Spiorad na Mara Offshore Wind Farm

Offshore Project

Environmental Impact Assessment Report

Appendix 16.1: Navigational Risk Assessment, Volume 2c

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Spiorad na Mara
Offshore Wind Farm
Navigational Risk Assessment

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Glossary

Term	Meaning
Allision	Contact between a vessel and a stationary object.
The Applicant	Spiorad na Mara Limited (the Project owner)
Array Area	The offshore area within which the offshore wind turbine generators (WTGs), associated foundations, Offshore Cables, and Offshore Substation Platform (OSP) (if required), will be located. This area encompasses the Turbine Area that will contain all above water surface infrastructure (WTGs / OSP) and an additional area within which further below water infrastructure (foundations and cables) may also be located.
Array Cables	The offshore electrical and communication cables that connect infrastructure located within the Array Area, for: • Scenario 1: Array Cables will used to connect Wind Turbine Generators (WTGs) to each other, and to connect WTGs to the OSP. • Scenario 2: Array Cables will used to connect WTGs to each other.
Array Cables to Landfall	The offshore electrical and communication cables located in the Array Area and Offshore Cables Area of Search that connect the wind turbine generators (WTGs) directly to Landfall for Scenario 2.
Automatic Identification System (AIS)	A system by which vessels automatically broadcast their identity, key statistics including location, destination, length, speed, and current status, e.g., under power. Most commercial vessels and United Kingdom (UK)/European Union (EU) fishing vessels over 15 metre (m) length are required to carry AIS.
Collision	The act of colliding (crashing) between 2 moving objects.
Embedded or 'Designed-in' Mitigation	Mitigation measures to avoid or reduce environmental effects that are directly incorporated into the preferred design for the Project. This can include standard practice in accordance with or without guidance. Embedded mitigation is considered as part of the impact assessment, before effect significance is identified.
Environmental Impact Assessment (EIA)	The process of evaluating the likely significant environmental effects of a proposed development over and above the existing circumstances (or 'baseline').
Formal Safety Assessment (FSA)	A structured and systematic process for assessing the risks and costs (if applicable) associated with shipping activity.
Future Baseline	Refers to the situation in future years without the Project.

Term	Meaning
Hazard Workshop	A consultation opportunity for Shipping and Navigation stakeholders to discuss navigational hazards associated with the Project in order to feed into the Navigational Risk Assessment process.
Marine Guidance Note (MGN)	A system of guidance notes issued by the Maritime and Coastguard Agency (MCA) which provide significant advice relating to the improvement of the safety of shipping at sea, and to prevent or minimise pollution from shipping.
Navigational Risk Assessment (NRA)	A document which assesses the impacts to Shipping and Navigation of a proposed Offshore Renewable Energy Installation (OREI) based upon FSA.
Offshore Cable Area of Search	The area within which the offshore cable infrastructure between the Array Area and Landfall up to Mean High Water Springs (MHWS) will be located.
Offshore Project (Offshore Components of the Project)	Components of the Project seaward of Mean High Water Springs (MHWS) which includes Array Area and Offshore Cable Area of Search.
Offshore Project Boundary	The ‘red line boundary’ encompassing the Offshore Project.
Offshore Substation Platform (OSP)	The optional offshore substation located within the Array Area. Includes the platform and associated components which allows the voltage to be increased to meet onward transmission requirements.
Project	To describe the Project as a whole, this includes all offshore and onshore components of the Project.
Radio Detection and Ranging (Radar)	An object-detection system which uses radio waves to determine the range, altitude, direction, or speed of objects.
Regular Operator	A vessel operator identified from the vessel traffic data to be regularly utilising the sea room in the vicinity of the proposed Offshore Project.
Safety Zone	A statutory marine zone demarcated for the purposes of safety around a possibly hazardous installation or works/construction area.
Scoping Report	The report that was produced in order to request a Scoping Opinion from the Scottish Ministers.
Spiorad na Mara Offshore Wind farm	The Project.
Turbine Area	A reduced area within the Array Area where above water surface infrastructure would be located i.e. wind turbine generators (WTG) or Offshore Substation Platform (OSP) (if required). This area has been

Term	Meaning
	developed and refined through stakeholder consultation and environmental assessment.
Unique Vessel	An individual vessel identified on any particular calendar day, irrespective of how many tracks were recorded for that vessel on that day. This prevents vessels being over counted. Individual vessels are identified using their Maritime Mobile Service Identity (MMSI).
Wind Turbine Generators (WTG)	The wind turbines that generate electricity consisting of tubular towers and blades attached to a nacelle housing mechanical and electrical generating equipment

Abbreviations Table

Abbreviation	Definition
AC	Alternating Current
AIS	Automatic Identification System
ALARP	As Low As Reasonably Practicable
ALB	All-Weather Lifeboat
ARPA	Automatic Radar Plotting Aid
ATBA	Area to be Avoided
AtoN	Aid to Navigation
BATNEEC	Best Available Technology Not Entailing Excessive Cost
BWEA	British Wind Energy Association
CA	Cruising Association
CAA	Civil Aviation Authority
CBA	Cost Benefit Analysis
CBRA	Cable Burial Risk Assessment
CD	Chart Datum
CFLO	Company Fisheries Liaison Officer
CHIRP	Confidential Human Factors Incident Reporting Programme
COLREGs	Convention on the International Regulations for Preventing Collisions at Sea
CTV	Crew Transfer Vessel
DC	Direct Current
DF	Direction Finding
DfT	Department for Transport
DSC	Digital Selective Calling

Abbreviation	Definition
DSLP	Development Specification and Layout Plan
DWR	Deep Water Route
EEA	European Economic Area
EEZ	Exclusive Economic Zone
EIA	Environmental Impact Assessment
EIAR	Environmental Impact Assessment Report
EMF	Electromagnetic Fields
ERCoP	Emergency Response Cooperation Plan
EU	European Union
FLiDAR	Floating Light Detection and Ranging
FSA	Formal Safety Assessment
GMDSS	Global Maritime Distress and Safety System
GPS	Global Positioning System
GRP	Glass Reinforced Plastic
GT	Gross Tonnage
HAT	Highest Astronomical Tide
HDD	Horizontal Directional Drilling
HF	High Frequency
HMCG	His Majesty's Coastguard
HVAC	High Voltage Alternating Current
HVDC	High Voltage Direct Current
IALA	International Association of Marine Aids to Navigation and Lighthouse Authorities
IHO	International Hydrographic Organisation
ILB	Inshore Lifeboat
IMO	International Maritime Organization
IPS	Intermediate Peripheral Structure
ITOPF	International Tanker Owners Pollution Federation
JRCC	Joint Rescue Coordination Centre
kHz	Kilohertz
km^2	Square Kilometre
LMP	Lighting and Marking Plan
LNG	Liquefied Natural Gas
LPG	Liquefied Petroleum Gas
m	Metre

Abbreviation	Definition
MAIB	Marine Accident Investigation Branch
MCA	Maritime and Coastguard Agency
MD-LOT	Marine Directorate – Licensing Operations Team
MDS	Maximum Design Scenario
MEHRA	Marine Environmental High Risk Areas
MEPC	Marine Environment Protection Committee
MF	Medium Frequency
MGN	Marine Guidance Note
MHWS	Mean High Water Springs
MoD	Ministry of Defence
MPCP	Marine Pollution Contingency Plan
MRCC	Maritime Rescue Coordination Centre
MSC	Maritime Safety Committee
MSI	Maritime Safety Information
MSL	Mean Sea Level
NAVTEX	Navigational Telex
NLB	Northern Lighthouse Board
nm	Nautical Mile
nm^2	Square Nautical Mile
NRA	Navigational Risk Assessment
NSA	National Scenic Area
NSVMP	Navigational Safety and Vessel Management Plan
NUC	Not Under Command
OCAS	Offshore Cable Area of Search
OFLO	Offshore Fisheries Liaison Officer
OREI	Offshore Renewable Energy Installation
OSP	Offshore Substation Platform
OWF	Offshore Wind Farm
PEXA	Practice and Exercise Area
PDE	Project Design Envelope
PLA	Port of London Authority
PLL	Potential Loss of Life
POB	People on Board
QHSE	Quality, Health, Safety and Environment

Abbreviation	Definition
Racon	Radar Beacon
Radar	Radio Detection and Ranging
RAM	Restricted in their Ability to Manoeuvre
REZ	Renewable Energy Zone
RIB	Rigid-hulled Inflatable Boat
RNLI	Royal National Lifeboat Institution
RoPax	Roll-on/Roll-off Passenger
RoRo	Roll-on/Roll-off Cargo
RYA	Royal Yachting Association
SAR	Search and Rescue
SCADA	Supervisory Control and Data Acquisition
SFF	Scottish Fishermen’s Federation
SMS	Safety Management System
SOLAS	Safety of Life at Sea
SONAR	Sound Navigation Ranging
SOV	Service Operation Vessel
SPFA	Scottish Pelagic Fishermen’s Association
SPS	Significant Peripheral Structure
SWFPA	Scottish White Fish Producers Association
TCE	The Crown Estate
TSS	Traffic Separation Scheme
UK	United Kingdom
UKHO	United Kingdom Hydrographic Office
UXO	Unexploded Ordnance
VHF	Very High Frequency
VMS	Vessel Monitoring System
VTS	Vessel Traffic Service
WTG	Wind Turbine Generator

1 Introduction

1.1 Background

1. Anatec was commissioned by WSP UK Limited on behalf of Spiorad na Mara Limited (hereafter referred to as 'the Applicant') to undertake a Navigational Risk Assessment (NRA) for the Spiorad na Mara Offshore Wind Farm (OWF), hereafter referred to as the 'Project'. The NRA has been undertaken with respect to the offshore components of the Project comprising of the Array Area, Turbine Area, and the Offshore Cable Area of Search (OCAS), hereafter referred to as the 'Offshore Project.

2. This NRA presents information on the Offshore Project relative to the existing and estimated future navigational activity and forms a supporting study to **Chapter 16: Shipping and Navigation, Volume 2a** of the Environmental Impact Assessment Report (EIAR).

1.2 Navigational Risk Assessment

3. EIA is a process which identifies the environmental effects of a project, both adverse and beneficial. An important requirement of the EIA for offshore projects is the NRA. Following the Maritime and Coastguard Agency's (MCA) Marine Guidance Note (MGN) 654 (MCA, 2021), this NRA includes:

- Outline of methodology applied in the NRA including relevant guidance;
- Summary of consultation undertaken with shipping and navigation stakeholders;
- Lessons learnt from previous OWF developments;
- Summary of the Project Design Envelope (PDE) relevant to shipping and navigation;
- Overview of existing baseline including:
  - Navigational features;
  - Meteorological and oceanographic conditions;
  - Emergency response resources;
  - Historical maritime incidents;
  - Vessel traffic movements.
- Implications for marine navigation and communication equipment;
- Cumulative and transboundary overview;
- Overview of anticipated future case vessel traffic;
- Assessment of navigation risk pre and post construction of the Offshore Project including collision and allision risk modelling;
- Risk assessment following Formal Safety Assessment (FSA) process;
- Identification of embedded mitigation measures;
- Completion of the MGN 654 Checklist (see **Appendix A**).

4. Potential hazards have been considered for each phase of the Offshore Project as follows:

- Construction (including pre-construction);
- Operation and maintenance;
- Decommissioning.

2 Guidance and Legislation

2.1 Legislation

5. As part of the EIA Directive (2011/92/European Union (EU), as amended by Directive 2014/52/EU) (which remains applicable following EU Exit), an EIAR is required to support the relevant consents for the Offshore Project. The MCA require that, as part of the EIAR, an NRA is undertaken to "*inform the shipping and navigation chapter of the EIA Report*" (MCA, 2021).

2.2 Primary Guidance

6. The primary guidance documents used during the assessment are the following:

- *MGN 654 (Merchant and Fishing) Safety of Navigation: Offshore Renewable Energy Installations (OREIs) – Guidance on UK Navigational Practice, Safety and Emergency Response and its annexes* (MCA, 2021);
- *Revised Guidelines for Formal Safety Assessment (FSA) for Use in the Rule-Making Process* (International Maritime Organization (IMO), 2018).

7. MGN 654 highlights issues that shall be considered when assessing the potential effect on navigational safety from offshore renewable energy developments proposed in United Kingdom (UK) internal waters, territorial sea or Renewable Energy Zones (REZ).

8. MGN 654 includes several annexes including the *Methodology for Assessing the Marine Navigational Safety & Emergency Response Risks of Offshore Renewable Energy Installations (OREI)* which the MCA require to be used as a template for preparing NRAs. The methodology is centred on risk management and requires a submission that shows that sufficient controls are, or will be, in place for the assessed risk to be judged as broadly acceptable or tolerable with mitigation (see **Section 3.2**). In both **Chapter 16, Volume 2a** and the NRA, the base and future case levels of risk have been identified as well as the mitigation measures required to ensure the future case remains broadly acceptable, or tolerable with mitigation.

2.3 Other Guidance

9. Other guidance documents used during the assessment include:

- *MGN 371 Marine Guidance Note 371 (Merchant and Fishing) Offshore Renewable Energy Installations (OREIs): Guidance on UK Navigational Practice, Safety and Emergency Response Issues* (MCA, 2008);
- *MGN 372 Amendment 1 (Merchant and Fishing) Offshore Renewable Energy Installations (OREI): Guidance to Mariners Operating in the Vicinity of UK OREIs* (MCA, 2022);

- *International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA) Recommendation O-139 on The Marking of Man-Made Offshore Structures* (IALA, 2021);
- *IALA Guidance G1162 The Marking of Offshore Man-Made Structures* (IALA, 2022);
- *IALA Guidance G1185 Enhancing the Safety and Efficiency of Navigation around Offshore Renewable Energy Installations* (IALA, 2024);
- *Maritime Navigation Commission (MarCom) PIANC Report No. 161 Interaction Between Offshore Wind Farms and Maritime Navigation (MarCom, 2018)*;
- *The Royal Yachting Association's (RYA) Position on Offshore Renewable Energy Developments: Paper 1 (of 4) – Wind Energy* (RYA, 2019 (a)).

2.4 Lessons Learnt

10. There is considerable benefit for the Offshore Project in the sharing of lessons learnt within the offshore industry. The NRA, and in particular the risk assessment undertaken in **Section 18** and **Chapter 16, Volume 2a**, includes general consideration for lessons learnt and expert opinion from previous OWF developments and other sea users, capitalising upon the UK's position as a leading generator of offshore wind power.

11. Data sources for lessons learnt include the following:

- *Sharing the Wind – Recreational Boating in the Offshore Wind Strategic Areas* (RYA) and Cruising Association (CA), 2004);
- *Results of the Electromagnetic Investigations* (MCA and QinetiQ, 2004);
- *Offshore Wind Farm Helicopter Search and Rescue Trials Undertaken at the North Hoyle Wind Farm* (MCA, 2005);
- *Interference to Radar Imagery from Offshore Wind Farms* (Port of London Authority (PLA), 2005);
- *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* (Anatec and The Crown Estate (TCE), 2012);
- *Offshore Wind and Marine Energy Health and Safety Guidelines* (RenewableUK, 2014);
- *Influence of UK Offshore Wind Farm Installation on Commercial Vessel Navigation: A Review of Evidence* (Anatec, 2016);
- *G+ Global Offshore Wind Health & Safety Organisation 2020 Incident Data Report* (G+, 2021).

3 Navigational Risk Assessment Methodology

3.1 Formal Safety Assessment Methodology

12. A shipping and navigation user can only be affected by a hazard if there is a pathway through which a 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. The assessments presented herein for shipping and navigation users have considered the following criteria:

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

13. With regards to commercial fishing vessels, the methodology and assessment considers hazards to commercial fishing vessels in transit. A separate methodology and assessment have been applied in **Chapter 21: Commercial Fisheries, Volume 2a** to consider hazards to commercial fishing vessels related to commercial fishing activity (rather than commercial fishing vessels in transit).

3.2 Formal Safety Assessment Process

14. The IMO FSA process (IMO, 2018) (the FSA process) as approved by the IMO in 2018 under Maritime Safety Committee (MSC) – Marine Environment Protection Committee (MEPC).2/circ. 12/Rev.2 has been applied to the risk assessment in **Chapter 16, Volume 2a** and **Section 18** of the NRA.

15. The FSA process 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 5 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);

- **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)

3.2.1 Hazard Workshop Methodology

16. A key tool used when undertaking an NRA is the Hazard Workshop which ensures that all risks are identified and qualified in agreement with relevant consultees prior to assessment within the EIAR. Risks (and the determined qualification) are recorded via the hazard log which is presented in full in **Appendix B**.

17. **Table 3-1** and **Table 3-2** identify how the severity of consequence and the frequency of occurrence has been defined within the hazard log, respectively. The tier levels described in **Table 3-1** are defined within *The UK National Contingency Plan for Responding to Marine Pollution Incidents* (HM Government, 2024).

Table 3-1 Severity of Consequence Ranking Definitions for Shipping and Navigation

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 for Shipping and Navigation

Rank	Description	Definition
1	Negligible	Less than 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

18. An aggregate of the severity of consequence (**Table 3-1**) and frequency of occurrence (**Table 3-2**) provide the level of risk for each hazard; the method for undertaking this aggregation is through use of a tolerability matrix, as presented in **Table 3-3**. The risk of a hazard is defined as Broadly Acceptable (low risk), Tolerable with Mitigation (intermediate risk), or Unacceptable (high risk).

19. 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.

20. Outputs of the hazard log have been used as evidence to support and refine the assessment undertaken in **Chapter 16, Volume 2a** and **Section 18** of the NRA.

Table 3-3 Tolerability Matrix and Risk Rankings for Shipping and Navigation

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

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

3.3 Methodology for Cumulative Risk Assessment

21. The hazards identified in the FSA are also assessed for cumulative risks with other projects and proposed developments within the cumulative risk assessment. Given the varying type, status and location of developments, different scenarios have been considered in the cumulative risk assessment, which allocates developments into the scenarios depending upon the following criterion:

- Development status;
- Distance from the Offshore Project;
- Level of interaction with baseline traffic relevant to the Offshore Project;
- Level of concern raised during consultation;
- Data confidence.

22. Given the unique nature of shipping and navigation, the tiering system applied in the NRA differs from that assumed in the overarching EIAR (see **Chapter 5: Approach to EIA, Volume 1a)**.

23. The scenarios and associated level of assessment undertaken for each, are summarised in **Table 3-4**. A detailed qualitative and quantitative (where applicable) approach to the cumulative risk assessment has been applied for each scenario.

24. The maximum distance within which developments are considered for the cumulative risk assessment is 50 nautical miles (nm) from the Array Area on the basis that there is not considered to be a direct pathway for shipping and navigation hazards between the Offshore Project and any development beyond 50 nm from the Array Area. This distance is standard within NRAs and is considered to give a reasonable overview of cumulative traffic patterns.

25. An aggregate of the criterion can determine the relevant scenario(s) for each development. For example, if a development is located within 50 nm of the Array Area but does not impact a main commercial route passing within 1 nm of the Array Area and has low data confidence it may still be screened out of the cumulative risk assessment.

26. Projects meeting the assessment criteria are detailed in **Section 14**.

Table 3-4 Cumulative Development Screening Summary for Shipping and Navigation

Tier	Minimum Development Status	Criterion	Data Confidence Level	Level of Cumulative Risk Assessment
1	Under construction, consented or under determination	May impact a main commercial route passing within 1 nm of the Array Area. *OWFs:* ▪ Up to 25 nm from the Array Area; or ▪ Up to 2 nm from the OCAS. *Sub-sea cables:* ▪ Up to 2 nm from the Array Area; or ▪ Up to 2 nm from the OCAS. *Other:* ▪ Oil and gas platform within 10 nm of the Array Area. ▪ Other developments within 50 nm of the Array Area.	High or medium	Quantitative cumulative re-routeing of main commercial routes
2	Under construction, consented or under determination	May impact a main commercial route passing within 1 nm of the Array Area. *OWFs:* ▪ Between 25 nm and 50 nm from the Array Area; or ▪ Between 2 nm and 5 nm from the OCAS. *Sub-sea cables:* ▪ Between 2 nm and 5 nm from the Array Area; or ▪ Between 2 nm and 5 nm from the OCAS. *Other:* ▪ Oil and gas platform within 10 nm of the Array Area. ▪ Other developments within 50 nm of the Array Area.	High or medium	Quantitative cumulative re-routeing of main commercial routes

Tier	Minimum Development Status	Criterion	Data Confidence Level	Level of Cumulative Risk Assessment
3	Scoped or under examination / in determination	Does not impact a main commercial route passing within 1 nm of the Array Area. *OWFs:* ▪ Up to 50 nm from the Array Area; or ▪ Further than 5 nm from the OCAS. *Sub-sea cables:* ▪ Further than 5 nm from the Array Area; or ▪ Further than 5 nm from the OCAS. *Other:* ▪ Other developments within 50 nm of the Array Area.	Low	Qualitative assumptions of routeing only

3.4 Shipping and Navigation Study Area

27. A minimum 10 nm buffer has been applied around the Array Area of the Offshore Project (hereafter the ‘study area’), and has been cropped to the coast, as shown in **Figure 3-2**. This study area has been defined to provide local context to the analysis of risks by obtaining vessel traffic movements within, and in proximity to, the Offshore Project. This study area also encompasses the entirety of the OCAS and is thus considered comprehensive to capture vessel routeing relevant to the OCAS and the surrounding area.

28. A 10 nm study area has been used within the majority of UK OWF NRAs and is suitable for collection of Radio Detection and Ranging (Radar) data. Onshore areas within the study area have been excluded for the purposes of marine analysis.

29. The study area has been presented to stakeholders including the MCA, the UK Chamber of Shipping and the Northern Lighthouse Board (NLB) within the Scoping Report and at the Hazard Workshop (held February 2025), and no concern was raised by any stakeholder in attendance (see **Section 4.4**).

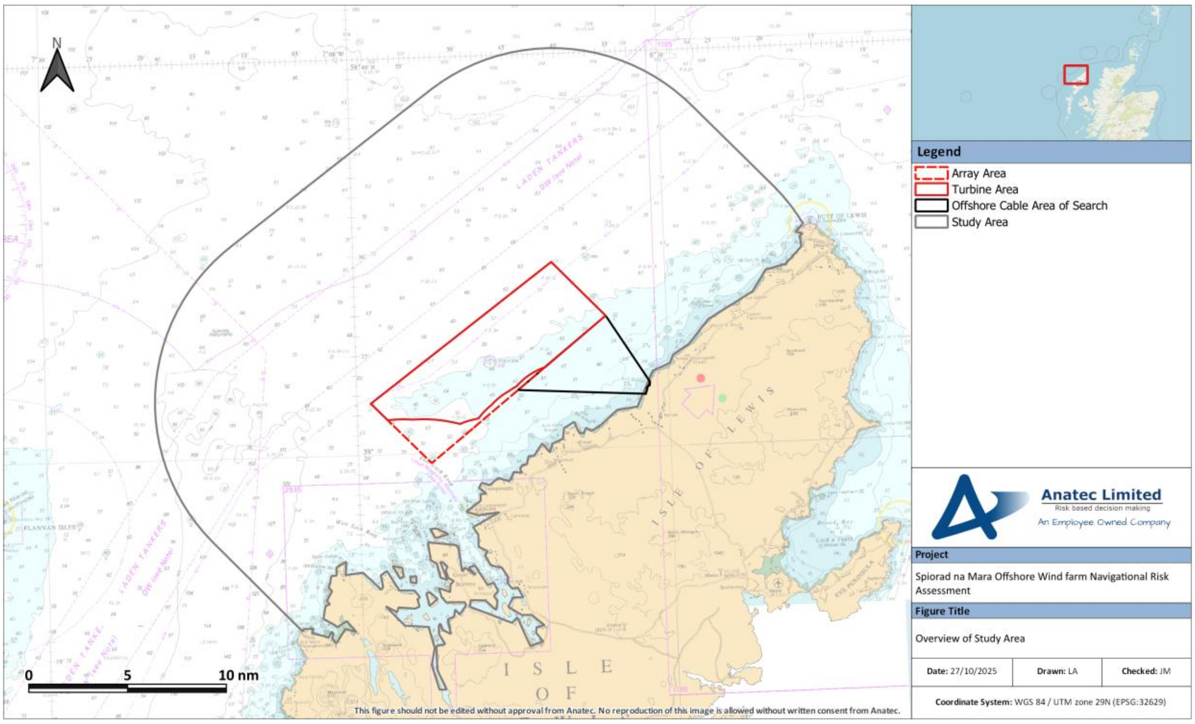

Figure 3-2 Overview of Study Area

4 Consultation

4.1 Stakeholders Consulted in the Navigational Risk Assessment Process

30. Key shipping and navigation stakeholders have been consulted in the NRA process including across the Scoping stage, Hazard Workshop (see **Section 4.4**), Regular Operator outreach (see **Section 4.2**), and standalone consultation meetings. These include:

- Marine Directorate – Licensing Operations Team (MD-LOT) (via the Scoping Opinion);
- MCA;
- NLB;
- UK Chamber of Shipping;
- RYA Scotland;
- Scottish Fishermen's Federation (SFF);
- Bakkafrost;
- Inverlussa;
- Navigare Logistics AS.

31. Other organisations (excluding Regular Operators – see **Section 4.2**) also contacted for input include the Cruising Association, Scottish White Fish Producers Association (SWFPA), Scottish Pelagic Fishermen's Association (SPFA), Royal National Lifeboat Institution (RNLI), Western Isles Council / *Comhairle Nan Eilean Siar*, and Stornoway Port.

4.2 Regular Operator Outreach

32. A total of 12 Regular Operators were identified from the vessel traffic surveys and long-term vessel traffic data and were provided with an overview of the Project with subsequent opportunity to provide feedback. Specific questions were included to aid Regular Operators wishing to make a response, including in relation to changes in routeing or adverse weather routeing. The Regular Operator letter is presented in full in **Appendix D** and was also provided to the UK Chamber of Shipping upon request for circulation among members.

33. The full list of Regular Operators identified and subsequently contacted is provided below:

- Leco Marine;
- Bakkafrost;
- Solvtrans;
- Seatrek Marine;
- Inverlussa;
- Navigare Logistics AS;
- Teekay;
- Royal Wagenborg;
- Noble Caledonia;
- Unibaltic;
- Dynagas;
- Intership.

34. Of the Regular Operators contacted, Inverlussa, Bakkafrost, and Navigare Logistics AS provided feedback, as summarised in the relevant entries in **Table 4-1**.

4.3 Consultation Responses

35. Various responses have been received from stakeholders during consultation undertaken in the NRA process including during the Hazard Workshop, other consultation meetings, via email correspondence, and through the Scoping Opinion. The key points and where they have been addressed in the NRA or **Chapter 16, Volume 2a** are summarised in **Table 4-1**.

36. Responses from MD-LOT in the Scoping Opinion (MD-LOT, 2024) have been reviewed and responses align with input from shipping and navigation stakeholders including the MCA, UK Chamber of Shipping, RYA, and SFF, and thus are not included in **Table 4-1** below. Further detail on the responses received in the Scoping Opinion are presented within Section 16.3.4 of **Chapter 16, Volume 2a.**

Table 4-1 Consultation Summary for Shipping and Navigation

Stakeholder	Date	Form of Correspondence	Remarks	Response and Where Addressed in the NRA
MCA	15/12/2023	Scoping Response	The EIAR should supply detail on the possible impact on navigational issues for both commercial and recreational craft, specifically: ▪ Collision Risk; ▪ Navigational Safety; ▪ Visual intrusion and noise; ▪ Risk Management and Emergency response; ▪ Marking and lighting of site and information to mariners; ▪ Effect on small craft navigational and communication equipment; ▪ The risk to drifting recreational craft in adverse weather or tidal conditions; ▪ The likely squeeze of small craft into the routes of larger commercial vessels.	The listed hazards are assessed within the NRA (see **Section 18**) and in **Chapter 16, Volume 2a**.
			The development area carries a moderate amount of traffic. Attention needs to be paid to routing, particularly in heavy weather so that vessels can continue to make safe passage without large-scale deviations.	Anticipated main commercial route deviations have been defined for the Project in isolation and cumulatively (see **Sections 15.5.2**). Adverse weather routeing is considered in **Section 12**.
			An NRA will need to be submitted in accordance with MGN 654. This NRA should be accompanied by a detailed MGN 654 Checklist.	The relevant MCA guidance has been considered (see **Section 2**). A completed MGN 654 Checklist can be found in **Appendix A**.

Stakeholder	Date	Form of Correspondence	Remarks	Response and Where Addressed in the NRA
			The Development Specification and Layout Plan (DSLP) will require MCA approval prior to construction to minimise the risks to surface vessels, including rescue boats, and Search and Rescue (SAR) aircraft operating within the site. Any additional navigation safety and/or SAR requirements, as per MGN 654 Annex 5, will be agreed at the approval stage.	As per **Section 1**, compliance with MGN 654 is included as embedded mitigation measure including SAR requirements.
			Attention should be paid to cabling routes and where appropriate, burial depth for which a Burial Protection Index study should be completed and, subject to the traffic volumes, an anchor penetration study may be necessary. If cable protection measures are required e.g., rock bags or concrete mattresses, the MCA would be willing to accept a 5% reduction in surrounding depths referenced to CD. This will be particularly relevant where depths are decreasing towards shore and potential impacts on navigable water increase, such as at the Horizontal Directional Drilling (HDD) location.	As per **Section 1**, there will be full MGN 654 compliance including in relation to anchor studies and water depth reductions. A cable burial risk assessment (CBRA) will be undertaken post consent (outlined in measure M030).
			A SAR checklist will also need to be completed in consultation with MCA, as per MGN 654 Annex 5 SAR requirements.	As per **Section 1**, there will be full MGN 654 compliance including in relation to MCA SAR requirements.
			MGN 654 Annex 4 requires that hydrographic surveys should fulfil the requirements of the International Hydrographic Organisation (IHO) Order 1a standard.	As per **Section 1**, there will be full MGN 654 compliance including in relation to hydrographic surveys.

Stakeholder	Date	Form of Correspondence	Remarks	Response and Where Addressed in the NRA
			If HVDC cables are being considered as the export cable, consideration must be given to the effect of electromagnetic deviation on ships' compasses.	HVDC is no longer under consideration (see **Sections 6** and **13.6** and **Chapter 3: Project Description, Volume 1a**.).
			Agree with the methodology, study area, data sources identified and proposed vessel traffic surveys outlined in the Scoping Report and all potential hazards have been identified. On the understanding that the Shipping and Navigation aspects are undertaken in accordance with MGN 654 and its annexes, along with a completed MGN checklist, MCA is likely to be content with the approach.	Methodology is as per set out in the Scoping Report (Spiorad na Mara limited, 2023). Mitigation measures are detailed in **Section 1**. A completed MGN 654 Checklist is provided in **Appendix A**.
NLB	30/10/2023	Scoping Response	NLB have no objection to the content of the Scoping Report, and no suggestions for additional content	The NRA methodology set out in **Section 3** is as per the Scoping Report (Spiorad na Mara limited, 2023).
RYA Scotland	30/10/2023	Scoping Response	The UK Coastal Atlas of Recreational Boating and Clyde Cruising Club Sailing Directions and Anchorages should be considered.	The NRA includes the relevant data sources in **Sections 5** and **10**. Anchorages are identified in **Section 17**.
			Relatively few recreational vessels currently pass up the west coast of Lewis to round the Butt of Lewis as there is no safe shelter between Loch Roag and the Butt of Lewis. Some may be circumnavigating the UK and Ireland and others may be heading from St Kilda to Stornoway.	This aligns with vessel traffic data as presented in **Section 10.2.5**.
			The round Britain and Ireland yacht race is held every four years, the last being in 2022, with the route going through, or close to, the proposed site. Thus, as	Recreational activity is presented in **Section 10.2.5** with long-term analysis in **Appendix E**. Recreational activity within the Array Area is minimal and it is understood that the race route passes west of St Kilda and Sula Sgeir

Stakeholder	Date	Form of Correspondence	Remarks	Response and Where Addressed in the NRA
			mentioned in the Scoping Report, some recreational vessels do pass through the site area.	which are approximately 56 nm southwest and 40 nm northeast of the Array Area, respectively.
			Skippers of vessels in these challenging waters are likely to be experienced and self-sufficient.	This is considered in **Section 18**.
			It is thought that fewer than half the recreational craft in these waters transmit an AIS signal, although there is no need to collect additional data.	The NRA methodology is as per the Scoping Report (Spiorad na Mara Limited, 2023).
			Another effect that should be added is the danger of losing navigational aids such as lights and AIS signals due to storm damage, and the difficulty of repairing them timeously.	This is considered within **Section 18.2.5**.
			Agree with the methodology outlined for assessing potential hazards in the Scoping Report and with the embedded mitigation measures outlined.	The NRA methodology and mitigation measures are set out in **Sections 3** and **1** respectively, are as per the Scoping Report (Spiorad na Mara limited, 2023).
UK Chamber of Shipping	19/10/2023	Scoping Response	Strongly advocates that when the OWF is to be fully decommissioned, there should be the full removal of all infrastructure above and below the seabed, acknowledging Best Available Technology Not Entailing Excessive Cost (BATNEEC) when it comes to turbine foundations which penetrate deep into the seabed. This explicitly includes inter array and export cables.	**Section 6.4.3** acknowledges that a decommissioning plan and programme will be updated during the operation and maintenance phase of the Offshore Project to account for any changes to industry best practice, relevant legislation and policy, or developments in technology (in terms of the extent of infrastructure removal).

Stakeholder	Date	Form of Correspondence	Remarks	Response and Where Addressed in the NRA
			Wish to see a 50 nm study area for cumulative impacts. This is industry standard for large projects such as this as provides for wider impact analysis of the development.	The NRA includes a wider 50 nm study area for assessing cumulative routeing (see **Sections 3.3** and **14.2**).
			Safety concerns with interference and visual impediment of Aird Laimishader Lighthouse, which has a rated visibility of 8 nm, from the many OWF structures, given their greater height and lighting, which will result in “visual clutter” for mariners. The Chamber wishes to see analysis into the impact of and mitigation measures considered for safety of navigation.	The NRA considers this impact in **Section 18**.
			The Chamber wishes to see further analysis of routes passing inshore of the Array Area and the safety of navigation as well as potential anchoring activity in the bay.	The NRA considers main commercial routes in **Section 11**, and anchored vessels within **Section 10** and **Appendix E**. **Section 7** identifies anchorages.
			Rig moves are safety critical and important navigational movements, and the Chamber wishes to see careful longer term analysis of this type of navigation, in particular recognising that a rig stranding occurred in Lewis in the last 10 years at considerable cost and consequence.	The NRA considers 12 months of AIS data within **Appendix E** and no regular rig moves were identified. One rig move was identified as temporary and recorded within the Deep Water Route (DWR). This is considered in **Section 18.2.5**. **Section 9.5** considers the *Transocean Winner* incident and analysis of long-term MAIB data.
			Wish to see a full 12 months of AIS data for a longer term vessel traffic survey, in particular to consider adverse weather and any rig moves that may be captured.	The NRA considers 12 months of AIS data within **Appendix E**. No regular rig moves were identified. One rig move was identified as temporary and recorded within the Deep Water Route (DWR). This is considered in **Section 18.2.5**.

Stakeholder	Date	Form of Correspondence	Remarks	Response and Where Addressed in the NRA
			For long term projects such as offshore wind farms, examining 10 years of accident data is not truly representative of trends and historic incidents. As such the Chamber recommends that 20 years of MAIB spatial accident data be included in the EIA baseline.	The NRA includes assessment of a total of 20 years of MAIB data (see **Sections 5** and **9.5**).
MCA	04/11/2024	Post-Scoping Meeting	Noted that cables will be expected to be protected with the main issue being the risk of fishing gear snagging. Different protection types will have different levels of risk.	The NRA assumes worst-case for fishing gear snagging risk within **Section 18**. It is acknowledged that cables may be surface laid, buried or protected with the appropriate approach determined by a CBRA undertaken post consent.
			Noted that for aviation lighting there are statutory requirements for SAR purposes.	Lighting and marking requirements are included in **Section 17** as embedded mitigation.
NLB	04/11/2024	Post-Scoping Meeting	Noted that Loch Roag is at capacity and resource availability will be limited if it is being considered as a base location.	The NRA considers this within **Section 18**.
			Confirmed that adjustments to lighting have been made for projects nearshore previously (e.g. Aberdeen Bay) to reduce light range of land-facing turbines but insight of traffic patterns would be needed to inform any adjustments of the LMP, especially analysis of the timing of transits.	Timings of inshore transits are considered within **Section 10.2.2** and **Table 4-1**.
			Noted that there is unlikely a large impact from visual impediment of the Aird Laimishader Lighthouse as it is only used for entry into Loch Roag. It is owned by Western Isles Council who can liaise with NLB if they feel there is an issue.	This is considered in **Section 18**.

Stakeholder	Date	Form of Correspondence	Remarks	Response and Where Addressed in the NRA
			Noted an outline LMP would be well received.	Lighting and marking is included as an embedded mitigation measure within **Section 17,** and **Outline Lighting and Marking Plan, Volume 3** has been submitted as part of the application.
UK Chamber of Shipping	07/11/2024	Post-Scoping Meeting	Request to be provided the list of Regular Operators.	The list and letter were provided on 10 February 2025, the latter of which is included in **Appendix D**.
			Commented that the main concerns regard the DWR used by tankers to the northwest of the Array, as well as displacement of near-shore traffic.	The NRA captures the DWR and the vessels transiting through it (see **Sections 7**, **10**, and **Appendix E**).
Bakkafrost	22/01/2025	Regular Operator Outreach	Bakkafrost have 5 salmon farms in Loch Roag, with well boats transiting to and from Stornoway.	This is considered within **Section 18**.
Inverlussa	27/01/2025	Regular Operator Outreach	Noted that if transiting through the OCAS is permitted during construction and operation phases, there is no reason operations would be impacted.	This is considered within **Section 18**.
			Inverlussa mainly transit the west coast of the Isle of Lewis to access aquaculture sites in Loch Roag.	Use of Loch Roag by aquaculture vessels is considered within **Section 18**.
			Noted it was unlikely that Inverlussa vessels will choose to pass through the array but very likely to route through the OCAS.	This is considered within **Section 18**.
Navigare Logistics	28/01/2025	Regular Operator Outreach	Navigare Logistics are engaged in delivering fish food to Bakkafrost fish farms in Loch Roag.	Use of Loch Roag by aquaculture vessels is considered within **Section 18**.
			Noted that the Project will most likely not impact routeing, passage planning, or pose any safety	This is considered within **Section 18**.

Stakeholder	Date	Form of Correspondence	Remarks	Response and Where Addressed in the NRA
			concerns. Noted no reason for their vessels to make passage internally through the array.	
Bakkafrost	25/02/2025	Hazard Workshop	Noted importance of access to Loch Roag especially in adverse weather. Project vessels using the same pier facilities as Bakkafrost would impact operations.	Reduced access to facilities is considered within **Section 18**.
			Bakkafrost may increase use of Loch Roag including expansion of activities within the loch, this will not create new routeing patterns but would increase traffic volumes.	Vessel traffic increases are considered within **Section 18** as well as quantitative modelling (see **Section 16**).
			Confirmed that nearshore routes are not restricted by water depths, and exact routeing is determined by skipper preference. Though nearshore routes are not currently present following a factory closure in Stornoway, however, may occur depending on weather.	This is considered within **Section 18**.
			Encounters with other vessels do not typically occur on nearshore routes.	This is considered within **Section 18**.
			Confirmed a small deviation would be required for one route but is unlikely to cause an issue for approaches to Loch Roag, noting familiarity with transiting around islands and close to shore.	This is considered within **Section 18**.
NLB	25/02/2025	Hazard Workshop	IALA Guidance 1185 has recently been published and should be included.	The NRA considers this guidance (see **Section 2.3**).
			If Crew Transfer Vessels (CTVs) are to be used in Loch Roag then a further risk assessment will be required	This is considered as additional mitigation in **Section 17**.

Stakeholder	Date	Form of Correspondence	Remarks	Response and Where Addressed in the NRA
			including a review of Aids to Navigation (AtoNs). This can be undertaken post consent if required.	
			Green Energy Project in Loch Roag and Spaceport at North Uist should be investigated for cumulative screening.	The NRA considers these within the cumulative screening in **Section 14**.
			Wreck response should be considered within the NRA.	As per **Section 17**, there will be full MGN 654 compliance including in relation to the completion of an Emergency Response Cooperation Plan (ERCoP) post consent, which will include consideration of wreck response.
			Noted recent preference at Invergordon for use of semi submersible vessels for long distance moves rather than relying on towage for rigs. Moves by towage remain the preference in the North Sea.	This is considered within **Section 18**.
UK Chamber of Shipping	25/02/2025	Hazard Workshop	The *Transocean Winner* grounding incident should be considered.	This incident is considered within **Section 9** and **Section 18**.
			The NRA should be explicit in the reasoning behind an internal substation being considered as worst-case.	Explanation is included within **Section 6**.
Company Fisheries Liaison Officer (CFLO)	25/02/2025	Hazard Workshop	A small number of potting vessels are active within the Shipping and Navigation study area and operate out of Carloway Pier between April – September.	This is considered within **Section 18**.
RYA Scotland	08/05/2025	Hazard Workshop materials response	Loch Roag is an important location as a refuge for recreational vessels in case of adverse weather with a lot of places that can be used as anchorages.	This is acknowledged in **Section 7** and **10**, and considered within **Section 18**.

Stakeholder	Date	Form of Correspondence	Remarks	Response and Where Addressed in the NRA
			Discussions with the organisers of the Round Britain and Ireland yacht race may lead to the Array Area being able to serve as a mark of the course which vessels are required to pass outside.	This is considered within **Section 18**.
			Loss of AtoNs marking the Array Area are not an infrequent occurrence on the Scottish east coast and waters around the west coast of Lewis can be wild making repair works a greater issue.	This is considered within **Section 18**.
NLB	06/08/2025	Outline LMP Meeting	NLB have agreed that shore-facing Significant Peripheral Structure (SPS) lights may use a range of 2 nm rather than the nominal range of 5 nm and this will not adversely impact upon the safety of navigation.	This is considered within **Section 17.2.1**.

4.4 Hazard Workshop

37. A key element of the consultation undertaken 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 to be used as input into the risk assessment undertaken in **Chapter 16, Volume 2a** and **Section 18** of the NRA. This ensured that expert opinion and local knowledge was incorporated into the hazard identification process and that the hazard log was site-specific.

4.4.1 Hazard Workshop Attendance

38. The Hazard Workshop was held on the 25 February 2025 on the Isle of Lewis / *Eilean Leòdhais* and was attended, either in-person or virtually, by the Applicant and following stakeholders:

- UK Chamber of Shipping;
- MCA;
- NLB;
- SFF;
- Bakkafrost.

4.4.2 Hazard Workshop Process and Hazard Log

39. During the Hazard Workshop, key maritime hazards associated with the construction, operation and maintenance, and decommissioning of the 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.

40. Following the Hazard Workshop, the risks associated with the identified hazards were ranked in the hazard log based upon the discussions held during the workshop. Where appropriate, mitigation measures were 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.

41. The hazard log has been used to inform the risk assessment undertaken in **Chapter 16, Volume 2a** and **Section 18** of the NRA , and is presented in full in **Appendix B**.

5 Data Sources

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

5.1 Summary of Data Sources

43. The main data sources used in assessing the shipping and navigation baseline relative to the Offshore Project are outlined in **Table 5-1**.

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

Data	Sources(s)	Purpose
Vessel traffic	14 Days vessel traffic survey data winter 2024 (21 February - 6 March).	Characterising vessel traffic movements within and in proximity to the Offshore Project.
	14 Days vessel traffic survey data summer 2024 (18 June - 2 July).	
	13.8 Days vessel traffic survey data summer 2023 (18 July – 14 August).	Validation of survey data for the study area.
	12 Months AIS data for the study area (1 July 2023 - 30 June 2024).	
	Anatec's ShipRoutes database (Anatec, 2025).	
	UK Coastal Atlas of Recreational Boating (RYA, 2019 (b)).	Characterising recreational activity in proximity to the Offshore Project.
	Vessel Monitoring System (VMS) data for 2024 (Scottish Government, 2025).	Characterising fishing activity in proximity to the Offshore Project.
Maritime incidents	MAIB marine accidents database (2004 - 2023).	Review of historical maritime incidents within and in proximity to the Offshore Project.
	Royal National Lifeboat Institution (RNLI) incident data (2014 - 2023).	
	Department for Transport (DfT) UK Civilian SAR helicopter taskings (2015 - 2024)	
Other navigational features	Admiralty Charts 2720, 2721, and 2515 (UKHO, 2023-2025).	Characterising other navigational features within and in proximity to the Offshore Project.
	Admiralty Sailing Directions North-West Coast of Scotland Pilot NP66B 3rd Edition (UKHO, 2023).	
	Clyde Cruising Club (CCC) Sailing Directions and Anchorages Outer Hebrides 3rd Edition (CCC, 2024)	
Weather	Wind direction data provided by the Project.	Characterising weather conditions in proximity to the Offshore Project for use as input to the collision and allision risk modelling.
	Tidal data from Admiralty Chart 2720 (UKHO, 2024)	
	Visibility data from Admiralty Sailing Directions North-West Coast of Scotland Pilot NP66B 3rd Edition (UKHO, 2023).	

5.2 Vessel Traffic Surveys

44. The vessel traffic surveys were undertaken using the methodology agreed with the MCA and NLB. Two 14-day AIS, Radar, and visual observation shore-based surveys undertaken in winter 2024 (21 February - 6 March) and summer 2024 (18 June - 2 July) have been considered within the baseline for a total of 28 full days, with a long-term dataset from 1 July 2023 - 30 June 2024 used as validation (see **Section 5.3** and **Appendix E**) alongside a vessel-based survey undertaken in summer 2023.

45. The vessel-based survey ran from 18 July - 14 August 2023 and culminated in an effective total of 13.8 days of AIS, Radar, and visual observation vessel traffic data. The survey was carried out from the multi-purpose vessel *Boulder* during a geotechnical survey of the Array Area, which left site occasionally due to adverse weather conditions, crew changes, and/or repairs. Given the non-comprehensive coverage provided by this vessel-based survey, it is considered as a secondary data source for validation of the vessel traffic movements in proximity to the Project.

46. The shore-based surveys were undertaken from a location within the village of Brue, on the west coast of the Isle of Lewis, approximately 4.7 nm southeast of the Array Area during winter 2024 (21 February - 6 March 2024) and summer 2024 (18 June - 2 July 2024). Each survey spanned an effective period of 14 days, giving an effective total of 28 days of AIS, Radar, and visual observation vessel traffic data. This dataset is fully compliant with MGN 654 and is considered the primary data source for characterising vessel traffic movements in proximity to the Project.

47. A number of vessel tracks recorded during the survey periods were classified as temporary (non-routine), such as non-routeing survey vessels. These have therefore been excluded from the analysis. Vessel tracks which remained moored for the duration of the survey periods were also excluded to avoid over-representation of active vessel traffic activity. Such instances were located solely within Loch Roag.

48. The dataset is assessed in full in **Section 10**.

5.3 Long-Term Vessel Traffic Data

49. Long-term vessel traffic data consisting of AIS covering 12 months between the 1 July 2023 -30 June 2024 was collected from coastal receivers. Accounting for the distance offshore of the Offshore Project, the long-term vessel traffic data is considered to be comprehensive for the study area. The assessment of this dataset allowed seasonal variations to be captured.

50. The analysis of this dataset is presented in full in **Appendix E**.

5.4 Data Limitations

5.4.1 AIS Data

51. For the purposes of the NRA, it has been assumed that vessels under an obligation to broadcast information via AIS have done so, both in the vessel traffic surveys and long-term vessel traffic data. It has also been assumed that the details broadcast via AIS (such as vessel type and dimensions) are accurate unless clear evidence to the contrary was identified during Anatec's thorough quality assurance of the data. Additionally, the collection of Radar data during the vessel traffic surveys captures smaller vessels that may not broadcast on AIS.

5.4.2 Historical Incident Data

52. Although all UK commercial vessels are required to report accidents to the MAIB, this is not mandatory for non-UK vessels unless they are in a UK port, within 12 nm of territorial waters or carrying passengers to a UK port. There are also no requirements for a non-commercial recreational craft to report accidents to the MAIB. Therefore, it is possible that not every incident that occurred within the Shipping and Navigation study area will be recorded within the MAIB dataset (noting that the Shipping and Navigation study area does extend beyond 12 nm territorial waters).

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

54. To minimise potential data gaps, historical incident data was discussed with stakeholders during the Hazard Workshop including the grounding incident of Transocean Winner, which was not included in the dataset within the Shipping and Navigation study area.

5.4.3 UKHO Charts

55. The UKHO Admiralty Charts are updated periodically, and therefore the information shown may not reflect the real-time features within the region with total accuracy. For AtoNs, only those charted and considered key to establishing the shipping and navigation baseline are shown.

56. 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 at the time of writing, alongside stakeholder input.

6 Project Description

57. The NRA reflects the PDE, which is outlined in full in the **Chapter 3, Volume 1a**. The following subsections outline the maximum extent of the Offshore Project for which any shipping and navigation hazards are assessed.

58. A High Voltage Alternating Current (HVAC) substation will be necessary on the west side of the Isle of Lewis. There are currently two options being considered with either an Offshore Substation Platform (OSP) located within the Turbine Area or alternatively an onshore Landfall Substation on the west coast at Barvas. These options are discussed further within **Chapter 3, Volume 1a**. As a brief summary, these 2 substation location options include:

- An option for the Wind Turbine Generators (WTGs) to connect to an Offshore Substation Platform (OSP), with 2 Export Cables connecting the OSP to Landfall (henceforth referred to as 'Scenario 1'); and
- An option for Array Cables to be installed in several string circuit configurations, connecting multiple WTGs together. The final WTG in each chain will transmit the generated power from the WTG directly to the Landfall (referred to as 'Array Cables to Landfall') (henceforth referred to as 'Scenario 2').

59. It should be noted that only 1 of these options will be progressed to completion; however, both options will be considered within the NRA due to the requirement to identify and assess the worst-case scenario for individual shipping and navigation related hazards. Hazards relating to surface infrastructure (including the OSP) will consider Scenario 1 while hazards relating to Offshore Cable infrastructure will consider Scenario 2 (since the latter maximises use of the OCAS).

6.1 Project Boundaries

6.1.1 Array Area and Turbine Area

60. The Array Area is located approximately 2.5 nm (4.6 km) west of the Isle of Lewis at its closest point. The total area covered by the Array Area is approximately 47 square nautical miles (nm^2) (161 km^2) with water depths ranging between 34 m and 64 m below CD. The Array Area fully encompasses the Turbine Area.

61. The Turbine Area is set back approximately 3.2 nm (6 km) from the coast, and approximately 5.9 nm (11 km) from a National Scenic Area (NSA) to the south. All surface piercing structures (WTGs and OSP) will be located within the Turbine Area. Subsea infrastructure (i.e., cables) may be located within the portion of the Array Area not encompassed by the Turbine Area.

62. The Turbine Area and the coordinates defining the boundary of the Array Area are illustrated in **Figure 6-1** and provided in **Table 6-1**. It is not intended that the Array Area be designated as an Area to be Avoided (ATBA), with navigation only restricted where Safety Zones are active (see **Section 17**).

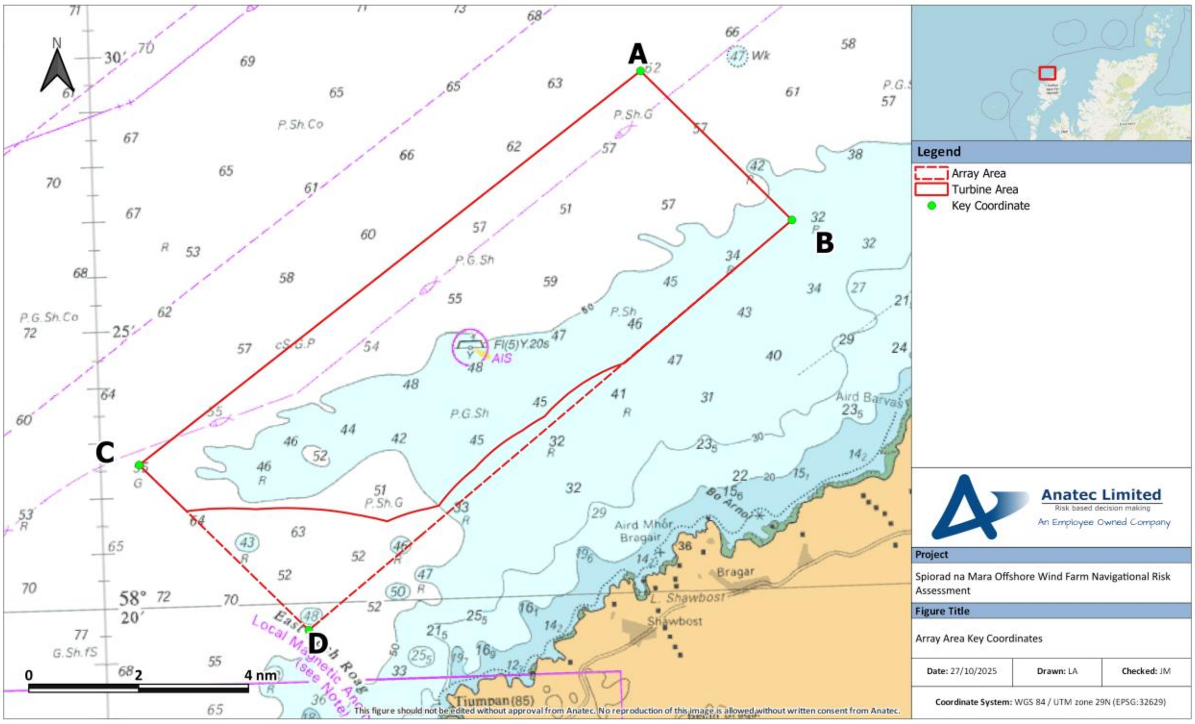

Figure 6-1 Array Area Key Coordinates

Table 6-1 Array Area Key Coordinates for Shipping and Navigation

Point	Latitude (World Geodetic System 1984 (WGS84))	Longitude (WGS84)
A	58° 29' 26.74" N	006° 40' 53.59" W
B	58° 26' 38.68" N	006° 35' 49.55" W
C	58° 22' 35.25" N	006° 58' 41.46" W
D	58° 19' 29.76" N	006° 53' 00.34" W

6.1.2 Offshore Cable Area of Search

63. The OCAS connects the Array Area to the coast and is presented in **Figure 6-2**. The total area is approximately 13.7 nm^2 (47 km^2) with water depths within the OCAS ranging between 0 m (Landfall) and 47 m below CD. The Offshore Cables will be located fully within the OCAS and Array Area.

64. The OCAS has been refined from the original OCAS, which covered an area of 26.3 nm^2 (91 km2). The original OCAS and the since refined OCAS are compared within **Figure 6-3.**

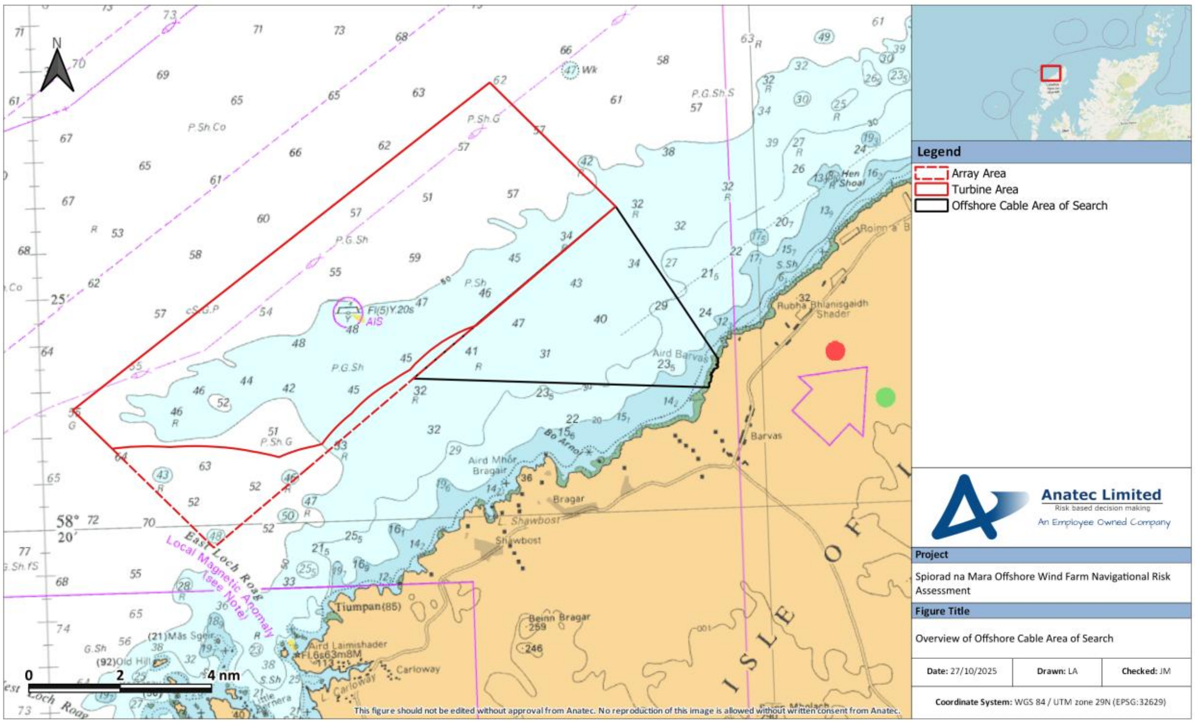

Figure 6-2 Overview of Offshore Cable Area of Search

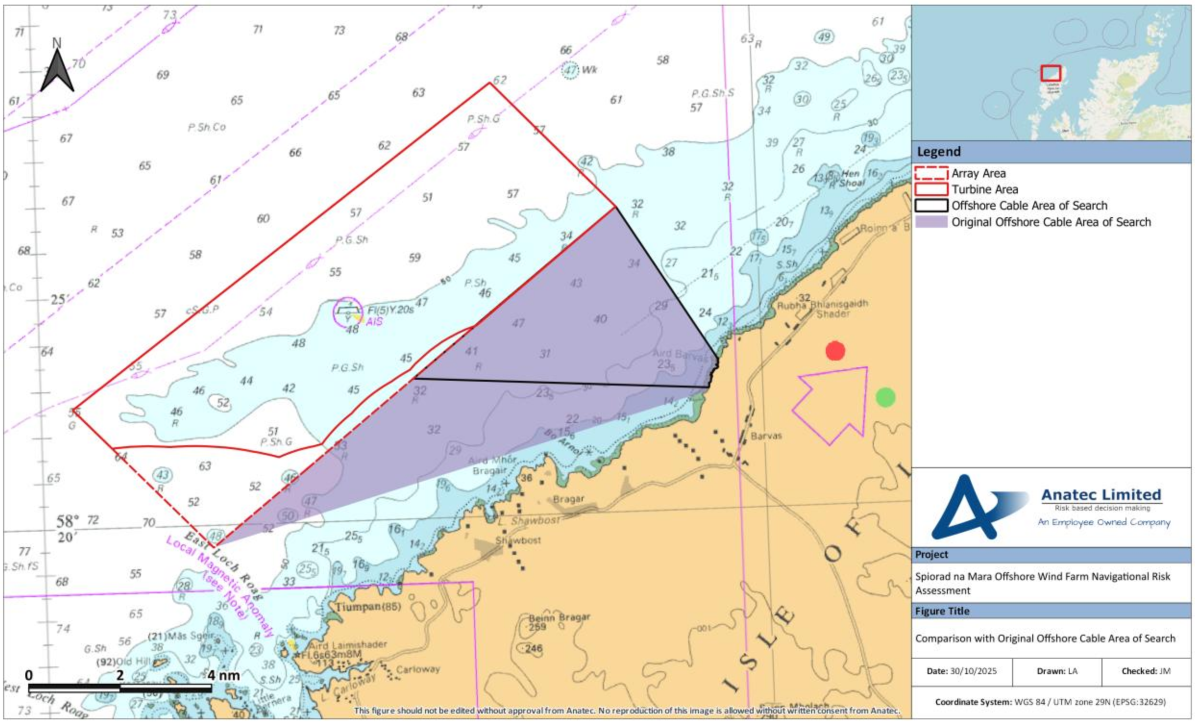

Figure 6-3 Comparison with Original Offshore Cable Area of Search

65. The refinement of the OCAS was in part driven by impacts to coastal navigation and inshore fishery activity. The refinement aids in minimising spatial overlap with known potting areas and maximises sea room available for safe anchoring, particularly in an

emergency. This is considered further within **Section 18.** Impacts specific to commercial fishing are assessed within **Chapter 21, Volume 2a**.

6.2 Surface Infrastructure

6.2.1 Indicative Array Layout

66. A maximum of up to 61 surface structures (comprising of up to 60 WTGs and 1 OSP) will be installed within the Turbine Area. An indicative array layout option has been considered in this NRA which represents the maximum number of surface-piercing structures over the maximum spatial area. This layout is generally considered in the risk assessment in **Section 18**; however, this layout does not account for the minimum centre-to-centre spacing of 900 m and therefore this parameter is accounted for qualitatively where relevant.

67. This layout is shown in **Figure 6-4**. An alternative layout associated with a 45-structure scenario (up to 44 WTGs and 1 OSP) is considered where appropriate for other specific EIA topics in the wider EIAR but is not considered to reflect the worst case scenario for shipping and navigation and is therefore not considered in this NRA.

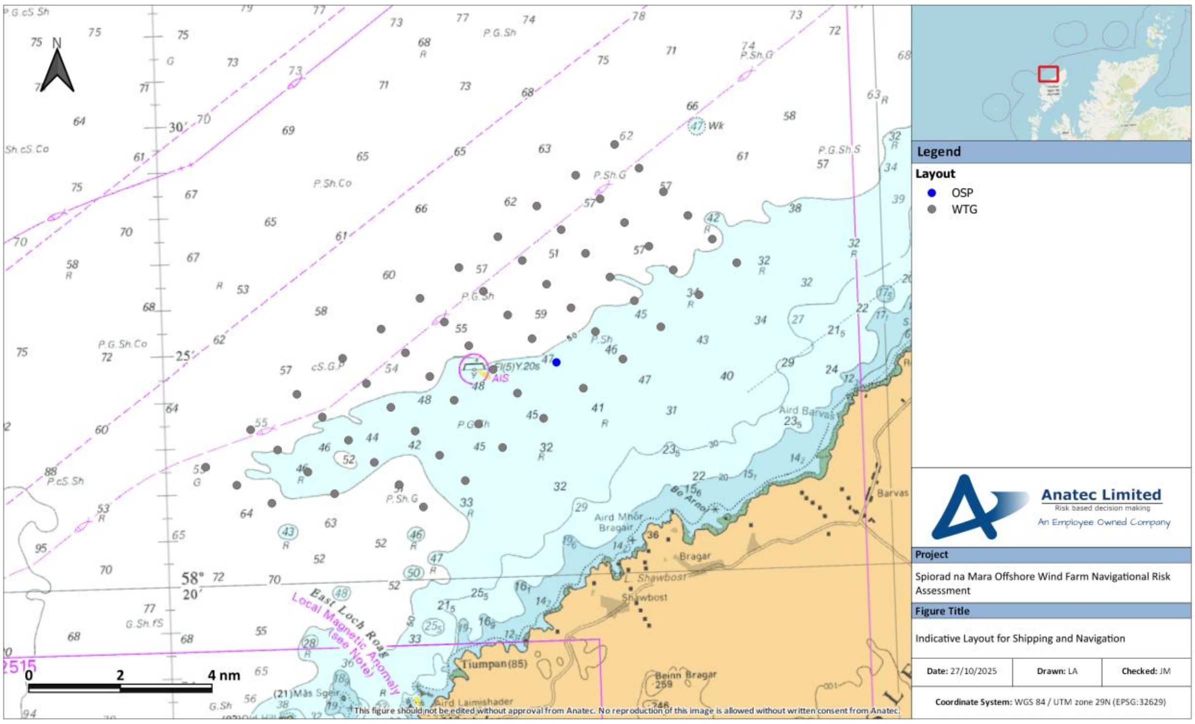

Figure 6-4 Indicative Layout for Shipping and Navigation

68. The indicative layout incorporates an 11 km set-back from the NSA to the southwest, and a 6 km set-back from the coastline. Under Scenario 1, it consists of up to 60 WTGs and 1 OSP to maximise exposure for passing (or adrift) vessels. The OSP will not be located on the perimeter of the array.

6.2.2 Wind Turbine Generators

69. The Maximum Design Scenario (MDS) for the WTGs within the indicative array layout is for a maximum rotor diameter of 236 m and maximum blade tip height (above Mean Sea Level (MSL)) of up to 293.8 m. These values reflect the worst-case values from a shipping and navigation perspective (i.e. maximum number of WTGs).

70. Four-legged jackets have been considered the MDS for shipping and navigation as this foundation type provides the maximum structure dimension at the sea surface and therefore maximises exposure for passing (or adrift) vessels. The MDS for the WTGs, which assumes use of a jacket foundation, are provided in **Table 6-2**.

Table 6-2 WTG MDS for Shipping and Navigation

Parameter	MDS for Shipping and Navigation
Foundation type	Four-legged jacket
Dimensions at sea surface	35×35 m
Blade clearance above MSL	30 m (28.33 m)
Maximum blade tip height above MSL	293.8 m
Maximum rotor diameter	236 m

6.2.3 Offshore Substations

71. Under Scenario 1, the OSP will be installed on a piled jacket foundation, utilising High Voltage Alternating Current (HVAC). The maximum topside dimensions are 70×70 m.

6.3 Subsea Infrastructure

6.3.1 Scenario 1

72. Under Scenario 1, up to 86 nm (160 km) of Array Cables will be fully installed within the Array Area to connect individual WTGs to each other, as well as to the OSP. The final length will depend upon the final array layout. No cable crossings will be required in the Array Area.

73. Two Export Cables of up to 16 nm (30 km) will be installed within the Turbine Area and OCAS to carry the electricity generated between the OSP and the Landfall location. No cable crossings will be required.

6.3.2 Scenario 2

74. Under Scenario 2, up to 189 nm (350 km) of Array Cables to will be fully installed within the Array Area to connect individual WTGs to the final WTG, and 12 Array Cables to Landfall will connect the final WTGs directly to the Landfall location. This

will include up to 12 Array Cables installed within the OCAS. The final length will depend upon the final array layout. No cable crossings will be required.

6.3.3 Cable Burial and Protection

75. Subsea cables will be surface laid or protected. The extent and method by which the subsea cables are protected will depend on the results of a detailed seabed survey of the final subsea cable routes and associated CBRA.

76. Where possible, the primary means of cable protection will be by seabed burial, with a minimum burial depth of 0.2 m for all subsea cables associated with the Offshore Project assumed as part of the MDS. Noting actual burial depths will be determined via the CBRA process which will be undertaken post consent once geotechnical survey data are available (outlined in measure M030).

77. Where cable burial is not possible, alternative cable protection methods may be deployed which will again be determined within the CBRA. These methods may include a combination of concrete mattresses and rock placement.

78. Under Scenario 1, it is assumed that up to 100% of the Array Cables and 100% of the Array Cables to Landfall may require protection. Under Scenario 2, it is assumed that up to 100% of the Array Cables may require cable protection. For both options a cable protection height of 1.1 m and width of 3 m is considered as part of the MDS.

6.4 Vessel Numbers

6.4.1 Construction Phase

79. The offshore construction phase will last for 5 years, noting schedules will be subject to change (e.g. due to adverse weather, vessel availability). Due to the potential for adverse weather, construction activities will only take place between the months of April – October (inclusive). Base port(s) for offshore construction are not available at this stage.

80. Indicatively, up to 35 vessels will be on site simultaneously throughout the construction phase. **Table 6-3** provides a breakdown of the installation activities and vessel types during the construction phase.

Table 6-3 Indicative Vessel Numbers during Construction for Shipping and Navigation

Activity	Vessel Type	Estimated Max. Vessels on Site	Max. Annual Return Trips
Main Installation and Support Vessels	WTG Installation Vessel	1	15
	Jacket Installation Vessel	1	2
	Drilling Vessel	2	4
	Grout and Pile Supply Vessel	2	80
	Barge	2	80
	Pile Install Vessel	1	60
	Installation vessel, trencher, rock dumper, boulder clearance / grabber, gravel bed / carpet layer	9	100
Other Vessels	Tug/Anchor Handler Vessel	2	180
	Guard Vessel	2	25
	Boulder Clearance/ Grab Vessel	3	25
	Gravel Bed/Rock Dumping Vessel	3	
	CTV or Service Operation Vessel (SOV)	3 CTV or 1 SOV	250
	Scour Protection Installation Vessel	2	25
	Cable Protection Installation Vessel	2	25
Total		**35**	**871**

6.4.2 Operation and Maintenance

81. The operation and maintenance phase will last 35 years. Throughout the operation and maintenance phase, a maximum number of 10 operation and maintenance vessels may be located on site simultaneously with a maximum of 32,034 total return trips to port.

82. **Table 6-4** provides a breakdown of the installation activities and vessel types during the operation and maintenance phase. Base port(s) for the operation and maintenance phase are not available at this stage.

Table 6-4 Indicative Vessel Numbers during Operation and Maintenance for Shipping and Navigation

Vessel Type	Maximum Number of Vessels on Site	Maximum Number of Return Trips
CTV/Workboat	3	31,850
Jack-up Vessel	1	140
Cable Repair Vessel	1	12
Other Vessels	4	20
Excavators or Backhoe Dredger	1	12
Total	**10**	**32,034**

83. 1 helicopter may be operated throughout the year to support operations if required.

6.4.3 Decommissioning Phase

84. The decommissioning phase will generally be the reverse of the construction phase in terms of duration, vessel types and vessel numbers. A decommissioning plan and programme will be developed prior to construction and updated during the operation and maintenance phase of the Offshore Project to account for any changes to industry best practice, relevant legislation and policy, or developments in technology.

6.5 Maximum Design Scenario

85. The MDS for each shipping and navigation hazard is provided in **Table 6-5** and is based on the parameters described in the previous subsections.

Table 6-5 MDS for Shipping and Navigation

Potential Hazard	Maximum Design Scenario	Justification
Construction		
Vessel displacement	**Offshore infrastructure** Full build out of Scenario 2, consisting of: - Up to 60 WTGs - Installation of up to x12 Array Cables to final WTG in string (within Array Area) and up to x12 Array Cables to Landfall (within OCAS) up to 189 nm (350 kilometres (km)) in length. **Construction working arrangements** - Buoyed construction area encompassing the maximum extent of the Turbine Area; - Presence of 500 m construction and 50 m pre commissioning safety zones; - Assume that all third-party vessels will choose not to navigate within the buoyed construction area based on experience at previously under construction offshore wind farms which are delineated with buoyage. **Vessel movements** - Up to 35 construction vessels on site simultaneously; - Up to 871 vessel movements (return trips) per year **Construction programme** - Duration is up to 5 years. - Working hours are expected to be 24 hours, 7 days a week. - Offshore construction within the Offshore Project Boundary will only be undertaken during the April-October period, except for offshore Landfall construction works located within the HDD Exit Pit Area.	Largest possible extent of infrastructure, greatest number of simultaneous vessel activities and greatest duration resulting in the maximum spatial and temporal effect on vessel displacement and subsequent vessel to vessel collision risk.
Increased vessel to vessel collision risk (third-party to third-party vessels)	The MDS used for this assessment is identical to the MDS for the Offshore Project construction phase *'Vessel displacement'* pathway above.	Largest possible extent of infrastructure, greatest number of simultaneous vessel activities and greatest duration resulting in the maximum spatial and temporal effect on vessel to vessel collision risk.
Vessel to vessel collision (third-party vessel to Offshore Project vessel)	The MDS used for this assessment is identical to the MDS for the Offshore Project construction phase *'Vessel displacement'* pathway above.	Largest possible extent of infrastructure, greatest number of simultaneous vessel activities and greatest duration resulting in the maximum spatial and temporal effect on vessel displacement and subsequent vessel to vessel collision risk involving an third-party vessel and an Offshore Project vessel.
Reduced access to local ports, harbours, and facilities	The MDS used for this assessment is identical to the MDS for the Offshore Project construction phase *'Vessel displacement'* pathway above.	Largest possible extent of infrastructure, greatest number of simultaneous vessel activities, and greatest duration resulting in the maximum spatial and temporal effect on reduced access to local ports and harbours.
Operation and maintenance		
Vessel displacement	**Offshore infrastructure** Full build out of Scenario 2, consisting of: **WTGs** - Up to 60 WTGs - Minimum spacing 900 m between WTGs - WTG with up to 4 legged jacket foundations with sea surface dimensions of 35 m x 35m **Array Cables** - Cable length: 12 Array Cables to Final WTG (within the Turbine Area) and 12 Array Cables to Landfall (within the OCAS) equating to a maximum cable length of 189 nm (350 km). - Surface lay cables installed with 100% of cables requiring protection. - Cable protection: will be achieved using rock berms, rock bags, concrete mattresses or other inert material and will have a maximum width of 3 m, height of 1.1 m.	Largest possible extent of infrastructure, greatest number of simultaneous vessel activities and greatest duration resulting in the maximum spatial and temporal effect on vessel displacement.

Potential Hazard	Maximum Design Scenario	Justification
	Construction working arrangements - Presence of 500 m safety zones during major maintenance; - Assume that commercial vessels will choose not to navigate within the Turbine Area. - Small craft (fishing vessels and recreational vessels may choose to navigate internally within the Turbine Area. **Vessel movements** - Up to 10 operational and maintenance vessels on site simultaneously; - Up to 32,034 vessel movements (return trips) per year **Operational and maintenance programme** - Duration is up to 35 years.	
Increased vessel to vessel collision risk (third-party to third-party vessels)	The MDS used for this assessment is identical to the MDS for the Offshore Project O&M phase *'Vessel displacement'* pathway above.	Largest possible extent of infrastructure, greatest number of simultaneous vessel activities and greatest duration resulting in the maximum spatial and temporal effect on vessel to vessel collision risk.
Reduced access to local ports, harbours, and facilities	The MDS used for this assessment is identical to the MDS for the Offshore Project O&M phase *'Vessel displacement'* pathway above.	Largest possible extent of infrastructure, greatest number of simultaneous vessel activities and greatest duration resulting in the maximum spatial and temporal effect on reduced access to local ports and harbours.
Increased vessel to structure allision risk	**Offshore infrastructure** Full build out of Scenario 1, consisting of: **WTGs** - Up to 60 WTGs - Minimum spacing 900 m between WTGs - Blade clearance: 30 m (28.33 m AMSL) - WTG with up to 4 legged jacket foundations with sea surface dimensions of 35 m x 35m **OSP** - Up to 1 OSP - Topside dimensions 70 m x 70 m **Construction working arrangements** - Presence of 500 m safety zones during major maintenance; - Assume that commercial vessels will choose not to navigate within the Turbine Area. - Small craft (fishing vessels and recreational vessels may choose to navigate internally within the Turbine Area. **Operational and maintenance programme** - Duration is up to 35 years.	Largest possible extent of surface infrastructure, greatest number of surface structures and greatest duration resulting in the maximum spatial and temporal effect on vessel to structure allision risk.
Reduced under keel clearance due to cable protection	**Offshore infrastructure** Full build out of Scenario 2, relevant components consisting of: **Array Cables** - Cable length: 12 Array Cables to Final WTG (within the Turbine Area) and 12 Array Cables to Landfall (within the OCAS) equating to a maximum cable length of 189 nm (350 km). - Surface lay cables installed with 100% of cables requiring protection. - Cable protection: will be achieved using rock berms, rock bags, concrete mattresses or other inert material and will have a maximum width of 3 m, height of 1.1 m. **Operational and maintenance programme** - Duration is up to 35 years. As per parameter for 'Vessel displacement' (operational and maintenance phase) above.	Largest possible extent of subsea infrastructure and greatest duration resulting in the maximum spatial and temporal effect on under keel clearance.
Anchor and/or fishing gear interaction with subsea cables	The MDS used for this assessment is identical to the MDS for the Offshore Project O&M phase '*Reduced under keel clearance due to cable protection'* pathway above.	Largest possible extent of subsea infrastructure and greatest duration resulting in the maximum spatial and temporal effect on anchor interaction with subsea cables.

Potential Hazard	Maximum Design Scenario	Justification
Reduction of emergency response capability due to increased incident rates and/or reduced access for SAR responders	**Offshore infrastructure** Full build out of Scenario 1, consisting of: **WTGs** - Up to 60 WTGs - Minimum spacing 900 m between WTGs - Blade clearance: 30 m (28.33 m AMSL) - WTG with up to 4 legged jacket foundations with sea surface dimensions of 35 m x 35m **OSP** - Up to 1 OSP - Topside dimensions 70 m x 70 m **Array Cables** - Cable length: 12 Array Cables to Final WTG (within the Turbine Area) and 12 Array Cables to Landfall (within the OCAS) equating to a maximum cable length of 189 nm (350 km). All other parameters as per the Offshore Project O&M phase *'Vessel displacement'* pathway above.	Largest possible extent, greatest number of surface structures, greatest number of simultaneous vessel activities and greatest duration resulting in the maximum spatial and temporal effect on emergency response capability.
Decommissioning		
Vessel displacement	**Offshore infrastructure** Full build out of Scenario 2, consisting of: - Up to 60 WTGs - 12 Array Cables to Final WTG (within the Turbine Area) and 12 Array Cables to Landfall (within the OCAS) equating to a maximum cable length of 189 nm (350 km). **Decommissioning working arrangements** - Buoyed decommissioning area encompassing the maximum extent of the Turbine Area; - Presence of 500 m decommissioning and 50 m pre decommissioning safety zones; - Assume that all third-party vessels will choose not to navigate within the buoyed decommissioning area based on experience at previously under construction offshore wind farms which are delineated with buoyage. **Vessel movements** - Up to 35 decommissioning vessels on site simultaneously; - Up to 871 vessel movements (return trips) per year **Decommissioning programme** - Duration is up to 5 years. - Working hours are expected to be 24 hours, 7 days a week.	Largest possible extent of infrastructure, greatest number of simultaneous vessel activities and greatest duration resulting in the maximum spatial and temporal effect on vessel displacement.
Increased vessel to vessel collision risk (third-party to third-party vessels)	The MDS used for this assessment is identical to the MDS for the Offshore Project decommissioning phase *'Vessel displacement'* pathway above.	Largest possible extent of infrastructure, greatest number of simultaneous vessel activities and greatest duration resulting in the maximum spatial and temporal effect on vessel to vessel collision risk.
Vessel to vessel collision (third-party vessel to Offshore Project vessel)	The MDS used for this assessment is identical to the MDS for the Offshore Project decommissioning phase *'Vessel displacement'* pathway above.	Largest possible extent of infrastructure, greatest number of simultaneous vessel activities and greatest duration resulting in the maximum spatial and temporal effect on vessel displacement and subsequent vessel to vessel collision risk involving an third-party vessel and an Offshore Project vessel.
Reduced access to local ports, harbours, and facilities	The MDS used for this assessment is identical to the MDS for the Offshore Project decommissioning phase *'Vessel displacement'* pathway above.	Largest possible extent of infrastructure, greatest number of simultaneous vessel activities, and greatest duration resulting in the maximum spatial and temporal effect on reduced access to local ports and harbours.

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7 Navigational Features

86. The navigational features within, and in proximity to, the Array Area, Turbine Area, and OCAS are presented in **Figure 7-1**. Following this, **Figure 7-2** presents the key navigational features located within Loch Roag, located to the south of the Array Area.

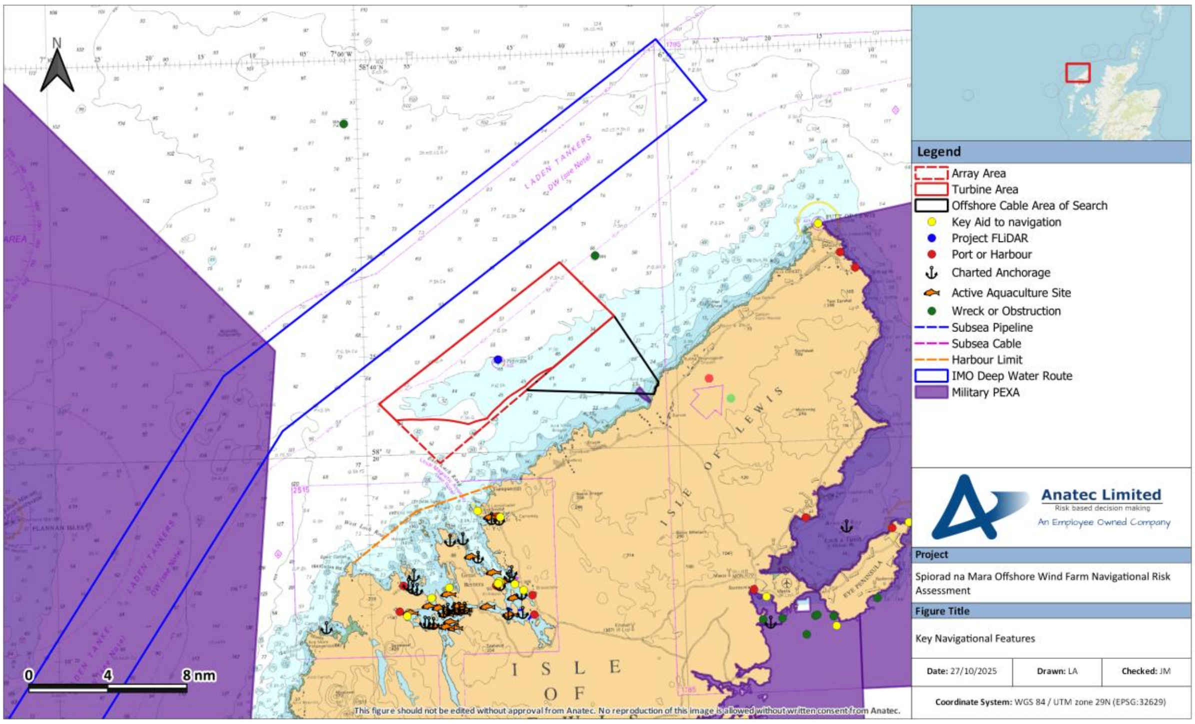

Figure 7-1 Key Navigational Features

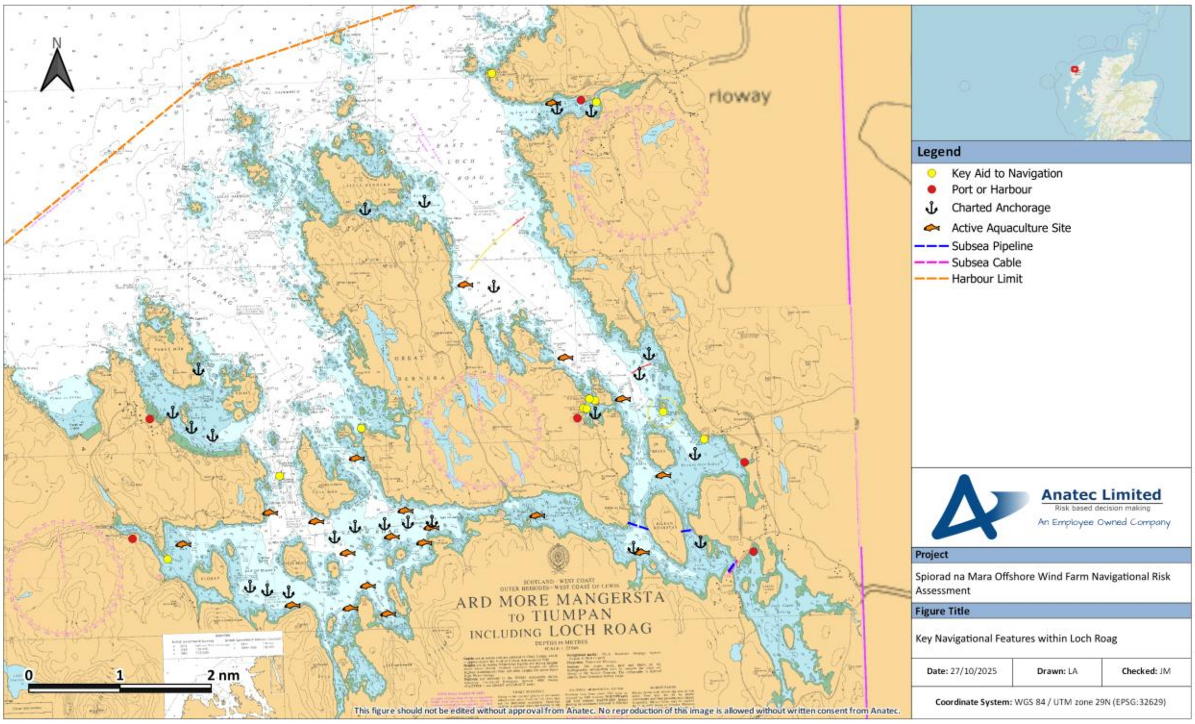

Figure 7-2 Key Navigational Features within Loch Roag

7.1 Ports and Related Services

87. The most prominent harbour area is within Loch Roag, with the harbour limit located approximately 1.9 nm southeast of the Array Area. The Admiralty Sailing Directions (UKHO, 2023) states "*Loch Roag is a statutory harbour area which includes all waters within the seaward limits*". Several small fishing and recreational harbours are located within West Loch Roag including at Bhaltos and Miavaig. Likewise, East Loch Roag includes Kirkibost and Carloway, the latter of which is the closest to the Array Area at 4 nm. Carloway Harbour is primarily used by local fishing vessels and small leisure craft. The Admiralty Sailing Directions note that "*all vessels of more than 24 metres (m) registered length must advise the Harbour Authority of their intended arrival and destination within the loch*". Western Isles Council / *Comhairle nan Eilean Siar* is the statutory harbour authority for Loch Roag.

88. The closest commercial port is Stornoway Harbour, on the east coast of the Isle of Lewis, which is described by the Admiralty Sailing Directions (UKHO, 2023) as "*the most important in the Hebrides, serving a large fishing industry and providing the main terminal on the Isle of Lewis for the vehicular ferry from Ullapool.*"

7.2 Aquaculture Sites

89. Numerous aquaculture sites are located across Loch Roag and are described in the Admiralty Sailing Directions (UKHO, 2023) as "*the source of farmed organic salmon and organic mussels*", and that the "*area should be regarded as environmentally*

fragile". Generally, active shellfish sites are located towards the south of Loch Roag, whilst active seawater finfish sites are situated further north (Scotland's Aquaculture, 2024). Bakkafrost confirmed during Regular Operator outreach that they have 5 salmon farms located in Loch Roag.

7.3 IMO Routeing Measures

90. A DWR is positioned between the Isle of Lewis and the Flannan Islands and runs from Cape Wrath to Skerryvore. Its use is recommended for laden tankers of 10,000 Gross Tonnage (GT) or above, with available depths of 34 m or more. Use of this DWR is weather permitting but allows vessels to avoid transiting through the restricted waters of the Minches to the east of the Isle of Lewis. The DWR is approximately 1.9 nm from the Array Area at all points of its northern boundary (i.e., the DWR runs parallel with the Array Area).

7.4 Charted Anchorages

91. No charted anchorages are observed within or in close proximity to the Array Area.

92. The Admiralty Sailing Directions (UKHO, 2023) characterise various accessible anchorages within Loch Roag. The majority are only suitable for small to medium vessels and coasters; however, shelter is afforded to certain larger vessels. The CCC Sailing Directions and Anchorages for the Outer Hebrides note that in terms of anchorages there are "*many which can be discovered by an enterprising skipper and careful use of Chart 2515*" (CCC, 2024).

7.5 Key Aids to Navigation

93. Several key AtoNs are located within Loch Roag, including Aird Lamishader lighthouse with 8 nm range, which is located at the entrance to East Loch Roag approximately 3.1 nm south of the Array Area. Additionally, the Butt of Lewis lighthouse with 25 nm range is located approximately 11.3 nm northeast of the Array Area.

94. A floating Light Detection and Ranging (FLiDAR) buoy associated with the Project lies within the centre of the Array Area. This is expected to be removed in early 2026 and therefore is not considered relevant during any phase of the Offshore Project.

7.6 Military Practice and Exercise Areas

95. To the west of the Array Area is a Ministry of Defence (MoD) Practice and Exercise Area (PEXA). This is a firing practice area (D701F) and is situated approximately 5 nm from the Array Area. There are no restrictions in place on the right to transit within the area as it is only operational when the area is considered to be clear of all shipping.

96. There is also a small PEXA located within the OCAS. This is the Barvas Rifle Range which is not included on UKHO charts.

7.7 Subsea Cables and Pipelines

97. There are no offshore subsea cables or pipelines recorded in proximity to the Array Area.

98. Subsea infrastructure such as cables and pipelines are present within Loch Roag, including a water pipeline which connects the island of Eilean Kearstay to the Isle of Lewis mainland and the island of Great Bernera. A subsea cable and pipeline also run across the entrance to Loch Ceann Hulavig.

7.8 Charted Wrecks or Obstructions

99. The closest charted wreck to the Array Area is located 1.5 nm to the northeast. No other charted wrecks were recorded within the study area. It is noted not all wrecks are charted, although all those considered a danger to the safety of navigation (and therefore relevant to Shipping and Navigation) are charted.

8 Meteorological Ocean Data

100. This section presents local meteorological and oceanographic (metocean) statistics provided by the Project. The data presented in this section has been used as input to the collision and allision risk modelling (see **Section 16**).

8.1 Wind

101. Based on wind direction data the proportion of the wind direction within each 30-degree interval is presented in **Figure 8-1** in the form of a wind rose. It can be seen that wind is predominantly from the southwest.

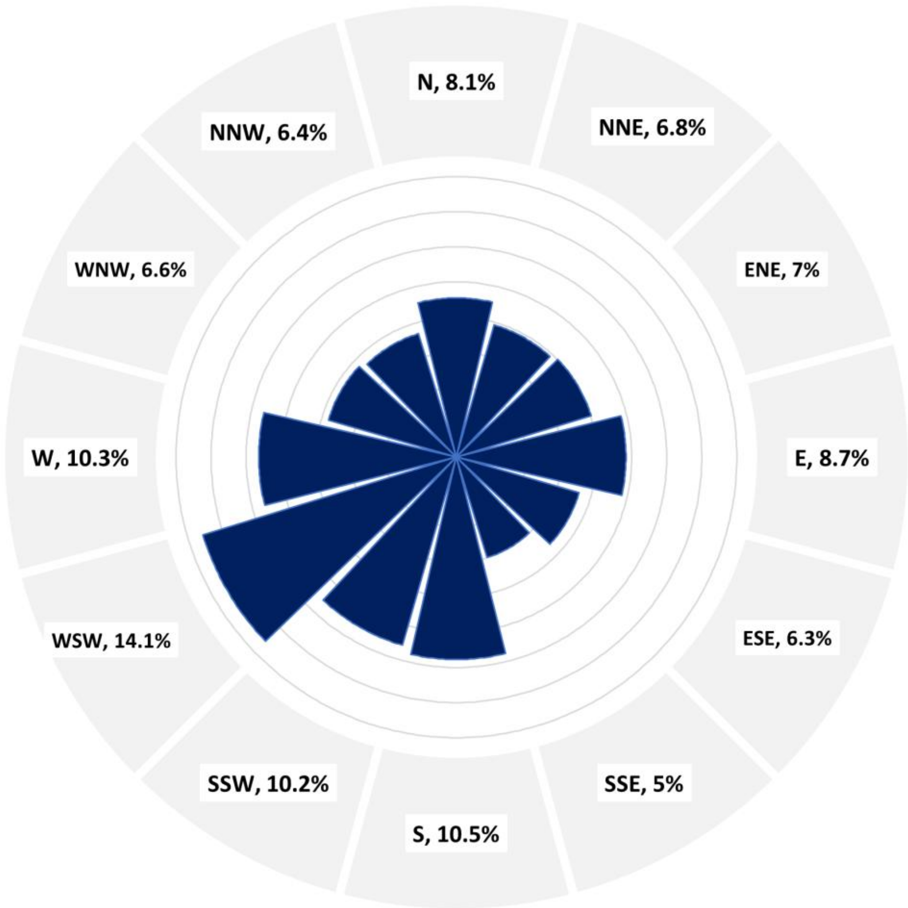

Figure 8-1 Wind Direction Distribution

8.2 Wave

102. Based on significant wave height data the proportion of the sea state within each of the three defined ranges, where the sea state is based upon significant wave height, is presented in **Table 8-1**.

Table 8-1 Sea State Data for Shipping and Navigation

Sea State	Proportion (%)
Calm (<1m)	4.9
Moderate (1-5m)	87.6
Severe (>5m)	7.5

8.3 Visibility

103. Based on information provided in the Admiralty Sailing Directions (UKHO, 2023) the proportion of poor visibility is 2%. This is defined as the proportion of the year where the visibility can be expected to be less than 1 km.

8.4 Tidal Speed and Direction

104. From UKHO Admiralty Chart 2720 (UKHO, 2025), currents within and in proximity to the Offshore Project are set in a general southeast to southwest direction on the flood tide and southwest to northwest direction on the ebb tide. The greatest flood peak tidal rate is 0.9 knots and the greatest peak ebb tidal rate is 1.0 knots. The peak speed and corresponding direction data for the flood and ebb tides for the relevant tidal diamonds on the UKHO Admiralty Chart 2720 (UKHO, 2024) are presented in **Table 8-2**.

Table 8-2 Peak Flood and Ebb Tidal Data

Tidal Diamond (Chart 2720)	Flood		Ebb	
	Direction (°)	Speed (knots)	Direction (°)	Speed (knots)
A	118	0.6	300	0.6
B	221	0.9	228	1.0
C	113	0.6	308	0.7
D	112	0.8	296	0.8

105. Based upon the available data, no hazards 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 result in any additional risk on the existing tidal streams in relation to their effect on existing shipping and navigation users.

9 Emergency Response and Incident Overview

106. This section summarises the existing SAR activities recorded within the study area.

9.1 Search and Rescue Helicopters

107. In July 2022, the Bristow Group were awarded a new 10-year contract by the MCA (as an executive agency of the DfT) beginning in September 2024 to provide helicopter SAR operations in the UK. Bristow have been operating the service since April 2015.

108. The SAR helicopter service is currently operated out of 10 base locations around the UK, with the closest to the Array Area located approximately 15 nm southeast at Stornoway. This base operates two Sikorsky S92 helicopters.

109. The DfT has produced data on civilian SAR helicopter activity in the UK by the Bristow Group on behalf of the MCA between April 2015 - March 2024.

110. The locations of SAR helicopter taskings within the study area are presented in **Figure 9-1**, colour-coded by tasking type.

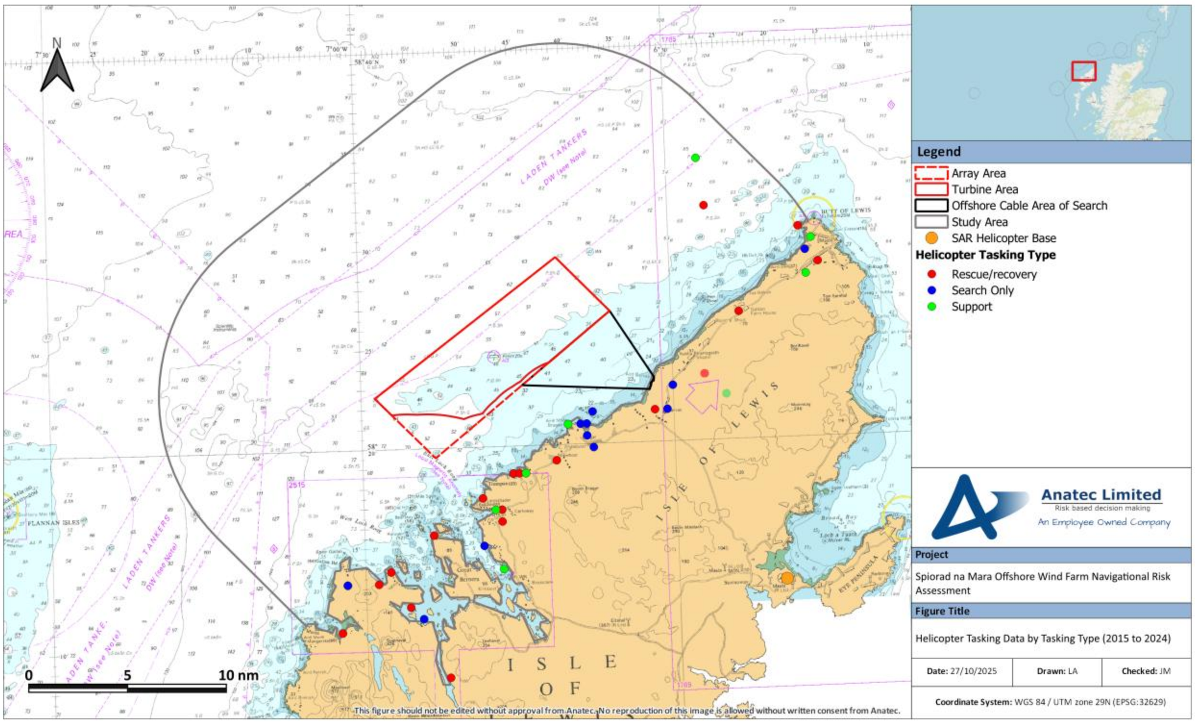

Figure 9-1 Helicopter Tasking Data by Tasking Type (2015 - 2024)

111. There were 44 helicopter taskings in proximity to the Offshore Project between April 2015 - March 2024. This corresponds to an average of between 4 - 5 per year. Almost half (48%) of taskings were classed as 'Rescue/Recovery', with 21 taskings recorded. 'Search Only' and 'Support' accounted for 15 (34%) and 8 (18%) taskings,

respectively. All taskings originated from the Stornoway base, aside from one 'Support' tasking from the Prestwick base which was terminated en route, noting that 2 helicopters were tasked to the same incident.

9.2 Royal National Lifeboat Institution

112. The RNLI is organised into 6 regions, with the relevant region for the Offshore Project being 'Scotland'. Based out of more than 230 stations, there are over 400 active lifeboats across the RNLI fleet, including both All-Weather Lifeboats (ALB) and Inshore Lifeboats (ILB).

113. **Figure 9-2** presents the RNLI station in proximity to the Array Area at Stornoway, as well as the incidents documented by the RNLI that occurred within the study area, colour-coded by incident type. **Figure 9-3** presents the same data colour-coded by casualty type.

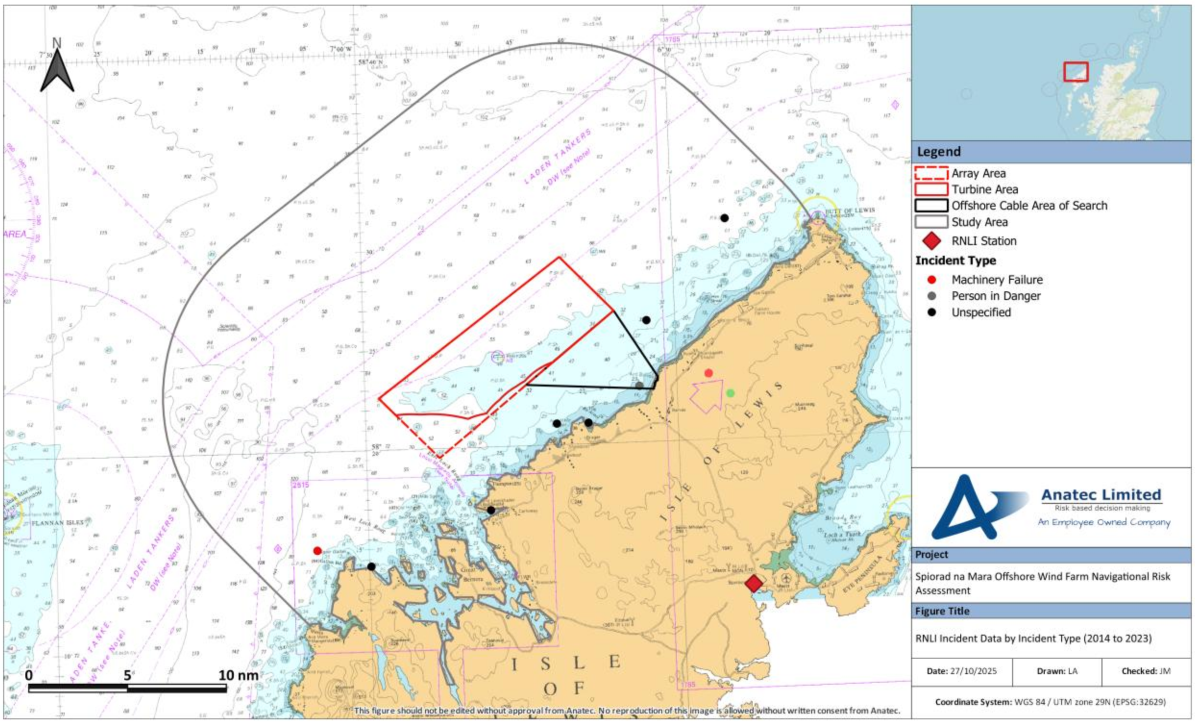

Figure 9-2 RNLI Incident Data by Incident Type (2014 - 2023)

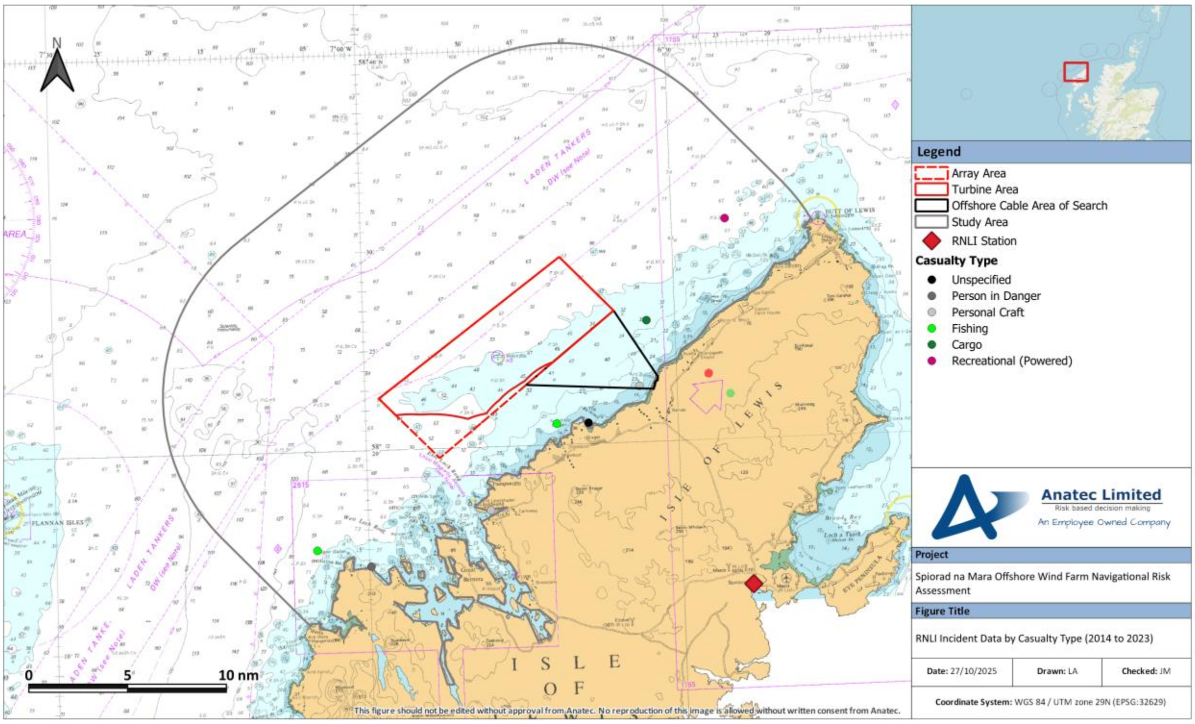

Figure 9-3 RNLI Incident Data by Casualty Type (2014 - 2023)

114. The closest RNLI station to the Offshore Project is located at Stornoway, approximately 15 nm southeast of the Array Area, where an ALB is available.

115. The RNLI responded to 8 incidents within the study area over the period between 2014 - 2023, equating to an average of 1 incident every 1 to 2 years. The majority of incidents occurred close to the coast, with none located within the Array Area. 6 of the 8 incidents were not assigned an incident type. The remaining incidents were classed as ‘Person in Danger’ and ‘Machinery Failure’, the former located approximately 3.8 nm southeast of the Array Area and the latter 7.7 nm southwest.

116. Personal craft and fishing vessels were the most common casualty types for incidents responded to by the RNLI, with 2 instances each. Other casualty types include person in danger, cargo vessels, and powered recreational vessels.

117. No incidents were recorded within the Array Area or Turbine Area, with 1 incident located within the OCAS involving a surfer. No false alarms were reported by the RNLI within the study area during the 10-year period.

9.3 Maritime Rescue Coordination Centres and Joint Rescue Coordination Centres

118. His Majesty’s Coastguard (HMCG), a division of the MCA, is responsible for requesting and tasking SAR resources made available to other authorities and for coordinating the subsequent SAR operations (unless they fall within military jurisdiction).

119. HMCG coordinates SAR operations through a network of 11 Maritime Rescue Coordination Centres (MRCC), including a Joint Rescue Coordination Centre (JRCC) based in Hampshire.

120. All of the MCA's operations, including SAR, are divided into 18 geographical regions. The 'Area 2 – North of Scotland' region covers the Array Area, Turbine Area, and OCAS. The Stornoway MRCC is located approximately 15.7 nm southeast of the Array Area, as illustrated in **Figure 9-4**, and coordinates the SAR response for maritime and coastal emergencies within the district boundary.

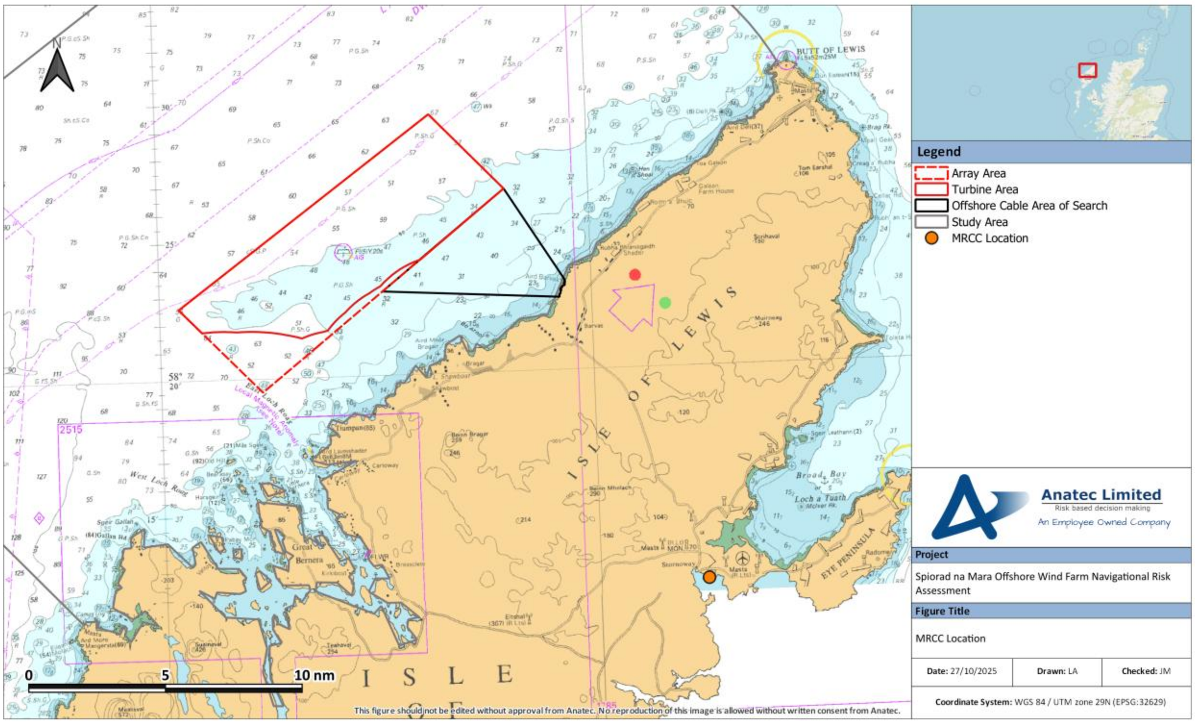

Figure 9-4 MRCC Location

9.4 Global Maritime Distress and Safety System

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

122. There are 4 GMDSS sea areas, with the areas applicable in proximity to the UK shown in **Figure 9-5**. Vessels in proximity to the Array Area would be located within sea area A1.

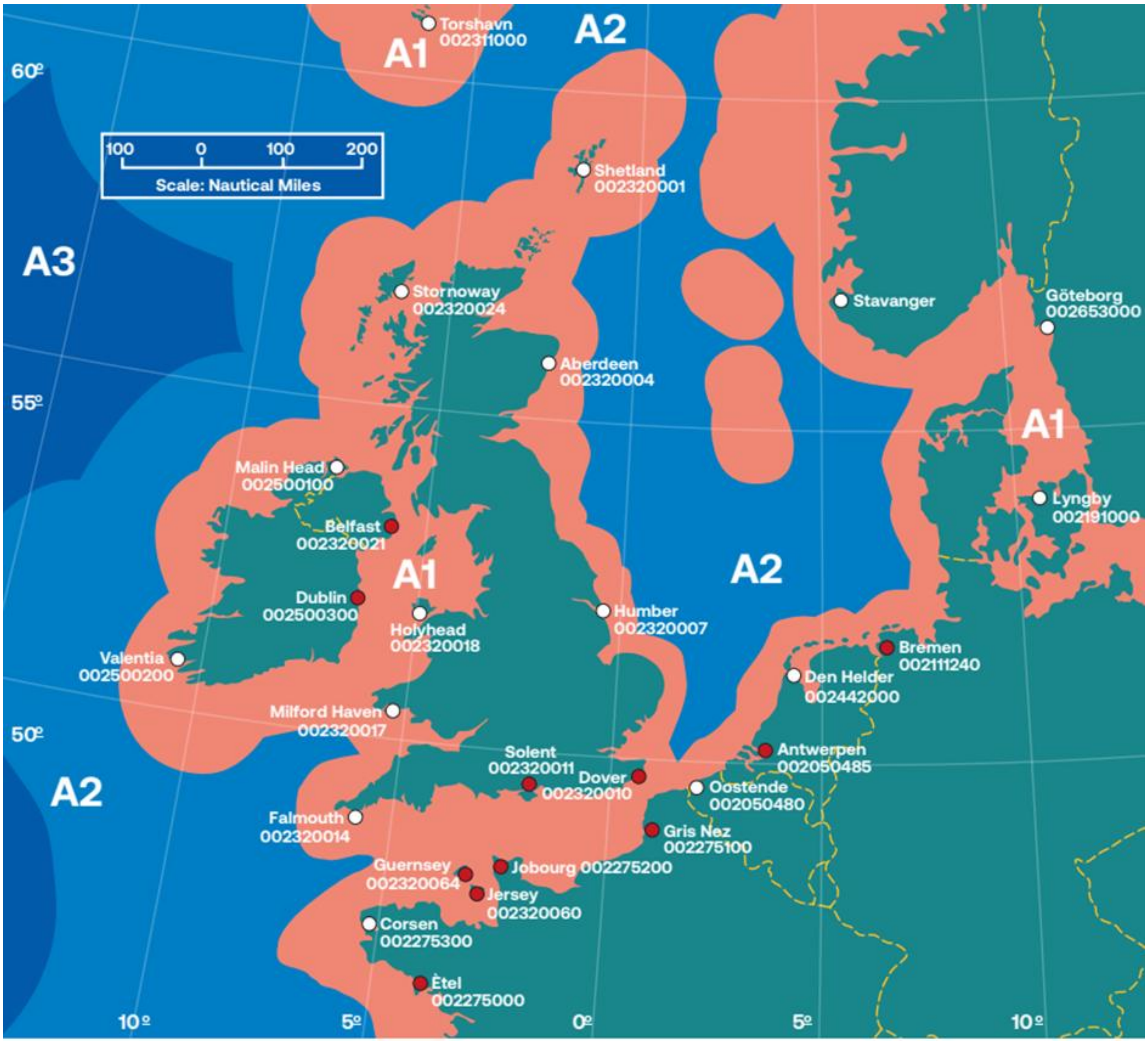

Figure 9-5 GMDSS Sea Areas (MCA, 2021)

123. In the event of an emergency involving a vessel located further offshore within sea area A1 or A2, vessels are able to contact coastal stations using High Frequency (HF) or Medium Frequency (MF) radio or otherwise contact other offshore resources.

9.5 Marine Accident Investigation Branch

124. 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 incidents to the MAIB. Data arising from these reports are assessed within this section, primarily covering the 10-year period between 2014 - 2023.

125. The incidents recorded within the MAIB data between 2014 - 2023 occurring within the study area, colour-coded by incident type, are presented in **Figure 9-6**. Following this, **Figure 9-7** shows the same data colour-coded by the type of vessels involved in each incident.

126. It should be noted that, following loss of tow, the grounding of the *Transocean Winner* occurred within the study area at Dalmore Bay on the 8 August 2016, however is not shown within **Figure 9-6** nor **Figure 9-7**. It has been verified that the MAIB data point associated with this incident is located outside the study area, likely around the location where the tow was lost and the incident developed. However, given the relevance to the study area, this incident is included in the analysis below.

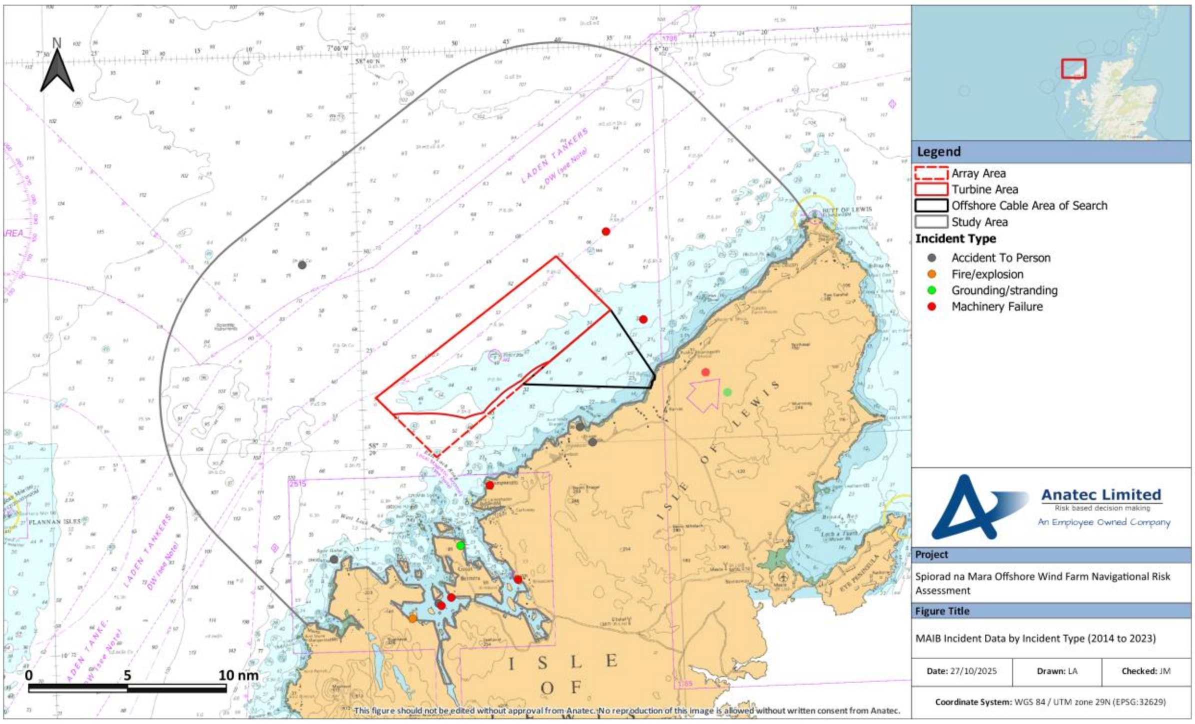

Figure 9-6 MAIB Incident Data by Incident Type (2014 - 2023)

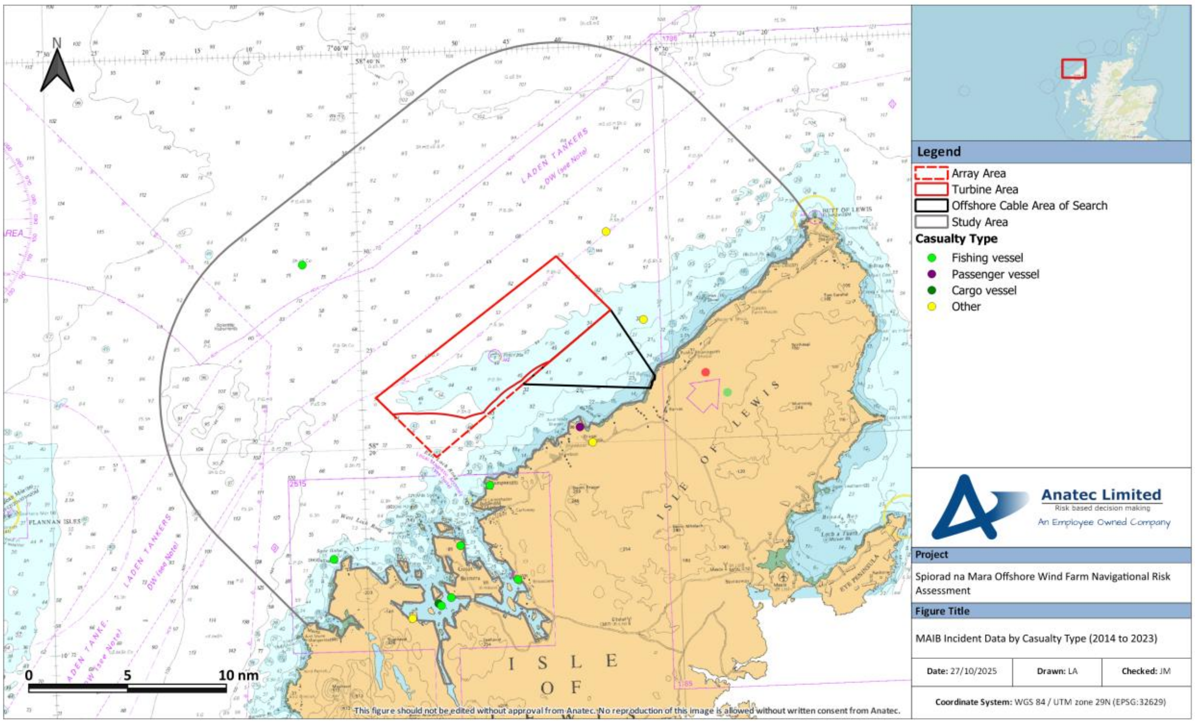

Figure 9-7 MAIB Incident Data by Casualty Type (2014 - 2023)

127. A total of 14 incidents were recorded within the study area during the period between 2014 - 2023, corresponding to an average of between 1 and 2 incidents per year. The most common incident type recorded was ‘Machinery Failure’, accounting for 43% of incidents. Other notable incidents included ‘Accident to Person’ (36%) as well as a ‘Fire/Explosion’ incident and two ‘Grounding/stranding’ incidents. The most common vessel types involved were fishing vessels at 50%, with cargo vessels and passenger vessels accounting for 7% each. Other vessel types, including multipurpose workboats and a semi-submersible rig, accounted for 36% of casualties.

128. No MAIB incidents were recorded within the Array Area, Turbine Area, nor the OCAS.

129. A review of older MAIB data between 2004 - 2013 indicates that the number of incidents has remained consistent in proximity to the Array Area, with a total of 14 incidents recorded within the study area. Again, none were recorded within the Array Area, Turbine Area nor within the OCAS.

130. With regards to the *Transocean Winner* incident, the semi-submersible rig grounded on the north coast of the Isle of Lewis after the loss of tow from an anchor handling tug in severe weather west of the Hebrides. No injuries were reported but 53 m^3 of diesel oil was lost. The *Transocean Winner* was refloated 14 days later.

9.6 Historical Offshore Wind Farm Incidents

9.6.1 Incidents Involving UK Offshore Wind Farm Developments

131. As of October 2025, there are 43 operational OWFs in the UK, ranging from the North Hoyle OWF (fully commissioned in 2003) to the Seagreen OWF (fully commissioned in March 2025). Between them, these developments encompass 27,595 fully constructed structure years.

132. MAIB incident data (MAIB, 2024) has been used to collate a list of reported historical collision and allision incidents involving UK OWF developments, which is summarised in **Table 9-1**. This only includes incidents reported to an accident investigation branch or an anonymous reporting service. Other sources have also been used to produce this list including the UK CHIRP for Aviation and Maritime, IMCA and basic web searches.

Table 9-1 Summary of Historical Collision and Allision Incidents Involving UK Offshore Wind Farm Developments for Shipping and Navigation

Incident Vessel	Incident Type	Date	Description of Incident	Vessel Damage*	Harm to Persons	Source
Project	Allision	07 August 2005	WTG installation vessel allision with WTG base whilst manoeuvring alongside it. Minor damage sustained to a gangway on the vessel, the WTG tower and a WTG blade.	Minor damage to gangway on the vessel	None	MAIB
Project	Allision	29 September 2006	Offshore services vessel allision with rotating WTG blade.	None	None	MAIB
Project	Allision	08 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 WTG foundation following watchkeeping failure. Two hull breaches to vessel.	Major	None	MAIB

Incident Vessel	Incident Type	Date	Description of Incident	Vessel Damage*	Harm to Persons	Source
Project/ project	Collision	02 June 2012	CTV collision with flotel. 9 persons safely evacuated and transferred to nearby vessel before being brought back into port.	Moderate	None	UK Confidential Human Factors Incident Reporting Programme (CHIRP)
Project	Allision	20 October 2012	Project vessel allision with WTG monopile following human error (misjudgement of distance). Minor damage sustained by vessel.	Minor	None	MAIB
Project	Allision	21 November 2012	Passenger transfer catamaran allision with buoy following navigational error. Vessel abandoned by crew of 12 having been holed, causing extensive flooding but no injuries sustained.	Major	None	MAIB
Project	Allision	21 November 2012	Work boat allision with unlit WTG transition piece at moderate speed following navigational error. Vessel able to proceed to port unassisted with no water ingress but some structural damage sustained.	Moderate	None	MAIB
Project	Allision	01 July 2013	Service vessel allision with WTG foundation following machinery failure. Minor damage sustained by vessel.	Minor	None	IMCA Safety Flash
Project	Allision	14 August 2014	Standby safety vessel allision with WTG 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 WTG following human error (autopilot). Lifeboat attended the incident.	Moderate	Injury	Web search (RNLI, 2016)
Project	Allision	14 February 2019	Survey vessel allision with WTG jacket while autopilot was engaged.	Minor	None	MAIB

Incident Vessel	Incident Type	Date	Description of Incident	Vessel Damage*	Harm to Persons	Source
Project	Allision	17 January 2020	Project vessel allision with WTG. Injury sustained by crew member but vessel able to proceed to port unassisted.	None	Injury	Web search (Vessel Tracker, 2020)
Project	Allision	27 January 2020	Project vessel allision with WTG. Minor damage to vessel and WTG sustained, with no personnel injuries.	Minor	None	Marine Safety Forum
Project	Allision	February 2021	The deckhand engineer fell asleep whilst supposed to be on watch, resulting in a CTV making contact with a WTG at low speed.	None	None	MAIB
Project	Allision	12 April 2021	An allision occurred with a WTG resulting in a passenger suffering a chest injury and was attended to by paramedics upon the vessel's return to port.	None	Injury	MAIB
Project	Allision	May 2021	A CTV was drifting towards the WTG it was tied off to. The Master started the engines but was with insufficient time to avoid contact. Upon returning to port the vessel began listing due to substantial water ingress.	Moderate	None	MAIB
Third-party	Allision	09 June 2022	Fishing vessel allision with WTG resulting in damage to vessel and 2 minor injuries for crew members. RNLI lifeboat escorted vessel under its own power to port.	Minor	Injury	Web search (RNLI, 2022)
Project	Allision	October 2022	A project vessel allision with the boat landing for a WTG causing a deformation to the port side midship area.	Minor	None	MAIB
Project	Allision	November 2022	A high speed craft allision with a WTG whilst the vessel propulsion was in neutral resulting in damage to the starboard jet platform and bucket.	Minor	None	MAIB

Incident Vessel	Incident Type	Date	Description of Incident	Vessel Damage*	Harm to Persons	Source
Project	Allision	April 2023	A supply vessel was drifting after deploying personnel to WTGs. The Master was reportedly distracted and failed to notice that the vessel was closing on a WTG. An allision occurred at 5 knots resulting in one crew member falling and suffering a rib fracture. No damage was caused to the vessel or the WTG and there was no pollution.	None	Injury	MAIB
Project	Allision	November 2023	A trainee on a CTV misjudged the wind and current causing the vessel to drift sideways and make contact with a WTG resulting in a broken window but no reported injuries.	Minor	None	MAIB
Third-party	Allision	January 2024	A stern trawler was navigating through an offshore wind farm when it collided with one of the WTGs. Cosmetic damage to the vessel was reported and it was able to make its own way back to port. No injuries were reported.	Minor	None	MAIB
Third-party	Allision	April 2024	Whilst undertaking fishing operations a crew member made a navigational error resulting in turning towards an offshore wind farm, and subsequently an allision occurred. Minor damage to the bow and paint marks were sustained, with the vessel able to maintain their fishing operations and land their catch in a port. No injuries were reported.	Minor	None	MAIB
Project	Allision	19 September 2024	An SOV allided with a WTG causing damage to the starboard side above the waterline and the helideck.	Minor	None	Web search (Maritime Executive, 2024)

* As per incident reports.

133. As of October 2025, there have been no reported third-party collisions directly as a result of the presence of an OWF in the UK. The only reported third-party collision incident in relation to a UK OWF involved a project vessel hitting a third party vessel whilst in harbour.

134. As of October 2025, there have been 23 reported cases of an allision between a vessel and a WTG (under construction, operational or disused) in the UK, with all but 4 involving a support vessel for the development. There have been 4 cases where the errant vessel was drifting rather than under power, all involving project vessels. Therefore, there has been an average of 1,200 years per structure allision incident in the UK, noting that this is a conservative calculation given that only fully constructed structure hours have been included (whereas allision incidents counted include under-construction structures).

135. On an individual project basis, there has been an average of 0.024 allision incidents per operational OWF year, noting this is an average across the 22-year period since the first UK OWF became operational.

136. The presence of OWFs and associated activities does increase the likelihood of an incident occurring based on consideration of existing datasets (see **Section 9.6.1**). This includes the Offshore Project given that it will represent new offshore infrastructure and activities. The analysis above incorporates only collision and allision incidents since these are more likely to result in notable consequences and thus are more comprehensively reported and are also of primary interest to the NRA. The worst consequences reported for vessels involved in a collision or allision incident involving a UK OWF development has been flooding, with no life-threatening injuries to persons reported.

137. Other types of incidents (such as medical incidents) may also require emergency response and therefore the rates reported above should not be considered comprehensive for all emergency response incidents. An accident to person requiring medical attention (which may include emergency response) is considered the most likely type of incident that may occur at an OWF.

9.6.2 Incidents Involving Non-UK Offshore Wind Farms

138. There have also been collision and allision incidents involving non-UK OWF developments. However, it is not possible to maintain a comprehensive list of such incidents and the associated operational hours.

139. 1 high profile non-UK incident of relevance involved a bulk carrier in January 2022 which broke its anchor chain during a storm in Dutch waters and collided with a nearby anchored vessel. The vessel began to take on water, leading to all crew members being evacuated by helicopter. The vessel then continued to drift towards shore including through an under construction OWF where it allided with a WTG

foundation and a platform foundation before being taken under tow (Marine Safety Investigation Unit, 2024).

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

140. Although the presence of OWFs and associated activities does increase the likelihood of an incident requiring emergency response it is also acknowledged that the presence of project vessels can aid with emergency response efforts, particularly for OWFs located further offshore where a project vessel is more likely to be able to serve as the first responder to an incident.

141. From news reports, web searches and experience working with existing OWF developments, a list has been collated of historical incidents responded to by vessels associated with UK OWF developments, which is summarised in **Table 9-2**. The initial cause of these incidents is not related to the OWF in question.

Table 9-2 Historical Incidents Responded to by Vessels Associated with UK Offshore Wind Farm Developments for Shipping and Navigation

Incident Type	Date	Related Development	Description of Incident	Source
Capsize	21 June 2018	Walney	HMCG issued mayday relay broadcast following a trimaran capsize. Support vessel for Walney arrived and recovered 2 persons from the water who were then winched onboard a Coastguard helicopter.	Web search (4C Offshore, 2018)
Capsize	05 November 2018	Race Bank	Fishing vessel capsized resulting in 2 persons in the water. Vessel operating at the nearby Race Bank were reported to have assisted with the rescue which also involved a Belgian military helicopter and the RNLI.	Web search (British Broadcasting Corporation (BBC), 2018)
Vessel in distress	15 May 2019	London Array	Yacht in difficulty sought shelter by tying up to a WTG 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	07 July 2019	Gwynt y Môr	Speedboat suffered mechanical failure stranding 4 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)

Incident Type	Date	Related Development	Description of Incident	Source
Machinery failure	28 September 2019	Race Bank	Fishing vessel suffered mechanical failure and launched flares. Guard vessel and SOV for Race Bank both immediately offered assistance until the MCA's arrival on-scene.	Internal daily progress report received by Anatec
Vessel in distress	13 December 2019	Race Bank	Passing vessel got into difficulty and guard vessel for Race Bank was requested to assist. The Coastguard later requested that the guard vessel tow the casualty vessel into port.	Internal daily progress report received by Anatec
Search	21 May 2020	Walney	Coastguard contacted guard vessel for Walney reporting red flare sighting at the wind farm. Guard vessel proceeded to undertake search but did not find anything to report.	Internal daily progress report received by Anatec
Aircraft crash	15 June 2020	Hornsea Project One	United States jet crashed into sea during a routine flight. CTVs and SOVs 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 and evacuated the casualty vessel.	Web search (Offshore WIND, 2020)
Person in danger	10 July 2021	Unknown (East Irish Sea)	2 swimmers were in difficulty against a rising tide near to Talacre beach. An RNLI lifeboat was launched but a commercial wind farm vessel recovered the swimmers from the water. They were then transferred to the lifeboat.	Web search (RNLI, 2021)
Drifting	17 July 2021	Neart na Gaoithe	Small dinghy with 2 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)
Vessel in distress	01 September 2022	Rampion	A recreational motorboat experienced power failure and anchored near Rampion. The anchor could then not be recovered and Coastguard assistance was requested. A CTV for Rampion responded and towed the vessel back to port.	MAIB
Machinery failure	01 December 2022	Unknown	A survey vessel suffered an engine failure and was towed back to port by a wind farm RIB.	MAIB
Person in danger	12 July 2024	Stromar	A deckhand on a fishing vessel became entangled in a creel rope and was pulled overboard. The vessel's crew alerted HM Coastguard and manoeuvred to attempt a rescue. The deckhand was recovered on board and attempts to revive were supported by a	Web search (BBC, 2024)

Incident Type	Date	Related Development	Description of Incident	Source
			paramedic from a HM Coastguard helicopter, an RNLI lifeboat and crew from a nearby survey vessel for the Stromar Offshore Wind Farm. The deckhand could not be revived and was declared deceased.	

142. It is clear that the presence of OWFs create new emergency response resources which can be mobilised to attend a third-party incident in liaison with HMCG. This will include the Offshore Project, with project vessel compliance with international marine regulations including Safety of Life at Sea (SOLAS) (IMO, 1974) and pollution planning included as embedded mitigation measures (see **Section 17**). Additionally, an ERCoP will be completed post consent in consultation with the MCA.

10 Vessel Traffic Movements

143. This section presents an analysis of vessel traffic movements in relation to the Array Area and OCAS within the study area. The methodology for vessel traffic data collection including details of the shore-based vessel traffic surveys is provided is **Section 5.2**. Overall, 6% of vessel traffic was recorded via Radar with the remaining vessel traffic recorded via AIS.

144. **Figure 10-1** presents the vessel tracks, excluding any temporary traffic, recorded during the 14-day winter survey period during February - March 2024 colour-coded by vessel type. Following this, an equivalent plot is presented in **Figure 10-2** which shows the vessel traffic data recorded during the 14-day summer survey period. The term 'fishing vessel' as used throughout this NRA refers to commercial fishing vessels, and any non-commercial fishing activity (such as rod and line angling) is categorised under recreational vessel activity.

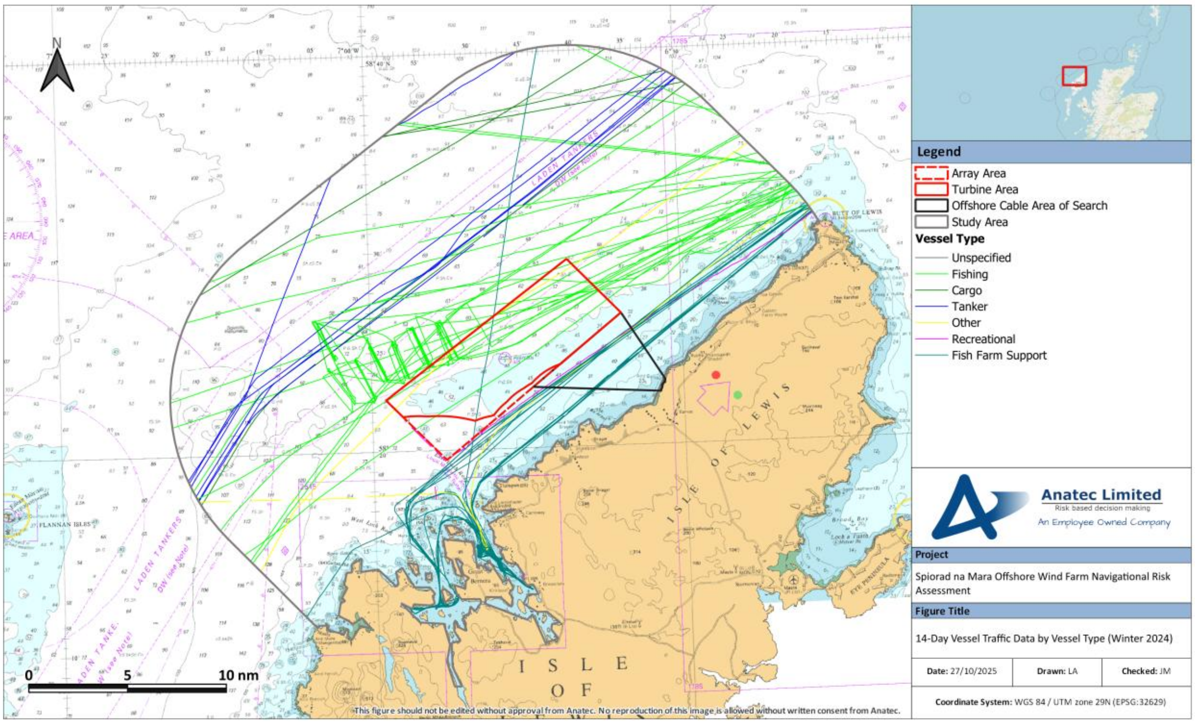

Figure 10-1 14-Day Vessel Traffic Data by Vessel Type (Winter 2024)

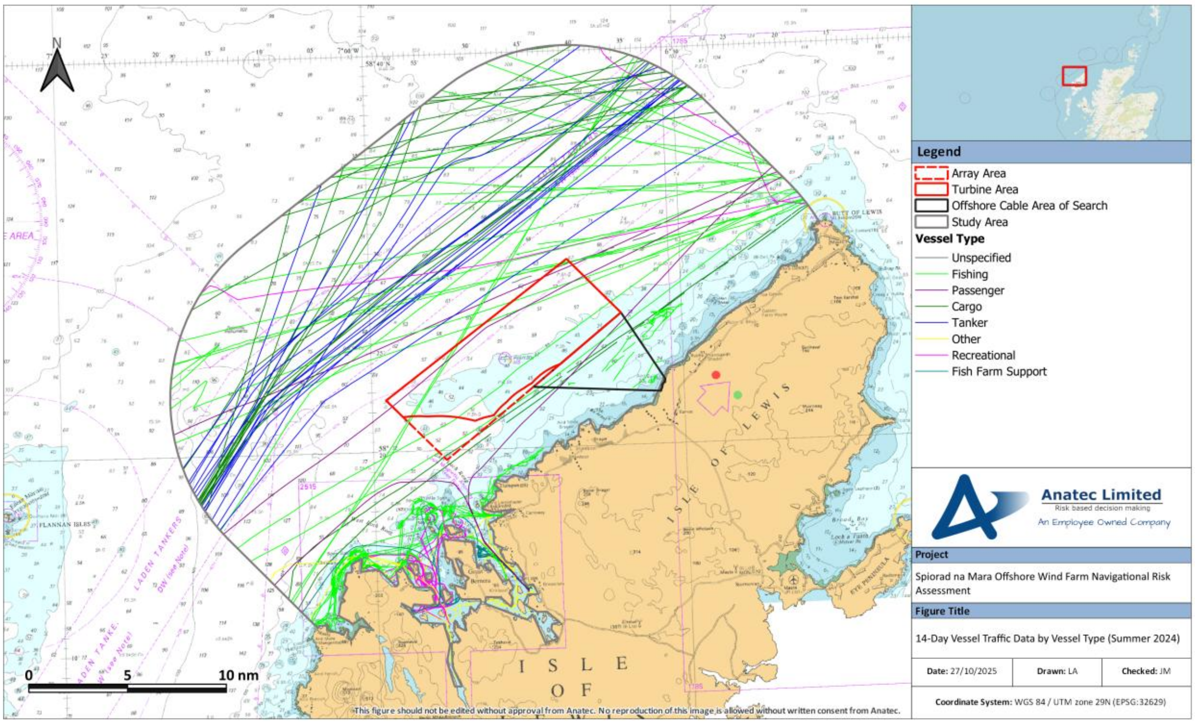

Figure 10-2 14-Day Vessel Traffic Data by Vessel Type (Summer 2024)

145. These vessel tracks have been converted into density heat maps and are presented in **Figure 10-3** for the winter survey period, and **Figure 10-4** for the summer survey period. The same density brackets have been used in both cases to allow for direct comparison.

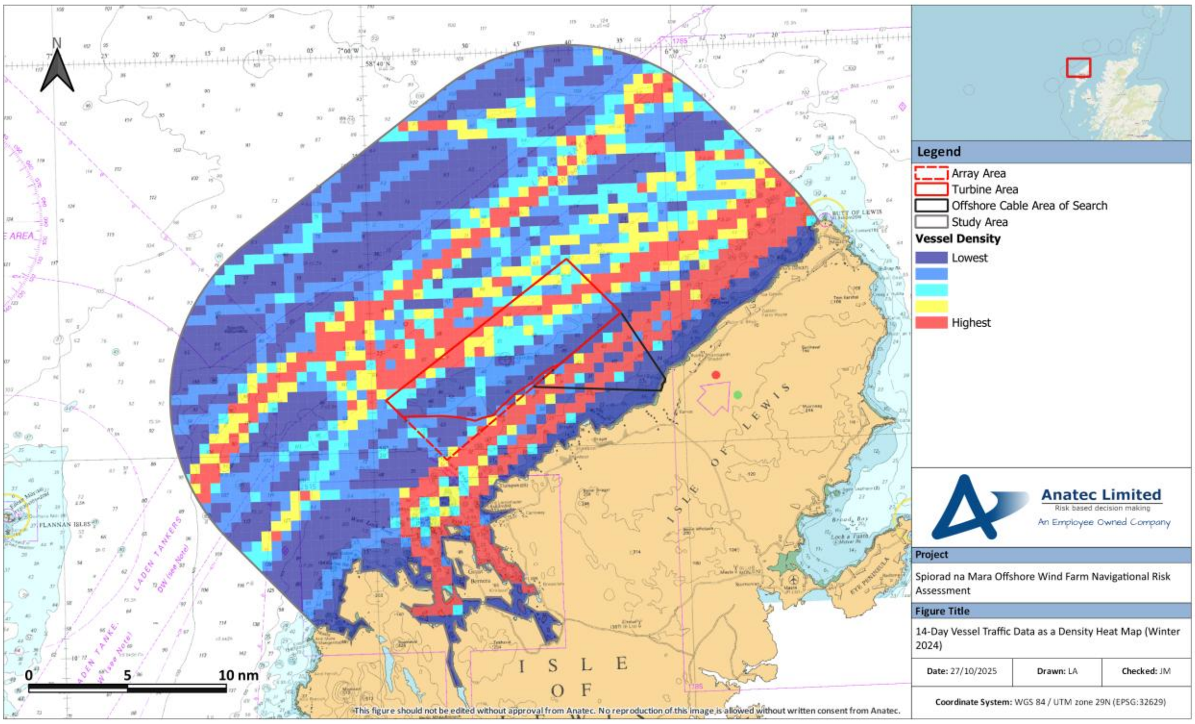

Figure 10-3 14-Day Vessel Traffic Data as a Density Heat Map (Winter 2024)

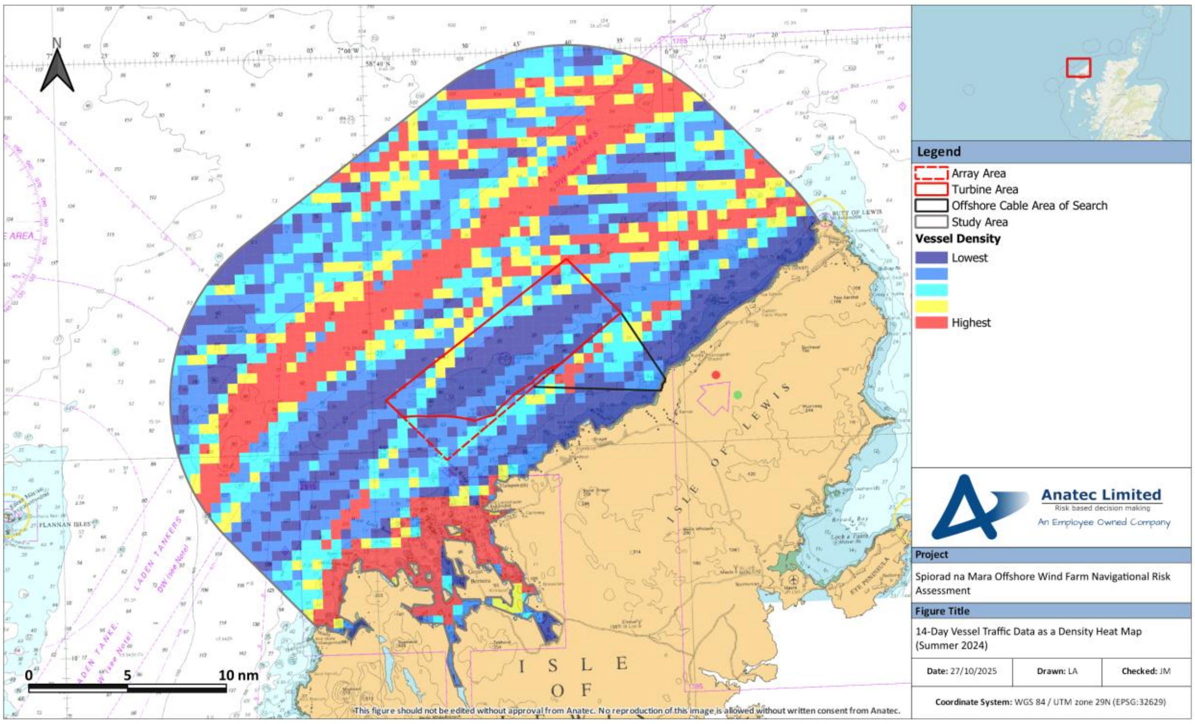

Figure 10-4 14-Day Vessel Traffic Data as a Density Heat Map (Summer 2024)

10.1 Vessel Counts

146. During the 14-day winter survey period, there was an average of between 5 – 6 unique vessels recorded per day within the study area. There was an average of 1 vessel per day within the Array Area and the OCAS.

147. The number of unique vessels recorded within the study area, Array Area, and OCAS during the winter period is presented in **Figure 10-5**.

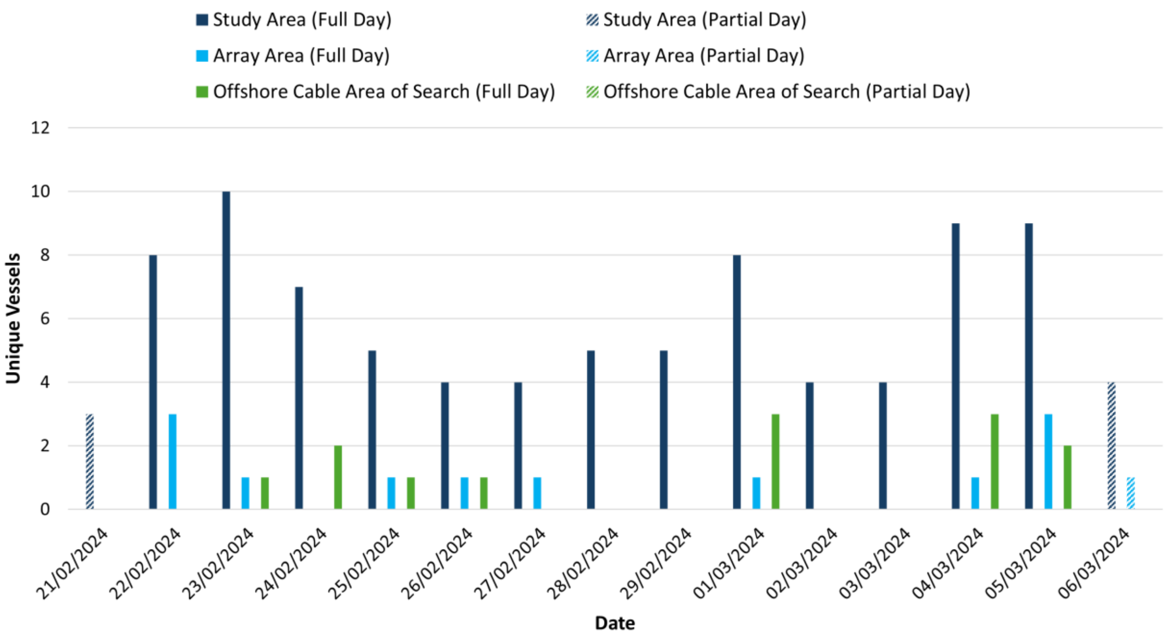

Figure 10-5 Distribution of Unique Vessels per Day (14 Days Winter 2024)

148. Throughout the winter survey period, approximately 15% of vessels were recorded to intersect the Array Area and the OCAS. The busiest day recorded within the study area during the winter survey period was the 23 February 2024 during which 10 unique vessels were recorded. The busiest days within the Array Area were the 22 February and 05 March which both recorded 3 unique vessels. The busiest days recorded within the OCAS were the 01 and 04 March which recorded 3 unique vessels.

149. The quietest full days recorded within the study area occurred on 4 separate days, all of which recorded 4 unique vessels. Within the Array Area and OCAS various days recorded no vessels during the winter survey period.

150. During the 14-day summer survey period, there was an average of between 7 - 8 unique vessels recorded per day within the study area. There was an average of 1 vessel per day within the Array Area and an average of 1 unique vessel recorded to intersect the OCAS every 1 to 2 days.

151. The number of unique vessels recorded within the study area, Array Area, and OCAS during the summer period is presented in **Figure 10-6**.

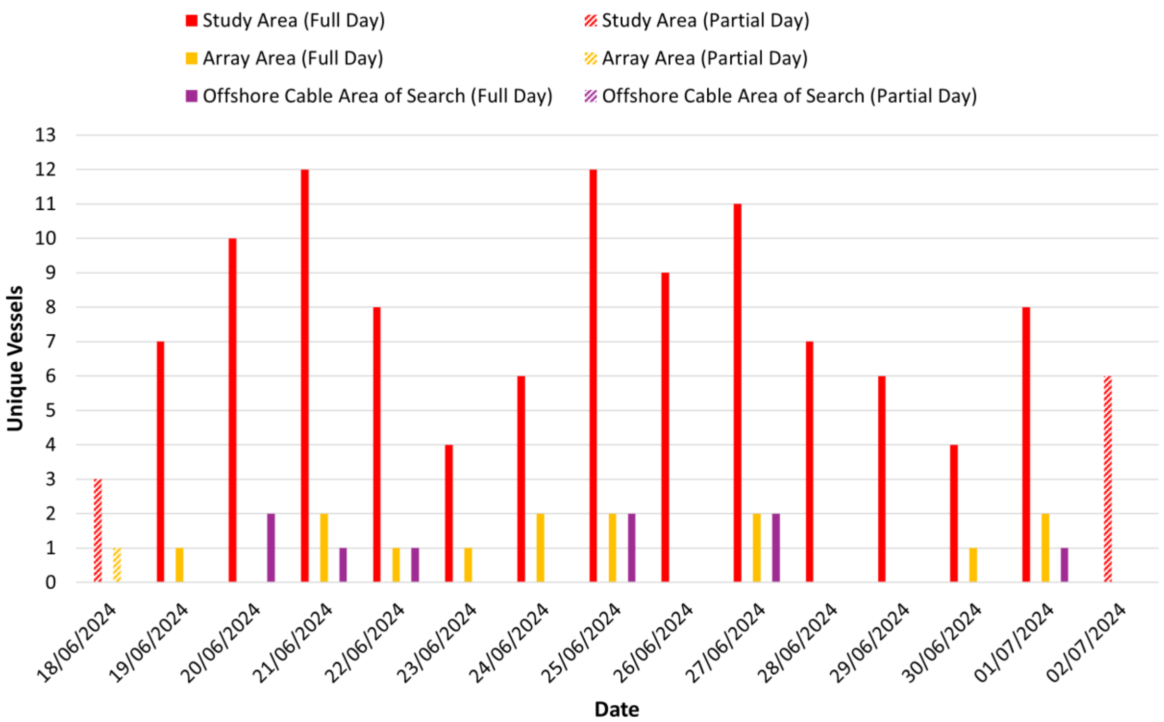

Figure 10-6 Distribution of Unique Vessels per Day (14 Days Summer 2024)

152. Throughout the summer survey period, approximately 13% of vessels were recorded to intersect the Array Area, with 8% noted to intersect the OCAS. The busiest days recorded within the study area during the summer survey period were the 21 and 25 June 2024 during both of which 12 unique vessels were recorded. The busiest days within the Array Area were 5 separate days, all of which recorded 2 unique vessels. The busiest days recorded within the OCAS were the 20, 25, and 27 June 2024 which all recorded 2 unique vessels.

153. The quietest full days recorded within the study area occurred on the 23 and 30 June 2024, when 4 unique vessels were recorded. Within the Array Area and OCAS various days recorded no vessels during the summer survey period.

10.2 Vessel Type

154. The percentage distributions of the vessel types recorded within the study area, Array Area, and OCAS during the winter and summer survey periods are presented in **Figure 10-7** and **Figure 10-8**, respectively.

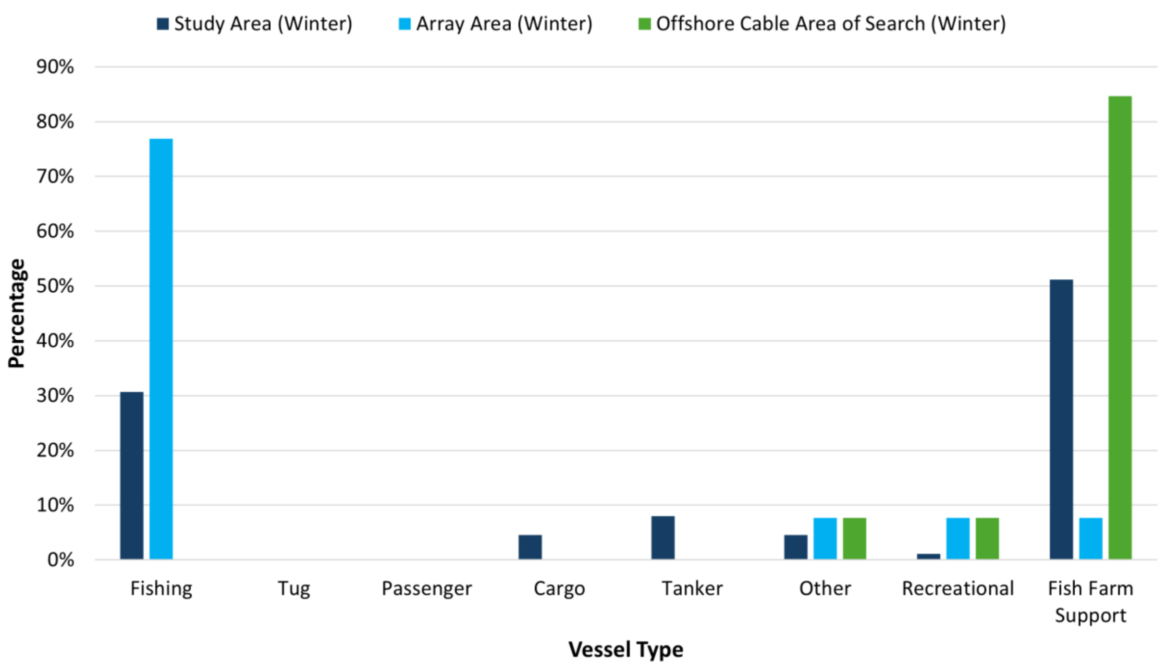

Figure 10-7 Vessel Type Distribution (14 Days Winter 2024)

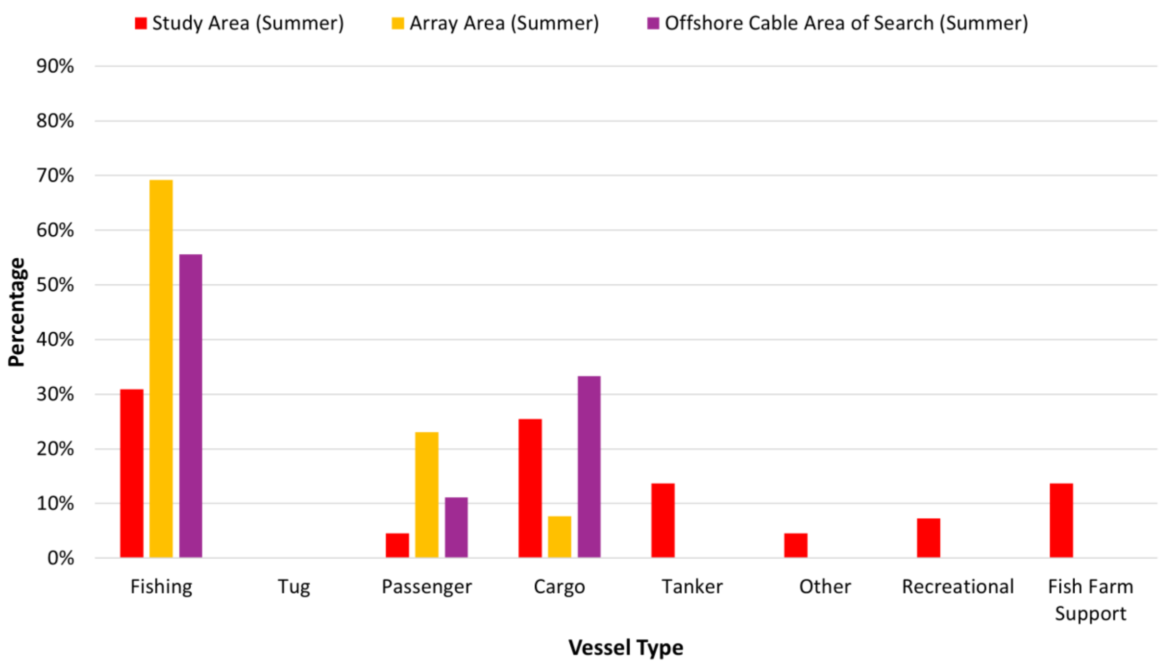

Figure 10-8 Vessel Type Distribution (14 Days Summer 2024)

155. Throughout the winter survey period, the most common vessel types within the study area were fish farm support vessels (51%) and fishing vessels (31%). Within the Array Area, the majority of recorded vessels were fishing vessels (77%), with a majority of fish farm support vessels noted within the OCAS (85%).

156. During the summer survey period, the most common vessel types within the study area were fishing vessels (31%) and cargo vessels (25%). Within the Array Area, fishing vessels and passenger vessels were most prominent at 69% and 23%, respectively. For the OCAS, fishing vessels accounted for 56% of vessel traffic, with cargo vessels also notable at 33%.

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

10.2.1 Fishing Vessels

158. Fishing vessel tracks recorded during both the winter and summer survey periods are presented in **Figure 10-9**.

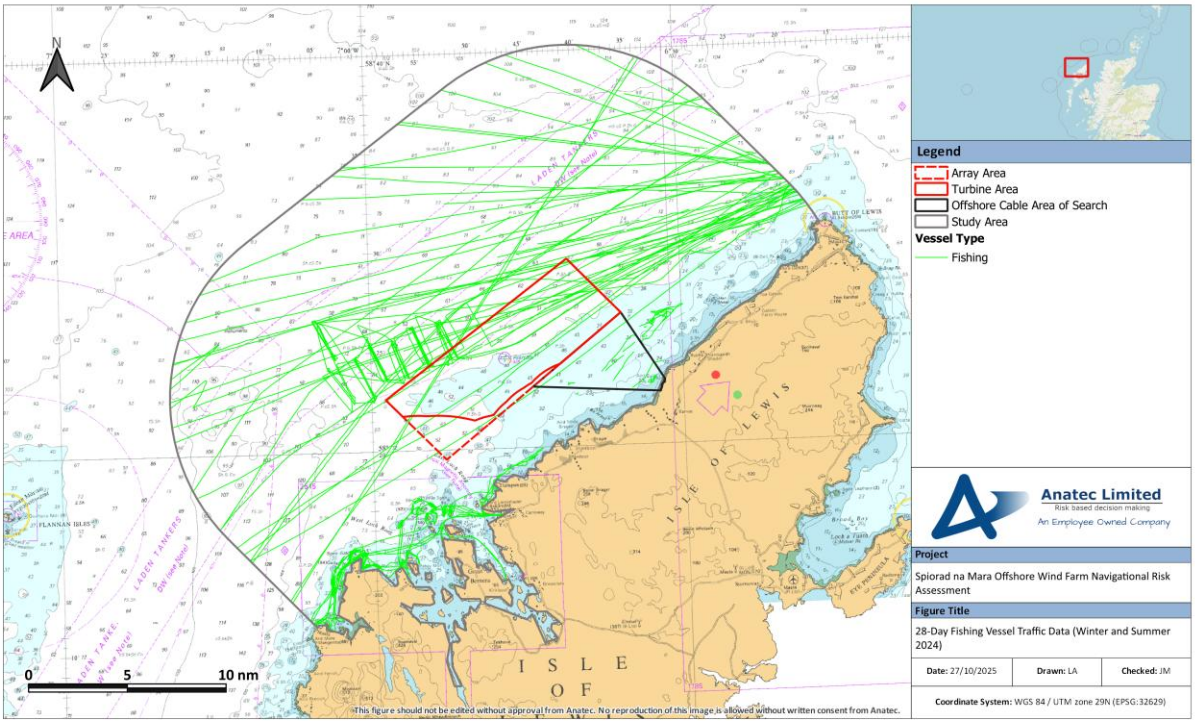

Figure 10-9 28-Day Fishing Vessel Traffic Data (Winter and Summer 2024)

159. During the winter survey period, there was an average of 2 unique fishing vessels recorded per day within the study area, and an average of 1 unique fishing vessel recorded every 1 to 2 days within the Array Area. No fishing vessels were recorded within the OCAS during the winter survey period. The most prominent gear type recorded within the study area was demersal trawlers (38%), with these estimated to be transiting rather than engaged in active fishing behaviour. A potter was observed to be actively collecting and/or laying traps within the Array Area and Turbine Area.

160. During the summer survey period, there was an average of between 2 - 3 unique fishing vessels recorded per day within the study area. 1 fishing vessel was recorded every 1 - 2 days within the Array Area, and 1 every 2 - 3 days within the OCAS. During

the summer survey period, the most common gear type recorded was potters at 44%. The majority of vessels engaged in active fishing were noted within and around the entrance to Loch Roag and used potting gear. Several tracks recorded on Radar were identified as a lobster boat actively fishing within the OCAS.

161. Overall, active fishing took place to the west, east, and south of the Array Area. Transiting fishing vessels were seen on a general northeast/southwest course, converging around the Butt of Lewis.

162. In addition to the vessel traffic survey data, VMS data recorded within the study area throughout 2024 has also been analysed. **Figure 10-10** presents the VMS data as a density heat map.

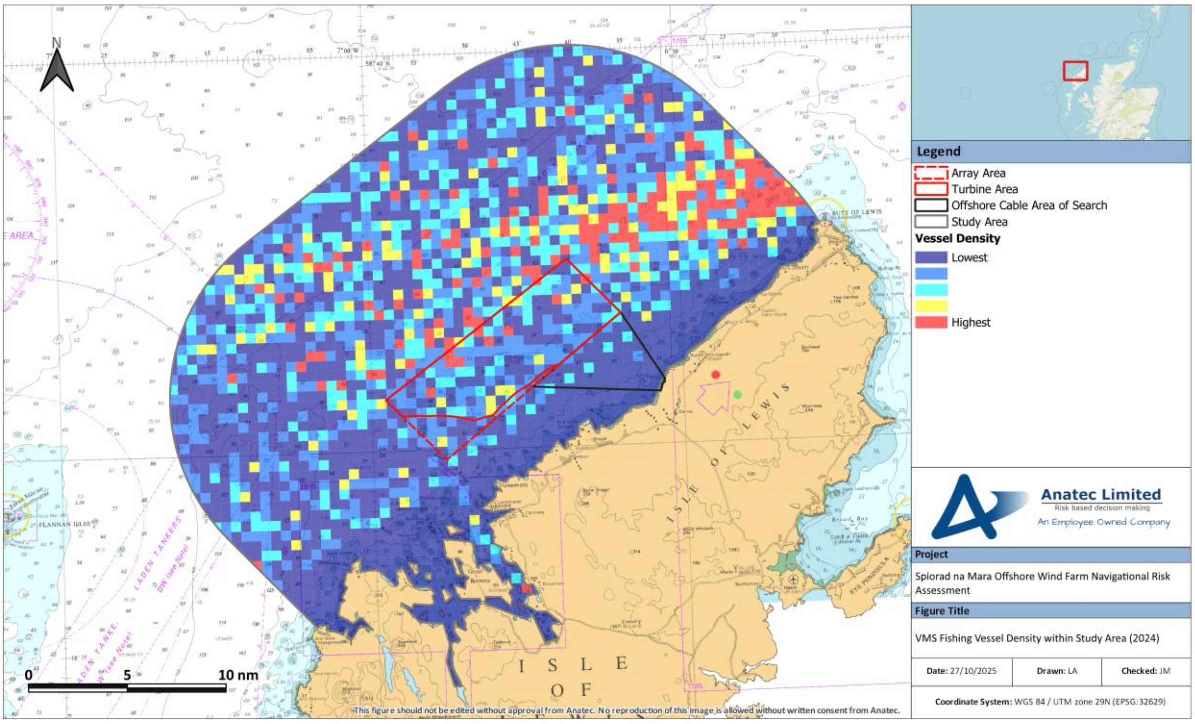

Figure 10-10 VMS Fishing Vessel Density within Study Area (2024)

163. Areas of highest VMS fishing vessel density occur offshore of the Array Area, and to the northeast towards the Butt of Lewis. Fishing vessels were generally common further from the coast. This broadly aligns with the fishing vessel traffic recorded during the 12-month assessment presented in **Appendix E**, with the exception of the absence of nearshore activity. However, VMS requirements within Scottish waters currently apply only to vessels with overall length of 12m or more, noting that fishing vessels recorded operating in nearshore waters were generally 10 m in length or below.

10.2.2 Fish Farm Support Vessels

164. Fish farm support vessels recorded to be working on-site within the study area were identified within both survey periods, the tracks of which are presented in **Figure 10-11**.

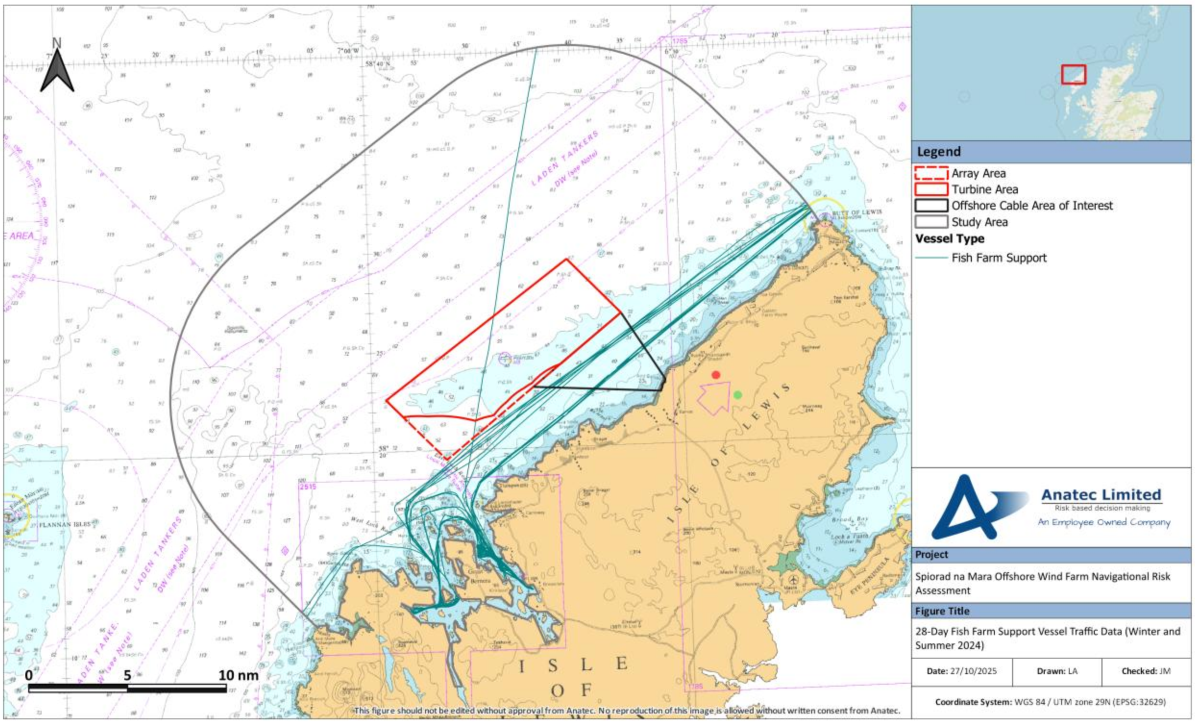

Figure 10-11 28-Day Fish Farm Support Vessel Traffic Data (Winter and Summer 2024)

165. Fish farm support vessels were recorded to transit inshore of the Array Area, as well as within Loch Roag to active aquaculture sites. In general, fish farm support vessels were more prominent during the winter survey period and were recorded at various times throughout the day and night.

166. During the winter survey period, an average of between 3 - 4 unique fish farm support vessels were recorded within the study area per day, with only 1 recorded within the Array Area in total. 1 unique fish farm vessel was recorded on average once every 1 - 2 days within the OCAS.

167. During the summer survey period, an average of 1 unique fish farm support vessel was recorded within the study area per day, with none recorded within the Array Area nor the OCAS.

168. However, it was indicated during consultation that inshore fish farm support vessel routes are not currently active due to a factory closure in Stornoway (see **Table 4-1**).

10.2.3 Cargo Vessels

169. Cargo vessel tracks recorded during the winter and summer survey periods are presented in **Figure 10-12**.

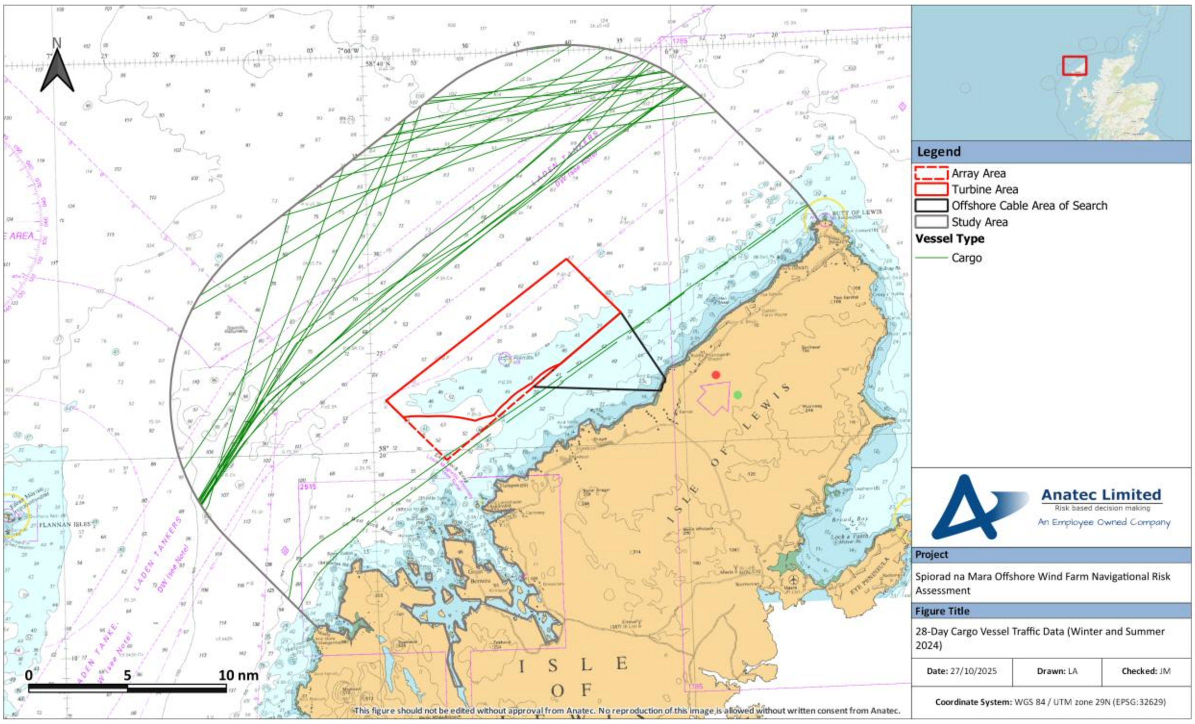

Figure 10-12 28-Day Cargo Vessel Traffic Data (Winter and Summer 2024)

170. Cargo vessels were seen to transit the study area generally following the DWR as well as northeast/southwest transits further offshore.

171. During the winter survey period, there was an average of 1 unique cargo vessel every 3 - 4 days recorded within the study area, with none observed to intersect the Array Area nor the OCAS. All cargo vessels recorded during the winter survey period were bulk carriers with various destinations including Norway and Saint Petersburg (Russia).

172. During the summer survey period, there was an average of 2 unique cargo vessels recorded per day within the study area, with 1 vessel recorded to intersect the Array Area. On average, 1 cargo vessel was recorded every 4 - 5 days within the OCAS, noting that this is attributed to 2 separate transits by the same fish carrier, between Ullapool and West Loch Tarbert. The majority of cargo vessels recorded during the summer survey period were bulk carriers (61%).

173. 2 Roll-on/Roll-off cargo (RoRo) vessels were recorded during the summer survey period with destinations of Hamburg (Germany) and Uddevalla (Sweden). However, no regular RoRo routeing was observed.

10.2.4 Tankers

174. Tracks of tankers recorded within the study area during the winter and summer survey periods are presented in **Figure 10-13**.

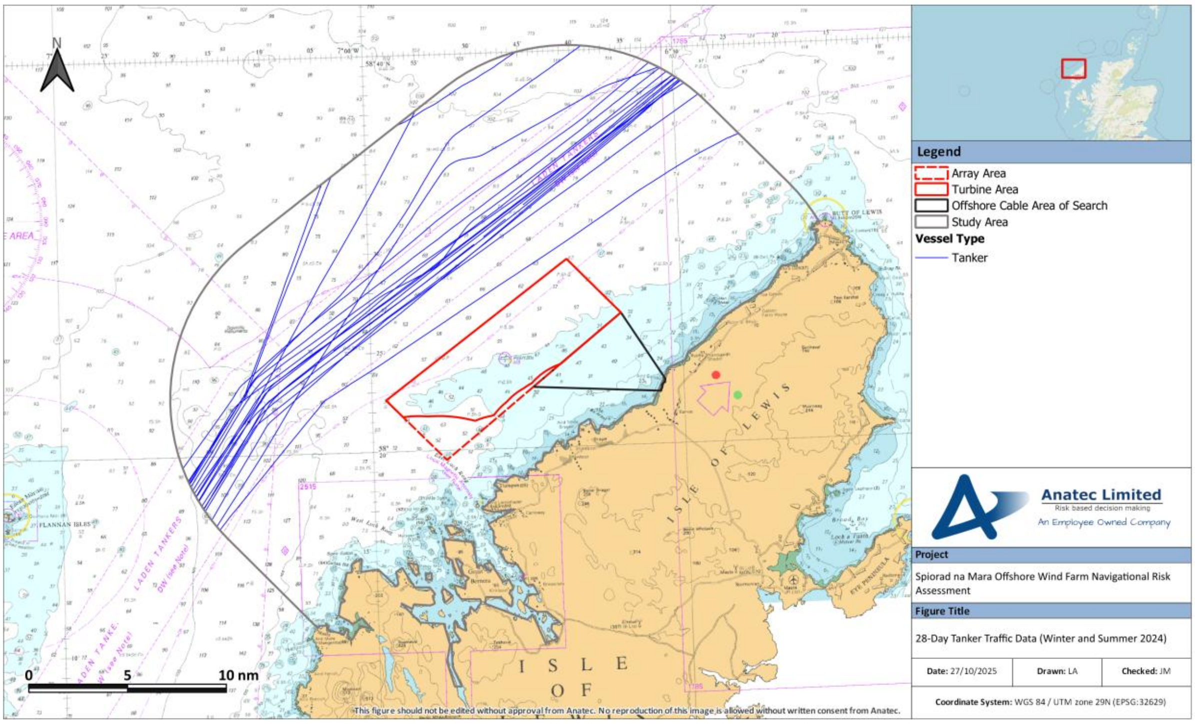

Figure 10-13 28-Day Tanker Traffic Data (Winter and Summer 2024)

175. Tankers were recorded to generally follow the DWR through the study area, with several tracks noted to transit further offshore. No tankers were observed within the Array Area nor the OCAS. There was 1 instance of a tanker passing inshore of the DWR; this was a Liquefied Petroleum Gas (LPG) tanker with 9.9 m draught which passed approximately 0.8 nm from the Array Area.

176. During the winter survey period, 1 tanker was recorded within the study area on average every 2 days. During the summer survey period this doubled to an average of approximately 1 unique tanker per day.

177. Crude oil tankers were the most common tanker sub-type during both the winter and summer survey periods, at 57% and 40%, respectively.

10.2.5 Recreational Vessels

178. The recreational vessel tracks recorded during both winter and summer survey periods are presented in **Figure 10-14**.

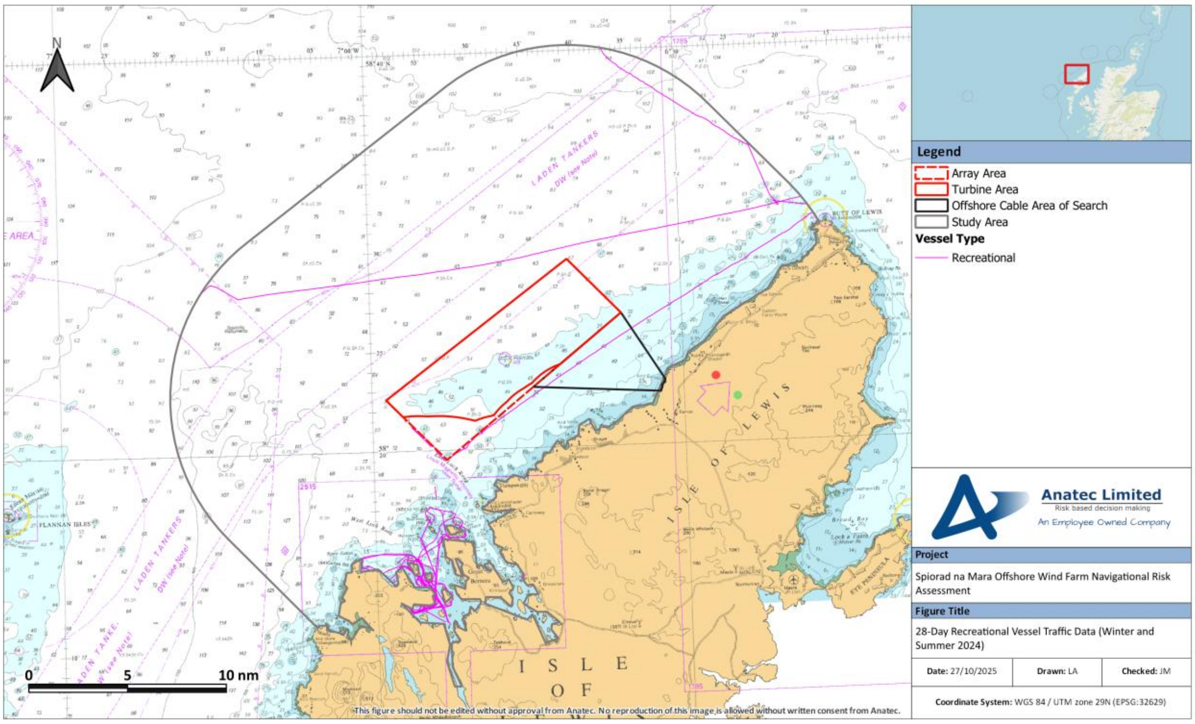

Figure 10-14 28-Day Recreational Vessel Traffic Data (Winter and Summer 2024)

179. As shown, recreational vessels were primarily recorded within and around the entrance to Loch Roag. During the winter survey period only 1 recreational vessel was recorded within the study area and was noted to intersect the Array Area and OCAS. During the summer survey period, there was an average of 1 recreational vessel every 1 – 2 days within the study area, none of which intersected the Array Area nor the OCAS.

180. **Figure 10-15** presents a plot of the RYA Coastal Atlas heat map relative to the Array Area, Turbine Area, and OCAS. Following this, **Figure 10-16** presents a plot of RYA features relevant to recreational boating.

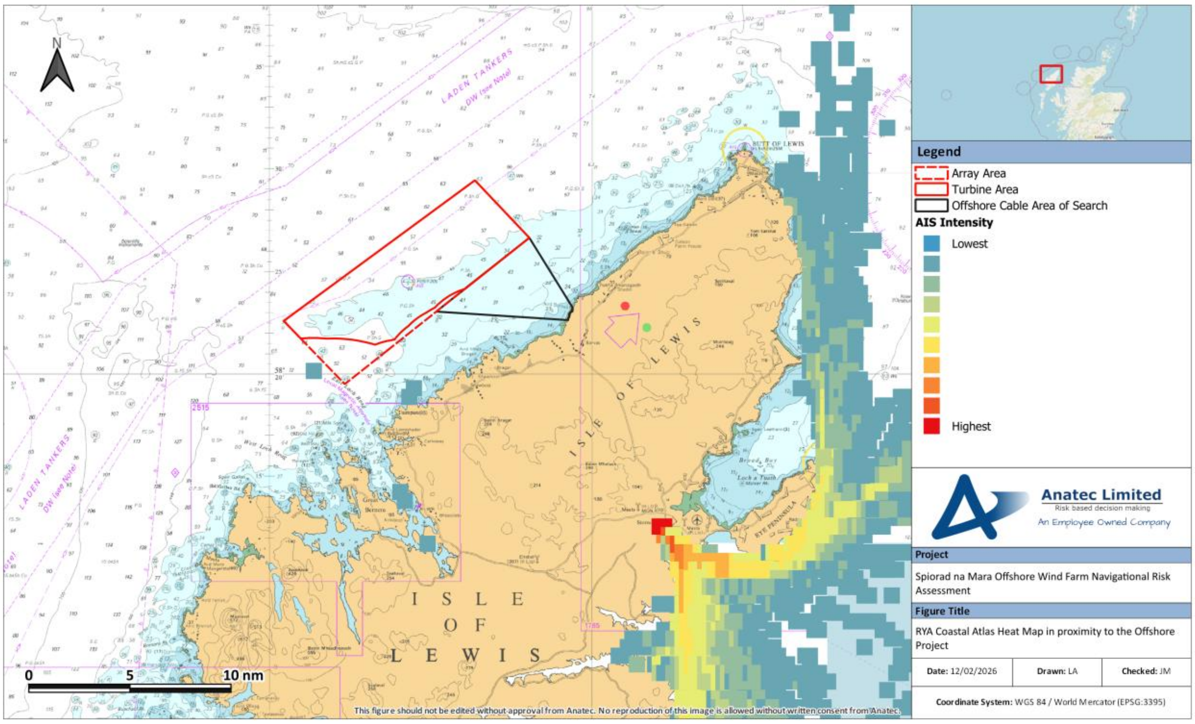

Figure 10-15 RYA Coastal Heat Map in proximity to the Offshore Project

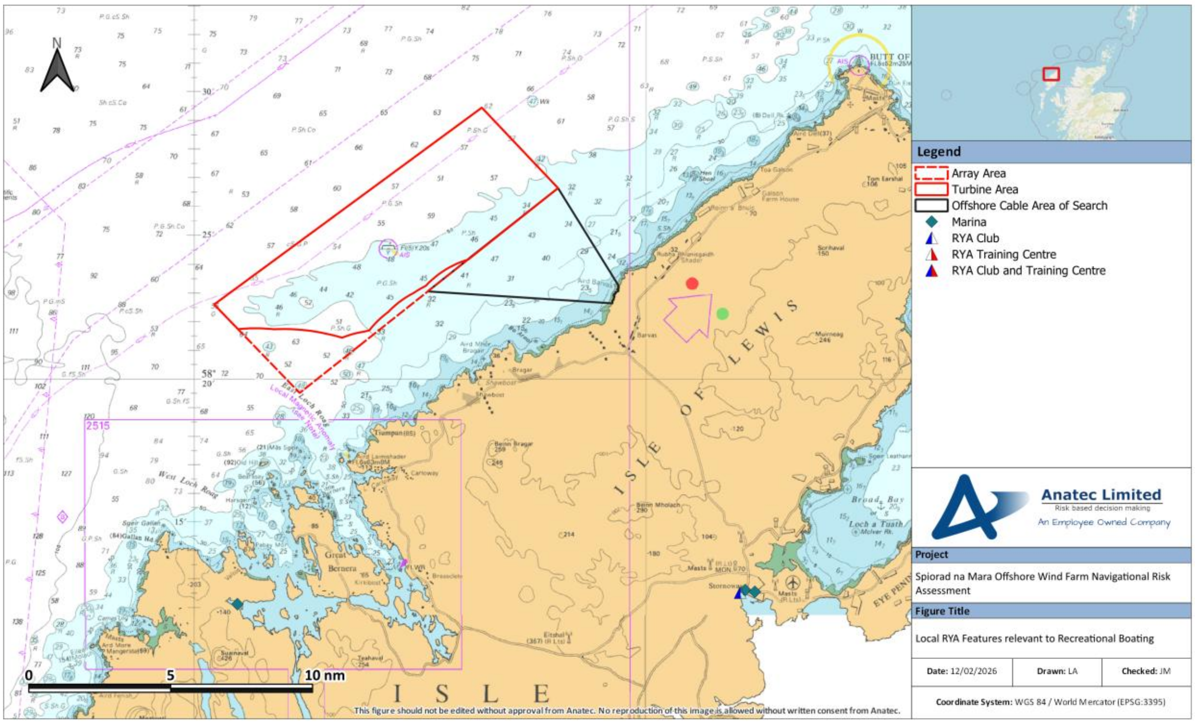

Figure 10-16 Local RYA Features relevant to Recreational Boating

181. As shown, recreational activity in the region is highest on the east coast of the Isle of Lewis, notably out of Stornoway. Minimal recreational activity is recorded on the west coast, which corroborates the vessel traffic survey data. The RYA Coastal Atlas

and vessel traffic survey datasets also align with relevant RYA features local to the area, including marinas located at Miavaig within East Loch Roag, and Stornoway. An RYA Club is also located in Stornoway.

10.2.6 Passenger Vessels

182. Passenger vessel tracks recorded during the winter and summer survey periods are shown in **Figure 10-17** below.

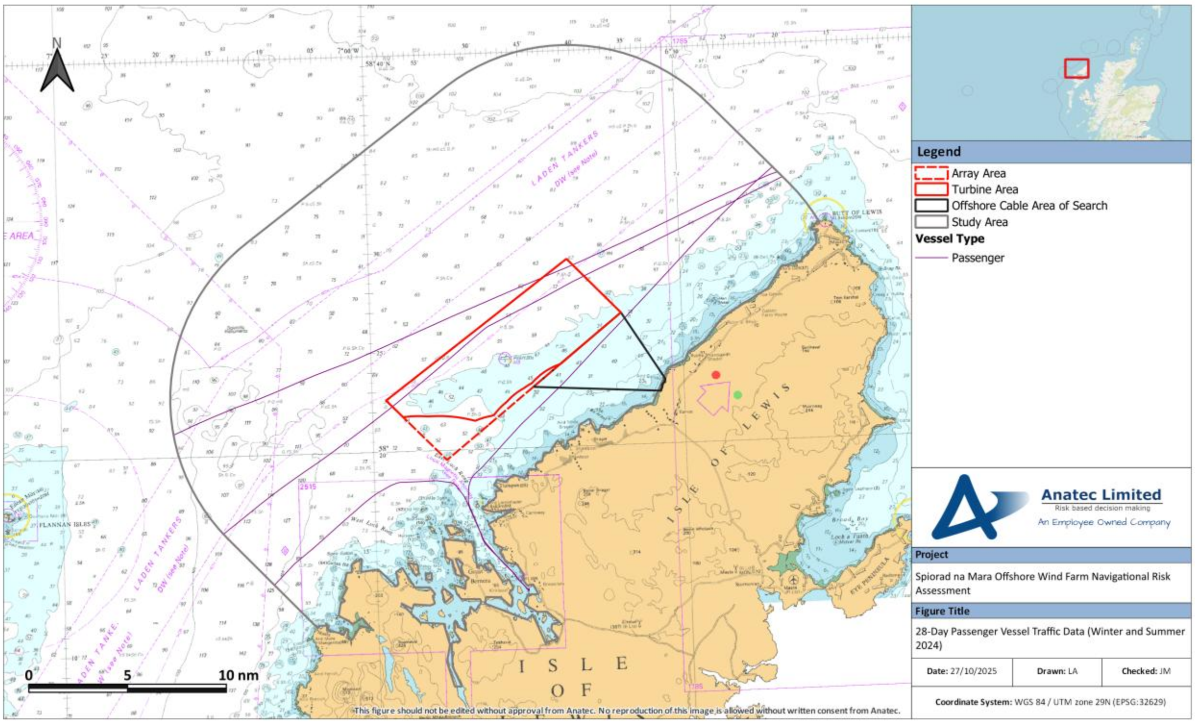

Figure 10-17 28-Day Passenger Vessel Traffic Data (Winter and Summer 2024)

183. Passenger vessels were not recorded within the study area during the winter survey period and were recorded on average once every 2 - 3 days during the summer survey period. Recorded passenger vessel transits were attributed to 2 different cruise liners, 1 of which was recorded to transit between Stornoway (UK) and St Kilda (UK) on 2 occasions. The other was recorded with destinations of Lerwick (UK) and Loch Roag and appeared to anchor at Callanish for several hours.

184. No Roll-on/Roll-off passenger (RoPax) vessels were recorded within the study area during either survey periods.

10.3 Vessel Size

10.3.1 Vessel Length

185. Vessel length was available for 86% of all vessel traffic recorded during the survey periods combined. It is noted that length information was not available for Radar

targets. A plot of the non-excluded vessel traffic recorded during both survey periods colour-coded by vessel length is shown in **Figure 10-18**. Following this, **Figure 10-19** presents the distribution of vessel lengths recorded within the study area during both survey periods.

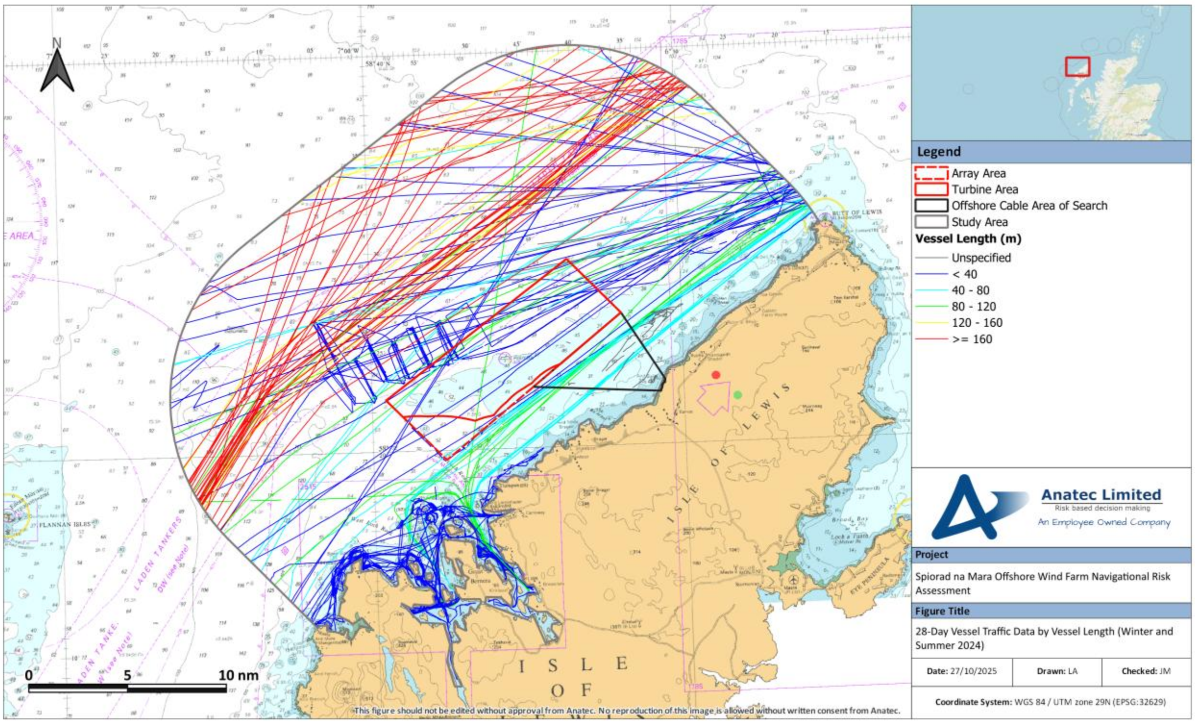

Figure 10-18 28-Day Vessel Traffic Data by Vessel Length (Winter and Summer 2024)

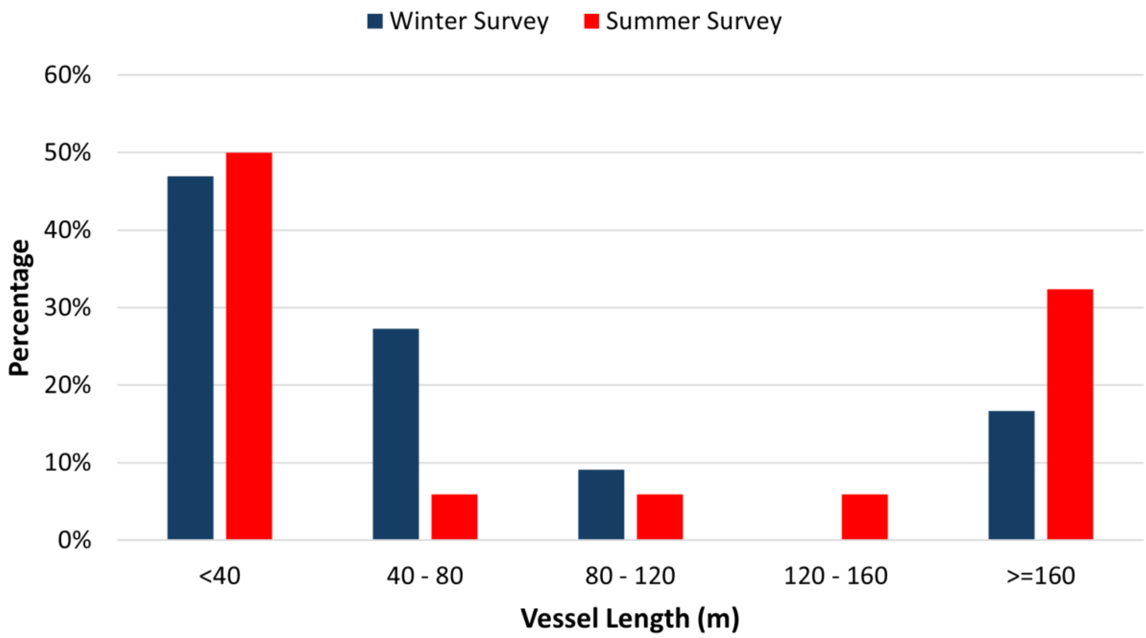

Figure 10-19 Vessel Length Distribution (28 Days Winter and Summer 2024)

186. The overall average length of vessels during the winter and summer survey periods was 75 m and 99 m, respectively. Larger vessels (above 160 m length) were primarily observed to transit the DWR as well as north of the Array Area. These corresponded to tankers and cargo vessels, with the largest vessel recorded being a Liquefied Natural Gas (LNG) tanker of 299 m length.

187. Smaller vessels (below 40 m length) were recorded throughout the study area but were more common within and around Loch Roag. Those recorded further offshore included transiting fishing vessels, as well as an active potter. Smaller vessels noted in proximity to Loch Roag and the coast included fishing vessels, recreational vessels, and fish farm support vessels operating out of Miavaig.

10.3.2 Vessel Draught

188. Vessel draught information was available for 43% of recorded vessel tracks during the combined 28-day survey period. Vessels that did not broadcast draught information included fish farm support vessels, smaller fishing vessels, and recreational vessels. These vessels were noted within and around Loch Roag, as well as throughout the study area. **Figure 10-20** presents the vessel tracks recorded within the study area during both survey periods colour-coded by draught.

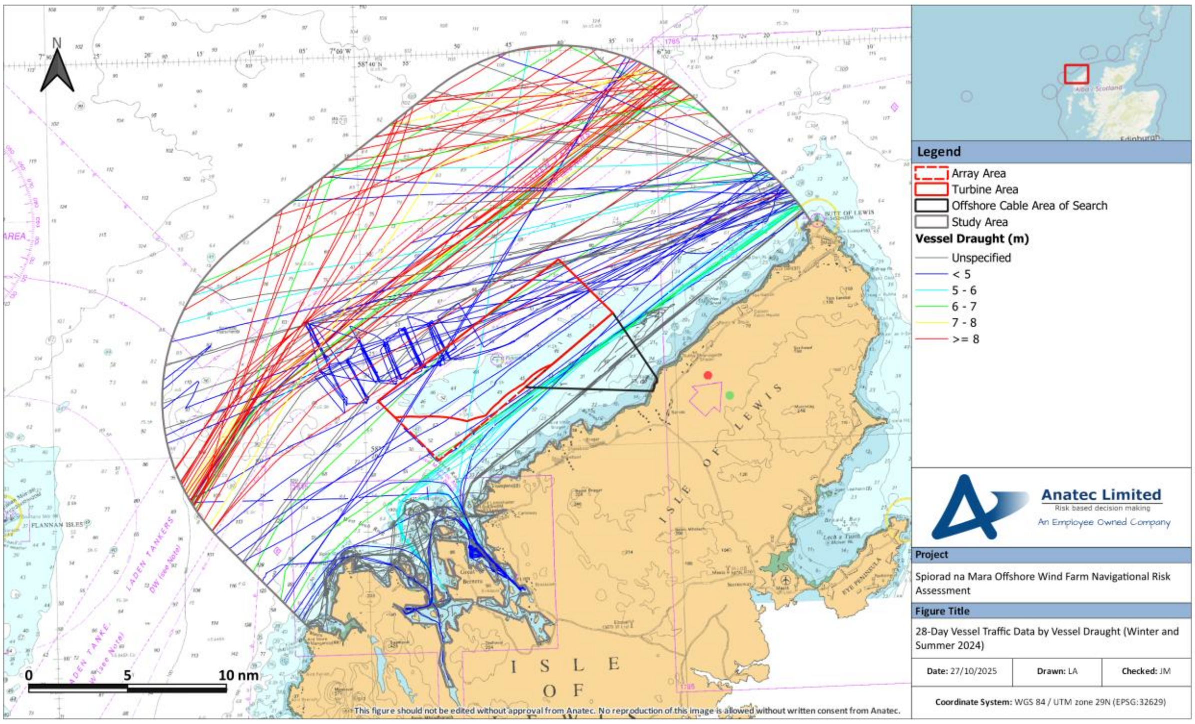

Figure 10-20 28-Day Vessel Traffic Data by Vessel Draught (Winter and Summer 2024)

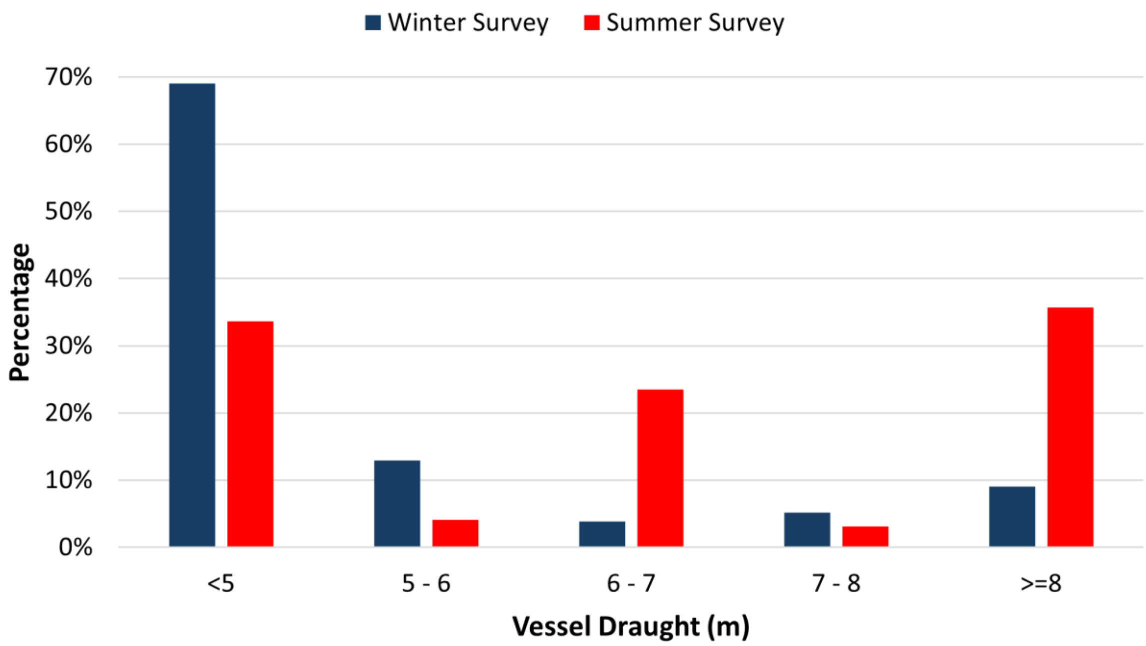

Figure 10-21 Vessel Draught Distribution (28 Days Winter and Summer 2024)

189. Excluding vessels of invalid draughts, the overall average draught recorded during the winter and summer survey period was 4.3 m and 6.8 m, respectively. The increase in draught for the summer period can be attributed to an increase in larger vessels such as cargo vessels and tankers.

190. Vessels of larger draughts (above 8 m) were primarily recorded transiting the DWR and offshore of the Array Area. 1 fishing vessel with a draught of 8.5 m was recorded within the Array Area. Smaller draughts (less than 5 m) were attributed to fishing vessels, passenger vessels, and fish farm support vessels, and were observed within the Array Area, OCAS, and Loch Roag.

10.4 Anchoring Activity

191. Vessels can transmit their navigation status over AIS, including whether at anchor. However, navigational status of vessels may not always be up to date as it relies on manual data entry. For this reason, instances of vessels travelling at less than 1 knot for over 30 minutes has been identified. These vessel tracks have then been manually checked for characteristic anchoring behaviour.

192. After applying the criteria above, several vessels were deemed to be at anchor within the study area during the winter and summer survey periods and are presented in **Figure 10-22**.

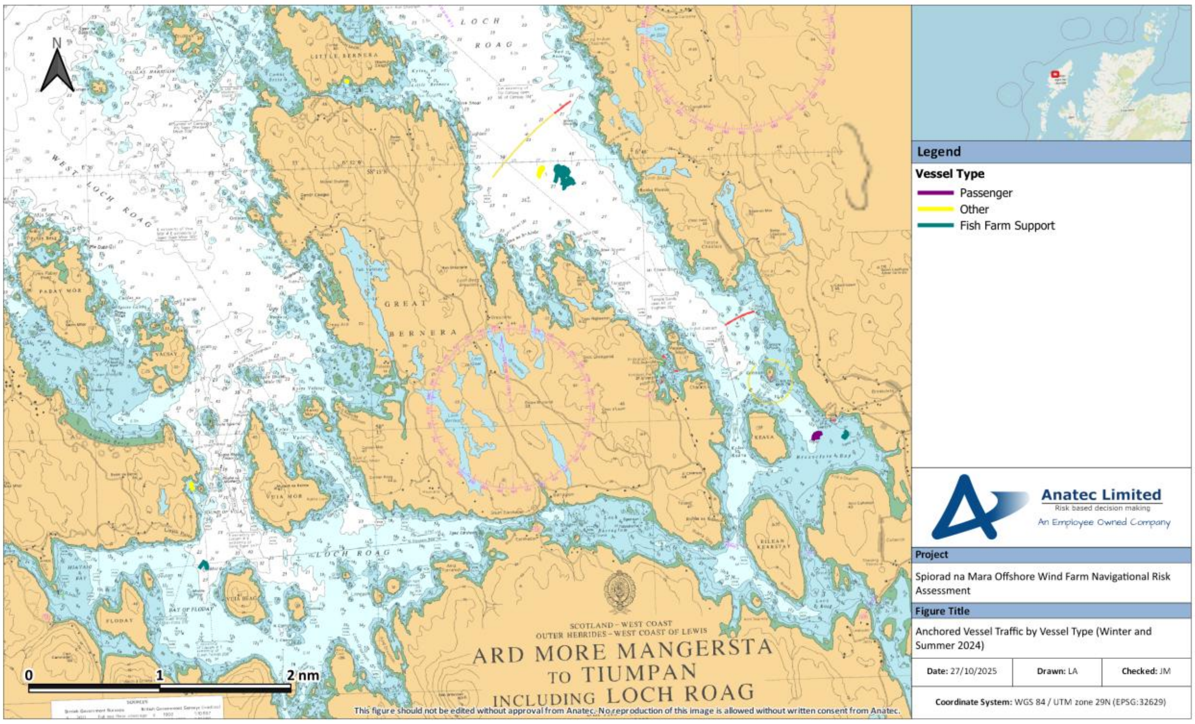

Figure 10-22 Anchored Vessel Traffic by Vessel Type (Winter and Summer 2024)

193. 5 different vessels were recorded at anchor within Loch Roag during the winter and summer survey periods, including within East Loch Roag, Breasclete Bay, and between the Bay of Floday and the Sound of Vuis. These vessels included several fish farm support vessels, and a buoy-laying vessel during the winter survey period, and a law enforcement vessel and cruise liner during the summer survey period.

194. No anchoring activity was identified in the Array Area nor OCAS.

11 Base Case Vessel Routeing

11.1 Definition of a Main Commercial Route

195. Main commercial routes have been identified using the principles set out in MGN 654 (MCA, 2021). Vessel traffic data are assessed and vessels transiting at similar headings and locations are identified as a main route. To help identify main routes, vessel traffic data can also be interrogated to show vessels (by name and/or operator) that frequently transit those routes. The route width is then calculated using the 90th percentile rule from the median line of the potential shipping route as shown in **Figure 11-1**.

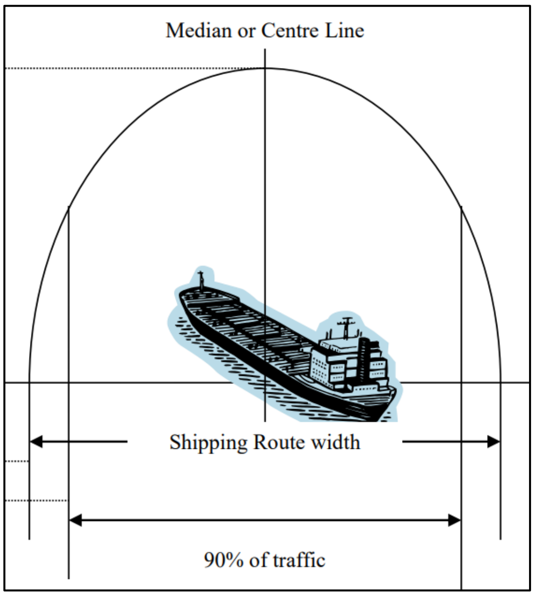

Figure 11-1 Illustration of Main Route Calculation (MCA, 2021)

11.2 Pre Wind Farm Main Commercial Route

196. A total of 10 main commercial vessel routes were identified within the study area from the vessel traffic data. These main routes and their corresponding 90th percentiles within the routeing study area are shown relative to the Array Area, Turbine Area, and OCAS in **Figure 11-2**. Following this, a description of each route is provided in **Table 11-1**, including the average number of vessels per day, start and end locations, and main vessel types. Start and end locations are based on the most common destinations transmitted via AIS by vessels on those routes (i.e. there may be vessels on any given route bound for destinations other than those listed).

197. To ensure all main commercial routes are captured, the long-term vessel traffic AIS data has been used to validate the main commercial routes identified from the vessel traffic survey data. This also ensures low use routeing (less than 1 vessel a week) was still identified and captured within the modelling (see **Section 16**). This low use

routeing was observed to include vessels supporting the aquaculture sites within Loch Roag.

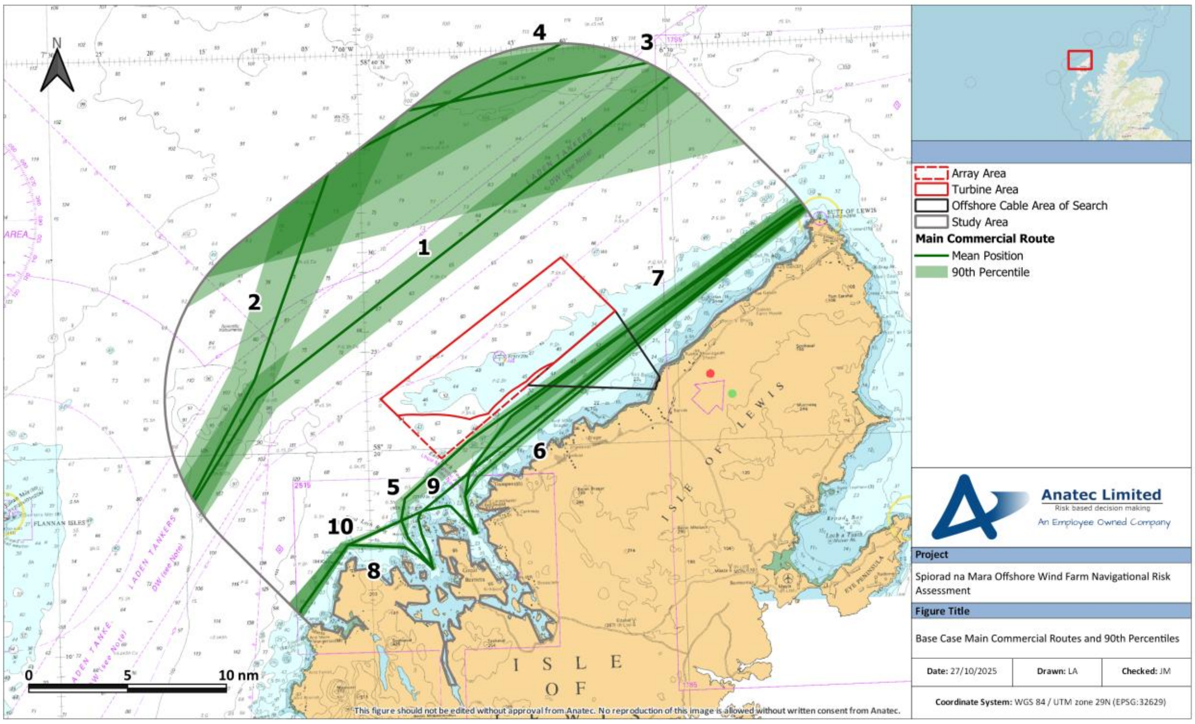

Figure 11-2 Base Case Main Commercial Routes and 90th Percentiles

198. The majority of vessels on main routes were identified to transit within the DWR (routes 1 and 2). These routes equate to a total average of between 1 - 2 vessels per day. As previously noted, inshore routeing between Loch Roag and the Butt of Lewis is not currently active, however, to ensure a worst-case approach these have been retained as part of the assessment.

Table 11-1 Main Commercial Route Description[1]

Route Number	Average Vessels Per Week	Description
1	7	UK West Coast – Norway/Russia. Mainly tankers (66%) and cargo vessels (34%).
2	3	Murmansk – Mediterranean Sea. Mainly cargo vessels (53%) and tankers (47%).
3	2-3	North America – Skagerrak strait. Mainly cargo vessels (90%) and tankers (10%).
4	1-2	North America – Skagerrak strait. Mainly cargo vessels (93%) and tankers (7%).

[1] Noted that an average of 0.5 vessels or greater is rounded up to 1.

Route Number	Average Vessels Per Week	Description
5	1-2	Stornoway – West Loch Roag. Fish farm support vessels (100%).
6	1	West Coast Scotland – East Loch Roag. Fish farm support vessels (100%).
7	1	Stornoway – East Loch Roag. Fish farm support vessels (100%).
8	0-1	Harris – West Loch Roag. Fish farm support vessels (100%).
9	0-1	Ullapool – West Loch Roag. Fish farm support vessels (100%).
10	0-1	Harris – East Loch Roag. Fish farm support vessels (100%).

12 Adverse Weather Vessel Traffic Movements

199. Some vessels and vessel operators may operate alternative routes during periods of adverse weather. This section focuses on vessel movements in adverse weather. This takes into consideration the implications of a scenario when a commercial vessel is unable to make passage, or a small craft is unable to access safe havens in adverse weather due to the presence of the Project or activities associated with the Project.

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

12.1 Identification of Periods of Adverse Weather

201. The vessel traffic survey data and long-term vessel traffic data has been checked for instances of adverse weather. Based on the weather log maintained during the shore-based surveys, the sea state was rough from the 21 - 22 February and 27 - 28 February 2024, with very rough sea states recorded on the 29 February 2024. During the summer survey period, rough sea state was recorded on the 24 June 2024, as well as from the 28 - 29 June 2024.

202. Historical weather information provided by the Met Office (Met Office, 2025) has been used to identify periods of adverse weather during the 12-month period July 2023 - June 2024 (covering the long-term vessel traffic data) and during the 2 14-day survey periods in February/March 2024 and June/July 2024 (covering the vessel traffic survey data). By investigating such identified periods, cases where routes may have been altered or cancelled can then be identified. The key weather events identified, and the datasets overlapped, are detailed in **Table 12-1**. No key weather events occurred during the 14-day winter or summer survey periods.

Table 12-1 Key Weather Events (Met Office, 2025) for Shipping and Navigation

Weather Event	Date	Dataset Overlap	Met Office Details
Storm Betty	18 - 19 August 2023	Long-term data	Storm Betty brought strong winds and heavy rain to western parts of the UK, with the strongest winds around Irish Sea coasts.
Storm Babet	18 - 21 October 2023	Long-term data	Storm Babet brought very strong winds, gusting at over 50 knots across northeast England and much of Scotland.
Storm Debi	13 November 2023	Long-term data	Storm Debi brought strong winds and heavy rain to the UK with parts of Northern Ireland, southwest Scotland, northwest England and North Wales worst affected. The strongest winds were around Irish Sea coasts with gusts in exposed locations exceeding 60 knots.
Storm Gerrit	27 - 28 December 2023	Long-term data	Storm Gerrit brought damaging winds and heavy rain to the UK with Wales, northwest England and Scotland worst affected. In the most exposed locations, winds gusted at over 70 knots with heavy rain.
Storms Isha and Jocelyn	21 - 24 January 2024	Long-term data	Storm Isha brought widespread strong winds, particularly across the northern half of the UK where winds gusted at 60 - 70 knots. Storm Jocelyn wind gusts were very strong across northern areas. Cairngorm Summit recorded a gust of 122 knots.
Storm Kathleen	06 -o 07 April 2024	Long-term data	Storm Kathleen brought strong winds gusting widely at over 50 knots around coastlines in the west and north and over 60 knots in some locations.

12.2 Adverse Weather Effects of Vessel Traffic

203. The vessel traffic survey data and the long-term vessel traffic data was assessed for any vessel movements which could be associated with periods of adverse weather. This analysis has been utilised to identify potential routeing activity related to adverse weather conditions in proximity to the Offshore Project with the periods outlined in **Table 12-1**. No routeing activity specific to adverse weather conditions were identified from the long-term dataset, including the nearshore routeing displayed by fish farm support vessels.

13 Navigation, Communication, and Position Fixing Equipment

13.1 Very High Frequency Communications (Including Digital Selective Calling)

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

205. 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.

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

207. Furthermore, as part of SAR trials carried out at North Hoyle in 2005, radio checks were undertaken between the Sea King helicopter and both Holyhead and Liverpool coastguards. The aircraft was positioned offshore of the array 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).

208. In addition to the North Hoyle trials, a desk-based study was undertaken for the Horns Rev 3 OWF 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).

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

13.2 Very High Frequency Direction Finding

210. During the North Hoyle 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 DF equipment and would not impact operational or SAR activities (MCA and QinetiQ, 2004).

211. 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.

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

13.3 AIS

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

214. 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 Offshore Project.

13.4 Navigational Telex System

215. 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.

216. There are 2 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.

217. 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.

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

13.5 Global Positioning System

219. Global Positioning System (GPS) is a satellite based navigational system. GPS trials were also undertaken throughout the 2004 trials at North Hoyle and it was stated

that "*no problems with basic GPS reception or positional accuracy were reported during the trials*".

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

221. Therefore, there are not expected to be any significant impacts associated with the use of GPS systems within or in proximity to the Offshore Project, noting that there have been no reported issues relating to GPS within or in proximity to any operational OWFs to date.

13.6 Electromagnetic Interference

222. 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 may be used to calculate heading, used with a sextant to calculate latitude, and with a marine chronometer to calculate longitude.

223. 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 EMF are minimised to ensure continued safe navigation.

224. 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 the Offshore Project would 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

225. The subsea cables for the Offshore Project will be Alternating Current (AC). Direct Current (DC) is not under consideration.

226. Studies indicate 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 Offshore Project are not considered any further.

13.6.2 Wind Turbine Generators

227. 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 Wind Farms

228. 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 OWFs.

13.7 Marine Radar

229. This section summarises the results of trials and studies undertaken in relation to Radar effects from OWFs 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. Other Radar interference effects (including aviation) are discussed within **Chapter 17: Military and Civil Aviation, Volume 2a**.

13.7.1 Trials

230. 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.

231. In 2004 trials undertaken at North Hoyle (MCA, 2005) 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).

232. 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**.

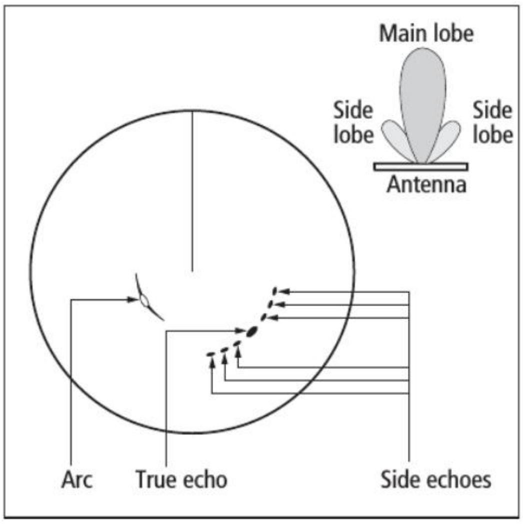

Figure 13-1 Illustration of Side Lobes on Radar Screen

233. 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**.

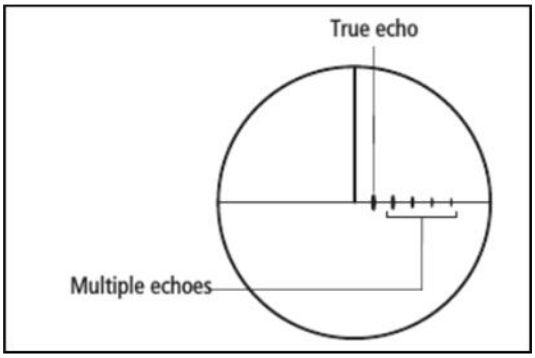

Figure 13-2 Illustration of Multiple Reflected Echoes on Radar Screen

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

235. A second set of trials conducted at Kentish Flats OWF in 2006 on behalf of the British Wind Energy Association (BWEA) (BWEA, 2007) – now called RenewableUK – also found that Radar antennas which are sited unfavourably with respect to components of the vessel's structure may 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.

236. Theoretical modelling of the effects of the development of the proposed Atlantic Array OWF, 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[2]. 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 vessels and recreational craft). It is noted that this situation would arise with or without WTGs in place;
- There is potential for the performance of a vessel’s Automatic Radar Plotting Aid (ARPA) to be affected when tracking targets in or near the array. Although greater vigilance is required, during the Kentish Flats trials it was shown that false targets were quickly identified as such by the mariners and then by the equipment itself.

237. In summary, experience in UK waters has shown that mariners have become increasingly aware of any Radar effects as more OWFs become operational. Based

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

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 may be effectively mitigated by "*careful adjustment of Radar controls*".

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

Table 13-1 Distance at Which Impacts on Marine Radar Occur for Shipping and Navigation

Distance at Which Effect Occurs (nm)	Identified Effects
0.5	▪ Intolerable impacts may 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 - 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.

239. 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 the 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 Vessel Traffic Service (VTS) or AIS (MCA, 2016).

13.7.2 Experience from Operational Developments

240. The evidence from mariners operating in proximity to existing OWFs is that they quickly learn to adapt to any effects. **Figure 13-3** presents the example of the Galloper and Greater Gabbard OWFs, which are located in proximity to IMO routeing measures. Despite this proximity to heavily trafficked Traffic Separation Scheme (TSS) lanes, there have been no reported incidents or issues raised by mariners operating in close proximity. The interference buffers presented in **Figure 13-3** are as per **Table 13-1**.

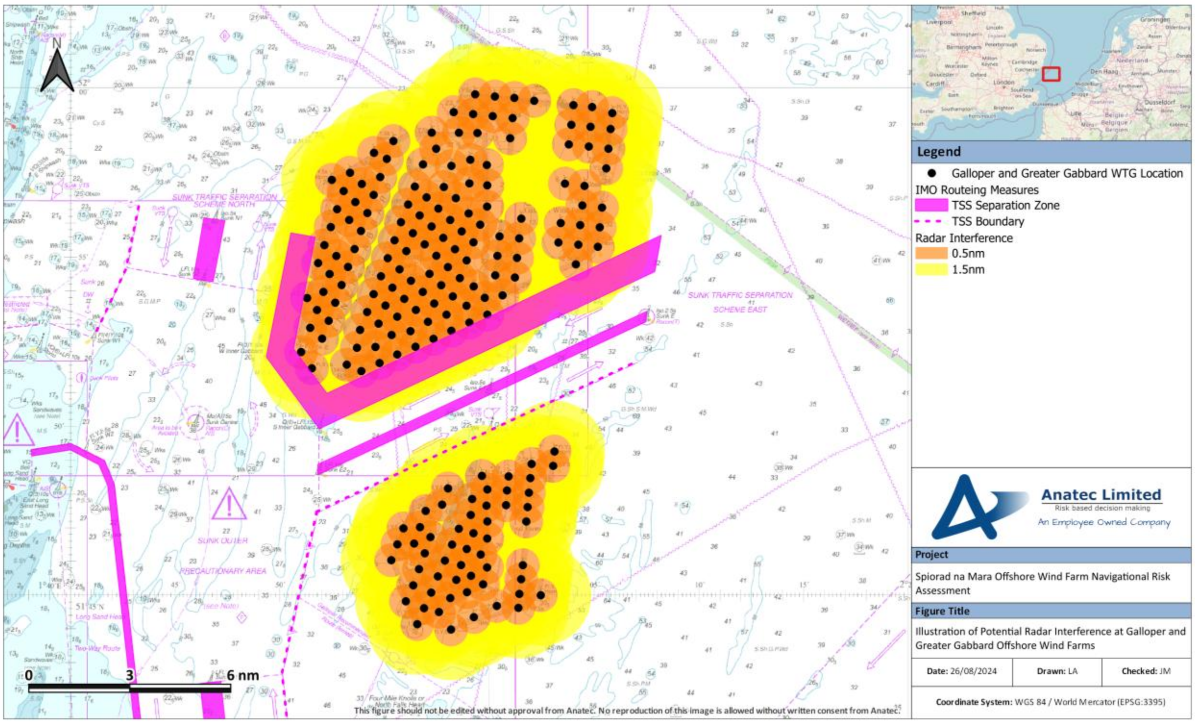

Figure 13-3 Illustration of Potential Radar Interference at Galloper and Greater Gabbard Offshore Wind Farms

241. As indicated by **Figure 13-3**, vessels utilising these TSS lanes would experience some Radar interference based on the available guidance. Both developments are operational, and the lanes are used by a minimum of 8 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.

242. AIS information may also be used to verify the targets of larger vessels (generally vessels over 15 m in length – the minimum threshold for fishing vessel AIS carriage requirements). Approximately 9% of the vessel traffic recorded within the study area was under 15 m in length, although throughout the vessel traffic surveys approximately 99% of vessel tracks were recorded on AIS, indicating a high level of AIS take-up among vessels for which AIS carriage is not mandatory.

243. 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 OWF.

13.7.3 Increased Radar Returns

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

245. Larger WTGs (either in height or width) would return greater target sizes and/or stronger false targets. However, there is a limit to which the vertical beam width would be affected (20° - 25°) dependent upon the distance from the target, and at closer distances this 5 degree width would be limited much further. Therefore, increased WTG height in the Turbine Area would not create any effects in addition to those already identified from existing operational wind farms (interfering side lobes, multiple and reflected echoes).

246. 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 may be managed effectively.

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

247. There are multiple operational OWFs including Galloper 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 Proposed Development

248. Upon development of the Offshore 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 may be mitigated by adjustment of Radar controls.

249. **Figure 13-4** presents an illustration of potential Radar interference due to the Project. The Radar effects have been applied to the indicative full build out array layout of the Turbine Area introduced in **Section 6.2**, as this layout presents the greatest spatial extent of potential Radar interference for passing vessels.

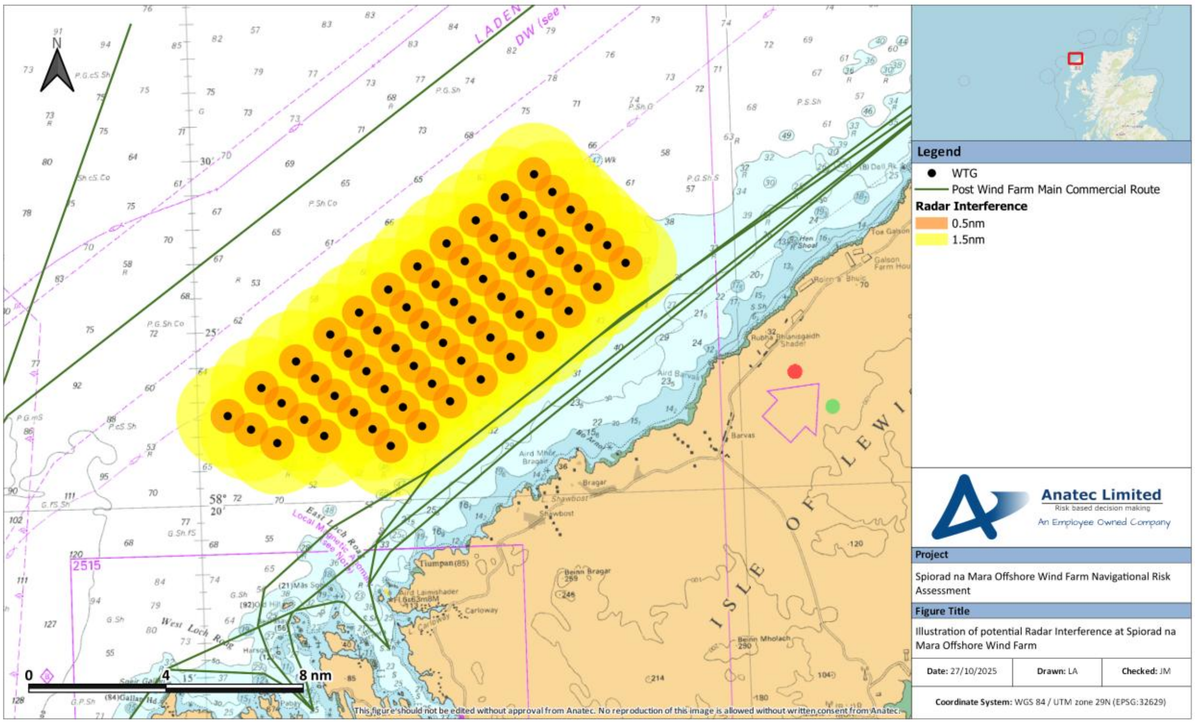

Figure 13-4 Illustration of Potential Radar Interference at the Turbine Area

250. Vessels passing within 1.5 nm of the Offshore Project would be subject to a greater level of interference with impacts becoming more substantial in close proximity to WTGs. This would require additional mitigation by any vessels including consideration of the navigational conditions (visibility) when passage planning and compliance with the COLREGs (IMO, 1972/77) would be essential.

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

13.8 Sound Navigation Ranging System

252. No evidence has been found to date with regard to existing OWFs 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 Offshore Project.

13.9 Noise

253. No evidence has been found to date with regard to existing OWFs 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 on Use

254. Based on the detailed technical assessment of the effects due to the presence of the Offshore Project on navigation, communication and position fixing equipment in the previous subsections, **Table 13-2** summarises the assessment of frequency of occurrence and severity of consequence and the resulting significance of risk for each component of this hazard as per the FSA methodology referenced in **Section 3.2**.

Table 13-2 Summary of Risk to Navigation, Communication, and Position Fixing Equipment for Shipping and Navigation

Topic	Frequency of Occurrence	Severity of Consequence	Significance of Risk
VHF	Negligible	Minor	Broadly Acceptable
VHF DF	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

255. On the basis of these findings, associated risks are screened out of the risk assessment undertaken in **Section 18**.

14 Cumulative Overview

256. Cumulative risks have been considered for activities in combination and cumulatively with the Offshore Project. This section provides an overview of cumulative developments screened for the cumulative risk assessment upon the criteria outlined in **Section 3.3**. Development types considered include (but are not limited to):

- OWF;
- Subsea cables;
- Oil and gas infrastructure;
- Marine aggregate dredging areas;
- Port developments.

257. The cumulative risk assessment itself is undertaken in **Section 19**.

14.1 Screened in Other Developments

258. In addition to the Project, there are other developments located in the region. **Table 14-1** includes details of these developments, whether they are screened into the cumulative risk assessment and the cumulative tier applied (where applicable). The statuses listed are correct as of March 2025.

259. As per the cumulative risk assessment methodology (see **Section 3.3**), any development greater than 50 nm from the Offshore Project is not considered.

260. These developments have been considered as Tier 3 within the cumulative risk assessment (see **Section 19**) as no main commercial route is directly impacted by both the Project and any of these developments cumulatively (see **Section 14.2**).

Table 14-1 Cumulative Screening for Shipping and Navigation

Development	Development Type	Development Status	Closest Distance (nm)		Data Confidence	Tier
			Array Area	OCAS		
Talisk	OWF	Proposed (Scoping Report submitted)	15.1	17.3	High	3
Havbredey	OWF	Proposed (Scoping Report submitted)	29.7	29.7	Medium	3
Spaceport 1	Sub-Orbital Vertical Launch Spaceport	Under Construction	44.8	50.2	High	3

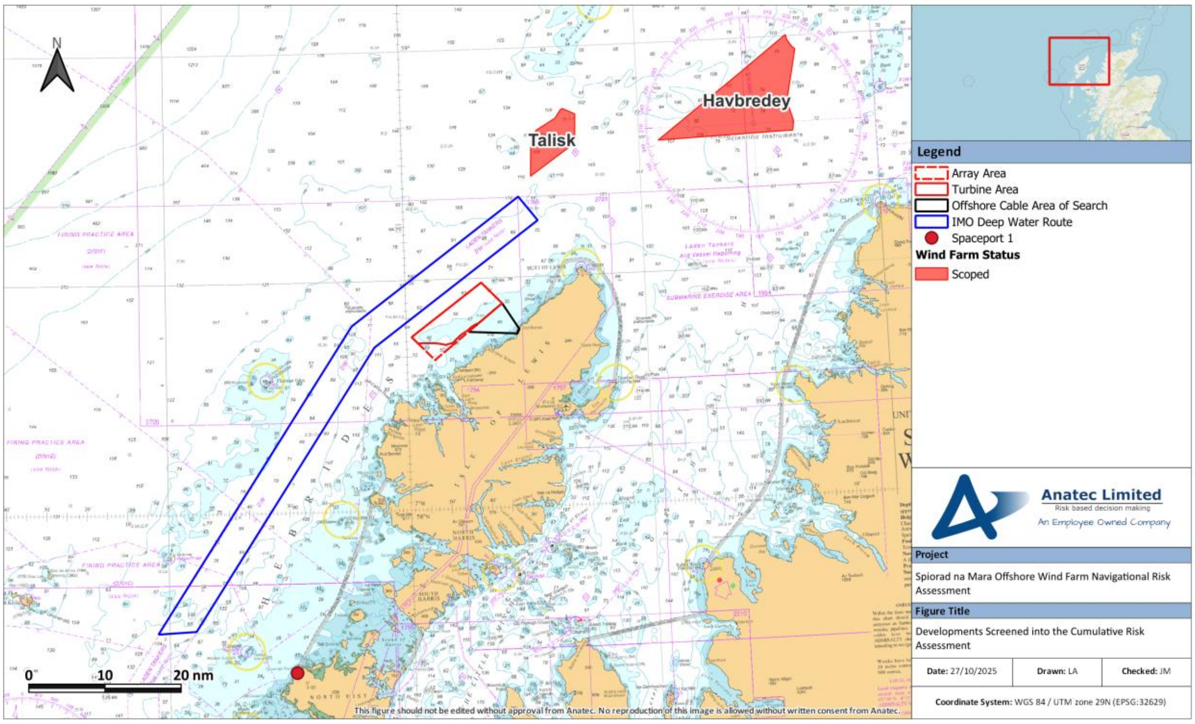

Figure 14-1 Developments Screened into the Cumulative Risk Assessment

261. The screened in developments include Talisk and Havbredey OWFs, as well as Spaceport 1 located at North Uist. The latter has been included within the cumulative assessment due to the implementation of temporary marine Exclusion Zones up to 135 nm from Spaceport 1 (Atlantic58, 2023).

14.2 Routeing Interaction with Screened in Developments

262. As per the methodology for re-routeing due to the Offshore Project in isolation (see **Section 15.5.1**), it is assumed that any main commercial route within 1 nm of a surface piercing installation will require a deviation.

263. Both developments screened into the cumulative risk assessment (Talisk and Havbredey OWFs) may lead to deviations of the main commercial routes identified, in particular routes 1 and 4, as demonstrated in **Figure 14-2**.

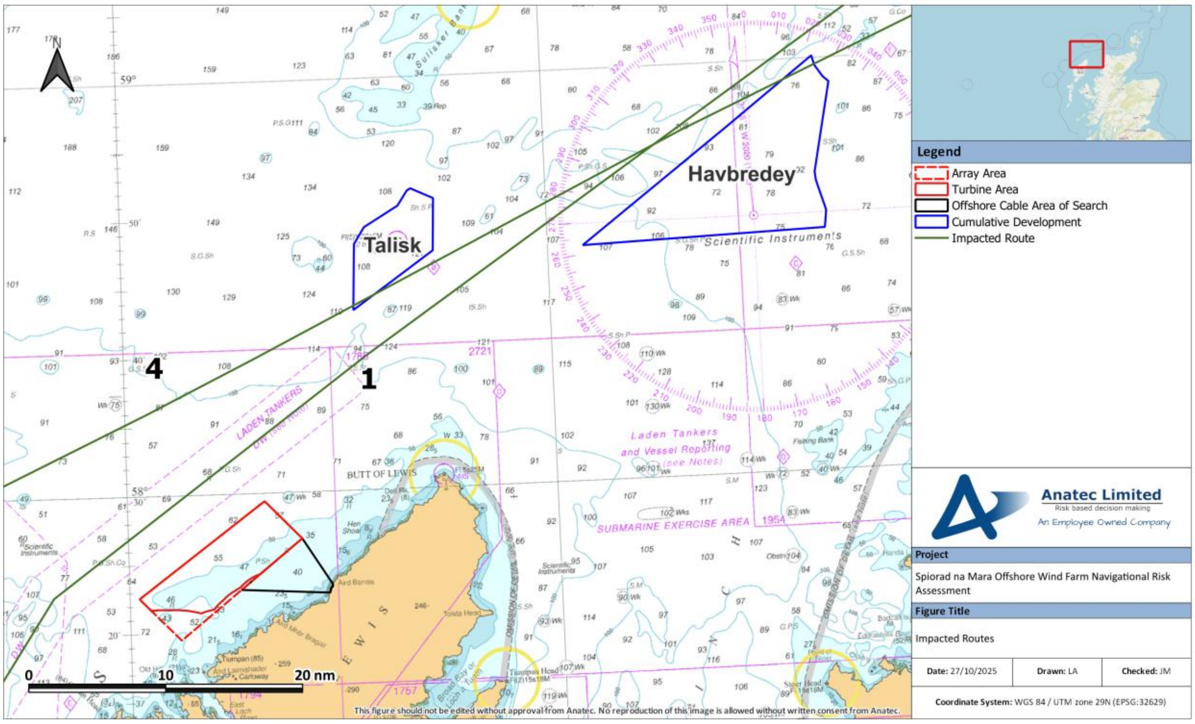

Figure 14-2 Impacted Routes

264. No routes required to deviate due to the Offshore Project will be cumulatively affected. Routes 1 and 4 pass approximately 3.7 nm and 9.5 nm northwest of the Array Area, respectively. It is anticipated that these routes will most likely pass south of Talisk OWF and north of Havbredey OWF requiring minor deviations. Further discussion of these deviations can be found in **Section 19**.

265. It is not anticipated that any of the main commercial routes will be deviated by the presence of Spaceport 1, as any impact imposed by marine Exclusion Zones will be transient and restricted to the area immediately surrounding the launch vehicle. Exclusion Zones are not expected to be active for more than 4 hours, with up to 10 individual launch events per year (Atlantic58, 2023).

15 Future Case Vessel Traffic

266. The characterisation of vessel traffic established in the baseline (see **Section 10** and **Section 11**) is used as input to the risk assessment (see **Section 18**). However, it is also necessary to consider potential future case vessel traffic, in terms of general volume and size changes, port developments which may influence movements, and changes to movements associated with the presence of the Offshore Project (the post wind farm scenario).

267. The following subsections provide details of high-level future case scenarios which have been used to inform the risk assessment.

15.1 Increases in Commercial Vessel Activity

268. There is uncertainty associated with long-term predictions of vessel traffic growth including the potential for any other new developments in UK or transboundary ports.

269. Therefore, 2 independent scenarios of potential growth in commercial vessel movements of 10% and 20% have been estimated throughout the lifetime of the Offshore Project. These are considered conservative over the operational life of the Offshore Project.

15.2 Increases in Commercial Fishing Vessel and Recreational Vessel Activity

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

271. Therefore, a conservative potential growth in commercial fishing vessel and recreational vessel movements of 10% and 20% has been estimated throughout the lifetime of the Offshore Project.

15.3 Increases in Traffic Associated with Offshore Wind Farm Operations

272. During the operation and maintenance phase, up to 32,034 total return trips to port would be made by vessels involved in the operation and maintenance of the Offshore Project (see **Section 6.4.2**).

15.4 Increases in Commercial Fish Farm Support Activity

273. Similarly, a conservative potential growth in fish farm support vessels of 10% and 20% have also been assumed. This is on the basis that there may be an increase in aquaculture sites on the west coast of the Isle of Lewis in the future (see **Table 4-1**). This is a conservative assumption noting that fish farm support vessel main routes

presented in **Section 11** are not currently active due to a factory closure in Stornoway (see **Table 4-1**).

15.5 Commercial Traffic Routeing (Project in Isolation)

15.5.1 Methodology

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

- All alternative routes maintain a minimum mean distance of 1 nm from offshore installations and existing OWF boundaries in line with industry experience. This distance is considered for shipping and navigation from a safety perspective as explained below;
- All mean routes account for known routeing preferences including consideration of banks/shallows and AtoNs.

275. Annex 1 of MGN 654 defines a methodology for assessing passing distance from OWF boundaries but states that it is “*not a prescriptive tool but needs intelligent application”* (MCA, 2021).

276. To date, internal and external studies undertaken by Anatec on behalf of the UK Government and individual clients (e.g., Anatec, 2016) show that vessels do pass consistently and safely within 1 nm of established OWFs and these distances vary depending upon the sea room available as well as the prevailing conditions. This evidence also demonstrates that the Mariner defines their own safe passing distance based upon the conditions and nature of the traffic at the time, but they are shown to frequently pass 1 nm off established developments.

277. Evidence also demonstrates that commercial vessels do not transit through OWF arrays. On this basis, it has been assumed for the purposes of worst-case assessment that all commercial vessels on the main routes identified will deviate, with this assumption noted at the Hazard Workshop (held February 2025).

278. The NRA also aims to establish the MDS based on navigational safety parameters, and when considering this the most conservative realistic scenario for vessel routeing is when main commercial routes pass 1 nm off of developments. Evidence collected during numerous assessments at an industry level confirms 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.

15.5.2 Post Wind Farm Routeing

279. An illustration of the anticipated worst-case shift in the mean positions of the main commercial routes (see **Section 11**) within the study area following the

developments of the Offshore Project is presented in **Figure 15-1**. These deviations are based on Anatec's assessment of the MDS and the methodology set out in **Section 15.5.1**.

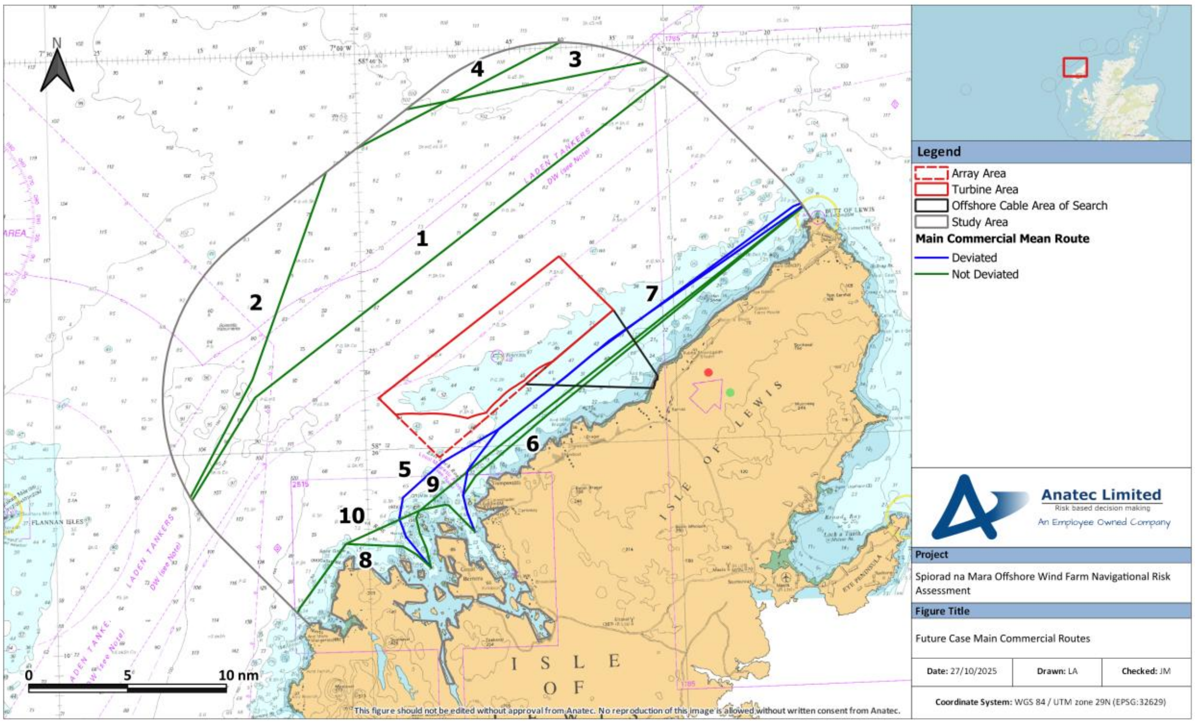

Figure 15-1 Future Case Main Commercial Routes

280. Deviations from the pre wind farm scenario would be required for two of the 10 main commercial routes identified, with the level of deviation being a 0.02 nm increase for Route 5, and a 0.03 nm decrease for Route 7. **Table 15-1** presents further detail on each of the deviations required.

Table 15-1 Summary of Post Wind Farm Main Commercial Deviations for Shipping and Navigation

Route Number	Change in Route Length (nm)	Change in Total Route Length (%)	Nature of Deviation
5	+0.02	0.03	Passing further inshore.
7	-0.03	0.05	Passing slightly closer to the coast.

281. The increase in route length associated with Route 5 is attributed to this route being observed further offshore upon exiting West Loch Roag, prior to the deviation inshore of the Turbine Area. The decrease in route length associated with Route 7 is attributed to this route not extending relatively far offshore upon exiting East Loch Roag, and thus the deviation is a minor shift towards the coast which overall reduces route length.

16 Collision and Allision Risk Modelling

16.1 Overview

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

16.1.1 Scenarios Under Consideration

283. For each element of the quantitative assessment, both a pre and post wind farm scenario with base and future case traffic levels have been considered. As a result, 6 distinct scenarios have been modelled:

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

284. The results of the base case scenarios are detailed in full in the following subsections, with the equivalent results for each future case scenario provided in **Section 16.3**.

16.1.2 Hazards Under Consideration

285. Hazards considered on 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;
- Increased fishing vessel to structure allision risk.

286. The pre wind farm assessment has been informed by the vessel traffic survey data (see **Section 10** and **Appendix C**) and other baseline data sources (such as Anatec's ShipRoutes database). Conservative assumptions have been made with regard to route deviations and future shipping growth over the lifetime of the Offshore Project (see **Section 15.5.2** for re-routeing assumptions).

16.2 Pre Wind Farm Modelling

16.2.1 Vessel to Vessel Encounters

287. An assessment of current vessel to vessel encounters has been undertaken by replaying at high speed the vessel traffic data collected as part of the vessel traffic surveys (see **Section 10** and **Appendix C**). The model defines an encounter as 2 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 OWF, could potentially increase congestion and therefore also increase the risk of encounters and collisions. No account of whether encounters are head on or stern to head are given; only close proximity is identified for.

288. **Figure 16-1** presents a heat map based upon the geographical distribution of vessel encounter tracks within a density grid. Following this, **Figure 16-2** illustrates the daily number of encounters recorded within the study area throughout the survey periods.

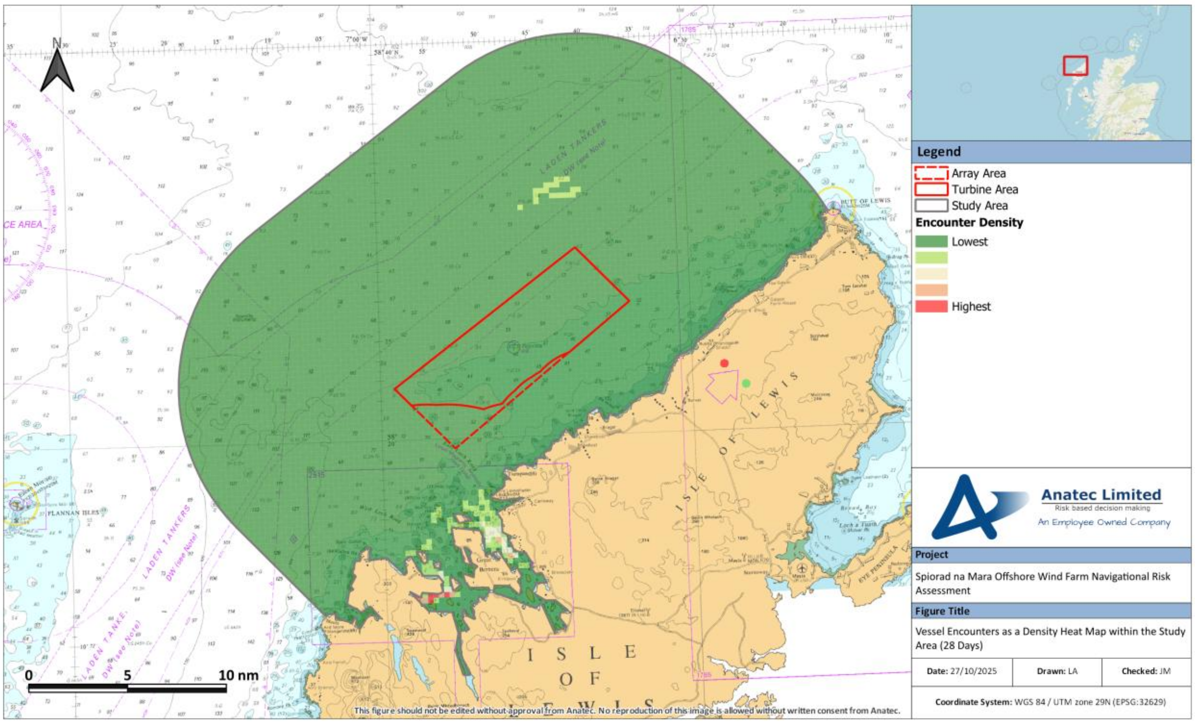

Figure 16-1 Vessel Encounters as a Density Heat Map within the Study Area (28 Days)

289. No encounters were recorded within the Array Area or the inshore area between the Array Area and the coast. The majority of encounters occurred within Loch Roag where there is limited sea room.

290. There was an overall average of between 1 - 2 vessel encounters recorded per day within the study area during the combined 28-day survey periods. The greatest number of encounters recorded during 1 day was 5, which was recorded on both the 21 February and 02 July 2024. This was primarily due to vessels encountering each other when exiting or entering Loch Miavaig and Miavaig Bay.

291. The most common vessel types involved in encounters within the study area were fish farm support vessels (66%) and recreational vessels (17%).

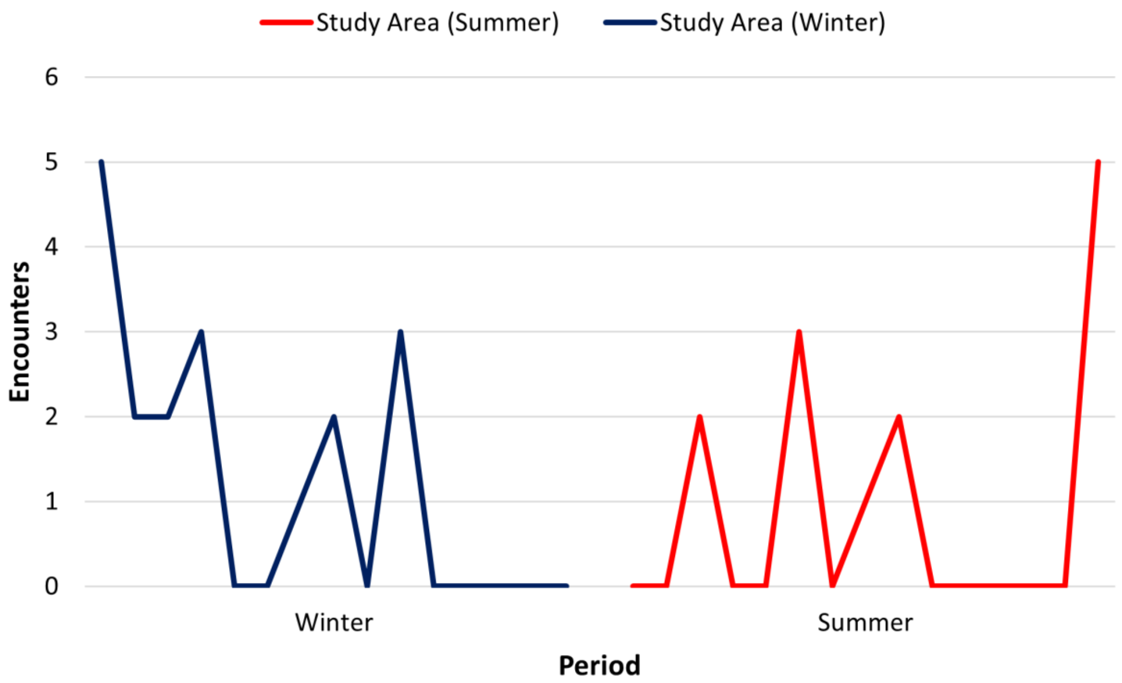

Figure 16-2 Vessel Encounters per Day within the Study Area (28 Days Winter and Summer 2024)

16.2.2 Vessel to Vessel Collision Risk

292. Using the pre wind farm vessel routeing as input, Anatec's COLLRISK model has been run to estimate the existing vessel to vessel collision risk within the study area. The route positions and widths are based on the vessel traffic survey data and validated with the long-term AIS data presented in **Appendix E**.

293. A heat map based upon the geographic distribution of collision risk within a density grid for the pre wind farm base case is presented in **Figure 16-3**.

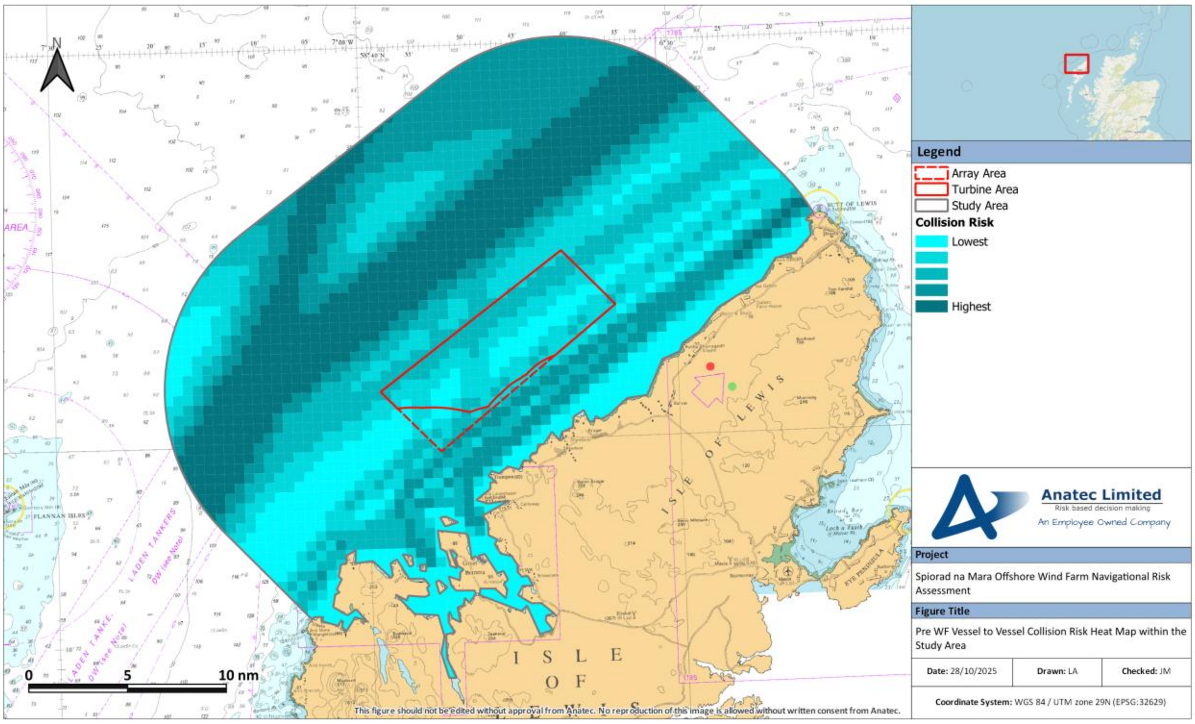

Figure 16-3 Pre Wind Farm Vessel to Vessel Collision Risk Heat Map within the Study Area

294. Assuming base case vessel traffic levels, the annual collision frequency pre wind farm was estimated to be 4.99×10^{-4} , corresponding to a return period of approximately one in 2,002 years. This is below average for UK OWF developments which have been modelled in NRAs. The greatest collision risk density was associated with routeing in the DWR.

295. It should be considered that the model is calibrated based on major incident data at sea which allows for benchmarking but does not cover all incidents. Other incident data, which includes minor incidents, is presented in **Section 9**.

16.3 Post Wind Farm Modelling

16.3.1 Simulated Automatic Identification System

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

297. A figure of 28 days of simulated AIS (matching the total duration of the vessel traffic surveys) within the study area, based on the deviated main commercial routes, is presented in **Figure 16-4**.

298. The simulated AIS represents an MDS based on commercial routes passing at a minimum mean distance of 1 nm from the Turbine Area.

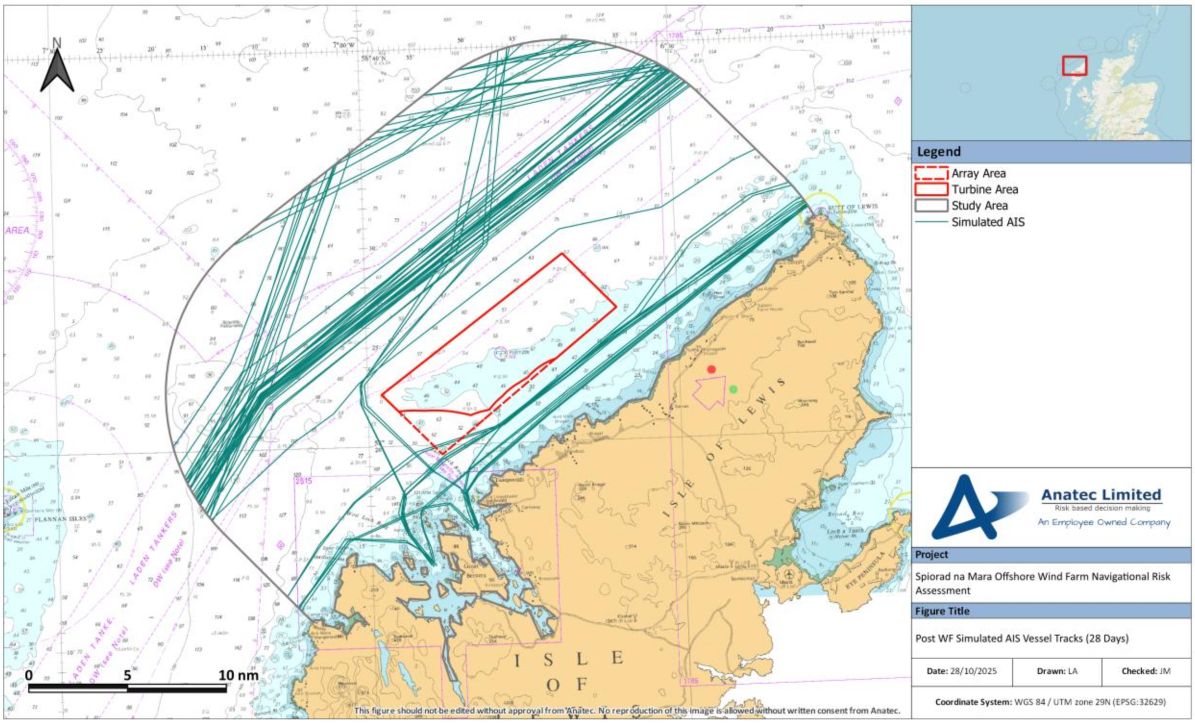

Figure 16-4 Post Wind Farm Simulated AIS Vessel Tracks (28 Days)

16.3.2 Vessel to Vessel Collision Risk

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

300. A heat map based on the geographical distribution of collision risk within a density grid for post wind farm base case is presented in **Figure 16-5**.

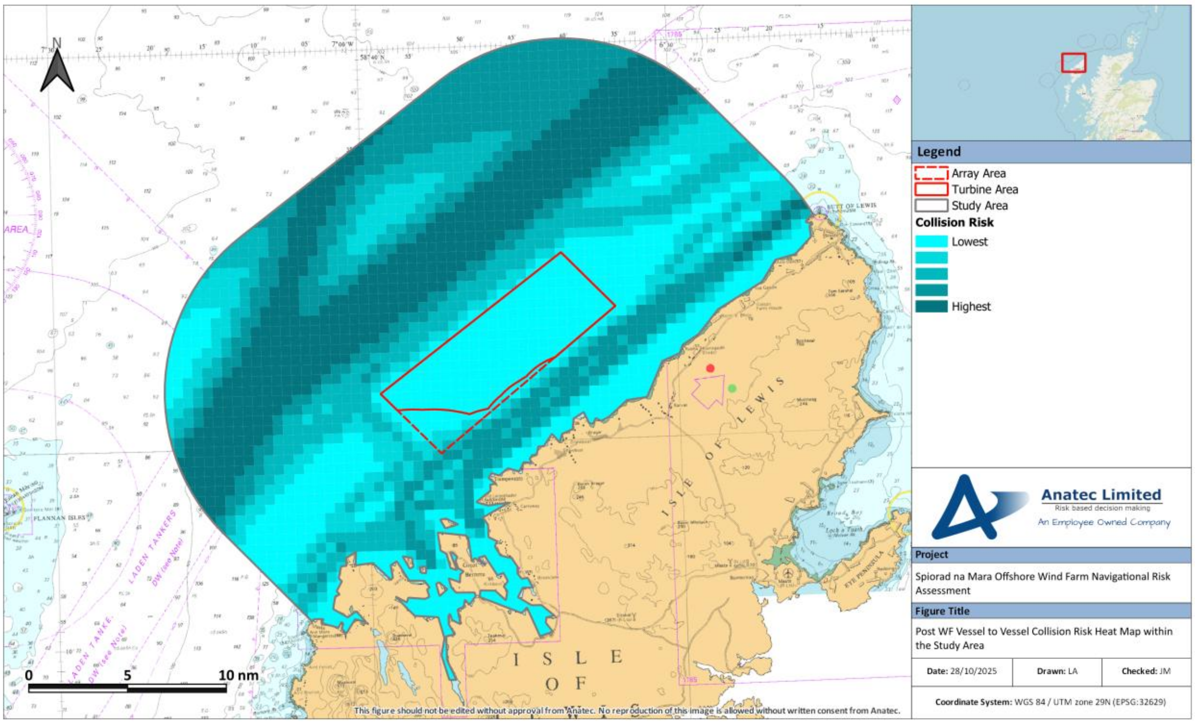

Figure 16-5 Post Wind Farm Vessel to Vessel Collision Risk Heat Map within the Study Area

301. Assuming base case traffic levels, the annual collision frequency post wind farm was estimated to be 5.00×10^{-4}, corresponding to a return period of approximately one in 1,998 years. This represents a less than 1% increase in collision frequency compared to the pre wind farm base results and reflects the small magnitude of the main commercial route deviations anticipated.

16.3.3 Powered Vessel to Structure Allision Risk

302. Based upon the vessel routeing identified in the routeing study area, the anticipated re-routeing as a result of the presence of the Offshore Project, and assumptions that relevant embedded mitigation measures are in place (see **Section 17**), the frequency of an errant vessel under power deviating from its route to the extent that it came into proximity with a wind farm structure associated with the Offshore Project is considered to be low.

303. Based on consultation feedback from the shipping industry, it is also assumed that commercial vessels would be highly unlikely to navigate between wind farm structures due to the restricted sea room, and will instead be directed by the AtoNs located in the region and those present at the Offshore Project (noting this is observed at other UK OWF including those with larger minimum spacing than the Project). During construction and decommissioning phases, this will primarily consist of a buoyed construction/decommissioning area whilst during the operation and

maintenance phase, this will primarily consist of the lighting and marking of the wind farm structures.

304. Using the post wind farm routeing as input, together with the indicative array layout and local metocean data, Anatec's COLLRISK model was run to estimate the likelihood of a commercial vessel alliding with one of the wind farm structures within the Turbine Area whilst under power. To maintain a worst-case scenario, the model did not consider one structure shielding another.

305. A plot of the annual powered allision frequency per structure for the base case is presented in **Figure 16-6**.

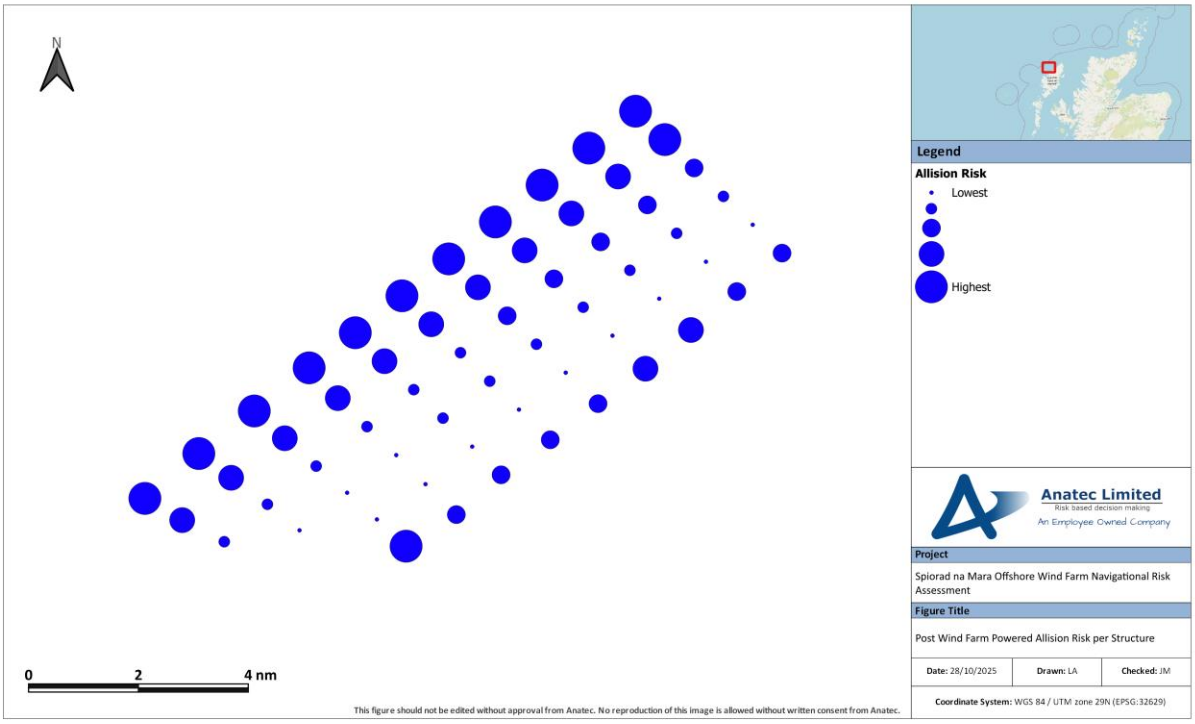

Figure 16-6 Post Wind Farm Powered Allision Risk per Structure

306. Assuming base case vessel traffic levels, the annual powered allision frequency was estimated to be 4.53×10^{-6}, corresponding to a return period of approximately 1 in 220,809 years. This is very low for UK OWF developments which have been modelled in NRAs and reflects the low volume of vessel traffic in the study area, particularly on main commercial routes which pass at the minimum mean distance of 1 nm.

307. The greatest powered vessel to structure allision risk was associated with structures at the northern-most corner of the Turbine Area, as well as along the northwestern periphery. Structures along the southeastern periphery were also associated with higher powered vessel to structure allision risk.

16.3.4 Drifting Vessel to Structure Allision Risk

308. Using the post wind farm routeing as input, together with the indicative array layout and local metocean data, Anatec's COLLRISK model was run to estimate the likelihood of a commercial vessel alliding with one of the wind farm structures within the Turbine Area when not under power. The model is based on the premise that propulsion of 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 recover but does not consider navigational errors caused by human actions.

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

310. Using this information, the overall rate of mechanical failure in proximity to the Turbine Area was estimated. The probability of a vessel drifting towards a wind farm structure and the drift speed are dependent on the prevailing wind, wave, and tidal conditions at the time of the incident. Therefore, 3 drift scenarios were modelled, each using the metocean data provided in **Section 8**:

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

311. After modelling the 3 drifting scenarios, it was established that the wind dominated scenario produced the worst-case results. A plot of the annual drifting allision frequency per structure for the base case is presented in **Figure 16-7**, with the chart background removed to increase the visibility of those structures with a low allision frequency.

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

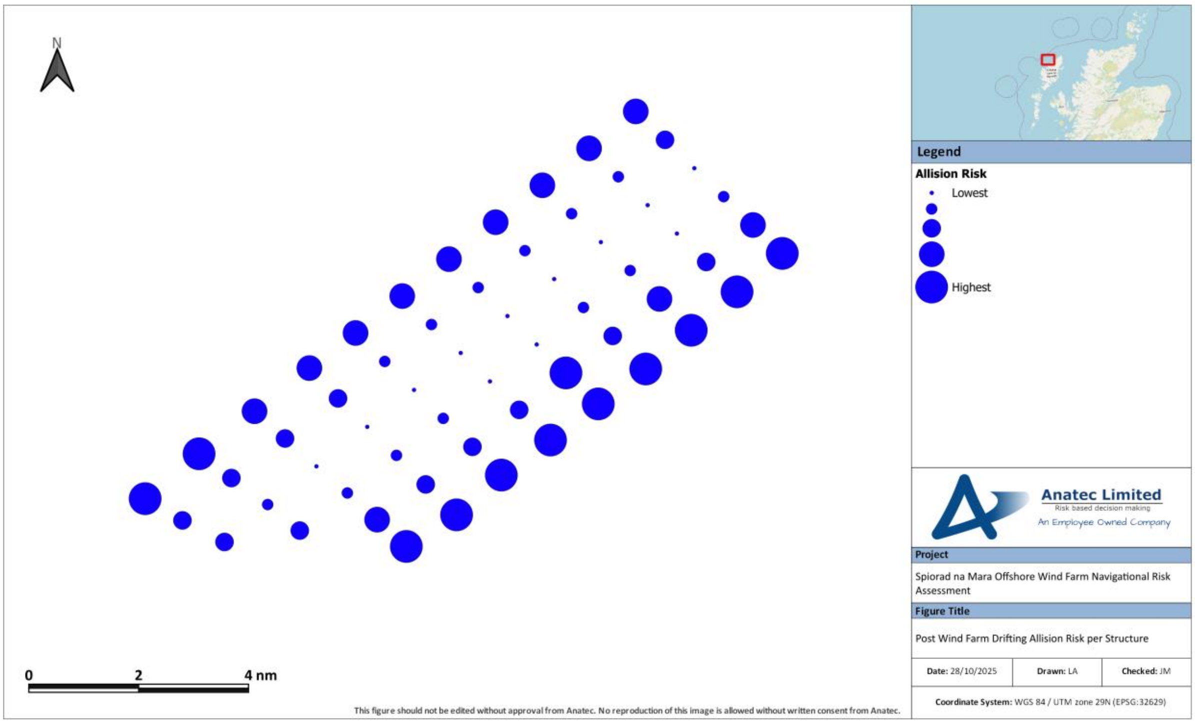

Figure 16-7 Post Wind Farm Drifting Allision Risk per Structure

313. Assuming base case vessel traffic levels, the annual drifting allision frequency was estimated to be 2.65×10^{-5}, corresponding to a return period of approximately one in 37,790 years. This is low for UK OWF developments which have been modelled in NRAs and reflects the low volume of vessel traffic in the study area, particularly on main commercial routes which pass at the minimum mean distance of 1 nm. The return period is greater than that calculated for a powered allision; this is justified by the highest volume main commercial routes (Routes 1 to 4) being located much further than 1 nm from the Array Area and therefore being highly unlikely to experience an allision whilst under power. Vessels on these routes would be more likely to allide with a structure due a drifting situation, although as reflected in the return period this remains unlikely given the expected distance over which the vessel would have to drift to allide with a structure.

314. The greatest drifting vessel to structure allision risk was associated with structures along the southeastern periphery of the Turbine Area, where fish farm support vessels pass in close proximity to the Array Area and Turbine Area.

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

16.3.5 Fishing Vessel to Structure Allision Risk

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

317. A fishing vessel allision is classified separately from other allisions since fishing vessels may be either in transit or actively fishing within the Turbine Area (unlike the transiting commercial traffic characterised by the main commercial routes). Additionally, fishing vessels could be observed internally within the Turbine Area (i.e., between structures) as well as externally. Anatec's model uses vessel numbers, sizes (length and beam), array layout and structure dimensions. The likelihood of a major allision incident has been calibrated against historical maritime incident data and historical AIS vessel traffic data within operational wind farm arrays. 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.

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

319. A plot of the annual fishing vessel allision frequency per structure for the base case is presented in **Figure 16-8**.

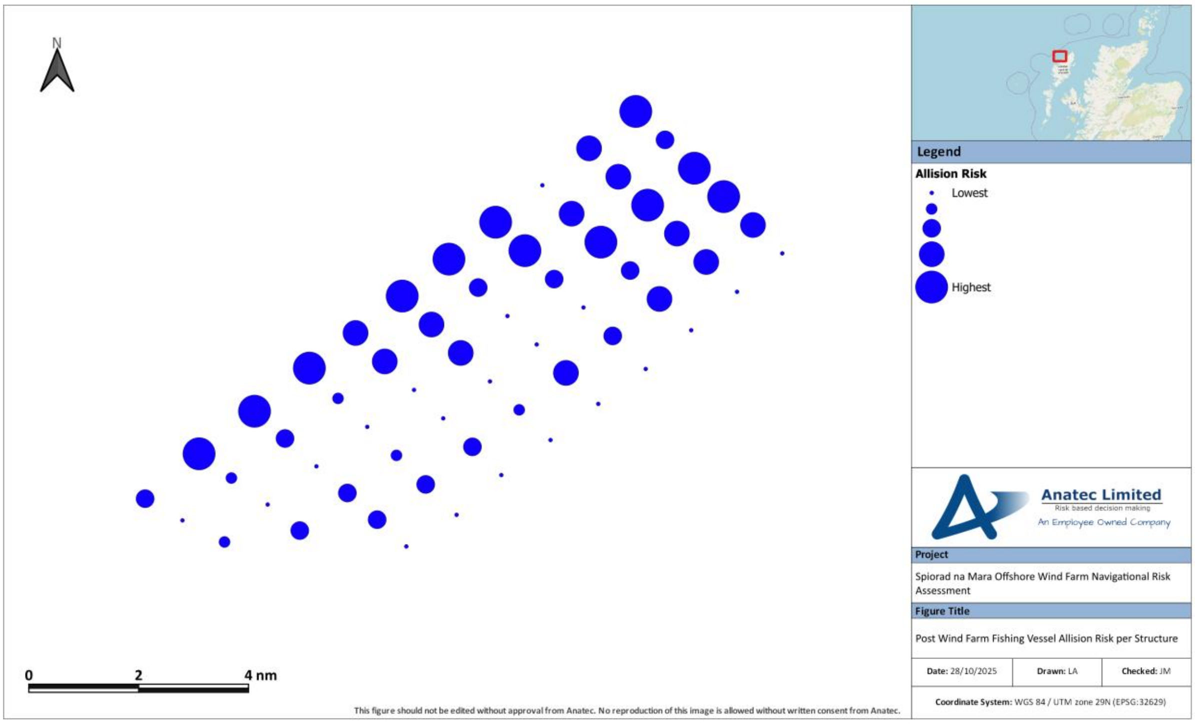

Figure 16-8 Post Wind Farm Fishing Vessel Allision Risk per Structure

320. Assuming base case traffic levels, the annual fishing vessel to structure allision frequency was estimated to be 6.95×10^{-2}, corresponding to a return period of approximately 1 in 14 years.

321. The fishing vessel to structure allision risk was distributed throughout the Turbine Area, reflective of the fishing activity recorded. The greatest individual allision risk was associated with a structure on the northwest periphery of the Turbine Area with an allision risk of 2.27×10^{-3}, corresponding to a return period of approximately 1 in 441 years.

322. The model is calibrated against known allision incidents within UK wind farms (see **Section 9.6**). Most likely consequences will be a low impact/minor contact with no significant damage, no injuries to persons, and no pollution (in line with incident statistics to date as per **Section 9.6.1**).

16.4 Risk Results Summary

323. The previous sections modelled 2 scenarios, namely the pre and post wind farm scenarios with base case traffic levels. In order to incorporate the potential for future traffic growth, pre and post wind farm scenarios have also been modelled for future case traffic levels (both 10% and 20% increases). **Table 16-1** summarises the results of all 6 scenarios.

324. Overall, the base case collision and allision frequency due to the presence of the Offshore Project was estimated to increase by approximately 6.95×10^{-2} (equating to an additional collision or allision every 14.2 years).

Table 16-1 Summary of Annual Collision and Allision Risk Results for Shipping and Navigation

Risk	Scenario	Annual Frequency (Return Period)		
		Pre Wind Farm	Post Wind Farm	Change
Vessel to vessel collision	Base Case	4.99×10^{-4} (1 in 2,002 years)	5.00×10^{-4} (1 in 1,998 years)	9.98×10^{-7} (1 in 1,002,253 years)
	Future Case (10%)	6.17×10^{-4} (1 in 1,620 years)	6.19×10^{-4} (1 in 1,616 years)	1.47×10^{-6} (1 in 682,498 years)
	Future Case (20%)	7.27×10^{-4} (1 in 1,375 years)	7.29×10^{-4} (1 in 1,372 years)	1.59×10^{-6} (1 in 629,300 years)
Powered vessel to structure allision	Base Case	-	4.53×10^{-6} (1 in 220,809 years)	4.53×10^{-6} (1 in 220,809 years)
	Future Case (10%)	-	5.02×10^{-6} (1 in 199,292 years)	5.44×10^{-6} (1 in 199,292 years)

Risk	Scenario	Annual Frequency (Return Period)		
		Pre Wind Farm	Post Wind Farm	Change
	Future Case (20%)	-	5.50×10^{-6} (1 in 181,925 years)	5.70×10^{-6} (1 in 181,925 years)
Drifting vessel to structure allision	Base Case	-	2.65×10^{-5} (1 in 37,790 years)	2.65×10^{-5} (1 in 37,790 years)
	Future Case (10%)	-	2.91×10^{-5} (1 in 34,354 years)	2.91×10^{-5} (1 in 34,354 years)
	Future Case (20%)	-	3.18×10^{-5} (1 in 31,491 years)	3.18×10^{-5} (1 in 31,491 years)
Fishing vessel to structure allision	Base Case	-	6.95×10^{-2} (1 in 14 years)	6.95×10^{-2} (1 in 14 years)
	Future Case (10%)	-	7.61×10^{-2} (1 in 13 years)	7.61×10^{-2} (1 in 13 years)
	Future Case (20%)	-	8.27×10^{-2} (1 in 12 years)	8.27×10^{-2} (1 in 12 years)
Total	**Base Case**	**4.99×10^{-4} (1 in 2,002 years)**	**7.00×10^{-2} (1 in 14 years)**	**6.95×10^{-2} (1 in 14 years)**
	Future Case (10%)	**6.17×10^{-4} (1 in 1,620 years)**	**7.68×10^{-2} (1 in 13 years)**	**7.61×10^{-2} (1 in 13 years)**
	Future Case (20%)	**7.27×10^{-4} (1 in 1,375 years)**	**8.35×10^{-2} (1 in 11 years)**	**8.28×10^{-2} (1 in 12 years)**

17 Mitigation Measures

17.1 Embedded Mitigation Measures

325. As part of the design process for the Offshore Project, a number of embedded mitigation measures have been adopted to reduce the risk of hazards identified, including those relevant to shipping and navigation.

326. These measures typically include those that have been identified as good or standard practice and include actions that will be undertaken to meet existing legislation requirements. As there is a commitment to implementing these measures, and also to various standard sectoral practices and procedures, they are considered inherently part of the design of the Offshore Project.

327. The embedded mitigation measures within the design relevant to shipping and navigation are outlined in **Table 17-1**.

Table 17-1 Embedded Mitigation Measures for Shipping and Navigation

ID	Environmental Measure Proposed	Project Phase Measure Introduced	How the Environmental Measures will be Secured	Relevance to Shipping and Navigation Assessment
M002	A Cable Installation Plan will be produced to confirm routeing, method of installation and aspects such as target depth of burial and need for/location of/type of external cable protection. This plan will also contain the outputs of a formal CBRA. Data from the project-specific geophysical surveys will be used to identify the preferred route, with the use of natural crevasses or channels within the bedrock proposed, where feasible, and areas of thicker Quaternary sediments identified (to maximise opportunities for cable burial).	Pre-construction, Construction	Secured in the Section 36 Consent and/or Marine Licence conditions. Details will be provided within the Cable Installation Plan.	Ensures risk associated with presence of subsea cables (including anchor interaction, fishing gear snagging and reduced under keel clearance) is minimised.
M010	Compliance with MGN 654 and its annexes including development and implementation of a SAR Checklist, ERCoP and guard vessels as required by risk assessment.	Pre-construction, Construction, O&M, Decommissioning	Secured in the Section 36 Consent and/or Marine Licence conditions. Details will be provided within the ERCOP.	MGN 654 sets out considerations when assessing the impact on navigational safety and emergency response caused by OREIs.
M011	The Offshore Project infrastructure inclusive of surface piercing structures and subsea cables will be appropriately marked on Admiralty and aeronautical charts, and information on structure positions and heights will be provided to the UKHO.	Pre-construction, Construction	To be secured through a condition of the Section 36 consent and/or Marine Licence.	Appropriate marking on relevant nautical charts aids mariners when navigating in proximity to the Offshore Project.
M012	Timely and efficient distribution of Notices to Mariners (NtMs), Kingfisher notifications, and other navigational warnings of the position and nature of works associated with the Offshore Project, including information for vessel routes, timings and locations, safety zones (around surface piercing infrastructure) and advisory passing distances. Physical notices will be placed at marinas and harbours in the vicinity of the Offshore Project and final locations of installed infrastructure will be charted and distributed to recreational clubs.	Pre-construction, construction, O&M, and decommissioning	Secured in the Section 36 consent and/or Marine Licence via the requirement for notifications and promulgation of information and will be set out within the NSVMP.	Promulgation of information including Notices to Mariners and Kingfisher Bulletins gives advance warning to mariners which allows appropriate passage planning. Approach will be detailed in Navigational Safety and Vessel Management Plan (NSVMP). An outline NSVMP is provided in **Outline NSVMP, Volume 3.**

ID	Environmental Measure Proposed	Project Phase Measure Introduced	How the Environmental Measures will be Secured	Relevance to Shipping and Navigation Assessment
M013	Surface piercing structures - application for safety zones of up to 500 m pre-commissioning.	Pre-construction, Construction, O&M, Decommissioning	To be secured through a condition of the Section 36 consent and/or Marine Licence.	Safety zones will help protect Offshore Project vessels undertaking construction and major maintenance activity and help ensure third-party vessels awareness of activity is maximised. Approach will be detailed in NSVMP. Outline NSVMP is provided in **Outline NSVMP, Volume 3.**
M014	Marking and lighting of the Array Area in agreement with NLB and as per the requirements of IALA Recommendation O-139 (IALA, 2021a) and Guidance G1162 (IALA, 2021b). This will include a buoyed construction area.	Pre-construction, Construction, O&M, Decommissioning	To be secured through a condition of the Section 36 consent and/or Marine Licence.	Lighting and marking of structures provides AtoNs to mariners operating in the vicinity of the Array Area. Approach will be detailed in Lighting and Marking Plan (LMP). An outline LMP is provided in **Outline LMP, Volume 3.**
M015	Compliance of all Offshore Project vessels with international marine regulations as adopted by the Flag State, notably the International Regulations for Preventing Collisions at Sea (COLREGs) (IMO, 1972/1977) and the International Convention for the Safety of Life at Sea (SOLAS) (IMO, 1974).	Pre-construction, Construction, O&M, Decommissioning	To be secured through a condition of the Section 36 consent and/or Marine Licence.	Compliance with international marine regulations aids collision avoidance and maximises safety at sea.
M016	Wind turbines blade clearance of at least 28.33 m above Mean High Water Springs (MHWS) (30 m above MSL).	Design, Construction, O&M	To be secured through a condition of the Section 36 consent and/or Marine Licence.	There will be a minimum blade tip clearance of at least 28.33 m above MHWS to minimise allision risk.
M020	A Decommissioning Plan will be developed prior to the construction of the Project in compliance with legislative requirements and/or best practice standards and guidance and adhered to.	Decommissioning	Secured in the Section 36 Consent and/or Marine Licence via the condition for a Decommissioning Plan to be submitted to MD-LOT for approval and the Energy Act 2004	Reduce risk of adverse Shipping and Navigation effects on receptors.
M022	A Final NSVMP will be developed prior to commencement of construction (building on the **Outline NSVMP, Volume 3**) in compliance with legislative requirements and/or best practice standards and guidance and adhered to.	Pre-construction, Construction, O&M, Decommissioning	Secured in the Section 36 Consent and/or Marine Licence via the condition for an NSVMP to be submitted to MD-LOT for approval.	Ensures active and safe management of navigational activities to minimise risk of adverse Shipping and Navigation effects on receptors.
M024	Dedicated risk assessment post consent if a location within Loch Roag is planned to be used as a base port taking account of vessel traffic in	Pre-construction, Construction, O&M, Decommissioning	To be secured through a condition of the Section 36 consent and/or Marine Licence.	Is required by the NLB as per consultation input during the Hazard Workshop, Ensures disruption to third-party vessel movements

ID	Environmental Measure Proposed	Project Phase Measure Introduced	How the Environmental Measures will be Secured	Relevance to Shipping and Navigation Assessment
	Loch Roag, full details of planned Offshore Project vessels, their movements, and bases within Loch Roag, plus any impact on use of existing AtoNs within Loch Roag.			and activities in Loch Roag are minimised and details of requirements will be determined in consultation with NLB post consent if Loch Roag is used as a base port.
M026	A Fisheries Mitigation, Monitoring and Communication Plan (FMMCP) (building on **FMMCP, Volume 3**) will be developed in compliance with legislative requirements and/or best practice standards and guidance prior to the operation of the Project and adhered to.	Pre-construction, Construction, O&M, Decommissioning	Secured in the Section 36 Consent and/or Marine Licence via the condition for an FMMCP to be submitted to MD-LOT for approval.	Reduce risk of adverse Shipping and Navigation effects on fishing vessels and maximise awareness of the Offshore Project.
M029	A Marine Coordination Centre will be established to monitor all vessel activity (Project, fishing and other maritime vessels), issue Notices to Mariners, and serve as a contact point for all maritime stakeholders.	Pre-construction, Construction, O&M, Decommissioning	To be secured through a condition of the Section 36 consent and/or Marine Licence.	Coordination and communication of Offshore Project vessel movements minimises disruption to third-party receptors. Approach will be detailed in NSVMP. The NSVMP will detail navigational safety measures and details relating to the coordination of Offshore Project vessels including indicative transit routes. An outline NSVMP is provided in **Outline NSVMP, Volume 3.**
M030	Suitable implementation and monitoring of subsea cable burial, scour protection and cable protection in line with MGN 654 (via burial, or external protection where adequate burial depth as identified via risk assessment is not feasible). Surveys will be coordinated with the fishing industry, and results will be shared to support collaborative engagement and minimise conflict.	Pre-construction, Construction, O&M, Decommissioning	To be secured through a condition of the Section 36 consent and/or Marine Licence.	Cable protection reduces under keel clearance and protects against vessel interaction. The Cable Installation Plan will confirm planning cable routing, burial, and any additional protection and will set out methods for post-installation cable monitoring.
M031	A Marine Pollution Contingency Plan (MPCP) will be developed prior to commencement of construction (building on **MPCP, Volume 3**) in compliance with legislative requirements and/or best practice standards and guidance and adhered to.	Pre-construction, Construction, O&M, Decommissioning	Secured in the Section 36 Consent and/or Marine Licence via the condition for an MPCP to be submitted to MD-LOT for approval.	An MPCP will include emergency plans and mitigation for a range of potential marine pollution incidents and outline procedures to protect personnel working and to safeguard the marine environment.
M033	A LMP will be developed prior to commencement of construction (building on the **Outline LMP, Volume 3**) in compliance with legislative	Pre-construction, Construction, O&M, Decommissioning	Secured in the Section 36 Consent and/or Marine Licence conditions via the condition	Lighting and marking of structures provides AtoNs to mariners operating in the vicinity of

ID	Environmental Measure Proposed	Project Phase Measure Introduced	How the Environmental Measures will be Secured	Relevance to Shipping and Navigation Assessment
	requirements and best practice standards and guidance and adhered to.		for a LMP to be submitted to MD-LOT for approval.	the Array Area. An outline LMP is provided in **Outline LMP, Volume 3.**
M039	Lighting and marking failures will be appropriately reported and rectified as soon as possible. Interim hazard warnings will be put in place.	Construction, Operation and Maintenance and Decommissioning	To be secured through a condition of the Section 36 consent and/or Marine Licence.	Lighting and marking of structures provides AtoNs to mariners operating in the vicinity of the Array Area. An outline LMP is provided in **Outline LMP, Volume 3.**

17.2 Marine Aids to Navigation

328. Throughout all phases, marine AtoNs will be provided in accordance with NLB and MCA requirements, with consideration being given to IALA Guidance G1162 (IALA, 2022) and MGN 654 (MCA, 2021).

17.2.1 Operation and Maintenance

329. Marking during the operations and maintenance phase will be agreed in consultation with NLB once the final array layout has been selected post consent; however, the following subsections summarise likely requirements.

17.2.1.1 Marking of Individual Array Structures

330. As per IALA Guidelines G1162, each surface structure within the Turbine Area will be painted yellow from the level of HAT to at least 15 m above HAT. Each structure will also be clearly marked with a unique alphanumeric identifier which will be clearly visible from all directions. The MCA will advise post consent on the specific requirements for the identifiers, but a logical pattern with potential for additional visual marks may be considered by statutory stakeholders. Each identifier will be illuminated by a low-intensity light such that the sign is available from a vessel thus enabling the structure to be identified at a suitable distance to avoid an allision incident.

331. The identifiers will be situated such that under normal conditions of visibility and all known tidal conditions, they are clearly readable by an observer (with the naked eye), stationed 3 m above sea level and at a distance of at least 150 m from the WTG. The light will be either hooded or baffled so as to avoid unnecessary light pollution or confusion with navigational marks.

17.2.1.2 Marking of Array as a Whole

332. The marking of the Turbine Area as a whole will be agreed with NLB, MCA, and CAA once the final array layout has been selected and will be in line with IALA Recommendation O-139 and G1162. As per the IALA guidance, and in consultation with NLB, it will be ensured that:

- All corner structures will be marked as a Significant Peripheral Structure (SPS) and where necessary, to satisfy the spacing requirements between SPSs, additional periphery structures may also be marked as SPSs;
- Structures designated as an SPS will exhibit a flashing yellow 5 second (flash yellow every 5 seconds) light of at least 5 nm nominal range (with exceptions outlined in **Section 17.2.1.3**) and omnidirectional fog signals as appropriate and where prescribed by NLB, and will be sounded at least when the visibility is 2 nm or less;

- Further periphery structures may be marked as Intermediate Peripheral Structures (IPS) including a flashing yellow light with a distinctly different flash character from those displayed on the SPSs and at least 2 nm nominal range;
- All lights will be visible to shipping through 360˚ and if more than 1 lantern is required on a structure to meet the all-round visibility requirement, then all the lanterns on that structure will be synchronised;
- All lights will be exhibited at the same height at least 6 m above HAT and below the arc of the lowest WTG blades;
- Remote monitoring sensors using Supervisory Control and Data Acquisition (SCADA) will be included as part of the lighting and marking scope to ensure a high level of availability for all AtoNs;
- Aviation lighting will be as per CAA requirements; however, will likely be synchronised Morse "W" at the request of NLB; and
- All lighting will be considered cumulatively with existing AtoNs to avoid the potential for light confusion to passing traffic.

333. Consideration will also be given to the use of marking via AIS, or other electronic means (such as Radar Beacons (Racon)) to assist safe navigation particularly in reduced visibility.

17.2.1.3 Land-Facing Lights

334. As noted in **Table 4-1**, there is precedent to reduce the light range of land-facing lights due to their proximity to shore in order to reduce light pollution. This would be considered by NLB in the LMP post consent if considered not detrimental to the safety of navigation. Further information can be found in **Outline Lighting and Marking Plan, Volume 3**.

17.3 Design Specifications Noted in MGN 654

335. The individual WTGs and other structures will have functions and procedures in place for generator shut down in emergency situations, as per MGN 654 (MCA, 2021).

18 Risk Assessment

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

- Vessel displacement due to activities associated with the Project or due to the presence of the Project;
- Increased vessel to vessel collision risk between third-party vessels due to vessel displacement;
- Vessel to vessel collision between a third-party vessel and a project vessel;
- Reduced access to local ports, harbours and facilities due to activities associated with the Project or due to the presence of the Project;
- Vessel to structure allision risk;
- Reduction in under keel clearance due to presence of cable protection;
- Vessel interaction with subsea cables;
- Interference with marine navigation, communications and position fixing equipment;
- Reduction of emergency response capability (including reduced access for SAR responders).

337. For each hazard, embedded mitigation measures which have been identified as relevant to reducing risk are listed, with the full list provided in **Section 17**. This is followed by statements defining the frequency of occurrence, severity of consequence, and subsequent significance of risk based on the methodology defined in **Section 3**. Where an additional mitigation measure has been identified for a hazard to achieve ALARP status, this is also outlined and a residual significance of risk given.

338. The risk control log (see **Section 20**) summarises the risk assessment and a concluding risk statement is provided (see **Section 22.5**).

18.1 Construction Phase

18.1.1 Vessel Displacement

339. Construction activities associated with the installation of structures and cables may displace existing routes/activity.

18.1.1.1 Qualification and Quantification of Risk

340. The volume of vessel traffic passing within or in proximity to the Array Area has been established using vessel traffic data collected during dedicated surveys (28 days over winter and summer 2024) and from AIS coastal receivers (12 months, 2023-2024) as well as Anatec's ShipRoutes database (Anatec, 2025). These datasets were

interrogated to identify main routes using the principles set out in MGN 654 (MCA, 2021) (see **Section 11**).

341. Although there will be no restrictions on entry into the buoyed construction area, other than through active safety zones, based on experience at previously under construction OWFs and consultation, it is anticipated that the majority of commercial vessels will choose not to navigate internally within the buoyed construction area and therefore some main route deviations will be required (noting this aligns with feedback provided at the Hazard Workshop). Operators associated with the aquaculture industry (Bakkafrost, Inverlussa, and Navigare Logistics) responded to the regular operators outreach (see **Section 4.3**) stating that it would be unlikely that they would choose to make passage internally within the Array Area. On this basis, it is likely that the majority of commercial vessels will deviate around the buoyed construction area.

342. The full methodology for main route deviations is provided in **Section 15.5**, with deviations established in line with MGN 654 (MCA, 2021). A deviation will be required for 2 of the 10 main routes identified within the study area, with details as follows:

- Route 5 (between Stornoway and West Loch Roag) – 1 vessel per week, deviation of 0.02 nm (0.03%). Likely these vessels will pass further inshore to increase passing distance from the Array Area leading to a minor deviation;
- Route 7 (between Stornoway and East Loch Roag) – 1 vessel per week, route decrease of 0.03 nm (0.05%). Likely these vessels will pass further inshore to increase passing distance from the Array Area leading to a minor deviation.

343. However, based on feedback received during the Hazard Workshop, routes 5 and 7 are not currently in operation due to a factory closure at Stornoway (see **Table 4-1**), though it has been conservatively assumed during the assessment that they remain present or will return in the future. Additionally, it was confirmed during the Hazard Workshop that any deviation required would be minimal (see **Table 4-1**).

344. RoRo vessels were recorded in the study area within all datasets; however, no regular routeing was observed, and all RoRo tracks passed offshore of the Array Area. No RoPax vessels were recorded within the study area in any dataset.

345. Based on experience at previously under construction OWFs, it is anticipated that fishing vessels and recreational vessels will choose not to routinely navigate internally within the buoyed construction area, noting there would be no restriction on transit other than through active safety zones. There is considered to be sufficient sea room outside of the Array Area for transits from such vessel to be accommodated. This includes for the Round Britain and Ireland yacht race which could interact with the buoyed construction area, although the works could serve as a mark for the course. Displacement of active commercial fishing is assessed separately in **Chapter 21, Volume 2a**.

346. Due to the proximity of the Array Area to the coast, and the potential for up to 12 Array Cables landing ashore, there may be an increased risk of displacement within the OCAS for third-party vessels. However, any impact would be localised to the spatial area immediately around the project vessel(s) undertaking installation activities, be temporary in nature, and be limited to between the months of April – October (inclusive). Additionally, it was confirmed during the Hazard Workshop that vessels transiting on nearshore routes are not constrained by water depth (see **Table 4-1**).

347. The main consequence of vessel displacement if it occurs will be increased journey times and distances for affected third-party vessels, although given the nature of the deviations anticipated due to the buoyed construction area or cable installation activities, such consequences will be limited. Project vessels associated with installation works in the OCAS will comply with international and flag state regulations (including COLREGs (IMO, 1972/77)) outlined in M015 and third-party vessels will be able to passage plan in advance given the promulgation of information relating to the Project (M012) and relevant nautical charts (across both the Array Area and OCAS) (M011).

18.1.1.2 Embedded Mitigation Measures

348. The embedded mitigation measures which have been identified as relevant to reducing risk are as follows:

- M010: Compliance with MGN 654 and its annexes including development and implementation of a SAR Checklist, ERCoP and guard vessels as required by risk assessment.;
- M011: The Offshore Project infrastructure inclusive of surface piercing structures and subsea cables will be appropriately marked on Admiralty and aeronautical charts, and information on structure positions and heights will be provided to the UKHO;
- M012: Timely and efficient distribution of Notices to Mariners (NtMs), Kingfisher notifications, and other navigational warnings of the position and nature of works associated with the Offshore Project, including information for vessel routes, timings and locations, safety zones (around surface piercing infrastructure) and advisory passing distances. Physical notices will be placed at marinas and harbours in the vicinity of the Offshore Project and final locations of installed infrastructure will be charted and distributed to recreational clubs;
- M013: Surface piercing structures - application for safety zones of up to 500 m pre-commissioning;
- M014: Marking and lighting of the Array Area in agreement with NLB and as per the requirements of IALA Recommendation O-139 (IALA, 2021a) and Guidance G1162 (IALA, 2021b). This will include a buoyed construction area;
- M015: Compliance of all Offshore Project vessels with international marine regulations as adopted by the Flag State, notably the International Regulations

for Preventing Collisions at Sea (COLREGs) (IMO, 1972/1977) and the International Convention for the Safety of Life at Sea (SOLAS) (IMO, 1974);
- M019: A final Offshore Environmental Management Plan (OEMP) will be developed prior to commencement of construction (building on **Outline Offshore EMP, Volume 3**) in compliance with legislative requirements and/or best practice standards and guidance and adhered to;
- M022: A final NSVMP will be developed prior to commencement of construction (building on the **Outline NSVMP, Volume 3**) in compliance with legislative requirements and/or best practice standards and guidance and adhered to;
- M026: A Fisheries Mitigation, Monitoring and Communication Plan (FMMCP) (building on **FMMCP, Volume 3**) will be developed in compliance with legislative requirements and/or best practice standards and guidance prior to the operation of the Project and adhered to;
- M029: A Marine Coordination Centre will be established to monitor all vessel activity (Project, fishing and other maritime vessels), issue Notices to Mariners, and serve as a contact point for all maritime stakeholders;
- M033: A LMP will be developed prior to commencement of construction (building on the **Outline LMP, Volume 3**) in compliance with legislative requirements and best practice standards and guidance and adhered to; and
- M039: Lighting and marking failures will be appropriately reported and rectified as soon as possible. Interim hazard warnings will be put in place.

18.1.1.3 Frequency of Occurrence

349. The frequency of occurrence in relation to displacement of vessel traffic across all aspects of the Offshore Project is considered **Frequent**.

18.1.1.4 Severity of Consequence

350. The severity of consequence in relation to displacement of vessel traffic for all aspects of the Offshore Project is considered **Negligible** in terms of navigational safety.

18.1.1.5 Significance of Risk

351. Taking the frequency of occurrence as Frequent and the severity of consequence as Negligible, the overall significance of risk for all aspects of the Offshore Project is deemed **Tolerable with Mitigation** which is considered ALARP.

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

352. Vessel displacement as a result of construction activities associated with the Offshore Project may increase encounters and collision risk between third-party vessels operating in the area.

18.1.2.1 Qualification and Quantification of Risk

353. Based on the vessel traffic data collected, it was estimated that 2 of the 10 main commercial routes would deviate as a result of the construction of the Offshore Project. This could lead to increased vessel densities inshore of the Array Area, which could in turn lead to an increase in vessel to vessel encounters and therefore increased collision risk. Additionally, during the Hazard Workshop, it was indicated that expansion of aquaculture activities within Loch Roag and the west coast of the Isle of Lewis in general may increase the number of vessels utilising the main commercial routes (see **Table 4-1**) which may further increase the likelihood of vessel to vessel encounters and collision risk.

354. Based on the pre OWF modelling, the baseline collision risk levels within the study area are low, with an estimated vessel to vessel collision frequency of 1 every 2,002 years. The low level of collision risk is due to the volume of traffic in the area relative to the available sea space.

355. Based on the post OWF scenario, the baseline collision frequency was estimated at 1 in 1,998 years, with the change associated with fish farm support vessels displaced from the Turbine Area towards the coast. This represents an increase of less than 1% and reflect the small-scale nature of the main commercial route deviations as well as the low volumes of traffic associated with them. When anticipating the potential for an increase in vessels associated with new aquaculture sites, up to a 20% increase in overall vessel numbers was also considered, with an estimated vessel to vessel collision frequency of 1 every 1,372 years. Overall, this is regarded as a low collision risk particularly considering that the 20% increase was conservatively applied to total vessel numbers rather than fish farm support vessels only.

356. Additionally, it was confirmed during the Hazard Workshop that encounters do not usually occur on nearshore routes (see **Table 4-1**) i.e. routes 5 and 7. This aligns with the results of the encounters assessment (see **Section 16.2.1**) findings of the incident data assessment (see **Section 9**), which showed no recorded collisions in the study area over the periods studied. Furthermore, it was confirmed that, due to a factory closure in Stornoway, the nearshore routes are not currently in operation (see **Table 4-1**) but are conservatively assumed as in operation for this assessment.

357. The promulgation of information relating to construction activities and charting of infrastructure outlined in measure M012 will allow vessel Masters to passage plan in advance, minimising any displacement and hence collision risk. Appropriate lighting and marking during construction including the buoyed construction area outlined in measure M014 will be agreed with the NLB. These navigational aids will further maximise mariner awareness when in proximity. Additionally, information for fishing vessels will be promulgated through ongoing liaison with fishing fleets via an appointed Company Fisheries Liaison Officer (CFLO) as part of the FMMCP outlined in M026.

358. In the event that an encounter does occur, it is likely to be localised and occur for only a short duration, with collision avoidance action implemented by the vessels involved, in line with the COLREGs (Rule 8), thus ensuring that the situation does not develop into a collision incident. This is supported by experience at previous under construction OWFs, where no collision incidents involving 2 third-party vessels have been reported.

359. Specifically for collision avoidance associated with the DWR, the PIANC guidance for collision avoidance indicates that there should be sufficient sea room for a vessel to complete a full round turn with diameter of 6 vessel lengths. Additionally, a 0.3 nm initial turning distance and a 500 m safety distance zone should be considered (PIANC, 2018). Conservatively using the maximum vessel length recorded across all of the vessel traffic datasets (336 m), the corresponding distance required for a full round turn is 1.66 nm. This is less than the actual distance between the DWR and the Array Area (1.9 nm). Furthermore, based on the Shipping Route Template (Annex 2 of MGN 654) a distance of 1.9 nm from an IMO routeing measure is considered to be “medium risk” and “tolerable if ALARP”. Given the volume of traffic utilising the DWR (average of 7 per week) and the compliance with the PIANC guidance for collision avoidance, the 1.9 nm distance is considered to be ALARP.

360. Historical collision incident data (see **Section 9.6**) also indicates that the most likely consequences will be low should a collision occur, with minor contact between the vessels resulting in minor damage and no injuries to persons, with both vessels able to resume their respective passages and undertake a full inspection at the next port. As an unlikely worst-case, 1 or more of the vessels could be foundered resulting in a Potential Loss of Life (PLL) and pollution.

18.1.2.2 Embedded Mitigation Measures

361. The embedded mitigation measures which have been identified as relevant to reducing risk are as follows:

- M010: Compliance with MGN 654 and its annexes including development and implementation of a SAR Checklist, ERCOP and guard vessels as required by risk assessment;
- M011: The Offshore Project infrastructure inclusive of surface piercing structures and subsea cables will be appropriately marked on Admiralty and aeronautical charts, and information on structure positions and heights will be provided to the UKHO;
- M012: Timely and efficient distribution of Notices to Mariners (NtMs), Kingfisher notifications, and other navigational warnings of the position and nature of works associated with the Offshore Project, including information for vessel routes, timings and locations, safety zones (around surface piercing infrastructure) and advisory passing distances. Physical notices will be placed at marinas and harbours in the vicinity of the Offshore Project and final locations of installed infrastructure will be charted and distributed to recreational clubs;

- M013: Surface piercing structures - application for safety zones of up to 500 m pre-commissioning;
- M014: Marking and lighting of the Array Area in agreement with NLB and as per the requirements of IALA Recommendation O-139 (IALA, 2021a) and Guidance G1162 (IALA, 2021b). This will include a buoyed construction area;
- M019: A final OEMP will be developed prior to commencement of construction (building on **Outline Offshore EMP, Volume 3**) in compliance with legislative requirements and/or best practice standards and guidance and adhered to;
- M022: A Final NSVMP will be developed prior to commencement of construction (building on the **Outline NSVMP, Volume 3**) in compliance with legislative requirements and/or best practice standards and guidance and adhered to;
- M026: A Fisheries Mitigation, Monitoring and Communication Plan (FMMCP) (building on **FMMCP, Volume 3**) will be developed in compliance with legislative requirements and/or best practice standards and guidance prior to the operation of the Project and adhered to;
- M031: A Marine Pollution Contingency Plan (MPCP) will be developed prior to commencement of construction (building on **MPCP, Volume 3**) in compliance with legislative requirements and/or best practice standards and guidance and adhered to;
- M033: A Lighting and Marking Plan (LMP) will be developed prior to commencement of construction (building on the **Outline LMP, Volume 3**) in compliance with legislative requirements and best practice standards and guidance and adhered to; and
- M039: Lighting and marking failures will be appropriately reported and rectified as soon as possible. Interim hazard warnings will be put in place.

18.1.2.3 Frequency of Occurrence

362. The frequency of occurrence in relation to increased third-party vessel to third-party vessel collision risk for all aspects of the Offshore Project is considered **Extremely Unlikely**.

18.1.2.4 Severity of Consequence

363. The severity of consequence in relation to increased third-party vessel to third-party vessel collision risk for all aspects of the Offshore Project is considered **Serious**.

18.1.2.5 Significance of Risk

364. Taking the frequency of occurrence as Extremely Unlikely and the severity of consequence as Serious, the overall significance of risk for all aspects of the Offshore Project is deemed **Tolerable with Mitigation** which is considered ALARP.

18.1.3 Third-Party Vessel to Project Vessel Collision Risk

365. Project vessels associated with construction activities may increase encounters and collision risk for third-party vessels already operating in the area.

18.1.3.1 Qualification of Risk

366. Up to 871 annual return trips by construction vessels may be made throughout the construction phase, noting this will include vessels which are restricted in their ability to manoeuvre (RAM). During the construction phase, project vessels will be on site between April – October (inclusive).

367. Encounters and collision risk involving project vessels will be managed by marine coordination including the application of traffic management procedures such as the designation of entry and exit points to/from the buoyed construction area and routes to and from construction ports. These measures will be set out in the Navigational Safety and Vessel Management Plan (NSVMP) (M022) and will be particularly important should a construction port be located within Loch Roag where traffic density is greatest. From consultation feedback received during the Hazard Workshop, in such a scenario a dedicated risk assessment should be undertaken post consent taking account of vessel traffic in Loch Roag and full details of planned project vessels, their movements and bases to ensure effects associated with interactions between third-party vessels and project vessels are ALARP (M024).

368. Additionally, project vessels will carry AIS and be compliant with Flag State regulations including IMO conventions such as the COLREGs outlined in measure M015, and information for fishing vessels will also be promulgated through ongoing liaison with fishing fleets via an appointed CFLO part of the FMMCP (M026).

369. An application for safety zones of 500 m will be sought pre-commissioning around structures where construction activity is ongoing outlined in measure M013 (i.e. where a construction vessel is present). These will serve to protect project vessels engaged in construction activities. Minimum advisory passing distances, as defined by risk assessment, may also be applied where safety zones do not apply (e.g. around cable installation vessels), with advanced warning and details of both safety zones and any minimum advisory safe passing distances provided by Notifications to Mariners and Kingfisher Bulletins (M012).

370. Appropriate marine lighting and marking during construction including the buoyed construction area will be agreed with the NLB and MCA outlined in measure M014. These navigational aids will further maximise mariner awareness when in proximity to ongoing construction works in the Array Area.

371. Third-party vessels may have reduced capabilities to visually identify project vessels entering and exiting the Array Area during reduced visibility; however, this hazard will be mitigated by the application of the COLREGs (Rule 19) (M015) in adverse weather conditions and project vessels mandatorily will carry AIS regardless of size. The likelihood of a collision is likely to be greater in reduced visibility when the identification of project vessels entering and exiting the Array Area may be encumbered. However, again the COLREGs regulate vessel movements in adverse weather conditions and require all vessels operating in reduced visibility to reduce

speed to allow more time for reacting to encounters, thus minimising the collision risk.

372. Based on historical incident data since 2003, there has been one instance of a third-party vessel colliding with an OWF development project vessel in the UK (see **Section 9.6**). In this incident, moderate vessel damage was reported with no harm to persons. This occurred in 2011, and awareness of offshore wind developments and application of the industry standard measures outlined above has improved and been refined considerably in the interim, with no further collision incidents reported since.

373. Similar to third-party vessel to third-party vessel collision risk (see **Section 18.1.2.1**), if an encounter occurs between a third-party vessel and a project vessel, the encounter is likely to be localised and occur for only a short duration. With collision avoidance action implemented in line with the COLREGs (Rule 8), the vessels involved will likely be able to resume their respective passages and/or activities with no long-term consequences.

374. Should a collision occur, the most likely consequences will be similar to that outlined for the case of a collision between 2 third-party vessels (see **Section 18.1.2.1**), namely minor contact between the vessels resulting in minor damage and no injuries to persons with both vessels able safely to make their next port to undertake a full inspection. As an unlikely worst-case, 1 or more of the vessels could be foundered resulting in a PLL and pollution. If pollution were to occur in proximity to the Offshore Project or involving a project vessel, then the MPCP will be implemented to minimise the environmental risks (M031).

18.1.3.2 Embedded Mitigation Measures

375. The embedded mitigation measures which have been identified as relevant to reducing risk are as follows:

- M010: Compliance with MGN 654 and its annexes including development and implementation of a SAR Checklist, ERCOP and guard vessels as required by risk assessment;
- M011: The Offshore Project infrastructure inclusive of surface piercing structures and subsea cables will be appropriately marked on Admiralty and aeronautical charts, and information on structure positions and heights will be provided to the UKHO;
- M012: Timely and efficient distribution of Notices to Mariners (NtMs), Kingfisher notifications, and other navigational warnings of the position and nature of works associated with the Offshore Project, including information for vessel routes, timings and locations, safety zones (around surface piercing infrastructure) and advisory passing distances. Physical notices will be placed at marinas and harbours in the vicinity of the Offshore Project and final locations of installed infrastructure will be charted and distributed to recreational clubs;

- M013: Surface piercing structures - application for safety zones of up to 500 m pre-commissioning;
- M014: Marking and lighting of the Array Area in agreement with NLB and as per the requirements of IALA Recommendation O-139 (IALA, 2021a) and Guidance G1162 (IALA, 2021b). This will include a buoyed construction area;
- M015: Compliance of all Offshore Project vessels with international marine regulations as adopted by the Flag State, notably the International Regulations for Preventing Collisions at Sea (COLREGs) (IMO, 1972/1977) and the International Convention for the Safety of Life at Sea (SOLAS) (IMO, 1974);
- M019: A final OEMP will be developed prior to commencement of construction (building on **Outline Offshore EMP, Volume 3**) in compliance with legislative requirements and/or best practice standards and guidance and adhered to;M022: A final NSVMP will be developed prior to commencement of construction (building on the **Outline NSVMP, Volume 3**) in compliance with legislative requirements and/or best practice standards and guidance and adhered to;
- M024: Dedicated risk assessment post consent if a location within Loch Roag is planned to be used as a base port taking account of vessel traffic in Loch Roag and full details of planned Offshore Project vessels, their movements, and bases within Loch Roag, plus any impact on use of existing AtoNs within Loch Roag;
- M026: A Fisheries Mitigation, Monitoring and Communication Plan (FMMCP) (building on **FMMCP, Volume 3**) will be developed in compliance with legislative requirements and/or best practice standards and guidance prior to the operation of the Project and adhered to;
- M029: A Marine Coordination Centre will be established to monitor all vessel activity (Project, fishing and other maritime vessels), issue Notices to Mariners, and serve as a contact point for all maritime stakeholders;
- M031: An MPCP will be developed prior to commencement of construction (building on **Outline MPCP, Volume 3**) in compliance with legislative requirements and/or best practice standards and guidance and adhered to;
- M033: A LMP will be developed prior to commencement of construction (building on the **Outline LMP, Volume 3**) in compliance with legislative requirements and best practice standards and guidance and adhered to; and
- M039: Lighting and marking failures will be appropriately reported and rectified as soon as possible. Interim hazard warnings will be put in place.

18.1.3.3 Frequency of Occurrence

376. The frequency of occurrence in relation to third-party vessel to project vessel collision risk for all aspects of the Offshore Project is considered **Remote**.

18.1.3.4 Severity of Consequence

377. The severity of consequence in relation to third-party vessel to project vessel collision risk for all aspects of the Offshore Project is considered **Serious**.

18.1.3.5 Significance of Risk

378. Taking the frequency of occurrence as Remote and the severity of consequence as Serious, the overall significance of risk for all aspects of the Offshore Project is deemed **Tolerable with Mitigation** which is considered ALARP.

18.1.4 Reduced Access to Local Ports, Harbours, and Facilities

379. Construction activities associated with the Offshore Project may increase the risk of reduced access to local harbours.

18.1.4.1 Qualification of Risk

380. Up to 871 annual return trips by construction vessels may be made annually throughout the construction phase and will include vessels which are RAM.

381. The closest port or harbour area to the Array Area is Loch Roag, located approximately 1.9 nm south of the Array Area. Loch Roag itself contains various piers, harbours and jetties, the closest to the Array Area being Carloway Pier which is situated at the entrance to East Loch Roag. Stornoway Port is situated approximately 15 nm (over land) southeast of the Array Area on the opposite coast of the Isle of Lewis. It is noted that vessels would have to transit north of the Butt of Lewis prior to heading south to Stornoway (a journey of approximately 45 nm), thus it is not anticipated that construction activities of the Offshore Project would have an impact on access to Stornoway Port.

382. The closest port/harbour to the OCAS is also Loch Roag, also located 5.2 nm to the southwest at its closest point. Based on the distance between the Offshore Project and the Loch Roag harbour limits, it is considered unlikely that there will be a large impact on access to Loch Roag due to the presence of the Offshore Project. This was supported by feedback at the Hazard Workshop indicating that the manner by which vessels approach the entrance to Loch Roag is not expected to be impacted by the Offshore Project.

383. In addition to various harbour facilities, Loch Roag contains several aquaculture sites operated by Bakkafrost (see **Table 4-1**). 6 of the 10 main commercial routes are associated with aquaculture vessels servicing these sites within the loch. Base ports for the Offshore Project are not yet known. However, feedback received during stakeholder consultation including the Hazard Workshop highlighted that Loch Roag is currently at capacity, and the use of Loch Roag as a base port during construction of the Offshore Project may reduce access to facilities which could impact on local aquaculture operations (see **Table 4-1**). There is also potential that the presence of project vessels may restrict recreational vessels from accessing safe anchorage during adverse weather.

384. It was indicated during the Hazard Workshop that many of the vessels utilising the area are familiar with transiting around islands and close to shore (see **Table 4-1**)

and the majority of vessels recorded utilising the loch are of small size (see **Section 10.3.1**), which reduces the risk of reduced access. It was also confirmed during consultation that the Aird Laimishader Lighthouse at the entrance to East Loch Roag would likely be unimpacted by the Project, and will retain its ability as a key AtoN upon entrance to the loch (see **Table 4-1**).

385. The risk is further reduced by managing project vessels by marine coordination (M029), including the use of traffic management procedures such as the designation of entry and exit points to and from the buoyed construction area, and designated routes to and from construction ports. These measures will be set out in the NSVMP (M022) and will be particularly important should a construction port be located within Loch Roag where traffic density is greatest. From consultation feedback received during the Hazard Workshop, in such a scenario a dedicated risk assessment should be undertaken post consent taking account of vessel traffic in Loch Roag and full details of planned project vessels, their movements and bases to ensure effects associated with interactions between third-party vessels and project vessels (which may affect port access) are ALARP (M024).

386. Project vessels will also carry AIS and be compliant with Flag State regulations including the COLREGs outlined in measure M015.

18.1.4.2 Embedded Mitigation Measures

387. The embedded mitigation measures which have been identified as relevant to reducing risk are as follows:

- M011: The Offshore Project infrastructure inclusive of surface piercing structures and subsea cables will be appropriately marked on Admiralty and aeronautical charts, and information on structure positions and heights will be provided to the UKHO;
- M012: Timely and efficient distribution of Notices to Mariners (NtMs), Kingfisher notifications, and other navigational warnings of the position and nature of works associated with the Offshore Project, including information for vessel routes, timings and locations, safety zones (around surface piercing infrastructure) and advisory passing distances. Physical notices will be placed at marinas and harbours in the vicinity of the Offshore Project and final locations of installed infrastructure will be charted and distributed to recreational clubs;
- M015: Compliance of all Offshore Project vessels with international marine regulations as adopted by the Flag State, notably the International Regulations for Preventing Collisions at Sea (COLREGs) (IMO, 1972/1977) and the International Convention for the Safety of Life at Sea (SOLAS) (IMO, 1974);
- M019: A final OEMP will be developed prior to commencement of construction (building on **Outline Offshore EMP, Volume 3**) in compliance with legislative requirements and/or best practice standards and guidance and adhered to;M022: A Final NSVMP will be developed prior to commencement of construction (building on the **Outline NSVMP, Volume 3**) in compliance with

legislative requirements and/or best practice standards and guidance and adhered to; and

- M024: Dedicated risk assessment post consent if a location within Loch Roag is planned to be used as a base port taking account of vessel traffic in Loch Roag and full details of planned Offshore Project vessels, their movements, and bases within Loch Roag, plus any impact on use of existing AtoNs within Loch Roag.
- M026: A Fisheries Mitigation, Monitoring and Communication Plan (FMMCP) (building on **FMMCP, Volume 3**) will be developed in compliance with legislative requirements and/or best practice standards and guidance prior to the operation of the Project and adhered to;
- M029: A Marine Coordination Centre will be established to monitor all vessel activity (Project, fishing and other maritime vessels), issue Notices to Mariners, and serve as a contact point for all maritime stakeholders;

18.1.4.3 Frequency of Occurrence

388. The frequency of occurrence in relation to reduced access to local ports, harbours, and facilities for all aspects of the Offshore Project is considered **Reasonably Probable**.

18.1.4.4 Severity of Consequence

389. The severity of consequence in relation to reduced access to local ports, harbours, and facilities for all aspects of the Offshore Project is considered **Moderate**.

18.1.4.5 Significance of Risk

390. Taking the frequency of occurrence as Reasonably Probable and the severity of consequence as Moderate, the overall significance of risk for all aspects of the Offshore Project is deemed **Tolerable with Mitigation** which is considered ALARP.

18.2 Operation and Maintenance Phase

18.2.1 Vessel Displacement

391. The presence of surface structures within the Turbine Area and maintenance activities associated with subsea cables may displace existing routes/activity.

18.2.1.1 Qualification and Quantification of Risk

392. Though there will be no restrictions on entry into the Turbine Area during the operation and maintenance phase, other than through active safety zones during periods of major maintenance, based on experience at currently operational OWFs and consultation, it is anticipated that the majority of commercial vessels will choose not to navigate internally within the Turbine Area and therefore route deviations for the main commercial routes established for the equivalent construction phase hazard in line with MGN 654 (MCA, 2021) are again considered (see **Section 18.1.1.1**).

393. It is again noted however, that routes 5 and 7 are not currently in operation, as per feedback received during the Hazard Workshop (see **Table 4-1**).

394. As per the equivalent construction phase, it is anticipated that fishing vessels and recreational vessels will generally choose not to routinely navigate internally within the Turbine Area; however, there is considered to be sufficient spacing between structures for internal navigation where individual mariners choose to do so. Additionally, 'wind farm tourism' may occur in the area, noting that recreational marine tours are already in operation out of Loch Roag, this is assessed separately within **Chapter 20: Other Sea Users, Volume 2a**. Displacement of active commercial fishing is assessed separately in **Chapter 21, Volume 2a**.

395. Given the available sea room and implementation of the NSVMP in **Outline Navigational Safety and Vessel Management Plan, Volume 3,** it is considered unlikely that cable maintenance activities will lead to any notable displacement or disruption, as any impact would be localised to the spatial area immediately around the project vessel and would be temporary in nature. Additionally, it was confirmed during the Hazard Workshop that vessels transiting on nearshore routes are not constrained by water depth (see **Table 4-1**).

396. As per the equivalent construction phase effect, the main consequence of vessel displacement if it occurs will be increased journey times and distances for affected third-party vessels but is anticipated to be limited. Project vessels associated with maintenance works in the OCAS will comply with international and flag state regulations (including COLREGs (IMO, 1972/77) (M015)) and third-party vessels will be able to passage plan in advance given the promulgation of information relating to the Offshore Project and relevant nautical charts (across both the Array Area and OCAS).

18.2.1.2 Embedded Mitigation Measures

397. The embedded mitigation measures which have been identified as relevant to reducing risk are as follows:

- M010: Compliance with MGN 654 and its annexes including development and implementation of a SAR Checklist, ERCoP and guard vessels as required by risk assessment;
- M011: The Offshore Project infrastructure inclusive of surface piercing structures and subsea cables will be appropriately marked on Admiralty and aeronautical charts, and information on structure positions and heights will be provided to the UKHO;
- M012: Timely and efficient distribution of Notices to Mariners (NtMs), Kingfisher notifications, and other navigational warnings of the position and nature of works associated with the Offshore Project, including information for vessel routes, timings and locations, safety zones (around surface piercing infrastructure) and advisory passing distances. Physical notices will be placed at

marinas and harbours in the vicinity of the Offshore Project and final locations of installed infrastructure will be charted and distributed to recreational clubs;
- M013: Surface piercing structures - application for safety zones of up to 500 m pre-commissioning;
- M014: Marking and lighting of the Array Area in agreement with NLB and as per the requirements of IALA Recommendation O-139 (IALA, 2021a) and Guidance G1162 (IALA, 2021b);
- M015: Compliance of all Offshore Project vessels with international marine regulations as adopted by the Flag State, notably the International Regulations for Preventing Collisions at Sea (COLREGs) (IMO, 1972/1977) and the International Convention for the Safety of Life at Sea (SOLAS) (IMO, 1974);
- M022: A Final NSVMP will be developed prior to commencement of construction (building on the **Outline NSVMP, Volume 3**) in compliance with legislative requirements and/or best practice standards and guidance and adhered to;
- M026: A Fisheries Mitigation, Monitoring and Communication Plan (FMMCP) (building on **FMMCP, Volume 3**) will be developed in compliance with legislative requirements and/or best practice standards and guidance prior to the operation of the Project and adhered to;
- M029: A Marine Coordination Centre will be established to monitor all vessel activity (Project, fishing and other maritime vessels), issue Notices to Mariners, and serve as a contact point for all maritime stakeholders;
- M033: A LMP will be developed prior to commencement of construction (building on the **Outline LMP, Volume 3**) in compliance with legislative requirements and best practice standards and guidance and adhered to; and
- M039: Lighting and marking failures will be appropriately reported and rectified as soon as possible. Interim hazard warnings will be put in place.

18.2.1.3 Frequency of Occurrence

398. The frequency of occurrence in relation to displacement of vessel traffic for all aspects of the Offshore Project is considered **Frequent**.

18.2.1.4 Severity of Consequence

399. The severity of consequence in relation to displacement of vessel traffic for all aspects of the Offshore Project is considered **Negligible** in terms of navigational safety.

18.2.1.5 Significance of Risk

400. Taking the frequency of occurrence as Frequent and the severity of consequence as Negligible, the overall significance of risk for all aspects of the Offshore Project is deemed **Tolerable with Mitigation** which is considered ALARP.

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

401. Vessel displacement as a result of surface structures within the Turbine Area may increase encounters and collision risk between third-party vessels operating in the area.

18.2.2.1 Qualification and Quantification of Risk

402. Given the main route deviations are anticipated to remain as per those established for the equivalent construction phase hazard (see **Section 18.1.2.1**), the likelihood of an encounter occurring are also likely to be similar and potentially lower in the OCAS since displacement will be limited to when maintenance activity is ongoing. As discussed in **Section 18.1.2.1**, the baseline annual collision frequency for the post OWF scenario (one in 1,998 years) represents a minor increase compared to the pre OWF base scenario. This relatively low level of estimated collision risk aligns well with the incident datasets assessed (see **Section 9**).

403. Similar to the equivalent construction phase hazard, the promulgation of information relating to maintenance activities and charting of infrastructure outlined in measure M012 will allow vessel Masters to passage plan in advance, minimising any displacement and hence collision risk. Appropriate marine lighting and marking of the Turbine Area outlined in measure M014 will be agreed with the NLB and MCA. These navigational aids will further maximise mariner awareness when in proximity. Additionally, information for fishing vessels will be promulgated through ongoing liaison with fishing fleets via an appointed CFLO as part of the FMMCP (M026).

404. The minimum spacing between WTGs (900 m) is sufficient to ensure the view of other vessels will not be blocked or hindered, again reducing the likelihood of an encounter occurring in proximity to the Offshore Project.

405. As per the equivalent construction phase effect, the most likely consequences will be low should a collision occur, with minor contact between the vessels resulting in minor damage and no injuries to persons, with both vessels able to resume their respective passages and undertake a full inspection at the next port. As an unlikely worst-case, 1 or more of the vessels could be foundered resulting in a PLL and pollution.

18.2.2.2 Embedded Mitigation Measures

406. The embedded mitigation measures which have been identified as relevant to reducing risk are as follows:

- M010: Compliance with MGN 654 and its annexes including development and implementation of a SAR Checklist, ERCoP and guard vessels as required by risk assessment;
- M011: The Offshore Project infrastructure inclusive of surface piercing structures and subsea cables will be appropriately marked on Admiralty and aeronautical

charts, and information on structure positions and heights will be provided to the UKHO;

- M012: Timely and efficient distribution of Notices to Mariners (NtMs), Kingfisher notifications, and other navigational warnings of the position and nature of works associated with the Offshore Project, including information for vessel routes, timings and locations, safety zones (around surface piercing infrastructure) and advisory passing distances. Physical notices will be placed at marinas and harbours in the vicinity of the Offshore Project and final locations of installed infrastructure will be charted and distributed to recreational clubs;
- M013: Surface piercing structures - application for safety zones of up to 500 m pre-commissioning;
- M014: Marking and lighting of the Array Area in agreement with NLB and as per the requirements of IALA Recommendation O-139 (IALA, 2021a) and Guidance G1162 (IALA, 2021b);
- M022: A Final NSVMP will be developed prior to commencement of construction (building on the **Outline NSVMP, Volume 3**) in compliance with legislative requirements and/or best practice standards and guidance and adhered to;
- M026: A Fisheries Mitigation, Monitoring and Communication Plan (FMMCP) (building on **FMMCP, Volume 3**) will be developed in compliance with legislative requirements and/or best practice standards and guidance prior to the operation of the Project and adhered to;
- M029: A Marine Coordination Centre will be established to monitor all vessel activity (Project, fishing and other maritime vessels), issue Notices to Mariners, and serve as a contact point for all maritime stakeholders;
- M031: An MPCP will be developed prior to commencement of construction (building on **Outline MPCP, Volume 3**) in compliance with legislative requirements and/or best practice standards and guidance and adhered to;
- M033: A LMP will be developed prior to commencement of construction (building on the **Outline LMP, Volume 3**) in compliance with legislative requirements and best practice standards and guidance and adhered to; and
- M039: Lighting and marking failures will be appropriately reported and rectified as soon as possible. Interim hazard warnings will be put in place.

18.2.2.3 Frequency of Occurrence

407. The frequency of occurrence in relation to increased third-party vessel to third-party vessel collision risk for all aspects of the Offshore Project is considered **Extremely Unlikely**.

18.2.2.4 Severity of Consequence

408. The severity of consequence in relation to increased third-party vessel to third-party vessel collision risk for all aspects of the Offshore Project is considered **Serious**.

18.2.2.5 Significance of Risk

409. Taking the frequency of occurrence as Extremely Unlikely and the severity of consequence as Serious, the overall significance of risk for all aspects of the Offshore Project is deemed **Tolerable with Mitigation** which is considered ALARP.

18.2.3 Third-Party Vessel to Project Vessel Collision Risk

410. Project vessels associated with operation and maintenance activities may increase encounters and collision risk for third-party vessels already operating in the area.

18.2.3.1 Qualification of Risk

411. Up to 32,034 return trips by operation and maintenance vessels may be made throughout the life of the Project, noting this may include RAM vessels. The total vessel movements during the operation and maintenance phase represents a decrease in movements compared to the construction phase.

412. Encounter and collision risk involving project vessels during the operation and maintenance phase will be managed by marine coordination (M029) including the application of traffic management procedures such as the designation of entry and exit points to/from the Turbine Area and routes to and from base ports. These measures will be set out in the NSVMP (M022), again noting that from consultation should a base port during the operation and maintenance phase be located within Loch Roag then a dedicated risk assessment should be undertaken post consent taking account of vessel traffic in Loch Roag and full details of planned project vessels, their movements and bases (M024).

413. Additionally, project vessels will carry AIS and be compliant with Flag State regulations including IMO conventions such as the COLREGs outlined in measure M015, and information for fishing vessels will also be promulgated through ongoing liaison with fishing fleets via an appointed CFLO as part of the FMMCP (M026).

414. An application for safety zones of 500 m will be sought pre-commissioning around structures where major maintenance activity is ongoing outlined in measures M013. These will serve to protect project vessels engaged in maintenance activities. Minimum advisory passing distances, as defined by risk assessment, may also be applied where safety zones do not apply, with advanced warning and details of both safety zones and any minimum advisory safe passing distances provided by Notifications to Mariners and Kingfisher Bulletins outlined in measures M012.

415. Appropriate marine lighting and marking of the Turbine Area will be agreed with the NLB and MCA outlined in measure M014. These navigational aids will further maximise mariner awareness when in proximity to ongoing maintenance works in the Array Area.

416. Similar to the equivalent construction phase hazard, third-party vessels may have reduced capabilities to visually identify project vessels entering and exiting the Turbine Area during reduced visibility; however, this hazard will be mitigated by the application of the COLREGs (Rule 19) in adverse weather conditions and project vessels mandatorily will carry AIS regardless of size. The likelihood of a collision is likely to be greater in reduced visibility when the identification of project vessels entering and exiting the Turbine Area may be encumbered. However, again the COLREGs regulate vessel movements in adverse weather conditions and require all vessels operating in reduced visibility to reduce speed to allow more time for reacting to encounters, thus minimising the collision risk (M015).

417. Should a collision occur, the most likely consequences will be similar to that outlined for the case of a collision between 2 third-party vessels (see **Section 18.1.2.1**), namely minor contact between the vessels resulting in minor damage and no injuries to persons with both vessels able safely to make their next port to undertake a full inspection. As an unlikely worst-case, 1 or more of the vessels could be foundered resulting in a PLL and pollution. If pollution were to occur in proximity to the Offshore Project or involving a project vessel, then the MPCP will be implemented to minimise the environmental risks, outlined in M031.

18.2.3.2 Embedded Mitigation Measures

418. The embedded mitigation measures which have been identified as relevant to reducing risk are as follows:

- M010: Compliance with MGN 654 and its annexes including development and implementation of a SAR Checklist, ERCoP and guard vessels as required by risk assessment;
- M011: The Offshore Project infrastructure inclusive of surface piercing structures and subsea cables will be appropriately marked on Admiralty and aeronautical charts, and information on structure positions and heights will be provided to the UKHO;
- M012: Timely and efficient distribution of Notices to Mariners (NtMs), Kingfisher notifications, and other navigational warnings of the position and nature of works associated with the Offshore Project, including information for vessel routes, timings and locations, safety zones (around surface piercing infrastructure) and advisory passing distances. Physical notices will be placed at marinas and harbours in the vicinity of the Offshore Project and final locations of installed infrastructure will be charted and distributed to recreational clubs;
- M013: Surface piercing structures - application for safety zones of up to 500 m pre-commissioning;
- M014: Marking and lighting of the Array Area in agreement with NLB and as per the requirements of IALA Recommendation O-139 (IALA, 2021a) and Guidance G1162 (IALA, 2021b);

- M015: Compliance of all Offshore Project vessels with international marine regulations as adopted by the Flag State, notably the International Regulations for Preventing Collisions at Sea (COLREGs) (IMO, 1972/1977) and the International Convention for the Safety of Life at Sea (SOLAS) (IMO, 1974);
- M022: A Final NSVMP will be developed prior to commencement of construction (building on the **Outline NSVMP, Volume 3**) in compliance with legislative requirements and/or best practice standards and guidance and adhered to;
- M024: Dedicated risk assessment post consent if a location within Loch Roag is planned to be used as a base port taking account of vessel traffic in Loch Roag and full details of planned Offshore Project vessels, their movements, and bases within Loch Roag, plus any impact on use of existing AtoNs within Loch Roag;
- M026: A Fisheries Mitigation, Monitoring and Communication Plan (FMMCP) (building on **FMMCP, Volume 3**) will be developed in compliance with legislative requirements and/or best practice standards and guidance prior to the operation of the Project and adhered to;
- M029: A Marine Coordination Centre will be established to monitor all vessel activity (Project, fishing and other maritime vessels), issue Notices to Mariners, and serve as a contact point for all maritime stakeholders;
- M031: An MPCP will be developed prior to commencement of construction (building on **Outline MPCP, Volume 3**) in compliance with legislative requirements and/or best practice standards and guidance and adhered to;
- M033: A LMP will be developed prior to commencement of construction (building on the **Outline LMP, Volume 3**) in compliance with legislative requirements and best practice standards and guidance and adhered to; and
- M039: Lighting and marking failures will be appropriately reported and rectified as soon as possible. Interim hazard warnings will be put in place.

18.2.3.3 Frequency of Occurrence

419. The frequency of occurrence in relation to third-party vessel to project vessel collision risk for all aspects of the Offshore Project is considered **Extremely Unlikely**.

18.2.3.4 Severity of Consequence

420. The severity of consequence in relation to third-party vessel to project vessel collision risk for all aspects of the Offshore Project is considered **Serious** in terms of navigational safety.

18.2.3.5 Significance of Risk

421. Taking the frequency of occurrence as Extremely Unlikely and the severity of consequence as Serious, the overall significance of risk for all aspects of the Offshore Project is deemed **Tolerable with Mitigation** which is considered ALARP.

18.2.4 Reduced Access to Local Ports, Harbours, and Facilities

422. Operation and maintenance activities associated with the Offshore Project may increase the risk of reduced access to local harbours.

18.2.4.1 Qualification of Risk

423. Up to 32,034 return trips by operation and maintenance vessels may be made during the lifetime of the Offshore Project and may include vessels which are RAM.

424. Similar to the equivalent construction phase effect, it is not anticipated that operation and maintenance activities within the Offshore Project will have a substantial effect on vessel approaches to and from Loch Roag. It is not yet known which base ports will be used for the Project. However, feedback received during stakeholder consultation including the Hazard Workshop highlighted that Loch Roag is currently at capacity, and the use of Loch Roag as a base port may reduce access to facilities which may impact on aquaculture operations (see **Table 4-1**) and restrict recreational vessels from accessing safe anchorage during adverse weather.

425. The risk is reduced by managing project vessels by marine coordination (M029), including the use of traffic management procedures such as the designation of entry and exit points to and from the Turbine Area, and designated routes to and from operational ports. These measures will be set out in the NSVMP (M022) and will be particularly important should an operational port be located within Loch Roag where traffic density is greatest. From consultation, in such a scenario a dedicated risk assessment should be undertaken post consent taking account of vessel traffic in Loch Roag and full details of planned project vessels, their movements and bases to ensure effects associated with interactions between third-party vessels and project vessels (which may affect port access) are ALARP (M024).

426. Project vessels will also carry AIS and be compliant with Flag State regulations including the COLREGs outlined in M015.

18.2.4.2 Embedded Mitigation Measures

427. The embedded mitigation measures which have been identified as relevant to reducing risk are as follows:

- M012: Timely and efficient distribution of Notices to Mariners (NtMs), Kingfisher notifications, and other navigational warnings of the position and nature of works associated with the Offshore Project, including information for vessel routes, timings and locations, safety zones (around surface piercing infrastructure) and advisory passing distances. Physical notices will be placed at marinas and harbours in the vicinity of the Offshore Project and final locations of installed infrastructure will be charted and distributed to recreational clubs;

- M014: Marking and lighting of the Array Area in agreement with NLB and as per the requirements of IALA Recommendation O-139 (IALA, 2021a) and Guidance G1162 (IALA, 2021b);
- M015: Compliance of all Offshore Project vessels with international marine regulations as adopted by the Flag State, notably the International Regulations for Preventing Collisions at Sea (COLREGs) (IMO, 1972/1977) and the International Convention for the Safety of Life at Sea (SOLAS) (IMO, 1974);
- M022: A Final NSVMP will be developed prior to commencement of construction (building on the **Outline NSVMP, Volume 3**) in compliance with legislative requirements and/or best practice standards and guidance and adhered to;
- M024: Dedicated risk assessment post consent if a location within Loch Roag is planned to be used as a base port taking account of vessel traffic in Loch Roag and full details of planned Offshore Project vessels, their movements, and bases within Loch Roag, plus any impact on use of existing AtoNs within Loch Roag;
- M026: A Fisheries Mitigation, Monitoring and Communication Plan (FMMCP) (building on **FMMCP, Volume 3**) will be developed in compliance with legislative requirements and/or best practice standards and guidance prior to the operation of the Project and adhered to;
- M029: A Marine Coordination Centre will be established to monitor all vessel activity (Project, fishing and other maritime vessels), issue Notices to Mariners, and serve as a contact point for all maritime stakeholders;
- M033: A LMP will be developed prior to commencement of construction; and
- M039: Lighting and marking failures will be appropriately reported and rectified as soon as possible.

18.2.4.3 Frequency of Occurrence

428. The frequency of occurrence in relation to reduced access to local ports, harbours, and facilities is for all aspects of the Offshore Project considered **Extremely Unlikely**.

18.2.4.4 Severity of Consequence

429. The severity of consequence in relation to reduced access to local ports, harbours, and facilities is for all aspects of the Offshore Project considered **Moderate**.

18.2.4.5 Significance of Risk

430. Taking the frequency of occurrence as Remote and the severity of consequence as Moderate, the overall significance of risk for all aspects of the Offshore Project is deemed **Broadly Acceptable**.

18.2.5 Vessel to Structure Allision Risk

431. Presence of structures within the Turbine Area will lead to creation of powered, drifting and internal allision risk for vessels, which may be exacerbated by loss of navigational aids such as lights and AIS signals due to storm damage and difficulty in repairing them timeously.

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

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

18.2.5.1 Powered Allision Risk

Qualification and Quantification of Risk

433. Based on the quantitative assessment undertaken (see **Section 16**), the base case annual powered vessel to structure allision frequency was estimated to be 4.53×10^{-6}, corresponding to a return period of approximately 1 in 220,809 years. This is a very low return period compared to that estimated for other UK OWF developments and is reflective of the relatively low volume of vessel traffic intersecting or passing in close proximity to the Turbine Array Area. When anticipating the potential for an increase in vessels associated with new aquaculture sites, up to a 20% increase in overall vessel numbers was also considered, with an estimated powered vessel to structure allision frequency of 1 every 181,925 years. Overall, this is regarded as a low allision risk particularly considering that the 20% increase was conservatively applied to total vessel numbers rather than fish farm support vessels only.

434. Based on historical incident data, there have been 2 reported instances of a third-party vessel alliding with an operational OWF structure in the UK during 2016 and 2022 in the Irish Sea and Southern North Sea, respectively. The former resulted in vessel damage and partial submerging, as well as a head injury sustained by one of the three crew. The allision incident occurring in 2022 resulted in minor damage to the bow with water ingress and two minor injuries to crew. Both of these incidents involved a fishing vessel, with an RNLI lifeboat attending on both occasions and a helicopter deployed in 1 case.

435. Vessels are expected to comply with international flag state regulations (including the COLREGs and SOLAS, outlined in measure M015) and will be able to passage plan a route which minimises risk given the promulgation of information relating to the Offshore Project (outlined in measure M012), including the charting of infrastructure on relevant nautical charts (outlined in M011). On approach, the operational marine lighting and marking on the structures (which will be agreed with the MCA and NLB, outlined in M014) will also assist in maximising awareness. It should be noted that the operational marine lighting and marking will be in compliance with IALA requirements, including in relation to the availability of AtoNs, with this secured through the AtoN Management Plan post consent in consultation with NLB and MCA. This ensures that any window during which AtoNs are not in place is minimised, and

subsequently minimises the increases in allision risk considered further in **Section 18.2.5.3**).

436. There is also a related allision risk in the event that an AtoN goes off station. Again, the AtoN Management Plan would be implemented to ensure the off station AtoN is recovered as soon as practicable in liaison with NLB, particularly noting the presence of the DWR to the northwest of the Array Area and the high potential for adverse weather in the region, as highlighted by RYA Scotland in their Hazard Workshop materials response.

437. The final layout will be agreed via MCA and NLB consultation as required under MGN 654 (M010) to ensure it is safe from a surface navigation perspective (noting internal allision risk is considered further below).

438. Should an allision occur, the consequences will depend on multiple factors including the energy of the impact, structural integrity of the vessel and sea state at the time of the impact and type of structure contacted. Fishing vessels and recreational vessels are considered most vulnerable to the impact given the potential for a non-steel construction and possible internal navigation within the Turbine Area by such vessels. In such cases, the most likely consequences will be minor damage with the vessel able to resume passage and undertake a full inspection at the next port. As an unlikely worst-case, the vessel could be foundered resulting in a PLL and pollution. If pollution were to occur, then the MPCP will be implemented to minimise the environmental risk outlined in M031.

Embedded Mitigation Measures

439. The embedded mitigation measures which have been identified as relevant to reducing risk are as follows:

- M010: Compliance with MGN 654 and its annexes including development and implementation of a SAR Checklist, ERCoP and guard vessels as required by risk assessment;
- M011: The Offshore Project infrastructure inclusive of surface piercing structures and subsea cables will be appropriately marked on Admiralty and aeronautical charts, and information on structure positions and heights will be provided to the UKHO;
- M012: Timely and efficient distribution of Notices to Mariners (NtMs), Kingfisher notifications, and other navigational warnings of the position and nature of works associated with the Offshore Project, including information for vessel routes, timings and locations, safety zones (around surface piercing infrastructure) and advisory passing distances. Physical notices will be placed at marinas and harbours in the vicinity of the Offshore Project and final locations of installed infrastructure will be charted and distributed to recreational clubs;
- M013: Surface piercing structures - application for safety zones of up to 500 m pre-commissioning;

- M014: Marking and lighting of the Array Area in agreement with NLB and as per the requirements of IALA Recommendation O-139 (IALA, 2021a) and Guidance G1162 (IALA, 2021b);
- M015: Compliance of all Offshore Project vessels with international marine regulations as adopted by the Flag State, notably the International Regulations for Preventing Collisions at Sea (COLREGs) (IMO, 1972/1977) and the International Convention for the Safety of Life at Sea (SOLAS) (IMO, 1974);
- M016: Wind turbines blade clearance of at least 28.33 m above MHWS (30 m above MSL);
- M026: A Fisheries Mitigation, Monitoring and Communication Plan (FMMCP) (building on **FMMCP, Volume 3**) will be developed in compliance with legislative requirements and/or best practice standards and guidance prior to the operation of the Project and adhered to;
- M031: An MPCP will be developed prior to commencement of construction (building on **Outline MPCP, Volume 3**) in compliance with legislative requirements and/or best practice standards and guidance and adhered to;
- M033: A LMP will be developed prior to commencement of construction (building on the **Outline LMP, Volume 3**) in compliance with legislative requirements and best practice standards and guidance and adhered to; and
- M039: Lighting and marking failures will be appropriately reported and rectified as soon as possible. Interim hazard warnings will be put in place.

Frequency of Occurrence

440. The frequency of occurrence in relation to powered allision risk for all aspects of the Offshore Project is considered **Extremely Unlikely**.

Severity of Consequence

441. The severity of consequence in relation to powered allision risk for all aspects of the Offshore Project is considered **Serious**.

Significance of Risk

442. Taking the frequency of occurrence as Extremely Unlikely and the severity of consequence as Serious, the overall significance of risk for all aspects of the Offshore Project is deemed **Tolerable with Mitigation** which is considered ALARP.

18.2.5.2 Drifting Allision Risk

Qualification and Quantification of Risk

443. Based on the quantitative assessment undertaken (see **Section 16**), the base case annual drifting vessel to structure allision frequency was estimated to be 2.65×10^{-5}, corresponding to a return period of approximately 1 in 37,790 years. This is a low return period compared to that estimated for other UK OWF developments and is reflective of the relatively low volume of vessel traffic passing in proximity to or

within the Turbine Area. When anticipating the potential for an increase in vessels associated with new aquaculture sites, up to a 20% increase in overall vessel numbers was also considered, with an estimated drifting vessel to structure allision frequency of 1 every 31,491 years. Overall, this is regarded as a low allision risk particularly considering that the 20% increase was conservatively applied to total vessel numbers rather than fish farm support vessels only.

444. Based on historical incident data, there have been no instances of a third-party vessel alliding with an operational OWF structure whilst Not Under Command (NUC). However, there is considered to be potential for a vessel to be adrift in the area; this is reflected in the MAIB incident data reviewed in proximity to the Offshore Project which indicates that machinery failure is the most common incident type (approximately 46%). Additionally, the semi-submersible rig *Transocean Winner* ran aground at Dalmore Bay after becoming adrift due to loss of tow.

445. A vessel adrift may only develop into an allision situation if in proximity to an OWF structure. This is only the case where the adrift vessel is located internally within or in close proximity to the Turbine Area and the direction of the wind and/or tide directs the vessel towards a structure. It should be noted however, that for the case of *Transocean Winner*, loss of tow occurred outside the 10 nm study area of the Offshore Project and, due to strong winds, drifted ashore. This type of incident occurs infrequently as it is conditional on several contributing factors, including but not limited to the presence of a rig move, adverse weather, and human error. Upon analysis of the vessel traffic survey data and the long-term vessel traffic data, no rig moves were identified as regularly occurring within the study area, with one temporary rig movement recorded during July 2023 within the DWR, reflecting the infrequency of rig move operations, as well as being scheduled during periods of more favourable weather conditions. Additionally, due to the deep draught of rig moves, it is likely that these transits will occur further offshore rather than in close proximity to the Turbine Area. Moreover, from consultation feedback received during the Hazard Workshop, there is a growing trend for use of semi-submersible vessels for transporting rigs rather than relying on towage.

446. In circumstances where a vessel drifts towards a structure in the Turbine Area, there are actions which the vessel may take to prevent the drift incident developing into an allision situation. Powered vessels may be able to regain power prior to reaching the Turbine Array Area (i.e. by rectifying any fault). Failing this, the vessel's emergency response procedures would be implemented which may include an emergency anchoring event following a check of the relevant nautical charts to ensure the deployment of the anchor will not lead to other risks (such as anchor snagging on a subsea cable), or the use of thrusters (depending on availability and power supply).

447. Where the deployment of the anchor is not possible (e.g. for small craft), any project vessels on site may be able to render assistance in liaison with the MCA and in line

with SOLAS obligations under Regulation 33 (IMO, 1974) (M015). This response will be managed via the coastguard and marine coordination and depends on the type and capability of vessels on site. This would be particularly relevant for sailing vessels relying on metocean conditions for propulsion, noting if the vessel becomes adrift in proximity to a structure there may be limited time to render assistance.

448. Should an allision occur, the consequences will be similar to those noted for the case of a powered allision including the unlikely worst-case of foundering and pollution; in the highly unlikely scenario of a drifting allision incident resulting in pollution, the implementation of the MPCP will minimise the environmental risk (M031). Additionally, a drifting vessel is likely to transit at a reduced speed compared to a powered vessel, thus reducing the energy of the impact, including in the case of a recreational vessel under sail.

Embedded Mitigation Measures

449. The embedded mitigation measures which have been identified as relevant to reducing risk are as follows:

- M010: Compliance with MGN 654 and its annexes including development and implementation of a SAR Checklist, ERCoP and guard vessels as required by risk assessment;
- M011: The Offshore Project infrastructure inclusive of surface piercing structures and subsea cables will be appropriately marked on Admiralty and aeronautical charts, and information on structure positions and heights will be provided to the UKHO;
- M012: Timely and efficient distribution of Notices to Mariners (NtMs), Kingfisher notifications, and other navigational warnings of the position and nature of works associated with the Offshore Project, including information for vessel routes, timings and locations, safety zones (around surface piercing infrastructure) and advisory passing distances. Physical notices will be placed at marinas and harbours in the vicinity of the Offshore Project and final locations of installed infrastructure will be charted and distributed to recreational clubs;
- M013: Surface piercing structures - application for safety zones of up to 500 m pre-commissioning;
- M014: Marking and lighting of the Array Area in agreement with NLB and as per the requirements of IALA Recommendation O-139 (IALA, 2021a) and Guidance G1162 (IALA, 2021b);
- M015: Compliance of all Offshore Project vessels with international marine regulations as adopted by the Flag State, notably the International Regulations for Preventing Collisions at Sea (COLREGs) (IMO, 1972/1977) and the International Convention for the Safety of Life at Sea (SOLAS) (IMO, 1974);
- M016: Wind turbines blade clearance of at least 28.33 m above MHWS (30 m above MSL).

- M026: A Fisheries Mitigation, Monitoring and Communication Plan (FMMCP) (building on **FMMCP, Volume 3**) will be developed in compliance with legislative requirements and/or best practice standards and guidance prior to the operation of the Project and adhered to;
- M031: An MPCP will be developed prior to commencement of construction (building on **Outline MPCP, Volume 3**) in compliance with legislative requirements and/or best practice standards and guidance and adhered to;

Frequency of Occurrence

450. The frequency of occurrence in relation to drifting allision risk for all aspects of the Offshore Project is considered **Remote**.

Severity of Consequence

451. The severity of consequence in relation to drifting allision risk for all aspects of the Offshore Project is considered **Moderate**.

Significance of Risk

452. Taking the frequency of occurrence as Remote and the severity of consequence as Moderate, the overall significance of risk for all aspects of the Offshore Project is deemed **Tolerable with Mitigation** which is considered ALARP.

18.2.5.3 Internal Allision Risk

Qualification and Quantification of Risk

453. As noted previously, based on experience at existing operational OWFs, it is anticipated that commercial vessels will be unlikely to navigate internally within the Turbine Area.

454. Fishing and recreational vessels may be more likely to transit through the Turbine Area. For fishing vessels, feedback provided by the CFLO indicates that the presence of WTGs may create new habitats for crabs and lobsters which could increase potting activity within the Turbine Area. However, the presence of any cable protection may dictate the practicality of potting activities. For recreational vessels, ‘wind farm tourism’ may occur in the area, as recreational marine tours are already in operation out of Loch Roag, thus the presence of recreational vessels within the Turbine Area may be anticipated.

455. The base case annual fishing vessel to structure allision frequency (see **Section 16**) is estimated to be 6.95×10^{-2}, corresponding to a return period of approximately 1 in 14 years. When considering a potential of a 20% increase in vessel traffic in the future, the return period increases to 1 every 12 years. This return period is reflective of the volume of fishing vessel traffic in the area, both in transit and engaged in fishing activities. This result is conservative, as the assumption is made that baseline activity in terms of proximity to WTGs will not change. In practice, fishing vessels will account

for the presence of the WTGs. Furthermore, this result does not consider the potential consequences of an allision, with the worst consequences reported for vessels involving a UK OWF development having been flooding, with no life-threatening injuries to persons reported (the model is calibrated against known reported incidents).

456. The minimum spacing between structures of 900 m is considered sufficient for safe internal navigation i.e. for vessels to keep clear of the OWF structures within the Turbine Area. Additionally, the final layout will be agreed via MCA and NLB consultation as required under MGN 654 to ensure it is safe from a surface navigation perspective, including in compliance with the requirements of MGN 654 (MCA, 2021), outlined in M010.

457. As with any passage, any vessel navigating within the Turbine Area is expected to passage plan in accordance with SOLAS Chapter V (IMO, 1974) outlined in measure M015 and the promulgation of information will ensure that such vessels have good awareness (outlined in measure M012). Operational marine lighting and marking will be in place as required by and agreed with the NLB and MCA (outlined in M014). This will include unique identification marking of each OWF structure in an easily understandable pattern to minimise the risk of a mariner navigating internally within the Turbine Area becoming disoriented.

458. Should a recreational vessel under sail enter the proximity of a WTG, there is also potential for effects such as wind shear, masking and turbulence to occur. From previous studies of OWF developments, it has been concluded that WTGs do reduce wind velocity downwind of a WTG (MCA, 2008) but that no negative effects on recreational craft have been reported on the basis of the limited spatial extent of the effect and its similarity to that experienced when passing a large vessel or close to other large structures (such as bridges) or the coastline. In addition, no practical issues have been raised by recreational users to date when operating in proximity to existing OWF developments. For recreational vessels with a mast there is an additional allision risk when navigating internally within the array associated with the WTG blades. However, the minimum blade tip clearance (outlined in M016) exceeds the minimum clearance the RYA recommend (22 m above MHWS) for minimising allision risk (RYA, 2019 (a)) and which is also noted in MGN 654 (MCA, 2021).

Embedded Mitigation Measures

459. The embedded mitigation measures which have been identified as relevant to reducing risk are as follows:

- M010: Compliance with MGN 654 and its annexes including development and implementation of a SAR Checklist, ERCoP and guard vessels as required by risk assessment;

- M011: The Offshore Project infrastructure inclusive of surface piercing structures and subsea cables will be appropriately marked on Admiralty and aeronautical charts, and information on structure positions and heights will be provided to the UKHO;
- M012: Timely and efficient distribution of Notices to Mariners (NtMs), Kingfisher notifications, and other navigational warnings of the position and nature of works associated with the Offshore Project, including information for vessel routes, timings and locations, safety zones (around surface piercing infrastructure) and advisory passing distances. Physical notices will be placed at marinas and harbours in the vicinity of the Offshore Project and final locations of installed infrastructure will be charted and distributed to recreational clubs;
- M013: Surface piercing structures - application for safety zones of up to 500 m pre-commissioning;
- M014: Marking and lighting of the Array Area in agreement with NLB and as per the requirements of IALA Recommendation O-139 (IALA, 2021a) and Guidance G1162 (IALA, 2021b);
- M015: Compliance of all Offshore Project vessels with international marine regulations as adopted by the Flag State, notably the International Regulations for Preventing Collisions at Sea (COLREGs) (IMO, 1972/1977) and the International Convention for the Safety of Life at Sea (SOLAS) (IMO, 1974);
- M016: Wind turbines blade clearance of at least 28.33 m above MHWS (30 m above MSL);
- M026: A Fisheries Mitigation, Monitoring and Communication Plan (FMMCP) (building on **FMMCP, Volume 3**) will be developed in compliance with legislative requirements and/or best practice standards and guidance prior to the operation of the Project and adhered to;
- M031: An MPCP will be developed prior to commencement of construction (building on **Outline MPCP, Volume 3**) in compliance with legislative requirements and/or best practice standards and guidance and adhered to;
- M033: A LMP will be developed prior to commencement of construction (building on the **Outline LMP, Volume 3**) in compliance with legislative requirements and best practice standards and guidance and adhered to; and
- M039: Lighting and marking failures will be appropriately reported and rectified as soon as possible. Interim hazard warnings will be put in place.

Frequency of Occurrence

460. The frequency of occurrence in relation to internal allision risk for all aspects of the Offshore Project is considered **Remote**.

Severity of Consequence

461. The severity of consequence in relation to internal allision risk for all aspects of the Offshore Project is considered **Moderate**.

Significance of Risk

462. Taking the frequency of occurrence as Remote and the severity of consequence as Moderate, the overall significance of risk for all aspects of the Offshore Project is deemed **Tolerable with Mitigation** which is considered ALARP.

18.2.6 Reduction in Under Keel Clearance

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

18.2.6.1 Qualification of Risk

464. For all subsea cables relating to the Offshore Project where cable burial is applied, the minimum burial depth is 0.2 m, noting actual burial depths will be determined via the CBRA process which will be undertaken post consent once geotechnical survey data is available (outlined in M030).

465. Where cable burial is not possible, alternative cable protection methods may be deployed which will again be determined within the CBRA (outlined in M030). The requirements of MGN 654 in relation to cable protection will apply, namely cable protection will not change the charted water depth by more than 5% unless appropriate mitigation is agreed with the MCA. This aligns with the RYA's recommendation that the "*minimum safe under keel clearance over submerged structures and associated infrastructure should be determined in accordance with the methodology set out in MGN 543 [since superseded by MGN 654]*" (RYA, 2019 (a)).

466. As a worst case, Scenario 2 is considered for this hazard given that this maximises the spread of cables within the OCAS and subsequent exposure for the main commercial routes and small craft navigating between the Array Area and shore. Up to 100% of cables are anticipated to require protection in the event of surface lay, although this is across both cables located within the Array Area and the OCAS. The worst case cable protection height of 1.1 m should largely fall within the 5% requirement outlined above (22 m LAT charted depth) given that charted depths are generally greater than 20 m LAT. Installation of HDD Exit Pits at the Landfall is located approximately 500-1,500 m offshore, in water depths of 15-27 m MSL (13.5-24.7 m LAT). The Landfall Exit Pit Area is shown on **Figure 3.1c, Volume 1b**. The HDD Exit Pits will be excavated up to 3.5 m below the seabed prior to HDD installation works. Following cable pull through, the HDD Exit Pits will be protected with inert material. The requirements for HDD Exit Pit area protection will be determined following detailed design, therefore the worst-case for the height of the HDD Exit Pit area is the same as the height for Offshore Cable protection (1.1 m LAT). However, the HDD Exit Pit area protection is likely to be lower due to the pits being excavated prior to construction works and therefore the requirement for protection will be for the Offshore Cables as they exit the pit, rather than for the HDD Exit Pit area. As noted

above, where the 5% requirement cannot be met, the tolerability of any changes to depth will be discussed with the MCA, as per the requirements of MGN 654.

467. Additionally, based on feedback from the Hazard Workshop, it was confirmed that aquaculture vessels which regularly transit between the Array Area and the coast are not constrained by water depths, with exact routeing subject to the skipper's preference accounting for weather conditions (see **Table 4-1**). As a result, the impact of a reduction of under keel clearance is considered to be low.

468. Should an underwater allision occur, minor damage incurred is the most likely consequence, and foundering of the vessel resulting in a PLL and pollution the unlikely worst-case consequences, with the environmental risks of the latter minimised by the implementation of the MPCP (outlined in M031).

18.2.6.2 Embedded Mitigation Measures

469. The embedded mitigation measures which have been identified as relevant to reducing risk are as follows:

- M002: A Cable Installation Plan will be produced to confirm routeing, method of installation and aspects such as target depth of burial and need for/location of/type of external cable protection. This plan will also contain the outputs of a formal CBRA;
- M010: Compliance with MGN 654 and its annexes including development and implementation of a SAR Checklist, ERCOP and guard vessels as required by risk assessment;
- M011: The Offshore Project infrastructure inclusive of surface piercing structures and subsea cables will be appropriately marked on Admiralty and aeronautical charts, and information on structure positions and heights will be provided to the UKHO;
- M012: Timely and efficient distribution of Notices to Mariners (NtMs), Kingfisher notifications, and other navigational warnings of the position and nature of works associated with the Offshore Project, including information for vessel routes, timings and locations, safety zones (around surface piercing infrastructure) and advisory passing distances. Physical notices will be placed at marinas and harbours in the vicinity of the Offshore Project and final locations of installed infrastructure will be charted and distributed to recreational clubs;
- M030: Suitable implementation and monitoring of subsea cable burial, scour protection and cable protection in line with MGN 654 (via burial, or external protection where adequate burial depth as identified via risk assessment is not feasible). Surveys will be coordinated with the fishing industry, and results will be shared to inform ongoing coexistence;
- M031: An MPCP will be developed prior to commencement of construction (building on **Outline MPCP, Volume 3**) in compliance with legislative requirements and/or best practice standards and guidance and adhered to.

18.2.6.3 Frequency of Occurrence

470. The frequency of occurrence in relation to reduction in under keel clearance for all aspects of the Offshore Project is considered **Reasonably Probable**.

18.2.6.4 Severity of Consequence

471. The severity of consequence in relation to reduction in under keel clearance for all aspects of the Offshore Project is considered **Minor** in terms of navigational safety.

18.2.6.5 Significance of Risk

472. Taking the frequency of occurrence as Reasonably Probable and the severity of consequence as Minor, the overall significance of risk for all aspects of the Offshore Project is deemed **Tolerable with Mitigation** which is considered ALARP.

18.2.7 Vessel Interaction with Subsea Cables

473. Presence of cables may increase the potential for interaction with subsea cables including via the anchors and/or fishing gear of third-party vessels.

18.2.7.1 Qualification of Risk

474. The spatial extent of the hazard is relatively small given that a vessel must be in close proximity to a cable for an interaction to occur.

475. There are 3 anchoring scenarios which are considered for this hazard:

- Planned anchoring – may result from adverse weather conditions, machinery failure or sub-sea operations;
- Unplanned anchoring – generally resulting from an emergency situation where the vessel has experienced steering failure;
- Anchor dragging – caused by anchor failure.

476. Although the second of these scenarios may involve limited decision-making time if drifting towards a hazard, in all 3 scenarios it is anticipated that the charting of infrastructure including the subsea cables will inform the decision to anchor, as per Regulation 34 of SOLAS (IMO, 1974).

477. No anchored vessels were identified outside of Loch Roag within the vessel traffic survey data assessed, and no charted anchorages are located in proximity to the Offshore Project. Risk of interaction on a planned anchoring or anchor dragging basis is therefore anticipated to be low. In terms of emergency anchoring, any areas of high traffic volume are likely to represent the highest risk.

478. The likelihood of anchor interaction with a subsea cable is further minimised by the use of external cable protection where required. This will be informed by the CBRA (outlined in M002 and M030) process which will account for traffic volumes and

sizes, particularly for the OCAS where main commercial routes and small craft regularly navigate following the Isle of Lewis coast.

479. Additionally, the refinement of the OCAS (see **Section 6.1.2**) maximises the unaffected sea room between the Array Area and the coast, further reducing the likelihood of an anchor interaction on subsea cables within the OCAS, particularly during unplanned anchoring emergencies.

480. Should an anchor interaction incident occur, the most likely consequences will be low based on historical anchor interaction incidents, with no damage incurred to the cable or the vessel. As an unlikely worst-case, a snagging incident could occur and/or the vessel's anchor and the cable could be damaged, and lead to risk of loss of stability of a small vessel. However, with the CBRA and consideration of MGN 654, this risk will be minimised.

481. Fishing gear snagging risk will depend on the type of gear deployed as well as the type of cable protection used (see **Table 4-1**). Demersal gear types are subject to increased risk compared to pelagic gear types due to their likelihood of encountering an object or cable protection on the seabed.

482. As per **Section 10.2.1**, demersal trawlers were a common gear type observed within the study area; however, these vessels were estimated to be transiting rather than actively fishing based on their average speed and track behaviour. Another common gear type recorded within the study area were potters, which were noted to be actively fishing within and in proximity to the Array Area. The fishing method of using pots is likely to present a low snagging risk compared to demersal trawling, as it is carried out at a slower pace and is a static gear type. Additionally, based on feedback received via the CFLO, only a small number of potting vessels are active within the study area and operate out of Carloway Pier between April and September; thus, the impact would likely be temporally restricted in nature.

483. Although 100% of cables may require cable protection (outlined in Table 6-5), active fishing vessels are infrequent and utilise static gears, and so the likelihood of a fishing gear snagging incident is considered to be low. The risk is further reduced by the refinement of the OCAS, which decreases overlap with areas of known potting activity (see **Section 6.1.2**). The likelihood of fishing gear snagging may also be minimised by the burial of cables where possible which will be informed by the CBRA (outlined in M030). **Chapter 21, Volume 2a** provides further details of risk to commercial fishing vessels.

18.2.7.2 Embedded Mitigation Measures

484. The embedded mitigation measures which have been identified as relevant to reducing risk are as follows:

- M002: A Cable Installation Plan will be produced to confirm routeing, method of installation and aspects such as target depth of burial and need for/location of/type of external cable protection. This plan will also contain the outputs of a formal CBRA;

- M010: Compliance with MGN 654 and its annexes including development and implementation of a SAR Checklist, ERCoP and guard vessels as required by risk assessment;
- M011: The Offshore Project infrastructure inclusive of surface piercing structures and subsea cables will be appropriately marked on Admiralty and aeronautical charts, and information on structure positions and heights will be provided to the UKHO;
- M012: Timely and efficient distribution of Notices to Mariners (NtMs), Kingfisher notifications, and other navigational warnings of the position and nature of works associated with the Offshore Project, including information for vessel routes, timings and locations, safety zones (around surface piercing infrastructure) and advisory passing distances. Physical notices will be placed at marinas and harbours in the vicinity of the Offshore Project and final locations of installed infrastructure will be charted and distributed to recreational clubs;
- M026: A Fisheries Mitigation, Monitoring and Communication Plan (FMMCP) (building on **FMMCP, Volume 3**) will be developed in compliance with legislative requirements and/or best practice standards and guidance prior to the operation of the Project and adhered to;
- M030: Suitable implementation and monitoring of subsea cable burial, scour protection and cable protection in line with MGN 654 (via burial, or external protection where adequate burial depth as identified via risk assessment is not feasible). Surveys will be coordinated with the fishing industry, and results will be shared to inform ongoing coexistence.

18.2.7.3 Frequency of Occurrence

485. The frequency of occurrence in relation to vessel interaction with subsea cables for all aspects of the Offshore Project is considered **Extremely Unlikely**.

18.2.7.4 Severity of Consequence

486. The severity of consequence in relation to vessel interaction with subsea cables for all aspects of the Offshore Project is considered **Moderate** in terms of navigational safety.

18.2.7.5 Significance of Risk

487. Taking the frequency of occurrence as Extremely Unlikely and the severity of consequence as Moderate, the overall significance of risk for all aspects of the Offshore Project is deemed **Broadly Acceptable** which is considered ALARP.

18.2.8 Reduction in Emergency Response Capability

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

18.2.8.1 Qualification of Risk

489. Given the distances that would likely be covered by air-based SAR support (the SAR helicopter base at Stornoway is located approximately 15 nm from the Turbine Area), the spatial extent of this hazard is considered reasonably small. The Turbine Area covers approximately 41 nm^2 (141 square kilometres (km^2)) which represents a small area to search compared to other OWFs. Additionally, a SAR operation may not require the entire Turbine Area to be searched; it is more likely that, with potential drift of the casualty taken into account, a search could be restricted to a smaller area within which a casualty is known to be located.

490. Up to 32,034 return trips by operation and maintenance vessels may be made throughout the operation and maintenance phase. It is assumed that operation and maintenance vessels will be on site throughout the majority of the operation and maintenance phase, although there may be instances of severe weather conditions where they may be withdrawn. The presence of such vessels will increase the likelihood of an incident and subsequently increase the likelihood of multiple incidents occurring simultaneously, diminishing emergency response capability. As an unlikely worst-case, the consequences of such a situation could include a failure of emergency response to an incident, resulting in a PLL and pollution.

491. However, with Project vessels to be managed through marine coordination and compliance with Flag State regulations (outlined in measure M015), the likelihood of an incident is minimised. Additionally, should an incident occur, project vessels would likely be well equipped to assist, either through self-help capability or through SOLAS obligations under Regulation 33 (IMO, 1974), noting this would be undertaken in liaison with the MCA. The MPCP will also be implemented to minimise the environmental risks of any incident involving pollution (outlined in M031).

492. From recent SAR helicopter taskings data, the frequency of SAR operations in proximity to the Offshore Project is low, with no SAR helicopter incidents occurring within the Turbine Area. The frequency of SAR operations in proximity to the Turbine Area is not anticipated to change markedly from the current level given the measures noted above which will be in place. The layout will be agreed with the MCA and NLB in line with MGN 654 requirements (outlined in M010) to ensure any SAR operations that do occur within the Turbine Area are facilitated. Additionally, an ERCoP will be submitted to the MCA in line with the requirements of MGN 654 (MCA, 2021), and a SAR checklist will be completed and agreed with the MCA post consent.

18.2.8.2 Embedded Mitigation Measures

493. The embedded mitigation measures which have been identified as relevant to reducing risk are as follows:

- M002: A Cable Installation Plan will be produced to confirm routeing, method of installation and aspects such as target depth of burial and need for/location of/type of external cable protection. This plan will also contain the outputs of a formal CBRA;
- M010: Compliance with MGN 654 and its annexes including development and implementation of a SAR Checklist, ERCoP and guard vessels as required by risk assessment;
- M011: The Offshore Project infrastructure inclusive of surface piercing structures and subsea cables will be appropriately marked on Admiralty and aeronautical charts, and information on structure positions and heights will be provided to the UKHO;
- M012: Timely and efficient distribution of Notices to Mariners (NtMs), Kingfisher notifications, and other navigational warnings of the position and nature of works associated with the Offshore Project, including information for vessel routes, timings and locations, safety zones (around surface piercing infrastructure) and advisory passing distances. Physical notices will be placed at marinas and harbours in the vicinity of the Offshore Project and final locations of installed infrastructure will be charted and distributed to recreational clubs;
- M014: Marking and lighting of the Array Area in agreement with NLB and as per the requirements of IALA Recommendation O-139 (IALA, 2021a) and Guidance G1162 (IALA, 2021b);
- M015: Compliance of all Offshore Project vessels with international marine regulations as adopted by the Flag State, notably the International Regulations for Preventing Collisions at Sea (COLREGs) (IMO, 1972/1977) and the International Convention for the Safety of Life at Sea (SOLAS) (IMO, 1974);
- M016: Wind turbines blade clearance of at least 28.33 m above MHWS (30 m above MSL);
- M029: A Marine Coordination Centre will be established to monitor all vessel activity (Project, fishing and other maritime vessels), issue Notices to Mariners, and serve as a contact point for all maritime stakeholders;
- M030: Suitable implementation and monitoring of subsea cable burial, scour protection and cable protection in line with MGN 654 (via burial, or external protection where adequate burial depth as identified via risk assessment is not feasible). Surveys will be coordinated with the fishing industry, and results will be shared to inform ongoing coexistence;
- M031: An MPCP will be developed prior to commencement of construction (building on **Outline MPCP, Volume 3**) in compliance with legislative requirements and/or best practice standards and guidance and adhered to;
- M033: A LMP will be developed prior to commencement of construction; and

- M039: Lighting and marking failures will be appropriately reported and rectified as soon as possible.

18.2.8.3 Frequency of Occurrence

494. The frequency of occurrence in relation to reduction in emergency response capability for all aspects of the Offshore Project is considered **Extremely Unlikely**.

18.2.8.4 Severity of Consequence

495. The severity of consequence in relation to reduction in emergency response capability for all aspects of the Offshore Project is considered **Serious** in terms of navigational safety.

18.2.8.5 Significance of Risk

496. Taking the frequency of occurrence as Extremely Unlikely and the severity of consequence as Serious, the overall significance of risk for all aspects of the Offshore Project is deemed **Tolerable with Mitigation** which is considered ALARP.

18.3 Decommissioning Phase

18.3.1 Vessel Displacement

497. Decommissioning activities associated with the removal of structures and cables may displace existing routes/activity.

18.3.1.1 Qualification and Quantification of Risk

498. Since the methods used to remove structures and subsea cables are expected to be similar to those used to install them, this hazard is expected to be similar in nature to the equivalent construction phase hazard (see **Section 18.1.1.1**). In the case of subsea cables sections may be left in situ to avoid unnecessary disturbance of the seabed. This would be confirmed through consultation and assessment prior to the decommissioning phase to ensure the most suitable approach was taken, including consideration of long-term navigational safety. For the purposes of this assessment (as a worst-case) it has been assumed that all subsea cables will be removed during decommissioning with only cable protection left in situ.

499. The use of a buoyed decommissioning area analogous to the buoyed construction area is assumed and will result in similar main route deviations to those established for the equivalent construction phase hazard.

500. Relevant mitigation measures for this impact are analogous to the equivalent construction phase effect (see **Section 18.1.1.2**), with the addition of the development and adherence to a Decommissioning Plan (M020).

18.3.1.2 Frequency of Occurrence

501. The frequency of occurrence in relation to vessel displacement for all aspects of the Offshore Project is considered **Frequent**.

18.3.1.3 Severity of Consequence

502. The severity of consequence in relation to vessel displacement for all aspects of the Offshore Project is considered **Negligible** in terms of navigational safety.

18.3.1.4 Significance of Risk

503. Taking the frequency of occurrence as Frequent and the severity of consequence as Negligible, the overall significance of risk for all aspects of the Offshore Project is deemed **Tolerable with Mitigation** which is considered ALARP.

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

504. Vessel displacement as a result of the removal of structures and cables may increase encounters and collision risk with other third-party vessels.

18.3.2.1 Qualification and Quantification of Risk

505. Since the methods used to remove structures and subsea cables are expected to be similar to those used to install them, this hazard is expected to be similar in nature to the equivalent construction phase (see **Section 18.1.2.1**). In the case of subsea cables, sections may be left in situ but for the purposes of this assessment (as a worst-case) it has been assumed that all subsea cables will be removed during decommissioning with only cable protection left in situ.

506. Relevant mitigation measures for this impact are analogous to the equivalent construction phase impact (see **Section 18.1.2.2**), with the addition of the development and adherence to a Decommissioning Plan (M020).

18.3.2.2 Frequency of Occurrence

507. The frequency of occurrence in relation to increased third-party vessel to third-party vessel collision risk for all aspects of the Offshore Project is considered **Extremely Unlikely**.

18.3.2.3 Severity of Consequence

508. The severity of consequence in relation to increased third-party vessel to third-party vessel collision risk for all aspects of the Offshore Project is considered **Serious** in terms of navigational safety.

18.3.2.4 Significance of Risk

509. Taking the frequency of occurrence as Extremely Unlikely and the severity of consequence as Serious, the overall significance of risk for all aspects of the Offshore Project is deemed **Tolerable with Mitigation** which is considered ALARP.

18.3.3 Third-Party Vessel to Project Vessel Collision Risk

510. Project vessels associated with decommissioning activities may increase encounters and collision risk for third-party vessels already operating in the area.

18.3.3.1 Qualification of Risk

511. Since the methods used to remove structures and subsea cables are expected to be similar to those used to install them, this hazard is expected to be similar in nature to the equivalent construction phase hazard (see **Section 18.1.3.1**) including the number of return trips by vessels. In the case of subsea cables, sections may be left in situ but for the purposes of this assessment (as a worst-case) it has been assumed that all subsea cables will be removed during decommissioning with only cable protection left in situ.

512. Relevant mitigation measures for this impact are analogous to the equivalent construction phase impact (see **Section 18.1.3.2**), with the addition of the development and adherence to a Decommissioning Plan (M020).

18.3.3.2 Frequency of Occurrence

513. The frequency of occurrence in relation to third-party vessel to project vessel collision risk for all aspects of the Offshore Project is considered **Remote**.

18.3.3.3 Severity of Consequence

514. The severity of consequence in relation to third-party vessel to project vessel collision risk for all aspects of the Offshore Project is considered **Serious** in terms of navigational safety.

18.3.3.4 Significance of Risk

515. Taking the frequency of occurrence as Remote and the severity of consequence as Serious, the overall significance of risk for all aspects of the Offshore Project is deemed **Tolerable with Mitigation** which is considered ALARP.

18.3.4 Reduced Access to Local Ports, Harbours, and Facilities

516. Decommissioning activities associated with the removal of structures and cables may displace existing routes/activity restricting access to ports/harbours.

18.3.4.1 Qualification of Risk

517. Since the methods used to remove structures and subsea cables are expected to be similar to those used to install them, this hazard is expected to be similar in nature to the equivalent construction phase hazard, including the number of return trips by vessels. In the case of subsea cables, it is expected that they will be left in situ but for the purposes of this assessment (as a worst-case) it has been assumed that all cables will be removed during decommissioning, with only cable protection will be left in situ.

518. As with the construction phase, it is not yet known from which port(s) decommissioning activity will be based for the Project and therefore the same concerns raised during consultation in relation to use of Loch Roag are again applicable.

519. Relevant mitigation measures for this impact are analogous to the equivalent construction phase impact (see **Section 18.1.4.2**), with the addition of the development and adherence to a Decommissioning Plan (M020).

18.3.4.2 Frequency of Occurrence

520. The frequency of occurrence in relation to vessel displacement for all aspects of the Offshore Project is considered **Remote**.

18.3.4.3 Severity of Consequence

521. The severity of consequence in relation to vessel displacement for all aspects of the Offshore Project is considered **Moderate**.

18.3.4.4 Significance of Risk

522. Taking the frequency of occurrence as Reasonably Probable and the severity of consequence as Moderate, the overall significance of risk for all aspects of the Offshore Project is deemed **Tolerable with Mitigation** which is considered ALARP.

19 Cumulative Risk Assessment

19.1 Vessel Displacement

523. Construction, operation and maintenance, and decommissioning activities associated with the installation of structures and cables associated with the Offshore Project and cumulative developments may displace existing routes/activity.

19.1.1 Tier 3

524. 2 main commercial routes are expected to deviate as a result of the presence of nearby future developments (whether due to the presence of a buoyed construction/decommissioning area or surface structures). These are routes 1 and 4, which have mean positions 3.7 nm and 9.5 nm northwest of the Array Area, respectively. Since these routes are not directly impacted by the Offshore Project, it is not considered appropriate to quantify the displacement i.e. the deviations are not influenced by the presence of the Offshore Project.

525. Route 1 follows the DWR and passes parallel to the Array Area, Talisk OWF and Havbredey OWF. The mean passing distance from Havbredey OWF may increase, but this is not expected to substantially affect the mean position route of the route across the region as a whole, including where it passes the Array Area.

526. Route 4 interacts with Talisk OWF and Havbredey OWF. Should this route pass south of Talisk OWF then the mean passing distance from the Array Area may decrease; indeed, the route may adapt to use the DWR. However, this is not expected to result in a substantial deviation across the region as a whole in terms of increased journey time and distance.

527. During launches at Spaceport 1, a temporary exclusion zone of up to 135 nm from the launch site may be put in place. It is unlikely the main commercial routes will be cumulatively impacted by the Offshore Project and an Exclusion Zone associated with Spaceport 1. Any impact would be transient in nature (up to 4 hours 10 times per year) and restricted to the area immediately surrounding the launch vehicle (Atlantic58, 2023). It is also expected that the operator of Spaceport 1 will coordinate with the Applicant where a temporary exclusion zone may interact with the Offshore Project and the immediate environment.

528. On this basis, the frequency of occurrence of cumulative displacement of vessel traffic is considered **Frequent** and the severity of consequence is considered **Negligible**. Therefore, the overall significance of risk is deemed **Tolerable with Mitigation** which is ALARP.

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

529. Vessel displacement as a result of construction, operation and maintenance, and decommissioning activities associated with the Offshore Project and cumulative

developments may increase encounters and collision risk between third-party vessels operating in the area.

19.2.1 Tier 3

530. With the cumulative displacement outlined in **Section 19.1**, increased vessel densities in the area could lead to an increase in vessel to vessel encounters and therefore increased collision risk.

531. This is applicable for Route 4 should it adapt to use the DWR which is already utilised by Routes 1 and 2. This evolution of vessel traffic movements is independent of the presence of the Offshore Project, although the Array Area may affect the ability of a vessel to safely take collision avoidance action in the event of an encounter, including a full round turn. However, as detailed for the equivalent in isolation hazard (see **Section 18.1.2**), there is considered to be sufficient sea room for such a manoeuvre to be undertaken safely.

532. For Spaceport 1, should a temporary exclusion zone be put in place in proximity to the Offshore Project this may reduce navigable sea room and subsequently increase collision risk. However, any impact would be transient in nature (up to 4 hours 10 times per year) and restricted to the area immediately surrounding the launch vehicle (Atlantic58, 2023). It is also expected that the operator of Spaceport 1 will coordinate with the Applicant where a temporary exclusion zone may interact with the Project and the immediate environment.

533. On this basis, the frequency of occurrence of increased cumulative third-party to third-party vessel collision risk is considered **Extremely Unlikely** and the severity of consequence is considered **Serious**. Therefore, the overall significance of risk is deemed **Tolerable with Mitigation** which is ALARP.

19.3 Third-Party Vessel to Project Vessel Collision Risk

534. Project vessels associated with construction, operation and maintenance, and decommissioning activities associated with the Offshore Project and cumulative developments may increase encounters and collision risk for third-party vessels already operating in the area.

19.3.1 Tier 3

535. There is the potential that the same ports or similarly located ports could be used by cumulative developments in terms of base ports for construction, operation and maintenance vessels, and/or decommissioning vessels. On this basis, there may be an overall cumulative increase in project vessel presence within the general area, and as such the potential for increased encounters and collision risk with third-party traffic. However, all developers (including the Applicant) are expected to establish appropriate vessel management systems including through marine coordination, and as such any encounters will be managed, including by COLREGs and SOLAS.

536. On this basis, the frequency of occurrence of increased cumulative third-party to third-party vessel collision risk is considered **Remote** and the severity of consequence is considered **Serious**. Therefore, the overall significance of risk is deemed **Tolerable with Mitigation** which is ALARP.

19.4 Reduced Access to Local Ports, Harbours, and Related Facilities

537. Construction, operation and maintenance, and decommissioning activities associated with the Offshore Project and cumulative developments may increase the risk of reduced access to local harbours.

19.4.1 Tier 3

538. Given the relative distance to ports in the area and the anticipated deviations for the main commercial routes, it is not anticipated that there will be any substantial effect due to activities associated with cumulative developments beyond those outlined for the equivalent in isolation hazard (see **Section 18.1.4**).

539. There is potential for reduced access to Loch Roag should future developments utilise Loch Roag as a base port during their construction phase, operation and maintenance phase and/or decommissioning phase. It is currently not known which ports will be used for the Offshore Project nor for Talisk OWF or Havbredey OWF, though it is considered unlikely that simultaneous use of Loch Roag will occur. However, in the event that this arises, it is anticipated that the developments would coordinate activities in liaison with the Western Isles Council so as to ensure that access constraints are minimised. As identified for the in isolation assessment, if required a dedicated risk assessment should be undertaken post consent taking account of vessel traffic in Loch Roag and full details of planned project vessels, their movements and bases (outlined in M024 and M029). Promulgation of information to allow mariners to passage plan accordingly (outlined in M012) and the NSVMP (M022) are again considered key mitigation measures.

540. On this basis, the frequency of occurrence of cumulative reduced access to local harbours is considered **Reasonably Probable** and the severity of consequence is considered **Moderate**. Therefore, the overall significance of risk is deemed **Tolerable with Mitigation** which is ALARP.

19.5 Vessel to Structure Allision Risk

541. Presence of structures associated with the Offshore Project and cumulative developments will lead to creation of powered, drifting and internal allision risk for vessels, which may be exacerbated by loss of navigational aids such as lights and AIS signals due to storm damage and difficulty in repairing them timeously.

19.5.1 Tier 3

542. The nearest screened in cumulative development is Talisk OWF, located in excess of 15 nm northeast of the Array Area. Given the available sea room between the Turbine Area and the screened-in developments, it is unlikely that vessels will experience increased allision risk beyond the localised risk when passing any given development. This is compounded by the requirement for each individual development to implement marine lighting and marking in agreement with NLB and MCA and in compliance with IALA G1162 (IALA, 2021).

543. As noted in **Section 19.1**, there is potential that the mean passing distance from the Array Area of Route 4 may decrease due to displacement associated with Talisk OWF, with potential that the route may adapt to use the DWR. However, this is not expected to significantly increase allision risk for this route, noting the 1.9 nm separation between the DWR and Array Area.

544. On this basis, the frequency of occurrence of cumulative powered allision risk is considered **Extremely Unlikely** and the severity of consequence is considered **Serious**. Therefore, the overall significance of risk is deemed **Tolerable with Mitigation** which is ALARP.

545. The frequency of occurrence of cumulative drifting allision risk is considered **Remote** and the severity of consequence is considered **Moderate**. Therefore, the overall significance of risk is deemed **Tolerable with Mitigation** which is ALARP.

546. The frequency of occurrence of cumulative internal allision risk is considered **Remote** and the severity of consequence is considered **Moderate**. Therefore, the overall significance of risk is deemed **Tolerable with Mitigation** which is ALARP.

19.6 Reduction in Under Keel Clearance

547. The presence of protection over subsea cables associated with the Offshore Project and cumulative developments may reduce charted water depths leading to increased risk of under keel interaction for passing vessels.

19.6.1 Tier 3

548. No specific subsea developments have been screened into the cumulative assessment (see **Table 14-1**) although there will be transmission infrastructure associated with Talisk OWF and Havbredey OWF.

549. Impacts associated with under keel clearance are generally localised to individual cables, in particular in areas where water depths are low (e.g., landfalls), where cable crossings occur resulting in greater cable protection height, or in a scenario where vessel movements may be altered resulting in increased navigation over an area with reduced water depths. Subsea cables associated with Talisk OWF and Havbredey OWF are not expected to be located in proximity to the Offshore Project and the

respective arrays are not anticipated to substantially influence vessel movements in proximity to the Offshore Project. Therefore, no cumulative hazard is identified.

550. Nevertheless, as per the in isolation assessment (see **Section 18.2.6**), the localised risk from the Offshore Project will be managed via MGN 654 compliance in terms of limiting any reductions in charted water depth to less than a 5% change unless agreed otherwise with the MCA (outlined in M030). The same mitigations will apply for any future subsea cable developments.

551. On this basis, the frequency of occurrence of cumulative reduction in under keel clearance is considered **Reasonably Probable** and the severity of consequence is considered **Minor**. Therefore, the overall significance of risk is deemed **Tolerable with Mitigation** which is ALARP.

19.7 Vessel Interaction with Subsea Cables

552. Presence of cables associated with the Offshore Project and cumulative developments may increase the potential for interaction with subsea cables including via the anchors and/or fishing gear of third-party vessels.

19.7.1 Tier 3

553. As per the cumulative assessment of under keel clearance reduction (see **Section 19.6**), the risk of anchor or fishing gear interaction is considered localised to individual cables. The CBRA undertaken by the Applicant (outlined in M030) will ensure cable burial and protection is suitable including accounting for existing cables, with similar assessments required to be undertaken by any other subsea cable developments.

554. Given the distance between the Offshore Project and cumulative developments, it is not anticipated that any anchoring or fishing activity located in proximity to cumulative developments could be directly displaced into the proximity of the Offshore Project.

555. On this basis, the frequency of occurrence of cumulative vessel interaction risk is considered **Extremely Unlikely** and the severity of consequence is considered **Moderate**. Therefore, the overall significance of risk is deemed **Broadly Acceptable** which is ALARP.

19.8 Reduction in Emergency Response Capability

556. Presence of structures, increased vessel activity and personnel numbers associated with the Offshore Project and cumulative developments may reduce emergency response capability by increasing the number of incidents, increase consequences or reducing access for the responders.

19.8.1 Tier 3

557. The presence of additional project vessels and activities in the region will increase the potential for multiple incidents occurring simultaneously, creating additional stress on emergency responders. However, given baseline incident rates, and noting the additional resources that would be available for the Offshore Project and other cumulative developments, there is not considered likely to be a notable effect on emergency response resources on a cumulative level. This takes account of historical data showing that allisions and collisions caused by OWFs do not occur at a high frequency (see **Section 9.6**).

558. Under MGN 654, all OWF developments will be required to agree a layout with the MCA to ensure suitable SAR access is available. As such no cumulative impact on SAR access is anticipated noting SAR operations are likely to be localised to individual areas (i.e. unlikely to span both the Offshore Project and other cumulative developments given the nearest screened in development is in excess of 15 nm from the Array Area).

559. On this basis, the frequency of occurrence of cumulative impacts on emergency response capability is considered **Extremely Unlikely** and the severity of consequence is considered **Serious**. Therefore, the overall significance of risk is deemed **Tolerable with Mitigation** which is ALARP.

20 Risk Control Log

560. **Table 20-1** presents a summary of the assessment of shipping and navigation hazards. This includes the proposed embedded mitigation measures, frequency of occurrence, severity of consequence and significance of risk, per hazard. The Hazard Log in **Appendix B** provides a breakdown based on vessel type and project component.

Table 20-1 Risk Control Log for Shipping and Navigation

Hazard	Scenario	Phase	Embedded Mitigation Measures	Frequency of Occurrence	Severity of Consequence	Significance of Risk	Additional Mitigation	Residual Risk
Vessel displacement	In isolation	Construction/ decommissioning	▪ M010: MGN 654 compliance; ▪ M011: Charting of infrastructure; ▪ M012: Promulgation of information; ▪ M013: Safety Zones; ▪ M014: Lighting and Marking; ▪ M019: OEMP; ▪ M020: Decommissioning Plan; ▪ M022: NSVMP; ▪ M026: FMMCP; ▪ M029: Marine Coordination; ▪ M033: LMP; ▪ M039: Lighting and marking failures.	Frequent	Negligible	**Tolerable with Mitigation**	N/A	**Tolerable with Mitigation**
		Operation and Maintenance		Frequent	Negligible	**Tolerable with Mitigation**	N/A	**Tolerable with Mitigation**
	Cumulative	Construction/ decommissioning		Frequent	Negligible	**Tolerable with Mitigation**	N/A	**Tolerable with Mitigation**
		Operation and Maintenance		Frequent	Negligible	**Tolerable with Mitigation**	N/A	**Tolerable with Mitigation**
Increased third-party to third-party	In isolation	Construction/ decommissioning	▪ M010: MGN 654 compliance;	Extremely Unlikely	Serious	**Tolerable with Mitigation**	N/A	**Tolerable with Mitigation**

Hazard	Scenario	Phase	Embedded Mitigation Measures	Frequency of Occurrence	Severity of Consequence	Significance of Risk	Additional Mitigation	Residual Risk
vessel collision risk		Operation and Maintenance	▪ M011: Charting of infrastructure; ▪ M012: Promulgation of information; ▪ M013: Safety Zones; ▪ M014: Lighting and Marking; ▪ M019: OEMP;M020: Decommissioning Plan ▪ M022: NSVMP; ▪ M026: FMMCP; ▪ M029: Marine Coordination; ▪ M031: Pollution Planning; ▪ M033: LMP; ▪ M039: Lighting and marking failures.	Extremely Unlikely	Serious	**Tolerable with Mitigation**	N/A	**Tolerable with Mitigation**
	Cumulative	Construction/ decommissioning		Extremely Unlikely	Serious	**Tolerable with Mitigation**	N/A	**Tolerable with Mitigation**
		Operation and Maintenance		Extremely Unlikely	Serious	**Tolerable with Mitigation**	N/A	**Tolerable with Mitigation**
Third-party vessel to Project vessel collision risk	In isolation	Construction/ decommissioning	▪ M010: MGN 654 compliance; ▪ M011: Charting of infrastructure; ▪ M012: Promulgation of information;	Remote	Serious	**Tolerable with Mitigation**	N/A	**Tolerable with Mitigation**
		Operation and Maintenance		Extremely unlikely	Serious	**Tolerable with Mitigation**	N/A	**Tolerable with Mitigation**

Hazard	Scenario	Phase	Embedded Mitigation Measures	Frequency of Occurrence	Severity of Consequence	Significance of Risk	Additional Mitigation	Residual Risk
	Cumulative	Construction/ decommissioning	▪ M013: Safety Zones; ▪ M014: Lighting and Marking; ▪ M019: OEMP M022: NSVMP; ▪ M024: Marine Coordination;M026: FMMCP; ▪ M029: Marine Coordination; ▪ M031: Pollution Planning; ▪ M033: LMP; ▪ M039: Lighting and marking failures.	Remote	Serious	**Tolerable with Mitigation**	N/A	**Tolerable with Mitigation**
		Operation and Maintenance		Remote	Serious	**Tolerable with Mitigation**	N/A	**Tolerable with Mitigation**
Reduced access to local ports, harbours and facilities	In isolation	Construction/ decommissioning	▪ M011: Charting of infrastructure; ▪ M012: Promulgation of information; ▪ M014: Lighting and Marking; ▪ M019: OEMP M020: Decommissioning Plan; ▪ M022: NSVMP.	Remote	Moderate	**Tolerable with Mitigation**	N/A	**Tolerable with Mitigation**
		Operation and Maintenance		Extremely Unlikely	Moderate	**Broadly Acceptable**	N/A	**Broadly Acceptable**
	Cumulative	Construction/ decommissioning		Reasonably Probable	Moderate	**Tolerable with Mitigation**	N/A	**Tolerable with Mitigation**

Hazard	Scenario	Phase	Embedded Mitigation Measures	Frequency of Occurrence	Severity of Consequence	Significance of Risk	Additional Mitigation	Residual Risk
		Operation and Maintenance	▪ M024: Marine Coordination; ▪ M026: FMMCP; ▪ M029: Marine Coordination; ▪ M033: LMP; ▪ M039: Lighting and marking failures.	Reasonably Probable	Moderate	**Tolerable with Mitigation**	N/A	**Tolerable with Mitigation**
Vessel to structure allision risk	In isolation - powered	Operation and Maintenance	▪ M010: MGN 654 compliance; ▪ M011: Charting of infrastructure; ▪ M012: Promulgation of information; ▪ M013: Safety Zones; ▪ M014: Lighting and Marking; ▪ M016: Blade Clearance;M026: FMMCP; ▪ M031: Pollution Planning; ▪ M033: LMP; ▪ M039: Lighting and marking failures.	Extremely Unlikely	Serious	**Tolerable with Mitigation**	N/A	**Tolerable with Mitigation**
	In isolation – drifting			Remote	Moderate	**Tolerable with Mitigation**	N/A	**Tolerable with Mitigation**
	In isolation – internal			Remote	Moderate	**Tolerable with Mitigation**	N/A	**Tolerable with Mitigation**
	Cumulative – powered	Operation and Maintenance		Extremely Unlikely	Serious	**Tolerable with Mitigation**	N/A	**Tolerable with Mitigation**
	Cumulative – drifting			Remote	Moderate	**Tolerable with Mitigation**	N/A	**Tolerable with Mitigation**

Hazard	Scenario	Phase	Embedded Mitigation Measures	Frequency of Occurrence	Severity of Consequence	Significance of Risk	Additional Mitigation	Residual Risk
	Cumulative – internal			Remote	Moderate	**Tolerable with Mitigation**	N/A	**Tolerable with Mitigation**
Reduction in under keel clearance	In isolation	Operation and Maintenance	▪ M002: Cable Burial; ▪ M010: MGN 654 compliance; ▪ M011: Charting of infrastructure; ▪ M012: Promulgation of information; ▪ M030: Cable burial and protection; ▪ M031: Pollution Planning.	Reasonably Probable	Minor	**Tolerable with Mitigation**	N/A	**Tolerable with Mitigation**
	Cumulative	Operation and Maintenance		Reasonably Probable	Minor	**Tolerable with Mitigation**	N/A	**Tolerable with Mitigation**
Vessel interaction with subsea cables	In isolation	Operation and Maintenance	▪ M002: Cable Burial; ▪ M010: MGN 654 compliance; ▪ M011: Charting of infrastructure; ▪ M012: Promulgation of information; ▪ M026: FMMCP; ▪ M030: Cable burial and protection.	Extremely Unlikely	Moderate	**Broadly Acceptable**	N/A	**Broadly Acceptable**
	Cumulative	Operation and Maintenance		Extremely Unlikely	Moderate	**Broadly Acceptable**	N/A	**Broadly Acceptable**

Hazard	Scenario	Phase	Embedded Mitigation Measures	Frequency of Occurrence	Severity of Consequence	Significance of Risk	Additional Mitigation	Residual Risk
Reduction in emergency response capabilities	In isolation	Operation and Maintenance	▪ M002: Cable Burial; ▪ M010: MGN 654 compliance; ▪ M011: Charting of infrastructure; ▪ M012: Promulgation of information; ▪ M014: Lighting and Marking; ▪ M016: Blade Clearance; ▪ M029: Marine Coordination; ▪ M033: LMP; ▪ M039: Lighting and marking failures.	Extremely Unlikely	Serious	**Tolerable with Mitigation**	N/A	**Tolerable with Mitigation**
	Cumulative	Operation and Maintenance		Extremely Unlikely	Serious	**Tolerable with Mitigation**	N/A	**Tolerable with Mitigation**

21 Through Life Safety Management

21.1 Quality, Health, Safety and Environment

561. Quality, Health, Safety and Environment (QHSE) documentation including a Safety Management System (SMS) will be in place for the Offshore Project and will be continually updated throughout the development process. The following subsections provide an overview of this documentation and how it will be maintained and reviewed with reference, where required, to specific marine documentation.

562. Monitoring, reviewing, and auditing will be carried out on all procedures and activities and feedback actively sought. Any designated person (identified in QHSE documentation), managers, and supervisors are to maintain continuous monitoring of all marine operations and determine if all required procedures and processes are being correctly implemented.

21.2 Incident Reporting

563. After any incidents, including near misses, an incident report form will be completed in line with the Project QHSE documentation. This will then be assessed for relevant outcomes and reviewed for possible changes required to operations.

564. The Applicant will maintain records of investigation and analyse incidents in order to:

- Determine underlying deficiencies and other factors that may be causing or contributing to the occurrence of incidents;
- Identify the need for corrective action;
- Identify opportunities for preventative action;
- Identify opportunities for continual improvement;
- Communicate the results of such investigations.

565. All investigations shall be performed in a timely manner.

566. A database of lessons learnt from all marine incidents will be developed. It will include the outcomes of investigations and any resulting actions. The Applicant will promote awareness of their potential occurrence and provide information to assist monitoring, inspection, and auditing of documentation.

567. When appropriate, the designated person (noted within the ERCoP) should inform the MCA of any exercise or incidents including any implications on emergency response. If required, the MCA should be invited to take part in incident debriefs.

21.3 Review of Documentation

568. The Applicant will be responsible for reviewing and updating all documentation including the risk assessments, ERCoP, SMS and, if required, will convene a review panel of stakeholders to quantify risk.

569. Reviews of the risk register should be made after any of the following occurrences:

- Changes to the development, conditions of operation and prior to decommissioning;
- Planned reviews;
- Following an incident or exercise.

570. A review of potential risks should be carried out annually. A review of the response charts should be undertaken annually to ensure that response procedures are up to date and should include any amendments from audits, incident reports and identified deficiencies.

21.4 Inspection of Resources

571. All vessels, facilities, and equipment necessary for marine operations are to be subject to appropriate inspection and testing to determine fitness for purpose and availability in relation to their performance standards. This will include monitoring and inspection of all AtoNs to determine compliance with the performance standards specified by NLB.

21.5 Audit Performance

572. Auditing and performance review are the final steps in QHSE management systems. The feedback loop enables an organisation to reinforce, maintain and develop its ability to reduce risks to the fullest extent, and to ensure the continued effectiveness of the system. The Applicant will carry out audits and periodically evaluate the efficiency of the marine safety documentation.

573. The audits and possible corrective actions should be undertaken in accordance with standard procedures and results of the audits and reviews should be brought to the attention of all personnel having responsibility in the area involved.

21.6 Safety Management System

574. An integrated SMS, which ensures that the safety and environmental risks of those activities are ALARP, will be established. This includes the use of remote monitoring and switching for AtoNs to ensure that if a light is faulty a quick fix can be instigated, which will allow IALA availability requirements to be met.

21.7 Cable Monitoring

575. The subsea cable routes will be subject to periodic inspection post-construction to monitor the cable protection, including burial depths. Maintenance of the protection will be undertaken as necessary.

576. If exposed cables or ineffective protection measures are identified during post-construction monitoring (M030), these would be promulgated to relevant sea users including via Notice to Mariners and Kingfisher Bulletins. Where immediate risk was observed, the Applicant would also deploy additional temporary measures (such as a guard vessel or temporary buoyage) until such time as the risk was permanently mitigated.

577. Details will be included in full within the assessment of cable burial and protection document, to be produced post-consent.

21.8 Hydrographic Surveys

578. As required by Annex 4 of MGN 654, detailed and accurate hydrographic surveys will be undertaken periodically at intervals agreed with the MCA.

21.9 Decommissioning Plan

579. A Decommissioning Plan will be developed post consent (M020). With regards to hazards to shipping and navigation, this will also include consideration of the scenario where upon decommissioning and completion of removal operations, an obstruction is left on site (attributable to the Offshore Project) which is considered to be a danger to navigation and which it has not proved possible to remove. Such an obstruction may require marking until such time as it is either removed or no longer considered a danger to navigation, the continuing cost of which would need to be met by the Applicant. The Decommissioning Plan will be based on good decommissioning OWF practices at the time of decommissioning.

22 Summary

22.1 Consultation

580. The NRA process has included consultation with stakeholders of relevance to shipping and navigation. This has included consideration of the outputs of the scoping process, direct liaison with key stakeholders (both statutory and non-statutory), outreach to Regular Operators of the area, and a Hazard Workshop. Key stakeholders consulted include:

- MCA;
- NLB;
- UK Chamber of Shipping;
- RYA Scotland;
- SFF;
- Inverlussa;
- Navigare Logistics;
- Bakkafrost.

22.2 Existing Environment

22.2.1 Navigational Features

581. Key nearby features to the Offshore Project include the aquaculture sites within Loch Roag and the DWR approximately 2 nm northwest of the Offshore Project. The nearest harbour area is Loch Roag. Many charted anchorages can be found in Loch Roag, generally for small vessels and coasters. A military PEXA exists to the west of the Offshore Project.

22.2.2 Maritime Incidents

582. From DfT SAR helicopter taskings data recorded between April 2015 - March 2024, there was an average of between 4 - 5 SAR tasking per year in proximity to the Offshore Project, with the most common taskings being ‘Rescue/Recovery’ (48%).

583. Within the study area there was an average of 1 unique RNLI incident every 1 to 2 years with ‘Machinery Failure’ and ‘Person in Danger’ incidents noted. No incidents were recorded within the Array Area, with one incident involving a surfer recorded within the OCAS.

584. From MAIB data, 14 incidents occurred within proximity to the Offshore Project, corresponding to an average of 1 - 2 incidents per year. ‘Machinery Failure’ accounted for 43% of incidents. Fishing vessels were the most common vessel type involved in incidents, at 50%. No incidents were recorded within the Offshore Project.

22.2.3 Vessel Traffic Movements

585. From the 28-days of vessel traffic survey data recorded in winter and summer 2024 within the study area, there was an average of between 5 - 6 unique vessels per day recorded during the winter survey period, with an average of 1 unique vessel recorded per day within the Array Area and the OCAS. During the summer survey period, an average of between 7 - 8 unique vessels were recorded within the study area per day, with an average of 1 vessel per day within the Array Area, and an average of one vessel within the OCAS every 1 - 2 days.

586. The main vessel types within the study area during the winter survey period were fish farm support vessels (51%) and fishing vessels (31%). The main vessel types within the study area during the summer survey period were fishing vessels (31%) and cargo vessels (25%).

22.2.3.1 Main Commercial Vessel Routes

587. A total of 10 main commercial routes were identified from the vessel traffic survey data. The highest use main commercial routes operated within the DWR, with destinations such as the UK, Norway, and Russia. Vessels on this route were recorded on average once per day. Other routes with the highest vessel numbers included those between Murmansk (Russia) and the Mediterranean Sea, as well as between North America and the Skagerrak strait, both of which recorded an average of 3 vessels per week.

22.3 Future Case Vessel Traffic

588. Of the 10 main commercial routes identified, it is anticipated that 2 will deviate as a result of the Offshore Project. The largest percentage increase in terms of overall change in route length was to Route 5, with a 0.03% increase. The largest change on an absolute basis was to Route 7, with a 0.03 nm decrease.

22.4 Collision and Allision Risk Modelling

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

590. It was estimated that the return period of a vessel being involved in a collision post wind farm was 1,998 years assuming base case traffic levels. This represents a less than 1% increase in collision frequency compared to the pre wind farm base case result.

591. The powered allision return period post wind farm was estimated at 220,809 years assuming base case traffic levels. The corresponding drifting allision return period post wind farm was estimated at 37,790 years. The fishing vessel allision return period was estimated at 14 years.

22.5 Risk Statement

592. Overall, the risk assessment concluded that there will be no significant risks (not ALARP) arising from the Offshore Project in isolation with embedded mitigations in place during the construction, operation and maintenance or decommissioning phases, assuming the implementation of additional mitigation where appropriate as identified by the FSA (see **Section 3**).

593. The cumulative risk assessment concluded that there will be no significant cumulative risks (not ALARP) arising from the Offshore Project in combination with cumulative developments with embedded mitigations in place during the construction, operation and maintenance or decommissioning phases, again assuming the implementation of additional mitigation where appropriate as identified by the FSA.

594. The significance of risk for all hazards across the in isolation and cumulative risk assessments were predicted to be broadly acceptable or tolerable with mitigation which are considered ALARP.

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Appendix A MGN 654 Checklist

595. The MGN 654 checklist can be divided into 2 distinct checklists, 1 considering the main MGN 654 guidance document and 1 considering the Methodology for Assessing Marine Navigational Safety and Emergency Response Risks of OREIs (MCA, 2021) which serves as Annex 1 to MGN 654.

596. The checklist for the main MGN 654 guidance document is presented in **Table A.1**. Following this, the checklist for the MCA's methodology annex is presented in **Table A.2**. For both checklists, references to where the relevant information and/or assessment is provided in the NRA is given.

Table A.1 MGN 654 Checklist for Main Document for Shipping and Navigation

Issue	Compliance	Reference and Notes
Site and Installation Co-ordinates. Developers are responsible for ensuring that formally agreed coordinates and subsequent variations of site perimeters and individual OREI structures are made available, on request, to interested parties at relevant project stages, including application for consent, development, array variation, operation and decommissioning. This should be supplied as authoritative Geographical Information System (GIS) data, preferably in Environmental Systems Research Institute (ESRI) format. Metadata should facilitate the identification of the data creator, its date and purpose, and the geodetic datum used. For mariners' use, appropriate data should also be provided with latitude and longitude coordinates in WGS84 (European Terrestrial Reference System 1989 (ETRS89)) datum.		
Traffic Survey. Includes:		
All vessel types	✓	**Section 10: Vessel Traffic Movements** All vessel types are considered with specific breakdowns by vessel type given for the Array Area and OCAS (see **Section 10**).
At least 28 days duration, within either 12 or 24 months prior to submission of the ES.	✓	**Section 5.2: Vessel Traffic Surveys** A total of 28 full days of vessel traffic survey data from winter and summer 2024 has been assessed within the study area.
Multiple data sources	✓	**Section 5.2: Vessel Traffic Surveys** The vessel traffic survey data includes AIS, visual observations and Radar for the summer and winter periods in order to ensure maximal coverage of vessels not broadcasting on AIS. **Section 5: Data Sources** Additional data sources including the long term AIS data and consultation input have also been considered.
Seasonal variations	✓	**Section 5.2: Vessel Traffic Surveys** A total of 28 full days of vessel traffic survey data from winter and summer 2024 has been assessed within the study area. **Section 5: Data Sources** Additional long term data sources including the long term AIS data have also been considered.

Issue	Compliance	Reference and Notes
MCA consultation	✓	**Section 4: Consultation** The MCA has been consulted as part of the NRA process including through the Hazard Workshop.
General Lighthouse Authority (GLA) consultation	✓	**Section 4: Consultation** NLB has been consulted as part of the NRA process including through the Hazard Workshop.
UK Chamber of Shipping consultation	✓	**Section 4: Consultation** The UK Chamber of Shipping has been consulted as part of the NRA process including through the Hazard Workshop.
Recreational and fishing vessel consultation	✓	**Section 4: Consultation** RYA Scotland, the SFF, the SPFA, and the SWFPA have been invited to consult as part of the NRA process including through the Hazard Workshop. Extensive fisheries consultation has also been undertaken through the CFLO.
Port and navigation authorities consultation, as appropriate	✓	**Section 4: Consultation** Stornoway Port and Western Isles Council have been invited to consult as part of the NRA process including through the Hazard Workshop.
Assessment of the cumulative and individual effects of (as appropriate):		
i. Proposed OREI site relative to areas used by any type of marine craft.	✓	**Section 10: Vessel Traffic Movements** Vessel traffic data in proximity to the Offshore Project has been analysed.
ii. Numbers, types and sizes of vessels presently using such areas.	✓	**Section 10: Vessel Traffic Movements** Vessel traffic data in proximity to the Offshore Project has been analysed and includes breakdowns of daily vessel count, vessel type and vessel size.
iii. Non-transit uses of the area, e.g. fishing, day cruising of leisure craft, racing, aggregate dredging, personal watercraft etc.	✓	**Section 7: Navigational Features** There are no marine aggregate dredging areas in proximity to the Project. **Section 10: Vessel Traffic Movements** Non-transit users were identified in the vessel traffic survey data and included fishing vessels engaged in fishing activities and recreational tours.
iv. Whether these areas contain transit routes used by coastal or deep-draught or international scheduled vessels on passage.	✓	**Section 10: Vessel Traffic Movements** Main commercial routes have been identified using the principles set out in MGN 654 in proximity to the Array Area (see **Section 11.2**), with these routes taking into account coastal, deep-draught and internationally scheduled vessels.
v. Alignment and proximity of the site relative to adjacent shipping routes.	✓	**Section 7: Navigational Features** A DWR runs parallel to the Array Area at approximately 1.9 nm northwest (see **Section 7**).

Issue	Compliance	Reference and Notes
vi. Whether the nearby area contains prescribed routeing schemes or precautionary areas.	✓	**Section 7: Navigational Features** **Section 7.6** identifies relevant areas such as military PEXAs in proximity to the Offshore Project.
vii. Proximity of the site to areas used for anchorage (charted or uncharted), safe haven, port approaches and pilot boarding or landing areas.	✓	**Section 7: Navigational Features** **Sections 7.2** and **7.4** identify nearby ports and anchorages.
viii. Whether the site lies within the jurisdiction of a port and/or navigation authority.	✓	**Section 7: Navigational Features** **Section 7** identifies nearby ports and harbours. The Offshore Project does not lie within any jurisdiction of a port and/or harbour authority.
ix. Proximity of the site to existing fishing grounds, or to routes used by fishing vessels to such grounds.	✓	**Section 10: Vessel Traffic Movements** Fishing vessel movements and activities are considered within the study area.
x. Proximity of the site to offshore firing/bombing ranges and areas used for any marine military purposes.	✓	**Section 7: Navigational Features** **Section 7.6** identifies military PEXAs in proximity to the Offshore Project.
xi. Proximity of the site to existing or proposed submarine cables or pipelines, offshore oil/gas platform, marine aggregate dredging, marine archaeological sites or wrecks, Marine Protected Area or other exploration/exploitation sites.	✓	**Section 7: Navigational Features** There are no marine aggregate dredging areas in the region. **Section 7.8** identifies charted wrecks in proximity to the Project. **Section 7.7** considers subsea cables. **Section 14: Cumulative Overview** There are no planned subsea cables in proximity to the Offshore Project.
xii. Proximity of the site to existing or proposed OREI developments, in cooperation with other relevant developers, within each round of lease awards.	✓	**Section 7: Navigational Features** There are no baseline OREIs in proximity to the Offshore Project. **Section 14: Cumulative Overview** Planned nearby OREIs are considered in **Section 14.1**.
xiii. Proximity of the site relative to any designated areas for the disposal of dredging spoil or other dumping grounds.	✓	**Section 7: Navigational Features** There are no spoil grounds or other dumping grounds in proximity to the Offshore Project.
xiv. Proximity of the site to aids to navigation and/or VTS in or adjacent to the area and any impact thereon.	✓	**Section 7: Navigational Features** **Section 7.5** identifies AtoNs in proximity to the Offshore Project.

Issue	Compliance	Reference and Notes
xv. Researched opinion using computer simulation techniques with respect to the displacement of traffic and, in particular, the creation of "choke points" in areas of high traffic density and nearby or consented OREI sites not yet constructed.	✓	**Section 16: Collision and Allision Risk Modelling** Collision risk modelling has been undertaken for the Turbine Area and identifies areas where collision risk is greatest.
xvi. With reference to xv. above, the number and type of incidents to vessels which have taken place in or near to the proposed site of the OREI to assess the likelihood of such events in the future and the potential impact of such a situation.	✓	**Section 9: Emergency Response** Historical vessel incident data published by the MAIB (**Section 9.5**), RNLI (**Section 9.2**) and DfT (**Section 9.1**) in proximity to the Offshore Project has been considered alongside historical OWF incident data throughout the UK (see **Section 9**).
xvii. Proximity of the site to areas used for recreation which depend on specific features of the area.	✓	**Section 10: Vessel Traffic Movements** Non-transit users were identified in the vessel traffic survey data and included recreational activity within Loch Roag.
Predicted effect of OREI on traffic and interactive boundaries. Where appropriate, the following should be determined:		
a. The safe distance between a shipping route and OREI boundaries.	✓	**Section 15: Future Case Vessel Traffic** A methodology for post wind farm routeing is outlined and includes a minimum distance of 1 nm from offshore installations and boundaries.
b. The width of a corridor between sites or OREIs to allow safe passage of shipping.	✓	No defined navigation corridors have been noted in relation to the Offshore Project.
OREI structures. The following should be determined:		
a. Whether any feature of the OREI, including auxiliary platforms outside the main generator site, mooring and anchoring systems, inter-device and export cabling could pose any type of difficulty or danger to vessels underway, performing normal operations, including fishing anchoring and emergency response.	✓	**Section 16: Collision and Allision Risk Modelling** Collision and allision risk modelling has been undertaken for the Turbine Area. **Section 18: Risk Assessment – In Isolation** The hazards due to the Project have been assessed for each phase and include consideration of routeing traffic, anchoring activity and effects on emergency response capability.

Issue	Compliance	Reference and Notes
b. Clearances of fixed or floating WTG blades above the sea surface are not less than 22 m (above MHWS for fixed). Floating turbines allow for degrees of motion.	✓	**Section 17: Mitigation Measures** The minimum blade tip height is included as embedded mitigation (see **Sections 6.2** and **17**).
c. Underwater devices: i. Changes to charted depth; ii. Maximum height above seabed; and iii. Under keel clearance.	✓	**Section 6.5: Maximum Design Scenario** Cable specifications are included in the MDS for cables (see **Table 6-5**).
d. Whether structure block or hinder the view of other vessels or other navigational features.	✓	**Section 18: Risk Assessment – In Isolation** The hazards due to the Offshore Project have been assessed for each phase and include consideration of the potential for vessels navigating in proximity to structures to be visually obscured.
The effects of tides, tidal streams and weather. It should be determined whether:		
a. Current maritime traffic flows and operations in the general area are affected by the depth of water in which the proposed installation is situated at various states of the tide, i.e. whether the installation could pose problems at high water which do not exist at low water conditions, and vice versa.	✓	**Section 6.5: Maximum Design Scenario** The range of water depths within the Array Area is provided in the MDS. **Section 8: Meteorological Ocean Data** Various states of the tide local to the Offshore Project are provided. **Section 10: Vessel Traffic Movements** Vessel traffic data in proximity to the Offshore Project has been analysed. **Section 16: Collision and Allision Risk Modelling** Collision and allision risk modelling takes into account tidal conditions.
b. The set and rate of the tidal stream, at any state of the tide, has a significant effect on vessels in the area of the OREI site.	✓	**Section 8: Meteorological Ocean Data** Various states of the tide local to the Offshore Project are provided. **Section 16: Collision and Allision Risk Modelling** The collision and allision risk modelling takes into account tidal conditions.
c. The maximum rate tidal stream runs parallel to the major axis of the proposed site layout, and, if so, its effect.	✓	
d. The set is across the major axis of the layout at any time, and, if so, at what rate.	✓	

Issue	Compliance	Reference and Notes
e. In general, whether engine failure or other circumstance could cause vessels to be set into danger by the tidal stream, including unpowered vessels and small, low speed craft.	✓	**Section 8: Meteorological Ocean Data** Various states of the tide local to the Offshore Project are provided and it is noted that hazards are not anticipated at high or low water only. **Section 16: Collision and Allision Risk Modelling** The drifting allision risk model considers tidal conditions and assesses whether machinery failure could cause vessels to be set into danger.
f. The structures themselves could cause changes in the set and rate of the tidal stream.	✓	**Section 8: Meteorological Ocean Data** Provides meteorological data in proximity to the Offshore Project relating to various states of the tide and notes that no effects are anticipated.
g. The structures in the tidal stream could be such as to produce siltation, deposition of sediment or scouring, affecting navigable water depths in the wind farm area or adjacent to the area.	✓	**Section 8: Meteorological Ocean Data** Provides meteorological data in proximity to the Offshore Project relating to various states of the tide.
h. The site, in normal, bad weather, or restricted visibility conditions, could present difficulties or dangers to craft, including sailing vessels, which might pass in close proximity to it.	✓	**Section 8: Meteorological Ocean Data** Weather and visibility data local to the Offshore Project is provided. **Section 10: Vessel Traffic Movements** Vessel traffic data in proximity to the Offshore Project has been analysed including recreational vessels. **Section 12: Adverse Weather Vessel Traffic Movements** Vessel traffic during periods of key weather events were analysed with no clear adverse weather routeing identified.
i. The structures could create problems in the area for vessels under sail, such as wind masking, turbulence or sheer.	✓	**Section 8: Meteorological Ocean Data** The hazards due to the Offshore Project have been assessed for each phase and include consideration of internal allision risk for vessels under sail.
j. In general, taking into account the prevailing winds for the area, whether engine failure or other circumstances could cause vessels to drift into danger, particularly if in conjunction with a tidal set such as referred to above.	✓	**Section 16: Collision and Allision Risk Modelling** The drifting allision risk model considers weather and tidal conditions and assesses whether machinery failure could cause vessels to be set into danger.

Issue	Compliance	Reference and Notes
Assessment of access to and navigation within, or close to, an OREI. To determine the extent to which navigation would be feasible within the OREI site itself by assessing whether:		
a. Navigation within or close to the site would be safe:		
i. For all vessels.	✓	**Section 4 Consultation** **Section 4.1** outlines Regular Operator consultation undertaken following the vessel traffic surveys. **Section 12: Adverse Weather Vessel Traffic Movements** Alternative routeing used by Regular Operators during periods of adverse weather are discussed. **Section 16: Collision and Allision Risk Modelling** Collision and allision risk modelling has been undertaken for the Array Area and Turbine Area and includes use of post wind farm routeing, as well as taking account of tidal and weather conditions.
ii. For specified vessel types, operations and/or sizes.	✓	
iii. In all directions or areas.	✓	
iv. In specified directions or areas.	✓	
v. In specified tidal, weather or other conditions.	✓	
b. Navigation in and/or near the site should be prohibited or restricted:		
i. For specified vessel types, operations and/or sizes.	✓	**Section 13: Navigation, Communication and Position Fixing Equipment** Potential hazards on navigation of the different communications and position fixing devices used in and around OWFs are assessed. **Section 16: Collision and Allision Risk Modelling** Collision and allision risk modelling has been undertaken for the Array Area and Turbine Area and includes use of post wind farm routeing which assumes commercial vessel traffic avoids the Array Area. **Section 17: Mitigation Measures** Outlines the embedded mitigation measures to be implemented to reduce the significance of risk of shipping and navigation hazards including the application for Safety Zones.
ii. In respect of specific activities.	✓	
iii. In all areas or directions.	✓	
iv. Prohibited in specified areas or directions.	✓	
v. In specified tidal or whether conditions.	✓	
c. Where it is not feasible for vessels to access or navigate through the site it could cause navigational, safety or routeing problems for vessels operating in the area e.g. by preventing vessels from responding to calls for assistance from persons in distress.	✓	**Section 16: Collision and Allision Risk Modelling** Collision and allision risk modelling has been undertaken for the Array Area and Turbine Area and includes use of post wind farm routeing which assumes commercial vessel traffic avoids the Array Area.

Issue	Compliance	Reference and Notes
d. Guidance on the calculation of safe distance of OREI boundaries from shipping routes has been considered.	✓	**Section 18: Risk Assessment – In Isolation** The hazards due to the Project have been assessed for each phase and include consideration of the Shipping Route Template and PIANC guidance for collision avoidance in relation to the DWR located in proximity to the Array Area. **Section 15: Future Case Vessel Traffic** The methodology applied when considering the safe distance at which main routes should be deviated around offshore installations has been described and includes consideration of the Shipping Route Template (see **Section 15.5.1**).
SAR, maritime assistance service, counter pollution and salvage incident response.		
The MCA, through HM Coastguard, is required to provide SAR and emergency response within the sea area occupied by all OREIs in UK waters. To ensure that such operations can be safely and effectively conducted, certain requirements must be met by developers and operators.		
a. An ERCoP will be developed for the construction, operation and decommissioning phases of the OREI.	✓	**Section 17: Mitigation Measures** Embedded mitigation measures have been proposed and are summarised in **Section 17** including compliance with MGN 654, which requires the creation of an ERCoP.
b. The MCA's guidance document Offshore Renewable Energy Installations: Requirements, Guidance and Operational Considerations for Search and Rescue and Emergency Response (MCA, 2024) for the design, equipment and operation requirements will be followed.	✓	**Section 17: Mitigation Measures** Embedded mitigation measures have been proposed and are summarised in **Section 17** including compliance with MGN 654, which requires the fulfilment of requirements in the stated guidance document.
c. A SAR checklist will be completed to record discussions regarding the requirements, recommendations and considerations outlined in **Annex 5** (to be agreed with MCA).	✓	**Section 17: Mitigation Measures** Embedded mitigation measures have been proposed and are summarised in **Section 17** including compliance with MGN 654, which requires the SAR checklist to be completed.
Hydrography. In order to establish a baseline, confirm the safe navigable depth, monitor seabed mobility and to identify underwater hazards, detailed and accurate hydrographic surveys are included or acknowledged for the following stages and to MCA specifications:		
i. Pre-construction: The proposed generating assets area and proposed cable route.	✓	**Section 17: Mitigation Measures** Embedded mitigation measures have been proposed and are summarised in **Section 17** including compliance with

Issue	Compliance	Reference and Notes
ii. On a pre-established periodicity during the life of the development.	✓	MGN 654, which requires the specified hydrographic surveys to be completed.
iii. Post construction: Cable route(s).	✓	
iv. Post decommissioning of all or part of the development: the installed generating assets area and cable route.	✓	
Communications, Radar and positioning systems. To provide researched opinion of a generic and, where appropriate, site specific nature concerning whether:		
a. The structures could produce radio interference such as shadowing, reflections or phase changes, and emissions with respect to any frequencies used for marine positioning, navigation and timing (PNT) or communications, including GMDSS and AIS, whether ship borne ashore or fitted to any of the proposed structures, to:		
i. Vessels operating at a safe navigational distance.	✓	**Section 13: Navigation, Communication and Position Fixing Equipment** Potential hazards on navigation of the different communications and position fixing devices used in and around OWFs are assessed.
ii. Vessels by the nature of their work necessarily operating at less than the safe navigational distance to the OREI, e.g. support vessels, survey vessels, SAR assets.	✓	
iii. Vessels by the nature of their work necessarily operating within the OREI.	✓	
b. The structures could produce radar reflections, blind spots, shadow areas or other adverse effects:		
i. Vessel to vessel	✓	**Section 13: Navigation, Communication and Position Fixing Equipment** Potential hazards on navigation of the different communications and position fixing devices used in and around OWFs are assessed.
ii. Vessel to shore	✓	
iii. VTS radar to vessel	✓	
iv. Racon to/from vessel	✓	
c. The structures and generators might produce SONAR interference affecting fishing, industrial or military systems used in the area.	✓	**Section 13: Navigation, Communication and Position Fixing Equipment** **Section 13.8** assesses the potential risk of SONAR interference due to the Offshore Project.
d. The site might produce acoustic noise which could mask prescribed sound signals.	✓	**Section 13: Navigation, Communication and Position Fixing Equipment** **Section 13.9** assesses the potential risk of noise due to the Offshore Project.

Issue	Compliance	Reference and Notes
e. Generators and the seabed cabling within the site onshore might produce EMFs affecting compasses and other navigation systems.	✓	**Section 13: Navigation, Communication and Position Fixing Equipment** **Section 13.6** assesses the potential risk of electromagnetic interference due to the Offshore Project.
Risk mitigation measures recommended for OREI during construction, operation and decommissioning.		
Mitigation and safety measures will be applied to the OREI development appropriate to the level and type of risk determined during the EIA. The specific measures to be employed will be selected in consultation with the MCA and will be listed in the Applicant's EIA Report. These will be consistent with international standards contained in, for example, Chapter V of SOLAS (IMO, 1974), and could include any or all of the following:		
i. Promulgation of information and warnings through notices to mariners and other appropriate MSI dissemination methods.	✓	**Section 17: Mitigation Measures** Embedded mitigation measures have been proposed and are summarised in **Section 17** including the promulgation of information.
ii. Continuous watch by multi-channel VHF, including DSC.	✓	**Section 17: Mitigation Measures** Embedded mitigation measures have been proposed and are summarised in **Section 17** including marine coordination.
iii. Safety Zones of appropriate configuration, extent and application to specified vessels[3].	✓	**Section 17: Mitigation Measures** Embedded mitigation measures have been proposed and are summarised in **Section 17** including use of Safety Zones.
iv. Designation of the site as an area to be avoided (ATBA)	✓	**Section 6: Project Description** It is not planned to designate the Array Area as an ATBA (see **Section 6.1.1**).
v. Provision of aids to navigation as determined by the GLA.	✓	**Section 17: Mitigation Measures** Embedded mitigation measures have been proposed and are summarised in **Section 17** including the provision of AtoNs in accordance with NLB and MCA requirements.
vi. Implementation of routeing measures within or near to the development.	✓	It is not planned to implement any new routeing measures within or near to the Offshore Project.
vii. Monitoring by radar, AIS, Closed Circuit Television (CCTV) or other agreed means.	✓	**Section 17: Mitigation Measures** As required under MGN 654 (MCA, 2021) the Applicant will agree suitable site mitigation with the MCA via the SAR checklist.
viii. Appropriate means for OREI operators to notify, and provide evidence of, the infringement of Safety Zones.	✓	Means for notifying and providing evidence of the infringement of Safety Zones will be provided in the Safety Zone Application, submitted post consent.

[3] As per SI 2007 No 1948 "The Electricity (Offshore Generating Stations) (Safety Zones) (Application Procedures and Control of Access) Regulations 2007.

Issue	Compliance	Reference and Notes
ix. Creation of an ERCoP with the MCA's SAR branch for the construction phase onwards.	✓	**Section 17: Mitigation Measures** Embedded mitigation measures have been proposed and are summarised in **Section 17** including compliance with MGN 654, which requires the creation of an ERCoP.
x. Use of guard vessels, where appropriate.	✓	**Section 17: Mitigation Measures** Embedded mitigation measures have been proposed and are summarised in **Section 17** including the use of guard vessels where appropriate.
xi. Update NRAs every 2 years, e.g. at testing sites.	✓	Not applicable to the Offshore Project.
xii. Device-specific or array-specific NRAs.	✓	**Section 6.5: Maximum Design Scenario** All offshore elements of the Offshore Project have been considered in this NRA including Array Area and OCAS (surface and subsea) infrastructure. **Section 17: Mitigation Measures** Embedded mitigation measures have been proposed and are summarised in **Section 17** including a CBRA undertaken prior to construction which will serve as additional assessment relating to shipping and navigation.
xiii. Design of OREI structures to minimise risk to contacting vessels or craft.	✓	There is no additional risk posed to craft compared to previous OWFs and so no additional measures are identified.
xiv. Any other measures and procedures considered appropriate in consultation with other stakeholders.	✓	**Section 17: Mitigation Measures** Embedded and additional mitigation measures have been proposed and are summarised in **Section 17**.

Table A.2 MGN 654 Annex 1 Checklist for Shipping and Navigation

Item	Compliance	Comments
A risk claim is included that is supported by a reasoned argument and evidence.	✓	**Section 18: Risk Assessment – In Isolation** The risk assessment provides a risk claim for a range of hazards based on a number of inputs including baseline data, quantitative modelling, expert opinion, stakeholder concerns and lessons learnt from existing offshore developments.

Item	Compliance	Comments
Description of the marine environment.	✓	**Section 7: Navigational Features** Navigational features in proximity to the Offshore Project have been described including (but not limited to) local ports and harbours, aquaculture sites, IMO routeing measures, key AtoNs and charted wrecks. **Section 14: Cumulative Overview** Potential future offshore developments have been screened into the cumulative risk assessment where a cumulative or in combination activity has been identified based upon the location and distance from the Array Area. Developments screened include other OWFs and a spaceport.
SAR overview and assessment.	✓	**Section 9: Emergency Response and Incident Overview** Existing SAR resources in proximity to the Offshore Project are summarised including the UK SAR operations contract, RNLI stations, and HMCG stations.
Description of the OREI development and how it changes the marine environment.	✓	**Section 6: Project Description** The maximum extent of the Offshore Project for which any shipping and navigation hazards are assessed is provided including a description of the Offshore Project, associated infrastructure, programme, and indicative vessel and helicopter numbers during the construction and operation and maintenance phases.
Analysis of the vessel traffic, including base case and future traffic densities and types.	✓	**Section 10: Vessel Traffic Movements** Vessel traffic data in proximity to the Array Area has been analysed and includes vessel density and breakdowns of vessel type. **Section 15: Future Case Vessel Traffic** Future vessel traffic levels have been considered, with consideration of increases in commercial vessel activity, commercial fishing vessel and recreational vessel activity, and traffic associated with Project operations. Additionally, worst-case alternative routeing for commercial traffic has been considered.
Status of the hazard log: ▪ Hazard identification; ▪ Risk assessment; ▪ Influences on level of risk; ▪ Tolerability of risk; ▪ Risk matrix.	✓	**Section 3: Navigational Risk Assessment Methodology** A tolerability matrix has been defined to determine the tolerability (significance) of risks. **Appendix B: Hazard Log** The complete hazard log is presented and includes a description of the hazards considered, possible causes, consequences (most likely and worst-case) and relevant embedded mitigation measures. Using this information, each hazard is then ranked in terms of frequency of occurrence and severity of consequence to give a tolerability (significance) level.

Item	Compliance	Comments
NRA: ▪ Appropriate risk assessment; ▪ MCA acceptance for assessment techniques and tools; ▪ Demonstration of results; ▪ Limitations.	✓	**Section 2: Guidance and Legislation** MGN 654 and the IMO's FSA guidelines are the primary guidance documents used for the assessment. **Section 16: Collision and Allision Risk Modelling** Provides quantification of collision and allision risk resulting from the with the results outlined numerically and graphically, where appropriate.
Risk control log	✓	**Section 20: Risk Control Log** Provides the risk control log which summarises the assessment of shipping and navigation hazards scoped into the risk assessment. This includes the proposed embedded mitigation measures, frequency of occurrence, severity of consequence and significance of risk, per hazard.

Appendix B Hazard Log

The complete hazard log, created following the Hazard Workshop, is presented in **Table B 1**. Definitions of the rankings used in the Hazard Log are detailed in **Section 3**.

Table B 1 Hazard Log

User	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							Further Mitigation Required	Additional Comments
						Frequency	Consequences					Risk		Frequency	Consequences					Risk		
							People	Environment	Property	Business	Average Consequence				People	Environment	Property	Business	Average Consequence			
Vessel displacement due to activities associated with the Project or due to the presence of the Project																						
Commercial vessels (excluding fish farm support vessels)	Array Area	C/D	Compliance with Marine Guidance Note (MGN) 654 and its annexes. Appropriate marking on United Kingdom Hydrographic Office (UKHO) Admiralty Charts. Promulgation of information as required. Buoyed construction area in agreement with Northern Lighthouse Board (NLB). Marking and lighting in agreement with NLB, Maritime and Coastguard Agency (MCA), and Civil Aviation Authority (CAA) (and in line with International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA) Recommendation G1162). Application for safety zones	Presence of buoyed construction or decommissioning area. Construction or decommissioning vessels which are restricted in their ability to manoeuvre (RAM). Adverse weather.	Displacement with manageable effects on schedules.	4	1	1	1	1	1.0	Broadly Acceptable	Displacement with effects on schedules and compliance with COLREGs.	2	1	2	1	2	1.5	Broadly Acceptable		

User	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							Further Mitigation Required	Additional Comments
						Frequency	Consequences					Risk		Frequency	Consequences					Risk		
							People	Environment	Property	Business	Average Consequence				People	Environment	Property	Business	Average Consequence			
			during construction.																			
		O	Compliance with MGN 654 and its annexes. Appropriate marking on UKHO Admiralty Charts. Promulgation of information as required. Marking and lighting in agreement with NLB, MCA, and CAA (and in line with IALA Recommendation G1162). Application for safety zones during major maintenance.	Presence of surface structures. Maintenance vessels which are RAM. Adverse weather.	Displacement with manageable effects on schedules.	4	1	1	1	1	1.0	Broadly Acceptable	Displacement with effects on schedules and compliance with COLREGs.	2	1	2	1	2	1.5	Broadly Acceptable		
	OCAS	C/D	Compliance with MGN 654 and its annexes. Appropriate marking on UKHO	Construction or decommissioning vessels which are RAM. Adverse weather.	Displacement with manageable effects on schedules.	3	1	1	1	1	1.0	Broadly Acceptable	Displacement with effects on schedules and compliance with COLREGs.	1	1	2	1	2	1.5	Broadly Acceptable		

User	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							Further Mitigation Required	Additional Comments
						Frequency	Consequences					Risk		Frequency	Consequences					Risk		
							People	Environment	Property	Business	Average Consequence				People	Environment	Property	Business	Average Consequence			
			Admiralty Charts. Promulgation of information as required.																			
		O	Compliance with MGN 654 and its annexes. Appropriate marking on UKHO Admiralty Charts. Promulgation of information as required.	Maintenance vessels which are RAM. Adverse weather.	Displacement with manageable effects on schedules.	2	1	1	1	1	1.0	Broadly Acceptable	Displacement with effects on schedules and compliance with COLREGs.	1	1	2	1	2	1.5	Broadly Acceptable		
Fish Farm Support Vessels	Array Area	C/D	Compliance with MGN 654 and its annexes. Appropriate marking on UKHO Admiralty Charts. Promulgation of information as required. Buoyed construction area in agreement with NLB. Marking and lighting in agreement with NLB, MCA, and CAA (and in line with IALA Recommendation G1162). Application for safety zones during construction.	Presence of buoyed construction or decommissioning area. Construction or decommissioning vessels which are RAM. Adverse weather.	Displacement with manageable effects on schedules.	5	1	1	1	1	1.0	Tolerable with Mitigation	Displacement with effects on schedules and compliance with COLREGs.	3	1	2	1	2	1.5	Broadly Acceptable		Bakkafrost indicated that due to a factory closure in Stornoway, fish farm support vessel routes are not currently operating between the Array Area and the coast. Bakkafrost confirmed that fish farm support vessels routeing between the Array Area and the coast are not restricted by water depths.

User	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							Further Mitigation Required	Additional Comments
						Frequency	Consequences					Risk		Frequency	Consequences					Risk		
							People	Environment	Property	Business	Average Consequence				People	Environment	Property	Business	Average Consequence			
		O	Compliance with MGN 654 and its annexes. Appropriate marking on UKHO Admiralty Charts. Promulgation of information as required. Marking and lighting in agreement with NLB, MCA, and CAA (and in line with IALA Recommendation G1162). Application for safety zones during major maintenance.	Presence of surface structures. Maintenance vessels which are RAM. Adverse weather.	Displacement with manageable effects on schedules.	5	1	1	1	1	1.0	Tolerable with Mitigation	Displacement with effects on schedules and compliance with COLREGs.	3	1	2	1	2	1.5	Broadly Acceptable		
	OCAS	C/D	Compliance with MGN 654 and its annexes. Appropriate marking on UKHO Admiralty Charts. Promulgation of information as required.	Construction or decommissioning vessels which are RAM. Adverse weather.	Displacement with manageable effects on schedules.	5	1	1	1	1	1.0	Tolerable with Mitigation	Displacement with effects on schedules and compliance with COLREGs.	3	1	2	1	2	1.5	Broadly Acceptable		
		O	Compliance with MGN 654 and its annexes. Appropriate marking on UKHO Admiralty Charts. Promulgation of information as required.	Maintenance vessels which are RAM. Adverse weather.	Displacement with manageable effects on schedules.	4	1	1	1	1	1.0	Broadly Acceptable	Displacement with effects on schedules and compliance with COLREGs.	2	1	2	1	2	1.5	Broadly Acceptable		

User	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							Further Mitigation Required	Additional Comments
						Frequency	Consequences					Risk		Frequency	Consequences					Risk		
							People	Environment	Property	Business	Average Consequence				People	Environment	Property	Business	Average Consequence			
Commercial fishing vessels in transit	Array Area	C/D	Compliance with MGN 654 and its annexes. Appropriate marking on UKHO Admiralty Charts. Promulgation of information as required. Buoyed construction area in agreement with NLB. Marking and lighting in agreement with NLB, MCA, and CAA (and in line with IALA Recommendation G1162). Application for safety zones during construction.	Presence of buoyed construction or decommissioning area. Construction or decommissioning vessels which are RAM. Adverse weather.	Displacement with manageable effects on routines.	5	1	1	1	1	1.0	Tolerable with Mitigation	Displacement with effects on routines and compliance with COLREGs.	4	1	2	1	2	1.5	Broadly Acceptable		
		O	Compliance with MGN 654 and its annexes. Appropriate marking on UKHO Admiralty Charts. Promulgation of information as required. Marking and lighting in agreement with NLB, MCA, and CAA (and in line with IALA Recommendation	Presence of surface structures. Maintenance vessels which are RAM. Adverse weather.	Displacement with manageable effects on routines.	5	1	1	1	1	1.0	Tolerable with Mitigation	Displacement with effects on routines and compliance with COLREGs.	4	1	2	1	2	1.5	Broadly Acceptable		

User	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							Further Mitigation Required	Additional Comments
						Frequency	Consequences					Risk		Frequency	Consequences					Risk		
							People	Environment	Property	Business	Average Consequence				People	Environment	Property	Business	Average Consequence			
			G1162). Application for safety zones during major maintenance.																			
	OCAS	C/D	Compliance with MGN 654 and its annexes. Appropriate marking on UKHO Admiralty Charts. Promulgation of information as required.	Construction or decommissioning vessels which are RAM. Adverse weather.	Displacement with manageable effects on routines.	4	1	1	1	1	1.0	Broadly Acceptable	Displacement with effects on routines and compliance with COLREGs.	2	1	2	1	2	1.5	Broadly Acceptable		
	OCAS	O	Compliance with MGN 654 and its annexes. Appropriate marking on UKHO Admiralty Charts. Promulgation of information as required.	Maintenance vessels which are RAM. Adverse weather.	Displacement with manageable effects on routines.	3	1	1	1	1	1.0	Broadly Acceptable	Displacement with effects on routines and compliance with COLREGs.	1	1	2	1	2	1.5	Broadly Acceptable		
Recreational vessels (2.5 to 24m length)	Array Area	C/D	Compliance with MGN 654 and its annexes. Appropriate marking on UKHO Admiralty Charts. Promulgation of information as required. Buoyed construction area in agreement with NLB. Marking and	Presence of buoyed construction or decommissioning area. Construction or decommissioning vessels which are RAM. Adverse weather.	Displacement with manageable effects on routines.	5	1	1	1	1	1.0	Tolerable with Mitigation	Displacement with effects on routines and compliance with COLREGs.	3	1	1	1	2	1.3	Broadly Acceptable		

User	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	Further Mitigation Required	Additional Comments
			lighting in agreement with NLB, MCA, and CAA (and in line with IALA Recommendation G1162). Application for safety zones during construction.																			
		O	Compliance with MGN 654 and its annexes. Appropriate marking on UKHO Admiralty Charts. Promulgation of information as required. Marking and lighting in agreement with NLB, MCA, and CAA (and in line with IALA Recommendation G1162). Application for safety zones during major maintenance.	Presence of surface structures. Maintenance vessels which are RAM. Adverse weather.	Displacement with manageable effects on routines.	5	1	1	1	1	1.0	Tolerable with Mitigation	Displacement with effects on routines and compliance with COLREGs.	3	1	1	1	2	1.3	Broadly Acceptable		
	OCAS	C/D	Compliance with MGN 654 and its annexes. Appropriate marking on UKHO Admiralty Charts. Promulgation of	Construction or decommissioning vessels which are RAM. Adverse weather.	Displacement with manageable effects on routines.	5	1	1	1	1	1.0	Tolerable with Mitigation	Displacement with effects on routines and compliance with COLREGs.	2	1	1	1	2	1.3	Broadly Acceptable		

User	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	Further Mitigation Required	Additional Comments
			information as required.																			
		O	Compliance with MGN 654 and its annexes. Appropriate marking on UKHO Admiralty Charts. Promulgation of information as required.	Maintenance vessels which are RAM. Adverse weather.	Displacement with manageable effects on routines.	4	1	1	1	1	1.0	Broadly Acceptable	Displacement with effects on routines and compliance with COLREGs.	1	1	1	1	2	1.3	Broadly Acceptable		
Increased vessel to vessel collision risk between third-party vessels due to vessel displacement																						
Commercial vessels (excluding fish farm support vessels)	Array Area	C/D	Compliance with MGN 654 and its annexes. Appropriate marking on UKHO Admiralty Charts. Promulgation of information as required. Buoyed construction area in agreement with NLB. Marking and lighting in agreement with NLB, MCA, and CAA (and in line with IALA Recommendation G1162). Application for safety zones during construction. MPCP.	Presence of buoyed construction or decommissioning area. Construction or decommissioning vessels which are RAM. Adverse weather. Reduction of navigable sea room.	Displacement results in an increase in encounters and potential for low impact collision to occur.	2	2	2	2	3	2.3	Broadly Acceptable	Displacement results in an increase in encounters and potential for high impact collision to occur involving vessel damage, potential loss of life (PLL), and/or pollution.	1	4	4	4	5	4.3	Tolerable with Mitigation		

User	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	Further Mitigation Required	Additional Comments
			Guard vessel(s) consideration as required by risk assessment.																			
		O	Compliance with MGN 654 and its annexes. Appropriate marking on UKHO Admiralty Charts. Promulgation of information as required. Marking and lighting in agreement with NLB, MCA, and CAA (and in line with IALA Recommendation G1162). Application for safety zones during major maintenance. MPCP. Guard vessel(s) consideration as required by risk assessment.	Presence of surface structures. Maintenance vessels which are RAM. Adverse weather. Reduction of navigable sea room.	Displacement results in an increase in encounters and potential for low impact collision to occur.	2	2	2	2	3	2.3	Broadly Acceptable	Displacement results in an increase in encounters and potential for high impact collision to occur involving vessel damage, PLL, and/or pollution.	1	4	4	4	5	4.3	Tolerable with Mitigation		

User	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							Further Mitigation Required	Additional Comments
						Frequency	Consequences					Risk		Frequency	Consequences					Risk		
							People	Environment	Property	Business	Average Consequence				People	Environment	Property	Business	Average Consequence			
	OCAS	C/D	Compliance with MGN 654 and its annexes. Appropriate marking on UKHO Admiralty Charts. Promulgation of information as required. MPCP. Guard vessel(s) consideration as required by risk assessment.	Construction or decommissioning vessels which are RAM. Adverse weather. Reduction of navigable sea room.	Displacement results in an increase in encounters and potential for low impact collision to occur.	1	2	2	2	3	2.3	Broadly Acceptable	Displacement results in an increase in encounters and potential for high impact collision to occur involving vessel damage, PLL, and/or pollution.	1	4	4	4	5	4.3	Tolerable with Mitigation		
	OCAS	O	Compliance with MGN 654 and its annexes. Appropriate marking on UKHO Admiralty Charts. Promulgation of information as required. MPCP. Guard vessel(s) consideration as required by risk assessment.	Maintenance vessels which are RAM. Adverse weather. Reduction of navigable sea room.	Displacement results in an increase in encounters and potential for low impact collision to occur.	1	2	2	2	3	2.3	Broadly Acceptable	Displacement results in an increase in encounters and potential for high impact collision to occur involving vessel damage, PLL, and/or pollution.	1	4	4	4	5	4.3	Tolerable with Mitigation		

User	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							Further Mitigation Required	Additional Comments
						Frequency	Consequences: People	Environment	Property	Business	Average Consequence	Risk		Frequency	Consequences: People	Environment	Property	Business	Average Consequence	Risk		
Fish Farm Support Vessels	Array Area	C/D	Compliance with MGN 654 and its annexes. Appropriate marking on UKHO Admiralty Charts. Promulgation of information as required. Buoyed construction area in agreement with NLB. Marking and lighting in agreement with NLB, MCA, and CAA (and in line with IALA Recommendation G1162). Application for safety zones during construction. MPCP. Guard vessel(s) consideration as required by risk assessment.	Presence of buoyed construction or decommissioning area. Construction or decommissioning vessels which are RAM. Adverse weather. Reduction of navigable sea room.	Displacement results in an increase in encounters and potential for low impact collision to occur.	3	3	2	2	2	2.3	Broadly Acceptable	Displacement results in an increase in encounters and potential for high impact collision to occur involving vessel damage, PLL, and/or pollution.	2	5	3	5	4	4.3	Tolerable with Mitigation		Bakkafrost indicated that due to a factory closure in Stornoway, fish farm support vessel routes are not currently operating between the Array Area and the coast.

User	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								Further Mitigation Required	Additional Comments
						Frequency	Consequences					Risk			Frequency	Consequences					Risk			
							People	Environment	Property	Business	Average Consequence					People	Environment	Property	Business	Average Consequence				
		O	Compliance with MGN 654 and its annexes. Appropriate marking on UKHO Admiralty Charts. Promulgation of information as required. Marking and lighting in agreement with NLB, MCA, and CAA (and in line with IALA Recommendation G1162). Application for safety zones during major maintenance. MPCP. Guard vessel(s) consideration as required by risk assessment.	Presence of surface structures. Maintenance vessels which are RAM. Adverse weather. Reduction of navigable sea room.	Displacement results in an increase in encounters and potential for low impact collision to occur.	3	3	2	2	2	2.3	Broadly Acceptable		Displacement results in an increase in encounters and potential for high impact collision to occur involving vessel damage, PLL, and/or pollution.	2	5	3	5	4	4.3	Tolerable with Mitigation			
	OCAS	C/D	Compliance with MGN 654 and its annexes. Appropriate marking on UKHO Admiralty Charts. Promulgation of information as required. MPCP. Guard vessel(s) consideration as required by risk assessment.	Construction or decommissioning vessels which are RAM. Adverse weather. Reduction of navigable sea room.	Displacement results in an increase in encounters and potential for low impact collision to occur.	2	3	2	2	2	2.3	Broadly Acceptable		Displacement results in an increase in encounters and potential for high impact collision to occur involving vessel damage, PLL, and/or pollution.	2	5	3	5	4	4.3	Tolerable with Mitigation			

User	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							Further Mitigation Required	Additional Comments
						Frequency	Consequences					Risk		Frequency	Consequences					Risk		
							People	Environment	Property	Business	Average Consequence				People	Environment	Property	Business	Average Consequence			
		O	Compliance with MGN 654 and its annexes. Appropriate marking on UKHO Admiralty Charts. Promulgation of information as required. MPCP. Guard vessel(s) consideration as required by risk assessment.	Maintenance vessels which are RAM. Adverse weather. Reduction of navigable sea room.	Displacement results in an increase in encounters and potential for low impact collision to occur.	1	3	2	2	2	2.3	Broadly Acceptable	Displacement results in an increase in encounters and potential for high impact collision to occur involving vessel damage, PLL, and/or pollution.	1	5	3	5	4	4.3	Tolerable with Mitigation		
Commercial fishing vessels in transit	Array Area	C/D	Compliance with MGN 654 and its annexes. Appropriate marking on UKHO Admiralty Charts. Promulgation of information as required. Buoyed construction area in agreement with NLB. Marking and lighting in agreement with NLB, MCA, and CAA (and in line with IALA Recommendation G1162). Application for safety zones during construction. MPCP. Guard vessel(s)	Presence of buoyed construction or decommissioning area. Construction or decommissioning vessels which are RAM. Adverse weather. Reduction of navigable sea room.	Displacement results in an increase in encounters and potential for low impact collision to occur.	3	3	2	2	2	2.3	Broadly Acceptable	Displacement results in an increase in encounters and potential for high impact collision to occur involving vessel damage, PLL, and/or pollution.	2	5	3	5	3	4.0	Tolerable with Mitigation		

User	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	Further Mitigation Required	Additional Comments
			consideration as required by risk assessment.																			
		O	Compliance with MGN 654 and its annexes. Appropriate marking on UKHO Admiralty Charts. Promulgation of information as required. Marking and lighting in agreement with NLB, MCA, and CAA (and in line with IALA Recommendation G1162). Application for safety zones during major maintenance. MPCP. Guard vessel(s) consideration as required by risk assessment.	Presence of surface structures. Maintenance vessels which are RAM. Adverse weather. Reduction of navigable sea room.	Displacement results in an increase in encounters and potential for low impact collision to occur.	3	3	2	2	2	2.3	Broadly Acceptable	Displacement results in an increase in encounters and potential for high impact collision to occur involving vessel damage, PLL, and/or pollution.	2	5	3	5	3	4.0	Tolerable with Mitigation		

User	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								Further Mitigation Required	Additional Comments
						Frequency	Consequences					Risk		Frequency	Consequences					Risk		
							People	Environment	Property	Business	Average Consequence				People	Environment	Property	Business	Average Consequence			
	OCAS	C/D	Compliance with MGN 654 and its annexes. Appropriate marking on UKHO Admiralty Charts. Promulgation of information as required. MPCP. Guard vessel(s) consideration as required by risk assessment.	Construction or decommissioning vessels which are RAM. Adverse weather. Reduction of navigable sea room.	Displacement results in an increase in encounters and potential for low impact collision to occur.	2	3	2	2	2	2.3	Broadly Acceptable	Displacement results in an increase in encounters and potential for high impact collision to occur involving vessel damage, PLL, and/or pollution.	1	5	3	5	3	4.0	Tolerable with Mitigation		
	OCAS	O	Compliance with MGN 654 and its annexes. Appropriate marking on UKHO Admiralty Charts. Promulgation of information as required. MPCP. Guard vessel(s) consideration as required by risk assessment.	Maintenance vessels which are RAM. Adverse weather. Reduction of navigable sea room.	Displacement results in an increase in encounters and potential for low impact collision to occur.	1	3	2	2	2	2.3	Broadly Acceptable	Displacement results in an increase in encounters and potential for high impact collision to occur involving vessel damage, PLL, and/or pollution.	1	5	3	5	3	4.0	Tolerable with Mitigation		

User	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							Further Mitigation Required	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)	Array Area	C/D	Compliance with MGN 654 and its annexes. Appropriate marking on UKHO Admiralty Charts. Promulgation of information as required. Buoyed construction area in agreement with NLB. Marking and lighting in agreement with NLB, MCA, and CAA (and in line with IALA Recommendation G1162). Application for safety zones during construction. MPCP. Guard vessel(s) consideration as required by risk assessment.	Presence of buoyed construction or decommissioning area. Construction or decommissioning vessels which are RAM. Adverse weather. Reduction of navigable sea room.	Displacement results in an increase in encounters and potential for low impact collision to occur.	3	3	1	2	3	2.3	Broadly Acceptable	Displacement results in an increase in encounters and potential for high impact collision to occur involving vessel damage, PLL, and/or pollution.	2	5	2	5	4	4.0	Tolerable with Mitigation		

User	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							Further Mitigation Required	Additional Comments
						Frequency	Consequences					Risk		Frequency	Consequences					Risk		
							People	Environment	Property	Business	Average Consequence				People	Environment	Property	Business	Average Consequence			
		O	Compliance with MGN 654 and its annexes. Appropriate marking on UKHO Admiralty Charts. Promulgation of information as required. Marking and lighting in agreement with NLB, MCA, and CAA (and in line with IALA Recommendation G1162). Application for safety zones during major maintenance. MPCP. Guard vessel(s) consideration as required by risk assessment.	Presence of surface structures. Maintenance vessels which are RAM. Adverse weather. Reduction of navigable sea room.	Displacement results in an increase in encounters and potential for low impact collision to occur.	3	3	1	2	3	2.3	Broadly Acceptable	Displacement results in an increase in encounters and potential for high impact collision to occur involving vessel damage, PLL, and/or pollution.	2	5	2	5	4	4.0	Tolerable with Mitigation		
	OCAS	C/D	Compliance with MGN 654 and its annexes. Appropriate marking on UKHO Admiralty Charts. Promulgation of information as required. MPCP. Guard vessel(s) consideration as required by risk assessment.	Construction or decommissioning vessels which are RAM. Adverse weather. Reduction of navigable sea room.	Displacement results in an increase in encounters and potential for low impact collision to occur.	2	3	1	2	3	2.3	Broadly Acceptable	Displacement results in an increase in encounters and potential for high impact collision to occur involving vessel damage, PLL, and/or pollution.	1	5	2	5	4	4.0	Tolerable with Mitigation		

User	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								Further Mitigation Required	Additional Comments
						Frequency	Consequences						Risk		Frequency	Consequences						Risk		
							People	Environment	Property	Business	Average Consequence					People	Environment	Property	Business	Average Consequence				
		O	Compliance with MGN 654 and its annexes. Appropriate marking on UKHO Admiralty Charts. Promulgation of information as required. MPCP. Guard vessel(s) consideration as required by risk assessment.	Maintenance vessels which are RAM. Adverse weather. Reduction of navigable sea room.	Displacement results in an increase in encounters and potential for low impact collision to occur.	1	3	1	2	3	2.3		Broadly Acceptable	Displacement results in an increase in encounters and potential for high impact collision to occur involving vessel damage, PLL, and/or pollution.	1	5	2	5	4	4.0		Tolerable with Mitigation		
Vessel to vessel collision between a third-party vessel and a project vessel																								
Commercial vessels (excluding fish farm support vessels)	Array Area	C/D	Appropriate marking on UKHO Admiralty Charts. Promulgation of information as required. Buoyed construction area in agreement with NLB. Application for safety zones during construction. MPCP. Marking and lighting in agreement with	Construction or decommissioning vessels which are RAM. Adverse weather. Reduction of navigable sea room. Lack of third-party awareness of ongoing works.	Increased encounters resulting to increased alertness but no safety risks.	3	1	1	1	2	1.3		Broadly Acceptable	Increase in encounters and potential for high impact collision to occur involving vessel damage, PLL, and/or pollution.	1	4	4	4	5	4.3		Tolerable with Mitigation		

User	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	Further Mitigation Required	Additional Comments
			NLB, MCA, and CAA (and in line with IALA Recommendation G1162). Guard vessel(s) consideration as required by risk assessment. Marine coordination and communication to manage project vessel movements. Compliance of project vessels with the international marine regulations including COLREGs and SOLAS.																			
		O	Appropriate marking on UKHO Admiralty Charts. Promulgation of information as required. Application for safety zones during major maintenance. MPCP. Marking and lighting in agreement with NLB, MCA, and CAA (and in line with IALA	Maintenance vessels which are RAM. Adverse weather. Reduction of navigable sea room. Lack of third-party awareness of ongoing works.	Increased encounters resulting to increased alertness but no safety risks.	2	1	1	1	2	1.3	Broadly Acceptable	Increase in encounters and potential for high impact collision to occur involving vessel damage, PLL, and/or pollution.	1	4	4	4	5	4.3	Tolerable with Mitigation		

User	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	Further Mitigation Required	Additional Comments
			Recommendation G1162). Guard vessel(s) consideration as required by risk assessment. Marine coordination and communication to manage project vessel movements. Compliance of project vessels with the international marine regulations including COLREGs and SOLAS.																			
	OCAS	C/D	Appropriate marking on UKHO Admiralty Charts. Promulgation of information as required. MPCP. Guard vessel(s) consideration as required by risk assessment. Marine coordination and communication to manage project vessel movements. Compliance of project vessels with the	Construction or decommissioning vessels which are RAM. Adverse weather. Reduction of navigable sea room. Lack of third-party awareness of ongoing works.	Increased encounters resulting to increased alertness but no safety risks.	2	1	1	1	2	1.3	Broadly Acceptable	Increase in encounters and potential for high impact collision to occur involving vessel damage, PLL, and/or pollution.	1	4	4	4	5	4.3	Tolerable with Mitigation		

User	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	Further Mitigation Required	Additional Comments
			international marine regulations including COLREGs and SOLAS.																			
		O	Appropriate marking on UKHO Admiralty Charts. Promulgation of information as required. MPCP. Guard vessel(s) consideration as required by risk assessment. Marine coordination and communication to manage project vessel movements. Compliance of project vessels with the international marine regulations including COLREGs and SOLAS.	Maintenance vessels which are RAM. Adverse weather. Reduction of navigable sea room. Lack of third-party awareness of ongoing works.	Increased encounters resulting to increased alertness but no safety risks.	1	1	1	1	2	1.3	Broadly Acceptable	Increase in encounters and potential for high impact collision to occur involving vessel damage, PLL, and/or pollution.	1	4	4	4	5	4.3	Tolerable with Mitigation		
Fish Farm Support Vessels	Array Area	C/D	Appropriate marking on UKHO Admiralty Charts. Promulgation of	Construction or decommissioning vessels which are RAM.	Increased encounters resulting to increased	3	1	1	1	2	1.3	Broadly Acceptable	Increase in encounters and potential for high impact	1	5	3	5	4	4.3	Tolerable with Mitigation		

User	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								Further Mitigation Required	Additional Comments
						Frequency	Consequences					Risk			Frequency	Consequences					Risk			
							People	Environment	Property	Business	Average Consequence					People	Environment	Property	Business	Average Consequence				
			information as required. Buoyed construction area in agreement with NLB. Application for safety zones during construction. MPCP. Marking and lighting in agreement with NLB, MCA, and CAA (and in line with IALA Recommendation G1162). Guard vessel(s) consideration as required by risk assessment. Marine coordination and communication to manage project vessel movements. Compliance of project vessels with the international marine regulations including COLREGs and SOLAS.	Adverse weather. Reduction of navigable sea room. Lack of third-party awareness of ongoing works.	alertness but no safety risks.									collision to occur involving vessel damage, PLL, and/or pollution.										

User	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							Further Mitigation Required	Additional Comments
						Frequency	Consequences					Risk		Frequency	Consequences					Risk		
							People	Environment	Property	Business	Average Consequence				People	Environment	Property	Business	Average Consequence			
		O	Appropriate marking on UKHO Admiralty Charts. Promulgation of information as required. Application for safety zones during major maintenance. MPCP. Marking and lighting in agreement with NLB, MCA, and CAA (and in line with IALA Recommendation G1162). Guard vessel(s) consideration as required by risk assessment. Marine coordination and communication to manage project vessel movements. Compliance of project vessels with the international marine regulations including COLREGs and SOLAS.	Maintenance vessels which are RAM. Adverse weather. Reduction of navigable sea room. Lack of third-party awareness of ongoing works.	Increased encounters resulting to increased alertness but no safety risks.	2	1	1	1	2	1.3	Broadly Acceptable	Increase in encounters and potential for high impact collision to occur involving vessel damage, PLL, and/or pollution.	1	5	3	5	4	4.3	Tolerable with Mitigation		

User	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	Further Mitigation Required	Additional Comments
	OCAS	C/D	Appropriate marking on UKHO Admiralty Charts. Promulgation of information as required. MPCP. Guard vessel(s) consideration as required by risk assessment. Marine coordination and communication to manage project vessel movements. Compliance of project vessels with the international marine regulations including COLREGs and SOLAS.	Construction or decommissioning vessels which are RAM. Adverse weather. Reduction of navigable sea room. Lack of third-party awareness of ongoing works.	Increased encounters resulting to increased alertness but no safety risks.	4	1	1	1	2	1.3	Broadly Acceptable	Increase in encounters and potential for high impact collision to occur involving vessel damage, PLL, and/or pollution.	2	5	3	5	4	4.3	Tolerable with Mitigation		
		O	Appropriate marking on UKHO Admiralty Charts. Promulgation of information as required. MPCP. Guard vessel(s) consideration as required by risk assessment. Marine coordination and communication to manage project	Maintenance vessels which are RAM. Adverse weather. Reduction of navigable sea room. Lack of third-party awareness of ongoing works.	Increased encounters resulting to increased alertness but no safety risks.	3	1	1	1	2	1.3	Broadly Acceptable	Increase in encounters and potential for high impact collision to occur involving vessel damage, PLL, and/or pollution.	1	5	3	5	4	4.3	Tolerable with Mitigation		

User	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							Further Mitigation Required	Additional Comments
						Frequency	Consequences: People	Environment	Property	Business	Average Consequence	Risk		Frequency	Consequences: People	Environment	Property	Business	Average Consequence	Risk		
			vessel movements. Compliance of project vessels with the international marine regulations including COLREGs and SOLAS.																			
Commercial fishing vessels in transit	Array Area	C/D	Appropriate marking on UKHO Admiralty Charts. Promulgation of information as required. Buoyed construction area in agreement with NLB. Application for safety zones during construction. MPCP. Marking and lighting in agreement with NLB, MCA, and CAA (and in line with IALA Recommendation G1162). Guard vessel(s) consideration as required by risk assessment. Marine coordination and communication to	Construction or decommissioning vessels which are RAM. Adverse weather. Reduction of navigable sea room. Lack of third-party awareness of ongoing works.	Increased encounters resulting to increased alertness but no safety risks.	3	1	1	1	2	1.3	Broadly Acceptable	Increase in encounters and potential for high impact collision to occur involving vessel damage, PLL, and/or pollution.	1	5	3	5	4	4.3	Tolerable with Mitigation		

User	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	Further Mitigation Required	Additional Comments
			manage project vessel movements. Compliance of project vessels with the international marine regulations including COLREGs and SOLAS.																			
		O	Appropriate marking on UKHO Admiralty Charts. Promulgation of information as required. Application for safety zones during major maintenance. MPCP. Marking and lighting in agreement with NLB, MCA, and CAA (and in line with IALA Recommendation G1162). Guard vessel(s) consideration as required by risk assessment. Marine	Maintenance vessels which are RAM. Adverse weather. Reduction of navigable sea room. Lack of third-party awareness of ongoing works.	Increased encounters resulting to increased alertness but no safety risks.	3	1	1	1	2	1.3	Broadly Acceptable	Increase in encounters and potential for high impact collision to occur involving vessel damage, PLL, and/or pollution.	1	5	3	5	4	4.3	Tolerable with Mitigation		

User	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							Further Mitigation Required	Additional Comments
						Frequency	Consequences: People	Environment	Property	Business	Average Consequence	Risk		Frequency	Consequences: People	Environment	Property	Business	Average Consequence	Risk		
			coordination and communication to manage project vessel movements. Compliance of project vessels with the international marine regulations including COLREGs and SOLAS.																			
	OCAS	C/D	Appropriate marking on UKHO Admiralty Charts. Promulgation of information as required. MPCP. Guard vessel(s) consideration as required by risk assessment. Marine coordination and communication to manage project vessel movements. Compliance of project vessels with the international marine regulations including COLREGs and SOLAS.	Construction or decommissioning vessels which are RAM. Adverse weather. Reduction of navigable sea room. Lack of third-party awareness of ongoing works.	Increased encounters resulting to increased alertness but no safety risks.	3	1	1	1	2	1.3	Broadly Acceptable	Increase in encounters and potential for high impact collision to occur involving vessel damage, PLL, and/or pollution.	2	5	3	5	4	4.3	Tolerable with Mitigation		

User	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								Further Mitigation Required	Additional Comments
						Frequency	Consequences						Risk		Frequency	Consequences						Risk		
							People	Environment	Property	Business	Average Consequence					People	Environment	Property	Business	Average Consequence				
		O	Appropriate marking on UKHO Admiralty Charts. Promulgation of information as required. MPCP. Guard vessel(s) consideration as required by risk assessment. Marine coordination and communication to manage project vessel movements. Compliance of project vessels with the international marine regulations including COLREGs and SOLAS.	Maintenance vessels which are RAM. Adverse weather. Reduction of navigable sea room. Lack of third-party awareness of ongoing works.	Increased encounters resulting to increased alertness but no safety risks.	2	1	1	1	2	1.3		Broadly Acceptable	Increase in encounters and potential for high impact collision to occur involving vessel damage, PLL, and/or pollution.	1	5	3	5	4	4.3		Tolerable with Mitigation		
Recreational vessels (2.5 to 24m length)	Array Area	C/D	Appropriate marking on UKHO Admiralty Charts. Promulgation of information as required. Buoyed construction area in agreement with NLB. Application for safety zones during construction. MPCP.	Construction or decommissioning vessels which are RAM. Adverse weather. Reduction of navigable sea room. Lack of third-party awareness of ongoing works.	Increased encounters resulting to increased alertness but no safety risks.	2	1	1	1	2	1.3		Broadly Acceptable	Increase in encounters and potential for high impact collision to occur involving vessel damage, PLL, and/or pollution.	1	5	2	5	4	4.0		Tolerable with Mitigation		

User	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							Further Mitigation Required	Additional Comments
						Frequency	Consequences					Risk		Frequency	Consequences					Risk		
							People	Environment	Property	Business	Average Consequence				People	Environment	Property	Business	Average Consequence			
			Marking and lighting in agreement with NLB, MCA, and CAA (and in line with IALA Recommendation G1162). Guard vessel(s) consideration as required by risk assessment. Marine coordination and communication to manage project vessel movements. Compliance of project vessels with the international marine regulations including COLREGs and SOLAS.																			

User	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							Further Mitigation Required	Additional Comments
						Frequency	Consequences					Risk		Frequency	Consequences					Risk		
							People	Environment	Property	Business	Average Consequence				People	Environment	Property	Business	Average Consequence			
		O	Appropriate marking on UKHO Admiralty Charts. Promulgation of information as required. Application for safety zones during major maintenance. MPCP. Marking and lighting in agreement with NLB, MCA, and CAA (and in line with IALA Recommendation G1162). Guard vessel(s) consideration as required by risk assessment. Marine coordination and communication to manage project vessel movements. Compliance of project vessels with the international marine regulations including COLREGs and SOLAS.	Maintenance vessels which are RAM. Adverse weather. Reduction of navigable sea room. Lack of third-party awareness of ongoing works.	Increased encounters resulting to increased alertness but no safety risks.	2	1	1	1	2	1.3	Broadly Acceptable	Increase in encounters and potential for high impact collision to occur involving vessel damage, PLL, and/or pollution.	1	5	2	5	4	4.0	Tolerable with Mitigation		

User	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								Further Mitigation Required	Additional Comments
						Frequency	Consequences						Risk		Frequency	Consequences						Risk		
							People	Environment	Property	Business	Average Consequence					People	Environment	Property	Business	Average Consequence				
	OCAS	C/D	Appropriate marking on UKHO Admiralty Charts. Promulgation of information as required. MPCP. Guard vessel(s) consideration as required by risk assessment. Marine coordination and communication to manage project vessel movements. Compliance of project vessels with the international marine regulations including COLREGs and SOLAS.	Construction or decommissioning vessels which are RAM. Adverse weather. Reduction of navigable sea room. Lack of third-party awareness of ongoing works.	Increased encounters resulting to increased alertness but no safety risks.	2	1	1	1	2	1.3		Broadly Acceptable	Increase in encounters and potential for high impact collision to occur involving vessel damage, PLL, and/or pollution.	1	5	2	5	4	4.0		Tolerable with Mitigation		
		O	Appropriate marking on UKHO Admiralty Charts. Promulgation of information as required. MPCP. Guard vessel(s) consideration as required by risk assessment. Marine coordination and communication to manage project	Maintenance vessels which are RAM. Adverse weather. Reduction of navigable sea room. Lack of third-party awareness of ongoing works.	Increased encounters resulting to increased alertness but no safety risks.	1	1	1	1	2	1.3		Broadly Acceptable	Increase in encounters and potential for high impact collision to occur involving vessel damage, PLL, and/or pollution.	1	5	2	5	4	4.0		Tolerable with Mitigation		

User	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							Further Mitigation Required	Additional Comments
						Frequency	Consequences: People	Consequences: Environment	Consequences: Property	Consequences: Business	Consequences: Average Consequence	Risk		Frequency	Consequences: People	Consequences: Environment	Consequences: Property	Consequences: Business	Consequences: Average Consequence	Risk		
			vessel movements. Compliance of project vessels with the international marine regulations including COLREGs and SOLAS.																			
Reduced Access to Local Ports, Harbours and Marinas																						
Commercial vessels	Array Area	C/D	Appropriate marking on UKHO Admiralty Charts. Promulgation of information as required. Marine coordination and communication to manage project vessel movements.	Presence of buoyed construction or decommissioning area. Construction or decommissioning vessels operating out of Loch Roag which are RAM. Adverse weather. Reduction of navigable sea room.	Limited disruption to port schedules.	5	1	1	1	2	1.3	Tolerable	Presence of project vessels in Loch Roag causing disruption to port schedules for visiting cruise liners.	4	1	2	1	4	2.0	Tolerable	Risk assessment required post consent should CTV use of Loch Roag be taken forward.	Project vessel routes should be clearly promulgated and defined to minimise impact to third-party vessels.
Commercial vessels	Array Area	O	Appropriate marking on UKHO Admiralty Charts. Promulgation of information as required. Marine coordination and communication to manage project vessel movements.	Presence of surface structures. Maintenance vessels which are RAM. Adverse weather. Reduction of navigable sea room.	Limited disruption to port schedules.	4	1	1	1	2	1.3	Broadly Acceptable	Presence of project vessels in Loch Roag causing disruption to port schedules for visiting cruise liners.	3	1	2	1	4	2.0	Broadly Acceptable		
Commercial vessels	OCAS	C/D	Promulgation of information as required. Marine	Construction or decommissioning vessels which are RAM.	Limited disruption to port schedules.	4	1	1	1	2	1.3	Broadly Acceptable	Presence of project vessels in Loch Roag causing	3	1	2	1	4	2.0	Broadly Acceptable		

User	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							Further Mitigation Required	Additional Comments
						Frequency	Consequences					Risk		Frequency	Consequences					Risk		
							People	Environment	Property	Business	Average Consequence				People	Environment	Property	Business	Average Consequence			
			coordination and communication to manage project vessel movements.										disruption to port schedules for visiting cruise liners.									
		O	Promulgation of information as required. Marine coordination and communication to manage project vessel movements.	Maintenance vessels which are RAM.	Limited disruption to port schedules.	3	1	1	1	2	1.3	Broadly Acceptable	Presence of project vessels in Loch Roag causing disruption to port schedules for visiting cruise liners.	2	1	2	1	4	2.0	Broadly Acceptable		
Fish Farm Support Vessels	Array Area	C/D	Appropriate marking on UKHO Admiralty Charts. Promulgation of information as required. Marine coordination and communication to manage project vessel movements.	Presence of buoyed construction or decommissioning area. Construction or decommissioning vessels which are RAM. Adverse weather. Reduction of navigable sea room.	Limited disruption to port schedules.	5	1	1	1	3	1.5	Tolerable	Presence of project vessels in Loch Roag sharing facilities with fish farm support vessels causing disruption to port schedules.	4	1	2	1	5	2.3	Tolerable		Bakkafrost indicated that the use of Loch Roag as a base port may have an impact on their operations.
		O	Appropriate marking on UKHO Admiralty Charts. Promulgation of information as required. Marine coordination and communication to manage project vessel movements.	Presence of surface structures. Maintenance vessels which are RAM. Adverse weather. Reduction of navigable sea room.	Limited disruption to port schedules.	4	1	1	1	3	1.5	Broadly Acceptable	Presence of project vessels in Loch Roag sharing facilities with fish farm support vessels causing disruption to port schedules.	3	1	2	1	5	2.3	Broadly Acceptable		

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User	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							Further Mitigation Required	Additional Comments
							Consequences								Consequences							
						Frequency	People	Environment	Property	Business	Average Consequence	Risk		Frequency	People	Environment	Property	Business	Average Consequence	Risk		
	OCAS	C/D	Promulgation of information as required. Marine coordination and communication to manage project vessel movements.	Construction or decommissioning vessels which are RAM.	Limited disruption to port schedules.	4	1	1	1	3	1.5	Broadly Acceptable	Presence of project vessels in Loch Roag sharing facilities with fish farm support vessels causing disruption to port schedules.	3	1	2	1	5	2.3	Broadly Acceptable		
		O	Promulgation of information as required. Marine coordination and communication to manage project vessel movements.	Maintenance vessels which are RAM.	Limited disruption to port schedules.	3	1	1	1	3	1.5	Broadly Acceptable	Presence of project vessels in Loch Roag sharing facilities with fish farm support vessels causing disruption to port schedules.	2	1	2	1	5	2.3	Broadly Acceptable		
Commercial fishing vessels in transit	Array Area	C/D	Appropriate marking on UKHO Admiralty Charts. Promulgation of information as required. Marine coordination and communication to manage project vessel movements.	Presence of buoyed construction or decommissioning area. Construction or decommissioning vessels which are RAM. Adverse weather. Reduction of navigable sea room.	Limited disruption to port schedules.	5	1	1	1	2	1.3	Tolerable	Presence of project vessels in Loch Roag causing disruption to port schedules.	4	1	2	1	3	1.8	Broadly Acceptable		Project vessel routes should be clearly promulgated and defined to minimise impact to third-party vessels.
		O	Appropriate marking on UKHO Admiralty Charts. Promulgation of information as required. Marine coordination and communication to	Presence of surface structures. Maintenance vessels which are RAM. Adverse weather. Reduction of navigable sea room.	Limited disruption to port schedules.	4	1	1	1	2	1.3	Broadly Acceptable	Presence of project vessels in Loch Roag causing disruption to port schedules.	3	1	2	1	3	1.8	Broadly Acceptable		

User	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							Further Mitigation Required	Additional Comments
						Frequency	Consequences: People	Consequences: Environment	Consequences: Property	Consequences: Business	Consequences: Average Consequence	Risk		Frequency	Consequences: People	Consequences: Environment	Consequences: Property	Consequences: Business	Consequences: Average Consequence	Risk		
			manage project vessel movements.																			
	OCAS	C/D	Promulgation of information as required. Marine coordination and communication to manage project vessel movements.	Construction or decommissioning vessels which are RAM.	Limited disruption to port schedules.	4	1	1	1	2	1.3	Broadly Acceptable	Presence of project vessels in Loch Roag causing disruption to port schedules.	3	1	2	1	3	1.8	Broadly Acceptable		
		O	Promulgation of information as required. Marine coordination and communication to manage project vessel movements.	Maintenance vessels which are RAM.	Limited disruption to port schedules.	3	1	1	1	2	1.3	Broadly Acceptable	Presence of project vessels in Loch Roag causing disruption to port schedules.	2	1	2	1	3	1.8	Broadly Acceptable		
Recreational vessels (2.5 to 24m length)	Array Area	C/D	Appropriate marking on UKHO Admiralty Charts. Promulgation of information as required. Marine coordination and communication to manage project vessel movements.	Presence of buoyed construction or decommissioning area. Construction or decommissioning vessels which are RAM. Adverse weather. Reduction of navigable sea room.	Limited disruption to port schedules.	5	1	1	1	1	1.0	Tolerable	Presence of project vessels in Loch Roag causing disruption to port schedules.	4	1	1	1	2	1.3	Broadly Acceptable		

User	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							Further Mitigation Required	Additional Comments
						Frequency	Consequences: People	Environment	Property	Business	Average Consequence	Risk		Frequency	Consequences: People	Environment	Property	Business	Average Consequence	Risk		
		O	Appropriate marking on UKHO Admiralty Charts. Promulgation of information as required. Marine coordination and communication to manage project vessel movements.	Presence of surface structures. Maintenance vessels which are RAM. Adverse weather. Reduction of navigable sea room.	Limited disruption to port schedules.	4	1	1	1	1	1.0	Broadly Acceptable	Presence of project vessels in Loch Roag causing disruption to port schedules.	3	1	1	1	2	1.3	Broadly Acceptable		
	OCAS	C/D	Promulgation of information as required. Marine coordination and communication to manage project vessel movements.	Construction or decommissioning vessels which are RAM.	Limited disruption to port schedules.	4	1	1	1	1	1.0	Broadly Acceptable	Presence of project vessels in Loch Roag causing disruption to port schedules.	3	1	1	1	2	1.3	Broadly Acceptable		
		O	Promulgation of information as required. Marine coordination and communication to manage project vessel movements.	Maintenance vessels which are RAM.	Limited disruption to port schedules.	3	1	1	1	1	1.0	Broadly Acceptable	Presence of project vessels in Loch Roag causing disruption to port schedules.	2	1	1	1	2	1.3	Broadly Acceptable		
Vessel to structure allision risk.																						

User	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							Further Mitigation Required	Additional Comments
						Frequency	Consequences					Risk		Frequency	Consequences					Risk		
							People	Environment	Property	Business	Average Consequence				People	Environment	Property	Business	Average Consequence			
Commercial vessels (excluding fish farm support vessels)	Array Area	O	Compliance with MGN 654 and its annexes. Appropriate marking on UKHO Admiralty Charts. Promulgation of information as required. Marking and lighting in agreement with NLB (and in line with IALA Recommendation G1162). MPCP. Blade clearance of at least 22m above Mean High Water Springs (MHWS). Guard vessel(s) consideration as required by risk assessment. Application for safety zones during periods of major maintenance.	Presence of surface structures. Human/navigation error. Mechanical/technical failure. Adverse weather. Aids to navigation failure.	Vessel passes in close proximity resulting in a need to make a late adjustment to course/speed, or drifts towards a structure but is able to regain power prior to an allision event.	2	1	1	2	2	1.5	Broadly Acceptable	Allision event occurs involving vessel damage, PLL, and/or pollution.	1	4	4	4	5	4.3	Tolerable with Mitigation		Based on industry experience, it is expected that commercial vessels will not transit within an array.

User	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								Further Mitigation Required	Additional Comments
						Frequency	Consequences						Risk		Frequency	Consequences						Risk		
							People	Environment	Property	Business	Average Consequence					People	Environment	Property	Business	Average Consequence				
Fish Farm Support Vessels	Array Area	O	Compliance with MGN 654 and its annexes. Appropriate marking on UKHO Admiralty Charts. Promulgation of information as required. Marking and lighting in agreement with NLB (and in line with IALA Recommendation G1162). MPCP. Blade clearance of at least 22m above MHWS. Guard vessel(s) consideration as required by risk assessment. Application for safety zones during periods of major maintenance.	Presence of surface structures. Human/navigation error. Mechanical/technical failure. Adverse weather. Aids to navigation failure.	Vessel passes in close proximity resulting in a need to make a late adjustment to course/speed, or drifts towards a structure but is able to regain power prior to an allision event.	4	1	1	2	1	1.3		Broadly Acceptable	Allision event occurs involving vessel damage, PLL, and/or pollution.	2	5	3	5	4	4.3		Tolerable with Mitigation		

User	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								Further Mitigation Required	Additional Comments
						Frequency	Consequences						Risk		Frequency	Consequences						Risk		
							People	Environment	Property	Business	Average Consequence					People	Environment	Property	Business	Average Consequence				
Commercial fishing vessels in transit	Array Area	O	Compliance with MGN 654 and its annexes. Appropriate marking on UKHO Admiralty Charts. Promulgation of information as required. Marking and lighting in agreement with NLB (and in line with IALA Recommendation G1162). MPCP. Blade clearance of at least 22m above MHWS. Guard vessel(s) consideration as required by risk assessment. Application for safety zones during periods of major maintenance.	Presence of surface structures. Human/navigation error. Mechanical/technical failure. Adverse weather. Aids to navigation failure.	Vessel passes in close proximity resulting in a need to make a late adjustment to course/speed, or drifts towards a structure but is able to regain power prior to an allision event.	5	1	1	2	1	1.3		Tolerable with Mitigation	Allision event occurs involving vessel damage, PLL, and/or pollution.	2	5	3	5	3	4.0		Tolerable with Mitigation		Based on industry experience, it is expected that fishing vessels may choose to navigate within an array. Based on feedback from the FLO, fishing vessels may actively fish within the array due to new habitats.

User	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							Further Mitigation Required	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)	Array Area	O	Compliance with MGN 654 and its annexes. Appropriate marking on UKHO Admiralty Charts. Promulgation of information as required. Marking and lighting in agreement with NLB (and in line with IALA Recommendation G1162). MPCP. Blade clearance of at least 22m above MHWS. Guard vessel(s) consideration as required by risk assessment. Application for safety zones during periods of major maintenance.	Presence of surface structures. Human/navigation error. Mechanical/technical failure. Adverse weather. Aids to navigation failure.	Vessel passes in close proximity resulting in a need to make a late adjustment to course/speed, or drifts towards a structure but is able to regain power prior to an allision event.	5	1	1	2	1	1.3	Tolerable with Mitigation	Allision event occurs involving vessel damage, PLL, and/or pollution.	2	5	2	5	4	4.0	Tolerable with Mitigation		
Reduction in under keel clearance due to presence of cable protection.																						
All vessels	All subsea cables	O	Appropriate marking on UKHO Admiralty Charts. Promulgation of information as required. Compliance with MGN 654 and its annexes. Guard vessel(s)	Presence of subsea infrastructure and/or protection resulting in reduced navigable water depth.	Vessel transits over an area of reduced under keel clearance and a light contact occurs with the vessel able to continue passage.	3	2	1	1	2	1.5	Broadly Acceptable	Grounding on cable protection resulting in vessel damage and/or pollution.	2	1	3	4	4	3.0	Broadly Acceptable		The transmission option with the maximum number of cables is considered for this impact.

User	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	Further Mitigation Required	Additional Comments
			consideration as required by risk assessment. MPCP. Implementation and monitoring of cable protection.																			
Vessel interaction with subsea cables.																						
All vessels	All subsea cables	O	Compliance with MGN 654 and its annexes. Appropriate marking on UKHO Admiralty Charts. Promulgation of information as required. Implementation and monitoring of cable protection.	Human/navigation error. Mechanical/technical failure. Adverse weather. Presence of subsea infrastructure.	Fishing gear is deployed over a subsea cable but no interaction occurs.	4	1	1	1	1	1.0	Broadly Acceptable	Vessel anchors on or drags anchor over a subsea cable resulting in damage to the cable, protection, and/or anchor.	2	3	2	3	3	2.8	Broadly Acceptable		The transmission option with the maximum number of cables is considered for this impact.
Interference with marine navigation, communications and position fixing equipment.																						
All vessels	Array Area	O	Compliance with MGN 654 and its annexes. Appropriate marking on UKHO Admiralty Charts. Promulgation of information as required. Implementation and monitoring of cable protection. Guard vessel(s) as required by risk assessment.	Human error relating to adjustment of Radar controls. Presence of surface structures and subsea infrastructure.	Structures have no effect on Radar, communications, and navigation equipment on a vessel.	4	1	1	1	1	1.0	Broadly Acceptable	Structures have a minor but manageable effect on Radar, communications, and navigation equipment on a vessel.	3	1	1	1	1	1.0	Broadly Acceptable		

User	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							Further Mitigation Required	Additional Comments
						Frequency	Consequences					Risk		Frequency	Consequences					Risk		
							People	Environment	Property	Business	Average Consequence				People	Environment	Property	Business	Average Consequence			
All vessels	OCAS	O	Compliance with MGN 654 and its annexes. Appropriate marking on UKHO Admiralty Charts. Promulgation of information as required. Implementation and monitoring of cable protection. Guard vessel(s) as required by risk assessment.	Presence of subsea infrastructure producing Electromagnetic Fields (EMF).	Subsea infrastructure has no effect on Radar, communications, and navigation equipment on a vessel.	5	1	1	1	1	1.0	Tolerable with Mitigation	Subsea infrastructure has a minor but manageable effect on Radar, communications, and navigation equipment on a vessel.	4	1	1	1	1	1.0	Broadly Acceptable		The transmission option with the maximum number of cables is considered for this impact.
Reduction of emergency response capability (including reduced access for SAR responders).																						
Emergency responders	Project	O	Compliance with MGN 654 and its annexes. Promulgation of information as required. Marine coordination and communication to manage project vessel movements. Marking and lighting in agreement with NLB (and in line with IALA Recommendation G1162). Compliance of project vessels with the international marine	Presence of the Project and project vessels may lead to increased incidents. Presence of surface structures may impede SAR operations. Limited resource capability. Adverse weather.	Delay to emergency response request.	3	1	1	1	2	1.3	Broadly Acceptable	Delay to emergency response request leading to vessel damage, PLL, and/or pollution.	1	5	5	5	5	5.0	Tolerable with Mitigation		

User	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							Further Mitigation Required	Additional Comments
						Frequency	Consequences					Risk		Frequency	Consequences					Risk		
							People	Environment	Property	Business	Average Consequence				People	Environment	Property	Business	Average Consequence			
			regulations including COLREGs and SOLAS. MPCP.																			

Appendix C Consequences Assessment

C.1 Introduction

597. This appendix presents an assessment of the consequences of collision and allision incidents, in terms of people and the environment, due to the presence of the Offshore Project.

598. The significance of the impact due to the presence of the Offshore Project is also assessed based on risk evaluation criteria and comparison with historical incident data in UK waters. For the purposes of this assessment, UK waters are defined as the UK Exclusive Economic Zone (EEZ) and UK territorial waters refers to the 12 nm limit from the British Isles, excluding the Republic of Ireland.

C.2 Risk Evaluation Criteria

C.2.1 Risk to People

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

- Individual risk;
- Societal risk.

C.2.1.1 Individual Risk

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

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

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

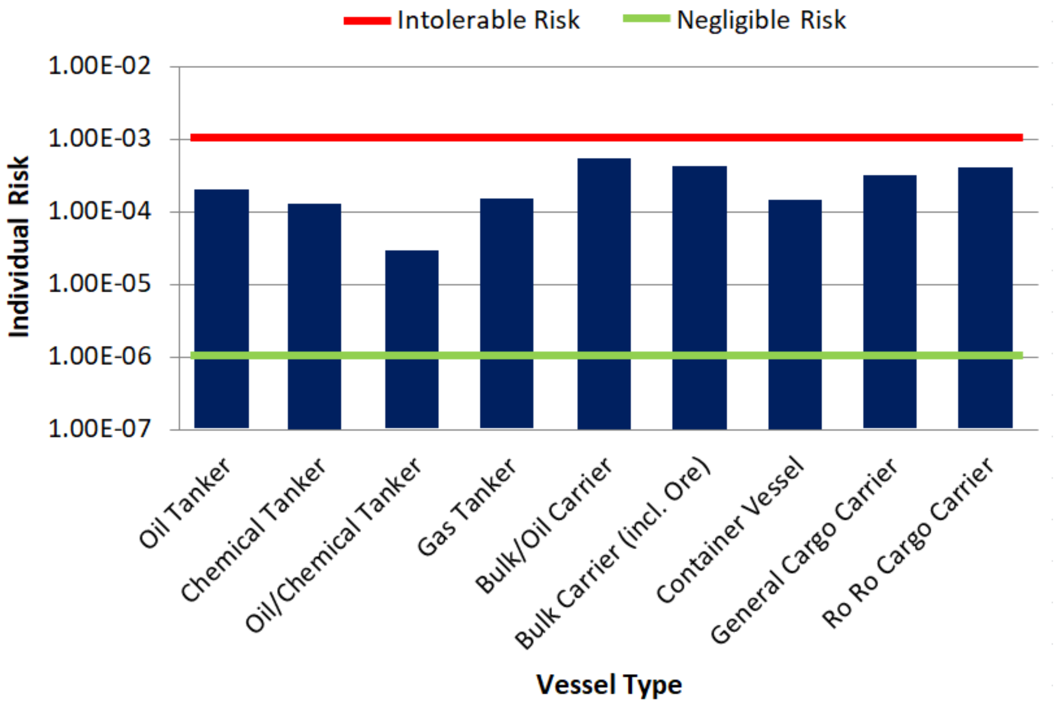

Figure C.1 Individual Risk Levels and Acceptance Criteria per Vessel Type

603. The typical bounds defining the ALARP regions for decision making within shipping are presented in **Table C.1** For a new vessel, the target upper bound for ALARP is set lower since new vessels are expected to benefit (in terms of design) from changes in legislation and improved maritime safety.

Table C.1 Individual Risk ALARP Criteria for Shipping and Navigation

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

604. On a UK basis, the MCA have presented individual risks for various UK industries based on HSE data from 1987 to 1991. The risks for different industries are presented in **Figure C.2**.

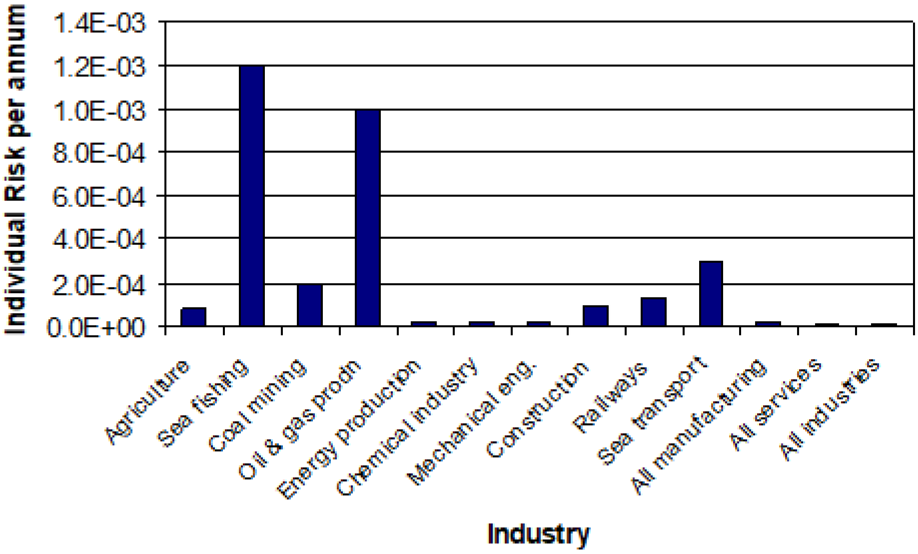

Figure C.2 Individual Risk per Year for Various UK Industries

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

C.2.1.2 Societal Risk

606. 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.

607. Within this assessment, societal (navigation based) risk can be assessed for the Offshore Project, giving account to the change in risk associated with each incident scenario caused by the introduction of the WTGs. Societal risk may be expressed as:

- Annual fatality rate where frequency and fatality are combined into a convenient one-dimensional measure of societal risk (also known as PLL);
- F-N diagrams showing explicitly the relationship between the cumulative frequency of an accident and the number of fatalities in a multi-dimensional diagram.

608. 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.

C.2.2 Risk to Environment

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

610. It is recognised that there will be other potential pollution, e.g. hazardous containerised cargoes; however, oil is considered the most likely pollutant and the extent of predicted oil spills will provide an indication of the significance of pollution risk due to the Offshore Project compared to UK background pollution risk levels.

C.3 Marine Accident Investigation Branch

C.3.1 All Incidents in UK Waters

611. 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.

612. 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.

613. Only incidents occurring in UK waters have been considered within this assessment for which the MAIB data is most comprehensive. It is also noted that incidents occurring in ports/harbours and rivers/canals have been excluded since the causes and consequences may differ considerably from an incident occurring offshore, which is the location of most relevance to the Offshore Project.

614. 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 - 2021 involving 13,415 vessels (some incidents, such as collisions, involved more than 1 vessel).

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

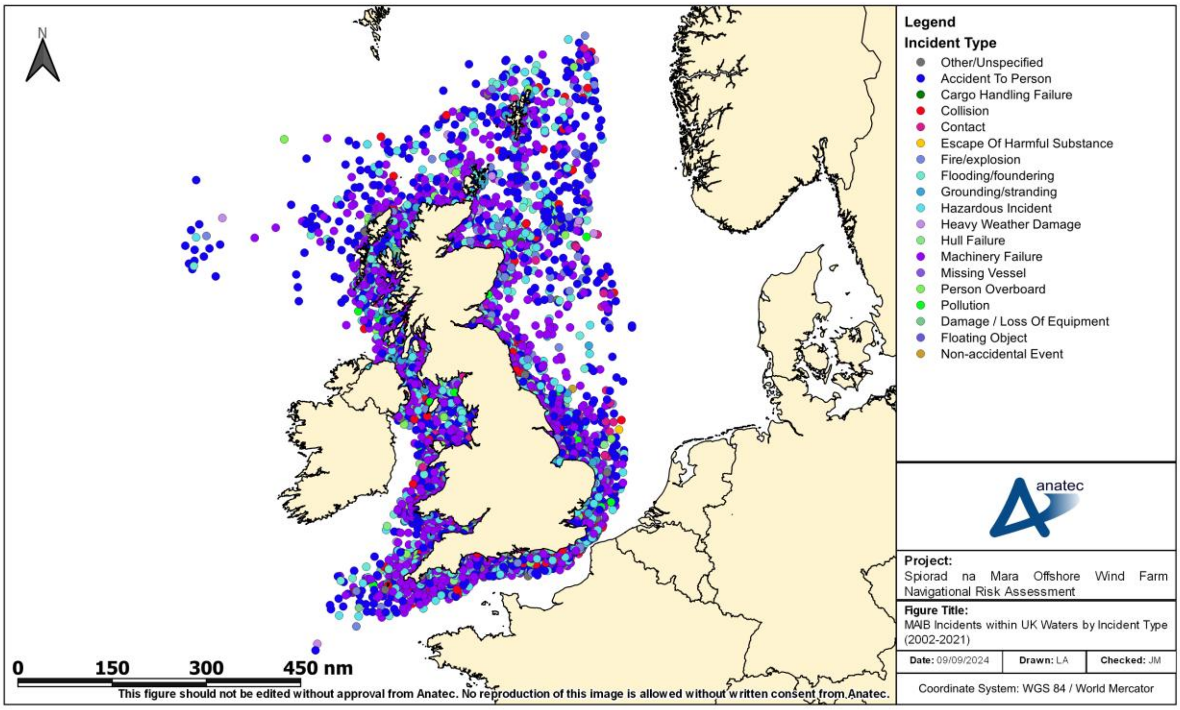

Figure C.3 MAIB Incident Locations by Incident Type within UK Waters (2002 - 2021)

616. The distribution of incidents by year in UK waters is presented in **Figure C.4**.

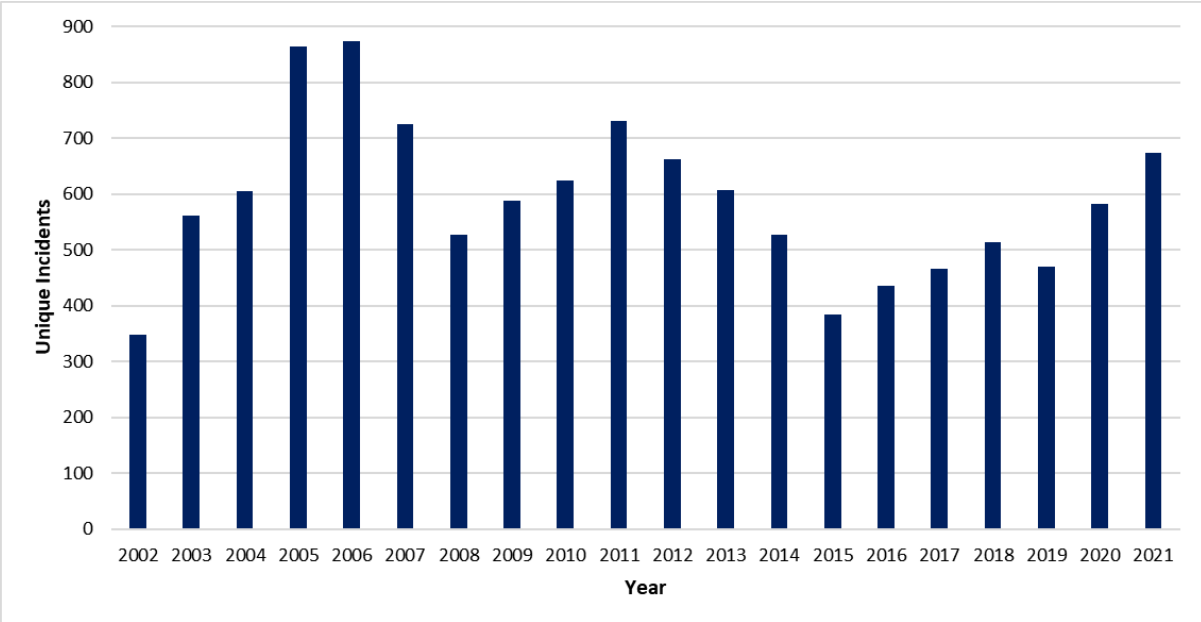

Figure C.4 MAIB Unique Incidents per Year within UK Waters (2002 - 2021)

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

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

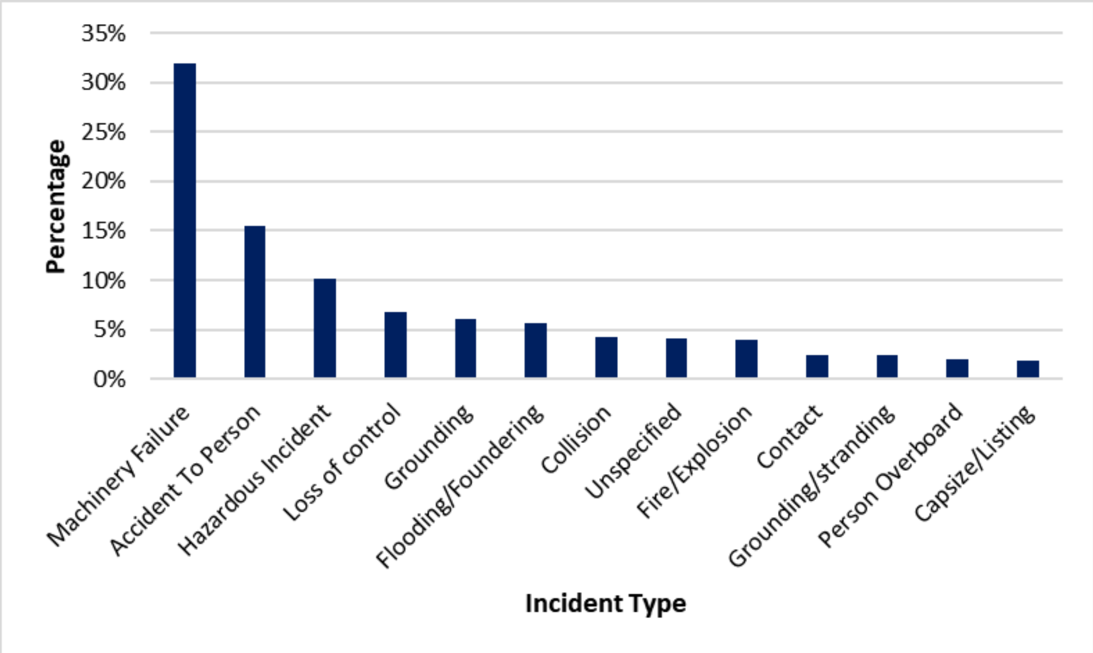

Figure C.5 MAIB Incident Types Breakdown within UK Waters (2002 - 2021)

619. 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.

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

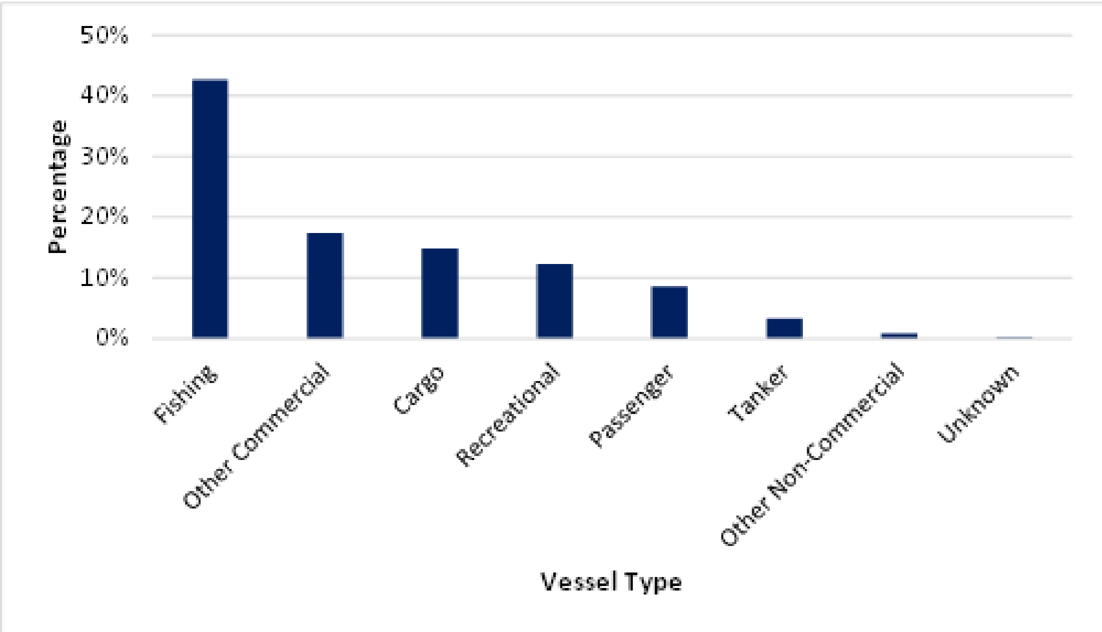

Figure C.6 MAIB Vessel Types Breakdown within UK Waters (2002 - 2021)

621. 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%).

622. 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.

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

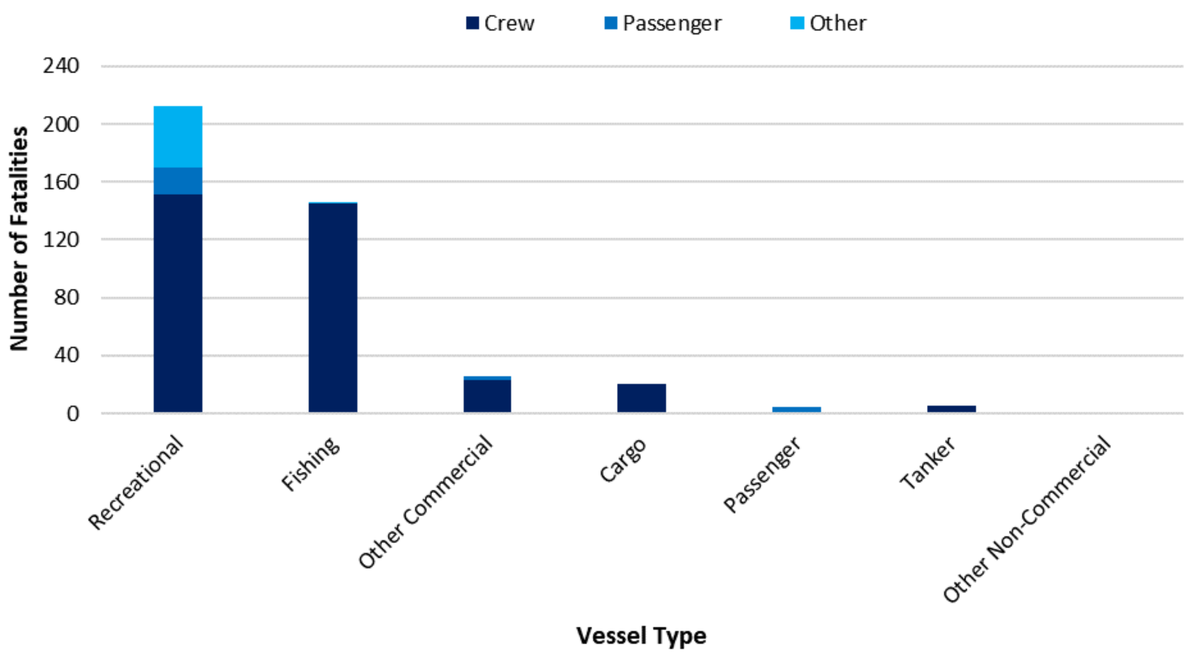

Figure C.7 MAIB Fatalities by Vessel Type within UK Waters (2002 to 2021)

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

C.3.2 Collision Incidents

625. 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).

626. 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).

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

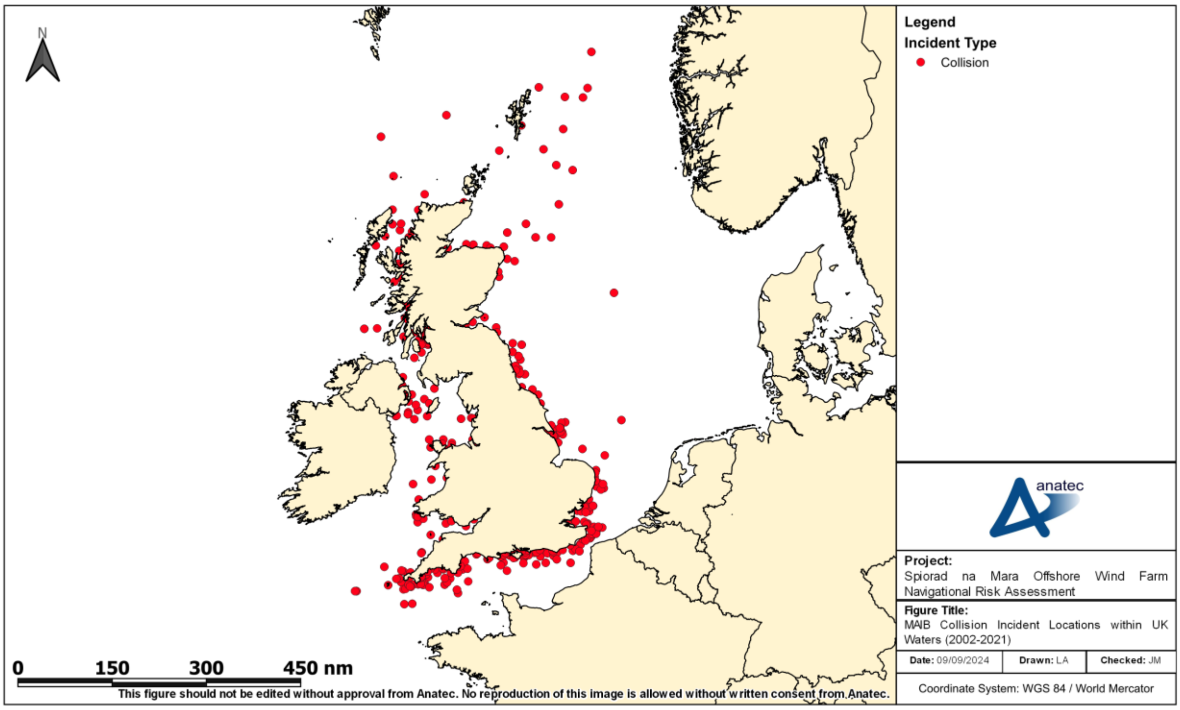

Figure C.8 MAIB Collision Incident Locations within UK Waters (2002 - 2021)

628. The distribution of collision incidents per year is presented in **Figure C.9**.

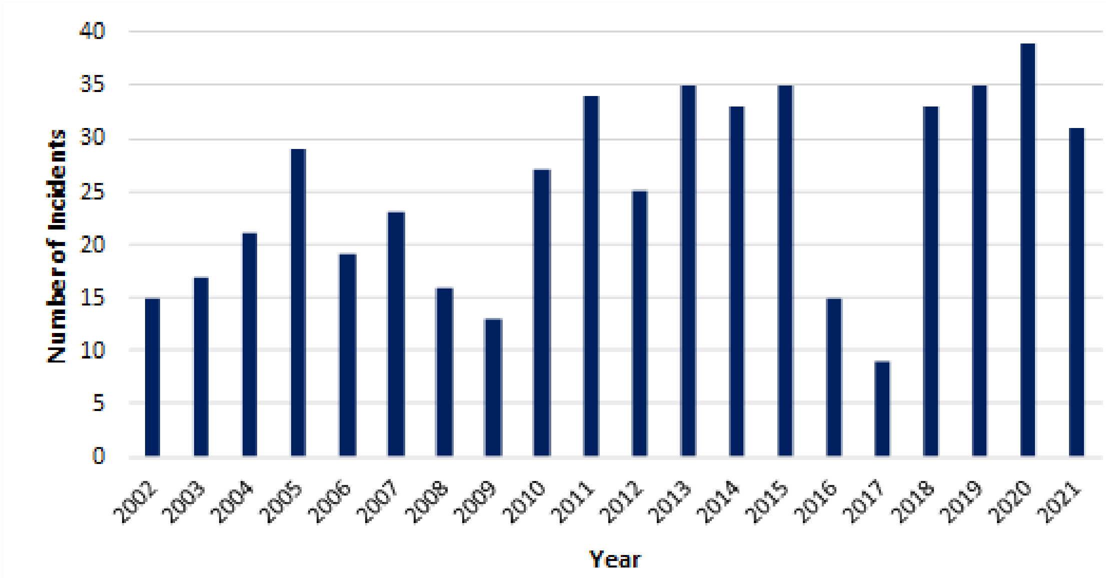

Figure C.9 MAIB Annual Collision Incidents within UK Waters (2002 - 2021)

629. 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.

630. The distribution of vessel types involved in collision incidents is presented in **Figure C.10**.

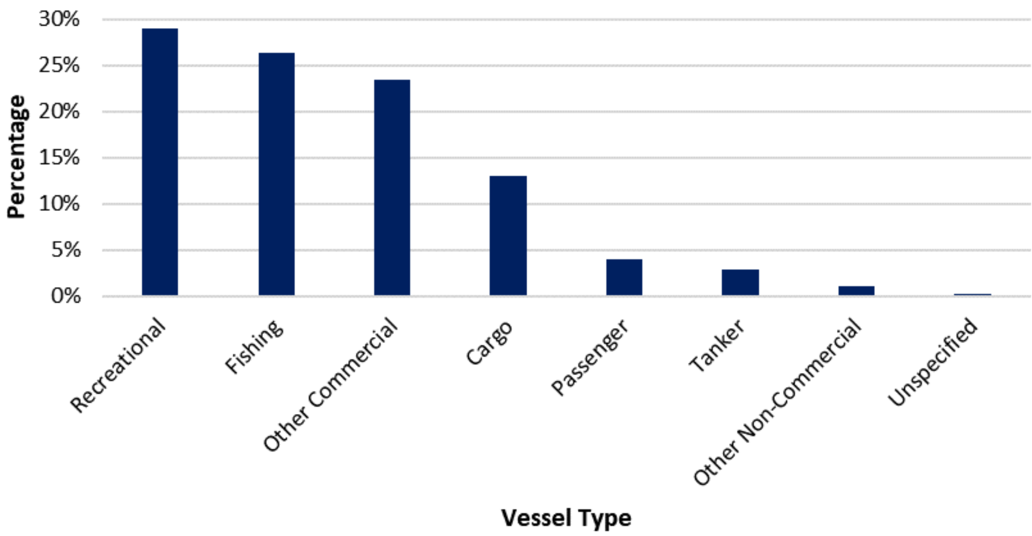

Figure C.10 MAIB Collision Incidents by Vessel Type within UK Waters (2002 - 2021)

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

632. A total of 5 fatalities were reported in MAIB collision incidents within UK waters between 2002 - 2021. Details of each of these fatal incidents reported by the MAIB are presented in **Table C.2**.

Table C.2 Description of Fatal MAIB Collision Incidents (2002 - 2021) for Shipping and Navigation

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 3 of the 4 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 1 of the 2 crew members recovered from the sea but the other member was not recovered despite an extensive search.	1
June 2015	Collision between Rigid-hulled Inflatable Boat (RIB) and yacht. Believed that around 12 persons were onboard the motorboat with the majority taken ashore by lifeboat. 1 person seriously injured and airlifted to hospital before being pronounced dead later.	1

Date	Description	Fatalities
June 2018	Collision between power boats during a race. 1 of the vessels overturned with the pilot pronounced dead at the scene.	1

C.3.3 Allision Incidents

633. 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.

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

635. The locations of allision incidents reported in proximity to the UK are presented in **Figure C.11**.

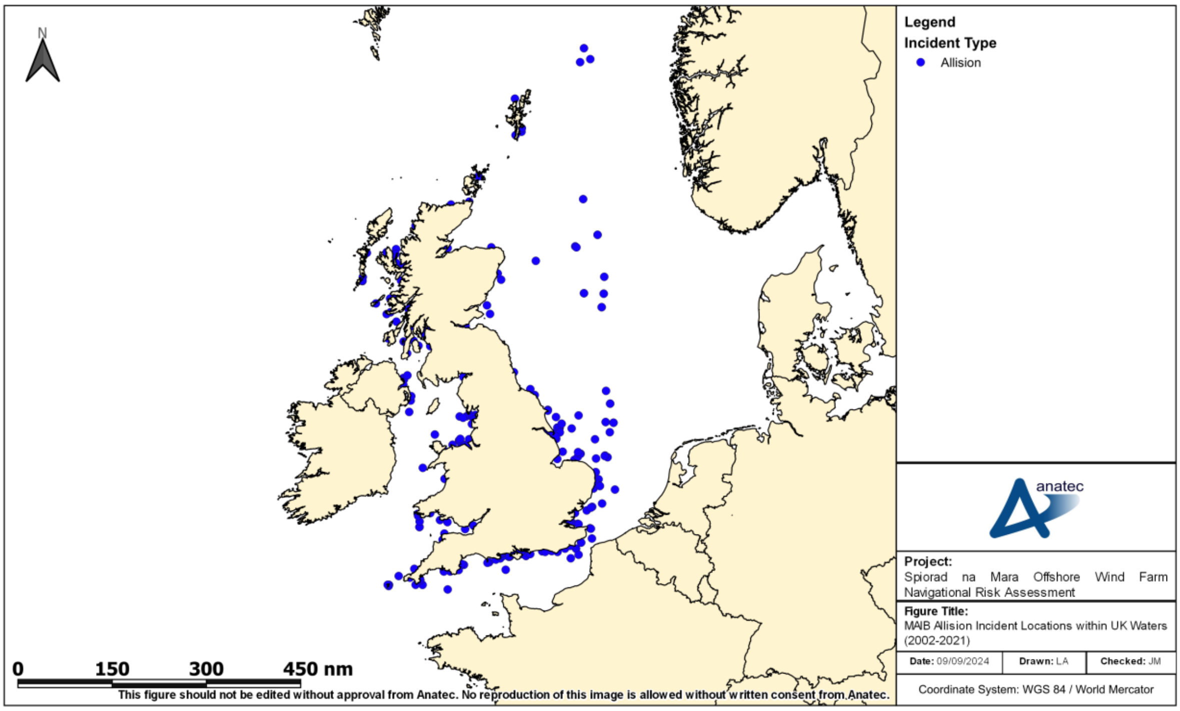

Figure C.11 MAIB Allision Incident Locations within UK Waters (2002 - 2021)

636. The distribution of allision incidents per year is presented in **Figure C.12**.

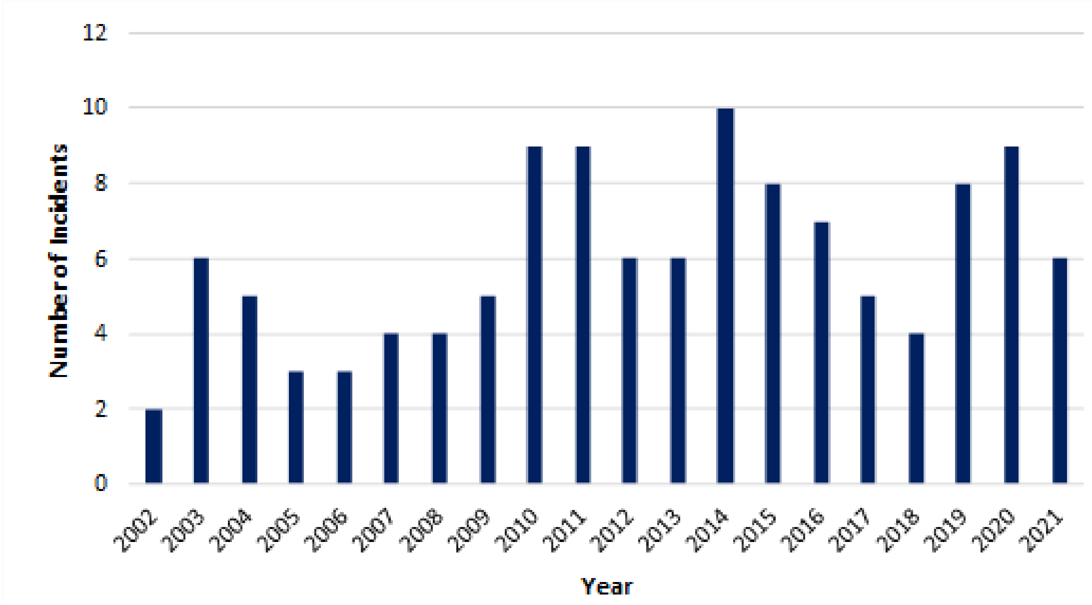

Figure C.12 MAIB Allision Incidents per Year within UK Waters (2002 - 2021)

637. The average number of allision incidents per year was 6. As with collision incidents, there has been an overall slight increasing trend in allision incidents over the 20-year period, which may be due to better reporting of less serious incidents in recent years.

638. The distribution of vessel types involved in allision incidents is presented in **Figure C.13**.

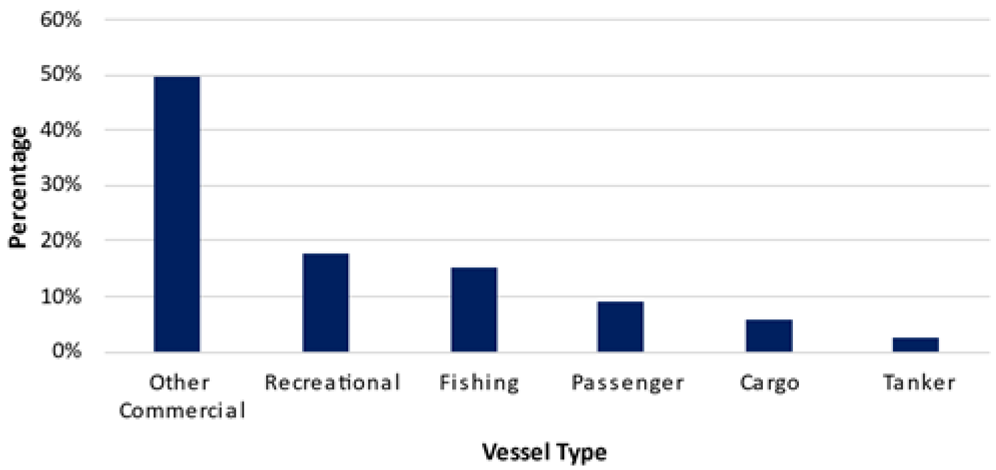

Figure C.13 MAIB Allision Incidents by Vessel Type within UK Waters (2002 - 2021)

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

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

C.4 Fatality Risk

C.4.1 Incident Data

641. This section uses the MAIB incident data along with information on average manning levels per vessel type to estimate the probability of a fatality in a maritime incident associated with the Offshore Project.

642. The Offshore 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;
- Fishing vessel to structure allision.

643. Of these incident types, only vessel to vessel collisions match the MAIB definition of collisions and hence the fatality analysis presented in **Section 3.2** is considered directly applicable to these types of incidents.

644. 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 C.3.3**). Additionally, none of the allision incidents reported by the MAIB between 2002 - 2021 resulted in a fatality.

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

C.4.2 Fatality Probability

646. 5 of the 504 collision incidents reported by the MAIB within UK waters between 2002 - 2021 resulted in 1 or more fatalities. This gives a 0.99% probability that a collision incident will lead to a fatal accident.

647. 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 C.3** presents the average number of People on Board (POB) estimated for each category of vessel navigating in proximity to the Offshore 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 C.3 Estimated Average POB by Vessel Category for Shipping and Navigation

Vessel Category	Sub Categories	Source of Estimated Average POB	Estimated Average POB
Cargo/freight	Dry cargo, other commercial, service ship, etc.	MAIB incident data	15
Tanker	Tanker/combination carrier	MAIB incident data	23
Passenger	RoRo passenger, cruise liner, etc.	Vessel traffic survey data/online information	627
Fishing	Trawler, potter, dredger, etc.	MAIB incident data	3.3
Recreational	Yacht, small commercial motor yacht, etc.	MAIB incident data	3.3

648. 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.

649. Using the average POB, along with the vessel type information involved in collision incidents reported by the MAIB (see **Section C.3.2**), there was an estimated 31,082 POB the vessels involved in the collision incidents.

650. Based upon five fatalities during the period 2002 - 2021, the overall fatality probability in a collision for any individual onboard is approximately 1.61×10^{-4} per collision.

651. 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 3 categories of vessel as presented in **Table C.4**. In addition, due to 0 fatalities resulting from commercial vessel collisions between 2002 - 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 C.4 Collision Incident Fatality Probability by Vessel Category for Shipping and Navigation

Vessel Category	Sub Categories	Fatalities	People Involved	Fatality Probability	Time Period
Commercial	Dry cargo, passenger, tanker, etc.	1	29,132	3.43×10^{-5}	1997 - 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 - 2021 (20 years)
Recreational	Yacht, small commercial motor yacht, etc.	3	1,023	2.9×10^{-3}	2002 - 2021 (20 years)

C.4.3 Fatality Risk due to the Project

652. The base case and future case annual collision frequency levels pre and post wind farm for the Offshore Project are summarised in **Table C.5**.

Table C.5 Summary of Annual Collision and Allision Risk Results for Shipping and Navigation

Risk	Scenario	Annual Frequency (Return Period)		
		Pre Wind Farm	Post Wind Farm	Change
Vessel to vessel collision	Base Case	$4.99\text{x}10^{-4}$ (1 in 2,002 years)	$5.00\text{x}10^{-4}$ (1 in 1,998 years)	$9.98\text{x}10^{-7}$ (1 in 1,002,253 years)
	Future Case (10%)	$6.17\text{x}10^{-4}$ (1 in 1,620 years)	$6.19\text{x}10^{-4}$ (1 in 1,616 years)	$1.47\text{x}10^{-6}$ (1 in 682,498 years)
	Future Case (20%)	$7.27\text{x}10^{-4}$ (1 in 1,375 years)	$7.29\text{x}10^{-4}$ (1 in 1,372 years)	$1.59\text{x}10^{-6}$ (1 in 629,300 years)
Powered vessel to structure allision	Base Case	-	$4.53\text{x}10^{-6}$ (1 in 220,809 years)	$4.53\text{x}10^{-6}$ (1 in 220,809 years)
	Future Case (10%)	-	$5.44\text{x}10^{-6}$ (1 in 199,292 years)	$5.44\text{x}10^{-6}$ (1 in 199,292 years)
	Future Case (20%)	-	$5.70\text{x}10^{-6}$ (1 in 181,925 years)	$5.70\text{x}10^{-6}$ (1 in 181,925 years)
Drifting vessel to structure allision	Base Case	-	$2.65\text{x}10^{-5}$ (1 in 37,790 years)	$2.65\text{x}10^{-5}$ (1 in 37,790 years)
	Future Case (10%)	-	$2.91\text{x}10^{-5}$ (1 in 34,354 years)	$2.91\text{x}10^{-5}$ (1 in 34,354 years)
	Future Case (20%)	-	$3.18\text{x}10^{-5}$ (1 in 31,491 years)	$3.18\text{x}10^{-5}$ (1 in 31,491 years)
Fishing vessel to structure allision	Base Case	-	$6.95\text{x}10^{-2}$ (1 in 14 years)	$6.95\text{x}10^{-2}$ (1 in 14 years)
	Future Case (10%)	-	$7.61\text{x}10^{-2}$ (1 in 13 years)	$7.61\text{x}10^{-2}$ (1 in 13 years)
	Future Case (20%)	-	$8.27\text{x}10^{-2}$	$8.27\text{x}10^{-2}$

Risk	Scenario	Annual Frequency (Return Period)		
		Pre Wind Farm	Post Wind Farm	Change
			(1 in 12 years)	(1 in 12 years)
Total	**Base Case**	**4.99x10^{-4} (1 in 2,002 years)**	**7.00x10^{-2} (1 in 14 years)**	**6.95x10^{-2} (1 in 14 years)**
	Future Case (10%)	**6.17x10^{-4} (1 in 1,620 years)**	**7.68x10^{-2} (1 in 13 years)**	**7.61x10^{-2} (1 in 13 years)**
	Future Case (20%)	**7.27x10^{-4} (1 in 1,375 years)**	**8.35x10^{-2} (1 in 11 years)**	**8.28x10^{-2} (1 in 12 years)**

653. From the detailed results of the collision and allision risk modelling, the distribution of the predicted change in annual collision and allision frequency by vessel type due to the Offshore Project for the base case and future case are presented in **Figure C.14**.

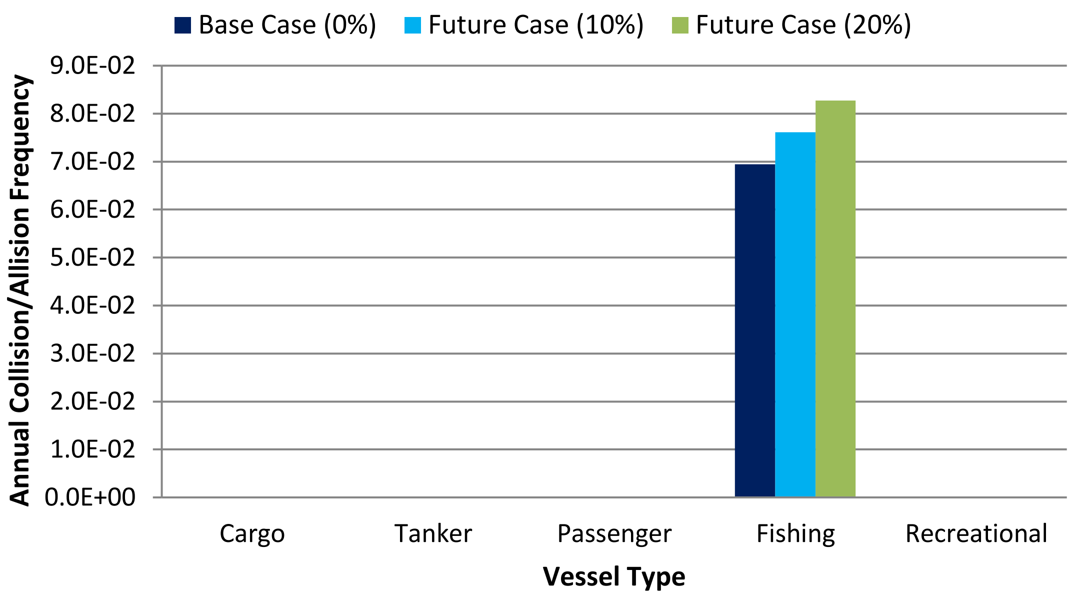

Figure C.14 Estimated Change in Annual Collision and Allision Frequency by Vessel Type

654. It can be seen that the majority of change in collision and allision frequency is associated with fishing vessels, owing to the greater duration spent in proximity to the Array Area by fishing vessels engaged in fishing activities and the possibility of fishing occurring internally within the Turbine Area itself.

655. Combining the annual collision and allision frequency, estimated number of POB for each vessel type, and estimated fatality probability for each vessel category, the total annual increase in PLL due to the presence of the Project for the base case is estimated to be 4.66x10^{-4}, equating to 1 additional fatality every 2,144 years.

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

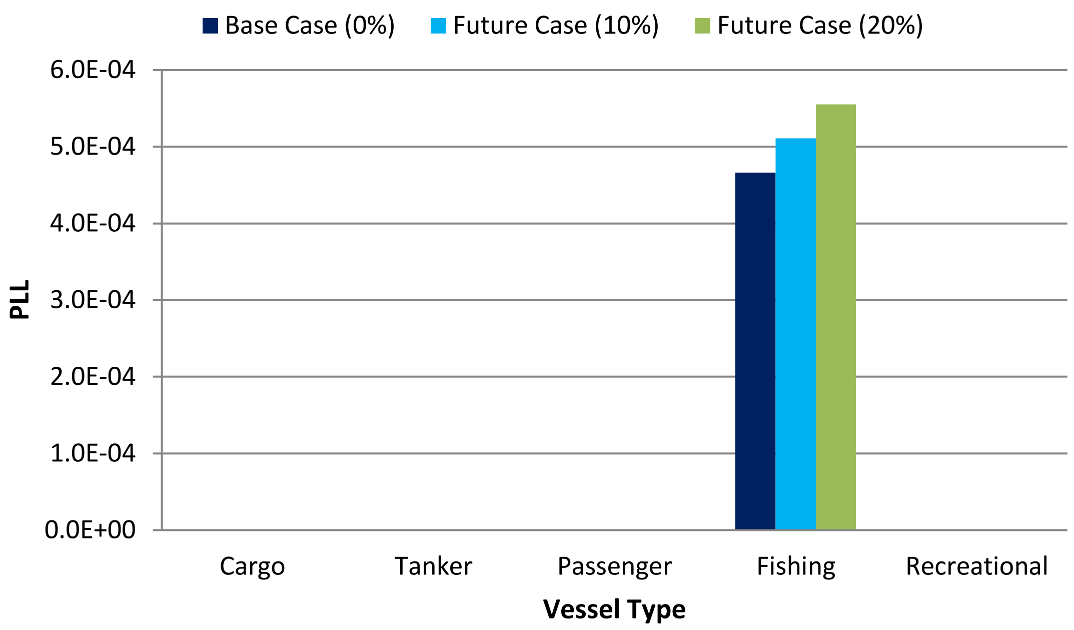

Figure C.15 Estimated Change in Annual PLL by Vessel Type

657. As with the change in annual collision and allision frequency, it can be seen that the majority of the change in annual PLL is associated with fishing vessels, which historically have a higher fatality probability than commercial vessels.

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

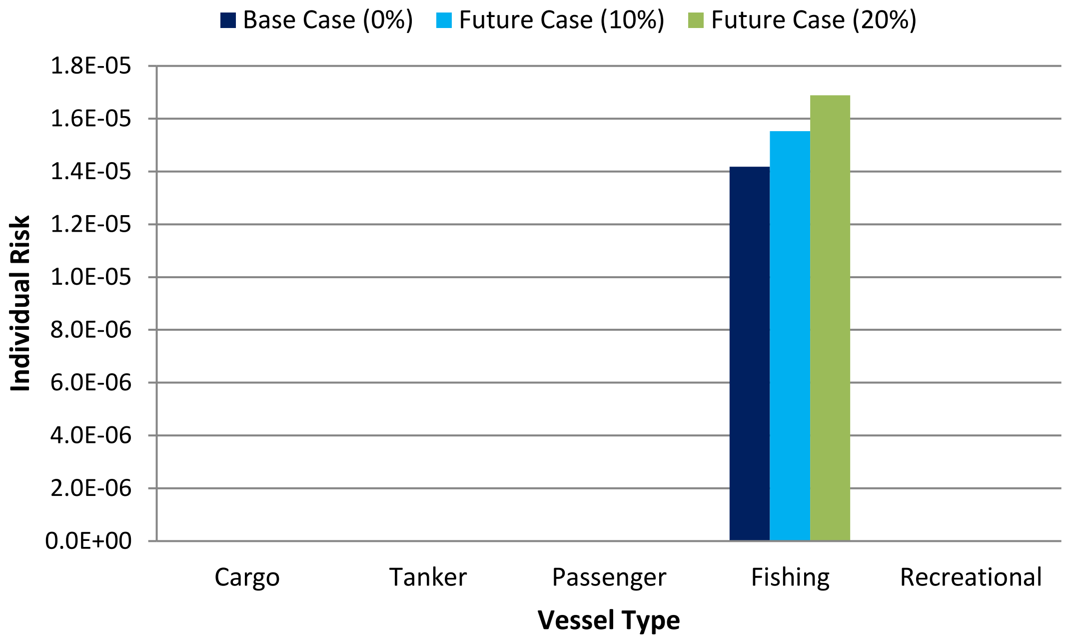

Figure C.16 Estimated Change in Individual Risk by Vessel Type

659. It can be seen that the individual risk is highest for people on fishing vessels, which reflects the higher probability of a fatality occurring in the event of an incident involving a fishing vessel.

C.4.4 Significance of Increase in Fatality Risk

660. In comparison to MAIB statistics, which indicate an average of 18 - 19 fatalities per year in UK territorial waters during the 20-year period between 2002 - 2021, the overall increase for the base case in PLL of 1 additional fatality per 2,144 years represents a small change.

661. In terms of individual risk to people, the change for commercial vessels attributed to the Offshore Project (approximately 1.14×10^{-10} for the base case) is very low compared to the background risk level for the UK sea transport industry of 2.9×10^{-4} per year.

662. For fishing vessels, the change in individual risk attributed to the Offshore Project (approximately 1.42×10^{-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.

C.5 Pollution Risk

C.5.1 Historical Analysis

663. 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);
- Spill size (quantity of oil).

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

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

665. The research undertaken as part of the DfT's Marine Environmental High Risk Areas (MEHRA) 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 C.17**.

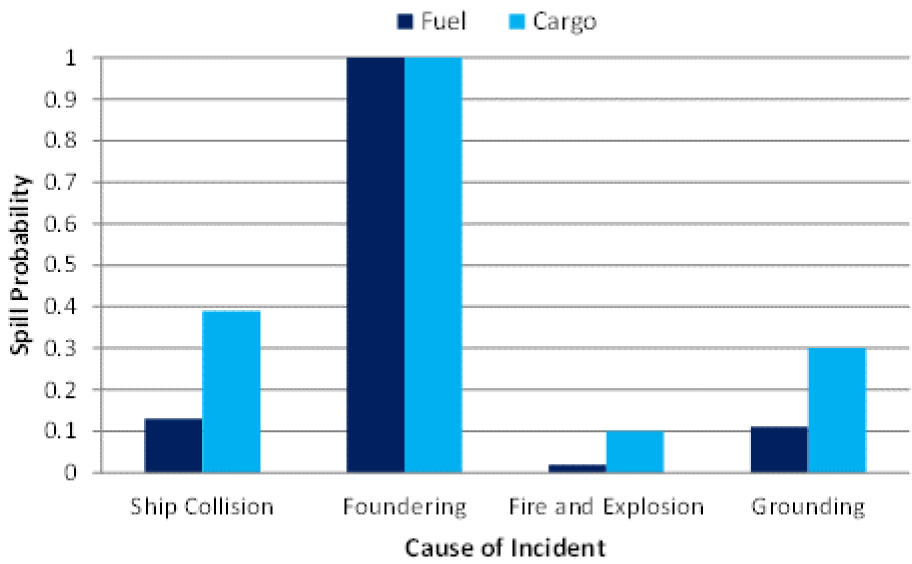

Figure C.17 Probability of an Oil Spill Resulting from an Accident

666. 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.

667. 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.

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

669. For cargo spills from laden tankers, the spill size can vary significantly. The International Tanker Owners Pollution Federation (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;

- 17% of spills greater than 700 tonnes.

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

671. 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 5 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.

C.5.2 Pollution Risk due to the Project

672. Applying the above probabilities to the annual collision and allision frequency by vessel type presented in **Table C.14** and the average spill size per vessel, the amount of oil spilled per year due to the impact of the Offshore Project is estimated to be 0.18 tonnes per year for the base case and 0.19 and 0.21 tonnes per year for the future cases of 10% and 20% increases in vessel traffic, respectively.

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

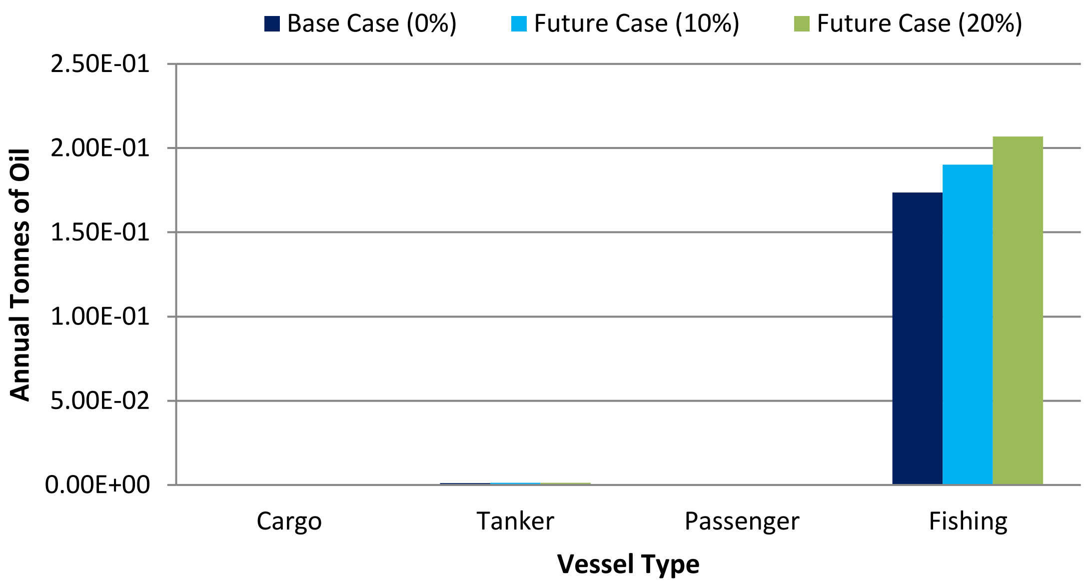

Figure C.18 Estimated Change in Pollution by Vessel Type

674. The majority of annual oil spill results are associated with fishing vessels due to the high annual allision frequency associated with fishing vessels.

C.5.3 Significance of Increase in Pollution Risk

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

676. 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 - 1998 was 16,111. This is based upon a total of 146 reported oil pollution incidents of greater than 1 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%.

677. The overall increase in pollution estimated due to the Project of 0.18 tonnes for the base case represents a 0.001% increase compared to the historical average pollution quantities from maritime incidents in UK waters.

C.6 Conclusion

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

679. Overall, the impact of the Offshore 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 OWF development and there may be additional maritime risks associated with other OWF developments in the UK.

Appendix D Regular Operator Consultation

680. As part of the consultation process for the Offshore Project, Regular Operators identified (from the vessel traffic surveys and long-term vessel traffic data) that would be required to deviate their routes due to the presence of the Array Area were consulted via email. An example of the correspondence sent to the Regular Operators (which shows the extent of the Array Area and OCAS at that time) is presented below. Further details relating to Regular Operator outreach is provided in **Section 4.1**.

anatec

Address: Anatec Ltd.
10 Exchange Street
Aberdeen AB11 6PH
Tel: 01224 253700

Email: aberdeen@anatec.com
Website: www.anatec.com

Date: 17th January 2025
Ref: A5018-WSP-RO-1

Opportunity to Participate in Consultation Relating to Shipping and Navigation for the Proposed Spiorad na Mara Offshore Wind Farm

Dear Stakeholder,

As you may be aware, Spiorad na Mara Offshore Wind Farm ('the Project') is a proposed offshore wind farm development between 3nm and 7nm off the western coast of the Isle of Lewis, in the outer Hebrides. The project has a potential expected capacity of around 900 Megawatts. The Project is owned by Northland Power and ESB, with Northland Power (hereafter, "the Developer") leading on development. Further information relating to the Project is available on the Project website here.

Following a Scoping Report for the Project submitted to Scottish Ministers in September 2023 (see here), with a Scoping Opinion received from Marine Directorate in May 2024 (see here) the Developer is proceeding to create the associated Navigational Risk Assessment (NRA) which will inform the shipping and navigation assessment undertaken for the application.

As part of the NRA process, the Developer would like to ensure that comprehensive consultation is undertaken to identify any potential impacts that the Project may have upon shipping and navigation users. To analyse shipping movements within and in the vicinity of the Project, vessel traffic survey data collected across two 14-day periods (February/March and June/July 2024) in line with Marine Guidance Note (MGN) 654 requirements has been analysed. Additionally, Automatic Identification System (AIS) data covering 12 months from July 2023 to June 2024 has been collected and assessed and will feed into the NRA. According to the assessment of the available datasets, your company's vessel(s) have been recorded regularly navigating within and/or in the vicinity of the Project. Consequently, your company has been identified as a potential marine stakeholder for the Project. We therefore invite your feedback on the potential development, including any impact it may have upon the navigation of vessels.

An overview of the Project is provided in **Figure 1** for your reference. This includes the Array Area within which wind turbines and offshore substation (if required) will be located and the Offshore Cable Corridor Area of Search within which the offshore cables connecting the Array Area to landfall will be laid. **Table 1** presents the coordinates of the Array Area. Additionally, **Figure 2** presents the vessel traffic data recorded during the two 14-day surveys.

We would be grateful if you could provide us with any comments or feedback that you may have, including any impact the Project may have upon the navigation of your vessels, by the **14 February 2025**. 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.

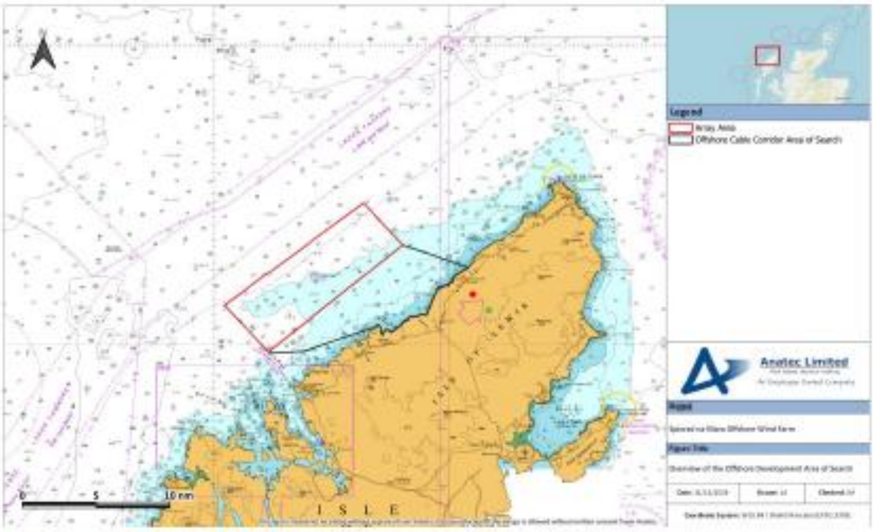

Figure 1 Overview of the Offshore Project

Table 1 Array Area Coordinates

Latitude (World Geodetic System 1984 (WGS84))	Longitude (WGS84)
58° 22’ 35.25” N	006° 58’ 41.46” W
58° 19’ 29.76” N	006° 53’ 00.34” W
58° 21’ 09.04” N	006° 49’ 01.75” W
58° 29’ 26.74” N	006° 40’ 53.59” W
58° 27’ 34.28” N	006° 37’ 30.13” W
58° 26’ 38.68” N	006° 35’ 49.55” W

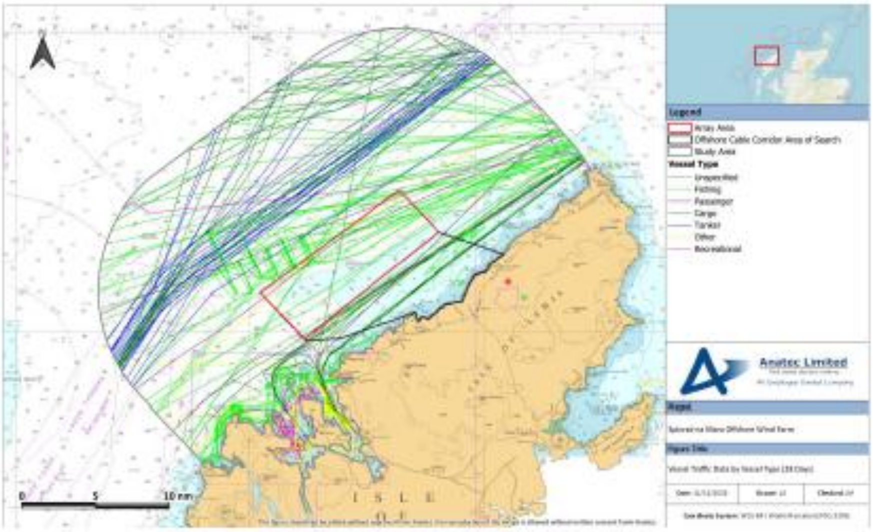

Figure 2 Vessel Traffic Data by Vessel Type (28 Days Winter and Summer 2024)

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; and
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 planned to take place on the 25th February 2025 on the Isle of Lewis, noting a dial in option will also be available for anyone unable to attend in person. The workshop will be held at:

Museum nan Eilean (Stornoway)
Lews Castle Castle Grounds
Stornoway, Isle of Lewis
HS2 0XS

Please provide your responses via email to [redacted] as well as an indication of whether you are interested in attending the Hazard Workshop noted above.

Yours sincerely,

[redacted]
Risk Analyst
Anatec Ltd

Appendix E Long-Term Vessel Traffic Movements

E.1 Introduction

681. Although seasonally varied, the 28 days of vessel traffic survey data (see **Section 5.2**) in isolation may not fully capture all maritime activities or periods of relevance to shipping and navigation. Therefore, in line with good practice assessment procedures, and following scoping responses from the Scottish Ministers and UK Chamber of Shipping, a long-term AIS dataset covering 12 months from 1 July 2023 - 30 June 2024 has been analysed to ensure a comprehensive picture of vessel traffic can be established, including any seasonal variation in vessel routeing or activities. This data is summarised in this appendix and is used where appropriate to inform the NRA in addition to other vessel traffic datasets and stakeholder consultation.

682. The key aims and objectives of this assessment are to identify seasonal variations in vessel traffic via the analysis of long-term data. It is noted the NRA validates the 28 days of MGN 654 (MCA, 2021) compliant vessel traffic survey data against this 12-month analysis, including identification of any findings of the 12-month analysis not reflected within the 28-day assessment.

E.2 Data Sources

E.2.1 Study Area

683. The same 10 nm buffer of the Array Area as established in **Section 3.4** is again used throughout this assessment.

E.2.2 Long-Term Dataset

684. The long-term dataset was collected from terrestrial and satellite receivers between 1 July 2023 - 30 June 2024. Any vessel traffic identified as temporary and/or non-routine in nature based on AIS information has been omitted from further analysis; this typically consisted of vessels engaged in survey work associated with the Project. This also included vessels transiting to a survey site outside of the study area where there was clear indication that they were doing so. The tracks of vessels excluded from further analysis are presented in **Figure E.1**.

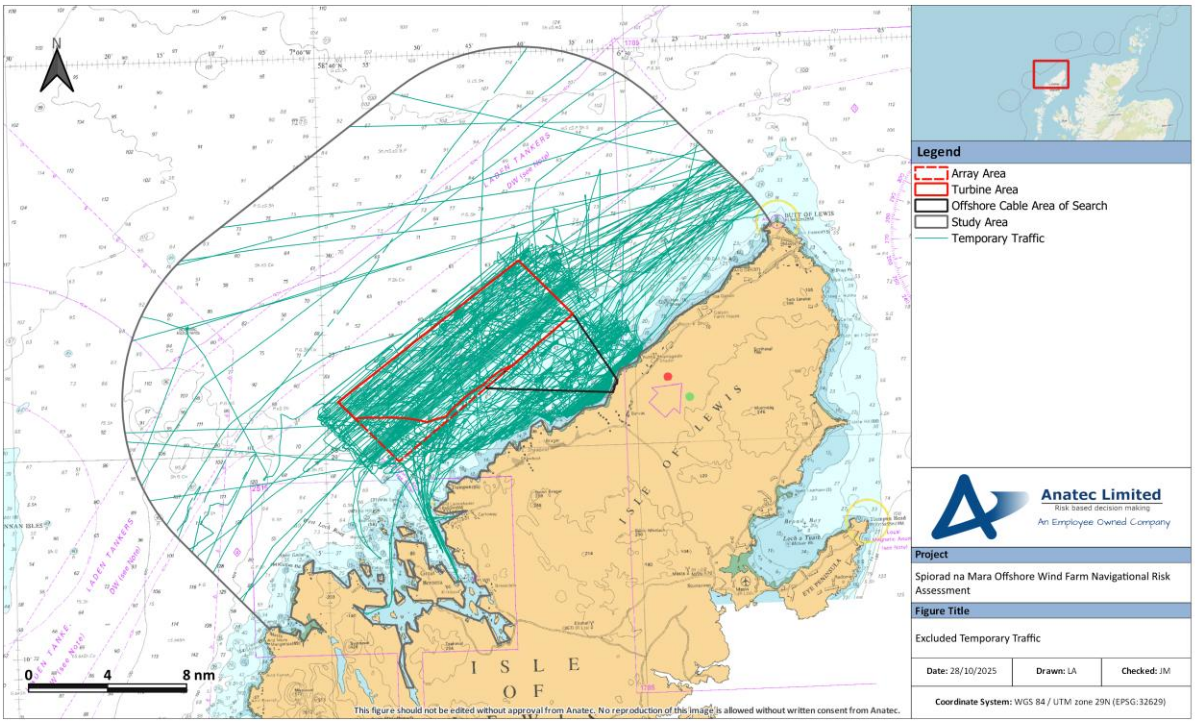

Figure E.1 Excluded Temporary Traffic

685. The long-term dataset has been analysed for potential adverse weather routeing, where vessels may have sought shelter to avoid adverse weather conditions. No such routeing was identified.

E.2.3 Limitations

686. It is recognised that the long-term dataset is AIS only and therefore may underrepresent vessels which are not required to carry an AIS transceiver. AIS carriage is mandatory for all vessels of 300 GT and upwards on international voyages, cargo vessels of 500 GT and upwards not engaged on international voyages and all passenger vessels irrespective of size.

687. In addition, fishing vessels with length overall (LOA) of 15 m and greater must carry AIS. Smaller fishing vessels, recreational vessels and military vessels are not required to broadcast on AIS but may do so voluntarily. Therefore, a proportion of vessel traffic is not fully covered by AIS data and is covered by other means in the NRA, such as the MGN 654 compliant survey data, existing desk-based datasets and stakeholder consultation on small vessel activity.

688. For the purposes of this assessment, it has been assumed that vessels under an obligation to broadcast information via AIS have done so. It has also been assumed that the details broadcast via AIS (such as vessel type and dimensions) are accurate unless clear evidence to the contrary was identified during Anatec’s thorough quality assurance of the data.

E.3 Long-Term Assessment

E.3.1 Vessel Traffic Overview

689. This section presents an overview of the vessel traffic data collected within the study area during the 12-month period. Analysis within this section is based on unique vessels per day to avoid over-representation of vessels, when multiple AIS tracks were recorded due to a momentary drop off in coverage. Such instances were minimal, with the majority of AIS tracks having full coverage.

690. An overview of all vessel tracks recorded during the 12-month period within the study area is presented in **Figure E.2**, colour-coded by vessel type. Following this, **Figure E.3** presents the vessel density within the study area.

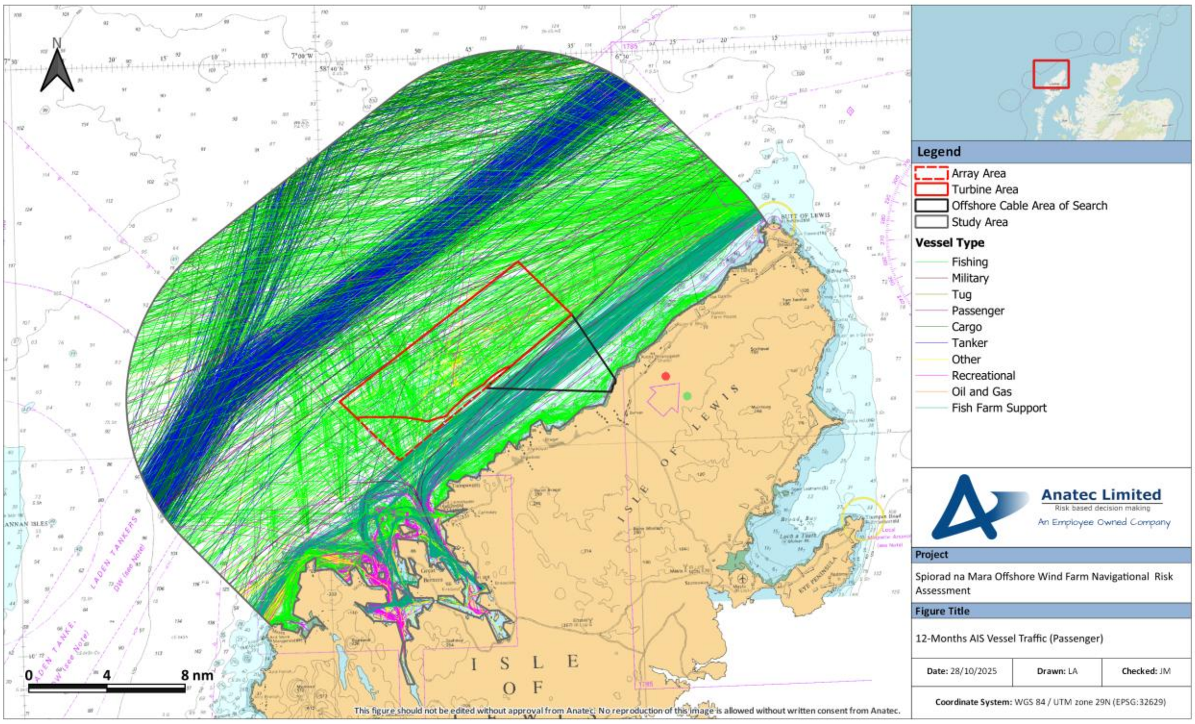

Figure E.2 12-Months AIS Vessel Traffic Colour-Coded by Vessel Type

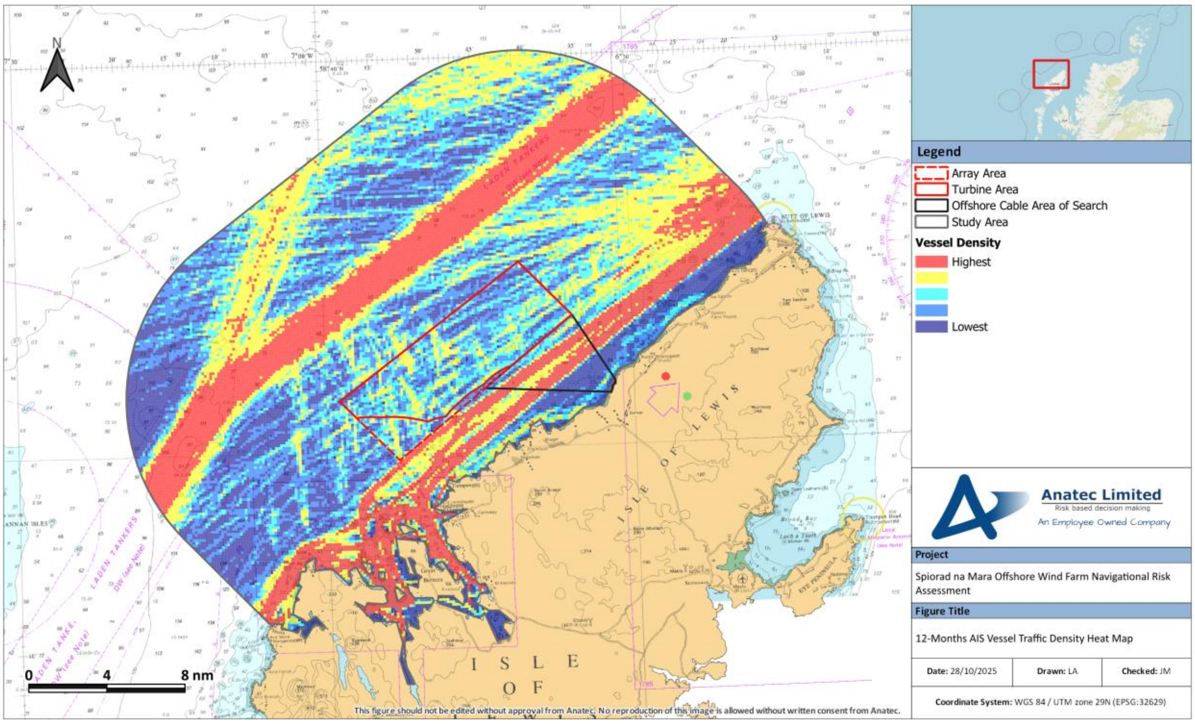

Figure E.3 12-Months AIS Vessel Traffic Density Heat Map

E.3.1.2 Vessel Count

691. **Figure E.4** presents the average number of daily unique vessels recorded within the study area per month of the study period.

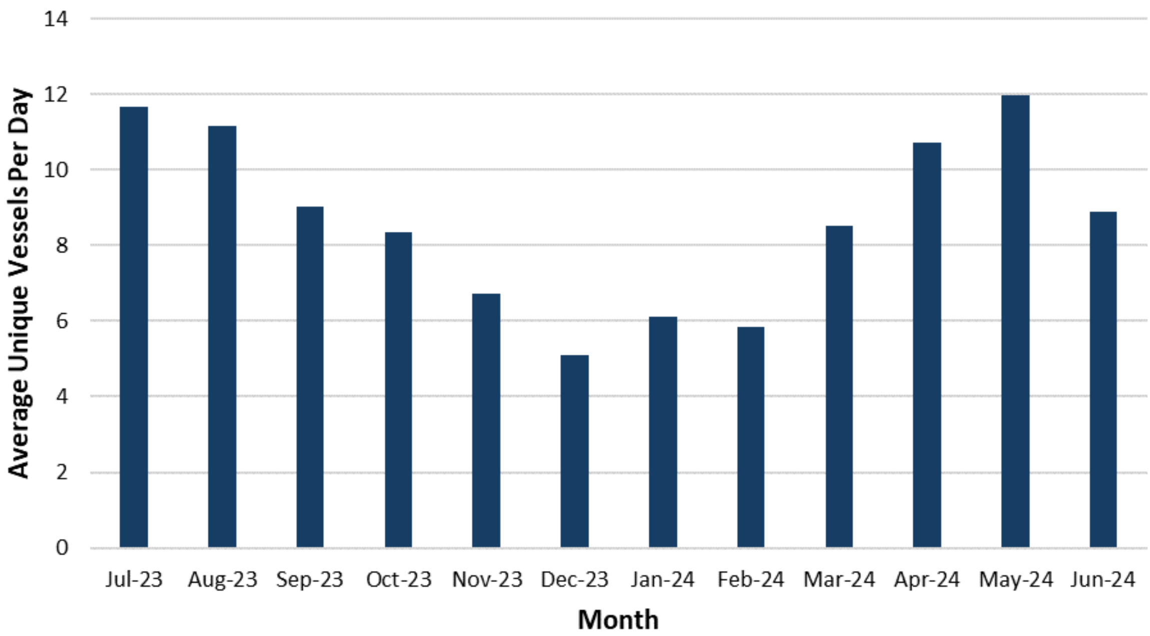

Figure E.4 Average Daily Unique Vessels per Month

692. There was an overall average of 9 unique vessels recorded per day within the study area, during the 12-month period. The highest averages were associated with July 2023 and May 2024, both having an average of 12 unique vessels per day. The lowest average was associated with December 2023, which had an average of 5 unique vessels per day. The busiest day overall was the 8 July 2023, when 21 unique vessels were recorded.

693. **Figure E.5** presents the AIS vessel tracks recorded within the study area during May 2024, one of the busiest periods, colour-coded by vessel type.

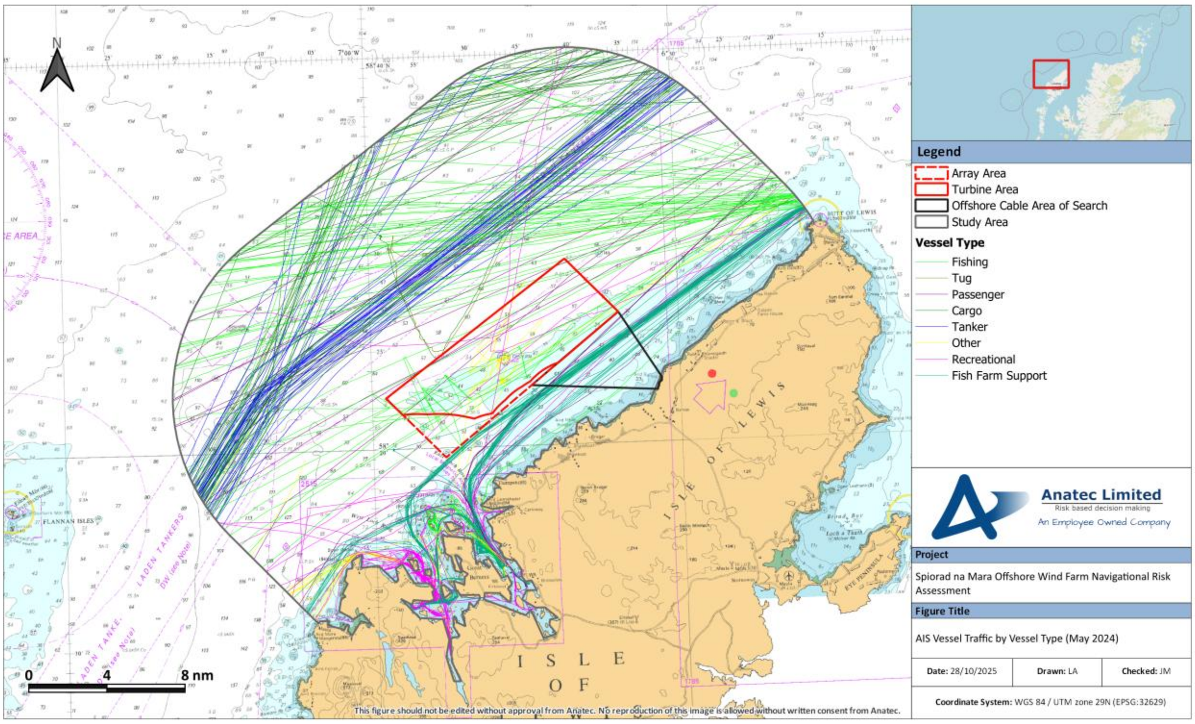

Figure E.5 AIS Vessel Traffic by Vessel Type (May 2024)

694. The main routeing patterns can be identified from the above figure, including use of the DWR by tankers and cargo vessels, inshore routeing to and from Loch Roag by smaller vessels, and fishing vessel behaviour. Further analysis of individual vessel types is presented in **Section E.3.2**.

E.3.1.3 Vessel Type

695. **Figure E.6** presents the distribution of vessel types recorded within the study area during the 12-month period. It should be noted that vessel types accounting for less than 1% of the total vessel traffic have been incorporated into the “All Others” category; this included tugs, military vessels and oil and gas support vessels.

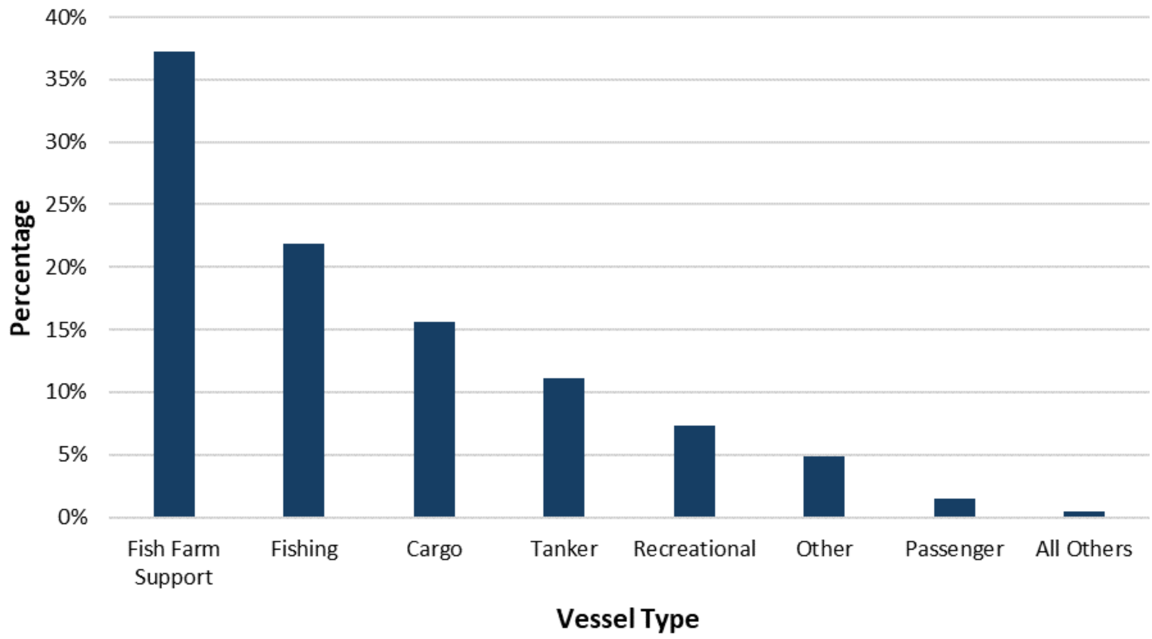

Figure E.6 Vessel Type Distribution

696. The most common vessel type recorded within the study area during the 12-month period was fish farm support (37%). This was followed by fishing vessels (22%), cargo vessels (16%), tankers (11%), recreational vessels (7%), other vessels (5%) and passenger vessels (1%). The other vessel category consisted of marine service vessels and local vessels.

E.3.1.4 Vessel Length

697. An overview of all vessel tracks recorded during the 12-month period within the study area is presented in **Figure E.7**, colour-coded by vessel length. It should be noted that a single vessel was not able to be associated with a valid length, a fish farm support vessel, which accounted for 11% of the total vessel traffic.

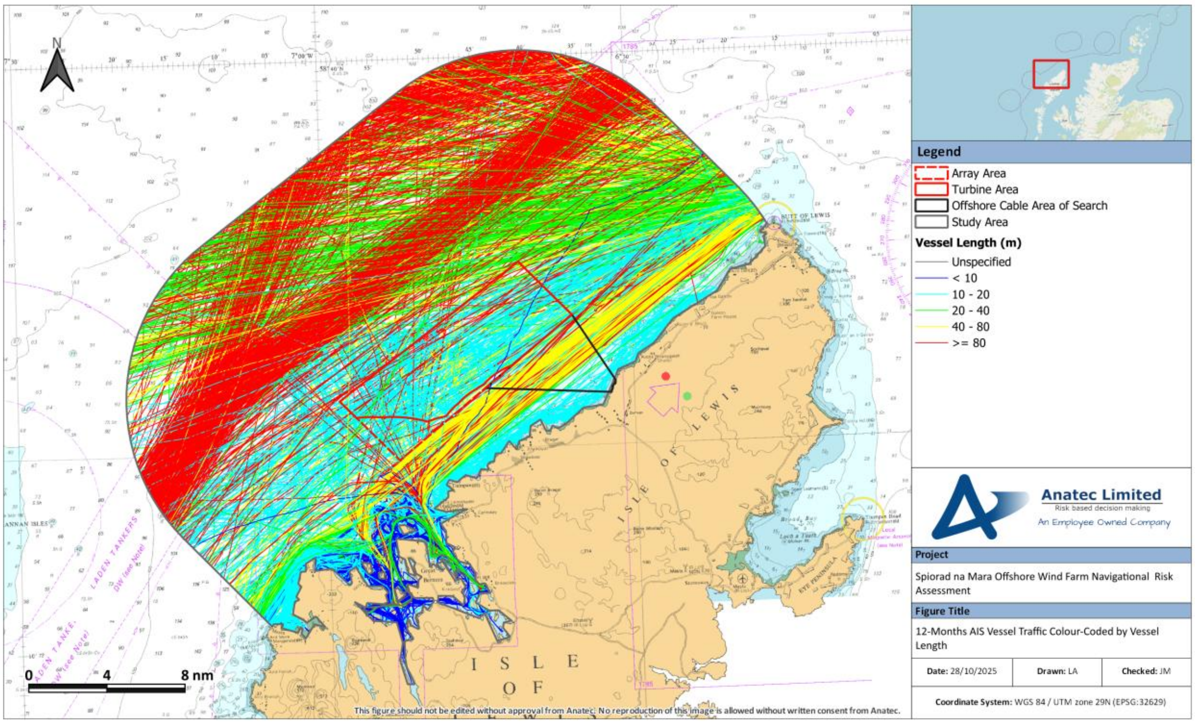

Figure E.7 12-Months AIS Vessel Traffic Colour-Coded by Vessel Length

698. Vessels below 15 m were recorded inshore in most cases; these included recreational vessels, small fishing vessels, vessels attending fish farms and marine support vessels. Vessels with lengths 15 m - 30 m were identified further offshore (including within the Array Area) and were typically fishing vessels with tracks indicative of active fishing. Vessels 30 m - 70 m noted inshore were generally small fish carriers visiting the fish farms around Loch Roag, approaching from the north. This category also included fishing vessels recorded on transit, to the north of the Array Area in an east/west direction. Vessels 70 m - 160 m included larger fish carriers seen on prominent routeing, approaching from the north. Additionally, this category included various commercial traffic throughout the study area. Vessels of 160 m and above were commercial traffic on well-defined routeing, to the north of the Array Area.

699. **Figure E.8** presents the distribution of vessel lengths recorded within the study area during the 12-month period.

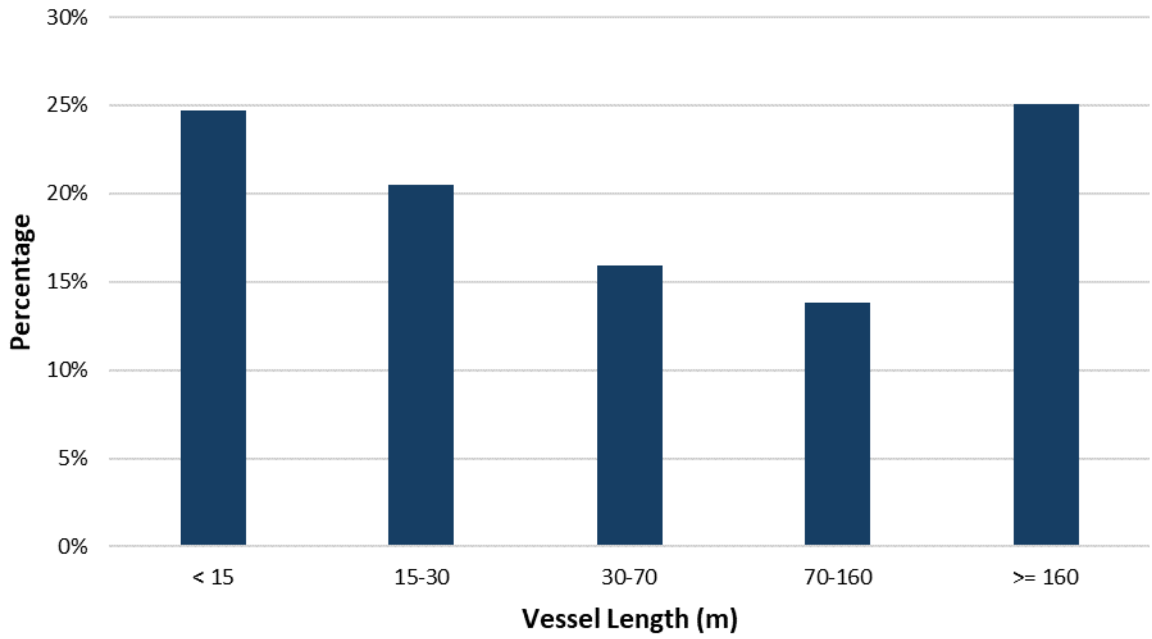

Figure E.8 Vessel Length Distribution

700. The average vessel length recorded in the study area during the 12-month period was 88 m. The most common vessel length categories were below 15 m and above or equal to 160 m, both accounting for 25% of total vessel traffic. The largest vessel recorded within the study area during the 12-month period was a 336 m crude oil tanker utilising the DWR.

E.3.2 Review of Activity by Vessel Type

701. This section reviews the vessel activity within the study area during the 12-month period for each of the main vessel types recorded on AIS within **Section E.3.1.2** considered of relevance to the Offshore Project.

E.3.2.1 Fish Farm Support Vessels

702. Fish farm support vessels accounted for 37% of total vessel activity. These vessels have been classified as those regularly visiting an active aquaculture site within Loch Roag; vessels categorised as fish carriers but not actively visiting any site in the area have been excluded from this classification but have been retained in the cargo vessels category, as standard. **Figure E.9** presents the fish farm support vessels, alongside the active aquaculture sites being visited.

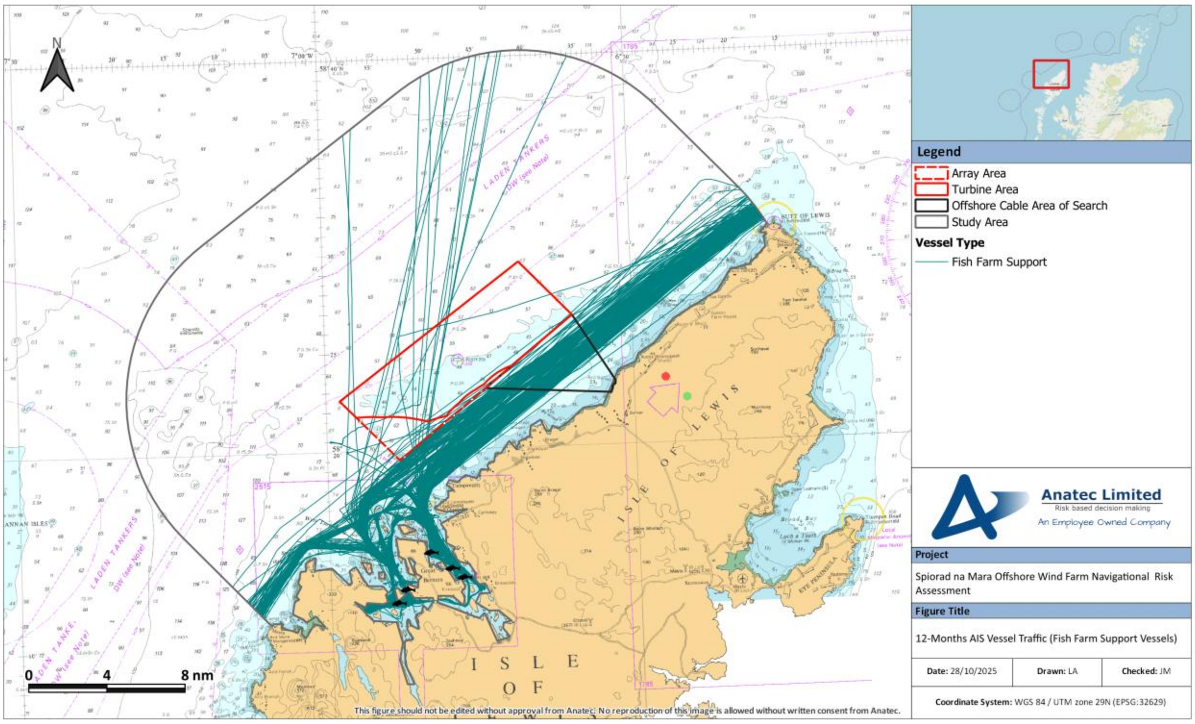

Figure E.9 12-Months AIS Vessel Traffic (Fish Farm Support Vessels)

703. These vessels were a combination of fish carriers transiting between the fish farms and various Scottish ports, and vessels regularly operating at the fish farms. Vessels transporting fish were primarily seen near the coast heading northeast, while also heading southwest in some instances. A small proportion were noted heading north, through the Array Area, to/from Fuglafjord (Faroe Islands).

704. **Figure E.10** presents the distribution of average weekly unique fish farm support vessels per month within the study area, during the 12-month period.

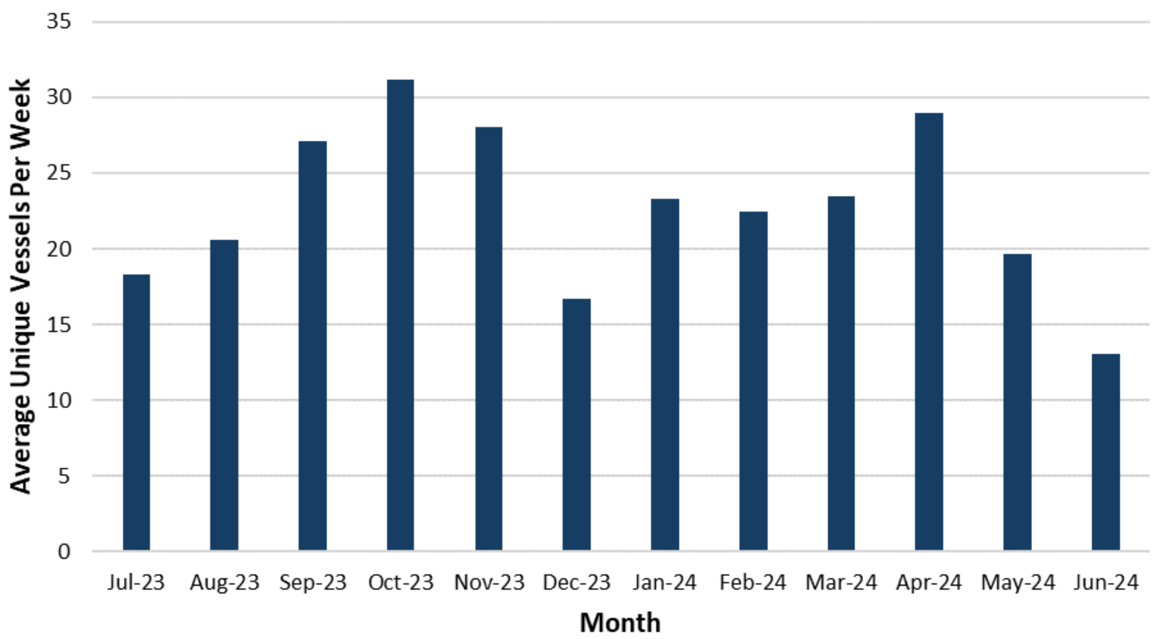

Figure E.10 Average Weekly Fish Farm Support Vessels per Month

705. There was an overall average of 23 fish farm support vessels recorded within the study area per week. The busiest period was October 2023 which recorded an average of 31 fish farm support vessels per week, with volumes varying across the year but with no clear seasonal trend.

E.3.2.2 Fishing Vessels

706. Fishing vessels accounted for 22% of the total vessel traffic. **Figure E.11** presents the fishing vessel tracks recorded within the study area during the 12-month period, colour-coded by activity. It is noted that fishing vessel activity has been identified at a high-level (based on average speed and track behaviour) and further assessment would be required to refine each vessel's intentions.

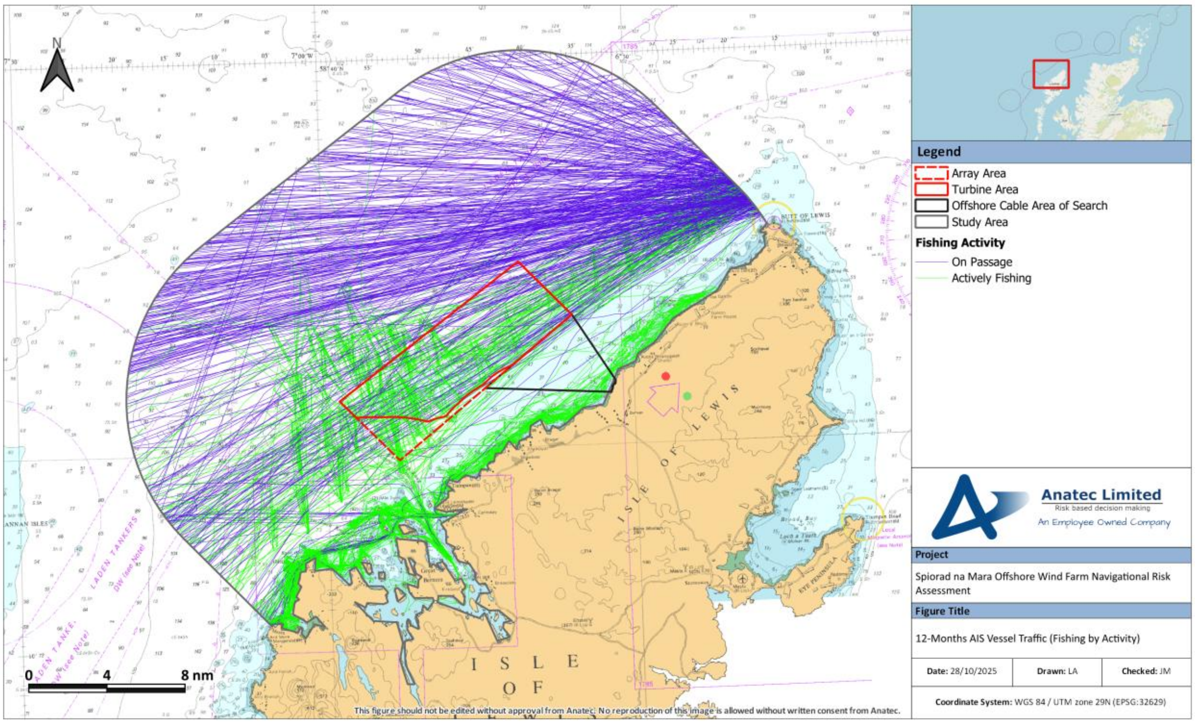

Figure E.11 12-Months AIS Vessel Traffic (Fishing by Activity)

707. As seen in the above figure, fishing vessels with tracks indicative of active fishing were generally recorded along the coastline and within the Array Area. Fishing vessels on passage were typically seen further offshore, transiting in an east/west direction, with a proportion heading southwest intersecting the Array Area. All fishing vessels were assigned a valid gear type; the most common gear type was demersal trawlers (40%), followed by potters (35%), long liners (14%) and pelagic trawlers (7%).

708. As noted in **Section E.2.3**, not all fishing vessels are required to broadcast on AIS and therefore their coverage may be underrepresented.

709. **Figure E.12** presents the average weekly unique fishing vessels per month within the study area, during the 12-month period.

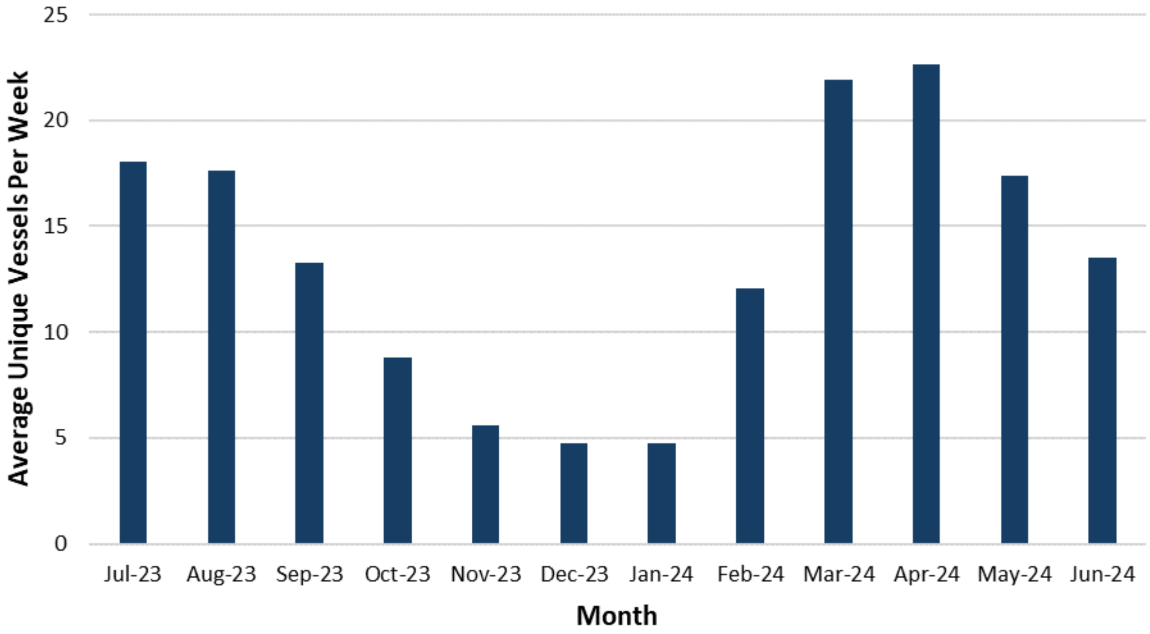

Figure E.12 Average Weekly Fishing Vessels per Month

710. Overall, there was an average of 13 unique fishing vessels recorded per week within the study area during the 12-month period. April 2024 was the busiest month, when an average of 23 fishing vessels were recorded per week. The quietest months were December 2023 and January 2024, each with an average of 5 unique fishing vessels recorded per week. Seasonality is suggested by the data, with lower volumes during winter and greater volumes during spring/summer.

E.3.2.3 Cargo Vessels

711. Cargo vessels accounted for 16% of the total vessel traffic. **Figure E.13** presents the cargo vessel tracks recorded within the study are during the 12-month period.

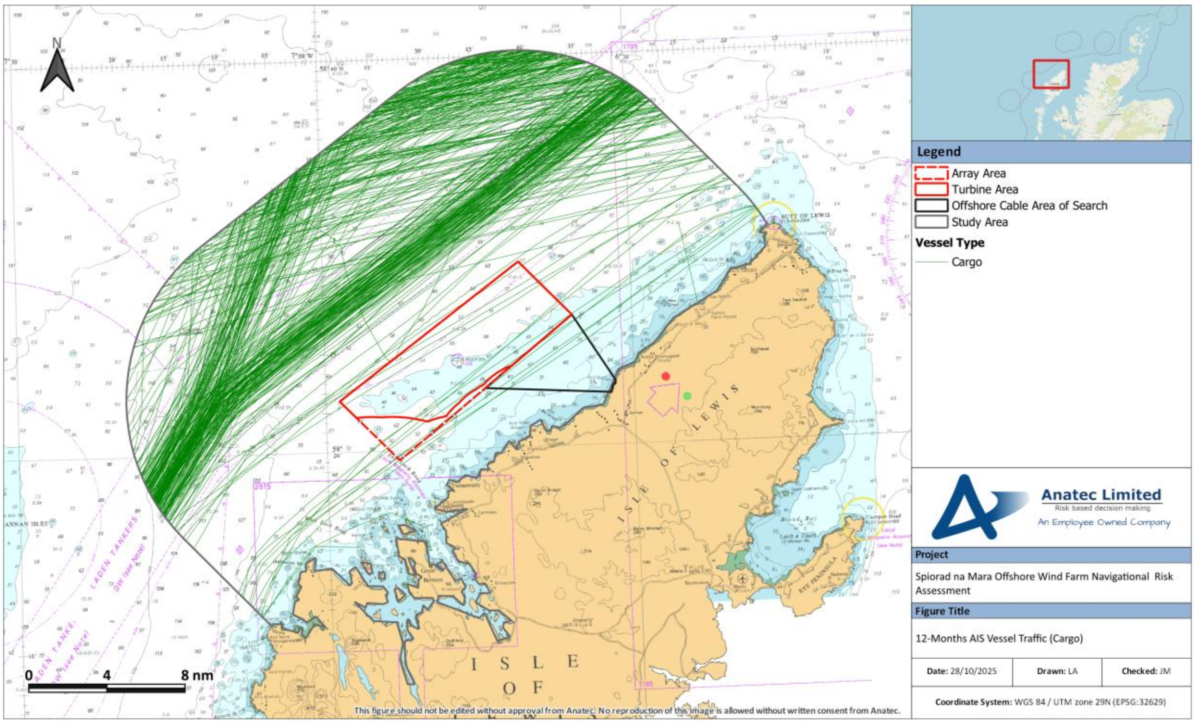

Figure E.13 12-Months AIS Vessel Traffic (Cargo)

712. Well-defined routeing can be seen within the study area. Traffic on the DWR transiting in a northeast/southwest direction was primarily heading to/from Denmark, Norway and Russia, while traffic heading in a north/south direction broadcast destinations including Egypt, Turkey and Russia. The DWR is situated approximately 1.9 nm northwest of the Array Area.

713. Further moderate levels of routeing were noted to the north of the study area, these transits are between a variety of ports and include a small percentage of RoRo cargo vessels. RoRo vessels are particularly sensitive to re-routeing given the scheduled nature of their transits.

714. Minor cargo routeing inshore of the DWR is noted intersecting the Array Area as it follows the Isle of Lewis coastline; vessels on this route were fish carriers not associated with the fish farms at Loch Roag.

715. **Figure E.14** presents the average weekly unique cargo vessels per month within the study area, during the 12-month period.

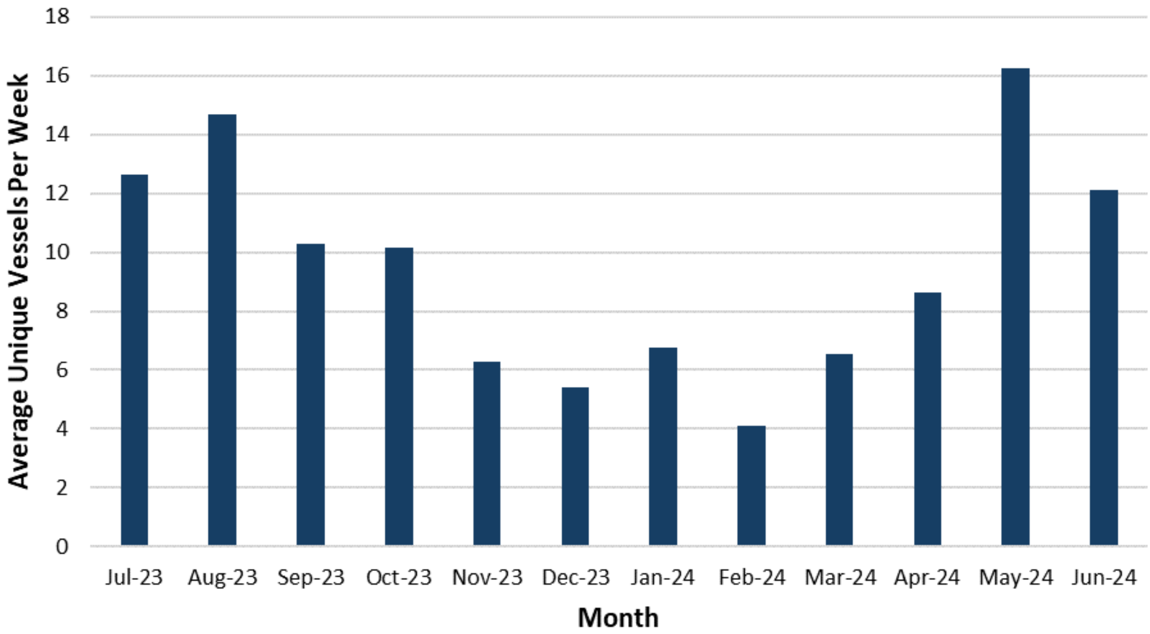

Figure E.14 Average Weekly Cargo Vessels per Month

716. Overall, there was an average of 9 cargo vessel per week within the study area, during the 12-month period. May 2024 was the busiest month for cargo vessels, recording an average of 16 cargo vessels per week. Seasonality is suggested by the data, with lower volumes during winter and greater volumes during summer.

E.3.2.4 Tankers

717. Tankers accounted for 11% of all vessel traffic. **Figure E.15** presents the tracks of tankers recorded within the study area during the 12-month period.

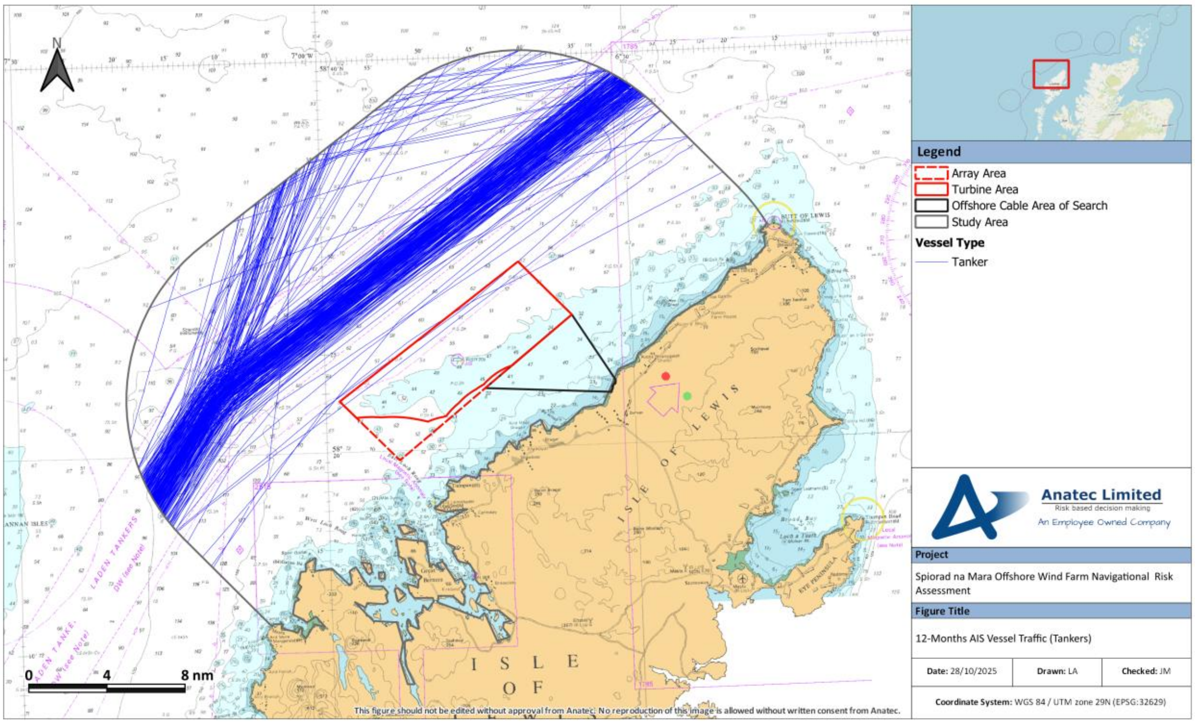

Figure E.15 12-Months AIS Vessel Traffic (Tankers)

718. Tanker routeing was primarily seen on the DWR passing parallel with the Array Area. Traffic using this route recorded destinations including Pembroke (UK), Tranmere (UK), Mongstad (Norway) and Clydebank (UK). Alternate routeing was identified branching off from the DWR, heading northbound with tankers largely broadcasting 'for orders'.

719. **Figure E.16** presents the average weekly unique tankers per month within the study area, during the 12-month period.

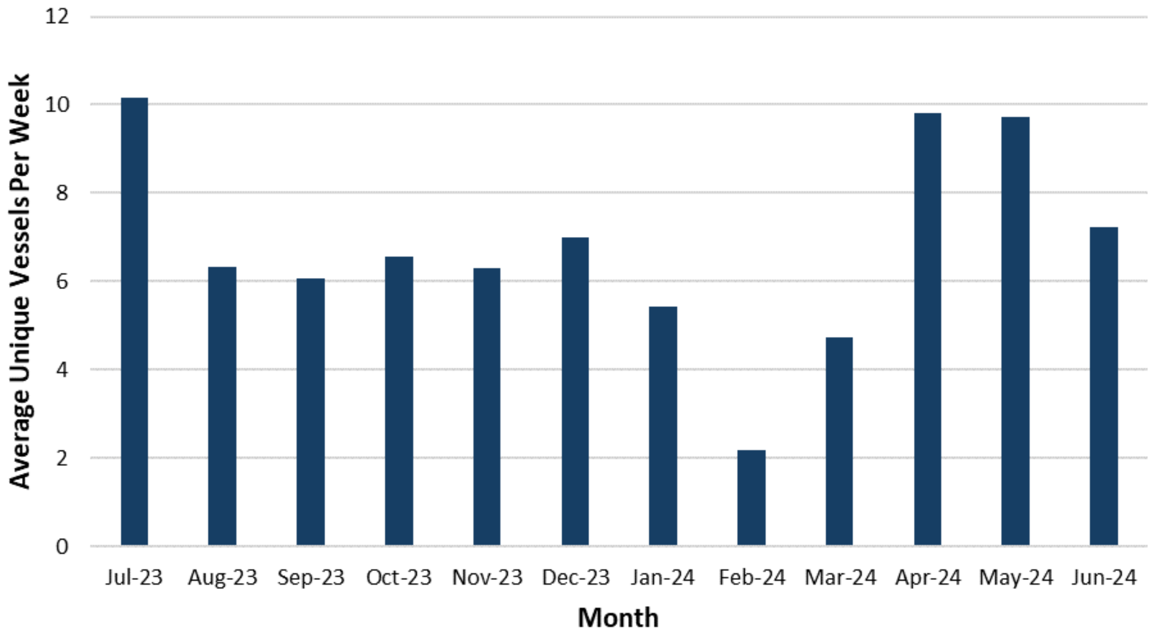

Figure E.16 Average Weekly Tankers per Month

720. Overall, there was an average of 7 tankers per week within the study area, during the 12-month period. July 2023, April 2024 and May 2024 were the busiest months, each with an average of approximately 10 unique tankers per week recorded. Slight seasonality is suggested by the data, with lower volumes during winter and greater volumes during spring/summer.

E.3.2.5 Recreational Vessels

721. Recreational vessels accounted for 7% of the total vessel traffic. **Figure E.17** presents the recreational vessel tracks recorded within the study are during the 12-month period.

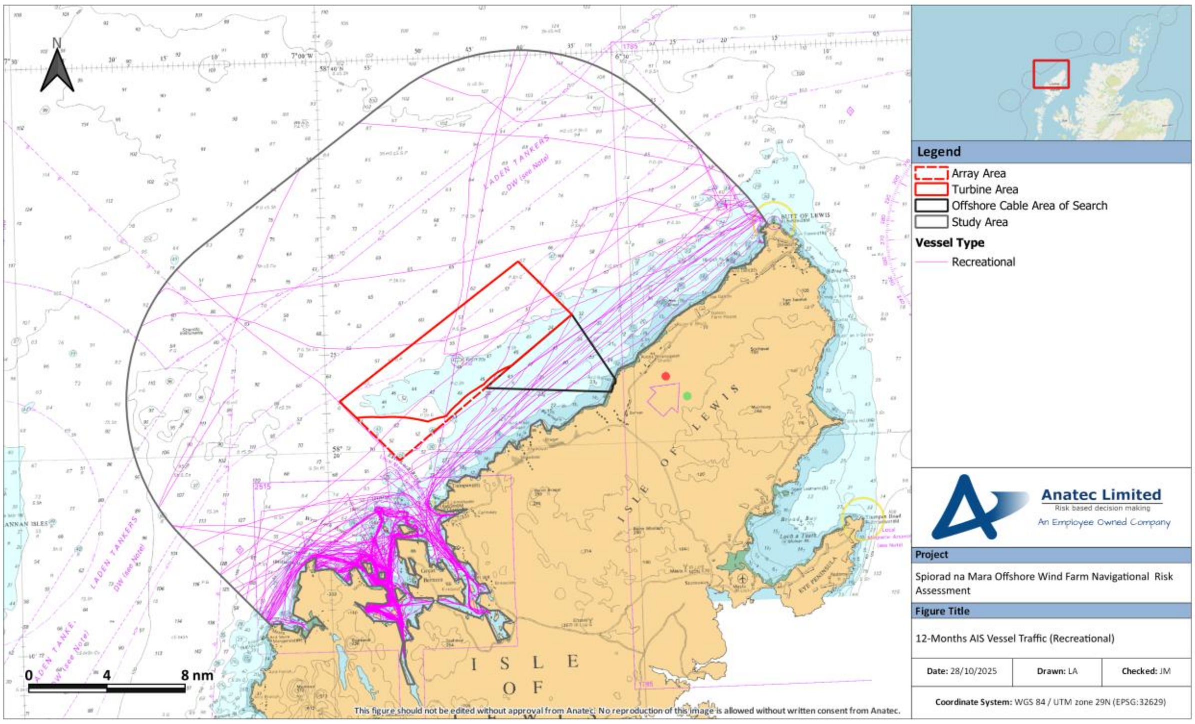

Figure E.17 12-Months AIS Vessel Traffic (Recreational)

722. Recreational vessels were predominately seen inshore during the 12-month period. Vessels were primarily recorded visiting the smaller islands in and around Loch Roag; these were assumed to be charter vessels operating sightseeing tours in the area. Others were recorded following the coastline to the northeast and southwest. Only very occasional recreational vessel transits pass further offshore, including through the Array Area.

723. As noted in **Section E.2.3**, recreational vessels are not required to broadcast on AIS and therefore their coverage may be underrepresented.

724. **Figure E.18** presents the average weekly unique recreational vessels per month within the study area, during the 12-month period.

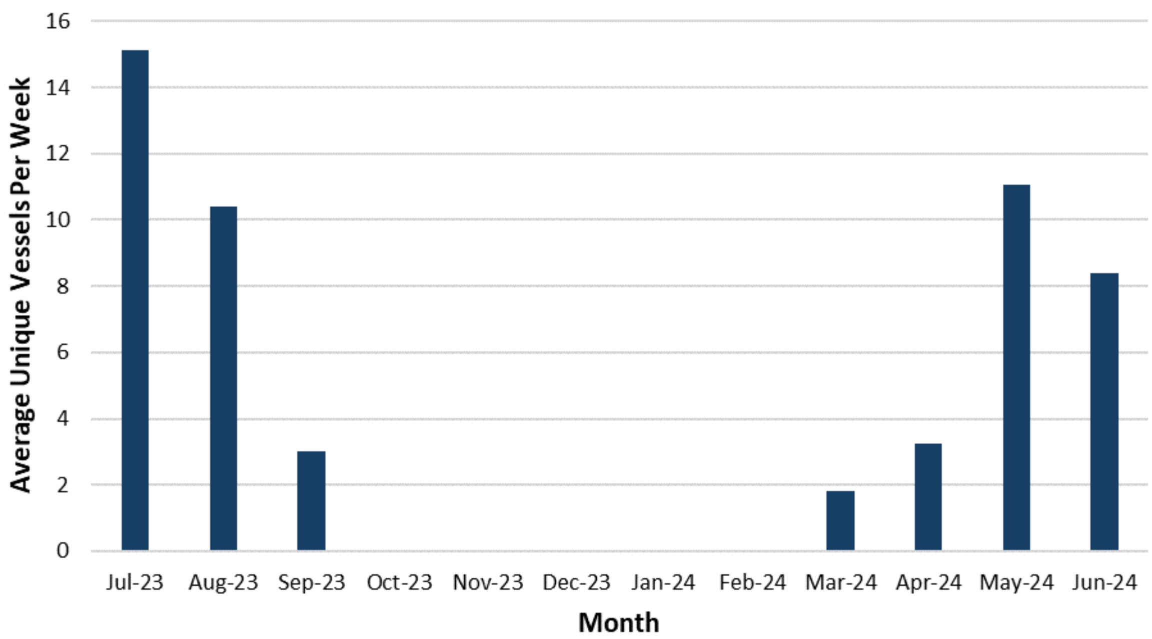

Figure E.18 Average Weekly Recreational Vessels per Month

725. Overall, there was an average of 4 unique recreational vessels per week within the study area during the 12-month period. July 2023 was the busiest month, when an average of 15 unique recreational vessels were recorded per week. There was notable seasonable variation, with no recreational vessels recorded between October 2023 and February 2024.

E.3.2.6 Passenger Vessels

726. Passenger vessels accounted for 1% of the total vessel traffic. **Figure E.19** presents the passenger vessel tracks recorded within the study area during the 12-month period.

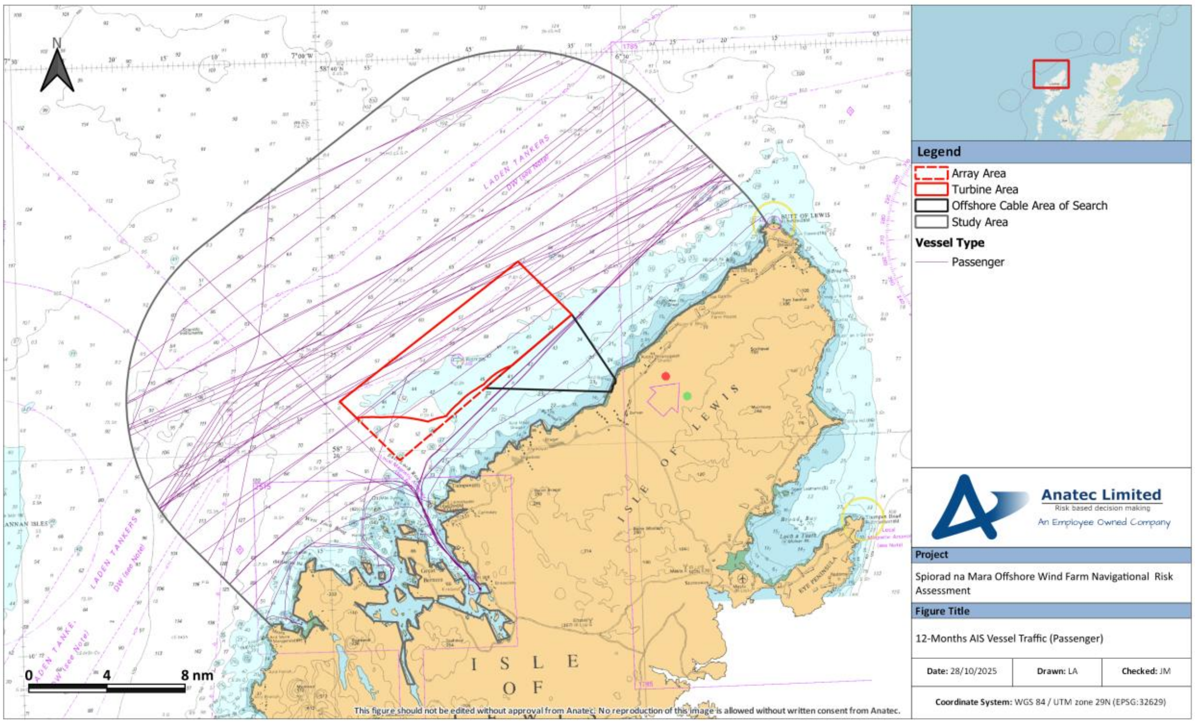

Figure E.19 12-Months AIS Vessel Traffic (Passenger)

727. Passenger vessels were seen within the study area heading in a northeast/southwest direction, including intersecting the Array Area. These were predominantly cruise liners broadcasting destinations of Callanish (UK), Ullapool (UK) and Saint Kilda (UK), with the former located within Loch Roag.

728. **Figure E.20** presents the average weekly unique passenger vessels per month within the study area, during the 12-month period.

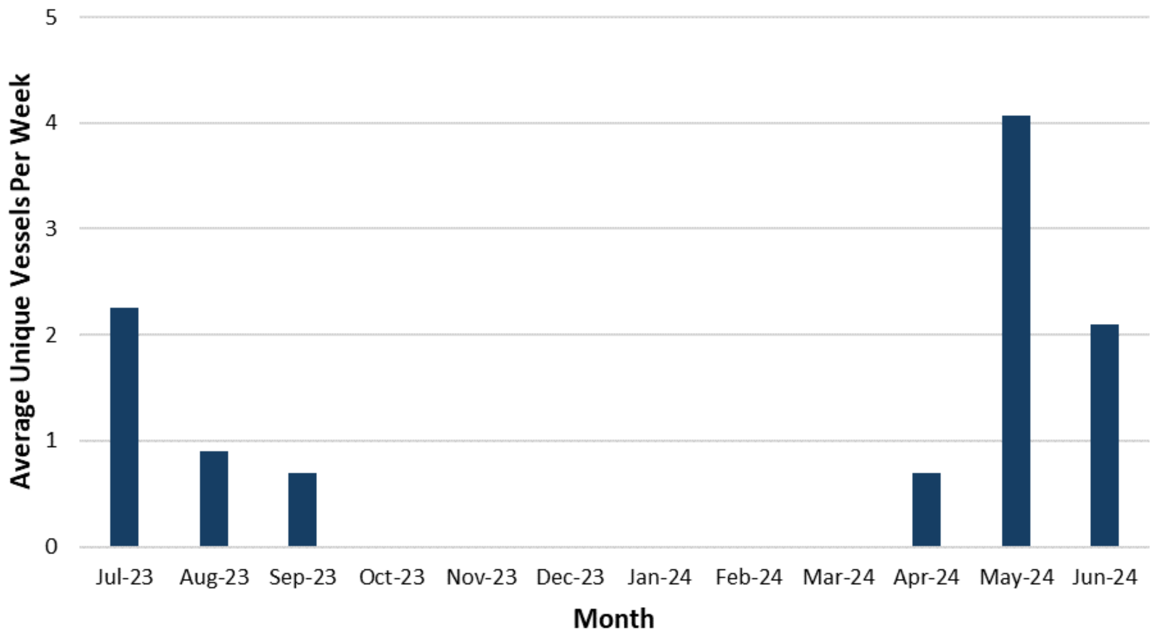

Figure E.20 Average Weekly Passenger Vessels per Month

729. Passenger vessels were infrequent within the study area during the 12-month period, with notable seasonal variation; no passenger vessels were recorded between October 2023 and March 2024. May 2024 was the busiest month, with an average of 4 passenger vessels per week recorded.

E.3.3 Anchored Vessels

730. The same methodology for identifying anchoring activity outlined in **Section 10.4** has been applied to the long-term dataset.

731. After applying the criteria, numerous vessels were deemed to be at anchor within the study area and are presented in **Figure E.21**.

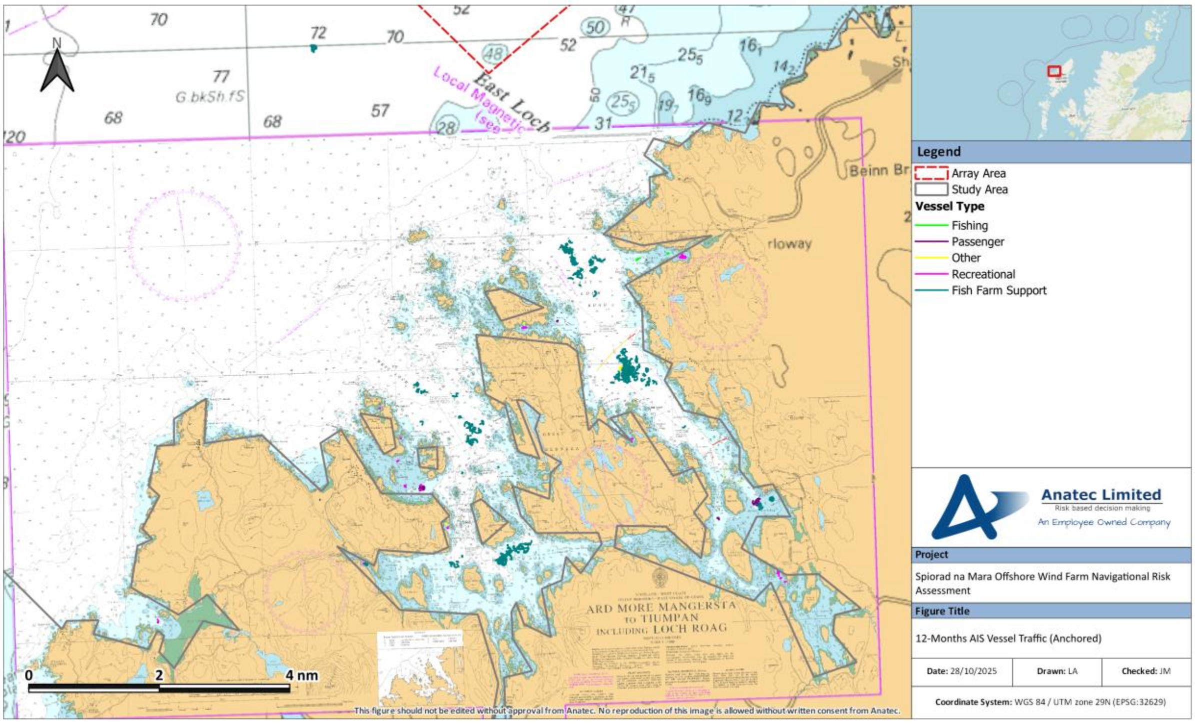

Figure E.21 12-Months AIS Vessel Traffic (Anchored)

732. As shown above, the majority of anchoring activity recorded within the study area occurred within the harbour limits of Loch Roag. The primary vessel type recorded to anchor was fish farm support vessels. It is noted that several fish farm support vessels were recorded anchoring over a long period whilst working on site within the loch, specifically within Breasclete Bay and at Miavaig.

733. Passenger vessels and recreational vessels were also recorded anchoring at these locations, as well as in proximity to Callanish pier and Carloway harbour within East Loch Roag, and at the Reef Beach within West Loch Roag.

734. Two instances of anchoring activity were recorded outside Loch Roag. 1 fish farm support vessel was recorded anchoring overnight approximately 1.5 nm southwest of the Array Area from the 11 - 12 May 2024, and a sailing yacht was recorded anchoring in proximity to Uig Bay, approximately 9.8 nm southwest of the Array Area, on the 8 July 2023.

E.3.4 Intersecting Traffic Analysis

735. **Figure E.22** presents the vessel tracks recorded intersecting the Array Area during the 12-month period.

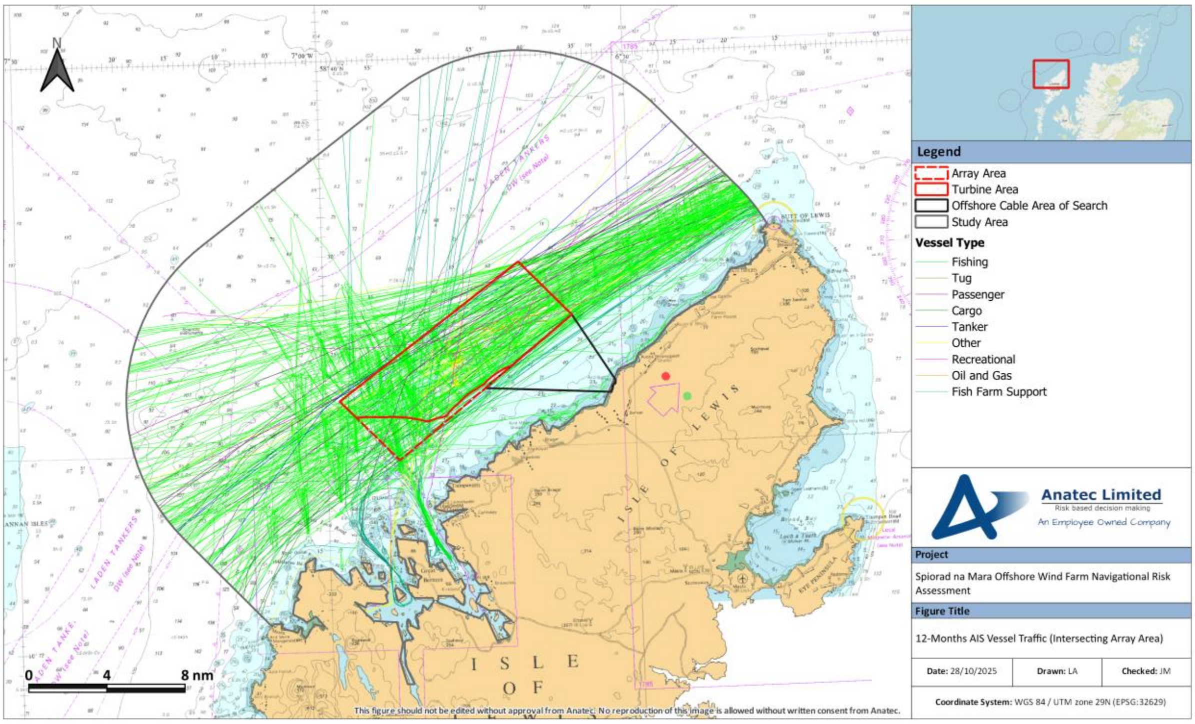

Figure E.22 12-Months AIS Vessel Traffic (Intersecting Array Area)

736. Fishing vessels were the most prominent vessel type recorded intersecting the Array Area during the 12-month period, accounting for 71% of all intersecting traffic. These vessels were recorded in a northeast/southwest direction, typically heading to/from fishing grounds.

737. Fish farm support vessels were also recorded intersecting the Array Area, and accounted for 10% of all intersecting traffic, these vessels were identified heading to/from Fuglafjord.

738. Overall, an average of between 4 - 5 vessels per week were recorded intersecting the Array Area. The busiest month was March 2024, when 36 unique vessels were recorded intersecting the Array Area. The busiest day was the 24 October 2023, when 4 unique vessels were recorded intersecting the Array Area.

E.4 Data Comparison

739. A summary of the vessel type distribution, based on daily unique vessels, for the main vessel types recorded within the study area during the 12-month period is presented in **Table E.1**. A comparison with the average daily unique vessels from the summer and winter vessel traffic survey data (covering 2 14-day periods in June/July 2024 and February/March 2024) is also presented.

Table E.1 Summary and Comparison of the Project Datasets (Study Area) for Shipping and Navigation

Vessel Type	Average Daily Unique Vessels Per Week within the Study Area		
	12-month Period	Summer 14-day Period	Winter 14-day Period
Fishing	13	17	14
Passenger	1	3	0
Cargo	10	14	2
Tanker	7	8	4
Recreational	4	4	1
Fish farm support	23	8	20
All vessels	**58**	**54**	**41**

740. The distribution of vessel types within the study area broadly aligns with that of the summer and winter survey periods.

741. It is noted that the 12-months AIS dataset has marginally lower overall averages of fishing vessels compared to the 2 14-day survey periods. This may be due to the addition of vessels which were recorded via non-AIS methods during the 2 survey periods, as well as relatively higher vessel activity over the survey periods due to seasonal peaks.

742. Fish farm support vessels are noted as the most common vessel type within the 12-month dataset, as well as the winter survey dataset. This somewhat aligns with the seasonality displayed by fish farm support vessels noted in **Section E.3.2.1**. Fish farm support vessels were less common during the summer survey period, which may be due to a variety of reasons including fish farm schedules and lifecycle of the fish species involved.

743. Cargo vessels were common within the 12-month dataset and the summer survey dataset, and significantly lower in the winter survey dataset. This aligns with the seasonality presented in **Section E.3.2.2**, where cargo vessels counts were generally lower in the winter months.

744. Passenger vessels and recreational vessels were highly seasonal, with no passenger vessels noted during the winter survey period and less recreational vessels during the winter survey period compared to the summer survey period. This is as expected, as the summer months offer more favourable sailing conditions as well as busier cruise timetables.

745. Fishing vessels and tankers were relatively consistent through all 3 datasets, with slightly higher counts noted in summer than in winter.

E.5 Summary

746. This appendix has presented the analysis of 12 months of AIS data recorded between 1 July 2023 - 30 June 2024 within 10 nm of the Array Area. The aim was to capture long-term vessel routeing and activity within the area and to assess any seasonal variation in vessel volumes or behaviours.

747. On average, approximately 9 vessels per day were recorded within the study area during the 12-month period (after excluding non-routine traffic). The most common vessel type recorded was fish farm support vessels (37%). The overall average vessel length recorded was 88 m, with vessels below 15 m (25%) and above 160 m (25%) the most common vessel length categories.

748. The most common vessel type to transit within the Array Area was fishing vessels (71%), followed by fish farm support vessels (10%).

749. Fish farm support vessels were typically identified inshore transiting northbound along the Isle of Lewis coastline. In the majority of cases tracks were outside of the Array Area.

750. Seasonal variation was noted for recreational vessels, which were not recorded within the study area between October 2023 - February 2024. Passenger vessels also displayed seasonal variation, with none recorded within the study area between October 2023 - March 2024.