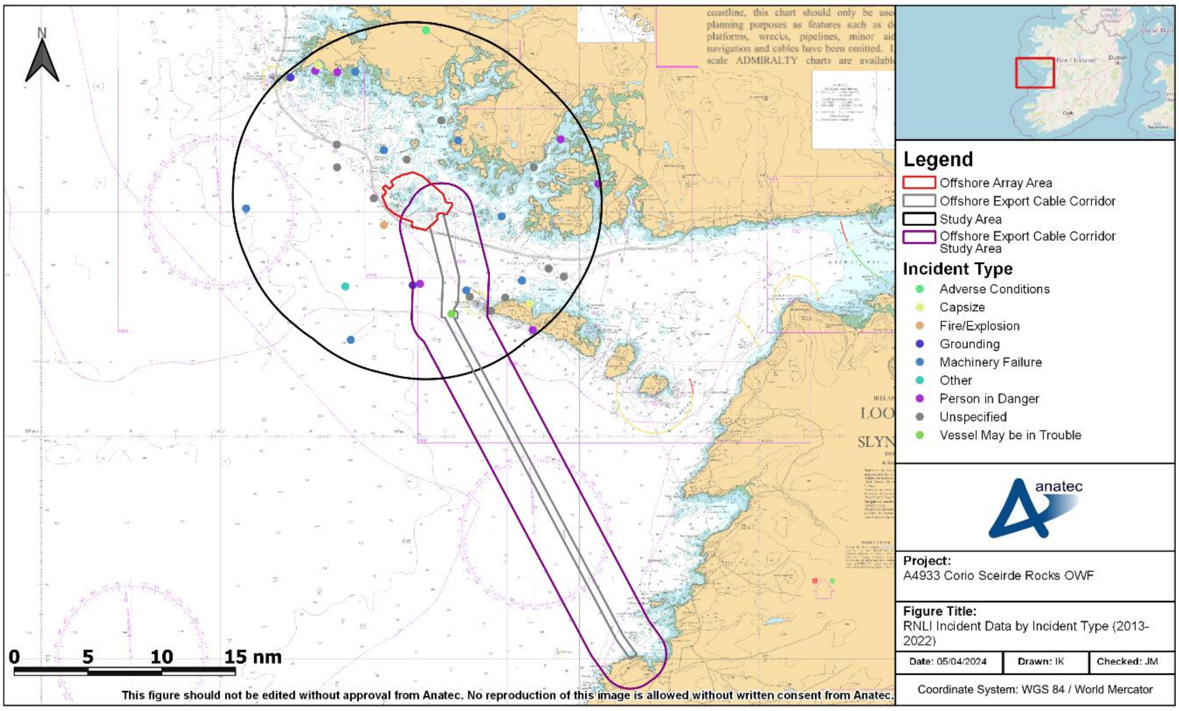


Figure 9.3 RNLI Incident Data by Incident Type within the Study Areas (2013-2022)

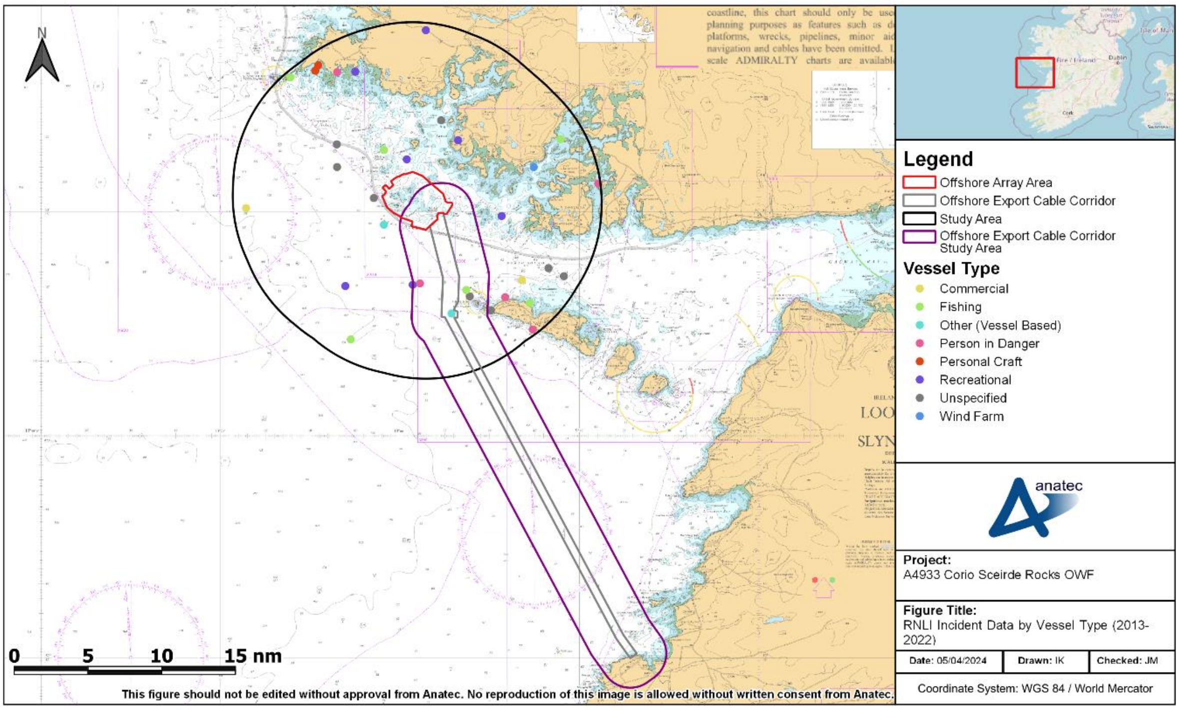


Figure 9.4 RNLI Incident Data by Vessel Type within the Study Areas (2013-2022)

105. A total of 38 incidents were responded to by the RNLI within the study area between 2013 and 2022. This corresponds to an average of approximately four incidents per year. The most frequent station for incident response was Aran Islands (63%), with Clifden (37%) the only other station used. Incident type was able to be specified for 63% of all incidents. The most common incident types of these recorded were "*machinery failure*" (42%) and "*person in danger*" (21%). Vessel type was able to be specified for 79% of all incidents. The most common vessel types recorded were fishing vessels (27%) followed by recreational vessels (23%). No incidents were responded to by the RNLI within the OAA itself.

106. A total of four incidents were responded to by the RNLI within the OECC study area between 2013 and 2022, with all four also captured within the study area for the OAA. This corresponds to an average of approximately one incident every two to three years.

9.5 Marine Casualty Investigation Board

107. The MCIB is tasked with examining and, if necessary, carrying 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.

108. Although the MCIB do not publish comprehensive incident data in the public domain, they do publish investigation reports online (MCIB, 2023). From a full search of the publicly available database of incident reports and news articles, Table 9.1 outlines

relevant incidents in proximity to the OAA for which the MCIB have published an incident report between 1994 and 2023.

Table 9.1 MCIB Incident Summary

Incident Type	Year	Summary
Grounding	2007	Steering problems with the cargo vessel *MV Locator* led to it being run aground on the shoreline of Saint MacDara's Island off the Galway coast. It was later refloated with no damage to the vessel or injuries to personnel.
Man overboard	2010	An individual left Doire Fhearte Mór in Galway to go mackerel fishing. Heading past Calladh Thaigue they fell overboard, with the empty vessel spotted ashore. The individual was later found in the water deceased.
Man overboard	2012	The alarm was raised for an overdue fisher near Carna in Galway. A resulting search discovered the fishing vessel close to the shore of Aran Islands, with the individual found deceased close to MacDara's Island off the Galway coast.

109. Although not documented by the MCIB, it is recognised that in 2000 a fishing vessel ran aground on the rocks off the west coast in this area. The incident resulted in the fatalities of 12 of the 13 crew and loss of the vessel (MAIB, 2001).

9.6 Third-Party Assistance

110. Companies operating offshore (e.g., offshore wind farm developers) typically have resources including vessels, helicopters, and other equipment available for normal operations that can assist with emergencies offshore. Moreover, all vessels under IMO obligations set out in 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.

111. Emergency response and cooperation procedures between the Applicant and the IRCG will be agreed prior to construction as per Section 16.

9.7 Global Maritime Distress and Safety System

112. 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.

113. There are four GMDSS sea areas, and in Ireland it is the responsibility of the IRCG to ensure Very High Frequency (VHF) coverage from coastal stations within sea area A1. The OAA is located within sea area A1, as shown in Figure 9.5, and therefore in the event of an emergency any vessel located in proximity to the OAA would be able to contact IRCG via VHF.

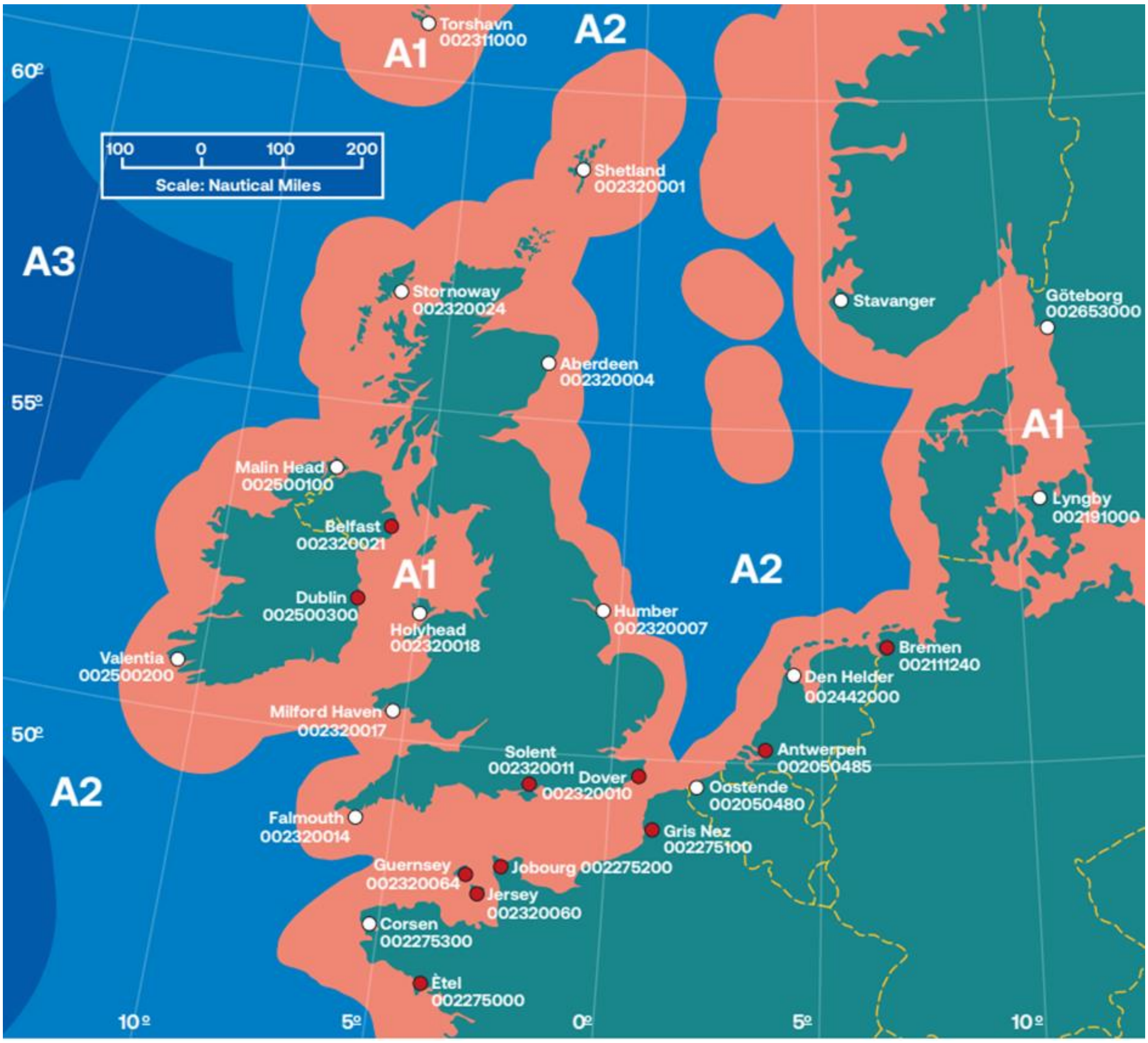


Figure 9.5 GMDSS Sea Areas (MCA, 2021)

9.8 Historical Offshore Wind Farm Incidents

114. Given the early stage of offshore wind farm development in Ireland there is no historical incident data available. Therefore, UK experience has been considered in this section given it provides a wide range of incidents relating to offshore wind development in a similar regulatory framework. Other European countries have more regulations restricting access to arrays which can distort results.

115. 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.

9.8.1 Incidents Involving UK Offshore Wind Farm Developments

116. As of October 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 24,500 fully operational wind turbine years.

117. 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

Incident Vessel	Incident Type	Date	Description of Incident	Vessel Damage	Harm to Persons	Source
Project / project	Collision	2 June 2012	CTV allision with flotel. Nine persons safely evacuated and transferred to nearby vessel before being brought back into port.	Moderate	None	UK Confidential Human Factors Incident Reporting Programme (CHIRP)
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	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

Incident Vessel	Incident Type	Date	Description of Incident	Vessel Damage	Harm to Persons	Source
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
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)

118. 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.

119. As of October 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.

120. As of October 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 two 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 1,750 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).

9.8.2 Incidents Involving Non-UK Offshore Wind Farm Developments

121. 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.

122. One high profile non-UK incident which is noted is that involving a bulk carrier in January 2022 which broke its anchor chain during a storm in Dutch waters and collided with a nearby anchored vessel. The vessel began to take on water, leading to all crew members being evacuated by helicopter. The vessel then continued to

drift towards shore including through an under construction offshore wind farm where it allided with a WTG foundation before being taken under tow (Marine Safety Investigation Unit, 2024).

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

123. From news reports, basic web searches and experience at working with existing offshore wind farm developments, a list has been collated of recent 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. It is noted that this list is a selection of incidents known to the authors in question – there are likely further incidents of OREI project vessels supporting non-project vessels which have not been well publicised.

124. 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)

Incident Type	Date	Related Development	Description of Incident	Source
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
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

125. This section presents an analysis of vessel traffic movements in relation to the OAA and OECC. The methodology for vessel traffic data collection including details of the on-site vessel traffic surveys is provided is Section 5.2.

10.1 OAA

126. A number of vessel tracks recorded during the survey periods were classified as temporary (non-routine), such as vessels undergoing surveys within the offshore study area during the data periods. These vessels have therefore been excluded from the analysis.

127. A plot of the vessel tracks recorded during the 14-day summer survey period in August/September 2022, colour-coded by vessel type and excluding any temporary traffic, is presented in Figure 10.1. Following this, a plot of the vessel tracks recorded during the further 14-day winter survey period in November 2022, colour-coded by vessel type and excluding any temporary traffic, is presented in Figure 10.2.

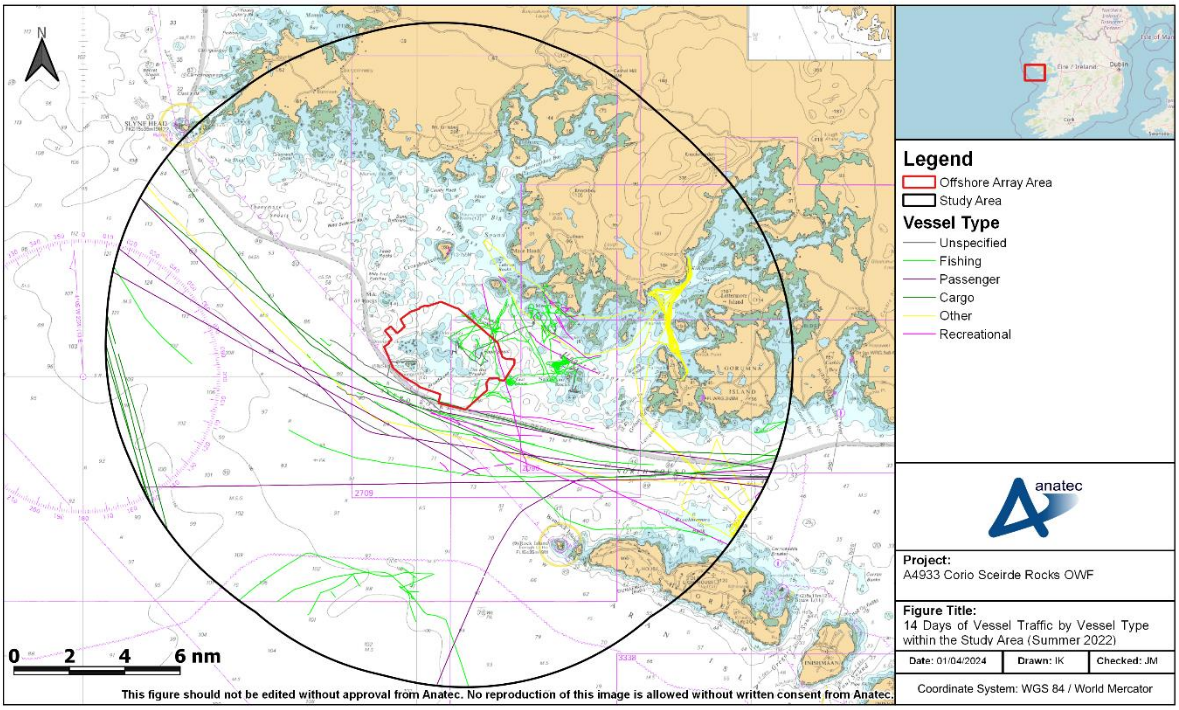


Figure 10.1 14 Days of Vessel Traffic by Vessel Type within the Study Area (Summer 2022)

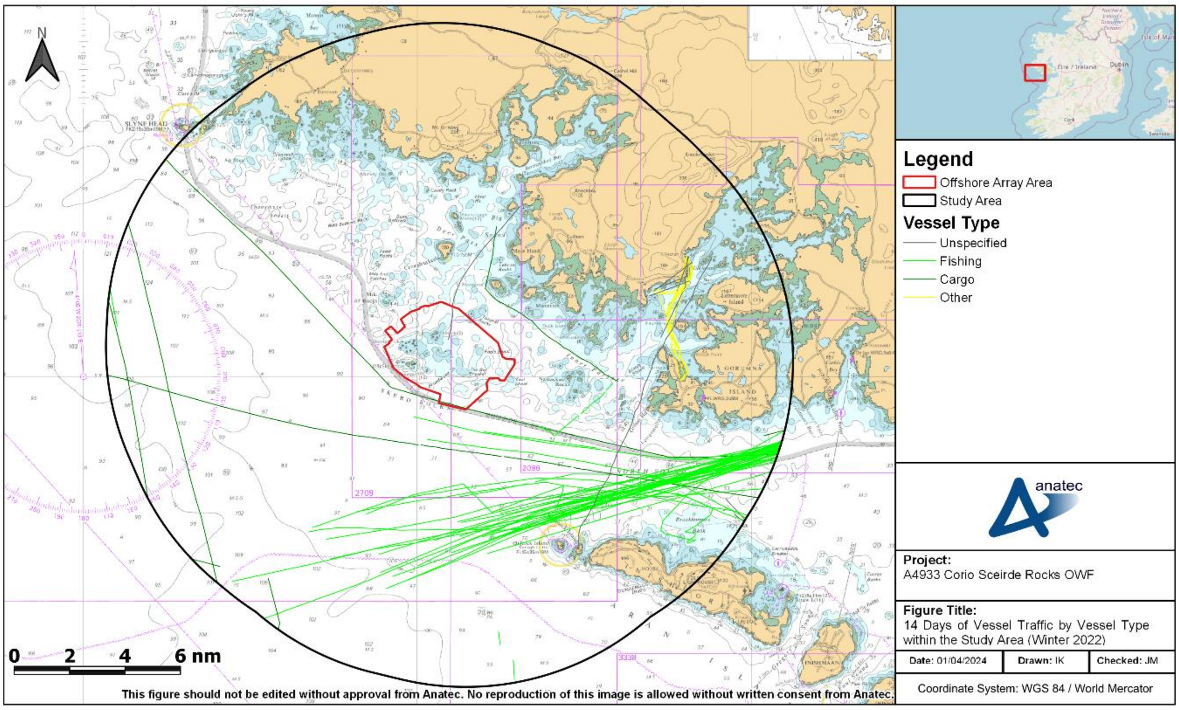


Figure 10.2 14 Days of Vessel Traffic by Vessel Type within the Study Area (Winter 2022)

128. Plots of the vessel tracks for the summer and winter survey periods converted to a density heat map are presented in Figure 10.3 and Figure 10.4, respectively. It is noted that the same density brackets were used for both survey periods to allow for direct comparison in vessel density.

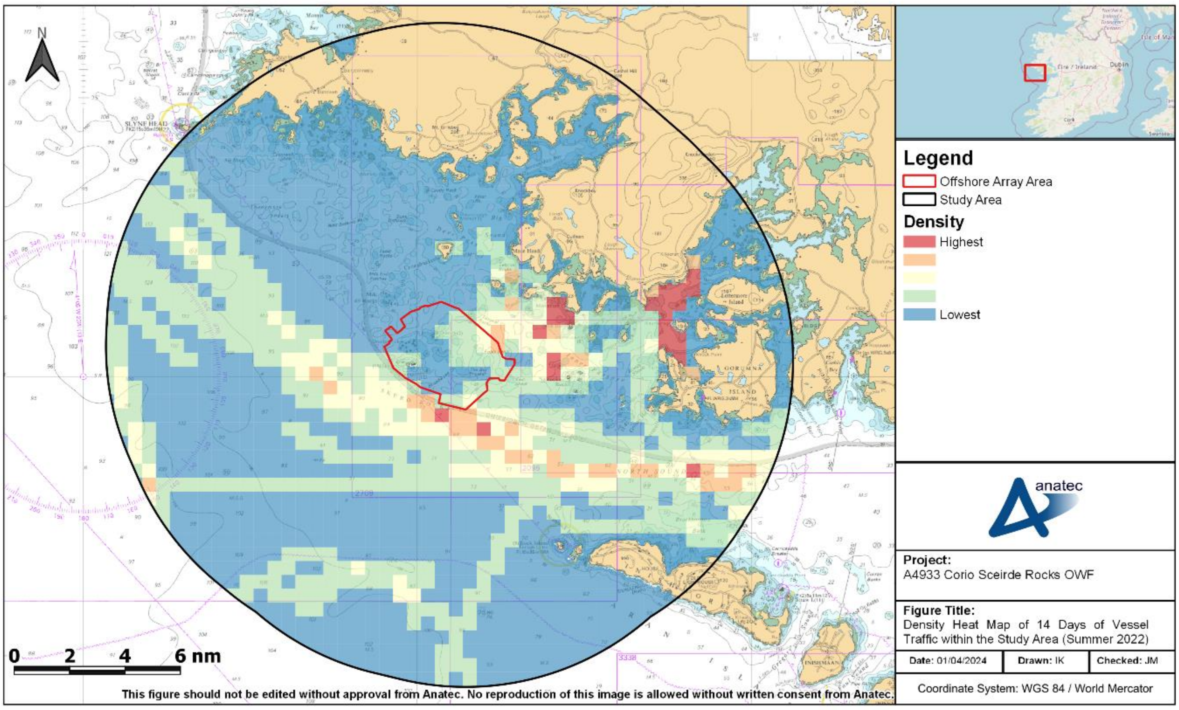


Figure 10.3 Density Heat Map of 14 Days of Vessel Traffic within the Study Area (Summer 2022)

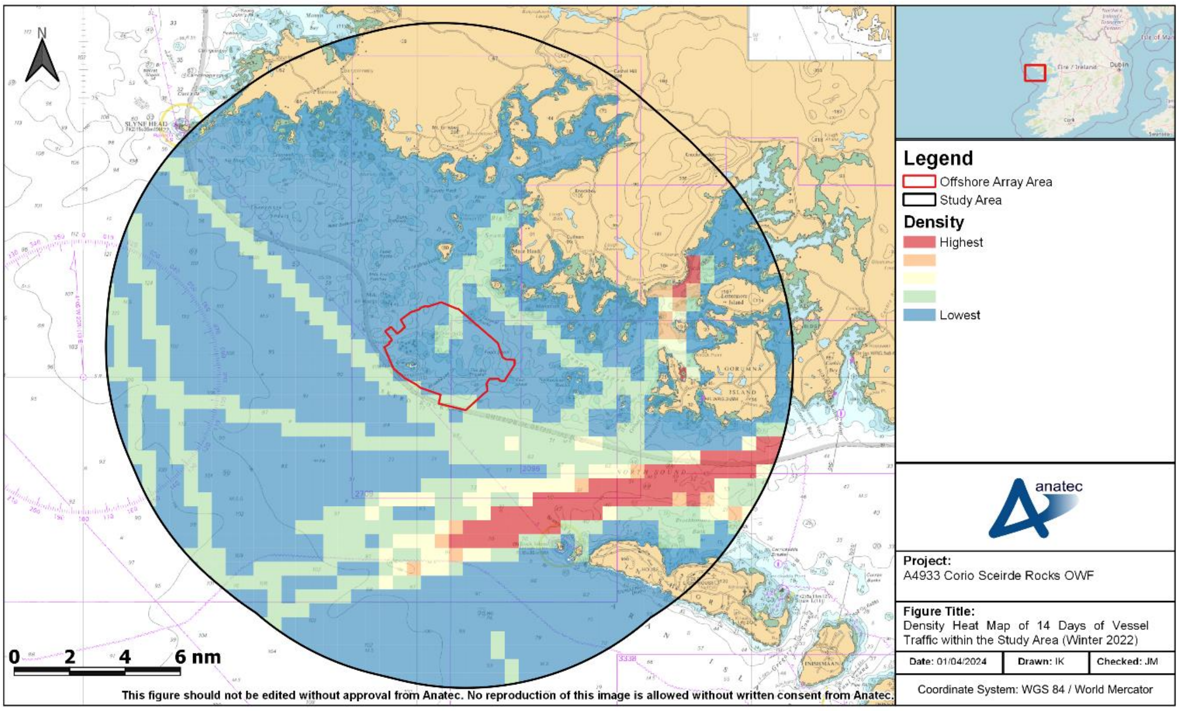


Figure 10.4 Density Heat Map of 14 Days of Vessel Traffic within the Study Area (Winter 2022)

10.1.1 Vessel Counts

129. For the 14 days analysed during the summer survey period, there were an average of five to six unique vessels[3] recorded per day within the study area. In terms of vessels intersecting the OAA itself, there were an average of one vessel every two days recorded.

130. The daily number of unique vessels recorded within the study area and OAA during the summer survey period are presented in Figure 10.5.

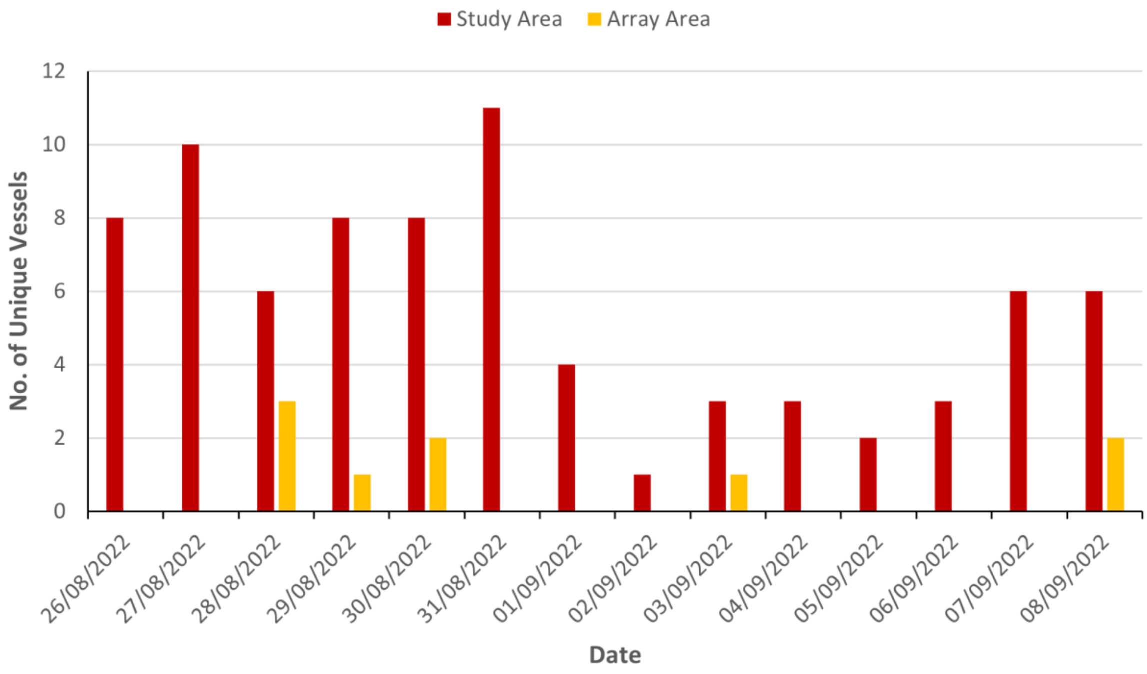


Figure 10.5 Unique Vessels per Day within the OAA and Study Area (14-Days Summer 2022)

131. Throughout the summer survey period, approximately 11% of unique vessel tracks recorded within the study area intersected the OAA.

132. The busiest full day recorded within the study area throughout the summer survey period was 31st August 2022, during which 11 unique vessels were recorded. The busiest full day recorded within the OAA during the summer survey period was 28th August 2022, during which three unique vessels were recorded.

133. The quietest full day recorded within the study area throughout the summer survey period was 2nd September 2022, during which one unique vessel was recorded.

[3] For the purposes of vessel traffic analysis, a unique vessel is considered to be 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.

Vessel activity was only recorded within the OAA during the summer survey period on 28th, 29th, and 30th August 2022; and 3rd and 9th September 2022.

134. For the 14 days analysed during the winter survey period, there were again an average of five to six unique vessels recorded per day within the study area. In terms of vessels intersecting the OAA itself, there were an average of one vessel every seven days recorded (just two intersections throughout the survey period).

135. The daily number of unique vessels recorded within the study area and OAA during the winter survey period are presented in Figure 10.6.

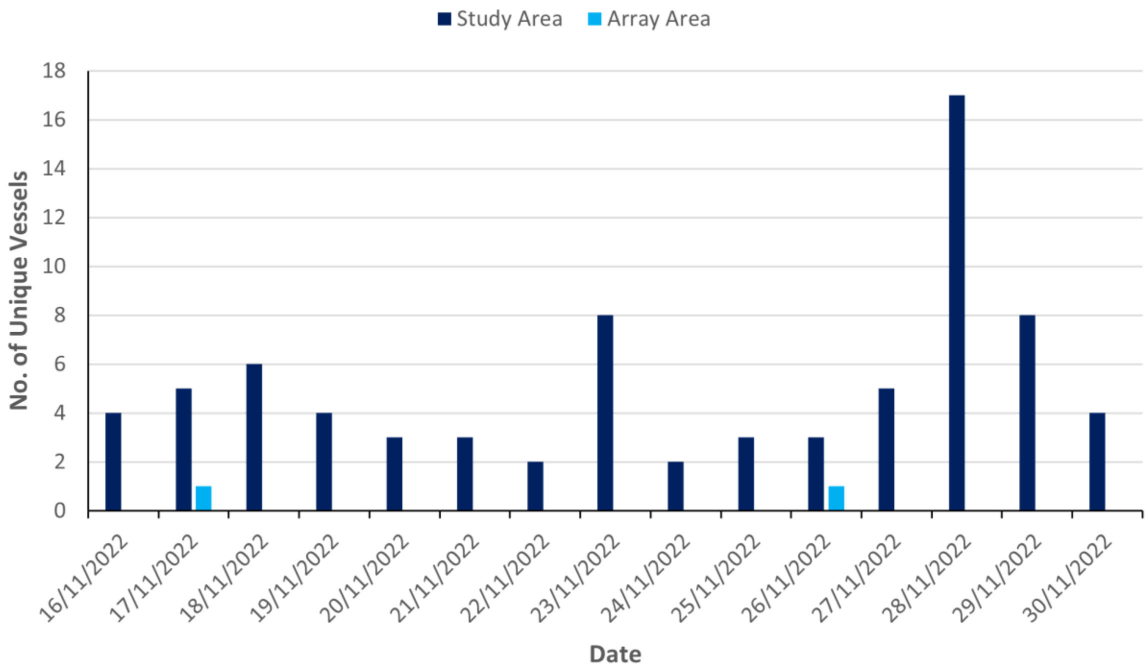


Figure 10.6 Unique Vessels per Day within the OAA and Study Area (14-Days Winter 2022)

136. Throughout the winter survey period, approximately 3% of unique vessel tracks recorded within the study area intersected the OAA.

137. The busiest full day recorded within the study area throughout the winter survey period was 28th November 2022, during which 17 unique vessels were recorded (primarily fishing vessels associated with Rossaveel). The only days in which a vessel was recorded within the OAA during the winter survey period were 17th and 26th November 2022, with one unique vessel recorded on both days.

138. The quietest full days recorded within the study area throughout the winter survey period were 22nd and 24th November 2022, during which two unique vessels were recorded each.

10.1.2 Vessel Types

139. The percentage distribution of the vessel types recorded within the study area during both survey periods is presented in Figure 10.7.

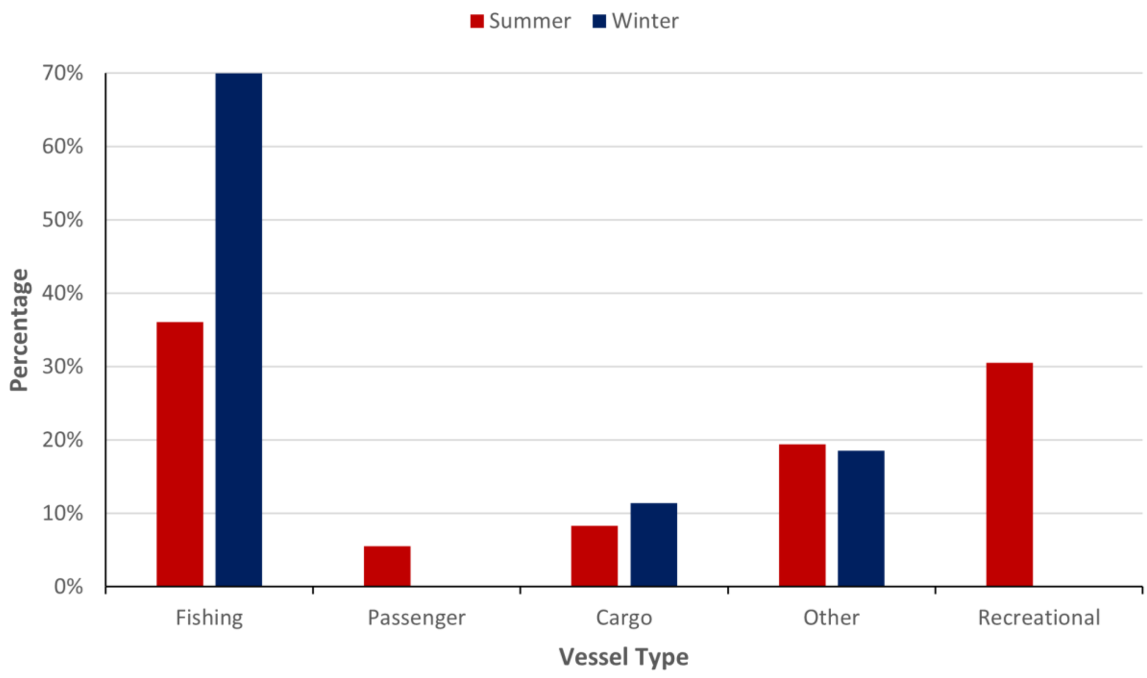


Figure 10.7 Vessel Type Distribution within the Study Area (28-Days Summer and Winter 2022)

140. Throughout the summer survey period, the most common vessel types within the study area were fishing vessels (36%) and recreational vessels (31%). Throughout the winter survey period, the most common vessel types within the study area were fishing vessels (70%) and 'other' vessels (19%).

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

10.1.2.1 Fishing Vessels

142. Commercial fishing vessel data was extracted from the vessel tracks recorded during the vessel traffic surveys. It is noted that the term 'fishing vessel' as used throughout this NRA refers to commercial fishing vessels, and any non-commercial fishing activity (such as rod and line angling) is categorised under recreational vessel activity. On this basis the tracks of commercial fishing vessels recorded within the study area throughout both survey periods are presented in Figure 10.8.

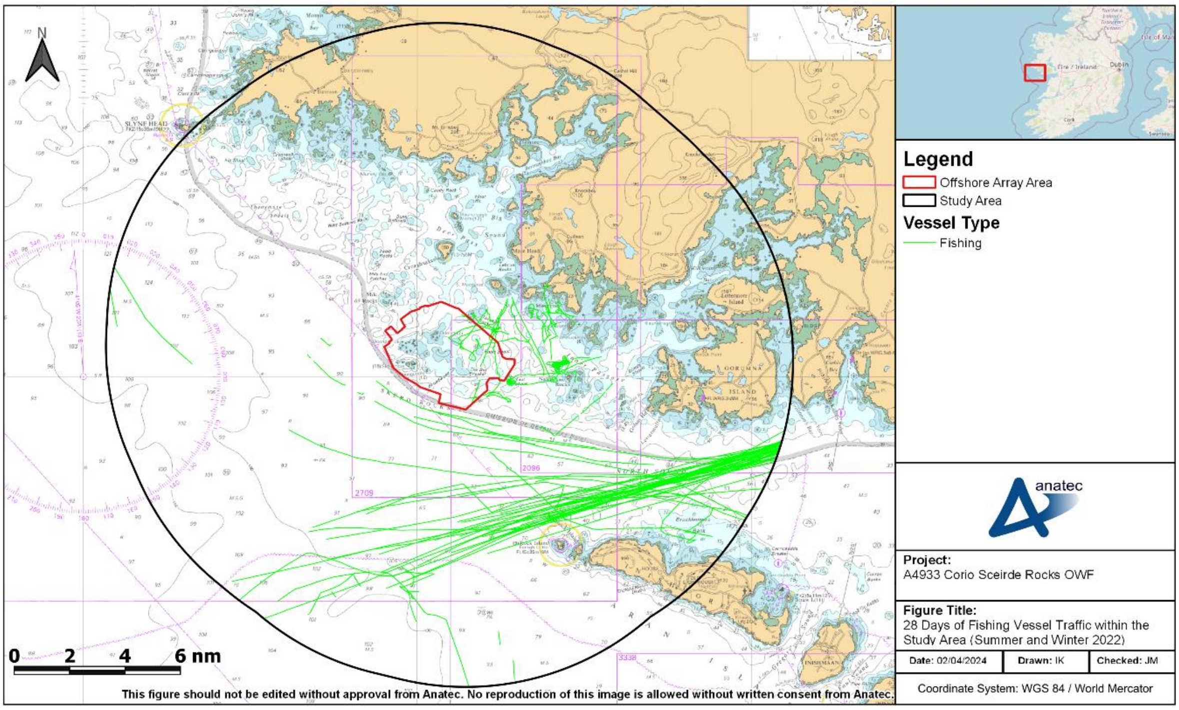


Figure 10.8 28 Days of Fishing Vessel Traffic within the Study Area (Summer and Winter 2022)

143. During the summer survey period, an average of two fishing vessels per day were recorded within the study area, with an average of one fishing vessel every three days intersecting the OAA. During the winter survey period, an average of three to four fishing vessels per day were recorded within the study area, with no fishing vessels recorded intersecting the OAA.

144. Fishing vessel behaviour was noted to differ between the summer and winter survey periods – whilst the fishing vessels in the summer period displayed behaviour typical of active fishing within and directly east of the OAA, those in winter were observed to be primarily transiting further offshore of the study area out of Rossaveel. During consultation, Rossaveel Harbour have confirmed that the winter survey period captures the peak period for fishing vessel activity.

10.1.2.2 Other Vessels

145. The tracks of other vessels within the study area throughout the summer and winter survey periods combined are presented in Figure 10.9.

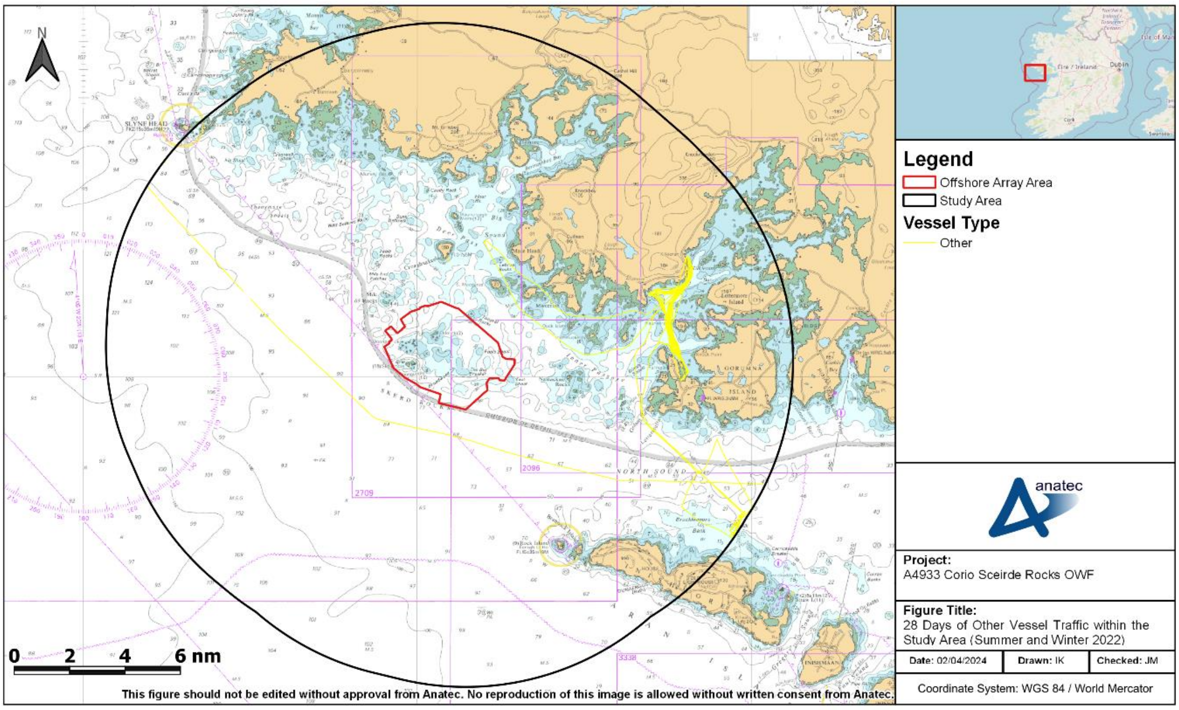


Figure 10.9 28 Days of Other Vessel Traffic within the Study Area (Summer and Winter 2022)

146. During the summer survey period, an average of one other vessel per day was recorded within the study area, with no other vessels recorded intersecting the OAA. During the winter survey period, again an average of one other vessel per day was recorded within the study area, with no other vessels recorded intersecting the OAA.

147. Other than a vessel assisting in research work, a buoy-laying vessel, and an RNLI lifeboat recorded on two instances, all other vessel transits were from a single vessel operating in relation to a fish farm within Kilkieran Bay.

10.1.2.3 Cargo Vessels

148. The tracks of cargo vessels within the study area throughout the summer and winter survey periods combined are presented in Figure 10.10.

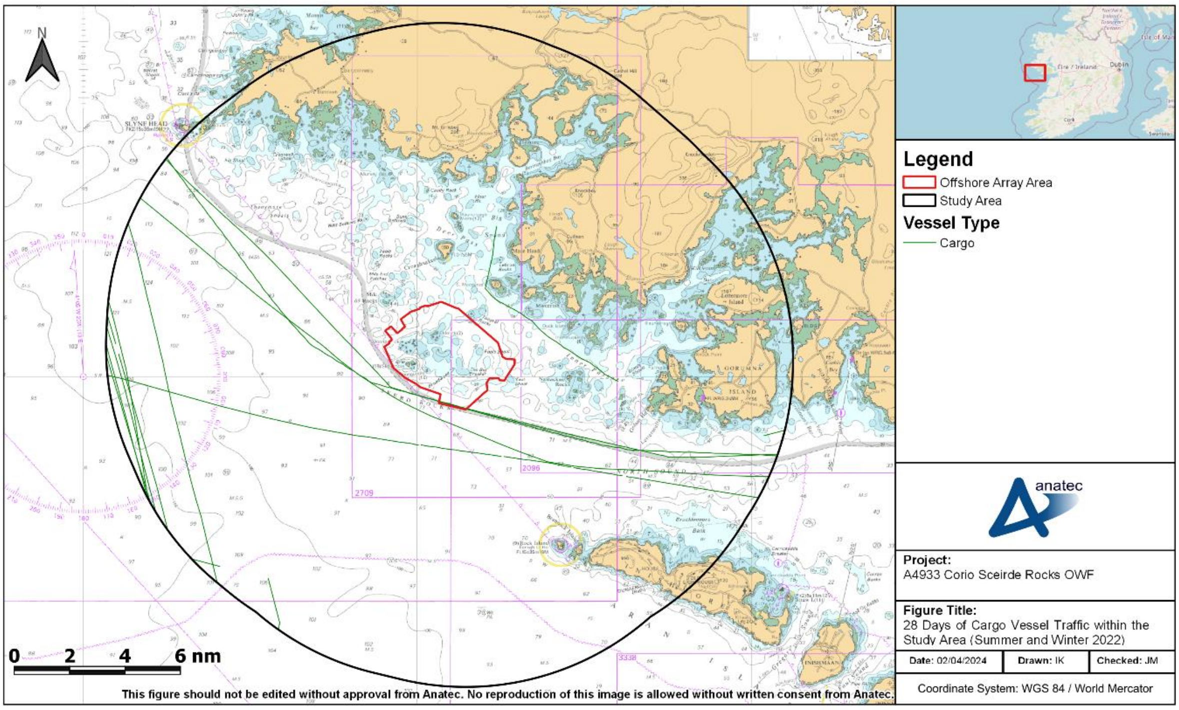


Figure 10.10 28 Days of Cargo Vessel Traffic within the Study Area (Summer and Winter 2022)

149. During the summer survey period, an average of one cargo vessel every two days was recorded within the study area. During the winter survey period, again an average of one cargo vessel every two days was recorded within the study area. Across both survey periods combined, there were two cargo vessels intersected the OAA.

150. Cargo vessels were recorded on two separate routes – one between Galway Bay and Rothesay on a northwest-southeast bearing (passing at the southern boundary of the OAA), and one between Limerick and Scandinavian ports (passing at the western extent of the study area).

10.1.2.4 Recreational Vessels

151. The tracks of recreational vessels within the study area throughout the summer survey period are presented in Figure 10.11.

152. It is noted that there were no recorded recreational vessels within the winter survey period.

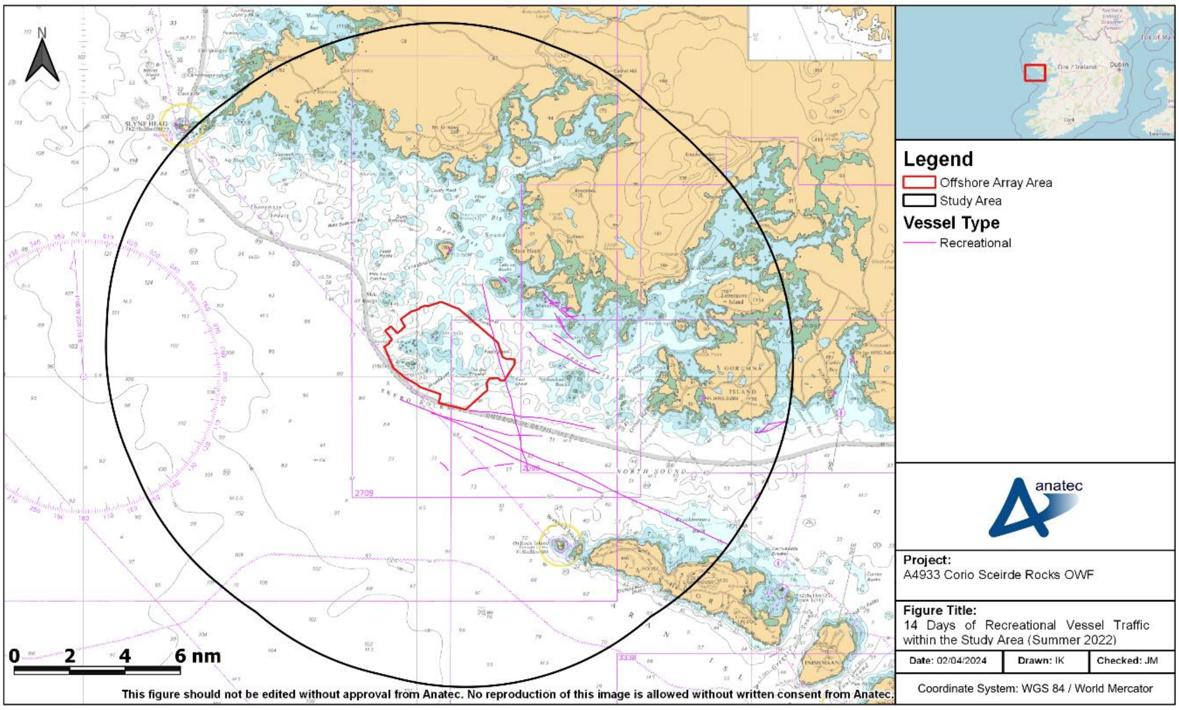


Figure 10.11 14 Days of Recreational Vessel Traffic within the Study Area (Summer 2022)

153. During the summer survey period, an average of one to two recreational vessels per day were recorded within the study area, with one recreational vessel recorded intersecting the eastern portion of the OAA.

154. Recreational vessel transits were primarily recorded close to the coast, with a transit from a recreational fishing vessel noted to the east of the study area.

10.1.2.5 Passenger Vessels

155. The tracks of passenger vessels within the study area throughout the summer survey period are presented in Figure 10.12.

156. It is noted that there were no recorded passenger vessels within the winter survey period.

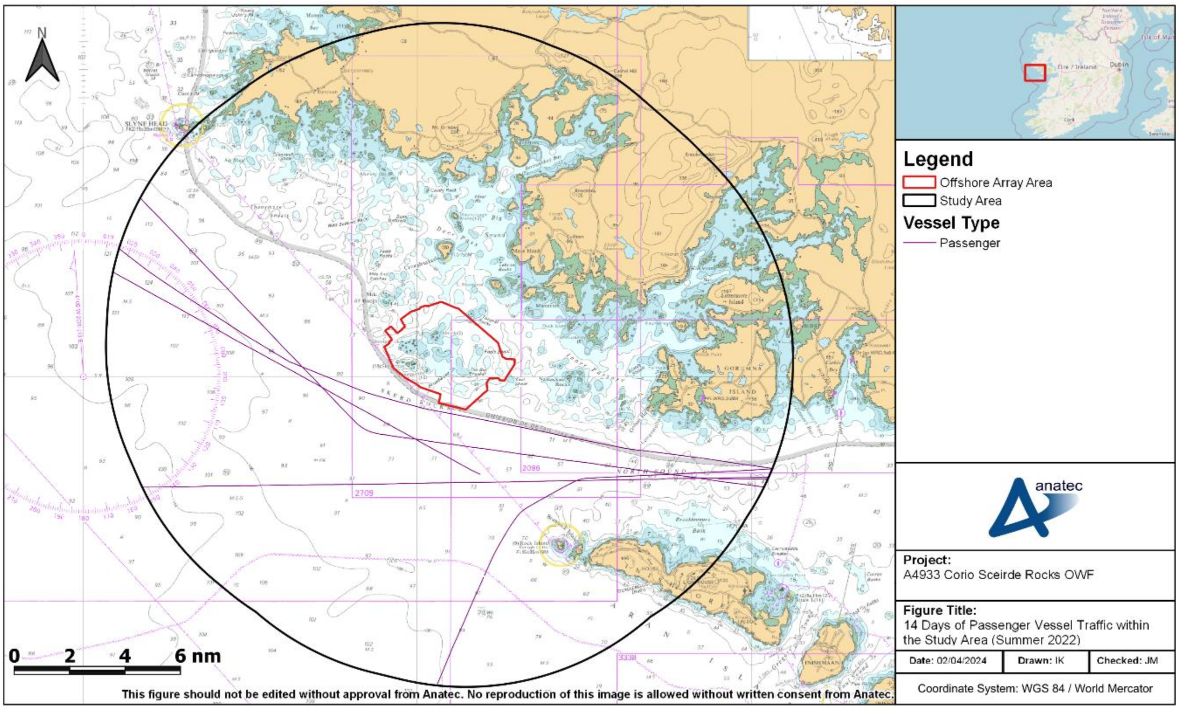


Figure 10.12 14 Days of Passenger Vessel Traffic within the Study Area (Summer 2022)

157. During the summer survey period, an average of one passenger vessel every four days was recorded within the study area, with no passenger vessels recorded intersecting the OAA.

158. All passenger vessels recorded within the summer survey period were separate cruise liners, with no regular passenger vessel routeing noted. During consultation, Rossaveel Harbour confirmed that the summer survey period captures the peak period for passenger vessel activity.

10.1.3 Vessel Sizes

10.1.3.1 Vessel Length

159. Vessel length information was available via the AIS broadcast for 64% of all vessels recorded throughout the combined summer and winter survey periods. This number was likely low due to the proportion of non-AIS and Class B AIS vessels – of the vessels within the study area during the survey period, approximately 29% were recorded via either Radar or manual observations; and of the vessels recorded via AIS, approximately 12% used Class B devices.

160. A plot of all vessel tracks (excluding temporary traffic) recorded within the study area throughout the survey periods, colour-coded by length, is presented in Figure 10.13. Following this, the distribution of these length classes is presented in Figure 10.14.

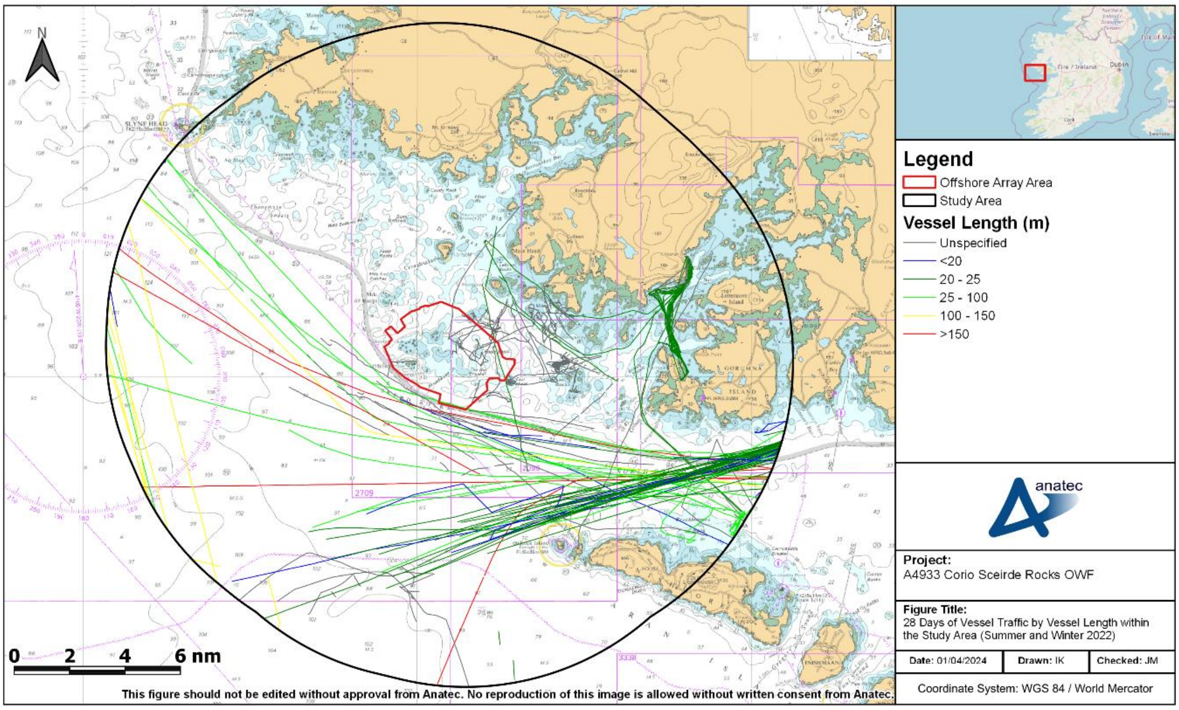


Figure 10.13 28 Days of Vessel Traffic by Vessel Length within the Study Area (Summer and Winter 2022)

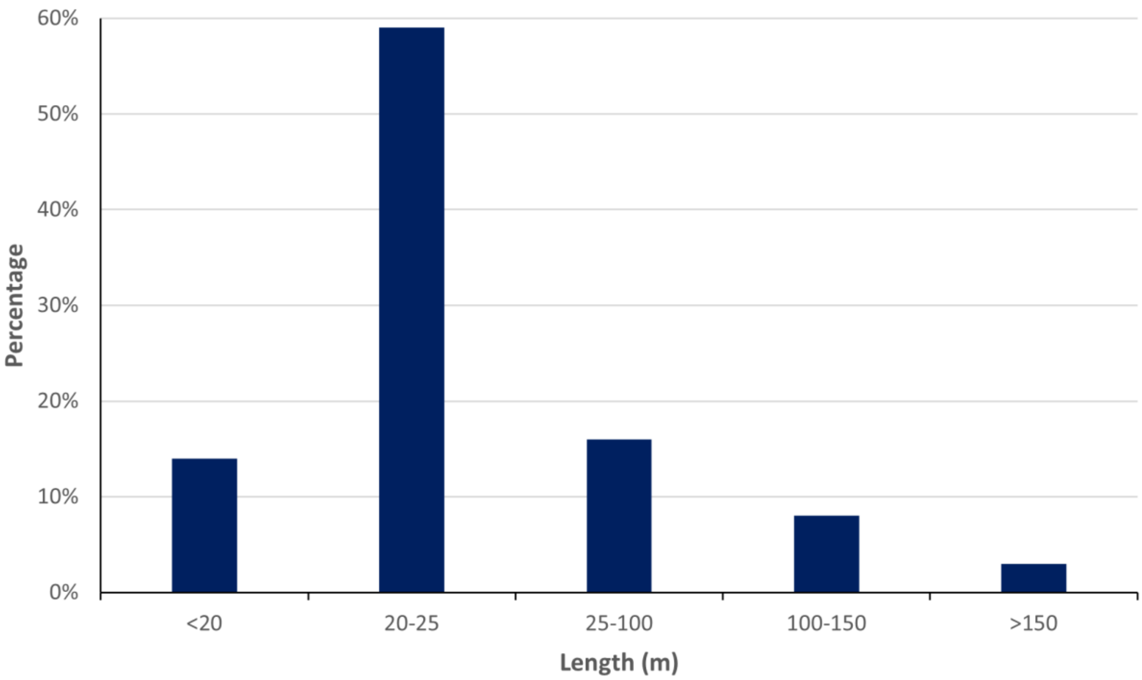


Figure 10.14 Vessel Length Distribution

161. Excluding the proportion of vessels for which length was not available, the average length of vessels within the study area was 42 m. Over the survey periods, vessel

length ranged between 8 m for a recreational fishing vessel, and 238 m for a cruise liner.

162. Vessels of greater lengths were primarily cargo and passenger vessels with the smaller lengths being fishing and recreational vessels.

10.1.3.2 Vessel Draught

163. Vessel draught information was available for 27% of all vessels recorded throughout the combined summer and winter survey periods. As per Section 10.1.3.1, this is likely due to the proportion of non-AIS and Class B AIS vessels recorded. A plot of all vessel tracks (excluding temporary traffic) recorded within the study area throughout the survey periods, colour-coded by draught, is presented in Figure 10.15. Following this, the distribution of these draught classes is presented in Figure 10.16.

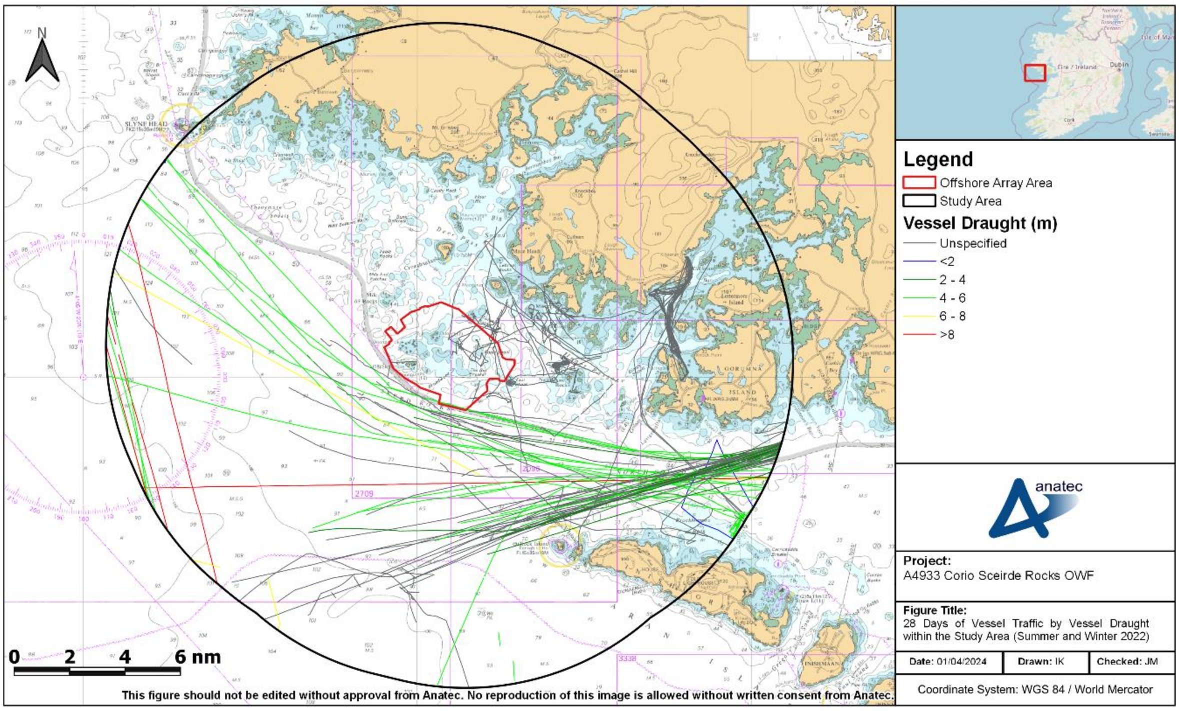


Figure 10.15 28 Days of Vessel Traffic by Vessel Draught within the Study Area (Summer and Winter 2022)

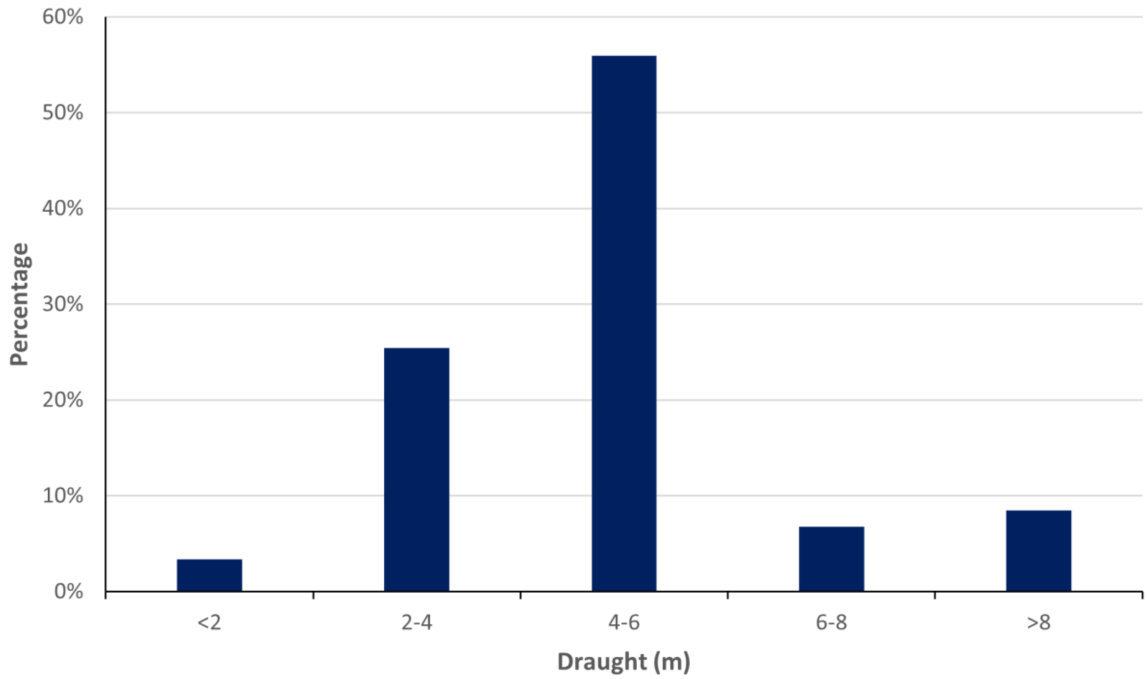


Figure 10.16 Vessel Draught Distribution

164. Excluding the proportion of vessels for which draught was not available, the average draught of vessels within the study area was 5.1 m. Over the survey periods, vessel draught ranged between 1.3 m for an RNLI lifeboat, and 8.6 m for a general cargo vessel.

165. Vessels of greater draughts were primarily cargo and passenger vessels.

10.1.4 Anchoring Activity

166. 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.

167. For this reason, those vessels which travelled at a speed of less than 1 kt for more than 30 minutes had their corresponding vessel tracks individually checked for patterns characteristic of anchoring activity.

168. After applying these criteria, no vessels were deemed to be at anchor within the study area in either survey period.

10.2 OECC

169. A number of vessel tracks recorded during the survey periods were classified as temporary and excluded from further analysis. These were primarily vessels participating in surveys.

170. A plot of the vessel tracks recorded within the OECC study area during the 14-day summer survey period, colour-coded by vessel type and excluding any temporary traffic, is presented in Figure 10.17. Following this, a plot of the vessel tracks recorded during the 14-day winter survey period, colour-coded by vessel type and excluding any temporary traffic, is presented in Figure 10.18.

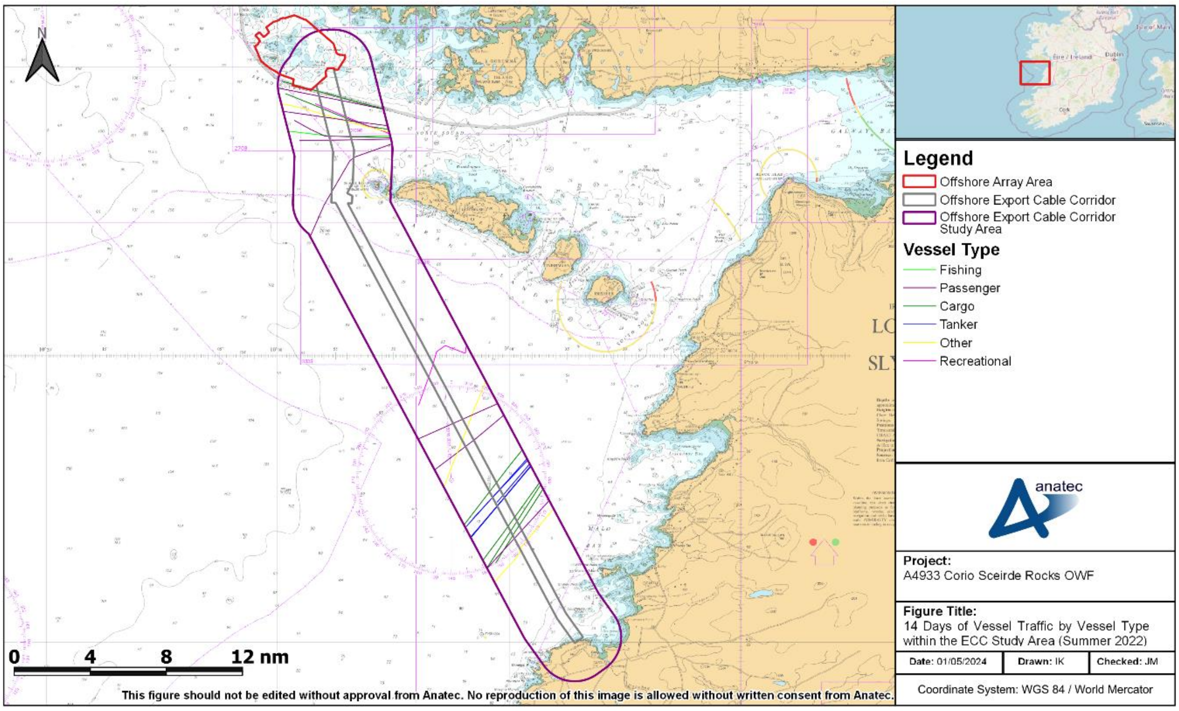


Figure 10.17 14 Days of Vessel Traffic within the OECC Study Area (Summer 2022)

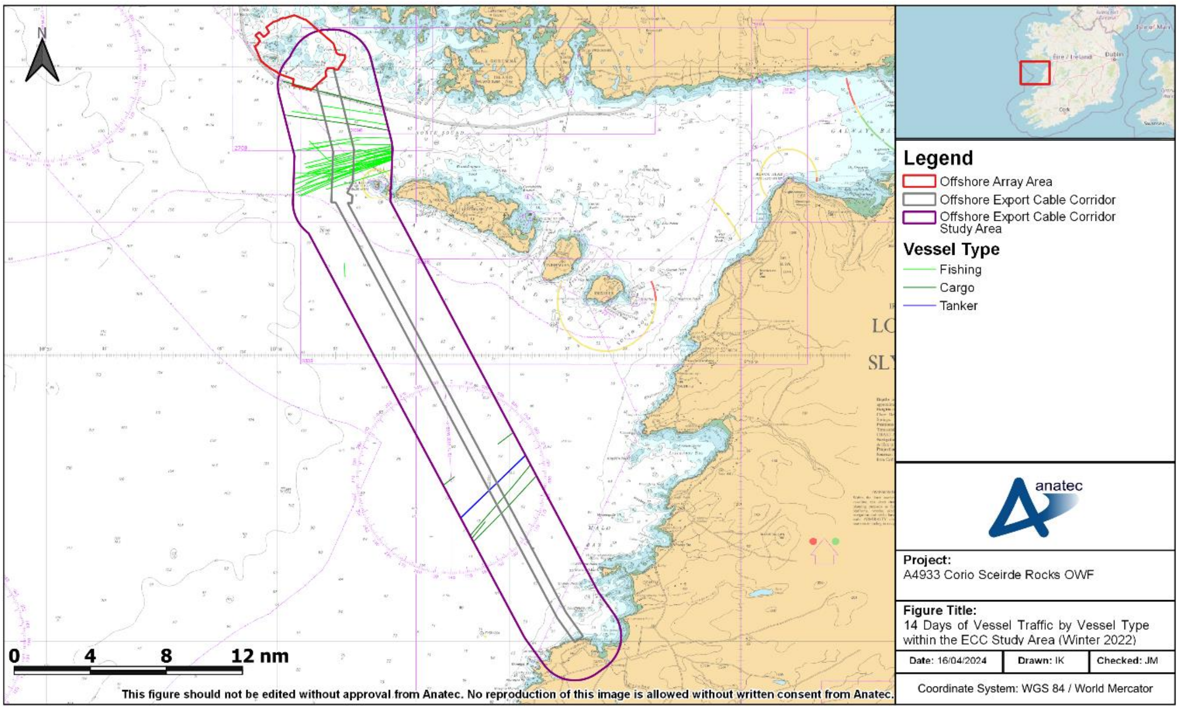


Figure 10.18 14 Days of Vessel Traffic within the OECC Study Area (Winter 2022)

10.2.1 Vessel Counts

171. For the 14 days analysed during the summer survey period, there was an average of one to two unique vessels recorded per day within the OECC study area. In terms of vessels intersecting the OECC itself, there was again an average of one to two vessels per day recorded, reflecting that traffic in proximity to the OECC generally crosses.

172. The daily number of unique vessels recorded within the OECC study area and OECC during the summer survey period are presented in Figure 10.19.

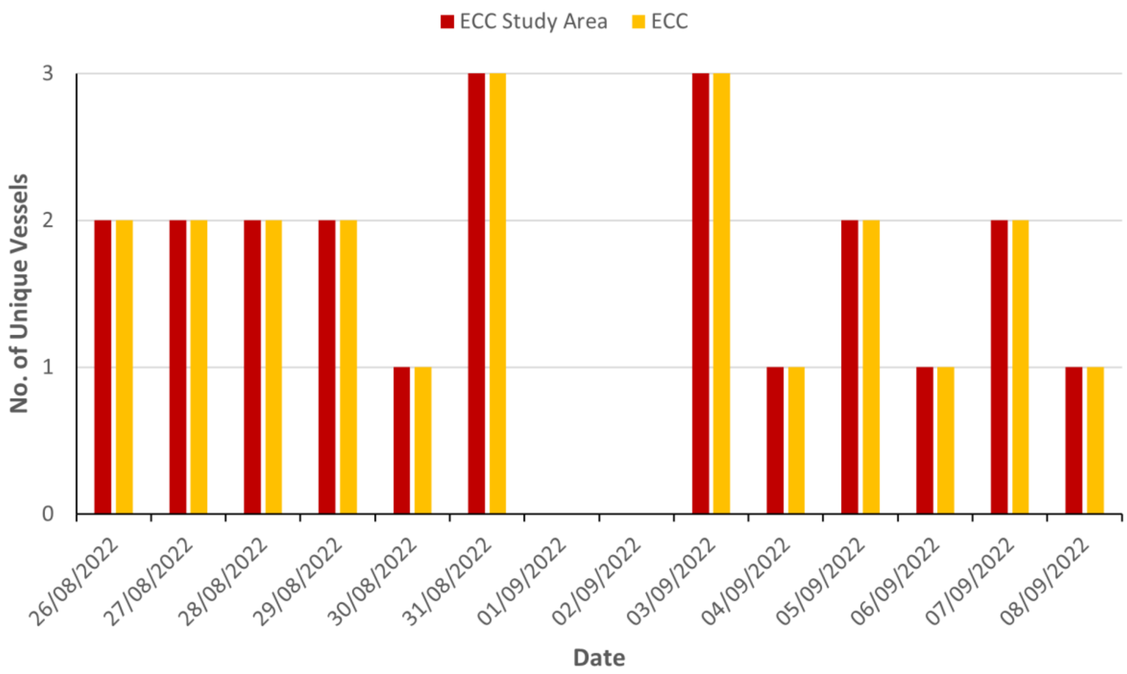


Figure 10.19 Unique Vessels per Day within the OECC and OECC Study Area (14-Days Summer 2022)

173. Throughout the summer survey period, all unique vessel tracks recorded within the OECC study area intersected the OECC.

174. The busiest days recorded within both the OECC and OECC study area throughout the summer survey period were 31st August and 3rd September 2022, during which three unique vessels were recorded.

175. The quietest days recorded within both the OECC and OECC study area throughout the summer survey period were 1st and 2nd September 2022, on which no vessel transits were recorded.

176. For the 14 days analysed during the winter survey period, there was an average of two to three unique vessels recorded per day within the OECC study area. In terms of vessels intersecting the OECC itself, there was again an average of two to three vessels per day recorded.

177. The daily number of unique vessels recorded within the OECC study area and OECC during the winter survey period are presented in Figure 10.20.

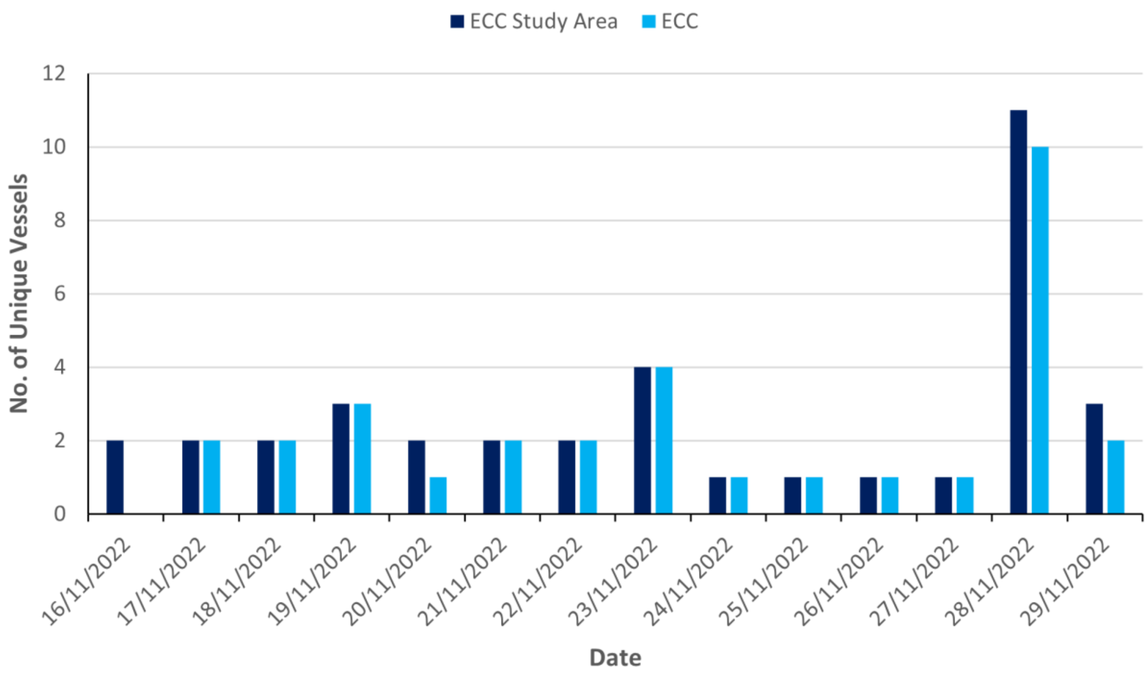


Figure 10.20 Unique Vessels per Day within the OECC and OECC Study Area (14-Days Winter 2022)

178. Throughout the winter survey period, approximately 86% of unique vessel tracks recorded within the OECC study area intersected the OECC.

179. The busiest day recorded within the OECC study area throughout the winter survey period was 28th November 2022, on which 11 unique vessels were recorded (primarily fishing vessels associated with Rossaveel). The busiest day recorded within the OECC itself throughout the winter survey period was also 28th November 2022, on which ten unique vessels were recorded.

180. The quietest days recorded within the OECC study area throughout the winter survey period were 24th to 27th November 2022, during which one unique vessel transit was recorded each. The quietest day recorded within the OECC itself throughout the winter survey period was 16th November 2022, on which no vessel transits were recorded.

10.2.2 Vessel Types

181. The percentage distribution of the vessel types recorded within the OECC study area during both survey periods is presented in Figure 10.21.

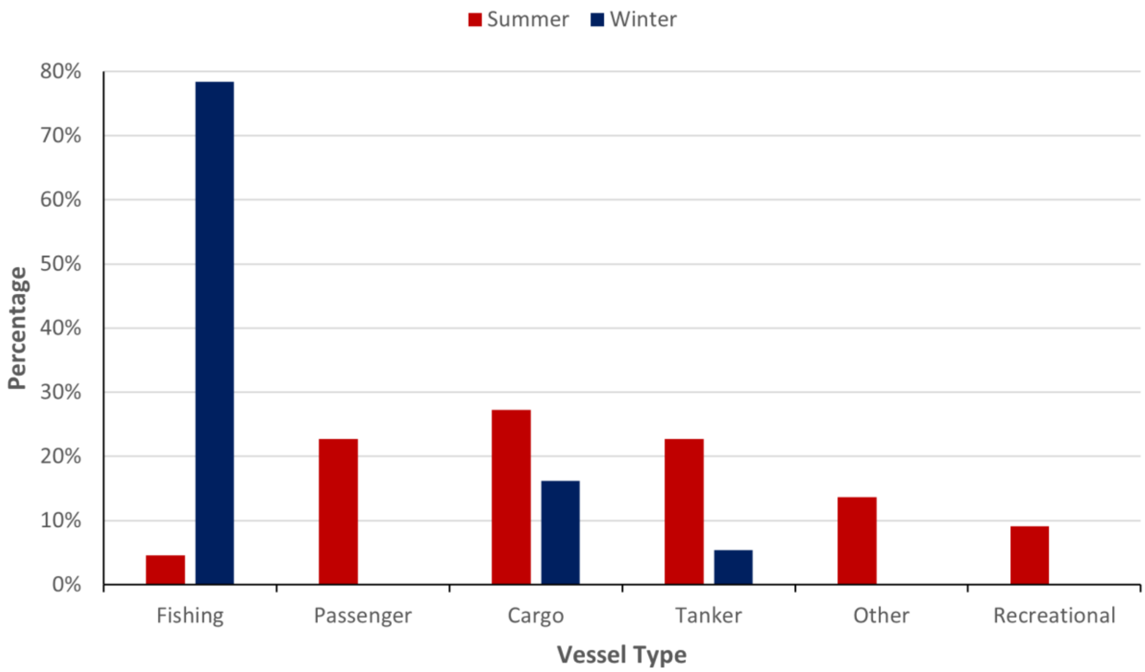


Figure 10.21 Vessel Type Distribution within the OECC Study Area (28-Days Summer and Winter 2022)

182. Throughout the summer survey period, the most common vessel types within the OECC study area were cargo vessels (27%), passenger vessels (23%), and tankers (23%). Throughout the winter survey period, the most common vessel types within the OECC study area were fishing vessels (78%) and cargo vessels (16%).

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

10.2.2.1 Fishing Vessels

184. The tracks of commercial fishing vessels recorded within the OECC study area throughout both survey periods are presented in Figure 10.22. It is noted that, as per Section 5.3.1, as this dataset covers AIS only there may be additional activity from fishing vessels under 15 m in length, although Rossaveel Harbour confirmed during consultation that AIS data for fishing vessels near the Landfall is representative.

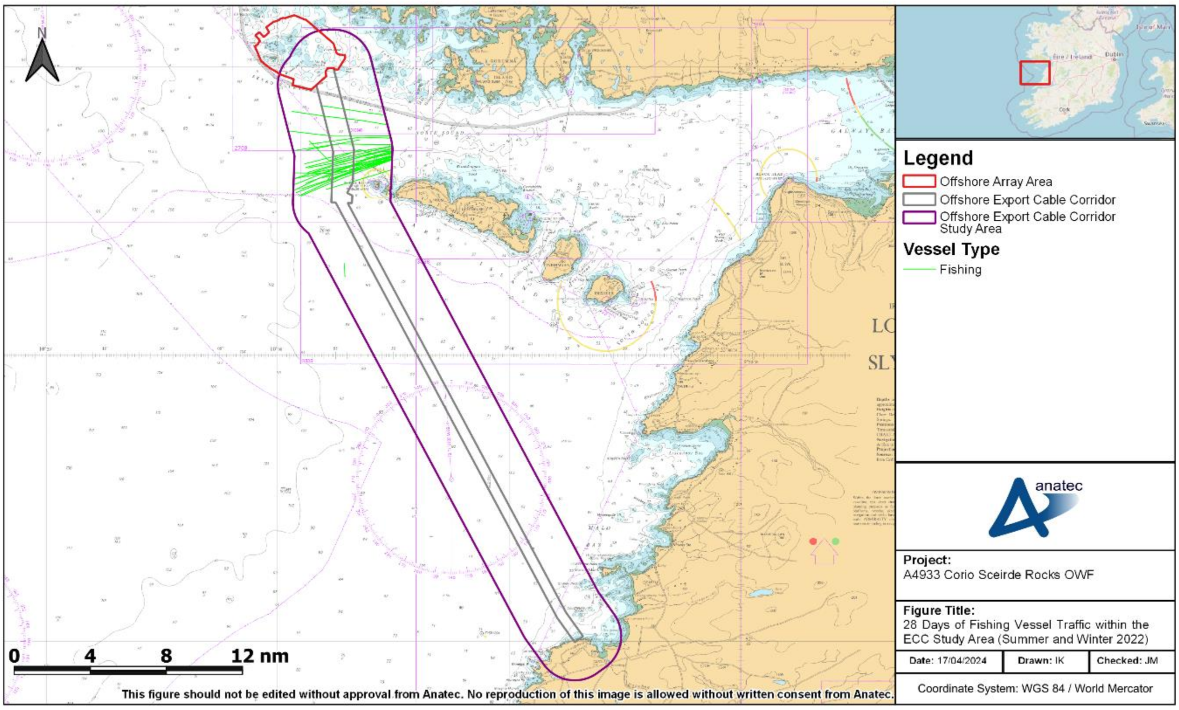


Figure 10.22 28 Days of Fishing Vessel Traffic within the OECC Study Area (Summer and Winter 2022)

185. During the summer survey period, a total of one fishing vessel was recorded within the OECC and OECC study area. During the winter survey period, an average of two fishing vessels per day were recorded within the OECC and OECC study area.

186. Fishing vessel activity was primarily associated with vessels transiting to areas further offshore, as recorded within Section 10.1.2.1. During consultation, Rossaveel Harbour noted that active fishing by vessels not broadcasting on AIS may be located close to the Landfall.

10.2.2.2 Cargo Vessels

187. The tracks of cargo vessels within the OECC study area throughout the summer and winter survey periods combined are presented in Figure 10.23.

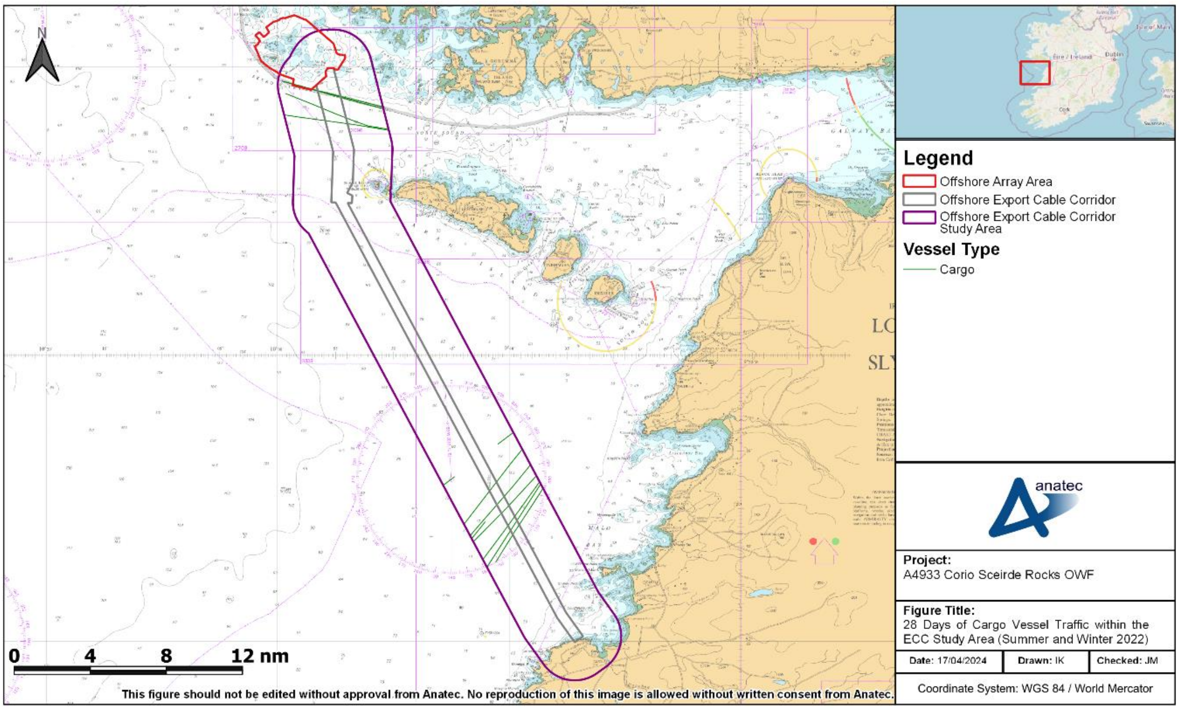


Figure 10.23 28 Days of Cargo Vessel Traffic within the OECC Study Area (Summer and Winter 2022)

188. During the summer survey period, an average of one cargo vessel every two days was recorded within the OECC and OECC study area. During the winter survey period, again an average of one cargo vessel every two days was recorded within the OECC and OECC study area.

189. Cargo vessels were recorded transiting to/from Galway through both the North Sound and South Sound, in all cases crossing the OECC. No regularly routeing Roll-on/Roll-off cargo (RoRo) vessels were recorded in either of the survey periods.

10.2.2.3 Tankers

190. The tracks of tankers within the study area throughout the summer and winter survey periods combined are presented in Figure 10.24.

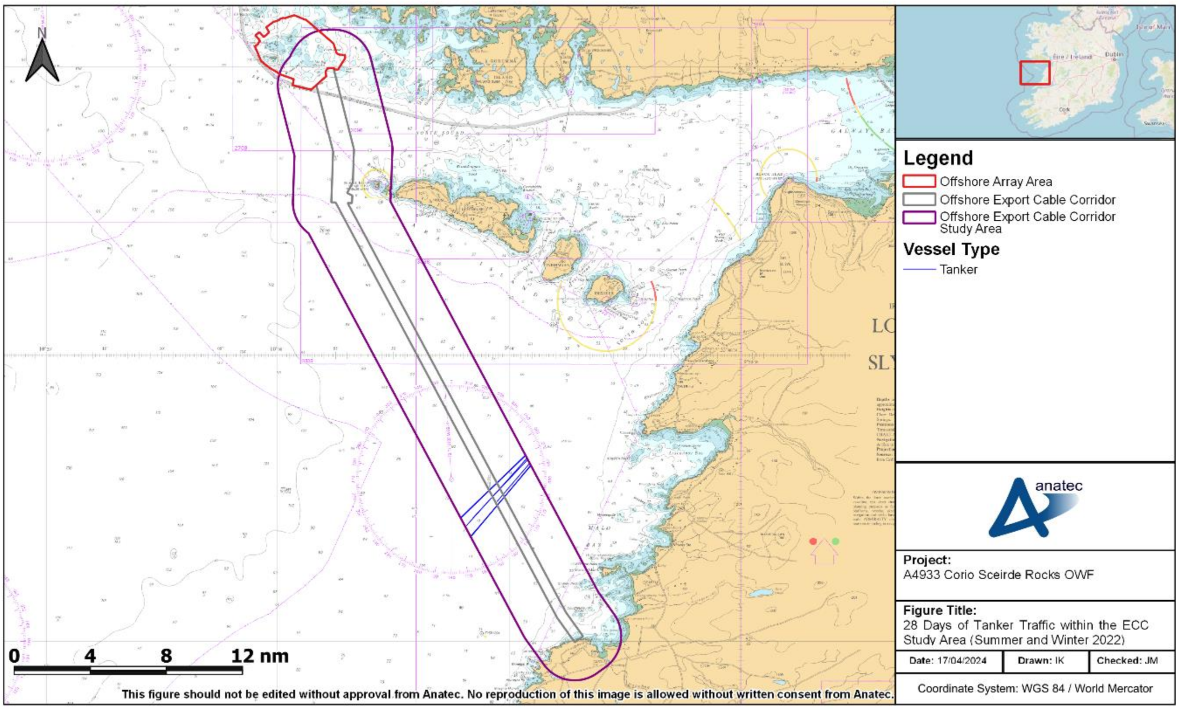


Figure 10.24 28 Days of Tanker Traffic within the OECC Study Area (Summer and Winter 2022)

191. During the summer survey period, an average of one tanker every three days was recorded within the OECC and OECC study area. During the winter survey period, an average of one per week was recorded within the OECC and OECC study area.

192. Tankers were noted routeing between Galway and mainland European ports transiting through the South Sound, on a similar route to that observed for cargo vessels.

10.2.2.4 Passenger Vessels

193. The tracks of passenger vessels within the OECC study area throughout the summer survey period are presented in Figure 10.25.

194. It is noted that there were no recorded passenger vessels within the winter survey period.

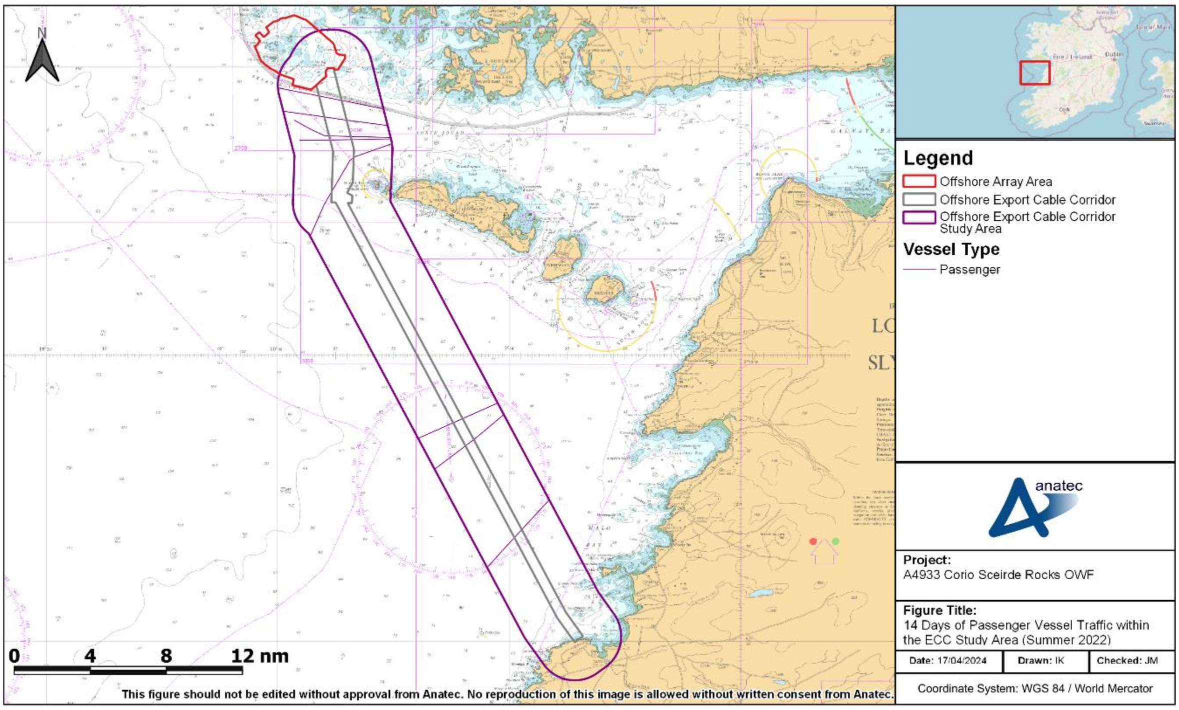


Figure 10.25 14 Days of Passenger Vessel Traffic within the OECC Study Area (Summer 2022)

195. During the summer survey period, an average of one passenger vessel every three days was recorded within the OECC and OECC study area.

196. Passenger vessels were recorded transiting to/from Galway both via the North Sound and South Sound. All passenger vessels recorded were cruise liners, with no regular Roll-on/Roll-off passenger (RoPax) vessel routeing noted.

10.2.2.5 Recreational Vessels

197. The tracks of recreational vessels within the OECC study area throughout the summer survey period are presented in Figure 10.26.

198. It is noted that there were no recorded recreational vessels within the winter survey period.

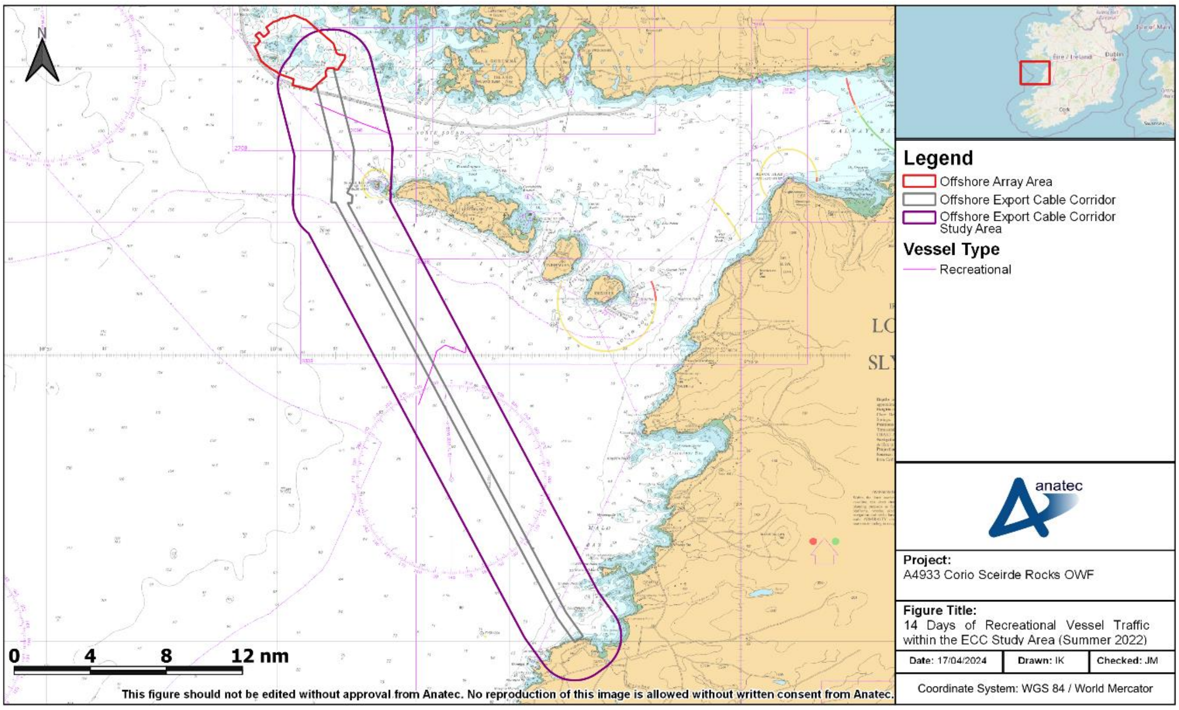


Figure 10.26 14 Days of Recreational Vessel Traffic within the OECC Study Area (Summer 2022)

199. During the summer survey period, a total of two recreational vessel transits were recorded within the OECC and OECC study area.

10.2.3 Vessel Sizes

10.2.3.1 Vessel Length

200. Vessel length information was available for all vessels recorded within the OECC study area throughout the combined summer and winter survey periods. A plot of all vessel tracks (excluding temporary traffic) recorded within the OECC study area throughout the survey periods, colour-coded by length, is presented in Figure 10.27. Following this, the distribution of these length classes is presented in Figure 10.28.

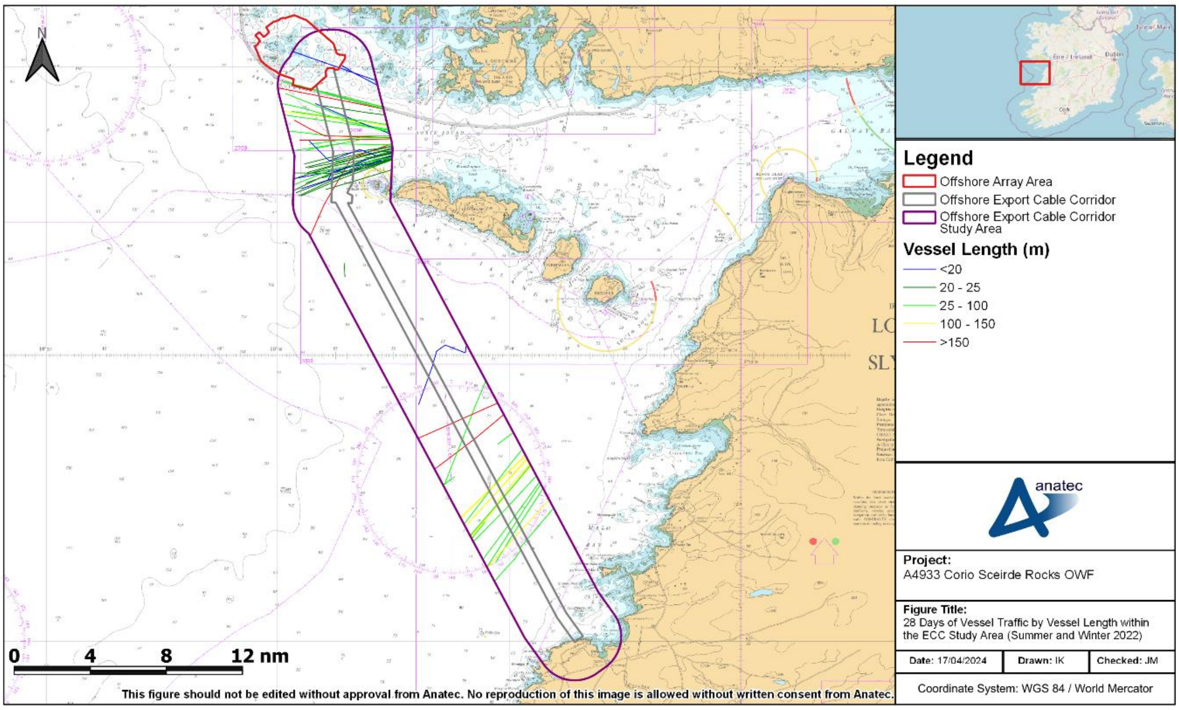


Figure 10.27 28 Days of Vessel Traffic by Vessel Length within the OECC Study Area (Summer and Winter 2022)

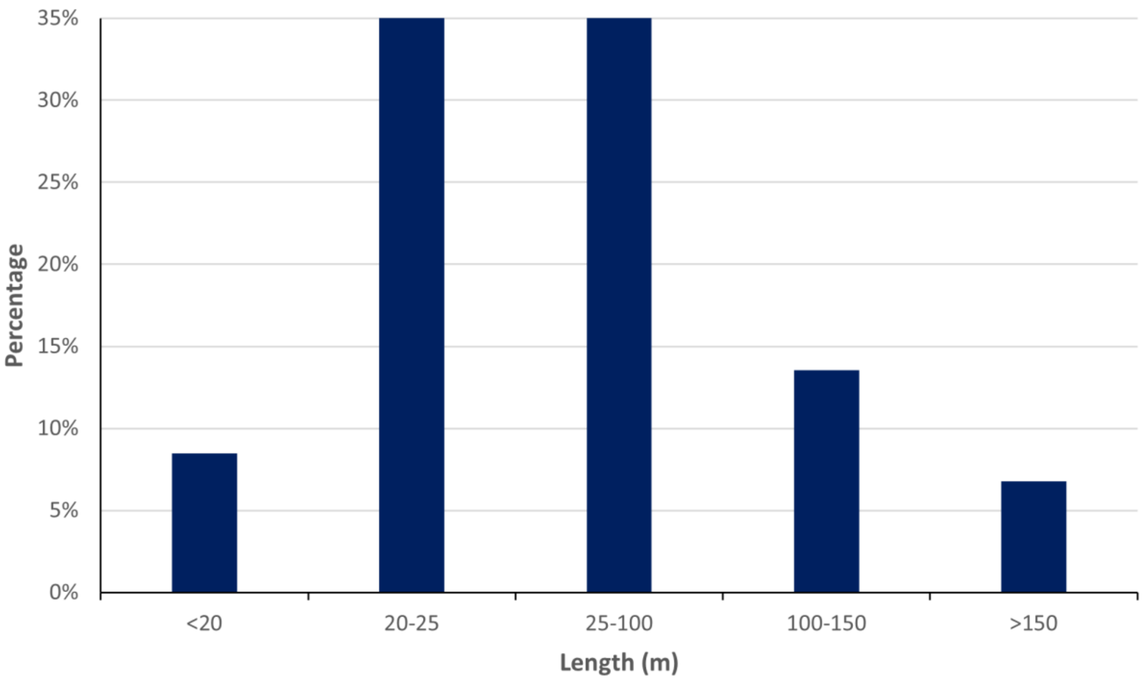


Figure 10.28 Distribution of Vessel Lengths within the OECC Study Area

201. The average length of vessels within the OECC study area was 61 m. Over the survey periods, vessel length ranged between 11 m for a survey vessel transiting in the area, and 238 m for a cruise liner.

202. Vessels of greater lengths were primarily cargo and passenger vessels with the smaller lengths being fishing and recreational vessels.

10.2.3.2 Vessel Draught

203. Vessel draught information was available for 68% of all vessels recorded within the OECC study area throughout the combined summer and winter survey periods. A plot of all vessel tracks (excluding temporary traffic) recorded within the OECC study area throughout the survey periods, colour-coded by draught, is presented in Figure 10.29. Following this, the distribution of these draught classes is presented in Figure 10.30.

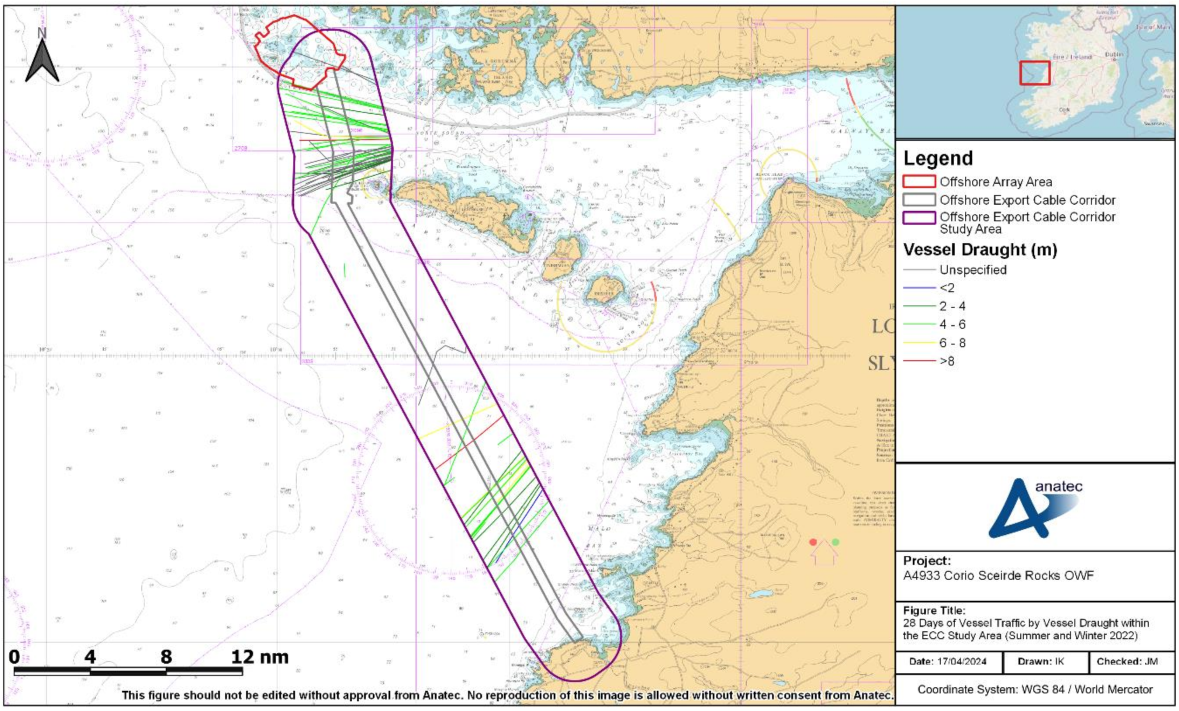


Figure 10.29 28 Days of Vessel Traffic by Vessel Draught within the OECC Study Area (Summer and Winter 2022)

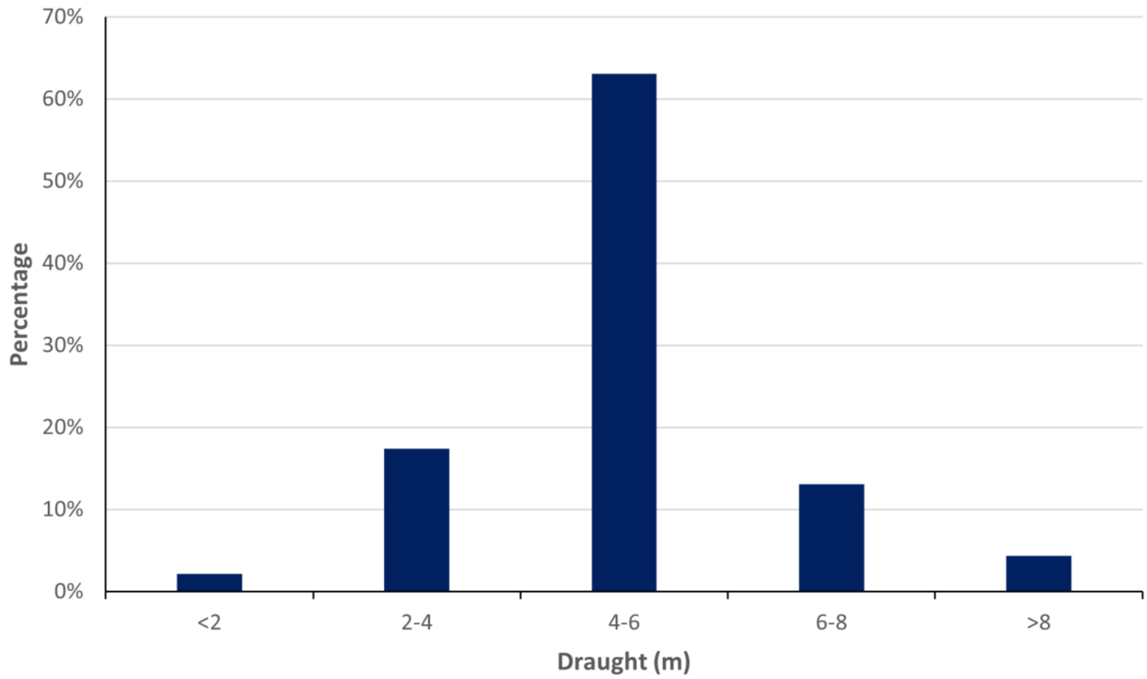


Figure 10.30 Distribution of Vessel Draughts within the OECC Study Area

204. Excluding the proportion of vessels for which draught was not available, the average draught of vessels within the study area was 5.0 m. Over the survey periods, vessel draught ranged between 2.6 m for a general cargo vessel, and 8.4 m for a cruise liner.

10.2.4 Anchoring Activity

205. As with the vessels recorded within the study area (see Section 10.1.4), vessel tracks within the OECC study area were investigated for potential anchoring activity. Again, no vessels were deemed to be at anchor within the OECC study area in either survey period.

11 Base Case Vessel Routeing

11.1 Definition of a Main Commercial Route

206. Main commercial routes have been identified using the AIS data based on commercial vessels transiting at similar headings and locations forming 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. Additionally, the outputs of consultation undertaken with local stakeholders assisted in the identification of the main commercial routes.

207. Typically, commercial fishing vessels are not incorporated into the main routes since they tend not to share the same uniformity in headings that commercial vessels do. However, in the case of the vessel traffic survey data, a fishing vessel route has been incorporated due to a degree of uniformity and the absence of many other routes.

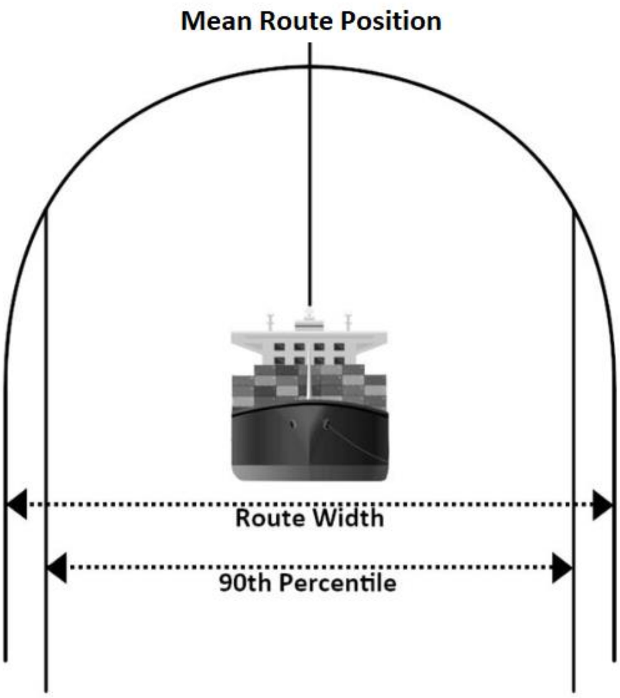


Figure 11.1 Illustration of Main Route Calculation (MCA, 2021)

11.2 Pre Wind Farm Main Commercial Routes

208. A total of three main commercial routes were identified within the study area from the 28 days of AIS, Radar, and manual observations within the vessel traffic surveys.

209. These routes and corresponding 90th percentiles are shown relative to the OAA in Figure 11.2. Following this, relevant details of each route are given in Table 11.1. This

includes terminus ports; however, it should be considered that these are based upon the most common destinations transmitted via AIS by vessels on those routes and therefore it should not be assumed that a transit through the study area on a given route will be to one of the destinations listed.

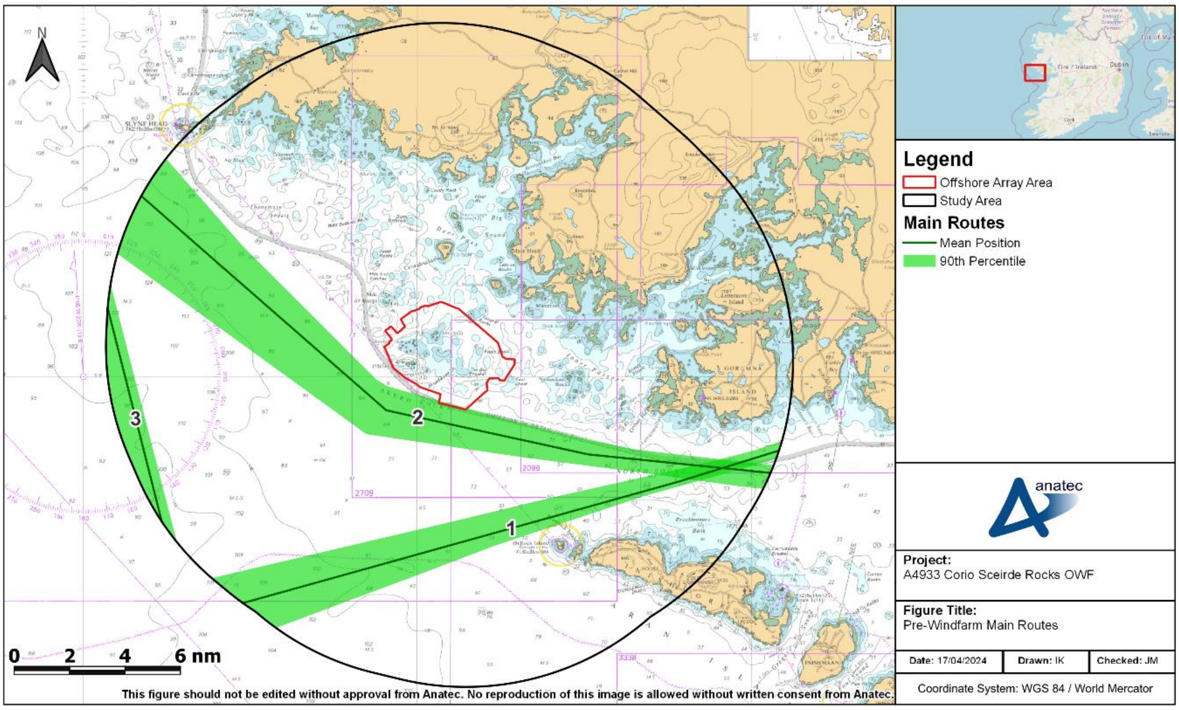


Figure 11.2 Pre Wind Farm Main Routes

Table 11.1 Main Route Descriptions

Route Number	Vessels Per Week	Description
1	9	**Rossaveel (Ireland) – Fishing grounds**. Used entirely by fishing vessels navigating between Rossaveel and the Porcupine Bank.
2	1-2	**Galway (Ireland) – Rothesay (UK)**. Used by cargo vessels (67%) and passenger vessels (33%).
3	1-2	**Limerick (Ireland) – Scandinavian ports**. Used entirely by cargo vessels.

12 Navigation, Communication, and Position Fixing Equipment

210. This section discusses the potential impacts upon communication and position fixing equipment of vessels that may arise due to the infrastructure associated with the Offshore Site.

211. 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.

12.1 Very High Frequency Communications (Including Digital Selective Calling)

212. 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.

213. The WTGs had no noticeable effect on voice communications within the wind farm 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.

214. During this trial, a number of telephone calls were made from ashore, within the wind farm, and on its seawards side. No effects were recorded using any system provider (MCA and QinetiQ, 2004).

215. 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 offshore of the wind farm and communications were reported to be very clear, with no apparent degradation of performance. Communications with the service vessel located within the wind farm were also fully satisfactory throughout the trial (MCA, 2005).

216. 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.dk, 2014).

217. 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 Offshore Site is anticipated to have no significant impact upon VHF communications.

12.2 Very High Frequency Direction Finding

218. 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 the WTGs (within approximately 50 m) this is deemed to be a relatively small-scale impact due to the limited use of VHF DF equipment and will not impact on operational or SAR activities (MCA, QinetiQ, 2004).

219. 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 target vessel within the wind farm, at a range of approximately 1 NM, the homer system operated as expected with no apparent degradation.

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

12.3 Automatic Identification System

221. No significant issues with interference to AIS transmission from operational offshore wind farms has been observed or reported to date. Such interference was also not evident in the trials carried out at the North Hoyle Offshore Wind Farm (MCA, QinetiQ, 2004)

222. In theory, there could be interference when there is a structure located between the transmitting and receiving antennas (i.e., blocking the line of site) 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 Offshore Site.

12.4 Navigational Telex System

223. 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.

224. 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 navigational 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 settings.

225. The 490 kHz national NAVTEX service may be transmitted in the local language. In UK and Irish waters 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.

226. 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 Offshore Site.

12.5 Global Positioning System

227. 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"*.

228. 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)

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

12.6 Electromagnetic Interference

230. 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 within a sextant to calculate latitude, and with a mariner chronometer to calculate longitude.

231. Like any magnetic device, compasses are affected by nearby ferrous materials as well as by strong electromagnetic forces, such as magnetic fields emitted by 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 should not be allowed to be affected to the extent that safe navigation is prohibited. The important factors with respect to cables that affect the resultant deviations are:

- Water depth;
- Burial depth;
- Type of current running through the cables;
- Spacing or separation of the two cables in a pair (balanced monopole or bipolar design); and/or
- Cable route alignment relative to the Earth's magnetic field.

232. The array cables and offshore export cable will carry Alternating Current (AC), with studies indicating that AC does not emit an Electromagnetic Field (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 Offshore Site is not expected to impact Shipping and Navigation users.

12.7 Marine Radar

233. This section summarises 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 minimum spacing then was achievable at the time of the studies undertaken, which is beneficial in terms of Radar interference effects (and surface navigation in general) as detailed below.

12.7.1 Trials

234. During the early years in offshore renewables in 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.

235. In 2004 trials undertaken at the North Hoyle Offshore Wind Farm (MCA, 2004) identified areas of concerns 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 the time). This results in Radar responses strong enough to produce interfering side lobes and reflected echoes (often referred to as false targets or ghosts).

236. 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 1.5 NM) 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 12.1.

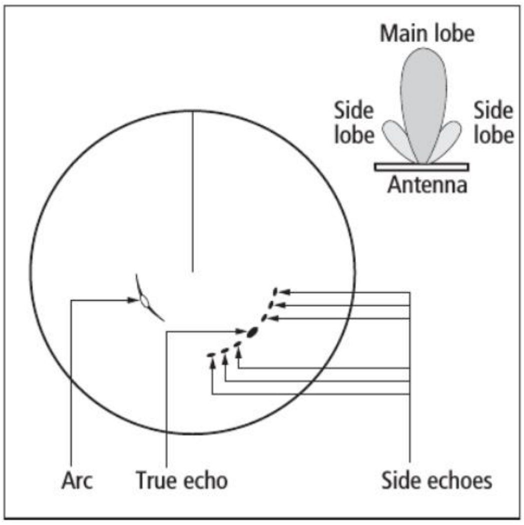


Figure 12.1 Illustration of Side Lobes on a Radar Screen

237. 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 or range, as illustrated in Figure 12.2.

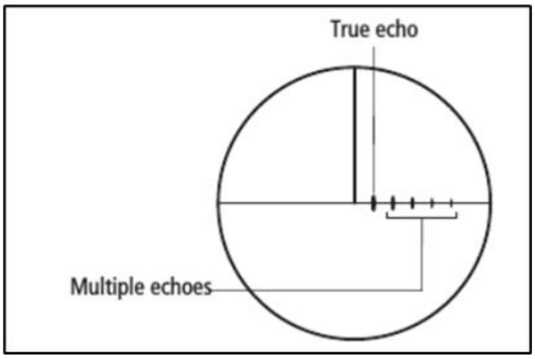


Figure 12.2 Illustration of Multiple Reflected Echoes on Radar Screen

238. Based upon 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.

239. 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 crafts, particularly yachts or Glass Reinforced Plastic (GRP) constructed craft; therefore, due care should be taken in making such adjustment.

240. Theoretical modelling of the effect of the development of the proposed Atlantic Array Offshore Wind Farm, which was to be located off the south coast of Wales in the UK, 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[4]. 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 against the WTGs and safe navigation;
- Even in the worst case with Radar operator settings artificially set to poor, there is a significant clear space around each of the WTGs 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 mode, 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 (i.e., those without AIS which are usually fishing and recreational crafts). 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. Although greater vigilance is required, during the Kentish Flats trials it was shown that false targets were quickly identified as such by mariners and then by the equipment itself.

241. In summary, experience in UK waters has shown that mariners have become increasingly aware of 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*" but also distancing (greater than 0.5 NM) where possible from the structures and where exposure time is limited.

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

242. The MCA has also produced guidance to mariners operating in proximity to OREIs in the UK, also relevant for OREIs in Irish waters, which highlights Radar issues amongst others to be taken into account when planning and undertaking voyages in proximity to OREIs. The interference buffers presented in Table 12.1 are primarily based on MGN 654 (MCA, 2021), but also consider MGN 371 (MCA, 2008a), MGN 543 (MCA, 2018), and MGN 372 (MCA, 2008b).

Table 12.1 Distances at which Impacts on Marine Radar Occur

Distance at which Effects Occurs (NM)	Identified Effects (as per MGNs)
0.5	▪ Intolerable impacts can be experienced at under 0.5 NM. ▪ X-Band Radar interference is intolerable under 0.25 NM. ▪ Vessels may generate multiple echoes on shore-based Radars under 0.45 NM.
1.5	▪ Under MGN 654, impacts on Radar are considered to be tolerable with mitigation between 0.5 NM and 3.5 NM. ▪ S-band Radar interference starts at 1.5 NM. ▪ Echoes develop at approximately 1.5 NM, 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 produced strong Radar echoes giving early warning of their presence. ▪ Target size of the WTG echo increase close to the WTG with a consequent degradation on both X and S-band Radars.

12.7.2 Experience from Operational Developments

243. The evidence from mariners operating in proximity to existing offshore wind farms is that they quickly learn to adapt to any effects. Figure 12.3 presents the example of the Galloper and Greater Gabbard Offshore Wind Farms, which are located in proximity to IMO routeing measures. Despite this proximity to a heavily trafficked Traffic Separation Scheme (TSS), there have been no reported incidents or issues raised by mariners who operate within the vicinity. The interference buffers presented in Figure 12.3 are as per Table 12.1.

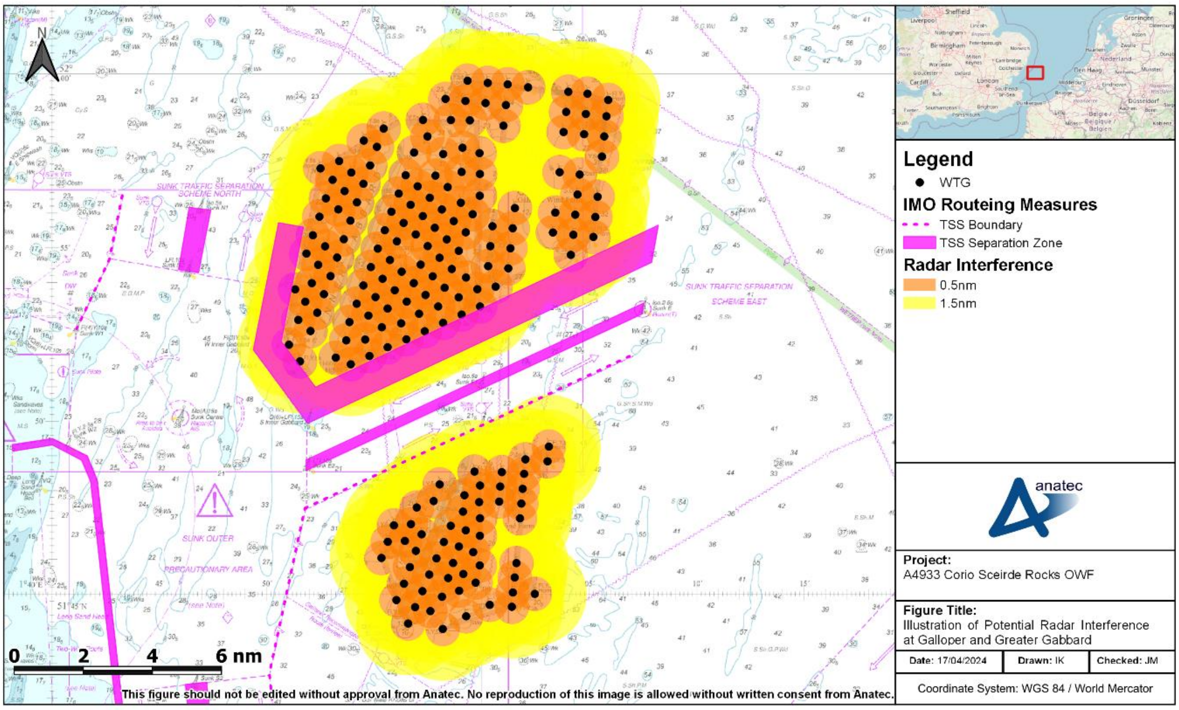


Figure 12.3 Illustration of Potential Radar Interference at Galloper and Greater Gabbard

244. As indicated by Figure 12.3, vessels utilising the 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.

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

12.7.3 Increased Target Returns

246. 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.

247. 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 OAA will not create any effects in addition to those already identified from existing operational wind farms (i.e., interfering side lobes, multiple, and reflected echoes).

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

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

249. It is noted that there are multiple operational wind farms in the UK including Galloper (see Section 12.7.2) 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.

12.7.5 Application to the Offshore Site

250. Upon development of the Offshore Site, some commercial vessels may pass within 1.5 NM of the wind farm infrastructure (in particular at the southern boundary), and therefore may be subject to a minor level of Radar interference. Trials, modelling, and experience from existing developments note that this impact can be mitigated by the adjustment of Radar controls.

251. Figure 12.4 presents an illustration of potential Radar interference due to the Offshore Site. The Radar effects have been applied to the layout introduced in Section 6.2.1. It has been conservatively assumed for the purpose of Figure 12.4 that the OSP will produce the same magnitude of Radar interference as the WTGs, however there is no indication that this would likely be the case.

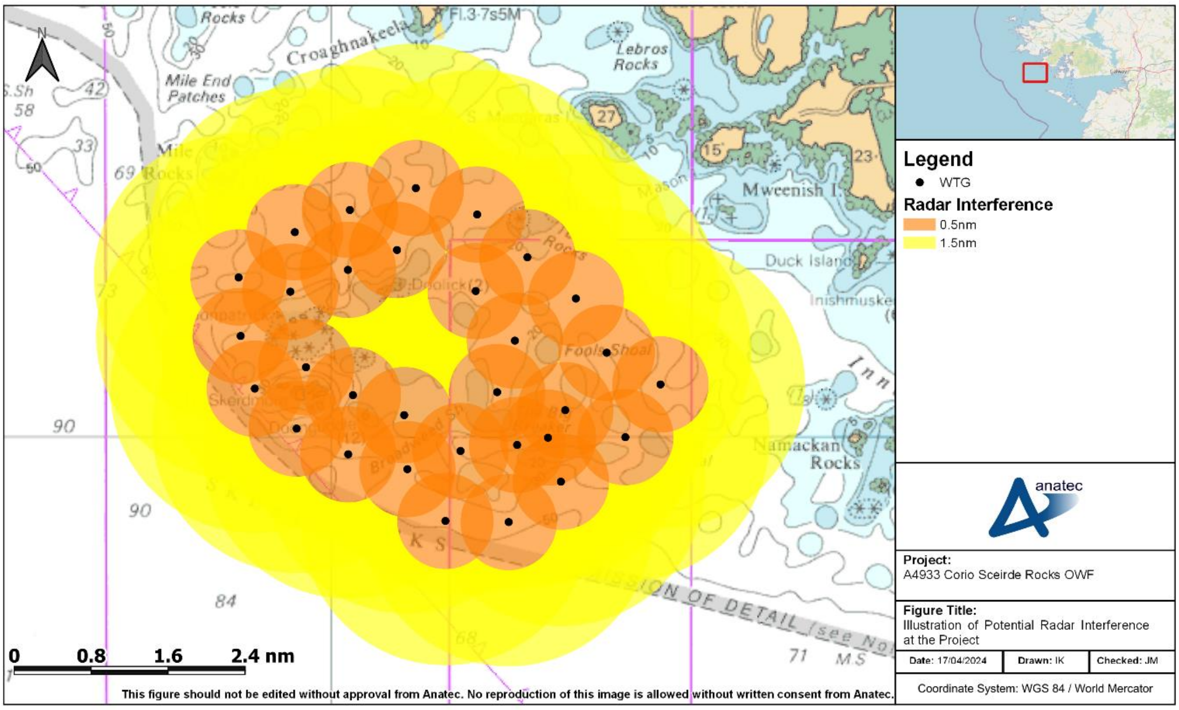


Figure 12.4 Illustration of Potential Radar Interference at the Offshore Site

252. Vessels passing within the array will be subject to a greater level of interference with impacts becoming more substantial in close proximity to the WTGs. This will require additional mitigation by any vessels including consideration of the navigational conditions (i.e., visibility) when passage planning and compliance with the Convention on International Regulations for Preventing Collisions at Sea (COLREGs) will be essential. Again, looking at existing experience within UK offshore wind farms, vessels do navigate safely within arrays including those with spacing significantly less than at the Offshore Site. In addition, due to the nature of the bathymetry in the area, it is unlikely that any commercial vessels would pass in proximity (see Section 16.4.3).

253. 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.

12.8 Sound Navigation Ranging Systems

254. No evidence has been found to date with regard to existing offshore wind farms to suggest that they cause any kind of SONAR interference which is detrimental to the fishing industry, or to military systems. No impact is therefore anticipated in relation to the Offshore Site.

12.9 Noise

255. 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.

12.10 Assessment Summary

256. Table 12.2 summarises the anticipated impacts from the Offshore Site on communication and position fixing equipment based on the assessment undertaken within Section 12.1 to Section 12.9.

Table 12.2 Assessment Summary

Topic	Frequency	Consequence	Significance of Risk
VHF	Negligible	Minor	Broadly Acceptable (ALARP)
VHF direction finding	Extremely Unlikely	Minor	Broadly Acceptable (ALARP)
AIS	Negligible	Minor	Broadly Acceptable (ALARP)
NAVTEX	Negligible	Minor	Broadly Acceptable (ALARP)
GPS	Negligible	Minor	Broadly Acceptable (ALARP)
EMF	Extremely Unlikely	Negligible	Broadly Acceptable (ALARP)

Topic	Frequency	Consequence	Significance of Risk
Marine Radar	Remote	Minor	Broadly Acceptable (ALARP)
SONAR	Negligible	Minor	Broadly Acceptable (ALARP)
Noise	Negligible	Minor	Broadly Acceptable (ALARP)

13 Cumulative and Transboundary Overview

13.1 Offshore Renewables

257. The Project is the only Relevant Project / Phase 1 offshore renewable development in the region with a Maritime Area Consent (MAC), the only offshore wind development in the region which was successful in Offshore Renewable Electricity Support Scheme (ORESS) 1 and the only offshore wind development in the region which is permitted to make a planning application.

258. A number of planned offshore renewable developments (at various levels of inception) were proposed to be developed off the western coast of Ireland before the State's policy changed to a plan-led regime. Current policy is such that none of these projects are permitted to seek a MAC or make a planning application. Whether any of them may progress in the future is entirely dependent on future policy decisions.

259. The other previously planned offshore renewable developments which are within 50 NM of the Offshore Site (as per the methodology outlined in Section 3.4) include:

- Atlantic Offshore Renewable Energy 1;
- Atlantic Offshore Renewable Energy 2;
- Clarus Offshore Wind Farm;
- Ilen Array Offshore Wind Farm;
- Inis Offshore Wind Kerry;
- Inis Offshore Wind Munster;
- Mainstream Tralee Wind Farm;
- Moneypoint Offshore Wind Farm;
- Rian Offshore Array;
- Saoirse Wave Energy; and
- Western Star Floating Wind.

260. Given that the State's new plan led policy is now in place, none of these projects may now progress to seek a MAC or a planning application in respect of their projects as conceived, with the State to dictate at which location(s) any future projects in the region will be sited. Therefore, there is no certainty that any of these projects may be progressed in the areas proposed or at all. In addition, given that the previously proposed projects were overtaken by a change in policy they could not submit a planning application, and therefore, it is not possible (or appropriate) to assess these projects in cumulation with the Project. It is noted that any future project will be required to assess its effects in cumulation with the Project.

261. It is also noted that no cumulative concerns were raised during consultation for the NRA in relation to offshore renewable developments.

262. Therefore, none of these offshore renewable developments are relevant to the cumulative risk assessment.

13.2 Subsea Cables

263. During the Hazard Workshop, the following planned subsea cable developments were identified in the region:

- Far North Fiber; and
- PISCES.

264. Both of these developments are planned to make landfall within Galway Bay, and therefore are expected to cross the OECC.

265. Each will be subject to a cable burial risk assessment similar to that required for the Project. Therefore, the likelihood of any crossings giving rise to additional Shipping and Navigation risk due to their physical presence is considered negligible, noting that no concerns were raised during consultation with local ports familiar with traffic movements in the area (see Section 4). Should activities associated with installation or maintenance coincide with that for the Project then it is expected that suitable coordination between the projects will be established to minimise disruption, noting that the footprint of such works for subsea cables will be small.

266. Therefore, neither of these subsea cable developments are relevant to the cumulative risk assessment.

13.3 Cumulative Summary

267. All planned offshore renewable (see Section 13.1) or subsea cable developments (see Section 13.2) with the potential to have a cumulative environmental impact with the Project have been considered. Following an assessment of likely cumulative risk, there have been no likely risks identified that would require further assessment in this NRA.

14 Future Case Vessel Traffic

268. This section considers future case vessel traffic within and in proximity to the Offshore Site, including in relation to future port expansion and the anticipated shift in the mean route positions of the main commercial routes post wind farm.

14.1 Increases in Commercial Vessel Activity

269. 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.

270. However, during the Hazard Workshop, the Port of Galway noted plans for the expansion of the Port of Galway (the 'New Port of Galway'). The planning application for this development was submitted in 2014 and has not yet been determined. If taken forward, the New Port of Galway would provide 660 m of quay berth to 12 m depth below CD, serviced by an 8 m deep channel. Berthing facilities would accommodate general cargo vessels, oil tankers, passenger vessels, and container vessels (Port of Galway, 2024a).

271. Currently the total berth length for the Port of Galway (excluding marinas and space for local vessels) is 1,016 m (Port of Galway, 2024b). Therefore, the increase in quay berth would add considerable potential for increased vessel volumes.

272. Accounting for all commercial vessel types throughout the study area including those resulting from the development of the New Port of Galway (noting that not all commercial vessel movements are associated with the Port of Galway), two independent scenarios of potential growth in commercial vessel movements of 10% and 20% have been estimated throughout the lifetime of the Project. Although increases associated with the New Port of Galway may be greater, it is noted that – at the time of writing – this port expansion has not yet been approved. Additionally, if taken forward, it is feasible that the expansion may not be realised in its entirety and not all vessel traffic associated with the expansion may navigate in proximity to the OAA. The use of 10% and 20% increases (applied across all commercial vessel types) is considered conservative on this basis.

14.2 Increases in Commercial Fishing Vessel and Recreational Vessel Activity

273. 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.

274. For fishing vessels, the proposed development of the New Port of Galway for which a planning application was made (approximately 10 years ago) does include additional berth space for fishing vessels (Port of Galway, 2024 a). For recreational vessels, the development of a new marina feature in the New Port of Galway

planning application, although as part of the latter stages of the potential development. Additional small craft activity associated with the New Port of Galway is not likely to be wholly relevant to the OAA, noting that the majority of fishing vessel traffic currently passing in proximity to the OAA is out of Rossaveel Harbour. Additionally, during consultation potential new leisure craft facilities at Kilronan on the Aran Islands were raised although there is limited information available on this development, and again some related activities may be limited to within Galway Bay rather than interacting with the OAA.

275. Rossaveel Harbour also is currently undergoing construction works to accommodate a harbour expansion. Whilst activity has been halted for the time being (The Fishing Daily, 2024), it is possible that this work will be completed in the future. These works are primarily related to supporting fishing vessels and include channel dredging and a new deep-water quay.

276. 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 Project and applied for the purposes of the assessment. Changes in fishing activity are considered further in relation to active fishing in **Chapter 13: Commercial Fisheries**.

277. As per Section 5.3.1, although a geophysical survey was partially ongoing during the summer 2022 vessel traffic survey, stakeholders confirmed that baseline data for fishing vessels was suitable. Nevertheless, the 10% and 20% potential growth in commercial fishing vessel movements outlined above is considered a conservative means of addressing any effects on volumes.

14.3 Increases in Traffic Associated with the Project

278. During the construction phase there will be traffic associated with the Project transiting through the study area between the base port(s) and OAA. During the operations and maintenance phase there will also be traffic associated with the Project transiting through the study area, although likely less frequently than during the construction phase.

279. The base port(s) for the construction phase are not yet know, but it is assumed that Rossaveel Harbour will be the primary operation and maintenance base.

280. Although this traffic is not considered within the collision risk modelling (as mean route positions will not be defined), associated increases are incorporated qualitatively into the risk assessment.

14.4 Commercial Traffic Routeing

14.4.1 Methodology

281. It is not possible to consider all possible alternative routeing options for commercial traffic and therefore worst-case alternatives have been considered where possible. Assumptions for re-routeing include:

- All alternative routes maintain a minimum mean distance of 1 NM from offshore installations in line with industry experience; and
- All mean routes take into account the shallow banks and known routeing preferences.

282. MGN 654 provides guidance to offshore renewable energy developers on both the assessment process and design elements associated with the development of an offshore wind farm. Annex 2 of MGN 654 defines a methodology for assessing passing distances between offshore wind farm boundaries but states that it is *"not a prescriptive tool but needs intelligent application"*.

283. 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 1 NM of established offshore wind farms and these distances vary depending on 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 nature of the traffic at the time, but they are shown to frequently pass 1 NM off established developments. Evidence also demonstrates that commercial vessels do not transit through wind farm arrays, and this is particularly likely for the Offshore Site given the nature of the OAA in terms of existing bathymetry.

284. The NRA also aims to estimate maximum possible risk based on navigational safety parameters, and when considering this the most conservative realistic scenario for vessel routeing is considered when main routes pass 1 NM off developments. Evidence collected during numerous assessments at an industry level confirm that it 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.

14.4.2 Main Commercial Route Deviations

285. Figure 14.1 presents the post wind farm main routes. Of the three main routes identified, one is anticipated to require deviation as a result of the OAA (Route 2). The deviation is summarised in Table 14.1, which shows the length of the route pre and post wind farm, and the change in distance that this represents.

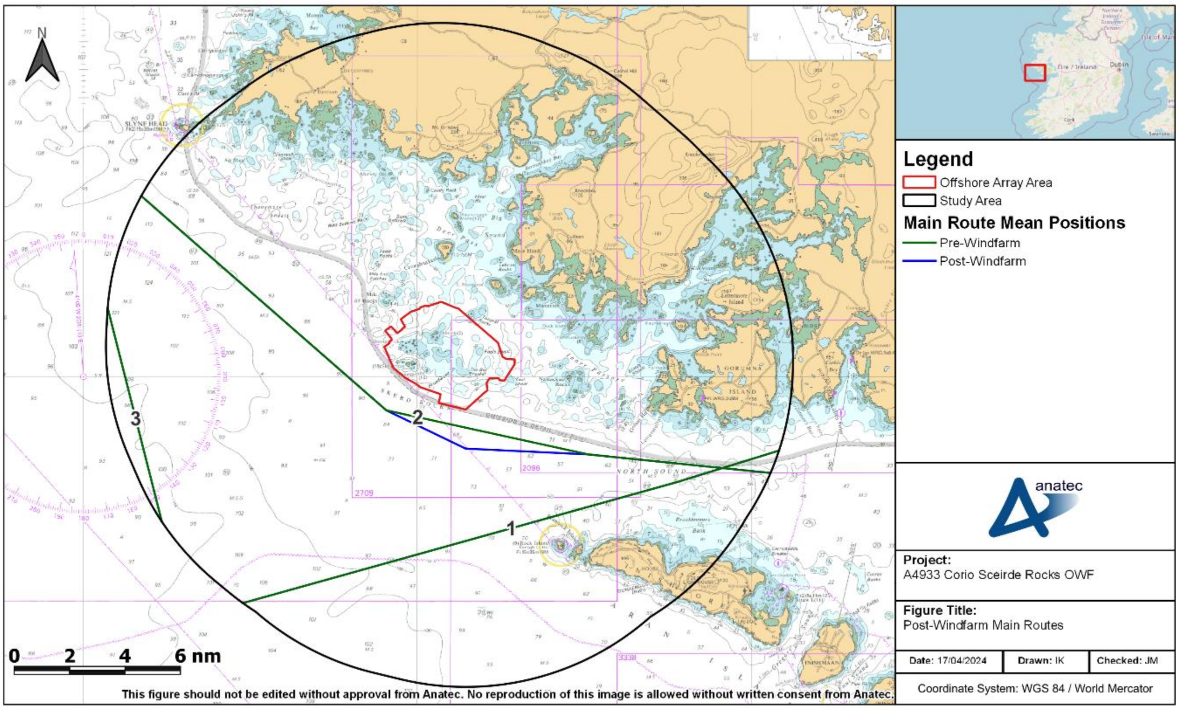


Figure 14.1 Post Wind Farm Main Routes

Table 14.1 Deviation Summary

Route	Distance (nm)		Change In Total Route Length	
	Pre Wind Farm	Post Wind Farm	Distance (nm)	%
2	357.4	357.5	0.1	0.04

286. The mean position of Route 2 is anticipated to shift to the south to pass further from the southern boundary of the OAA, corresponding to an increase in distance of 0.1 NM overall, or a 0.04% increase in the total route length.

287. It should be considered that while this deviation is minor, it will have an effect on collision risk given the small reduction in navigable sea room. This is assessed within Section 15.

15 Collision and Allision Risk Modelling

15.1 Overview

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

15.1.1 Scenarios Under Consideration

289. For each element of the quantitative assessment, both a pre and post wind farm scenario with base and future case traffic levels have been considered. As a result, six distinct scenarios have been modelled:

- Pre wind farm with base case traffic levels;
- Pre wind farm future case with a 10% increase on base case traffic levels;
- Pre wind farm future case with a 20% increase on base case traffic levels;
- Post wind farm with base case traffic levels;
- Post wind farm future case with a 10% increase on base case traffic levels; and
- Post wind farm future case with a 20% increase on base case traffic levels.

290. The results of the base case scenarios are detailed in full in the following subsections, with the equivalent results for each future case scenario provided in Section 15.4.

15.1.2 Hazards Under Consideration

291. 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.

292. The pre wind farm assessment has been informed by the vessel traffic survey data (see Section 10) and other baseline data sources (such as Anatec's ShipRoutes database). Conservative assumptions have been made with regard to route deviations and future shipping growth over the lifetime of the Project (see Section 14.4 for rerouting assumptions).

15.2 Pre Wind Farm Modelling

15.2.1 Vessel to Vessel Encounters

293. 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 vessel traffic surveys (see Section 5.2). The model defines an encounter as two vessels passing within 1 NM 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 identified for.

294. Figure 15.1 presents a heat map based upon the geographical distribution of vessel encounter tracks within a density grid. Following this, Figure 15.2 illustrates the daily number of encounters recorded within the study area throughout the survey periods.

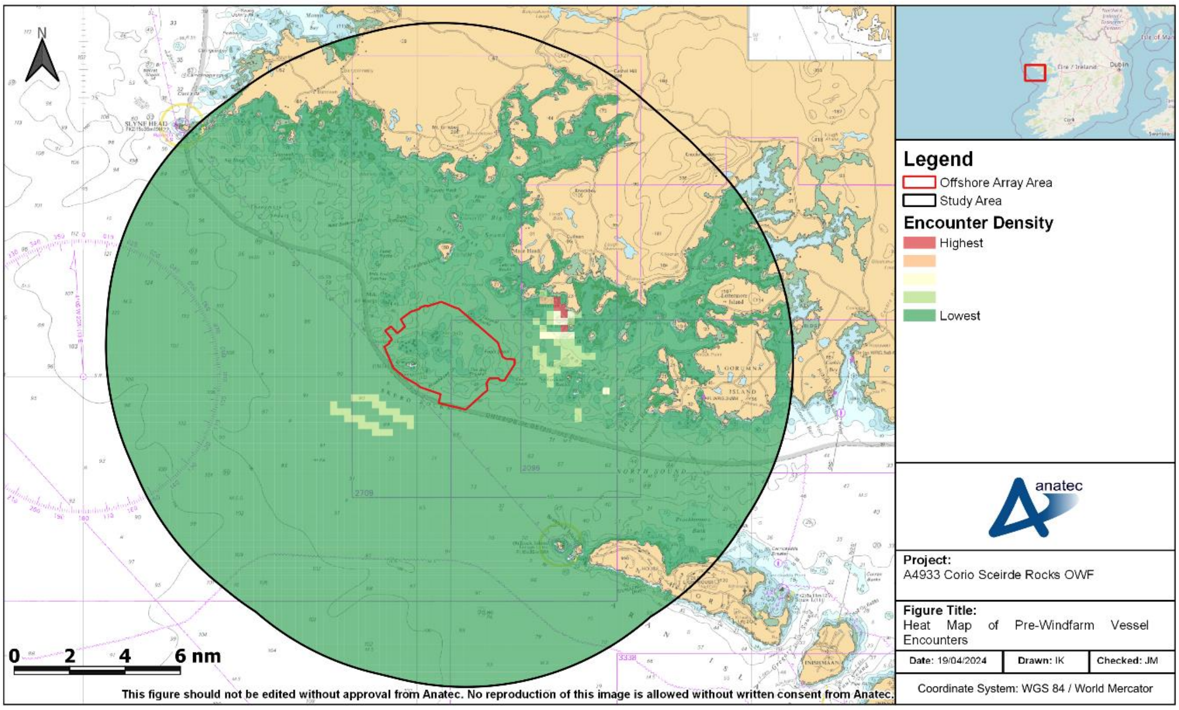


Figure 15.1 Heat Map of Pre Wind Farm Vessel Encounters

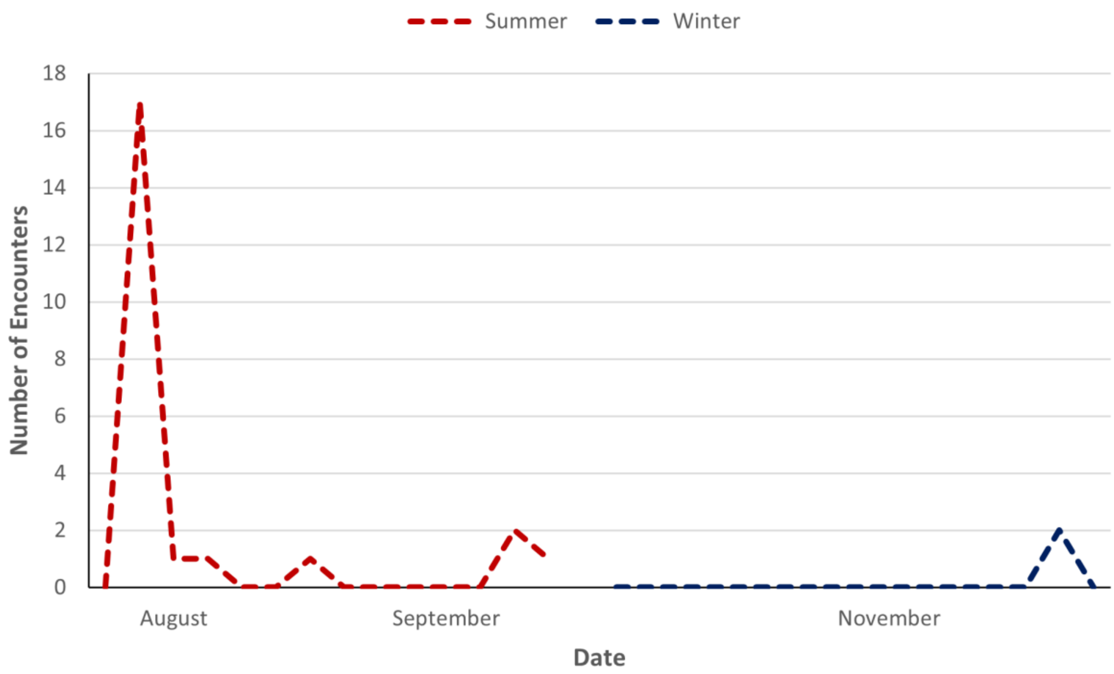


Figure 15.2 Vessel Encounters per Day

295. There was on average one encounter per day within the study area throughout the survey periods. The greatest number of encounters recorded in one day was 17, on 27th August 2022, due to a high number of recreational vessels. Aside from one instance of vessel encounters to the west of the OAA, all encounters occurred to the east of the OAA, with none within the OAA itself. The rate of encounters is low relative to other sea areas and reflected the relatively low volumes of vessel traffic in the region.

296. All known vessel types involved in encounters within the study area were recreational vessels (79%) or fishing vessels (21%). It is acknowledged that in line with the data limitations outlined in Section 5.3.1, the number of encounters involving fishing vessels within the OAA may ordinarily be greater.

15.2.2 Vessel to Vessel Collision Risk

297. 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 within the study area for commercial traffic. The route positions and widths are based on the vessel traffic survey data.

298. A heat map based upon the geographical distribution of collision risk within a density grid for the pre wind farm base case is presented in Figure 15.3.

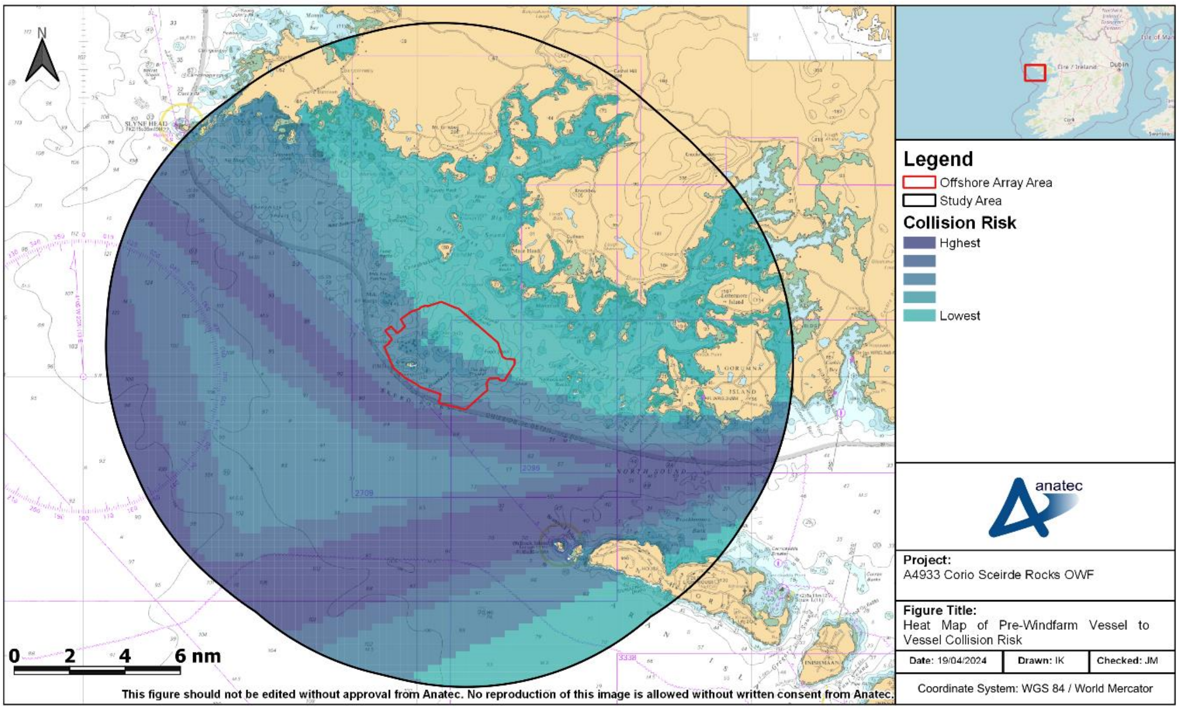


Figure 15.3 Heat Map of Pre Wind Farm Vessel to Vessel Collision Risk

299. Assuming base case vessel traffic levels, the annual collision frequency pre wind farm was estimated to be 2.16×10^{-5}, corresponding to a return period of approximately one in 46,334 years. This is generally far below the level modelled for UK offshore wind farm developments and is reflective of the low traffic volumes. 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. Other incident data, which includes minor incidents, are presented in Section 9.

15.3 Post Wind Farm Modelling

300. The methodology for determining the post wind farm routeing is outlined in Section 14.4.

15.3.1 Simulated Automatic Identification System

301. Anatec's AIS Simulator software was used to gain an insight into the potential re-routed commercial traffic following the installation of the wind farm structures within the OAA. 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 to simulate tracks.

302. A figure of 28 days of simulated AIS (matching the total duration of the vessel traffic surveys) within the study area, based on the deviated main commercial routes, is presented in Figure 15.4.

303. It is noted that the simulated AIS represents a conservative worst case based on commercial routes passing at a minimum mean distance of 1 NM from the OAA.

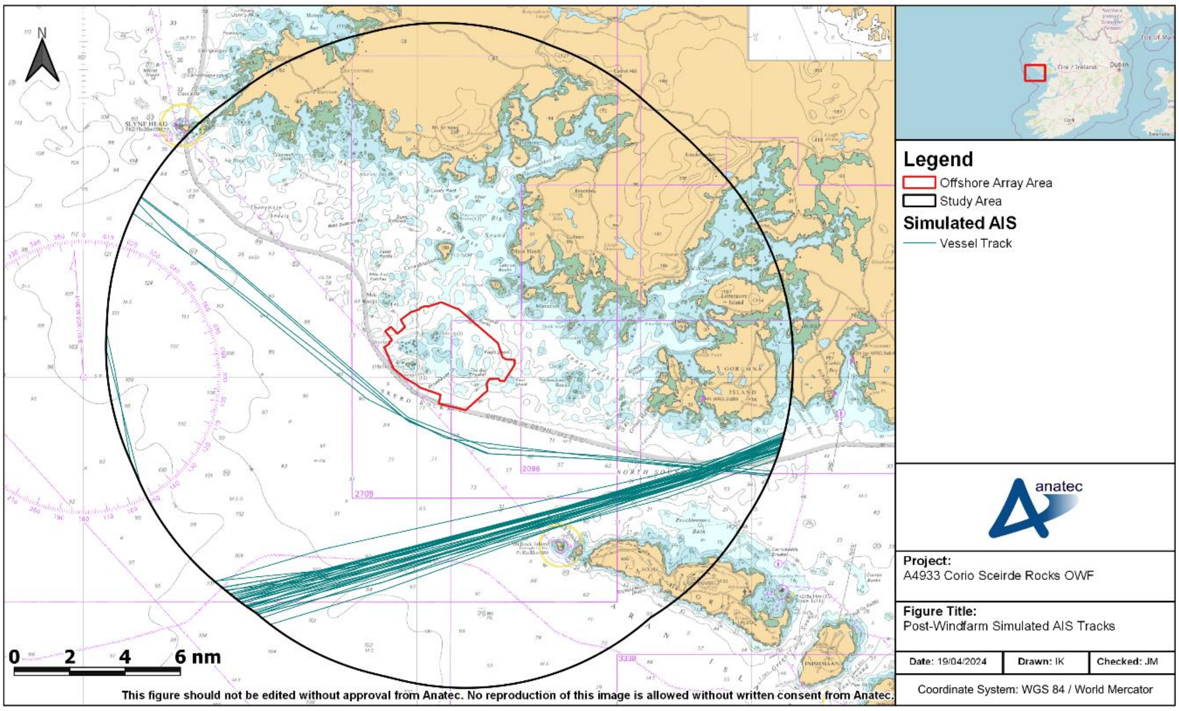


Figure 15.4 Post Wind Farm Simulated AIS Tracks

15.3.2 Vessel to Vessel Collision Risk

304. Using the post wind farm routeing as input, Anatec's COLLRISK model has been run to estimate the anticipated vessel to vessel collision risk within the study area.

305. A heat map based on the geographical distribution of collision risk within a density grid for post wind farm base case is presented in Figure 15.5.

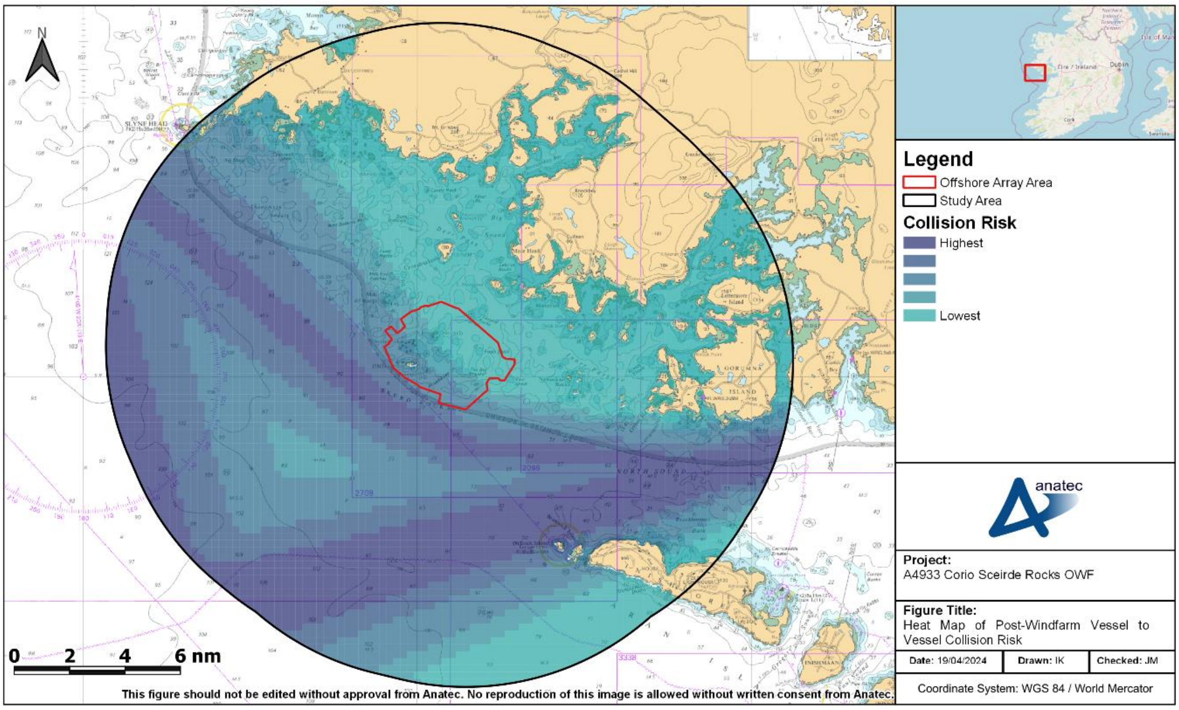


Figure 15.5 Heat Map of Post Wind Farm Vessel to Vessel Collision Risk

306. Assuming base case traffic levels, the annual collision frequency post wind farm was estimated to be 2.16×10^{-5}, corresponding to a return period of approximately one in 46,322 years. This represents a 0.03% increase in collision frequency compared to the pre wind farm base case result.

307. The change in vessel-to-vessel collision risk between the base case pre wind farm and post wind farm scenarios is presented in a heat map in Figure 15.6.

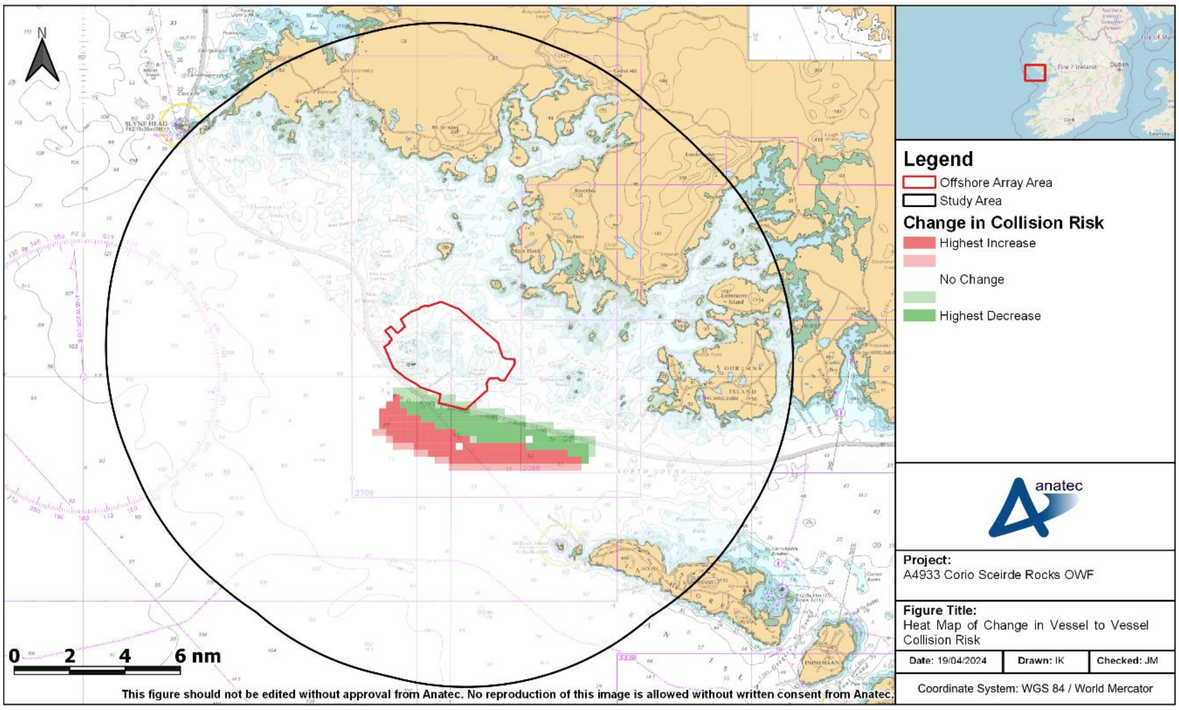


Figure 15.6 Heat Map of Change in Vessel-to-Vessel Collision Risk

308. The change in collision risk is wholly associated with the deviation to the main route pass south of the OAA, with the risk level increasing in the region 1 NM off the OAA. This may indicate that the presence of the Offshore Site will act as a deterrent for vessels which could otherwise allide with rocks in the area.

15.3.3 Powered Vessel to Structure Allision Risk

309. Based upon the vessel routeing identified in the study area, the anticipated re-routeing as a result of the presence of the Offshore Site, and assumptions that relevant embedded mitigation measures are in place (see Section 16), 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 Offshore Site is considered to be low.

310. 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 Offshore Site (noting this is observed at UK offshore wind farms including those with larger minimum spacing than for the Offshore Site). During the construction and decommissioning phases this will primarily consist of the buoyed construction area whilst during the operations and maintenance phase this will primarily consist of the lighting and marking of the wind farm structures.

311. Using the post wind farm routeing as input, together with the layout and local metocean 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 OAA whilst under power. In order to ensure a worst-case result, the model did not consider one structure shielding another.

312. A plot of the annual powered allision frequency per structure for the base case is presented in Figure 15.7, with the chart background removed to increase the visibility of those structures with lower allision frequencies.

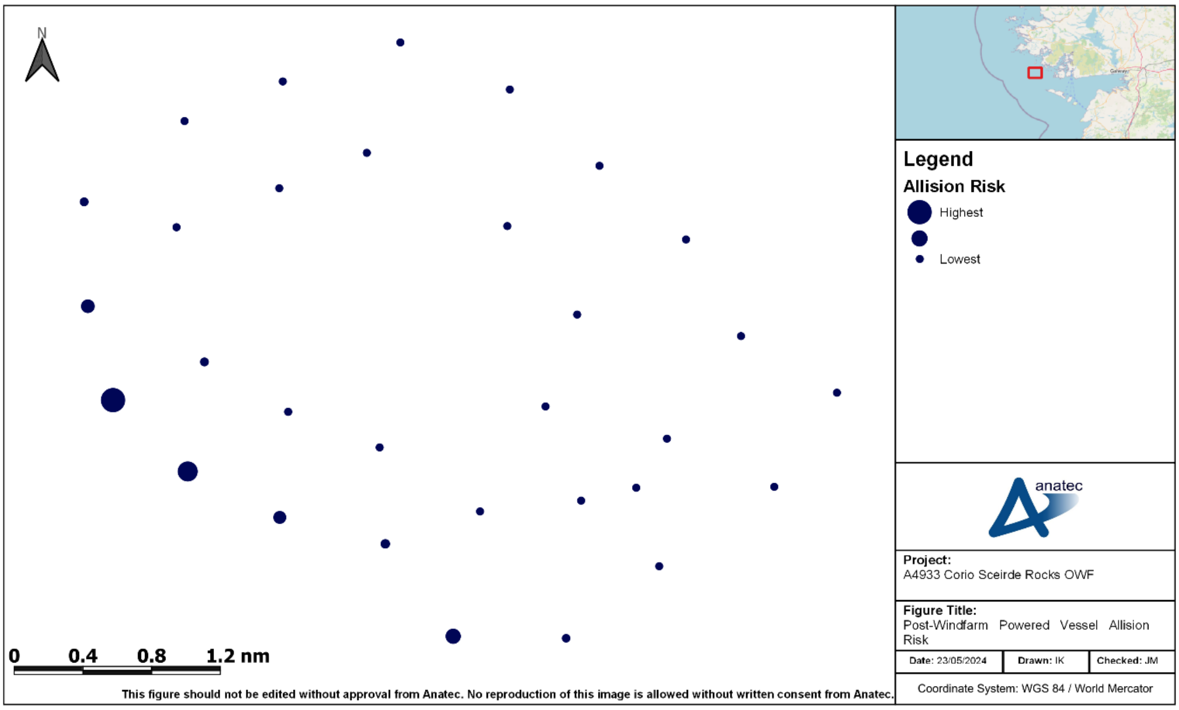


Figure 15.7 Post Wind Farm Powered Vessel Allision Risk

313. Assuming base case vessel traffic levels, the annual powered allision frequency was estimated to be 4.37×10^{-6}, corresponding to a return period of approximately one in 228,910 years. This is far below the level modelled for UK offshore wind farm developments and is reflective of the low traffic volumes and limited routeing in proximity to the OAA.

314. The greatest powered vessel to structure allision risk was associated with structures at the western extent of the OAA where commercial vessel traffic heading to/from Galway passes. The greatest individual allision risk was associated with a structure in this area (approximately 2.10×10^{-6} or one in 476,137 years).

15.3.4 Drifting Vessel to Structure Allision Risk

315. Using the post wind farm routeing as input, together with the indicative layout and local metocean 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 OAA. 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.

316. The exposure times for a drifting scenario are based upon the vessel hours spent in proximity to the OAA (up to 10 NM from the OAA). 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 accounted for in the modelling.

317. Using this information, the overall rate of mechanical failure in proximity to the OAA 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 metocean data provided in Section 8:

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

318. After modelling the three drifting scenarios, it was established that the wind dominated scenario produced the worst-case results. A plot of the annual drifting allision frequency per structure for the base case is presented in Figure 15.8, with the chart background removed to increase the visibility of those structures with a low allision frequency.

319. It is noted that 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 project vessel) rendering assistance.

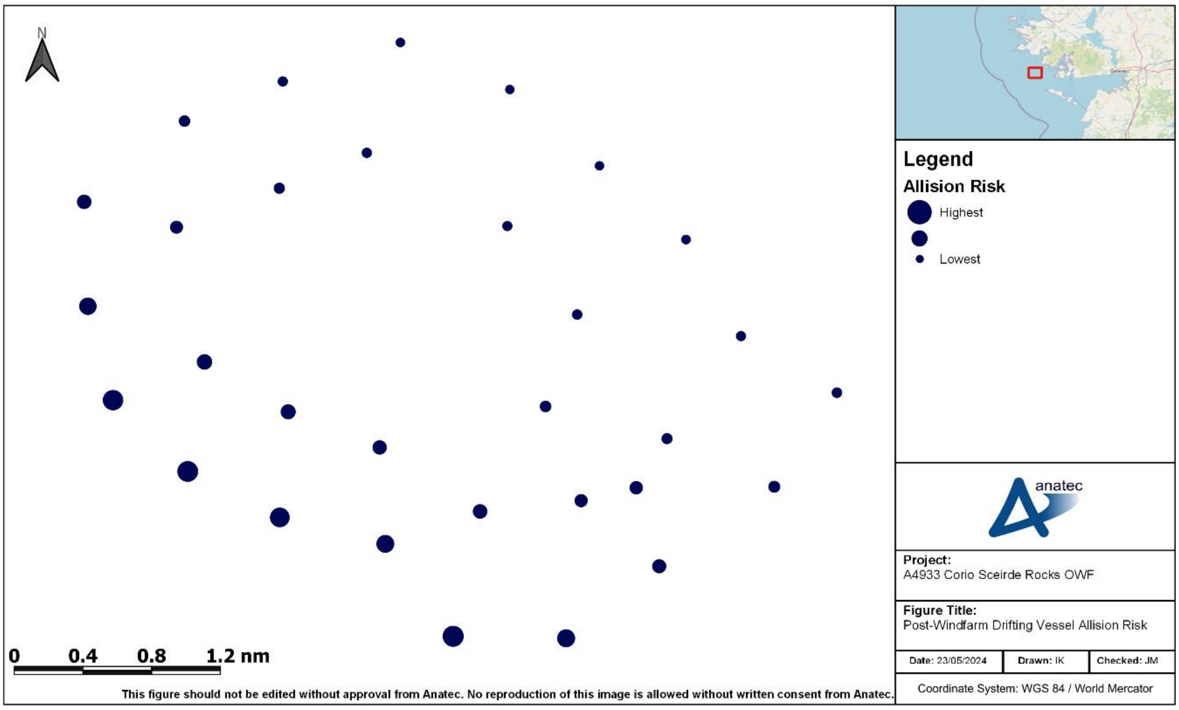


Figure 15.8 Post Wind Farm Drifting Vessel Allision Risk

320. Assuming base case vessel traffic levels, the annual drifting allision frequency was estimated to be 5.93×10^{-6}, corresponding to a return period of approximately one in 168,577 years. This is far below the level modelled for UK offshore wind farm developments and is again reflective of the low traffic volumes and limited routeing in proximity to the OAA.

321. The greatest drifting vessel to structure allision risk was associated with structures at the southwest of the OAA where fishing vessel traffic heading to/from Rossaveel passes. The greatest individual allision risk was associated with a structure on the southern perimeter of the OAA (approximately 6.71×10^{-7} or one in 1.49 million years).

322. It is noted that historically there have been no reported drifting allision incidents with wind farm structures in the UK. Whilst drifting vessel scenarios 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).

15.3.5 Fishing Vessel to Structure Allision Risk

323. 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 OAA.

324. A fishing vessel allision is classified separately from other allisions since fishing vessels may be either in transit or actively fishing within the OAA (unlike the

transiting commercial traffic characterised by the main commercial routes). Additionally, fishing vessels could be observed internally within the OAA (i.e., between structures) as well as externally. Anatec's model uses vessel numbers, sizes (length and beam), array 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 wind farm arrays.

325. The model conservatively assumes no change in baseline fishing activity i.e., no account is made of vessels passing over or in close proximity to structure locations choosing to increase passing distance post wind farm.

326. A plot of the annual fishing vessel allision frequency per structure for the base case is presented in Figure 15.9.

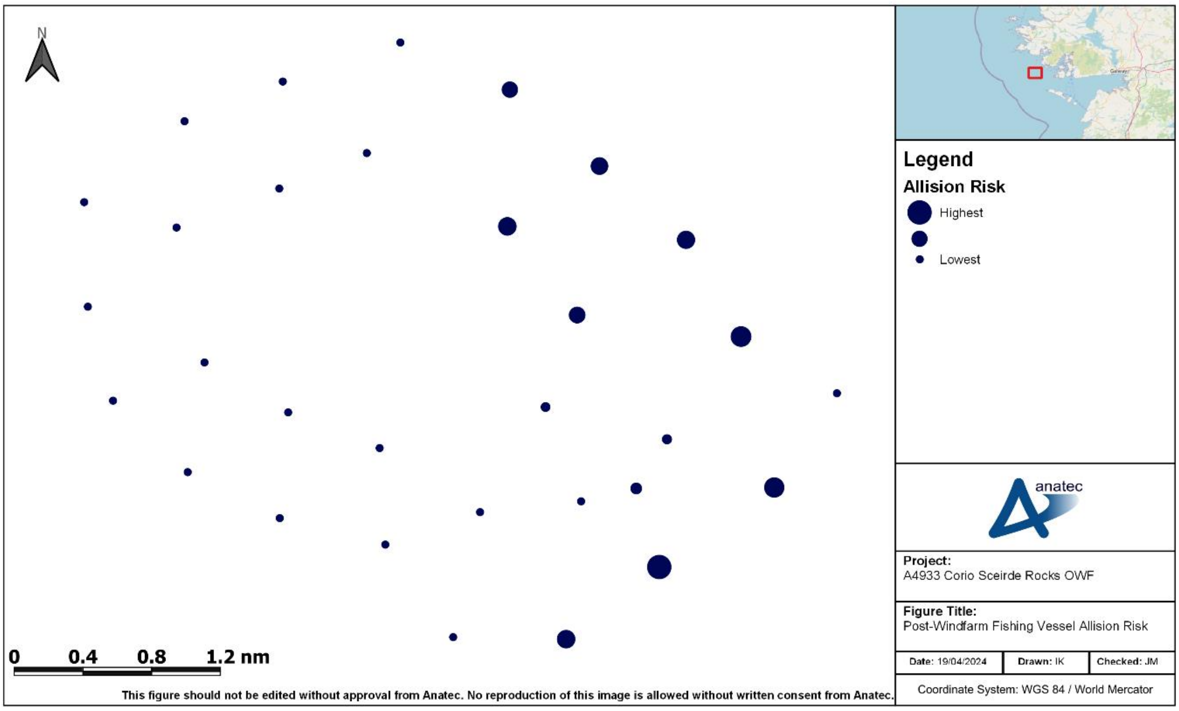


Figure 15.9 Post Wind Farm Fishing Vessel Allision Risk

327. Assuming base case traffic levels, the annual fishing vessel to structure allision frequency was estimated to be 1.47×10^{-2}, corresponding to a return period of approximately one in 68 years. When considering a future case increase of vessel numbers of 20%, this value increased to 1.76×10^{-2} (one allision every 56.7 years).

328. The fishing vessel to structure allision risk was highest in the eastern half of the OAA, reflective of the fishing activity recorded occurring throughout this area (see Section 10.1.2.1). The greatest individual allision risk was associated with a structure on the southeastern perimeter of the OAA (approximately 3.08×10^{-3} or one in 325 years).

329. The model is calibrated against known allision incidents within UK offshore wind farms (see Section 9.8). Most likely consequences will be a low impact / minor contact with no significant damage, no injuries to persons, and no pollution (in line with incident statistics to date as per Section 9.8.1).

15.4 Risk Results Summary

330. 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 15.1 summarises the results of all six scenarios.

331. Overall, the base case collision and allision frequency due to the presence of the Offshore Site was estimated to increase by approximately 1.47×10^{-2} (equating to an additional collision or allision every 68 years). The 10% and 20% increases for the future case scenarios recorded an approximate collision and allision frequency increase of 1.62×10^{-2} (an additional allision/collision every 61.8 years) and 1.77×10^{-2} (an additional allision/collision every 56.7 years) respectively.

Table 15.1 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	2.16×10^{-5} (1 in 46,334 years)	2.16×10^{-5} (1 in 46,322 years)	Negligible
	Future case (10%)	2.61×10^{-5} (1 in 38,267 years)	2.61×10^{-5} (1 in 38,257 years)	Negligible
	Future case (20%)	3.11×10^{-5} (1 in 32,148 years)	3.11×10^{-5} (1 in 32,140 years)	Negligible
Powered vessel to structure allision	Base case	-	4.37×10^{-6} (1 in 228,910 years)	4.37×10^{-6} (1 in 228,910 years)
	Future case (10%)	-	4.82×10^{-6} (1 in 207,527 years)	4.82×10^{-6} (1 in 207,527 years)
	Future case (20%)	-	5.21×10^{-6} (1 in 191,989 years)	5.21×10^{-6} (1 in 191,989 years)
Drifting vessel to structure allision	Base case	-	5.93×10^{-6} (1 in 168,577 years)	5.93×10^{-6} (1 in 168,577 years)
	Future case (10%)	-	6.50×10^{-6} (1 in 153,752 years)	6.50×10^{-6} (1 in 153,752 years)
	Future case (20%)	-	7.07×10^{-6} (1 in 141,344 years)	7.07×10^{-6} (1 in 141,344 years)
Fishing vessel to structure allision	Base case	-	1.47×10^{-2} (1 in 68.1 years)	1.47×10^{-2} (1 in 68.1 years)

Risk	Scenario	Annual Frequency (Return Period)		
		Pre Wind Farm	Post Wind Farm	Change
	Future case (10%)	-	1.62×10^{-2} (1 in 61.9 years)	1.62×10^{-2} (1 in 61.9 years)
	Future case (20%)	-	1.77×10^{-2} (1 in 56.7 years)	1.77×10^{-2} (1 in 56.7 years)
Total	**Base case**	**2.16×10^{-5} (1 in 46,334 years)**	**1.47×10^{-2} (1 in 67.9 years)**	**1.47×10^{-2} (1 in 68.0 years)**
	Future case (10%)	**2.61×10^{-5} (1 in 38,267 years)**	**1.62×10^{-2} (1 in 61.7 years)**	**1.62×10^{-2} (1 in 61.8 years)**
	Future case (20%)	**3.11×10^{-5} (1 in 32,148 years)**	**1.77×10^{-2} (1 in 56.6 years)**	**1.77×10^{-2} (1 in 56.7 years)**

16 Risk Assessment

16.1 Displacement of Third-Party Vessels and Resulting Increased Collision Risk (All Phases)

332. *Activities associated with the construction, operation and maintenance, and decommissioning of structures and cables may displace existing routes/activity and increase encounters and collision risk with other third-party vessels.*

16.1.1 Vessel Displacement

333. The volume of vessel traffic passing within, or in proximity to, the OAA has been established using vessel traffic data collected during dedicated surveys (28 days over summer and winter 2022) as well as Anatec's ShipRoutes database. These datasets were interrogated to identify main routes using the principles set out in MGN 654 (MCA, 2021) (see Section 11).

334. Although there will be no restrictions on entry into the buoyed construction area, based on experience at previously under construction offshore wind farms it is anticipated that the majority of commercial vessels will choose not to navigate internally within the buoyed construction area and therefore a main route deviation will be required.

335. The full methodology for main route deviations is provided in Section 14.4, with minor deviations established in line with MGN 654 (MCA, 2021). In particular, it is assumed that a minimum distance of 1 NM between the OAA and the mean position of main routes will be maintained. On this basis, a minor deviation will be required for one of the three main routes identified within the study area. This is a cargo vessel and passenger vessel route between Galway and Rothesay with a 0.1 NM increase in distance required to pass further south and increase the passing distance from the OAA. This corresponds to a 0.04% increase in the total route length.

336. Based on experience at previously under construction offshore wind farms, it is anticipated that fishing vessels and recreational vessels will choose not to routinely navigate internally within the buoyed construction area, noting there would be no restriction on transit. There is considered to be sufficient sea room outside of the OAA for transits from such vessel to be accommodated, although particular consideration is needed of navigation between Mile Rocks and Skerd Rocks.

337. As per Section 7.1, a flashing beacon providing leading lights in the area is located on Croaghnakeela Island, 1.7 NM north of the OAA. These leading lights assist vessels transiting between Mile Rocks and Skerd Rocks. The westernmost WTG position intersects this leading light, while another WTG position is located approximately 20 m from the extremity of the leading light sector. Therefore, the OAA may impede upon the ability to detect these for vessels. The vessel traffic survey data did not indicate use of this leading light and no concerns were raised during consultation

when raised, however it is possible that Irish Lights may require additional aids to navigation for WTGs at this extent of the OAA to minimise disruption.

338. It is noted that displacement of active commercial fishing is assessed separately in **Chapter 13: Commercial Fisheries**.

339. Given the available sea room, despite the OECC spanning the opening to Galway Bay, it is considered unlikely that cable installation will lead to any material displacement or disruption, noting any impact would be localised to the spatial area immediately around the vessel and would be temporary in nature. It is also advantageous that the OECC runs perpendicular to the general flow of vessel traffic, minimising the temporal extent of any exposure to displacement.

340. The main consequence of vessel displacement will be increased journey times and distances for affected third-party vessels. Vessels are expected to comply with international and flag state regulations including COLREGs (IMO, 1972/77) and SOLAS (IMO, 1974) and will be able to passage plan in advance given the promulgation of information relating to the Offshore Site and relevant nautical charts as any works progress.

16.1.2 Increased Third-Party to Third-Party Collision Risk

341. It is anticipated that one of the three main routes identified in Section 11.2 will deviate as a result of the construction of the OAA. This could lead to increased vessel densities within the area, which could in turn lead to an increase in vessel to vessel encounters and therefore increased collision risk.

342. Base and future case scenarios were assessed to investigate changes in collision risk post-commissioning of the Project. Based on the base case post wind farm scenario, the collision frequency was estimated at one in 46,322 years, which represents a 0.03% increase compared to the base case pre wind farm scenario. When considering a future case traffic increase of 20%, the change in collision frequency was instead an increase of 44% compared to the base case pre wind farm scenario - to one in 32,140 years. These changes are associated with the vessels displaced south of the OAA and align with the findings of the incident data assessment (see Section 9), which showed no recorded collisions in the study area over the periods studied. Details pertaining to the modelling of collision risk are provided in Section 15.

343. The promulgation of information relating to construction activities, deployment of the buoyed construction area, and charting of infrastructure will allow vessel Masters to passage plan in advance, minimising any displacement and hence collision risk. Appropriate lighting and marking during construction including the buoyed construction area will be agreed with Irish Lights. These navigational aids will further maximise mariner awareness when in proximity.

344. During the operation and maintenance phase, the minimum spacing between WTGs (1,017 m) is sufficient to ensure the view of other vessels will not be blocked or

hindered, again reducing the likelihood of an encounter occurring in proximity to the Offshore Site.

345. In the event that an encounter does occur, it is likely to be localised and occur for only a short duration, with collision avoidance action implemented by the vessels involved, in line with the COLREGs, thus ensuring that the situation does not develop into a collision incident. This is supported by experience at previous under construction offshore wind farms, where no collision incidents involving two third-party vessels have been reported.

346. Historical collision incident data (see Section 9.8) also indicates that the most likely consequences will be slight should a collision occur, with minor contact between the vessels resulting in minor damage and no injuries to persons, with both vessels able to resume their respective passages and undertake a full inspection at the next port. As an unlikely worst case, one or more of the vessels could be foundered resulting in a Potential Loss of Life (PLL) and pollution.

16.1.3 Embedded Mitigation Measures

347. Embedded mitigation measures identified as relevant to reducing the significance of risk are as follows:

- Advisory safe passing distances;
- Guard vessel(s);
- Lighting and marking;
- Marking on nautical charts; and
- Promulgation of information.

16.1.4 Potential Significance of Risk

348. The frequency of occurrence and severity of consequence for each phase of the Project is presented in Table 16.1 alongside the resulting significance of risk.

Table 16.1 Significance of Risk for Displacement of Third-Party Vessels and Resulting Increased Collision Risk

Element of Hazard	Phase	Frequency of Occurrence	Severity of Consequence	Significance of Risk
Vessel displacement	Construction	Frequent	Negligible	Tolerable with Mitigation (ALARP)
	Operation and maintenance	Frequent	Negligible	Tolerable with Mitigation (ALARP)

Element of Hazard	Phase	Frequency of Occurrence	Severity of Consequence	Significance of Risk
	Decommissioning	Frequent	Negligible	Tolerable with Mitigation (ALARP)
Third-party vessel to vessel collision risk	Construction	Extremely unlikely	Moderate	Broadly Acceptable (ALARP)
	Operation and maintenance	Extremely unlikely	Moderate	Broadly Acceptable (ALARP)
	Decommissioning	Extremely unlikely	Moderate	Broadly Acceptable (ALARP)

16.2 Collision Risk Between Third-Party Vessels and Project Vessels (All Phases)

349. *Vessels associated with construction, operation and maintenance, and decommissioning activities may increase encounters and collision risk for other vessels already operating in the area.*

16.2.1 Qualification of Risk

350. Up to 10 different vessel activities are required throughout the construction and decommissioning phases, noting this will include Restricted in Ability to Manoeuvre (RAM) vessels. It is assumed that a total of 23 project vessels (up to 11 per day) will be on-site throughout the duration of the construction and decommissioning phases.

351. Up to 1,098 return trips per year by operation and maintenance vessels may be made throughout the operation and maintenance phase, including RAM vessels. It is assumed that project vessels will be on-site throughout the operation and maintenance phase, with likely seasonal differences present – it is estimated that there will be more vessel movements in summer months. It is noted that the movement of project vessels during the operation and maintenance phase represents a decrease in movements in comparison to the construction and decommissioning phases.

352. Encounter and collision risk involving project vessels in all phases will be managed by marine coordination including the application of traffic management procedures such as the designation of entry and exit points to and from the OAA and routes to and from base ports. Additionally, project vessels will carry AIS and be compliant with Flag State regulations including IMO conventions such as the COLREGs. These

mitigations will particularly benefit any third-party vessels choosing to navigate internally within the array during the operation and maintenance phase (expected to be limited to fishing and recreational vessels – see Section 16.4.3) by minimising the likelihood of an interaction.

353. Advisory safe passing distances may be deployed around project vessels where works are ongoing during all phases as defined by risk assessment. Advanced warning and accurate locations of advisory safe passing distances will be promulgated by Notices to Mariners.

354. Appropriate marine lighting and marking during construction including the buoyed construction area will be agreed with Irish Lights (provisional scheme provided in **Appendix 5-9: LMP**. These navigational aids will further maximise mariner awareness when in proximity to ongoing construction works in the OAA. The structures within the OAA will exhibit lights, marks, sounds, signals and other aids to navigation as required by Irish Lights, maximising mariner awareness to the potential for project vessel presence when in proximity, both in day and night conditions including in poor visibility.

355. Third-party vessels may experience restrictions on visually identifying project vessels entering and exiting the OAA during reduced visibility; however, this hazard will be mitigated by the application of the COLREGs (reduced speeds) in adverse weather conditions and project vessels mandatorily will carry AIS regardless of size. It is noted that the likelihood of a collision is likely to be greater in reduced visibility when the identification of project vessels entering and exiting the OAA may be encumbered. However, again the COLREGs regulate vessel movements in adverse weather conditions and require all vessels operating in reduced visibility to reduce speed to allow more time for reacting to encounters, thus minimising the collision risk.

356. Based on historical incident data, there has been one instance of a third-party vessel colliding with a project vessel for an offshore wind farm in the UK (see Section 9.8). In this incident, occurring in 2011, moderate vessel damage was reported with no harm to persons. Since then, awareness of offshore wind developments and application of the measures outlined above has improved and been refined considerably in the interim, with no further collision incidents reported since.

357. If an encounter occurs between a third-party vessel and a project vessel, the encounter is likely to be localised and occur for only a short duration. With 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.

358. Should a collision occur, the most likely consequences will be similar to that outlined for the case of a collision between two third-party vessels (see Section 16.1), namely minor contact between the vessels resulting in minor damage and no injuries to persons with both vessels able safely to make their next port to undertake a full

inspection. This is particularly the case where a third-party vessel is navigating internally within the array as such transits are more likely to be at lower speeds given the existing bathymetry conditions and presence of surface infrastructure.

359. As an unlikely worst case, one or more of the vessels involved in a collision could be foundered resulting in a PLL and pollution. If pollution were to occur in proximity to the Offshore Site or involving a project vessel, then the Project's pollution planning (Marine Pollution Contingency Plan (MPCP)) will be implemented to minimise the environmental risks, with this developed in accordance with the International Convention for the Prevention of Pollution from Ships (MARPOL).

16.2.2 Embedded Mitigation Measures

360. Embedded mitigation measures identified as relevant to reducing the significance of risk are as follows:

- Advisory safe passing distances;
- Buoyed construction area;
- Guard vessel(s);
- Lighting and marking;
- Marine coordination for project vessels;
- Marking on nautical charts;
- Pollution planning;
- Project vessel compliance with international marine regulations; and
- Promulgation of information.

16.2.3 Potential Significance of Risk

361. The frequency of occurrence and severity of consequence for each phase of the Project is presented in Table 16.2 alongside the resulting significance of risk.

Table 16.2 Significance of Risk for Collision Risk Between Third-Party Vessels and Project Vessels

Phase	Frequency of Occurrence	Severity of Consequence	Significance of Risk
Construction	Extremely unlikely	Moderate	**Broadly Acceptable (ALARP)**
Operation and maintenance	Extremely unlikely	Moderate	**Broadly Acceptable (ALARP)**
Decommissioning	Extremely unlikely	Moderate	**Broadly Acceptable (ALARP)**

16.3 Reduced Access to Local Ports (All Phases)

362. *Construction, operation and maintenance, and decommissioning activities as well as the presence of surface structures within the OAA may result in reduced access to local ports and harbours for vessels owing to both the physical presence of the OAA and Project vessels accessing local ports and harbours.*

16.3.1 Qualification of Risk

363. The closest port or harbour to the OAA is Kilronan Harbour, located approximately 11.9 NM to the southeast. Rossaveel Harbour is 12.4 NM to the east, and Galway Harbour is located approximately 31 NM to the east. Given the relative distance to ports in the area and the anticipated deviations for the main commercial routes, it is not anticipated that there will be any substantial effect on vessel approaches to and from the local ports due to the OAA beyond the deviations already outlined for impacts on vessel displacement (see Section 16.1).

364. The same parameters for vessel activities outlined in Section 16.2 are again assumed. Project vessel movements also have the potential to affect port access, particularly at base ports for activities. The construction and decommissioning port(s) have not yet been determined and therefore limited assessment may be undertaken.

365. For operation and maintenance, it is assumed that Rossaveel Harbour will be the primary base. The use of facilities and frequent transits by project vessels may disrupt third-party access to the harbour, particularly when considering the narrow approach to the harbour through Cashla Bay. However, project vessels will be managed by marine coordination such as designated routes to and from Rossaveel harbour. During consultation, Rossaveel Harbour indicated no concerns with use of the harbour, with the proposed mitigation measures suitable to allow continued safe navigation.

366. Pilotage activities are also not expected to be affected based on feedback from Rossaveel Harbour and the Port of Galway, even with the future movement further west of the Galway pilot boarding station following the planned port expansion.

367. The most likely consequences of the impact are increased journey times and distances due to the presence of the buoyed construction area and project vessels, as per the vessel displacement impact.

16.3.2 Embedded Mitigation Measures

368. Embedded mitigation measures identified as relevant to reducing the significance of risk are as follows:

- Lighting and marking;
- Marine coordination for project vessels;
- Marking on nautical charts;

- Project vessel compliance with international marine regulations; and
- Promulgation of information.

16.3.3 Potential Significance of Risk

369. The frequency of occurrence and severity of consequence for each phase of the Project is presented in Table 16.3 alongside the resulting significance of risk.

Table 16.3 Significance of Risk for Reduced Access to Local Ports

Phase	Frequency of Occurrence	Severity of Consequence	Significance of Risk
Construction	Remote	Negligible	Broadly Acceptable (ALARP)
Operation and maintenance	Remote	Negligible	Broadly Acceptable (ALARP)
Decommissioning	Remote	Negligible	Broadly Acceptable (ALARP)

16.4 Creation of Third-Party Allision Risk (Operation and Maintenance Phase)

370. *Presence of structures within the OAA will lead to creation of powered, drifting and internal allision risk for vessels.*

371. The spatial extent of the hazard is small given that a vessel must be in close proximity to an offshore wind farm structure for an allision incident to occur. Each allision element is considered in turn in terms of frequency of occurrence and severity of consequence, with the resulting significance of the residual risk across the various elements summarised at the end of the assessment. The forms of allision considered include:

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

16.4.1 Powered Allision Risk

16.4.1.1 Qualification and Quantification of Risk

372. Based on the quantitative assessment undertaken (see Section 15), the base case annual powered vessel to structure allision frequency was estimated to be one in 228,910 years. When considering a future case traffic increase of 20%, the powered allision frequency was estimated to be one in 191,989 years. This is a very low return period compared to that estimated for other offshore wind farm developments and is reflective of the relatively low volume of vessel traffic

intersecting or passing in close proximity to the OAA. Details pertaining to the modelling of powered allision risk are provided in Section 15. Based on historical incident data, there have been two reported instances of a third-party vessel alliding with an operational offshore wind farm structure in the UK. Both of these incidents involved a fishing vessel, with an RNLI lifeboat attending on both occasions and a helicopter deployed in one case.

373. Vessels are expected to comply with national and international flag state regulations (including the COLREGs and SOLAS) and will be able to passage plan a route which minimises risk given the promulgation of information relating to the Offshore Site, including the charting of infrastructure on relevant nautical charts. On approach, the operational marine lighting and marking on the structures (which will be agreed with Irish Lights) will also assist in maximising awareness. The lighting and marking may also assist any vessel navigating between Mile Rocks and Skerd Rocks where use of the existing leading lights may be partially impeded due to the presence of WTGs.

374. Should an allision occur, the consequences will depend on multiple factors including the energy of the impact, structural integrity of the vessel and sea state at the time of the impact. Fishing vessels and recreational vessels are considered most vulnerable to the impact given the potential for a non-steel construction and possible internal navigation within the OAA by such vessels. 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 an unlikely worst case, the vessel could be foundered resulting in a PLL and pollution. If pollution were to occur, then the Project’s pollution planning (MPCP) will be implemented to minimise the environmental risk.

16.4.2 Drifting Allision Risk

16.4.2.1 Qualification and Quantification of Risk

375. Based on the quantitative assessment undertaken (see Section 15), the base case annual drifting vessel to structure allision frequency was estimated to be one in 168,577 years. When considering a future case traffic increase of 20%, the drifting allision frequency was estimated to be one in 141,344 years. This is again a very low return period compared to that estimated for other offshore wind farm developments and is reflective of the relatively low volume of vessel traffic passing in proximity to or within the OAA. Details pertaining to the modelling of drifting allision risk are provided in Section 15.

376. Based on historical incident data, there have been no instances of a third-party vessel alliding with an operational offshore wind farm structure whilst adrift. However, there is considered to be potential for a vessel to be adrift in the area; this is reflected in the incident data reviewed in proximity to the Offshore Site which indicates that

machinery failure[5] is the most common incident type (approximately 42%). A vessel adrift may only develop into an allision situation if in proximity to an offshore wind farm structure. This is only the case where the adrift vessel is located internally within or in close proximity to the OAA and the direction of the wind and/or tide directs the vessel towards a structure.

377. In circumstances where a vessel drifts towards a structure in the OAA, there are actions which the vessel may take to prevent the drift incident developing into an allision situation. Powered vessels may be able to regain power prior to reaching the OAA (i.e., by rectifying any fault). Failing this, the vessel's emergency response procedures would be implemented which 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 risks (such as anchor snagging on a subsea cable), or the use of thrusters (depending on availability and power supply). Given the water depths in the area it is expected that emergency anchoring would not be restricted to larger vessels, i.e., it would also be an option for small craft.

378. Where the deployment of the anchor is not possible (e.g., for small craft), any project vessels on-site may be able to render assistance in liaison with the IRCG and in line with SOLAS obligations (IMO, 1974). This response will be managed via the IRCG and marine coordination and depends on the type and capability of vessels on site. This would be particularly relevant for sailing vessels relying on metocean conditions for propulsion, noting if the vessel becomes adrift in proximity to a structure there may be limited time to render assistance.

379. Should an allision occur, the consequences will be similar to those noted for the case of a powered allision including the unlikely worst-case of foundering and pollution; in the highly unlikely scenario of a drifting allision incident resulting in pollution, the implementation of the Project's pollution planning (MPCP) will minimise the environmental risk. Additionally, a drifting vessel is likely to transit at a reduced speed compared to a powered vessel, thus reducing the energy of the impact, including in the case of a recreational vessel under sail.

16.4.3 Internal Allision Risk

16.4.3.1 Qualification and Quantification of Risk

380. As noted previously, based on experience at existing operational offshore wind farms, and due to the nature of the existing bathymetry conditions, it is anticipated that commercial vessels will be unlikely to navigate internally within the OAA. Fishing and recreational vessels may be more likely to transit through noting they may be less likely to do so while the buoyed construction area is in place.

381. The base case annual fishing vessel to structure allision frequency (see Section 15) is estimated to be one in 68 years. When considering a future case traffic increase of

[5] Noting that machinery failure may not lead to a situation as severe as the vessel being adrift.

20%, the fishing allision frequency was estimated to be one in 57 years. This return period is reflective of the volume of fishing vessel traffic in the area, both in transit and engaged in fishing activities, and the conservative assumptions made within the modelling process; in particular that baseline activity in terms of proximity to WTGs will not change. This is a very conservative assumption, and in reality fishing vessels will account for the presence of the WTGs. Furthermore, the worst consequences reported for vessels involved in an allision incident involving a UK offshore wind farm development has been flooding, with no life-threatening injuries to persons reported (the model is calibrated against known reported incidents). Details pertaining to the modelling of fishing allision risk are provided in Section 15.

382. The minimum spacing between structures of 610 m (WTG to OSS) is considered sufficient for safe internal navigation i.e., for vessels to keep clear of the offshore wind farm structures within the OAA. During consultation, Rossaveel Harbour indicated that internal navigation by fishing vessels can be managed through marine coordination.

383. As with any passage, any vessel navigating within the array is expected to passage plan in accordance with SOLAS Chapter V (IMO, 1974) and effective promulgation of information will ensure that such vessels have good awareness. Given the existing bathymetry conditions, it is also expected that mariners navigating within the array will already have a heightened alertness. Operational marine lighting and marking will be in place as required by and agreed with the Irish Lights. This will include unique identification marking of each offshore wind farm structure in an easily understandable pattern to minimise the risk of a mariner navigating internally within the OAA becoming disoriented.

384. Should a recreational vessel under sail enter the proximity of a WTG, there is also potential for effects such as wind shear, masking and turbulence to occur. From previous studies of offshore wind developments, it has been concluded that WTGs do reduce wind velocity downwind of a WTG (MCA, 2008) 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. As an unlikely worst case, such effects could contribute to an allision incident with similar consequences to those outlined for powered and drifting allisions.

385. For recreational vessels with a mast there is an additional allision risk when navigating internally within the array associated with the WTG blades. However, the minimum blade tip clearance (27.5 m above HAT) exceeds the minimum clearance the RYA recommend (22 m) for minimising allision risk (RYA, 2019) which is also noted in MGN 654.

16.4.4 Embedded Mitigation Measures

386. Embedded mitigation measures identified as relevant to reducing the significance of risk are as follows:

- Advisory safe passing distances;
- Buoyed construction area;
- Compliance with MGN 654;
- Lighting and marking;
- Marine coordination for project vessels;
- Marking on nautical charts;
- Minimum blade clearance;
- Pollution planning; and
- Promulgation of information.

16.4.5 Potential Significance of Risk

387. The frequency of occurrence and severity of consequence for each phase of the Project is presented in Table 16.4 alongside the resulting significance of risk.

Table 16.4 Significance of Risk for Creation of Third-Party Allision Risk

Element of Hazard	Phase	Frequency of Occurrence	Severity of Consequence	Significance of Risk
Powered allision risk	Operation and maintenance	Extremely unlikely	Moderate	Broadly Acceptable (ALARP)
Drifting allision risk		Negligible	Moderate	Broadly Acceptable (ALARP)
Internal allision risk		Remote	Moderate	Tolerable with Mitigation (ALARP)

16.5 Reduction in Under-Keel Clearance due to Cable Protection (Operation and Maintenance and Decommissioning Phases)

388. *The presence of protection over subsea cables may reduce charted water depths leading to increased risk of under keel interaction for passing vessels.*

16.5.1 Qualification of Risk

389. For all subsea cables relating to the Offshore Site, the minimum burial depth is 1.0 m, noting actual burial depths will be determined via the cable burial risk assessment

process. Given existing water depths, it is not anticipated that there will be any notable changes in navigable depths other than potentially near the landfall location.

390. Where cable burial is not possible, alternative cable protection methods will be deployed which will again be determined within the cable burial risk assessment. The requirements of MGN 654 in relation to cable protection will apply, namely cable protection will not change the charted water depth by more than 5% unless appropriate mitigation is agreed with the MSO and Irish Lights.

391. For the OECC, charted water depths in offshore areas are reasonably deep and therefore such a circumstance is considered unlikely. For nearshore areas with a cable protection height of 3.4 m discussions with the MSO and Irish Lights may be necessary. However; it is acknowledged that from the baseline data vessel traffic does not navigate in close proximity to the Landfall and therefore there is a limited pathway through which an under-keel interaction may occur. For the OAA, transits by deeper draught vessels are not anticipated, limiting the risk.

392. Should an underwater allision occur, minor damage incurred is the most likely consequence, and foundering of the vessel resulting in a PLL and pollution the unlikely worst-case consequences, with the environmental risks of the latter minimised by the implementation of the Project's pollution planning (MPCP).

393. Given that rockberms associated with subsea cable protection are not planned to be removed during decommissioning or post-decommissioning, this hazard will remain present at these times.

16.5.2 Embedded Mitigation Measures

394. Embedded mitigation measures identified as relevant to reducing the significance of risk are as follows:

- Cable protection;
- Compliance with MGN 654 and its annexes;
- Decommissioning Plan;
- Marking on charts;
- Pollution planning; and
- Promulgation of information.

16.5.3 Potential Significance of Risk

395. The frequency of occurrence and severity of consequence for each phase of the Project is presented in Table 16.5 alongside the resulting significance of risk.

Table 16.5 Significance of Risk for Reduction in Under-Keel Clearance due to Cable Protection

Phase	Frequency of Occurrence	Severity of Consequence	Significance of Risk
Operation and maintenance	Extremely unlikely	Moderate	Broadly Acceptable (ALARP)
Decommissioning	Extremely unlikely	Moderate	Broadly Acceptable (ALARP)

16.6 Anchor Interaction with Subsea Infrastructure (Operation and Maintenance and Decommissioning Phases)

396. *Presence of export and array cables may increase the potential for interaction with subsea cables.*

16.6.1 Qualification of Risk

397. The spatial extent of the hazard is limited given that a vessel must be in close proximity to an export cable or array cable for an interaction to occur.

398. 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.

399. 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).

400. No anchored vessels were identified within the vessel traffic survey data assessed, and no anchorages (preferred or charted) were identified in immediate proximity to the Offshore Site. The closest anchorages to the Offshore Site were located in sheltered areas closer to shore. Risk of interaction on a planned anchoring or dragged anchoring basis is therefore anticipated to be low and is exacerbated by the existing hazards within the OAA. In terms of emergency anchoring, any areas of high traffic volume are likely to represent the areas of highest risk, particularly where there are hazards nearby (e.g., structures, rocks, shallows).

401. The likelihood of anchor interaction with a subsea 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 process, which will account for traffic volumes and sizes.

402. Given that rockberms associated with subsea cable protection are not planned to be removed during decommissioning or post-decommissioning, this hazard will remain present at these times.

403. Should an anchor interaction incident occur, the most likely consequences will be low based on historical anchor interaction incidents, with no material damage incurred to the cable or the vessel. As an unlikely worst case, a snagging incident could occur and/or the vessel's anchor and the cable could be damaged, and lead to risk of loss of stability of a small vessel. However, with the mitigation measures discussed in the above paragraphs in place, this risk will be minimised.

16.6.2 Embedded Mitigation Measures

404. Embedded mitigation measures identified as relevant to reducing the significance of risk are as follows:

- Cable protection;
- Compliance with MGN 654 and its annexes;
- Decommissioning Plan;
- Marking on nautical charts; and
- Promulgation of information.

16.6.3 Potential Significance of Risk

405. The frequency of occurrence and severity of consequence for each phase of the Project is presented in Table 16.6 alongside the resulting significance of risk.

Table 16.6 Significance of Risk for Anchor Interaction with Subsea Infrastructure

Phase	Frequency of Occurrence	Severity of Consequence	Significance of Risk
Operation and maintenance	Negligible	Minor	**Broadly Acceptable (ALARP)**
Decommissioning	Negligible	Minor	**Broadly Acceptable (ALARP)**

16.7 Reduction of Emergency Response Capability Including SAR Access (Operation and Maintenance Phase)

406. *Presence of structures, increased vessel activity and personnel numbers may reduce emergency response capability by increasing the number of incidents, increase consequences or reducing access for the responders.*

16.7.1 Emergency Response Resources

407. The same parameters for vessel activities outlined in Section 16.2 are again assumed. It is recognised that in instances of severe weather conditions project vessel activities are likely to be withdrawn. Nevertheless, the presence of such vessels will increase the likelihood of an incident and subsequently increase the likelihood of multiple incidents occurring simultaneously, diminishing emergency response capability. As an unlikely worst case, the consequences of such a situation could include a failure of emergency response to an incident, resulting in a PLL and pollution.

408. Given the distances that may be covered by air-based SAR support (the SAR helicopter base at Shannon is located approximately 49 NM from the OAA), the spatial extent of this hazard is considered reasonably large. The OAA covers approximately 11 NM^2 which represents a small area to search compared to other existing offshore wind farms. In addition, it is unlikely that a SAR operation will require the entire OAA 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 (noting account of assumptions on any potential drift of the casualty).

409. Where a SAR helicopter is required, the range and endurance time of the assets which will be available at Shannon is such that there will be no issue with reaching the OAA. However, the base at Shannon responds to a wide region and in the event of simultaneous incidents that require a SAR response the response time could be substantially affected.

410. However, with project vessels to be managed through marine coordination and compliance with Flag State regulations, the likelihood of an incident is minimised and should an incident occur project vessels would likely be well equipped to assist, either through self-help capability or through SOLAS obligations (IMO, 1974). The Project's pollution planning (MPCP) will also be implemented to minimise the environmental risks of any incident involving pollution.

411. Indeed, there is potential that the presence of project vessels will have a positive effect on emergency response, possibly serving as first responder under SOLAS obligations should an incident occur (whether related to the OAA or otherwise). This is demonstrated by various reported historical instances of wind farm related vessels responding to unrelated incidents (see Section 9.8 for full details).

412. It is also acknowledged that the presence of the OAA within an area containing existing navigational hazards and the associated aids to navigation may assist in preventing vessels encountering such hazards.

16.7.2 Search and Rescue Access

413. Separate to the NRA the Project has undertaken an assessment of SAR access. This assessment (Appendix E: Safety Justification undertaken by NASH Maritime) notes that "*whilst the proposed Project layout is not a regular grid, it does integrate several*

of the underlying elements of best practice to ensure the safety and effectiveness of SAR operations. These elements include maintaining consistent lines of orientation, establishing clear SAR routes and creating a Helicopter Refuge Area (HRA) with well-defined entry and exit points". The Safety Justification identified several key conclusions:

- The site is heavily constrained with numerous competing constraints, particularly natural ground conditions, which makes a viable regular grid layout impossible. The existing guidance (both DoT and MCA) note that projects should be considered on a case-by-case basis and that deviations from regular grid layouts and two lines of orientation can occur, which is necessary with the unique constraints of the Project, given sufficient safety justification.
- Sceirde Rocks is also a small project, at 3.1 NM by 3.8 NM, and as noted in the guidance (MCA, 2024), the key principles of the guidance have been developed specifically for large offshore projects >10 NM across.
- The layout proposed does seek to integrate as far as practically possible several of the underlying elements of best practice to ensure the safety and effectiveness of SAR operations.
- The incorporation of two parallel lines of orientation, approximately 1,020 m apart, aligns the majority of the infrastructure and forms a central area clear of WTGs. This structured layout could provide for safe and efficient SAR operations and general navigation within the wind farm.
- The Inter-WTG Route, a 500 m wide swath around the OAA, further supports SAR activities by providing additional offsets from WTGs and ensuring direct entry and exit points on each corner of the OAA. This route maintains more than a 75 m offset from any infrastructure, with most offsets exceeding 100 m.
- The proposed HRA, spanning 1.9 NM^2, provides a possible area for SAR helicopters to reorient and manoeuvre safely. The HRA exceeds the 1 NM guidance and is offset from all infrastructure by more than 250 m, ensuring minimal obstruction.
- Furthermore, the design includes five entry and exit routes for the HRA, all bearing 064˚/244˚, which aligns with the northwest line of orientation. These routes, each 500 m wide, ensure more than 150 m of additional separation from any WTG, enhancing safety during SAR operations.
- As concluded in the NRA, the risk of a navigational incident occurring within the OAA is low due to the low density of traffic and risk profile and therefore it is unlikely that SAR activities will be required within the array.
- The Project has proposed mitigation which would manage SAR provision at Sceirde Rocks.
- There is a pressing need for increased offshore wind farms in Ireland.

414. On the basis of this assessment this risk is deemed to be Tolerable with Mitigation (ALARP) noting the project has "*committed to engaging further with the IRCG to ensure that the Project satisfies their requirements and would not compromise the safety and efficiency of SAR operations*".

16.7.3 Embedded Mitigation Measures

415. Embedded mitigation measures identified as relevant to reducing the significance of risk are as follows:

- Compliance with MGN 654 and its annexes;
- Guard vessel(s);
- Marine coordination for project vessels;
- Pollution planning; and
- Project vessel compliance with international marine regulations.

16.7.4 Potential Significance of Risk

416. The frequency of occurrence and severity of consequence for each phase of the Project is presented in Table 16.7 alongside the resulting significance of risk, noting this includes consideration of conclusions from Appendix E: Safety Justification.

Table 16.7 Significance of Risk for Reduction of Emergency Response Capability Including SAR Access

Phase	Frequency of Occurrence	Severity of Consequence	Significance of Risk
Operation and maintenance	Remote	Serious	Tolerable with Mitigation (ALARP)

17 Mitigation Measures

17.1 Embedded Mitigation

417. As part of the design process for the Project, 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 Project.

418. The embedded mitigation measures relevant to Shipping and Navigation are outlined in Table 17.1.

Table 17.1 Embedded Mitigation Measures Relevant to Shipping and Navigation

Embedded Mitigation Measure	Details
Advisory safe passing distances	Advisory safety zones or safe passing distances may be deployed around ongoing work being undertaken by a construction or maintenance vessel. It is noted that there is no mechanism for deployment of statutory safety zones in Irish waters and therefore the application of advisory safe passing distances is considered a suitable alternative means of mitigating risk.
Buoyed construction area	A buoyed construction (or decommissioning) area around the OAA will be implemented during the construction phase in agreement with Irish Lights. An LMP which incorporates the buoyed construction area is provided in **Appendix 5-9: LMP**.
Cable protection	Cable protection (via burial or external protection where burial is not possible) will be implemented and monitored, with any damage, destruction, or decay of cables notified to appropriate regulatory bodies no later than 24 hours after discovered.
Compliance with MGN 654 and its annexes	The Project will be compliant with UK MGN 654 (MCA, 2021) noting that, as per Section 2, draft guidance has been published by the DoT for OREIs in Irish waters and closely resembles MGN 654.
Decommissioning Plan	A Decommissioning Plan will be implemented prior to the start of decommissioning works which includes details of how the subsea cables and associated protection (left in situ) will be routinely monitored post-decommissioning to ensure that there is no further change to under keel clearance or increased risk of anchor interaction.
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 Applicant will liaise with the IRCG in relation to SAR resources to ensure suitable emergency response plans and procedures are in place, with suitable consideration of the National SAR Plan (Government of Ireland, 2019).

Embedded Mitigation Measure	Details
Lighting and marking	Lighting and marking of the array will be in compliance with IALA O-139 and G1162 (IALA, 2021) and agreed with Irish Lights. An LMP is provided in **Appendix 5-9: LMP**.
Marine coordination for project vessels	Marine coordination and communication will be implemented to manage project vessel movements.
Marking on nautical charts	There will be appropriate marking of all offshore infrastructure associated with the Offshore Site on UKHO Admiralty charts.
Minimum blade clearance	There will be a minimum blade clearance of 27.5 m above HAT.
Pollution planning	An MPCP will be developed in accordance with (MARPOL requirements outlining procedures to protect personnel working and safeguard the environment should a pollution event occur.
Project vessel compliance with international marine regulations	All project vessels will comply with international marine regulations as adopted by the Flag State including COLREGs and SOLAS.
Promulgation of information	Information relating to the Offshore Site will be circulated via Notices to Mariners including in relation to project vessel routes, timings and locations, and advisory safety zones and safe passing distances.

18 Summary

18.1 Consultation

419. Consultation with Shipping and Navigation stakeholders has been undertaken as part of the NRA process, primarily through Regular Operator outreach and the Hazard Workshop. Engagement has been limited, but both the Port of Galway and Rossaveel Harbour have provided feedback which has been incorporated into the characterisation of the baseline environment and considered in the risk assessment.

18.2 Navigational Features

420. The closest key aid to navigation to the OAA is a flashing beacon at Croaghnakeela Island, approximately 1.7 NM north of the OAA. This aid to navigation includes several leading lights with 5 NM range, one of which intersects the OAA.

421. Kilronan is the closest port or harbour to the Offshore Site, located 11.9 NM southeast of the OAA. Rossaveel Harbour is located 12.4 NM east of the OAA, with the OECC situated across the entrance to Galway Bay.

422. The IRIS subsea cable intersects the OECC south of the Aran Islands, and there are charted anchorages situated throughout the coast, with none located within either the OAA or OECC.

18.3 Maritime Incidents

423. Incidents reported to the RNLI for the 10-year period between 2013 and 2022 have been analysed, with approximately four unique incidents per year within 10 NM of the OAA, all responded to out of either the Aran Islands or Clifden station. The most common incident types were "*machinery failure*" (42%) and "*person in danger*" (21%). The most common vessel types recorded were fishing vessels (27%) and recreational vessels (23%).

424. A total of three incidents in the region with reports released by the MCIB were identified between 1992 and 2023, comprising one grounding and two instances of a man overboard.

18.4 Vessel Traffic Movements

425. A total of 28 days of vessel traffic survey data was assessed as part of the NRA process. This comprised of two distinct 14-day periods in August/September and November 2022 to account for seasonal variation, in line with the requirements of MGN 654 (MCA, 2021).

426. An average of five to six unique vessels per day were recorded within 10 NM of the OAA during both the summer and winter survey periods. Fishing vessels (53%), 'other' vessels (19%), and recreational vessels (15%) were the most prominent vessel

types, noting that recreational vessels and passenger vessels were only present in the summer survey period.

427. Three main commercial routes were identified from the vessel traffic survey data, comprising a fishing vessel route in/out of Rossaveel, a cargo vessel and passenger vessel route in/out of Galway, and a cargo vessel route to/from Limerick.

428. There were no vessels identified within either dataset that were likely to be at anchor.

18.5 Future Case Vessel Traffic

429. During consultation the New Port of Galway was identified as a potential expansion of the existing Port of Galway. This may increase the volume and size of vessels navigating in the region as well as the types of vessels.

430. Using the principles of MGN 654 (MCA, 2021), a deviation has been anticipated for one of the three main commercial routes identified, consisting of a 0.1 NM increase in distance required, equating to a 0.04% increase in the total route length.

18.6 Collision and Allision Risk Modelling

431. The NRA process included quantitative modelling of the change in collision and allision frequency as a result of the Offshore Site, with consideration given to future cases in terms of potential future traffic increases.

432. It was estimated that the return period of a vessel being involved in a collision post wind farm was one in 46,322 years assuming base case traffic levels. This represents a 0.03% increase in collision frequency compared to the pre wind farm base case result.

433. The powered allision return period post wind farm was estimated at one in 228,910 years assuming base case traffic levels. The corresponding drifting allision return period post wind farm was estimated at one in 168,577 years assuming base case traffic levels. The fishing vessel allision return period post wind farm was estimated at one in 68 years assuming base case traffic levels.

18.7 Risk Statement

434. Using the outputs of consultation, lessons learnt from previous offshore wind farm developments, the baseline characterisation of the existing environment, outputs of collision and allision risk modelling, and expert opinion, the potential Shipping and Navigation hazards due to the presence of the Offshore Site have been risk assessed in line with the FSA approach.

435. The significance of risk has been determined as either **Broadly Acceptable** or **Tolerable with Mitigation** (and ALARP) for all shipping and navigation hazards assessed.

19 References

Atlantic Array (2012). *Atlantic Array Offshore Wind Farm Draft Environmental Statement Annex 18.3: Noise and Vibration (Anthropogenic Receptors): Predictions of Operational Wind Turbine Noise Affecting Fishing Vessel Crews*. Swindon, UK: Channel Energy Limited.

Bristow Group (2023). *Bristow Ireland Limited Signs New Sar Contract With Irish Department Of Transport*. Houston, US. https://www.bristowgroup.com/news-media/press-releases/detail/539/bristow-ireland-limited-signs-new-sar-contract-with-irish (accessed January 2024).

BWEA (2007). *Investigation of Technical and Operational Effects on Marine Radar Close to Kentish Flats Offshore Wind Farm*. London, UK: BWEA (now RenewableUK), Business, Energy and Industrial Strategy (BEIS) (now Department of Energy, Security and Net Zero), MCA & PLA.

Deltares (2022). *Skerd Rocks offshore wind farm metocean study.*

Department of Housing, Local Government and Heritage (2021). *National Marine Planning Framework.*

Energinet.dk (2014). *Horns Rev 3 Offshore Wind Farm Technical Report no. 12 – Radio Communication and Radars*. Fredericia, Denmark: Energinet.dk.

Government of Ireland (2019). *National Search and Rescue Plan*. Dublin, Ireland: Government of Ireland.

Government of Ireland (2021). *Project Ireland 2040 National Marine Planning Framework*. Dublin, Ireland: Government of Ireland.

IALA (2021). *IALA Guidance G1162 on The Marking of Offshore Man-Made Structures*. Edition 2. Saint Germain en Laye, France: IALA.

IMO (1972/77). *Convention on International Regulations for Preventing Collisions at Sea (COLREGs) – Annex 3*. London, UK: IMO.

IMO (1973/78). *International Convention for the Prevention of Pollution from Ships (MARPOL)*. London, UK: IMO.

IMO (1974). *International Convention for the Safety of Life at Sea (SOLAS)*. London, UK: IMO.

IMO (2018). *Revised Guidelines for Formal Safety Assessment (FSA) for Use in the Rule-Making Process*. MSC-MEPCC.2/Circ.12/Rev.2. London, UK: IMO.

MAIB (2001). *Report on the Investigation of the Grounding and Total Loss of the United Kingdom-registered Fishing Vessel Arosa (M321) on Doonguddle Rock Off the West Coast of Ireland with the Loss of 12 Crew Members*. Report No 41/2001. Southampton, UK: MAIB.

Marine Safety Investigation Unit (2024). *Safety investigation into the loss of control of the Maltese registered bulk carrier JULIETTA D*. https://msiu.gov.mt/wp-content/uploads/2023/11/MV-Julietta-D_Final-Safety-Investigation-Report.pdf (accessed October 2024).

MCA & QinetiQ (2004). *Results of the Electromagnetic Investigations*. 2nd Edition. Southampton, UK: MCA & QinetiQ.

MCA (2005). *Offshore Wind Farm Helicopter Search and Rescue Trials Undertaken at the North Hoyle Wind Farm*. Southampton, UK: MCA.

MCA (2008a). *MGN 371 (Merchant and Fishing) Offshore Renewable Energy Installations (OREIs): Guidance on UK Navigational Practice, Safety and Emergency Response Issues*. Southampton, UK: MCA.

MCA (2008b). *MGN 372 (Merchant and Fishing) Offshore Renewable Energy Installations (OREIs): Guidance to Mariners Operating in the Vicinity of UK OREIs*. Southampton, UK: MCA.

MCA (2021). *MGN 654 (Merchant and Fishing) Safety of Navigation: Offshore Renewable Energy Installations (OREIs) – Guidance on UK Navigational Practice, Safety and Emergency Response*. Southampton, UK: MCA.

MCA (2022). *MGN 372 Amendment 1 (Merchant and Fishing) Offshore Renewable Energy Installations (OREIs): Guidance to Mariners Operating in the Vicinity of UK OREIs*. Southampton, UK: MCA.

OSPAR (2008). *Background Document on Potential Problems Associated with Power Cables Other Than Those for Oil and Gas Activities*. Paris, France: OSPAR Convention.

Port of Galway (2024a). *Galway Harbour Extension*. Galway, Ireland. http://www.galwayharbourextension.com/ (accessed October 2024).

Port of Galway (2024b). *General Information*. Galway, Ireland. https://theportofgalway.ie/port-of-galway-general-information/ (accessed October 2024).

RNLI (2016). *Barrow RNLI Rescues Crew After Fishing Vessel Collides with Wind Turbine*. Barrow: RNLI. https://rnli.org/news-and-media/2016/may/26/barrow-rnli-rescues-crew-after-fishing-vessel-collides-with-wind-turbine (accessed October 2024).

RYA (2019). *The RYA Position on Offshore Renewable Energy Developments: Paper 1 (of 4) – Wind Energy*. 5th Edition. Southampton, UK: RYA.

The Fishing Daily (2024). Works Cease Immediately at Ros an Mhil Harbour Over Planning Dispute. https://thefishingdaily.com/latest-news/works-cease-immediately-at-ros-an-mhil-harbour-over-planning-dispute/ (accessed October 2024).

UKHO (2019). *Admiralty Sailing Directions Irish Coast Pilot NP40*. Taunton, UK: UKHO.

Appendix A Marine Guidance Note 654 Checklist

436. 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.

437. 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 presented is provided in the NRA is given.

438. It is again acknowledged that the specific guidance for undertaking NRAs in Irish waters has not been formally published at the time of writing but the draft guidance published by the DoT is closely aligned with UK MGN 654 (MCA, 2021) and therefore the completion of the MGN 654 Checklist is likely to be helpful for ensuring compliance.

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 for the OAA (see Section 6.1) and OECC (see Section 6.3.3) study areas.
At least 28 days duration, within either 12 or 24 months prior to submission of the ES.	✓	**Section 5.2: Vessel Traffic Surveys** A total of 28 full days of vessel traffic survey data from August/September and November 2022 has been assessed within the OAA and OECC study areas.
Multiple data sources.	✓	**Section 5.2: Vessel Traffic Surveys** The vessel traffic survey data includes AIS, visual observations and radar for the summer and winter periods in order to ensure maximal coverage of vessels not broadcasting on AIS. **Section 5: Data Sources** Additional data sources have also been considered.

Issue	Compliance	Comments
Seasonal variations.	✓	**Section 5.2: Vessel Traffic Surveys** A total of 28 full days of vessel traffic survey data from August and November 2022 has been assessed within OAA and OECC study areas. **Section 5: Data Sources** Additional long-term data have also been considered.
MCA consultation.	**N/A**	**Section 4: Consultation** Not applicable to the Project but the Irish equivalent bodies the MSO and IRCG were invited to attend the Hazard Workshop and have been engaged with directly.
General Lighthouse Authority (GLA) consultation.	✓	**Section 4: Consultation** Irish Lights were invited to attend the Hazard Workshop and have been engaged with directly.
UK Chamber of Shipping consultation.	**N/A**	**Section 4: Consultation** Not applicable to the Project but the Irish equivalent body the Irish Chamber of Shipping were invited to attend the Hazard Workshop.
Recreational and fishing vessel organisations consultation.	✓	**Section 4: Consultation** The Royal Irish Yacht Club, Galway Bay Sailing Club, and Galway City Sailing Club were invited to attend the Hazard Workshop.
Port and navigation authorities consultation, as appropriate.	✓	**Section 4: Consultation** The Port of Galway and Rossaveel Harbour 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 Offshore Site has been analysed.
ii. Numbers, types and sizes of vessels presently using such areas.	✓	**Section 10: Vessel Traffic Movements** Vessel traffic data in proximity to the Offshore Site 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** There are no marine aggregate dredging areas in proximity to the Offshore Site. **Section 10: Vessel Traffic Movements** Non-transit users were identified in the vessel traffic survey data and included fishing vessels engaged in fishing activities.
iv. Whether these areas contain transit routes used by coastal or deep-draught vessels on passage.	✓	**Section 10: Vessel Traffic Movements** Main routes have been identified using the principles set out in MGN 654 in proximity to the OAA (see Section 11.2), with these routes taking into account coastal, deep-draught and internationally scheduled vessels.

Issue	Compliance	Comments
v. Alignment and proximity of the site relative to adjacent shipping lanes.	✓	**Section 7: Navigational Features** There are no IMO routeing measures in proximity to the Offshore Site.
vi. Whether the nearby area contains prescribed routeing schemes or precautionary areas.	✓	**Section 7: Navigational Features** There are no prescribed routeing schemes or precautionary areas in proximity to the Offshore Site.
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 7.2 identifies nearby ports, Section 7.3 identifies nearby pilot boarding stations, and Section 7.5 identifies nearby anchorages.
viii. Whether the site lies within the jurisdiction of a port and/ or navigation authority.	✓	**Section 7: Navigational Features** Section 7.2 identifies nearby ports. The Offshore Site does not lie within any jurisdiction of a port and/or harbour authority.
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 and activities are considered within the OAA (Section 10.1.2.1) and OECC (Section 10.2.2.1) study areas.
x. Proximity of the site to offshore firing/ bombing ranges and areas used for any marine military purposes.	✓	**Section 7: Navigational Features** There are no military practice or exercise areas in proximity to the Offshore Site.
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** There are no marine aggregate dredging areas in the region. Section 7.4 considers subsea cables in proximity to the Offshore Site. **Section 13: Cumulative and Transboundary Overview** Planned subsea cables are identified in Section 13.2.
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** There are no baseline OREIs in proximity to the Offshore Site. **Section 13: Cumulative and Transboundary Overview** Planned nearby OREIs presented are shown in Section 13.1.
xiii. Proximity of the site relative to any designated areas for the disposal of dredging spoil or other dumping ground.	✓	**Section 7: Navigational Features** There are no spoil grounds or other dumping grounds in proximity to the Offshore Site.
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 7.1 identifies aids to navigation in proximity to the Offshore Site.

Issue	Compliance	Comments
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 15: Collision and Allision Risk Modelling** Collision and allision risk modelling has been undertaken for the OAA.
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 Resources** Historical vessel incident data published by the MCIB (Section 9.5) and RNLI (Section 9.3) in proximity to the Offshore Site has been considered alongside historical offshore wind farm incident data throughout the UK (Section 9.8).
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 limited recreational activity.
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 14: Future Case Vessel Traffic** A methodology for post wind farm routeing is outlined and includes a minimum distance of 1 NM from offshore installations and WTG boundaries.
b. The width of a corridor between sites or OREIs to allow safe passage of shipping.	✓	No defined navigation corridors have been noted in relation to the Offshore Site.
OREI Structures. The following should be determined:		
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 15: Collision and Allision Risk Modelling** Collision and allision risk modelling has been undertaken for the OAA.

Issue	Compliance	Comments
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 17: Mitigation Measures** The minimum blade tip height is included in Table 17.1.
c. Underwater devices: i. Changes to charted depth; ii. Maximum height above seabed; and iii. Under keel clearance.	✓	**Section 6.3: Subsea Infrastructure** Inter array and export cable specifications are included in Section 6.3.
d. Whether structures block or hinder the view of other vessels or other navigational features.	✓	**Section 16: Risk Assessment** The hazards due to the Offshore Site have been assessed for each phase and include consideration of the potential for vessels navigating in proximity to structures to be visually obscured
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 6.1.: OAA** The range of water depths within the OAA is provided. **Section 8: Meteorological Ocean Data** Various states of the tide local to the Offshore Site are provided. **Section 10: Vessel Traffic Movements** Vessel traffic data in proximity to the Offshore Site has been analysed. **Section 15: Collision and Allision Risk Modelling** Collision and allision risk models take into account tidal conditions.
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.	✓	**Section 8: Meteorological Ocean Data** Various states of the tide local to the Offshore Site are provided. **Section 15: Collision and Allision Risk Modelling** The collision and allision risk models take into account tidal conditions.
c. The maximum rate tidal stream runs parallel to the major axis of the proposed site layout, and, if so, its effect.	✓	
d. The set is across the major axis of the layout at any time, and, if so, at what rate.	✓	

Issue	Compliance	Comments
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.	✓	**Section 8: Meteorological Ocean Data** Various states of the tide local to the Offshore Site are provided and it is noted that hazards are not anticipated at high or low water only. **Section 15: Collision and Allision Risk Modelling** The drifting allision risk model takes into account tidal conditions and assesses whether machinery failure could cause vessels to be set into danger.
f. The structures themselves could cause changes in the set and rate of the tidal stream.	✓	**Section 8: Meteorological Ocean Data** Provides meteorological data in proximity to the Offshore Site relating to various states of the tide and notes that no effects are anticipated.
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.	✓	**Section 8: Meteorological Ocean Data** Provides meteorological data in proximity to the Offshore Site relating to various states of the tide.
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** Weather and visibility data local to the Offshore Site is provided. **Section 10: Vessel Traffic Movements** Vessel traffic data in proximity to the Offshore Site has been analysed including recreational vessels.
i. The structures could create problems in the area for vessels under sail, such as wind masking, turbulence or sheer.	✓	**Section 16: Risk Assessment** The hazards due to the Offshore Site have been assessed for each phase and include consideration of internal allision risk for vessels under sail.
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 15: Collision and Allision Risk Modelling** The drifting allision risk model takes into account weather and tidal conditions and assesses whether machinery failure could cause vessels to be set into danger.
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 4.1 outlines Regular Operator consultation undertaken following the vessel traffic surveys.

Issue	Compliance	Comments
ii. For specified vessel types, operations and/ or sizes.		**Section 15: Collision and Allision Risk Modelling** Collision and allision risk modelling has been undertaken for the OAA and includes use of post wind farm routeing, as well as taking account of tidal and weather conditions.
iii. In all directions or areas.		
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 12: Navigation, Communication, and Position Fixing Equipment** Potential hazards on navigation of the different communications and position fixing devices used in and around offshore wind farms are assessed. **Section 15: Collision and Allision Risk Modelling** Collision and allision risk modelling has been undertaken for the OAA and includes use of post wind farm routeing which assumes commercial vessel traffic avoids the OAA. **Section 17: 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 advisory safe passing distances.
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 15: Collision and Allision Risk Modelling** Collision and allision risk modelling has been undertaken for the OAA and includes use of post wind farm routeing which assumes commercial vessel traffic avoids the array.
d. Guidance on the calculation of safe distance of OREI boundaries from shipping routes has been considered.	✓	**Section 14: Future Case Vessel Traffic** The methodology applied when considering the safe distance at which main routes should be deviated around offshore installations has been described and includes consideration of the Shipping Route Template (see Section 14.4.1).

<table>
<tr><th>Issue</th><th>Compliance</th><th>Comments</th></tr>
<tr><td colspan="3">SAR, maritime assistance service, counter pollution, and salvage incident response.</td></tr>
<tr><td colspan="3">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.</td></tr>
<tr><td>a. An Emergency Response Cooperation Plan (ERCoP) will be developed for the construction, operation, and decommissioning phases of the OREI.</td><td>✓</td><td>Section 17: Mitigation Measures
Embedded mitigation measures have been proposed and are summarised in Section 17 including compliance with MGN 654, which requires the creation of an ERCoP.</td></tr>
<tr><td>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.</td><td>✓</td><td>Section 17: Mitigation Measures
Embedded mitigation measures have been proposed and are summarised in Section 17 including compliance with MGN 654, which requires the fulfilment of requirements in the stated guidance document.</td></tr>
<tr><td>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).</td><td>✓</td><td>Section 17: Mitigation Measures
Embedded mitigation measures have been proposed and are summarised in Section 17 including compliance with MGN 654, which requires the SAR checklist to be completed.</td></tr>
<tr><td colspan="3">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:</td></tr>
<tr><td>i. Pre-construction: The proposed generating assets area and proposed cable route.</td><td>✓</td><td rowspan="4">Section 17: Mitigation Measures
Embedded mitigation measures have been proposed and are summarised in Section 17 including compliance with MGN 654, which requires the specified hydrographic surveys to be completed.</td></tr>
<tr><td>ii. On a pre-established periodicity during the life of the development.</td><td>✓</td></tr>
<tr><td>iii. Post construction: Cable route(s).</td><td>✓</td></tr>
<tr><td>iv. Post decommissioning of all or part of the development: the installed generating assets area and cable route.</td><td>✓</td></tr>
<tr><td colspan="3">Communications, Radar, and positioning systems. To provide researched opinion of a generic and, where appropriate, site-specific nature concerning whether:</td></tr>
</table>

Issue	Compliance	Comments
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 12: Navigation, Communication, and Position Fixing Equipment** Potential hazards on navigation of the different communications and position fixing devices used in and around offshore wind farms are assessed.
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.	✓	
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 12: Navigation, Communication, and Position Fixing Equipment** Potential hazards on navigation of the different communications and position fixing devices used in and around offshore wind farms are assessed.
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 12: Navigation, Communication, and Position Fixing Equipment** Section 12.8 assesses the potential risk of SONAR interference due to the Offshore Site.
d. The site might produce acoustic noise which could mask prescribed sound signals.	✓	**Section 12: Navigation, Communication, and Position Fixing Equipment** Section 12.9 assesses the potential risk of noise due to the Offshore Site.
e. Generators and the seabed cabling within the site and onshore might produce EMFs affecting compasses and other navigation systems.	✓	**Section 12: Navigation, Communication, and Position Fixing Equipment** Section 12.6 assesses the potential risk of electromagnetic interference due to the Offshore Site.
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 17: Mitigation Measures** Embedded mitigation measures have been proposed and are summarised in Section 17 including the promulgation of information.

Issue	Compliance	Comments
ii. Continuous watch by multi-channel VHF, including DSC.	✓	**Section 17: Mitigation Measures** Embedded mitigation measures have been proposed and are summarised in Section 17 including marine coordination.
iii. Safety zones of appropriate configuration, extent, and application to specified vessels.	✓	**Section 17: Mitigation Measures** Embedded mitigation measures have been proposed and are summarised in Section 17 including use of advisory safe passing distances.
iv. Designation of the site as an Area to be Avoided (ATBA).	✓	**Section 6: Project Description Relevant to Shipping and Navigation** It is not planned to designate the OAA as an ATBA.
v. Provision of aids to navigation as determined by the GLA.	✓	**Section 17: Mitigation Measures** Embedded mitigation measures have been proposed and are summarised in Section 17 including the provision of aids to navigation in consultation with Irish Lights.
vi. Implementation of routeing measures within or near to the development.	✓	It is not planned to implement any new routeing measures within or near to the Offshore Site.
vii. Monitoring by Radar, AIS, CCTV or other agreed means.	✓	**Section 17: Mitigation Measures** As required under MGN 654 (MCA, 2021) the Project will agree suitable site mitigation with IRCG via the SAR checklist.
viii. Appropriate means for OREI operators to notify, and provide evidence of, the infringement of Safety Zones.	**N/A**	Not applicable to the Project.
ix. Creation of an ERCoP with the MCA's SAR Branch for the construction phase onwards.	✓	**Section 17: Mitigation Measures** Embedded mitigation measures have been proposed and are summarised in Section 17 including compliance with MGN 654, which requires the creation of an ERCoP.
x. Use of guard vessels, where appropriate.	✓	**Section 17: Mitigation Measures** Embedded mitigation measures have been proposed and are summarised in Section 17 including the use of guard vessels where appropriate.
xi. Update NRAs every two years, e.g. at testing sites.	**N/A**	Not applicable to the Project.
xii. Device-specific or array-specific NRAs.	✓	**Section 6: Project Description Relevant to Shipping and Navigation** All offshore elements of the Project have been considered in this NRA including OAA and OECC (surface and subsea) infrastructure. **Section 17: Mitigation Measures** Embedded mitigation measures have been proposed and are summarised in Section 17 including a cable burial risk assessment undertaken prior to construction which will serve as additional assessment relating to Shipping and Navigation.

Issue	Compliance	Comments
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.
xiv. Any other measures and procedures considered appropriate in consultation with other stakeholders.	✓	**Section 17: Mitigation Measures** Embedded mitigation measures have been proposed and are summarised in Section 17.

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 16: Risk Assessment** The risk assessment provides a risk claim for a range of hazards based on a number of inputs including baseline data, expert opinion, stakeholder concerns and lessons learnt from existing offshore developments.
Description of the marine environment.	✓	**Section 7: Navigational Features** Navigational features in proximity to the Offshore Site have been described including (but not limited to) nearby ports and harbours, key aids to navigation, and subsea cables. **Section 13: Cumulative and Transboundary Overview** A review of other planned developments has been undertaken including consideration of offshore renewable and subsea cable developments based upon the location and distance from the Offshore Site as well as data confidence.
SAR overview and assessment.	✓	**Section 9: Emergency Response Resources** Existing SAR resources in proximity to the Offshore Site are summarised including RNLI stations and SAR helicopter bases.
Description of the OREI development and how it changes the marine environment.	✓	**Section 6: Project Description Relevant to Shipping and Navigation** The maximum extent of the Offshore Site for which any Shipping and Navigation hazards are assessed is provided including a description of the Offshore Site, associated infrastructure, construction phase programme, and indicative vessel and helicopter numbers during the construction and operation and maintenance phases.
Analysis of the vessel traffic, including base case and future traffic densities and types.	✓	**Section 10: Vessel Traffic Movements** Vessel traffic data in proximity to the OAA has been analysed and includes vessel density and breakdowns of vessel type. **Section 14: Future Case Vessel Traffic** Future vessel traffic levels have been considered, with consideration of increases in commercial vessel activity, commercial fishing vessel and recreational vessel activity, and traffic associated with the Project operations. Additionally,

Item	Compliance	Comments
		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: Navigation 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, noting that specific guidance for undertaking NRAs in Irish waters has not been finalised at the time of writing. **Section 15: 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

439. 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 Offshore Site.

440. The significance of the impact due to the presence of the Offshore Site is also assessed based on risk evaluation criteria and comparison with historical incident data in UK waters[6]. UK data has been applied due to the extensive availability (particularly MAIB data) and is considered reasonable to apply given the proximity of UK and Irish waters as well as the international nature of shipping.

B.1 Risk Evaluation Criteria

B.1.1 Risk to People

441. Regarding the assessment of risk to people two measures are considered, namely:

- Individual risk; and
- Societal risk.

B.1.1.1 Individual Risk

442. Individual risk considers whether the risk from an incident to a particular individual changes significantly due to the presence of the Offshore Site. 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.

443. The purpose of estimating the individual risk is to ensure that individuals who may be affected by the presence of the Offshore Site 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 Offshore Site relative to the UK background individual risk levels.

444. 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 MSC 72/16 (IMO, 2001). The annual individual risk level to crew falls within the ALARP region for each of the vessel types presented.

[6] 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.

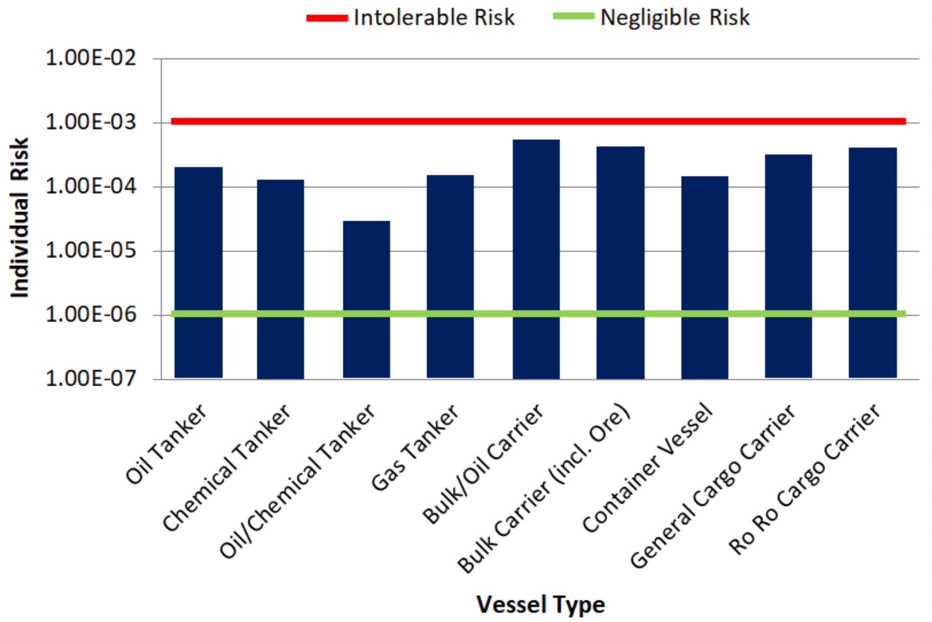


Figure B.1 Individual Risk Levels and Acceptance Criteria per Vessel Type

445. 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 in column reduced by one order of magnitude

446. 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.3, noting that since 1991 these may have improved (rendering this a conservative review).

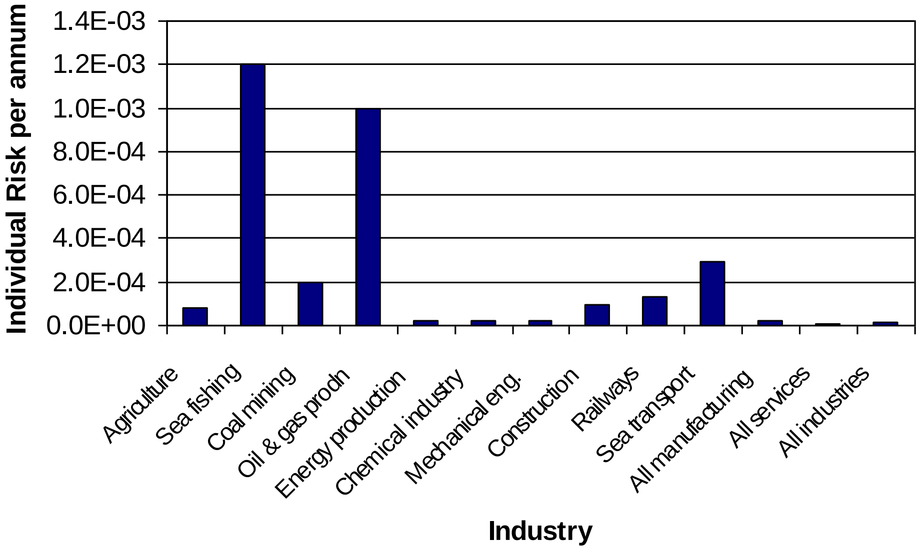


Figure B.2 Individual Risk per Year for Various UK Industries

447. 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.1.1.2 Societal Risk

448. 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.

449. Within this assessment, societal (navigation based) risk can be assessed for the Offshore Site, giving account to the change in risk associated with each incident scenario caused by the introduction of the wind farm structures. 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.

450. When assessing societal risk this study focuses on PLL, which accounts for the number of people likely to be involved in an incident (which varies by vessel type) and assesses the significance of the change in risk compared to the UK background risk levels.

B.1.2 Risk to Environment

451. For risk to the environment the key criteria considered in terms of the risk due to the Offshore Site is the potential quantity of oil spilled from a vessel involved in an incident.

452. 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 Offshore Site compared to UK background pollution risk levels.

B.2 Marine Accident Investigation Branch Incident Analysis

B.2.1 All Incidents in UK Waters

453. All UK flagged commercial vessels are required to report incidents to the MAIB. Non-UK flagged vessels do not have to report an incident to the MAIB unless located at a UK port or within 12 NM of 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.

454. 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.

455. 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 Offshore Site.

456. Accounting for these criteria, a total of 11,773 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).

457. The location of all incidents in proximity to the UK are presented in Figure B.3, colour-coded by incident type. The majority of incidents occur in coastal waters.

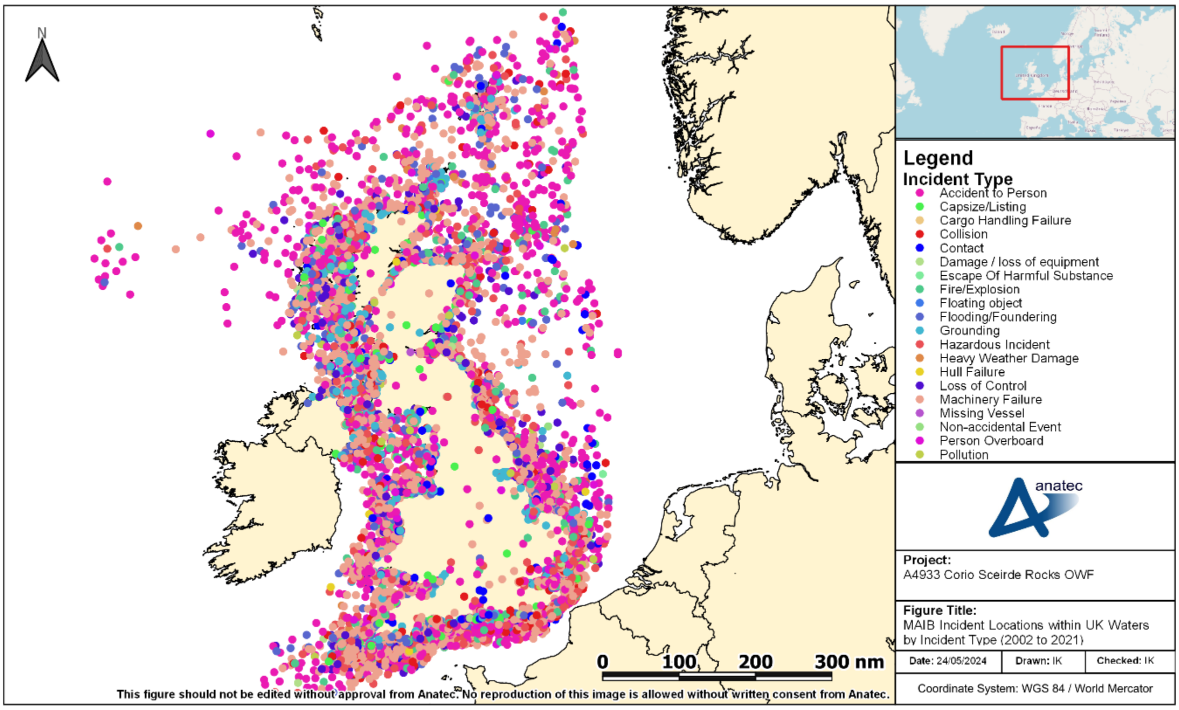


Figure B.3 MAIB Incident Locations by Incident Type within UK Waters (2002 to 2021)

458. The distribution of incidents by year in UK waters is presented in Figure B.4.

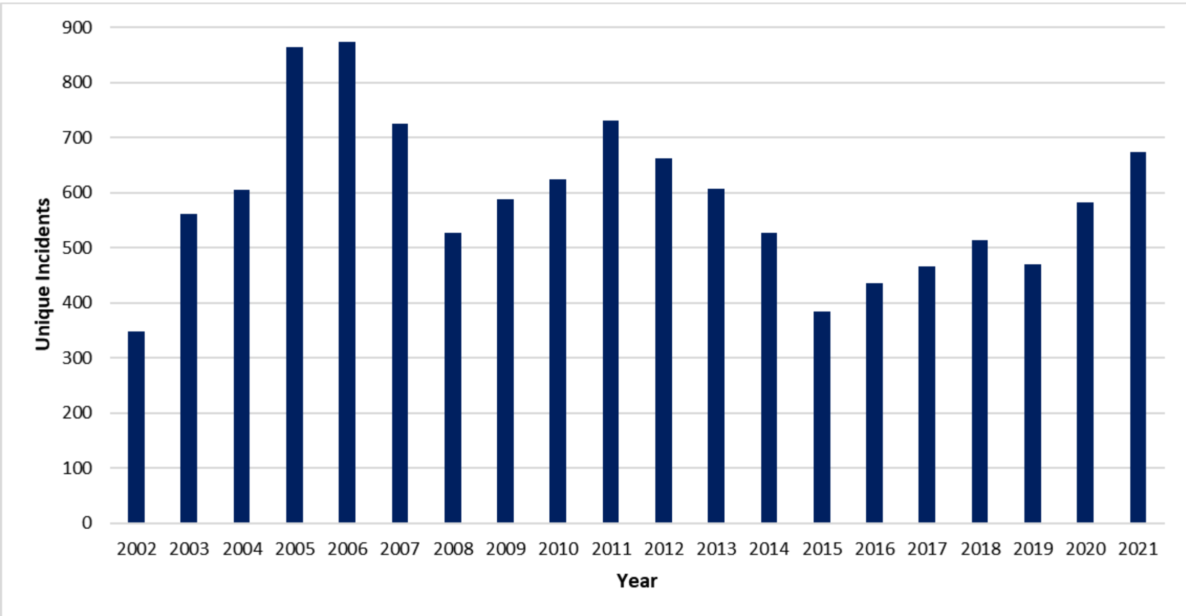


Figure B.4 MAIB Unique Incidents per Year within UK Waters (2002 to 2021)

459. The average number of unique incidents per year was 589. There has generally been a fluctuating trend in incidents over the 20-year period.

460. The distribution of incidents in UK waters by incident type is presented in Figure B.5.

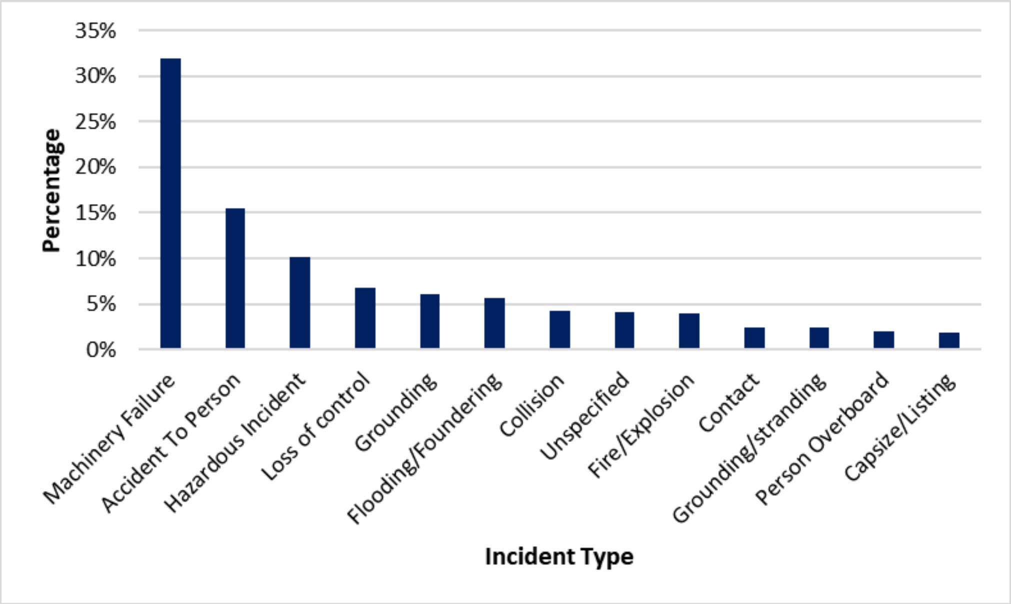


Figure B.5 MAIB Incident Type Breakdown within UK Waters (2002 to 2021)

461. 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.

462. The distribution of incidents in UK waters by vessel type is presented in Figure B.6.

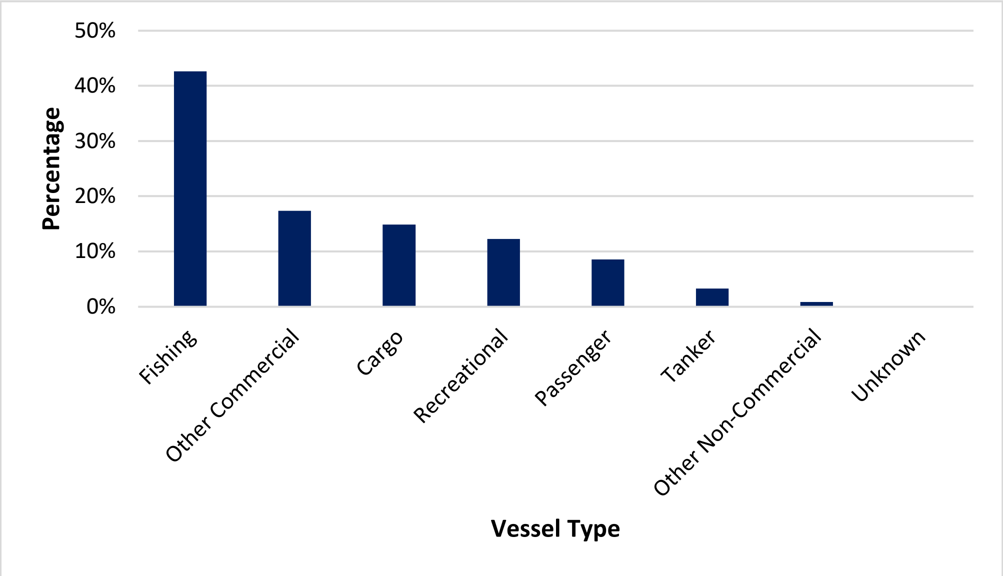


Figure B.6 MAIB Vessel Type Breakdown within UK Waters (2002 to 2021)

463. 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%).

464. 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.

465. The distribution of fatalities in UK waters by vessel type and person category (crew, passenger and other) is presented in Figure B.7.

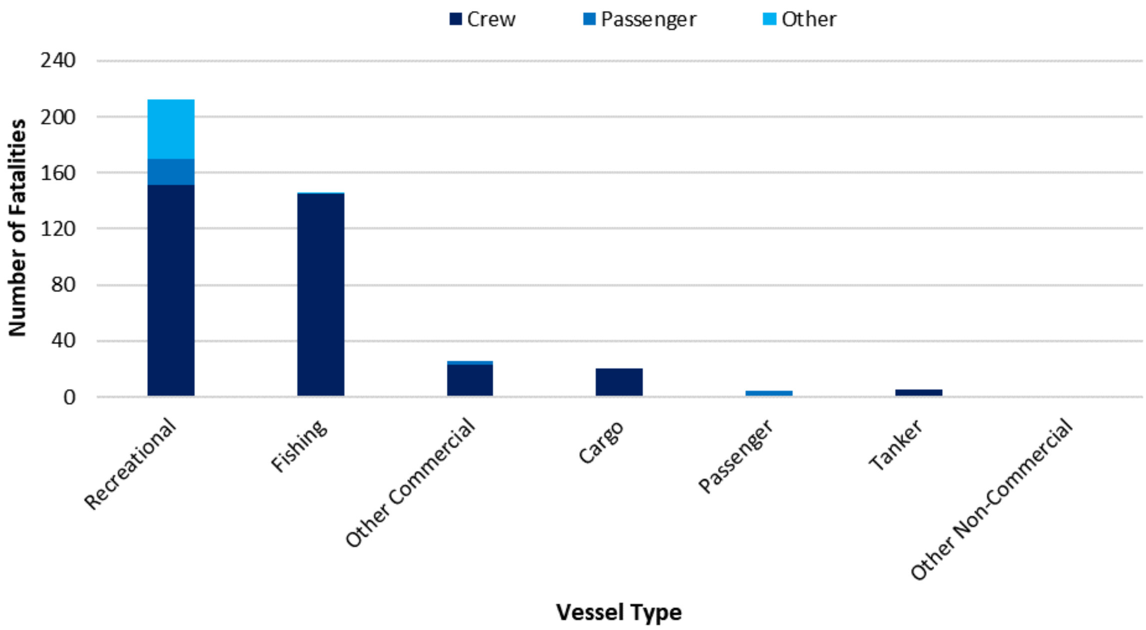


Figure B.7 MAIB Fatalities by Vessel Type within UK Waters (2002 to 2021)

466. The majority of fatalities occurred to recreational vessels (51%) and fishing vessels (35%), with crew members the main people involved (83%).

B.2.2 Collision Incidents

467. 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).

468. 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).

469. The locations of collision incidents reported in proximity to the UK are presented in Figure B.8.

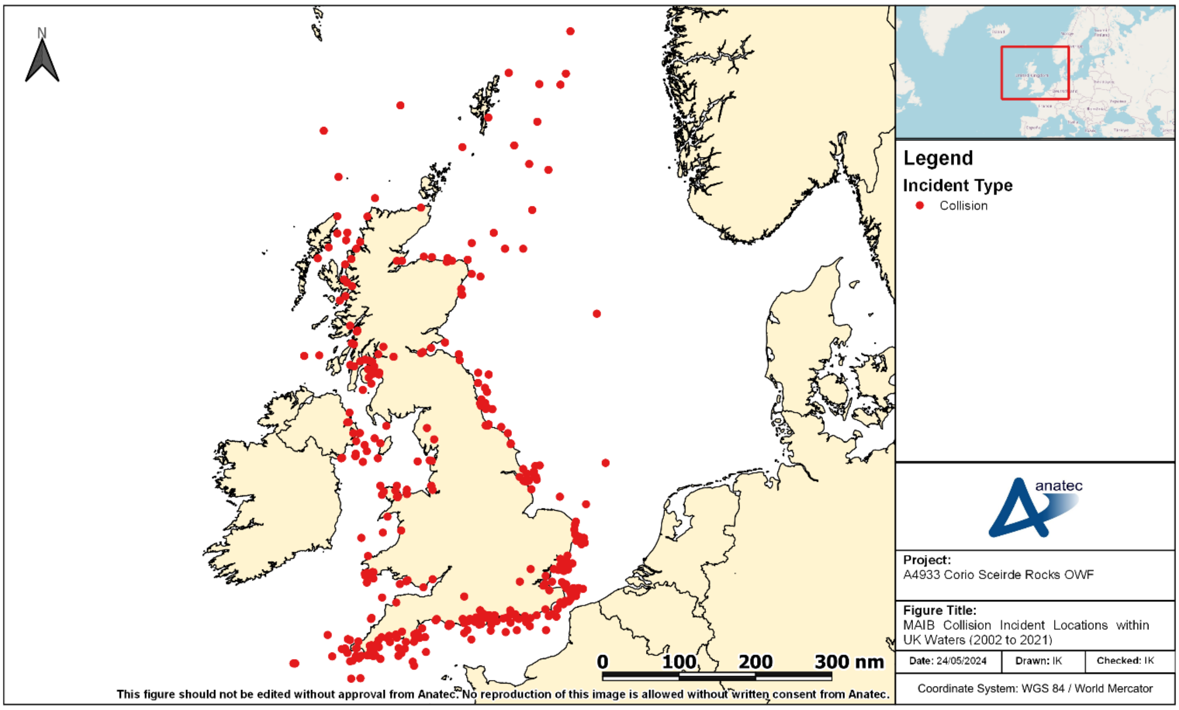


Figure B.8 MAIB Collision Incident Locations within UK Waters (2002 to 2021)

470. The distribution of collision incidents per year is presented in Figure B.9.

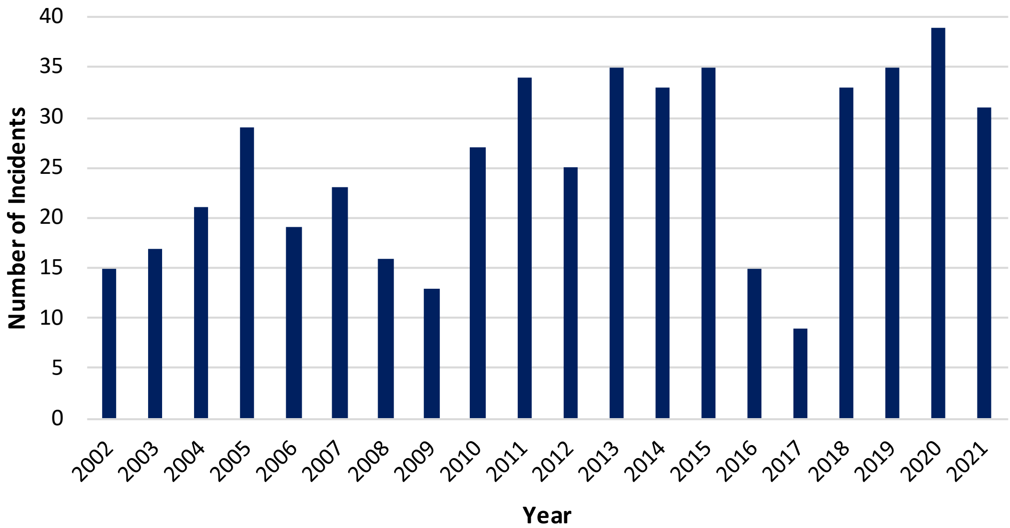


Figure B.9 MAIB Annual Collision Incidents within UK Waters (2002 to 2021)

471. 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.

472. The distribution of vessel types involved in collision incidents is presented in Figure B.10.

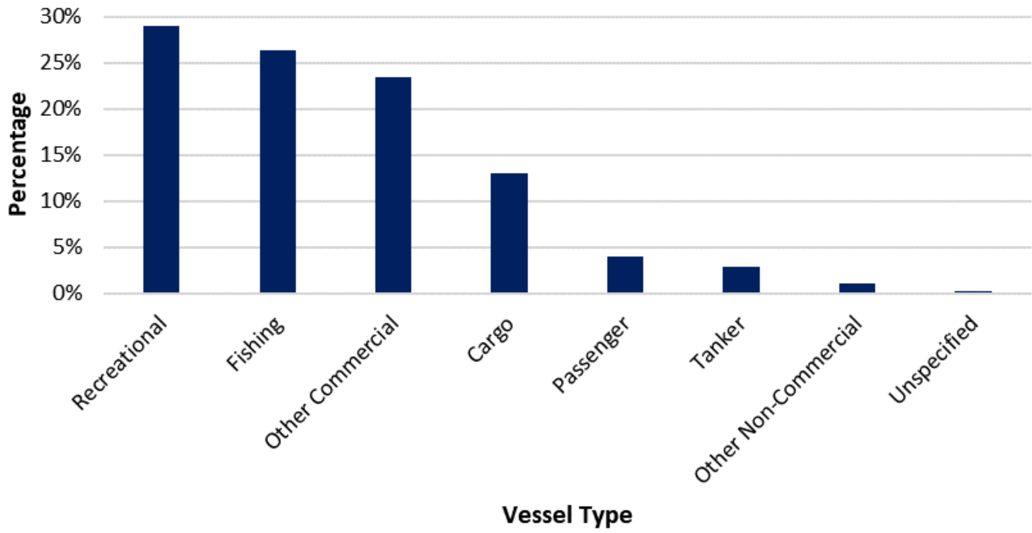


Figure B.10 MAIB Collision Fatalities by Vessel Type within UK Waters (2002 to 2021)

473. The most frequent vessel types involved in collision incidents were recreational vessels (29%), fishing vessels (26%), other commercial vessels (24%) and cargo vessels (13%).

474. 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
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.2.3 Allision Incidents

475. 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). In line with the NRA as a whole, an allision is considered to involve a moving object and a stationary object at sea, with port infrastructure excluded from consideration; the MAIB contact incidents have been individually inspected and filtered in line with the NRA definition.

476. A total of 119 allision incidents were reported to the MAIB within UK waters between 2002 and 2021 involving 119 vessels.

477. The locations of allision incidents reported in proximity to the UK are presented in Figure B.11.

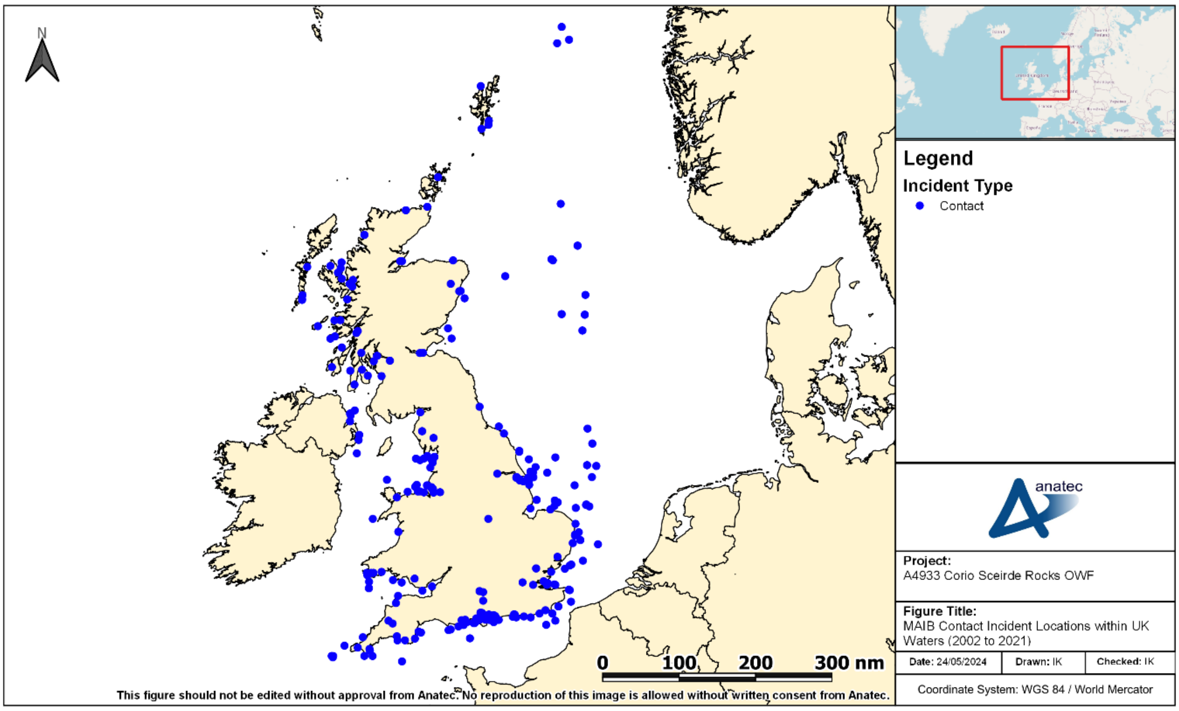


Figure B.11 MAIB Allision Incident Locations within UK Waters (2002 to 2021)

478. The distribution of allision incidents per year is presented in Figure B.12.

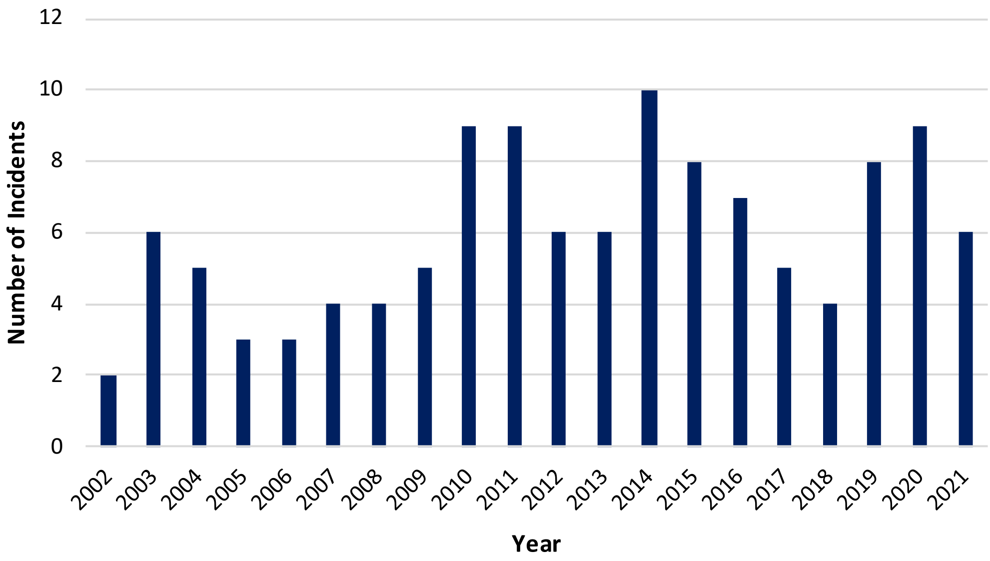


Figure B.12 MAIB Allision Incidents per Year within UK Waters (2002 to 2021)

479. The average number of allision incidents per year was six. As with collision incidents, there has been an overall slight increasing trend in allision incidents over the 20-year period, which may be due to better reporting of less serious incidents in recent years.

480. The distribution of vessel types involved in allision incidents is presented in Figure B.13.

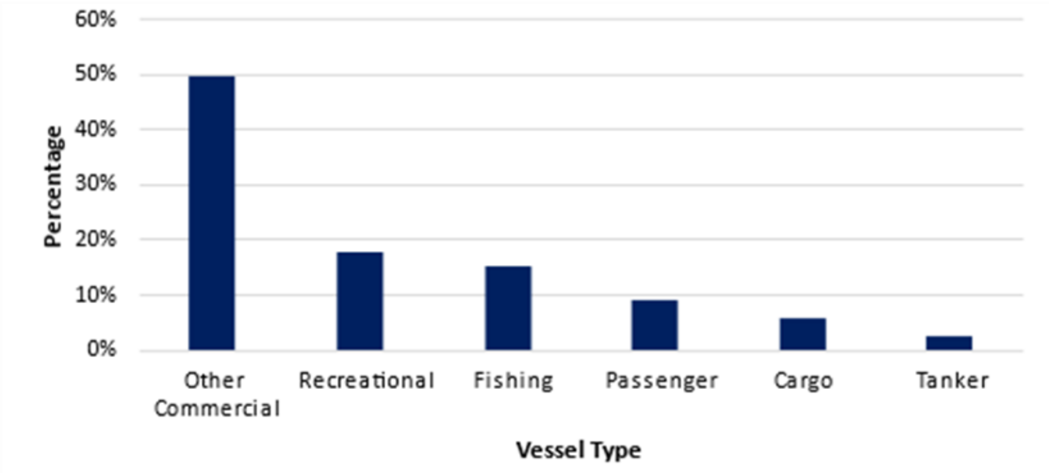


Figure B.13 MAIB Allision Incidents by Vessel Type within UK Waters (2002 to 2021)

481. The most frequent vessel types involved in allision incidents were other commercial vessels (50%), recreational vessels (18%) and fishing vessels (15%).

482. No fatalities were reported in MAIB allision incidents within offshore UK waters between 2002 and 2021.

B.3 Fatality Risk

B.3.1 Incident Data

483. 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 Offshore Site.

484. The Offshore Site 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.

485. Of these incident types, only vessel to vessel collisions match the MAIB definition of collisions and hence the fatality analysis presented in Section B.2 is considered directly applicable to these types of incidents.

486. The other scenarios of powered vessel to structure allision, drifting vessel to structure allision and fishing vessel to structure allision are not clearly represented by the MAIB data (as discussed in Section B.2.3). Additionally, none of the allision incidents reported by the MAIB between 2002 and 2021 resulted in a fatality.

487. Therefore, the MAIB collision fatality risk rate has also been conservatively applied for the allision incident types.

B.3.2 Fatality Probability

488. 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 0.99% probability that a collision incident will lead to a fatal accident.

489. 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.3 presents the average number of POB estimated for each category of vessel navigating in proximity to the Offshore Site. 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.3 Estimated Average POB by Vessel Category

Vessel Category	Subcategories	Source of Estimated Average POB	Estimated Average POB
Cargo/freight	Dry cargo, other commercial, service ship, etc.	MAIB incident data	15

Vessel Category	Subcategories	Source of Estimated Average POB	Estimated Average POB
Tanker	Tanker/combination carrier	MAIB incident data	23
Passenger	RoRo passenger, cruise liner, etc.	Vessel traffic survey data / online information	970
Fishing	Trawler, potter, dredger, etc.	MAIB incident data	3.3
Recreational	Yacht, small commercial motor yacht, etc.	MAIB incident data	3.3

490. 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 appropriate 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.

491. Using the average POB, along with the vessel type information involved in collision incidents reported by the MAIB (see Section B.2.2), there was an estimated 4,748 POB the vessels involved in the collision incidents.

492. Based upon five fatalities during the period 2002 to 2021, the overall fatality probability in a collision for any individual onboard is approximately 4.21×10^{-4} per collision.

493. 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.4. In addition, due to zero fatalities resulting from commercial vessel collisions between 2002 and 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.4 Collision Incident Fatality Probability by Vessel Category

Vessel Category	Subcategories	Fatalities	People Involved	Fatality Probability	Time Period
Commercial	Dry cargo, passenger, tanker, etc.	1	2,798	3.6×10^{-4}	1997 to 2021 (25 years)
Fishing	Trawler, potter, dredger, etc.	2	927	2.2×10^{-3}	2002 to 2021 (20 years)

Vessel Category	Subcategories	Fatalities	People Involved	Fatality Probability	Time Period
Recreational	Yacht, small commercial motor yacht, etc.	3	1,023	2.9×10^{-3}	2002 to 2021 (20 years)

B.3.3 Fatality Risk due to the Offshore Site

494. The base case and future case annual collision frequency levels pre and post wind farm for the Offshore Site are summarised in Table 15.1.

495. 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 Offshore Site for the base case and future case are presented in Figure B.14.

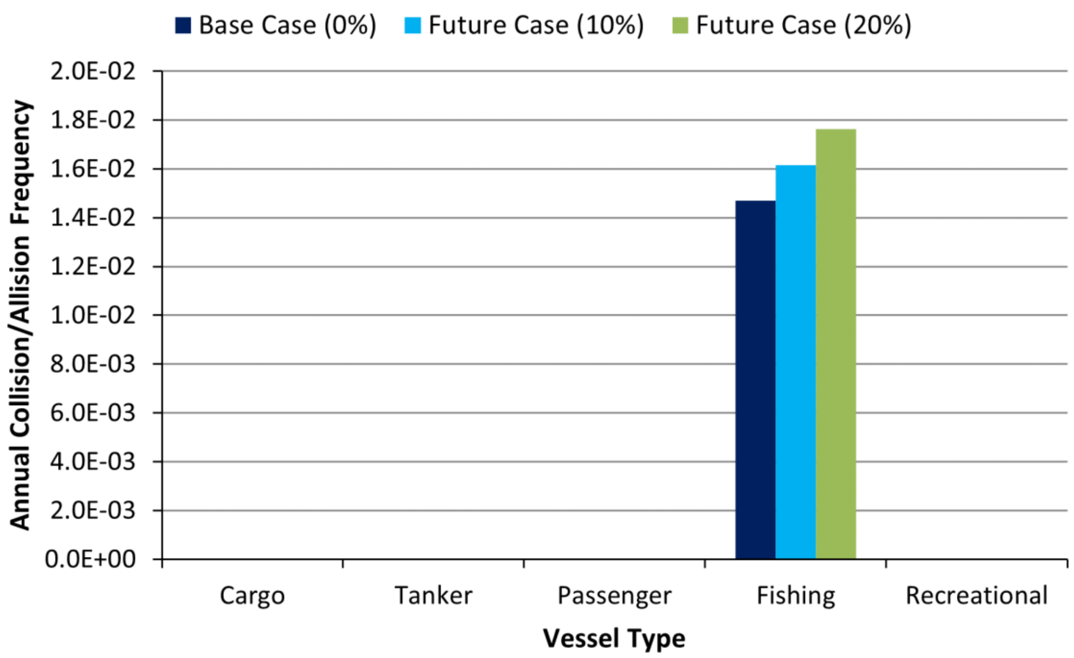


Figure B.14 Estimated Change in Annual Collision and Allision Frequency by Vessel Type

496. The change in collision and allision frequency is dominated by fishing vessels due to their active presence within and in proximity to the OAA and the conservative nature of Anatec's COLLRISK model for fishing vessel allisions. A minor effect of cargo vessels, tankers, passenger vessels, and recreational vessels was recorded; but these were noted as being negligible.

497. The second greatest collision and allision frequency change was associated with cargo vessels but was significantly lower than fishing vessels.

498. Combining the annual collision and allision frequency (see Table 15.1), estimated number of POB for each vessel type (see Table B.3) and the estimated fatality probability for each vessel type category (see Table B.4), the annual increase in PLL due to the presence of the Offshore Site for the base case is estimated to be 9.86×10^{-5}, equating to one additional fatality every 10,139 years.

499. The estimated incremental increases in PLL due to the Offshore Site, distributed by vessel type and for the base case and future case, are presented in Figure B.15.

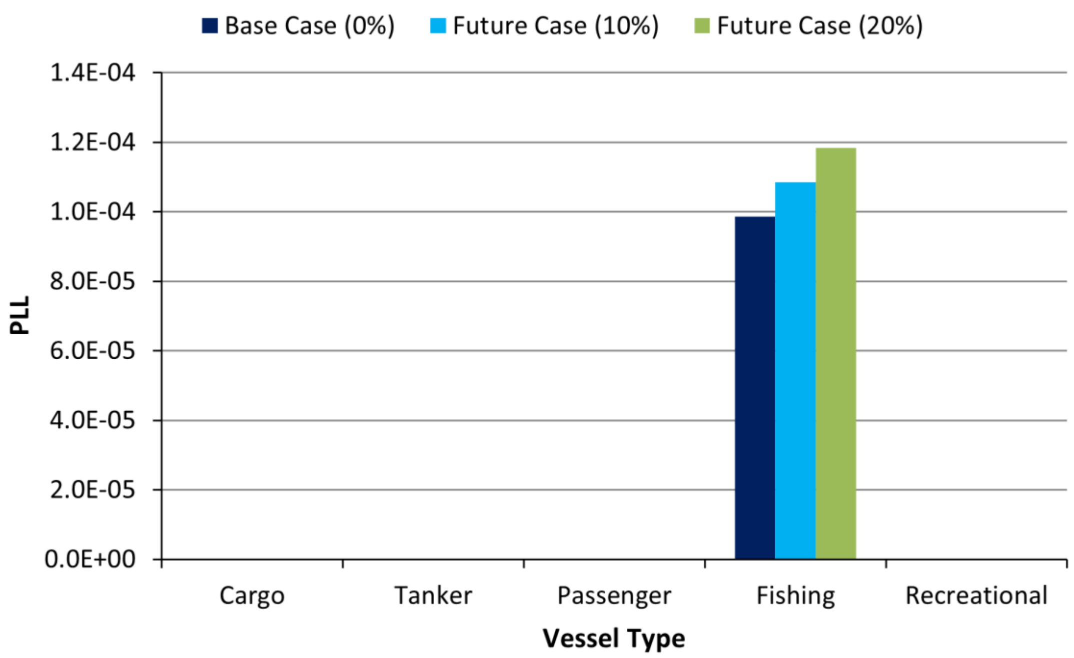


Figure B.15 Estimated Change in Annual PLL by Vessel Type

500. 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. As with the allision and collision increases, the effect from other vessel types was present but negligible.

501. The second greatest annual PLL change was associated with recreational vessels. Converting the PLL to individual risk based upon the average number of people exposed by vessel type, the results are presented in Figure B.16.

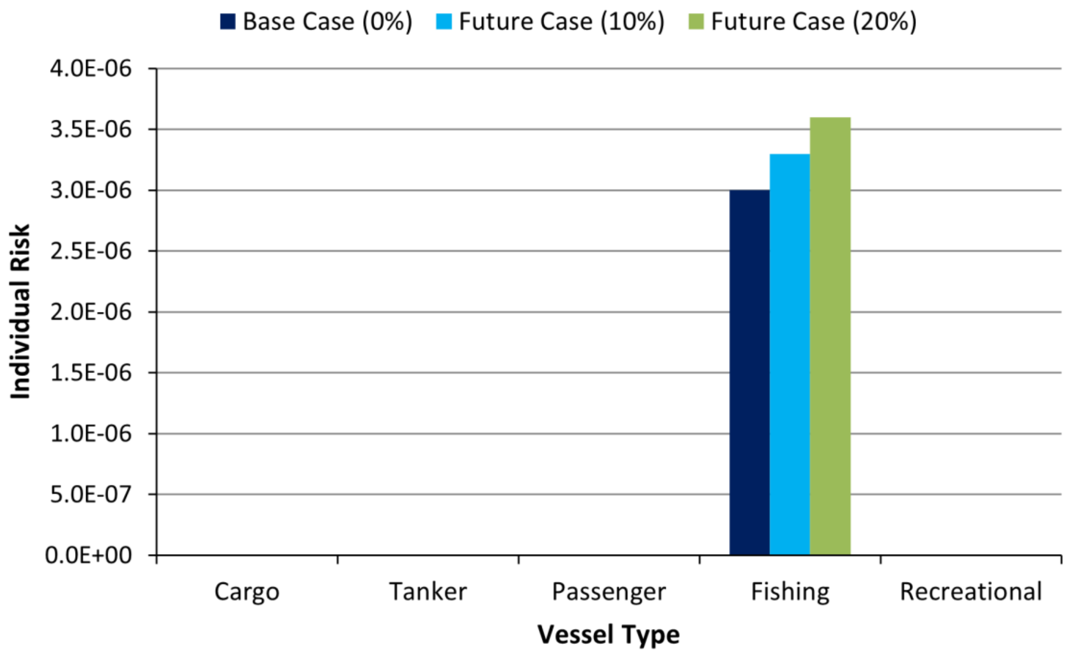


Figure B.16 Estimated Change in Individual Risk by Vessel Type

502. The change in individual risk to people is dominated by fishing vessels, again reflecting the higher probability of a fatality occurring in the event of an incident involving a fishing vessel compared to other vessel types, which were noted to be negligible.

503. The second greatest individual risk change was associated with recreational vessels.

B.3.4 Significance of Increase in Fatality Risk

504. 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 10,139 years represents a small change.

505. In terms of individual risk to people, the change for commercial vessels attributed to the Offshore Site is negligible compared to the background risk level for the UK sea transport industry of 2.9×10^{-4} per year.

506. For fishing vessels, the change in individual risk attributed to the Offshore Site (approximately 3.00×10^{-6} 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.4 Pollution Risk

B.4.1 Historical Analysis

507. 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).

508. Two types of oil spill are considered in this assessment:

- Fuel oil spills from bunkers (all vessel types); and
- Cargo oil spills (laden tankers).

509. The research undertaken as part of the UK 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.17.

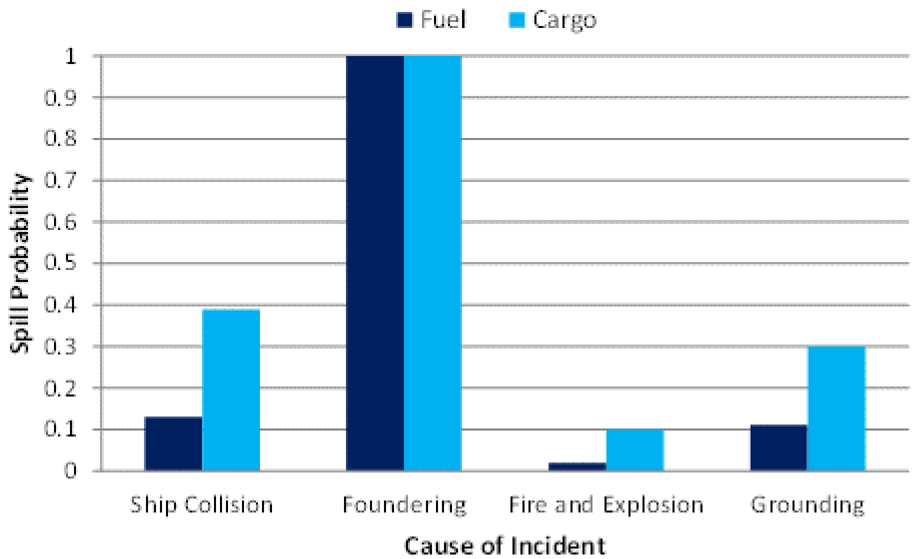


Figure B.17 Probability of an Oil Spill Resulting from an Accident

510. 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.

511. 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.

512. For the types and sizes of vessels exposed to the Offshore Site, an average spill size of 100 tonnes of fuel oil is considered a conservative assumption.

513. 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.

514. Based upon this data and the tankers transiting in proximity to the Offshore Site, an average spill size of 400 tonnes is considered a conservative assumption.

515. 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.4.2 Pollution Risk due to the Offshore Site

516. Applying the above probabilities to the annual collision and allision frequency by vessel type presented in Figure B.17 and the average spill size per vessel, the average amount of oil spilled per year due to the impact of the Offshore Site is estimated to be 0.037 tonnes per year for the base case, rising to 0.044 tonnes for the 20% future case.

517. The estimated increase in tonnes of oil spilled, distributed by vessel type, for the base case and future case are presented in Figure B.18.

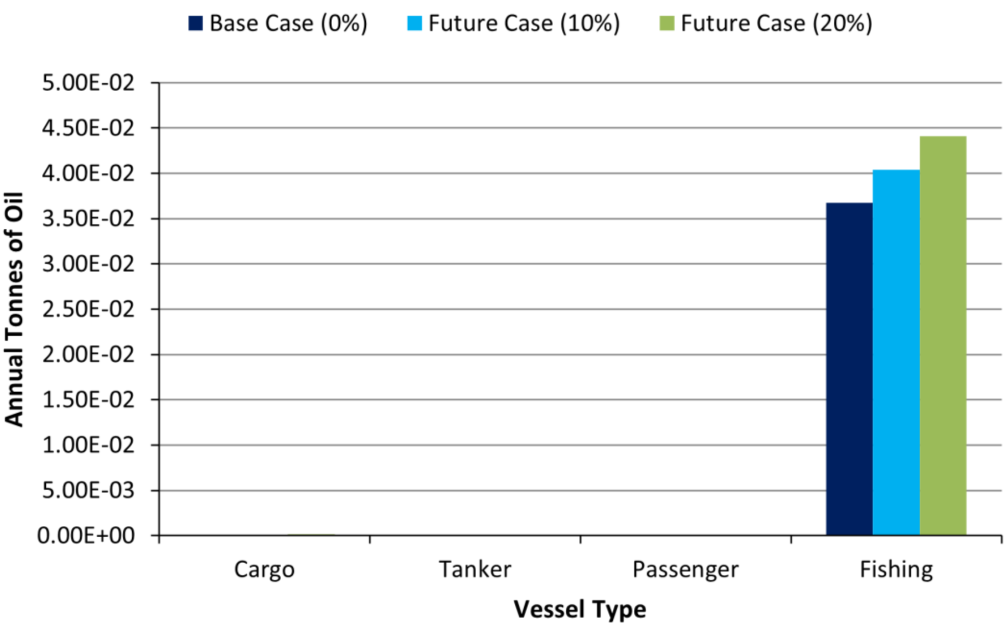


Figure B.18 Estimated Change in Pollution by Vessel Type

518. The annual oil spill results are dominated by fishing vessels due to their high associated annual collision and allision frequency. The increase in pollution from other vessel types was negligible.

B.4.3 Significance of Increase in Pollution Risk

519. To assess the significance of the increased pollution risk from vessels caused by the Offshore Site, historical oil spill data for the UK has been used as a benchmark.

520. 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%.

521. The overall increase in pollution estimated due to the Offshore Site of 0.037 tonnes for the base case represents a negligible increase compared to the historical average pollution quantities from maritime incidents in UK waters. This may also be conservative given the potential for future changes towards less polluting vessel fuels.

B.5 Conclusion

522. This appendix has quantitively assessed the fatality and pollution risk associated with the Offshore Site 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.

523. Overall, the impact of the Offshore Site 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 Irish Sea.

524. Discussion of relevant mitigation measures and monitoring is provided in Section 17.

Appendix C Regular Operator Consultation

525. As part of the consultation process for the Project, Regular Operators identified (from the vessel traffic surveys and long-term vessel traffic data) that would be required to deviate their routes due to the presence of the OAA were consulted via email. An example of the correspondence sent to the Regular Operators (which shows the extent of the OAA and OECC at that time) is presented below.

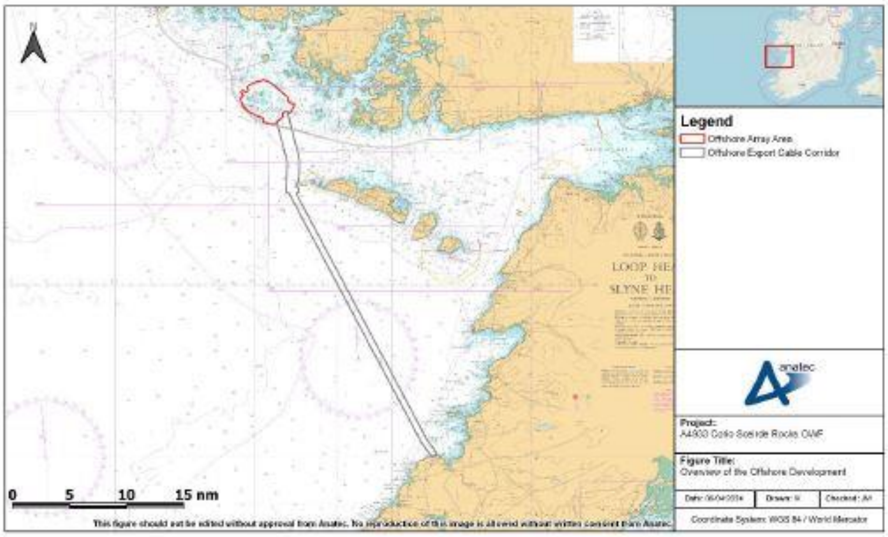
Anatec Ltd.
Cain House
10 Exchange Street
Aberdeen AB11 6PH
Tel: 01224 253700
Email: aberdeen@anatec.com
Web: www.anatec.com

Date: 19th of April 2024

Opportunity to Participate in Consultation Relating to Shipping and Navigation for the Proposed Sceirde Rocks Windfarm

Dear Sir/Madam,

As you may be aware, the Sceirde Rocks Windfarm (the 'Offshore Development') is being developed by Corio Generation off the western coast of Ireland. This will consist of 30 Wind Turbine Generators (WTG) and one Offshore Substation (OSS), as well as export cables to shore and an onshore grid connection with landfall at Doonbeg. The location and proximity of the Offshore Development to the Irish coast is presented below.



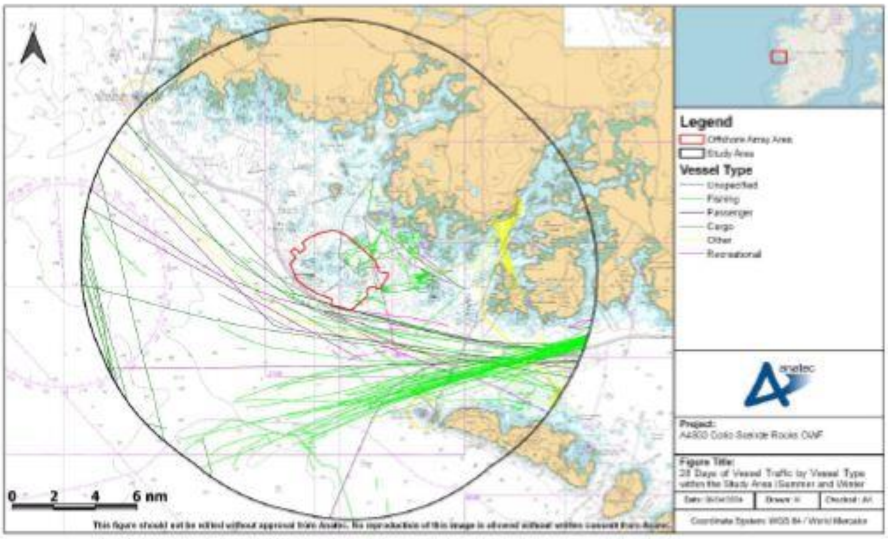
The Offshore Development is located approximately 2.6NM (4.8km) off the Galway coast and covers an area of approximately 11NM^2 (38km^2).

Further information about the Offshore Development can be found here.

Anatec Ltd. has been contracted by Corio Generation to provide baseline information and technical support on shipping and navigation during the consent process, and to co-ordinate consultation with stakeholders.

Page 1

The Environmental Impact Assessment (EIA) Report process requires Corio Generation to identify impacts that the Offshore Development may potentially have upon shipping and navigation, and to ensure comprehensive consultation with relevant stakeholders is carried out. In order to analyse shipping movements within, and in the vicinity of, the Offshore Array Area, Automatic Identification System (AIS) and Radar data, along with visual observations obtained from shore-based surveys undertaken in summer and winter 2022, has been collected and assessed. All data will feed into the Navigational Risk Assessment (NRA). The 28 days of vessel traffic data collected within a ten nautical mile buffer of the Offshore Array Area has been colour-coded by vessel type and presented below.



According to the assessment of the available datasets, your company's vessel(s) navigates within, and/or in the vicinity of, the Offshore Array Area. Consequently, your company has been identified as a potential stakeholder for the Offshore Development and we are writing to you on behalf of Corio Generation to request your comments, which will help inform the proposed development. We invite your feedback on the Offshore Development, including any impact it may have upon the navigation of your vessels.

In particular, we are interested in receiving comments on the following:

1. Whether the proposal to construct the Offshore Development is likely to impact the routeing of any specific vessels, including how it might impact your transits;
2. Whether any aspect of the Offshore Development poses any safety concerns to your vessels, including in adverse weather conditions;
3. Whether you would choose to make passage internally through the Offshore Array Area; and
4. Whether you wish to be retained on our list of marine stakeholders and consulted throughout the assessment process.

Additionally, we wish to invite you to attend a shipping and navigation Hazard Workshop which will provide further input to the Navigational Risk Assessment (NRA) for the Offshore

Development which Anatec are undertaking. Further details on timing for this workshop will follow (noting it will be held virtually via Microsoft Teams on Wednesday the 1st of May).

We would appreciate if any responses are provided via email to [redacted] by Friday the 10th of May, as well as an indication of whether you are interested in attending the Hazard Workshop noted above.

Yours sincerely,
[redacted]

Lead Risk Analyst
Anatec Ltd.

Appendix D Hazard Log

526. The complete hazard log, produced following the Hazard Workshop held on 1st May 2024, is presented below.

User	Phase (C/O/D)	Embedded Mitigation Measures (Full Descriptions Provided in Separate Sheet)	Possible Causes	Most Likely Consequences	Realistic Most Likely Consequences							Worst Case Consequences	Realistic Worst Case Consequences							Additional Comments and Further Mitigation Required
						Consequences								Consequences						
					Frequency	People	Environment	Property	Business	Average Consequence	Risk		Frequency	People	Environment	Property	Business	Average Consequence	Risk	
Vessel Displacement for Third-Party Vessels (Including Adverse Weather Routeing)																				
Commercial vessels	C/D	• Advisory passing distances • Charting of infrastructure • Compliance with MGN 654 (noting draft DoT guidance) • Lighting and marking including buoyed construction/ decommissioning area • Promulgation of information	• Presence of buoyed construction/ decommissioning area • Adverse weather • Construction/ decommissioning vessels which are RAM	Displacement with manageable effects on schedule but no safety risks	5	1	1	1	1	1.0	Tolerable with Mitigation	Displacement with effects on schedule and vessel stability in adverse weather	1	2	2	1	3	2.0	Broadly Acceptable	The Port of Galway noted that the proposed expansion of the port will result in changes to vessel numbers and sizes.
	O	• Advisory passing distances • Charting of infrastructure • Compliance with MGN 654 (noting draft DoT guidance) • Lighting and marking • Promulgation of information	• Presence of surface structures • Adverse weather • Maintenance vessels which are RAM		5	1	1	1	1	1.0	Tolerable with Mitigation		1	2	2	1	3	2.0	Broadly Acceptable	
Commercial fishing vessels in transit	C/D	• Advisory passing distances • Charting of infrastructure • Compliance with MGN 654 (noting draft DoT guidance) • Lighting and marking including buoyed construction/ decommissioning area • Promulgation of information	• Presence of buoyed construction/ decommissioning area • Adverse weather • Construction/ decommissioning vessels which are RAM	Displacement with manageable effects on schedule but no safety risks	5	1	1	1	1	1.0	Tolerable with Mitigation	Displacement with effects on schedule	2	1	2	1	3	1.8	Broadly Acceptable	The majority of fishing vessels in the OAA are typically engaged in active fishing as opposed to transit. The Port of Galway noted that during installation of the subsea cables there may be navigational safety risk for fishing vessels but this would no longer be the case post installation.
	O	• Advisory passing distances • Charting of infrastructure • Compliance with MGN 654 (noting draft DoT guidance) • Lighting and marking • Promulgation of information	• Presence of surface structures • Adverse weather • Maintenance vessels which are RAM		5	1	1	1	1	1.0	Tolerable with Mitigation		2	1	2	1	3	1.8	Broadly Acceptable	
Recreational vessels (2.5 to 24 m length)	C/D	• Advisory passing distances • Charting of infrastructure • Compliance with MGN 654 (noting draft DoT guidance) • Lighting and marking including buoyed construction/ decommissioning area • Promulgation of information	• Presence of buoyed construction/ decommissioning area • Adverse weather • Construction/ decommissioning vessels which are RAM	Displacement with manageable effects on schedule but no safety risks	4	1	1	1	1	1.0	Broadly Acceptable	Displacement with effects on schedule	1	1	1	1	2	1.3	Broadly Acceptable	
	O	• Advisory passing distances • Charting of infrastructure • Compliance with MGN 654 (noting draft DoT guidance) • Lighting and marking • Promulgation of information	• Presence of surface structures • Adverse weather • Maintenance vessels which are RAM		4	1	1	1	1	1.0	Broadly Acceptable		1	1	1	1	2	1.3	Broadly Acceptable	

User	Phase (C/O/D)	Embedded Mitigation Measures (Full Descriptions Provided in Separate Sheet)	Possible Causes	Most Likely Consequences	Realistic Most Likely Consequences							Worst Case Consequences	Realistic Worst Case Consequences							Additional Comments and Further Mitigation Required
						Consequences								Consequences						
					Frequency	People	Environment	Property	Business	Average Consequence	Risk		Frequency	People	Environment	Property	Business	Average Consequence	Risk	
Increased Vessel to Vessel Collision Risk Between Third-Party Vessels																				
Commercial vessels	C/D	• Advisory passing distances • Buoyed construction/ decommissioning area • Charting of infrastructure • Compliance with MGN 654 (noting draft DoT guidance) • Guard vessels • Lighting and marking including buoyed construction/ decommissioning area • Pollution planning • Promulgation of information	• Presence of buoyed construction/ decommissioning area • Adverse weather • Construction/ decommissioning vessels which are RAM	Displacement results in increased encounters and potential for low impact collision to occur	2	2	2	3	3	2.5	Broadly Acceptable	Displacement results in increased encounters and high impact collision occurs involving vessel damage, PLL, and/or pollution	1	3	3	4	4	3.5	Broadly Acceptable	The Port of Galway noted that the proposed expansion of the port will result in changes to vessel numbers and sizes.
	O	• Advisory passing distances • Charting of infrastructure • Compliance with MGN 654 (noting draft DoT guidance) • Guard vessels • Lighting and marking • Pollution planning • Promulgation of information	• Presence of surface structures • Adverse weather • Maintenance vessels which are RAM		2	2	2	3	3	2.5	Broadly Acceptable		1	3	3	4	4	3.5	Broadly Acceptable	
Commercial fishing vessels in transit	C/D	• Advisory passing distances • Buoyed construction/ decommissioning area • Charting of infrastructure • Compliance with MGN 654 (noting draft DoT guidance) • Guard vessels • Lighting and marking including buoyed construction/ decommissioning area • Pollution planning • Promulgation of information	• Presence of buoyed construction/ decommissioning area • Adverse weather • Construction/ decommissioning vessels which are RAM	Displacement results in increased encounters and potential for low impact collision to occur	2	3	2	3	2	2.5	Broadly Acceptable	Displacement results in increased encounters and high impact collision occurs involving vessel damage, PLL, and/or pollution	1	4	3	4	3	3.5	Broadly Acceptable	The majority of fishing vessels in the OAA are typically engaged in active fishing as opposed to transit. The Port of Galway noted that during installation of the subsea cables there may be navigational safety risk for fishing vessels but this would no longer be the case post installation.
	O	• Advisory passing distances• Charting of infrastructure• Compliance with MGN 654 (noting draft DoT guidance)• Guard vessels• Lighting and marking• Pollution planning• Promulgation of information	• Presence of surface structures• Adverse weather• Maintenance vessels which are RAM		1	3	2	3	2	2.5	Broadly Acceptable		1	4	3	4	3	3.5	Broadly Acceptable	

User	Phase (C/O/D)	Embedded Mitigation Measures (Full Descriptions Provided in Separate Sheet)	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	Additional Comments and Further Mitigation Required
Recreational vessels (2.5 to 24 m length)	C/D	• Advisory passing distances • Buoyed construction/ decommissioning area • Charting of infrastructure • Compliance with MGN 654 (noting draft DoT guidance) • Guard vessels • Lighting and marking including buoyed construction/ decommissioning area • Pollution planning • Promulgation of information	• Presence of buoyed construction/ decommissioning area • Adverse weather • Construction/ decommissioning vessels which are RAM	Displacement results in increased encounters and potential for low impact collision to occur	2	3	1	3	2	2.3	Broadly Acceptable	Displacement results in increased encounters and high impact collision occurs involving vessel damage, PLL, and/or pollution	1	4	2	4	2	3.0	Broadly Acceptable	
	O	• Advisory passing distances • Charting of infrastructure • Compliance with MGN 654 (noting draft DoT guidance) • Guard vessels • Lighting and marking • Pollution planning • Promulgation of information	• Presence of surface structures • Adverse weather • Maintenance vessels which are RAM		1	3	1	3	2	2.3	Broadly Acceptable		1	4	2	4	2	3.0	Broadly Acceptable	
Increased Vessel to Vessel Collision Risk Between a Third-Party Vessel and a Project Vessel																				
Commercial vessels	C/D	• Advisory passing distances • Buoyed construction/ decommissioning area • Charting of infrastructure • Guard vessels • Marine coordination for Project vessels • Pollution planning • Project vessel compliance with international marine regulations (COLREGs) • Promulgation of information	• Project vessels in transit • Lack of third-party awareness	Increased encounters resulting in increased alertness but no safety risks	2	1	1	1	2	1.3	Broadly Acceptable	Collision event occurs involving vessel damage, PLL, and/or pollution	1	3	3	4	4	3.5	Broadly Acceptable	The Port of Galway noted that the proposed expansion of the port will result in changes to vessel numbers and sizes.
	O				2	1	1	1	2	1.3	Broadly Acceptable		1	3	3	4	4	3.5	Broadly Acceptable	
Commercial fishing vessels in transit	C/D	• Advisory passing distances • Buoyed construction/ decommissioning area • Charting of infrastructure • Guard vessels • Marine coordination for Project vessels • Pollution planning • Project vessel compliance with international marine regulations (COLREGs) • Promulgation of information	• Project vessels in transit • Lack of third-party awareness	Increased encounters resulting in increased alertness but no safety risks	3	1	1	1	1	1.0	Broadly Acceptable	Collision event occurs involving vessel damage, PLL, and/or pollution	2	4	3	4	3	3.5	Broadly Acceptable	The Port of Galway noted that during installation of the subsea cables there may be navigational safety risk for fishing vessels but this would no longer be the case post installation.
	O				3	1	1	1	1	1.0	Broadly Acceptable		2	4	3	4	3	3.5	Broadly Acceptable	
Recreational vessels (2.5 to 24 m length)	C/D	• Advisory passing distances • Buoyed construction/ decommissioning area • Charting of infrastructure • Guard vessels • Marine coordination for Project vessels	• Project vessels in transit • Lack of third-party awareness	Increased encounters resulting in increased alertness but no safety risks	2	1	1	1	1	1.0	Broadly Acceptable	Collision event occurs involving vessel damage, PLL, and/or pollution	1	4	2	4	2	3.0	Broadly Acceptable	

User	Phase (C/O/D)	Embedded Mitigation Measures (Full Descriptions Provided in Separate Sheet)	Possible Causes	Most Likely Consequences	Realistic Most Likely Consequences							Worst Case Consequences	Realistic Worst Case Consequences							Additional Comments and Further Mitigation Required
						Consequences								Consequences						
					Frequency	People	Environment	Property	Business	Average Consequence	Risk		Frequency	People	Environment	Property	Business	Average Consequence	Risk	
	O	• Pollution planning • Project vessel compliance with international marine regulations (COLREGs) • Promulgation of information			2	1	1	1	1	1.0	Broadly Acceptable		1	4	2	4	2	3.0	Broadly Acceptable	
Reduced Access to Local Ports																				
Commercial vessels	C/D	• Advisory passing distances • Buoyed construction/ decommissioning area • Compliance with MGN 654 (noting draft DoT guidance) • Charting of infrastructure • Promulgation of information • Cable Burial Risk Assessment	• Presence of buoyed construction/ decommissioning area • Adverse weather • Construction/ decommissioning vessels which are RAM	Displacement with limited effects on port schedule	4	1	1	1	1	1.0	Broadly Acceptable	Displacement with effects on port schedule	1	1	3	1	3	2.0	Broadly Acceptable	The Port of Galway noted that the proposed expansion of the port will result in changes to vessel numbers and sizes, and the pilot boarding station will be moved further west.
	O	• Advisory passing distances • Compliance with MGN 654 (noting draft DoT guidance) • Charting of infrastructure • Promulgation of information • Cable Burial Risk Assessment	• Presence of surface structures • Adverse weather • Maintenance vessels which are RAM		4	1	1	1	1	1.0	Broadly Acceptable		1	1	3	1	3	2.0	Broadly Acceptable	
Commercial fishing vessels in transit	C/D	• Advisory passing distances • Buoyed construction/ decommissioning area • Compliance with MGN 654 (noting draft DoT guidance) • Charting of infrastructure • Promulgation of information • Cable Burial Risk Assessment	• Presence of buoyed construction/ decommissioning area • Adverse weather • Construction/ decommissioning vessels which are RAM	Displacement with limited effects on port schedule	4	1	1	1	1	1.0	Broadly Acceptable	Displacement with effects on port schedule	2	1	2	1	2	1.5	Broadly Acceptable	Assumes that Rossaveel will be used as the main port for construction and O&M.
	O	• Advisory passing distances• Compliance with MGN 654 (noting draft DoT guidance)• Charting of infrastructure• Promulgation of information• Cable Burial Risk Assessment	• Presence of surface structures• Adverse weather• Maintenance vessels which are RAM		4	1	1	1	1	1.0	Broadly Acceptable		2	1	2	1	2	1.5	Broadly Acceptable	
Recreational vessels (2.5 to 24 m length)	C/D	• Advisory passing distances • Buoyed construction/ decommissioning area • Compliance with MGN 654 (noting draft DoT guidance) • Charting of infrastructure • Promulgation of information • Cable Burial Risk Assessment	• Presence of buoyed construction/ decommissioning area • Adverse weather • Construction/ decommissioning vessels which are RAM	Displacement with limited effects on port schedule	3	1	1	1	1	1.0	Broadly Acceptable	Displacement with effects on port schedule	1	2	1	1	2	1.5	Broadly Acceptable	

User	Phase (C/O/D)	Embedded Mitigation Measures (Full Descriptions Provided in Separate Sheet)	Possible Causes	Most Likely Consequences	Realistic Most Likely Consequences							Worst Case Consequences	Realistic Worst Case Consequences							Additional Comments and Further Mitigation Required
					Frequency	Consequences: People	Environment	Property	Business	Average Consequence	Risk		Frequency	Consequences: People	Environment	Property	Business	Average Consequence	Risk	
	O	• Advisory passing distances • Compliance with MGN 654 (noting draft DoT guidance) • Charting of infrastructure • Promulgation of information • Cable Burial Risk Assessment	• Presence of surface structures • Adverse weather • Maintenance vessels which are RAM		3	1	1	1	1	1.0	Broadly Acceptable		1	2	1	1	2	1.5	Broadly Acceptable	
Creation of Vessel to Structure Allision Risk (Including Powered, Drifting and Internal)																				
Commercial vessels	O	• Advisory passing distances • Charting of infrastructure • Compliance with MGN 654 (noting draft DoT guidance) • Lighting and marking • Marine coordination for Project vessels • Pollution planning • Project vessel compliance with international marine regulations (SOLAS) • Promulgation of information	• Presence of surface structures • Human/navigation 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 with a structure involving vessel damage, PLL, and/or pollution	2	3	3	4	5	3.8	Broadly Acceptable	
Commercial fishing vessels in transit	O	• Advisory passing distances • Charting of infrastructure • Compliance with MGN 654 (noting draft DoT guidance) • Lighting and marking • Marine coordination for Project vessels • Pollution planning • Project vessel compliance with international marine regulations (SOLAS) • Promulgation of information	• Presence of surface structures • Human/navigation 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 with a structure involving vessel damage, PLL, and/or pollution	2	4	3	4	4	3.8	Broadly Acceptable	
Recreational vessels (2.5 to 24 m length)	O	• Advisory passing distances • Charting of infrastructure • Compliance with MGN 654 (noting draft DoT guidance) • Lighting and marking • Marine coordination for Project vessels • Minimum blade tip clearance • Pollution planning • Project vessel compliance with international marine regulations (SOLAS) • Promulgation of information	• Presence of surface structures • Human/navigation 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 with a structure involving vessel damage, PLL, and/or pollution	1	4	2	4	2	3.0	Broadly Acceptable	

User	Phase (C/O/D)	Embedded Mitigation Measures (Full Descriptions Provided in Separate Sheet)	Possible Causes	Most Likely Consequences	Realistic Most Likely Consequences							Worst Case Consequences	Realistic Worst Case Consequences							Additional Comments and Further Mitigation Required
						Consequences								Consequences						
					Frequency	People	Environment	Property	Business	Average Consequence	Risk		Frequency	People	Environment	Property	Business	Average Consequence	Risk	
Reduction of Under-Keel Clearance Due to Cable Protection																				
All vessels	O	• Guard vessels • Implementation and monitoring of cable protection • Pollution planning	• Reduced depth due to cable protection	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, pollution (including spillage of potentially hazardous cargo)	1	3	3	4	4	3.5	Broadly Acceptable	
Anchor Interaction with Subsea Cables																				
All vessels	O	• Charting of infrastructure • Compliance with MGN 654 (noting draft DoT guidance) • Implementation and monitoring of cable protection • Promulgation of information	• Presence of subsea cables • Human/navigation error • Mechanical/technical failure • Adverse weather	Commercial vessel drops or drag anchor in vicinity of an installed cable but no interaction occurs	2	1	1	1	1	1.0	Broadly Acceptable	Vessel anchors on or drags anchor over a cable/protection resulting in damage to the cable/protection and/or anchor	1	1	1	3	2	1.8	Broadly Acceptable	The Port of Galway noted that the proposed expansion of the port will allow cruise liners to moor at the port rather than anchoring further offshore.
Interference with Marine Navigation, Communication and Position Fixing Equipment																				
All vessels	O	• Implementation and monitoring of cable protection	• Human error relating to adjustment of Radar controls • Presence of surface structures • EMF from cables	Structures and cables have no material effect upon the Radar, communications and navigation equipment on a vessel	3	1	1	1	1	1.0	Broadly Acceptable	Minor level of Radar interference due to the structures or minor level of EMF interference due to the cables	2	1	1	1	1	1.0	Broadly Acceptable	
Reduction in Emergency Response Capability (Including SAR Access)																				
Emergency responders	O	• Compliance with MGN 654 (noting draft DoT guidance) • Lighting and marking • Marine coordination for Project vessels • Pollution planning • Project vessel compliance with international marine regulations (SOLAS)	• Array does not facilitate responder access • Limited resource capability • Adverse weather	Delay to response request	2	1	1	1	2	1.3	Broadly Acceptable	Delay to response request resulting from incident within the OAA leading to vessel damage, injury to person, PLL, and/or pollution	4	5	3	5	4	4.3	Unacceptable	With the findings of Appendix E: Safety Justification, the frequency is considered to be remote (rank 3) resulting in the residual significance of risk being Tolerable with Mitigation (ALARP).

Appendix E Navigation Risk Assessment Annex

Sceirde Rocks Wind Farm Navigation Risk Assessment Annex

09/12/2024

Doc No. 0468

Rev. 05-00

FEIRM GHAOITHE CHARRAIGEACHA SCEIRDE
Sceirde Rocks Windfarm

FUINNEAMH SCEIRDE TEO

Company:	NASH Maritime	**Asset:**	
Project:	Sceirde Rocks Windfarm	**Sub Project/Package:**	
Document Title:	Sceirde Rocks Navigation Risk Assessment		
Document Number:	0468	**Contractor Ref:**	

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Rev Number	Date	Status/Reason for Changing	Author	Checked by	Approved by
01-00	21/06/24	First draft for review	MS	AR	AR
02-00	23/10/24	Updated	ES	AR	AR
03-00	22/11/24	Updated	ES	AR	AR
04-00	06/12/24	Updated	ES	AR	AR
05-00	09/12/24	Updated	ES	AR	AR

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Contents

1. Introduction

1.1 Project Overview

The Sceirde Rocks Offshore Wind Farm Project (hereinafter referred to as “the Project”), is located off the Connemara coast in County Galway. The Project consists of 30 offshore wind turbine generators (WTGs) with a total export capacity of 450 megawatts (MW). Each turbine has a total tip height of 324.9 metres (m), a rotor diameter of 292 m, and a hub height of 178.9 m above Lowest Astronomical Tide (LAT). The turbines will be installed on gravity-based fixed bottom foundations. The Project also includes a 220 kilovolts (kV) offshore substation (OSS) and an offshore grid connection cable with landfall at Killard, County Clare. The substation footprint will be ca 58.5 m by 42.5 m with a height above LAT of 55 m (including cranes). Additionally, an onshore grid connection cable will extend from the landfall to the Moneypoint substation. **Figure 1** shows the Project’s boundary and layout, with the location of the 30 WTGs and the substation, as well as a study area boundary.

1.2 Project Need

There is a clear need for increased offshore renewables in Ireland driven by the need for climate action. According to Met Éireann’s Annual Climate Statement for 2023, 2023 was Ireland’s warmest year on record, with above average rainfall. The energy sector is one of the main generators of greenhouse gas and consequently a significant cause of climate change and global warming. Offshore wind energy will play a key role in achieving national renewable energy and decarbonisation targets. An overall energy target of at least 42.5% binding at European Union (EU) level by 2030 was set by the Revised Renewable Energy Directive in November 2023 (EU, 2009), and the Department of the Environment, Climate and Communications (DECC)’s *Climate Action Plan* (CAP) 2024 targets 80% renewable electricity in Ireland by 2030 (DECC, 2023). Given that the demand for energy is increasing across all sectors in Ireland, these demands need to be offset by electricity generated from renewable sources and other key national plans (such as the Department of Housing, Local Government and Heritage (DHLGH)’s National Planning Framework and the Government of Ireland (GoI)’s National Development Plan 2018-2027) are calling for increased electrification of the heat and transport sectors (DHLGH, 2018 & GoI, 2019). Decarbonising Ireland’s electricity generation would strengthen Ireland’s sustainable development performance, in line with the United Nations Sustainable Development Goals – particularly Goal 7 (Affordable and Clean Energy) and Goal 13 (Climate Action) (UN, 2015), inevitably leading to improved environmental and societal wellbeing.

The development of the Project will also help Ireland meet national targets set by the government. A national target of at least 5 GW (i.e. 5,000 MW) of offshore wind energy by 2030 in the CAP (DECC, 2023), of which, at present, there are just 25 MW being generated in Ireland. Hence, in proposing to generate 450 MW, which would represent approximately 9 % of the 5 GW of offshore wind energy objective, the Project can help enable the achievement of the national target when operational.

The Project can also aid Ireland in its development of energy security. While the importance of energy security has long been understood at EU and national levels, recent events (including the Covid-19 pandemic and the Russian invasion of Ukraine) have reinforced the risks inherent in long supply chains and dependence upon other states for energy sources. The DECC published *Energy Security in Ireland to 2030* in November 2023 which notes that Ireland is currently one of the most energy import dependent countries in the EU, having imported 77% of its energy supply in 2021 (DECC, 2023). As a result, by investing in multiple renewable energy sources (including offshore wind), Ireland will reduce its dependence on imported fossil fuels and, consequently, its vulnerability to energy shocks.

Moreover, from an economic perspective, offshore wind farms (including the Project) can benefit Ireland’s economy in multiple ways: broadly, through the provision of clean, reliable, cost-effective energy and a reduction in the need to import fossil fuels; and directly, through employment generation at construction, operational and maintenance, and decommissioning phases, while also generating indirect and induced employment. The EU Blue Economy Report 2023 (European Commission (EC), 2023) identifies marine renewable energy (offshore wind) development to be an established sector in Europe since 2021 and an increasingly important area for employment, gross value addition, gross profit, net investment in tangible good and turnover.

1.3 Aims and Objectives

Overall, offshore wind energy development therefore has a critical role to play in contributing to national and EU targets, with the Project capable of delivering 450 MW of offshore wind energy for Ireland. There is, however, an obligation for OWFs to be developed in a manner that is consistent with SAR. The draft guidance produced by the Department for Transport (DoT) "Marine Navigational Safety & Emergency Response Risk of Offshore Renewable Energy Installations (OREI)" (DoT, 2023a) and "Standard Operating Procedure 07-2023: OREI: Guidance and Operational Considerations for Search and Rescue (SAR) and Emergency Response" (DoT, 2023b) state that *"OREI structures (turbines, substations, platforms, and any other structure within the OREI site) that are aligned in straight rows and columns are considered the safest layout arrangement by Irish navigation stakeholders and IRCG contracted SAR helicopter pilots."*

It is recognised that the layout presented in **Figure 1** does not consist of such a grid system, due to significant constraints within the Project boundary (see **Section 3**). The purpose of this NRA Annex is to explore how the proposed Project layout could meet many of the underlying principles of the Irish and international SAR guidance for OREIs described in **Section 2** and whether the risk to SAR operations is manageable. The assessment will also consider what the likelihood is of an incident occurring which necessitates a SAR response. Consultation with the Irish Coastguard (IRCG) has been undertaken on this, including meetings on 11 April 2024 and the 19 July 2024. The Project has committed to engaging with the IRCG to ensure that the Project satisfies their requirements and would not compromise the safety and efficiency of SAR operations.

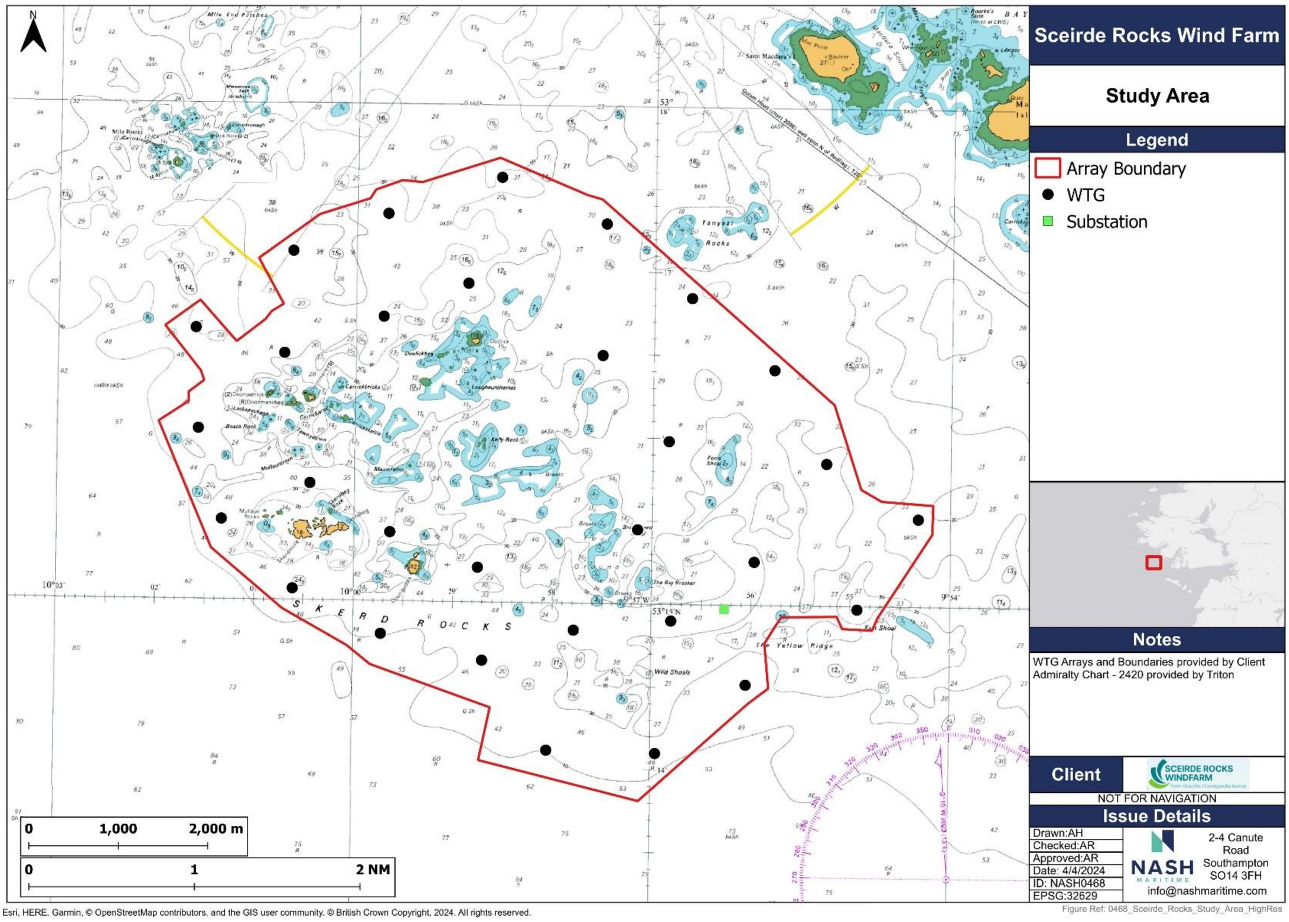

Figure 1: Study area boundary and location of the 30 WTGs and substation.

1.4 Statement of Expertise

This NRA Annex has been prepared by NASH Maritime Ltd, specialists in shipping, navigation and maritime risk. The multi-disciplinary team have worked in the maritime, ports and offshore renewable energy sectors, understanding the value of risk-based decision-making and taking an active role in driving new approaches to safety and cost reduction. NASH Maritime has extensive experience throughout the world in conducting Navigation Risk Assessments (NRAs) for offshore wind farms.

Peter Lloyd MBE FRAeS MBA MA spent a working career spanning two diverse professions with surprising parallels requiring similar competences and capabilities. The first career was built around military service as an officer in the Royal Air Force, with a core activity as a helicopter pilot, instructor, commander and staff officer delivering aviation Search and Rescue (SAR) (1979-2011). Away from SAR, periods were spent establishing a helicopter training school, supporting UK industry within defence exports and actively involved in overseas defence conflicts. A second career in the renewable wind industry was focused on health, safety, security, environmental protection and training (2011-2024). Specialising in risk management, as applied to the operation and maintenance of wind turbines both on and offshore; becoming the industry leader in offshore emergency response from wind farms, an activity that bridged both careers. Latterly, activity has been dedicated in sharing knowledge and experiences as a volunteer with the Royal National Lifeboat Institution and as a director of SAR with an exciting start-up company, Zelim PLC.

Peter was instigator and Chair of the UK's Offshore Renewable Energy Emergency Forum (OREEF), contributor to the G+ Good Practice Guidelines on Integrated Offshore Emergency Response and had a key role in the drafting and development of the UK's guidance on SAR in OWFS (MGN654).

Dr Andrew Rawson PhD BA (Hons) FRGS CMarEng MIMarEST is a maritime consultant with more than 14 years of experience, specialising in data analysis, modelling and NRAs. He has worked on a multitude of projects for developers, ports and governments as a project manager or technical lead. His specialism lies in developing and applying innovative quantitative methods to measure the risk of maritime accidents and predict the impact of developments such as offshore renewables. Andrew has an extensive track record in authoring NRAs, EIA technical chapters, quantitative risk assessments (QRAs) and providing specialist technical advice to clients. Andrew has led the development of scientific approaches to navigation risk, with numerous peer-reviewed academic publications in high-impact journals. In 2022, Andrew was awarded a PhD from the University of Southampton investigating the use of machine learning and big data to support maritime risk assessment. In 2023, Andrew acted as Chair of the Technical Committee at the European, Safety and Reliability Conference (ESREL).

2. Guidance & Requirements for SAR Operations

2.1 Introduction

Offshore Wind Farms (OWFs) may pose navigational and operational challenges and risks to SAR, both helicopter and vessel based. SAR helicopters in particular have specific requirements to allow them to operate safely within and around OWFs where there are multiple tall structures with fast moving blades. These have been developed over decades of experience of constructing and operating OWFs, particularly in the United Kingdom.

2.2 Guidance Documents

The following guidance documents provide a baseline understanding of layout requirements for safe and efficient SAR operations:

- Draft Marine Navigational Safety & Emergency Response Risk of Offshore Renewable Energy Installations (OREI) (DoT, 2023a).
- Draft Standard Operating Procedure (SOP) 07-2023: Offshore Renewable Energy Installations (OREI): Guidance and Operational Considerations for SAR and Emergency Response (DoT, 2023b).
- MCA Offshore Renewable Energy Installations: Requirements, guidance and operational considerations for SAR and Emergency Response (MGN 654, MCA, 2024).
- Exercise Sancho Post Exercise Report (MCA, 2022).
- Maritime Coastguard Agency (MCA) report following aviation trials and exercises in relation to offshore windfarms (MCA, 2019).
- Report of helicopter SAR trials undertaken with Royal Air Force Valley “C” Flight 22 Squadron on March 22nd 2005 (MCA, 2005).
- International Aeronautical and Maritime Search and Rescue Manual (IAMSAR; Volume 3; 2016).
- G+ Integrated Offshore Emergency Response (G+ IOER) Good practice guidelines for offshore renewable energy developments (G+, 2023).
- Offshore Renewables Aviation Guidance (ORAG): Good Practice Guidelines for Offshore Renewable Energy Developments (RenewableUK, 2016).

Whilst the draft guidance for Ireland was released in 2024 by DoT (2023a; 2023b), as of October 2024 this has not yet been finalised. Therefore, reference to the MCA MGN654 guidance is made as during consultation for Phase 1 Projects the IRCG indicated that developers should base OWF SAR requirements on these principles.

2.3 Layout Principles

The collective guidance (DoT, 2023a; 2023b; MCA, 2024) describe a number of key principles for OWFs which are summarised below:

- OWF developers should start with a layout option featuring at least two consistent lines of orientation and refine it as appropriate for the project. Multiple lines of orientation allow multiple entry points and safer navigation for SAR aircraft.
- The layout should be as regular as possible, resembling a grid pattern, to benefit the safer navigation of surface rescue craft or helicopters both within and outside the wind farm. Straight alignment accommodates maritime search patterns which are generally composed of patterns of straight lines in accordance with international standard practices contained in the International Aviation and Maritime SAR Manual (IAMSAR) (ICAO and IMO, 2016).
- A SAR helicopter should be able to fly from one side of an OWF to the other to either conduct searches amongst turbines or to access a location or turbine within the field, from low altitude.

- The paths through an OREI are termed SAR access lanes and there shall be no OREIs or other structures in the OWF or on the boundary that present an obstacle or risk to SAR helicopters flying along such SAR access lanes.
- SAR lanes should align with the lines of orientation, providing straight corridors between OREIs, and their details should be included in the Emergency Response Cooperation Plan (ERCoP). SAR aircraft typically navigate to pre-determined access points before transiting along the lanes and exiting into safe airspace or refuge areas.
- In situations where an aircraft captain relies solely on instruments to navigate through an OWF, the aircraft will not enter the wind farm if turbines are located less than 500 m apart between blade tips, unless the blades can be rotated away from the lane to increase the distance.
- Where the wind farm is large, more than 10 nm in any direction, a helicopter refuge area (HRA) may be necessary and designed for sufficient space which may allow the crew to reorientate themselves and to turn into before entering another SAR lane. HRAs are likely to need to exceed 1 nm.
- Non-linear OREI layouts may not provide an effective and safe search environment for SAR resources, as straight-line paths cannot be flown without encountering physical obstacles, which degrades search effectiveness and increases flight safety hazards. Non-linear layouts may also reduce the overall Probability of Detection (POD) during searches due to the inability to conduct searches at the optimal sweep width and track spacing, potentially requiring significantly more time and reducing the possible search area.
- The MGN654 guidance also notes "*Where a project proposed one line of orientation, this should be discussed with MCA (DoT) and a* <u>*safety justification*</u> *must be prepared to support this reduction and submitted to the MCA (DoT) for consideration*." "*The safety justification should build on work conducted as part of the Navigation Risk Assessment and the mitigations identified as part of that process. It should include a risk comparison between one and two (or more) lines of orientation, the reasons why two lines is not proposed and present sufficient information to enable the MCA (DoT) to adequately understand how the risks to navigation and SAR associated with the proposed layout have been reduced to ALARP*" (MCA, 2024).

2.4 Applicability of Guidance to Sceirde Rocks

Whilst it is noted that the aforementioned points are best practice, the guidance notes deviations and exceptions that can be implemented and that projects should be considered on a case-by-case basis. It is noted in the following sections that Sceirde Rocks is uniquely constrained by seabed conditions (see **Section 3**) and therefore what is best practice at other locations without such constraints could not be applied to this project whilst maintaining development viability.

MGN654 Annex 5 (MCA, 2024) also notes that the early generation of wind farms were small in both overall size, number of installed turbines and geographical coverage, and so SAR resources had little apparent difficulty in responding to incidents within or around them. Many of the key principles of the guidance have been developed to address SAR challenges at large scale OWFs >10 nm in width.

Given the Project's small size, it is anticipated that the equipment carried by SAR helicopters would be capable of achieving a good probability of detection of a casualty within the OWF without having to enter it. Sceirde Rocks is approximately 3.1 nm by 3.8 nm, and therefore the most likely initial response to an incident would be for a SAR helicopter to orbit the OWF to conduct an initial search. As described in IAMSAR (ICAO, 2016), a helicopter in good visibility (5 nm) and benign weather conditions (<15 kts and <1 m wave height) might detect a small boat (c.6 m) at a range of 2.5 nm, or a four person liferaft at 1.3 nm, both of which would therefore have a good likelihood of detection from outside the OWF. SAR helicopters are also equipped with radar and Forward Looking Infrared (FLIR) which can greatly increase detection range and coverage. The SAR helicopter may also use its equipment to look down each SAR lane using high zoom cameras to perform an initial search. However, in bad weather or for smaller targets, the SAR helicopter may be required to conduct a search within the OWF in which case the alignment of WTGs of the Project would facilitate this.

It should also be recognised that onshore wind farms, even in remote locations, are not required to have similar layout principles as described in **Section 2.3** and SAR in these locations is being appropriately managed.

Notwithstanding this, **Section 4** describes how the layout could enable safe and effective SAR access and therefore presents part of a safety justification as noted above in MGN654.

3. Layout Development

Designing an OWF necessitates balancing multiple, often competing constraints and requirements. The layout development process at Sceirde Rocks is particularly constrained due to the complex bathymetry of the location, coupled with:

- Infrastructure required to be located within Maritime Area Consent (MAC) boundary.
- Avoiding the numerous islands, shallow outcropping rocks and other complex bathymetric constraints which prevent installation of favourable foundation types.
- Avoiding other seabed features which prevent foundation installation.
- To reduce the risk of grounding for construction and maintenance vessels, WTGs/OSS must be at least 150 m from depths less than 12 m.
- To facilitate construction, slope constraints aim to keep the slope to less than 9 degrees (º) where possible, although localized areas of steeper slopes are acceptable if the overall area under the foundation meets the criterion.
- Sufficient searoom is required around the WTG/OSS for the mooring of construction vessels such as jackups or laying of cables.
- As per manufacture recommendations, spacing between WTGs should be at least 4.2 times the rotor diameter (292 m x 4.2 = 1,226 m) in order to minimise wake effects which might result in damage to WTGs and reduce yield. By increasing the spacing between WTGs in the prevailing direction, these impacts can be substantially reduced, but the small size of the Sceirde Rocks MAC minimises this opportunity. This prevented WTGs from being placed too close together to correct misalignments caused by other constraints. Alternatively, a slight “staggering” of WTG positions can reduce these effects as WTGs are not completely downwind of one another.
- Landscape and visual assessment to minimise impact on coastal viewpoints, noting the high sensitivity of this constraint given the significant proximity to the shore. This necessitated specific design and alignment of structures.
- Wind yield assessment to maximise generation capacity of the site.
- Need to maintain appropriate SAR access in compliance with the guidance described in **Section 2**.

To establish two lines of orientation with 4.2 times the rotor diameter spacing, the following layout would be required as shown in **Figure 2**. However, it is evident that such a layout would result in a large number of the WTGs in areas of very high constraint and it would not be possible to construct it.

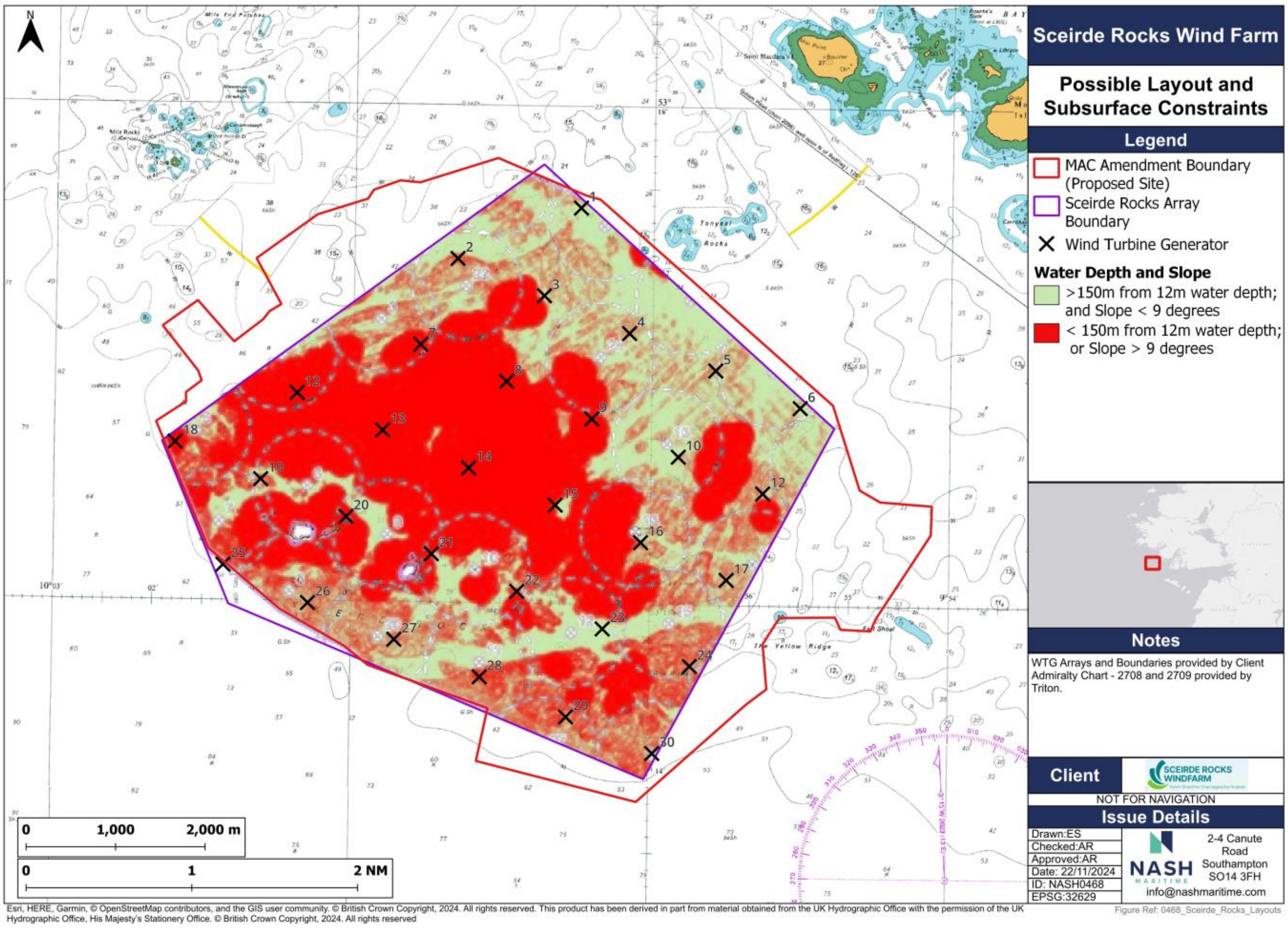

Figure 2: Bathymetric slope and depth constraints and a regular WTG layout.

The combined constraints added to the spatial requirements for construction vessels/infrastructure (such as jack-up rigs) collectively influenced the layout development process and yielded the proposed layout of the WTG and OSS, shown in **Figure 3**.

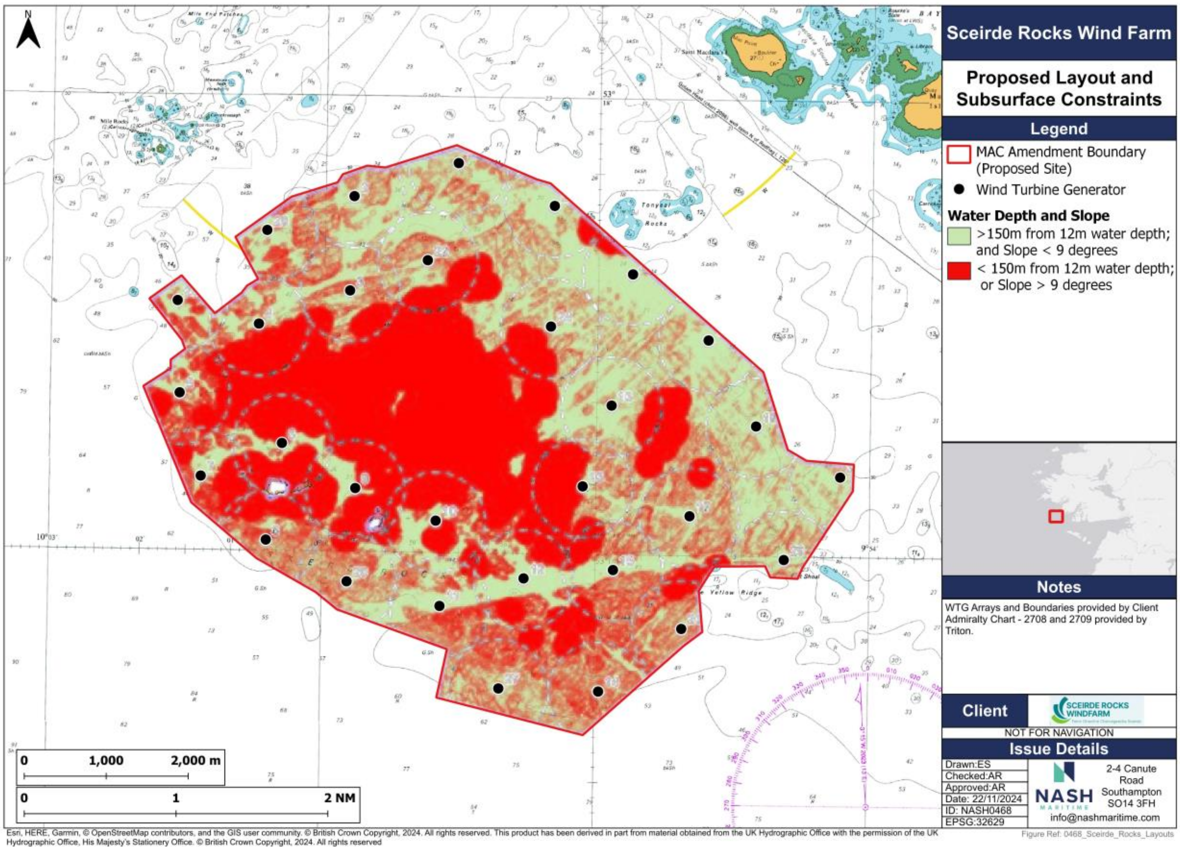

Figure 3: Bathymetric slope and depth constraints and the proposed WTG layout.

4. Proposed Layout

4.1 Underlying Layout Aims

It is recognised that the layout presented in **Figure 3** does not meet all of the layout requirements described in **Section 2.3**, particularly the aim for a regular grid pattern in the positioning of infrastructure within the array area. However, by taking a goal-based approach to SAR, whereby the goal is to safely and effectively conduct search and rescue operations, a credible, systematic and holistic SAR strategy across the site could be developed.

Section 4 describes how the Project layout does meet, or partly meets, the following key requirements for SAR operations, as summarised in **Table 1**:

Table 1: Underlying Layout Aims.

Format ID	Layout Principle	Comment
1	Are there multiple straight lines by which the WTGs and OSS can be aligned in different orientations (DoT, 2023b: Section 4.2)?	**Section 4.2** demonstrates that there are alignments of infrastructure in multiple directions, albeit not all structures are entirely aligned with that grid.
2	Is it possible to fly through the Project from one side to the other and maintain consistent heading (DoT, 2023b: Section 4.2)?	**Section 4.2** and **Section 4.3** show that lines of orientation and SAR access lanes are straight without requiring aircraft to alter their bearing to transverse the OWF.
3	Is there sufficient spacing between any two infrastructures with reference to the 500m requirement between infrastructure during instrument flight (DoT, 2023b: Section 3.3)?	**Section 4.3** and **Section 4.4** demonstrates that 500m access lanes do exist between rows of structures.
4	Can an HRA with dimensions greater than 1 nm in at least a one direction be included (DoT, 2023b: Section 4.2)?	**Section 4.4** shows that an HRA does exist in the centre of the Project.
5	Are the SAR access lanes aligned with the prevailing conditions to support SAR?	**Section 4.3** and **Section 4.4** demonstrates that 500m access lanes do exist between rows of structures.
6	Are there visual landmarks which can assist pilots in orientating themselves when flying through the Project?	**Section 4.3** and **Section 4.4** demonstrates that 500m access lanes are aligned with key geographic features that provide a visual reference for aircraft.
7	Are the areas of highest navigational risk (proximity of traffic, prevailing conditions and natural hazards) and therefore rescue requirements accessible?	**Section 4.5** demonstrates good coverage of key natural hazards, particularly to the southwest nearest to main vessel traffic routes.
8	Is the size of the development such that there is little need for in-OWF manoeuvring (DoT, 2023b: Section 3.1)?	**Section 2.4** notes the relatively small size of the Project compared to the large OWFs for which the guidance was developed.

4.2 Lines of Orientation

Based on the proposed layout, two parallel lines of orientation which align with the majority of infrastructure were identified (**Figure 4**). These are approximately 1,020 m apart on each face of the Project and create a box shape around a central area clear of WTGs. A similar bearing is maintained on adjacent faces of the Project. A single WTG located in the centre of the OWF (WTG016) which is not aligned with the lines of orientation. With the exception of WTG016, and two further WTGs along the northeastern face of the OWF, all WTGs are within 200 m of these lines of orientation.

The OSS located to the southeast of the OWF is located 200 m from the nearest line of orientation, and further comments are made:

- The substation is small in size, with a maximum height above LAT of 55 m including cranes, and dimensions of ca 58.5 m by 42.5 m.
- The substation is a single, unique structure and therefore could not be confused with the WTGs when visually identifying the lines of orientation.
- There is precedent within the UK for misalignment of substations from WTGs such as at the London Array (operational for more than ten years) demonstrating that SAR impacts can be successfully managed.

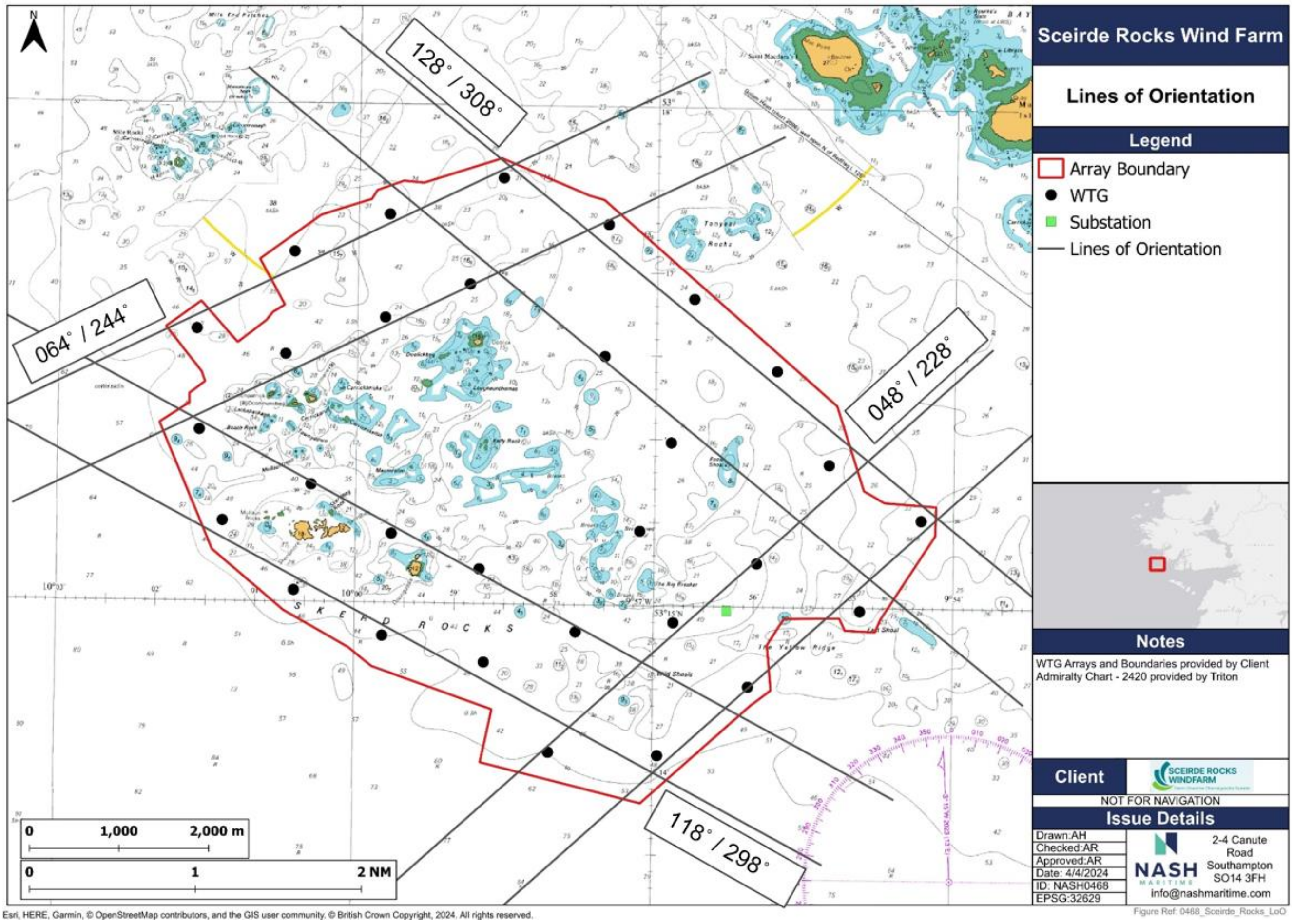

Figure 4: Lines of orientation.

4.3 Inter-WTG Route

The Inter-WTG route, shown in **Figure 5**, consists of a 500-metre-wide corridor, in compliance with guidance around the WTG array. Each of these 500m SAR access lanes is parallel to the lines of orientation in bearing and has direct, unobstructed entry and exit routes at the corners of the OWF.

All but seven WTGs have more than a 100 m separation from the 500 m SAR access lanes, and all exceed 60 m from the SAR access lanes. With a maximum rotor diameter of 292 m, blade rotation would be required and could be provided to facilitate SAR access, as set out within the guidance.

3D visualisations along the four SAR lanes are shown in **Figure 6** and **Figure 7**.

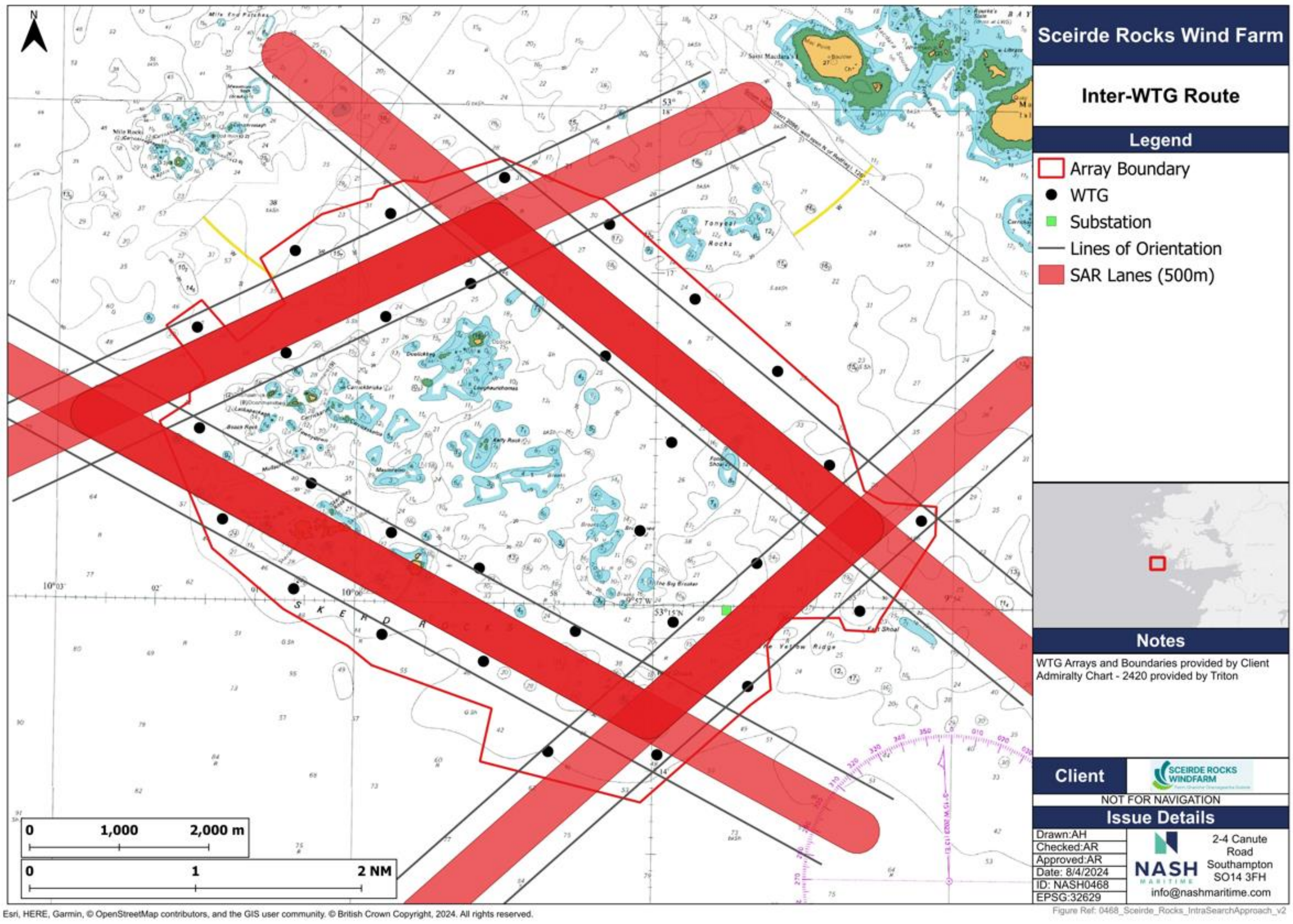

Figure 5: SAR Access Lanes along Project boundary.

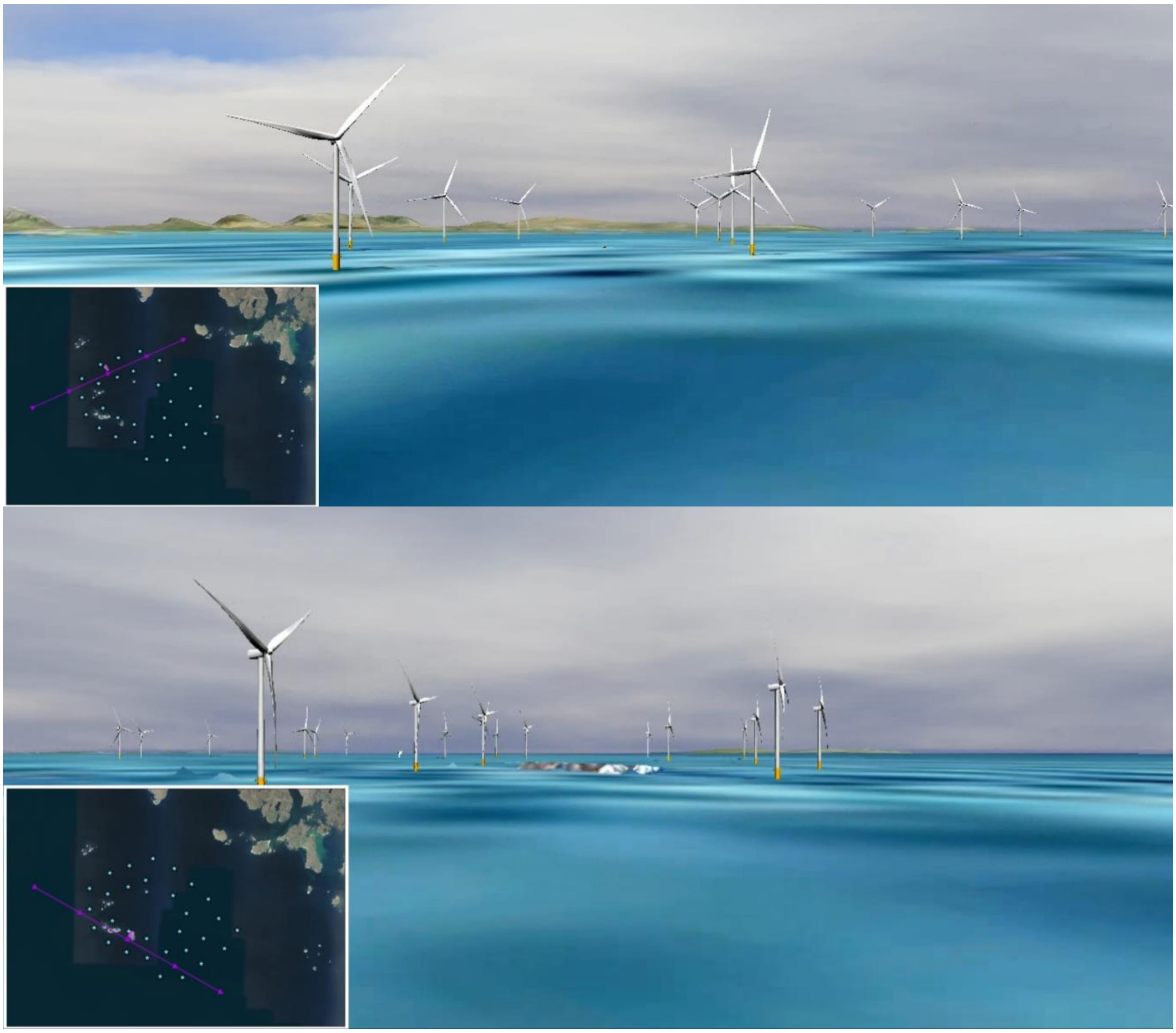

Figure 6: 3D visualisations of the four SAR lanes around the WTG array, aligned with the lines of orientation in bearing.

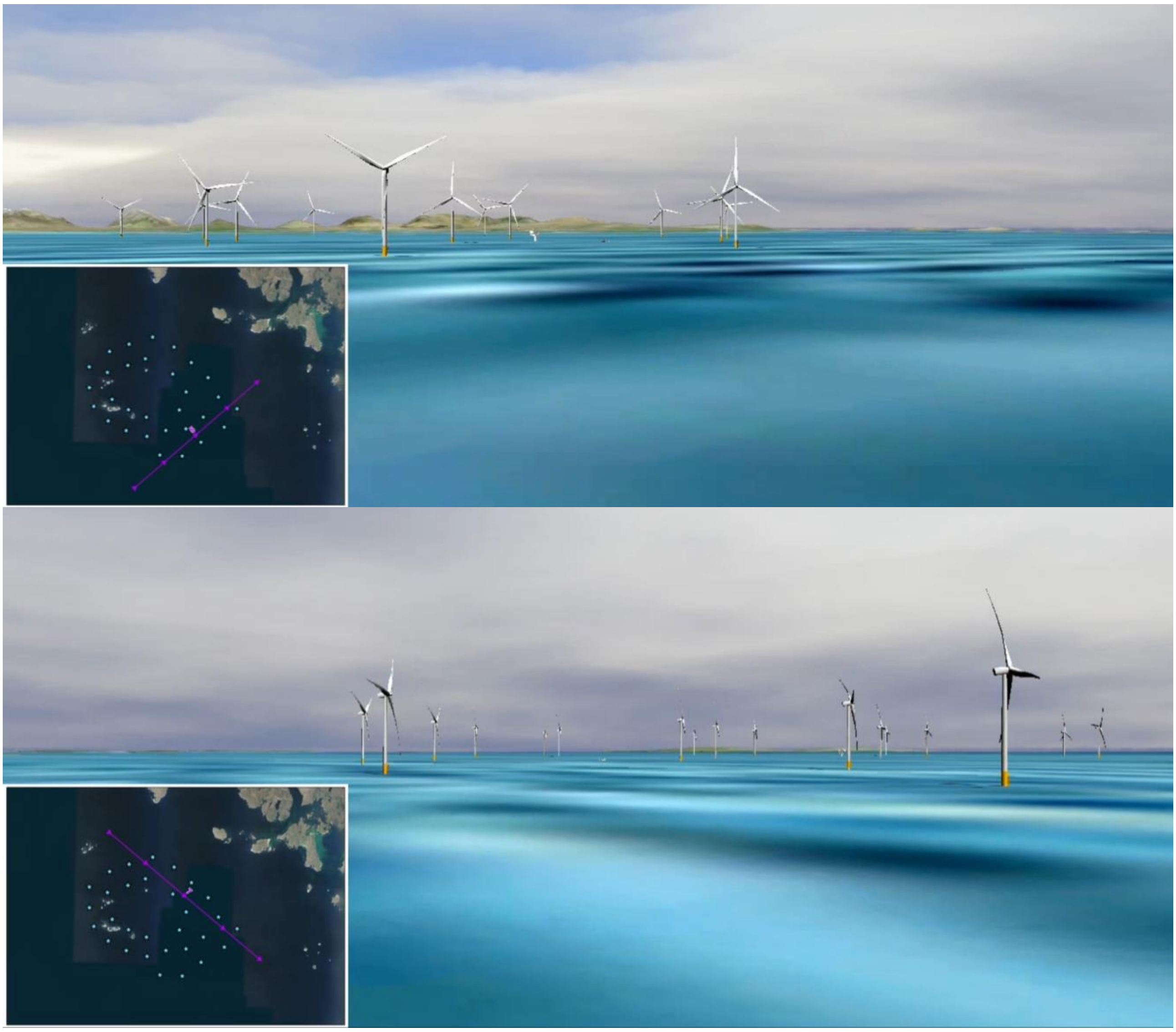

Figure 7: 3D visualisations of the four SAR lanes around the WTG array, aligned with the lines of orientation in bearing.

4.4 Helicopter Refuge Area

The proposed layout includes an area of 1.9 square nautical miles (nm^2) clear of all infrastructure, including at least a 250 m buffer from any infrastructure, with dimensions of approximately 2.1 nm by 0.9 nm (see **Figure 8**). A single WTG (WTG016) limits the southeast extent of this area, with further clear space located to the southeast of it.

This area could be interpreted as an HRA, as it provides a defined area of safe airspace "*to manoeuvre in preparation to enter or when exiting wind farms, to safely turn within a windfarm, to transfer between lanes or, in the event of an emergency requiring the helicopter to escape from the wind farm*" (DoT, 2023b). This area would exceed the 1 nm minimum size defined within the guidance and is larger to existing or proposed HRA precedents within the UK.

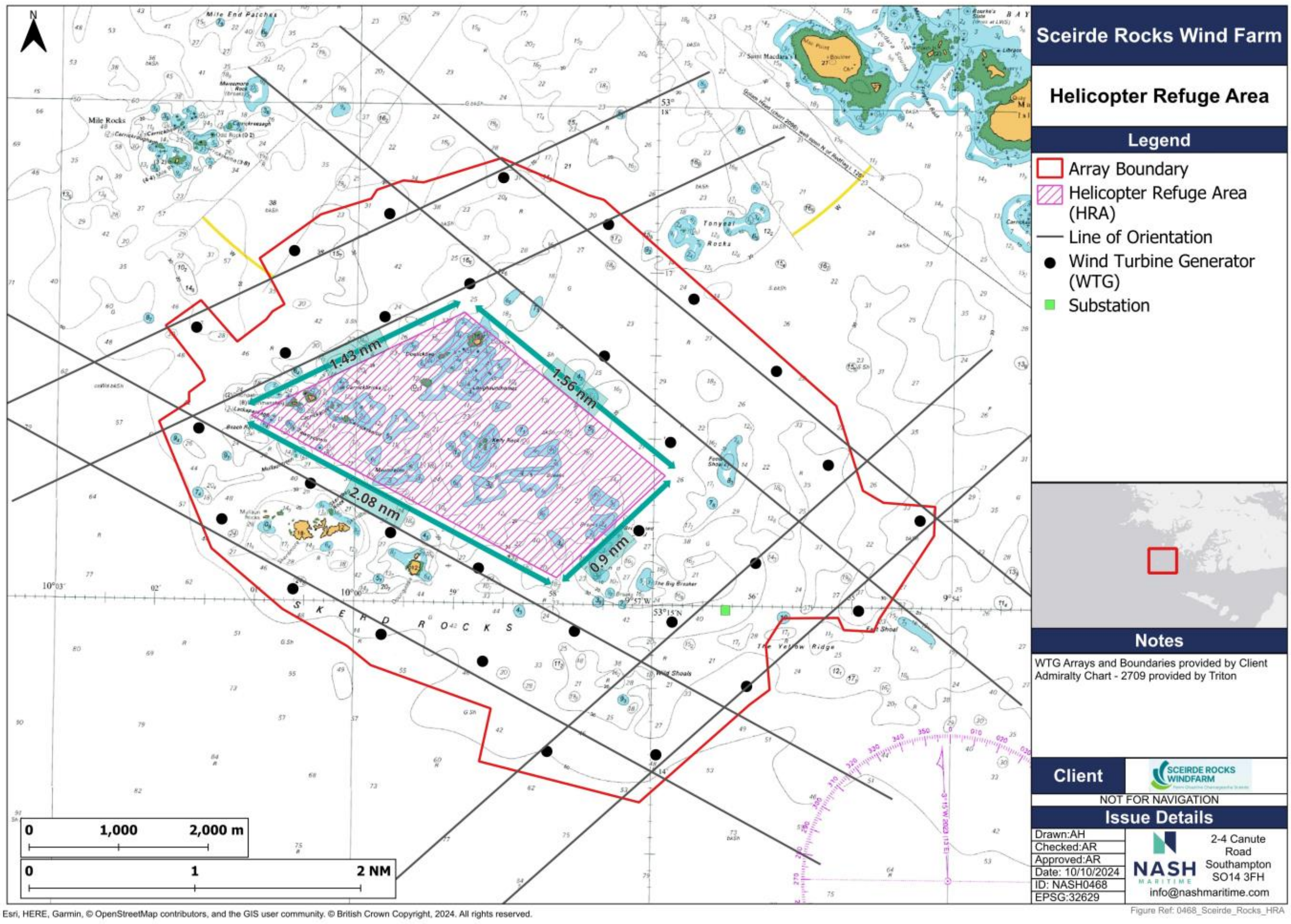

Figure 8: Helicopter Refuge Area.

To safely access this HRA, a series of further 500 m SAR access lanes were identified. These include more than 150 m of additional separation from any WTG, with the majority of WTGs offset by more than 250 m.

These include two routes which pass completely through the Project on a consistent bearing and one further entry/exit point. Each of these access routes have the same bearing of 064˚ / 244˚ as the northwestern SAR access lane/lines of orientation.

These routes, shown in **Figure 9**, align with key surface features which will both assist pilots with orientating themselves but also provide direct access to potential hazardous features on which vessels might run aground and therefore where rescue might be most required. These routes are:

1. Alignment between Tonyeal Rocks and Doolick.
2. Alignment with western shoals.
3. Alignment with Kelly Rock.
4. Overflight of Skerdbeg/Skerdmore.
5. Overflight of Doonguddle.

3D visualisations of the three HRA access lanes, which encompass the five HRA entry/exit routes, are shown in **Figure 10**.

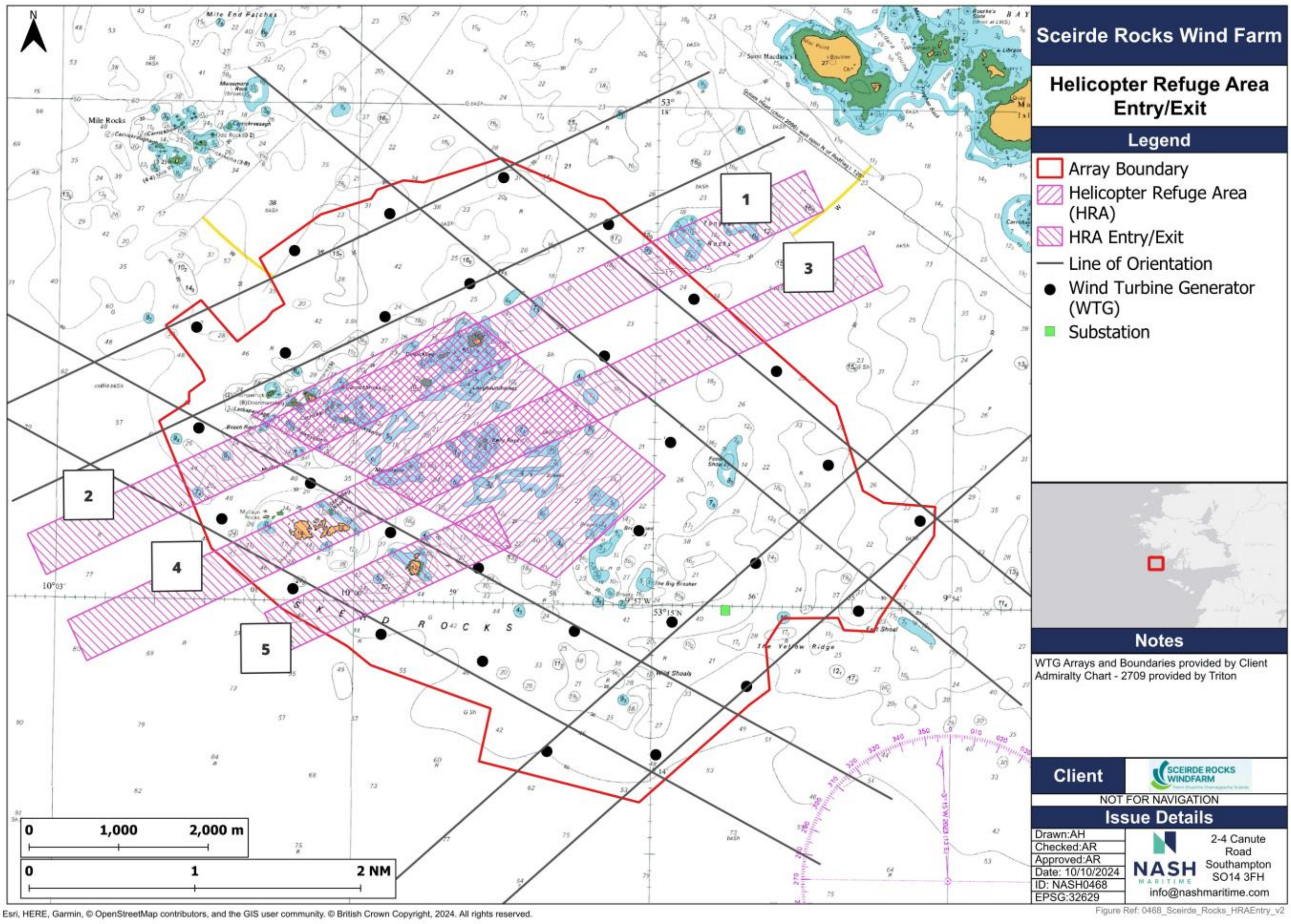

Figure 9:Entry and exit routes for the Helicopter Refuge Area.

Figure 10: 3D visualisations of the three HRA lanes, which encompass the five HRA entry/exit routes

4.5 Layout Summary

Figure 11 shows the combined SAR lanes around the perimeter of the turbine array, the five entry/exit routes and the central 1.9 nm^2 HRA.

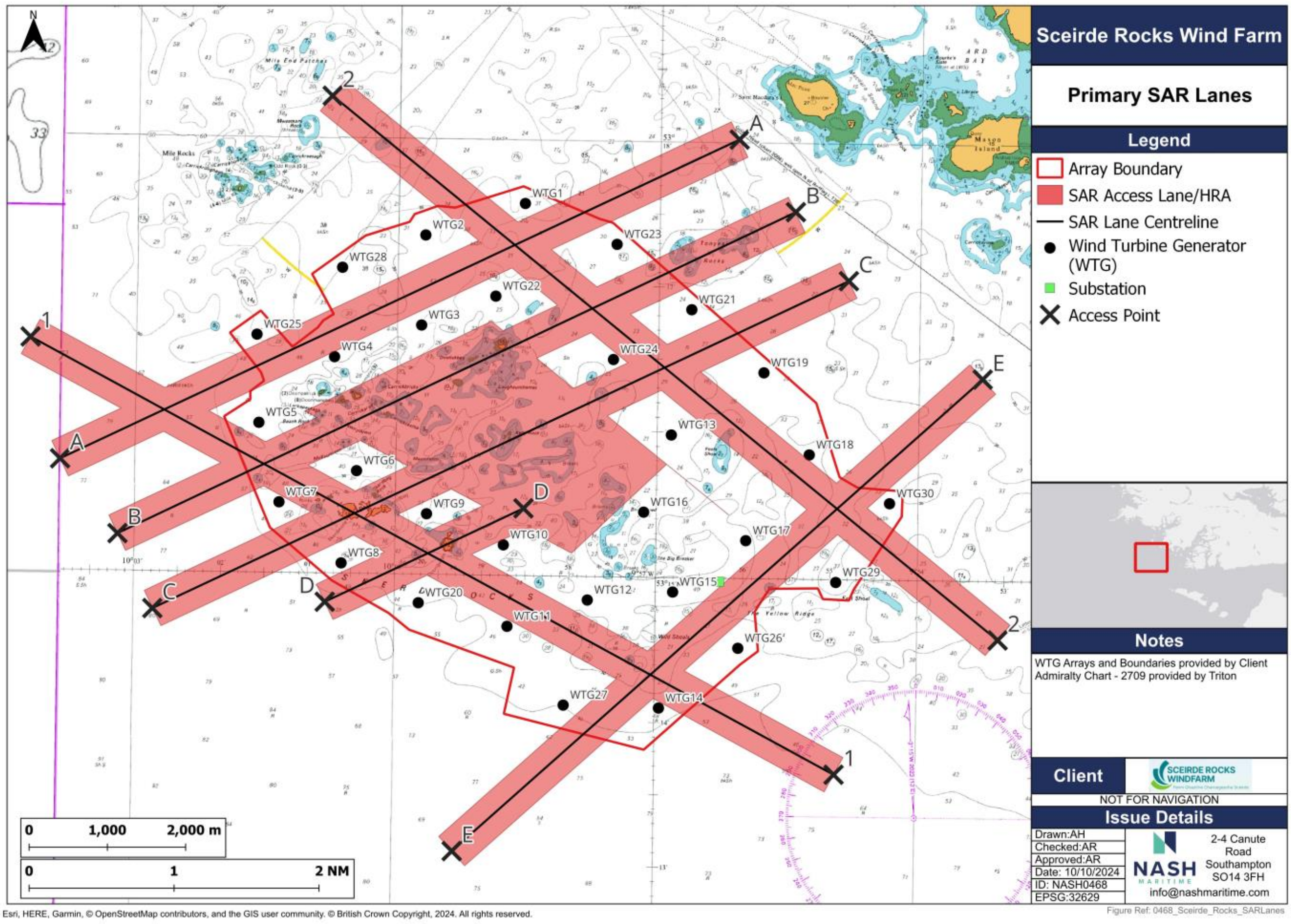

Figure 11: Combined Inter-WTG and Helicopter Refuge Area Access Routes.

Table 2: SAR Access Lanes Details.

	Entry		Exit			
Lane	**Long**	**Lat**	**Long**	**Lat**	**Bearing**	**Length**
A	-10.06436	53.26275	-9.93501	53.30043	064°	5.1 nm
B	-10.05316	53.25425	-9.92405	53.29218	064°	5.1 nm
C	-10.04627	53.2457	-9.91372	53.28434	064°	5.3 nm
D	-10.01329	53.24671	-9.9755	53.25776	064°	1.5 nm
E	-9.98833	53.21828	-9.88786	53.27323	048°	4.9 nm
1	-10.07035	53.27668	-9.91547	53.22764	118°	6.3 nm
2	-10.01313	53.30483	-9.88439	53.24329	128°	5.9 nm

5. Risk Profile and Mitigation

5.1 Likelihood of SAR at Sceirde Rocks

The NRA concluded that there is a low likelihood of an incident occurring at Sceirde Rocks which would necessitate a SAR response. This is evidenced by the following key points concluded by the NRA conducted for the Project:

- There is low vessel traffic activity in the region, with rarely more than 10 transits per day in the Study Area, and two transits per day in the Array Area. Those likely to be navigating within the Array Area post-construction would likely be local fishing boats with very good familiarity with the site and its hazards, utilising their local knowledge to avoid becoming a casualty.
- The current (base case) collision rate is low, and the future case collision likelihood is low:
  - There have been no third-party collisions directly as a result of the presence of an offshore wind farm development in the UK or Ireland.
  - The modelled collision risk with the proposed wind farm in situ is one in 46,322 years (0.03% increase)
  - Collision avoidance action is also likely to be implemented by the vessels involved, in line with the COLREGs, ensuring that the situation does not develop into a collision incident.
  - No collision incidents involving two third party vessels have been reported at previous under construction offshore wind farms.
- The future case allision risk is low:
  - The modelled powered commercial allision risk is one in 228,910 years which is negligible.
  - The highest modelled risk scenario is of a fishing vessel alliding with a structure in the future case scenario with a 20% increase in traffic. The modelled risk is one in 56.7 years, still unlikely given the proposed operational lifetime of the windfarm.
  - In circumstances where a vessel drifts towards a structure in the Array Area, there are actions which the vessel may take to prevent the drift incident developing, including regaining power (rectifying fault), emergency anchoring or the use of thrusters.
- Vessel displacement will be infrequent given the low traffic activity through the Array Area and, in the event of displacement, the available sea room and embedded mitigations enable this to be done safely, with a low risk of incident.
- There is a low likelihood of under keel clearance (UKC) reduction and a consequent snagging incident due to the target cable burial depth of 1 m and the current charted water depths in offshore areas.
- There is a low likelihood of anchor snagging given that no anchored vessels were identified within the Study Area and no anchorages were identified in immediate proximity to the Project.

Furthermore, an analysis of historical incident data occurring at OWFs in the UK (a combined duration of 500 project years) undertaken by NASH Maritime has revealed that:

- Excluding personal injuries and medical incidents, 92% of all recorded incidents did not result in any injuries.
- Only a single fatality was recorded, a personal injury aboard a large construction vessel.
- There are very few incidents of SAR helicopter missions into OWFs to conduct either search or rescue and it is understood that for most OWFs in the UK it has never been required.
- OWF project vessels have a strong record of managing their own risk profile, providing appropriate medical provision of incidents involving project personnel.
- Near shore OWFs, such as Sceirde Rocks, are most likely to be responded to by lifeboats rather than helicopters and are therefore less constrained by layout requirements.

Therefore, it is concluded that it is unlikely that an incident would occur at Sceirde Rocks necessitating search or rescue, particularly by SAR helicopters.

5.2 Mitigation

The NRA describes a number of key mitigation measures which would reduce the risk of an incident occurring, and thereby the likelihood of SAR assets being required, or improve the effectiveness of SAR activities within the OWF. These are summarised in **Table 3**.

Table 3: Key mitigation that reduces or manages SAR (Source: NRA).

Embedded Mitgation Measure	Effectiveness for SAR
Advisory safe passing distances	Vessels pass the Project at safe distance reducing the likelihood of an incident requiring an SAR response.
Buoyed construction area	Vessels pass the Project at safe distance reducing the likelihood of an incident requiring an SAR response.
Guard vessel(s)	Guard vessels will ensure safe passing distance of other vessels reducing the likelihood of an incident requiring SAR response and will also provide additional immediate response capability were an incident to occur.
Liaison with IRCG in relation to SAR resources	The Applicant will liaise with the IRCG in relation to SAR resources to ensure suitable emergency response plans and procedures are in place, with suitable consideration of the National SAR Plan (Government of Ireland, 2019).
Lighting and marking	Lighting and marking of the array will be in compliance with IALA O-139 and G1162 (IALA, 2021) and agreed with Irish Lights to reduce the likelihood of an incident requiring an SAR response.
Marine coordination for project vessels	Management of Project vessel movements would reduce the likelihood of an incident requiring an SAR response.
Marking on nautical charts	Marking of site will increase awareness to mariners and reduce the likelihood of an incident requiring an SAR response.
Project vessel compliance with international marine regulations	All project vessels will comply with international marine regulations as adopted by the Flag State including COLREGs and SOLAS, including their obligations for SAR response.
Promulgation of information	Increased awareness of Project reduces the likelihood of an incident requiring an SAR response.

5.3 Benefits of Sceirde Rocks to SAR Provision

In addition, it should be recognised that Sceirde Rocks can improve SAR within the region and this is recognised within the guidance (MCA, 2024):

1. Project assets can respond to incidents which occur within or adjacent to the OWF. The Project will necessitate well trained and equipped vessels, whether CTVs or SOVs, operating around and to/from the array area with suitably medically trained personnel. As such, they can provide immediate response to incidents in compliance with SOLAS obligations well before conventional assets such as RNLI or helicopters could reach the site.

a. The nearest RNLI lifeboat, based in the Aran Islands at 14.5 nm distance will require between 35 and 52 minutes to transit to the site (depending on conditions) plus approximately 15 minutes to launch. Similarly, the nearest SAR helicopter, based at Shannon at 49 nm would take approximately 18 minutes to reach the site but could have a scramble time between 15 and 45 minutes depending on time of day. Therefore, in all cases it would take more than 33 minutes for a helicopter and 50 minutes for a lifeboat to reach the site. This is compared to a CTV, on station, within a small OWF which could respond almost immediately to a casualty provided it was not attached to a WTG.

b. This has been demonstrated historically at other projects, for example in 2015 two CTVs from Lincs were first responders to a yachts mayday, finding the casualty and offering assistance before the RNLI lifeboats and SAR helicopters could reach it. Similar examples have occurred at Nng windfarm and Gwynt y Mor. In December 2020, an SOV rescued seven injured fishermen near Dudgeon following explosions on board, evacuating the fishing boat, providing first aid and then transferring them to a helicopter.

c. Whilst specific details of the training and equipment for Project personnel is yet to be determined, they could have:

   i. STCW 95.

   ii. GWO Basic Safety Training First Aid Module which enables participants, through theoretical and practical training, to recognise signs and symptoms of life threating situations and administer safe and effective first aid in the wind turbine industry/WTG environment in order to save lives and prevent further injury, until the casualty can be handed over to the next level of care.

   iii. GWO Enhanced First Aid (EFA) Training which enables participants to support and care for others working in the industry by possessing the knowledge, skills, and ability of enhanced first aid. Upon completion of the GWO EFA training, participants will be able to administer safe, effective, and immediate lifesaving and enhanced first aid measures to save life and give assistance in remote areas using advanced emergency equipment and medical teleconsultation.

   iv. Personal Locator Beacons/EPIRBs or other beacons for an emergency.

   v. Appropriate first aid equipment including first aid kits, stretchers etc.

2. The Project will enhance maritime surveillance through greater coverage of VHF and other monitoring means (such as CCTV) such that a vessel in difficulty can be more quickly identified and the appropriate SAR response initiated. The Marine Coordination Centre will be manned and monitoring the site 24/7 and will have the ability to respond to a request for assistance.

3. The Project construction and O&M strategy will include multiple independent assets, such as multiple Crew Transfer Vessels where feasible to provide greater redundancy and self-rescue capability were a Project asset to require assistance, reducing the burden on national SAR provision.

4. The Project will look to collaborate with the IRCG with regards to exercises within the Project or with Project vessels. This could include sharing of knowledge of the Applicant's experience in other offshore wind farms and undertaking exercises such as helicopter transfer onto CTVs or turbines. The Applicant has already collaborated with IRCG during geotechnical surveys in 2024.

5. The Project could reduce the likelihood that incidents occur. The most serious incident to occur at the project site was the loss of the Arosa (M321) on 3 October 2000 with the loss of 12 lives. Whilst the investigation by the Marine Accident Investigation Branch (MAIB, 2001) was not conclusive on the reasons for the grounding, it is noted that the site is not marked by any aids to navigation and may be difficult for vessels to avoid. Therefore, the addition of WTGs with appropriate aids to navigation will increase awareness of passing vessels of these shallows and reduce the risk of future groundings.

6. Conclusions

Whilst the proposed Project layout is not a regular grid, it does integrate several of the underlying elements of best practice to ensure the safety and effectiveness of SAR operations. These elements include maintaining consistent lines of orientation, establishing clear SAR routes and creating a HRA with well-defined entry and exit points.

This note has identified several key conclusions:

1. There is a pressing need for increased OWFs in Ireland (see **Section 1**).
2. The site is heavily constrained with numerous competing constraints, particularly natural ground conditions, which makes a viable regular grid layout impossible (see **Section 3**). The existing guidance (both DoT and MCA) note that projects should be considered on a case-by-case basis and that deviations from regular grid layouts and two lines of orientation can occur, which is necessary with the unique constraints of Sceirde Rocks, given sufficient safety justification.
3. Sceirde Rocks is also a small project, at 3.1 nm by 3.8 nm, and as noted in the guidance (MCA, 2024), the key principles of the guidance have been developed specifically for large offshore projects >10 nm across.
4. The layout proposed does seek to integrate as far as practically possible several of the underlying elements of best practice to ensure the safety and effectiveness of SAR operations (see **Section 4**):

- The incorporation of two parallel lines of orientation, approximately 1,020 m apart, aligns the majority of the infrastructure and forms a central area clear of WTGs. This structured layout could provide for safe and efficient SAR operations and general navigation within the wind farm.
- The Inter-WTG Route, a 500 m wide swath around the WTG array, further supports SAR activities by providing additional offsets from WTGs and ensuring direct entry and exit points on each corner of the offshore wind farm. This route maintains more than a 75 m offset from any infrastructure, with most offsets exceeding 100 m.
- The proposed HRA, spanning 1.9 nm^2 provides a possible area for SAR helicopters to reorient and manoeuvre safely. The HRA exceeds the 1 nm guidance and is offset from all infrastructure by more than 250 m, ensuring minimal obstruction.
- Furthermore, the design includes five entry and exit routes for the HRA, all bearing 064˚ / 244˚, which aligns with the northwest line of orientation. These routes, each 500 m wide, ensure more than 150 m of additional separation from any WTG, enhancing safety during SAR operations.

5. As concluded in the NRA, the risk of a navigational incident occurring within the OWF is low due to the low density of traffic and risk profile and therefore it is unlikely that SAR activities will be required within the site (see **Section 5.1**).
6. The Project has proposed mitigation which would manage or could even improve SAR provision at Sceirde Rocks (see **Section 5.2** and **Section 5.3**).

Overall, it is recognised that the site constraints prevent the development of a regular layout with two lines of orientation. However, the layout as described includes a degree of order and orientation with geographical features which would enable SAR helicopters to enter the OWF in most operating conditions. Furthermore, the likelihood of SAR helicopters being required to operate within Sceirde Rocks is anticipated to be very low. The impact of the Project on SAR access will be mitigated, and could even be improved beyond the present day, by the strengthening of the Project's self-rescue provision and increased redundancy, enhanced monitoring of array area and greater medical provision by project assets. Subject to further study, there may be further mitigations which could be developed to improve SAR access and safety, such as the use of visual identification markers for pilots strategically placed on the outcrops, enhanced monitoring of the site to minimise SAR time or additional training of Project vessels.

The Project has committed to engaging further with the IRCG to ensure that the Project satisfies their requirements and would not compromise the safety and efficiency of SAR operations.

References

DECC (2023). Climate Action Plan 2024. Available at: https://www.gov.ie/pdf/?file=https://assets.gov.ie/279555/25df7bb5-1488-4ba1-9711-e058d578371b.pdf#page=null. Accessed 10 October 2024.

DECC (2023). *Energy Security in Ireland to 2030*. Available at: https://www.gov.ie/en/publication/5c499-energy-security-in-ireland-to-2030/. Accessed 10 October 2024.

DHPLG (2018). National Planning Framework. Available at: https://www.npf.ie/wp-content/uploads/Project-Ireland-2040-NPF.pdf. Accessed 10 October 2024.

DoT (2023a). Marine Navigational Safety & Emergency Response Risk of Offshore Renewable Energy Installations.

DoT (2023b). Standard Operation Procedure 07-2023: Offshore Renewable Energy Installations (OREI): Guidance and Operational Considerations for SAR and Emergency Response.

European Commission (2023). The EU Blue Economy Report 2023. Available at: https://op.europa.eu/en/publication-detail/-/publication/9a345396-f9e9-11ed-a05c-01aa75ed71a1. Accessed 10 October 2024.

European Union (2009). Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC. Available at: https://eurlex.europa.eu/legalcontent/EN/TXT/?uri=CELEX%3A32009L0028&qid=1697184875388.

G+ (2023). Integrated Offshore Emergency Response (IOER): Good Practice Guidelines for Offshore Renewable Energy Developments.

Government of Ireland (2019). National Development Plan 2018 – 2027. Available at: https://assets.gov.ie/37937/12baa8fe0dcb43a78122fb316dc51277.pdf. Accessed 10 October 2024.

ICAO and IMO (2016). International Aviation and Maritime SAR Manual.

MAIB (2001). Report on the investigation of the grounding and total loss of the UK registered fishing vessel Aros (M321) on Doonguddle rock off the west coast of Ireland with the loss of 12 crew members 3 October 2000. Report No 41/2001.

MCA (2005). Offshore Wind Farm Helicopter Search and Rescue Trials Undertaken at the North Hoyle Wind Farm.

MCA (2019). MCA report following aviation trials and exercises in relation to offshore windfarms.

MCA (2024). MGN654. Available at: https://www.gov.uk/guidance/offshore-renewable-energy-installations-impact-on-shipping.

MCA (2022). Exercise Sancho: Post Exercise Report.

RenewableUK (2016). Offshore Renewables Aviation Guidance (ORAG): Good Practice Guidelines for Offshore Renewable Energy Developments.

United Nations (UN) (2015). Resolution adopted by the General Assembly on 25 September 2015. Transforming our world: the 2030 Agenda for Sustainable Development. Available at: https://sdgs.un.org/publications/transforming-our-world-2030-agenda-sustainable-development-17981. Accessed 10 October 2024.