Environmental Impact Assessment Report

Volume 4

Appendix 16.3 Navigational Risk Assessment

Codling Wind Park
Navigational Risk Assessment

Prepared by	Anatec Ltd
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02	16/05/2024	Updated based on comments
03	17/06/2024	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
BBC	British Broadcasting Corporation
BWEA	British Wind Energy Association
CA	Cruising Association
CBA	Cost Benefit Analysis
CEMP	Construction Environmental Management Plan
CD	Chart Datum
CEA	Cumulative Effect Assessment
CHIRP	Confidential Human Factors Incident Reporting Programme
COLREGs	Convention on International Regulations for Preventing Collisions at Sea
CTV	Crew Transfer Vessel
CWP	Codling Wind Park
DCCAE	Department of the Environment, Climate and Communications
DF	Direction Finding
DfT	Department for Transport
DSC	Digital Selective Calling
EEZ	Exclusive Economic Zone
EIA	Environmental Impact Assessment
EIAR	Environmental Impact Assessment Report
EIS	Environmental Impact Statement
EMF	Electromagnetic Field
EU	European Union
FRB	Fast Rescue Boat
FSA	Formal Safety Assessment

Abbreviation	Definition
GMDSS	Global Maritime Distress and Safety System
GPS	Global Positioning System
GRP	Glass Reinforced Plastic
GT	Gross Tonnage
HAT	Highest Astronomical Tide
HSE	Health and Safety Executive
IALA	International Association of Marine Aids to Navigation and Lighthouse Authorities
ILB	Inshore Lifeboats
IMCA	International Marine Contractors Association
IMO	International Maritime Organization
IRCG	Irish Coast Guard
JUV	Jackup Vessel
kHz	Kilohertz
Km	Kilometre
Lidar	Light Detection and Ranging
LNG	Liquified Natural Gas
LOA	Length Overall
LPG	Liquified Petroleum Gas
m	Metre
MAIB	Marine Accident Investigation Branch
MCA	Maritime and Coastguard Agency
MCIB	Marine Casualty Investigation Board
MEHRAS	Marine Environmental High Risk Areas
MEPC	Marine Environment Protection Committee
MGN	Marine Guidance Note
MSC	Maritime Safety Council
MSDA	Marine Safety Demarcation Area
MSI	Maritime Safety Information
MSO	Marine Survey Office

Abbreviation	Definition
NAVTEX	Navigational Telex
NIS	Natura Impact Statements
nm	Nautical mile
nm^2	Square nautical mile
NMOC	National Maritime Operations Centre
NRA	Navigational Risk Assessment
NSP	Navigational Safety Plan
O&M	Operations and Maintenance
OECC	Offshore Export Cable Corridor
OOS	Out of Service
OREI	Offshore Renewable Energy Installation
OSPAR	Convention for the Protection of the Marine Environment of the North-East Atlantic
OSS	Offshore Substation
PEXA	Practice and Exercise Area
PLA	Port of London Authority
PLGR	Pre-Lay Grapnel Run
PLL	Potential Loss of Life
POB	People on Board
Radar	Radio Detection and Ranging
REZ	Renewable Energy Zone
RNLI	Royal National Lifeboat Institution
RoPax	Roll-on/Roll-off Passenger
RoRo	Roll-on/Roll-off
RYA	Royal Yachting Association
SAR	Search and Rescue
SOLAS	Safety of Life at Sea
SONAR	Sound Navigation Ranging
SOV	Service Operation Vessel
TCE	The Crown Estate

Abbreviation	Definition
TP	Transition Piece
TSHD	Trailing Suction Hopper Dredger
TSS	Traffic Separation Scheme
UK	United Kingdom
UKHO	United Kingdom Hydrographic Office
US	United States
VHF	Very High Frequency
VTS	Vessel Traffic Service
WGS84	World Geodetic System 1984
WTG	Wind Turbine Generator

1 Introduction

1.1 Background

1. Anatec was commissioned by Codling Wind Park Ltd (hereafter 'the Applicant') to undertake a Navigational Risk Assessment (NRA) for the proposed Codling Wind Park (CWP) Project, which consists of the array site and offshore export cable corridor (OECC).

2. This NRA presents information on the CWP Project relative to the existing and estimated future navigational activity and forms the technical appendix to **Chapter 16: Shipping and Navigation**.

1.2 Navigational Risk Assessment

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

4. Noting that no specific guidance has been published for Ireland regarding the production of NRAs for offshore projects, and following consultation with key bodies including the Marine Survey Office (MSO) and Irish Lights, the Maritime and Coastguard Agency (MCA) Marine Guidance Note (MGN) 654 (MCA, 2021) has been used as primary guidance as detailed within **Section 2** (see **Section** for consultation background). Draft guidance from the Department of Transport was issued for consultation in January 2024, which closely resembles MGN 654 (MCA, 2021), however at the time of writing (April 2024) is yet to be finalised. Application of MGN 654 is therefore considered appropriate.

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

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

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

- Construction;
- Operation and maintenance (O&M); and
- Decommissioning.

7. Assessment parameters assumed within the NRA for the CWP Project are summarised in Section 6, with further details provided in **Chapter 16: Shipping and Navigation**. Further details on the overarching project design approach are provided in **Volume 2, Chapter 4: Project Description**.

8. 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

9. This section sets out the primary and secondary guidance considered for the purposes of the informing the NRA and **Chapter 16: Shipping and Navigation**.

2.1 Primary Guidance

10. It is understood that guidance specific to shipping and navigation assessment will be finalised by the MSO in the near future, and that this guidance is likely to closely resemble the Maritime and Coastguard (MCA) MGN 654 (MCA, 2021) which is the primary guidance used for equivalent assessment for United Kingdom (UK) Offshore Renewable Energy Installations (OREIs). Input to date by both the MSO and Irish Lights (see **Section 4**) was that until such guidance was in place, developers should apply the principles of MGN 654[1]. Draft guidance from the Department of Transport was issued for consultation in January 2024, which closely resembles MGN 654 (MCA, 2021), however at the time of writing (April 2024) is yet to be finalised. Application of MGN 654 is therefore considered appropriate.

11. Therefore, MGN 654 (MCA, 2021) has been used as the primary guidance document to inform the approach to shipping and navigation assessment.

12. MGN 654 (MCA, 2021) requires the use of the International Maritime Organization (IMO) Formal Safety Assessment (FSA) (IMO, 2018). Therefore, the FSA has been used to assess hazards to shipping and navigation users, and the NRA 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):

- 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 R139 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. 5th Edition - (RYA, 2019).

[1] Note at the time of consultation the relevant active guidance was MGN 543 which has since been superseded by MGN 654.

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.

15. Data sources for lessons learnt include the following:

- Interference to Radio Detection and Ranging (Radar) Imagery from Offshore Wind Farms (Port of London Authority (PLA), 2005);
- Offshore Wind and Marine Energy Health and Safety Guidelines (RenewableUK, 2014);
- Offshore Wind Farm Helicopter Search and Rescue (SAR) Trials Undertaken at the North Hoyle Wind Farm (MCA, 2005);
- Results of the Electromagnetic Investigations (MCA & QinetiQ, 2004);
- Sharing the Wind – Recreational Boating in the Offshore Wind Strategic Areas (RYA & Cruising Association (CA), 2004); and
- Strategic Assessment of Impacts on Navigation of Shipping and Related Effects on Other Marine Activities Arising from the Development of Offshore Wind Farms in the UK Renewable Energy Zone (REZ) (Anatec & The Crown Estate (TCE), 2012).

3 Navigational Risk Assessment Methodology

16. This section sets out the methodology by which this NRA and **Chapter 16: Shipping and Navigation** have been undertaken. In summary, the NRA represents the technical assessment for shipping and navigation, whereby hazards to shipping and navigation users are identified and assessed. The assessment informs **Chapter 16: Shipping and Navigation**.

3.1 Assumptions

17. 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. Details of data limitations are provided in **Section 5.4**.

3.2 Formal Safety Assessment Methodology

18. 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 Workshops;
- 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.

19. It is noted that, with regards to commercial fishing vessels, the methodology and assessment has been applied to hazards considering commercial fishing vessels in transit. A separate methodology and assessment has been applied in **Chapter 12: Commercial Fisheries** to consider hazards on fishing vessels including in relation to safety which are directly related to fishing activity rather than fishing vessels in transit.

3.3 Formal Safety Assessment Process

20. The IMO FSA process (IMO, 2018) as amended by the IMO in 2018 under Maritime Safety Council (MSC) Marine Environment Protection Committee (MEPC).2/Circ. 2/Rev2 was applied within the Hazard Workshop by using the five steps outlined below, and subsequently within the matrices used to assess impacts in **Chapter 16: Shipping and Navigation**. 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 (IMO, 2018)

3.3.1 Hazard Workshop Methodology

21. A key tool used in the NRA process is the Hazard Workshop, which ensures that all risks are identified and qualified in agreement with stakeholders prior to assessment within **Chapter 16: Shipping and Navigation**. **Table 3-1** and **Table 3-2** identify how the severity of consequence and the frequency of occurrence respectively have been defined within the hazard log.

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	Tier 1 local assistance required	Minor reputational risks – limited to users
3	Moderate	Multiple minor or single serious injury	Damage not critical to operations	Tier 2 limited external assistance required	Local reputational risks
4	Serious	Multiple serious injuries or single fatality	Damage resulting in critical risk to operations	Tier 2 regional assistance required	National reputational risks
5	Major	More than one fatality	Total loss of property	Tier 3 national assistance required	International reputational risks

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 risk of a hazard defined as Broadly Acceptable (low risk), Tolerable (intermediate risk), or Unacceptable (high risk).

Table 3-3 Tolerability Matrix and Risk Rankings

Severity of Consequence					
5	Tolerable	Tolerable	Unacceptable	Unacceptable	Unacceptable
4	Tolerable	Tolerable	Tolerable	Unacceptable	Unacceptable
3	Broadly Acceptable	Broadly Acceptable	Tolerable	Tolerable	Unacceptable
2	Broadly Acceptable	Broadly Acceptable	Broadly Acceptable	Tolerable	Tolerable
1	Broadly Acceptable	Broadly Acceptable	Broadly Acceptable	Broadly Acceptable	Tolerable
	1	2	3	4	5
	Frequency of occurrence				

(red)	Unacceptable (high risk)
(orange)	Tolerable (intermediate risk)
(green)	Broadly Acceptable (low risk)

23. Once identified, the risk of a hazard is assessed to ensure it is ALARP. Further risk control measures may be required to further mitigate a hazard in accordance with the ALARP principle. Unacceptable risks are not considered to be ALARP.

24. Outputs of the Hazard Log have been used as evidence to support and refine the risk assessment contained within **Chapter 16: Shipping and Navigation**.

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 projects and proposed developments, known as the Cumulative Effect Assessment (CEA). For shipping and navigation, given the international nature of shipping, other developments within 50 nautical miles (nm) are considered and screened as part of the NRA process. Where any hazard pathway is found, risk assessment is undertaken in **Chapter 16: Shipping and Navigation**.

26. The 50 nm radius is considered to be best practice and allows consideration of vessels as they approach and depart the array site to identify where there may be multiple deviations associated with different (cumulative) developments. Any deviations associated with developments that are further than 50 nm are considered to be mitigated by the length of the transit/journey.

27. Full details of the cumulative screening methodology are provided in **Chapter 16, Appendix 16.1** : Shipping and Navigation, Cumulative Effects Assessment. In summary, the following other developments will be assessed for potential cumulative effects with the CWP Project in relation to shipping and navigation on the grounds of there being sufficient data confidence to facilitate meaningful

assessment, and the potential that vessel routeing identified in proximity to the CWP Project may also interact with these developments:

- Dublin Array;
- Arklow Bank Phase 2;
- North Sea Irish Array; and
- Oriel Wind Farm.

3.5 Study Area

28. A buffer of 10 nm has been applied around the array site as the study area for shipping and navigation (hereafter the 'study area'). The radius of 10 nm is standard for shipping and navigation assessment and has been used in the majority of publicly available UK offshore wind farm NRAs and within the shipping and navigation assessment in the Scoping Report undertaken for the CWP Project. An additional buffer of minimum radius 2 nm has also been applied around the OECC[2] (hereafter the 'cable corridor study area'). These study areas are presented in **Figure 3-2**.

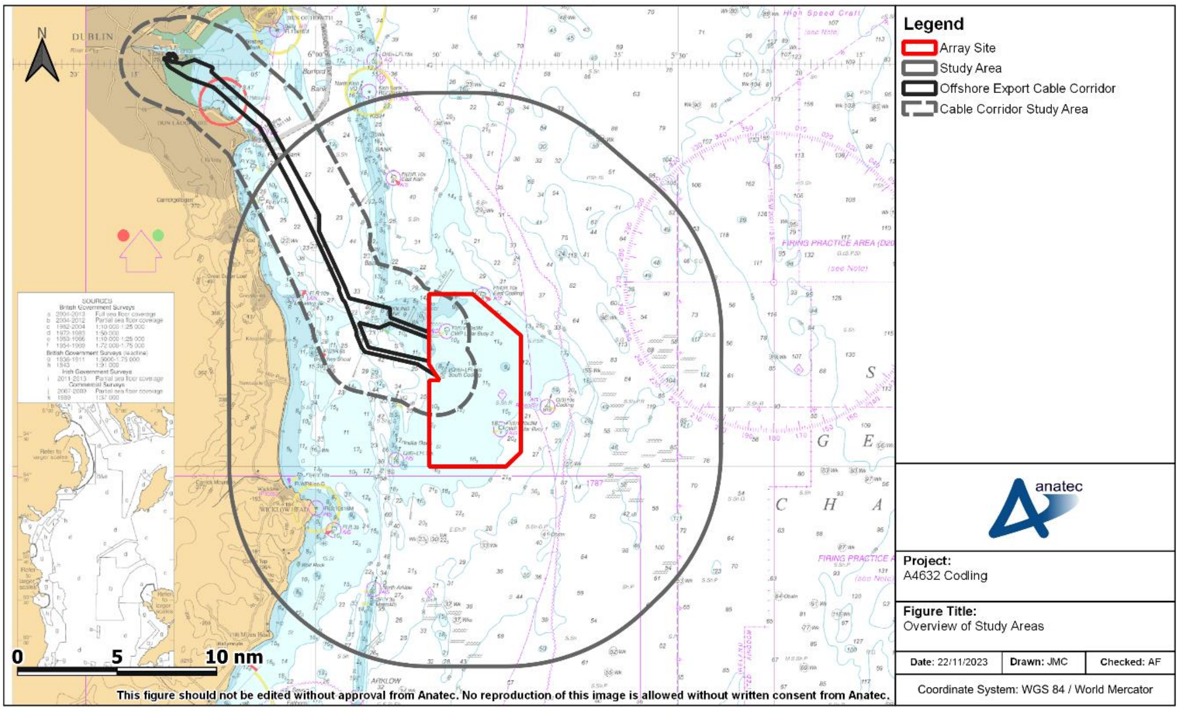

Figure 3-2 Overview of Study Areas

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 array site and OECC. Navigational features wholly or partially outside the study area are considered where appropriate

[2] Note that 2 nm Cable Corridor Study Area is based on a previous iteration of the OECC. Subsequent minor reductions to the OECC mean that the radius extends slightly beyond 2 nm in certain locations.

(i.e., where they are of relevance to vessel routeing within the study area e.g., IMO routeing measures).

4 Consultation

4.1 Key Stakeholder Meetings

30. **Table 4-1** summarises the key outputs of the consultation meetings that have been undertaken for the CWP Project during the NRA process. References to where each point raised has been addressed are included.

Table 4-1 Consultation Meeting Summary

Consultee / Date	Summary Points	Where Addressed
MSO 15 March 2021	MSO confirmed that they are content with MGN 543 being the guidance for the project in the absence of specific Irish guidance. Anatec stated that the risk assessment will be undertaken using the principles of the IMO FSA process.	MGN 654 (most up to date equivalent guidance which superseded MGN 543 in 2021) and the FSA have been applied as per **Section 2**.
	The MSO agreed with the use of 'advisory safe passing distances' instead of safety zones (as a statutory instrument would be required for the latter).	Advisory safe passing distances have been assumed as mitigation as per **Section 16**.
	Anatec stated that SAR consultation would be undertaken with the Irish Coast Guard (IRCG) and Royal National Lifeboat Institution (RNLI), and fishing and recreational outreach.	Meetings have been held with IRCG and RNLI (**Table 4-1**). Recreational representation present at the hazard workshop (**Section 4.3**). Fishing stakeholder consultation is provided in **Chapter 12 Commercial Fisheries**.
	Suggested any cruise liner operators be included in the regular operators outreach.	Regular operator outreach is summarised in **Section 4.2**.
	The MSO had no specific concerns about inshore routeing and would expect the majority of vessels to route outside of the proposed projects (the MSO would not want to encourage inshore routeing).	Deviations are quantitatively assessed on both an in isolation and cumulative basis in **Section 12.3** and **Section 1**Associated hazards are assessed in **Chapter 16: Shipping and Navigation**.
	Anatec confirmed that anchoring and inshore routeing would be considered in the NRA and Environmental Impact Assessment Report (EIAR).	Vessel routeing (**Section 12**) and anchoring (**Section 11**) have been considered. Associated hazards are assessed in **Chapter 16: Shipping and Navigation**.
Irish Lights 25 March 2021	Irish Lights confirmed content with the use of MGN 543 and FSA.	MGN 654 (most up to date equivalent guidance which superseded MGN 543 in 2021) and the FSA have been applied as per **Section 2**.
	Anatec confirmed that renewable projects, oil and gas and any port developments would be considered	A cumulative development screening has been undertaken (see **Section 1**).

Consultee / Date	Summary Points	Where Addressed
	where appropriate for the cumulative assessment.	
	Irish Lights noted that cumulative effects on routeing should be considered within the NRA.	Deviations are quantitatively assessed on both an in isolation and cumulative basis (see **Section 12.3** and **Section 1**). Associated hazards are assessed in **Chapter 16: Shipping and Navigation**.
	Irish Lights noted that risks associated with drifting vessels should be considered within the NRA.	Quantitative assessment of drifting risk has been undertaken in the NRA (see **Section 14.3.3**). Associated hazards are assessed in **Chapter 16: Shipping and Navigation**.
	Irish Lights queried whether effects on safe navigable depths would be considered within the NRA and the EIAR.	The NRA has assessed baseline vessel draughts (**Section 11**), with hazards associated with underkeel clearance assessed within **Chapter 16: Shipping and Navigation**.
Meeting with Dublin Port 16 June 2021	Dublin Port confirmed content with the use of MGN 654 and FSA.	MGN 654 (most up to date equivalent guidance which superseded MGN 543 in 2021) and the FSA have been applied as per **Section 2**.
	Anatec confirmed that the cumulative assessment will assess all projects on a tiered approach based on information available.	Cumulative development screening has been undertaken (see **Section 1).**
	Anatec confirmed that regular operators, local fisheries and yacht clubs would be contacted for feedback.	Regular operators, local fisheries and yacht clubs were invited to participate in the Hazard Workshop (see **Section 4.3**).
	Through subsequent email correspondence following meeting, future case traffic growth values of 10 and 25% were agreed.	Agreed future case scenarios have been applied (see **Section 12.3**).
Meeting with Irish Lights 15 February 2023	Confirmed content with vessel traffic survey data approach.	Data sources as per those agreed (see **Section 5**).
Meeting with MSO 27 February 2023	Confirmed content with vessel traffic survey data approach.	Data sources as per those agreed (see **Section 5**).
Meeting with RNLI 28 February 2023	Confirmed content with vessel traffic survey data approach.	Data sources as per those agreed (see **Section 5**).

Consultee / Date	Summary Points	Where Addressed
Meeting with IRCG 7 March 2023	Confirmed content with vessel traffic survey data approach.	Data sources as per those agreed (see **Section 5**).
Meeting with Irish Lights 23 October 2023	Layouts presented to Irish Lights. Indicative discussions on associated lighting and marking.	Lighting and marking has been assumed as mitigation as per **Section 16**. An **LMP** is provided with the planning application.
Meeting with IRCG 14 November 2023	Layouts and SAR access presented to IRCG.	SAR has been assessed in **Chapter 16: Shipping and Navigation**.

4.2 Regular Operator Outreach

31. The vessel traffic survey data studied (see **Section 11**) was used to identify regular commercial vessel operators of the area. These operators were subsequently contacted to request comment on the CWP Project. Responses received are provided in **Table 4-2**.

32. The letter sent to the operators is provided in Annex A for reference.

Table 4-2 Regular Operators Comments Log

Operator	Summary Points	Where Addressed
Irish Ferries	The array site is considered unlikely to directly impact the routeing of any specific vessels. However, there will be an indirect impact due to the displacement of other vessel traffic from the array site towards the positions of the routes. There will also be reduced sea room affecting the ability to avoid collision with this displaced traffic.	Associated hazards are assessed in **Chapter 16: Shipping and Navigation**.
	Vessels would not choose to transit through the array site itself, however they may intend to pass between the array site and the coast.	
CLdN	The array site would not interfere with routes except potentially in the case of limitations being imposed on vessels during the construction phase, e.g., speed limits.	Associated hazards are assessed in **Chapter 16: Shipping and Navigation**.

Operator	Summary Points	Where Addressed
	It is noted that previous experience has demonstrated that aviation lights have the potential to distract vessels due to their brightness; however, power can be reduced to limit the impact.	Lighting and marking will be agreed with Irish Lights are per **Section 16**.
	Noted potential interference with Radar signals caused by the presence of the infrastructure e.g. the Wind Turbine Generators (WTGs).	Assessed in **Section 13.7**.

4.3 Hazard Workshop

33. A key element of the consultation phase was the Hazard Workshop, a meeting of local and national marine stakeholders to identify and discuss potential shipping and navigation hazards. Using the information gathered from the Hazard Workshop, a Hazard Log was produced for use as input into the risk assessment undertaken in **Chapter 16: Shipping and Navigation**. This ensured that expert opinion and local knowledge was incorporated into the risk assessment and that the Hazard Log was site-specific.

4.3.1 Hazard Workshop Attendance

34. The Hazard Workshop was held at Clayton Hotel in Leopardstown, Dublin on 17 January 2023. The Hazard Workshop was attended by:

- Dublin Port;
- Dalkey Island Ferry;
- Irish Nautical Trust;
- Poolbeg Yacht and Boat Club;
- Irish Ferries;
- Stena Line;
- CLdN;
- Matrix Ship Management;
- Dun Laoghaire Harbour; and
- Royal Irish Yacht Club.

4.3.2 Hazard Workshop Process and Hazard Log

35. During the Hazard Workshop, key maritime hazards associated with the construction, O&M and decommissioning of the CWP Project were identified and discussed. Where appropriate, hazards were considered by vessel type to ensure risk control options could be identified on a type-specific basis.

36. Following the Hazard Workshop, the risks associated with the identified hazards were ranked in the Hazard Log based upon the discussions during the workshop, with

appropriate embedded mitigation measures identified, including any additional measures required to reduce the risks to ALARP. The Hazard Log was then provided to the Hazard Workshop attendees for comment and their feedback incorporated into the NRA. The Hazard Log is provided in full in **Table 18-1**.

4.3.3 Workshop Minutes

37. A summary of key minutes from the Hazard Workshop are provided in **Table 4-3**.

Table 4-3 Hazard Workshop Summary

Meeting	Point Raised	Where Addressed
Hazard Workshop 17 January 2023	Suggested key local port authorities (Dublin Port, Dún Laoghaire Harbour) should be included in cable burial process.	Outcomes of the process will be provided to relevant stakeholders for information noting input from ports has been considered.
	Queried any use of exclusion / safety zones that would be enforced around the cable lay vessels during operations	It is intended that advisory safe passing distances will be utilised as per Section 16.
	Noted that COVID may have impacted the 2021 vessel traffic survey datasets, and that vessel numbers to Dun Laoghaire and Dublin Port may increase.	Multiple data sources have been considered including post 2021 traffic survey (see Section 5). The NRA modelling has included multiple future case traffic growth scenarios.
	Noted that non AIS recreational activity should be considered.	Multiple data sources have been considered including non AIS data collected during vessel traffic surveys (see Section 5).
	General consensus was that the overarching cumulative picture in particular inshore of the banks was key concern. Agreed that effective promulgation of information would be a key mitigation, and that use of guard vessels where appropriate should also be considered.	Cumulative assessment has been undertaken in Chapter 16, Appendix 16.1: Cumulative Effects Assessment. Promulgation of information and use of guard vessels where appropriate have been assumed as mitigation as per Section 16.
	Noted that vessels in Dublin Bay may need to emergency anchor over or near to laid subsea cables.	Associated impacts assessed in Chapter 16: Shipping and Navigation.
	Dublin Port and Dun Laoghaire stated water depths should not be reduced in the harbour approaches.	Associated impacts assessed in Chapter 16: Shipping and Navigation.

4.4 Scoping Response

38. Responses received to the Scoping Report from Irish Lights are detailed in **Table 4-4**.

Table 4-4 Irish Lights Scoping Response

Summary Points	Where Addressed
Data sources considered for shipping and navigation at EIAR stage should include Radar and visual observation data.	The project has undertaken three vessel traffic surveys which included the recording of Radar and visual observation data (see **Section 5**).
Routeing and navigational features assessments should consider the Dublin Bay, Skerries, Tuskar and Smalls Traffic Separation Schemes (TSSs).	The referenced TSSs have been captured within the baseline assessment (see **Section 7.7**).
The NRA and EIAR should consider commercial vessels passing between the India and Codling Banks and intersecting the array site.	The referenced vessels have been captured in the data sources considered (see **Section 5**) and anticipated deviations for such routeing is considered (see **Section 12.3**) Associated hazards are assessed in **Chapter 16: Shipping and Navigation**.
Assessment of anchoring activity from vessels not broadcasting on Automatic Identification System (AIS) would be useful to include in the NRA.	No clear cases of non-AIS anchoring were identified in the vessel traffic survey data for the array site.
Consideration should be given to shared export cable infrastructure with other developments to minimise navigation disruption/risk.	There are no current plans to implement shared transmission infrastructure, noting that the CWP Project will be implementing minimum depth of cover and protection as per **Section 16**. CWP Project will be liaising closely with Dublin Array to ensure cable crossings are appropriately designed.
Queried where commercial shipping impacts will be considered in the EIAR.	The NRA considers navigational safety impacts. However, as per Section 12.3.2.2, any deviations to vessels are minimal, and therefore by extension no notable commercial impacts are anticipated.
Noted safety of navigation concerns in relation to deviated commercial vessel routeing should be assessed for the project in isolation and also on a cumulative basis.	Deviations are quantitatively assessed on both an in-isolation and cumulative basis in the NRA (see **Section 12.3** and **Section 1**). Associated hazards are assessed in **Chapter 16: Shipping and Navigation**.
Potential impacts on safe navigable depths within the project area due to potential sediment displacement should be considered.	Sediment displacement is considered in **Chapter 6: Marine Geology, Sediments and Coastal Processes**.
Potential impacts on safety of navigation of presence of wind farm in area of high tidal currents, i.e., whether vessels not under command could be set into danger by the tidal stream should be considered.	Quantitative assessment of drifting risk has been undertaken in the NRA (see **Section 14.3.3**). Associated hazards are assessed in **Chapter 16: Shipping and Navigation**.
Confirmed content with use of MGN 543 as primary guidance for NRA and shipping and navigation assessment purposes.	MGN 654 (most up to date equivalent guidance which superseded MGN 543 in 2021) has been applied as per **Section 2**.
Cumulative impacts should be assessed. In particular, altered routeing cumulatively and potential impact on	Deviations are assessed on both an in-isolation and cumulative basis in the NRA (see **Section 12.3** and

Summary Points	Where Addressed
safety of navigation if all Dublin traffic either diverts north of Kish with a dog-leg into/from the Irish Sea, or else goes inshore of the banks and between Wicklow Head and the array site in/out of Irish Sea.	**Section 1**). This includes discussion of the referenced scenarios. Associated hazards are assessed in **Chapter 16: Shipping and Navigation**.

5 Data Sources

39. This section summarises the main data sources used to characterise the shipping and navigation baseline relative to the CWP Project.

5.1 Summary of Data Sources

40. The main data sources used to characterise the shipping and navigation baseline relative to the CWP Project are outlined in **Table 5-1**.

Table 5-1 Data Sources Used to Inform Shipping and Navigation Baseline

Data	Source(s)	Purpose
Vessel traffic	Summer 2021 vessel traffic survey data consisting of AIS, Radar and visual observations for the study area (57 days, 30 April – 25 June 2021) recorded from a survey vessel that was on-site while it was engaged in geotechnical surveys.	Characterising vessel traffic movements within and in proximity to the array site and OECC.
	Summer 2022 vessel traffic survey data consisting of AIS, Radar and visual observations for the study area (14 days, 25 July – 8 August 2022) recorded from onshore receivers.	
	Winter 2023 vessel traffic survey data consisting of AIS, Radar and visual observations for the study area (14 days, 20 February – 6 March 2023) recorded from onshore receivers.	
	Long-term AIS data for the study area (12 months, 2021) recorded from satellite and terrestrial receivers.	
	AIS data for the OECC study area (28 days, 25 July – 8 August 2022 and 20 February – 6 March 2023) recorded from satellite and terrestrial receivers.	
Maritime incidents	RNLI incident data for the study area (2013 to 2022).	Review of maritime incidents within and in proximity to the array site and OECC.
	Marine Casualty Investigation Board (MCIB) database for the study area (1992 to 2022).	
Other navigational features	Admiralty Charts 1415-0, 1411-0 and 1410-0 (United Kingdom Hydrographic Office (UKHO), 2022).	Characterising other navigational features in proximity to the array site and OECC.
	Admiralty Sailing Directions Irish Coast Pilot NP40 (UKHO, 2019)	
Weather	Wind direction – CWP Project site specific metocean measurement campaign included wave measurements, current measurements, wind measurements and CTD data (Techworks 2021).	Characterising weather conditions in proximity to the array site for use as input to the collision and allision risk modelling.

Data	Source(s)	Purpose
	Significant wave height – CWP Project site-specific coupled hydrodynamic and wave models were developed for the EIAR (**Volume 4 Appendices, Appendix 6.3 Modelling Report**).	
	Visibility data provided in Admiralty Sailing Directions Irish Coast Pilot NP40 (UKHO, 2019).	
	Tidal data provided by Admiralty Chart 1411.	

5.2 Vessel Traffic Surveys

41. The summer 2021 vessel traffic survey was undertaken by the *LB Jill*, a lift vessel which was undertaking geotechnical work on site. This was a 57-day survey spanning the period 30 April – 25 June 2021.

42. The summer 2022 vessel traffic survey was shore-based, carried out from equipment set up at Wicklow Head Lighthouse on the east coast of Ireland. This was a 14-day survey spanning the period 25 July – 8 August 2022.

43. The winter 2023 vessel traffic survey was shore-based, carried out from equipment set up at Wicklow Head Lighthouse on the east coast of Ireland. This was a 14-day survey spanning the period 20 February 2023 to 6 March 2023.

44. A number of vessel tracks recorded during the survey period were classified as temporary (non-routine), such as the tracks of the survey vessel and tracks of other vessels engaged in temporary surveys.

5.3 Long-Term Vessel Traffic Data

45. The long-term vessel traffic data consists of Automatic Identification System (AIS) covering 12 months from 2021 and was collected from a combination of satellite and terrestrial receivers. Downtime was limited due to the combination of receivers.

46. The assessment of this long-term dataset allowed seasonal and weather-related variations in routeing patterns and activities, as well as lighter trafficked routes, to be captured and considered within the NRA.

47. The dataset is assessed in full in Annex B , which includes a comparison against the vessel traffic survey data.

5.4 Data Limitations

5.4.1 Automatic Identification System Data

48. 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 1 July 2002, and fishing vessels over 15 metres (m) length overall (LOA).

49. Therefore, for the vessel traffic surveys larger vessels were recorded on AIS, while smaller vessels without AIS installed (including fishing vessels under 15 m LOA and recreational craft) were recorded, where possible, on the Automatic Radar Plotting Aid (ARPA). A proportion of smaller vessels also carry AIS voluntarily, typically utilising a Class B AIS device.

50. Throughout the 2021 survey, over 99% of vessel tracks were recorded via AIS with the remainder recorded via Radar. Throughout the 2022 survey, approximately 90% of vessel tracks were recorded via AIS with the remaining 10% recorded via Radar.

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

52. The COVID pandemic was observed to have a tangible effect on worldwide vessel traffic volumes and behaviours during 2020. On this basis, there may still be effects of COVID present within the long-term 2021 dataset and the 2021 vessel traffic survey dataset. However, it should also be considered that Brexit has been known to have an effect on traffic volumes and behaviours in the area. For the purposes of modelling (see **Section 14**), account has been made for traffic volumes observed within the 2022 dataset.

5.4.2 Historical Incident Data

53. The Royal National Lifeboat Institution (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.

54. Similarly, the Marine Casualty Investigation Board (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.

5.4.3 United Kingdom Hydrographic Office Admiralty Charts

55. The United Kingdom Hydrographic Office (UKHO) admiralty charts are updated periodically, and therefore the information shown may not reflect the real-time features within the region with total accuracy. 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. Navigational features are based upon the most recently available UKHO Admiralty Charts and Sailing Directions as of 2023.

6 Project Description Relevant to Shipping and Navigation

56. The NRA reflects the design envelope which is detailed in full in **Volume 2, Chapter 4: Project Description**. The following subsections outline the representative scenario of the CWP Project for which any shipping and navigation hazards are assessed. Full details of the representative scenario assessed for shipping and navigation are provided in **Chapter 16: Shipping and Navigation**.

6.1 Offshore Boundary

57. For the purposes of the NRA, the offshore boundary of the CWP Project is considered to consist of the array site and OECC.

6.1.1 Array Site

58. The array site is located within the Irish Sea approximately 7 nm from the coast of County Wicklow, on the east coast of Ireland. The northern extent of the array site is located on the Codling Bank, with the southern extent of the array site located east of the India Bank. The entire array site covers an area of approximately 36.4 square nautical miles (nm^2) and water depths within the array site range from 3.7 m to 20.4 m below Chart Datum (CD).

59. The key coordinates defining the boundary of the array site are illustrated in **Figure 6-1** and provided in **Table 6-1** using longitude and latitude values under World Geodetic System 1984 (WGS84).

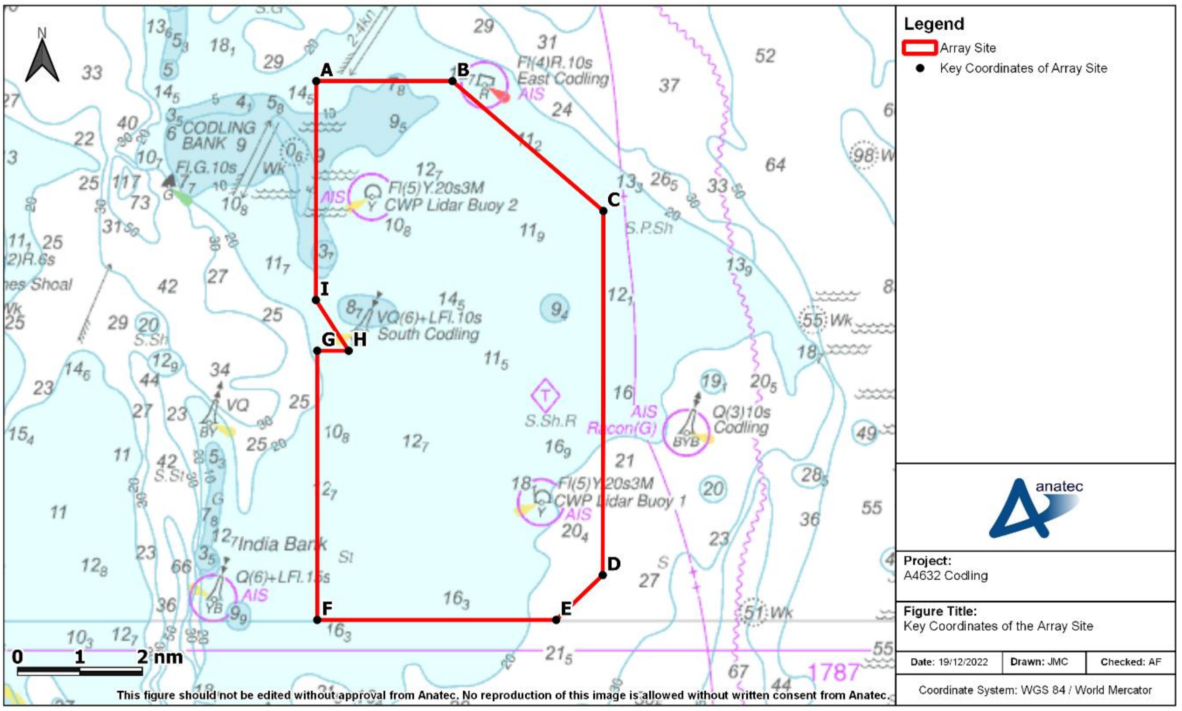

Figure 6-1 Key Coordinates of the Array Site

Table 6-1 List of Key Coordinates of the Array Site

Point	Longitude	Latitiude
A	005° 50’ 36.60” West	53° 08’ 36.00” North
B	005° 47’ 0.00” West	53° 08’ 36.00” North
C	005° 43’ 0.00” West	53° 06’ 31.80” North
D	005° 43’ 1.00” West	53° 00’ 43.00” North
E	005° 44’ 15.00” West	53° 00’ 0.00” North
F	005° 50’ 35.00” West	53° 00’ 0.00” North
G	005° 50’ 35.00” West	53° 04’ 18.00” North
H	005° 49’ 45.00” West	53° 04’ 18.00” North
I	005° 50’ 37.20” West	53° 05’ 6.60” North

6.1.2 Marine Safety Demarcation Area

60. The Marine Safety Demarcation Area (MSDA) is presented in **Figure 6-2**. The MSDA is defined by a boundary of width 500 m around the array site, creating an area of approximately 36 nm^2, and is the area within which the construction buoys will be placed. Further details of construction buoyage are presented in the.

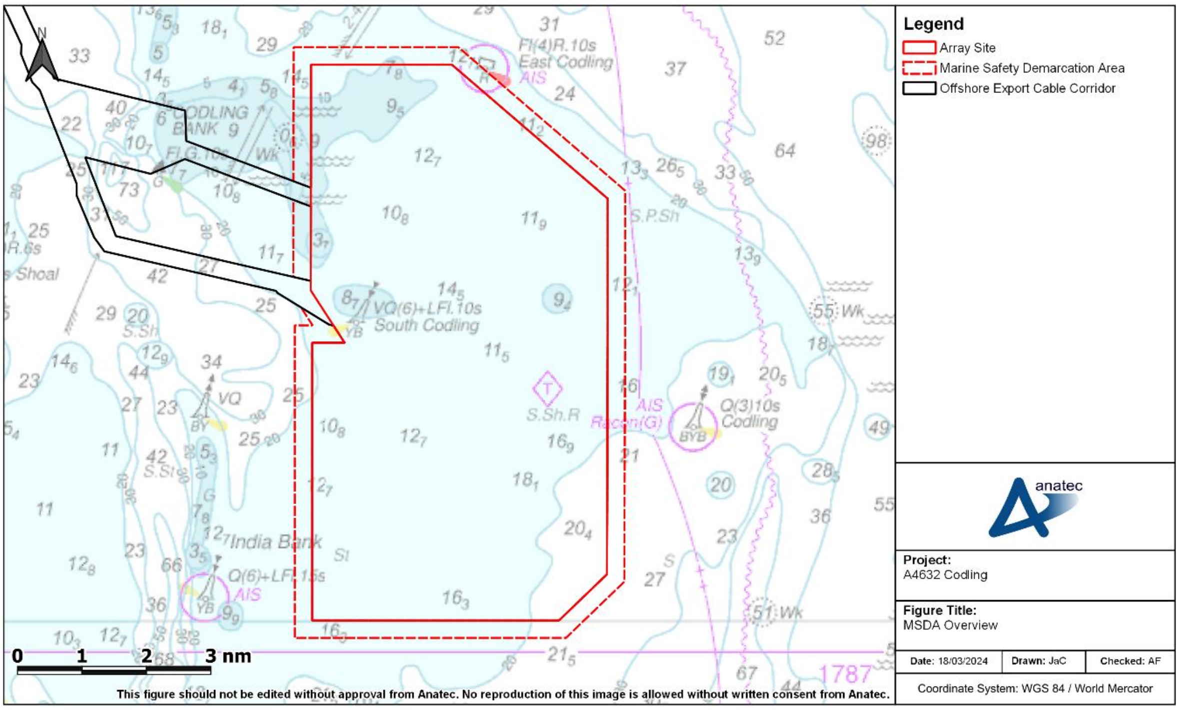

Figure 6-2 Marine Safety Demarcation Area Overview

6.1.3 Offshore Export Cable Corridor

61. The OECC is presented in **Figure 6-3**. The total area covered by the OECC is approximately 12.0 nm^2 with charted water depths ranging between zero (nearshore) and 50 m below CD. The OECC makes landfall at Poolbeg within Dublin Bay.

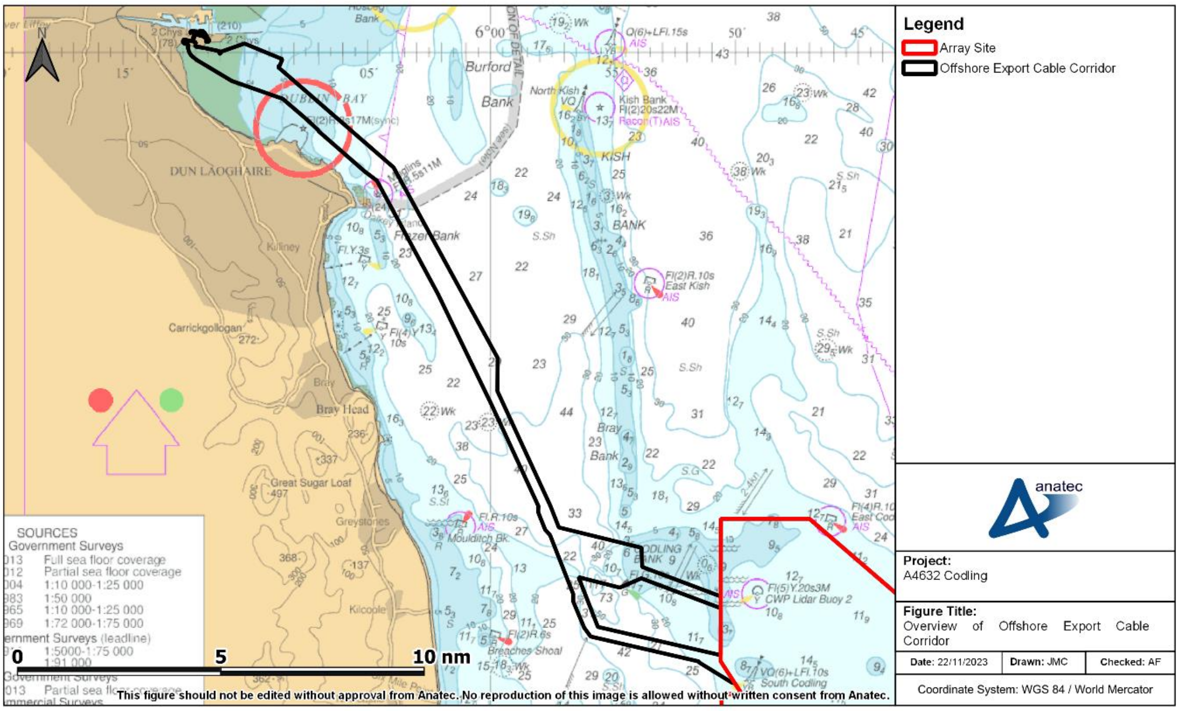

Figure 6-3 Overview of Offshore Export Cable Corridor

6.2 Surface Infrastructure

6.2.1 Layout

62. To enable flexibility in developing the Generating Station, the Applicant is seeking consent for two different Wind Turbine Generator (WTG) layout options, only one of which will be progressed to construction. This includes:

- **WTG Layout Option A**: A smaller WTG option which comprises 75 WTGs with a rotor diameter of 250 m; and
- **WTG Layout Option B**: A larger WTG option which comprises 60 WTGs with a rotor diameter of 276 m.

63. For the purposes of the NRA, the appropriate representative scenario from a shipping and navigation perspective is deemed to be Option A, which is shown in **Figure 6-4**. Full details are provided in **Chapter 16: Shipping and Navigation** and **Appendix 16.2: Representative Scenario and Limits of Deviation Assessment**. Both WTG layout options and associated components are described in detail within

Volume 2, Chapter 4 Project Description. The WTG numbers and locations are confirmed for each option, and the parameters for each option are clearly presented. Within this NRA, only the parameters for Option A are shown given this represents the appropriate representative scenario option from a shipping and navigation perspective.

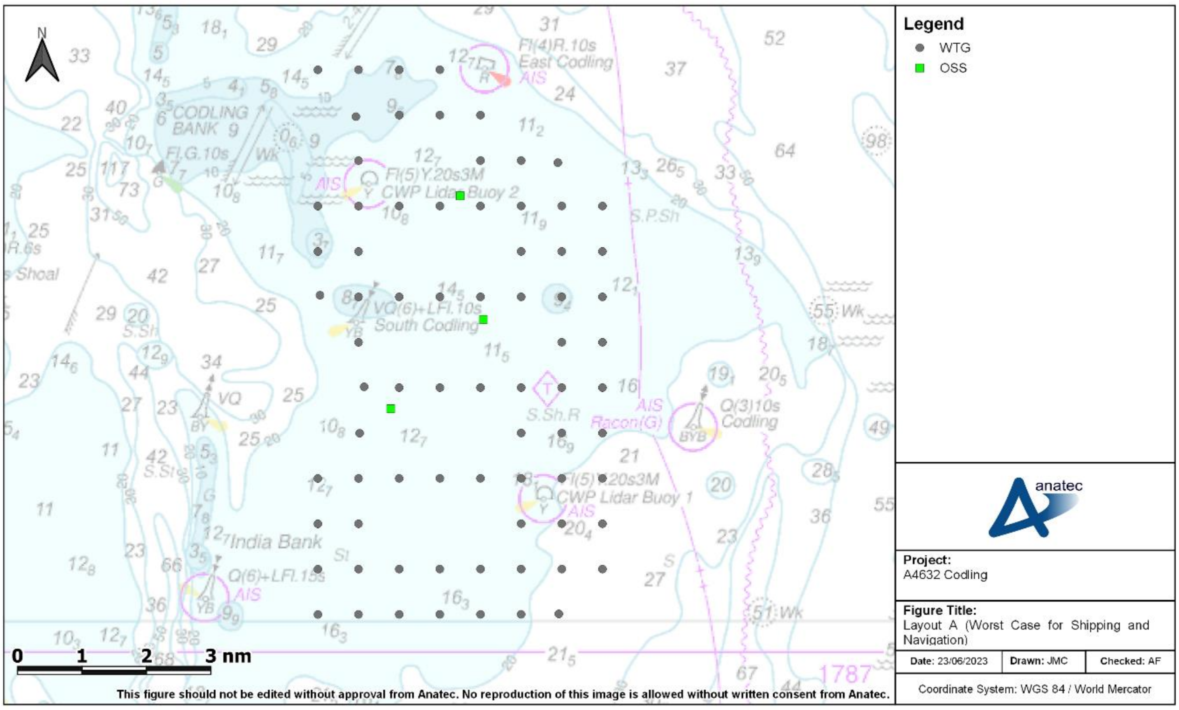

Figure 6-4 Layout A (Representative Scenario for Shipping and Navigation)

6.2.2 Wind Turbine Generators

64. Key parameters for the WTGs are given in **Table 6-2**, noting that the values provided are specific to the worst-case selected for shipping and navigation and do not necessarily represent the maximum within the design envelope overall.

Table 6-2 Key WTG Parameters

Parameter	Value
Number	75
Foundation type	Monopile
Dimensions at sea surface	9 m diameter
Maximum blade tip height (above LAT)	288 m
Minimum air gap (above Highest Astronomical Tide (HAT))	22 m
Maximum rotor diameter	250 m

6.2.3 Offshore Substations

65. The offshore substation (OSS) structures will be installed on monopile foundations with maximum topside dimensions being 45 m x 45 m. There will be three substations, with locations shown in **Figure 6-4**.

6.3 Subsea Cables

6.3.1 Inter-array Cables

66. The inter-array cables will connect individual WTGs to OSSs. Up to 75 nm of inter-array cables will be required with the final length dependent on the final layout. All inter-array cables will be installed within the array site.

6.3.2 Interconnector Cables

67. The interconnector cables will provide interlink connections between the OSSs within the array site. Up to two interconnector cables will be required with a total length of up to 5 nm.

6.3.3 Offshore Export Cables

68. The offshore export cables will carry the energy generated by the WTGs from the array site to shore. Up to three offshore export cables will be required with a combined total length of up to 80 nm and will be installed within the OECC of the CWP Project (see **Section 6.1.2**). The offshore export cables will make landfall at Poolbeg within Dublin Bay.

6.3.4 Cable Minimum Depth of Cover

69. As per **Section 16**, minimum depth of cover is 1.4 m for the offshore export cables (except cable buried within the zone of greater burial depth adjacent to Dun Laoghaire Harbour which will have a minimum depth of cover of 3.0m), and 1 m for the inter-array and interconnector cables will be implemented. In cases where burial is inadequate due to unforeseeable seabed conditions, and at cable crossings, cable protection will be implemented as mitigation to avoid risks to other marine operations.

6.4 Construction Phase

70. The offshore construction phase will last for up to approximately 2 years. Figure 6-5 outlines an indicative construction programme for the CWP Project which indicates the maximum duration of construction for each element.

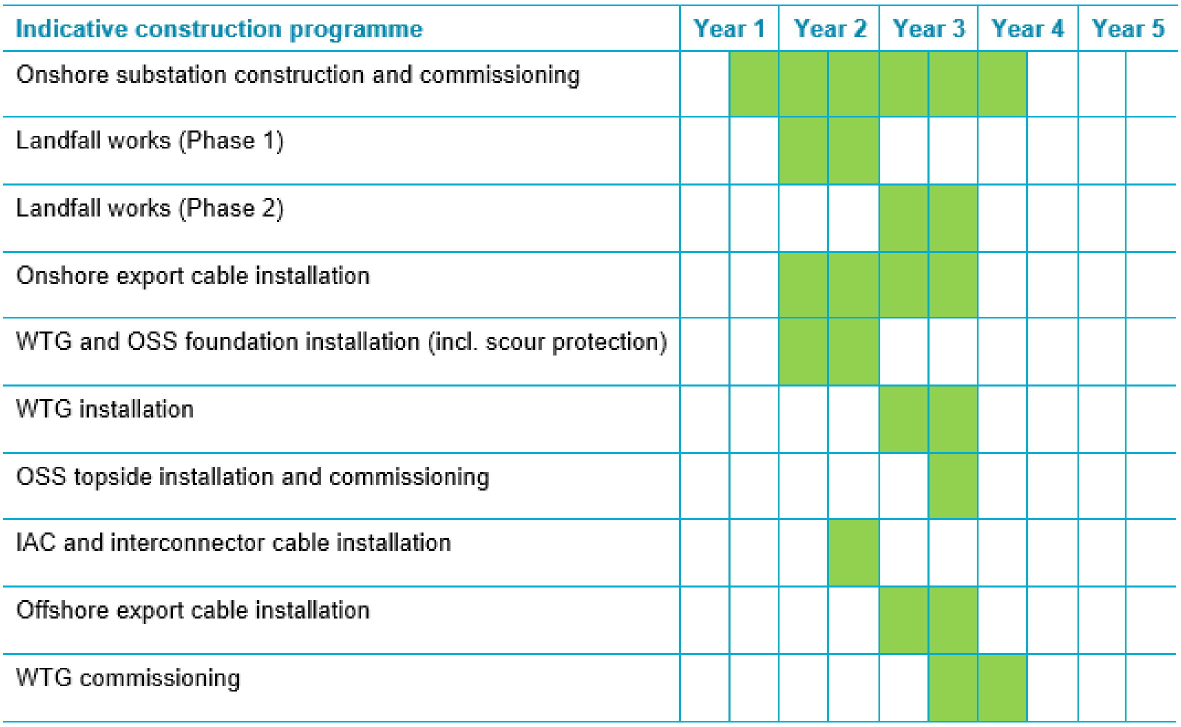

Figure 6-5 Indicative Construction Programme

6.5 Indicative Vessel and Helicopter Numbers

6.5.1 Construction Vessels

71. Up to 2,406 round trips by construction vessels may be made throughout the construction phase, broken down as summarised in **Table 6-3**.

Table 6-3 Maximum Vessel Numbers per Construction Activity

Vessel Type	Peak vessels	Round trips
Foundations		
Seabed preparation vessels (including surveys, unexploded ordnance investigation and boulder clearance)	4	20
WTG and OSS monopile installation vessels (includes installation vessel, feeder vessel and anchor handlers)	6	43
Transition Piece (TP) installation vessels	7	43
Scour protection installation vessels (including filter layer and seabed preparation)	7	107

Vessel Type	Peak vessels	Round trips
WTGs and OSSs		
WTG installation vessels (includes installation vessel, feeder vessel and anchor handlers)	4	50
OSS topside installation vessels	4	20
Cable installation vessels		
Seabed preparation vessels (including Trailing Suction Hopper Dredger (TSHD) for sand wave clearance and disposal off site, Pre-Lay Grapnel Run (PLGR), Out of Service (OOS) removal, boulder clearance, pre-crossing protection and survey vessel)	7	548
Array cable and interconnector installation vessels (includes support, cable protection and anchor handling vessels)	6	39
Export cable installation vessels (including at landfall) (includes support, cable protection and anchor handling vessels)	5	43
Nearshore export cable installation vessels (including at landfall) (includes barges, tugs and small work boats)	17	118
Commissioning vessels		
Commissioning vessels	2	48
Support vessels		
General support vessels (including guard vessel, project Service Operation Vessel (SOV) and work boats)	4	506
Crew transfer vessels	2	824
Total construction vessels		

Vessel Type	Peak vessels	Round trips
Maximum total construction vessels	75	2,409
Indicative peak vessels on site simultaneously	38	N/A

6.5.2 Operation and Maintenance Vessels

72. Up to 1,209 annual round trips are likely to be seen by vessels undertaking O&M activities, as broken down in **Table 6-3**. Helicopters are not being considered as a method for transferring technicians offshore to perform asset maintenance.

Table 6-4 Maximum Vessel Numbers per Construction Activity

Operation and Maintenance Activity	Peak Vessel Numbers	Annual Round Trips
Jackup Vessels (JUVs)	2	3
SOV	1	26
Operation support vessel	6	1,152
Cable maintenance vessel	2	1
Auxiliary vessel*	3	27
Total	**14**	**1,209**

* Includes survey vessels, ROV's, AUVs, Tug operations, cargo vessels, passenger vessels, and scour replacement vessels

6.6 Decommissioning Phase

73. The decommissioning sequence will generally be the reverse of the construction sequence and involve similar types and numbers of vessels. The decommissioning duration of the offshore infrastructure may take the same amount of time as construction, up to 2 years, although this indicative timing may reduce.

7 Navigational Features

74. **Figure 7-1** presents an overview of the charted navigational features within and in the vicinity of the array site and OECC. Following this, **Figure 7-2** presents a more detailed overview of the charted navigational features specifically within Dublin Bay. Each of the features shown are discussed in the proceeding subsections and have been identified using the most detailed UKHO admiralty chart available.

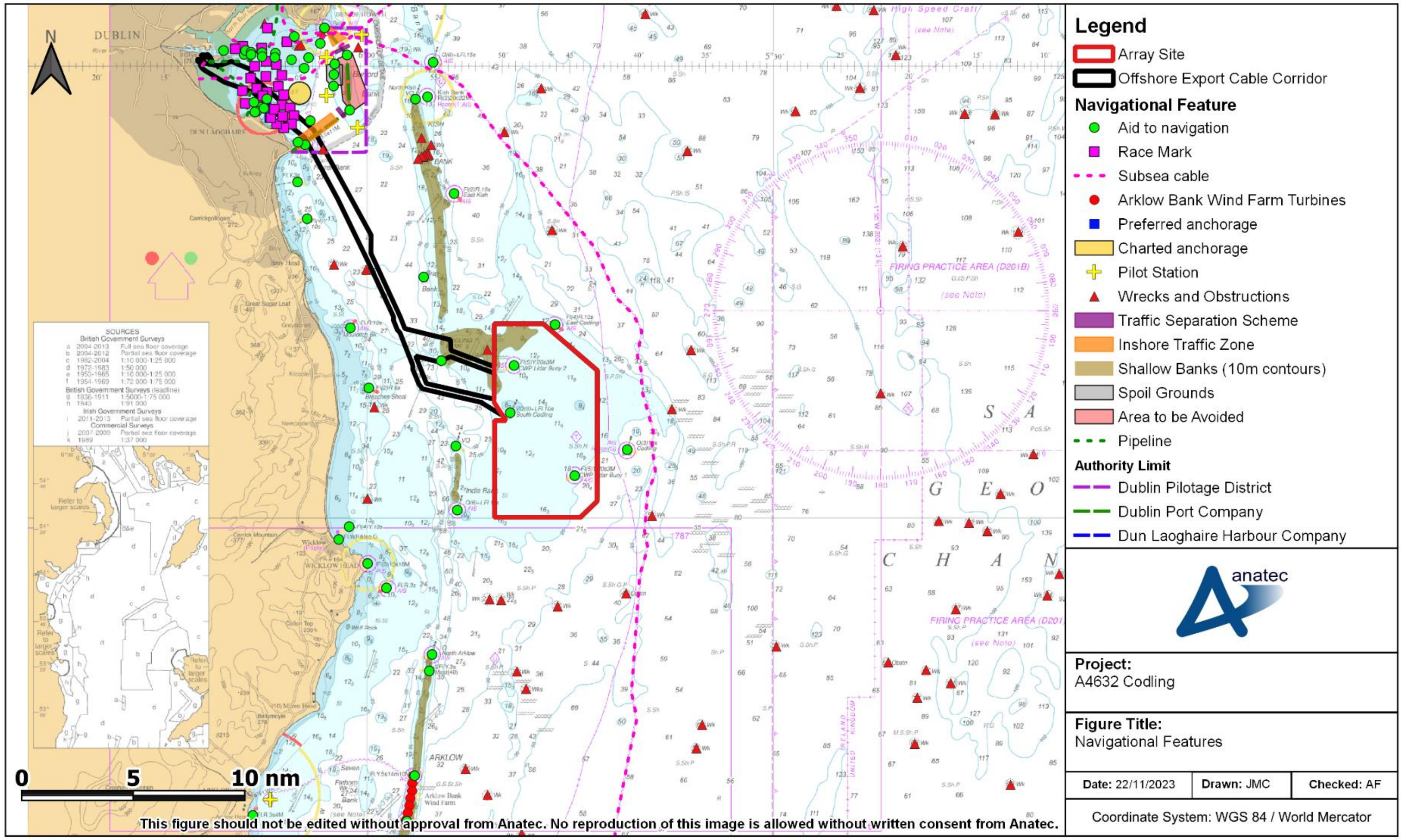

Figure 7-1 Navigational Features

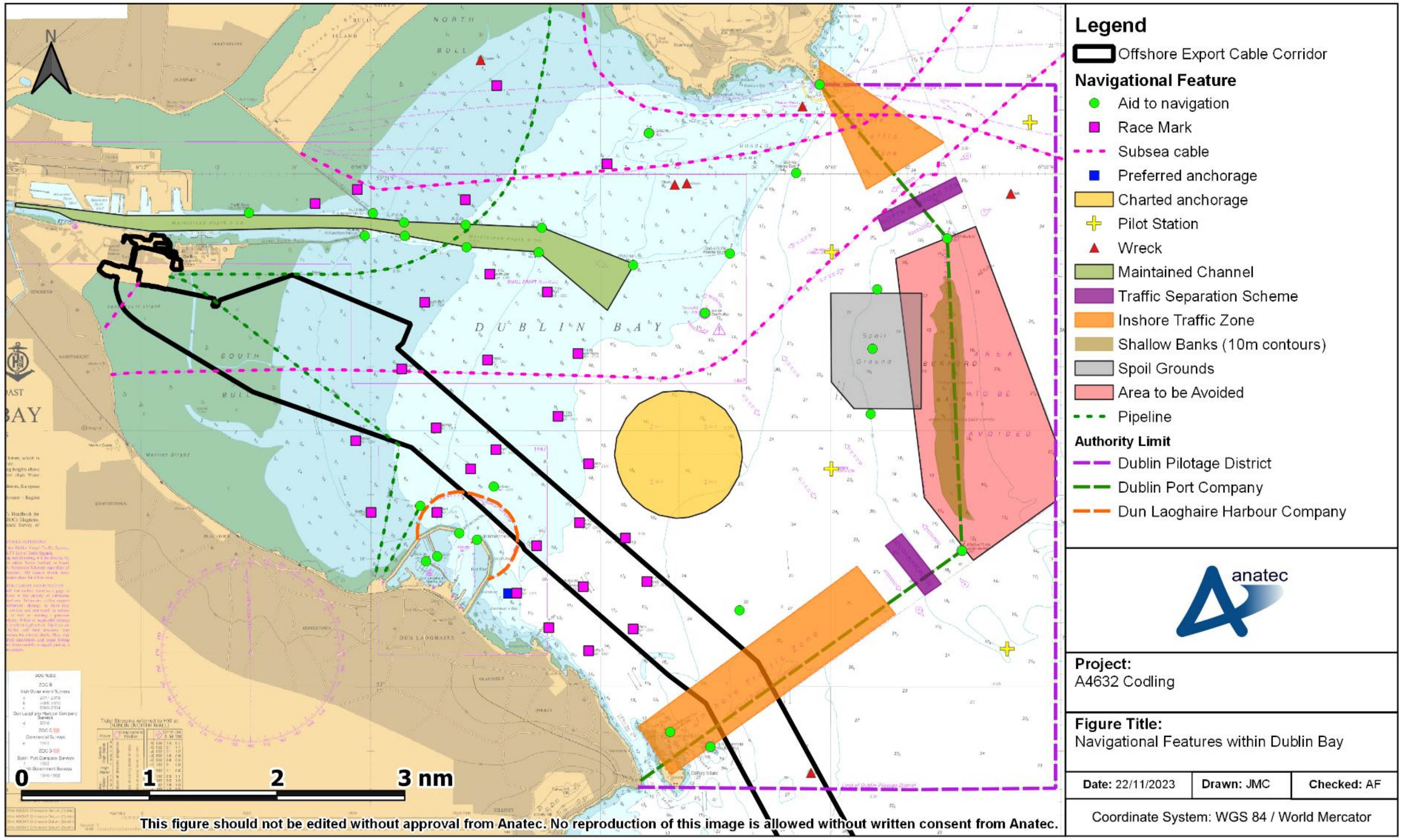

Figure 7-2 Navigational Features within Dublin Bay

75. The following subsections provide a more detailed overview of each type of navigational feature.

7.1 Other Offshore Wind Farms

76. Arklow Bank Wind Park is located approximately 12.1 nm southwest of the array site and 16.9 nm south of the OECC, and is currently the only operational offshore wind farm in Ireland. The development was commissioned in 2004 and consists of seven WTGs.

77. Planned developments are considered separately on a cumulative basis (see **Section 1**).

7.2 Subsea Cables and Pipelines

78. The EXA South cable (a subsea telecommunications cable) is located approximately 1.9 nm to the east of the array site. This cable runs between Ireland and Canada. The ESAT-2 (another subsea telecommunications cable) is located 14 nm northwest of the array site and connects Ireland to England. This cable intersects the OECC within Dublin Bay.

79. There are also two charted sewer pipelines that intersect the OECC, each meeting its landfall, with one running to the OECC's south and the other to its north.

7.3 Aids to Navigation

80. There are aids to navigation marking shallow banks in the area and the approach to Dublin Port. Aids to navigation near to Dublin Port indicate the recommended passage that vessels should take when entering or leaving the port, including the fairway where a depth of 7.8 m is maintained for larger vessels access. It is noted that small craft are instructed to remain outside of the buoyed area, and if they are required to cross should do so only with the permission of the Vessel Traffic Service (VTS), and at close to right angles as practicable (based on a note on the relevant chart).

81. There are three buoys located within the array site itself, noting that two are Light Detection and Ranging (Lidar) buoys associated with the CWP Project. The third is the South Codling cardinal mark, marking the Codling bank. Other key aids to navigation in proximity include:

- East Codling buoy including AIS transmission, within 600 m of the array site to the northeast;
- Codling buoy, east cardinal mark that utilises both AIS and Racon, approximately 1.3 nm to the east of the array site;
- South cardinal mark, marking the southern extent of India Bank that utilises AIS, approximately 1.6 nm to the west of the array site;

- North cardinal mark, marking the northern extent of India Bank, approximately 1.7 nm to the west of the array site; and
- Other local aids to navigation including those marking the Kish, Bray and Arklow Banks.

7.3.1 Race Marks

82. There are also 28 race marks within Dublin Bay, for the purposes of recreational racing, generally in place from April to October. The locations shown in **Figure 7-2** are the 2023 positions.

7.4 Charted Anchorages

83. There is a single charted anchorage location in the vicinity of the CWP Project, within Dublin Bay. This anchorage is approximately 600 m northeast of the OECC and is utilised by commercial vessels. Commercial anchoring is also known to occur south of Dublin Bay. Further details are provided in **Section 11.5.5**.

84. There is also a preferred anchorage location at Scotsman's Bay to the east of Dun Laoghaire and south of the OECC. Scotman's Bay is referenced within the UKHO Admiralty Sailing Directions for the area (Irish Coast Pilot NP40) (UKHO, 2019) as an area where anchorage may be found, and consultation input indicated recreational vessels use this area for anchorage.

7.5 Pilot Stations, Ports and Related Features

85. Wicklow Harbour is located approximately 7 nm to the southwest of the array site. There are a number of commercial maritime businesses operating out of Wicklow engaged in stevedoring, logistics, and transport and maritime engineering. The commercial vessels utilise the port facilities for cargo such as timber, glass and scrap metal (Wicklow County Council, 2023).

86. Dublin is located approximately 17 nm to the northwest of the array site and near to the landfall of the OECC. Dublin Port is the largest freight and passenger port in Ireland, and handles almost 50% of all trade in Ireland.

87. There are four pilot stations within the Dublin Pilotage District, noting that none are in proximity to the OECC.

88. In close vicinity to Dublin is Dun Laoghaire, which is located approximately 14 nm to the northwest of the array site and approximately 0.6 nm to the southwest of the OECC. Its charted authority limit intersects the OECC.

7.6 Shallow Banks

89. A key navigational feature in the area are the shallow banks given they are observed to dictate vessel routeing in proximity to the array site (see **Section 12.2**). The five main shallow sand banks in the vicinity of the array site and OECC are:

- Codling Bank, which intersects the array site and OECC;
- India Bank, located approximately 1 nm to the west of the array site and 2.5 nm south of the OECC;
- Bray Bank, located approximately 2 nm to the northwest of the array site and 1.7 nm north of the OECC;
- Kish Bank, located approximately 7 nm to the northwest of the array site and 2.3 nm east of the OECC; and
- Arklow Bank, located approximately 7 nm to the southwest of the array site and 11 nm south of the OECC.

7.7 Traffic Separation Schemes

90. Three major Traffic Separation Schemes (TSSs) are located in the vicinity of the CWP Project, as shown in **Figure 7-3**:

- TSS Off Skerries, approximately 34 nm to the northeast of the array site;
- TSS Off Tuskar Rock, approximately 46 nm to the south of the array site; and
- TSS Off Smalls, approximately 69 nm to the south of the array site.

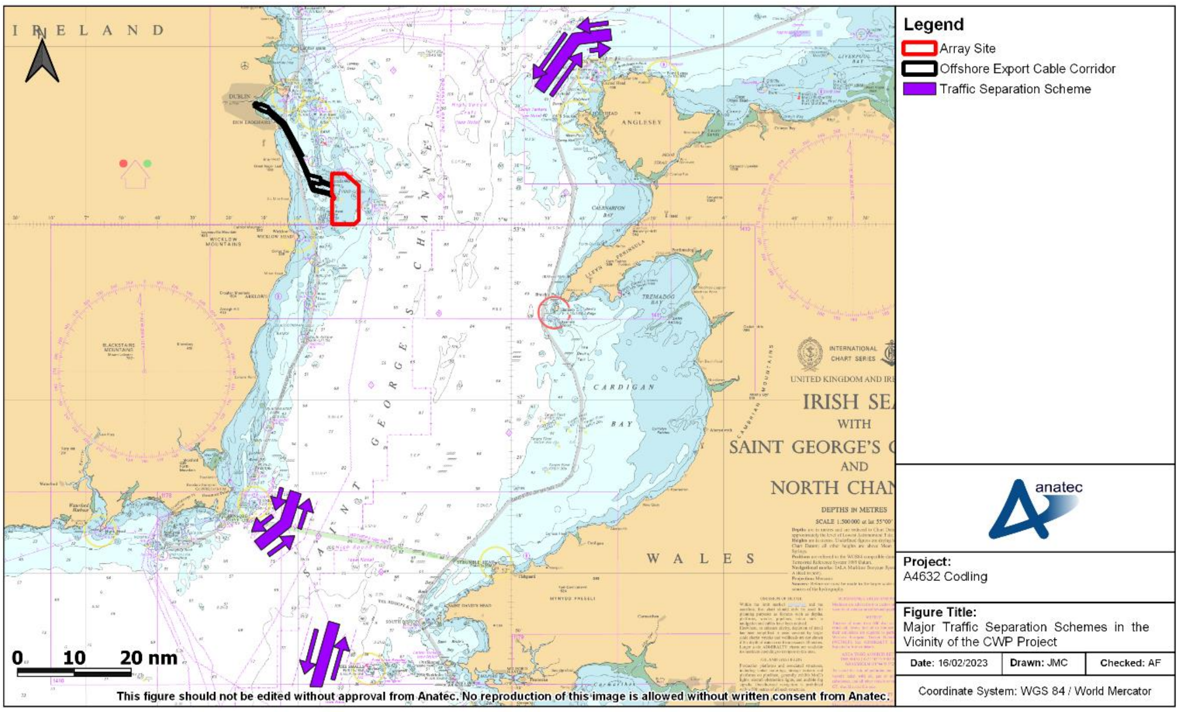

Figure 7-3 Major Traffic Separation Schemes

91. None of the measures are within the study area, however a notable proportion of commercial traffic passing within the vicinity of the array site are observed to be on routes associated with these TSSs (see **Section 12.2**).

7.8 Charted Wrecks and Obstructions

92. There are 25 charted wrecks within 10 nm of the array site, with nine of these being located within and around Kish Bank. There are four charted wrecks within 10 nm of the OECC. There are none within the array site itself, however the closest is within 600 m to the west of the boundary, at a depth of 0.6 m below CD. There is one within the OECC, at a depth of 29.5 m below CD.

93. There is also one charted obstruction in the vicinity of the CWP Project, approximately 4 nm to the southeast of the array site, at a depth of 41 m below CD.

7.9 Military Practice and Exercise Areas

94. Three military Practice and Exercise Areas (PEXAs) intersect the study area, approximately 7.8 nm east of the array site. The D201 firing practice area located south of D201B, and D201D is contained within D201B. No restrictions are placed on the right to transit the firing practice area at any time, with operations conducted using a clear range procedure – exercises and firing only take place when the area is considered to be clear of all shipping.

8 Meteorological Ocean Data

95. This section presents meteorological and oceanographic statistics local to the array site, primarily based on survey data (Techworks, 2021) and Admiralty Sailing Directions and Admiralty charts. The data presented in this section is used as input to the collision and allision risk modelling (see **Section 14**).

8.1 Wind Direction

96. The distribution of wind direction data is presented in **Figure 8-1** in the form of a wind rose.

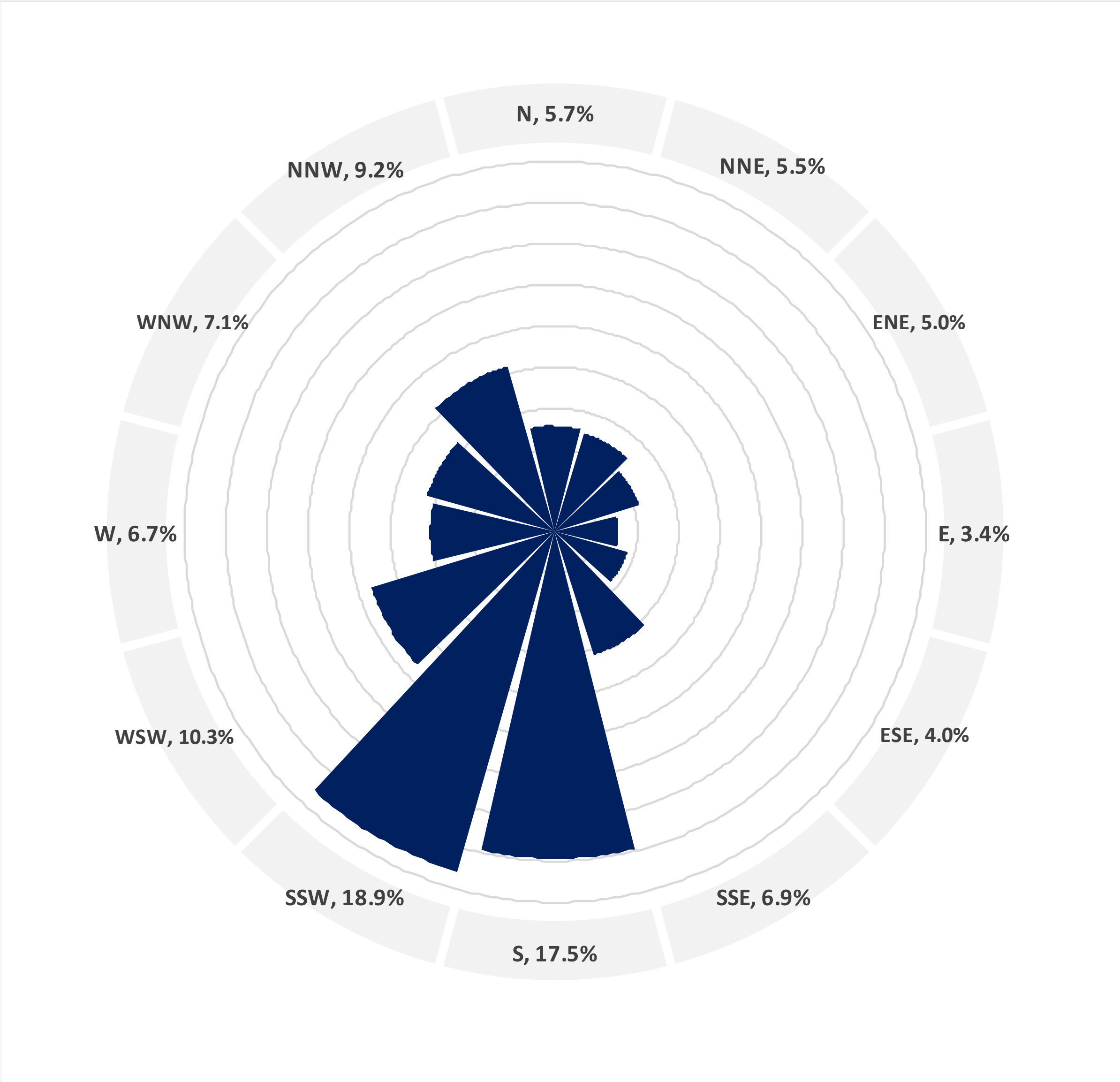

Figure 8-1 Wind Direction Distribution in Proximity to the Array Site

97. It can be seen that winds are predominantly from the south-southwest (18.9%) and the south (17.5%).

8.2 Significant Wave Height

98. Significant wave height data (Techworks, 2021) has been analysed. **Table 8-1** presents the proportion of the significant wave height within each of three defined ranges which are categorised as calm, moderate and severe sea states.

Table 8-1 Sea State Distribution in Proximity to the Array Site

Significant Wave Height (m)	Sea State	Proportion (%)
< 1	Calm	58
1 to 5	Moderate	42
≥ 5	Severe	< 1%

8.3 Visibility

99. It is assumed that the proportion of poor visibility (defined as the proportion of a year where the visibility can be expected to be less than 1 kilometre (km)) is 3%. This is based upon details provided in the UKHO Admiralty Sailing Directions for the area (Irish Coast Pilot NP40) (UKHO, 2019).

8.4 Tidal Speed and Direction

100. Tidal data to be used as an input to the allision modelling is based upon the information available from Admiralty Chart 1411. **Table 8-2** presents the peak flood and ebb direction and speed values for the charted tidal diamonds within proximity of the array site.

Table 8-2 Peak Flood and Ebb Speeds and Directions

Tidal Diamond (Chart 1411)	Flood		Ebb	
	Direction (°)	Speed (knots)	Direction (°)	Speed (knots)
P	350	2.2	171	2.2
Q	2	2.1	182	2.2
S	1	2.7	179	2.8
T	25	3.6	206	3.5
U	25	3.8	205	3.8
V	13	3.3	198	3.4

101. 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

102. This section summarises the existing SAR resources of relevance to the CWP Project.

9.1 Search and Rescue Helicopters

103. The IRCG is responsible for the response to, and coordination of, maritime accidents which require SAR, counter-pollution operations, and ship casualty operations. A new 10-year aviation services contract was awarded to Bristow Ireland Limited (BIL) by the Department of Transport in August 2023 and provides for year-round, day and night Search and Rescue helicopter services. This service will be delivered through a fleet of six SAR configured AW189 helicopters located in Dublin, Shannon, Sligo and Waterford.

104. The locations of these bases are presented in **Figure 9-1**.

Figure 9-1 Irish Coast Guard SAR Helicopter Base and Marine Rescue Centre Locations

105. The closest base to the array site, and the base most likely to respond to an incident requiring helicopter assistance near the CWP Project, is the Dublin Airport base approximately 13 nm northwest.

9.2 Marine Rescue Centres

106. The IRCG operates three marine rescue centres around Irish waters, based in Dublin, Malin Head, and Valentia Island. The locations of these bases are presented in **Figure 9-1**. The closest of these centres to the array site is Dublin (a National Maritime

Operations Centre (NMOC)) which provides marine SAR response services and co-ordinates the response to marine casualty incidents within the Irish Exclusive Economic Zone (EEZ).

9.3 Royal National Lifeboat Institution

107. The RNLI is organised into six divisions, with the relevant region for the CWP Project being the *Ireland* division. Based out of more than 230 stations, there are over 400 active lifeboats across the RNLI fleet, including both All-Weather Lifeboats (ALBs) and Inshore Lifeboats (ILBs).

108. **Figure 9-2** presents the locations of RNLI stations in the vicinity of the CWP Project. Following this, **Table 9-1** summarises the types of lifeboat operated by the RNLI out of these stations.

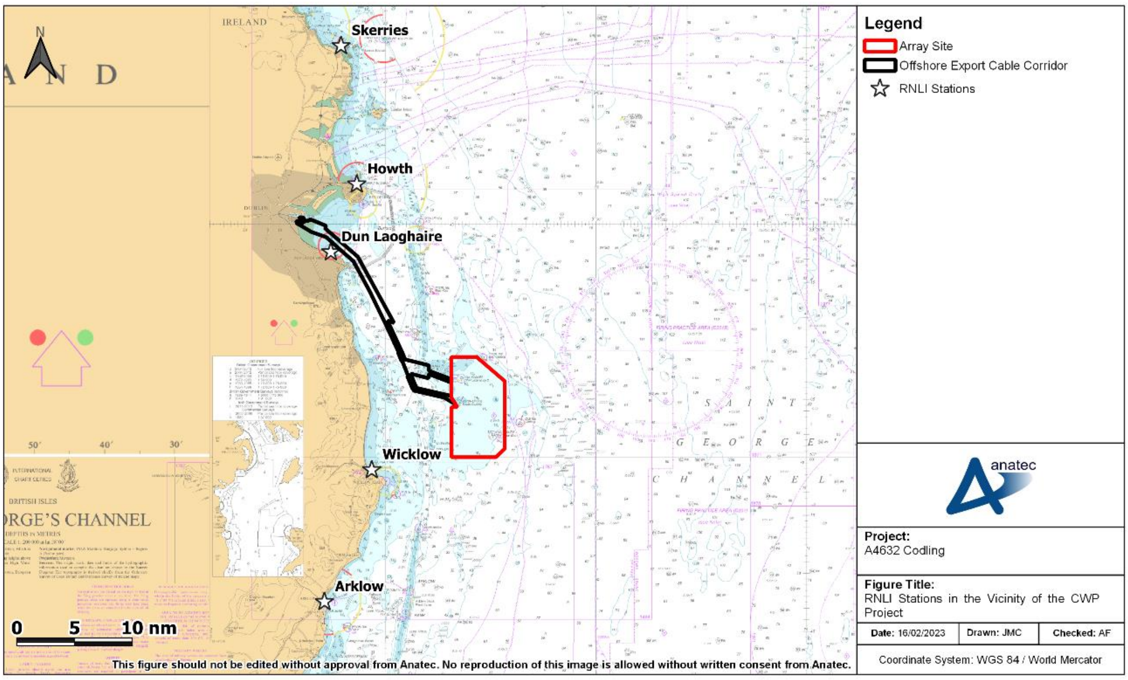

Figure 9-2 RNLI Station Locations in the Vicinity of the CWP Project

Table 9-1 Type of Lifeboat Held at RNLI Stations in the Vicinity of the CWP Project

Station	Lifeboat(s)	ALB Class	ILB Class	Distance to Array Site (nm)
Wicklow	ILB	–	D Class	7.0
Dun Laoghaire	ALB and ILB	Trent	D Class	13.7
Arklow	ALB	Trent	–	16.6
Howth	ALB and ILB	Trent	D Class	16.9

Station	Lifeboat(s)	ALB Class	ILB Class	Distance to Array Site (nm)
Skerries	ILB	–	B Class	28.2

9.4 Third-party Assistance

109. Companies operating offshore 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.

110. Emergency response and cooperation procedures between the CWP Project and the IRCG will be agreed prior to construction as per **Section 16**.

10 Maritime Incidents

111. This section reviews historic maritime incidents which have occurred in the vicinity of the CWP Project, and includes consideration of incidents which have occurred at existing offshore wind farm developments in the UK.

112. The analysis is intended to provide a general indication of whether the general area is currently low or high risk in terms of maritime incidents and whether offshore wind farms in general pose a high risk to vessels. If the area was found to be of particularly high risk for incidents, then this may indicate that the CWP Project could exacerbate the existing maritime safety risks in the area.

10.1 Royal National Lifeboat Institution Data

113. This section presents an overview of RNLI incident data within the study area and cable corridor study area. It is noted that only documented incidents could be assessed, and incidents which were deemed hoaxes or false alarms have been excluded from the analysis.

10.1.1 Array Site

114. **Figure 10-1** presents the RNLI stations in proximity to the array site as well as the incidents documented by the RNLI that occurred within the study area during the period 2013 to 2022 (inclusive), colour-coded by incident type. **Figure 10-2** presents the same data with the incidents colour-coded by casualty type.

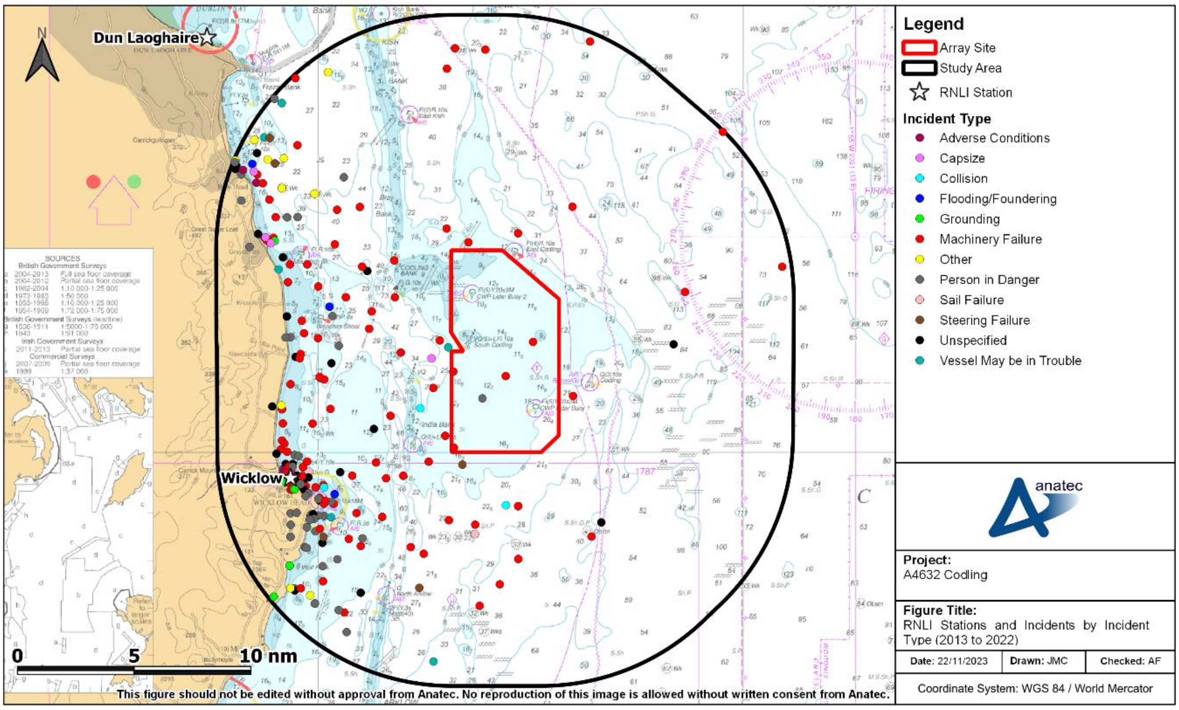

Figure 10-1 RNLI Stations and Incidents by Incident Type within Study Area (2013 to 2022)

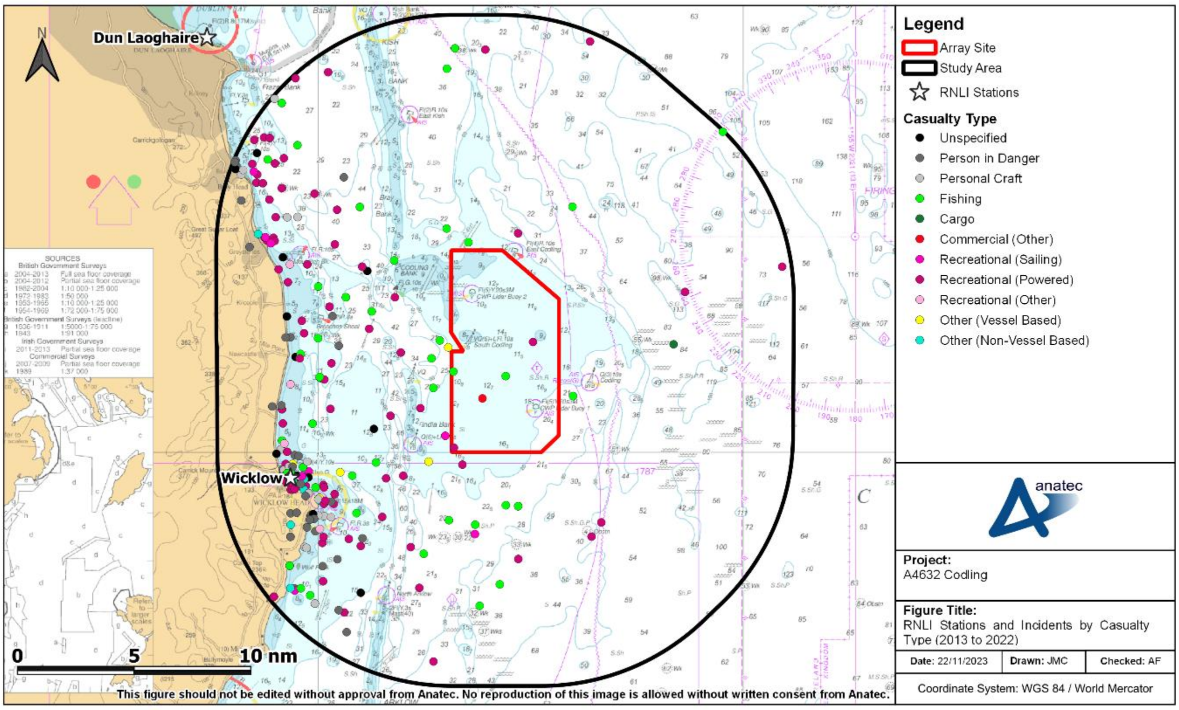

Figure 10-2 RNLI Stations and Incidents by Casualty Type within Study Area (2013 to 2022)

115. A total of 281 lifeboat responses to 269 unique incidents were recorded within the study area during the ten year period, corresponding to an average of 27 unique incidents per year. Incidents were mainly concentrated around Wicklow, with relatively few incidents occurring in open waters.

116. It is noted that five incidents occurred within the array site; one classed as "person in danger" and four classed as "machinery failure". Two involved fishing vessels, two involved powered recreational vessels and another involved a commercial vessel.

117. The most common incident type in the RNLI data was "machinery failure", accounting for 39% of the incidents. This was followed by "person in danger", which accounted for 23%. Excluding "person in danger" and non-vessel incidents, the most frequent casualty type was powered recreational vessels (44%), followed by fishing vessels (24%), and personal crafts (10%).

118. The large majority (85%) of lifeboat responses were from Wicklow station. This was followed by Dun Laoghaire (13%) as the next most common mobilisation station, with the remainder occurring from Arklow, Howth and Rosslare.

10.1.2 Offshore Export Cable Corridor

119. **Figure 10-3** presents the RNLI incidents documented by the RNLI that occurred within the cable corridor study area during the period 2013 to 2022 (inclusive),

colour-coded by incident type. **Figure 10-4** presents the same data with the incidents colour-coded by casualty type.

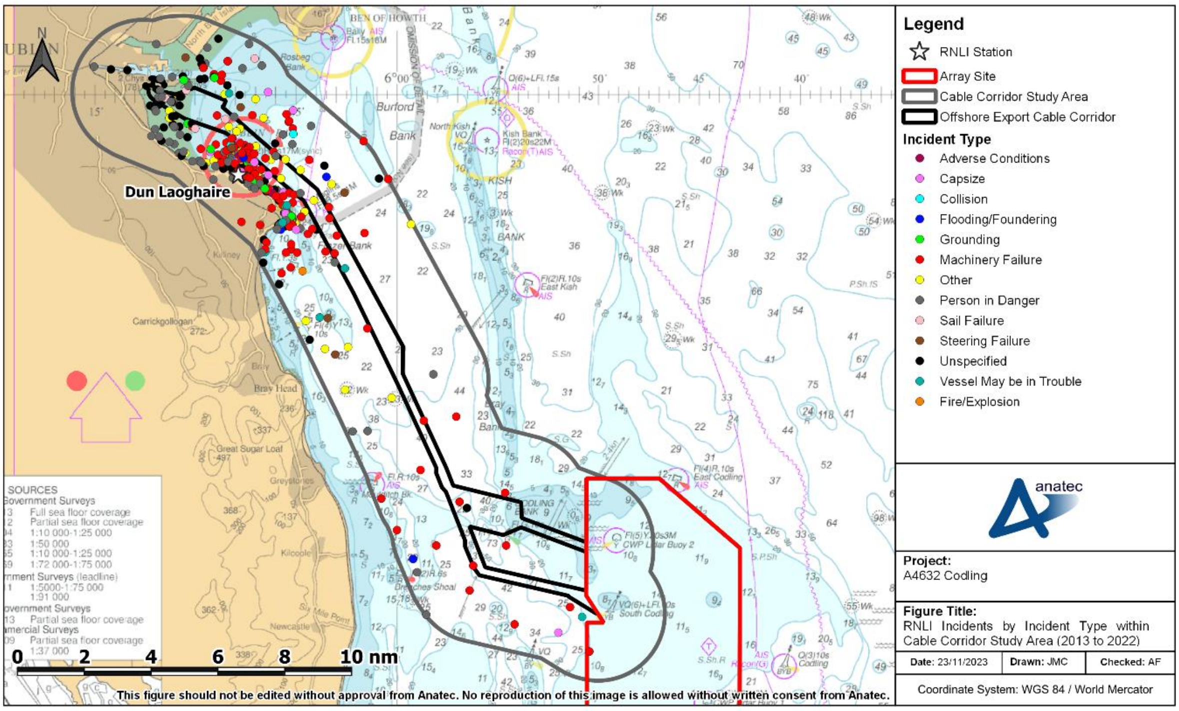

Figure 10-3 RNLI Incidents by Incident Type within Cable Corridor Study Area (2013 to 2022)

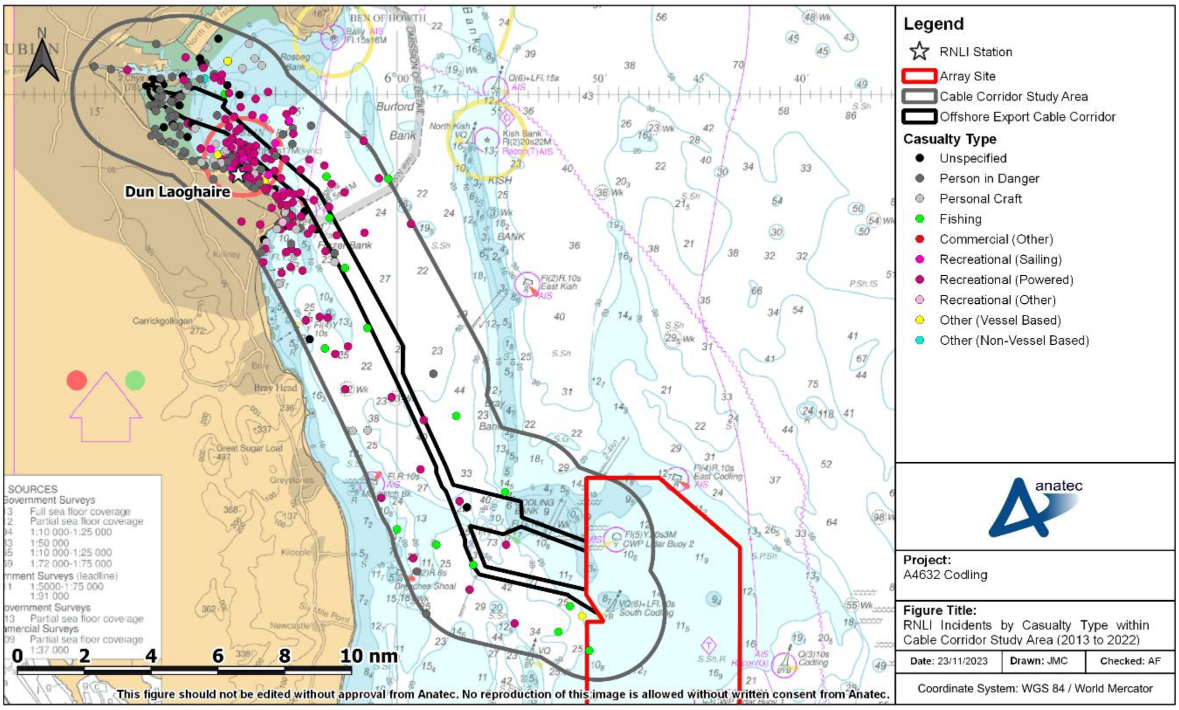

Figure 10-4 RNLI Incidents by Casualty Type within Cable Corridor Study Area (2013 to 2022)

120. A total of 457 lifeboat responses to 441 unique incidents were recorded within the cable corridor study area during the ten year period, corresponding to an average of 44 unique incidents per year. Incidents were mostly concentrated inshore of the OECC in Dublin Bay, in particular in the vicinity of Dun Laoghaire, with relatively few incidents occurring further south.

121. It is noted that 47 unique incidents occurred within the OECC itself (with the majority again occurring within Dublin Bay). These incidents most commonly involved machinery failure (34%). The most common casualty type was sailing vessels (32%).

122. Excluded unspecified (which accounted for 24% of incidents), the most common incident type in the RNLI data was "machinery failure" (38%), followed by "person in danger" (29%). Excluding "person in danger" and non-vessel incidents, the most frequent casualty types was powered recreational vessels (53%), followed by personal craft (14%).

123. The large majority (94%) of lifeboat responses were from Dun Laoghaire station. The remainder were from Wicklow and Howth.

10.2 Marine Casualty Investigation Board Data

124. 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. Although the MCIB do

not publish comprehensive incident data in the public domain, they do publish investigation reports online (MCIB, 2022) and details on each incident are thus provided.

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

10.2.1 Array Site

126. There were no documented MCIB incidents within the study area during the most recent ten year period (2013-2022), however there were incidents in older historical data, with two in 2000 and one in 2008. Further details of these incidents are seen in **Table 10-1**, with information from the publicly available database of incident reports. None of these incidents occurred within the array site itself.

Table 10-1 Summary of MCIB Incidents within Study Area

Incident Type	Year	Summary
Collision	2000	Collision between the fishing vessel *Clara* and the tanker *Coral Antillarum* off the coast of Wicklow.
Grounding	2000	Grounding of the car carrier *Asian Parade* on the Codling Bank. Haphazard passage planning and an excessive amount of responsibility for navigation taken by the Master given the confined waters were noted as causes.
Man Overboard	2008	Whilst participating in the annual Sean Whiston Perpetual Cup Race from Wicklow to the Poolbeg Yacht Club in Dublin, the yacht *Alana* lost a crewmember overboard off Bray Head on 14 September 2008.

10.2.2 Offshore Export Cable Corridor

127. A total of eight MCIB incidents were identified in the cable corridor study area over the data period studied. Further details of these incidents are seen in **Table 10-1**, with information from the publicly available database of incident reports. It is noted that six of these eight incidents occurred within Dublin Bay. The remaining two incidents occurred within the OECC itself, as highlighted within the table and within the study area i.e., within 10nm of the array site (see **Section 10.2.1**).

Table 10-2 Summary of MCIB Incidents within Cable Corridor Study Area

Incident Type	Year	Summary
Grounding*	2000	Grounding of the car carrier *Asian Parade* on the Codling Bank. Haphazard passage planning and an excessive amount of responsibility for navigation taken

Incident Type	Year	Summary
		by the Master given the confined waters were noted as causes.
Collision	2001	A collision in Dublin Bay between the workboat *Voe Trader* and yacht *Dai Mouse* on the 12 May 2001. The yacht was involved in the Royal Alfred Yacht Club Baily Bowl. The workboat was on passage from Poolbeg to Dun Laoghaire for a crew change.
Collision	2001	A collision between yacht *Debonair* and cargo vessel *Bluebird* in the entrance channel to Dublin Port on 20 May 2001. There were four fatalities.
Personal Injury	2003	A fatal injury occurred onboard the Roll-on/Roll-off (RoRo) cargo vessel *Merchant Bravery* while it was moored on 25 January 2003.
Grounding	2005	A tanker, *Bro Traveller,* grounded outside the northerly defined fairway channel in Dublin Bay on the 17 September 2005. There were no injuries and the vessel refloated an hour later without tug assistance.
Machinery Failure	2006	The fishing vessel *Felucca*, while departing from Dublin Port on the 3 June 2006, experienced engine power failure and grounded on the south side of the channel.
Man Overboard*	2008	Whilst participating in the annual Sean Whiston Perpetual Cup Race from Wicklow to the Poolbeg Yacht Club in Dublin, the yacht *Alana* lost a crewmember overboard off Bray Head on 14 September 2008.
Capsize	2020	On 13 September 2020, a kayak was unable to cope with waves outside Bulloch Harbour and drifted northwards before overturning.

* Occurred within the OECC itself.

10.3 Historical Offshore Wind Farm Incidents

128. Given the early stage of offshore wind farm development in Ireland, there is no historical incident data available in terms of incidents arising from or caused by the presence of offshore wind farm structures. There are no reported incidents to vessels associated with the existing Phase 1 Arklow turbines (see **Section 7.1**) noting a high profile incident did occur in October 2022 involving a lightning strike on one of the turbines (OffshoreWindBiz, 2022). No injuries or vessel damage has been reported.

129. Therefore, UK experience has been considered in this section given that it provides a wide range of incidents relating to offshore wind farm development in a similar regulatory framework.

10.3.1 Incidents Involving UK Offshore Wind Farm Developments

130. As of April 2024, there are 42 operational offshore wind farms in the UK, ranging from the North Hoyle Offshore Wind Farm (fully commissioned in 2003) to Hornsea Project Two (fully commissioned in 2022). Between them these developments encompass approximately 23,197 fully operational wind turbine years.

131. Marine Accident Investigation Branch (MAIB) incident data has been used to collate a list of historical collision and allision incidents involving UK offshore wind farm developments. All UK flagged vessels and non-UK flagged vessels in UK territorial waters (12 nm), a UK port or carrying passengers to a UK port are required to report accidents to the MAIB. Other sources have also been used to produce this list including the UK Confidential Human Factors Incident Reporting Programme (CHIRP) for Aviation and Maritime, International Marine Contractors Association (IMCA), and basic web searches. The list of historical collision and allision incidents involving UK offshore wind farm developments is presented in **Table 10-3**.

Table 10-3 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	Major	None	MAIB

Incident Vessel	Incident Type	Date	Description of Incident	Vessel Damage	Harm to Persons	Source
			following watchkeeping failure. Two hull breaches to vessel.			
Project / project	Collision	2 June 2012	Crew Transfer Vessel (CTV) allision with flotel. Nine persons safely evacuated and transferred to nearby vessel before being brought back in to port.	Moderate	None	UK 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 wind turbine TP 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	IMCA Safety Flash
Project	Allision	14 August 2014	Standby safety vessel allision with wind turbine pile. Oil leaked by vessel which moved away from environmentally sensitive areas until leak was stopped.	Minor with pollution	None	UK CHIRP
Third-party	Allision	26 May 2016	Third-party fishing vessel allision with wind turbine following human error (autopilot). Lifeboat attended the incident.	Moderate	Injury	Web search (RNLI, 2016)
Project	Allision	14 February 2019	Survey vessel contacted with wind turbine jacket whilst autopilot was engaged.	Minor	None	MAIB
Project	Allision	17 January 2020	Project vessel allision with wind turbine. Injury sustained by crew member but vessel able to proceed to port unassisted.	None	Injury	Web search (Vessel

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

(*) As per incident reports.

132. 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.

133. As of April 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.

134. As of April 2024, there have been 13 reported cases of an allision between a vessel and a wind turbine (under construction, operational or disused) in the UK, with all but one involving a support vessel for the development and the errant vessel in each case under power rather than drifting. Therefore, there has been an average of 1,784 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).

10.3.2 Incidents Involving Non-UK Offshore Wind Farms

135. 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. Other European countries also have more stringent regulations restricting access to arrays which can distort results.

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

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

137. From news reports, basic web searches and experience at working with existing offshore wind farm developments, a list has been collated of historical incidents responded to by vessels associated with UK offshore wind farm developments, which is summarised in **Table 10-4**. The initial cause of these incidents is not related to the offshore wind farm in question.

138. **Table 10-4** comprises known incidents that were responded to by a UK wind farm vessel. Additional incidents associated with the construction or operation of offshore wind farm 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 10-4 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	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 difficult sought shelter by tying up to a wind turbine but suffered damage and a person in the water. Support vessel for London Array identified and secured the casualty vessel and recovered the person in the water. The support vessel raised the alarm to the Coastguard. The Coastguard later instructed the support vessel to return to port and seek medical assistance for the casualty vessel's occupant.	Web search (The Isle of Thanet News, 2019)
Drifting	7 July 2019	Gwynt y Môr	Speedboat suffered mechanical failure stranding four persons. Support vessel for Gwynt y Môr responded to an 'all-ships' broadcast from the Coastguard and prevented the casualty vessel drifting into the Gwynt y Môr array. The support vessel later towed the casualty vessel back towards port.	Web search (Renews, 2019)
Machinery failure	28 September 2019	Race Bank	Fishing vessel suffered mechanical failure and launched flares. Guard vessel and SOV for Race	Internal daily progress report

Incident Type	Date	Related Development	Description of Incident	Source
			Bank both immediately offered assistance until the MCA's arrival on-scene.	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)

11 Vessel Traffic

139. This section presents analysis of vessel traffic in proximity to the array site and OECC, based on the vessel traffic survey data sources detailed in **Section 5.2**. It is noted that for validation purposes, comparison has been undertaken against the long term AIS data in Annex B (see **Section B.3.3.6**).

11.1 Shore Based 2023

140. This section presents assessment of vessel traffic recorded within the study area during a 14-day period between 20 February 2023 and the 6 March 2023 inclusive.

11.1.1 Overview

141. An overview of vessels recorded throughout the survey period colour-coded by vessel type, is presented in **Figure 11-1**. Following this, the distribution of these vessel types is provided in **Figure 11-2**. Overall, 92% of vessels could be associated with a vessel type. Those vessels classed as unspecified were recorded via Radar.

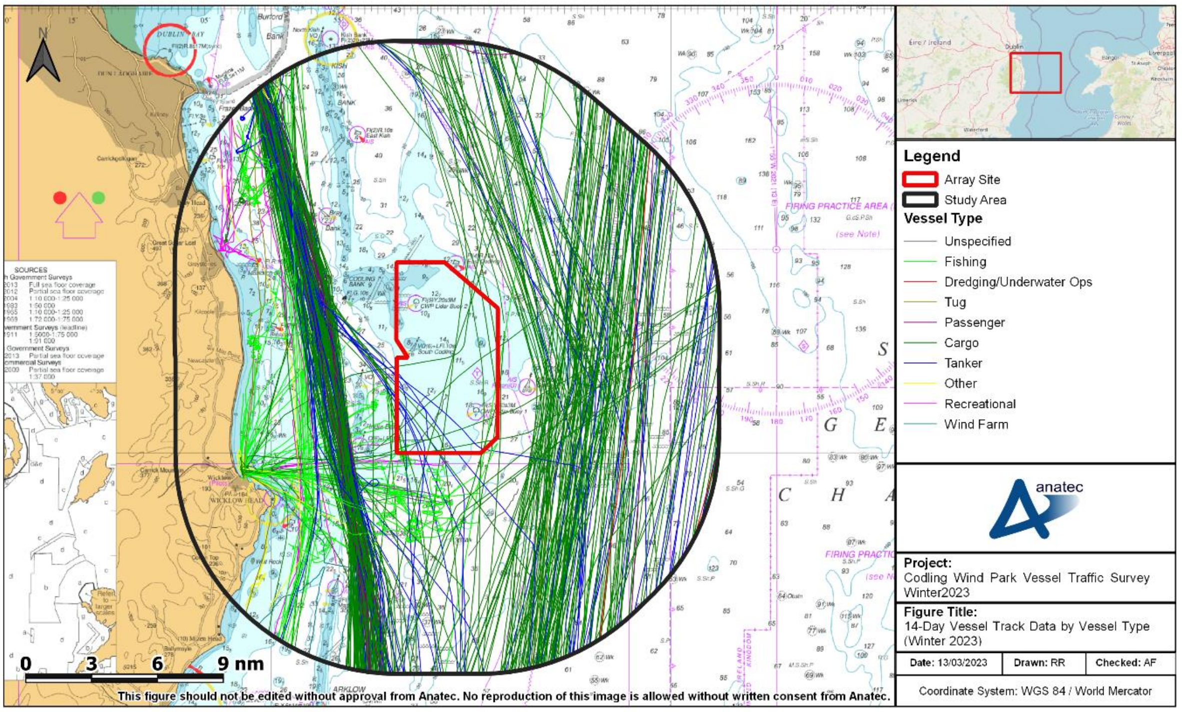

Figure 11-1 14-Day Vessel Track Data by Vessel Type (Winter 2023)

142. Within the study area, there were two general commercial (cargo vessels, tankers, and passenger vessels) shipping routes (see **Section 11.1.3.1**, **Section 11.1.3.2**, and **Section 11.1.3.3** for cargo vessels, tankers, and passenger vessels respectively). The most defined and condensed route passed north/south to the west of the array site, following the Irish coastline, and the other to the east routeing northeast/southwest. Fishing and recreational vessels were mainly coastal with high levels recorded in the

western extent of the study area (see **Section 11.1.3.4** and **Section 11.1.3.5** for fishing and recreational, respectively).

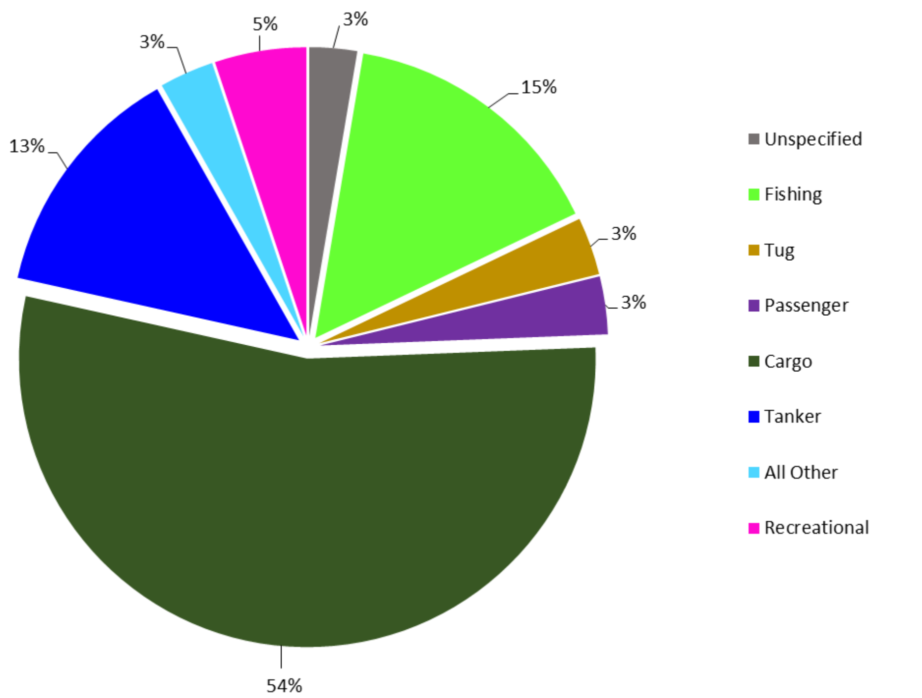

Figure 11-2 Vessel Type Distribution (Winter 2023)

143. For the distribution analysis, vessel types detected in low numbers (less than 1%) have been incorporated into the 'All other' category along with vessel classified as other[3]. The most common vessel types recorded within the study area were cargo vessels (54%), fishing vessels (15%), tankers (13%), and recreational vessels (5%). No other vessel type equated to more than 5% of all vessel types recorded.

11.1.2 Vessel Counts

144. The number of unique vessels per day present within the study area during the survey period are provided in **Figure 11-3**. it is noted that partial survey days are displayed by light shading in **Figure 11-3**.

[3] Including the following vessel types: dredger/ subsea operation, windfarm vessels.

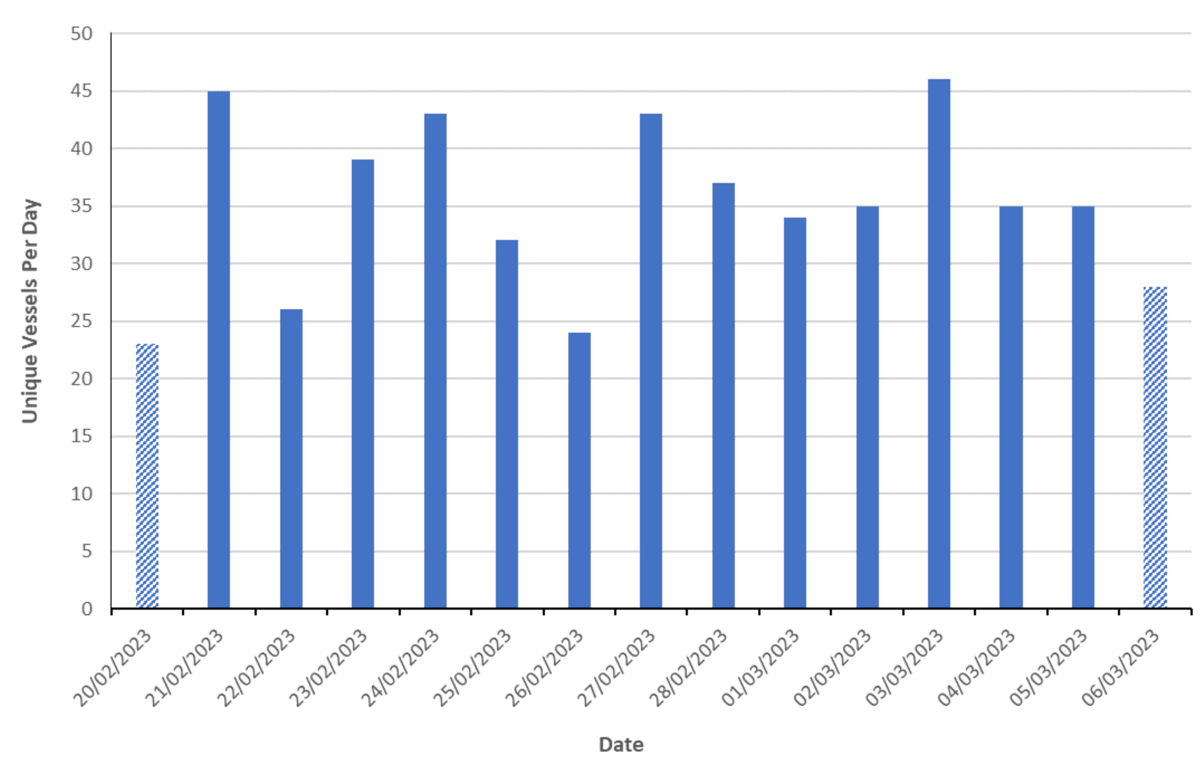

Figure 11-3 Number of Unique Vessel Counts Per Day (Winter 2023)

145. An average of 38 unique vessels per day were present within the study area during the survey period. The busiest day was the 3 March 2023, on which 46 unique vessels were present. The quietest full[4] day was the 26 February 2023, on which 24 unique vessels were present.

11.1.3 Vessel Types

146. The following sub-sections present a more detailed analysis of the main vessel types recorded within the study area during the survey period.

11.1.3.1 Cargo Vessels

147. An overview of the cargo vessels present within the study area throughout the survey period is presented in **Figure 11-4**. All cargo vessels were recorded via AIS.

[4] Noting the first and last day of the survey were partial survey days.

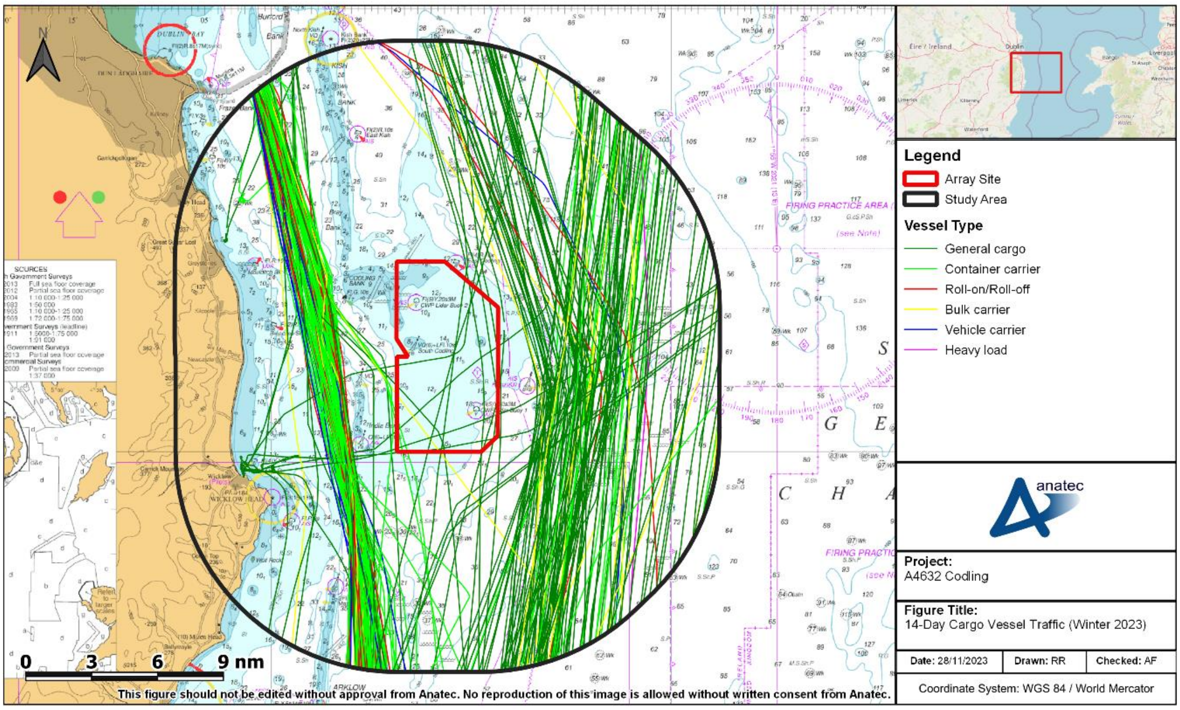

Figure 11-4 Cargo Vessels by Subtype (14 Days, Winter 2023)

148. On average, 20 to 21 unique cargo vessels per day were present in the study area during the survey period. Cargo vessels were seen transiting heavily in a well-defined route north/south to the west of the array site and were seen to avoid the shallow waters of Kish, Codling, and India Banks adjacent to the west of the array site. Vessels on this route were primarily routeing between Dublin (Ireland) and mainland Europe. This route is known to be a crucial route between Ireland and mainland Europe.

149. Vessels were also seen passing to the east of the array site on a northeast/southwest route, with vessels also merging to/from the northwest. These vessels were seen to stay in deeper waters avoiding transit near the shallow waters within the array site.

150. The distribution of cargo vessel sub-types within the study area is presented in **Figure 11-5**.

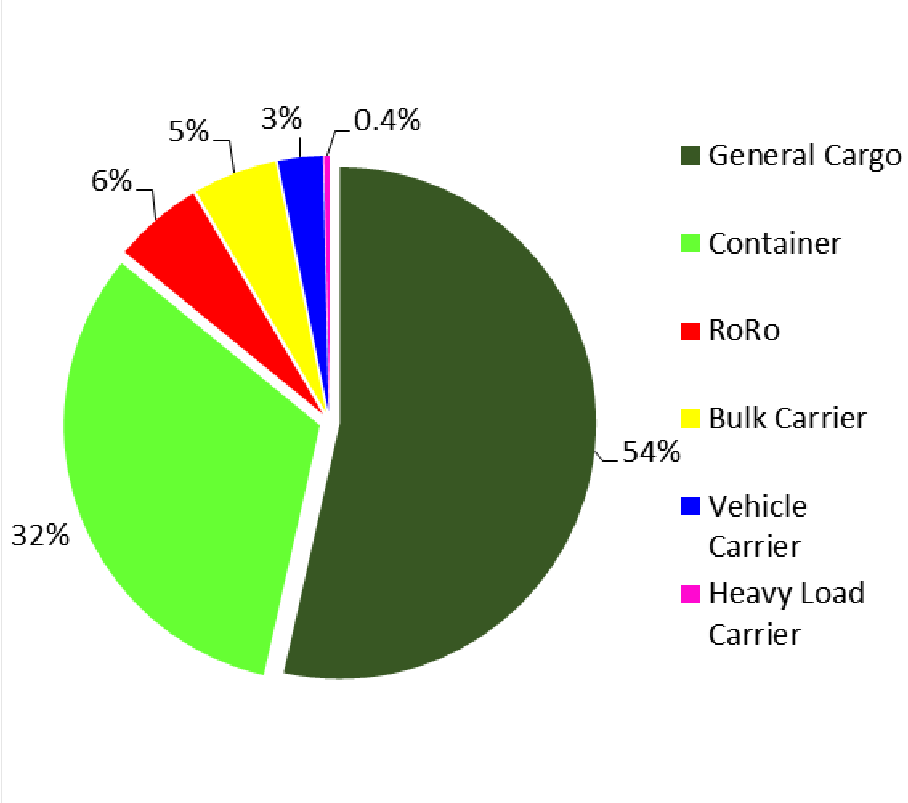

Figure 11-5 Distribution of Cargo Vessel Subtypes (14 Days, Winter 2023)

151. The most common cargo vessel sub-types present within the study area during the survey period were general cargo (54%), container vessels (32%), RoRo (6%), bulk carrier (5%) and vehicle carrier (3%).

152. An overview of the RoRo vessels present within the study area throughout the survey period, colour-coded by operator, is provided in **Figure 11-6**.

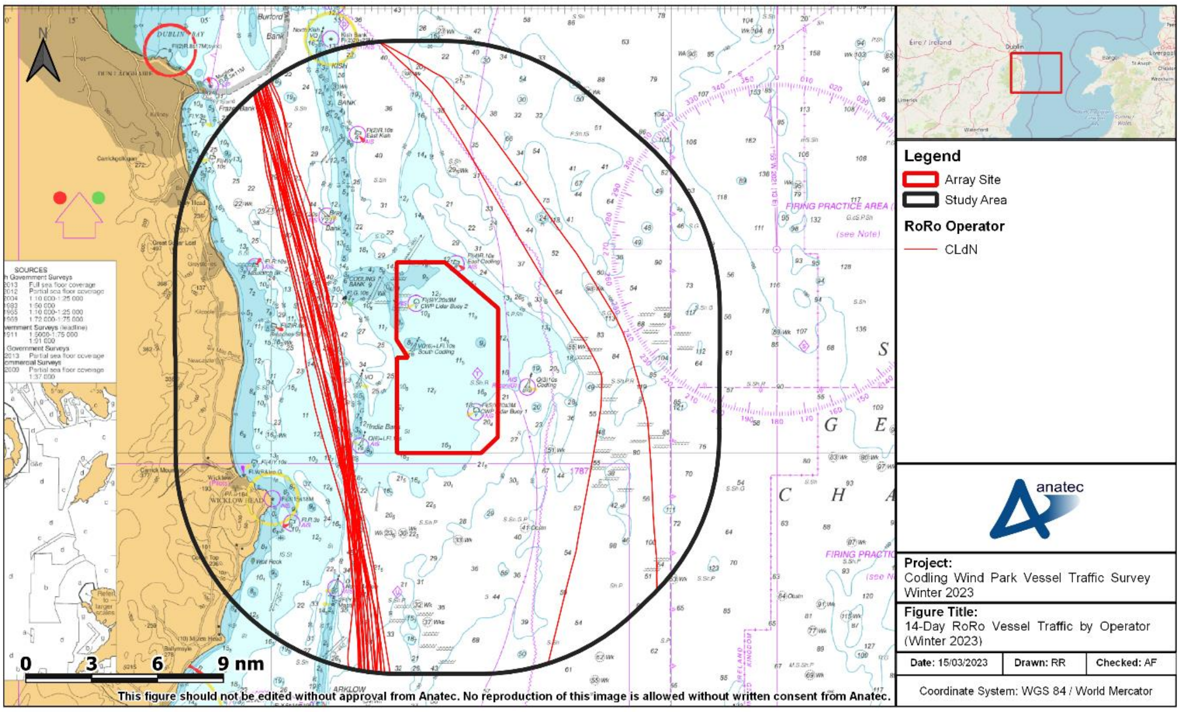

Figure 11-6 RoRo Cargo Vessels by Operator (14 Days, Winter 2023)

153. On average, there was one unique RoRo vessel per day present within the study area during the survey period. The only RoRo operator recorded was CLdN.

154. Regular routeing was present between Dublin (Ireland) - Rotterdam (The Netherlands), Dublin (Ireland) - Santander (Spain), and Dublin (Ireland) - Zeebrugge (Belgium). All three routes were on transit west of the array site in a north/south heading. One vessel on the Dublin (Ireland) - Santander (Spain) route was noted routeing to the east of the array site in the deeper waters on both route directions. All other RoRo vessels utilised the main commercial route to the east of the array site.

11.1.3.2 Tankers

155. An overview of the tankers present within the study area throughout the survey period is presented in **Figure 11-7**. All tankers were recorded via AIS.

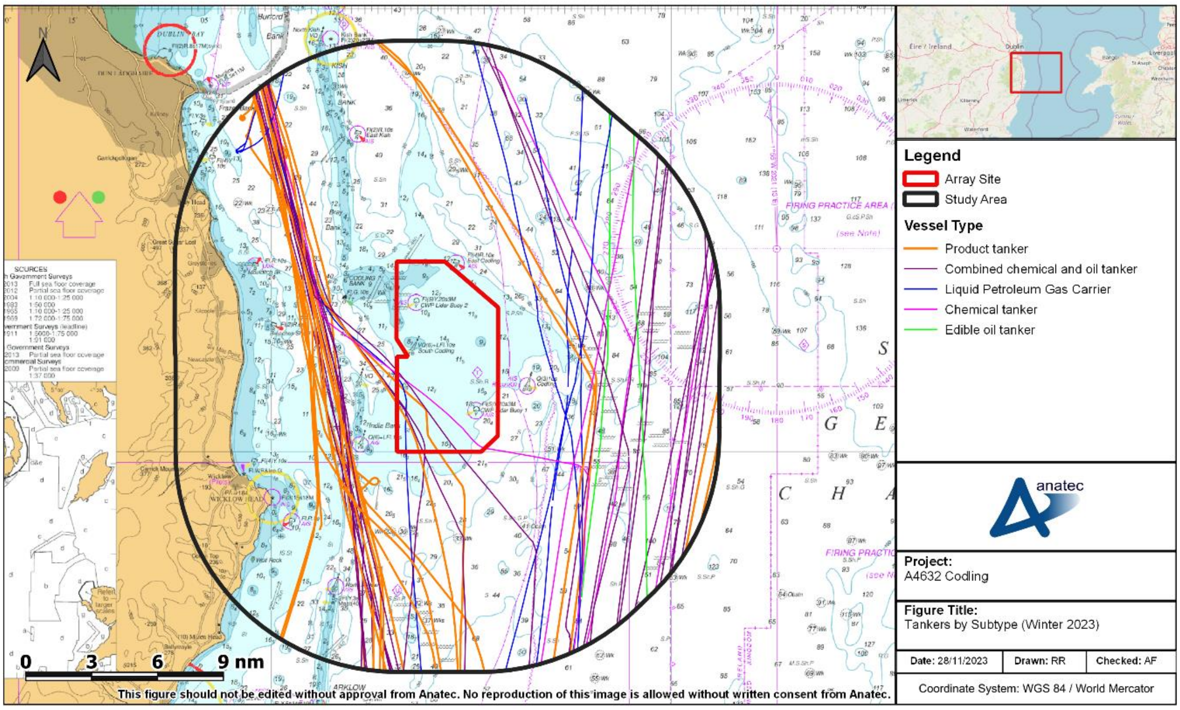

Figure 11-7 Tankers by Subtype (14 Days, Winter 2023)

156. An average of five unique tankers per day were present within the study area during the survey period. The most common tanker sub types were product tankers (44%), combined oil/chemical (33%), and liquified petroleum gas (LPG) carriers (13%).

157. Tankers transiting to the west of the array site were on the main north/south commercial route avoiding the sandbanks. Some vessels were noted routeing east between the Codling and India Banks into the array site before re-joining the main route further south. Other tankers were noted routeing to the east of the array site, mostly on a northeast/southwest heading with other vessels merging to/from this route to the northwest.

11.1.3.3 Passenger Vessels

158. An overview of the passenger vessels present within the study area throughout the survey period is presented in **Figure 11-8**. All passenger vessels were recorded via AIS.

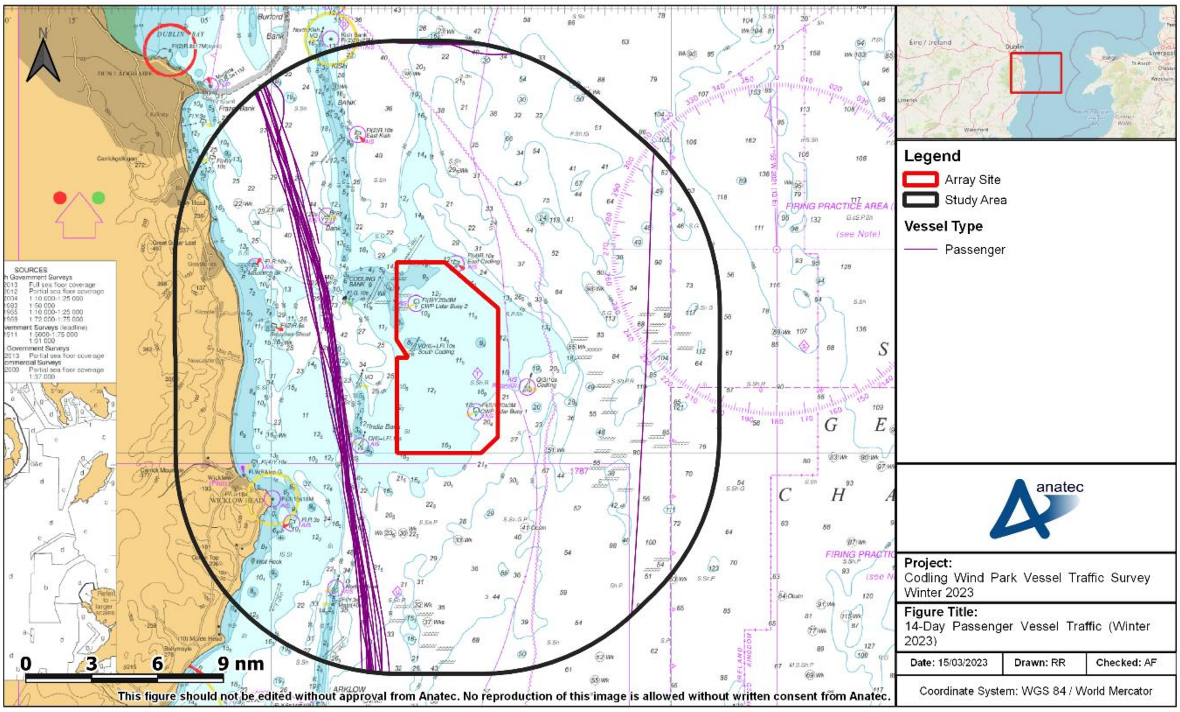

Figure 11-8 Passenger Vessels (14 Days, Winter 2023)

159. On average, between one and two unique passenger vessels per day were present within the study area during the survey period. All passenger vessels recorded were Roll-on/Roll-off Passenger (RoPax).

160. RoPax operators include Irish Ferries (76%) which were on route between Dublin (Ireland) – Cherbourg (France) within the main commercial route to the west of the array site. One vessel transit from Irish Ferries was noted routeing to Belfast to the east of the study area. The other operator was StenaLine (24%) which were on route between Dublin (Ireland) – Holyhead (UK). These vessels were routeing east/west at the northern extent of the study area.

11.1.3.4 Fishing Vessels

161. An overview of fishing vessels present within the study area during the survey period is presented in **Figure 11-9**. Of all fishing vessel tracks, 67% were recorded via AIS, 32% Radar, and 1% visual observation. As a general heuristic, average speeds of less than six knots are indicative of potential active fishing.

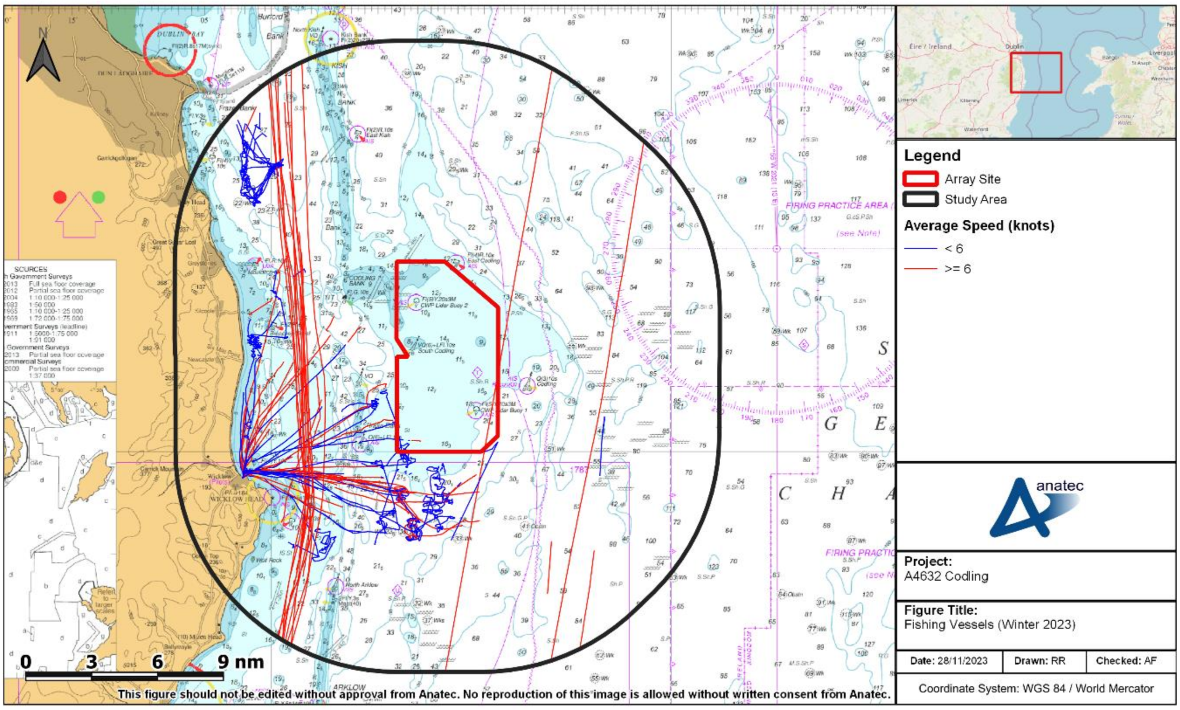

Figure 11-9 Fishing Vessels by Average Speed (14 Days, Winter 2023)

162. On average, there was between five and six unique fishing vessels per day present within the study area during the survey period. Vessel activity was determined by vessel speed and vessel track behaviour as well as navigational status information transmitted via AIS. A behavioural analysis was carried out for both AIS and Radar data to determine fishing activity. Most fishing vessels were considered likely to be in transit (68%) as opposed to engaged in fishing activities (32%).

163. Active fishing was primarily in the western half of study area with a high volume immediately south of the array site. Active fishing was also recorded in the northwest of the study area, south of Dublin Bay. Gear type and country of registration was able to be established for 70% of vessels recorded, those with unspecified information were all recorded via non-AIS methods. The main gear types recorded were potters (58%), demersal trawlers (16%) and pelagic trawlers (15%). The main country of registration was Ireland (89%), with UK (7%) and France (4%) also being recorded. Of those vessels engaged in fishing activities that could be associated with a gear type and country of registration (56% of vessels engaged in active fishing), all were Irish registered potters.

11.1.3.5 Recreational Vessels

164. An overview of the recreational vessels recorded within the study area throughout the survey period are presented in **Figure 11-10**. Of all recreational vessel recorded, 75% were recorded via AIS and the other 25% via Radar.

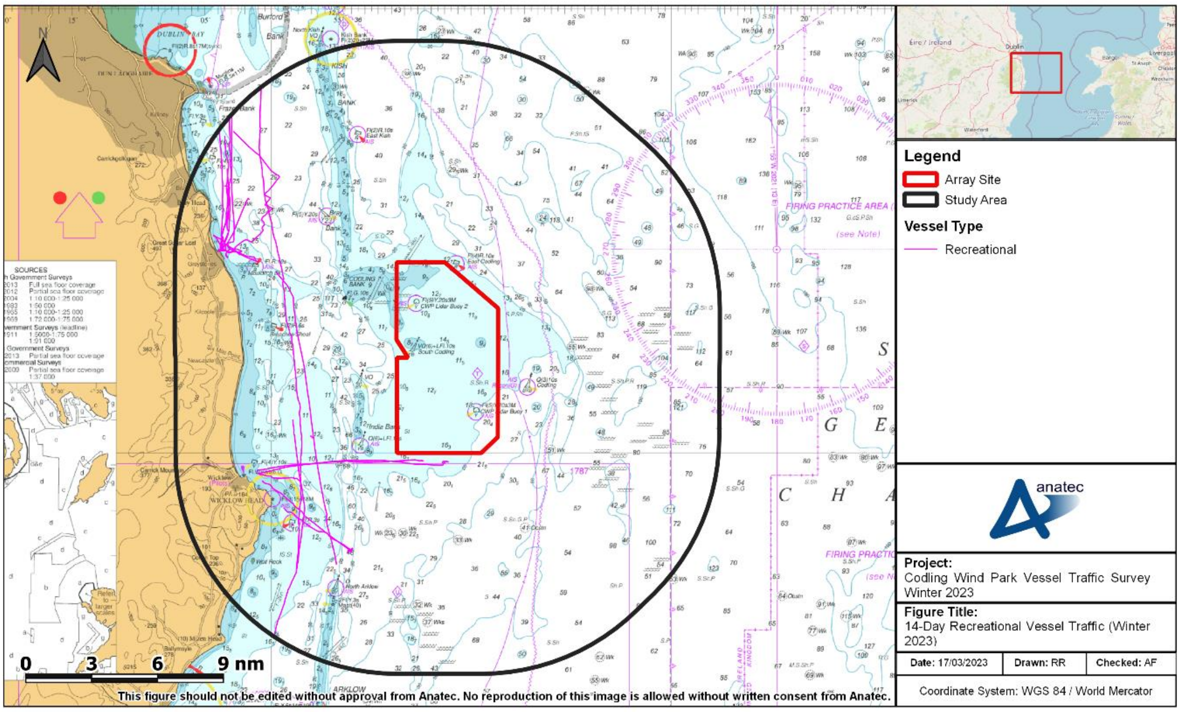

Figure 11-10 Recreational Vessels (14 Days, Winter 2023)

165. On average, there was two unique recreational vessels recorded per day within the study area during the survey period. All recreational vessels were to the west of the study area staying close to the shore and avoiding deeper waters to the east. The largest recreational vessel recorded was a 13 m sailing yacht.

166. Limited recreational activity is expected due to the time of year in which this survey was carried out.

11.1.4 Vessel Sizes

167. This section provides a breakdown of the vessel traffic in terms of vessel length and vessel draught.

11.1.4.1 Vessel Length

168. An overview of the vessels present within the study area throughout the survey period, colour-coded by vessel length, is provided in **Figure 11-11**. Following this, the distribution of these vessel lengths is then provided in **Figure 11-12**.

169. Vessel length was established for the majority of vessels recorded during the survey period (89%). Of those vessels with unspecified vessel length, 75% were recorded via Radar, 23% by AIS, and 1% visual observation. Those vessels with no recorded vessel length were removed from the length analysis, equating to a total of 11% of all data.

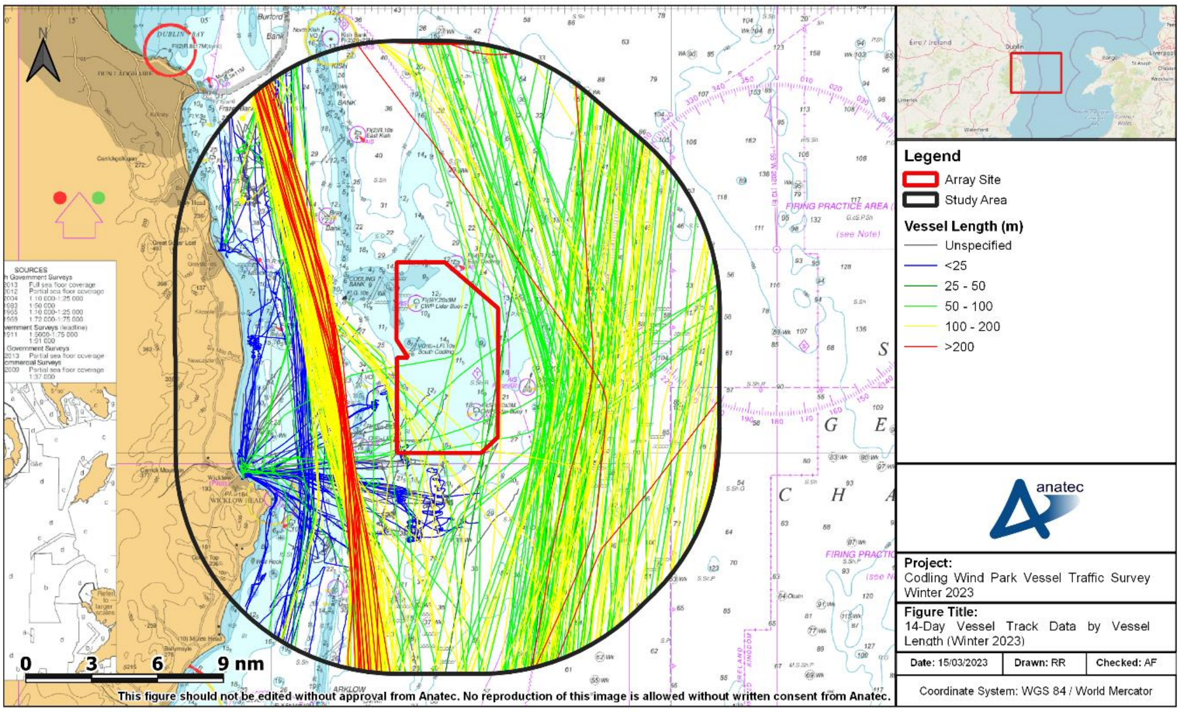

Figure 11-11 Vessels by Length (14 Days, Winter 2023)

170. Vessels of greater lengths were primarily cargo vessels, tankers, and passenger vessels. These vessels were seen mainly routeing north/south to the west of the array site, routeing to/from Dublin Bay to the north. Vessels of smaller length were primarily fishing and recreational vessels and seen mostly inshore to the western extent of the study area utilising harbours and marinas on the Irish west coast.

171. Those vessels with no length, and so excluded from the analysis, were typically located nearshore and were unspecified, fishing, and recreational vessels where data limitations would be expected (see **Section 5.4.1**).

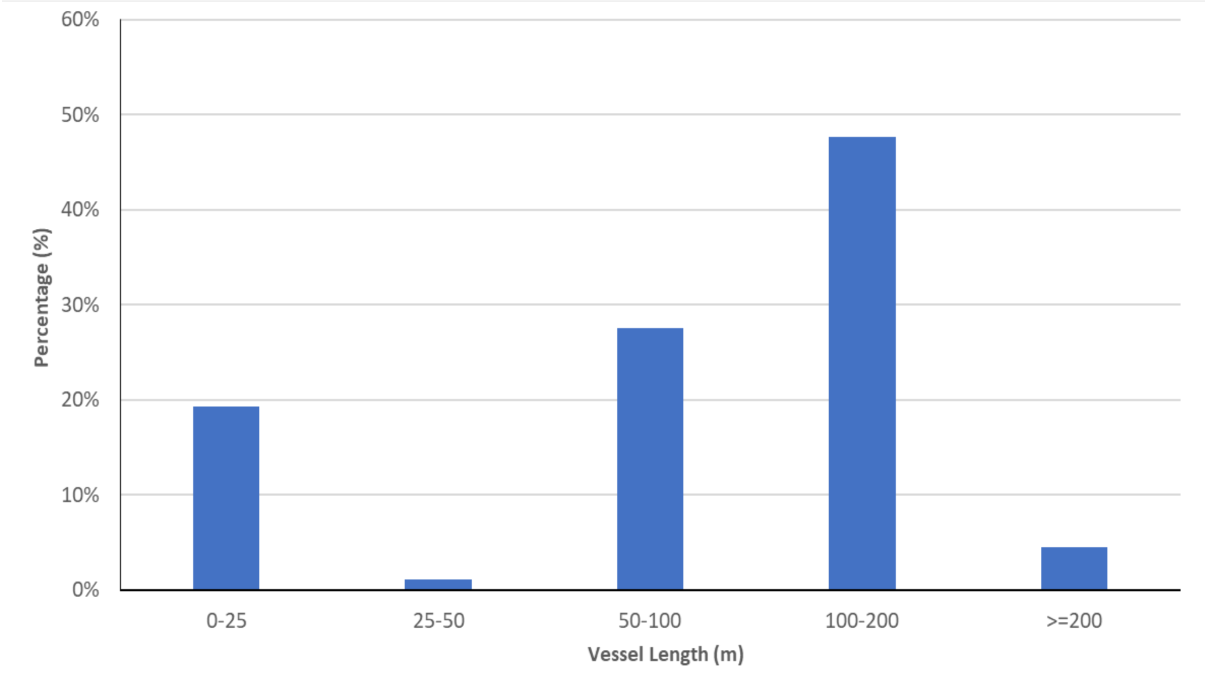

Figure 11-12 Distribution of Vessel Lengths (14 Days, Winter 2023)

172. The average length of vessels across the study area during the survey period was 104 m. The largest vessel recorded was a 294 m container cargo heading to Montreal, Canada, at approximately 7 nm southeast of the array site on the 6 March 2023. The most common vessel lengths were between 100 m and 200 m (48%).

11.1.4.2 Vessel Draught

173. An overview of the vessels present within the study area throughout the survey period colour-coded by vessel draught, is provided in **Figure 11-13**. Following this, the distribution of these vessel draughts is then provided in **Figure 11-14**.

174. Vessel draught was established for the majority of vessels recorded during the survey period (71%). Of those vessels with unspecified vessel draught, 53% were recorded via AIS, 47% by Radar, and less than 1% visual observation. Those vessels with no recorded vessel length were removed from the length analysis, equating to a total of 29% of all data.

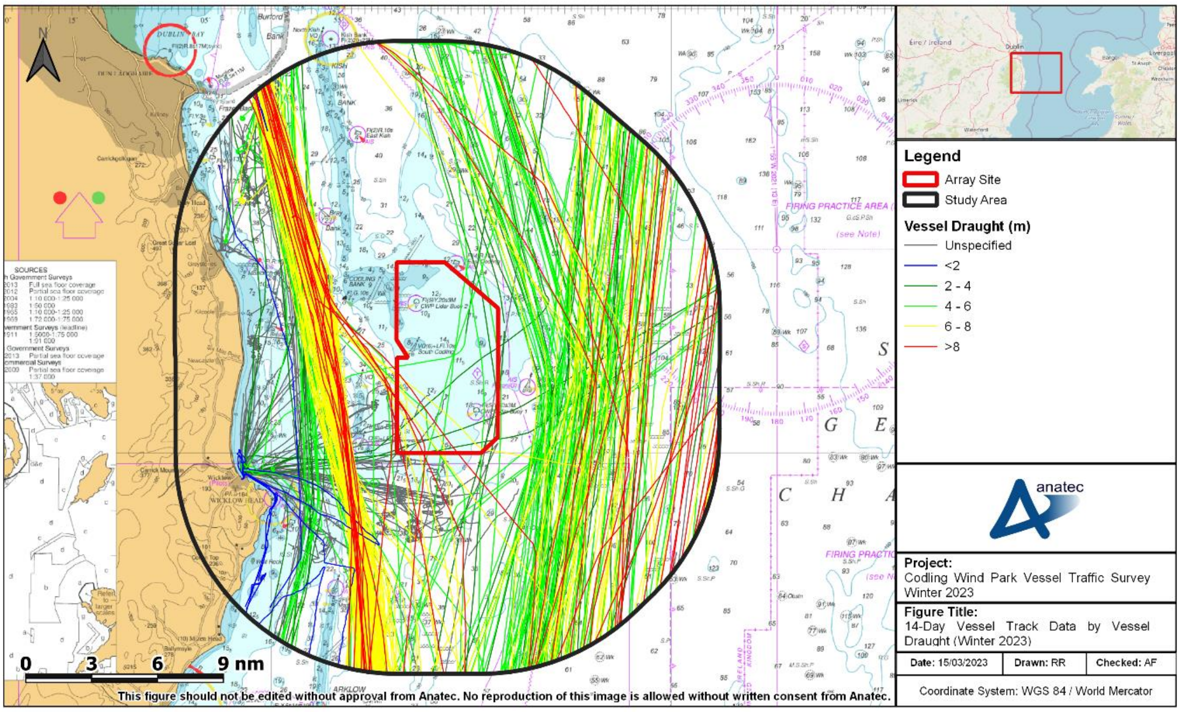

Figure 11-13 Vessels by Draught (14 Days, Winter 2023)

175. Vessels with larger draughts were primariliy cargo vessels and tankers. These vessels were seen routeing on two main commercial routes, north/south to the west of the array site to/from Dublin Bay, and routeing northeast/southwest at the eastern extent of the study area. Vessels with the smallest draughts were mostly inshore RNLI vessels (classed as vessel type ‘other’) and tugs.

176. Those vessels with no specified draught, and so excluded from the analysis, were mainly inshore fishing and recreational vessels where data limitations would be expected (see **Section 5.4.1**).

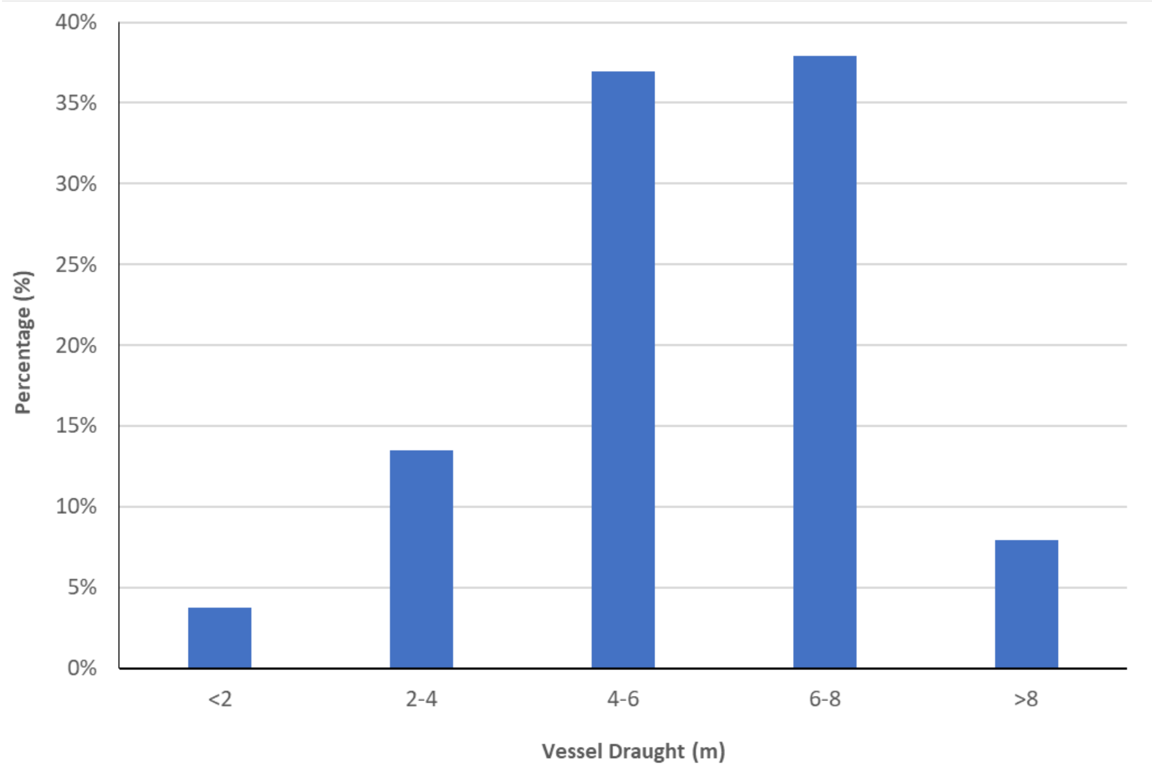

Figure 11-14 Distribution of Vessel Draughts (14 Days, Winter 2023)

177. The average draught of vessels across the study area during the survey period was 5.6 m. The vessel with the largest recorded draught was a bulk carrier at 17.4 m, recorded approximately 10 nm southeast of the array site heading for Qatar on the 21 February 2023. The most commonly recorded vessel draughts were between 6 m and 8 m (38%).

11.1.5 Anchored Vessels

178. 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. For this reason, vessels which travelled at a speed of less than 1 knot for more than 30 minutes are assumed to potentially be at anchor. Such cases have therefore been identified and checked for likely anchoring activity along with vessel track behaviour and AIS broadcasted navigational status. After applying the criteria, six unique vessels were deemed to be at anchor during the survey period and are presented in **Figure 11-15**.

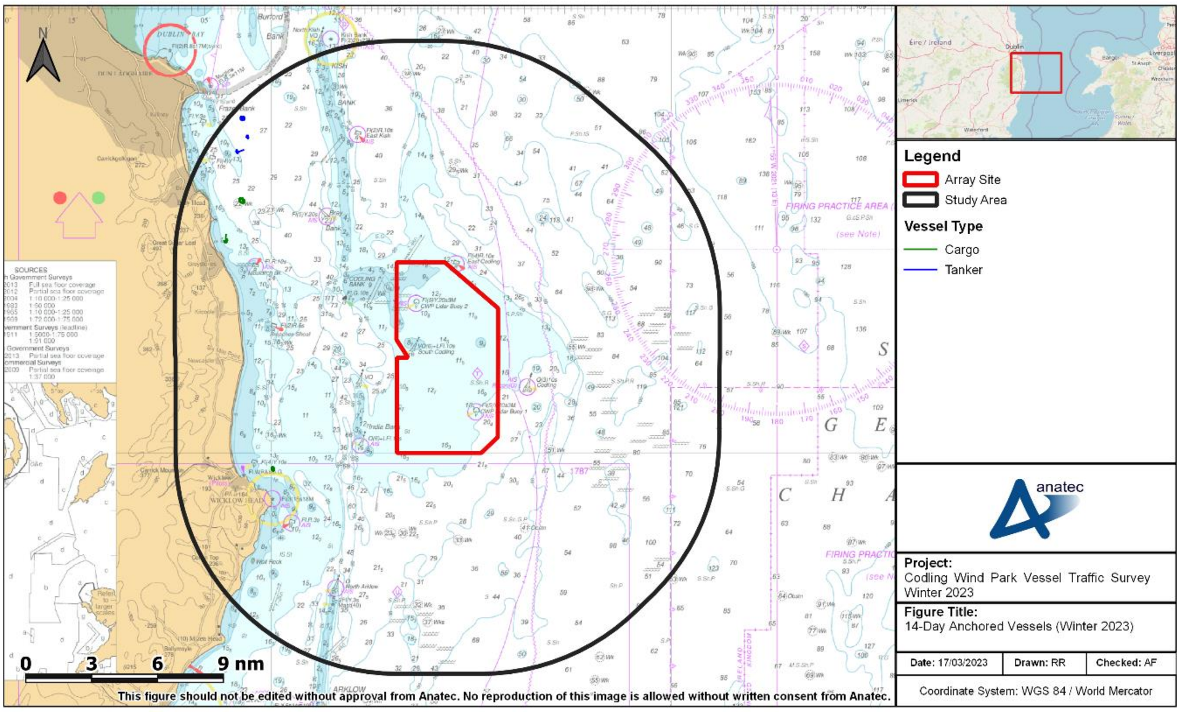

Figure 11-15 Anchored Vessels (14 Days, Winter 2023)

179. Vessels deemed to be at anchor during the survey period included three cargo vessels and three tankers. Five of these vessels were anchored at the northwest of the study area, south of Dublin Bay, likely awaiting a berth in Dublin Port. The sixth vessel was anchored immediately north of Wicklow Head at the southeast of the study area. This vessel, a general cargo vessel, was the closest anchored vessel to the array site, at approximately 5.6 nm west of the southern array site boundary and was anchored for approximately 27 hours over three consecutive days.

11.1.6 Average Vessel Speeds

180. An overview of the vessels present within the study area throughout the survey period, colour-coded by average vessel speed, is provided in **Figure 11-16**. Following this, the distribution of these average vessel speeds is then provided in **Figure 11-17**.

181. A valid average vessel speed was established for the majority of vessels recorded during the survey period (96%). Those vessels with unspecified average speeds were recorded via Radar (69%), AIS (28%), and visual observation (3%). A total of 4% of all data was remove from the speed analysis.

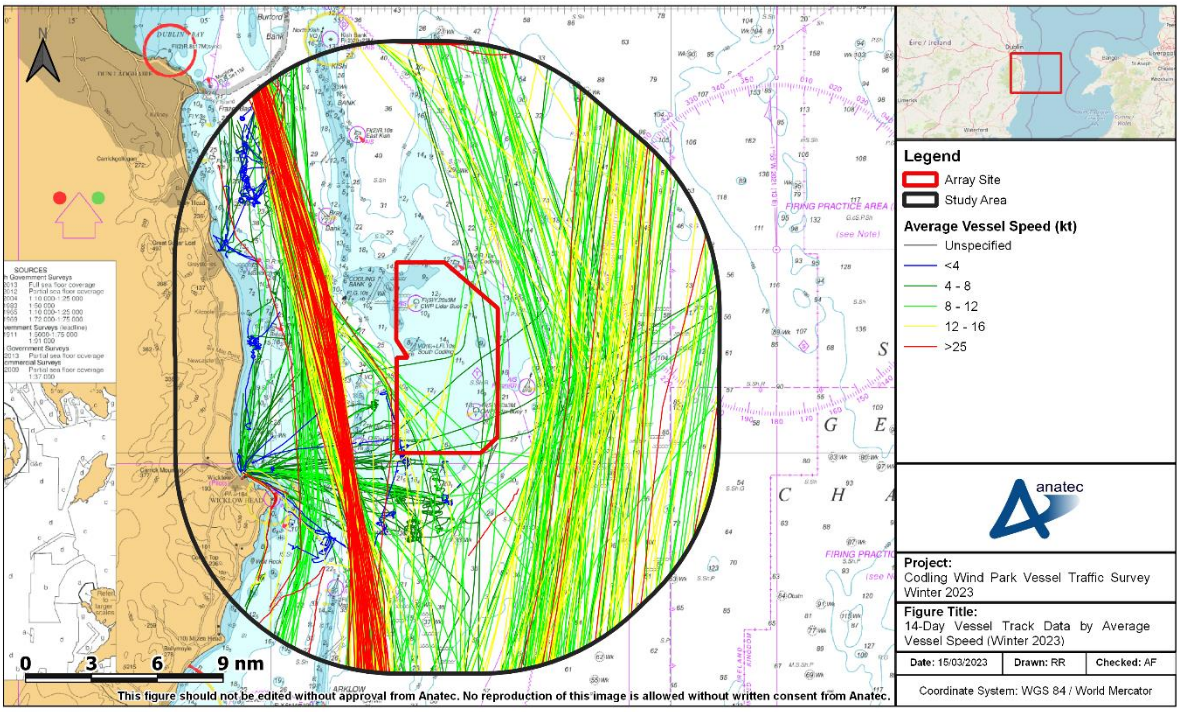

Figure 11-16 Vessels by Average Speed (14 Days, Winter 2023)

182. Vessels of greatest speeds recorded in the study area during the survey period were primarily passenger vessels and cargo vessels routeing to/from Dublin Bay at the west of the array site. Those vessels with the lowest speeds were primarily coastal fishing and recreational vessels.

183. Vessels with unspecified average vessel speeds, and so excluded from the analysis, were mainly inshore fishing vessels where data limitations would be expected (see **Section 5.4.1**). These vessels were likely associated with mooring or anchoring within Greystones Marina, but no information was broadcast via AIS to be certain.

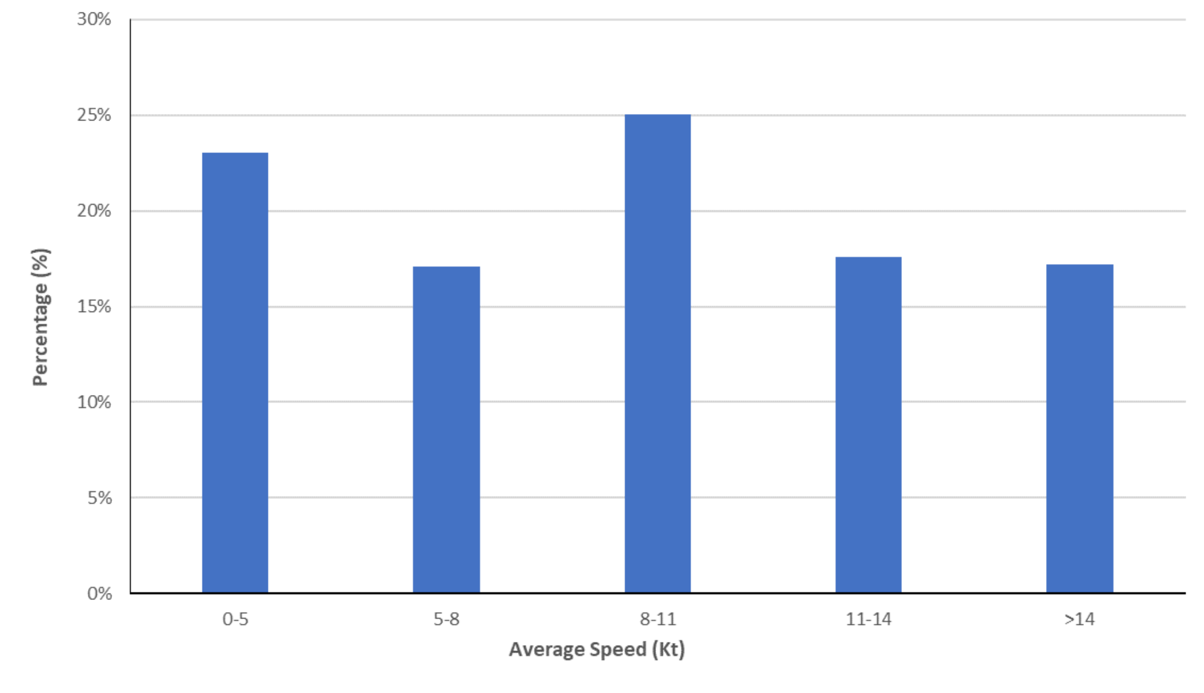

Figure 11-17 Distribution of Average Vessel Speeds (14 Days, Winter 2023)

184. The average vessel speed of all vessels across the study area during the survey period was 9 knots. The greatest average vessel speed was recorded by a RoPax vessel at 24.9 knots heading to Dublin, Ireland, approximately 2 nm to the west of the array site on the 23 February 2023.

11.1.7 Vessel Destinations

185. A summary of the main destinations for vessels broadcasted over AIS present within the study area during the survey period is provided in **Figure 11-18**. Vessels recorded via AIS that broadcasted a valid destination accounted for 75% of all AIS recorded vessels (69% of all data).

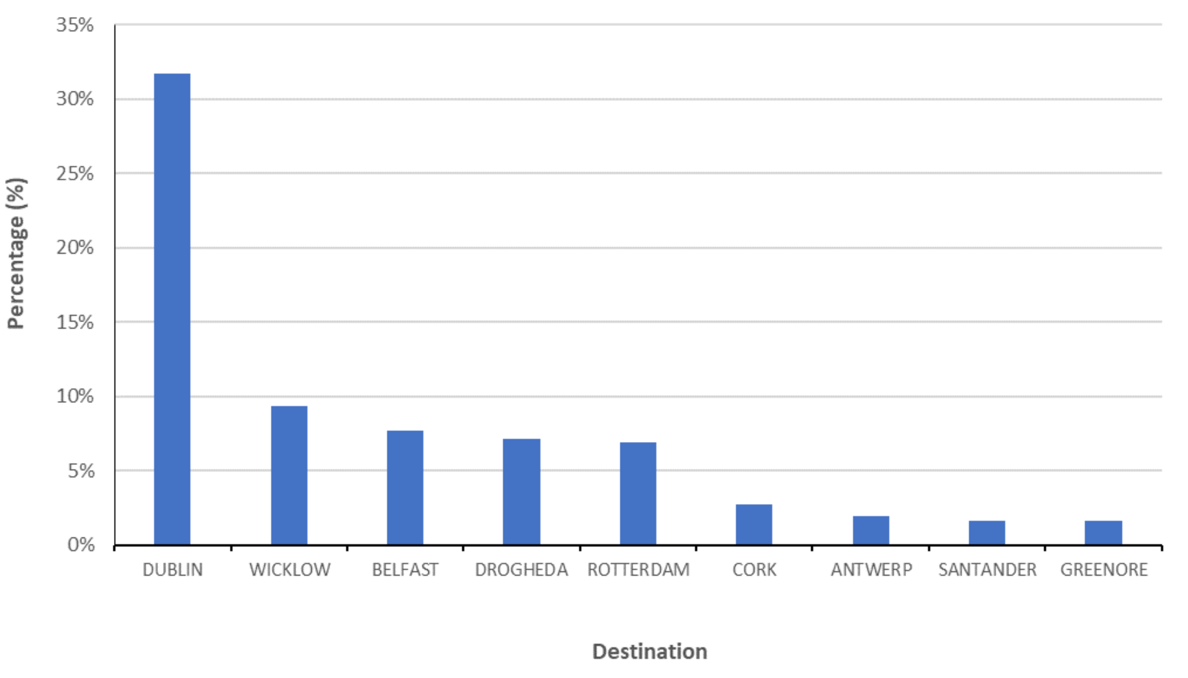

Figure 11-18 Distribution of Vessel Destinations (14 Days, Winter 2023)

186. The most-common broadcast destination of vessels within the study area during the survey period was Dublin, Ireland (32%). Other destinations included Wicklow, Ireland (9%), Belfast, UK (8%), Drogheda, Ireland (7%) Rotterdam, The Netherlands (7%), Cork, Ireland (3%), Antwerp, Belgium (2%), Santander, Spain (2%), and Greenore, Ireland (2%). In addition to these destinations, there was a wide variety of destinations broadcast in general, including Irish Ports, UK ports, Baltic ports, and other European ports.

11.1.8 Vessels Intersecting Array Site

187. An overview of the vessels recorded intersecting the array site throughout the survey period, colour-coded by vessel type, is presented in **Figure 11-19**. Following this, the distribution of these vessel types is then presented in **Figure 11-20**.

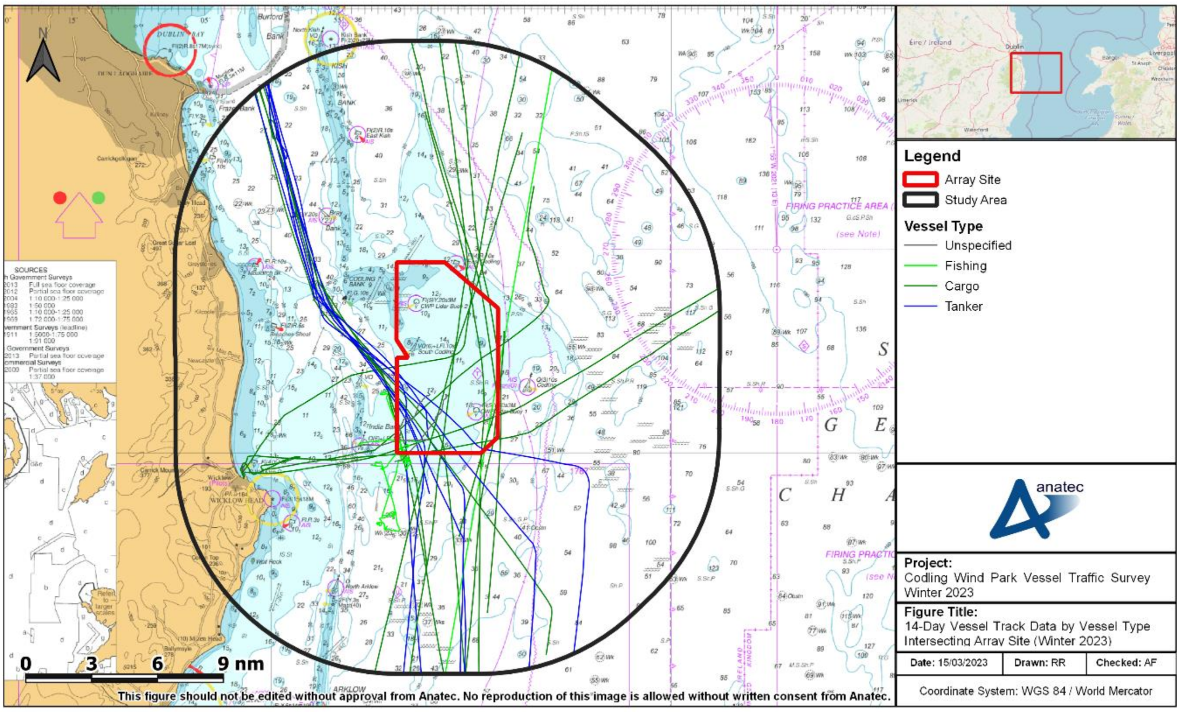

Figure 11-19 Vessels Intersecting Array Site by Vessel Type (14 Days, Winter 2023)

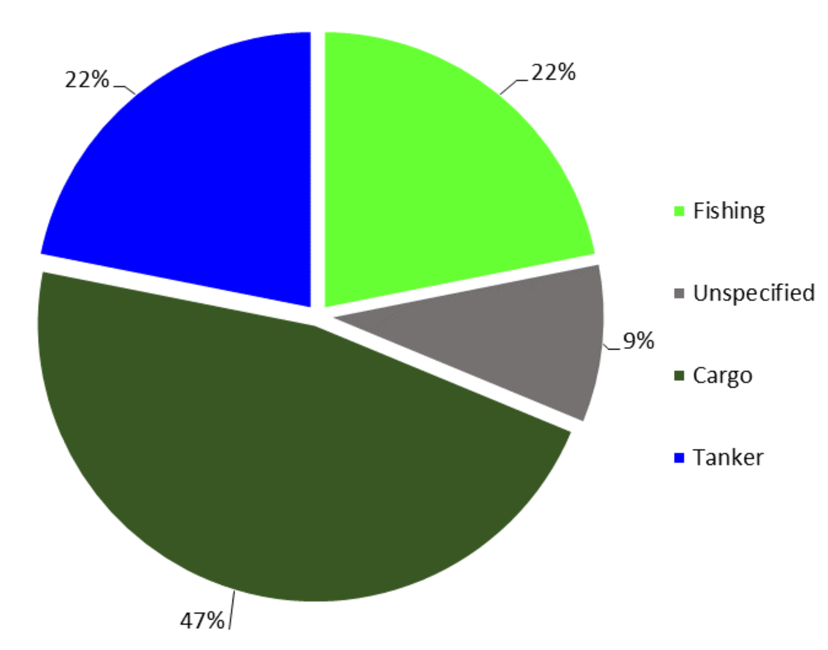

Figure 11-20 Distribution of Intersecting Vessel Types (14 Days, Winter 2023)

188. Overall, approximately 6% of all vessel traffic in the study area intersected the array site throughout the survey period, or an average of between two and three unique vessels per day. The vessel types recorded intersecting the array site were cargo vessels (47%), tankers (22%), fishing vessels (22%), and unspecified vessels (9%).

11.2 Shore Based Survey 2022

189. This section presents assessment of vessel traffic recorded within the study area during a 14-day period between 15 July 2022 and the 8 August 2022 inclusive.

11.2.1 Overview

190. An overview of vessels recorded throughout the survey period using AIS and Radar, colour-coded by vessel type, is presented in **Figure 11-21**.

191. All vessels present within the study area during the survey period that were recorded on AIS were able to be associated with a vessel type and 42% of Radar data was assigned a vessel type. A total of 8% of all data was classed as unspecified type.

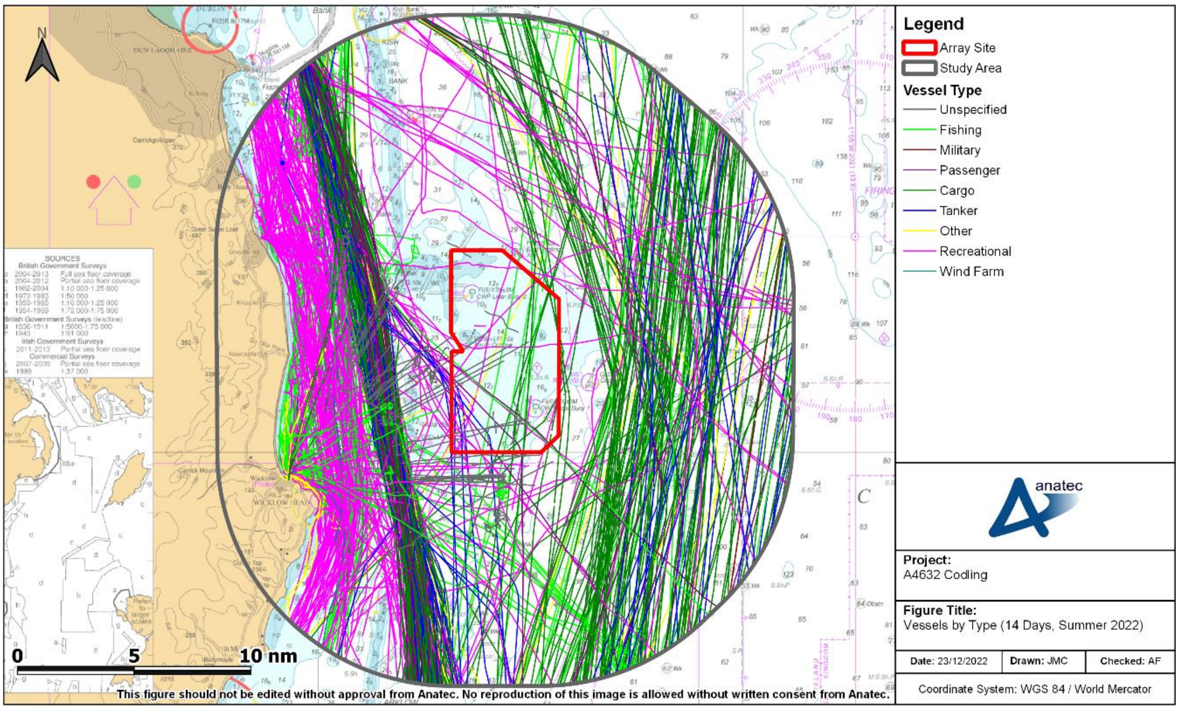

Figure 11-21 Vessels by Type (14 Days, Summer 2022)

192. The majority of commercial shipping (see **Section 11.2.3.1**, **Section 11.2.3.2** and **Section 11.2.3.3** for further details on cargo vessels, tankers, and passenger vessels respectively) in the area passes either offshore or inshore of the array site. This is reflective of the vessels choosing passage to avoid the local shallow banks (see **Section 7.6**). Fishing and recreational vessels were mainly coastal with levels high in the western extent of the study area (see **Section 11.2.3.4** and **Section 11.2.3.5** for fishing and recreational, respectively).

193. The distribution of these vessel types is provided in **Figure 11-22**.

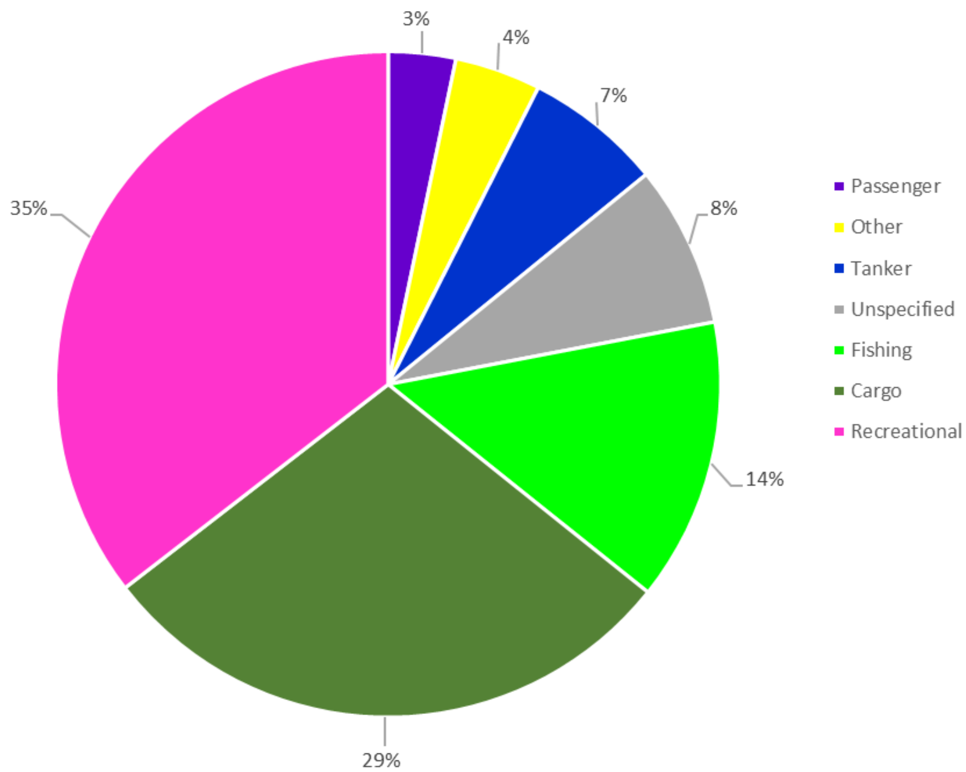

Figure 11-22 Vessel Type Distribution (14 Days, Summer 2022)

194. For the distribution analysis, vessel types detected in low numbers[5] (< 1%) have been incorporated into the 'other' category. The most common vessel types recorded within the study area were recreational vessels (35%), cargo vessels (29%), and fishing vessels (14%). The high proportion of recreational vessels recorded is likely due to the survey period being in summer. Long term analysis on an annual basis is given in Annex B .

195. A density plot of the vessel traffic within a 0.25 nm x 0.25 nm grid is presented in **Figure 11-23**.

[5] Including wind farm support vessels and military vessels.

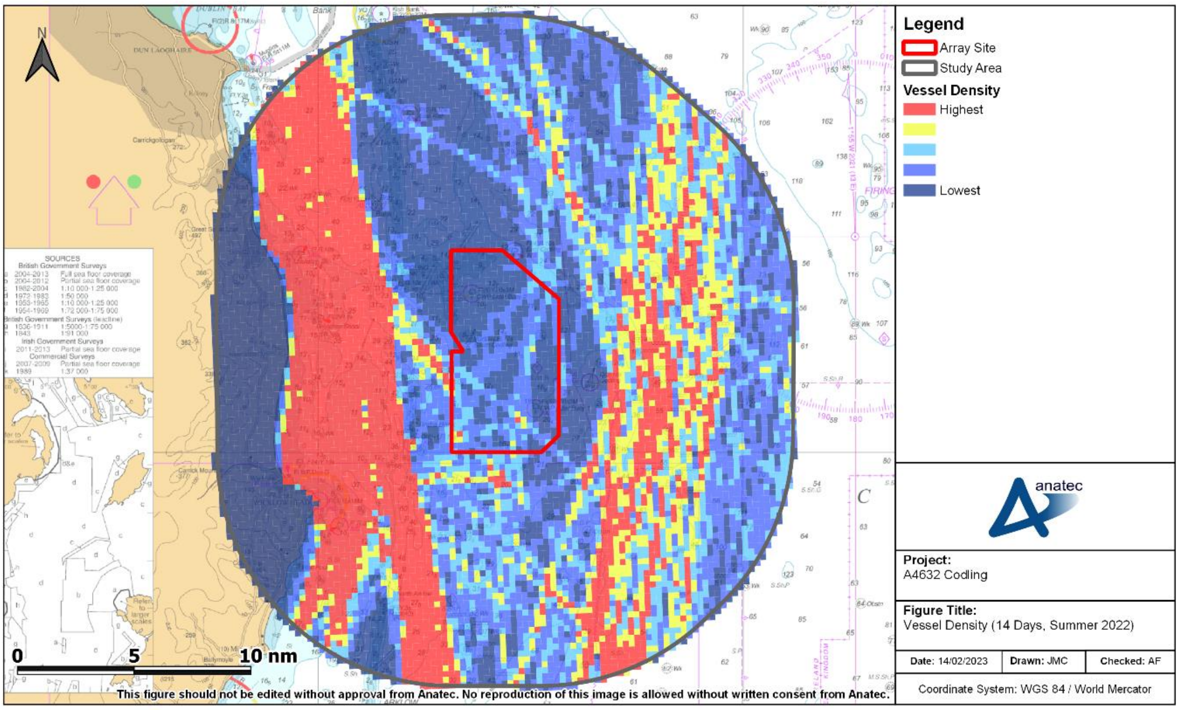

Figure 11-23 Vessel Density (14 Days, Summer 2022)

196. It can be seen that the highest levels of vessel density were mainly recorded inshore of the array site, reflecting the commercial routeing inshore of the banks and the nearshore recreational traffic.

11.2.2 Vessel Counts

197. The number of unique vessels per day present within the study area during the survey period are provided in **Figure 11-24**.

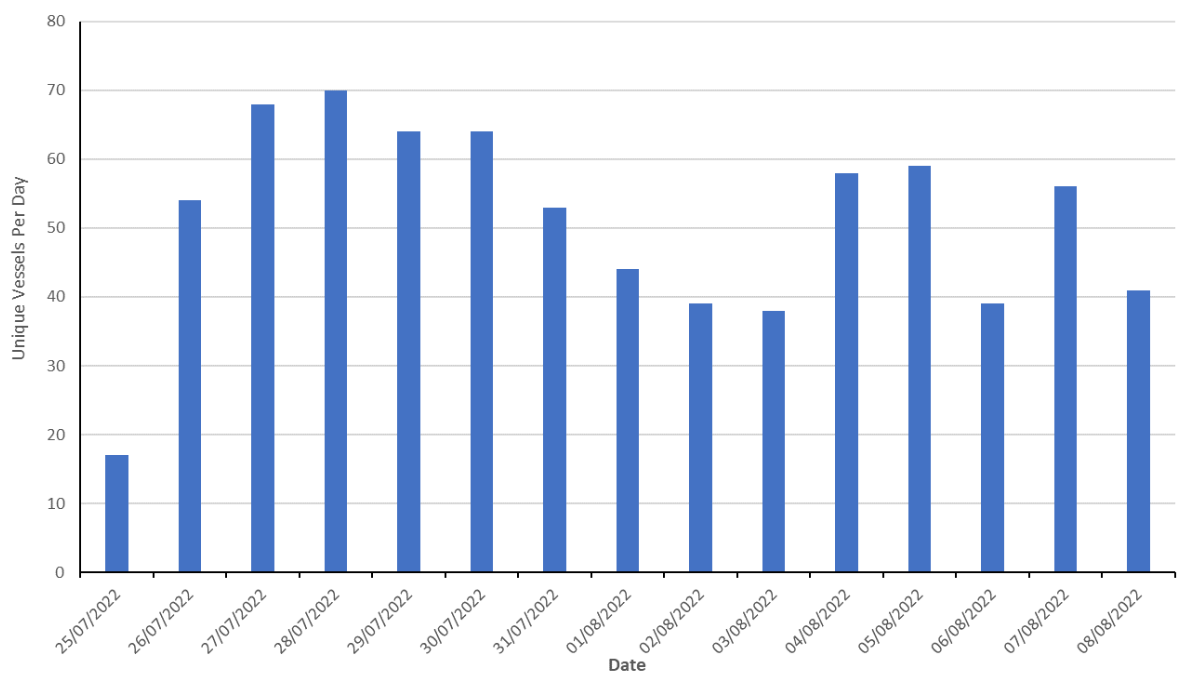

Figure 11-24 Vessel Count per Day (14 Days, Summer 2022)

198. An average of 54 unique vessels per day were present within the study area during the survey period. The busiest day was the 28 July 2022, on which 70 unique vessels were present. The quietest full day was the 3 August 2022, on which 38 unique vessels were present.

11.2.3 Vessel Types

199. The following sub-sections present a more detailed analysis of the main vessel types recorded within the study area during the survey period.

11.2.3.1 Cargo Vessels

200. An overview of the cargo vessels present within the study area throughout the survey period, colour-coded by cargo sub-type, is presented in **Figure 11-25**. All cargo vessels were recorded via AIS.

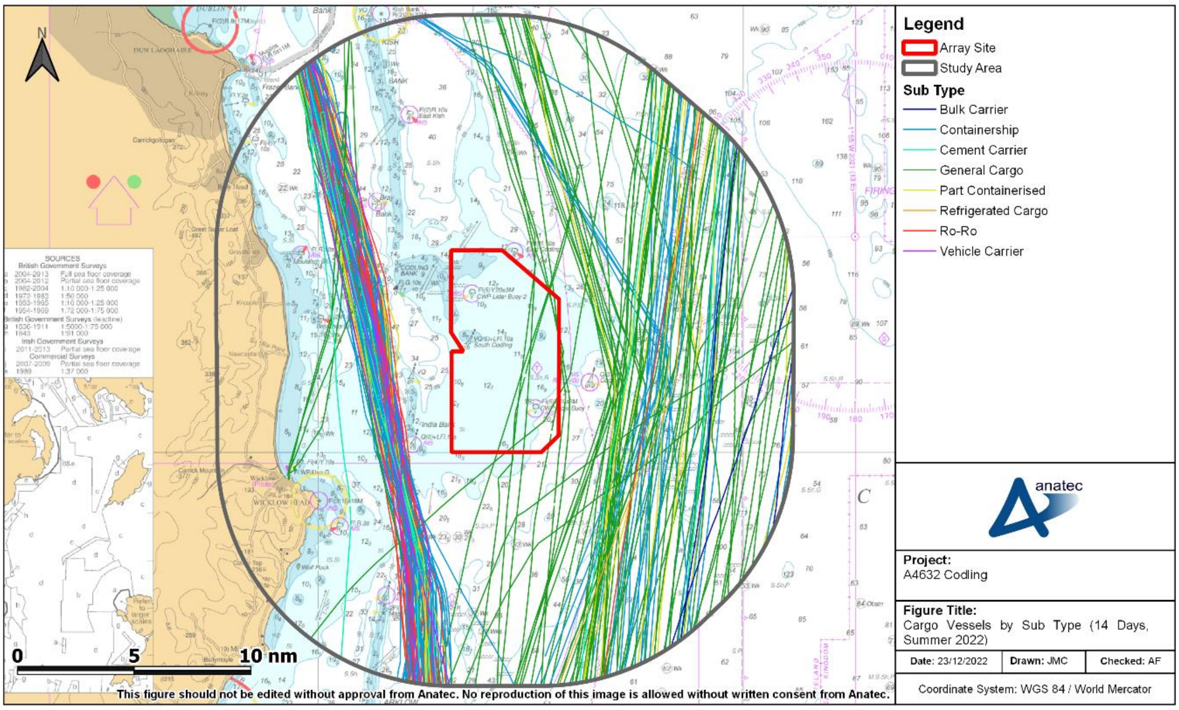

Figure 11-25 Cargo Vessels by Sub Type (14 Days, Summer 2022)

201. On average, 16 unique cargo vessels per day were present in the study area during the survey period. Cargo vessels were heavily seen in north/south transit to the west of the array site and were seen to avoid the shallow waters of the local banks. Vessels on this routeing were primarily containerships, RoRo cargo vessels, and vehicle carriers.

202. Cargo vessels, primarily general cargo and containerships, were seen passing to the east of the array site (i.e., offshore of the array site) on broad north/south routeing. These vessels were seen to stay in deeper waters avoiding the shallow waters within the array site.

203. It is noted that other data sets (and consultation) indicate certain cargo vessels make transit between the Codling and India Banks and hence intersect the array site. This has been captured in the identification of main routes in **Section 12**.

204. The distribution of cargo vessel sub-types within the study area is presented in **Figure 11-26**.

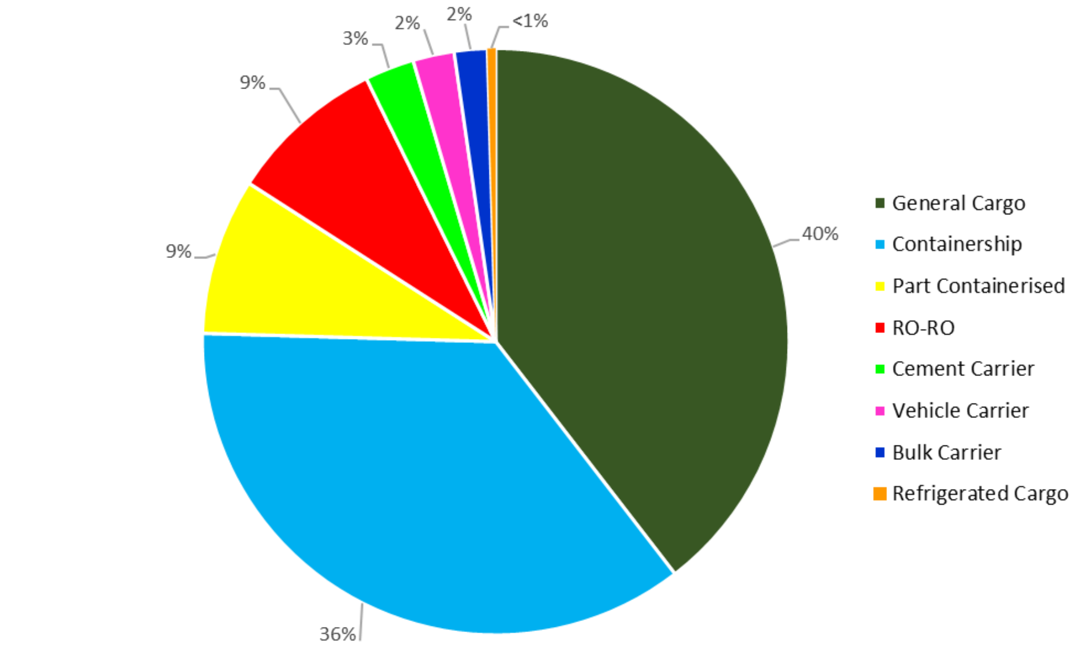

Figure 11-26 Distribution of Cargo Vessel Sub Types (14 Days, Summer 2022)

205. The most common cargo vessel sub-types present within the study area during the survey period were general cargo (40%), containerships (36%), RoRo cargo (9%), and part containerised cargo vessels (9%).

206. An overview of the RoRo vessels present within the study area throughout the survey period, colour-coded by operator, is provided in **Figure 11-27**.

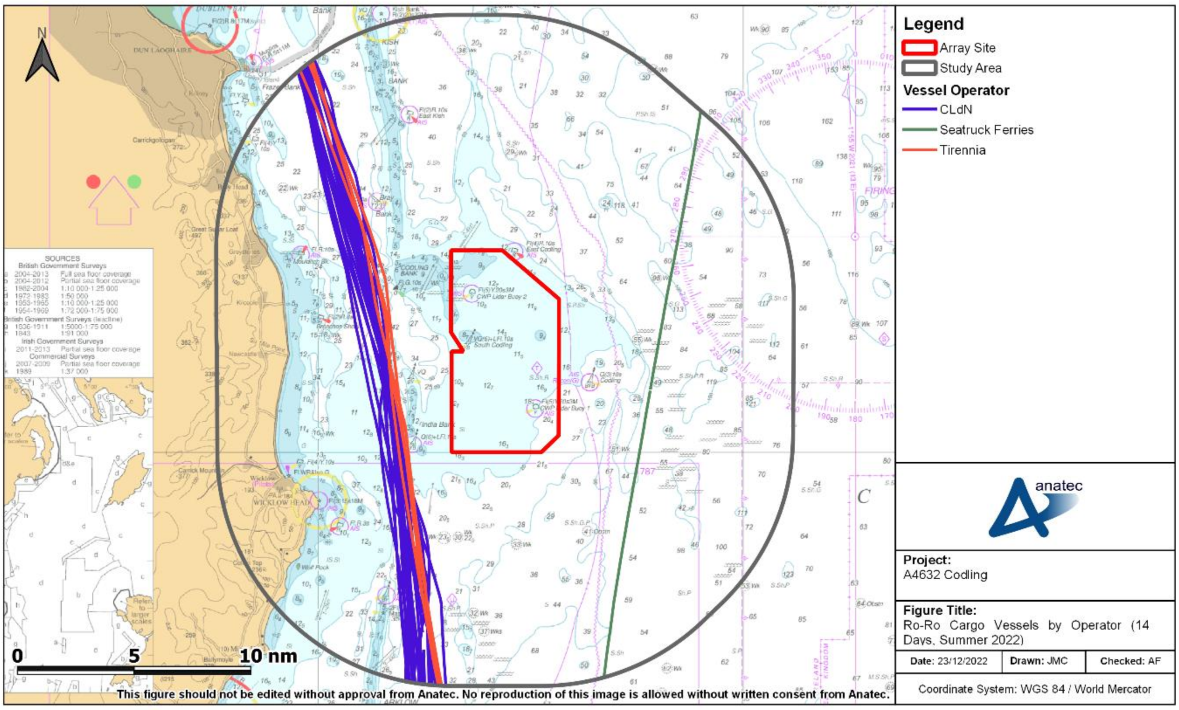

Figure 11-27 RoRo Cargo Vessels by Operator (14 Days, Summer 2022)

207. On average, there was one unique RoRo vessel per day present within the study area during the survey period. The most common RoRo operator was CLdN (79%), followed by Tirrenia (11%) and Seatruck (11%).

208. CLdN routeing was present between Dublin (Ireland) and Rotterdam (the Netherlands), Santander (Spain) and Zeebrugge (Belgium). All three routes passed west (i.e., inshore) of the array site on broad north/south transits. Tirrenia vessels were also following similar routeing from Dublin (Ireland) to Zeebrugge (Belgium).

11.2.3.2 Tankers

209. An overview of the tankers present within the study area throughout the survey period, colour-coded by tanker sub-type, is presented in **Figure 11-28**. All tankers were recorded via AIS.

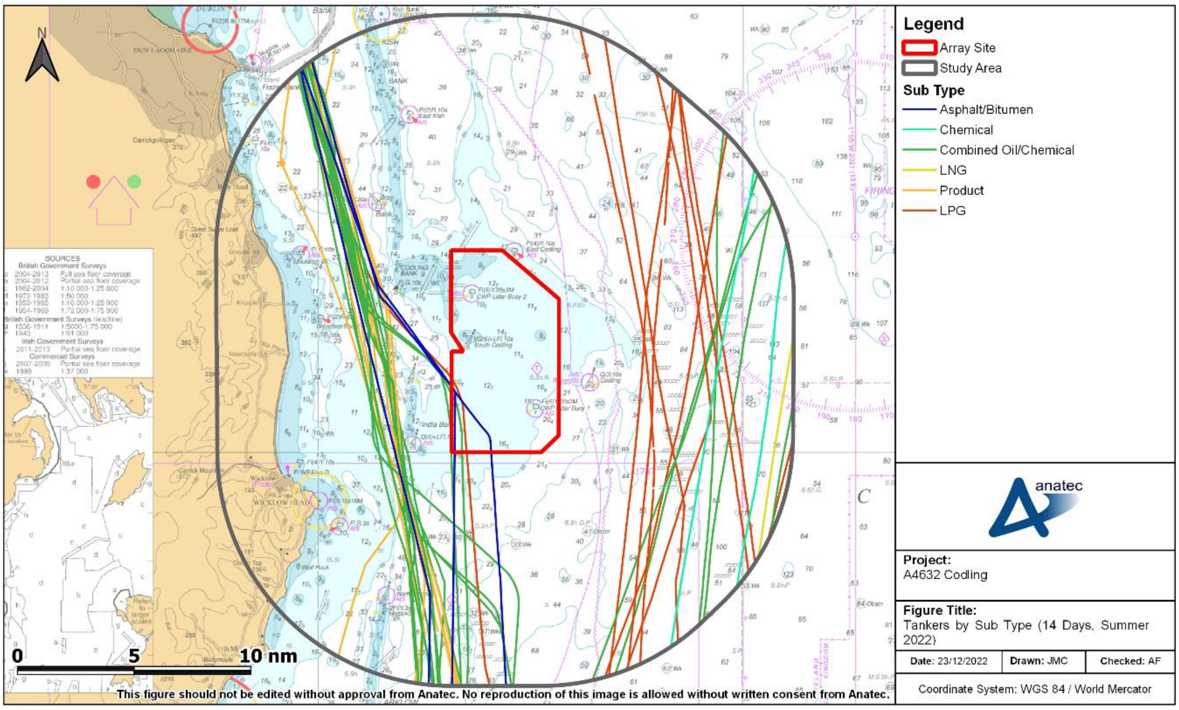

Figure 11-28 Tankers by Sub Type (14 Days, Summer 2022)

210. On average, between three and four unique tankers per day were present within the study area during the survey period. The most common tanker sub types were combined oil/chemical (45%), product tankers (24%), and LPG carriers (18%).

211. Routeing was broadly similar to that of cargo vessels (see **Section 11.2.3.1**), noting that vessels on transit between the Codling and India Banks were recorded intersecting the array site.

11.2.3.3 Passenger Vessels

212. An overview of the passenger vessels present within the study area throughout the survey period is presented in **Figure 11-29**. All passenger vessels were recorded via AIS.

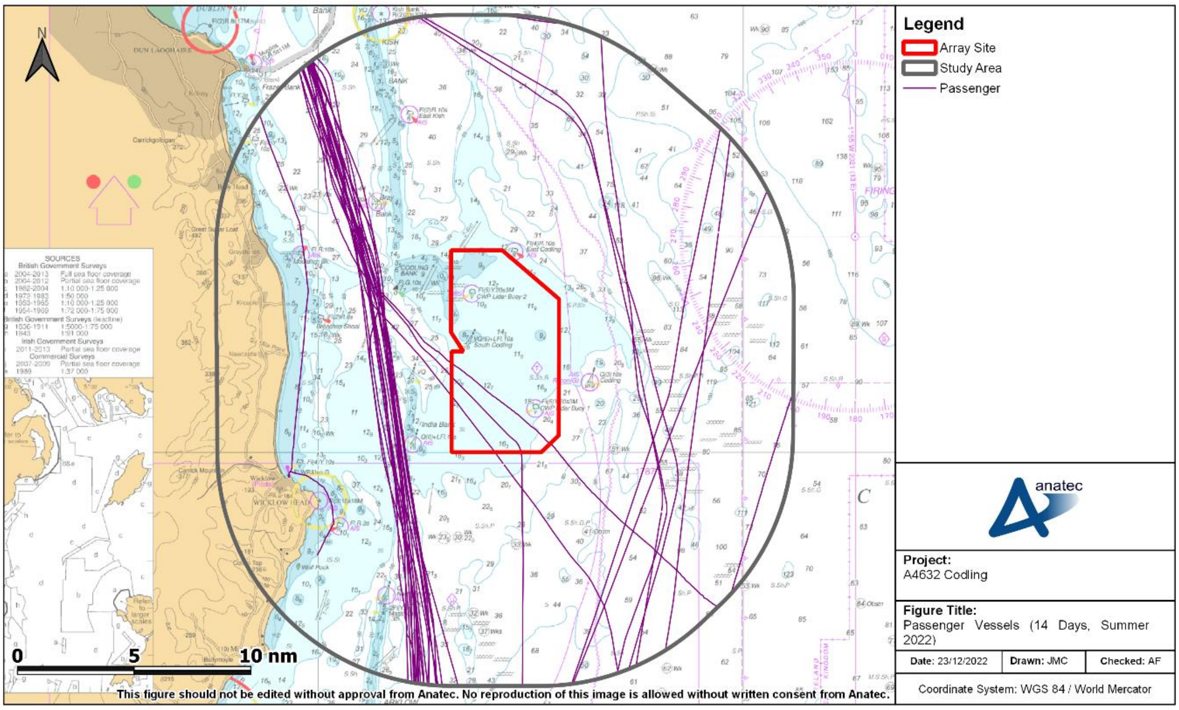

Figure 11-29 Passenger Vessels (14 Days, Summer 2022)

213. On average, between one and two unique passenger vessels per day were present within the study area during the survey period. Of all vessels recorded, 52% were RoPax, 32% cruise liners, and 16% passenger yachts. The majority of transits occurred inshore of the array site.

214. RoPax vessels were seen transiting within the main vessel route to the west of the study area, following the northwest/south route to/from the South Burford TSS. The RoPax operators were Irish Ferries (94%) transiting between Dublin (Ireland) and Cherbourg (France), and Stenaline (4%) transiting between Dublin (Ireland) and Holyhead (UK).

215. Cruise liners were noted transiting between Dublin (Ireland) and Dover (UK) as well as between Belfast (UK) and Dover (UK). These vessels were passing mostly to the east (i.e., offshore) of the array site, avoiding the shallow waters.

11.2.3.4 Fishing Vessels

216. An overview of fishing vessels present within the study area during the survey period, colour coded by average vessel speed, is presented in **Figure 11-30**. As a general heuristic, speeds of below six knots are deemed indicative of potential fishing activity. Of all fishing vessel tracks, 81% was recorded through AIS and the other 19% Radar.

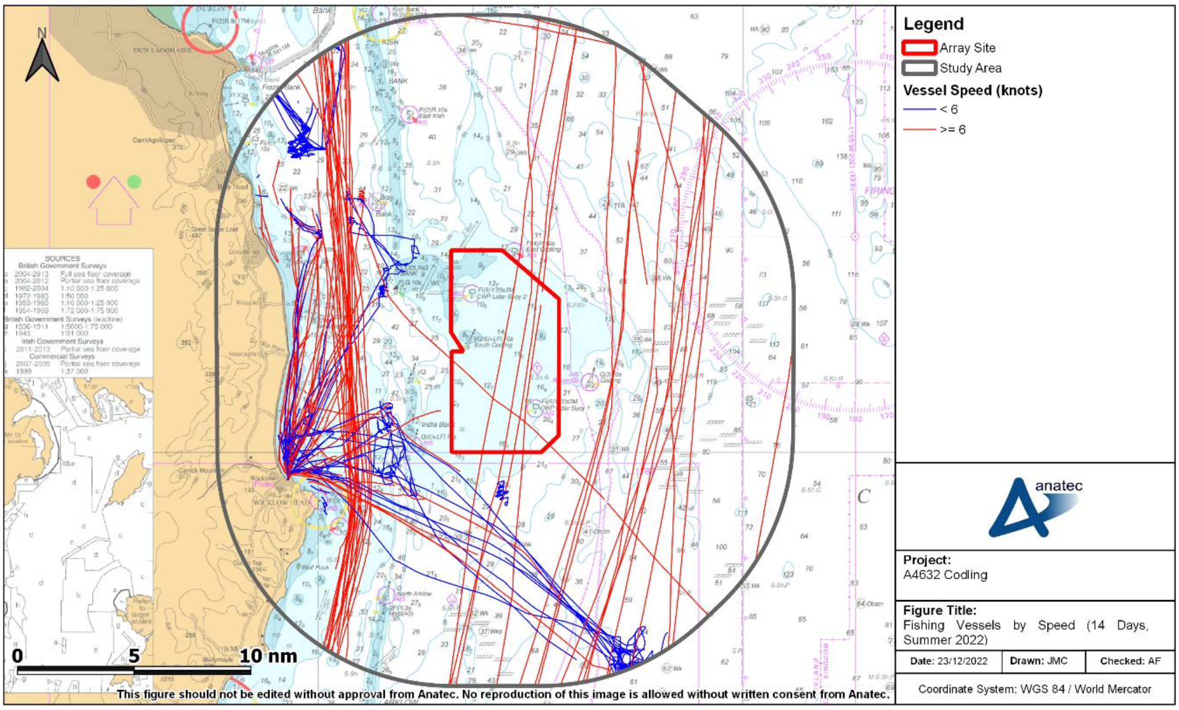

Figure 11-30 Fishing Vessels by Average Speed (14 Days, Summer 2022)

217. On average, there was between seven and eight unique fishing vessels per day present within the study area during the survey period.

218. Fishing vessels were generally seen in north/south transit, with this behaviour being more commonly seen inshore of the array site. Potential active fishing activity was also recorded, primarily inshore of the array site as well as to the south and southeast of the array site.

219. The majority of fishing vessels within the study area that could be associated with a registered county (84%) were registered to Ireland (77%). Great Britain (10%) and France (5%) followed, with Belgium, Germany, and Spain also present but at lower numbers (less than 5%).

11.2.3.5 Recreational Vessels

220. An overview of the recreational vessels recorded within the study area throughout the survey period using AIS and Radar are presented in **Figure 11-31**. Of all recreational vessels recorded, 91% were recorded by AIS and the other 9% via Radar.

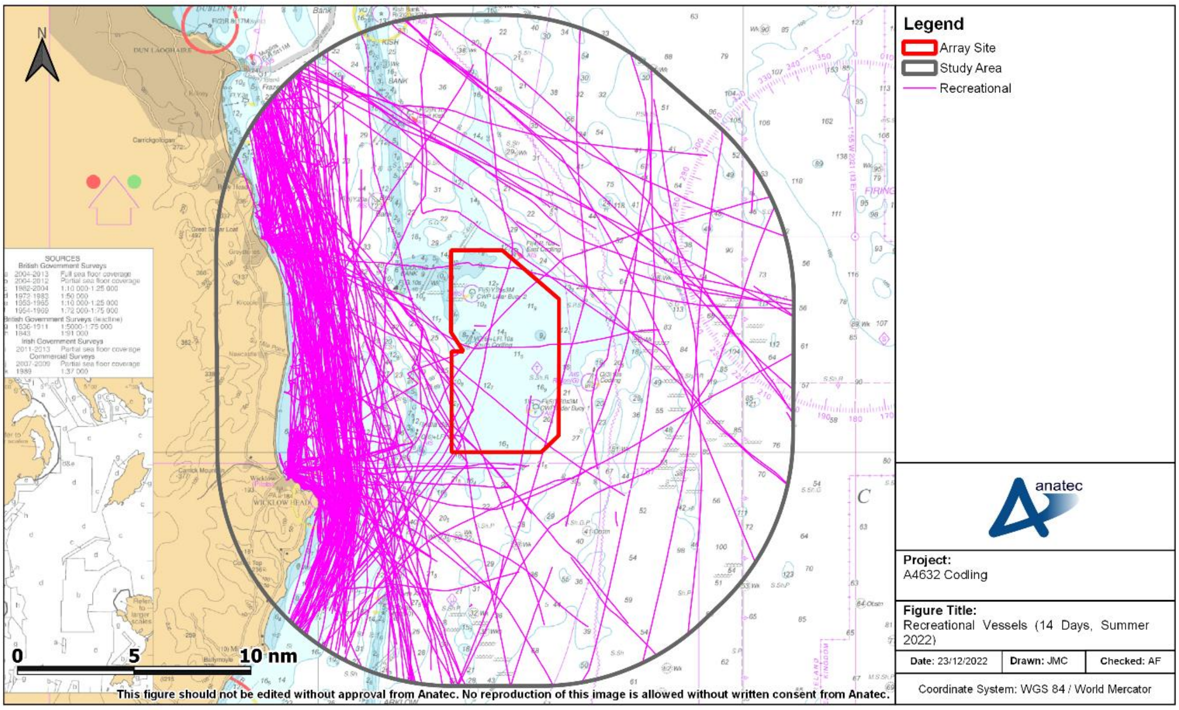

Figure 11-31 Recreational Vessels (14 Days, Summer 2022)

221. On average, there was 19 unique recreational vessel per day present within the study area during the survey period. The majority of recreational vessels were in the west of the study area staying closer to the shore and avoiding deeper waters to the east. The busiest day for recreational vessels was the 30 July 2022 with 32 unique vessels being present. No official sailing event was identified as being scheduled within the study area on this day, however there were sailing events in the area known to occur during the study period and on surrounding dates.

11.2.4 Vessel Sizes

222. This section provides a breakdown of the vessel traffic in terms of vessel length and vessel draught.

11.2.4.1 Vessel Lengths

223. An overview of the vessels present within the study area throughout the survey period using AIS and Radar, colour-coded by vessel length, is provided in **Figure 11-32**.

224. The majority of vessels recorded on AIS (87%) were associated with a valid length but only 3% of vessels recorded on Radar were associated with a valid length. Vessels with unspecified length accounted for 19% of the entire dataset. These vessels are shown in **Figure 11-32** but excluded from the analysis that follows.

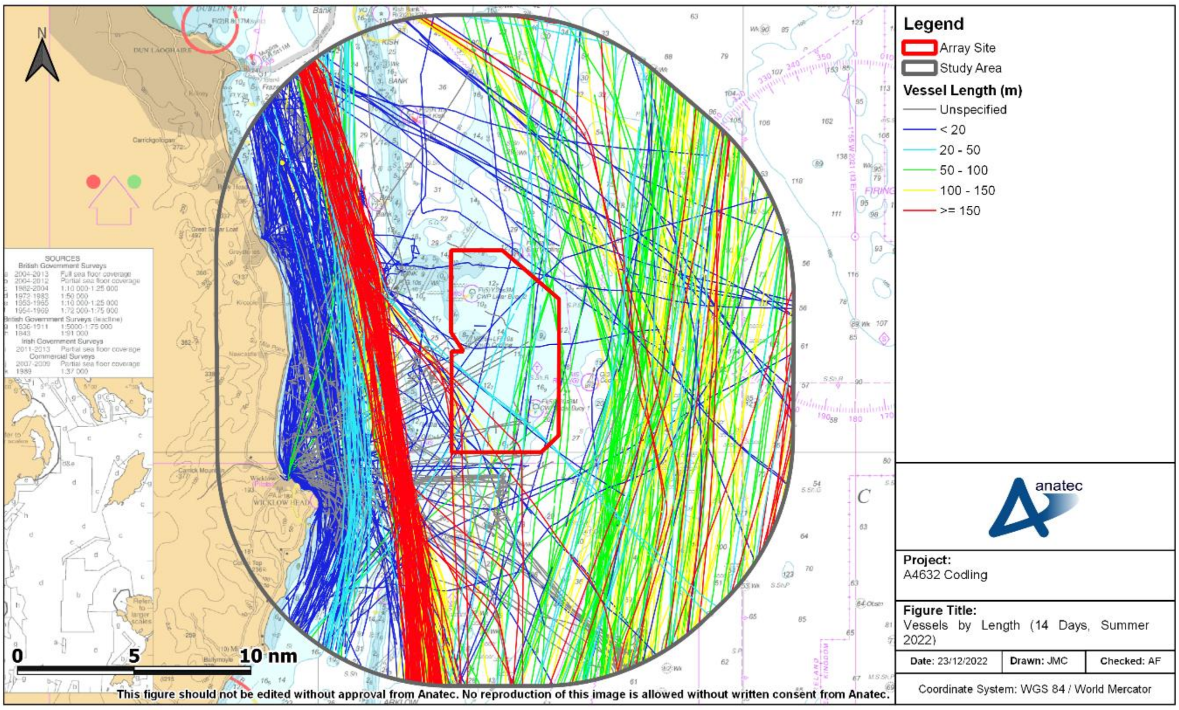

Figure 11-32 Vessel Lengths (14 Days, Summer 2022)

225. Vessels of greater lengths were primarily passenger vessels, cargo vessels, and tankers. These vessels were seen mainly routeing northwest/south to the west of the array site and routeing northwest to southwest around the east of the array site, avoiding shallow water depths within the array site and surrounding banks.

226. Vessels of smaller length were primarily fishing and recreational vessels and were primarily recorded inshore to the western extent of the study area. Vessels with unspecified length were typically located nearshore and tended to be fishing and recreational vessels where data limitations would be expected (see **Section 5.4.1**).

227. The distribution of the vessel lengths is provided in **Figure 11-33**.

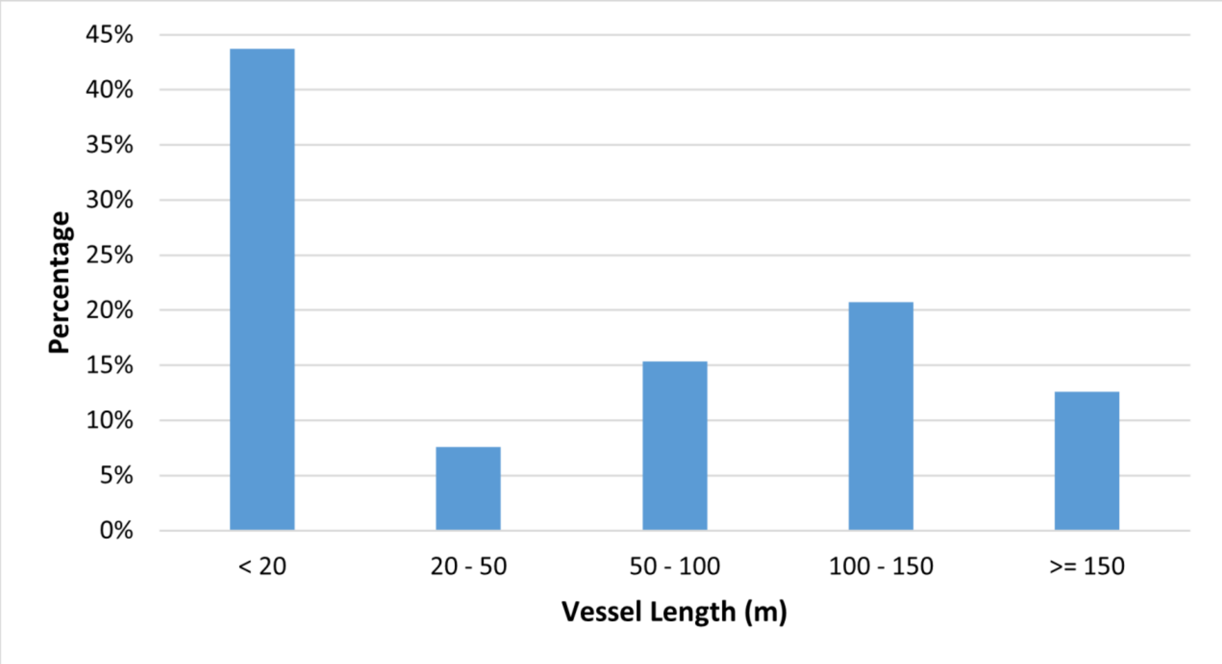

Figure 11-33 Vessel Length Distribution (14 Days, Summer 2022)

228. The average length of vessels across the study area during the survey period was 71 m. The largest vessel recorded was a passenger cruise liner at 319 m heading to Waterford, Ireland, at approximately 5 nm to the east of the array site on the 28 July 2022. The most common vessel lengths were below 20 m (44%).

11.2.4.2 Vessel Draughts

229. An overview of the vessels present within the study area throughout the survey period using AIS and Radar, colour-coded by vessel draught, is provided in **Figure 11-34**.

230. A valid vessel draught was associated with 44% of vessels recorded on AIS. For Radar data, 2% of vessels were associated with a vessel draught. Those vessels with unspecified vessel draught were removed from the draught analysis, equating to a total of 60% of all data.

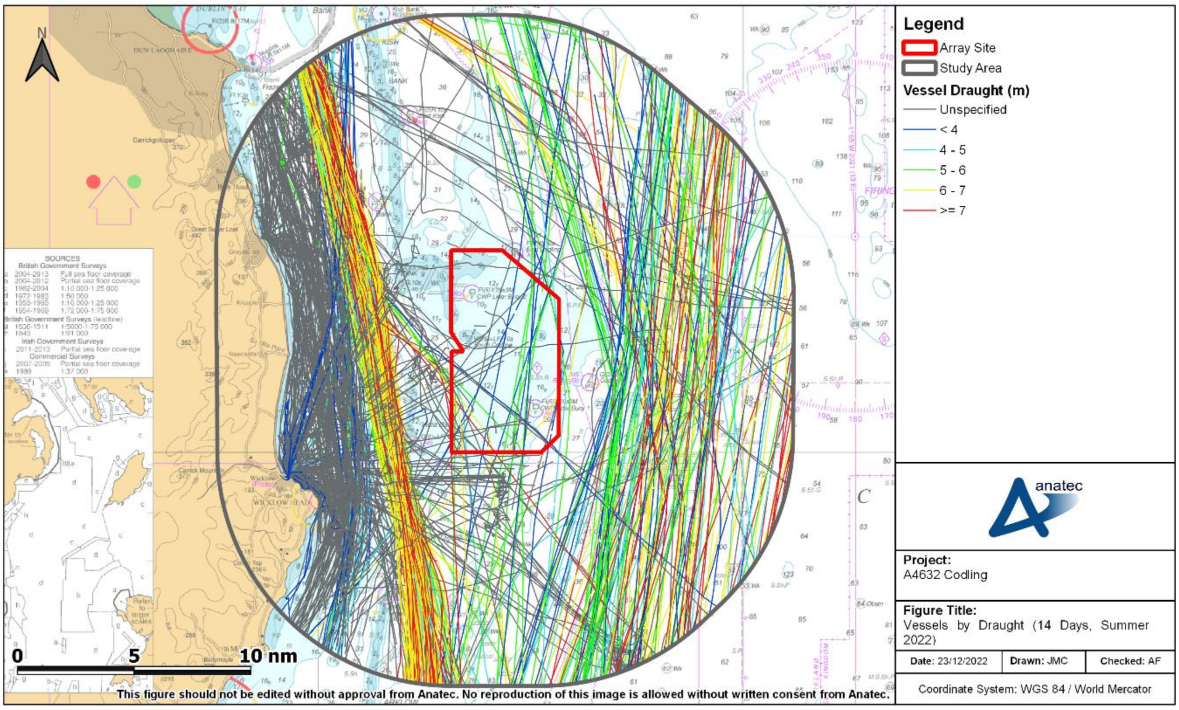

Figure 11-34 Vessel Draught (14 Days, Summer 2022)

231. Vessels with larger draughts were primarily passenger vessels, cargo vessels, and tankers. Vessels with the lowest draughts were mostly inshore fishing vessels and small length cargo vessels.

232. Those vessels with no draught, and so excluded from the analysis, were mainly inshore fishing and recreational vessels where data limitations would be expected (see **Section 5.4.1**).

233. The distribution of the vessel draughts is provided in **Figure 11-35**.

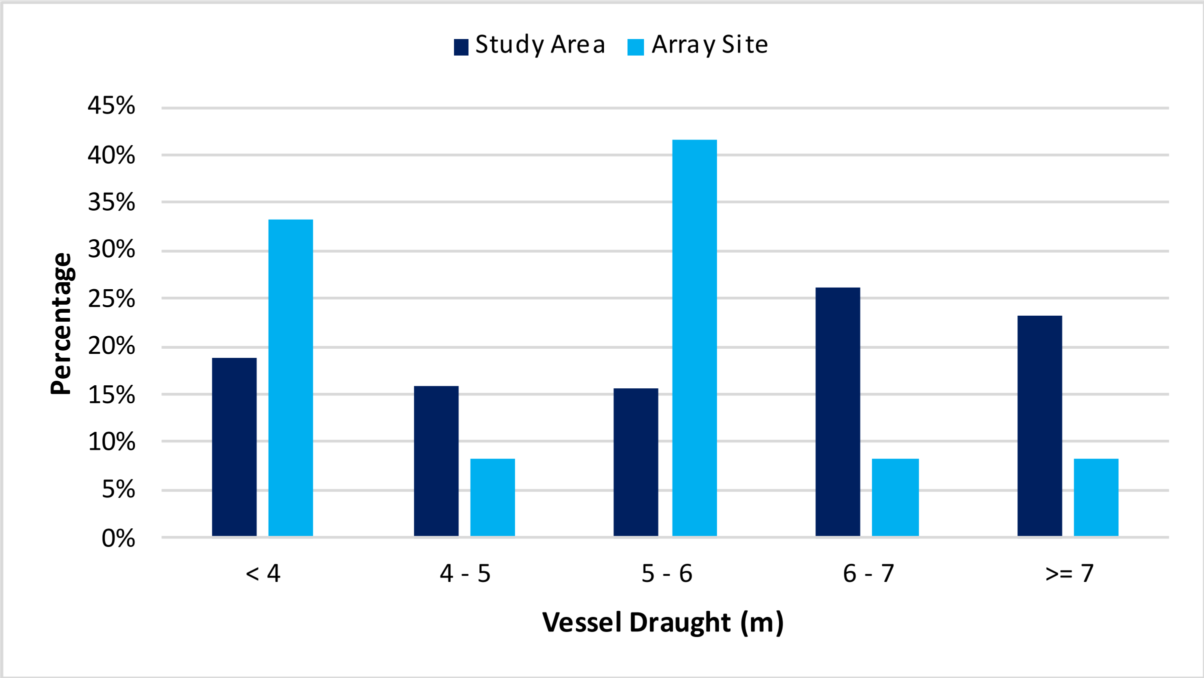

Figure 11-35 Vessel Draught Distribution (14 Days, Summer 2022)

234. The average draught of vessels across the study area during the survey period was 5.6 m. The vessel with the largest recorded draught was a liquefied natural gas (LNG) tanker at 12 m, recorded approximately 9 nm to the southeast of the array site on the 30 July 2022. The most commonly recorded vessel draughts were between 6 m and 8 m (42%).

11.2.5 Anchored Vessels

235. Vessels which travelled at a speed of less than 1 knot for more than 30 minutes are deemed to potentially be at anchor. Such cases have therefore been identified and checked for likely anchoring activity along with vessel track behaviour and AIS broadcasted navigational status. After applying the criteria, one vessel was deemed to be at anchor during the survey period and is presented in **Figure 11-36**.

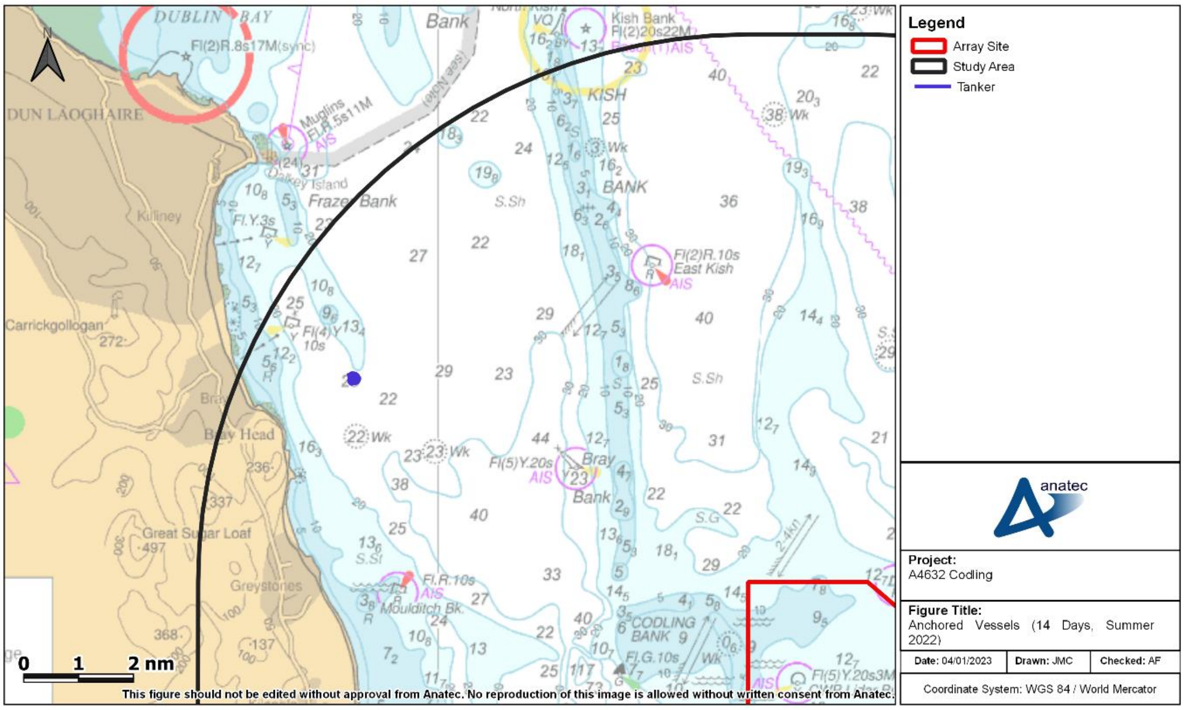

Figure 11-36 Anchored Vessels (14 Days, Summer 2022)

236. The vessel at anchor was a combined oil/chemical tanker which was anchored over five days from 30 July 2022 to 3 August 2022. The vessel was positioned approximately 1.4 nm from the coast, 3.5 nm from the entrance to Dublin Bay and approximately 7.5 nm from the northwest of the array site.

237. From consultation (see **Section 4**), this is an area where commercial vessels are known to anchor.

11.2.6 Average Vessel Speeds

238. An overview of the vessels present within the study area throughout the survey period using AIS and Radar, colour-coded by average vessel speed, is provided in **Figure 11-37**. Following this, the distribution of the average vessel speeds are then provided in **Figure 11-38**.

239. A valid average vessel speed was able to be established for all vessels recorded on Radar and 88% of AIS data. A total of 11% of all data was removed from the speed analysis (i.e., vessels with an unspecified speed).

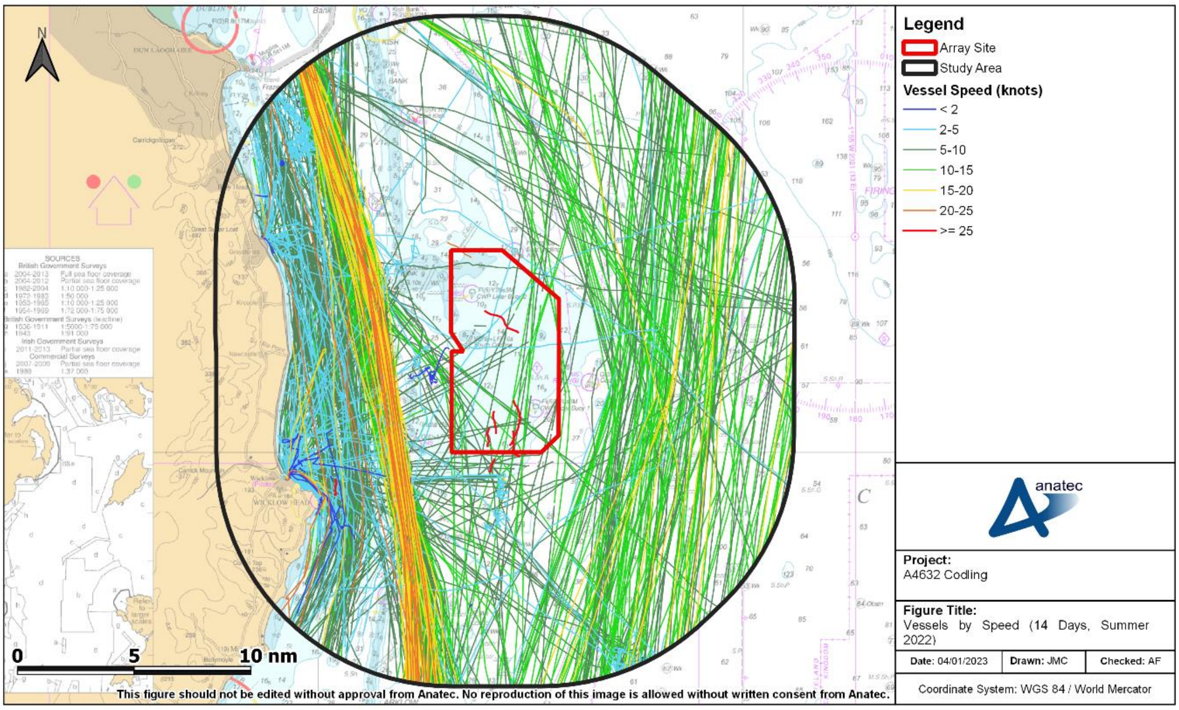

Figure 11-37 Vessels by Speed (14 Days, Summer 2022)

240. Vessels of greatest speeds recorded in the study area during the survey period were primarily passenger vessels and cargo vessels. Those with lowest speeds were primarily coastal fishing and recreational vessels.

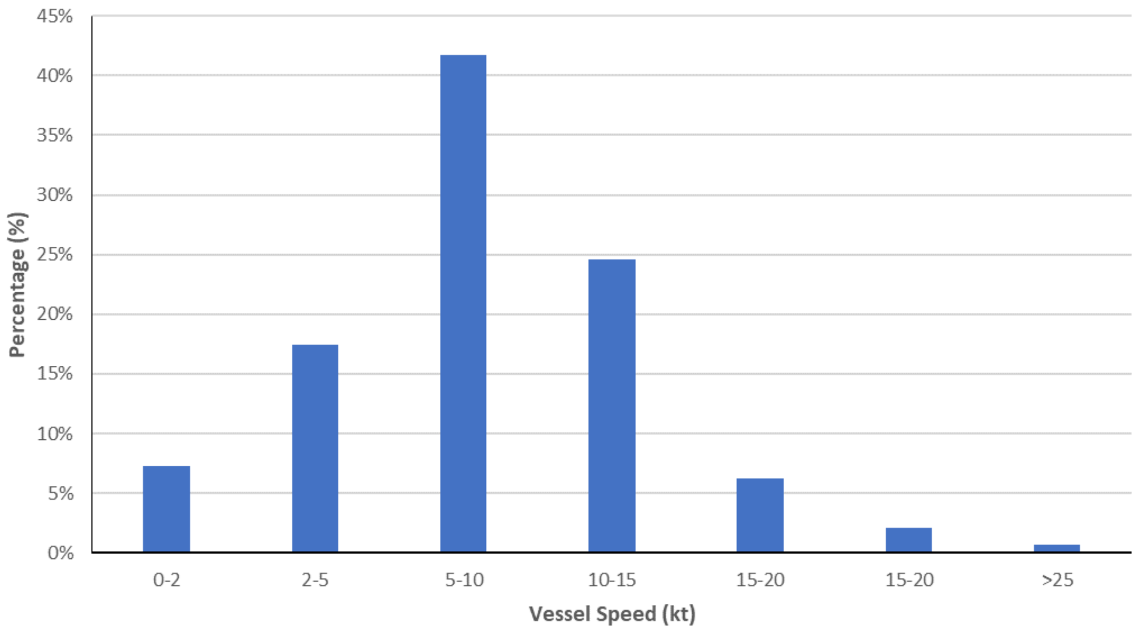

Figure 11-38 Vessel Speed Distribution (14 Days, Summer 2022)

241. The average vessel speed of all vessels across the study area during the survey period was 8.4 knots. The most commonly recorded vessel speeds were between 5 knots and 10 knots (42%).

11.2.7 Vessel Destinations

242. A summary of the main destinations for vessels broadcasted over AIS present within the study area during the survey period is provided in **Figure 11-39**. Vessels recorded via AIS that broadcast a valid destination accounted for 53% of all AIS vessels (46% of all data).

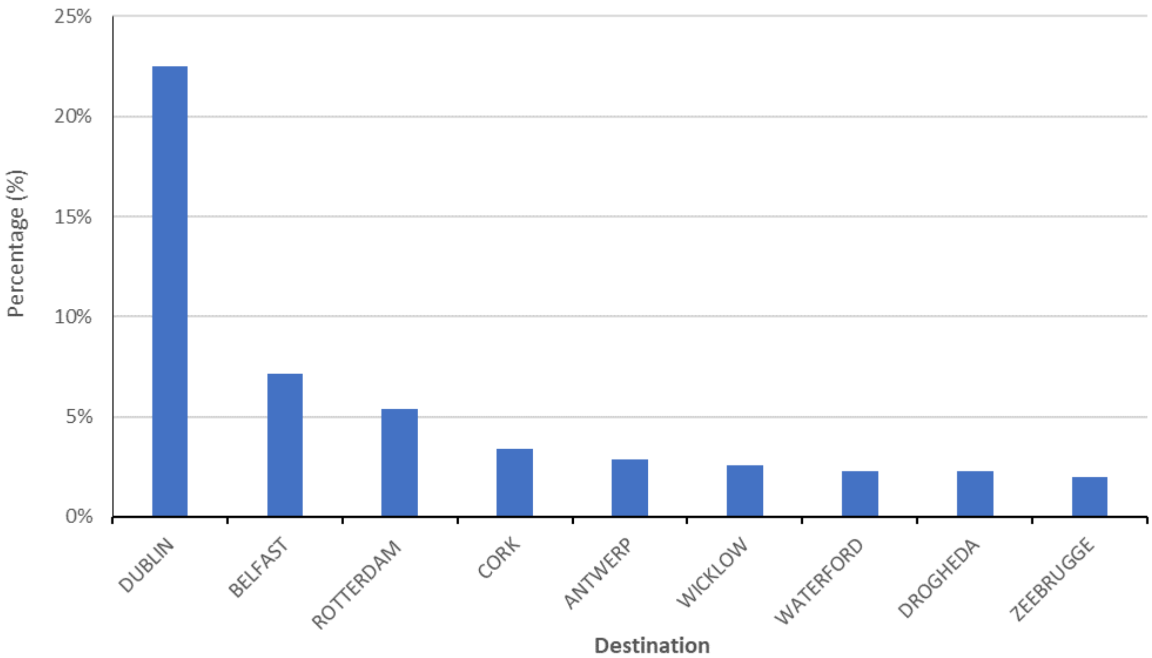

Figure 11-39 Distribution of Vessel Destination (14 Days, Summer 2022)

243. The most common broadcast destination by vessels within the study area during the survey period was Dublin (Ireland) (23%). Other destinations included Belfast (UK) (7%), Rotterdam (the Netherlands) (5%), Cork (Ireland) (3%), Antwerp (Belgium) (3%) and Wicklow (Ireland) (3%). In addition to these destinations, there was a wide variety of destinations in general, including UK ports, Baltic ports, and other European ports.

11.2.8 Vessels Intersecting Array Site

244. An overview of the vessels recorded intersecting the array site throughout the survey period using AIS and Radar, colour-coded by vessel type, is presented in **Figure 11-40**. Following this, the distribution of these vessel types is then presented in **Figure 11-41**.

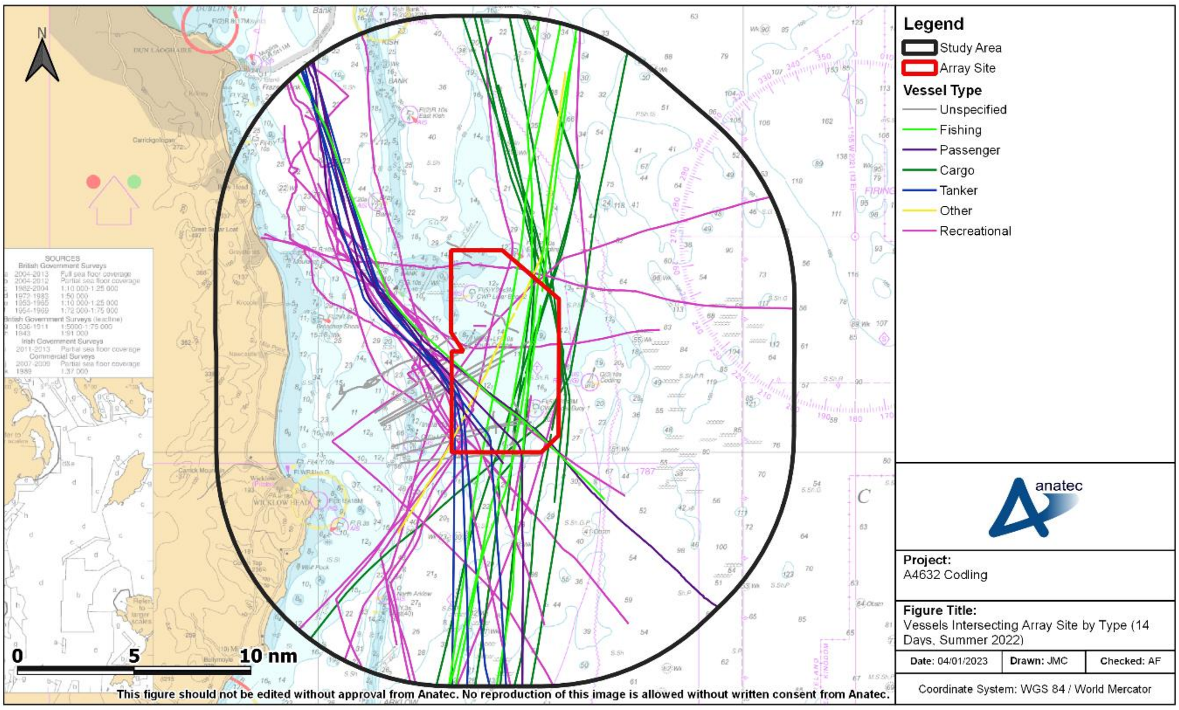

Figure 11-40 Vessels Intersecting Array Site by Type (14 Days, Summer 2022)

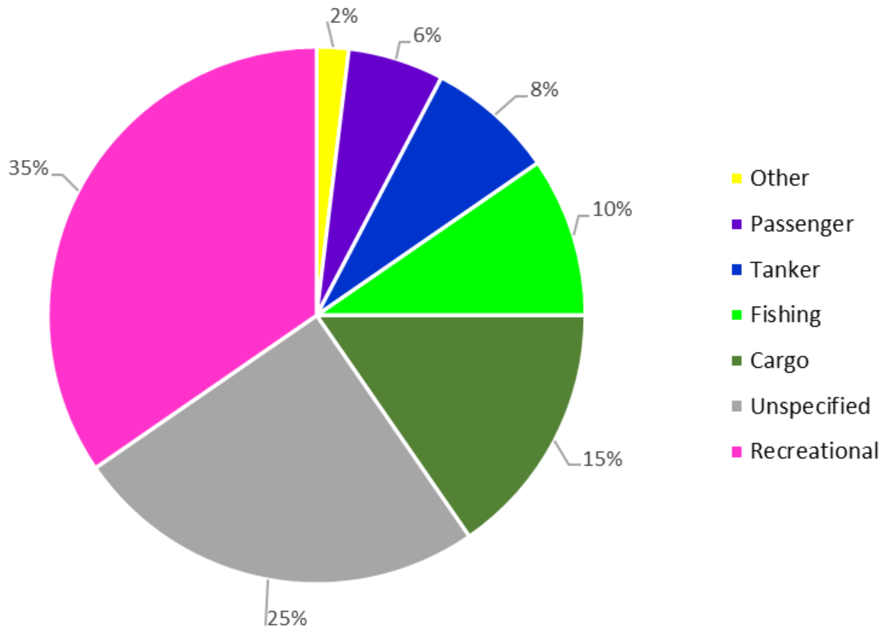

Figure 11-41 Distribution of Vessel Types Intersecting Array Site (14 Days, Summer 2022)

245. Overall, approximately 5% of all vessel traffic in the study area intersected the array site throughout the survey period or an average of between three and four unique vessels per day were seen to intersect.

246. Similar to the study area, the most common vessel type recorded intersecting the array site was recreational vessels (35%), followed by unspecified vessels (25%), cargo vessels (15%) and fishing vessels (10%). Tankers (8%) and passenger vessels (6%) were also present.

11.3 Vessel Traffic Survey - 2021

247. This section presents assessment of vessel traffic recorded within the study area during a 57-day survey period from the 30 April 2021 - 25 June 2021. This data has been included on a supplementary basis, noting the NRA has considered 28 days of up to date vessel traffic survey data in **Sections 11.1** and **11.2**.

11.3.1 Overview

248. The vessel tracks recorded during the survey period within the study area are colour-coded by vessel type and presented in **Figure 11-42**.

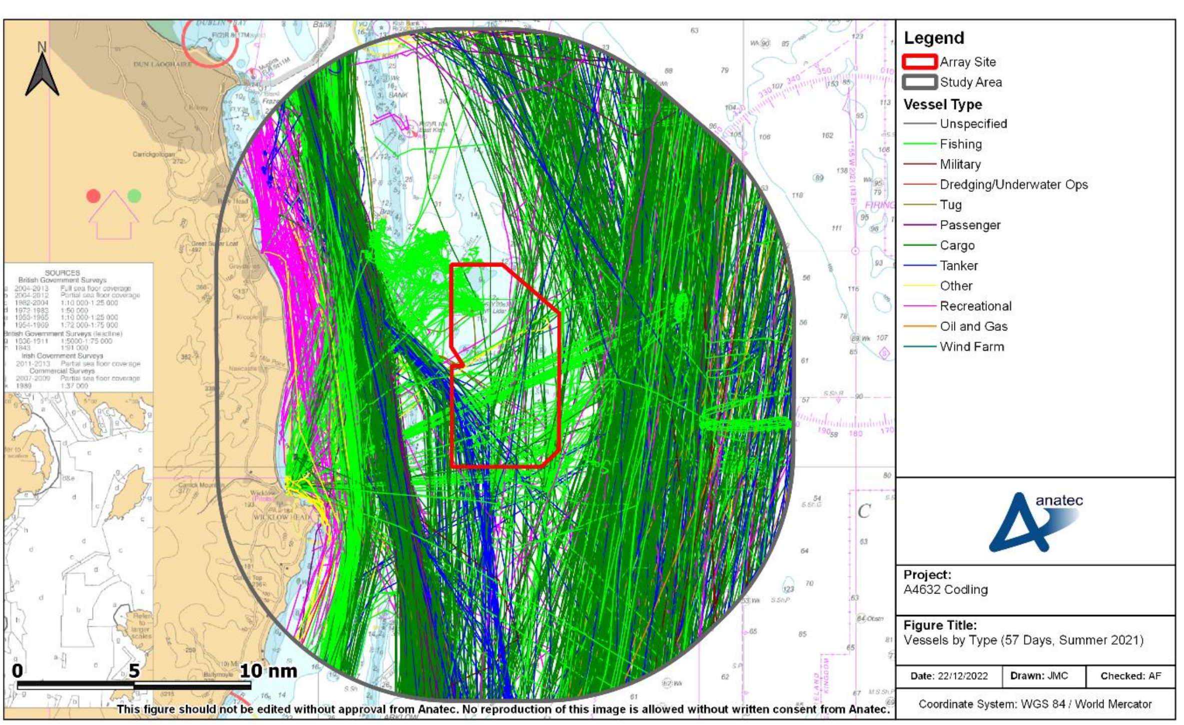

Figure 11-42 Vessels by Type (57 Days, Summer 2021)

249. The density of vessels within a 0.25 nm x 0.25 nm grid is presented in **Figure 11-43**.

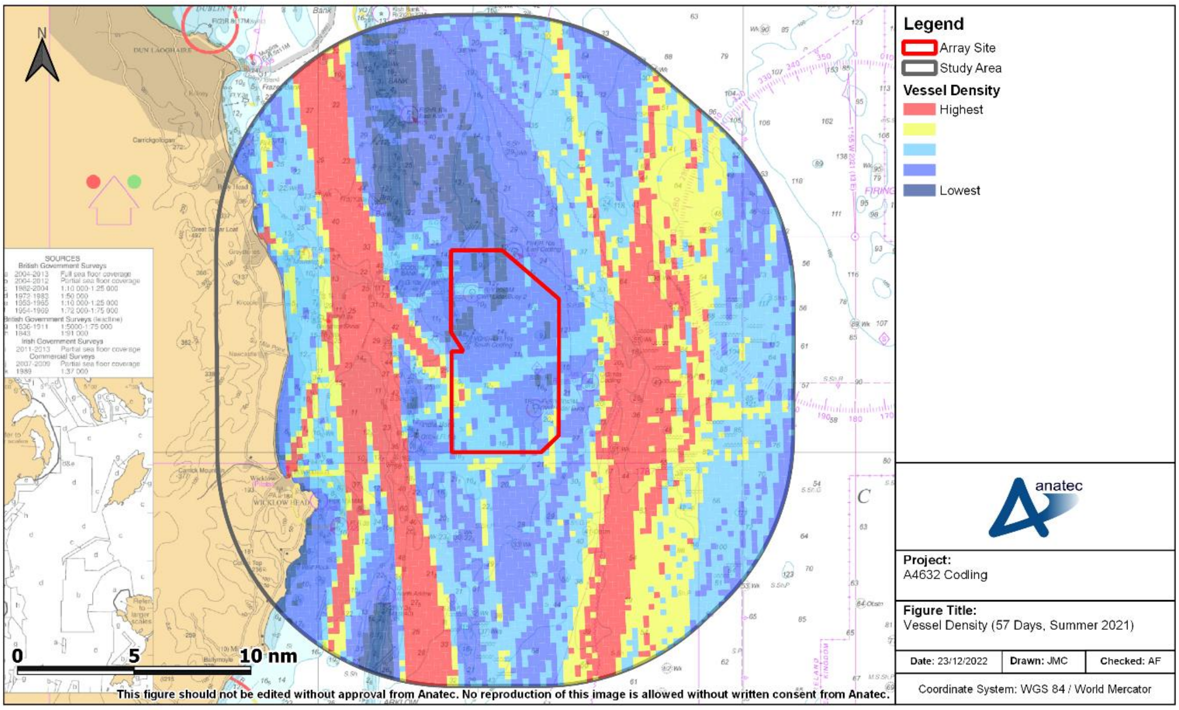

Figure 11-43 Vessel Density (57 Days, Summer 2021)

11.3.2 Vessel Counts

250. The number of unique vessels recorded in the study area and array site during the period 30 April 2021 – 31 May 2021 and during the period 1 June 2021 – 25 June 2021 are presented in **Figure 11-44** and **Figure 11-45** respectively.

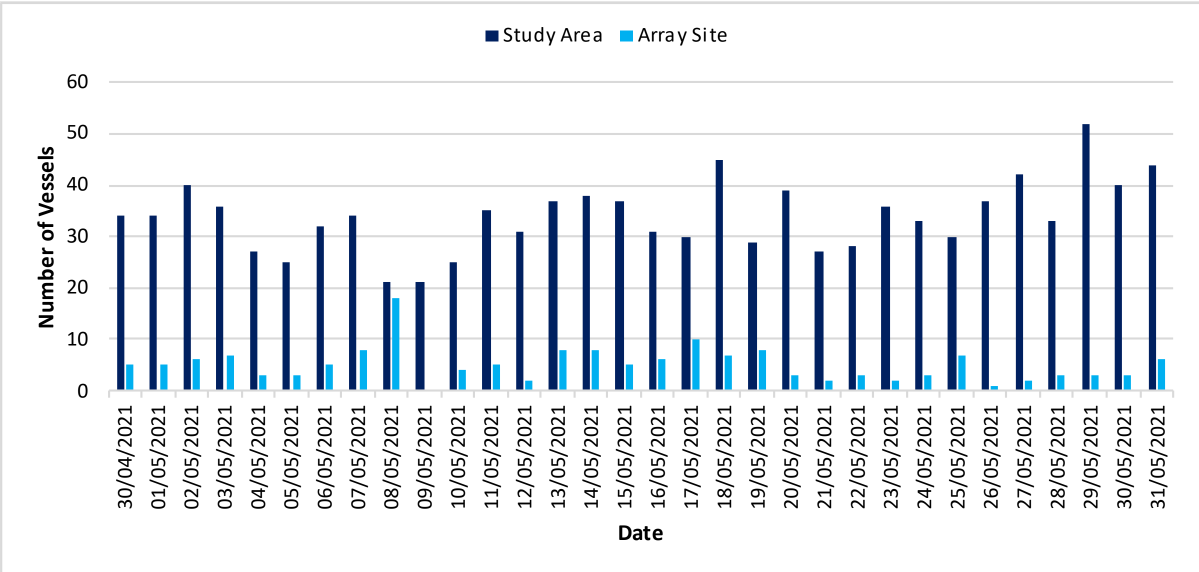

Figure 11-44 Vessel Count per Day (30 April 2021 – 31 May 2021)

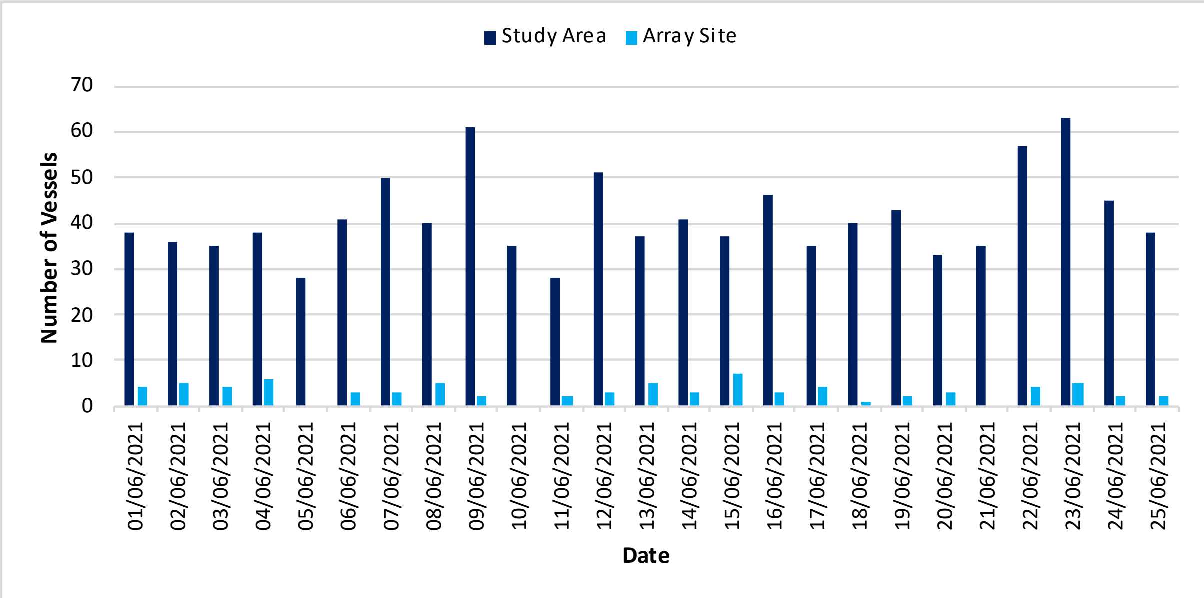

Figure 11-45 Vessel Count per Day (1 June 2021 – 25 June 2021)

251. On average, 37 unique vessels were recorded within the study area per day during the survey period. A general upward trend of activity was noted as the survey progressed, with an average of 34 vessels per day recorded within the study area up until the end of May, rising to 41 per day during the June period. The day with the highest number of unique vessels in the study area was the 23 June 2021, with 63 vessels recorded, and the days with the least vessels in the study area were the 8 May 2021 and 9 May 2021, with 21 vessels recorded each.

252. On average, three unique vessels were recorded within the array site per day during the survey period. The days with the highest number of unique vessels in the array site were the 3 May 2021 and 25 May 2021, with seven vessels recorded each. The days with the least number of unique vessels in the array site were the 9 May 2021, and the 5 June 2021, 10 June 2021, and 21 June 2021, with zero vessels recorded each.

11.3.3 Vessel Types

253. The distribution of main vessel types recorded in the study area and array site during the survey period is presented in **Figure 11-46**.

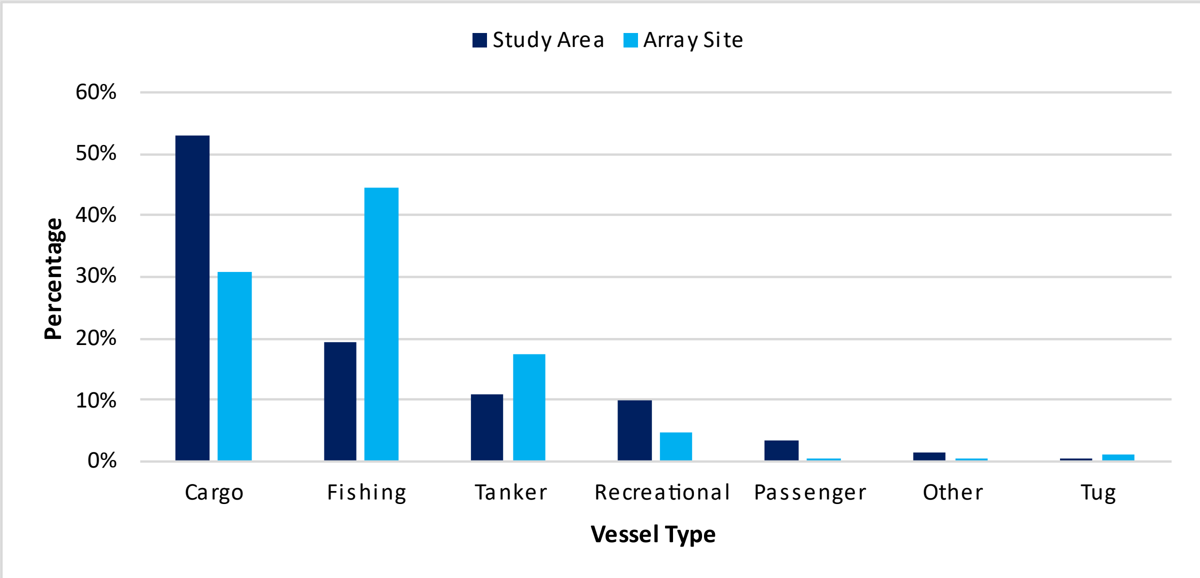

Figure 11-46 Distribution of Main Vessel Types (57 Days, Summer 2021)

254. In the study area, cargo vessels were the most commonly recorded vessel type during the survey period (comprising 53% of all vessels recorded). The other common vessel types recorded were fishing vessels (20%), tankers (11%), and recreational vessels (10%). No other vessel type comprised of 5% or over of the total distribution of vessel types in the study area during the survey period.

255. "Other" vessels accounted for 2% of the total vessel types in the study area during the survey period, noting that this category included RNLI lifeboats, utility vessels, law enforcement vessels, pilot vessels, and dive vessels.

256. In the array site, fishing vessels were the most commonly recorded vessel type during the survey period (comprising 45% of all vessels recorded in the array site). The other common vessel types recorded were cargo vessels (31%), tankers (17%), and recreational vessels (5%). No other vessel type comprised of 5% or over of the total distribution of vessel types in the array site during the survey period.

11.3.3.1 Commercial Vessels

257. The commercial vessel (passenger, cargo, and tanker) tracks recorded in the study area during the survey period are presented in **Figure 11-47**. Following this, the number of unique passenger, cargo, and tanker vessels in the study area during April/May and June 2021 are presented in **Figure 11-48** and **Figure 11-49** respectively.

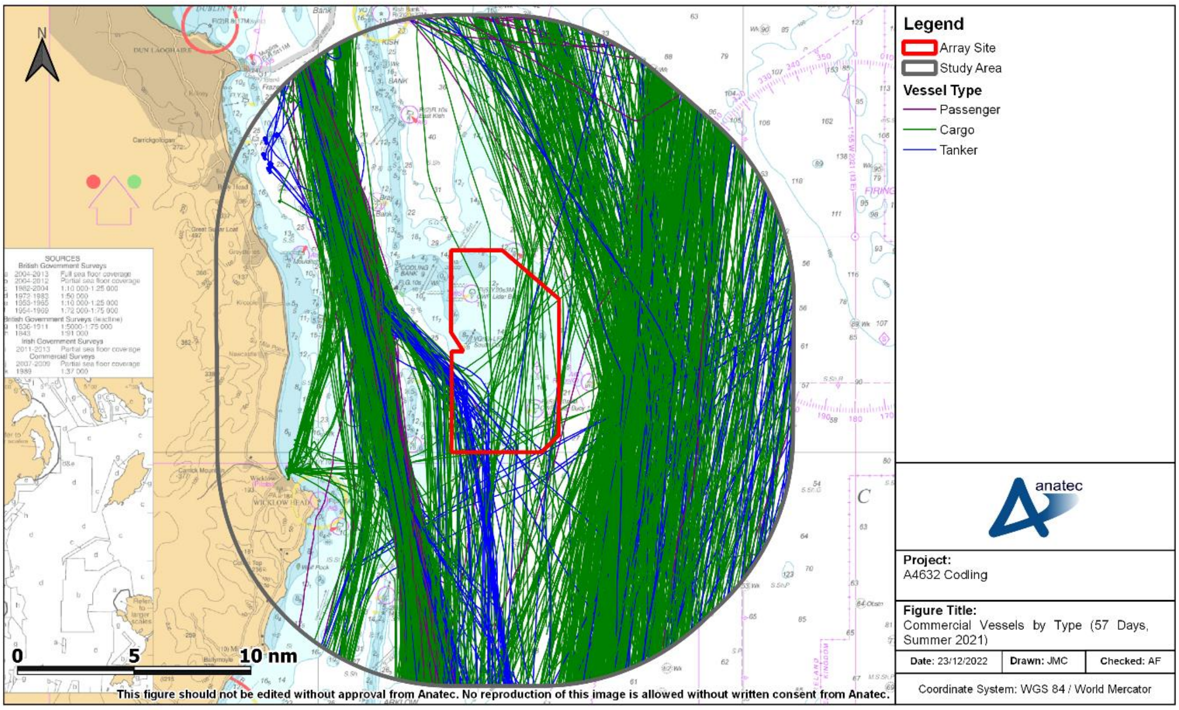

Figure 11-47 Commercial Vessels (57 Days, Summer 2021)

258. The commercial vessels were observed to be following main routes, noting that these routes avoided shallow banks.

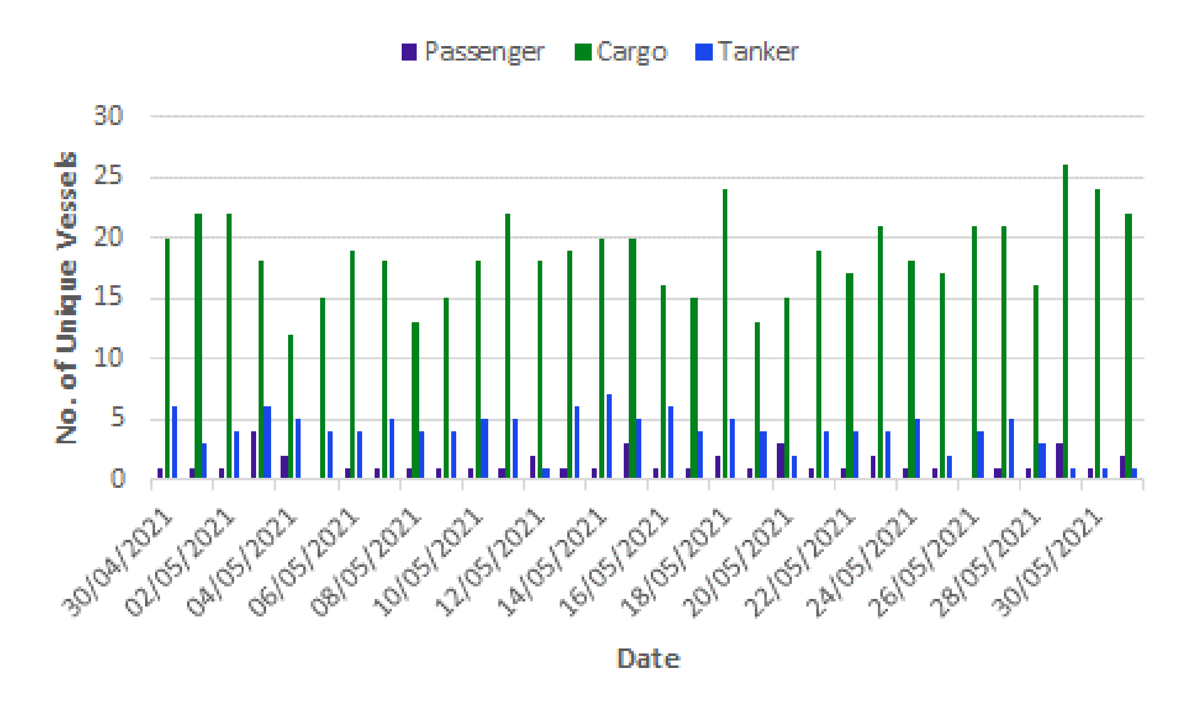

Figure 11-48 Commercial Vessel Count per Day (April/May 2021)

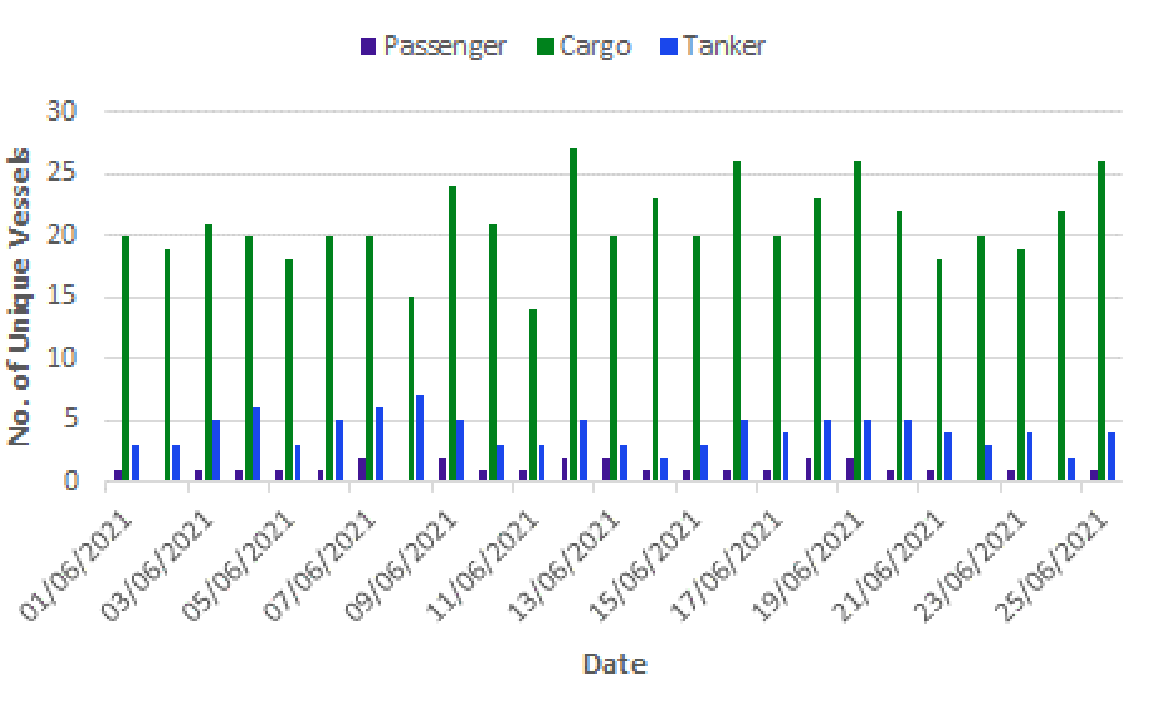

Figure 11-49 Commercial Vessel Count per Day (June 2021)

259. The summary of the average, maximum, and minimum numbers per day of passenger, cargo, and tanker vessels in the study area during the survey period is presented in **Table 11-1**.

Table 11-1 Commercial Vessel Numbers

Vessel Type	Minimum Daily Count	Maximum Daily Count	Average Vessels per Day
Passenger	0	4	1
Cargo	12	27	20
Tanker	1	7	4

11.3.3.2 Fishing Vessels

260. The fishing vessel tracks recorded in the study area during the survey period are presented in **Figure 11-50**.

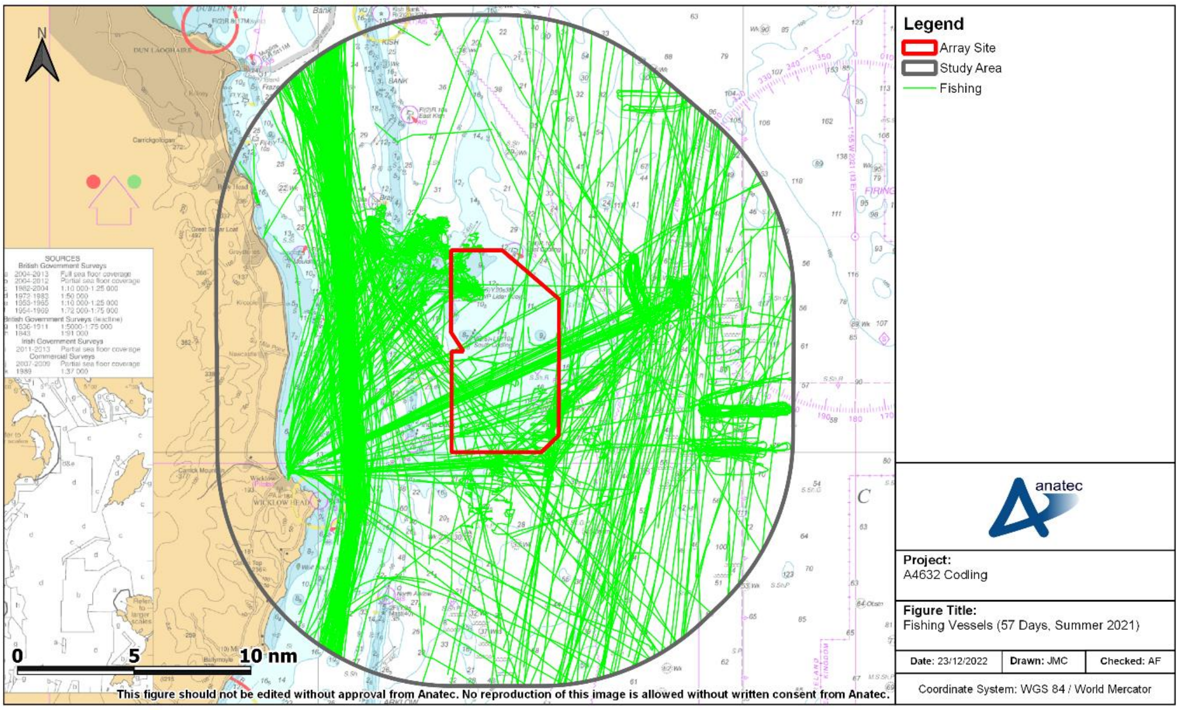

Figure 11-50 Fishing Vessels (57 Days, Summer 2021)

261. Fishing vessels were generally observed within the coastal regions of the study area, especially transiting to/from harbours on the coast. A small number of fishing vessels were observed to transit through the array site, particularly the southern half.

262. Although the majority of fishing activity involved transit, a small number of vessels actively engaged in fishing were also noted. These vessels appeared in several high-density areas:

- The area northwest of the array site;
- Within the southeast of the array site; and
- The area east of the array site.

263. There were, on average, seven unique fishing vessels recorded per day in the study area during the survey period. There was, on average, one unique fishing vessel recorded per day in the array site during the survey period.

11.3.3.3 Recreational Vessels

264. The recreational vessel tracks recorded in the study area during the survey period are presented in **Figure 11-51**.

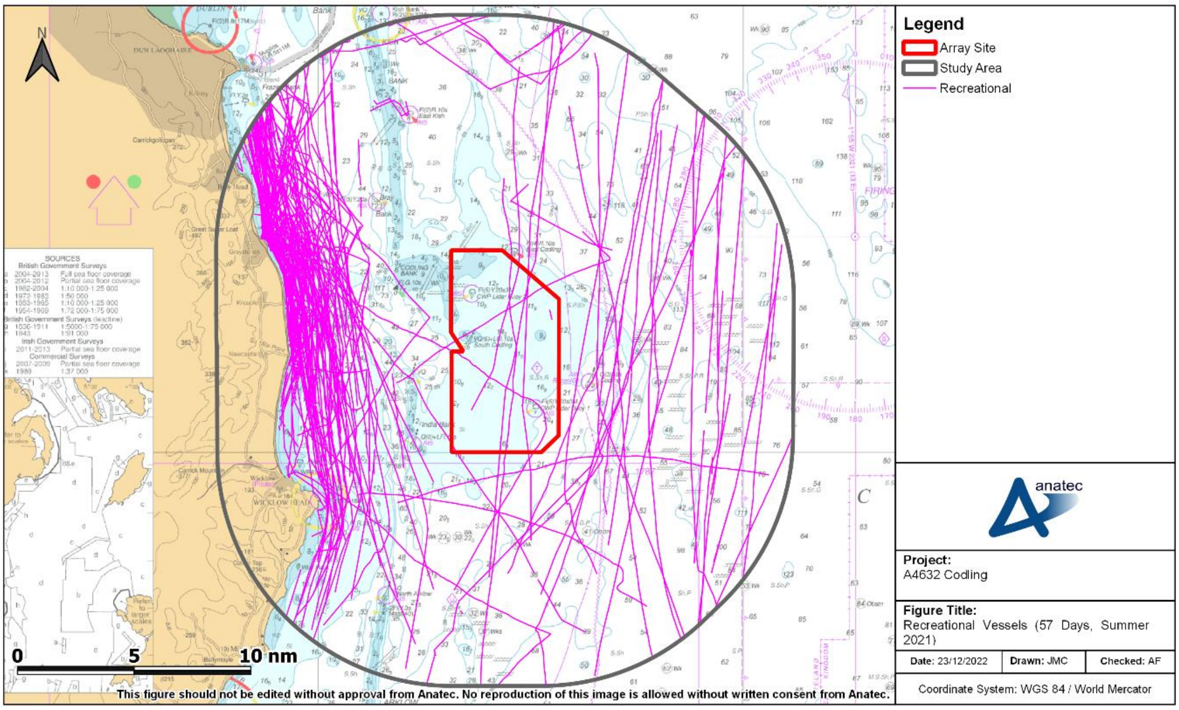

Figure 11-51 Recreational Vessels (57 Days, Summer 2021)

265. Recreational vessels were predominantly observed within coastal regions, particularly transiting to/from various harbours on the coast.

266. An average of between three and four unique recreational vessels were recorded within the study area during the survey period. There was a total of nine intersections through the array site from recreational vessels during the survey period.

11.3.4 Vessel Sizes

267. This section provides a breakdown of vessel traffic in terms of vessel length and vessel draught.

11.3.4.1 Vessel Lengths

268. The vessel tracks recorded in the study area during the survey period, colour-coded by vessel length, are presented in **Figure 11-52**. The distribution of these lengths is then presented in **Figure 11-53**.

269. It is noted a vessel length could not be confirmed for approximately 3% of vessels. These vessels have therefore been excluded from the distribution analysis.

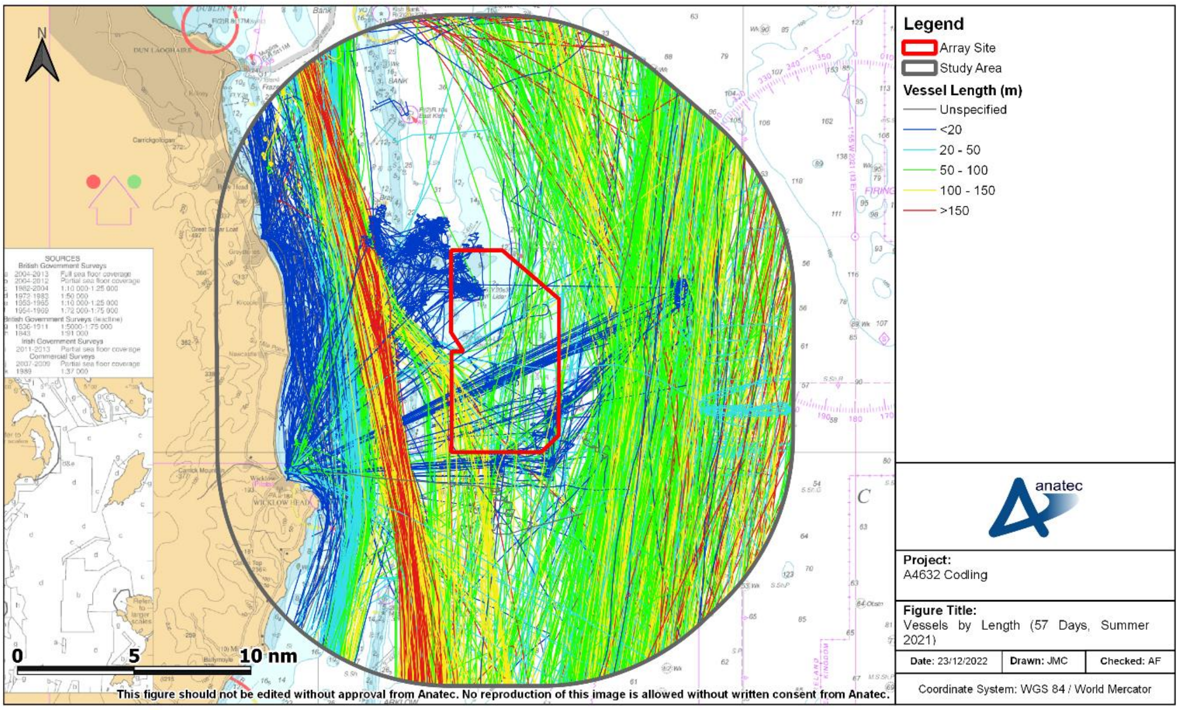

Figure 11-52 Vessel Lengths (57 Days, Summer 2021)

270. The majority of coastal traffic was comprised of smaller vessels (< 20 m). Larger vessels passed further offshore, but also avoided the shallow banks in the area, and as such the majority did not transit through the array site.

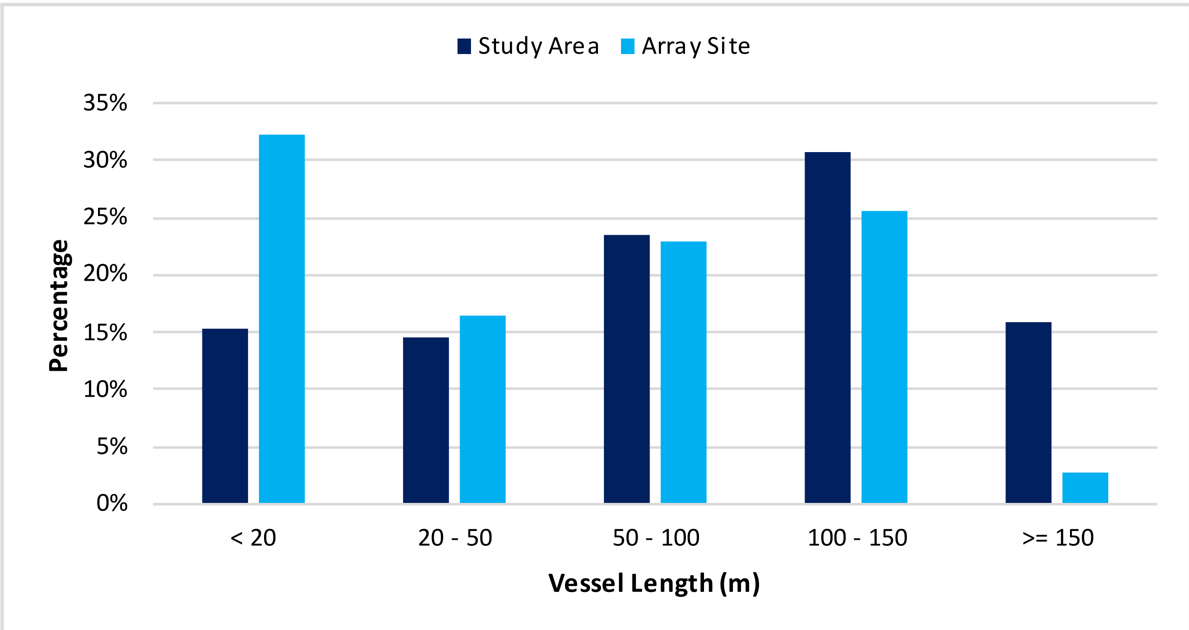

Figure 11-53 Distribution of Vessel Lengths (57 Days, Summer 2021)

271. Average vessel length recorded (excluding unspecified) was 94 m. The longest vessel recorded within the study area was the *MSC Virtuosa,* a 332 m passenger vessel. This vessel was observed on the 18 June 2021 transiting through the southeast extent of the study area bound for Southampton and did not come within 9 nm of the array site.

11.3.4.2 Vessel Draughts

272. The vessel tracks recorded in the study area during the survey period, colour-coded by vessel draught, are presented in **Figure 11-54**. The distribution of these draughts is then presented in **Figure 11-55**.

273. It is noted a vessel draught could not be confirmed for approximately 24% of vessels, noting that the majority of these were recreational and fishing vessels. These vessels have been excluded from the distribution analysis.

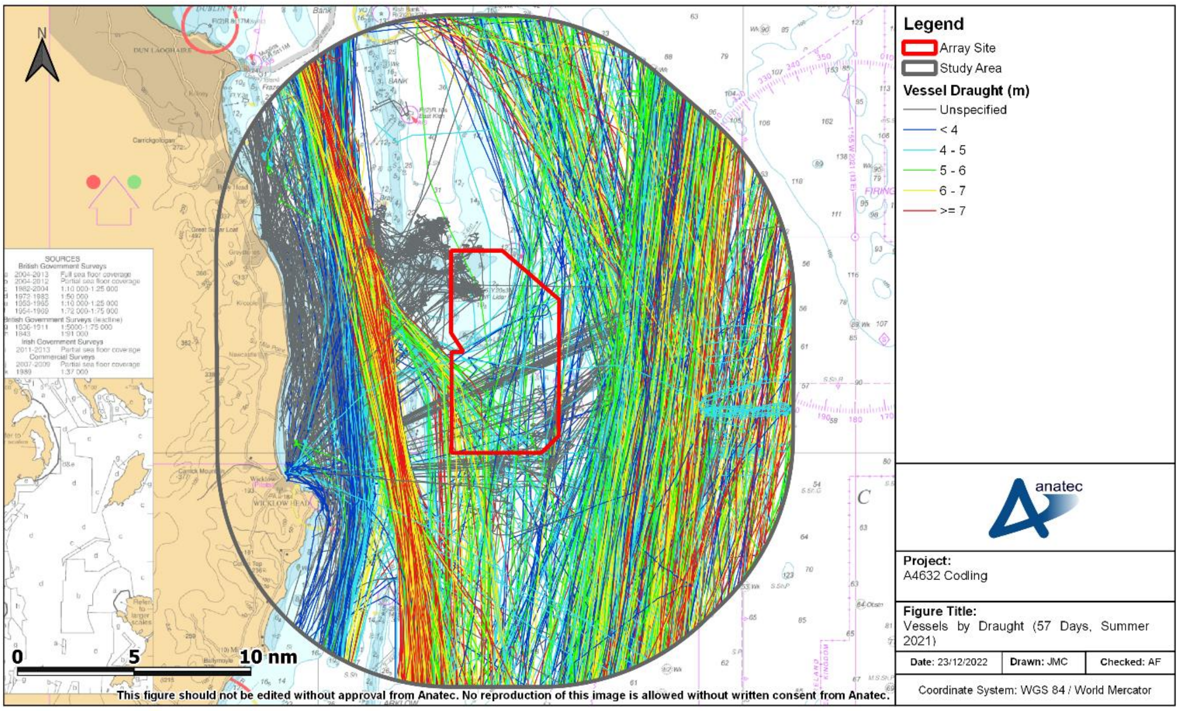

Figure 11-54 Vessel Draughts (57 Days, Summer 2021)

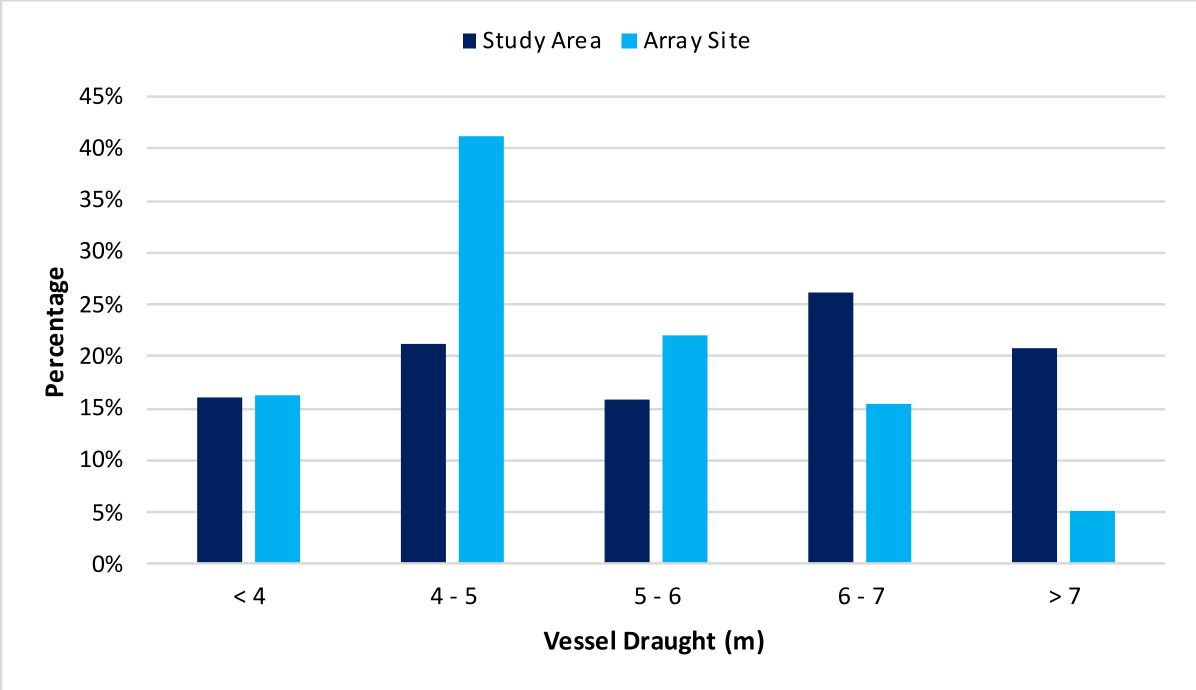

Figure 11-55 Distribution of Vessel Draughts (57 Days, Summer 2021)

274. Average vessel draught recorded (excluding unspecified) was 5.7 m; however, it should be considered that given the majority of vessels that did not specify a draught were fishing and recreational vessels and it is thus likely that the average is weighted towards larger vessels (i.e., actual average draught is likely to be lower). The deepest vessel draught recorded was 16.3 m by the *Lowlands Spirit* on the 15 June, a cargo vessel bound for Hadera. The vessel passed the site approximately 4.5 nm to the east.

11.3.5 Anchored Vessels

275. The vessels identified as being at anchor, based on the information transmitted via AIS (noting that additional high level behavioural assessment has also been undertaken to identify vessels which may be at anchor but without indicating this via AIS) are presented in **Figure 11-56**.

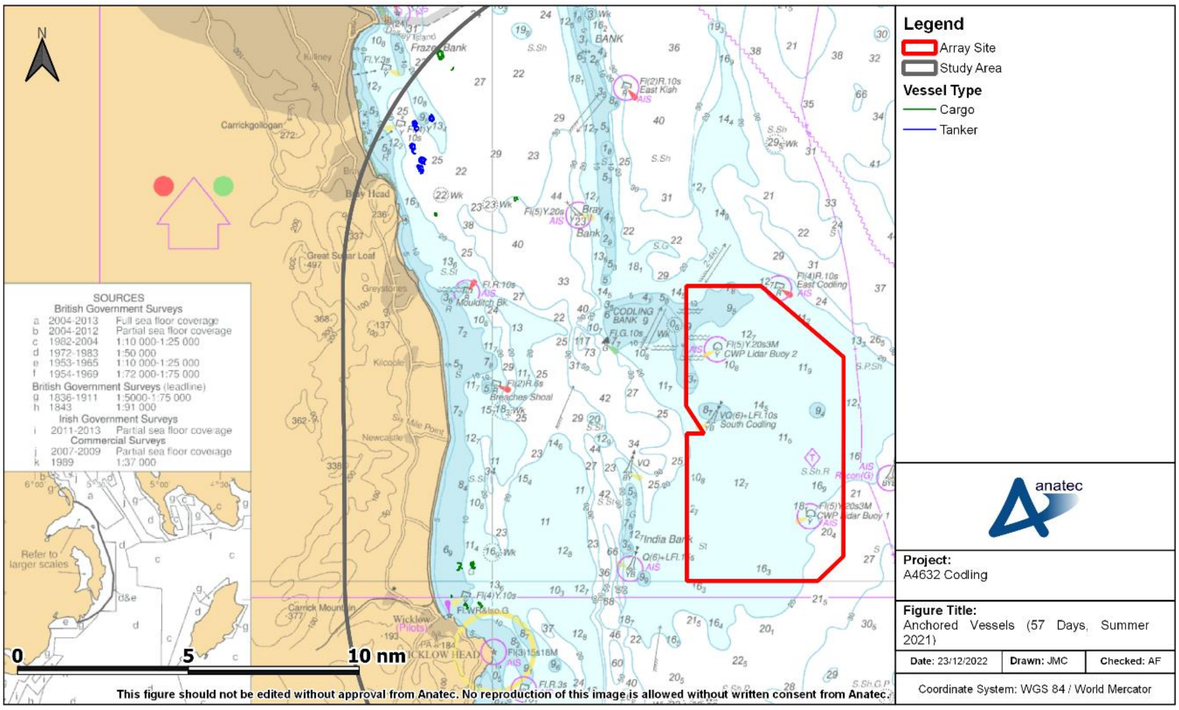

Figure 11-56 Vessels at Anchor (57 Days, Summer 2021)

276. There was one vessel every one to two days recorded at anchor in the study area, with the majority of this activity observed to be associated with areas off Bray Head (noting this aligns with consultation, see **Section 11.2.5**) and Wicklow. These vessels were all commercial, with 70% being tankers, and 30% cargo vessels. No vessels were identified as being at anchor within 5 nm of the array site.

11.4 Marine Safety Demarcation Area

277. **Figure 11-57** presents those vessels that intersected the MSDA during the 28 days of the 2023 and 2022 shore-based surveys.

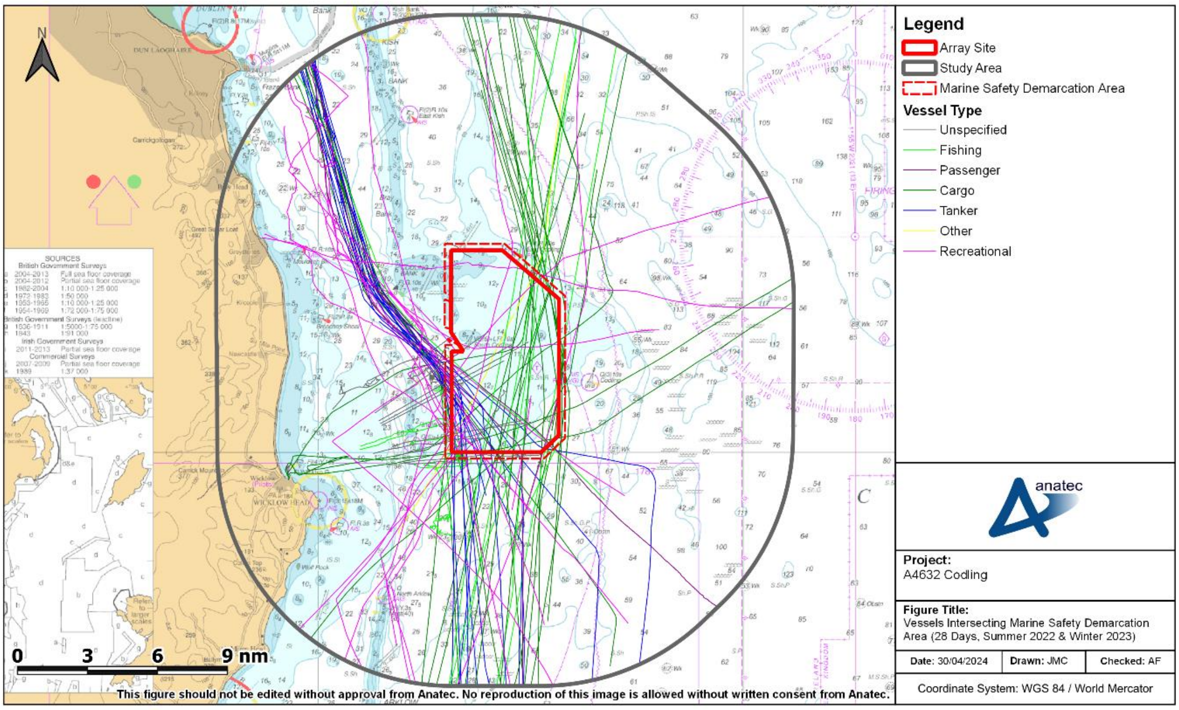

Figure 11-57 Vessels Intersecting MSDA (28 Days, Summer 2022 & Winter 2023)

278. A total of 88 intersections through the MSDA was recorded during the combined 28-day period, corresponding to an average of three per day. Intersections were most commonly from cargo vessels (28%), followed by recreational vessels (19%) and fishing vessels (18%).

279. Approximately 85% of vessels intersecting the MSDA also intersected the array site.

11.5 Offshore Export Cable Corridor

280. This section presents assessment of vessel traffic recorded on AIS within the cable corridor study area during the periods 25 July – 8 August 2022 and 20 February – 6 March 2023.

11.5.1 Overview

281. The vessel tracks recorded within the cable corridor study area, colour-coded by vessel type, are presented in **Figure 11-58**. Following this, the density of vessels within a 0.25 nm x 0.25 nm grid is presented in **Figure 11-59**.

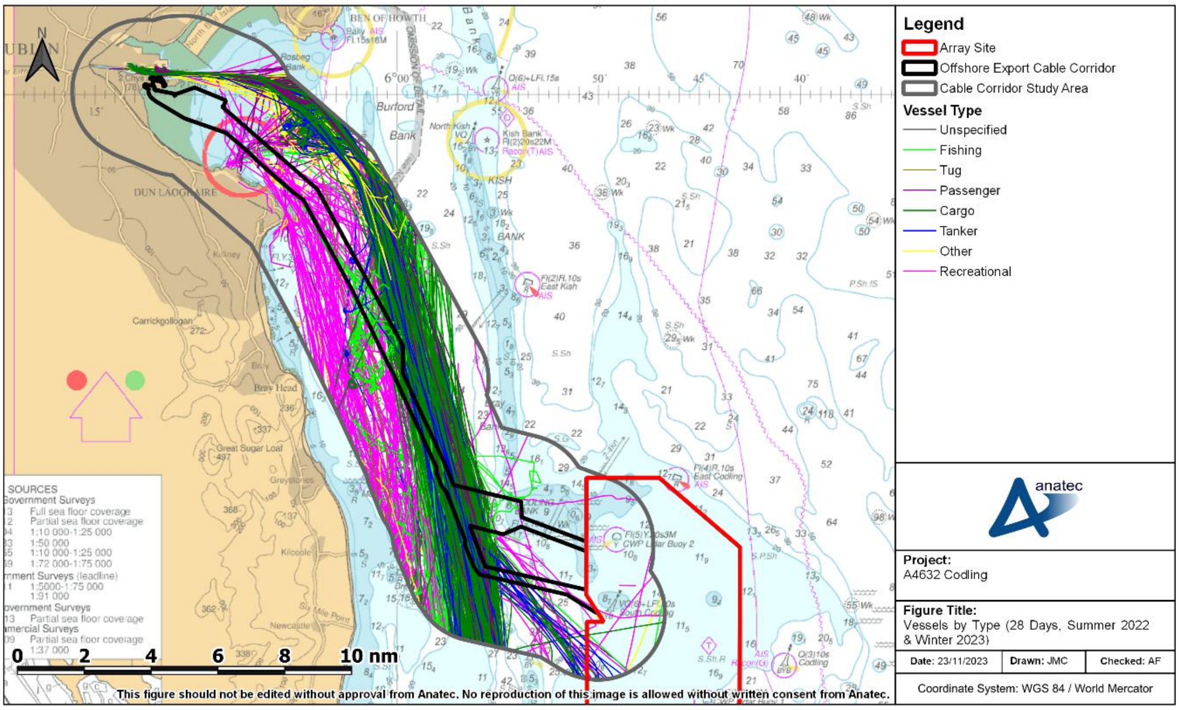

Figure 11-58 Vessels by Type (28 Days, Summer 2022 & Winter 2023)

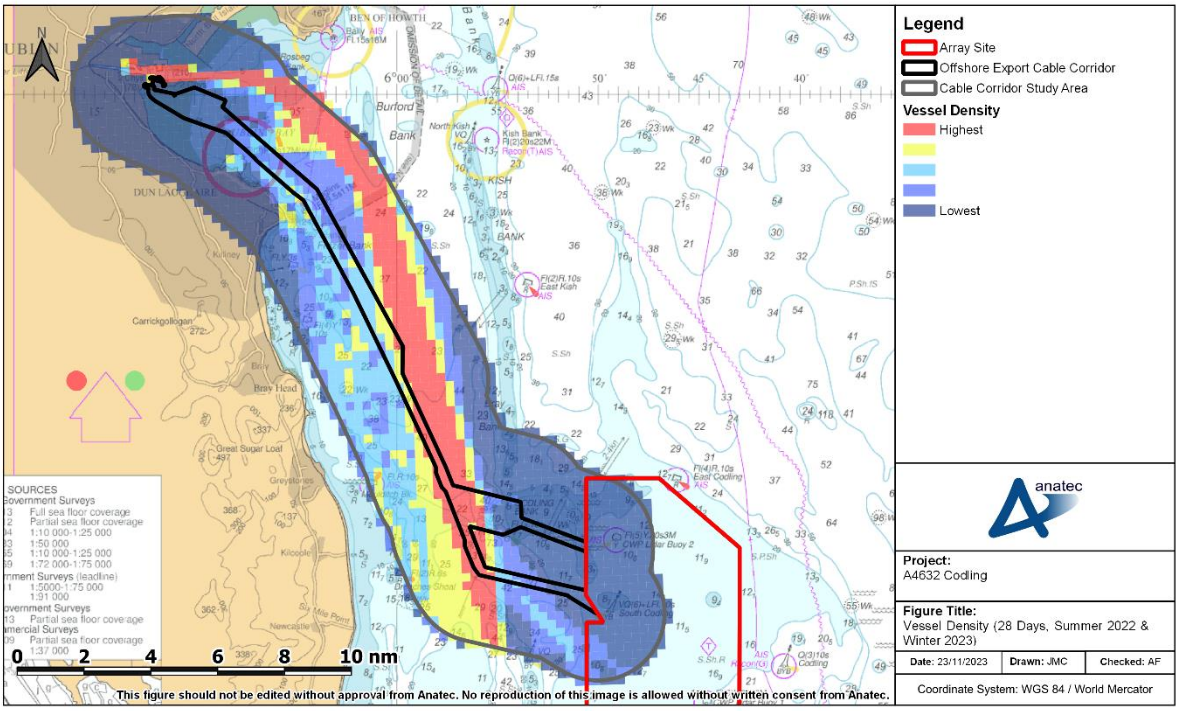

Figure 11-59 Vessel Density (28 Days, Summer 2022 & Winter 2023)

282. It can be seen that there is clearly defined high-density routeing to/from Dublin that intersects the southern portion of the OECC, which corresponds to the traffic passing

inshore of the array site in the study area. It is noted that the highest area of density (the top 3% of all densities, excluding counts of zero) is within Dublin Bay.

11.5.2 Vessel Counts

283. This section presents an overview of vessel counts within the cable corridor study area during the 28-day period.

284. The number of unique vessels recorded in the cable corridor study area and OECC itself during the period during the 28-day period is presented in **Figure 11-60**.

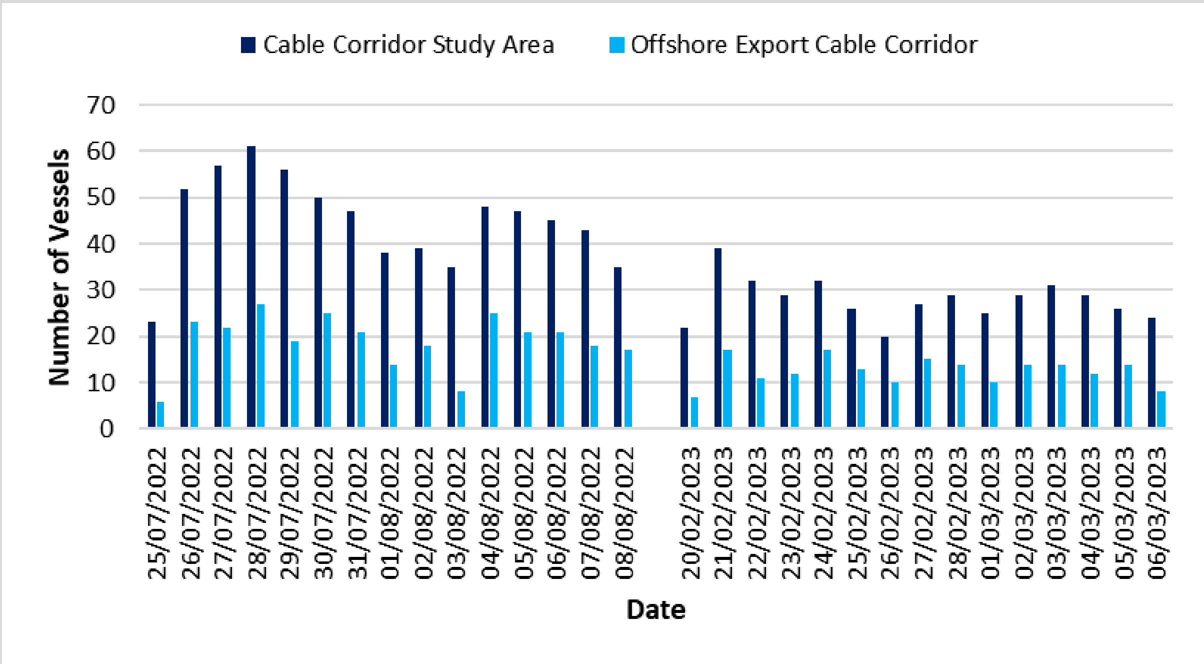

Figure 11-60 Vessel Count per Day (28 Days, Summer 2022 & Winter 2023)

285. On average, 39 unique vessels per day were recorded within the cable corridor study area during the 28-day period while 17 unique vessels per day were recorded within the OECC itself.

286. Traffic was generally busier within the cable corridor study area during the summer period, with an average of 48 unique vessels per day during the summer compared to an average of 30 during the winter. Traffic was also busier within the OECC itself during the summer period, although to a lesser extent, with an average of 20 unique vessels per day during the summer compared to an average of 13 during the winter. This difference can be largely attributed to recreational activity, which is further discussed in **Section 11.5.3.5**.

287. The busiest day within the cable corridor study area during the 28-day period was the 28 July 2022, with 61 unique vessels recorded. The busiest day within the OECC itself was also the 28 July 2022, with 27 unique vessels recorded.

11.5.3 Vessel Types

288. The distribution of main vessel types recorded in the cable corridor study area and OECC itself during the 28-day period is presented in **Figure 11-61**.

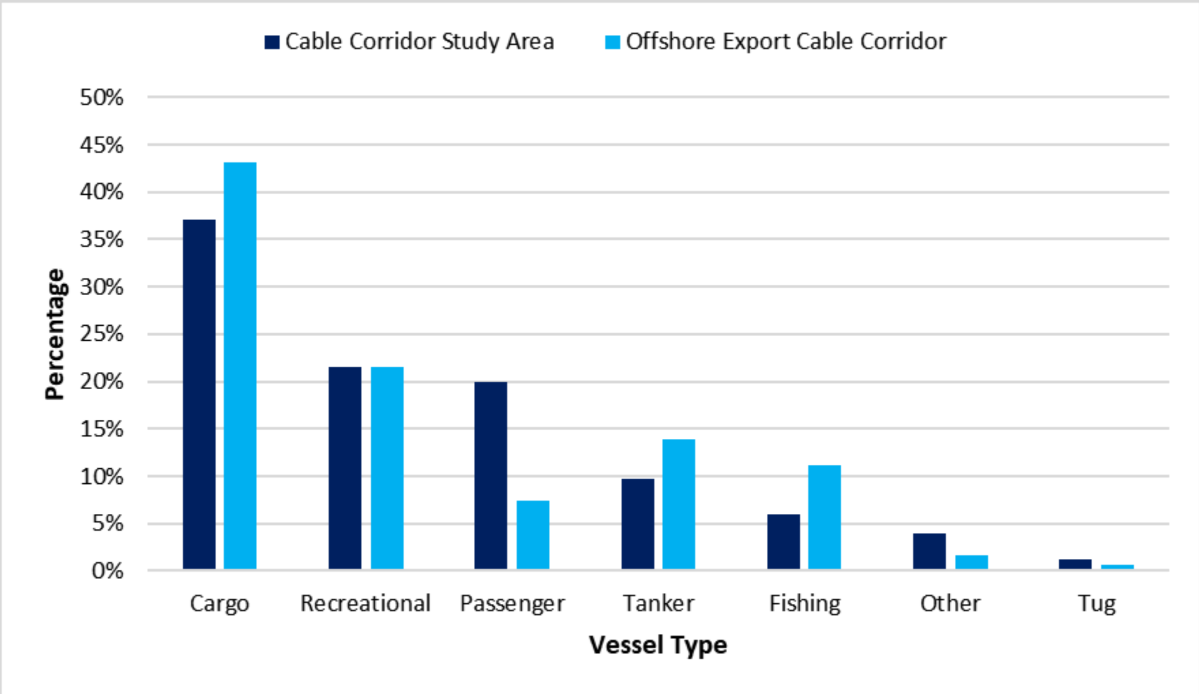

Figure 11-61 Distribution of Vessel Types (28 Days, Summer 2022 & Winter 2023)

289. The main difference between the distribution of types within the cable corridor study area and the distribution of types within the OECC itself was the proportion of passenger vessels. This is primarily due to a large proportion of east/westbound passenger vessel traffic out of Dublin not intersecting the OECC.

11.5.3.1 Cargo Vessels

290. **Figure 11-62** presents the cargo vessels recorded within the cable corridor study area during the 28-day period.

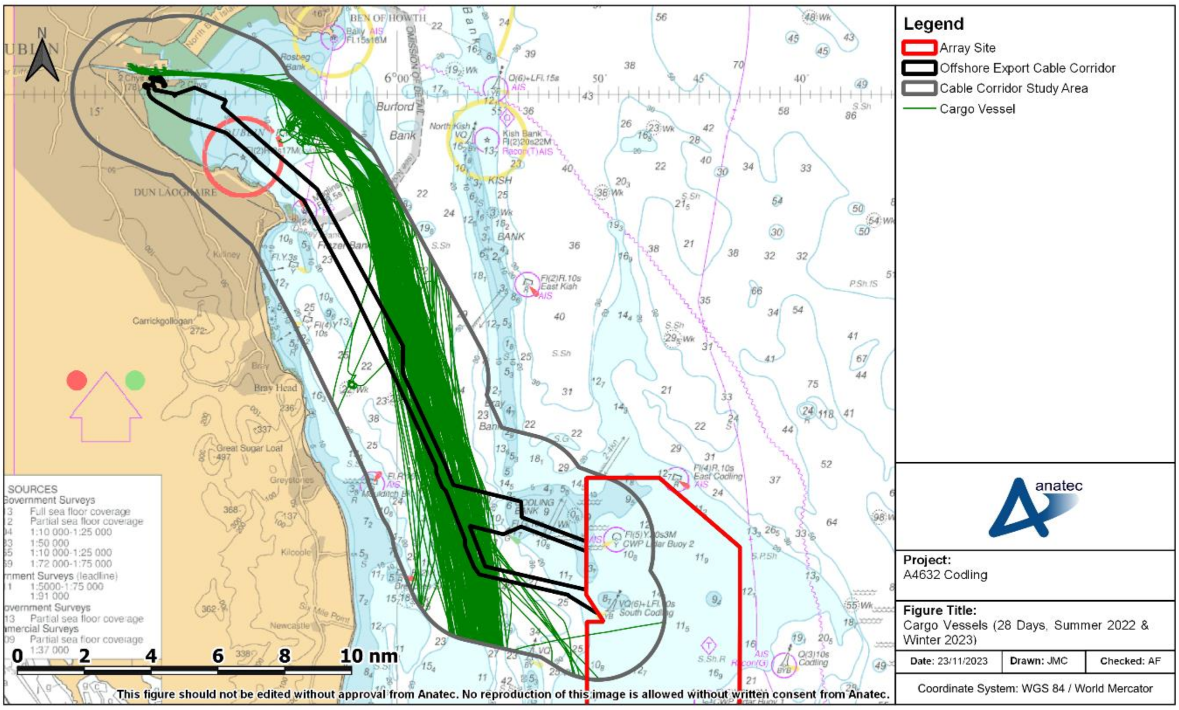

Figure 11-62 Cargo Vessels (28 Days, Summer 2022 & Winter 2023)

291. An average of 14 to 15 unique cargo vessels per day was recorded within the cable corridor study area during the 28-day period, with an average of seven to eight per day within the OECC itself.

292. A large proportion of cargo traffic was engaged in the north/southbound route through the OECC (and inshore of the array site); these vessels were transiting between Dublin and various locations (with Rotterdam being the most common).

11.5.3.2 Tankers

293. **Figure 11-63** presents the tankers recorded within the cable corridor study area during the 28-day period.

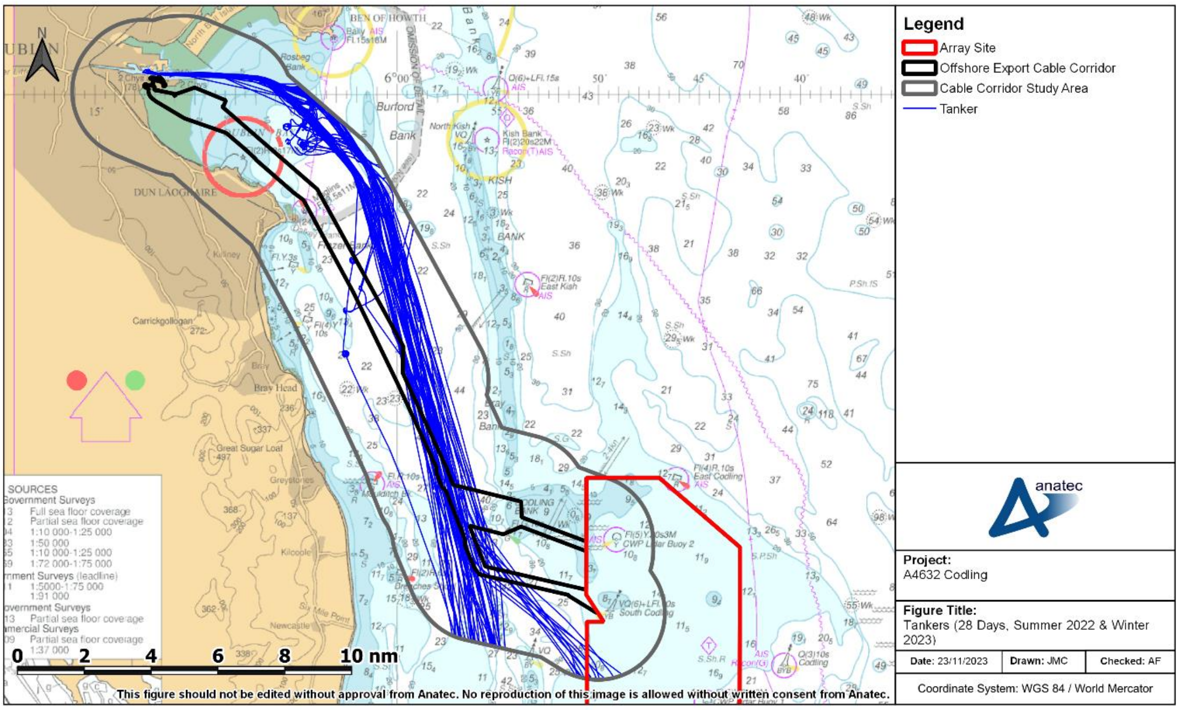

Figure 11-63 Tankers (28 Days, Summer 2022 & Winter 2023)

294. An average of four tankers per day was recorded within the cable corridor study area during the 28-day period, with an average of two to three per day within the OECC itself.

295. Trends were similar to those of cargo vessels (see **Figure 11-62**), with a significant proportion engaged in north/south transit through the OECC to/from Dublin (inshore of the array site).

11.5.3.3 Passenger Vessels

296. **Figure 11-64** presents the passenger vessels recorded within the cable corridor study area during the 28-day period.

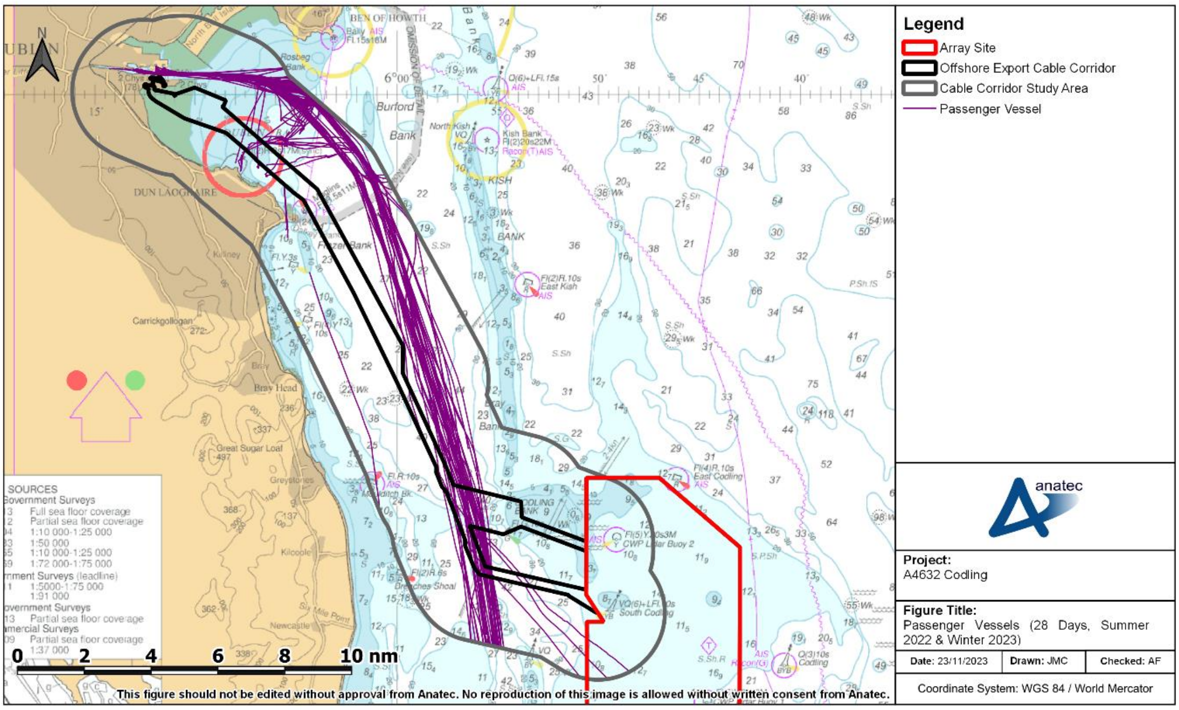

Figure 11-64 Passenger Vessels (28 Days, Summer 2022 & Winter 2023)

297. An average of eight unique passenger vessels per day was recorded within the cable corridor study area during the 28-day period, with an average of one to two per day within the OECC itself (noting the majority of passenger vessel traffic out of Dublin passes north of the OECC).

298. The passenger vessel traffic mainly consisted of RoPax vessels, operated by IrishFerries, StenaLines, and P&O on routes between Dublin and Holyhead, and Dublin and Liverpool.

11.5.3.4 Fishing Vessels

299. **Figure 11-65** presents the fishing vessels recorded within the cable corridor study area, colour-coded by average speed, during the 28-day period. As a general heuristic, speeds of below six knots are deemed indicative of potential fishing activity (see **Section 11.2.3.4**).

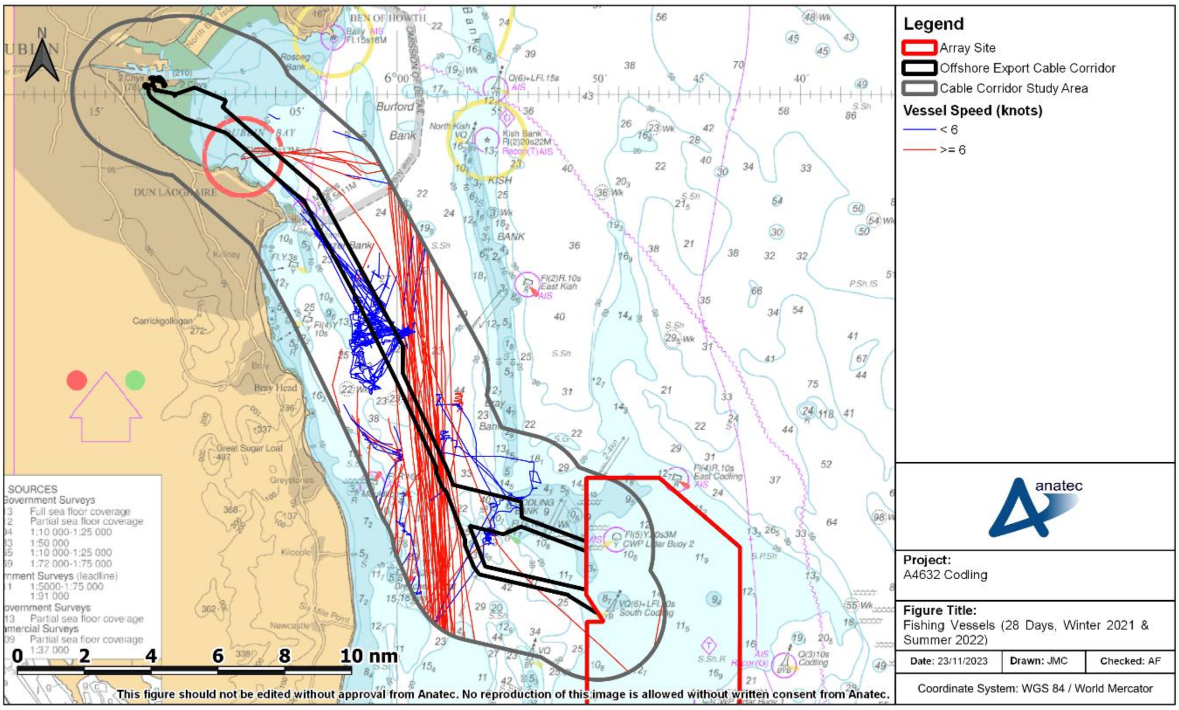

Figure 11-65 Fishing Vessels (28 Days, Summer 2022 & Winter 2023)

300. An average of two to three unique fishing vessels per day was recorded within the cable corridor study area during the 28-day period, with an average of two per day within the OECC itself.

301. Potential active fishing activity was recorded, including within the OECC itself. The remaining fishing vessel activity was generally recorded in north/south transit through the OECC.

11.5.3.5 Recreational Vessels

302. **Figure 11-66** presents the recreational vessels recorded within the cable corridor study area during the 28-day period.

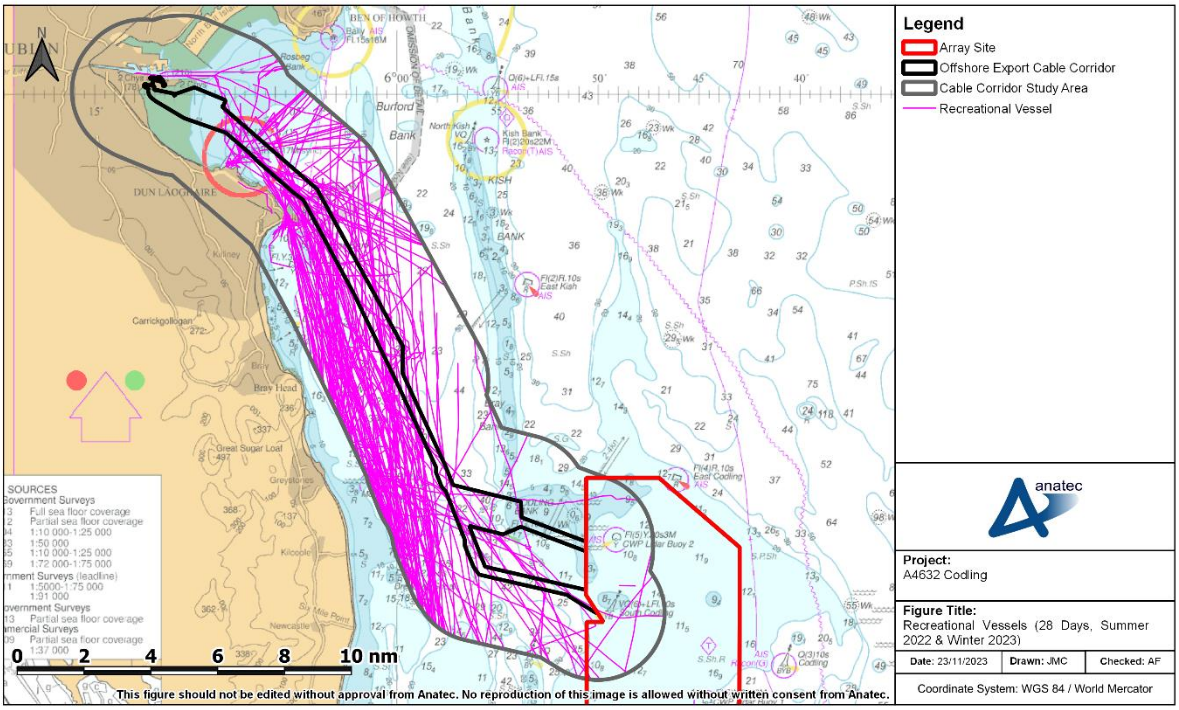

Figure 11-66 Recreational Vessels (28 Days, Summer 2022 & Winter 2023)

303. An average of eight to nine unique recreational vessels per day was recorded within the cable corridor study area during the 28-day period, with an average of three to four per day within the OECC itself.

304. Recreational traffic generally tended to be inshore of the OECC. Approximately 95% of recreational vessels were recorded during the summer period, with this weighting being attributable to summer conditions typically being more favourable.

11.5.4 Vessel Sizes

305. This section provides a breakdown of vessel traffic in terms of vessel length and vessel draught.

11.5.4.1 Vessel Lengths

306. **Figure 11-67** presents the vessels recorded within the cable corridor study area during the 28-day period, colour-coded by vessel length. Approximately 98% of vessels were assigned a valid length.

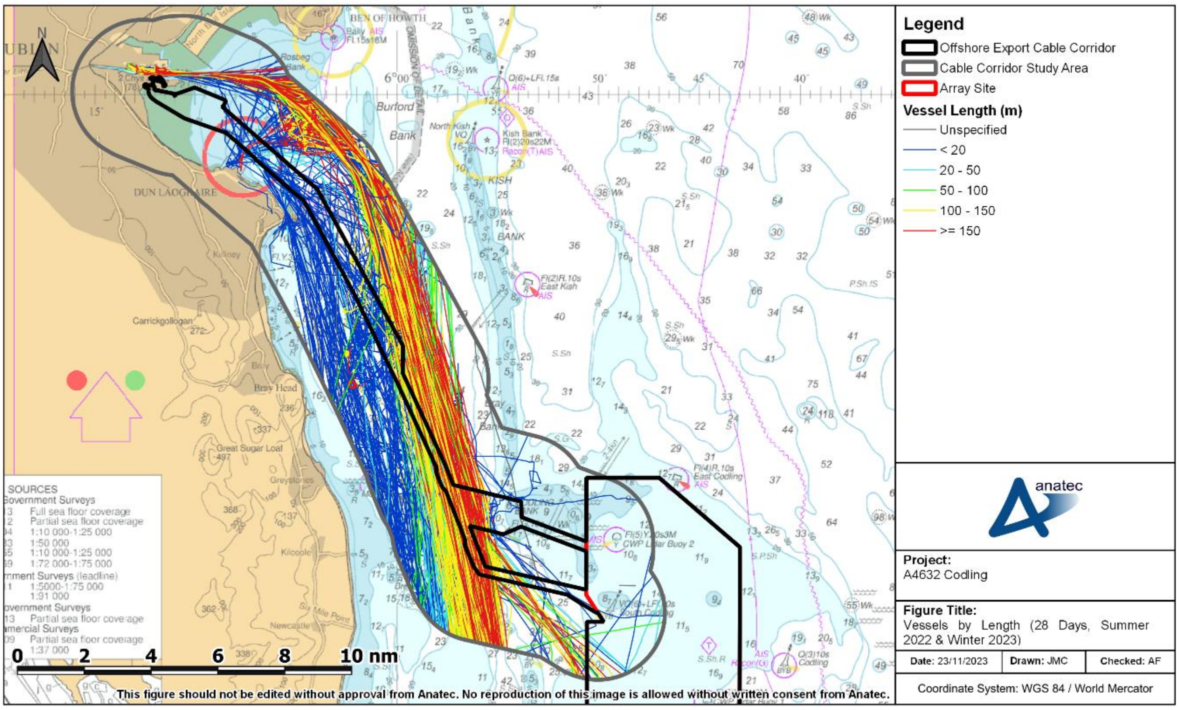

Figure 11-67 Vessels by Length (28 Days, Summer 2022 & Winter 2023)

307. The majority (59%) of the smallest vessels (less than 20 m) were recreational, with a large proportion of the remainder consisting of fishing vessels and pilot vessels. These vessels were the most common to remain inshore of the OECC. Vessels at least 100 m in length were largely seen undertaking the north/south route to/from Dublin (inshore of the array site) through the OECC.

308. **Figure 11-68** presents the distribution of vessel lengths recorded within the cable corridor study area and OECC itself during the 28-day period, excluding unspecified lengths.

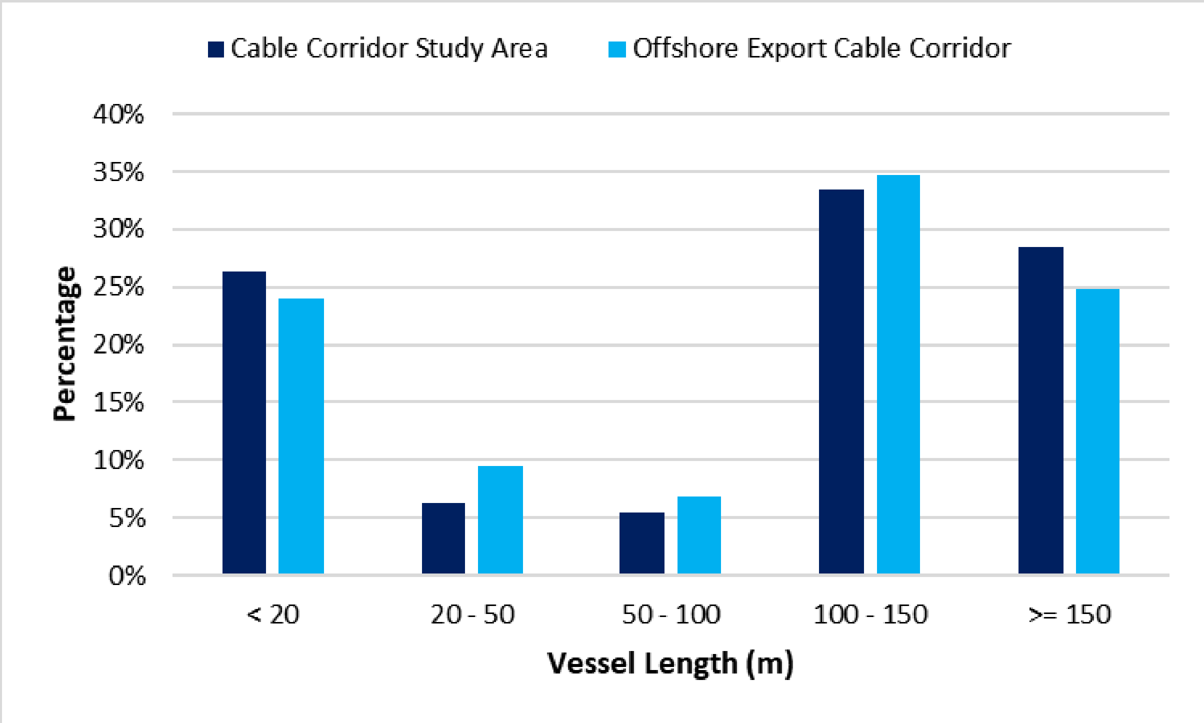

Figure 11-68 Distribution of Vessel Lengths (28 Days, Summer 2022 & Winter 2023)

309. It can be seen that the distribution of vessel lengths was similar between the cable corridor study area and OECC. The average vessel length within the cable corridor study area was 107 m, while the average within the OECC itself was 101 m. The longest vessel recorded within the cable corridor study area was a 292 m long cruise ship, and within the OECC itself this was a 238 m long cruise ship.

11.5.4.2 Vessel Draughts

310. **Figure 11-69** presents the vessels recorded within the cable corridor study area during the 28-day period, colour-coded by vessel draught. Approximately 82% of tracks were assigned a valid draught; most vessels with unassigned draught were recreational and fishing vessels, and therefore likely had shallow draught.

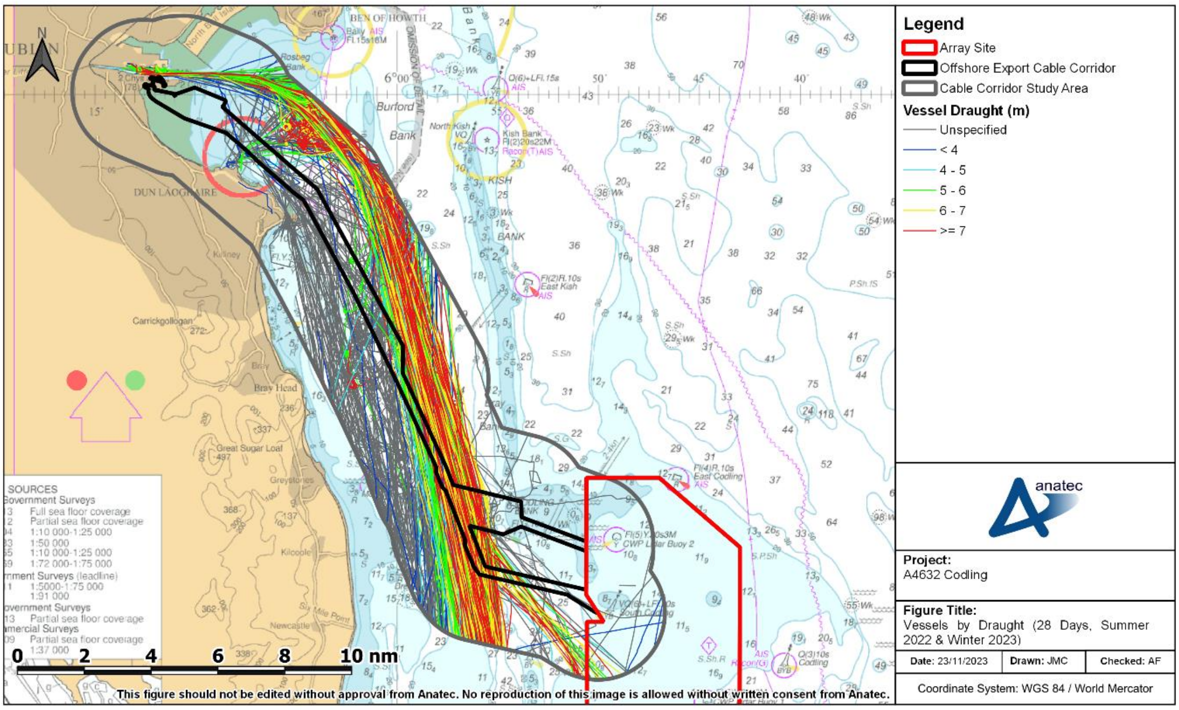

Figure 11-69 Vessels by Draught (28 Days, Summer 2022 & Winter 2023)

311. Vessels with small draught (less than 4 m) largely consisted of pilot vessels, fishing vessels and a high-speed catamaran RoPax. Vessels with large draught (at least 7 m) mostly consisted of cargo vessels and tankers engaged in north/south transit through the OECC.

312. The average vessel draught recorded within the cable corridor study area during the 28-day period was 5.9 m. The maximum vessel draught was 10.1 m, broadcast by a bulk carrier that was engaged in westward transit into Dublin.

11.5.5 Anchored Vessels

313. Vessels broadcast their navigational status via AIS and any vessels broadcasting their navigational status as 'at anchor' were identified. However, as this information is not always up to date, additional behavioural assessment to identify any vessels that may have been at anchor without broadcasting as such were identified. The tracks of vessels deemed to be at anchor are presented in **Figure 11-70**.

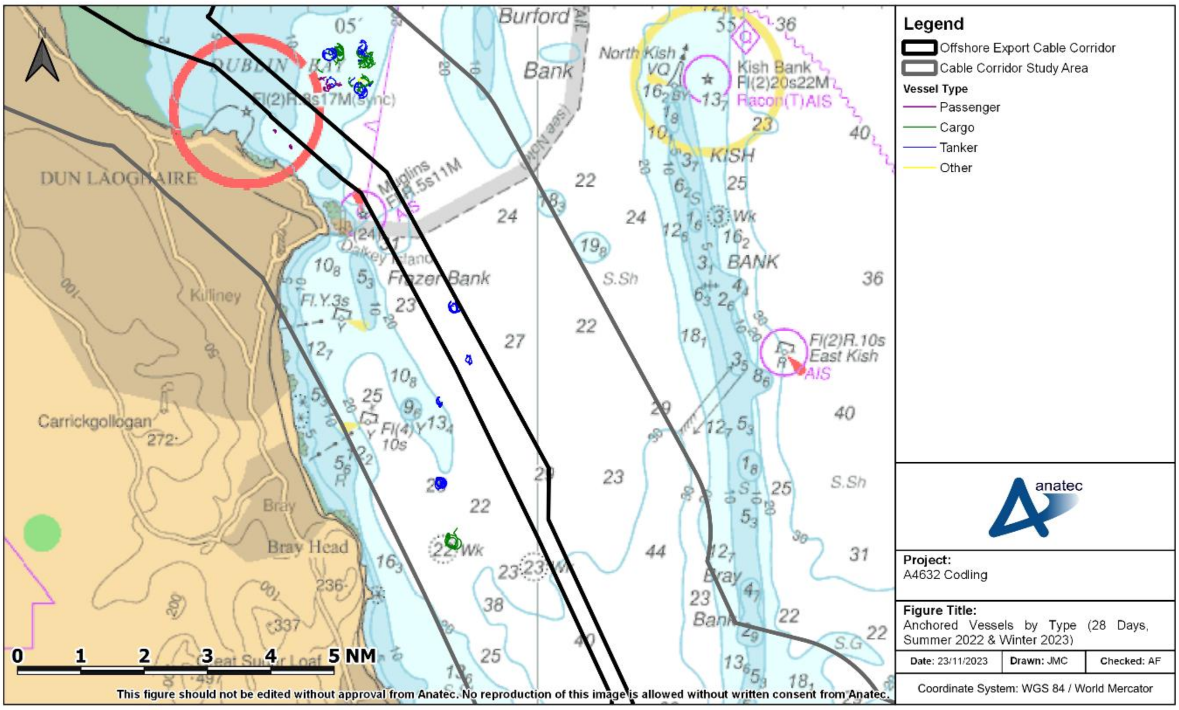

Figure 11-70 Anchored Vessels by Type (28 Days, Summer 2022 & Winter 2023)

314. The majority of anchored vessel activity took place within the designated anchorage area within Dublin Bay (see **Figure 7-1**). A passenger vessel was recorded at anchor inshore of the OECC near Scotsman's Bay on two separate occasions.

315. Anchoring activity was also seen inshore of the OECC further south, in vicinity to Bray Harbour. As per **Section 4**, consultation input indicates this area is utilised for commercial vessel anchoring.

12 Base Case Vessel Routeing

12.1 Definition of a Main Commercial Route

316. Main commercial routes have been identified using the principles set out in MGN 654 (MCA, 2021). Vessel traffic data are assessed and vessels transiting at similar headings and locations are identified as a main route. To help identify main routes, vessel traffic data can also be interrogated to show vessels (by name and/or operator) that frequently transit those routes. The route width is then calculated using the 90th percentile rule from the median line of the potential shipping route as shown in **Figure 12-1**.

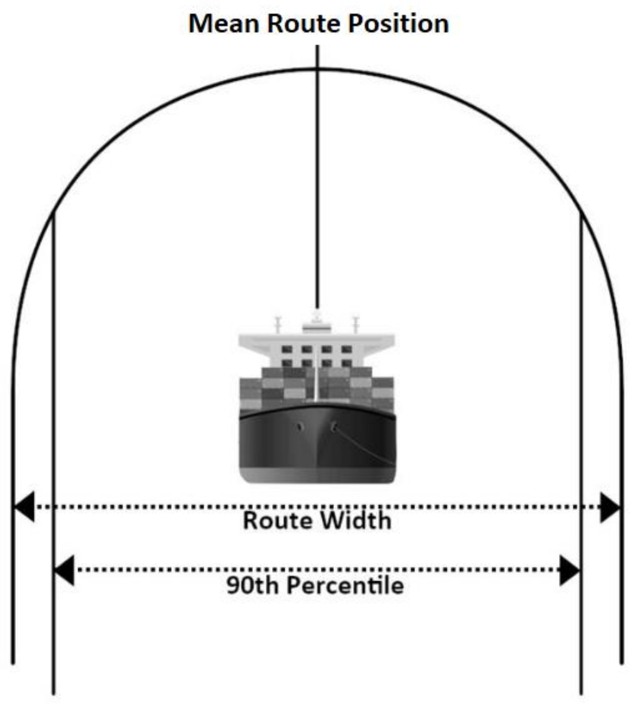

Figure 12-1 Illustration of Main Route

12.2 Pre Wind Farm Main Commercial Routes

317. A total of ten main commercial routes were identified from the long-term vessel traffic data. These main commercial routes and corresponding 90th percentiles within the study area are shown relative to the array site in **Figure 12-2**.

318. It is noted that while mean route positions have primarily been defined from the long term AIS data (Annex B), validation against multiple data sources (see **Section 5**) has been undertaken to ensure vessel numbers on each route are reflective of up to date data.

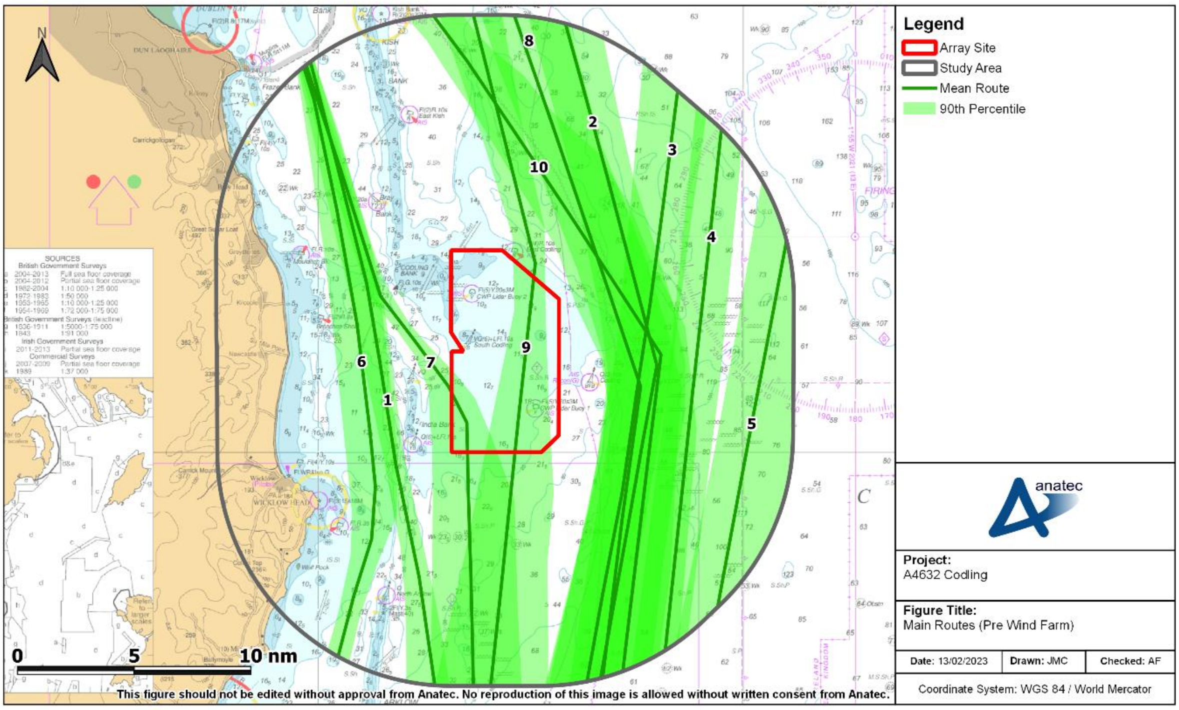

Figure 12-2 Main Routes (Pre Wind Farm)

319. A description of each route is provided in **Table 12-1**, including the average number of vessels per day, start and end locations, main vessel types and details of commercial ferry routeing (where applicable).

320. It is noted that the start and end locations are based on the most common destinations transmitted via AIS by vessels on those routes. In the case of routes where '*various*' is given as the start and/or end location, this is due to there being a wide range of destinations transmitted via AIS by vessels on these routes including those associated with nearby relevant TSSs (see **Section 7.7**).

Table 12-1 Details of Main Commercial Routes

Route number	Terminus Ports	Vessels per Day
1	Rotterdam (Netherlands) / Dublin (Ireland)	7-8
2	Warrenpoint (UK) and Greenore (Ireland) / Avonmouth (UK)	2-3
3	Belfast (UK) / Rotterdam (Netherlands)	2-3
4	Belfast (UK) / Various	1-2
5	Rotterdam (Netherlands) / Belfast (UK)	1-2
6	Dublin (Ireland) / Waterford (Ireland)	1-2
7	Dublin (Ireland) / Various	1-2
8	Drogheda (Ireland) / Various	< 1

Route number	Terminus Ports	Vessels per Day
9	Drogheda (Ireland) / Various	< 1
10	Dublin (Ireland) / Various	< 1

12.3 Post Wind Farm

321. This section presents future case level of activity assumptions and the anticipated shift in the mean route positions of the main commercial routes that may arise post wind farm. The deviations and future case assumptions have been applied as input to the modelling process as summarised in **Section 14**.

12.3.1 Future Case Vessel Traffic

12.3.1.1 Increases in Traffic Associated with Ports

322. Future case traffic levels are complex to predict and are reliant on a variety of factors. Two future case scenarios have therefore been considered for commercial traffic. The first assumes a 10% increase in all commercial traffic passing within the study area.

323. As per **Section 7.5**, the CWP Project is in proximity to Dublin Port. Dublin Port Company has published a 2012-2040 Master Plan with a view to increase both traffic volumes and the size of vessels that can be accommodated. The 2018 Review (Dublin Port, 2018) considered aspirational and subject to change. Discussions were held with the Dublin Port Authority (see **Section 4**) and it was agreed that an additional scenario of a 25% future case increase of commercial traffic would be included in the NRA.

12.3.1.2 Increases in Commercial Fishing and Recreational Vessel Activity

324. Given fishing trends will depend on a variety of factors, an indicative 10% increase in fishing vessel activity (transits and engaged in fishing) is considered conservative, and has therefore been applied. To ensure alignment with assumptions for commercial traffic (see **Section 12.3.1.1**), a 25% scenario has also been included (which again is considered conservative).

325. The same assumptions have been made for recreational vessels.

12.3.1.3 Increases in Traffic Associated with CWP Project Operations

326. Vessel numbers assumed for the CWP Project are described in **Section 6.5**.

12.3.2 Routeing

12.3.2.1 Methodology

327. It is not possible to consider all possible alternative routeing options for commercial traffic and therefore worst-case alternatives have been considered where possible taking into account points raised by commercial operators during consultation. Assumptions for re-routeing include:

- All alternative routes maintain a minimum mean distance of 1 nm from offshore installations in line with MGN 654;
- All mean routes take into account the local shallow banks (e.g., Codling and India) and known routeing preferences; and
- It has been assumed that local aids to navigation marking the banks that are located outside of the array site will remain in place post wind farm.

328. 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".

329. To date, internal and external studies undertaken by Anatec on behalf of the UK Government show that vessels do pass consistently and safely within 1 nm of established wind farms and these distances vary depending on searoom available as well as 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 will not choose to transit through wind farm arrays, noting that this correlated with the input received during consultation (see **Section 4**).

330. The NRA also aims to establish the worst case 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.

12.3.2.2 Main Route Deviations

331. **Figure 12-3** presents the post wind farm main routes. Of the ten main routes identified, two are anticipated to require deviation as a result of the CWP Project (routes 7 and 9). The effect that these deviations have on the lengths of the routes within the study area is summarised in **Table 12-2**.

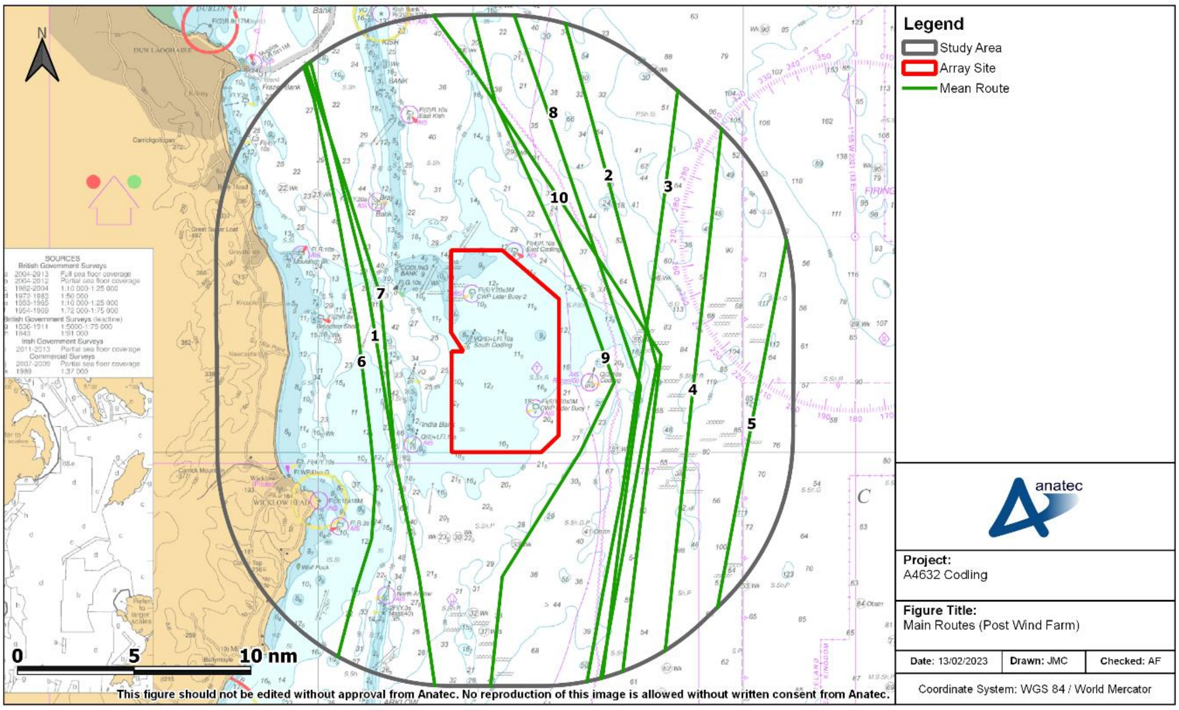

Figure 12-3 Main Routes (Post Wind Farm)

Table 12-2 Deviation Summary

Route	Vessels per Day	Distance within Study Area (nm)		Change	
		Pre-Wind Farm	Post Wind Farm	Distance(nm)	%
7	1-2	28.1	27.1	-1	-4%
9	< 1	29.0	31.1	+2.1	+7%

332. As shown, it is anticipated that vessels on Route 7 will choose to pass inshore of the India Bank (they currently pass between the Codling and India Banks). This aligns with consultation feedback (see **Section 4**) noting it was indicated at the hazard workshop that it was extremely unlikely vessels would choose to pass between the India Bank and the array site. The anticipated deviation leads to a shorter transit route within the study area, however this means that the deviated vessels will be required to pass through a smaller area of searoom in a busy area in terms of baseline traffic. Associated impacts including increased collision risk are assessed in **Chapter 16: Shipping and Navigation**.

333. Route 9 is anticipated to pass offshore of the array site. This represents an increase of approximately 7% within the study area, noting that the route is used by less than a vessel a day.

12.3.2.3 Cumulative Routeing

334. As per **Section 12.3.2.2**, two routes are anticipated to require deviation as a result of the CWP project. A summary of likely cumulative impact on these two routes is provided as follows:

- **Route 7:** Associated vessels are anticipated to pass inshore of the Codling and India Banks, and between the India and Arklow Banks. The presence of Dublin Array may mean that vessels choose to make a minor deviation to pass further west, and similarly may pass further east once past the India Bank to increase passing distance from Arklow Bank Wind Park Phase 2. This is a minor deviation in terms of increased distance (approximately 0.1 nm increase over the in isolation post wind farm case shown in **Section 12.3.2.2**). However, it was raised during consultation including at the hazard workshop (see **Section 4**) that impacts associated with increased vessel density and reduction of searoom in the area inshore of the Array Site and Dublin Array should be considered on a cumulative basis. These impacts have been assessed in **Chapter 16, Appendix 16.1**: Shipping and Navigation, Cumulative Effects Assessment.
- **Route 9:** Transits on this route were observed to include vessels bound to/from Drogheda, and hence such vessels will be required to navigate in proximity to the NISA project. The NISA Scoping Report (ARUP, 2021) indicates that the project is planning a “pod” concept whereby WTGs are installed in clusters of 10-12, with each group spaced approximately 5 km apart. It is unclear whether the NISA project will progress this concept, regardless port access to Drogheda will need to be considered within site and layout design by NISA (access to ports is a key policy element of the National Marine Planning Framework (2021)). The CWP Project does not have any impact on port access to Drogheda (located in excess of 30 nm north of the array site). On this basis deviations within the localised area around the array site are likely to be no different to the in isolation case.

13 Navigation, Communication and Position Fixing Equipment

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

336. 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.

13.1 Very High Frequency Communications (including Digital Selective Calling)

337. 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.

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

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

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

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

342. 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 CWP Project is anticipated to have no significant impact upon VHF communications.

13.2 Very High Frequency Direction Finding

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

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

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

13.3 Automatic Identification System

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

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

13.4 Navigational Telex System

348. 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.

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

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

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

351. 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 CWP Project.

13.5 Global Positioning System

352. 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*".

353. 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).

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

13.6 Electromagnetic Interference

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

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

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

13.6.1 Subsea Cables

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

13.6.2 Wind Turbine Generators

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

13.6.3 Experience at Operational Offshore Wind Farms

360. No issues with respect to magnetic compasses have been reported to date in any of the trials (MCA and QinetiQ, 2004) undertaken (inclusive of SAR helicopters) nor in any published reports from operational offshore wind farms.

13.7 Marine Radar

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

13.7.1 Trials

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

363. In 2004 trials undertaken at the North Hoyle Offshore Wind Farm (MCA and QinetiQ, 2004) identified areas of concern regarding the potential impact on marine- and shore-based Radar systems due to the large vertical extents of the WTGs (based on the technology at that time). This resulted in Radar responses strong enough to produce interfering side lobes and reflected echoes (often referred to as false targets or ghosts).

364. 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 13-1**.

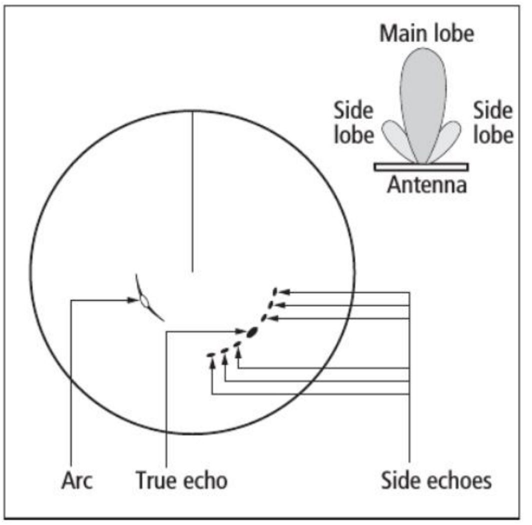

Figure 13-1 Illustration of side lobes on Radar screen

365. Multiple reflected echoes are returned from a real target by reflection from some object in the Radar beam. Indirect echoes or 'ghost' images have the appearance of true echoes but are usually intermittent or poorly defined; such echoes appear at a false bearing and false range, as illustrated in **Figure 13-2**.

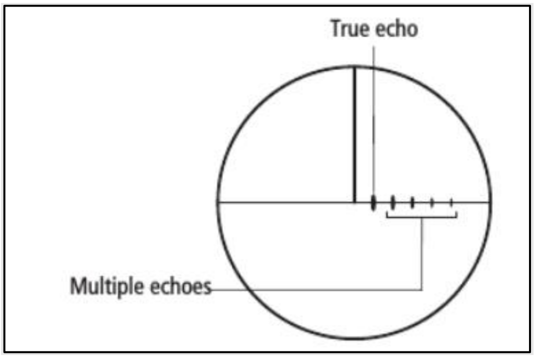

Figure 13-2 Illustration of multiple reflected echoes on Radar screen

366. Based on the results of the North Hoyle trials, the MCA produced a Shipping Route Template designed to give guidance to mariners on the distances which should be established between shipping routes and offshore wind farms. However, as experience of effects associated with use of marine Radar in proximity to offshore wind farms grew, the MCA refined their guidance, offering more flexibility within the most recent Shipping Route Template contained within MGN 654 (MCA, 2021).

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

368. Theoretical modelling of the effects of the development of the proposed Atlantic Array Offshore Wind Farm, which was to be located off the south coast of Wales, on marine Radar systems was undertaken by the Atlantic Array project (Atlantic Array, 2012) and considered a wider spacing of WTGs than that considered within the early trials[6]. The main outcomes of the modelling were the following:

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

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

during the Kentish Flats trials it was shown that false targets were quickly identified as such by the mariners and then by the equipment itself.

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

370. The MCA has also produced guidance to mariners operating in proximity to OREIs in the UK which highlights Radar issues amongst others to be taken into account when planning and undertaking voyages in proximity to OREIs (MCA, 2022). The interference buffers presented in **Table 13-1** are based on MGN 654 (MCA, 2021), MGN 371 (MCA, 2008), MGN 543 (MCA, 2016), MGN 372 (MCA, 2008) and MGN 372 Amendment 1 (MCA, 2022).

Table 13-1 Distances at which impacts on marine Radar occur

Distance at Which Effect Occurs (nm)	Identified Effects
0.5	▪ Intolerable impacts can be experienced. ▪ X-Band Radar interference is intolerable under 0.25 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 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 produce strong Radar echoes giving early warning of their presence. ▪ Target size of the WTG echo increases close to the WTG with a consequent degradation on both X and S-Band Radars.

371. As noted in **Table 13-1**, the onset range from the WTGs of false returns is approximately 1.5 nm, with progressive deterioration in the Radar display as the range closes. If interfering echoes develop, the requirements of the Convention on International Regulations for Preventing Collisions at Sea (COLREGs) *Rule 6 Safe Speed* are particularly applicable and must be observed with due regard to the prevailing circumstances (IMO, 1972/77). In restricted visibility, *Rule 19 Conduct of Vessels in Restricted Visibility* applies and compliance with *Rule 6* becomes especially relevant. In such conditions mariners are required, under *Rule 5 Look-out* to take into

account information from other sources which may include sound signals and VHF information, for example from a VTS or AIS (MCA, 2016).

13.7.2 Experience from Operational Developments

372. The evidence from mariners operating in proximity to existing offshore wind farms is that they quickly learn to adapt to any effects. **Figure 13-3** presents the example of the Galloper and Greater Gabbard Offshore Wind Farms in the UK, which are located in proximity to IMO routeing measures. Despite this proximity to heavily trafficked TSS lanes, there have been no reported incidents or issues raised by mariners who operate within the vicinity. The interference buffers presented in **Figure 13-3** are as per **Table 13-1**.

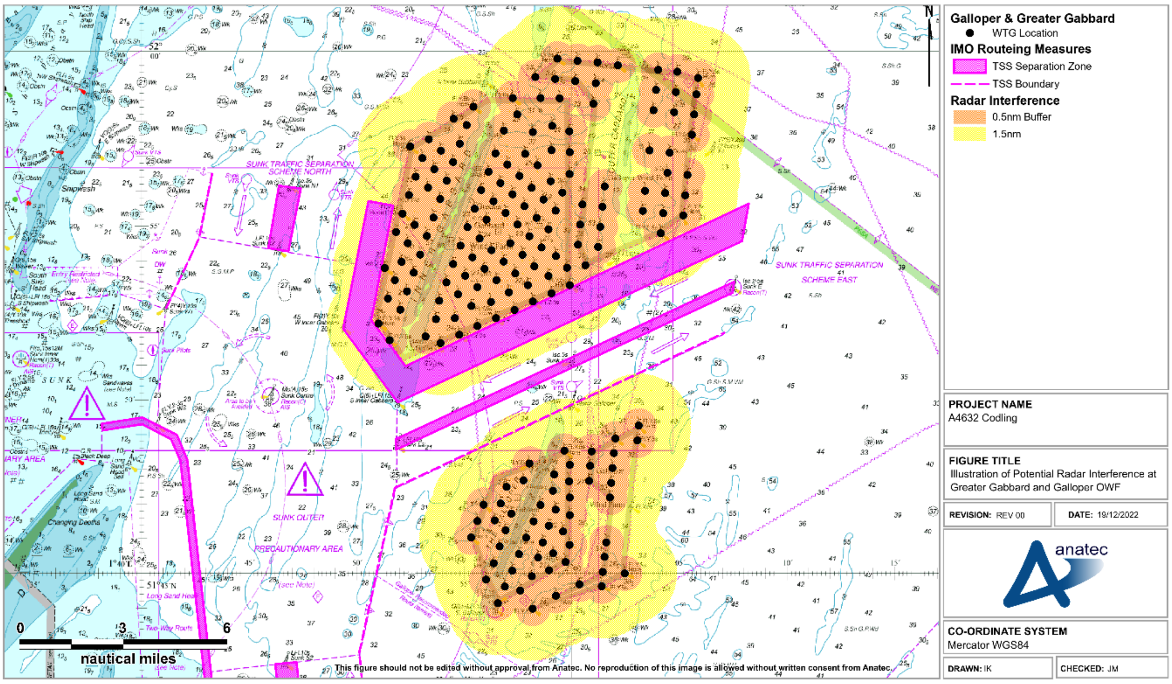

Figure 13-3 Illustration of potential Radar interference at Greater Gabbard and Galloper Offshore Wind Farms

373. As indicated by **Figure 13-3**, vessels utilising these TSS lanes will experience some Radar interference based on the available guidance. Both developments are operational, and each of the lanes is used by a minimum of five vessels per day on average. However, to date, there have been no incidents recorded (including any related to Radar use) or concerns raised by the users.

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

375. 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.

13.7.3 Increased Radar Returns

376. 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.

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

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

13.7.4 Fixed Radar Antenna Use in proximity to an Operational Wind Farm

379. It is noted that there are multiple operational offshore wind farms including Galloper in the UK (see **Section 13.7.2**) 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.

13.7.5 Application to the CWP Project

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

381. **Figure 13-4** presents an illustration of potential Radar interference due to the CWP Project relative to the post wind farm routeing illustrated in **Section 12.3**. The Radar effects have been applied to the layout introduced in **Section 6.2.1**. As shown, vessels passing inshore will do so at distances of greater than 1.5 nm due to the presence of the India and Codling Banks. There is sufficient searoom offshore of the array site for vessels to choose passing distance.

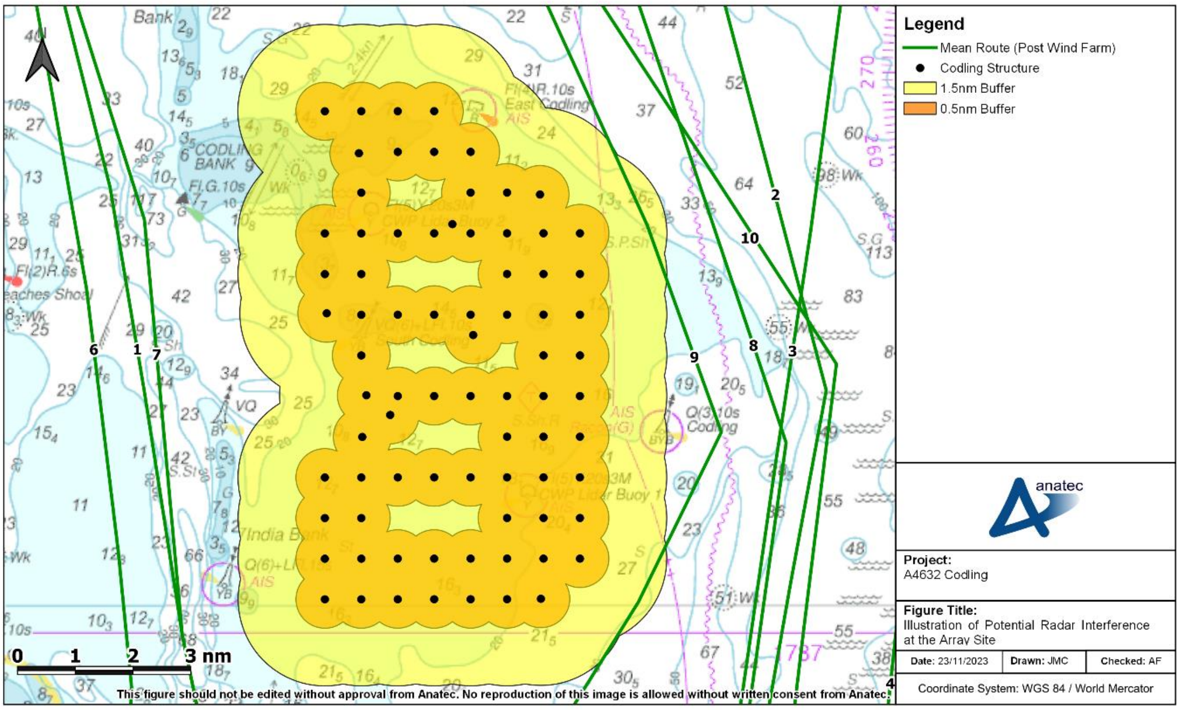

Figure 13-4 Illustration of Potential Radar Interference at the Array Site

382. Vessels passing within the array site will be subject to a greater level of interference with impacts becoming more substantial in close proximity to WTGs. This will require additional mitigation by any vessels including consideration of the navigational conditions (visibility) when passage planning and compliance with the COLREGs (IMO, 1972/77) will be essential. It is noted that the mean route position of Route 9 intersects the 1.5 nm buffer as shown in **Figure 13-4**, however there is searoom available for the low number of vessels using this route to pass further offshore to increase passing distance should they choose to do so. The mean route positions of the routes passing inshore (1, 6, and 7) all pass further than 1.5 nm, noting the natural separation resultant of the shallow banks in between these routes and the array site.

383. 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.

13.8 Sound Navigation Ranging Systems

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

13.9 Noise

385. 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.

13.10 Summary of Potential Effects in Use

386. Based on the detailed technical assessment of the effects due to the presence of the CWP Project on navigation, communication and position fixing equipment in the previous subsections, **Table 13-2** summarises the assessment of frequency and consequence and the resulting risk for each component of this impact.

Table 13-2 Summary of risk to navigation, communication and position fixing equipment

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

387. On the basis of these findings, associated risks are screened out of the risk assessment undertaken in **Chapter 16: Shipping and Navigation**.

14 Collision and Allision Risk Modelling

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

14.1 Overview

14.1.1 Hazards Under Consideration

389. 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.

390. The pre wind farm assessment has been informed by the vessel traffic survey data (see **Section 11**) in combination with the outputs of consultation (see **Section 4**) and other baseline data sources (see **Section 5**). Conservative assumptions have been made with regard to route deviations and future shipping growth over the lifetime of the CWP Project.

14.1.2 Scenarios Under Consideration

391. For each element of the quantitative assessment both a pre and post wind farm scenario with base and future case vessel traffic levels (as per **Section 12.3.1**) have been considered. As a result, six distinct scenarios have been modelled:

- Pre wind farm with the base case vessel traffic level;
- Pre wind farm with a future case vessel traffic level defined by:
  - A 10% increase in traffic; and
  - A 25% increase in traffic.
- Post wind farm with the base case traffic level; and
- Post wind farm with a future case vessel traffic level defined by:
  - A 10% increase in traffic; and
  - A 25% increase in traffic.

14.2 Pre Wind Farm

14.2.1 Vessel to Vessel Encounters

392. 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 busiest vessel traffic survey (summer 2022 as per **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 accounted for.

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

394. On this basis, a total of 535 encounters were identified. This corresponds to an average of 38 encounters per day. Approximately 70% of encounters were observed to involve at least one recreational vessel, with a total of 40% of encounters being between two recreational vessels. This is reflective of the recreational traffic volumes recorded during the summer 2022 survey (see **Section 11.2.3.5**).

395. **Figure 14-1** presents the density of the identified vessel encounters within a 0.25 nm x 0.25 nm grid.

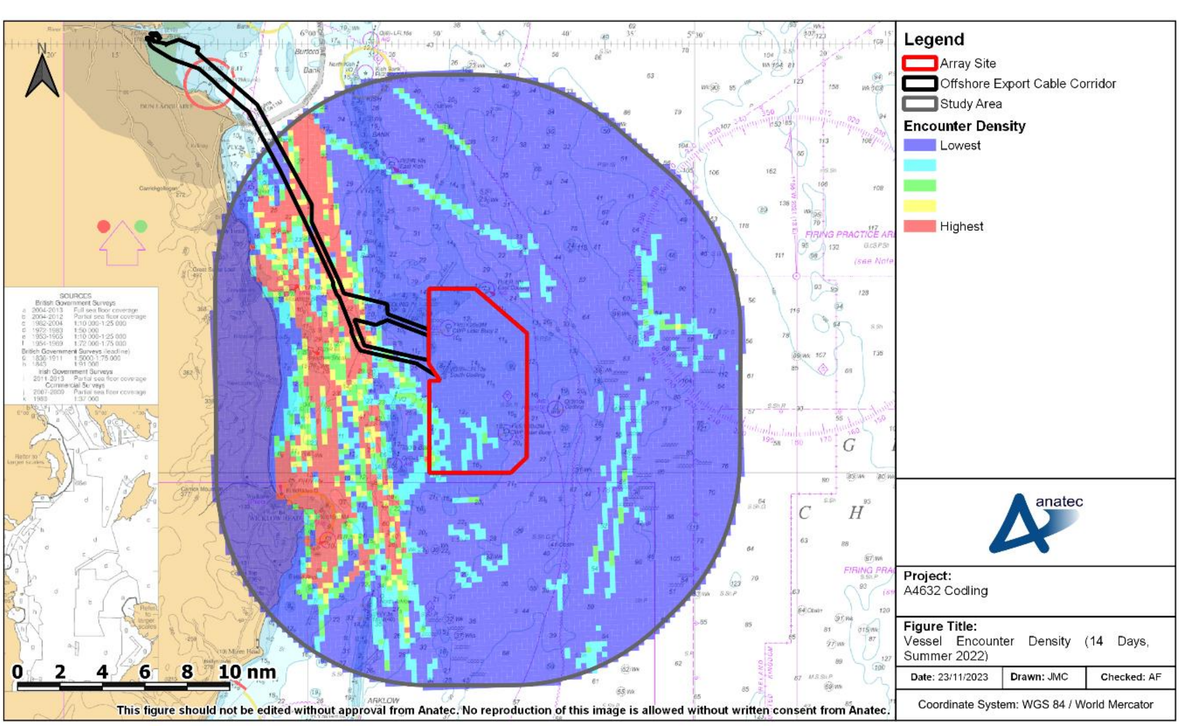

Figure 14-1 Vessel Encounter Density (Summer 2022)

396. It can be seen that the highest density areas for vessel encounters were inshore of the banks, noting that as above the majority of these encounters involved a recreational vessel. This aligns with the vessel traffic assessment of the summer 2022 survey data in that recreational vessels were the most common vessel type recorded

with the majority of the associated traffic remaining in coastal areas. Encounters further offshore were observed to be limited.

397. The impact of the CWP Project on encounters and collision risk is assessed within **Chapter 16: Shipping and Navigation**. Further assessment of vessel to vessel collision risk for commercial vessels is provided in **Sections 14.2.2** and **Section 14.3.1**.

14.2.2 Vessel to Vessel Collisions

398. Using the pre wind farm routeing (see **Section 12**) as input, Anatec's *COLLRISK* model has been run to estimate the existing vessel to vessel collision risk in proximity to the array site. The route positions and widths are based upon the long-term vessel traffic data.

399. A heat map within a 0.25 nm x 0.25 nm grid based upon collision risk for the base case pre wind farm is presented in **Figure 14-2**.

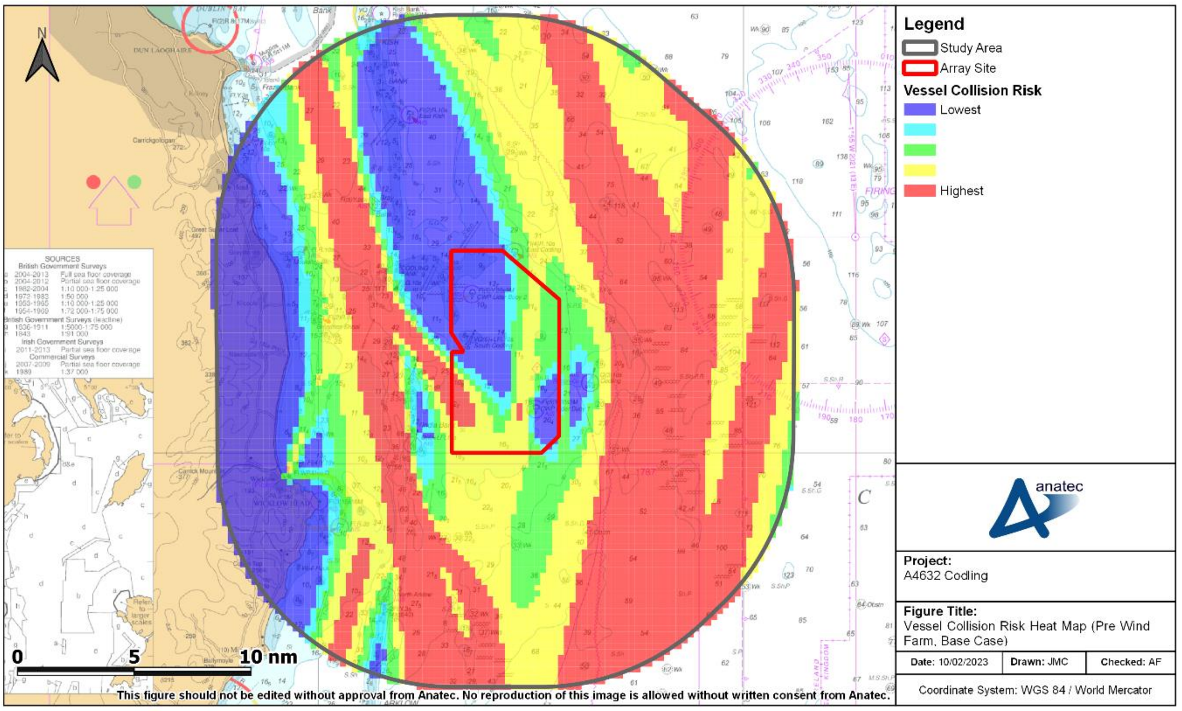

Figure 14-2 Vessel Collision Risk Heat Map (Pre Wind Farm, Base Case)

400. Assuming base case vessel traffic levels, the annual frequency of a vessel being involved in a collision pre-wind farm was estimated to be 7.66×10^{-3}, corresponding to a collision return period of approximately one every 131 years. The areas of highest collision risk correlated well with the areas of highest density commercial vessel routeing (see **Section 12**).

14.3 Post Wind Farm

14.3.1 Vessel to Vessel Collisions

401. Using the post wind farm routeing as an input (see **Section 12.3.2.2**), Anatec's *COLLRISK* model was run to estimate the vessel to vessel collision risk in proximity to the array site.

402. A heat map within a 0.25 nm x 0.25 nm grid based upon collision risk for the base case post wind farm is presented in **Figure 14-3**. Note the ranges used in **Figure 14-3** are the same as those used in **Figure 14-2**, allowing for a direct comparison.

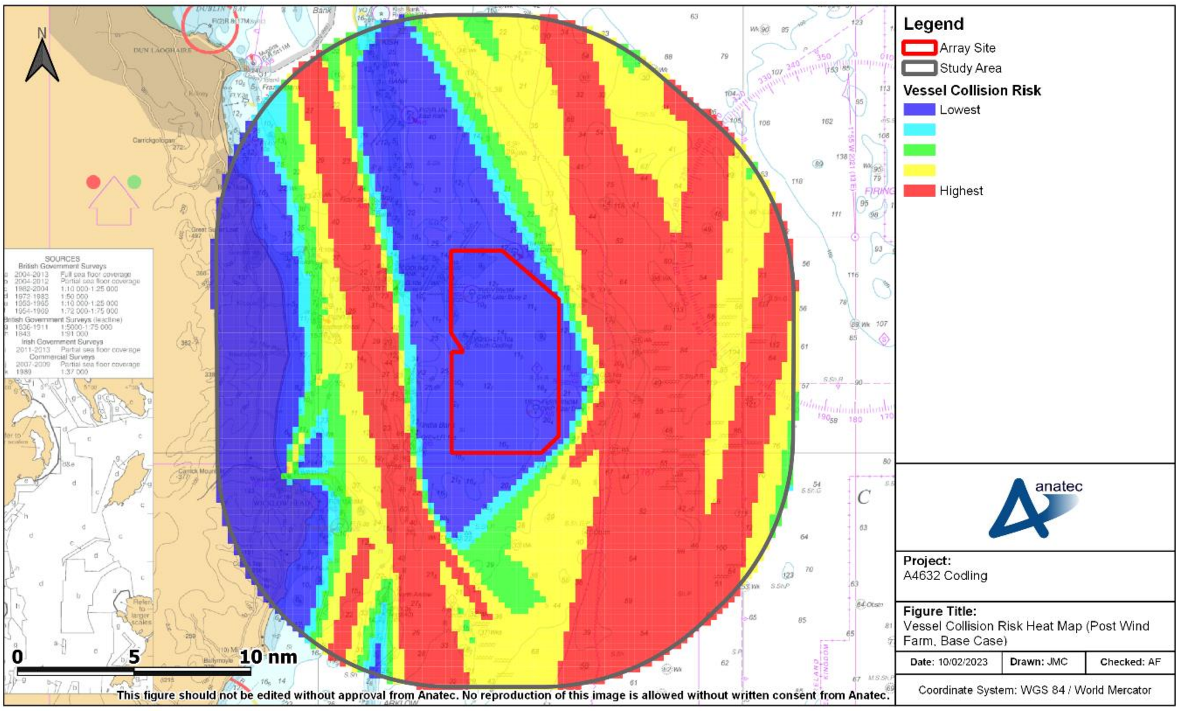

Figure 14-3 Vessel Collision Risk Heat Map (Post Wind Farm, Base Case)

403. Assuming the base case traffic levels, the annual frequency of a vessel being involved in a collision post wind farm was estimated to be 8.41×10^{-3}, corresponding to a collision return period of approximately one every 119 years, which represents a 10% increase in collision frequency compared to the pre wind farm scenario. This increase can be attributed to the displacement of routeing intersecting the array site boundary in the pre wind farm scenario (namely routes 7 and 9, detailed in Section 12) into areas of pre-existing routeing.

14.3.2 Powered Vessel to Structure Allision

404. Based upon the baseline vessel routeing identified in the region, the anticipated deviations, and the embedded mitigation measures in place (see **Section 16**) the frequency of an errant vessel under power deviating from its route to the extent that

it comes into proximity with the array site is considered to be low. It is noted that no account has been made for the potential for vessels to ground prior to alliding with a WTG, noting such a scenario is possible for vessels passing inshore of the banks.

405. **Figure 14-4** presents the annual powered vessel allision frequency for each structure within the array site.

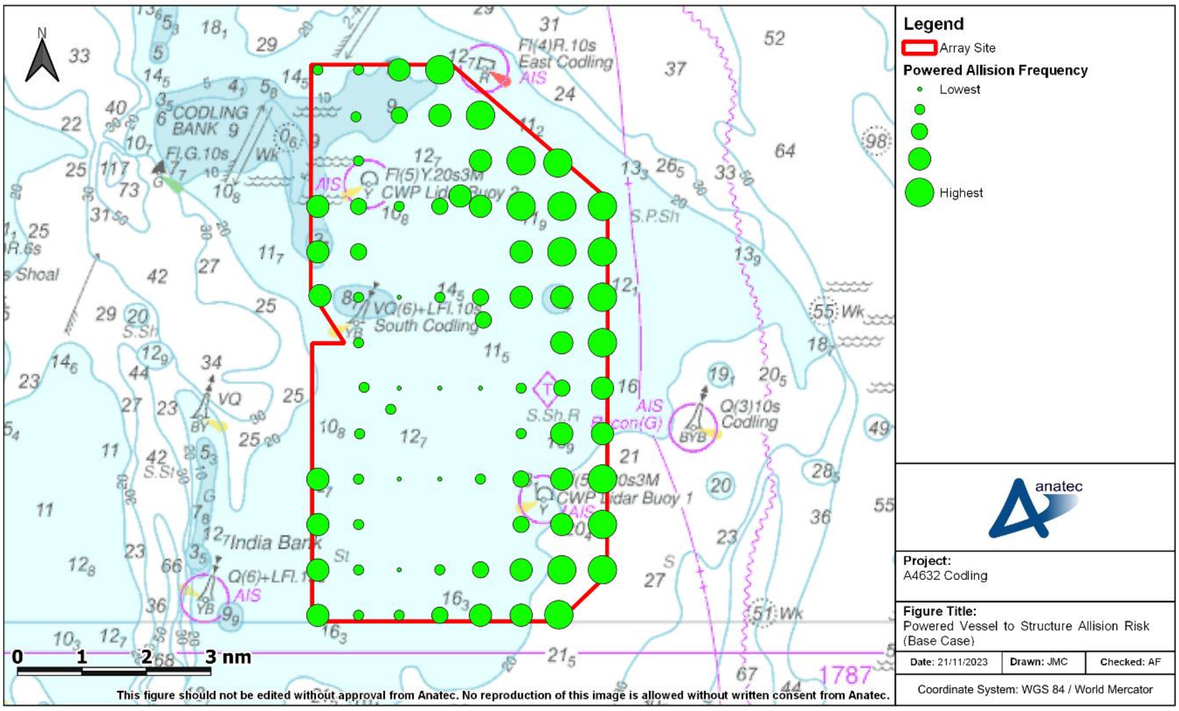

Figure 14-4 Powered Vessel to Structure Allision Risk (Base Case)

406. Assuming base case traffic levels within the post wind farm scenario, the annual powered drifting allision frequency was 1.19×10^{-4}, corresponding to an allision return period of approximately one every 8,384 years.

407. The structures with highest risk were generally located at the eastern extent of the array site. These relatively high frequencies can be attributed to the traffic passing offshore of the array site (see **Figure 12-3**). Allision frequency was lower on the western periphery, noting the presence of the banks mean a natural separation between passing vessels and the structures.

14.3.3 Drifting Vessel to Structure Allision

408. Using the post wind farm routeing as an input, alongside the array site layout, and local MetOcean data (see **Section 8**), Anatec's *COLLRISK* model was run to estimate the likelihood of a drifting commercial vessel alliding with one of the wind farm structures within the array site. 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.

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

410. Using this information, the overall rate of mechanical failure within proximity to the array site was estimated. The probability of a vessel drifting towards a wind farm structure and the drift speed are dependent upon the prevailing wind, wave, and tidal conditions at the time of the incident. Therefore, three drift scenarios were modelled, based upon the MetOcean data as summarised in **Section 8**.

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

411. The probability of vessel recovery from drift is estimated based upon the speed of drift and hence the time available before reaching the wind farm structure. Vessels which do not recover within this time are assumed to allide. It is noted that due to the shallow banks there is also a possibility of vessels grounding prior to alliding, however this is not accounted for in order to ensure modelling of a worst case.

412. After modelling the three drift scenarios, it was established that the flood-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 14-5**.

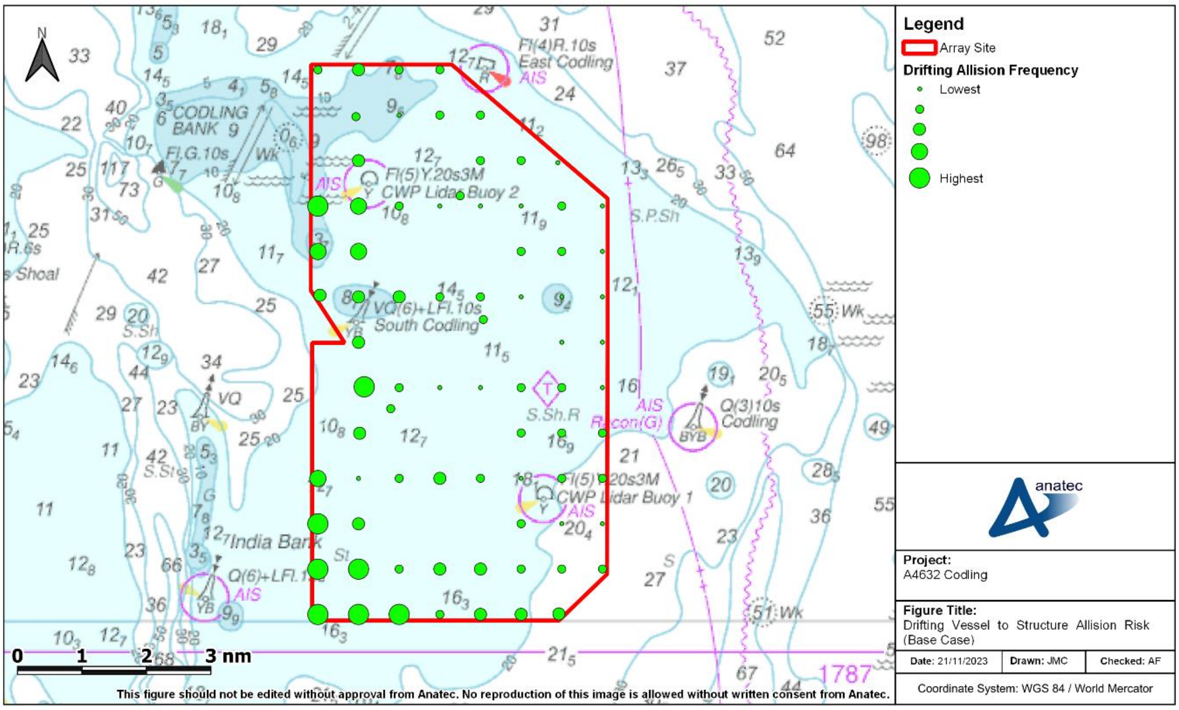

Figure 14-5 Drifting Vessel to Structure Allision Risk (Base Case)

413. Assuming base case vessel traffic levels within a post wind farm and flood-dominated scenario, the annual drifting allision frequency was 9.78×10^{-4}, corresponding to an allision return period of approximately one every 1,022 years.

414. Structures located at the western extent of the array site were the highest risk structures for a drifting allision, with the highest-risk structure being located at the southwest corner and accounting for 12% of the overall allision frequency. This is reflective of the main routes passing in proximity (routes 1 and 7 in **Figure 12-3**) and the dominant flood direction (north-northeast).

14.3.4 Fishing Vessel to Structure Allision

415. Using the 365 days of vessel traffic data (see Annex B) as an input to the fishing allision function of Anatec's *COLLRISK* modelling software suite, the potential fishing vessel to structure allision risk following installation of the array site has been assessed. Peak fishing vessel volumes have been assumed based on the findings of the available vessel traffic survey data.

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

417. The *COLLRISK* fishing allision model uses vessel numbers, sizes (length and beam), array layout, structure dimensions, and the likelihood of a major allision incident has

been calibrated against historical maritime incident data. Given that not all fishing vessels broadcast on AIS, the vessel density observed is scaled up to account for non-AIS fishing vessels, with the scaling factor dependent on the distance of the array offshore.

418. Following the running of the model, **Figure 14-6** presents the fishing vessel to structure allision risk for each individual offshore wind structure.

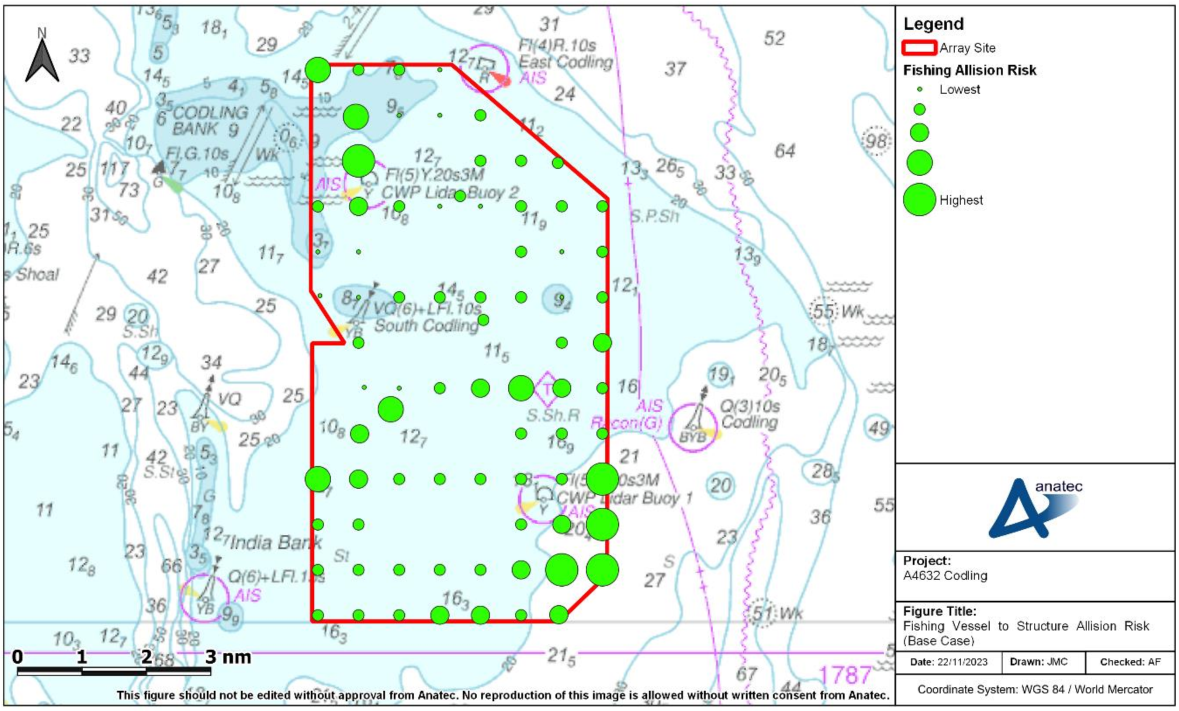

Figure 14-6 Fishing Vessel to Structure Allision Risk (Base Case)

419. Assuming base case vessel traffic levels, the annual fishing drifting allision frequency post wind farm was 8.19×10^{-2}, corresponding to an allision return period of approximately one every 12 years. This is a relatively high risk of allision; however, it is noted that the model is especially conservative in its estimations given that it assumes that the nature of fishing vessel activity (i.e., the number and geographic distribution of the vessels) will not change after the installation of the WTGs. Based on historical incident data (see **Section 10.3**), most likely consequences are minor.

14.4 Risk Results Summary

420. 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 25% increases). **Table 14-1** summarises the results of all six scenarios.

421. Overall, the base case collision and allision frequency due to the presence of the CWP Project was estimated to increase by approximately 8.37×10^{-2}, which represents an increase from one collision/allision every 131 years to one every 11 years.

Table 14-1 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	7.66E-03 (1 in 131 years)	8.41E-03 (1 in 119 years)	7.54E-04
	Future case (10%)	9.59E-03 (1 in 104 years)	1.06E-02 (1 in 94 years)	2.91E-03
	Future case (25%)	1.22E-02 (1 in 82 years)	1.34E-02 (1 in 75 years)	5.79E-03
Powered vessel to structure allision	Base case	-	1.19E-04 (1 in 8,384 years)	1.19E-04
	Future case (10%)	-	1.31E-04 (1 in 7,622 years)	1.31E-04
	Future case (25%)	-	1.49E-04 (1 in 6,707 years)	1.49E-04
Drifting vessel to structure allision	Base case	-	9.78E-04 (1 in 1,022 years)	9.78E-04
	Future case (10%)	-	1.08E-03 (1 in 929 years)	1.08E-03
	Future case (25%)	-	1.22E-03 (1 in 818 years)	1.22E-03
Fishing vessel to structure allision	Base case	-	8.19E-02 (1 in 12 years)	8.19E-02
	Future case (10%)	-	9.00E-02 (1 in 11 years)	9.00E-02
	Future case (25%)	-	1.02E-01 (1 in 10 years)	1.02E-01
Total	**Base case**	7.66E-03 (1 in 131 years)	9.14E-02 (1 in 11 years)	8.37E-02
	Future case (10%)	9.59E-03 (1 in 104 years)	1.01E-01 (1 in 10 years)	9.13E-02
	Future case (25%)	1.22E-02 (1 in 82 years)	1.17E-01 (1 in 9 years)	1.05E-01

15 Linkage to EIAR

422. This section of the NRA presents the shipping and navigation impacts which have been identified based upon the NRA process, including assessment of baseline data and the consultation undertaken including the hazard workshop (see **Section 4**). These impacts have been assessed within **Chapter 16: Shipping and Navigation**.

423. Each impact identified has been assessed as per the methodology set out in **Section 3**.

15.1 Construction and Decommissioning

- Collision risk and increased encounters associated with displacement;
- Collision risk with project vessels;
- Allision with structures (powered, drifting, internal navigation); and
- Reduction in emergency response capabilities.

15.2 O&M

- Collision risk and increased encounters associated with displacement;
- Collision risk with project vessels;
- Allision with structures (powered, drifting, internal navigation);
- Reduction in emergency response capabilities;
- Increase in under keel interaction risk (cable protection); and
- Anchor interaction with subsea cables.

16 Mitigation Measures

16.1 Embedded

424. For the purposes of the impact assessment undertaken within **Chapter 16: Shipping and Navigation** and as per the methodology set out in **Section 3**, it has been assumed that certain embedded mitigation measures will be in place. These are summarised in Table 16-1.

Table 16-1 Embedded Mitigation

Project Element	Description
Navigational Safety Plan (NSP)	A Navigational Safety Plan (NSP) has been prepared for shipping and navigation purposes, including the safe navigation of fishing vessels. The NSP includes details of: ▪ Advisory safe passing distances around structures and works; ▪ Marine coordination and communication to manage the movements of project vessels; ▪ Marking of all infrastructure associated with the project (including subsea cables) on appropriately scaled Admiralty Charts; ▪ Procedures in relation to Local Notices to Mariners, to be updated and re-issued during construction and prior to planned maintenance works; ▪ Consultation with the relevant harbour authorities; ▪ Compliance of all project vessels with international marine regulations as adopted by the Flag State, notably the COLREGs and International Convention for the Safety of Life at Sea (SOLAS); and ▪ Use of a guard vessel(s) as deemed appropriate by risk assessment. The NSP will be implemented by the Applicant and its appointed contractor(s) and will be secured through conditions of the development consent. It will be a live document which will be updated and submitted to the relevant authority, prior to the start of construction.

Project Element	Description
Lighting and Marking Plan	A Lighting and Marking Plan (LMP) has been prepared to capture construction and O&M phase lighting requirements for the offshore infrastructure and demarcation of the offshore development area such as construction buoy requirements. The LMP includes details of: ▪ Marking and lighting of the array site in agreement with Irish Lights and in line with IALA G1162 (IALA, 2021a); ▪ Buoyed construction area around the array in agreement with Irish Lights; and ▪ Specific requirements in terms of aviation lighting to be installed on the turbines. The LMP will be prepared in consultation with the IAA, DoD and IRCG. It will take into account DoD's requirement for WTGs to be observable to night vision equipment. The LMP will ensure appropriate lighting is in place to facilitate aeronautical safety. The LMP will be implemented by the Applicant and its appointed contractor(s) and will be secured through conditions of the development consent. It will be a live document which will be updated and submitted to the relevant authority, prior to the start of construction.
Cable protection	The Applicant will, where practicable, bury all cables within the offshore development area: ▪ IACs and interconnector cables will have a minimum depth of cover of 1.0 m; and ▪ Offshore export cables will have a minimum depth of cover of 1.4 m. In cases where burial is inadequate due to unforeseeable seabed conditions, and at cable crossings, cable protection will be implemented as mitigation to avoid risks to other marine operations.
Liaison with SAR resources	An Emergency Response Cooperation Plan (ERCoP) will be in place for the CWP Project. The ERCoP will detail liaison with SAR resources including the IRCG to ensure suitable emergency response plans and procedures are in place. The ERCoP will refer to the

Project Element	Description
	marking and lighting of the WTGs and will consider helicopters undertaking SAR operations when rendering assistance to vessels and persons in the vicinity of the offshore development area. This will ensure appropriate lighting is in place to facilitate aeronautical safety during SAR operations.
Minimum blade clearance	All WTGs for both layout options will feature a minimum blade tip clearance of 36 m above Mean Sean Level (MSL) (+37.72m LAT). This is beyond the minimum 22 m clearance above HAT required for safety of navigation and has been set by the Applicant to reduce the potential collision risk for offshore ornithology receptors.
Turbine and layout design	Positions of WTGs and OSSs have been informed by a wide range of site specific data, including metocean data (e.g. wind speed and direction), geophysical and geotechnical survey data (e.g. bathymetry), environmental data (e.g. benthic surveys and archaeological assessment) and stakeholder consultation. Designing and optimising the layout of the WTGs has considered multiple constraints identified from analysis of these datasets, alongside the consideration of layout principles taken from relevant guidance on the design of OWFs. A summary of the key actions taken to avoid or otherwise reduce impacts is provided below: ▪ The WTG layout options include SAR access lanes to allow a SAR resource to fly on the same orientation continuously through the array site. This is provided to minimise risks to surface vessels and/or SAR resource transiting through the array site. ▪ Archaeological exclusion zones around known features of archaeological interest have been avoided. No works that impact the seabed will be undertaken within the extent of an AEZ during the construction, operational, or decommissioning phases. ▪ The locations of offshore infrastructure been developed to avoid known sensitive ecological

Project Element	Description
	habitats, including areas with suitable conditions for Sabellaria spinulosa which can form reefs under some circumstances. Whilst reefs were not identified during the characterisation surveys, as an ephemeral feature it will be necessary to validate the results in advance of construction. A pre-construction geophysical survey will therefore be undertaken to facilitate the micrositing around sensitive habitats such as Sabellaria spinulosa. ▪ The WTG layout options have been developed to avoid or minimise interaction with known areas of high fishing density, where possible. As avoidance is not always possible, the layouts have also been developed to increase the potential for coexistence. ▪ A paleochannel (the remnants of a river or stream channel that flowed in the past) in the centre west of the array site has been avoided.
Construction Environmental Management Plan (CEMP)	A Construction Environmental Management Plan (CEMP) has been prepared to provide a management framework, to ensure appropriate controls are in place to manage environmental risks associated with the construction of the CWP Project. It outlines environmental procedures that require consideration throughout the construction process, in accordance with legislative requirements and industry best practice. In summary, the CEMP includes details of: • the Environmental Management Framework for the CWP Project including environmental roles and responsibilities (i.e. ecological clerk of works) and contractor requirements (i.e. method statements for specific construction activities); • mitigation measures and commitments made within the EIAR, Natura Impact Statement (NIS) and supporting documentation for the CWP Project. • measures proposed to ensure effective handling of chemicals, oils and fuels including compliance with the MARPOL convention;

Project Element	Description
	• a Marine Pollution Prevention and Contingency Plan to address the procedures to be followed in the event of a marine pollution incident originating from the operations of the CWP Project; • a Emergency Response Plan adhered to in the event of discovering unexploded ordnance; • Offshore biosecurity and invasive species management detailing how the risk of introduction and spread of invasive non-native species will be minimised; and • Offshore waste management and disposal arrangements. The CEMP will be implemented by the Applicant and its appointed contractor(s) and will be secured through conditions of the development consent. It will be a live document which will be updated and submitted to the relevant authority, prior to the start of construction.
Rehabilitation Schedule	A Rehabilitation Schedule is provided as part of the planning application. This has been prepared in accordance with the MAP Act (as amended by the Maritime and Valuation (Amendment) Act 2022) to provide preliminary information on the approaches to decommissioning the offshore and onshore components of the CWP Project. A final Rehabilitation Schedule will require approval from the statutory consultees prior to the undertaking of decommissioning works. This will reflect discussions held with stakeholders and regulators to determine the exact methodology for decommissioning, taking into account available methods, best practice and likely environmental effects.

16.2 Additional

425. Full details of additional mitigation measures identified are provided in **Chapter 16: Shipping and Navigation.**

17 Summary

426. Using a baseline assessment, quantitative assessment, and consultation with relevant stakeholders, impacts relating to shipping and navigation have been identified and assessed for the CWP Project for all phases of development (construction, O&M and decommissioning).

427. The following subsections summarise the key elements of the NRA.

17.1 Consultation

428. Consultation has been undertaken throughout the NRA process, including key shipping and navigation stakeholders including:

- MSO;
- Irish Lights;
- Local ports/harbours, e.g. Dublin Port and Dun Laoghaire Harbour;
- Regular operators, e.g. Irish Ferries and CLdN;
- Recreational stakeholders, e.g. Royal Irish Yacht Club and Poolbeg Yacht and Boat Club;
- Dalkey Island Ferry;
- Irish Nautical Trust; and
- Matrix Ship Management.

429. Key consultation aspects included a regular operator outreach, a Hazard Workshop and responses to the Scoping Report. Further details on consultation can be found in **Section 4**.

17.2 Navigational Features

430. The existing navigational features in proximity to the CWP Project have been presented in **Section 7**.

431. There are multiple shallow banks in proximity to the array site that are considered key navigational features given they are observed to dictate vessel routeing. Key banks include Codling Bank, India Bank, Bray Bank, Kish Bank and Arklow Bank. Aids to navigation mark the presence of these banks to passing mariners.

432. Arklow Bank Wind Park, currently the only operational offshore wind farm in Ireland, is located approximately 12.1 nm southwest of the array site and 16.9 nm south of the OECC.

433. A subsea telecommunications cable is located 1.9 nm to the east of the array site and another is located 14 nm northwest of the array site, intersecting the OECC.

434. There is a charted anchorage location within Dublin Bay that is utilised by commercial vessels, approximately 600 m northeast of the OECC. There is also a preferred

anchorage location at Scotman's Bay within 640 m of the OECC to its southwest, where recreational vessels anchor.

435. There are three major TSSs in vicinity to the CWP Project; TSS Off Skerries, TSS Off Tuskar Rock and TSS Off Smalls. None are within the study area, however vessel routeing in the area includes vessels bound to/from these TSSs.

17.3 Maritime Incidents

436. The maritime incident baseline is presented in **Section 10**.

17.3.1 RNLI

437. Ten years of RNLI data (2013 to 2022) was assessed within both the study area and cable corridor study area.

438. There was an average of 27 incidents per year within the study area, noting that the majority of these incidents were coastal. Five were within the array site itself.

439. There was an average of 44 incidents per year within the cable corridor study area, with the majority of these being concentrated inshore of the OECC within Dublin Bay. A total of 47 occurred within the OECC itself.

17.3.2 MCIB

440. The MCIB dataset assessed spanned the period 1992 to 2022 and was assessed for both the study area and cable corridor study area.

441. Three incidents were identified within the study area. None of these were within the array site itself.

442. Eight incidents were identified within the cable corridor study area, noting that six of these occurred within Dublin Bay and the remaining two occurred within the OECC itself.

17.4 Vessel Traffic Movements

443. The vessel traffic baseline is presented in **Section 11**.

444. Three vessel traffic surveys were undertaken to capture vessel traffic movements in the vicinity of the array site using AIS, Radar and visual observations; these spanned the periods 20 February 2023 – 6 March 2023 (14-day period), 15 July 2022 – 8 August 2022 (14-day period) and 30 April 2021 – 25 June 2021 (57-day period). In addition, a 28-day AIS-only dataset of vessel traffic within the cable corridor study area was assessed for the same summer 2022 period and winter 2023 period.

445. In the winter 2023 survey, cargo was the most common vessel type, accounting for 54%, followed by fishing (15%) and tanker (13%). An average of 38 vessels per day

was recorded, with two to three per day intersecting the array site. Anchoring activity was observed at the approach to Bray Head.

446. In the summer 2022 survey, recreational vessels were the most common vessel type, accounting for 35%, followed by cargo (29%). An average of 54 vessels per day was recorded, with three to four of these being within the array site itself. Anchoring activity was recorded in the vicinity of Bray Harbour.

447. In the summer 2021 survey, cargo was the most common vessel type, accounting for 53%, followed by fishing (20%). An average of 37 vessels per day was recorded, with three of these within the array site itself. Anchoring activity was recorded in the vicinity of Bray Harbour.

448. Within the dataset assessed for the cable corridor study area, an average of 39 vessels per day was recorded, with 17 of these being within the OECC itself. Cargo was the most common vessel type, followed by recreational. Anchoring activity was recorded within Dublin Bay, Scotsman's Bay and in vicinity of Bray Harbour.

17.5 Vessel Routeing

449. A total of ten main routes were identified based on an assessment of the long-term vessel traffic data. Two of these routes could require deviation as a result of the presence of the CWP Project (Routes 7 and Route 9).

450. The anticipated deviation for Route 9 will represent an increase in its distance of 2.1 nm (a 7% increase), noting that this route is used by less than a vessel a day.

451. The anticipated deviation Route 7 will represent a shorter transit within the study area, however it is noted that these deviated vessels would be required to pass through a smaller area of searoom in a busy area.

452. Further details of vessel routeing can be found in **Section 12.3**.

17.6 Collision and Allision Risk Modelling

453. The collision and allision risk modelling has been undertaken within six scenarios:

- Pre wind farm with the base case vessel traffic level;
- Pre wind farm with a future case vessel traffic level defined by:
  - A 10% increase in traffic; and
  - A 25% increase in traffic.
- Post wind farm with the base case traffic level; and
- Post wind farm with a future case vessel traffic level defined by:
  - A 10% increase in traffic; and
  - A 25% increase in traffic.

454. Table 17-1presents a summary of the collision and allision modelling results.

Table 17-1 Summary of Collision and Allision Risk Results

Risk	Scenario	Annual Frequency (Return Period)		
		Pre Wind Farm	Post Wind Farm	Change
Vessel to vessel collision	Base case	7.66E-03 (1 in 131 years)	8.41E-03 (1 in 119 years)	7.54E-04
	Future case (10%)	9.59E-03 (1 in 104 years)	1.06E-02 (1 in 94 years)	2.91E-03
	Future case (25%)	1.22E-02 (1 in 82 years)	1.34E-02 (1 in 75 years)	5.79E-03
Powered vessel to structure allision	Base case	-	1.19E-04 (1 in 8,384 years)	1.19E-04
	Future case (10%)	-	1.31E-04 (1 in 7,622 years)	1.31E-04
	Future case (25%)	-	1.49E-04 (1 in 6,707 years)	1.49E-04
Drifting vessel to structure allision	Base case	-	9.78E-04 (1 in 1,022 years)	9.78E-04
	Future case (10%)	-	1.08E-03 (1 in 929 years)	1.08E-03
	Future case (25%)	-	1.22E-03 (1 in 818 years)	1.22E-03
Fishing vessel to structure allision	Base case	-	8.19E-02 (1 in 12 years)	8.19E-02
	Future case (10%)	-	9.00E-02 (1 in 11 years)	9.00E-02
	Future case (25%)	-	1.02E-01 (1 in 10 years)	1.02E-01
Total	**Base case**	7.66E-03 (1 in 131 years)	9.14E-02 (1 in 11 years)	8.37E-02
	Future case (10%)	9.59E-03 (1 in 104 years)	1.01E-01 (1 in 10 years)	9.13E-02
	Future case (25%)	1.22E-02 (1 in 82 years)	1.17E-01 (1 in 9 years)	1.05E-01

17.7 Risk Assessment Results

455. The risk assessment undertaken in **Chapter 16: Shipping and Navigation** concluded that the significance of risk for all potential impacts is **broadly acceptable** or **tolerable and ALARP** which is not significant in EIA terms (assuming implementation of additional mitigation where necessary under the FSA). These significance rankings

were determined with consideration of the mitigation measures summarised in **Section 16**.

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Annex A Regular Operator Consultation

456. As part of the consultation process for the CWP Project, regular operators identified from the vessel traffic survey data were consulted via electronic mail. An example of the correspondence sent to the regular operators is presented below. Further details are provided in **Section 4.2**.

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

Date: 24/11/2022
Ref: A4632-CWP-RO-1

Opportunity to Participate in Consultation Relating to Shipping and Navigation for the Proposed Codling Wind Park Project

Dear Stakeholder,

Codling Wind Park Limited is the developer of the Codling Wind Park Project, a planned offshore wind farm located in the Irish Sea seven nautical miles (nm) off the coast of County Wicklow. Following issue of the Scoping Report in 2021, the project is now producing a Navigational Risk Assessment (NRA) in support of the shipping and navigation work being undertaken as part of the overarching application.

As part of this NRA process, the Project would like to ensure that comprehensive consultation is undertaken and to identify any potential impacts that the Project may have upon shipping and navigation. Therefore, shipping movements within and in the vicinity of the array site have been analysed via assessment of 12 months of Automatic Identification System (AIS) data for the purpose of identifying any regular vessel operators in the area.

According to this analysis, your company's vessel(s) have been recorded navigating within and/or in the vicinity of the array site. Consequently, your company has been identified as a potential marine stakeholder for the Codling Wind Park Project. We therefore invite your feedback on the potential development including any impact it may have upon the navigation of vessels.

Figure 1 presents the proposed array site relative to the coast. The wind turbine generators and associated structures including offshore substation platforms will be located within the array site.

Further information relating to the Codling Wind Park Project is also available here if of interest.

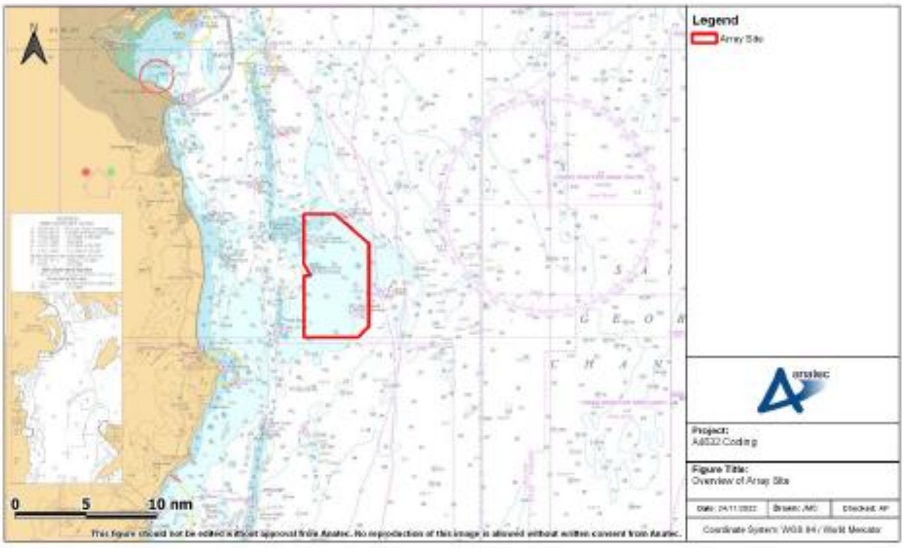

Figure 1 Overview of Array Site

We would be grateful if you could provide us with any comments or feedback that you may have, including any impact it may have upon the navigation of vessels, by the 9th December 2022. This will allow us to assess your feedback as part of the NRA which is currently being undertaken. We would also be grateful if you could forward a copy of this information to any other vessel operators/owners you feel may be interested in commenting.

Whilst we welcome all feedback we are particularly interested in any comments or feedback on the following:

1. Whether the proposal to construct the Project is likely to impact the routeing of any specific vessels, including the nature of any change in regular passage.
2. Whether any aspect of the Project poses any safety concerns to your vessels, including any adverse weather routeing.
3. Whether you would choose to make passage internally through the array site.
4. Whether you wish to be retained on our list of marine stakeholders and consulted throughout the NRA process.

Additionally, we would like to invite you to attend a Hazard Workshop for the project scheduled to take place in January 2023. We will be confirming details of the workshop imminently.

We would appreciate if any responses are provided via email to [redacted] as well as an indication of whether you are interested in participating in the Hazard Workshop noted above.

Yours sincerely,

[redacted]
Risk Analyst
Anatec Ltd

Annex B Long-Term Vessel Traffic Movements

B.1 Introduction

457. As part of the NRA process for the CWP Project, assessment of long-term AIS data has been undertaken. The assessment is designed to supplement the primary analysis within the NRA, which will be based on shorter term AIS, Radar and visual observation data collected during local vessel traffic surveys.

458. The approach to vessel traffic data collection for the CWP Project has been based on requirements of the MCA MGN 654 (MCA, 2021). While this is UK guidance, the relevant regulators have indicated it should be followed for Irish projects in lieu of equivalent dedicated Irish guidance. MGN 654 requires a minimum of 28 days of up to date vessel traffic data that accounts for non-AIS traffic and seasonal variation. However, short term periods in isolation can omit certain seasonal or infrequent marine activity. Therefore, in line with good practice assessment procedures, 12 months of AIS data covering the entirety of 2021 has also been considered to ensure a comprehensive overview of the vessel traffic baseline can be established, including the inclusion of any seasonal variation.

B.2 Methodology

B.2.1 Study Area

459. This annex has assessed the long-term vessel traffic data within the study area for the array site introduced in **Section 3.5**.

B.2.2 Data Collection Summary

460. The AIS data was collected from satellite and terrestrial receivers for the entirety of 2021 (1 January – 31 December 2021). Any traffic deemed as temporary in nature (e.g., survey vessels and jackup rigs) has been excluded from the assessment in **Section B.3** to ensure the assessment focuses on routine traffic and activity. Vessels at berth within Greystone and Wicklow have also been excluded from the assessment. Given a combination of satellite and terrestrial receivers were used, downtime was observed to be limited.

B.2.3 Data Limitations

461. General limitations associated with the use of AIS data (for example, carriage requirements) are discussed in full within **Section 5.4.1**. Effects of COVID and Brexit on the long-term dataset also apply and are also discussed in **Section 5.4.1**.

B.3 Long-Term Vessel Traffic Movements

462. This section provides analysis of the 12-month AIS data (as detailed in **Section B.2.2**).

B.3.1 Overview

463. An overview of all data recorded during 2021 within the study area is colour-coded by vessel type and presented in **Figure B.1**.

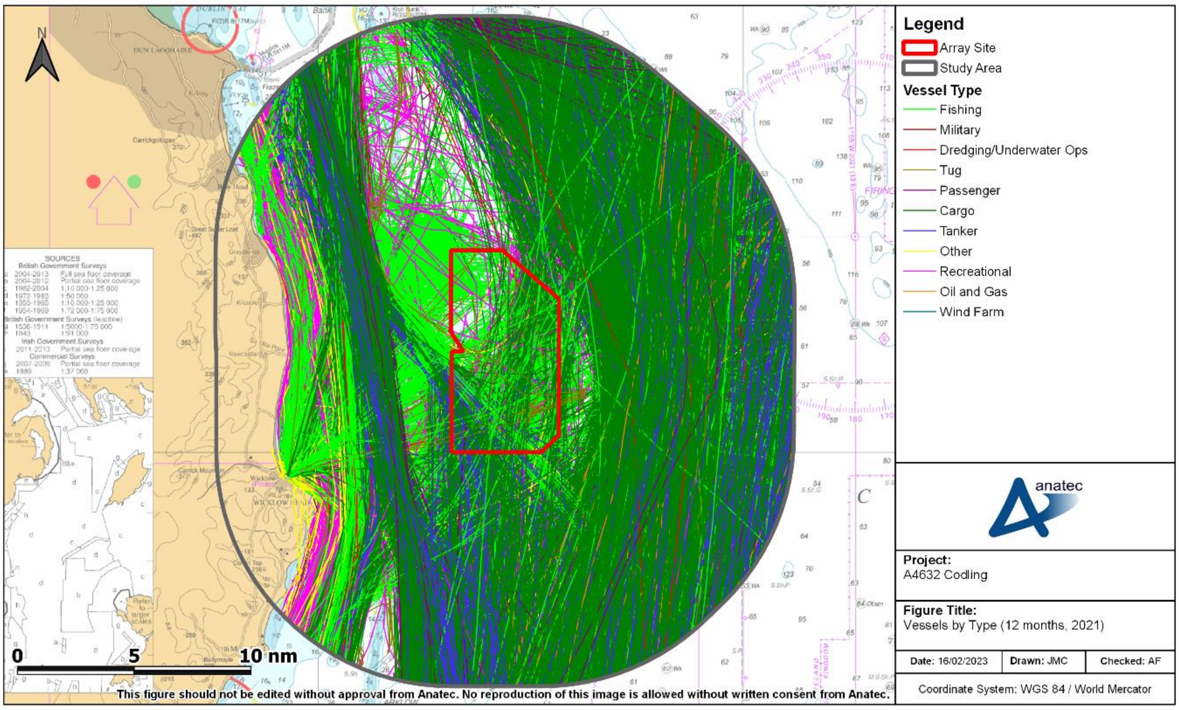

Figure B.1 Vessels by Type (12 months, 2021)

464. There was clearly defined north/south routeing to the west of the array site that was frequented by commercial vessels, with the area offshore also being busy in terms of commercial traffic. The majority of fishing and recreational activity was recorded inshore. Most tug vessels and vessels in the “other” category were recorded going to/from the port at Wicklow.

465. Further information about the distribution of vessel types and of each main type can be found in **Section B.3.3**.

B.3.2 Vessel Count

466. The average numbers of unique vessels recorded per day for each month of 2021 within the study area are presented in **Figure B.2**.

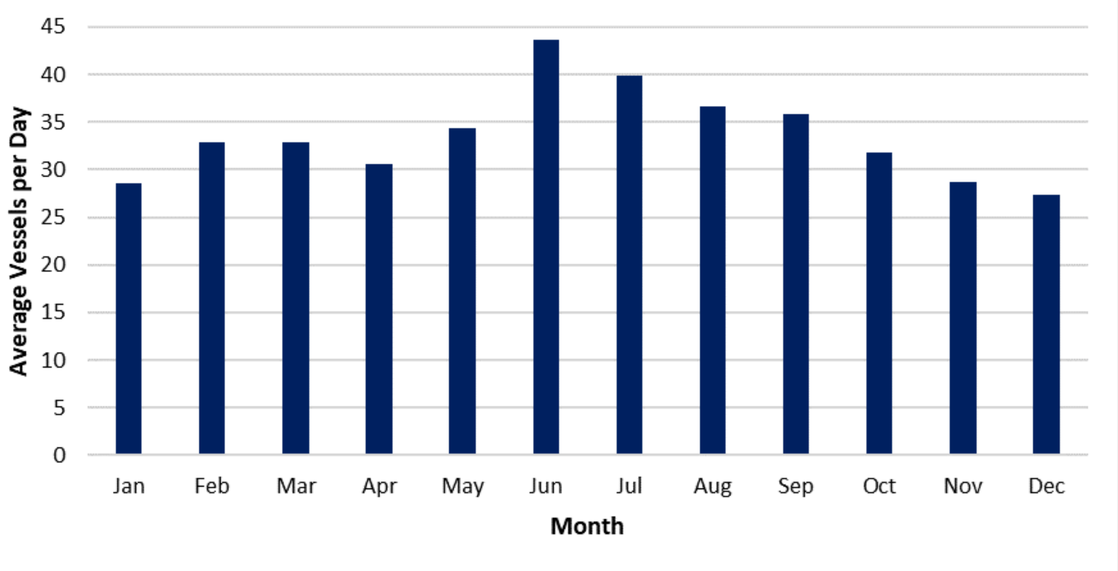

Figure B.2 Vessel Counts Within Study Area by Month (12 months, 2021)

467. There were on average 34 unique vessels per day recorded within the study area during 2021. The busiest month was June, during which an average number of 44 unique vessels per day were recorded. The quietest month was December, during which an average of 27 unique vessels per day were recorded.

468. The breakdown of vessel type distribution per month is presented in **Figure B.3**.

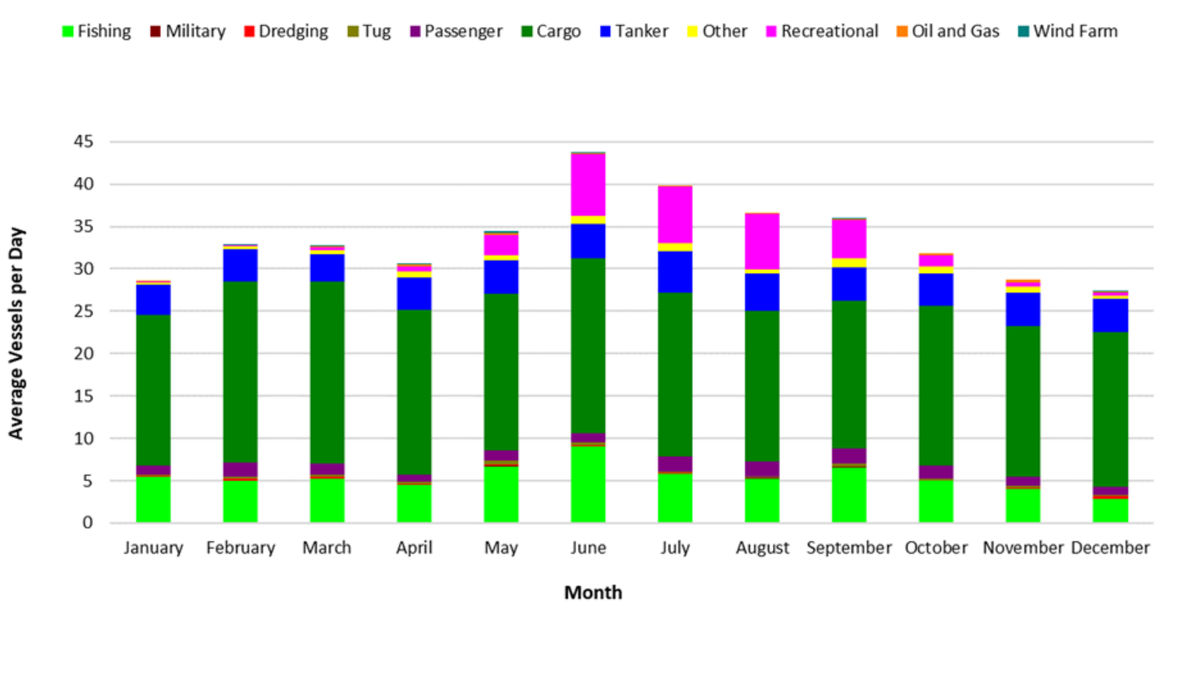

Figure B.3 Vessels Counts Within Study Area by Month & Type (12 months, 2021)

469. From this, it can be noted that seasonal variation of vessel counts within the study area during 2021 is largely related to recreational vessels levels, which peaked in June and remained high in July and August. Fishing vessel levels also peaked in June, with approximately nine unique vessels being recorded per day compared to the annual average of five to six per day.

B.3.3 Vessel Type

470. The distribution of vessel types recorded within the study area during 2021 are presented in **Figure B.4**. It is noted that vessel types[7] detected in low numbers (< 1%) during the study period have been incorporated into the 'other' type category.

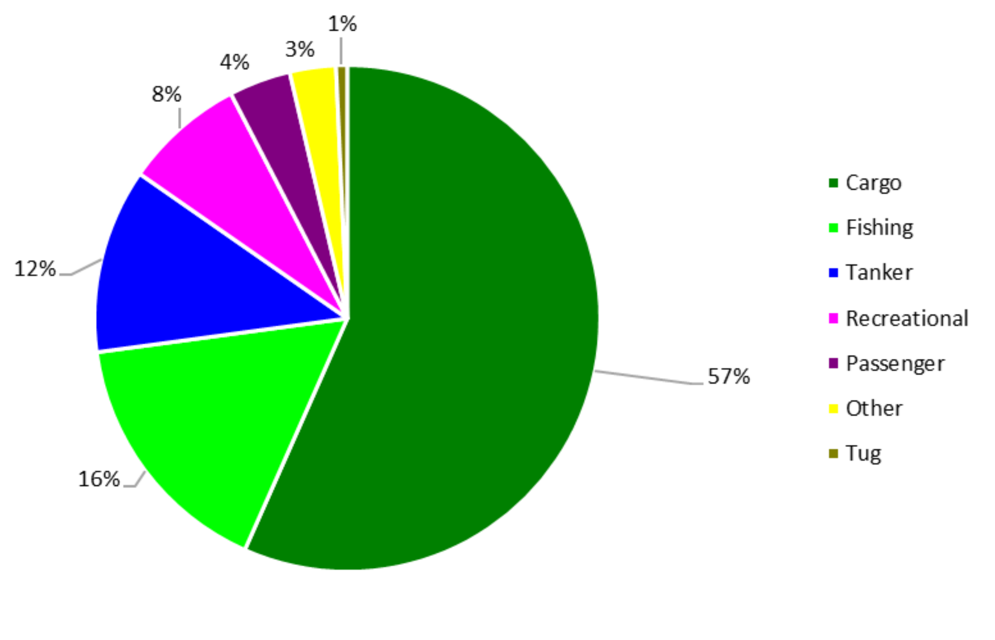

Figure B.4 Distribution of Vessel Types (12 months, 2021)

471. The most common vessel types recorded within the study area during 2021 were cargo (57%), fishing (16%), and tanker (12%). Commercial vessels accounted for 73% of the total traffic recorded within the study area; these vessels are discussed further in **Section B.3.3.2**.

B.3.3.2 Commercial Vessels

472. The commercial vessels recorded within the study area during 2021 are presented in **Figure B.5**.

[7] Including the following vessel types: military, dredging, oil and gas, and wind farm.

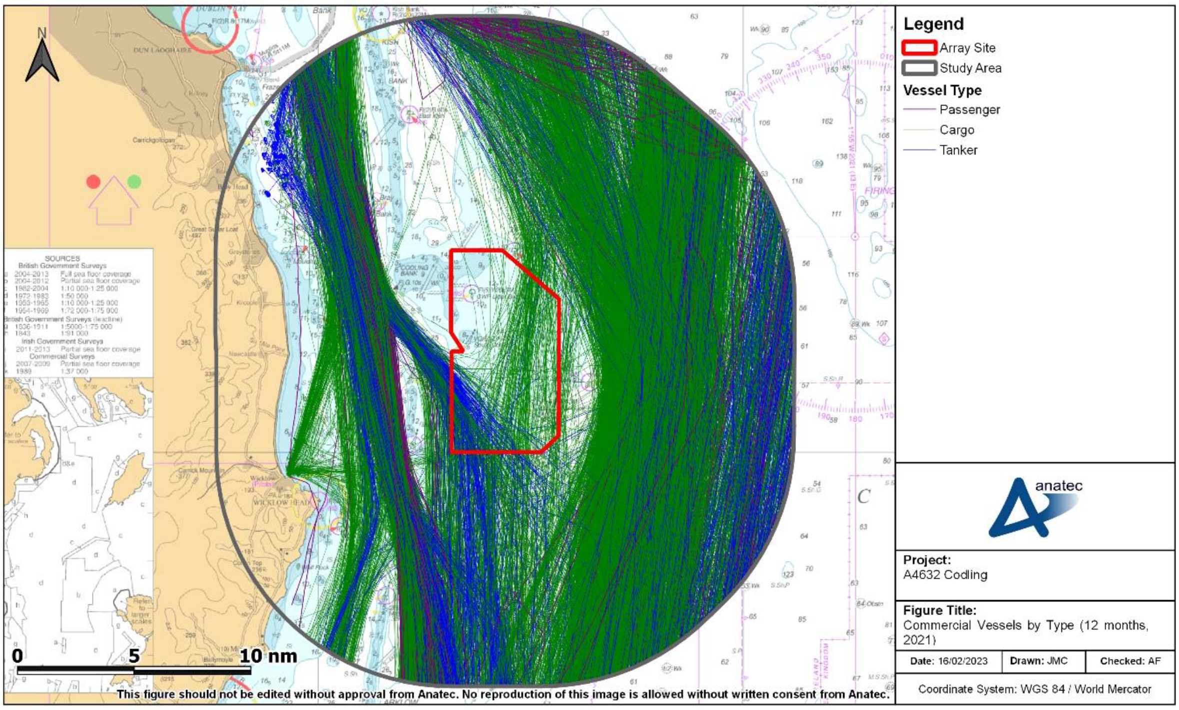

Figure B.5 Commercial Vessels by Type (12 months, 2021)

473. Commercial vessel routeing was observed to be heavily influenced by the presence of local shallow banks, given that the associated shallows are avoided by commercial vessels. On this basis the majority of commercial traffic passes either inshore of the array site (i.e., inshore of the Kish, Bray, Codling and India Banks) or offshore of the array site (i.e., offshore of the Kish and Bray Banks). Lower use routeing was still observed within the array site itself, from vessels passing between the Codling and India Banks, and vessels on north south transits passing offshore of the Codling and India Banks.

474. Routeing is discussed further in **Section 12**.

475. An average of between one and two unique commercial vessels passed through the array site per day, with the large majority of these vessels in north/south transit.

476. Commercial vessels were recorded at anchor at the northwest of the study area below Dublin and at the west of the study area below Wicklow (see **Section B.3.3.5**).

477. **Figure B.6** and **Figure B.7** present the average number of unique passenger, cargo and tanker vessels during 2021 passing through the study area and array site respectively. Following this, **Table A.1** presents summaries of the numbers of vessels on average, the quietest month, and busiest month recorded within the study area and array site itself, respectively.

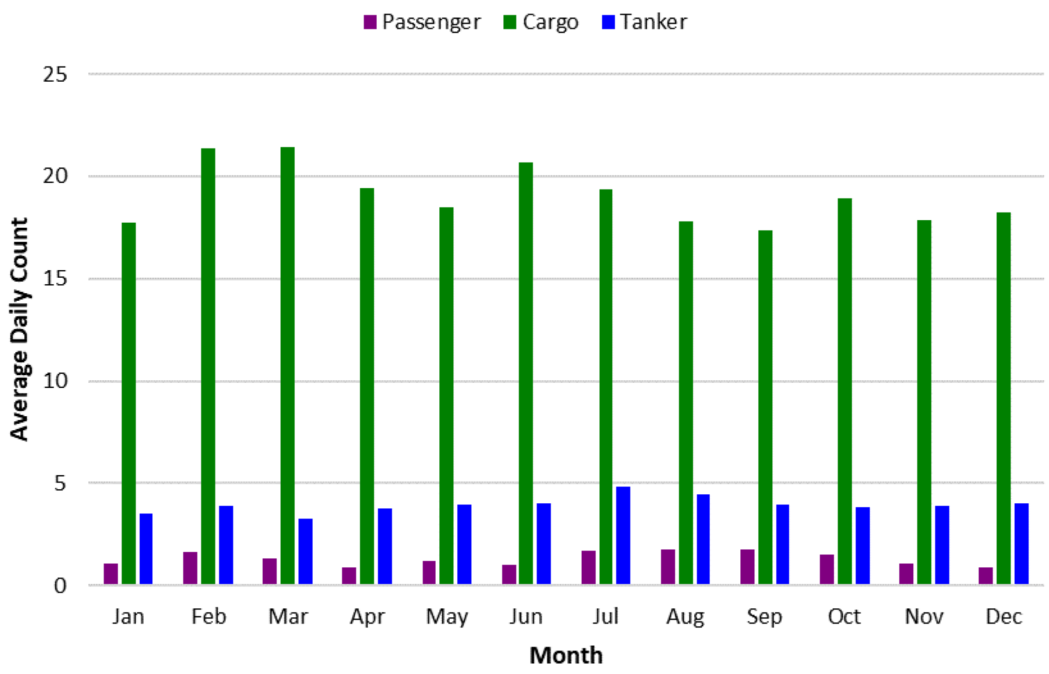

Figure B.6 Average Number of Commercial Vessels per Day Within the Study Area (12 months, 2021)

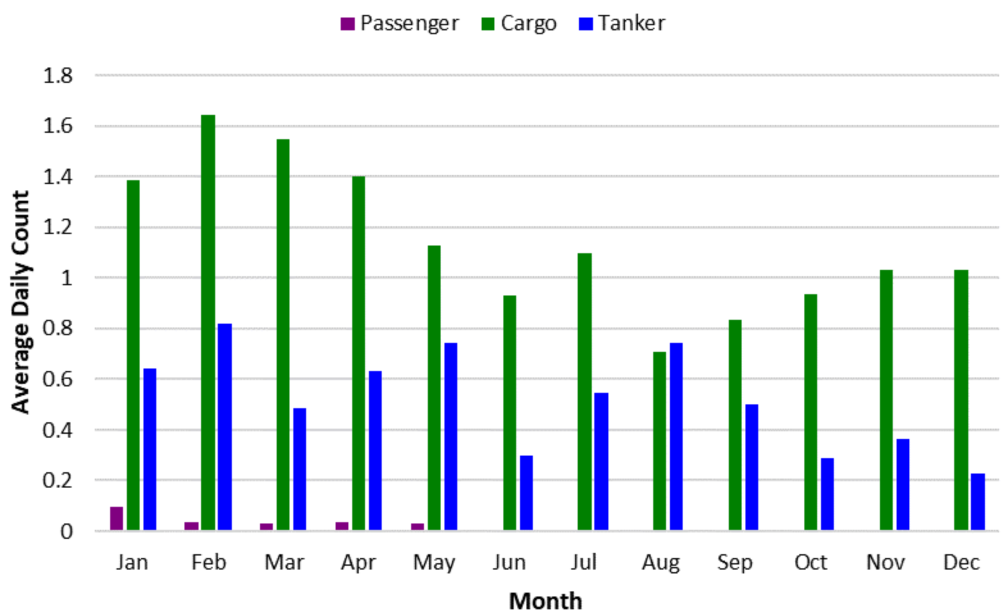

Figure B.7 Average Number of Commercial Vessels per Day Intersecting the Array Site (12 months, 2021)

Table A.1 Commercial Vessel Count Summary (12 months, 2021)

Vessel Type	Study Area			Array Site		
	Quietest	Busiest	Average	Quietest	Busiest	Average
Passenger	27	56	40	0	3	1
Cargo	521	665	579	22	48	35
Tankers	102	150	121	7	23	16

B.3.3.3 Fishing Vessels

478. **Figure B.8** presents the fishing vessels recorded via AIS within the study area during 2021. It should be considered that as this assessment is via AIS only, it is likely to be under-representative of actual fishing vessel levels.

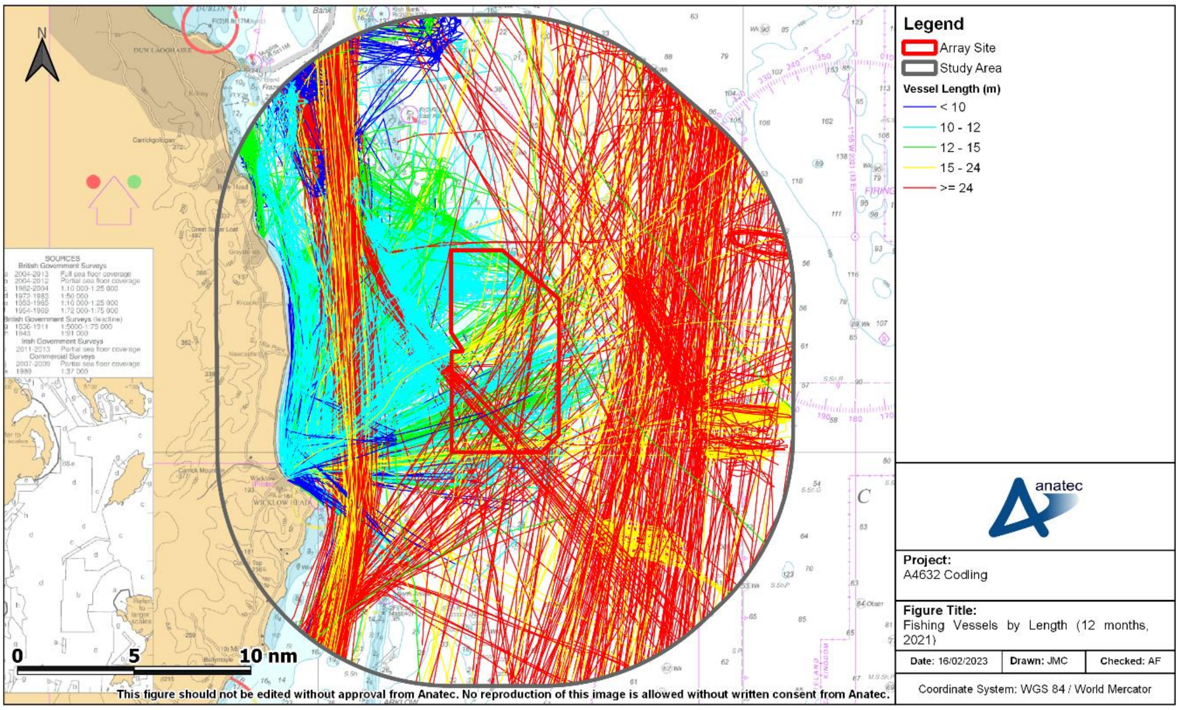

Figure B.8 Fishing Vessels by Length (12 months, 2021)

479. There was an average of five to six unique fishing vessels recorded per day within the study area during 2021. It can be seen from **Figure B.8** that the larger fishing vessels were mainly in north/south transit whereas the smaller fishing vessels were mostly concentrated inshore of the array site.

480. A speed assessment was undertaken to determine the likely status of fishing vessels within the study area (i.e., actively fishing or in transit). A speed of less than five knots for a period of at least 30 minutes may indicate potential fishing activity and such tracks have been identified and shown in **Figure B.9**. Note this is intended to be an

indicative analysis only, as there may be fishing vessels that exhibit this behaviour but which were not engaged in fishing (e.g., in approach to port).

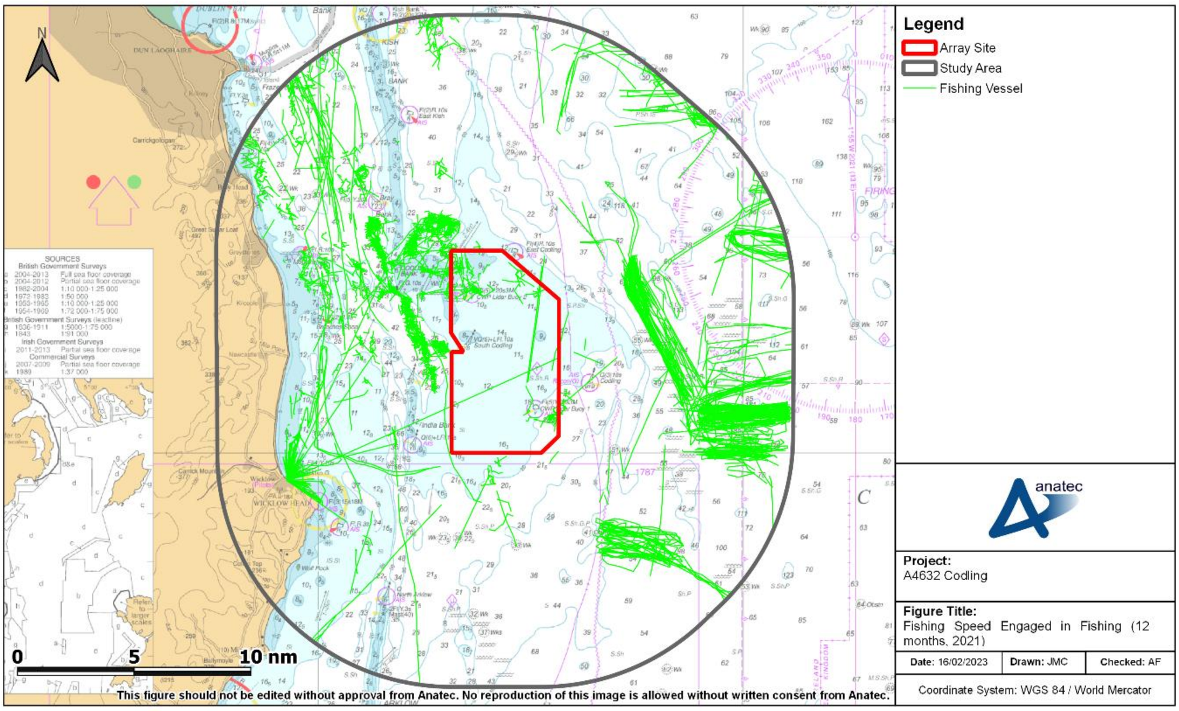

Figure B.9 Fishing Vessels Engaged in Fishing (12 months, 2021)

481. Limited activity was observed within the array site itself, with the majority of activity taking place to the east of the array site and around Codling Bank.

B.3.3.4 Recreational Vessels

482. **Figure B.10** presents the recreational vessels recorded via AIS within the study area during 2021.

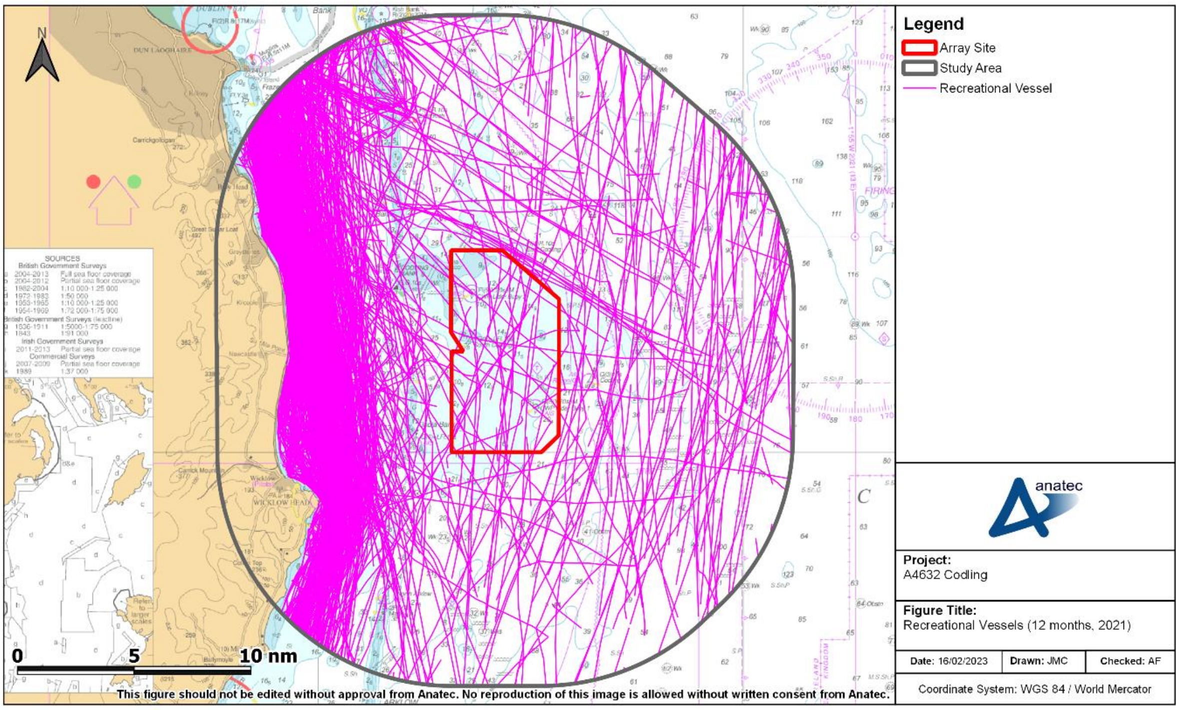

Figure B.10 Recreational Vessels (12 months, 2021)

483. Recreational activity was heavily concentrated inshore. An average of two to three unique recreational vessels were recorded per day within the study area during 2021, with most being recorded during June and July.

B.3.3.5 Anchored Vessels

484. A speed analysis has been performed on the 12-month dataset to identify vessels at anchor within the study area. This analysis has identified anchored vessels as vessels transiting at less than one knot for a period of at least 30 minutes. **Figure B.11** presents the vessels identified as at anchor within the study area during the 12-month study period.

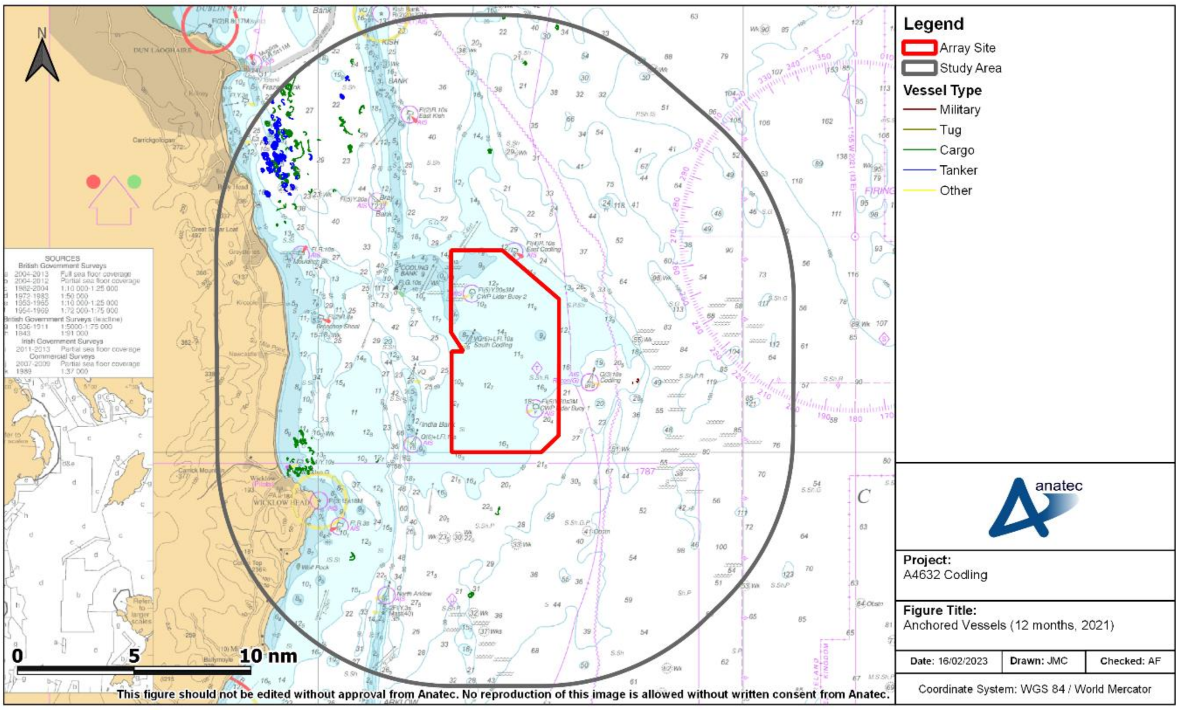

Figure B.11 Anchored Vessels (12 months, 2021)

485. It can be seen that anchored vessels were typically situated to the northwest of the array site, south of Dublin. Additionally, a number of anchored cargo vessels were also located to the west of the array site, north of Wicklow. The majority of anchored vessels were cargo and tanker vessels.

B.3.3.6 Summary

486. **Table A.2** provides a summary of the number of unique vessels, per vessel type, recorded within the study area during 2021.

Table A.2 Summary of Vessel Numbers (12 months, 2021)

Vessel Type	Quietest Month	Busiest Month	Average per Month
Fishing	89	272	166
Military	1	6	1-2
Dredger	1	8	3-4
Tug	3	15	7
Passenger	27	56	40
Cargo	521	665	579
Tanker	102	150	121
Other	8	31	19

Vessel Type	Quietest Month	Busiest Month	Average per Month
Recreational	3	216	79
Oil and gas	1	11	5
Wind farm	1	5	1-2

B.4 Survey Data Comparison

487. The routeing within the survey data was comparable to the routeing derived from the long-term data as defined in **Section 12.2**, with broad agreement that the main routes are north/south inshore of the shallow banks (i.e. Codling, Kish, Bray and India) and north/south offshore.

488. Active fishing behaviour was recorded west of the array site during all surveys. There was a similar level of daily fishing vessels recorded within the study area during all periods, with the lowest levels recorded during the winter 2023 survey period (see **Table A.3**).

489. A comparison of each main vessel type analysed in the previous sections recorded throughout the 12-month 2021 period against the average number of each vessel type recorded throughout the three vessel traffic surveys are presented in **Table A.3**.

Table A.3 Comparison of Main Vessel Type Averages During the 12-month Period and Each Survey Period

Vessel type	Long-term AIS data			Summer 2021	Summer 2022	Winter 2023
	Busiest month	Quietest month	Average vessels per day	Average vessels per day	Average vessels per day	Average vessels per day
Cargo	March	September	19	19 - 20	16	20 - 21
Tanker	July	March	4	4	3 - 4	5
Fishing	June	January	5 - 6	7	7 - 8	5 - 6
Recreational	June	February	2 - 3	3 - 4	19	2
Passenger	August	April	1 - 2	1 - 2	1 - 2	1

490. There was general agreement between the periods in terms of average vessels per day, with the largest difference being the average number of recreational vessels per day during the summer 2022 survey compared to the other periods. This is likely due to the fact that recreational traffic is weighted towards the summer season due to its more favourable weather, as well as the fact that the summer 2022 survey period encompasses a greater proportion of favourable weather compared to the summer 2021 survey period.

B.5 Summary and Conclusion

491. This annex has analysed a long-term 12-month AIS vessel traffic data set and compared the traffic behaviour, vessel numbers, and vessel types to those recorded in the vessel traffic survey data.

492. It was seen that clearly defined routes were frequented by commercial vessels, and that these routes were largely dictated by the nearby banks. The majority of fishing and recreational activity was recorded inshore, and fishing vessel activity was also recorded over Codling Bank. Most tug vessels and vessels in the "other" category were recorded travelling to/from the port at Wicklow.

493. There was an average of 34 unique vessels recorded per day within the study area during 2021, with June being the busiest and December being the quietest. The seasonal variation can be largely attributed to recreational and fishing vessel traffic levels. Commercial vessels accounted for 73% of total traffic, with cargo in particular accounting for 57% of total traffic. This was followed by fishing vessels (16%) and tankers (12%).

494. Approximately one unique commercial vessel passed through the array site every 14 hours during 2021. Commercial vessels were recorded at anchor at the northwest of the study area below Dublin and at the west of the study area below Wicklow. There was minimal variation over the 12-month period for each of the commercial vessel types. However, traffic intersecting the array site had a significant variation.

495. There was an average of five to six unique fishing vessels recorded per day within the study area during 2021. Larger fishing vessels were generally in north/south transit whereas smaller fishing vessels were mostly concentrated to the west of the array site. Limited fishing activity was observed within the array site itself, with the majority taking place to the east of the array site and around Codling Bank.

496. Recreational activity was heavily concentrated inshore, and there was an average of two to three unique recreational vessels per day with most being recorded during June and July.

497. Anchored vessels were typically situated to the northwest of the array site, south of Dublin. Additionally, a number of anchored cargo vessels were also located to the east of the array site, north of Wicklow. The majority of anchored vessels were cargo and tanker vessels.

Annex C Hazard Log

498. This annex presents the final Hazard Log. Full background details are provided in **Section 4.3**.

Table 18-1 Hazard Log

User	Isolation / Cumulative	Project Component(s)	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
							Frequency	Consequences					Risk		Frequency	Consequences					Risk	
								People	Environment	Property	Business	Average Consequence				People	Environment	Property	Business	Average Consequence		
Displacement from Routeing with Potential for Collision																						
Commercial vessels	Isolation	Array area	C/D	- Display on charts; - Promulgation of information; - Lighting and marking; - Emergency response plans and procedures.	• Presence of buoyed construction/ decommissioning area • Construction/ decommissioning vessels which are RAM	Increased encounters but does not impact on compliance with COLREGs Increased journey time/distance but does not impact on schedules	4	1	1	1	2	1.3	Broadly Acceptable	Increased encounters and impacts on compliance with COLREGs potentially leading to increased journey time, impacts on schedules and increased collisions	1	4	3	4	4	3.8	Broadly Acceptable	General consensus was that commercial vessels would be unlikely to enter array site aligning with UK experience.
			O	- Display on charts; - Promulgation of information; - Lighting and marking; - Emergency response plans and procedures.	• Presence of surface structures • Maintenance vessels which are RAM		4	1	1	1	2	1.3	Broadly Acceptable		2	4	3	4	4	3.8	Broadly Acceptable	
		Export cables	C/D	- Display on charts; - Promulgation of information; - Emergency response plans and procedures.	• Construction/ decommissioning vessels which are RAM	Increased encounters but does not impact on compliance with COLREGs Increased journey time/distance but does not impact on schedules	4	1	1	1	2	1.3	Broadly Acceptable	Increased encounters and impacts on compliance with COLREGs potentially leading to increased journey time, impacts on schedules and increased collisions	1	4	3	4	4	3.8	Broadly Acceptable	Specific concern was raised at the workshop in relation to vessels deviating to avoid cable installation works inshore of the banks, in particular for vessels on infrequent transits. Effective promulgation of information was stated as a key mitigation, and use of guard vessels to alert approaching vessels was suggested. It was noted that risk also managed by COLREGS.

User	Isolation / Cumulative	Project Component(s)	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
							Frequency	Consequences					Risk		Frequency	Consequences					Risk	
								People	Environment	Property	Business	Average Consequence				People	Environment	Property	Business	Average Consequence		
			O	- Display on charts; - Promulgation of information; - Emergency response plans and procedures.	• Maintenance vessels which are RAM		3	1	1	1	2	1.3	Broadly Acceptable		1	4	3	4	4	3.8	Broadly Acceptable	
	Cumulative	Array area	C/D	- Display on charts; - Promulgation of information; - Lighting and marking; - Emergency response plans and procedures.	• Simultaneous buoyed construction/ decommissioning areas for • Construction vessels which are RAM	Increased encounters but does not impact on compliance with COLREGs Increased journey time/distance but does not impact on schedules	5	1	1	1	2	1.3	Tolerable	Increased encounters and impacts on compliance with COLREGs potentially leading to increased journey time, impacts on schedules and increased collisions	2	3	3	4	5	3.8	Broadly Acceptable	General consensus was that commercial vessels would be unlikely to enter array site aligning with UK experience. On a cumulative basis, Noted that even if inshore searoom is not being reduced (due to the banks), there may be a "perceived" loss of searoom leading to narrower routeing.
			O	- Display on charts; - Promulgation of information; - Lighting and marking; - Emergency response plans and procedures.	• Presence of surface structures • Maintenance vessels which are RAM		5	1	1	1	2	1.3	Tolerable		1	3	3	4	5	3.8	Broadly Acceptable	
		Export cables	C/D	- Display on charts; - Promulgation of information; - Emergency response plans and procedures.	• Construction/ decommissioning vessels which are RAM	Increased encounters but does not impact on compliance with COLREGs Increased journey time/distance but does not impact on schedules	5	1	1	1	2	1.3	Tolerable	Increased encounters and impacts on compliance with COLREGs potentially leading to increased journey time, impacts on schedules and increased collisions	3	4	3	4	4	3.8	Tolerable	Specific concern was raised at the workshop in relation to vessels deviating to avoid cable installation works inshore of the banks, in particular for vessels on infrequent transits. Effective promulgation of information was stated as a key mitigation, and use of guard vessels to alert approaching vessels was suggested. It was noted that risk also managed by COLREGS.

User	Isolation / Cumulative	Project Component(s)	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
							Frequency	Consequences					Risk		Frequency	Consequences					Risk	
								People	Environment	Property	Business	Average Consequence				People	Environment	Property	Business	Average Consequence		
			O	- Display on charts; - Promulgation of information; - Emergency response plans and procedures.	• Maintenance vessels which are RAM		3	1	1	1	2	1.3	Broadly Acceptable		1	4	3	4	4	3.8	Broadly Acceptable	
Fishing vessels	Isolation	Array area	C/D	- Display on charts; - Promulgation of information; - Lighting and marking; - Emergency response plans and procedures.	• Presence of buoyed construction/ decommissioning area • Construction/ decommissioning vessels which are RAM	Increased encounters but does not impact on compliance with COLREGs Increased journey time/distance but does not impact on schedules	4	1	1	1	2	1.3	Broadly Acceptable	Increased encounters and impacts on compliance with COLREGs potentially leading to increased journey time, impacts on schedules and increased collisions	1	4	3	4	4	3.8	Broadly Acceptable	
			O	- Display on charts; - Promulgation of information; - Lighting and marking; - Emergency response plans and procedures.	• Presence of surface structures • Maintenance vessels which are RAM		3	1	1	1	2	1.3	Broadly Acceptable		1	4	3	4	4	3.8	Broadly Acceptable	
		Export cables	C/D	- Display on charts; - Promulgation of information; - Emergency response plans and procedures.	• Construction/ decommissioning vessels which are RAM	Increased encounters but does not impact on compliance with COLREGs Increased journey time/distance but does not impact on schedules	4	1	1	1	2	1.3	Broadly Acceptable	Increased encounters and impacts on compliance with COLREGs potentially leading to increased journey time, impacts on schedules and increased collisions	2	4	3	4	4	3.8	Broadly Acceptable	Specific concern was raised at the workshop in relation to vessels deviating to avoid cable installation works inshore of the banks. Effective promulgation of information was stated as a key mitigation, and use of guard vessels to alert approaching vessels was suggested. It was noted that risk also managed by COLREGS.

User	Isolation / Cumulative	Project Component(s)	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
							Frequency	Consequences					Risk		Frequency	Consequences					Risk	
								People	Environment	Property	Business	Average Consequence				People	Environment	Property	Business	Average Consequence		
			O	- Display on charts; - Promulgation of information; - Emergency response plans and procedures.	• Maintenance vessels which are RAM		3	1	1	1	2	1.3	Broadly Acceptable		1	4	3	4	4	3.8	Broadly Acceptable	
	Cumulative	Array area	C/D	- Display on charts; - Promulgation of information; - Lighting and marking; - Emergency response plans and procedures.	• Simultaneous buoyed construction/ decommissioning areas for • Construction vessels which are RAM	Increased encounters but does not impact on compliance with COLREGs Increased journey time/distance but does not impact on schedules	5	1	1	1	2	1.3	Tolerable	Increased encounters and impacts on compliance with COLREGs potentially leading to increased journey time, impacts on schedules and increased collisions	2	3	3	4	5	3.8	Broadly Acceptable	
			O	- Display on charts; - Promulgation of information; - Lighting and marking; - Emergency response plans and procedures.	• Presence of surface structures • Maintenance vessels which are RAM		4	1	1	1	2	1.3	Broadly Acceptable		1	3	3	4	5	3.8	Broadly Acceptable	
		Export cables		- Display on charts; - Promulgation of information; - Emergency response plans and procedures.	• Construction/ decommissioning vessels which are RAM	Increased encounters but does not impact on compliance with COLREGs Increased journey time/distance but does not impact on schedules	5	1	1	1	2	1.3	Tolerable	Increased encounters and impacts on compliance with COLREGs potentially leading to increased journey time, impacts on schedules and increased collisions	3	4	3	4	4	3.8	Tolerable	Specific concern was raised at the workshop in relation to vessels deviating to avoid cable installation works inshore of the banks. Effective promulgation of information was stated as a key mitigation, and use of guard vessels to alert approaching vessels was suggested. It was noted that risk also managed by COLREGS.

User	Isolation / Cumulative	Project Component(s)	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
				- Display on charts; - Promulgation of information; - Emergency response plans and procedures.	• Maintenance vessels which are RAM		3	1	1	1	2	1.3	Broadly Acceptable		1	4	3	4	4	3.8	Broadly Acceptable	
Recreational vessels (2.5 to 24m length)	Isolation	Array area	C/D	- Display on charts; - Promulgation of information; - Lighting and marking; - Emergency response plans and procedures.	• Presence of buoyed construction/ decommissioning area • Construction/ decommissioning vessels which are RAM	Increased encounters but does not impact on compliance with COLREGs Increased journey time/distance but does not impact on schedules	4	1	1	1	2	1.3	Broadly Acceptable	Increased encounters and impacts on compliance with COLREGs potentially leading to increased journey time, impacts on schedules and increased collisions	1	4	3	4	4	3.8	Broadly Acceptable	
			O	- Display on charts; - Promulgation of information; - Lighting and marking; - Emergency response plans and procedures.	• Presence of surface structures • Maintenance vessels which are RAM		4	1	1	1	2	1.3	Broadly Acceptable		1	4	3	4	4	3.8	Broadly Acceptable	
		Export cables	C/D	- Display on charts; - Promulgation of information; - Emergency response plans and procedures.	• Construction/ decommissioning vessels which are RAM	Increased encounters but does not impact on compliance with COLREGs Increased journey time/distance but does not impact on schedules	4	1	1	1	2	1.3	Broadly Acceptable	Increased encounters and impacts on compliance with COLREGs potentially leading to increased journey time, impacts on schedules and increased collisions	1	4	3	4	4	3.8	Broadly Acceptable	Specific concern was raised at the workshop in relation to vessels deviating to avoid cable installation works inshore of the banks. Effective promulgation of information was stated as a key mitigation, and use of guard vessels to alert approaching vessel.

User	Isolation / Cumulative	Project Component(s)	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
							Frequency	Consequences					Risk		Frequency	Consequences					Risk	
								People	Environment	Property	Business	Average Consequence				People	Environment	Property	Business	Average Consequence		
			O	- Display on charts; - Promulgation of information; - Emergency response plans and procedures.	• Maintenance vessels which are RAM		3	1	1	1	2	1.3	Broadly Acceptable		1	4	3	4	4	3.8	Broadly Acceptable	
	Cumulative	Array area	C/D	- Display on charts; - Promulgation of information; - Lighting and marking; - Emergency response plans and procedures.	• Simultaneous buoyed construction/ decommissioning areas for • Construction vessels which are RAM	Increased encounters but does not impact on compliance with COLREGsIncreased journey time/distance but does not impact on schedules	5	1	1	1	2	1.3	Tolerable	Increased encounters and impacts on compliance with COLREGs potentially leading to increased journey time, impacts on schedules and increased collisions	2	3	3	4	5	3.8	Broadly Acceptable	
			O	- Display on charts; - Promulgation of information; - Lighting and marking; - Emergency response plans and procedures.	• Presence of surface structures • Maintenance vessels which are RAM		5	1	1	1	2	1.3	Tolerable		2	3	3	4	5	3.8	Broadly Acceptable	
		Export cables	C/D	- Display on charts; - Promulgation of information; - Emergency response plans and procedures.	• Construction/ decommissioning vessels which are RAM	Increased encounters but does not impact on compliance with COLREGs Increased journey time/distance but does not impact on schedules	5	1	1	1	2	1.3	Tolerable	Increased encounters and impacts on compliance with COLREGs potentially leading to increased journey time, impacts on schedules and increased collisions	3	4	3	4	4	3.8	Tolerable	Specific concern was raised at the workshop in relation to vessels deviating to avoid cable installation works inshore of the banks. Effective promulgation of information was stated as a key mitigation, and use of guard vessels to alert approaching vessel.

User	Isolation / Cumulative	Project Component(s)	Phase (C/O/D)	Embedded Mitigation Measures (Full Descriptions Provided in Separate Sheet)	Possible Causes	Most Likely Consequences	Realistic Most Likely Consequences: Frequency	Realistic Most Likely Consequences: People	Realistic Most Likely Consequences: Environment	Realistic Most Likely Consequences: Property	Realistic Most Likely Consequences: Business	Realistic Most Likely Consequences: Average Consequence	Realistic Most Likely Consequences: Risk	Worst Case Consequences	Realistic Worst Case Consequences: Frequency	Realistic Worst Case Consequences: People	Realistic Worst Case Consequences: Environment	Realistic Worst Case Consequences: Property	Realistic Worst Case Consequences: Business	Realistic Worst Case Consequences: Average Consequence	Realistic Worst Case Consequences: Risk	Additional Comments
			O	- Display on charts; - Promulgation of information; - Emergency response plans and procedures.	• Maintenance vessels which are RAM		3	1	1	1	2	1.3	Broadly Acceptable		1	4	3	4	4	3.8	Broadly Acceptable	
Collision Risk (Third-Party with Project Vessel in Transit)																						
Commercial vessels	Isolation	Array Area	C/D	- Display on charts; - Promulgation of information; - Buoyed construction / decommissioning area; - Advisory safe passing distances; - Marine Coordination; - Lighting and marking; - COLREGS/ SOLAS; - Emergency response plans and procedures; - Guard vessel(s) as required by risk assessment.	• Project vessels in transit or within array site • Lack of third-party awareness	Increased encounters resulting in increased alertness but no safety risks	4	1	1	1	2	1.3	Broadly Acceptable	Collision event occurs involving vessel damage, injury to person and/or pollution	3	4	3	4	4	3.8	Tolerable	
			O				3	1	1	1	2	1.3	Broadly Acceptable		2	4	3	4	4	3.8	Broadly Acceptable	
		Export cables	C/D	- Display on charts; - Promulgation of information; - Buoyed construction / decommissioning	• Project vessels in transit or within cable corridor • Lack of third-party awareness	Increased encounters resulting in increased alertness but no safety risks	5	1	1	1	2	1.3	Tolerable	Collision event occurs involving vessel damage, injury to person and/or pollution	3	4	3	4	4	3.8	Tolerable	

User	Isolation / Cumulative	Project Component(s)	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
							Frequency	Consequences					Risk		Frequency	Consequences					Risk	
								People	Environment	Property	Business	Average Consequence				People	Environment	Property	Business	Average Consequence		
			O	area; - Advisory safe passing distances; - Marine Coordination; - Lighting and marking; - COLREGS/ SOLAS; - Emergency response plans and procedures; - Guard vessel(s) as required by risk assessment.			3	1	1	1	2	1.3	Broadly Acceptable		1	4	3	4	4	3.8	Broadly Acceptable	
	Cumulative	Array Area	C/D	- Display on charts; - Promulgation of information; - Buoyed construction / decommissioning area; - Advisory safe passing distances; - Marine Coordination; - Lighting and marking; - COLREGS/ SOLAS; - Emergency response plans and procedures; - Guard vessel(s) as required by risk assessment.	• Project vessels in transit or within array sites • Lack of third-party awareness • Simultaneous installation from same or similar ports	Increased encounters resulting in increased alertness but no safety risks	5	1	1	1	2	1.3	Tolerable	Collision event occurs involving vessel damage, injury to person and/or pollution	3	3	3	4	5	3.8	Tolerable	
			O				4	1	1	1	2	1.3	Broadly Acceptable		2	3	3	4	5	3.8	Broadly Acceptable	

User	Isolation / Cumulative	Project Component(s)	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
							Frequency	Consequences					Risk		Frequency	Consequences					Risk	
								People	Environment	Property	Business	Average Consequence				People	Environment	Property	Business	Average Consequence		
		Export cables	C/D	- Display on charts; - Promulgation of information; - Buoyed construction / decommissioning area; - Advisory safe passing distances; - Marine Coordination; - Lighting and marking; - COLREGS/ SOLAS; - Emergency response plans and procedures; - Guard vessel(s) as required by risk assessment.	• Project vessels in transit or in cable corridors • Lack of third-party awareness • Simultaneous operation from same or similar ports	Increased encounters resulting in increased alertness but no safety risks	5	1	1	1	2	1.3	Tolerable	Collision event occurs involving vessel damage, injury to person and/or pollution	3	4	3	4	4	3.8	Tolerable	
			O				3	1	1	1	2	1.3	Broadly Acceptable		1	4	3	4	4	3.8	Broadly Acceptable	
Commercial fishing vessels in transit	Isolation	Array Area	C/D	- Display on charts; - Promulgation of information; - Buoyed construction / decommissioning area; - Advisory safe passing distances; - Marine Coordination; - Lighting and marking; - COLREGS/ SOLAS; - Emergency response plans and procedures; - Guard vessel(s) as required by risk assessment.	• Project vessels in transit or within array site • Lack of third-party awareness	Increased encounters resulting in increased alertness but no safety risks	4	1	1	1	2	1.3	Broadly Acceptable	Collision event occurs involving vessel damage, injury to person and/or pollution	3	4	3	4	4	3.8	Tolerable	
			O				3	1	1	1	2	1.3	Broadly Acceptable		2	4	3	4	4	3.8	Broadly Acceptable	

User	Isolation / Cumulative	Project Component(s)	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
							Frequency	Consequences					Risk		Frequency	Consequences					Risk	
								People	Environment	Property	Business	Average Consequence				People	Environment	Property	Business	Average Consequence		
		Export cables	C/D	- Display on charts; - Promulgation of information; - Buoyed construction / decommissioning area; - Advisory safe passing distances; - Marine Coordination; - Lighting and marking; - COLREGS/ SOLAS; - Emergency response plans and procedures; - Guard vessel(s) as required by risk assessment.	• Project vessels in transit or within cable corridor • Lack of third-party awareness	Increased encounters resulting in increased alertness but no safety risks	5	1	1	1	2	1.3	Tolerable	Collision event occurs involving vessel damage, injury to person and/or pollution	3	4	3	4	4	3.8	Tolerable	
			O				3	1	1	1	2	1.3	Broadly Acceptable		2	4	3	4	4	3.8	Broadly Acceptable	
	Cumulative	Array Area	C/D	- Display on charts; - Promulgation of information; - Buoyed construction / decommissioning area; - Advisory safe passing distances; - Marine Coordination; - Lighting and marking; - COLREGS/ SOLAS; - Emergency response plans and procedures; - Guard vessel(s) as required by risk assessment.	• Project vessels in transit or within array sites • Lack of third-party awareness • Simultaneous installation from same or similar ports	Increased encounters resulting in increased alertness but no safety risks	5	1	1	1	2	1.3	Tolerable	Collision event occurs involving vessel damage, injury to person and/or pollution	3	3	3	4	5	3.8	Tolerable	
			O				4	1	1	1	2	1.3	Broadly Acceptable		2	3	3	4	5	3.8	Broadly Acceptable	

User	Isolation / Cumulative	Project Component(s)	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
							Frequency	Consequences					Risk		Frequency	Consequences					Risk	
								People	Environment	Property	Business	Average Consequence				People	Environment	Property	Business	Average Consequence		
		Export cables	C/D	- Display on charts; - Promulgation of information; - Buoyed construction / decommissioning area; - Advisory safe passing distances; - Marine Coordination; - Lighting and marking; - COLREGS/ SOLAS; - Emergency response plans and procedures; - Guard vessel(s) as required by risk assessment.	• Project vessels in transit or in cable corridors • Lack of third-party awareness • Simultaneous operation from same or similar ports	Increased encounters resulting in increased alertness but no safety risks	5	1	1	1	2	1.3	Tolerable	Collision event occurs involving vessel damage, injury to person and/or pollution	3	4	3	4	4	3.8	Tolerable	
			O				3	1	1	1	2	1.3	Broadly Acceptable		1	4	3	4	4	3.8	Broadly Acceptable	
Recreational vessels (2.5 to 24m length)	Isolation	Array area	C/D	- Display on charts; - Promulgation of information; - Buoyed construction / decommissioning area; - Advisory safe passing distances; - Marine Coordination; - Lighting and marking; - COLREGS/ SOLAS; - Emergency response plans and procedures; - Guard vessel(s) as required by risk assessment.	• Project vessels in transit or within array site • Lack of third-party awareness	Increased encounters resulting in increased alertness but no safety risks	4	1	1	1	2	1.3	Broadly Acceptable	Collision event occurs involving vessel damage, injury to person and/or pollution	3	4	3	4	4	3.8	Tolerable	
			O				3	1	1	1	2	1.3	Broadly Acceptable		2	4	3	4	4	3.8	Broadly Acceptable	

User	Isolation / Cumulative	Project Component(s)	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
		Export cables	C/D	- Display on charts; - Promulgation of information; - Buoyed construction / decommissioning area; - Advisory safe passing distances; - Marine Coordination; - Lighting and marking; - COLREGS/ SOLAS; - Emergency response plans and procedures; - Guard vessel(s) as required by risk assessment.	• Project vessels in transit or within cable corridor • Lack of third-party awareness	Increased encounters resulting in increased alertness but no safety risks	5	1	1	1	2	1.3	Tolerable	Collision event occurs involving vessel damage, injury to person and/or pollution	3	4	3	4	4	3.8	Tolerable	
			O				3	1	1	1	2	1.3	Broadly Acceptable		1	4	3	4	4	3.8	Broadly Acceptable	
	Cumulative	Array area	C/D	- Display on charts; - Promulgation of information; - Buoyed construction / decommissioning area; - Advisory safe passing distances; - Marine Coordination; - Lighting and marking; - COLREGS/ SOLAS; - Emergency response plans and procedures; - Guard vessel(s) as required by risk assessment.	• Project vessels in transit or within array sites • Lack of third-party awareness • Simultaneous installation from same or similar ports	Increased encounters resulting in increased alertness but no safety risks	5	1	1	1	2	1.3	Tolerable	Collision event occurs involving vessel damage, injury to person and/or pollution	3	3	3	4	5	3.8	Tolerable	
			O				4	1	1	1	2	1.3	Broadly Acceptable		2	3	3	4	5	3.8	Broadly Acceptable	

User	Isolation / Cumulative	Project Component(s)	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
							Frequency	Consequences					Risk		Frequency	Consequences					Risk	
								People	Environment	Property	Business	Average Consequence				People	Environment	Property	Business	Average Consequence		
		Export cables	C/D	- Display on charts; - Promulgation of information; - Buoyed construction / decommissioning area; - Advisory safe passing distances; - Marine Coordination; - Lighting and marking; - COLREGS/ SOLAS; - Emergency response plans and procedures; - Guard vessel(s) as required by risk assessment.	• Project vessels in transit or in cable corridors • Lack of third-party awareness • Simultaneous operation from same or similar ports	Increased encounters resulting in increased alertness but no safety risks	5	1	1	1	2	1.3	Tolerable	Collision event occurs involving vessel damage, injury to person and/or pollution	3	4	3	4	4	3.8	Tolerable	
			O				3	1	1	1	2	1.3	Broadly Acceptable		1	4	3	4	4	3.8	Broadly Acceptable	
Allision Risk (Powered, Drifting or Internal)																						
Commercial vessels	Isolation	Array area	C/D	- Display on charts; - Promulgation of information; - Buoyed construction / decommissioning area; - Advisory safe passing distances; - Lighting and marking; - Emergency response plans and procedures; - Layout design; - Guard vessel(s) as required by risk assessment.	• 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 involving vessel damage, injury to person and/or pollution	2	3	3	4	4	3.5	Broadly Acceptable	General consensus was that there was not a significant level of concern around allision for commercial vessels given the presence of the banks between site and anticipated routes. Lighting and marking deemed key mitigation. Noted that tides run north / south in area and hence limited concern on drifting risk.

User	Isolation / Cumulative	Project Component(s)	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
							Frequency	Consequences					Risk		Frequency	Consequences					Risk	
								People	Environment	Property	Business	Average Consequence				People	Environment	Property	Business	Average Consequence		
			O	- Display on charts; - Promulgation of information; - Advisory safe passing distances; - Lighting and marking; - Emergency response plans and procedures; - Layout design; - Guard vessel(s) as required by risk assessment.	• Presence of surface structures • Human/navigation error • Mechanical/technical failure • Adverse weather • Aid to navigation failure		3	1	1	1	1	1.0	Broadly Acceptable		2	3	3	4	4	3.5	Broadly Acceptable	
	Cumulative		C/D	- Display on charts; - Promulgation of information; - Buoyed construction / decommissioning area; - Advisory safe passing distances; - Lighting and marking; - Emergency response plans and procedures; - Layout design; - Guard vessel(s) as required by risk assessment.	• Presence of surface structures • Human/navigation error • Mechanical/technical failure • Adverse weather • Aid to navigation failure		4	1	1	1	1	1.0	Broadly Acceptable		2	3	3	4	4	3.5	Broadly Acceptable	Lighting and marking deemed key mitigation.
			O	- Display on charts; - Promulgation of information; - Advisory safe passing distances; - Lighting and marking; - Emergency response plans and procedures; - Layout design;	• Presence of surface structures • Human/navigation error • Mechanical/technical failure • Adverse weather • Aid to navigation failure		4	1	1	1	1	1.0	Broadly Acceptable		2	3	3	4	4	3.5	Broadly Acceptable	

User	Isolation / Cumulative	Project Component(s)	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	Environment	Property	Business	Average Consequence	Risk	Worst Case Consequences	Realistic Worst Case Consequences: Frequency	Consequences: People	Environment	Property	Business	Average Consequence	Risk	Additional Comments
				- Guard vessel(s) as required by risk assessment.																		
Commercial fishing vessels in transit	Isolation	Array area	C/D	- Display on charts; - Promulgation of information; - Buoyed construction / decommissioning area; - Advisory safe passing distances; - Lighting and marking; - Emergency response plans and procedures; - Layout design; - Guard vessel(s) as required by risk assessment.	• 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 involving vessel damage, injury to person and/or pollution	2	3	3	4	4	3.5	Broadly Acceptable	Lighting and marking deemed key mitigation.
			O	- Display on charts; - Promulgation of information; - Advisory safe passing distances; - Lighting and marking; - Emergency response plans and procedures; - Layout design; - Guard vessel(s) as required by risk assessment.	• Presence of surface structures • Human/navigation error • Mechanical/technical failure • Adverse weather • Aid to navigation failure		4	1	1	1	1	1.0	Broadly Acceptable		2	3	3	4	4	3.5	Broadly Acceptable	

User	Isolation / Cumulative	Project Component(s)	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
							Frequency	Consequences					Risk		Frequency	Consequences					Risk	
								People	Environment	Property	Business	Average Consequence				People	Environment	Property	Business	Average Consequence		
	Cumulative		C/D	- Display on charts; - Promulgation of information; - Buoyed construction / decommissioning area; - Advisory safe passing distances; - Lighting and marking; - Emergency response plans and procedures; - Layout design; - Guard vessel(s) as required by risk assessment.	• Presence of surface structures • Human/navigation error • Mechanical/technical failure • Adverse weather • Aid to navigation failure		4	1	1	1	1	1.0	Broadly Acceptable		2	3	3	4	4	3.5	Broadly Acceptable	Lighting and marking deemed key mitigation.
			O	- Display on charts; - Promulgation of information; - Advisory safe passing distances; - Lighting and marking; - Emergency response plans and procedures; - Layout design; - Guard vessel(s) as required by risk assessment.	• Presence of surface structures • Human/navigation error • Mechanical/technical failure • Adverse weather • Aid to navigation failure		4	1	1	1	1	1.0	Broadly Acceptable		2	3	3	4	4	3.5	Broadly Acceptable	

User	Isolation / Cumulative	Project Component(s)	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
							Frequency	Consequences					Risk		Frequency	Consequences					Risk	
								People	Environment	Property	Business	Average Consequence				People	Environment	Property	Business	Average Consequence		
Recreational vessels (2.5 to 24m length)	Isolation	Array area	C/D	- Display on charts; - Promulgation of information; - Buoyed construction / decommissioning area; - Advisory safe passing distances; - Lighting and marking; - Minimum blade clearance; - Emergency response plans and procedures; - Layout design;- Guard vessel(s) as required by risk assessment.	• 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 involving vessel damage, injury to person and/or pollution	2	3	3	4	4	3.5	Broadly Acceptable	General consensus was that most recreational vessels in the area would avoid the array site. Lighting and marking deemed key mitigation.
			O	- Display on charts; - Promulgation of information; - Advisory safe passing distances; - Lighting and marking; - Emergency response plans and procedures; - Layout design; - Guard vessel(s) as required by risk assessment.	• Presence of surface structures • Human/navigation error • Mechanical/technical failure • Adverse weather • Aid to navigation failure		3	1	1	1	1	1.0	Broadly Acceptable		2	3	3	4	4	3.5	Broadly Acceptable	

User	Isolation / Cumulative	Project Component(s)	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
							Frequency	Consequences					Risk		Frequency	Consequences					Risk	
								People	Environment	Property	Business	Average Consequence				People	Environment	Property	Business	Average Consequence		
	Cumulative		C/D	- Display on charts; - Promulgation of information; - Buoyed construction / decommissioning area; - Advisory safe passing distances; - Lighting and marking; - Minimum blade clearance; - Emergency response plans and procedures; - Layout design; - Guard vessel(s) as required by risk assessment.	• Presence of surface structures • Human/navigation error • Mechanical/technical failure • Adverse weather • Aid to navigation failure		4	1	1	1	1	1.0	Broadly Acceptable		2	3	3	4	4	3.5	Broadly Acceptable	General consensus was that most recreational vessels in the area would avoid the array sites. Lighting and marking deemed key mitigation.
			O	- Display on charts; - Promulgation of information; - Advisory safe passing distances; - Lighting and marking; - Minimum blade clearance; - Emergency response plans and procedures; - Layout design; - Guard vessel(s) as required by risk assessment.	• Presence of surface structures • Human/navigation error • Mechanical/technical failure • Adverse weather • Aid to navigation failure		4	1	1	1	1	1.0	Broadly Acceptable		2	3	3	4	4	3.5	Broadly Acceptable	
Interference with Marine Navigation, Communication and Position Fixing Equipment																						

User	Isolation / Cumulative	Project Component(s)	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
							Frequency	Consequences					Risk		Frequency	Consequences					Risk	
								People	Environment	Property	Business	Average Consequence				People	Environment	Property	Business	Average Consequence		
All vessels	Isolation	Array area	O	- Display on charts; - Promulgation of information; - Lighting and marking; - Layout design.	• Human error relating to adjustment of Radar controls • Presence of surface structures	Structures have no effect upon the Radar, communications and navigation equipment on a vessel	4	1	1	1	1	1.0	Broadly Acceptable	Minor but manageable level of Radar interference due to the structures	3	1	1	1	1	1.0	Broadly Acceptable	No concerns were raised on impacts to radar when query raised.
Reduction in Emergency Response Capability																						
Emergency responders	Isolation	Array area	C/D	- Marine Coordination; - COLREGS/ SOLAS; - Emergency response plans and procedures; - Layout design; - Guard vessel(s) as required by risk assessment.	• Under construction array does not facilitate responder access • Limited resource capability • Adverse weather	Delay to emergency response request	4	1	1	1	1	1.0	Broadly Acceptable	Delay to response request leading to injury to person or loss of life	2	4	4	5	4	4.3	Tolerable	
			O		• Array does not facilitate responder access • Limited resource capability • Adverse weather		4	1	1	1	1	1.0	Broadly Acceptable		2	4	4	5	4	4.3	Tolerable	

User	Isolation / Cumulative	Project Component(s)	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
							Frequency	Consequences					Risk		Frequency	Consequences					Risk	
								People	Environment	Property	Business	Average Consequence				People	Environment	Property	Business	Average Consequence		
	Cumulative	Array area	C/D	- Marine Coordination; - COLREGS/ SOLAS; - Emergency response plans and procedures; - Layout design; - Guard vessel(s) as required by risk assessment.	• Simultaneous buoyed construction/ decommissioning areas • Under construction array does not facilitate responder access • Limited resource capability • Adverse weather	Delay to emergency response request	4	1	1	1	1	1.0	Broadly Acceptable	Delay to response request leading to injury or loss of life	2	4	4	5	4	4.3	Tolerable	
			O		• Simultaneous operation • Array does not facilitate responder access • Limited resource capability • Adverse weather		4	1	1	1	1	1.0	Broadly Acceptable		2	4	4	5	4	4.3	Tolerable	
Reduction in Under keel Clearance																						
All vessels	Isolation	Subsea cables	O	- Display on charts; - Promulgation of information; - Advisory safe passing distances; - Cable burial risk assessment.	• Presence of cable protection causes reduction in water depth • Human error or navigational error	Vessel transits over a area of reduced clearance causing vibration etc. but does not make contact	4	1	1	1	1	1.0	Broadly Acceptable	Vessel makes contact with cable protection / infrastructure resulting in damage to the vessel and potentially pollution.	3	3	3	3	3	3.0	Tolerable	Suggested that Dublin and Dun Laoghaire should input into CBRA process. Both indicated depths should not be reduced in Dun Laoghaire approach. Noted that MGN 654 provisions mitigate this risk in UK however new Irish guidance yet to be released.
Anchor Interaction with Cables																						

User	Isolation / Cumulative	Project Component(s)	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
							Frequency	Consequences					Risk		Frequency	Consequences					Risk	
								People	Environment	Property	Business	Average Consequence				People	Environment	Property	Business	Average Consequence		
All vessels	Isolation	Subsea cables	O	- Display on charts; - Promulgation of information; - Cable burial risk assessment.	• Presence of subsea cables • Insufficient cable burial/protection • Emergency Incident requiring vessel to anchor unplanned • Human error or navigational error	Vessel anchors on or drags anchor over an installed cable/protection or other subsea infrastructure but no interaction occurs.	3	1	1	1	1	1.0	Broadly Acceptable	Vessel anchors on or drags anchor over an installed cable, cable protection or other subsea infrastructure resulting in damage to the cable/protection and/or anchor.	2	2	2	2	2	2.0	Broadly Acceptable	Suggested that Dublin and Dun Laoghaire should input into CBRA process. Key concern was emergency anchoring as opposed to planned anchoring.

Annex D Consequences

499. This annex presents an assessment of the consequences of collision and allision incidents, in terms of people and the environment, due to the presence of the CWP Project.

500. The significance of the impact due to the presence of the CWP Project is also assessed based on risk evaluation criteria and comparison with historical incident data in UK waters[8] (UK statistics have been used on a comparative basis for the CWP Project).

D.1 Risk Evaluation Criteria

D.1.1 Risk to People

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

- Individual risk; and
- Societal risk.

D.1.1.1 Individual Risk

502. Individual risk considers whether the risk from an incident to a particular individual changes significantly due to the presence of the CWP Project. 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.

503. The purpose of estimating the individual risk is to ensure that individuals who may be affected by the presence of the CWP Project 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 CWP Project relative to the UK background individual risk levels.

504. Annual risk levels to crew (the annual risk to an average crew member) for different vessel types are presented in **Figure D.1**, which also includes the upper and lower bounds for risk acceptance criteria as suggested in IMO Maritime Safety Committee 72/16 (IMO, 2001). The annual individual risk level to crew falls within the ALARP region for each of the vessel types presented.

[8] 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.

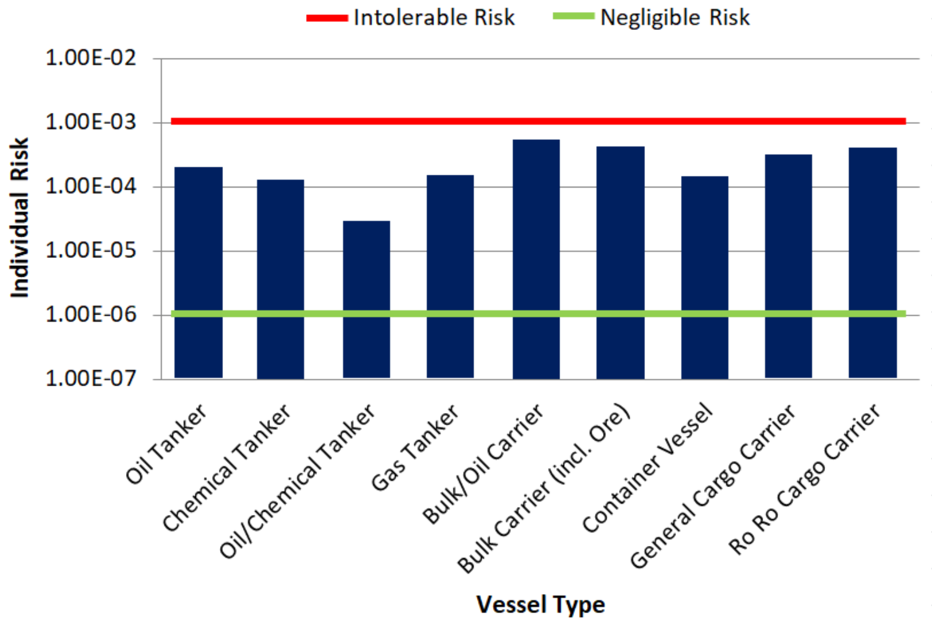

Figure D.1 Individual Risk Levels and Acceptance Criteria per Vessel Type

505. The typical bounds defining the ALARP regions for decision making within shipping and navigation are presented in **Table A.4**. 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 A.4 Individual Risk ALARP Criteria

Individual	Lower Bound for ALARP	Upper Bound for ALARP
To crew member	10^{-6}	10^{-3}
To passenger	10^{-6}	10^{-4}
Third-party	10^{-6}	10^{-4}
New vessel target	10^{-6}	Above values reduced by one order of magnitude

506. On a UK basis, the MCA have presented individual risks for various UK industries based on Health and Safety Executive (HSE) data from 1987 to 1991. The risks for different industries are presented in **Figure D.2**.

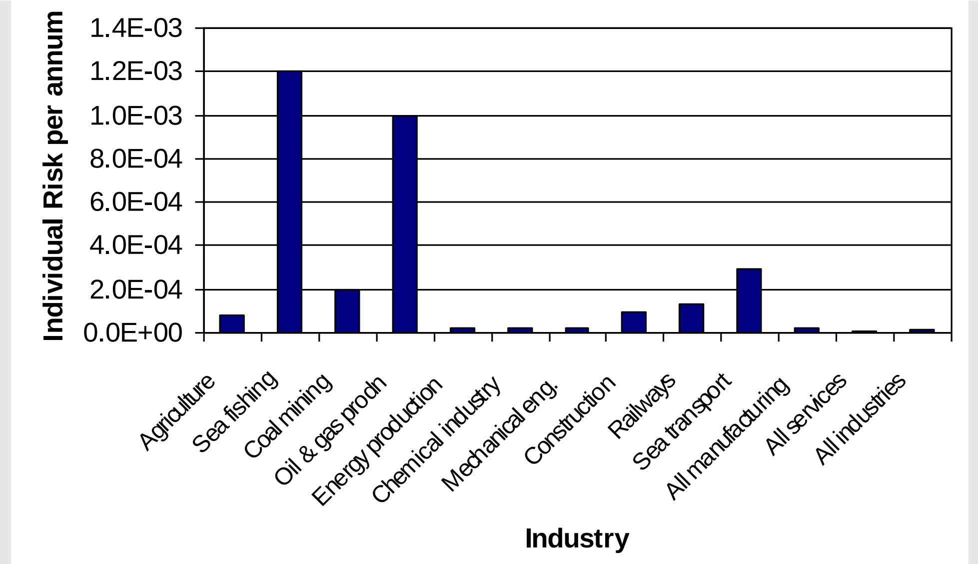

Figure D.2 Individual Risk per Year for Various UK Industries

507. The individual risk for sea transport of 2.9×10^{-4} per year is consistent with the worldwide data presented in **Figure D.1**, whilst the individual risk for sea fishing of 1.2×10^{-3} per year is the highest across all of the industries included.

D.1.1.2 Societal Risk

508. 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.

509. Within this assessment, societal (navigation based) risk can be assessed for the CWP Project, giving account to the change in risk associated with each incident scenario cause 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 potential loss of life (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.

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

D.1.2 Risk to Environment

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

512. 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 CWP Project compared to UK background pollution risk levels.

D.2 Marine Accident Investigation Branch Incident Data

D.2.1 All Incidents in UK Waters

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

514. 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.

515. 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 CWP Project.

516. 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).

517. The location of all incidents in proximity to the UK are presented in **Figure D.3**, colour-coded by incident type[9]. The majority of incidents occur in coastal waters.

[9] The MAIB aim for 97% accuracy in reporting the location of incidents.

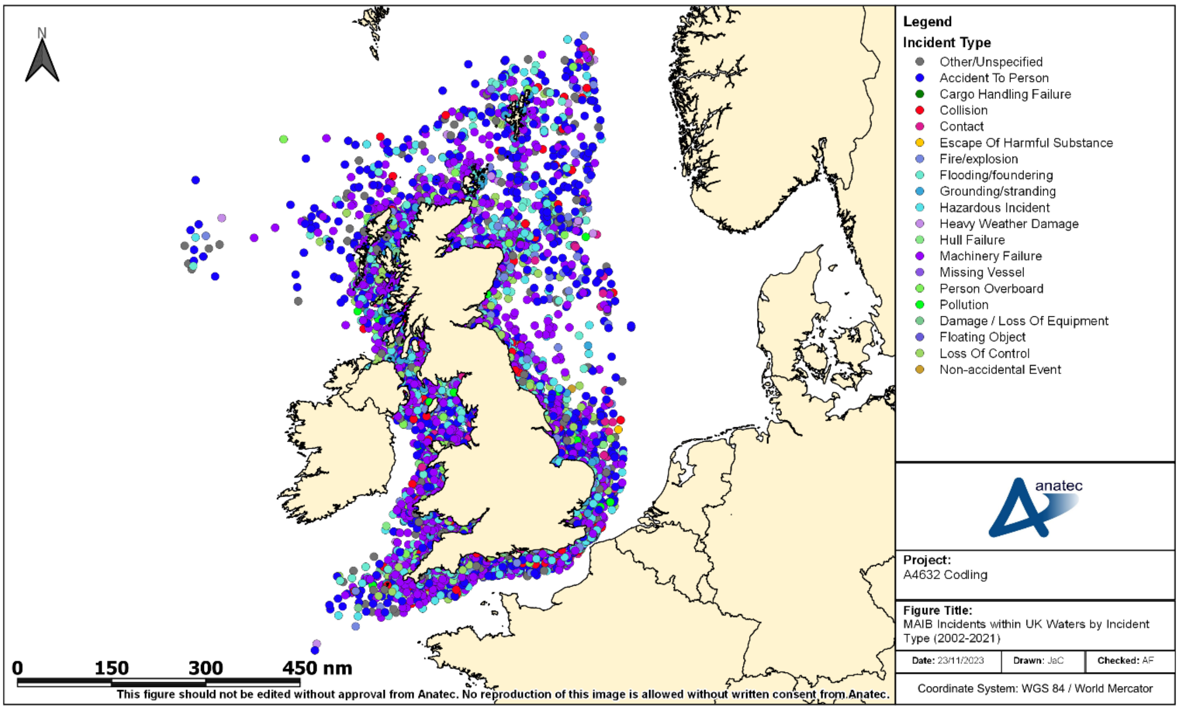

Figure D.3 MAIB Incident Locations by Incident Type within UK Waters (2002 to 2021)

518. The distribution of incidents by year in UK waters is presented in **Figure D.4**.

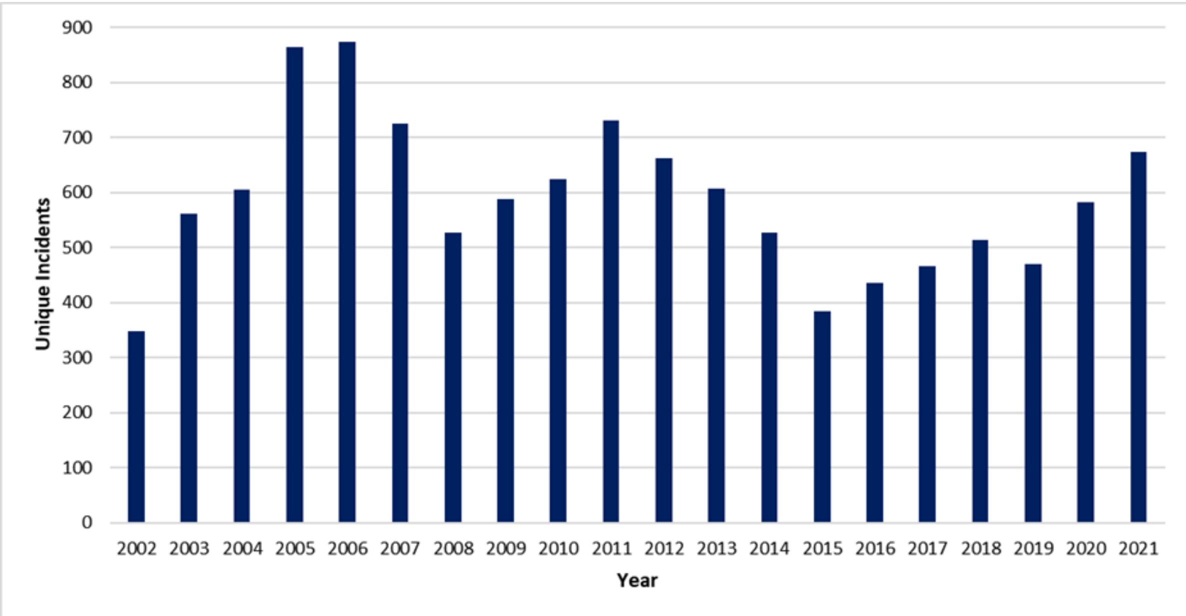

Figure D.4 MAIB Unique Incidents per Year within UK Waters (2002 to 2021)

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

520. The distribution of incidents in UK waters by incident type is presented in **Figure D.5**

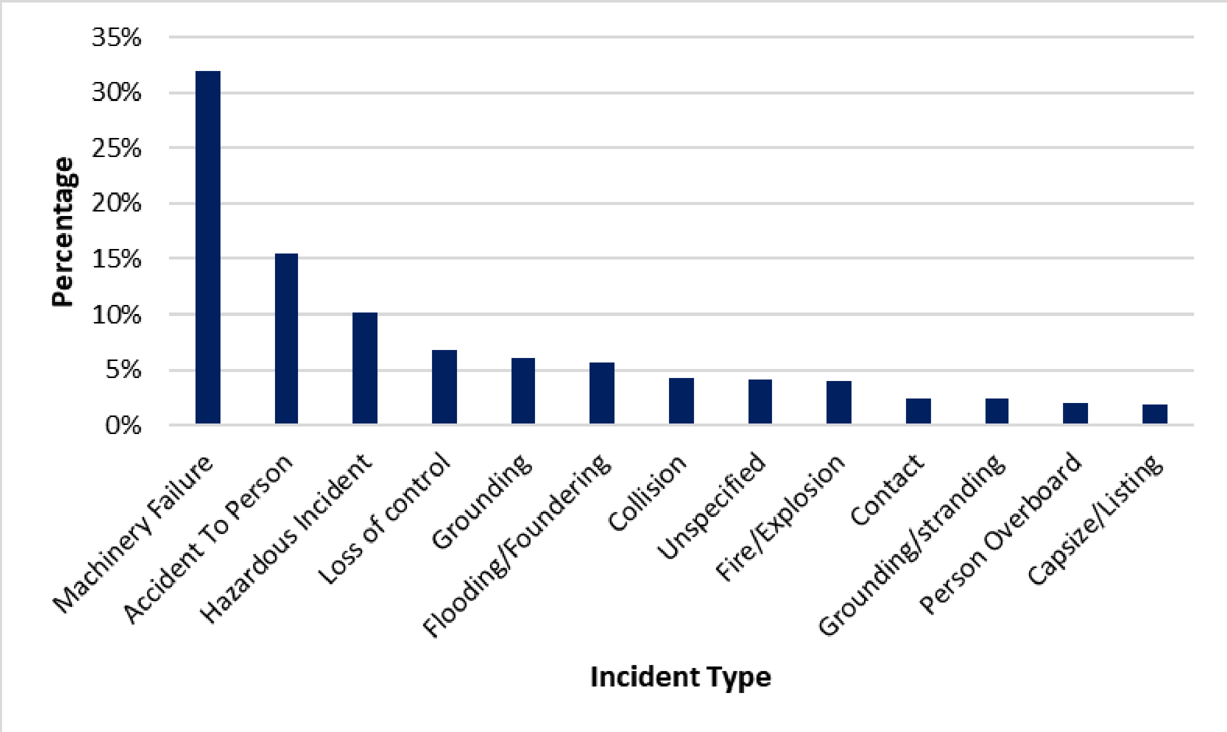

Figure D.5 MAIB Incident Types Breakdown within UK Waters (2002 to 2021)

521. 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.

522. The distribution of incidents in UK waters by vessel type is presented in **Figure D.6**.

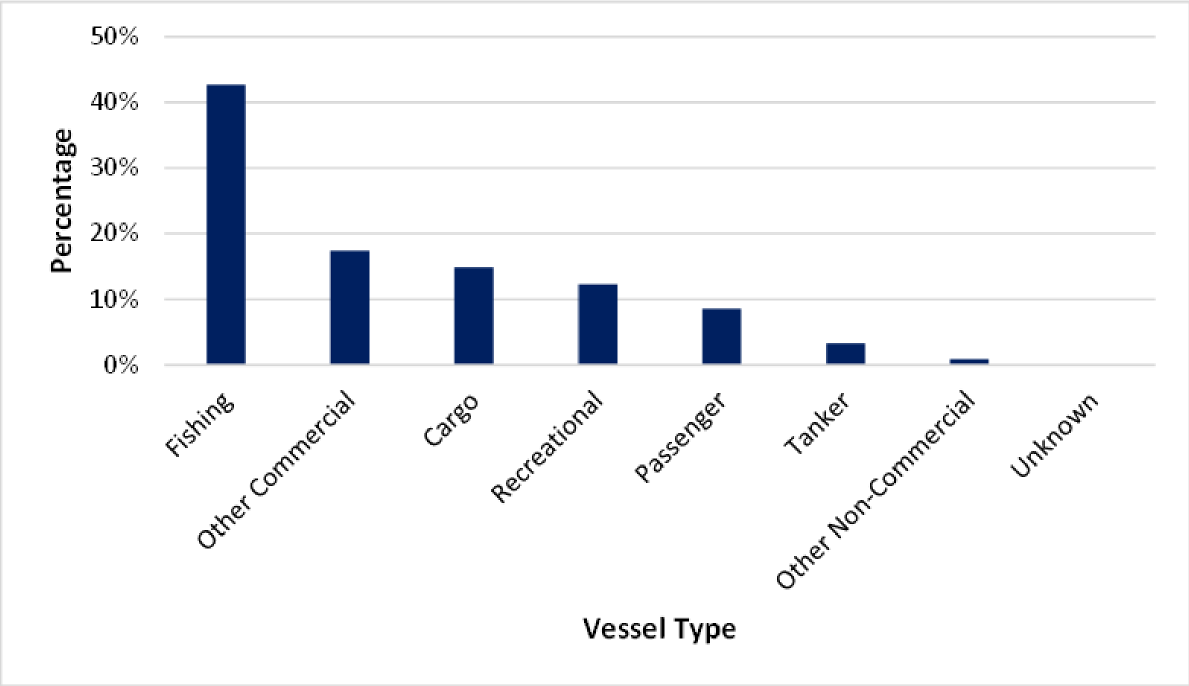

Figure D.6 MAIB Incident Types Breakdown within UK Waters (2002 to 2021)

523. 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%).

524. 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.

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

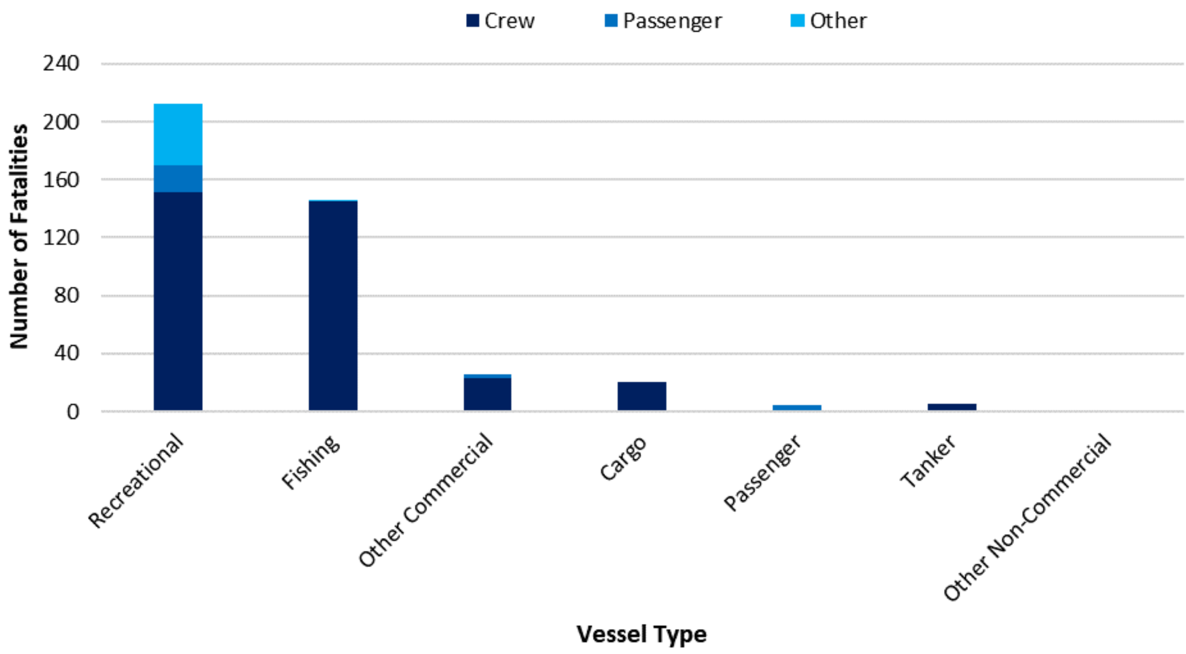

Figure D.7 MAIB Fatalities by Vessel Type within UK Waters (2002 to 2021)

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

D.2.2 Collision Incidents

527. 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).

528. 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).

529. The locations of collision incidents reported in proximity to the UK are presented in **Figure D.8**.

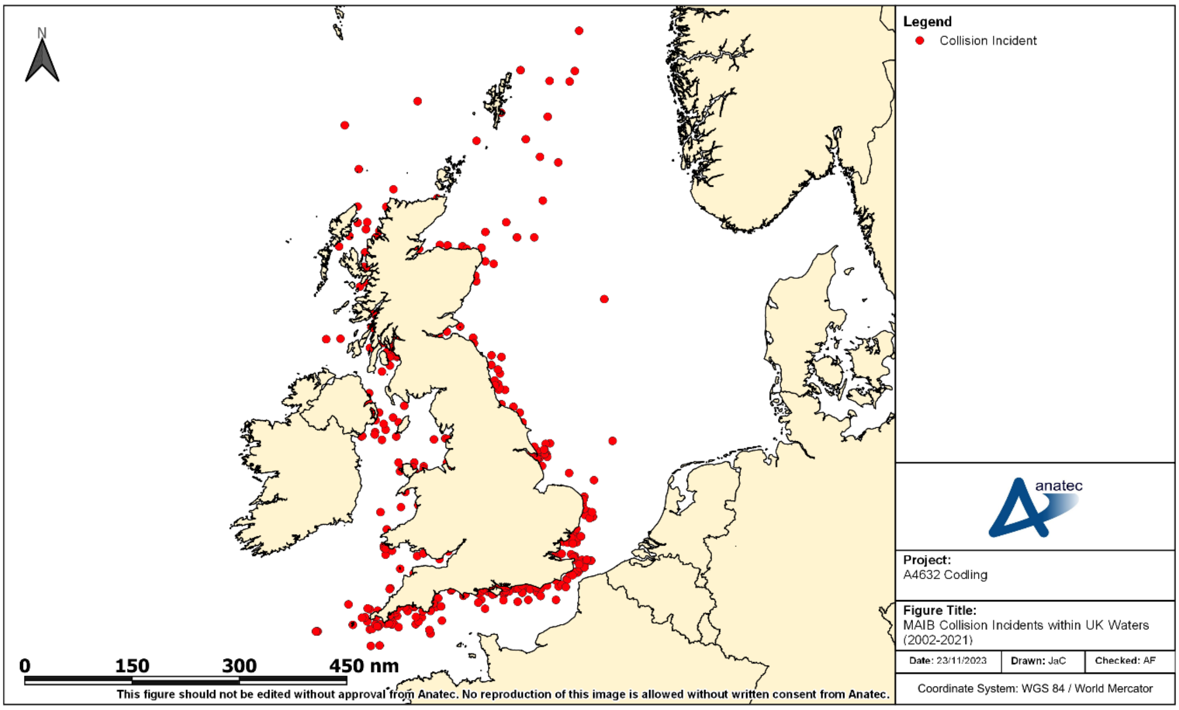

Figure D.8 MAIB Collision Incidents within UK Waters (2002 to 2021)

530. The distribution of collision incidents per year is presented in **Figure D.9**.

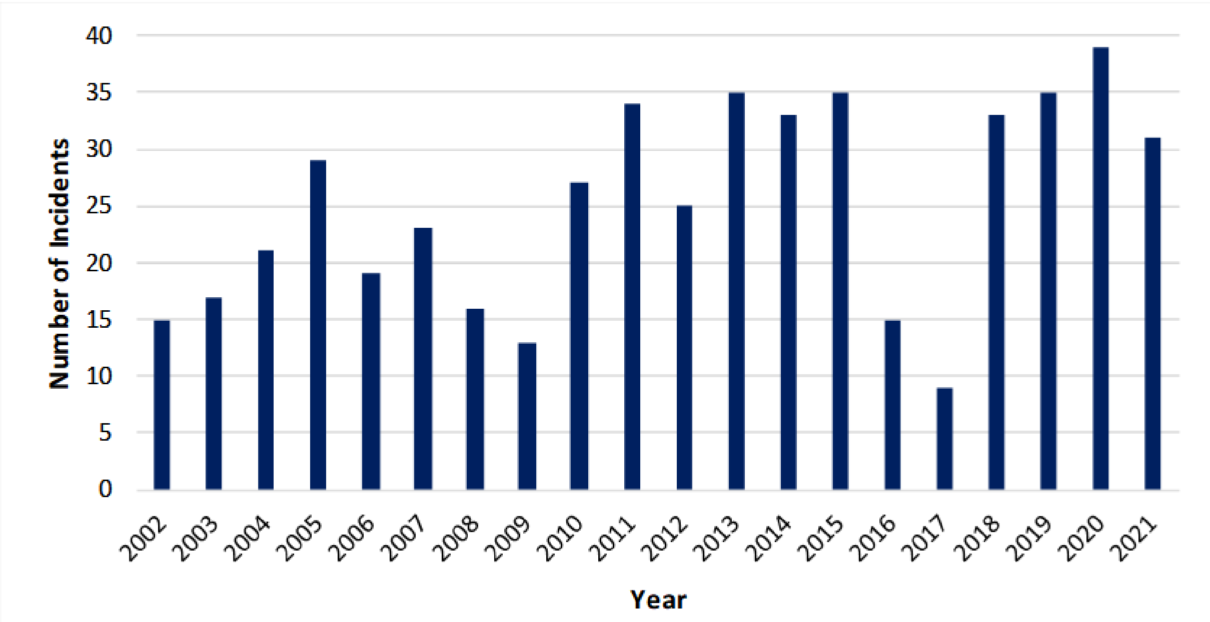

Figure D.9 MAIB Annual Collision Incidents within UK Water (2002 to 2021)

531. 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.

532. The distribution of vessel types involved in collision incidents is presented in **Figure D.10**.

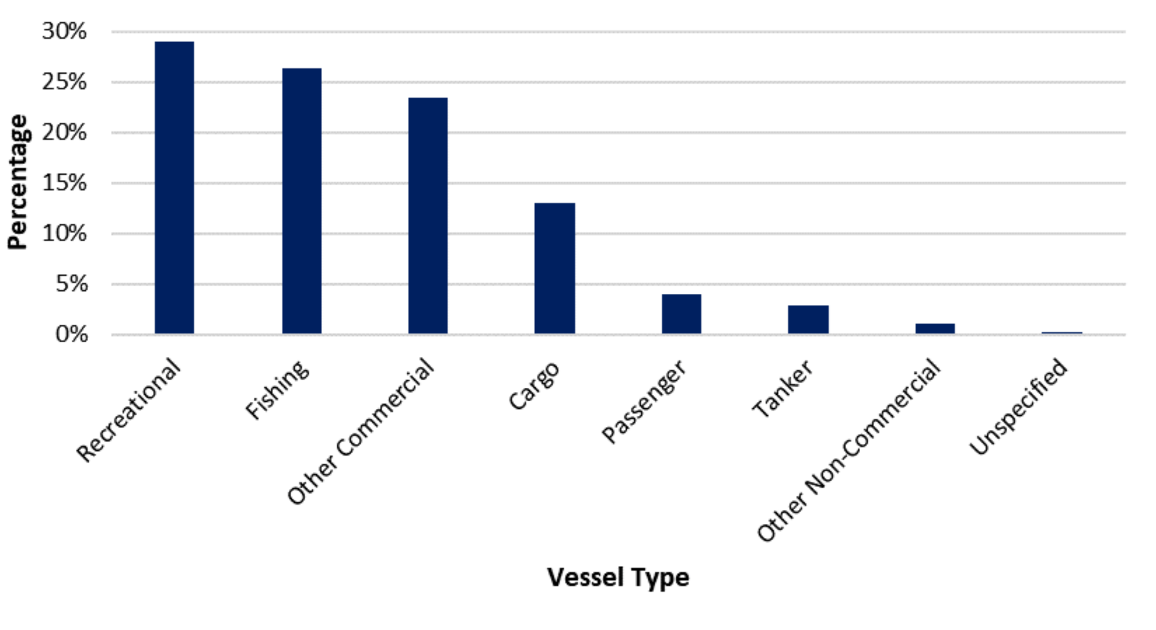

Figure D.10 MAIB Collision Incidents by Vessel Type within UK Water (2002 to 2021)

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

534. 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 A.5**.

Table A.5 Description of Fatal MAIB Collision Incidents (2002 to 2021)

Date	Description	Fatalities
July 2005	Collision between two powerboats at night. Both vessels were unlit and both helmsmen had consumed alcohol. One of the helmsmen died.	1
October 2007	Collision between fishing vessel and coastal general cargo vessel following failure to keep an effective lookout. Fishing vessel sank with three of the four crew members abandoning ship into a life raft but the fourth crew member was not recovered.	1
August 2010	Collision between passenger ferry and fishing vessel. Fishing vessel sank with one of the two crew members recovered from the sea but the other member was not recovered despite an extensive search.	1

Date	Description	Fatalities
June 2015	Collision between Rigid-hulled Inflatable Boat (RIB) and yacht. Believed that around a dozen persons were onboard the motorboat with the majority taken ashore by lifeboat. One person seriously injured and airlifted to hospital before being pronounced dead later.	1
June 2018	Collision between power boats during a race. One of the vessels overturned with the pilot pronounced dead at the scene.	1

D.2.3 Allision Incidents

535. 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.

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

537. The locations of contact incidents reported in proximity to the UK are presented in **Figure D.11**.

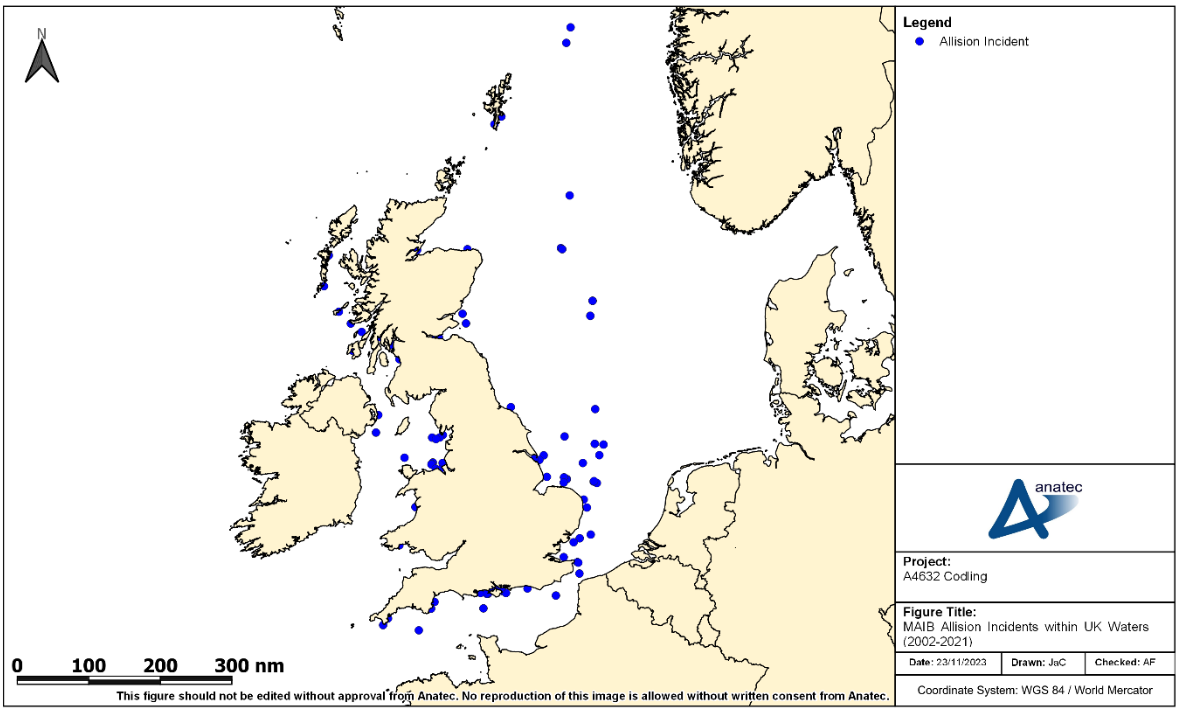

Figure D.11 MAIB Contact Incidents within UK Waters (2002 to 2021)

538. The distribution of contact incidents per year is presented in **Figure D.12**.

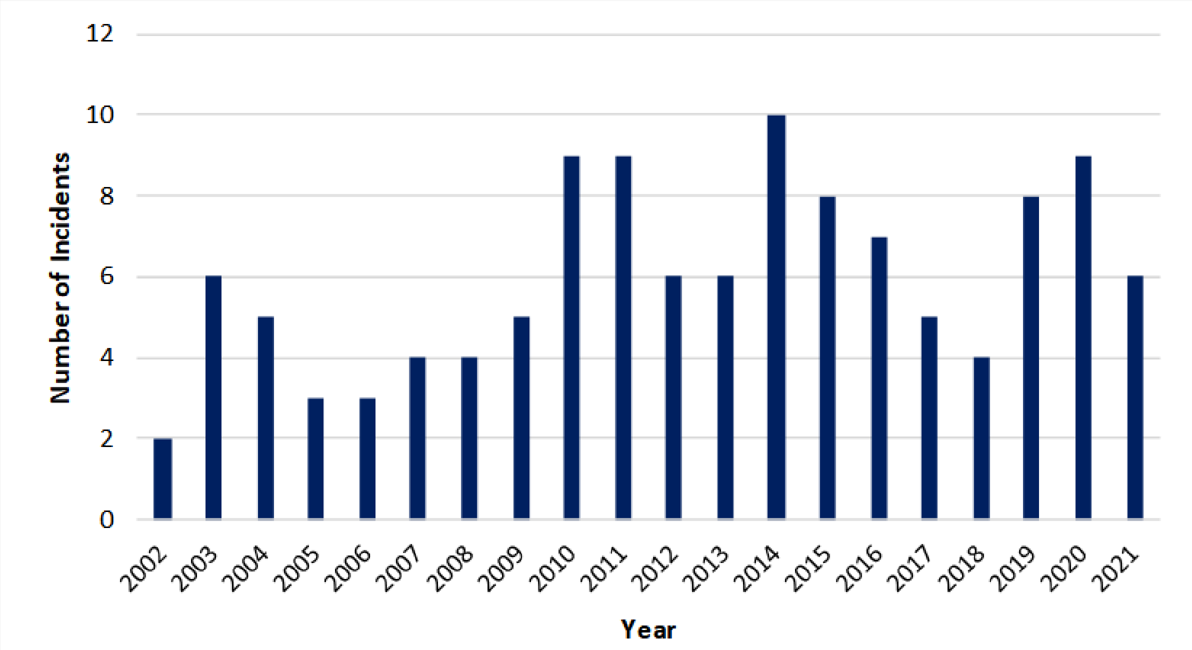

Figure D.12 MAIB Contact Incidents per Year within UK Waters (2002 to 2021)

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

540. The distribution of vessel types involved in allision incidents is presented in **Figure D.13**.

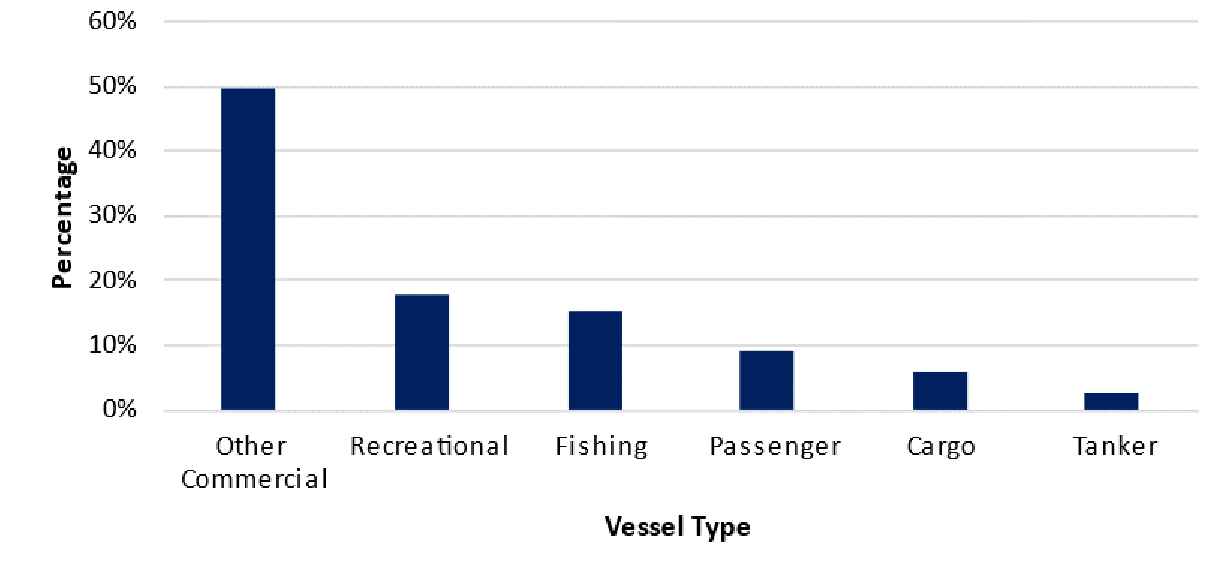

Figure D.13 MAIB Allision Incidents by Vessel Type within UK Waters (2002 to 2021)

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

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

D.3 Fatality Risk

D.3.1 Incident Data

543. 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 CWP Project.

544. The CWP Project 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.

545. Of these incident types, only vessel to vessel collisions match the MAIB definition of collisions and hence the fatality analysis presented in **Section D.2.2** is considered directly applicable to these types of incidents.

546. 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 D.2.3**). Additionally, none of the allision incidents reported by the MAIB between 2002 and 2021 resulted in a fatality.

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

D.3.2 Fatality Probability

548. 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.

549. 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 A.6** presents the average number of people on board (POB) estimated for each category of vessel navigating in proximity to the CWP Project. 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 A.6 Estimated Average POB by Vessel Category

Vessel Category	Sub Categories	Source of Estimated Average POB	Estimated Average POB
Cargo/freight	Dry cargo, other commercial, service ship, etc.	MAIB incident data	17
Tanker	Tanker/combination carrier	MAIB incident data	23
Passenger	RoRo passenger, cruise liner, etc.	Vessel traffic survey data / online information	1,625
Fishing	Trawler, potter, dredger, etc.	MAIB incident data	3.3
Recreational	Yacht, small commercial motor yacht, etc.	MAIB incident data	3.3

550. It is recognised that these average POB numbers can be substantially higher or lower on an individual vessel basis depending upon the size, subtype, etc. but applying reasonable averages is considered sufficient for this analysis, particularly when noting that the average POB for the dominant vessel category (passenger) is based upon the vessel traffic survey data where possible.

551. Using the average POB, along with the vessel type information involved in collision incidents reported by the MAIB (see **Section D.2.2**), there was an estimated 72,997 POB the vessels involved in the collision incidents.

552. Based upon five fatalities, the overall fatality probability in a collision for any individual onboard is approximately 6.85×10^{-5} per collision.

553. 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 A.7**. 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 A.7 Collision Incident Fatality Probability by Vessel Category (2002 to 2021)

Vessel Category	Sub Categories	Fatalities	People Involved	Fatality Probability	Time Period
Commercial	Dry cargo, passenger, tanker, etc.	1	71,047	1.41×10^{-5}	1997 to 2021 (25 years)

Vessel Category	Sub Categories	Fatalities	People Involved	Fatality Probability	Time Period
Fishing	Trawler, potter, dredger, etc.	2	927	2.2×10^{-3}	2002 to 2021 (20 years)
Recreational	Yacht, small commercial motor yacht, etc.	3	1,023	2.9×10^{-3}	2002 to 2021 (20 years)

554. The risk is higher by two orders of magnitude for POB small craft compared to larger commercial vessels.

D.3.3 Fatality Risk due to the CWP Project

555. The base case and future case annual collision frequency levels pre and post wind farm for the CWP Project are summarised in **Table A.8**.

Table A.8 Risk Results Summary

Risk	Scenario	Annual Frequency (Return Period)		
		Pre Wind Farm	Post Wind Farm	Change
Vessel to vessel collision	Base case	7.66E-03 (1 in 131 years)	8.41E-03 (1 in 119 years)	7.54E-04
	Future case (10%)	9.59E-03 (1 in 104 years)	1.06E-02 (1 in 94 years)	2.91E-03
	Future case (25%)	1.22E-02 (1 in 82 years)	1.34E-02 (1 in 75 years)	5.79E-03
Powered vessel to structure allision	Base case	-	1.19E-04 (1 in 8,384 years)	1.19E-04
	Future case (10%)	-	1.31E-04 (1 in 7,622 years)	1.31E-04
	Future case (25%)	-	1.49E-04 (1 in 6,707 years)	1.49E-04
Drifting vessel to structure allision	Base case	-	9.78E-04 (1 in 1,022 years)	9.78E-04
	Future case (10%)	-	1.08E-03 (1 in 929 years)	1.08E-03
	Future case (25%)	-	1.22E-03 (1 in 818 years)	1.22E-03
Fishing vessel to structure allision	Base case	-	8.19E-02 (1 in 12 years)	8.19E-02
	Future case (10%)	-	9.00E-02 (1 in 11 years)	9.00E-02

Risk	Scenario	Annual Frequency (Return Period)		
		Pre Wind Farm	Post Wind Farm	Change
	Future case (25%)	-	1.02E-01 (1 in 10 years)	1.02E-01
Total	**Base case**	**7.66E-03 (1 in 131 years)**	9.14E-02 (1 in 11 years)	8.37E-02
	Future case (10%)	**9.59E-03 (1 in 104 years)**	1.01E-01 (1 in 10 years)	9.13E-02
	Future case (25%)	**1.22E-02 (1 in 82 years)**	1.17E-01 (1 in 9 years)	1.05E-01

556. 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 CWP Project for the base case and future cases are presented in **Figure D.14**.

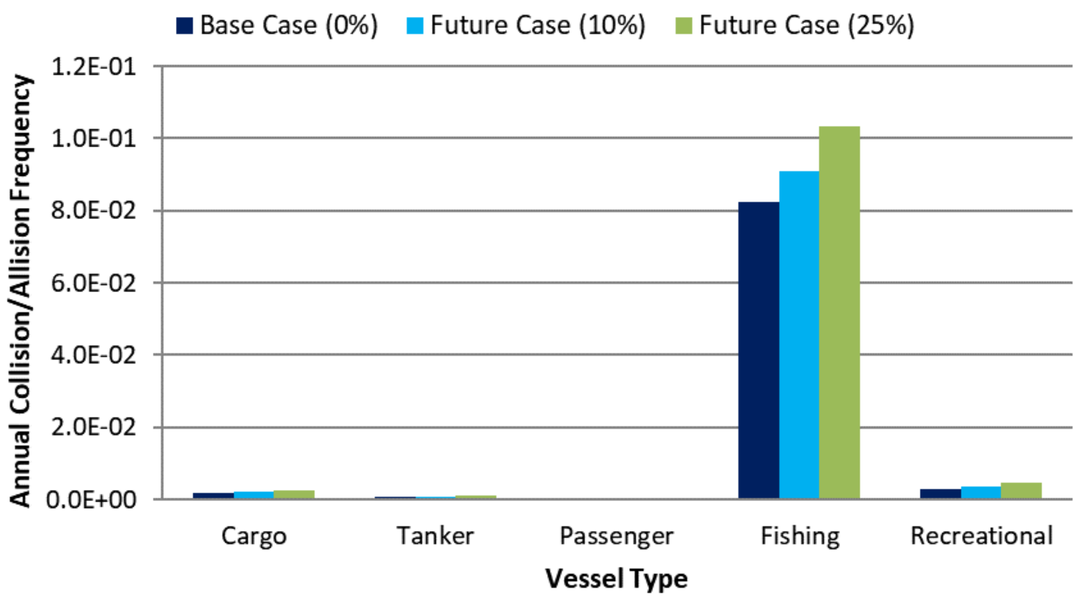

Figure D.14 Estimated Change in Annual Collision and Allision Frequency by Vessel Type

557. The highest change in annual collision/allision frequency is for fishing vessels. Full details of the modelling process, including assumptions, are provided in **Section 14** and should be read in conjunction with the consequences assessment (in particular the conservative assumptions that have been made in regards to fishing vessel activity).

558. Combining the annual collision and allision frequency (**Table A.8**) estimated number of POB for each vessel type and the estimated fatality probability for each vessel type category, the annual increase in PLL due to the presence of the CWP Project for the

base case is estimated to be 6.17×10^{-4}, equating to one additional fatality every 1,620 years.

559. The estimated incremental increases in PLL due to the CWP Project, distributed by vessel type and for the base case and future case, are presented in **Figure D.15**.

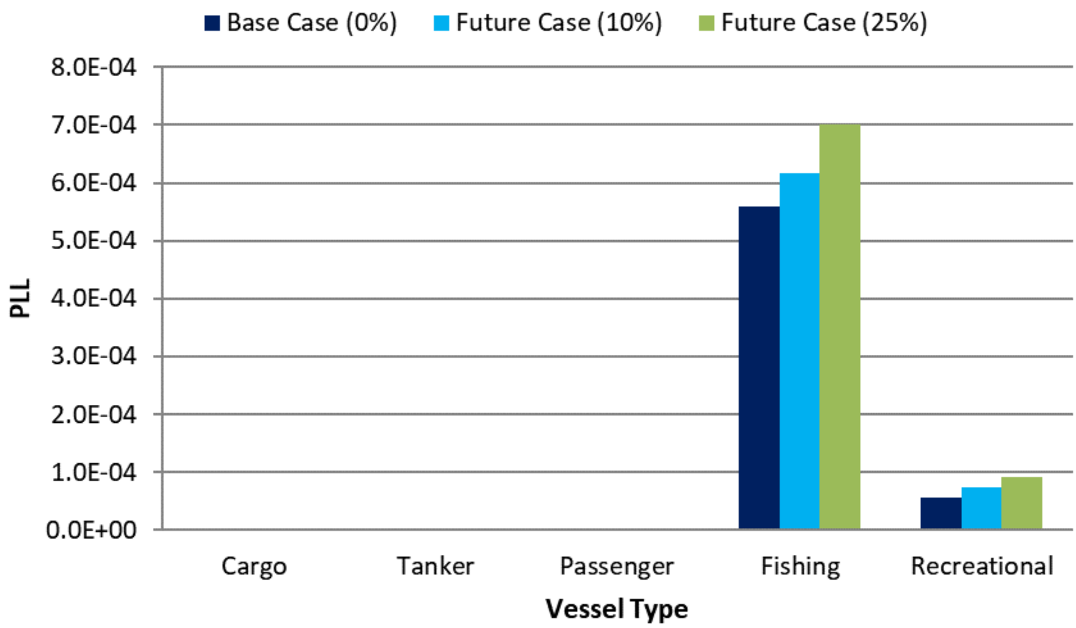

Figure D.15 Estimated Change in Annual PLL by Vessel Type

560. The majority of change in PLL was observed to be associated with fishing vessels. This is due to the estimated allision frequencies for fishing vessels. It is noted that the conservative assumptions of the associated modelling should be considered in this regard (see **Section 14.3.4**).

561. Converting the PLL to individual risk based upon the average number of people exposed by vessel type, the results are presented in **Figure D.16**.

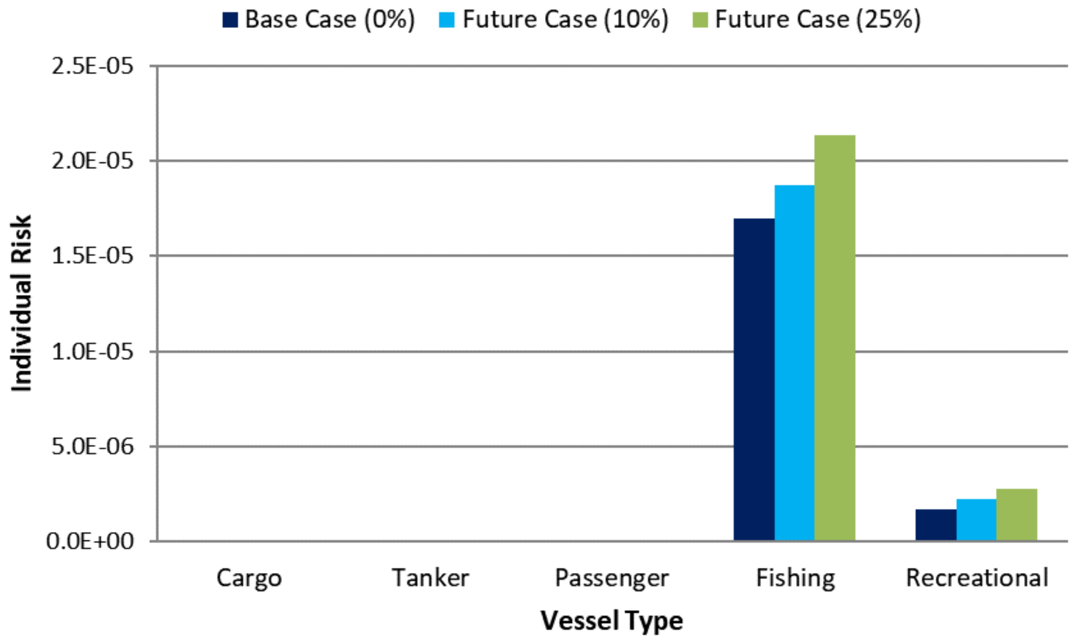

Figure D.16 Estimated Change in Individual Risk by Vessel Type

562. As for PLL, the majority of change in individual risk was observed to be associated with fishing vessels. This is due to the estimated allision frequencies for fishing vessels. It is noted that the conservative assumptions of the associated modelling should be considered in this regard (see **Section 14.3.4**).

D.3.4 Significance of Increase in Fatality Risk

563. 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 1,620 years represents a low change.

564. In terms of individual risk to people, the change for commercial vessels attributed to the CWP Project (approximately 5.32×10^{-9} for the base case) is low compared to the background risk level for the UK sea transport industry of 2.9×10^{-4} per year.

565. For fishing vessels, the change in individual risk attributed to the CWP Project (approximately 1.70×10^{-5} for the base case) is low compared to the background risk level for the UK sea fishing industry of 1.2×10^{-3} per year.

D.4 Pollution Risk

D.4.1 Historical Analysis

566. 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).

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

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

568. The research undertaken as part of the Department for Transport's (DfT's) Marine Environmental High Risk Areas (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 D.17**.

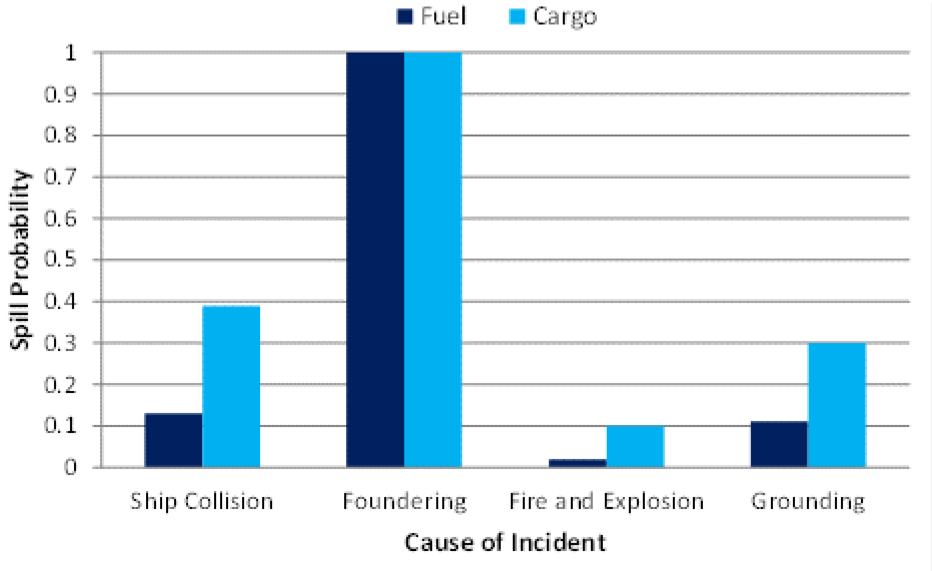

Figure D.17 Probability of an Oil Spill Resulting from an Accident

569. 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.

570. 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.

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

572. 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.

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

574. 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.

D.4.2 Pollution Risk due to the CWP Project

575. Applying the above probabilities to the annual collision and allision frequency by vessel type (**Table A.8**) and the average spill size per vessel, the amount of oil spilled per year due to the impact of the CWP Project is estimated to be 0.34 tonnes per year for the base case.

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

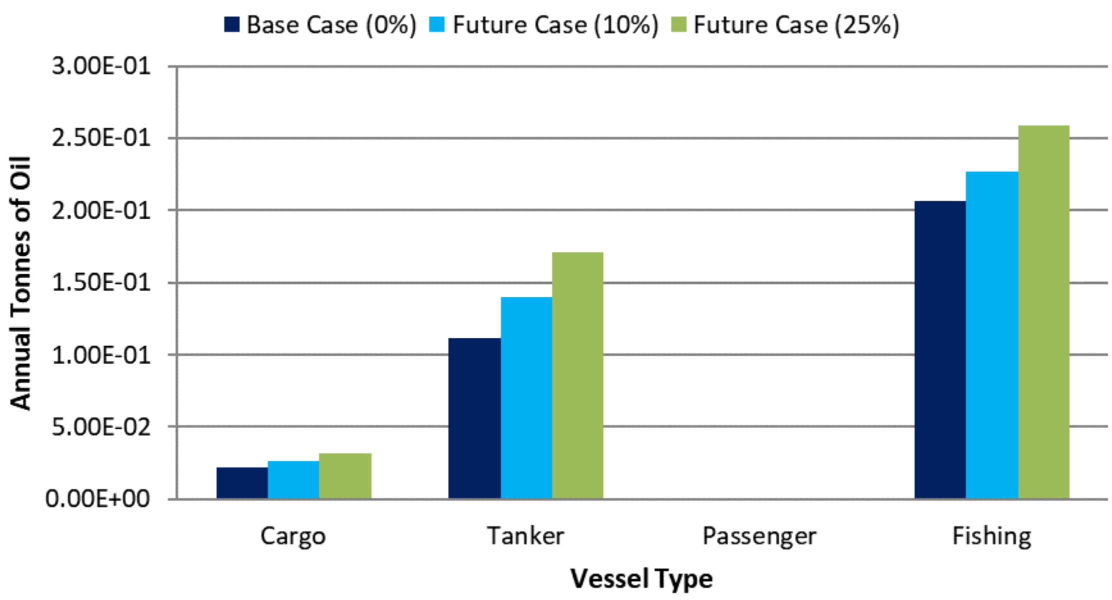

Figure D.18 Estimated Change in Pollution by Vessel Type

577. As shown, fishing vessels represented the largest contributor for potential pollution. This is due to the estimated allision frequencies for fishing vessels. It is noted that the conservative assumptions of the associated modelling should be considered in this regard (see **Section 14.3.4)**.

D.4.3 Significance of Increase in Pollution Risk

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

579. 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%.

580. The overall increase in pollution estimated due to the CWP Project of 0.34 tonnes for the base case represents a 0.002% increase compared to the historical average pollution quantities from maritime incidents in UK waters.

D.5 Conclusion

581. This annex has quantitively assessed the fatality and pollution risk associated with the CWP Project 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.

582. Overall, the impact of the CWP Project 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.

583. Discussion of relevant mitigation measures and monitoring is provided in **Section 16** of the NRA and **Chapter 16: Shipping and Navigation**.