

Morven North Offshore Wind Array Project

Environmental Impact Assessment Report

Volume 3, Annex 13.1: Shipping and Navigation Shared Navigational Risk Assessment

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The Morven North Offshore Wind Array Project and Morven South Offshore Wind Array Project

Volume 3, Annex 13.1: Shipping and Navigation Shared Navigational Risk Assessment

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Glossary Table

Term	Definition
Allision	The act of a moving object alliding (crashing) with a stationary object.
Applicant (The)	The entity making the applications: Morven Offshore Wind Limited (MvOWL).
Automatic Identification System	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 and European Union fishing vessels over 15 metres in length are required to carry an Automatic Identification System.
Collision	The act of colliding (crashing) between two or more moving objects.
Embedded Mitigation	Mitigation measures to avoid or reduce environmental effects that are directly incorporated into the preferred design for Morven North and Morven South. 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.
Formal Safety Assessment	A structured and systematic process for assessing the effects and costs (if applicable) associated with shipping activity.
Inter-array cables	Cables connecting wind turbines to each other and to Offshore Substation Platforms.
Interconnector cables	Cables connecting Offshore Substation Platforms to each other.
Landfall	Refers to the area where offshore export cables transition to onshore infrastructure, including the transitional zone between offshore cabling and onshore cabling. This can involve sub-surface installations through intertidal zones.
Marine Guidance Note	A system of guidance notes issued by the Maritime and Coastguard Agency which provide significant advice relating to the improvement of the safety of shipping at sea, and to prevent or minimise pollution from shipping.
Maximum Design Scenario	The maximum design parameters from the Project Design Envelope likely to result in the greatest impact on a particular topic receptor.
Morven Branxton Area	The Morven Branxton Area Grid Connection Project will be comprised of the offshore export cable in Scottish waters from the Morven North or the

Term	Definition
Grid Connection Project (hereafter "MBAGC Project")	Morven South Offshore Substation Platforms, the onshore export cable and the onshore land substation in the vicinity of Branxton in East Lothian, Scotland.
Morven Hawthorn Pit Grid Connection Project (hereafter, "MHPGC Project")	The Morven Hawthorn Pit Grid Connection Project is comprised of the offshore export cable in Scottish and English waters from the Morven North or the Morven South Offshore Substation Platforms, the onshore export cable in England and the onshore land substation at Hawthorn Pit in County Durham, England.
Morven North Boundary	Boundary within which the wind turbines and foundations, Offshore Substation Platforms and foundations, inter-array and interconnector cables and associated infrastructure for Morven North will be located.
Morven North Offshore Wind Array Project (hereafter 'Morven North')	The Morven North Offshore Wind Array Project, which includes the wind turbines and foundations, Offshore Substation Platforms and foundations, inter-array and interconnector cables and associated infrastructure located within the Morven North Boundary. Consent for the export cables for Morven North will be sought separately.
Morven Option Lease Agreement Site (hereafter 'Morven Site')	The 859km^2 area awarded to the Applicant as a result of the ScotWind leasing round and located in Plan Option area E1. Morven North and Morven South are two distinct projects, located with the Morven Site.
Morven South Boundary	Boundary within which the wind turbines foundations, Offshore Substation Platforms and foundations, inter-array and interconnector cables and associated infrastructure for Morven South will be located.
Morven South Offshore Wind Array Project (hereafter 'Morven South')	The Morven South Offshore Wind Array Project, which includes the wind turbines and foundations, Offshore Substation Platforms and foundations, inter-array and interconnector cables and associated infrastructure located within the Morven South Boundary. Consent for the export cables for Morven South will be sought separately.

Term	Definition
Navigational Risk Assessment (NRA)	A document which assesses the impacts to shipping and navigation of a proposed Offshore Renewable Energy Installation based upon a Formal Safety Assessment.
Offshore Substation Platform	Offshore Substation Platforms comprise the support structure, topside and electrical components used for collecting and/or converting the electricity generated by the wind turbines. These Offshore Substation Platforms can be divided into two types: ▪ High Voltage Alternating Current collector substations; ▪ High Voltage Direct Current converter substations.
Project Design Envelope (PDE)	A description of the range of possible elements that make up a proposed development's design options under consideration when the exact engineering parameters are not yet known.
Regular Operator	A commercial operator associated with one or more vessels that transit an area on a regular basis.
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.
Wind turbine	A machine that converts kinetic energy from the wind into electricity comprising the following main parts: nacelle, hub, blades, tower and drivetrain.

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
AtoNMP	Aids to Navigation Management Plan
BWEA	British Wind Energy Association
CA	Cruising Association
CBA	Cost Benefit Analysis
CCTV	Closed Circuit Television

Abbreviation	Definition
CfD	Contract for Difference
CHIRP	Confidential Human Factors Incident Reporting Programme
COLREGs	Convention on the International Regulations for Preventing Collisions at Sea
CPS	Cable Protection System
CSIP	Cable Specification and Installation Plan
CTV	Crew Transfer Vessel
°	Degrees
DC	Direct Current
DF	Direction Finding
DfT	Department for Transport
DSC	Digital Selective Calling
DSLP	Development Specification and Layout Plan
ECMWF	European Centre for Medium-Range Weather Forecasts
EEZ	Exclusive Economic Zone
EIA	Environmental Impact Assessment
EIAR	Environmental Impact Assessment Report
EMF	Electromagnetic Field
ERCoP	Emergency Response Co-operation Plan
EU	European Union
ESRI	Environmental Systems Research Institute
ETRS89	European Terrestrial Reference System 1989
FSA	Formal Safety Assessment
GIS	Geographical Information System
GLA	General Lighthouse Authority
GMDSS	Global Maritime Distress and Safety System
GPS	Global Positioning System
GRP	Glass Reinforced Plastic
HAT	Highest Astronomical Tide
HDD	Horizontal Directional Drilling
HF	High Frequency
HMCG	His Majesty's Coastguard
HSE	Health and Safety Executive
HVAC	High Voltage Alternating Current
HVDC	High Voltage Direct Current

Abbreviation	Definition
IALA	International Organization for Marine Aids to Navigation
IHO	International Hydrographic Organization
ILB	Inshore Lifeboat
IMCA	International Marine Contractors Association
IMO	International Maritime Organization
INTOG	Innovation and Targeted Oil and Gas
JRCC	Joint Rescue Coordination Centre
kHz	Kilohertz
km	Kilometre
kt	Knot
LMP	Lighting and Marking Plan
LPG	Liquefied petroleum gas
LOA	Length Overall
m	Metre
MAIB	Marine Accident Investigation Branch
MCA	Maritime and Coastguard Agency
MDS	Maximum Design Scenario
MEPC	Marine Environment Protection Committee
MetOcean	Meteorological and Oceanic
MF	Medium Frequency
MGN	Marine Guidance Note
MHWS	Mean High Water Springs
MPCP	Marine Pollution Contingency Plan
MRCC	Maritime Rescue Coordination Centre
MSC	Maritime Safety Committee
MSI	Maritime Safety Information
NAVTEX	Navigational Telex
NLB	Northern Lighthouse Board
nm	Nautical Mile
nm^2	Square Nautical Mile
NRA	Navigational Risk Assessment
NSP	Navigational Safety Plan
NSPVMP	Navigational Safety Plan and Vessel Management Plan
NUC	Not Under Command

Abbreviation	Definition
O&M	Operation and Maintenance
OREI	Offshore Renewable Energy Installation
OSP	Offshore Substation Platform
OWF	Offshore Wind Farm
PDE	Project Design Envelope
PLA	Port of London Authority
PLL	Potential Loss of Life
PNT	Positioning, Navigation and Timing
POB	People on Board
QHSE	Quality, Health, Safety and Environment
Racon	Radar Beacon
Radar	Radio Detection and Ranging
RAM	Restricted in 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
SMS	Safety Management System
SOLAS	International Convention for the Safety of Life at Sea
SONAR	Sound Navigation Ranging
SOV	Service Operations Vessel
TCE	The Crown Estate
TSS	Traffic Separation Scheme
UK	United Kingdom
UKHO	United Kingdom Hydrographic Office
US	United States
VHF	Very High Frequency
VMP	Vessel Management Plan
VTS	Vessel Traffic Service
WGS84	World Geodetic System 1984

1 Introduction

1.1 Background

1.1.1.1 Anatec was commissioned by Morven Offshore Wind Limited (MvOWL ('hereafter the Applicant')) to undertake a Navigational Risk Assessment (NRA) for the proposed Morven North Offshore Wind Array Project and Morven South Offshore Wind Array Project (hereafter "Morven North" and "Morven South"). This NRA constitutes the Morven North and Morven South Shipping and Navigation Shared Technical Report and presents information on Morven North and Morven South relative to the existing and estimated future navigation activity.

1.1.1.2 The information from this NRA provides the technical assessment to inform the assessment of likely significant effects of Morven North and Morven South on shipping and navigation receptors. This report accompanies the Environmental Impact Assessment (EIA) provided in Volume 2, Chapter 13: Shipping and Navigation of the Morven North Environmental Impact Assessment (EIA) Report; and Volume 2, Chapter 13: Shipping and Navigation of the Morven South EIA Report. Morven North and Morven South each contain separate wind turbines and foundations – the wind turbines and foundations for Morven North are located within the Morven North Boundary and the wind turbines and foundations for Morven South are located within the Morven South Boundary. Due to current uncertainty around proposed grid connections, there is a possibility that Morven North and Morven South will be constructed concurrently, or sequentially of each other. This NRA therefore considers three scenarios:

- Morven North in isolation (risk assessment Scenario 1a);
- Morven South in isolation (risk assessment Scenario 1b);
- Morven North and Morven South concurrently (hereafter the 'concurrent development' scenario) (risk assessment Scenario 2).

1.1.1.3 Scenario 2 considers concurrent development of Morven North and Morven South as opposed to sequential development of the sites, as this represents a worst-case area of searoom developed for the duration of the construction, operations and maintenance (O&M), and decommissioning phases. From consultation, stakeholder preference was to consider each scenario in turn.

1.1.1.4 In addition to the above assessments, additional scenarios are considered for the cumulative assessment and are presented in Section 3.3.

1.2 Navigational Risk Assessment

1.2.1.1 An EIA is a process which identifies the environmental effects of a proposed development, both negative and positive. 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) including the methodology document (Annex 1), this NRA includes:

- outline of methodology applied in the NRA;
- summary of consultation undertaken with shipping and navigation stakeholders to date;
- lessons learnt from previous Offshore Wind Farm (OWF) developments;
- summary of the project description relevant to shipping and navigation;
- baseline characterisation of the existing environment;
- discussion of potential impacts on navigation, communication and position fixing equipment;
- cumulative and transboundary overview;
- future case vessel traffic characterisation;
- collision and allision risk modelling;
- assessment of navigational risk (following the Formal Safety Assessment (FSA) process);
- outline of embedded mitigation measures;
- completion of the MGN 654 Checklist.

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

- construction;
- Operation and Maintenance (O&M);
- decommissioning.

1.2.1.3 The assessment of Morven North and Morven South is based on a Project Design Envelope (PDE), an approach which is standard practice for OWF developments given the potential for findings from further site investigations (to be undertaken post consent) and advancements in technology. The PDE includes conservative assumptions to form a Maximum Design Scenario (MDS) which is considered and assessed for all hazards on the basis that any deviation from the MDS (but still within the parameters of the PDE) will result in the risk of any relevant hazards being no greater than that assessed using the MDS. Further details on the PDE are provided in Section 6.

2 Guidance and legislation

2.1 Legislation

2.1.1.1 As part of the EIA Directive (2011/92/European Union (EU), as amended by Directive 2014/52/EU) (which remains applicable following withdrawal of the United Kingdom (UK) from the EU), an EIA is required to support the application for the Section 36 consent for Morven North and Morven South. The MCA require that, as part of the EIA, an NRA is undertaken to "inform the shipping and navigation chapter of the EIA Report" (MCA, 2021).

2.2 Primary guidance

2.2.1.1 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 FSA for Use in the Rule-Making Process (International Maritime Organization (IMO), 2018).

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

2.2.1.3 MGN 654 includes several annexes including the Methodology for Assessing the Marine Navigational Safety & Emergency Response Risks of Offshore Renewable Energy Installations (OREI) (Annex 1) 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). In this NRA, the base and future case levels of risk have been identified for each scenario as well as the mitigation measures required to ensure the future case remains broadly acceptable, or tolerable with mitigation.

2.3 Other guidance

2.3.1.1 Other guidance documents used during the assessment include:

- 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 Organization Marine Aids to Navigation (IALA) Recommendation O-139 on The Marking of Man-Made Offshore Structures (IALA, 2021 (a));
- IALA Guidance G1162 The Marking of Offshore Man-Made Structures (IALA, 2021 (b));

- IALA Guidance G1185 Enhancing the Safety and Efficiency of Navigation Around Offshore Renewable Energy Installations (OREI) (IALA, 2024);
- The Royal Yachting Association's (RYA) Position on Offshore Renewable Energy Developments: Paper 1 (of 4) – Wind Energy (RYA, 2019 (b)).

2.4 Lessons learnt

2.4.1.1 There is considerable benefit for Morven North and Morven South in the sharing of lessons learnt within the offshore industry. The NRA and particularly the risk assessment undertaken in Volume 2, Chapter 13: Shipping and Navigation of the Morven North EIA Report and Volume 2, Chapter 13: Shipping and Navigation of the Morven South EIA Report 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.

2.4.1.2 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 REZ (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

3.1.1.1 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.

3.1.1.2 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 Volume 2, Chapter 12: Commercial Fisheries of the Morven North EIA Report and Volume 2, Chapter 12: Commercial Fisheries of the Morven South EIA Report consider impacts to commercial fishing vessels related to commercial fishing activity (rather than navigational hazards to commercial fishing vessels in transit).

3.2 Formal Safety Assessment process

3.2.1.1 The IMO FSA process (IMO, 2018) 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 Sections 18 to 20 of the NRA.

3.2.1.2 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 five basic steps within this process as illustrated in Figure 3.1 and summarised in the following list:

- **Step 1** – identification of hazards (a list is produced of hazards prioritised by risk level specific to the problem under review);
- **Step 2** – risk analysis (investigation of the causes and initiating events and consequences of the more important hazards identified in Step 1);
- **Step 3** – risk control options (identification of measures to control and reduce the identified hazards);
- **Step 4** – CBA (identification and comparison of the benefits and costs associated with the risk control options identified in Step 3);
- **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 Formal Safety Assessment Methodology (IMO, 2018)

3.2.2 Hazard Workshop methodology

3.2.2.1 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 EIA Report. Risks (and the determined qualification) are recorded via the hazard log which is presented in full in Appendix B.

3.2.2.2 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.

Table 3.1: Severity of Consequence Ranking Definitions

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

Table 3.2: Frequency of Occurrence Ranking Definitions

Rank	Description	Definition
1	Negligible	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

3.2.2.3 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).

3.2.2.4 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.

3.2.2.5 Outputs of the hazard log have been used as evidence to support and refine the assessment undertaken in Sections 18 to 20 of the NRA.

Table 3.3: Tolerability Matrix and Risk Rankings

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

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

3.3 Cumulative risk assessment methodology

3.3.1.1 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 relative complexity of shipping and navigation in the region on a cumulative level, a bespoke approach to cumulative risk assessment has been applied, differing from the overarching approach outlined in Volume 1, Chapter 6: EIA Methodology of the Morven North EIA Report and Volume 1, Chapter 6: EIA Methodology of the Morven South EIA Report.

3.3.1.2 Multiple scenarios are considered to ensure that all reasonably foreseeable build out scenarios are suitably assessed, with these having been discussed with shipping and navigation stakeholders during consultation. A description of all assessment scenarios – including those relating to each of Morven North and Morven South in isolation – is provided in Table 3.4.

Table 3.4: Description of assessment scenarios

Scenario	Description
1a	Morven North in isolation. Only Morven North is present, consisting of the Morven North Boundary.
1b	Morven South in isolation. Only Morven South is present, consisting of the Morven South Boundary.

Scenario	Description
2	Concurrent development. Morven North and Morven South are present, consisting of the Morven North Boundary and Morven South Boundary, i.e. the Morven Option Lease Agreement Site (hereafter, the "Morven Site"), given that the Morven North and Morven South boundaries are the same as the Morven Site. The Morven Hawthorn Pit Grid Connection Project ('MHPGC Project') and Morven Branxton Area Grid Connection Project ('MBAGC Project') – are screened out on the basis that there is no clear pathway through which a user may be further affected by a hazard due to the combined presence of the Morven Site and the transmission projects. Quantitative review of commercial routeing including collision and allision risk modelling.
3a	Morven North and Tier 1 cumulative developments. The Morven North Boundary in combination with projects and plans considered most relevant for hazards identified in Scenarios 1a and 1b. Details of the specific criterion for determining Tier 1 cumulative developments is provided below.
3b	Morven South and Tier 1 cumulative developments. The Morven South Boundary in combination with projects and plans considered most relevant for hazards identified in Scenarios 1a and 1b.
3c	Concurrent development and Tier 1 cumulative developments. The Morven Site in combination with projects and plans considered most relevant for hazards identified in Scenario 2.
4	Concurrent development and Tier 1 cumulative developments and Tier 2 cumulative developments. The Morven Site in combination with all projects and plans considered relevant for hazards identified in Scenario 2.

3.3.1.3 Given the varying type, status and location of developments, two tiers of cumulative development have been considered in the cumulative risk assessment, depending upon the following criterion:

- development status;
- distance from Morven North and Morven South;
- level of interaction with baseline traffic relevant to Morven North and Morven South;
- level of concern raised during consultation;
- data confidence.

3.3.1.4 The tiers and associated level of assessment undertaken for each are summarised in Table 3.5. Given that there are multiple options for re-routeing of commercial traffic associated with each cumulative scenario, a qualitative approach has been taken for Scenarios 3 and 4 with a review of commercial traffic routeing and the optionality available in each scenario. The optionality considered incorporates consultation

feedback with regard to likely vessel behaviour and where appropriate identifies considerations for specific vessel types and sizes.

3.3.1.5 The maximum distance within which developments are considered for the cumulative risk assessment is 50nm from the Morven Site, on the basis that there is not considered to be a direct pathway between Morven North and Morven South and any development beyond 50nm from the Morven Site. This distance is standard within NRAs and provides a good overview of cumulative traffic patterns.

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

3.3.1.7 Projects meeting the assessment criteria are detailed in Section 14.

Table 3.5: Cumulative development screening summary[1]

Tier	Minimum Development Status[2]	Criterion	Data Confidence Level	Level of Cumulative Risk Assessment
Baseline	Under construction or operational	▪ Existing development.	High	Incorporated in the quantitative review of commercial vessel routeing for all scenarios (starting from Scenario 1).

[1] Note that development status is the minimum to be considered for each Tier, with the primary factor for consideration being the criterion descriptors.

- [2] 'Pre-scoping' indicates that a development has not yet produced a Scoping report detailing an initial outlook at all relevant receptors;
- 'Scoped' indicates that a development has produced a Scoping report;
- 'Under determination' indicates that the application for a development has been submitted, with the outcome pending;
- 'Consented' indicates that a development has been consented but does not have a Contract for Difference (CfD) secured;
- 'Under construction' indicates that offshore construction was ongoing at the time of the baseline being established and a buoyed construction area is present;
- 'Operational' indicates that a buoyed construction area has been removed, and that the development has begun exporting electricity.

Tier	Minimum Development Status[2]	Criterion	Data Confidence Level	Level of Cumulative Risk Assessment
1	Consented or under determination	▪ May impact a main commercial route passing within 1nm of the Morven Site. ▪ Raised as having possible cumulative effect during consultation. *Offshore wind farms:* ▪ Up to 50nm from the Morven Site. *Sub-sea cables:* ▪ Up to 2nm from the Morven Site.	High or medium	Incorporated in the qualitative review of commercial traffic routeing at the first cumulative level (Scenario 3).
2	Scoped	▪ May impact a main commercial route passing within 1nm of the Morven Site. *Offshore wind farms:* ▪ Up to 50nm from the Morven Site. *Sub-sea cables:* ▪ Up to 2nm from the Morven Site.	High or medium	Incorporated in the qualitative review of commercial traffic routeing at the second cumulative level (Scenario 4).
3	Pre-scoping	▪ Does not impact a main commercial route passing within 1nm of the Morven Site. *Offshore wind farms:* ▪ Further than 50nm from the Morven Site. *Sub-sea cables:* ▪ Further than 2nm from the Morven Site.	Low	Screened out

3.4 Study areas

3.4.1.1 A 10nm buffer has been applied around each of the Morven North Boundary (the 'Morven North Shipping and Navigation Study Area') and Morven South Boundary (the 'Morven South Shipping and Navigation Study Area') as shown in Figure 3.2.

3.4.1.2 The spatial extent of both of these study areas combined (the Morven North and Morven South Regional Shipping and Navigation Study Area, hereafter the 'Regional Shipping and Navigation Study Area'), as a 10nm buffer of the Morven Site, is also presented. This study area was agreed to be appropriate for use by MCA, Northern Lighthouse Board (NLB) and UK Chamber of Shipping as per Section 4.2.

3.4.1.3 These study areas have been defined to provide local context to the analysis of risks by obtaining the vessel traffic movements within and in proximity to, the Morven Site. Similar 10nm study areas have been used within the majority of UK OWF NRAs and are suitable for collection of Radio Detection and Ranging (Radar) data.

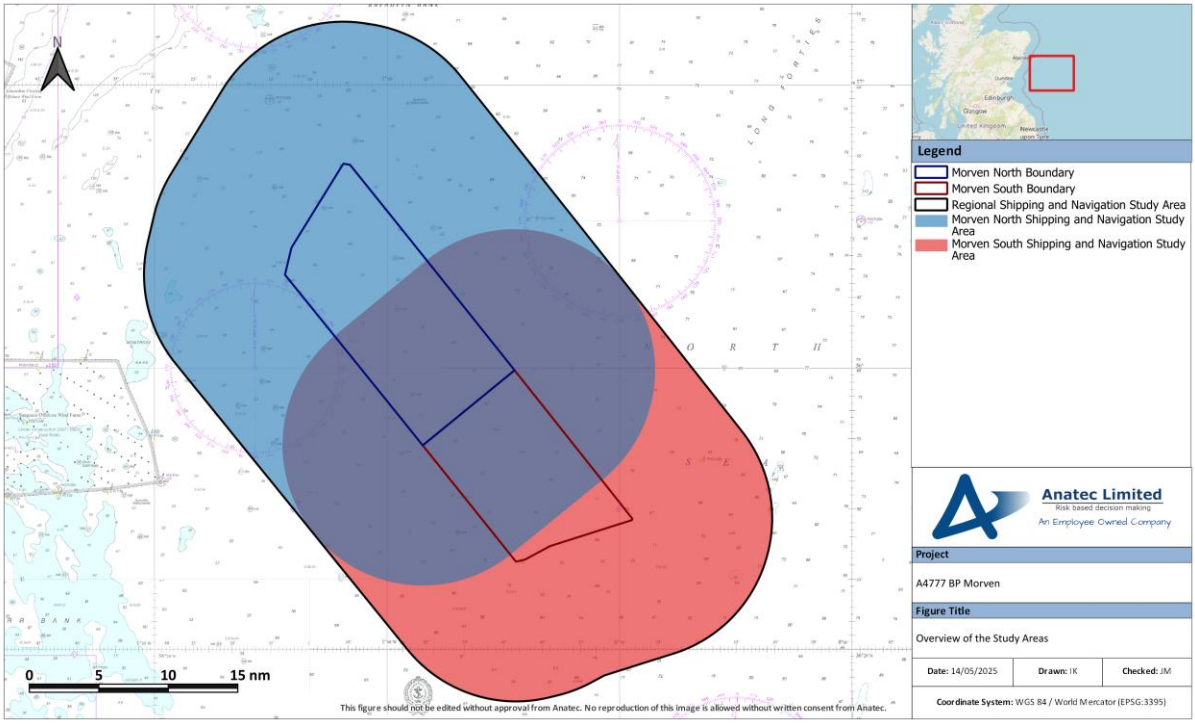


Figure 3.2: Overview of the Morven North and Morven South Shipping and Navigation Study Areas

4 Consultation

4.1 Stakeholders consulted in the Navigational Risk Assessment process

4.1.1.1 Key shipping and navigation stakeholders have been consulted in the NRA process. The following stakeholders have been consulted via dedicated meetings:

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

4.1.1.2 Additional stakeholders were consulted with during the Hazard Workshop, as included within Section 4.3.

4.1.1.3 In addition, Regular Operators were identified and provided with an overview of Morven North and Morven South, and offered the opportunity to provide feedback. The Regular Operator letter is presented in full in Appendix D. The full list of Regular Operators identified is provided below:

- Aggregate Industries/SMT Shipping;
- Aurora;
- Emskip;
- Havila Shipping;
- Longship BV;
- North Star Shipping;
- Rem Offshore;
- Samskip;
- Sentinel Marine;
- Smyril Line;
- Solstad;
- Tidewater;
- VMS Shipping;
- Vroon Offshore.

4.1.1.4 Of the Regular Operators consulted with, responses were received from Rem Offshore only.

4.2 Consultation responses

4.2.1.1 The key issues raised including via dedicated meetings, the Scoping Opinion, Regular Operator outreach and the Hazard Workshop, are summarised in Table 4.1.

Table 4.1: Summary of key points raised during consultation

Stakeholder	Form of Correspondence	Point Raised	Response and Where Addressed in the NRA
MCA	Scoping Response	The MCA noted that the EIA Report 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 relevant risks on the raised hazards have been assessed in Sections 18 to 20 as per the requirements of MGN 654.
		The MCA raised that the development area carries a moderate amount of traffic with several important commercial shipping routes. Cumulative and in combination effects on shipping routes should therefore be considered, including proximity to other developments and infrastructure, and the impact on safe navigable sea room.	Adverse weather routeing has been considered within Section 12. A cumulative effects assessment has been undertaken in Sections 20 to 22, with consideration to screened in developments.
		The MCA stated that an NRA will need to be submitted in accordance with MGN 654. This NRA should be accompanied by a detailed MGN 654 Checklist.	An NRA has been submitted, with associated MGN 654 checklist included in Appendix A.

Stakeholder	Form of Correspondence	Point Raised	Response and Where Addressed in the NRA
		The MCA noted that the traffic surveys need to be within 24 months of the consent application.	MGN 654-compliant vessel traffic surveys have been undertaken as per Section 5.3, within 24 months of the consent application. Since Scoping, additional vessel traffic surveys have been carried out to ensure compliance with MGN 654.
		The MCA raised that the Development Specification and Layout Plan (DSLP) will require MCA approval prior to construction. Any additional navigation safety and/or Search and Rescue (SAR) requirements, as per MGN 654 Annex 5, will be agreed at the approval stage.	The DSLP and compliance with MGN 654 are included as mitigation in the NRA, with the creation of an Emergency Response Co-operation Plan (ERCoP) also referenced (as per Section 17).
		The MCA stated that attention should be paid to cabling routes and where appropriate a Burial Protection Index study and 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 Chart Datum. 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 6.4 and Section 17, any export cable protection will be compliant with MGN 654, including in relation to underkeel clearance. The Burial Protection Index study and anchor penetration study will be covered within the Cable Burial Risk Assessment (CBRA) (an embedded mitigation measure included in Section 17) as required.
		The MCA noted that particular consideration will need to be given to the implications of the site size and location on SAR resources and ERCoPs. Due consideration should be given to the use of appropriate mitigation as outlined in MGN 654 Annex 5 and a SAR checklist will also need to be completed.	A SAR checklist is required under MGN 654, which will be adhered to as per Section 17.
		The MCA raised that MGN 654 Annex 4 requires that hydrographic surveys should fulfil the requirements of the International Hydrographic Organization (IHO) Order 1a standard.	As per Section 17, there will be full MGN 654 compliance including in relation to hydrographic surveys.

Stakeholder	Form of Correspondence	Point Raised	Response and Where Addressed in the NRA
		The MCA stated that in the case of any High Voltage Direct Current (HVDC) installation, consideration must be given to the effect of electromagnetic deviation on ships' compasses. The MCA would be willing to accept a three-degree deviation for 95% of the cable route. For the remaining 5% of the cable route no more than five degrees will be attained. A desk based compass deviation study based on the specifications of the cable lay proposed will be required and a deviation survey post the cable being laid may be required.	As noted within Section 6.4, there is potential only for the cable between the bridge-linked Offshore Substation Platforms (OSP) to be HVDC (with High Voltage Alternating Current (HVAC) also a possibility here), with all other cables to be HVAC. Impacts of Electromagnetic Fields (EMF) are discussed further within Section 13.7.
NLB	Scoping Response	The NLB raised that embedded mitigation measures should specifically reference the development of a Lighting and Marking Plan (LMP), alongside a Navigational Safety Plan (NSP) and Vessel Management Plan (VMP) (NSPVMP).	A combined LMP and Aids to Navigation Management Plan (AtoNMP) (Volume 4, Annex 4: Lighting and Marking Plan (Version 1) and NSPVMP (Volume 4, Annex 5: Navigation Safety Plan and Vessel Management Plan (Version 1)) are provided and are specifically referred to within the mitigation measures in Section 17.
UK Chamber of Shipping	Scoping Response	The UK Chamber of Shipping raised that additional sources should be used to assess cruise traffic.	Since Scoping and as per Section 5.2, a total of five MGN 654-compliant vessel traffic surveys have been undertaken in additional to long-term Automatic Identification System (AIS)-only data in Appendix E to provide additional vessel traffic data, including in relation to cruise liners.

Stakeholder	Form of Correspondence	Point Raised	Response and Where Addressed in the NRA
		The UK Chamber of Shipping stated that offshore construction traffic should be considered within the baseline.	Temporary traffic is excluded from the analysis given it will distort longer-term traffic patterns (noting that this is a standard industry approach). Details of the temporary traffic are provided in Section 5.3. Operational wind farm traffic is included as baseline as per Section 5.3, with potential construction traffic accounted for in Section 15.4.
United Kingdom Hydrographic Office (UKHO)	Scoping Response	The UKHO raised that they should be informed in advance of infrastructure being established/removed or other changes which may affect Admiralty Products and Services. These may include changes to seabed depths, new or removed buoys and seabed equipment, as well as the turbines, substations and cables associated with offshore wind farms.	As per the embedded mitigations in Section 17, all infrastructure associated with Morven North and Morven South (including subsea cables) will be promulgated to UKHO to be presented on appropriately scaled UKHO Admiralty charts. As per Section 6.7, it is the intention of the Applicant to remove all cable infrastructure, but the most appropriate approach will be decided upon at the time.
Scottish Fishermen's Federation (SFF)	Scoping Response	The SFF noted preference for all development related infrastructures to be recovered/removed to shore during decommissioning, and that the seabed should be restored to its pre-development condition, to ensure it is safe for fishing industry to fully resume in the area.	It is noted in Section 6.7 that it is anticipated that all sea surface structures will be completely removed above the seabed, and that all cable infrastructure will be removed, or some sections may be left in situ (with any exposed sections cut below mean seabed level and protected).
Forth Ports	Scoping Response	Forth Ports requested to be part of the consultation for the City of Edinburgh and City of Dundee from a ports point of view.	Forth Ports have been included as a consultee within Section 4.3, and attended the Hazard Workshop.
RYA Scotland	Scoping Response	RYA Scotland noted that shipping and navigation should be scoped in, and RYA Scotland wish to be involved with consultation for the NRA.	RYA Scotland have been included as a consultee within Section 4.3, and attended the Hazard Workshop.

Stakeholder	Form of Correspondence	Point Raised	Response and Where Addressed in the NRA
UK Chamber of Shipping	Meeting – 16 December 2022	The UK Chamber of Shipping raised that non-local stakeholders should also be considered in consultation.	Stakeholders that could experience transboundary effects have been consulted and are listed in Section 4.1 and Section 4.3.
		The UK Chamber of Shipping confirmed it is content with the proposed 10nm Regional Shipping and Navigation Study Area.	Acknowledged in Section 3.4.
		The UK Chamber of Shipping stated that although the Innovation and Targeted Oil and Gas (INTOG) sites are of low data confidence they should be included to some degree in the cumulative scope.	The INTOG sites have been included in the cumulative assessment screening in Section 14.
		The UK Chamber of Shipping noted that the movement of rigs in and around Dundee will be important to pick up on as these can be large and difficult to manoeuvre.	Vessel traffic data, including the identification of rig moves, has been assessed within Section 10, with secondary data provided in Appendix E to Appendix H.
		The UK Chamber of Shipping raised that Project vessels will add to constraints and their routeing to/from Morven North and Morven South should be considered.	The impact of project vessel activities has been assessed within Sections 18 to 20. An NSPVMP will be included as embedded mitigation, as per Section 17.
		The UK Chamber of Shipping noted concerns around navigational squeeze if future sites (beyond ScotWind) are developed.	Future case has been assessed within Section 15 and includes consideration of INTOG sites.
MCA	Meeting – 16 December 2022	The MCA confirmed it is content with the proposed 10nm Regional Shipping and Navigation Study Area.	Acknowledged in Section 3.4.
		The MCA flagged that it is important that fishing vessel traffic is analysed closely, as well as oil and gas/wind farm vessel transits to relevant North Sea infrastructure.	Fishing, oil and gas and wind farm vessel activity have been assessed in Section 10 for each scenario.

Stakeholder	Form of Correspondence	Point Raised	Response and Where Addressed in the NRA
		The MCA noted that the cumulative picture is the most important aspect of shipping and navigation analysis.	Cumulative effects of Morven North and Morven South have been assessed within Sections 20 to 22. Additionally, a cumulative baseline assessment, in collaboration with other offshore wind developments, has been produced (see Volume 3, Annex 13.2: East Region Developers Group Cumulative Baseline for Shipping and Navigation.
		The MCA flagged concerns around navigational squeeze if future sites (beyond ScotWind) are developed.	Future case has been assessed within Section 15 and includes consideration of INTOG sites.
NLB	Meeting – 16 December 2022	The NLB confirmed it is content with the proposed 10nm Regional Shipping and Navigation Study Area.	Acknowledged in Section 3.4.
UK Chamber of Shipping	Scoping Workshops for the Morven Site – 18 April 2023	The UK Chamber of Shipping queried the consideration of other developments in the area outside the 10nm Study Area and whether operators will be deviated toward the OWF Scoping Boundary. Specifically, due to the proposed Berwick Bank OWF which is not within the 10 nm Study Area.	Cumulative effects of Morven North and Morven South have been assessed within Sections 20 to 22 and Berwick Bank has been screened into the cumulative risk assessment in Section 14.
		The UK Chamber of Shipping requested analysis on rig movements to be undertaken as reactivation work may become more prevalent in the area.	Vessel traffic data, including the identification of rig moves, has been assessed within Section 10, with secondary data provided in Appendix E to Appendix H.
RYA Scotland	Scoping Workshops for the Morven Site – 18 April 2023	RYA Scotland advised individual consultation with the CA.	CA were represented by the RYA Scotland representative during the Hazard Workshop as per Section 4.3, and have been contacted regarding Morven North and Morven South.

Stakeholder	Form of Correspondence	Point Raised	Response and Where Addressed in the NRA
		RYA Scotland raised that passage planning could be considered in the NRA and passages between Scandinavia and Scotland should be considered, although it may be that the OWF Scoping Boundary will just be avoided.	Acknowledged by the Applicant. Recreational vessel baseline has been assessed within Section 10.
		RYA Scotland noted that recreational craft may end up spending more time within the OWF Scoping Boundary due to the lack of commercial vessels present there and that this should be analysed.	Recreational vessel activity has been assessed within Section 15.3.
MCA	Scoping Workshops for the Morven Site - 18 April 2023	The MCA noted that in relation to the Morven/Ossian gap, they would not necessarily recommend the use of such a long, narrow shipping route.	Referenced within the risk assessment in Sections 18 to 20.
Rem Offshore	Regular Operator feedback - 13 March 2023	Rem Offshore stated that upon detailed review, no major impacts on operations have been identified. As long as the construction and development area is announced through the Nav Warnings system, it will be possible to passage plan accordingly. Vessel Masters would prefer to navigate outside of the planned construction area, based on the required exclusion zone.	Acknowledged by the Applicant within the risk assessment in Sections 18 to 20. As noted here, passage planning is able to assist with minimising effects; from Regular Operator outreach this was considered feasible with appropriate promulgation.

Stakeholder	Form of Correspondence	Point Raised	Response and Where Addressed in the NRA
MCA	Meeting – 02 May 2024	▪ Cumulative routeing options were discussed with the MCA at a meeting on the 02 May 2024, with a focus on how vessels may route regionally in the area. This included presentation of the outputs of routeing assessment undertaken which showed usable routeing options to the east and west of the Ossian and Morven arrays, and evidence that local traffic volumes were relatively low. ▪ The sea space between Morven and Ossian was considered within these discussions, noting that general consultation input undertaken for Ossian has indicated that any use of this area would be limited, with vessels preferring to pass further inshore or further offshore. Feedback from the MCA post meeting indicated agreement that use of this area (sea space between Morven and Ossian) was unlikely, given the current activity, overall length of the gap formed by the sea space between the projects, other future case developments and expert opinion. On this basis the MCA confirmed they were content for the boundaries bordering the sea space between Morven and Ossian to remain as they were. ▪ The MCA noted in the same correspondence preference for developers to maximise searoom where practicable, with a focus of this additional searoom being beneficial to Shipping and Navigation and indicated this should be considered in future layout discussions.	Considered in the analysis of future case routeing in Section 15 and the cumulative risk assessment in Section 20 to 22.

Stakeholder	Form of Correspondence	Point Raised	Response and Where Addressed in the NRA
RYA Scotland	Hazard Workshop	RYA Scotland noted concern on the buoyage to be deployed, with potential for meteorological and oceanic (MetOcean) buoyage to drift off-station. It can be difficult for sea users to know that the buoyage is there due to the volume of added items to electronic charts and Notices to Mariners, especially if they are on the water at that time.	As will be included within the LMP and AtoNMP (Volume 4, Annex 4: Lighting and Marking Plan (Version 1)), buoyage to be deployed will be placed after consultation with NLB. Buoys which will be in place will use tracking devices, with recovery plans to be implemented within the LMP and AtoNMP (see Section 17). Impacts of Morven North and Morven South construction buoyage drifting off course have been assessed within Sections 18 to 20.
		RYA Scotland stated that there is uncertainty on recreational vessel traffic in the future. If recreational vessels are transiting long distances it may result in passage planning earlier in the course, resulting in sufficient time to pass around Morven. Although inshore transits will likely be of shorter distances and so result in less time to make these decisions. These transits will likely be much closer to the coast and further from Morven. However, recreational users are finding that weather conditions are becoming increasingly more uncertain, with forecasts becoming more unreliable.	Acknowledged, with raised points included within the future case discussion for recreational vessel traffic in Section 15.3.
		RYA Scotland raised that the distance offshore may make fatigue a factor, with the number of single-handers exacerbating the issue as there is less relief available for these.	Impacts of Morven North and Morven South on recreational craft have been assessed within Sections 18 to 20.
NLB	Hazard Workshop	The NLB stated preference of using construction buoys only where necessary, to avoid cordoning off large sea areas and improve safety.	Use of construction buoys for each scenario have been considered within the risk assessments in Sections 18 to 20. The specific marking scheme will be determined in consultation with NLB post consent.

Stakeholder	Form of Correspondence	Point Raised	Response and Where Addressed in the NRA
		The NLB raised that the Eastern Green Link 3 cable project between Morven and Ossian may be impactful, as if the developments are constructed at the same time as a cable-layer is present then this may affect navigational safety.	Eastern Green Link 3 has been scoped into the cumulative assessment in Section 14.
MCA	Hazard Workshop	The MCA noted that due to viable options for diversion to the east and west of the two developments, it is not necessary to request a safety case to expand the gap between Morven and Ossian.	Acknowledged, and included within the cumulative risk assessment in Sections 20 to 22.
SFF	Hazard Workshop	SFF noted that commissioning of the planned OWFs in the area will lead to vessel traffic increases.	Such increases in vessel traffic have been captured within the future case analysis in Section 15.3. Embedded mitigations (i.e. the NSPVMP (Volume 4, Annex 5: Outline Navigation Safety Plan and Vessel Management Plan) (see Section 17) both for Morven and the other projects will ensure that vessel activity interference with other sea user activities will be reduced. Additional traffic has been assessed and mitigated within Sections 18 to 20.
MCA	Email - 12 December 2024	The MCA stated that the proposed shipping and navigation methodology (completion of one NRA encompassing all three scenarios and two EIA chapters - one assessing Morven North in isolation and both sites concurrently and the other assessing Morven South in isolation and both sites concurrently) is suitable, noting that cumulative assessments will discuss all reasonable site build-out scenarios.	The approach to assessment is laid out in Section 1.2, with the assessed scenarios described in Section 3.3.

Stakeholder	Form of Correspondence	Point Raised	Response and Where Addressed in the NRA
MCA	Meeting - 30 January 2025	The MCA advised that if the SAR lanes will be in a northwest/southeast bearing, additional navigation corridors would be required due to the overall length of the arrays.	As per the mitigations presented in Section 17, it will be ensured post-consent that the layout options will comply with MGN 654, including the potential for multiple lines of orientation and further consultation to take place prior to final layout signoff. Initial SAR access lanes based on the indicative worst-case layouts within Section 6.3.1 have been produced, including the incorporation of Helicopter Refuge Areas.
Forth Ports	Meeting - 30 January 2025	Forth Ports raised no concerns with Morven for vessels routeing to and from Forth ports, with Berwick Bank being the most influential development for this vessel traffic.	Acknowledged, with routeing to/from Forth ports as presented in Section 15.5, including for a scenario with Berwick Bank present.
RYA Scotland	Meeting - 30 January 2025	RYA Scotland noted that maximum buildout of both arrays would be worst-case for recreational vessels in the vicinity.	Maximum buildout has been used for internal allision modelling.
NLB	Meeting - 30 January 2025	The NLB stated that it is feasible to have phased lighting and marking for the arrays depending on build out scenarios.	Acknowledged within the mitigations detailed in Section 17.
UK Chamber of Shipping	Meeting - 11 February 2025	The UK Chamber of Shipping stated that the developments presented within the cumulative Study Area are representative of current and future influences on nearby routeing.	Acknowledged, with these developments used within the cumulative risk assessment in Sections 20 to 22.
		The UK Chamber of Shipping raised that vessels towing rigs or floating wind turbines for future sites should be considered within the assessment.	Relevant mitigation measures to futureproof Morven for navigational safety have been included within Section 17, such as vessels complying with the Convention on the International Regulations for Preventing Collisions at Sea (COLREGs) (IMO, 1972/77) and marine coordination for project vessels. Potential increased incidence of towing vessel traffic has been discussed in Section 15.2.

4.3 Hazard workshop

4.3.1.1 A key element of the consultation undertaken was the Hazard Workshop, intended as 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 Sections 18 to 20. This ensured that expert opinion and local knowledge was incorporated into the hazard identification process and that the hazard log was site specific. At the time of the Hazard Workshop, the only considered scenario involved the construction of both Morven North and Morven South concurrently; further consultation on the other two scenarios was discussed in future meetings including a drop-in session for all Hazard Workshop attendees.

4.3.2 Hazard workshop attendance

4.3.2.1 The Hazard Workshop was held in Edinburgh on 04 September 2024, featuring a hybrid of in-person and remote attendance. The following organisations attended the Hazard Workshop:

- MCA;
- NLB;
- UK Chamber of Shipping;
- Ossian OWF;
- Bowdun OWF;
- Forth Ports;
- RYA Scotland (also representing CA);
- SFF;
- Wilson Ship Management.

4.3.2.2 Other organisations that were invited to the Hazard Workshop include:

- Port of Aberdeen;
- Montrose Port;
- Arbroath Port;
- Peterhead Port;
- Major Ports Group;
- British Ports Association;
- Royal National Lifeboat Institution (RNLI).

4.3.3 Workshop process and hazard log

4.3.3.1 During the Hazard Workshop, key maritime hazards associated with the construction, O&M and decommissioning of Morven North and Morven South 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.

4.3.3.2 Points raised during the Hazard Workshop are provided in Table 4.1. In summary it was not identified as necessary to request a safety case to widen the gap between Morven and Ossian due to viable options to the east and west, with vessels not expected to transit between the sites. However, there were some concerns over construction buoys, either related to potential hazards from drifting off-station, or that their usage would cordon off an unnecessarily large sea area.

4.3.3.3 The risks associated with the identified hazards were ranked in the hazard log based upon the discussions held during the Hazard 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 attendees for comment.

4.3.3.4 The final agreed hazard log has been used to inform the risk assessment undertaken in Sections 18 to 20 and is presented in full in Appendix B.

5 Data sources

5.1.1.1 This section summarises the main data sources used to characterise the shipping and navigation baseline relative to Morven North and Morven South.

5.2 Summary of data sources

5.2.1.1 The main data sources used to characterise the shipping and navigation baseline relative to Morven North and Morven South are outlined in Table 5.1. This includes a report undertaken on behalf of the East Region ScotWind Developer Group - a collaboration between the six East region ScotWind developers on the Scottish east coast - which, based on industry-wide feedback, developed a shared cumulative baseline (see Volume 3, Appendix 13.2: East Region Developers Group Cumulative Baseline for Shipping and Navigation).

Table 5.1: Data sources used to inform the shipping and navigation baseline

Data	Source(s)	Purpose
Vessel traffic	Summer vessel traffic data consisting of AIS, Radar and visual observations for the Regional Shipping and Navigation Study Area (14 days, 20 June to 04 July 2024) recorded from a dedicated survey vessel on-site.	Characterising vessel traffic movements within and in proximity to Morven North and Morven South in line with MGN 654 (MCA, 2021) requirements.
	Winter vessel traffic data consisting of AIS, Radar and visual observations for the Regional Shipping and Navigation Study Area (14 days, 26 November to 06 December 2024; then 09 December to 13 December 2024) recorded from a dedicated survey vessel on-site.	
	Winter vessel traffic data consisting of AIS, Radar and visual observations for the Regional Shipping and Navigation Study Area (14 days, 21 November to 05 December 2022) recorded from a dedicated survey vessel on-site.	Secondary source for characterising vessel traffic movements within and in proximity to Morven North and Morven South.
	Summer vessel traffic data consisting of AIS, Radar and visual observations for the Regional Shipping and Navigation Study Area (14 days, 01 June to 16 June 2023) recorded from a dedicated survey vessel on-site.	
	Winter vessel traffic data consisting of AIS, Radar and visual observations for the Regional Shipping and Navigation Study Area (14 days, 15 November to 02 December 2023) recorded from a dedicated survey vessel on-site.	
	Long-term AIS data for the Regional Shipping and Navigation Study Area (12 months, 01 October 2021 to 30 September 2022) recorded from terrestrial receivers.	

Data	Source(s)	Purpose
	Anatec's ShipRoutes database (2025).	
	Volume 3, Annex 13.2: East Region Developers Group Cumulative Baseline for Shipping and Navigation	
Maritime incidents	Marine Accident Investigation Branch (MAIB) marine accidents database (2004 to 2023).	Review of maritime incidents within and in proximity to Morven North and Morven South.
	RNLI incident data (2014 to 2023).	
	Department for Transport (DfT) UK civilian SAR helicopter taskings (2015 to 2024).	
Navigational features	Admiralty Charts 273, 278, 1407 and 1409. (UKHO, 2025).	Characterising navigational features in proximity to Morven North and Morven South.
	Admiralty Sailing Directions North Sea (West) Pilot NP54 (UKHO, 2021).	
Weather	Wind direction data from the Morven OWF Operational MetOcean Criteria (European Centre for Medium-Range Weather Forecasts (ECMWF)/MetOceanWorks, 2024).	Characterising weather conditions in proximity to Morven North and Morven South.
	Significant wave height data from the Morven Metocean Measurement report (bp/EnBW, 2024).	
	Tidal data from Admiralty Charts 273, 278, 1407 and 1409.	
	Visibility data from Admiralty Sailing Directions North Sea (West) Pilot NP54 (UKHO, 2021).	

5.3 Vessel traffic surveys

5.3.1.1 The vessel traffic surveys were undertaken using a methodology agreed with the MCA and NLB. Two 14-day AIS, Radar and visual observation surveys undertaken in summer 2024 (20 June to 04 July 2024) and winter 2024 (26 November to 13 December 2024) have been considered within the baseline for a total of 28 full days. It is noted that due to severe weather, the survey vessel left the area between 06 December and 09 December 2024, with this period of time appended to the end of the survey period to allow for the full 28 days of data to be collected.

5.3.1.2 A long-term dataset from October 2021 to September 2022 is used as validation (see Appendix E), in addition to three seasonal 14-day vessel traffic surveys covering winter 2022, summer 2023, and winter 2023 (Appendix F, Appendix G and Appendix H, respectively).

5.3.1.3 A number of vessel tracks recorded during the survey periods were classified as temporary (non-routine), such as the tracks of the survey vessel and other non-routeing survey vessels. These have therefore been excluded from the analysis. Wind farm vessels associated with operational developments have been retained.

5.3.1.4 The primary dataset is assessed in full in Section 10. A summary of the vessel traffic survey dates is provided in Table 5.2.

Table 5.2: Summary of the vessel traffic surveys undertaken

Vessel traffic survey	Dates
Winter 2024	26 November – 06 December 2024
Summer 2024	20 June – 04 July 2024
Winter 2023	15 November – 02 December 2023
Summer 2023	01 June – 16 June 2023
Winter 2022	21 November – 05 December 2022

5.4 Data limitations

5.4.1 Automatic Identification System data

5.4.1.1 The carriage of AIS is required on board all vessels of greater than 300 Gross Tonnage (GT) engaged on international voyages, cargo vessels of more than 500GT not engaged on international voyages, passenger vessels irrespective of size built on or after 01 July 2002 and fishing vessels over 15 metres (m) length overall (LOA).

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

5.4.1.3 Throughout the summer 2024 survey, all vessel tracks were recorded via AIS with none recorded via Radar. Throughout the winter 2024 survey, almost all vessel tracks were recorded via AIS with only one recorded via Radar.

5.4.2 Historical incident data

5.4.2.1 Although all UK commercial vessels are required to report accidents to the MAIB, non-UK vessels do not have to report unless they are in a UK port or within 12nm territorial waters (noting that the Regional Shipping and Navigation Study Area is not located within 12nm territorial waters) or carrying passengers to a UK port. There are also no requirements for non-commercial recreational craft to report accidents to the MAIB.

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

5.4.3 United Kingdom Hydrographic Office admiralty charts

5.4.3.1 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. However, during consultation input has been sought from relevant stakeholders regarding the navigational features baseline.

6 Project description relevant to shipping and navigation

6.1.1.1 The NRA reflects the PDE which is detailed in full in Volume 1, Chapter 3: Project Description of the Morven North EIA Report and Volume 1, Chapter 3: Project Description of the Morven South EIA Report. The following subsections outline the maximum extent of Morven North and Morven South for which any shipping and navigation hazards are assessed.

6.1.1.2 As noted within Section 1.1, Morven North Boundary and Morven South Boundary are two distinct boundaries, with flexibility sought to either build out Morven North and Morven South concurrently or sequentially. The following subsections outline the maximum extents of the three named scenarios for which any shipping and navigation hazards are assessed.

6.2 Morven Site

6.2.1 Concurrent development

6.2.1.1 The Morven Site is located approximately 33nm east of the Aberdeenshire coast, with a total area covered of 250nm^2. Water depths within the Morven Site range from between 62m and 76m at Lowest Astronomical Tide (LAT). All surface piercing structures (wind turbines and OSPs) will be located entirely within the Morven Site, inclusive of blade overfly.

6.2.1.2 The key coordinates defining the boundary of the Morven Site are illustrated in Figure 6.1 and provided in Table 6.1 using World Geodetic System 1984 (WGS84).

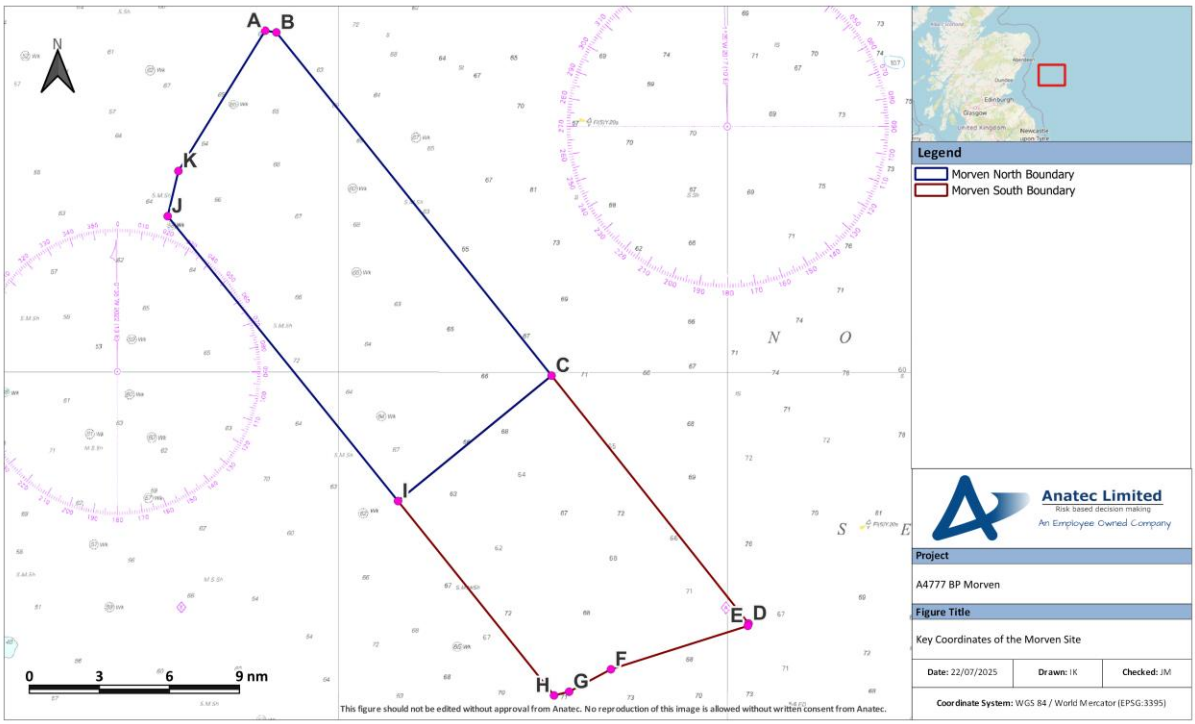


Figure 6.1: Key coordinates of the Morven Site

Table 6.1: Key coordinates of the Morven Site

Point	Latitude	Longitude
A	56° 54′ 26.48″ N	001° 05′ 38.89″ W
B	56° 54′ 22.10″ N	001° 04′ 47.19″ W
C	56° 39′ 50.85″ N	000° 43′ 33.62″ W
D	56° 29′ 18.27″ N	000° 28′ 22.25″ W
E	56° 29′ 12.05″ N	000° 28′ 25.62″ W
F	56° 27′ 20.96″ N	000° 38′ 59.01″ W
G	56° 26′ 23.51″ N	000° 42′ 12.44″ W
H	56° 26′ 14.07″ N	000° 43′ 22.19″ W
I	56° 34′ 31.05″ N	000° 55′ 24.28″ W
J	56° 46′ 36.25″ N	001° 13′ 10.17″ W
K	56° 48′ 30.91″ N	001° 12′ 20.33″ W

6.2.2 Morven North in isolation

6.2.2.1 Morven North is located approximately 33nm east of the Aberdeenshire coast. The total area covered by the Morven North Boundary is approximately 149nm^2. Charted water depths within the Morven North Boundary range from between 62m and 75m below LAT.

6.2.2.2 The key coordinates defining the Morven North Boundary are illustrated in Figure 6.2 and provided in Table 6.2 using WGS84.

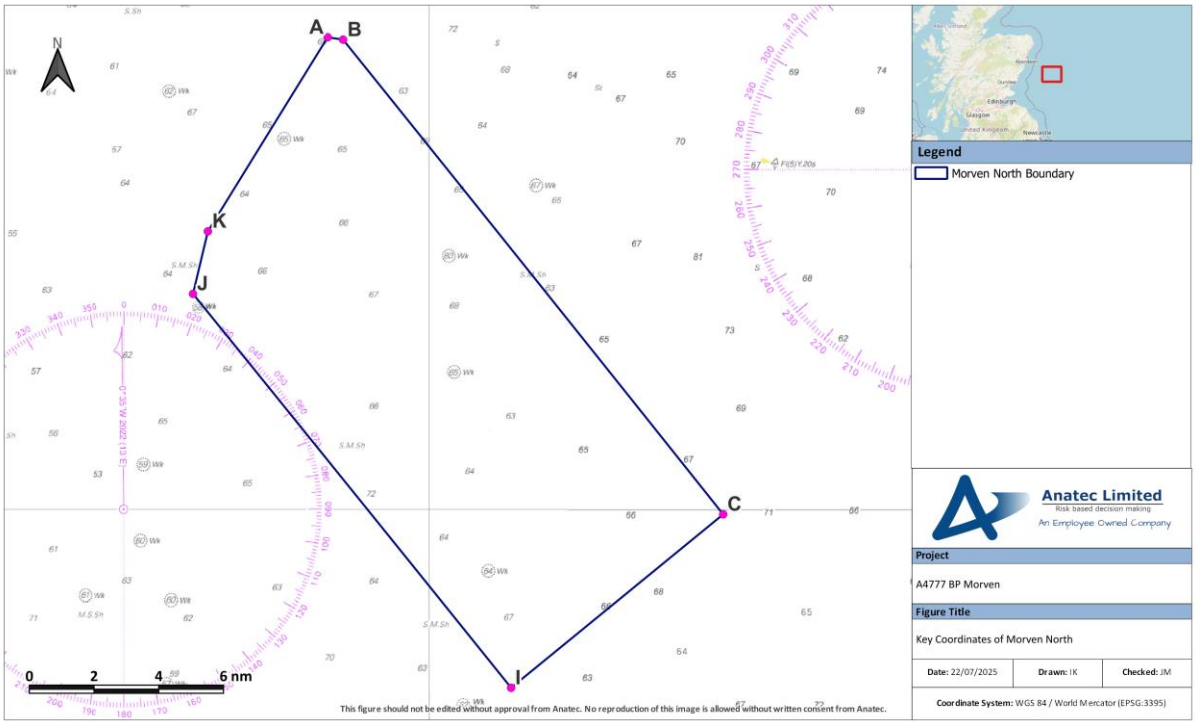


Figure 6.2: Key coordinates of Morven North

Table 6.2: Key coordinates of Morven North

Point	Latitude	Longitude
A	56° 54′ 26.48″ N	001° 05′ 38.89″ W
B	56° 54′ 22.10″ N	001° 04′ 47.19″ W
C	56° 39′ 50.85″ N	000° 43′ 33.62″ W
I	56° 34′ 31.05″ N	000° 55′ 24.28″ W
J	56° 46′ 36.25″ N	001° 13′ 10.17″ W
K	56° 48′ 30.91″ N	001° 12′ 20.33″ W

6.2.3 Morven South in isolation

6.2.3.1 Morven South is located approximately 47nm east of the Aberdeenshire coast. The total area covered by the Morven South Boundary is approximately 101nm^2. Charted water depths within the Morven South Boundary range from between 64m and 76m below LAT.

6.2.3.2 The key coordinates defining the Morven South Boundary are illustrated in Figure 6.3 and provided in Table 6.3 using WGS84.

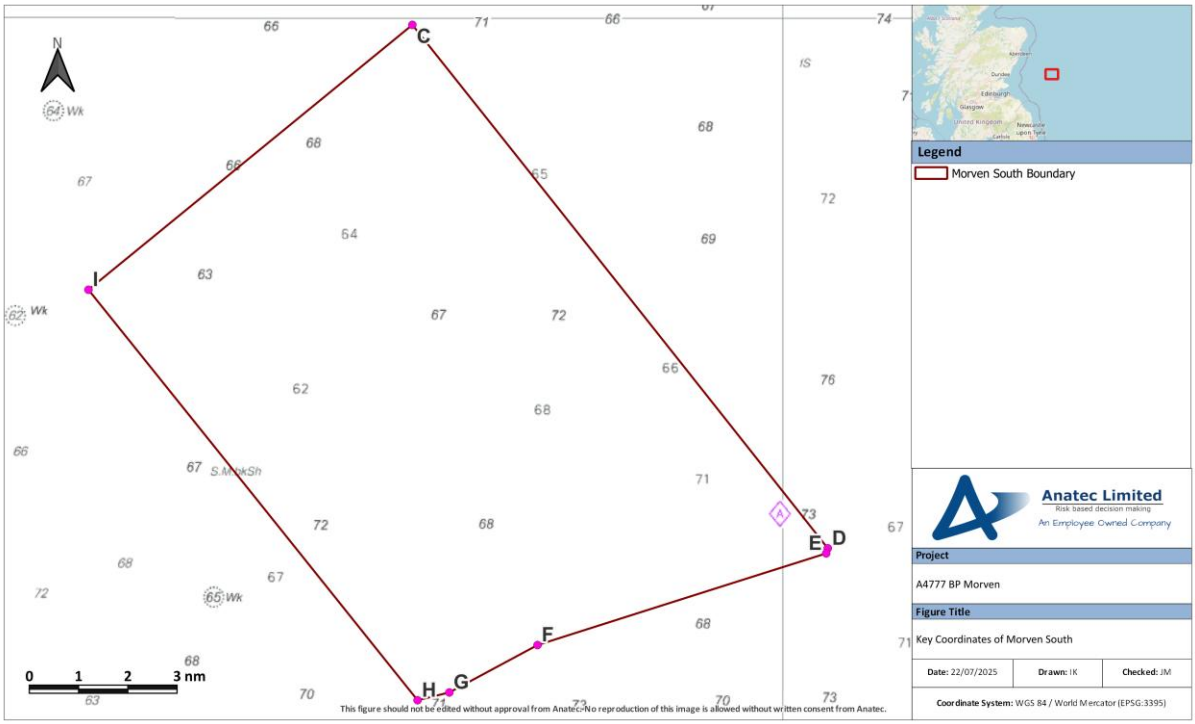


Figure 6.3: Key coordinates of Morven South

Table 6.3: Key coordinates of Morven South

Point	Latitude	Longitude
C	56° 39′ 50.85″ N	000° 43′ 33.62″ W
D	56° 29′ 12.05″ N	000° 28′ 25.62″ W
E	56° 27′ 20.96″ N	000° 38′ 59.01″ W
F	56° 26′ 23.51″ N	000° 42′ 12.44″ W
G	56° 26′ 14.07″ N	000° 43′ 22.19″ W
H	56° 34′ 31.05″ N	000° 55′ 24.28″ W
I	56° 46′ 36.25″ N	001° 13′ 10.17″ W

6.3 Surface infrastructure

6.3.1 Indicative layout

6.3.1.1 Although the final locations of infrastructure have not yet been defined, indicative worst-case layout options have been considered in this NRA which represents the maximum spatial area and maximum number of wind turbines for each scenario. This ensures that vessel displacement and exposure to allision risk for passing (or adrift) vessels is maximised for the purposes of the assessment. The minimum centre-to-centre spacing between wind turbines for each scenario is 1,000m.

Scenario 1a

6.3.1.2 Up to 101 surface structures in total will be installed within the Morven North Boundary, consisting of up to 96 wind turbines and up to five OSPs. The layout is presented in Figure 6.4.

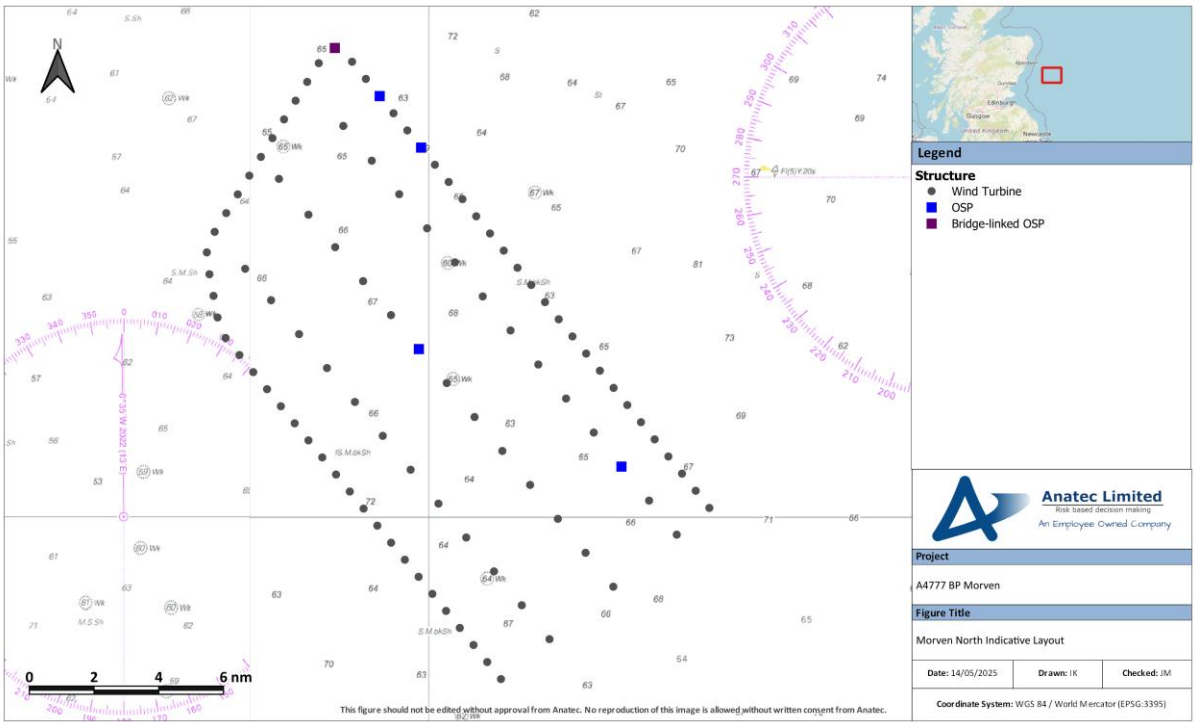


Figure 6.4: Morven North indicative worst-case layout

Scenario 1b

6.3.1.3 Up to 100 surface structures in total will be installed within the Morven South Boundary, consisting of up to 95 wind turbines and up to five OSPs. The layout is presented in Figure 6.5.

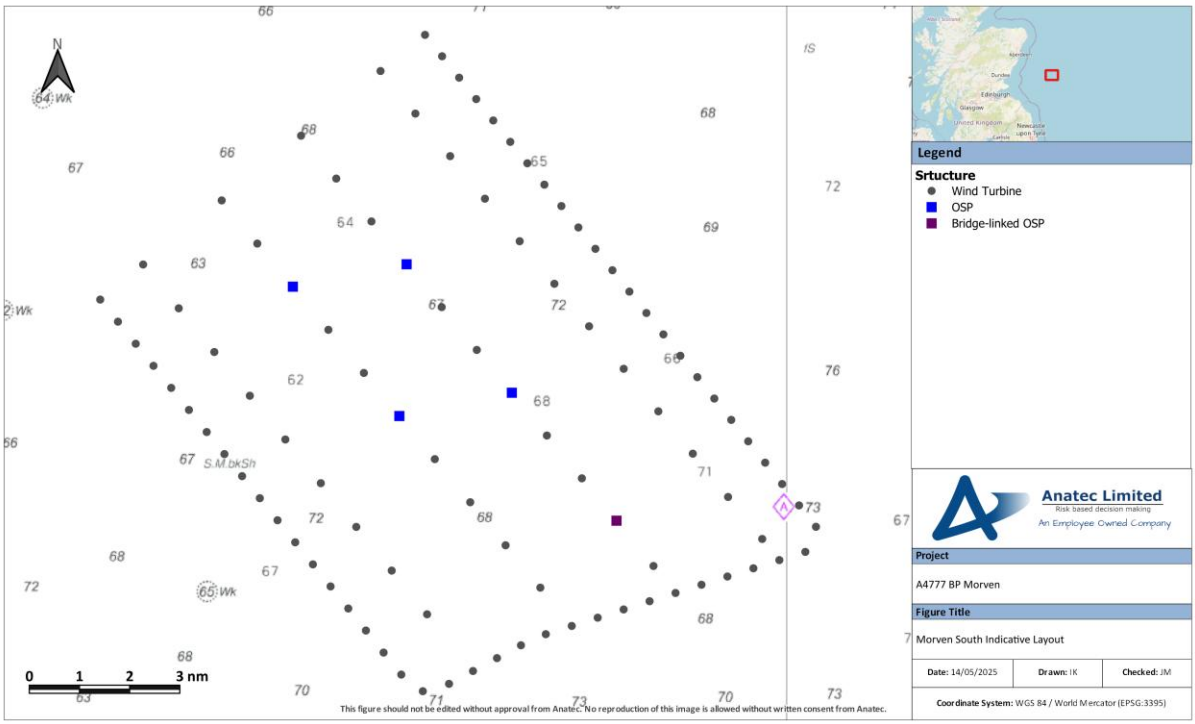


Figure 6.5: Morven South indicative worst-case layout

Scenario 2

6.3.1.4 Up to 201 surface structures in total will be installed within the Morven Site, consisting of up to 191 wind turbines and up to ten OSPs. The indicative worst-case layout is presented in Figure 6.6.

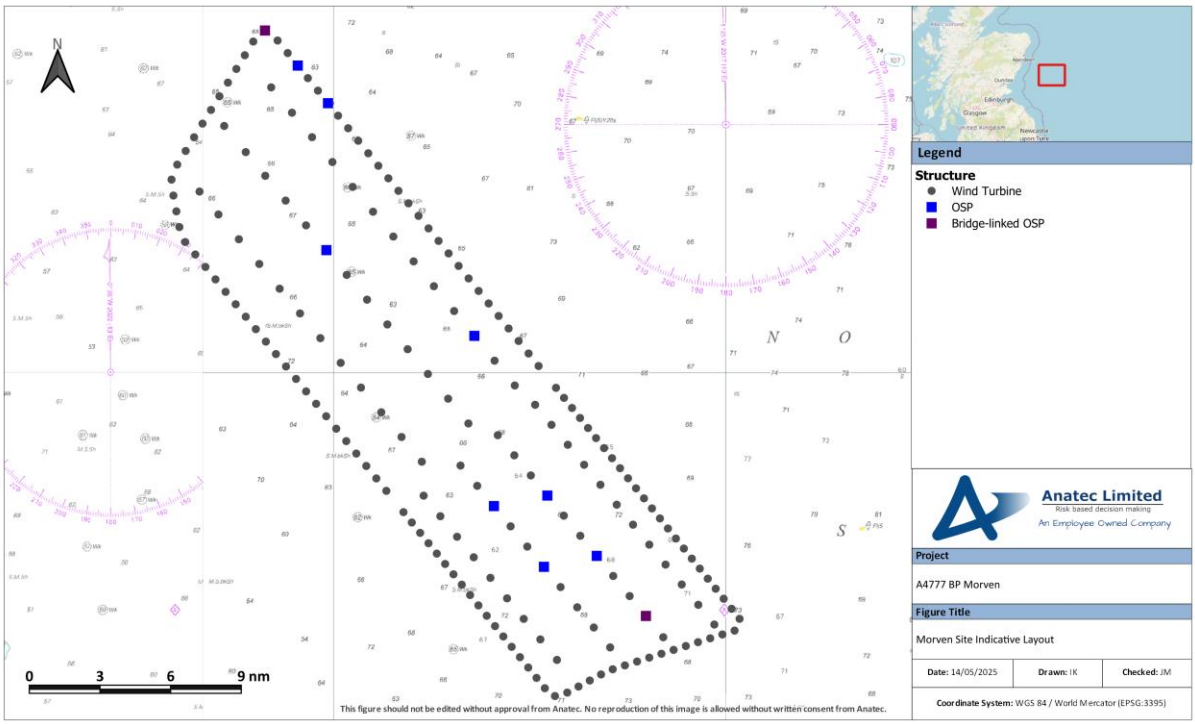


Figure 6.6: Morven Site indicative worst-case layout

6.3.1.5 Where deemed feasible for engineering, OSPs have been placed on the perimeter of the layout since these structures have a larger footprint at the sea surface and therefore greater associated allision risk.

6.3.1.6 Annex 5 to MGN 654 states that a SAR access lane is an area within which, "there shall be no OREIs, or other structures, in the wind farm or on the boundary that present an obstacle or risk to SAR helicopters flying along". The purpose of a SAR access lane is to ensure that "a SAR helicopter can fly from one side of a wind farm to the other". Furthermore, "the lanes also provide safer and more predictable paths through a wind farm for surface rescue vessels". Where a number of SAR lanes of consistent bearing can be identified within a site, these are referred to as a 'line of orientation'.

6.3.1.7 SAR lanes for the indicative worst-case layout of the Morven Site have been identified. Due to the length of the Morven Site being greater than 10nm, the searoom between the perimeter wind turbines and the internal array could be designated as a Helicopter Refuge Area (as could the space between the Morven North wind turbines and those in Morven South), in agreement with the MCA. Taking this into consideration, two lines of orientation have been identified for the Morven Site. These include a primary line of orientation of 140.6°/320.6°, and a secondary line of orientation of 50.4°/230.4°. These SAR access lanes are presented in Figure 6.7 and Figure 6.8 respectively. It is acknowledged that the ringroad Helicopter Refuge Area presented does not achieve a 1nm tip-to-tip spacing throughout, noting that the layout is

indicative at the NRA stage and the final layout will be agreed in consultation with the MCA (see Section 17).

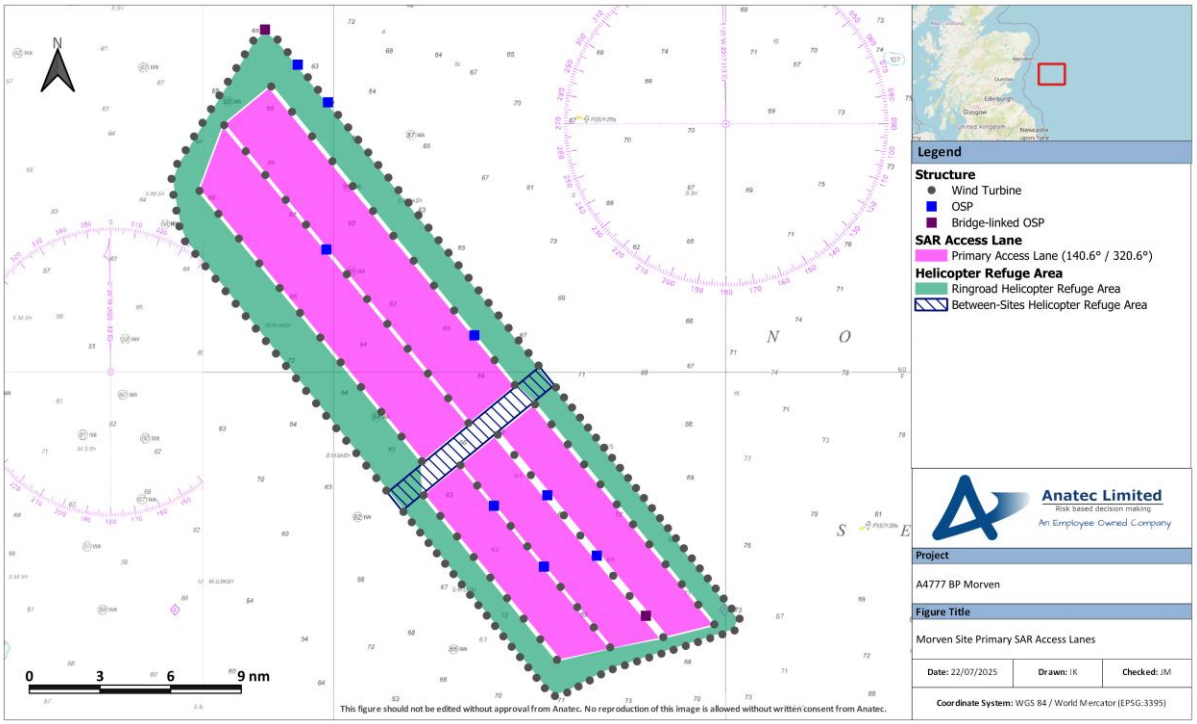


Figure 6.7: Morven Site primary Search and Rescue access lanes

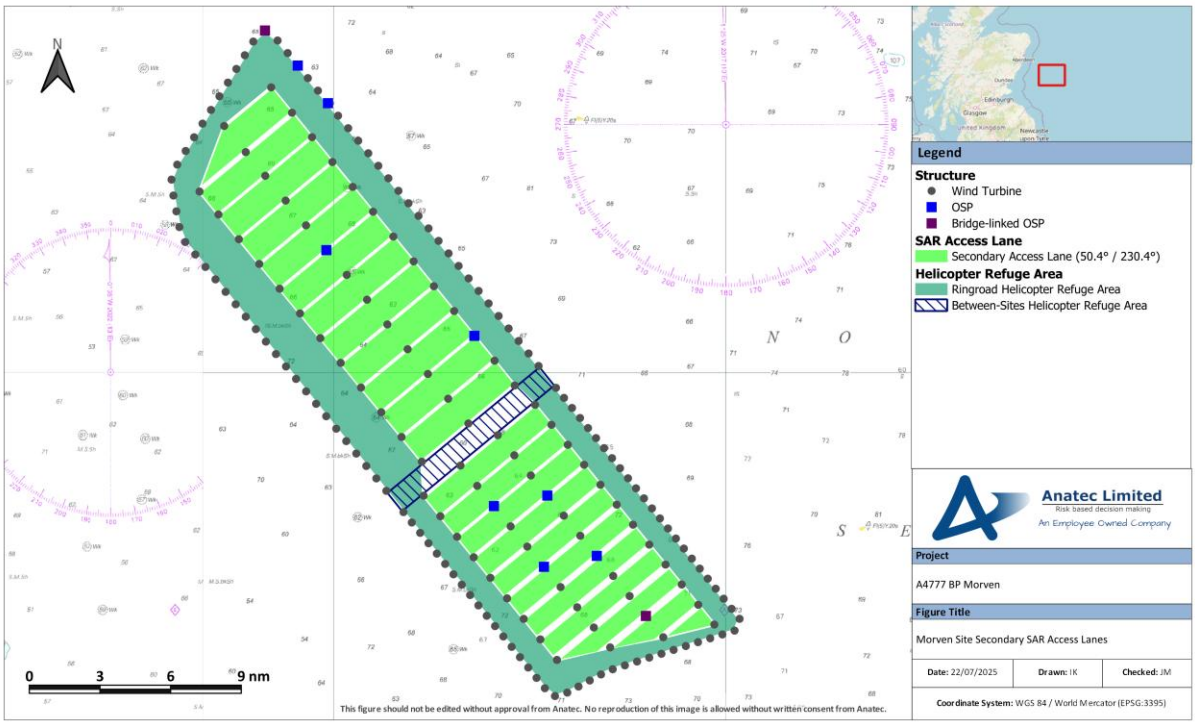


Figure 6.8: Morven Site secondary Search and Rescue access lanes

6.3.2 Wind turbines

6.3.2.1 The wind turbines within the layouts each have a maximum rotor diameter of 250m and a minimum blade tip height of 34m above LAT. The lowest rated wind turbine design has been selected from the PDE, as this entails the greatest possible number of wind turbines, representing the worst case for shipping and navigation.

6.3.2.2 Four-legged jacket foundations have been considered as the MDS for shipping and navigation as this foundation type provides the maximum structure dimensions at the sea surface. The wind turbine measurements assuming use of four-legged jacket foundations are provided in Table 6.4.

Table 6.4: Wind turbine Maximum Design Scenario for shipping and navigation

Parameter	MDS for Shipping and Navigation
Foundation type	Four-legged jacket
Dimensions at sea surface	43.2m×43.2m
Blade clearance (above LAT)	34m
Rotor diameter	250m

6.3.3 Offshore Substation Platforms

6.3.3.1 Two OSP options are assessed within the MDS, including up to four HVAC OSPs and one HVDC OSP for each of Morven North and Morven South. The HVAC OSPs may be installed on jacket foundations, with maximum topside dimensions of 80m×60m; whilst the MDS for the HVDC OSPs is considered to be gravity-based structure foundations, with maximum topside dimensions of 240m×180m.

6.3.3.2 The HVDC OSP may involve two adjacent OSPs connected by a bridge link of up to 100m length and 14m height above Highest Astronomical Tide (HAT); therefore the collision and allision risk modelling for these will consider two OSPs and a bridge link to be one singular structure of dimensions 580m×180m.

6.3.3.3 For the purposes of collision and allision risk modelling, the most sensitive viable OSP positions within each of Morven North and Morven South have been defined for bridge links with a single structure encompassing adjacent platforms modelled. Noting that only one bridge link will eventually be installed, this approach is considered conservative and accounts for the possibility of the bridge link being located in either Morven North or Morven South. Therefore, a total of two bridge-linked OSPs – one in Morven North and one in Morven South - have been included in relevant modelling (see Section 16.3.3) considering the Morven Site as a whole.

6.3.3.4 Bridge links are considered qualitatively where required in the risk assessment.

6.4 Subsea cables

6.4.1 Inter-array cables

6.4.1.1 The inter-array cables will be fully installed within the Morven Site to connect individual wind turbines to each other and to the OSPs and will all carry Alternating Current (AC). The inter-array parameters for each scenario are presented in Table 6.5.

Table 6.5: Inter-array cable parameters

Parameter	Concurrent	Morven North	Morven South
Number of cables	225	113	112
Maximum cable length	456nm	229nm	227nm
Maximum number of crossings	10	5	5
Maximum crossing height (from seafloor)	4m	4m	4m

6.4.2 Interconnector cables

6.4.2.1 The interconnector cables will be fully installed within the Morven Site to provide an interlink connection between the OSPs. Other than the cables connecting the bridge-linked cables to each other, which may carry AC or Direct Current (DC), all interconnectors will carry AC. The interconnector parameters for each scenario are presented in Table 6.6.

Table 6.6: Interconnector Cable Parameters

Parameter	Concurrent	Morven North	Morven South
Number of cables	20	10	10
Maximum cable length	404nm	261nm	143nm
Maximum number of crossings	10	5	5
Maximum crossing height (from seafloor)	4m	4m	4m

6.4.3 Cable burial and protection

6.4.3.1 Where possible, the primary means of cable protection will be by seabed burial. The extent and method by which the subsea cables will be buried will depend on the results of a detailed seabed survey of the final subsea cable routes and associated CBRA. However, a minimum burial depth of 0.5m for all subsea cables associated with Morven North and Morven South is assumed as part of the MDS.

6.4.3.2 Where cable burial is not possible, alternative cable protection methods may be deployed which will be determined within the CBRA. These methods may include a combination of concrete mattresses, rock placement, rock bags, grout bags, cement bags, sandbags, articulated pipes, cast iron shells, bend restrictors/stiffeners, Cable Protection Systems (CPS) and frond matts. It is described within the MDS (that there will be a maximum cable protection height of 3m and maximum cable protection width of 10m.

6.5 Construction phase

6.5.1.1 The indicative offshore construction phase will last for up to five years for Morven North and five years for Morven South, noting schedules will be subject to change (e.g. due to adverse weather, vessel availability). Table 6.7 provides a breakdown of the activities associated with the construction phase.

Table 6.7: Indicative construction phase vessel movements

Vessel type	Maximum on site (at any one time)			Vessel movements (return trips per year)		
	Concurrent	Morven North	Morven South	Concurrent	Morven North	Morven South
Main installation and support vessels	30	15	15	330	165	165
Tug/anchor handlers	16	8	8	208	104	104
Cable lay installation and support vessels	8	4	4	162	81	81
Guard vessels	4	2	2	130	65	65
Survey vessels	4	2	2	170	85	85
Seabed preparation vessels	6	3	3	50	25	25
Crew transfer vessels (CTV)	12	6	6	1,088	544	544
Scour protection installation vessels	2	1	1	160	80	80
Total	**82**	**41**	**41**	**2,298**	**1,149**	**1,149**

6.5.1.2 In addition, there will be a maximum of two helicopters on 75 return trips per year utilised for each of Morven North and Morven South (150 in total).

6.6 Operations and maintenance phase

6.6.1.1 The indicative O&M phase will last for up to 35 years for Morven North and 35 years for Morven South. Table 6.8 provides a breakdown of the activities associated with the O&M phase.

Table 6.8: Indicative operations and maintenance phase vessel movements

Vessel Type	Maximum on site (at any one time)			Vessel movements (per year)		
	Concurrent	Morven North	Morven South	Concurrent	Morven North	Morven South
CTVs	16	8	8	438	219	219
Jackup vessels	4	2	2	26	13	13
Cable repair vessels	4	2	2	6	3	3
Other vessels	6	3	3	118	59	59
Total	**30**	**15**	**15**	**586**	**293**	**293**

6.6.1.2 In addition, there will be a maximum of two helicopters on 1,660 return trips per year utilised for each of Morven North and Morven South (3,320 in total).

6.7 Decommissioning Phase

6.7.1.1 The decommissioning phase will generally be the reverse of the construction phase and therefore is assumed to be the same in terms of duration, vessel types and vessel numbers. It is anticipated that all sea surface structures will be completely removed above the seabed. All cable infrastructure will be removed if possible, else some sections may be left *in situ*, with any exposed sections cut below mean seabed level and protected. The best environmental option for decommissioning will be considered at the time and captured in a Decommissioning Plan (see Section 25.9).

6.8 Maximum Design Scenario

6.8.1.1 The MDS for each shipping and navigation hazard for the concurrent development, Morven North in isolation and Morven South in isolation are provided in Table 6.9, Table 6.10 and Table 6.11 respectively and is based on the parameters described in the previous subsections.

Table 6.9: Maximum Design Scenario for shipping and navigation by hazard (concurrent)

Potential hazard	Phase(s)	MDS for shipping and navigation	Justification
Increased vessel to vessel collision risk resulting from displacement (third party to third party)	Construction/ decommissioning	▪ Maximum extent of buoyed construction area assuming full build out of the Morven Site. ▪ 191 wind turbines and ten OSPs within the Morven Site. ▪ Structure locations as per Figure 6.6. ▪ Construction phase of up to five years. ▪ 500m safety zones around active construction. Mandatory pre-commissioning 50m safety zones established around each structure and/or their foundations when construction works have been completed but prior to OWF commissioning or where construction works have only been partially completed. These safety zones will be active at any structure during the construction phase where a construction vessel is not present. ▪ Up to 2,298 return trips per year from project vessels, with up to 82 project vessels on site at any one time.	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 collision risk involving third-party vessels.
	O&M	▪ Maximum extent of the Morven Site. ▪ 191 wind turbines and ten OSPs within the Morven Site. ▪ Structure locations as per Figure 6.6. ▪ Operational phase of up to 35 years. ▪ 500m safety zones around major maintenance. ▪ Up to 586 return trips per year from project vessels, with up to 30 total project vessels on site at any one time (15 for Morven North and 15 for Morven South).	
Increased vessel to vessel collision risk resulting from displacement (third	Construction/ decommissioning	▪ Maximum extent of buoyed construction area assuming full build out of the Morven Site. ▪ 191 wind turbines and ten OSPs within the Morven Site. ▪ Structure locations as per Figure 6.6. ▪ Construction phase of up to five years.	Largest possible extent of infrastructure, greatest number of simultaneous vessel activities and greatest duration resulting in the maximum spatial and temporal

Potential hazard	Phase(s)	MDS for shipping and navigation	Justification
party to project vessel)		▪ Up to 2,298 return trips per year from project vessels, with up to 82 project vessels on site at any one time.	effect on vessel to vessel collision risk involving a third-party vessel and a project vessel.
	O&M	▪ Maximum extent of the Morven Site. ▪ 191 wind turbines and ten OSPs within the Morven Site. ▪ Structure locations as per Figure 6.6. ▪ Operational phase of up to 35 years. ▪ Up to 586 return trips per year from project vessels, with up to 30 total project vessels on site at any one time (15 for Morven North and 15 for Morven South).	
Vessel to structure allision risk	Construction/ decommissioning	▪ Maximum extent of buoyed construction area assuming full build out of the Morven Site. ▪ 191 wind turbines and ten OSPs within the Morven Site. ▪ Structure locations as per Figure 6.6. ▪ Construction phase of up to five years. ▪ 500m safety zones around active construction. Mandatory pre-commissioning 50m safety zones established around each structure and/or their foundations when construction works have been completed but prior to OWF commissioning or where construction works have only been partially completed. These safety zones will be active at any structure during the construction phase where a construction vessel is not present. ▪ Wind turbine jacket leg diameter of 3.2m and jacket leg spacing of 40m. ▪ Wind turbine sea surface dimensions of 43.2m x 43.2m. ▪ OSP jacket leg diameter of 4.6m for HVAC/5m for HVDC and jacket leg spacing of 50m for HVAC/135m for HVDC. ▪ HVAC OSP topside of 80m x 60m. ▪ Bridge-linked HVDC OSPs with combined 580m x 180m topside. ▪ Maximum bridge link length of 100m and height of 14m above HAT.	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.

Potential hazard	Phase(s)	MDS for shipping and navigation	Justification
	O&M	▪ Maximum extent of the Morven Site. ▪ 191 wind turbines and ten OSPs within the Morven Site. ▪ Structure locations as per Figure 6.6. ▪ Operational phase of up to 35 years. ▪ 500m safety zones around major maintenance. ▪ Wind turbine jacket leg diameter of 3.2m and jacket leg spacing of 40m. ▪ Wind turbine sea surface dimensions of 43.2m x 43.2m. ▪ OSP jacket leg diameter of 4.6m for HVAC/5m for HVDC and jacket leg spacing of 50m for HVAC/135m for HVDC. ▪ HVAC OSP topside of 80m x 60m. ▪ Bridge-linked HVDC OSPs with combined 580m x 180m topside. ▪ Maximum bridge link length of 100m and height of 14m above HAT. ▪ Minimum structure spacing of 1,000m.	
Reduced access to local ports and harbours	Construction/ decommissioning	▪ Up to 2,298 return trips per year from project vessels, with up to 82 project vessels on site at any one time.	Greatest number of simultaneous vessel activities resulting in the maximum spatial and temporal effect on access to local ports and harbours.
	O&M	▪ Up to 586 return trips per year from project vessels, with up to 30 total project vessels on site at any one time (15 for Morven North and 15 for Morven South).	
Reduction of under keel clearance as a result of subsea infrastructure	O&M	▪ Maximum extent of the Morven Site. ▪ 191 wind turbines and ten OSPs within the Morven Site. ▪ Operational phase of up to 35 years. ▪ 500m safety zones around active construction, 50m safety zones otherwise. ▪ Up to 456nm (844 kilometres (km)) of inter-array cables. ▪ Maximum inter-array cable protection height of 3m and maximum inter-array cable protection width of 10m, with 10% of the inter-array cables requiring protection. ▪ Ten inter-array crossings, with maximum crossing height of 4m. ▪ Up to 404nm (748km) of interconnector cables.	Maximum length of subsea cable and maximum extent of protection leading to greatest under keel interaction risk.

Potential hazard	Phase(s)	MDS for shipping and navigation	Justification
		▪ Maximum interconnector cable protection height of 3m and maximum interconnector cable protection width of 10m, with 10% of the interconnector cables requiring protection. ▪ Ten interconnector crossings, with maximum crossing height of 4m.	
Anchor and fishing gear interaction with subsea cables	O&M	▪ Maximum extent of the Morven Site. ▪ 191 wind turbines and ten OSPs within the Morven Site. ▪ Operational phase of up to 35 years. ▪ 500m safety zones around active construction, 50m safety zones otherwise. ▪ Up to 456nm (844km) of inter-array cables. ▪ Maximum inter-array cable protection height of 3m, with 10% of the inter-array cables requiring protection. ▪ Ten inter-array crossings, with maximum crossing height of 4m. ▪ Up to 404nm (748km) of interconnector cables. ▪ Maximum interconnector cable protection height of 3m, with 10% of the interconnector cables requiring protection. ▪ Ten interconnector crossings, with maximum crossing height of 4m. ▪ Minimum target burial depth for all cables of 0.5m.	Largest possible extent of subsea infrastructure and greatest duration resulting in the maximum spatial and temporal effect on anchor or fishing gear interaction with subsea cables.
Interference with navigation, communications and position-fixing equipment	O&M	▪ Maximum extent of the Morven Site. ▪ 191 wind turbines and ten OSPs within the Morven Site. ▪ Structure locations as per Figure 6.6. ▪ Operational phase of up to 35 years. ▪ Up to 456nm (844km) of inter-array cables. ▪ Up to 404nm (748km) of interconnector cables.	Largest possible extent of infrastructure leading to maximum exposure to potential effects on equipment.
Reduction of SAR capability	O&M	▪ Maximum extent of the Morven Site. ▪ 191 wind turbines and ten OSPs within the Morven Site. ▪ Minimum structure spacing of 1,000m.	Largest possible extent, greatest number of surface structures, greatest number of simultaneous

Potential hazard	Phase(s)	MDS for shipping and navigation	Justification
		▪ Structure locations as per Figure 6.6. ▪ Operational phase of up to 35 years. ▪ Up to 456nm (844km) of inter-array cables. ▪ Up to 404nm (748km) of interconnector cables. ▪ Up to 586 return trips per year from project vessels, with up to 30 total project vessels on site at any one time (15 for Morven North and 15 for Morven South).	vessel activities and greatest duration resulting in the maximum spatial and temporal effect on emergency response capability.

Table 6.10: Maximum Design Scenario for shipping and navigation by hazard (Morven North)

Potential hazard	Phase(s)	MDS for shipping and navigation	Justification
Increased vessel to vessel collision risk resulting from displacement (third party to third party)	Construction/ decommissioning	▪ Maximum extent of buoyed construction area assuming full build out of Morven North Boundary. ▪ 96 wind turbines and five OSPs within the Morven North Boundary. ▪ Structure locations as per Figure 6.4. ▪ Construction phase of up to five years. ▪ 500m safety zones around active construction. Mandatory pre-commissioning 50m safety zones established around each structure and/or their foundations when construction works have been completed but prior to OWF commissioning or where construction works have only been partially completed. These safety zones will be active at any structure during the construction phase where a construction vessel is not present. ▪ Up to 1,149 return trips per year from project vessels, with up to 41 project vessels on site at any one time.	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 collision risk involving third-party vessels.
	O&M	▪ Maximum extent of Morven North Boundary. ▪ 96 wind turbines and five OSPs within the Morven North Boundary. ▪ Structure locations as per Figure 6.4. ▪ Operational phase of up to 35 years. ▪ 500m safety zones around major maintenance. ▪ Up to 293 return trips per year from project vessels, with up to 15 total project vessels on site at any one time.	
Increased vessel to vessel collision risk resulting from displacement (third	Construction/ decommissioning	▪ Maximum extent of buoyed construction area assuming full build out of Morven North Boundary. ▪ 96 wind turbines and five OSPs within the Morven North Boundary. ▪ Structure locations as per Figure 6.4. ▪ Construction phase of up to five years.	Largest possible extent of infrastructure, greatest number of simultaneous vessel activities and greatest duration resulting in the maximum spatial and temporal

Potential hazard	Phase(s)	MDS for shipping and navigation	Justification
party to project vessel)		▪ Up to 1,149 return trips per year from project vessels, with up to 41 project vessels on site at any one time.	effect on vessel to vessel collision risk involving a third-party vessel and a project vessel.
	O&M	▪ Maximum extent of Morven North Boundary. ▪ 96 wind turbines and five OSPs within the Morven North Boundary. ▪ Structure locations as per Figure 6.4. ▪ Operational phase of up to 35 years. ▪ Up to 293 return trips per year from project vessels, with up to 15 total project vessels.	
Vessel to structure allision risk	Construction/ decommissioning	▪ Maximum extent of buoyed construction area assuming full build out of Morven North Boundary. ▪ 96 wind turbines and five OSPs within the Morven North Boundary. ▪ Structure locations as per Figure 6.4. ▪ Construction phase of up to five years. ▪ 500m safety zones around active construction. Mandatory pre-commissioning 50m safety zones established around each structure and/or their foundations when construction works have been completed but prior to OWF commissioning or where construction works have only been partially completed. These safety zones will be active at any structure during the construction phase where a construction vessel is not present. ▪ Wind turbine jacket leg diameter of 3.2m and jacket leg spacing of 40m. ▪ Wind turbine sea surface dimensions of 43.2m x 43.2m. ▪ OSP jacket leg diameter of 4.6m for HVAC/5m for HVDC and jacket leg spacing of 50m for HVAC/135m for HVDC. ▪ HVAC OSP topside of 80m x 60m. ▪ Bridge-linked HVDC OSP with combined 580m x 180m topside. ▪ Maximum bridge link length of 100m and height of 14m above HAT.	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.
	O&M	▪ Maximum extent of Morven North Boundary.	

Potential hazard	Phase(s)	MDS for shipping and navigation	Justification
		▪ 96 wind turbines and five OSPs within the Morven North Boundary. ▪ Structure locations as per Figure 6.4. ▪ Operational phase of up to 35 years. ▪ 500m safety zones around major maintenance. ▪ Wind turbine jacket leg diameter of 3.2m and jacket leg spacing of 40m. ▪ Wind turbine sea surface dimensions of 43.2m x 43.2m. ▪ OSP jacket leg diameter of 4.6m for HVAC/5m for HVDC and jacket leg spacing of 50m for HVAC/135m for HVDC. ▪ HVAC OSP topside of 80m x 60m. ▪ Bridge-linked HVDC OSP with combined 580m x 180m topside. ▪ Maximum bridge link length of 100m and height of 14m above HAT. ▪ Minimum structure spacing of 1,000m.	
Reduced access to local ports and harbours	Construction/ decommissioning	▪ Up to 1,149 return trips per year from project vessels, with up to 41 project vessels on site at any one time.	Greatest number of simultaneous vessel activities resulting in the maximum spatial and temporal effect on access to local ports and harbours.
	O&M	▪ Up to 293 return trips per year from project vessels, with up to 15 total project vessels on site at any one time.	
Reduction of under keel clearance as a result of subsea infrastructure	O&M	▪ Maximum extent of Morven North Boundary. ▪ 96 wind turbines and five OSPs within the Morven North Boundary. ▪ Operational phase of up to 35 years. ▪ 500m safety zones around active construction, 50m safety zones otherwise. ▪ Up to 229nm (424km) of inter-array cables. ▪ Maximum inter-array cable protection height of 3m, with 10% of the inter-array cables requiring protection. ▪ Five inter-array crossings, with maximum crossing height of 4m. ▪ Up to 261nm (484km) of interconnector cables.	Maximum length of subsea cable and maximum extent of protection leading to greatest under keel interaction risk.

Potential hazard	Phase(s)	MDS for shipping and navigation	Justification
		▪ Maximum interconnector cable protection height of 3m, with 10% of the interconnector cables requiring protection. ▪ Five interconnector crossings, with maximum crossing height of 4m.	
Anchor and fishing gear interaction with subsea cables	O&M	▪ Maximum extent of Morven North Boundary. ▪ 96 wind turbines and five OSPs within the Morven North Boundary. ▪ Operational phase of up to 35 years. ▪ 500m safety zones around active construction, 50m safety zones otherwise. ▪ Up to 229nm (424km) of inter-array cables. ▪ Maximum inter-array cable protection height of 3m, with 10% of the inter-array cables requiring protection. ▪ Five inter-array crossings, with maximum crossing height of 4m. ▪ Up to 261nm (484km) of interconnector cables. ▪ Maximum interconnector cable protection height of 3m, with 10% of the interconnector cables requiring protection. ▪ Five interconnector crossings, with maximum crossing height of 4m. ▪ Minimum target burial depth for all cables of 0.5m.	Largest possible extent of subsea infrastructure and greatest duration resulting in the maximum spatial and temporal effect on anchor or fishing gear interaction with subsea cables.
Interference with navigation, communications and position-fixing equipment	O&M	▪ Maximum extent of Morven North Boundary. ▪ 96 wind turbines and five OSPs within the Morven North Boundary. ▪ Structure locations as per Figure 6.4. ▪ Operational phase of up to 35 years. ▪ Up to 229nm (424km) of inter-array cables. ▪ Up to 261nm (484km) of interconnector cables.	Largest possible extent of infrastructure leading to maximum exposure to potential effects on equipment.
Reduction of SAR capability	O&M	▪ Maximum extent of Morven North Boundary. ▪ 96 wind turbines and five OSPs within the Morven North Boundary. ▪ Minimum structure spacing of 1,000m. ▪ Structure locations as per Figure 6.4.	Largest possible extent, greatest number of surface structures, greatest number of simultaneous vessel activities and greatest

Potential hazard	Phase(s)	MDS for shipping and navigation	Justification
		▪ Operational phase of up to 35 years. ▪ Up to 229nm (424km) of inter-array cables. ▪ Up to 261nm (484km) of interconnector cables. ▪ Up to 293 return trips per year from project vessels, with up to 15 total project vessels on site at any one time.	duration resulting in the maximum spatial and temporal effect on emergency response capability.

Table 6.11: Maximum Design Scenario for shipping and navigation by hazard (Morven South)

Potential hazard	Phase(s)	MDS for shipping and navigation	Justification
Increased vessel to vessel collision risk resulting from displacement (third party to third party)	Construction/ decommissioning	▪ Maximum extent of buoyed construction area assuming full build out of Morven South Boundary. ▪ 95 wind turbines and five OSPs within the Morven South Boundary. ▪ Structure locations as per Figure 6.5. ▪ Construction phase of up to five years. ▪ 500m safety zones around active construction. Mandatory pre-commissioning 50m safety zones established around each structure and/or their foundations when construction works have been completed but prior to OWF commissioning or where construction works have only been partially completed. These safety zones will be active at any structure during the construction phase where a construction vessel is not present. ▪ Up to 1,149 return trips per year from project vessels, with up to 41 project vessels on site at any one time.	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 collision risk involving third-party vessels.
	O&M	▪ Maximum extent of Morven South. ▪ 95 wind turbines and five OSPs within the Morven South Boundary. ▪ Structure locations as per Figure 6.5. ▪ Operational phase of up to 35 years. ▪ 500m safety zones around major maintenance. ▪ Up to 293 return trips per year from project vessels, with up to 15 total project vessels on site at any one time.	
Increased vessel to vessel collision risk resulting from displacement (third	Construction/ decommissioning	▪ Maximum extent of buoyed construction area assuming full build out of Morven South. ▪ 95 wind turbines and five OSPs within the Morven South Boundary. ▪ Structure locations as per Figure 6.5. ▪ Construction phase of up to five years.	Largest possible extent of infrastructure, greatest number of simultaneous vessel activities and greatest duration resulting in the

Potential hazard	Phase(s)	MDS for shipping and navigation	Justification
party to project vessel)		▪ Up to 1,149 return trips per year from project vessels, with up to 41 project vessels on site at any one time.	maximum spatial and temporal effect on vessel to vessel collision risk involving a third-party vessel and a project vessel.
	O&M	▪ Maximum extent of Morven South. ▪ 95 wind turbines and five OSPs within the Morven South Boundary. ▪ Structure locations as per Figure 6.5. ▪ Operational phase of up to 35 years. ▪ Up to 293 return trips per year from project vessels, with up to 15 total project vessels on site at any one time.	
Vessel to structure allision risk	Construction/ decommissioning	▪ Maximum extent of buoyed construction area assuming full build out of Morven South. ▪ 95 wind turbines and five OSPs within the Morven South Boundary. ▪ Structure locations as per Figure 6.5. ▪ Construction phase of up to five years. ▪ 500m safety zones around active construction. Mandatory pre-commissioning 50m safety zones established around each structure and/or their foundations when construction works have been completed but prior to OWF commissioning or where construction works have only been partially completed. These safety zones will be active at any structure during the construction phase where a construction vessel is not present. ▪ Wind turbine jacket leg diameter of 3.2m and jacket leg spacing of 40m. ▪ Wind turbine sea surface dimensions of 43.2m x 43.2m. ▪ OSP jacket leg diameter of 4.6m for HVAC/5m for HVDC and jacket leg spacing of 50m for HVAC/135m for HVDC. ▪ HVAC OSP topside of 80m x 60m. ▪ Bridge-linked HVDC OSP with combined 580m x 180m topside. ▪ Maximum bridge link length of 100m and height of 14m above HAT.	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.
	O&M	▪ Maximum extent of Morven South.	

Potential hazard	Phase(s)	MDS for shipping and navigation	Justification
		▪ 95 wind turbines and five OSPs within the Morven South Boundary. ▪ Structure locations as per 1.3 Worst Case wind turbine Layouts. ▪ Operational phase of up to 35 years. ▪ 500m safety zones around major maintenance. ▪ Wind turbine jacket leg diameter of 3.2m and jacket leg spacing of 40m. ▪ Wind turbine sea surface dimensions of 43.2m x 43.2m. ▪ OSP jacket leg diameter of 4.6m for HVAC/5m for HVDC and jacket leg spacing of 50m for HVAC/135m for HVDC. ▪ HVAC OSP topside of 80m x 60m. ▪ Bridge-linked HVDC OSP with combined 580m x 180m topside. ▪ Maximum bridge link length of 100m and height of 14m above HAT. ▪ Minimum structure spacing of 1,000m.	
Reduced access to local ports and harbours	Construction/ decommissioning	▪ Up to 1,149 return trips per year from project vessels, with up to 41 project vessels on site at any one time.	Greatest number of simultaneous vessel activities resulting in the maximum spatial and temporal effect on access to local ports and harbours.
	O&M	▪ Up to 293 return trips per year from project vessels, with up to 15 total project vessels on site at any one time.	
Reduction of under keel clearance as a result of subsea infrastructure	O&M	▪ Maximum extent of Morven South. ▪ 95 wind turbines and five OSPs within the Morven South Boundary. ▪ Operational phase of up to 35 years. ▪ 500m safety zones around active construction, 50m safety zones otherwise. ▪ Up to 227nm (420km) of inter-array cables. ▪ Maximum inter-array cable protection height of 3m and maximum inter-array cable protection width of 10m, with 10% of the inter-array cables requiring protection. ▪ Five inter-array crossings, with maximum crossing height of 4m. ▪ Up to 143nm (264km) of interconnector cables.	Maximum length of subsea cable and maximum extent of protection leading to greatest under keel interaction risk.

Potential hazard	Phase(s)	MDS for shipping and navigation	Justification
		▪ Maximum interconnector cable protection height of 3m and maximum interconnector cable protection width of 10m, with 10% of the interconnector cables requiring protection. ▪ Five interconnector crossings, with maximum crossing height of 4m.	
Anchor and fishing gear interaction with subsea cables	O&M	▪ Maximum extent of Morven South. ▪ 95 wind turbines and five OSPs within the Morven South Boundary. ▪ Operational phase of up to 35 years. ▪ 500m safety zones around active construction, 50m safety zones otherwise. ▪ Up to 227nm (420km) of inter-array cables. ▪ Maximum inter-array cable protection height of 3m, with 10% of the inter-array cables requiring protection. ▪ Five inter-array crossings, with maximum crossing height of 4m. ▪ Up to 143nm (264km) of interconnector cables. ▪ Maximum interconnector cable protection height of 3m, with 10% of the interconnector cables requiring protection. ▪ Five interconnector crossings, with maximum crossing height of 4m. ▪ Minimum target burial depth for all cables of 0.5m.	Largest possible extent of subsea infrastructure and greatest duration resulting in the maximum spatial and temporal effect on anchor or fishing gear interaction with subsea cables.
Interference with navigation, communications and position-fixing equipment	O&M	▪ Maximum extent of Morven South. ▪ 95 wind turbines and five OSPs within the Morven South Boundary. ▪ Structure locations as per Figure 6.5. ▪ Operational phase of up to 35 years. ▪ Up to 227nm (420km) of inter-array cables. ▪ Up to 143nm (264km) of interconnector cables.	Largest possible extent of infrastructure leading to maximum exposure to potential effects on equipment.
Reduction of SAR capability	O&M	▪ Maximum extent of Morven South. ▪ 95 wind turbines and five OSPs within the Morven South Boundary. ▪ Minimum structure spacing of 1,000m.	Largest possible extent, greatest number of surface structures, greatest number of simultaneous

Potential hazard	Phase(s)	MDS for shipping and navigation	Justification
		▪ Structure locations as per Figure 6.5. ▪ Operational phase of up to 35 years. ▪ Up to 227nm (420km) of inter-array cables. ▪ Up to 143nm (264km) of interconnector cables. ▪ Up to 293 return trips per year from project vessels, with up to 15 total project vessels on site at any one time.	vessel activities and greatest duration resulting in the maximum spatial and temporal effect on emergency response capability.

7 Navigational features

7.1.1.1 The navigational features noted in proximity to Morven North and Morven South are presented in Figure 7.1.

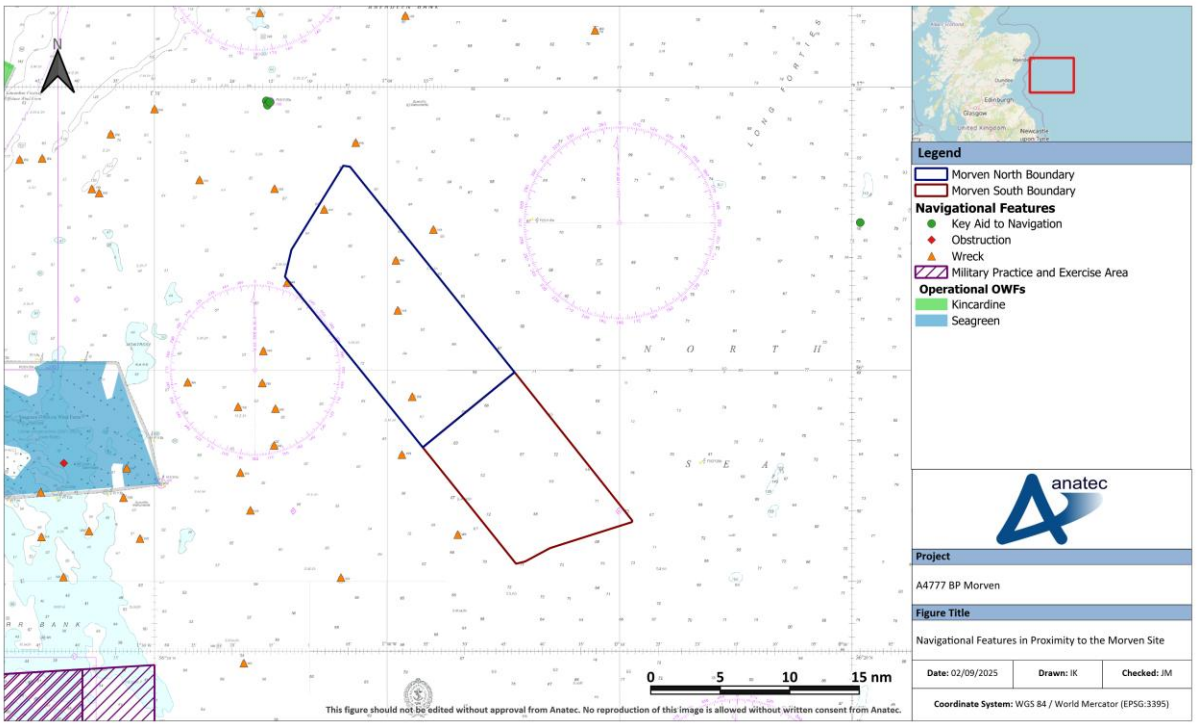


Figure 7.1: Navigational features in proximity to the Morven Site

7.1.1.2 It should be noted the following navigational features have been considered but none identified in proximity to Morven North and Morven South from the baseline review:

- port related features such as pilot boarding and landing areas;
- jurisdiction of a port and/or harbour authority;
- anchorage areas;
- marine aggregate dredging areas;
- spoil grounds.

7.1.1.3 Navigational features which were identified are described in the following subsections.

7.2 Key aids to navigation

7.2.1.1 There are no aids to navigation located within the Morven Site, although a cluster of four MetOcean buoys are located approximately 6.8nm northwest, within the

Bowdun array area. Two pairs of buoys were also located within the Ossian array area, serving a similar purpose in measuring MetOcean conditions, but were removed in April 2025 (Kingfisher Bulletin, 2025).

7.3 Wrecks and obstructions

7.3.1.1 Numerous charted wrecks and obstructions are in proximity to Morven North and Morven South and can be seen in Figure 7.1. Four charted wrecks can be found within the Morven North Boundary, with none within the Morven South Boundary.

7.4 Other offshore wind farms

7.4.1.1 Seagreen was commissioned in late 2023 with the associated construction buoyage removed in March 2025 and is located approximately 15nm west of Morven North and 19nm west of Morven South. Kincardine and Aberdeen OWF (European Offshore Wind Deployment Centre (EOWDC)) are the only other operational OWFs in proximity.

7.4.1.2 It should be noted that future OWFs in the region are considered as part of the cumulative screening in Section 14.

7.5 Ports and harbours

7.5.1.1 Noting the distance offshore of Morven North and Morven South, there are no ports or harbours in the direct vicinity. The closest is Aberdeen, located approximately 34nm to the northwest.

7.6 Military practice and exercise areas

7.6.1.1 There are two submarine exercise areas located in proximity to Morven North and Morven South. Both areas are located in the approaches to the Firth of Forth, with both area X5641 (Forth Outer) area X5642 (Forth Middle) comprising approximately 303nm^2. Area X5641 lies approximately 24nm southwest of Morven North, with area X5642 approximately 29nm to the southwest. Both areas overlap.

8 Meteorological ocean data

8.1.1.1 This section presents MetOcean statistics local to Morven North and Morven South. The data presented in this section has been used as input to the collision and allision risk modelling (Section 16).

8.2 Wind

8.2.1.1 The proportion of the wind direction within each 30-degree interval for a location in Morven North is presented in Figure 8.1 in the form of a wind rose, with similar data from Morven South presented in Figure 8.2. It can be seen from both sites that wind is predominately from the southwest. The concurrent development scenario utilises the data for both Morven North and Morven South.

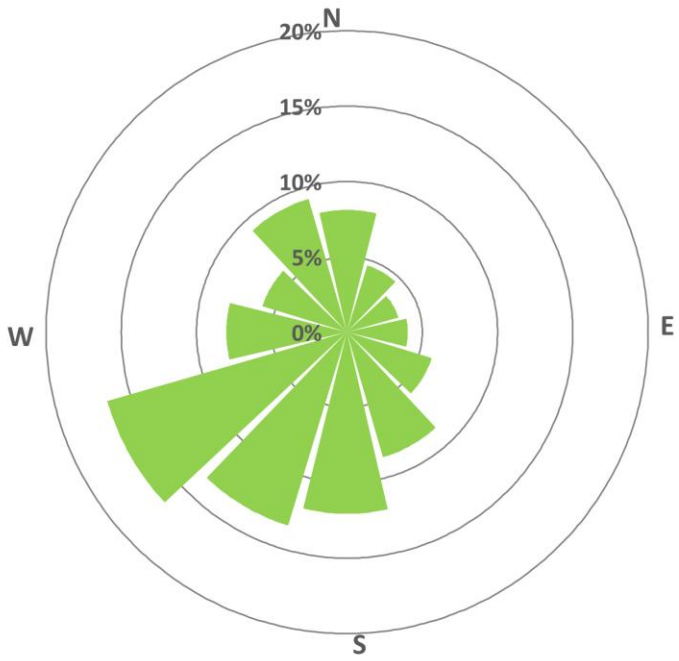


Figure 8.1: Wind direction distribution (Morven North)

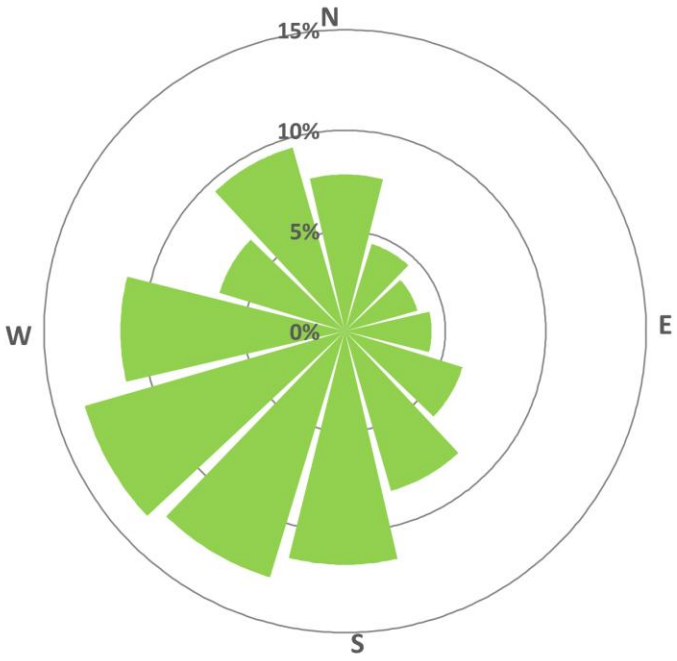


Figure 8.2: Wind direction distribution (Morven South)

8.3 Wave

8.3.1.1 The proportion of the sea state (significant wave height) within each of three defined ranges, using the output from the Morven Metocean Measurement report (bp/EnBW, 2024), is presented in Table 8.1. This applies across the Morven Site as a whole.

Table 8.1: Sea state probability

Sea State (Significant Wave Height)	Proportion (%)
Calm (<1m)	30.4
Moderate (1–5m)	68.3
Severe (>5m)	1.3

8.4 Visibility

8.4.1.1 It is assumed that the proportion of poor visibility (defined as the proportion of a year where the visibility can be expected to be less than 1km) is 3%. This is based upon information available within Admiralty Sailing Directions North Sea (West) Pilot Book NP54 (12th Edition, 2021) and applies across the Morven Site as a whole.

8.5 Tide

8.5.1.1 Tidal data to be used as input to the collision and allision modelling is based upon the information available from UK Admiralty charts 273, 278, 1407 and 1409. The greatest flood peak tidal rate is 1.4kt, and the greatest peak ebb tidal rate is 1.3kt. Table 8.2 presents the peak flood and ebb direction and speed values for each of the charted tidal diamonds in proximity to the Morven Site.

Table 8.2: Tidal data

UKHO Admiralty Chart	Tidal Diamond	Flood		Ebb	
		Direction (°)	Speed (kt)	Direction (°)	Speed (kt)
273	A	007	0.7	188	0.7
	D	355	0.7	161	0.6
278	E	19	0.7	196	0.7
1407	C	183	0.9	013	0.8
1409	G	185	1.4	007	1.3
	J	014	1.0	014	1.0

8.5.1.2 Based upon the available data, no impacts are expected at high water that would not also be expected at low water, and vice versa. The infrastructure associated with Morven North and Morven South are not expected to have any additional impact on the existing tidal streams in relation to their effect on existing shipping and navigation users.

9 Emergency response and incident overview

9.1.1.1 This section summarises the existing SAR resources in the region, as well as issues considered in relation to Morven North and Morven South.

9.2 Search and rescue helicopters

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

9.2.1.2 The SAR helicopter service is currently operated out of ten base locations around the UK, with the closest to the Morven Site located at Inverness, approximately 104nm to the northwest of Morven North (and approximately 118nm northwest of Morven South). This is also the closest SAR helicopter base to Morven South. The Inverness base operates two Agusta Westland AW189 helicopters. The location of the SAR helicopter bases in proximity to Morven North and Morven South are presented in Figure 9.1.

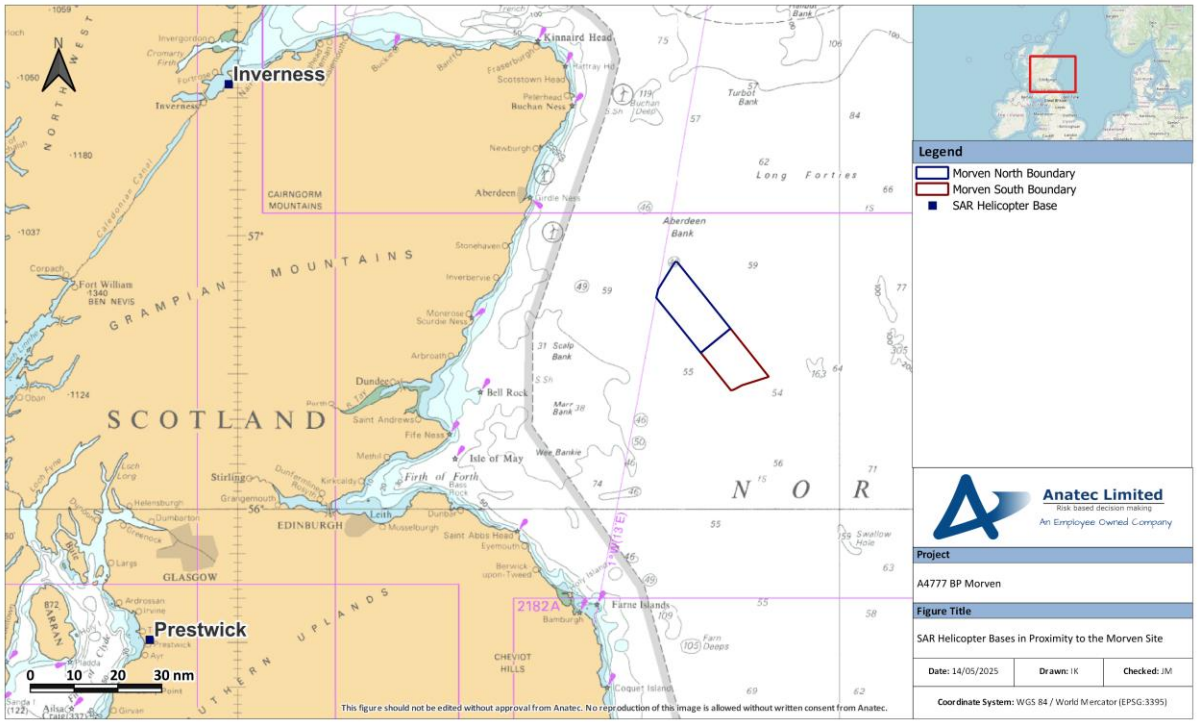


Figure 9.1: Search and Rescue helicopter bases in proximity to the Morven Site

9.2.1.3 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 and March 2024.

9.2.2 Concurrent development

9.2.2.1 The location of SAR helicopter taskings within the Regional Shipping and Navigation Study Area are colour-coded by tasking type and presented in Figure 9.2.

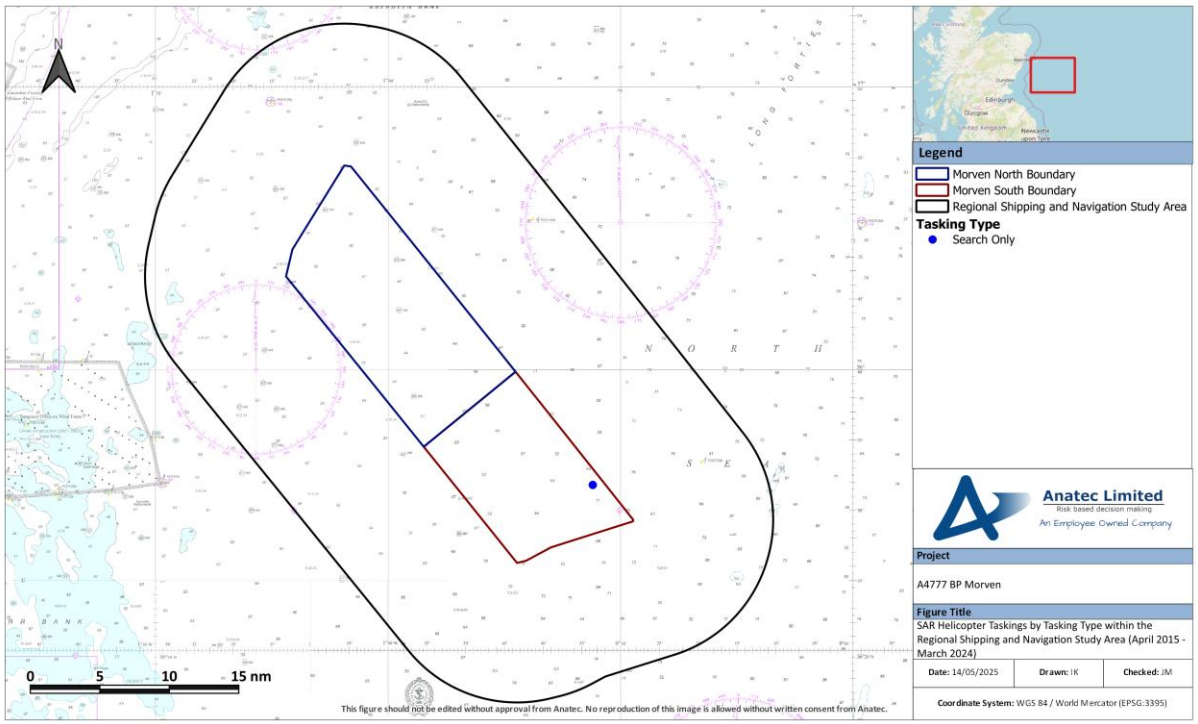


Figure 9.2: Search and Rescue helicopter taskings by tasking type within the Regional Shipping and Navigation Study Area (April 2015 - March 2024)

9.2.2.2 There was a single SAR helicopter tasking recorded in the ten-year period within the Regional Shipping and Navigation Study Area. This was located at the southeastern extent of the Morven Site and involved a search operation.

9.2.3 Morven North in isolation

9.2.3.1 The location of SAR helicopter taskings within the Morven North Shipping and Navigation Study Area are colour-coded by tasking type and presented in Figure 9.3.

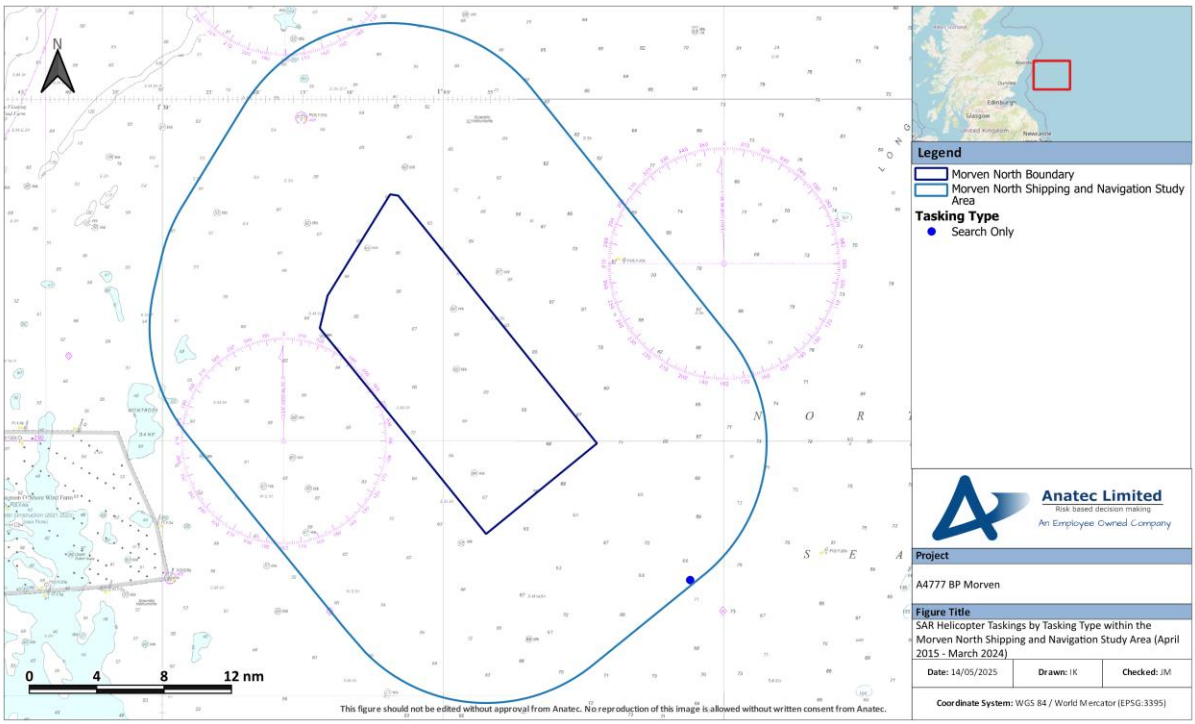


Figure 9.3: Search and rescue helicopter taskings by tasking type within the Morven North Shipping and Navigation Study Area (April 2015 - March 2024)

9.2.3.2 There was a single SAR helicopter tasking recorded in the ten-year period within the Morven North Shipping and Navigation Study Area. This involved a search operation south of Morven North close to the extent of the Morven North Shipping and Navigation Study Area.

9.2.4 Morven South in isolation

9.2.4.1 The location of SAR helicopter taskings within the Morven South Shipping and Navigation Study Area are colour-coded by tasking type and presented in Figure 9.4.

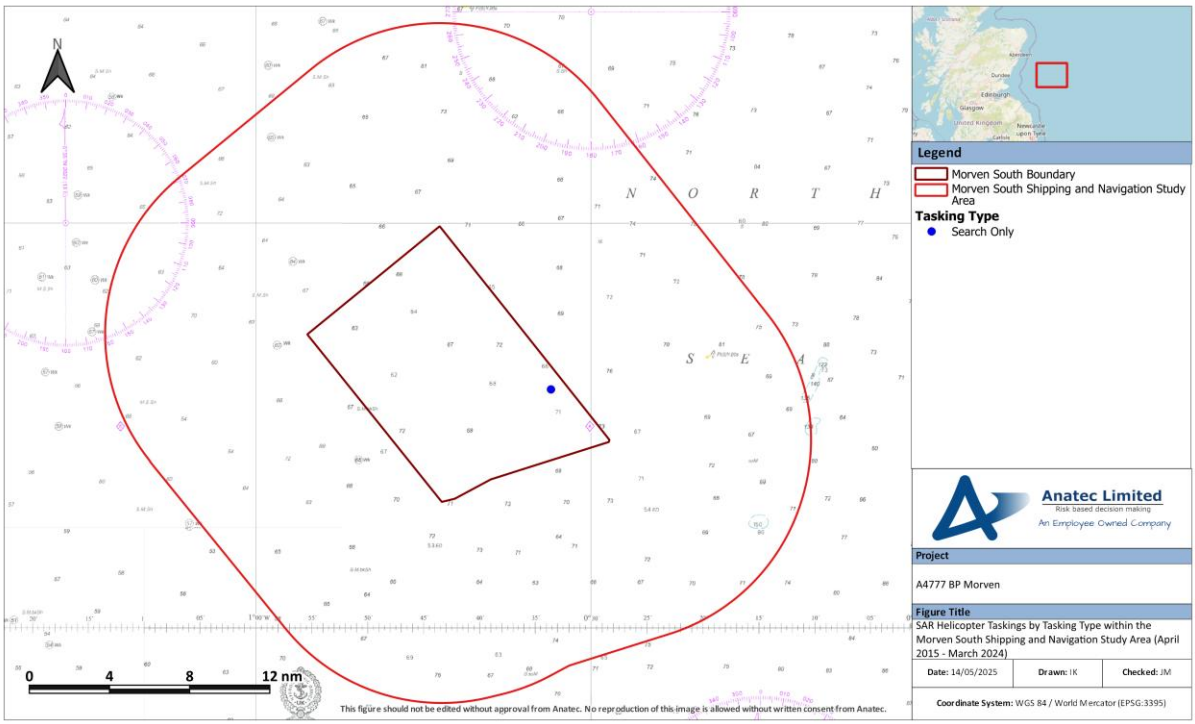


Figure 9.4 Search and Rescue helicopter taskings by tasking type within the Morven South Shipping and Navigation Study Area (April 2015 - March 2024)

9.2.4.2 There was a single SAR helicopter tasking recorded in the ten-year period within the Morven South Shipping and Navigation Study Area. This was located within the Morven South Boundary and involved a search operation.

9.3 Royal National Lifeboat Institution

9.3.1.1 The RNLI is organised into six regions, with the relevant region for the Morven Site 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).

9.3.1.2 The location of RNLI stations in proximity to the Morven Site are presented in Figure 9.5.

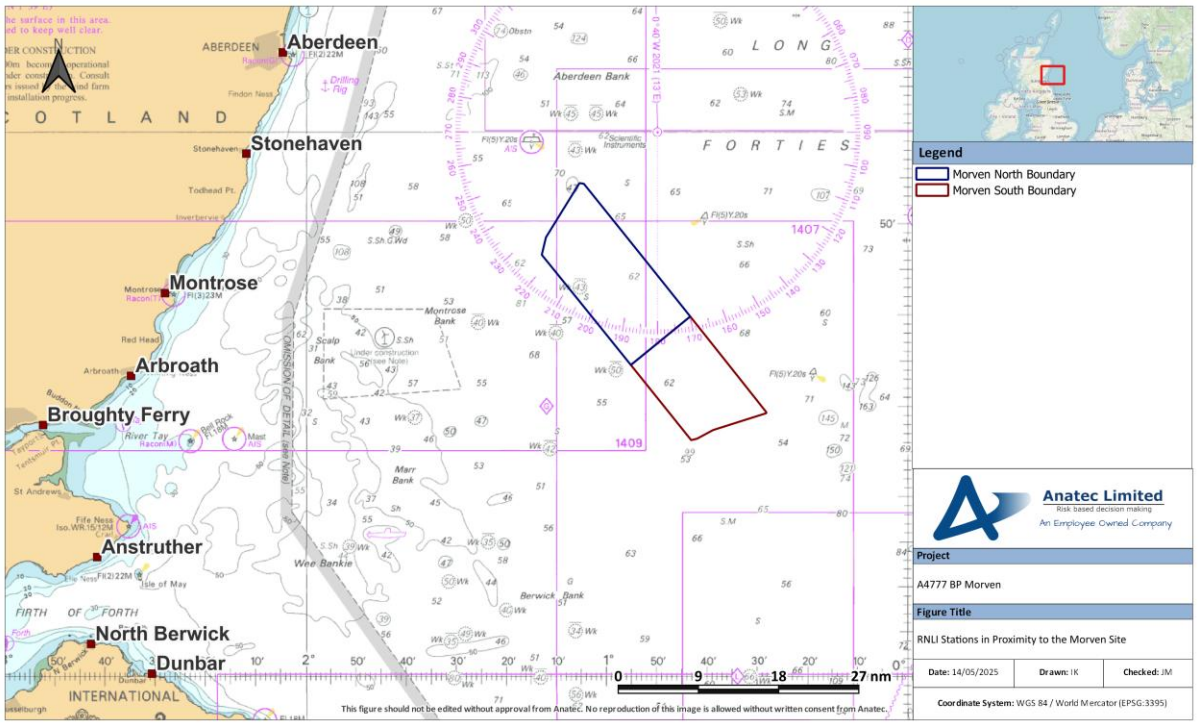


Figure 9.5: Royal National Lifeboat Institution stations in proximity to the Morven Site

9.3.1.3 The closest RNLI station to the Morven Site is at Stonehaven, approximately 34nm to the west of Morven North (and 52nm northwest of Morven South). This is also the closest RNLI station to Morven South. The Stonehaven RNLI station contains an ILB. Other stations in proximity include Aberdeen (35nm northwest of Morven North and 52nm northwest of Morven South) which contains an ALB and ILB; and Montrose (42nm west of Morven North and 52nm west of Morven South) which also contains an ALB and ILB.

9.3.1.4 Given that the RNLI have an operational limit of 100nm, it is anticipated that an incident occurring in proximity to the Morven Site could result in a response from an RNLI asset.

9.3.2 Concurrent development

9.3.2.1 The incidents documented by the RNLI that occurred within the Regional Shipping and Navigation Study Area during the ten-year period from 2014 to 2023 are colour-coded by incident type and presented in Figure 9.6. The same data is then colour-coded instead by casualty type and presented in Figure 9.7.

9.3.2.2 Incidents which were deemed as hoaxes or false alarms have been excluded from the analysis, with these comprising a single incidence of a false alarm approximately 3.5nm south of the Morven Site.

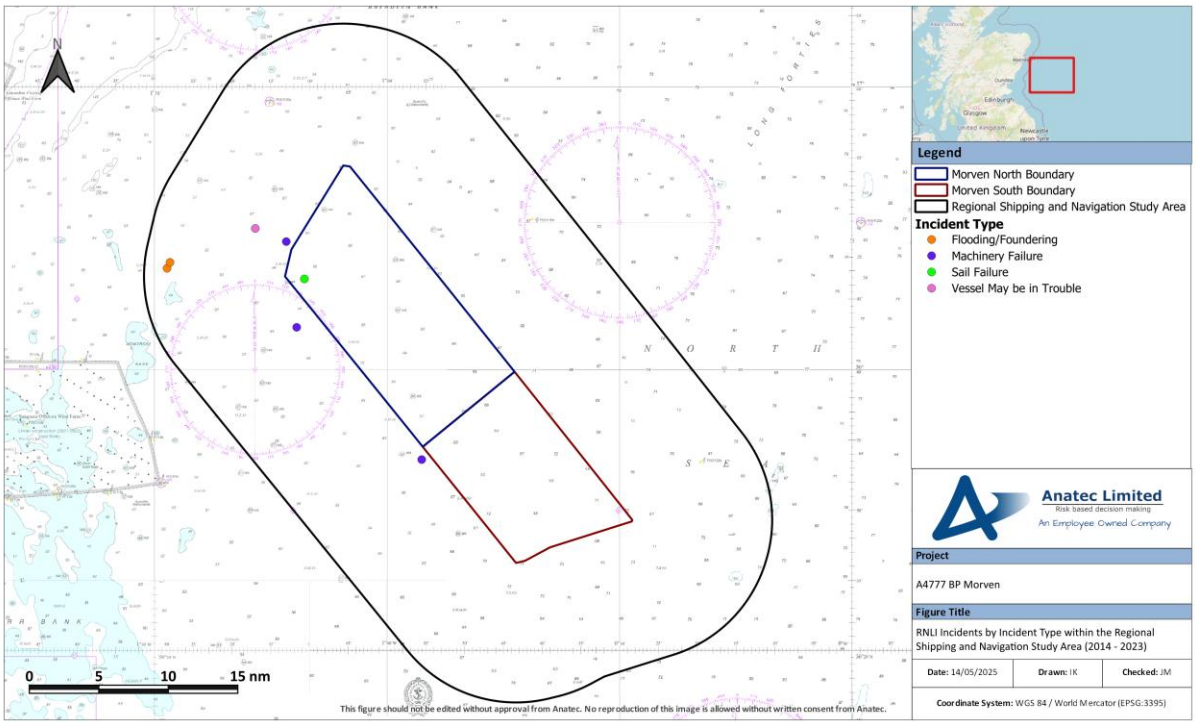


Figure 9.6: Royal National Lifeboat Institution incidents by incident type within the Regional Shipping and Navigation Study Area (2014-2023)

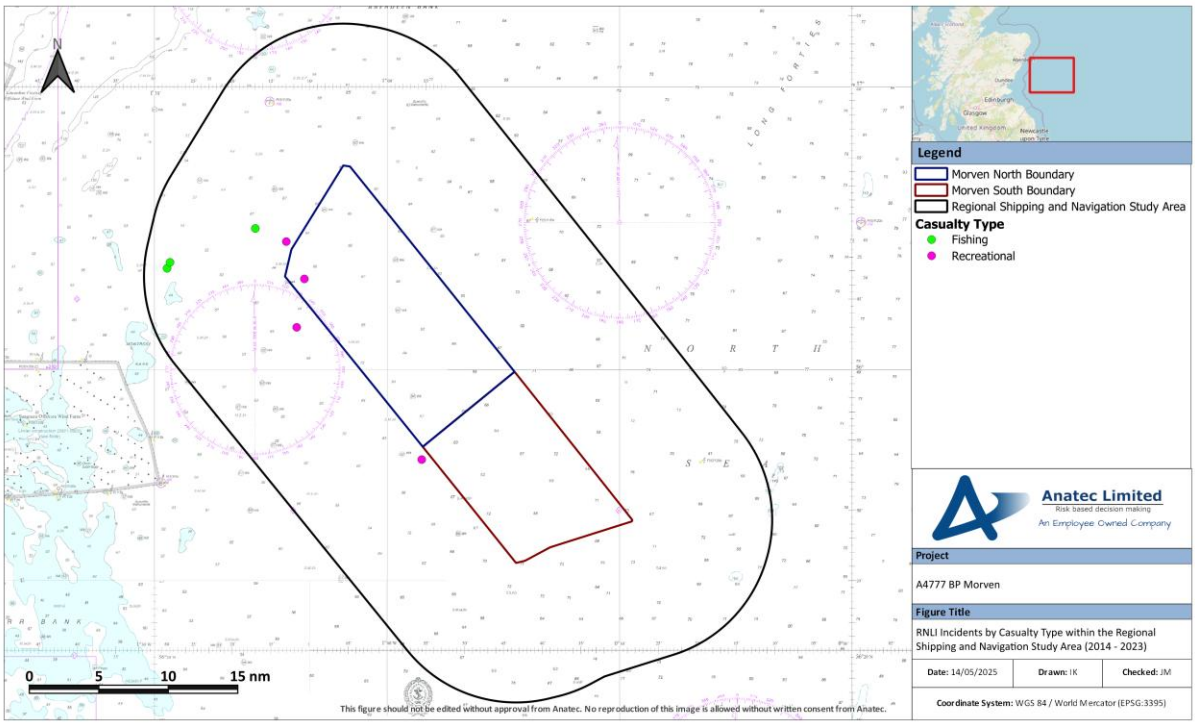


Figure 9.7: Royal National Lifeboat Institution incidents by casualty type within the Regional Shipping and Navigation Study Area (2014-2023)

9.3.2.3 There were a total of seven recorded RNLI responses to five unique incidents within the Regional Shipping and Navigation Study Area from 2014 to 2023, corresponding to an average of one incident every two years. The majority of incidents were inshore of the Morven Site.

9.3.2.4 Of the incidents within the Regional Shipping and Navigation Study Area, there were two instances of machinery failure, with one instance each of flooding/foundering, sail failure and 'vessel may be in trouble'. Of the casualty types, three were recreational vessels with the remaining two being fishing vessels. The Montrose station was used for four callouts, with Aberdeen used for two and a single callout recorded from the Stonehaven station. One incident was recorded within the Morven Site – a recreational vessel undergoing sail failure and responded to by the Montrose station.

9.3.3 Morven North in isolation

9.3.3.1 The incidents documented by the RNLI that occurred within the Morven North Shipping and Navigation Study Area during the ten-year period from 2014 to 2023 are colour-coded by incident type and presented in Figure 9.8. The same data is then colour-coded instead by casualty type and presented in Figure 9.9. Incidents which were deemed as hoaxes or false alarms were identified, with none located within the Morven North Shipping and Navigation Study Area.

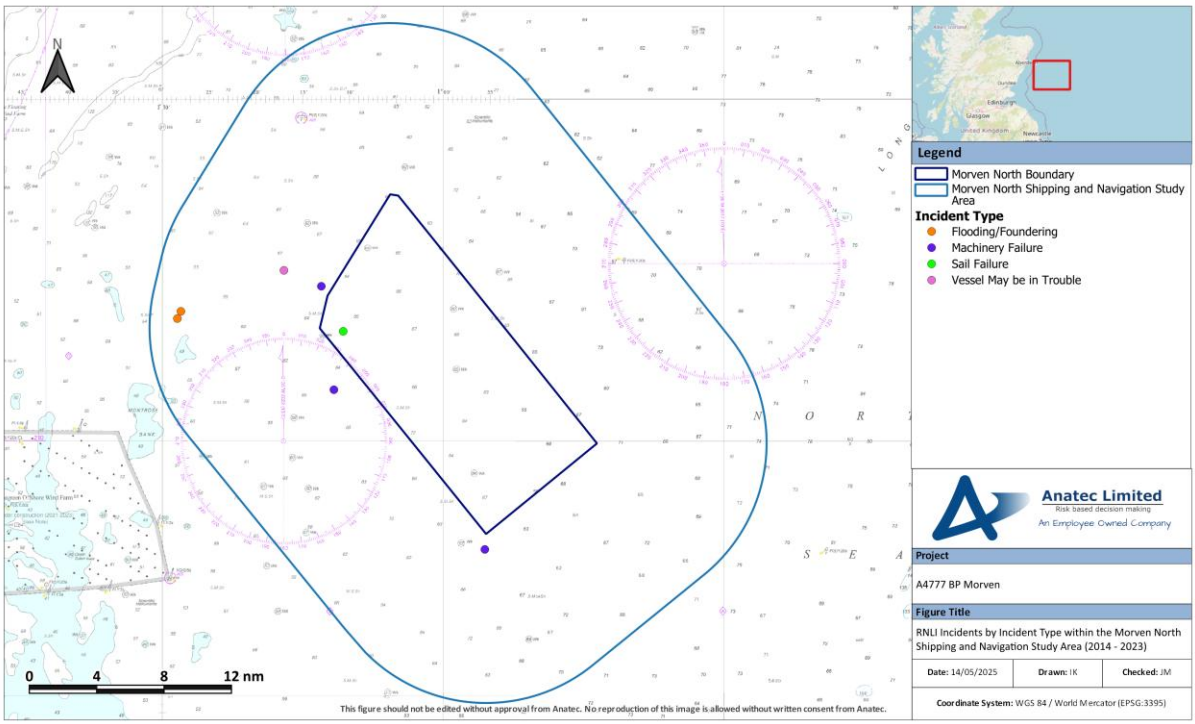


Figure 9.8: Royal National Lifeboat Institution incidents by incident type within the Morven North Shipping and Navigation Study Area (2014-2023)

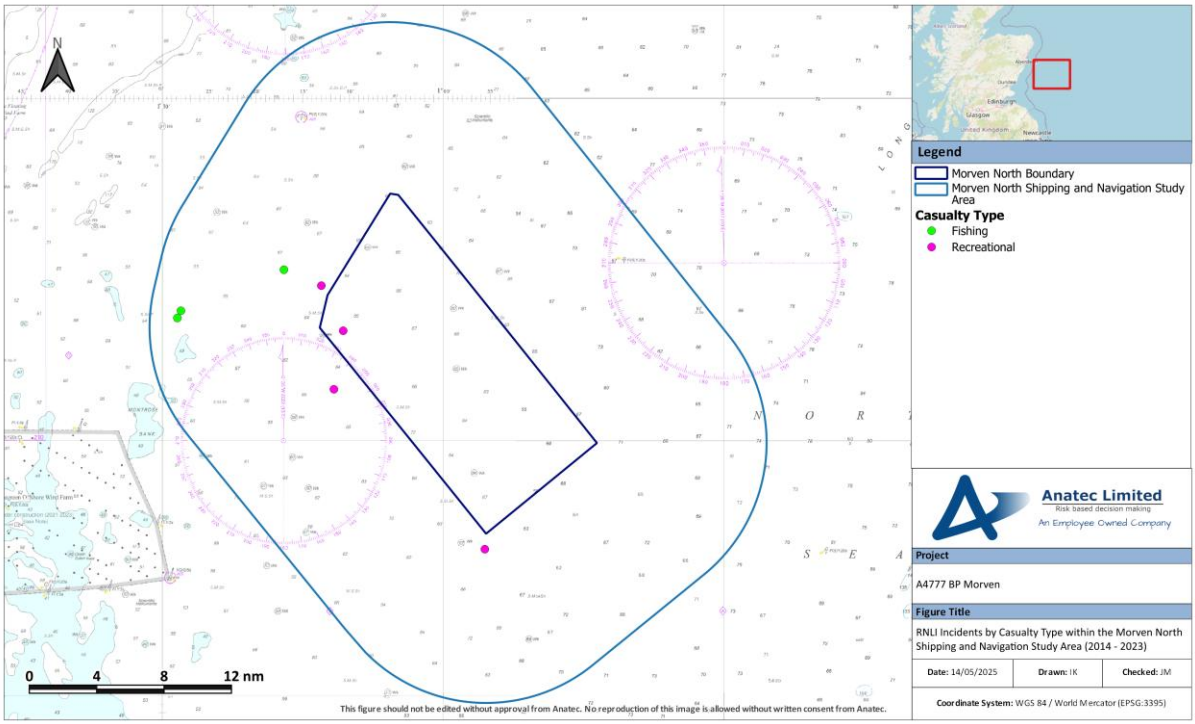


Figure 9.9: Royal National Lifeboat Institution incidents by casualty type within the Morven North Shipping and Navigation Study Area (2014-2023)

9.3.3.2 There were a total of seven recorded RNLI responses to five unique incidents within the Morven North Shipping and Navigation Study Area from 2014 to 2023, corresponding to an average of one incident every two years. The majority of incidents were inshore of Morven North.

9.3.3.3 Of the incidents within the Morven North Shipping and Navigation Study Area, the most frequent incident type was machinery failure (two instances), with an instance each of flooding/foundering, sail failure and 'vessel may be in trouble'. Of the casualty types, three were recreational vessels with the remaining two being fishing vessels. The Montrose station was used for four callouts, with Aberdeen used for two and a single callout recorded from the Stonehaven station. One incident was recorded within the Morven North Boundary itself – a recreational vessel undergoing sail failure and responded to by the Montrose station.

9.3.4 Morven South in isolation

9.3.4.1 The incidents documented by the RNLI that occurred within the Morven South Shipping and Navigation Study Area during the ten-year period from 2014 to 2023 are colour-coded by incident type and presented in Figure 9.10. The same data is then colour-coded instead by casualty type and presented in Figure 9.11. Incidents which were deemed as hoaxes or false alarms have been excluded from the analysis, with these comprising a single incidence of a false alarm approximately 3.5nm south of the Morven South boundary.

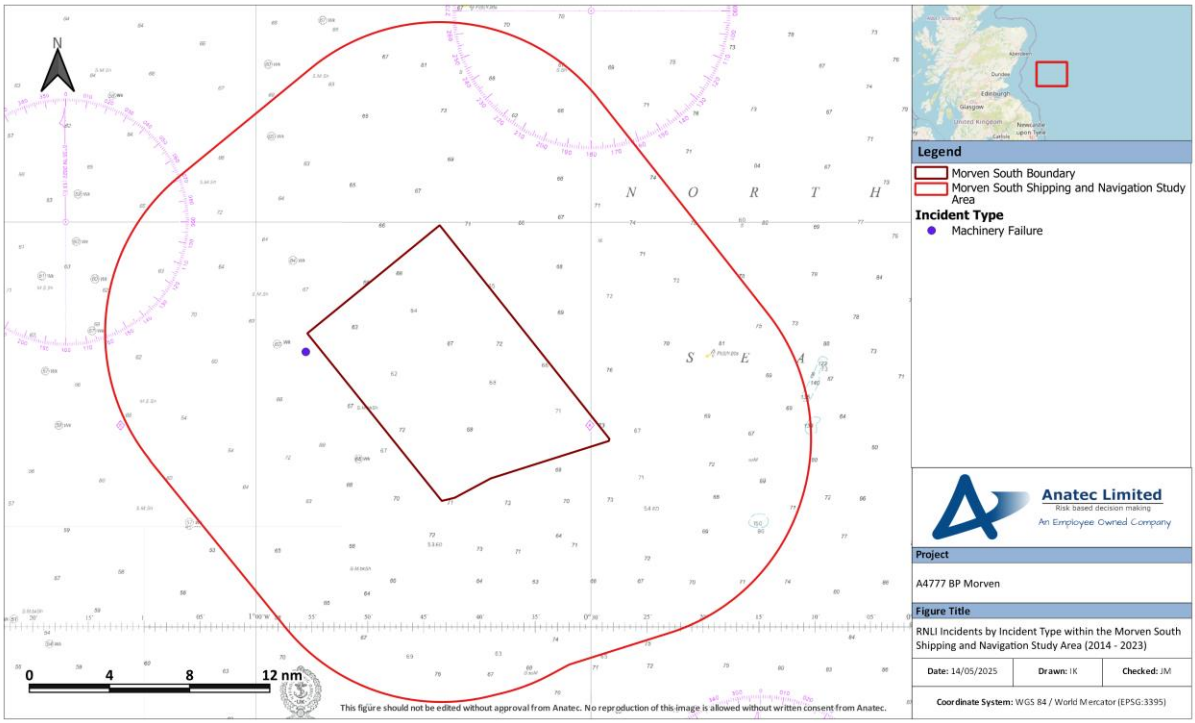


Figure 9.10: Royal National Lifeboat Institution incidents by incident type within the Morven South Shipping and Navigation Study Area (2014-2023)

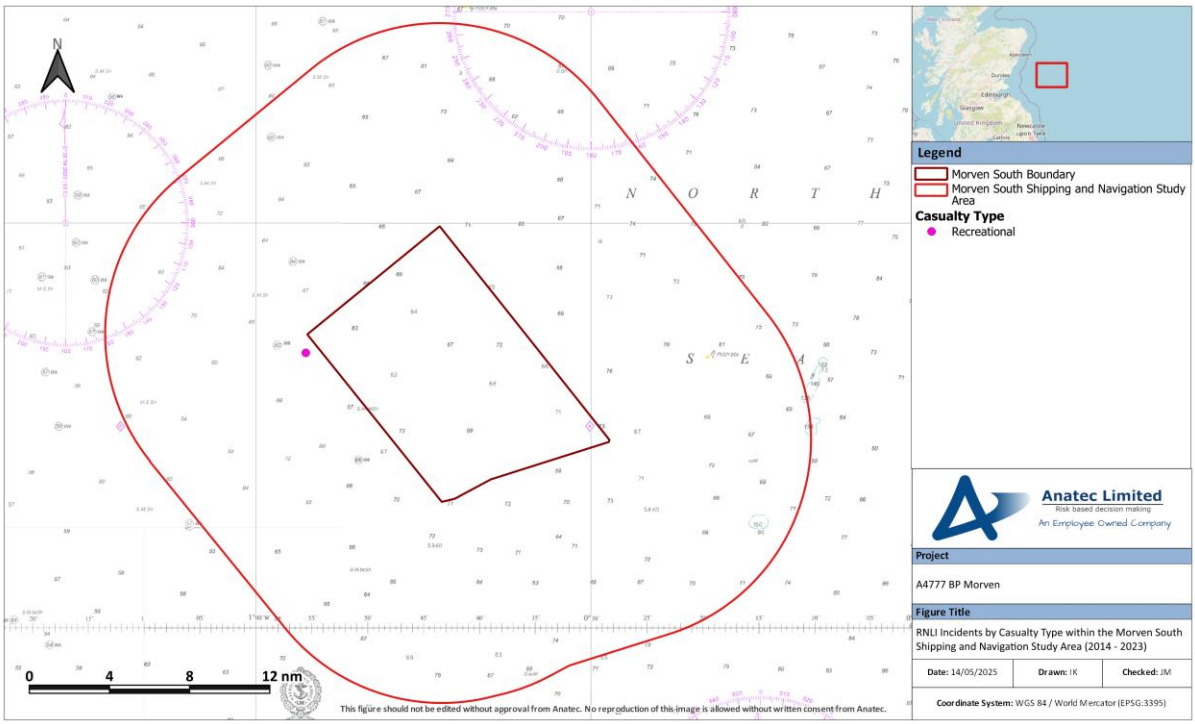


Figure 9.11: Royal National Lifeboat Institution incidents by casualty type within the Morven South Shipping and Navigation Study Area (2014-2023)

9.3.4.2 There was a total of one recorded RNLI response to an incident within the Morven South Shipping and Navigation Study Area from 2014 to 2023.

9.3.4.3 This incident involved a recreational vessel experiencing machinery failure and which was responded to by the Montrose station. This incident took place approximately 0.6nm from the Morven South Boundary.

9.4 Maritime Rescue Coordination Centres and Joint Rescue Coordination Centres

9.4.1.1 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).

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

9.4.1.3 All of the MCA's operations, including SAR, are divided into 18 geographical regions. Area 3 – 'East Scotland' – covers the area encompassing Morven North and Morven South. The Aberdeen MRCC is located within Area 3 approximately 35nm northwest of Morven North (and 51nm northwest of Morven South), as illustrated in Figure 9.12.

This MRCC coordinates the SAR response for maritime and coastal emergencies within the district boundary.

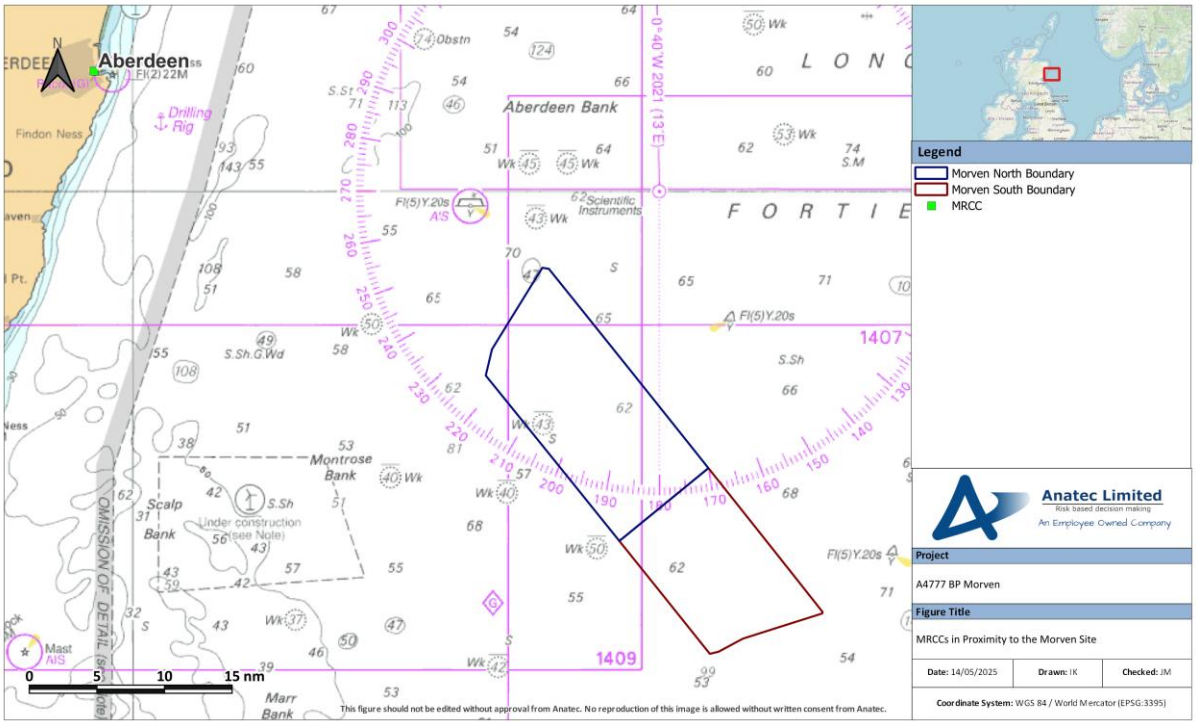


Figure 9.12: Maritime Rescue Coordination Centres in proximity to the Morven Site

9.5 Global Maritime Distress and Safety System

9.5.1.1 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.

9.5.1.2 There are four GMDSS sea areas, with the areas applicable in proximity to the UK shown in Figure 9.13. Vessels in proximity to the Morven Site would either be located within sea area A1 or A2.

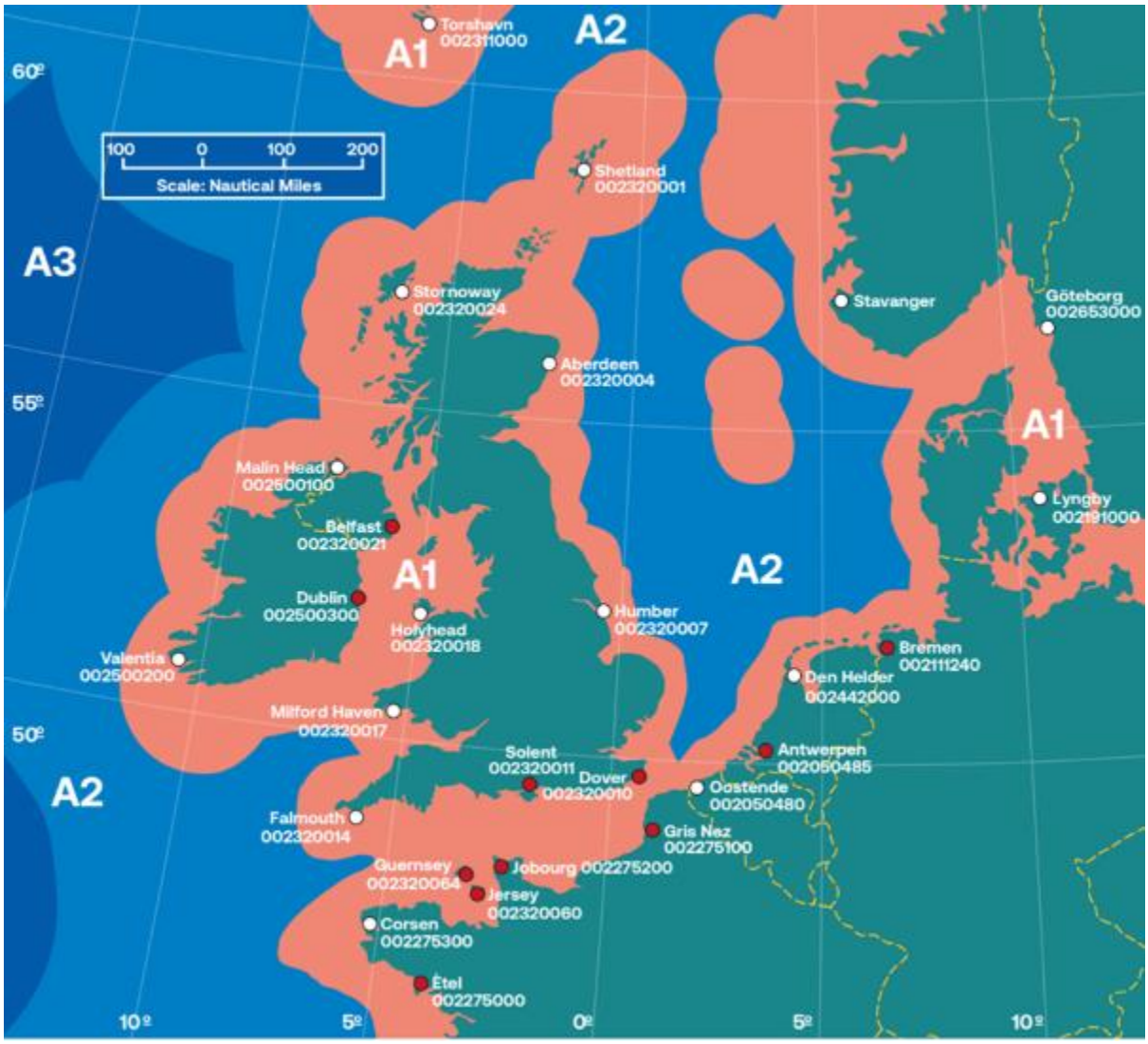


Figure 9.13: Global Maritime Distress and Safety System sea areas (MCA, 2021)

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

9.6 Marine Accident Investigation Branch

9.6.1.1 All UK flagged vessels and non-UK flagged vessels in UK territorial waters (extending to 12nm from the coast), 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 ten-year period between 2014 and 2023.

9.6.2 Concurrent development

9.6.2.1 The incidents documented by the MAIB that occurred within the Regional Shipping and Navigation Study Area during the ten-year period from 2014 to 2023 are colour-coded by incident type and presented in Figure 9.14. The same data is then colour-coded instead by vessel type and presented in Figure 9.15.

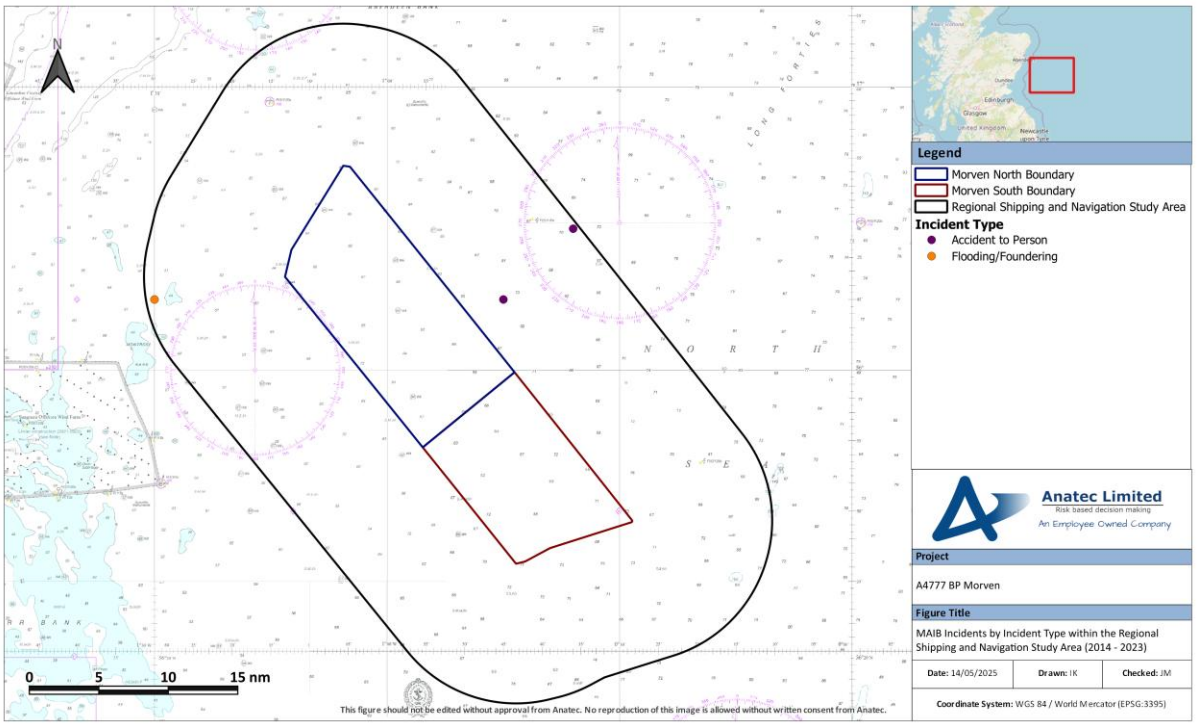


Figure 9.14: Marine Accident Investigation Branch incidents by incident type within the Regional Shipping and Navigation Study Area (2014-2023)

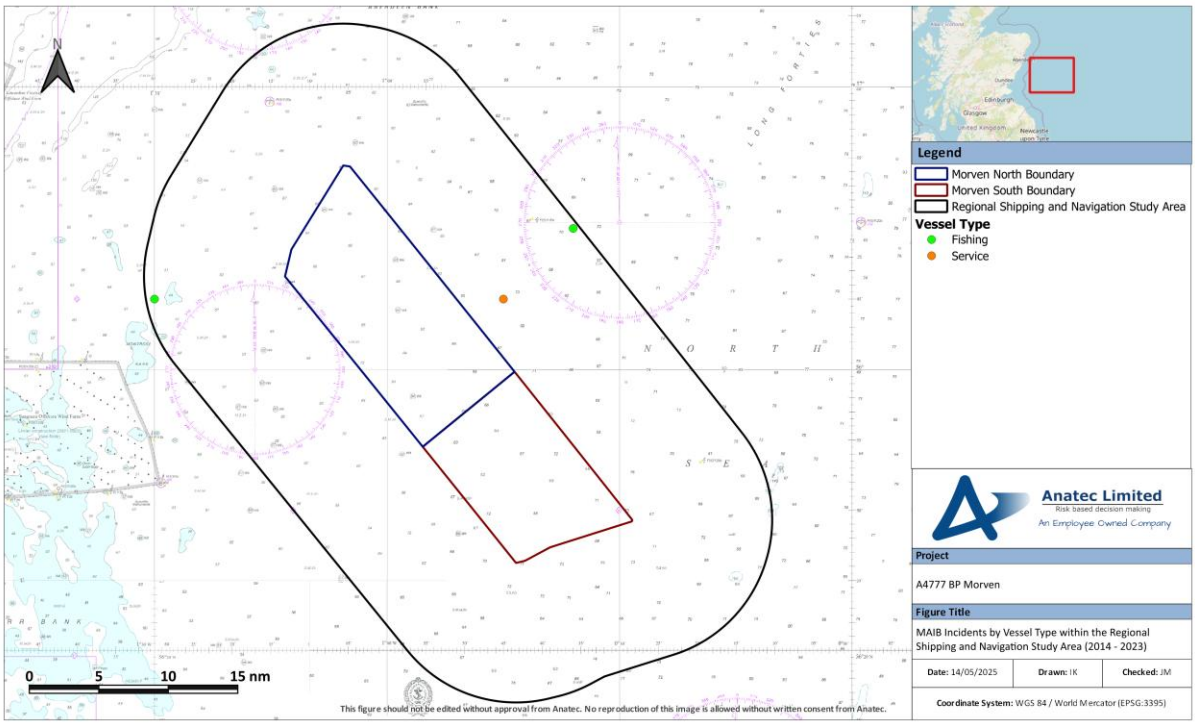


Figure 9.15: Marine Accident Investigation Branch incidents by vessel type within the Regional Shipping and Navigation Study Area (2014-2023)

9.6.2.2 There were a total of three unique incidents recorded by the MAIB within the Regional Shipping and Navigation Study Area from 2014 to 2023, corresponding to an average of one incident every three years.

9.6.2.3 Of the incidents within the Regional Shipping and Navigation Study Area, two were an 'accident to person', with one instance of flooding/foundering. Of the casualty types involved, two were fishing vessels with one recorded instance of a service vessel. No incidents were recorded within the Morven Site.

9.6.2.4 A review of older MAIB incident data within the Regional Shipping and Navigation Study Area between 2004 and 2013 indicates that the number of incidents has decreased in proximity to the Morven Site, with a total of six incidents within the Regional Shipping and Navigation Study Area recorded. One incident occurred within the Morven South Boundary, involving a fishing vessel undergoing machinery failure.

9.6.3 Morven North in isolation

9.6.3.1 The incidents documented by the MAIB that occurred within the Morven North Shipping and Navigation Study Area during the ten-year period from 2014 to 2023 are colour-coded by incident type and presented in Figure 9.16. The same data is then colour-coded instead by vessel type and presented in Figure 9.17.

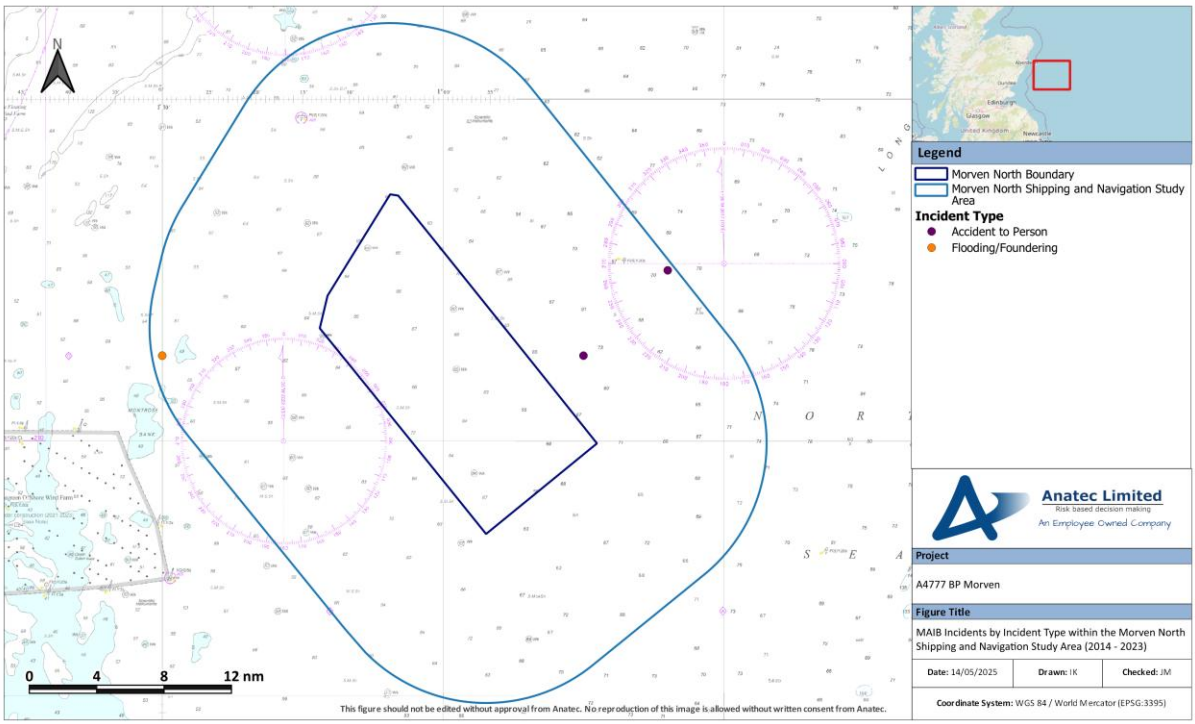


Figure 9.16: Marine Accident Investigation Branch incidents by incident type within the Morven North Shipping and Navigation Study Area (2014-2023)

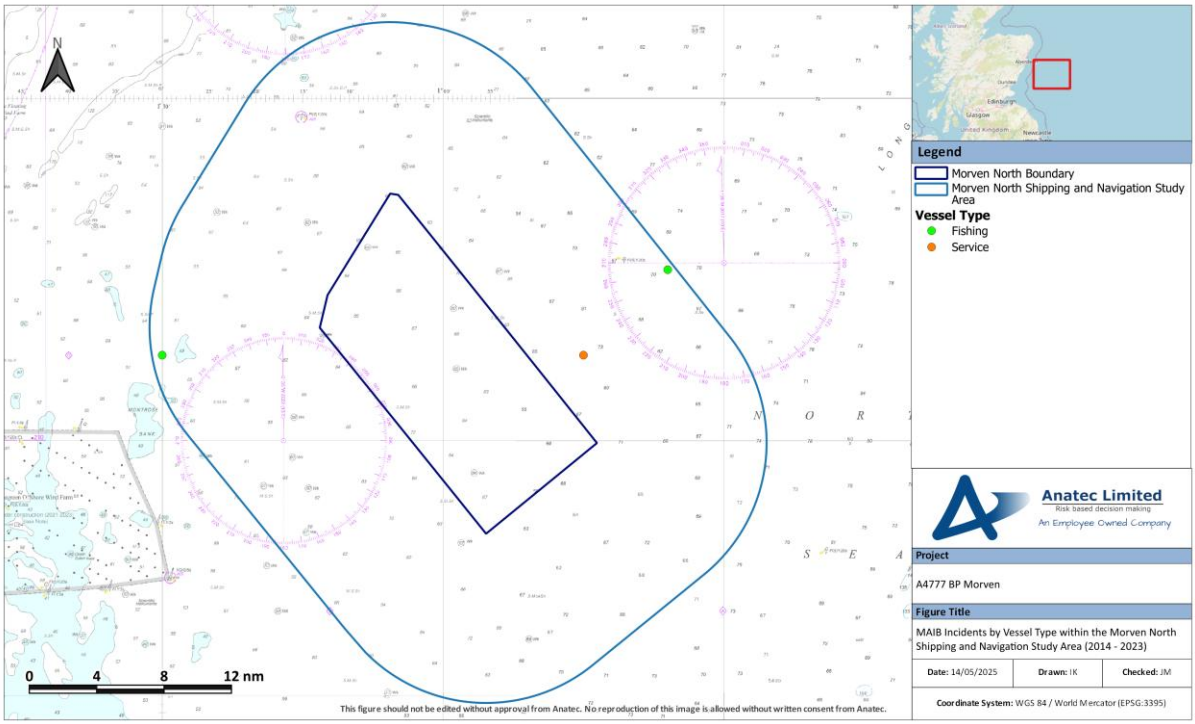


Figure 9.17: Marine Accident Investigation Branch within the Morven North Shipping and Navigation Study Area (2014-2023)

9.6.3.2 There were a total of three unique incidents recorded by the MAIB within the Morven North Shipping and Navigation Study Area from 2014 to 2023, corresponding to an average of one incident every three years.

9.6.3.3 Of the incidents within the Morven North Shipping and Navigation Study Area, the most frequent incident type was 'accident to person' with two instances, with a single instance of flooding/foundering. Of the casualty types involved, two were fishing vessels with one recorded instance of a service vessel. No incidents were recorded within the Morven North Boundary itself.

9.6.3.4 A review of older MAIB incident data within the Morven South Shipping and Navigation Study Area between 2004 and 2013 indicates that the number of incidents has marginally decreased in proximity to Morven North, with a total of four incidents within the Morven North Shipping and Navigation Study Area recorded. No incidents occurred within the Morven North Boundary.

9.6.4 Morven South in isolation

9.6.4.1 The incidents documented by the MAIB that occurred within the Morven South Shipping and Navigation Study Area during the ten-year period from 2014 to 2023 are colour-coded by incident type and presented in Figure 9.18. The same data is then colour-coded instead by vessel type and presented in Figure 9.19.

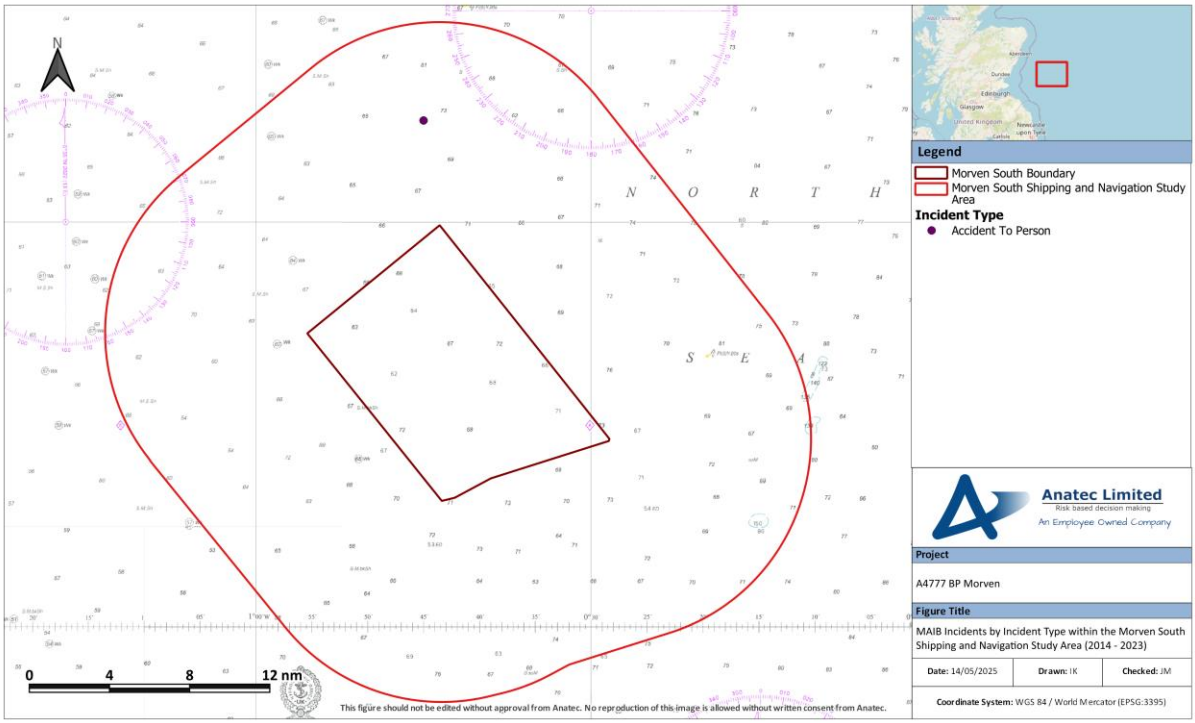


Figure 9.18: Marine Accident Investigation Branch incidents by incident type within the Morven South Shipping and Navigation Study Area (2014-2023)

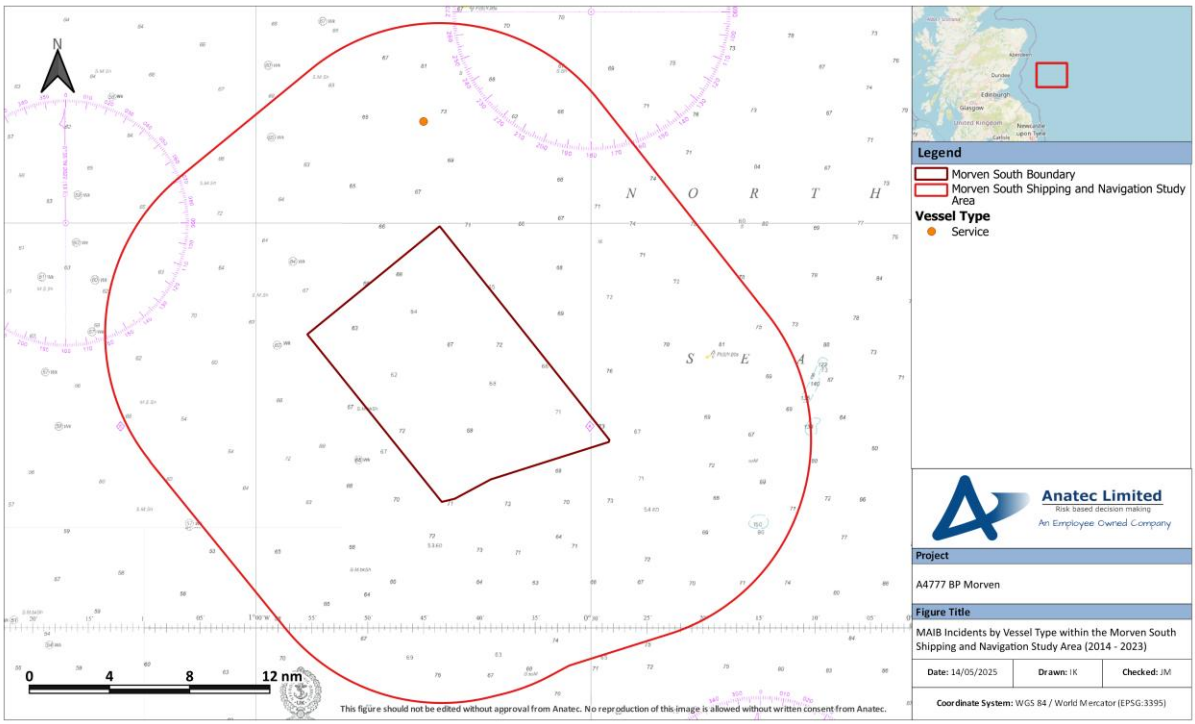


Figure 9.19: Marine Accident Investigation Branch incidents by vessel type within the Morven South Shipping and Navigation Study Area (2014-2023)

9.6.4.2 There was a total of one unique incident recorded by the MAIB within the Morven South Shipping and Navigation Study Area from 2014 to 2023.

9.6.4.3 This incident involved a service vessel with 'accident to person'. It did not take place within the Morven South Boundary.

9.6.4.4 A review of older MAIB incident data within the Morven South Shipping and Navigation Study Area between 2004 and 2013 indicates that the number of incidents has decreased in proximity to Morven South, with a total of four incidents within the Morven South Shipping and Navigation Study Area recorded. One incident occurred within the Morven South Boundary, involving a fishing vessel undergoing machinery failure.

9.7 Historical offshore wind farm incidents

9.7.1 Incidents involving United Kingdom offshore wind farm developments

9.7.1.1 As of September 2025, there are 43 operational[3] OWFs in the UK, ranging from the North Hoyle OWF (fully commissioned in 2003) to Seagreen (fully commissioned in

[3] For shipping and navigation purposes OWFs are considered operational only once the construction buoyage has been removed.

2025). Between them these developments encompass approximately 26,500 fully operational wind turbine years.

9.7.1.2 MAIB incident data has been used to collate a list of reported historical collision and allision incidents involving UK OWF developments[4], which is summarised in Table 9.1. Other sources have also been used to produce this list including the UK Confidential Human Factors Incident Reporting Programme (CHIRP) for Aviation and Maritime, International Marine Contractors Association (IMCA) and basic web searches.

Table 9.1: Summary of historical collision and allision incidents involving United Kingdom offshore wind farm developments

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

[4] Includes only those incidents reported explicitly as collisions or allisions to an accident investigation branch or anonymous reporting service. Unconfirmed incidents have not been considered.

Incident vessel	Incident type	Date	Description of incident	Vessel damage*	Harm to persons	Source
Project/project	Collision	02 June 2012	CTV allision with flotel. Nine persons safely evacuated and transferred to nearby vessel before being brought back into port.	Moderate	None	UK CHIRP
Project	Allision	20 October 2012	Project vessel allision with wind turbine monopile following human error (misjudgement of distance). Minor damage sustained by vessel.	Minor	None	MAIB
Project	Allision	21 November 2012	Passenger transfer catamaran allision with buoy following navigational error. Vessel abandoned by crew of 12 having been holed, causing extensive flooding but no injuries sustained.	Major	None	MAIB
Project	Allision	21 November 2012	Work boat allision with unlit wind turbine 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	Injury	MAIB
Project	Allision	01 July 2013	Service vessel allision with wind turbine foundation following machinery failure. Minor damage sustained by vessel.	Minor	None	IMCA Safety Flash
Project	Allision	14 August 2014	Standby safety vessel allision with wind turbine pile. Oil leaked by vessel which moved away from environmentally sensitive areas until leak was stopped.	Minor with pollution	None	UK CHIRP
Third-party	Allision	26 May 2016	Third-party fishing vessel allision with wind turbine following human error (autopilot). Lifeboat attended the incident.	Moderate	Injury	Web search (RNLI, 2016)
Project	Allision	14 February 2019	Survey vessel contacted with wind turbine jacket whilst autopilot was engaged.	Minor	None	MAIB

Incident vessel	Incident type	Date	Description of incident	Vessel damage*	Harm to persons	Source
Project	Allision	16 January 2020	Project vessel allision with wind turbine. Injury sustained by crew member but vessel able to proceed to port unassisted.	None	Injury	Web search (Vessel Tracker, 2020)
Project	Allision	27 January 2020	Project vessel allision with wind turbine. Minor damage to vessel and wind turbine sustained, with no personal injuries.	Minor	None	Marine Safety Forum
Project	Allision	February 2021	The deckhand engineer fell asleep whilst supposed to be on watch, resulting in a CTV making contact with a wind turbine at low speed.	None	None	MAIB
Project	Allision	12 April 2021	An allision occurred with a wind turbine 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 wind turbine 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 wind turbine resulting in damage to vessel and two minor injuries for crew members. RNLI lifeboat escorted vessel under its own power to port.	Minor	Injury	Web search (RNLI, 2022)
Project	Allision	October 2022	A project vessel allided with the boat landing for a wind turbine causing a deformation to the port side midship area.	Minor	None	MAIB

Incident vessel	Incident type	Date	Description of incident	Vessel damage*	Harm to persons	Source
Project	Allision	November 2022	A high speed craft allided with a wind turbine whilst the vessel propulsion was in neutral resulting in damage to the starboard jet platform and bucket.	Minor	None	MAIB
Project	Allision - project vessel with wind turbine	April 2023	A supply vessel was drifting after deploying personnel to wind turbines. The Master was reportedly distracted and failed to notice that the vessel was closing on a wind turbine. An allision occurred at 5kt resulting in one crew member falling and suffering a rib fracture. No damage was caused to the vessel or the wind turbine and there was no pollution.	None	Injury	MAIB
Project	Allision - project vessel with wind turbine	November 2023	A trainee on a CTV misjudged the wind and current causing the vessel to drift sideways and make contact with a wind turbine resulting in a broken window but no reported injuries.	Minor	None	MAIB
Project	Allision	19 September 2024	A Service Operations Vessel (SOV) allided with a wind turbine causing damage to the starboard side above the waterline and the helideck.	Minor	None	Web search (Maritime Executive, 2024)

(*) As per incident reports.

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

9.7.1.4 As of September 2025, there have been 21 reported cases of an allision between a vessel and a wind turbine (under construction, operational or disused) in the UK, with all but two involving a support vessel for the development and the errant vessel in each case under power rather than drifting. Therefore, there has been an average of 1,265 wind turbine years per allision incident in the UK, noting that this is a conservative calculation given that only operational wind turbine hours have been included (whereas allision incidents counted include non-operational wind turbines).

9.7.1.5 On an individual project basis, there has been an average of 0.022 allision incidents per operational OWF year, noting this is an average across the 22-year period since the first UK OWF became operational.

9.7.1.6 The presence of OWFs and associated activities does increase the likelihood of an incident occurring based on consideration of existing datasets (see Section 9.7.1). This includes Morven North and Morven South given that they 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.

9.7.1.7 Other types of incident (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 offshore wind farm.

9.7.2 Incidents involving non-United Kingdom offshore wind farms

9.7.2.1 It is acknowledged that collision and allision incidents involving non-UK OWF developments have also occurred. However, it is not possible to maintain a comprehensive list of such incidents.

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

9.7.3 Incidents responded to by vessels associated with United Kingdom offshore wind farms

9.7.3.1 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.

9.7.3.2 From news reports, basic web searches and experience at 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 United Kingdom offshore wind farm developments

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

Incident type	Date	Related development	Description of incident	Source
			undertake search but did not find anything to report.	
Aircraft crash	15 June 2020	Hornsea Project One	United States (US) jet crashed into sea during 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)	Two swimmers were in difficulty against a rising tide near to Talacre beach. A 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 two children aboard drifted offshore due to strong winds. A guard vessel associated with Neart na Gaoithe was able to retrieve the children.	Web search (Edinburgh Evening News, 2021)
Vessel in distress	1 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	1 December 2022	Unknown	A survey vessel suffered an engine failure and was towed back to port by a wind farm Rigid-hulled Inflatable Boat (RIB).	MAIB

9.7.3.3 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 includes Morven North and Morven South, with project vessel compliance with international marine regulations including the International Convention for the 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

10.1 Concurrent development

10.1.1.1 The vessel tracks recorded during the summer survey period within the Regional Shipping and Navigation Study Area, excluding temporary traffic, are colour-coded by vessel type and presented in Figure 10.1. Following this, the same data converted to a density heat map is presented in Figure 10.2.

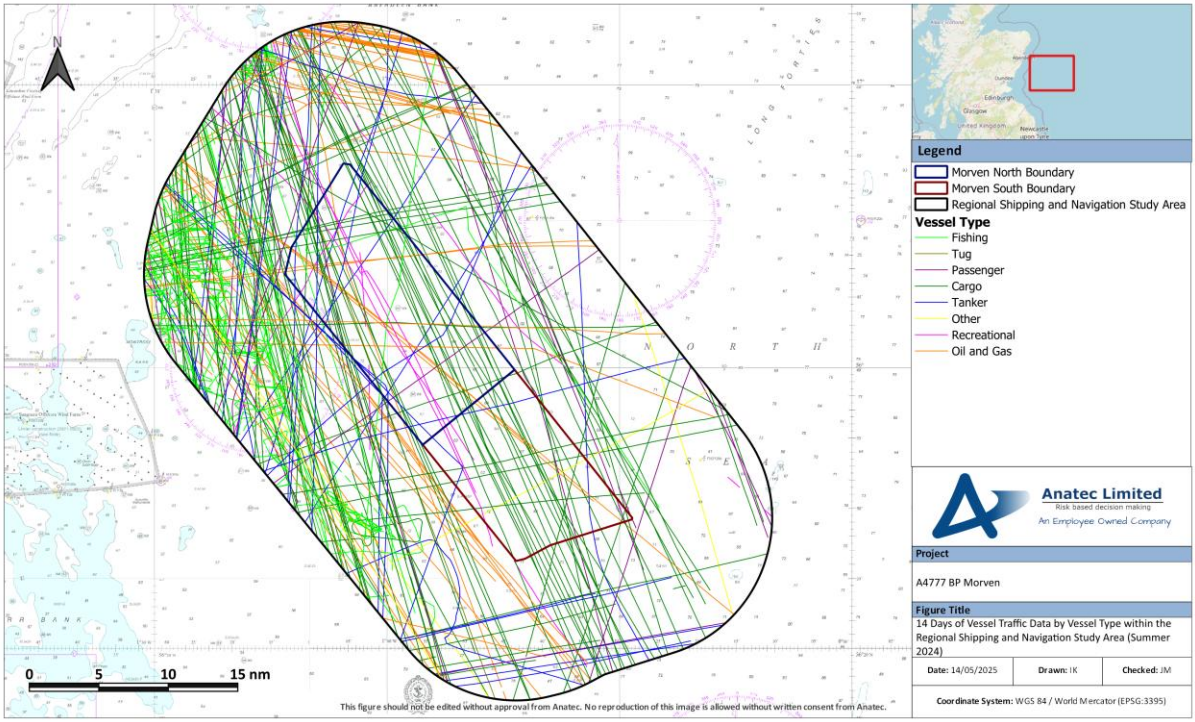


Figure 10.1: 14 days of vessel traffic data by vessel type within the Regional Shipping and Navigation Study Area (Summer 2024)

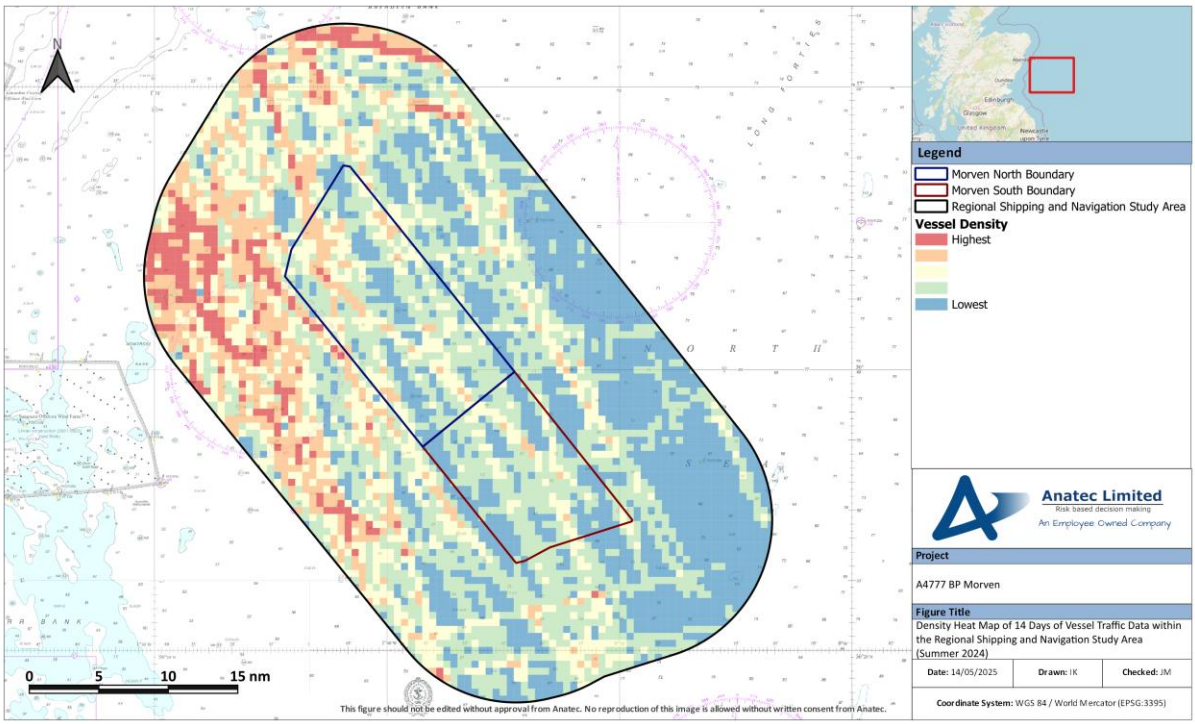


Figure 10.2: Density heat map of 14 days of vessel traffic data within the Regional Shipping and Navigation Study Area (Summer 2024)

10.1.1.2 The vessel tracks recorded during the winter survey period within the Regional Shipping and Navigation Study Area, excluding temporary traffic, are colour-coded by vessel type and presented in Figure 10.3. Following this, the same data converted to a density heat map is presented in Figure 10.4. The density ranges used in the winter data are those of the summer data, to allow direct comparison.

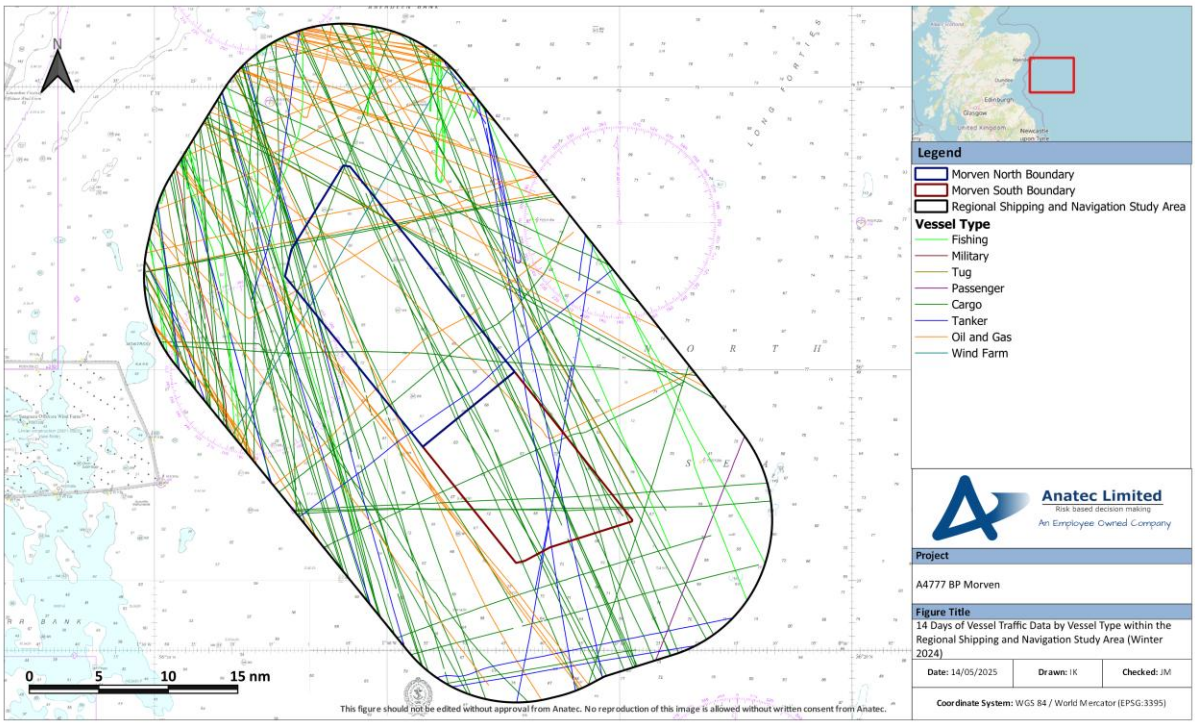


Figure 10.3: 14 days of vessel traffic data by vessel type within the Regional Shipping and Navigation Study Area (Winter 2024)

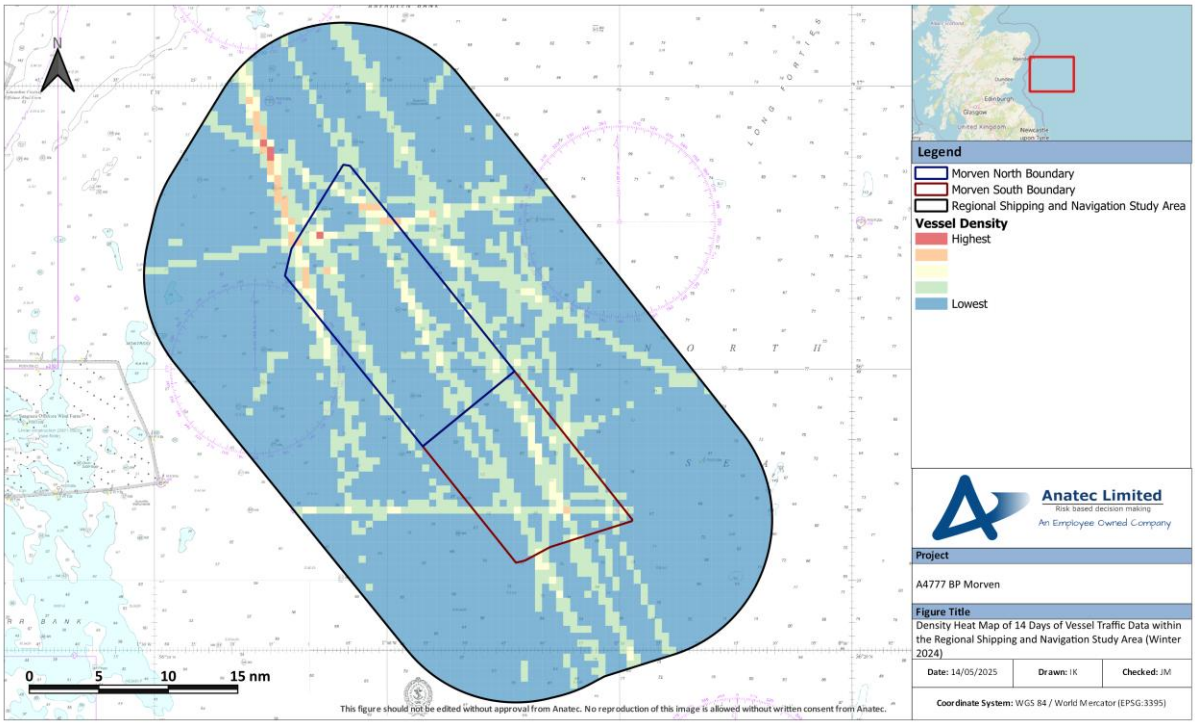


Figure 10.4: Density heat map of 14 days of vessel traffic data within the Regional Shipping and Navigation Study Area (Winter 2024)

10.1.2 Vessel count

10.1.2.1 The daily number of unique vessels recorded within the Regional Shipping and Navigation Study Area, as well as intersecting the Morven Site, during the summer survey period is presented in Figure 10.5. Throughout the summer survey period, approximately 31% of vessel traffic recorded within the Regional Shipping and Navigation Study Area intersected the Morven Site.

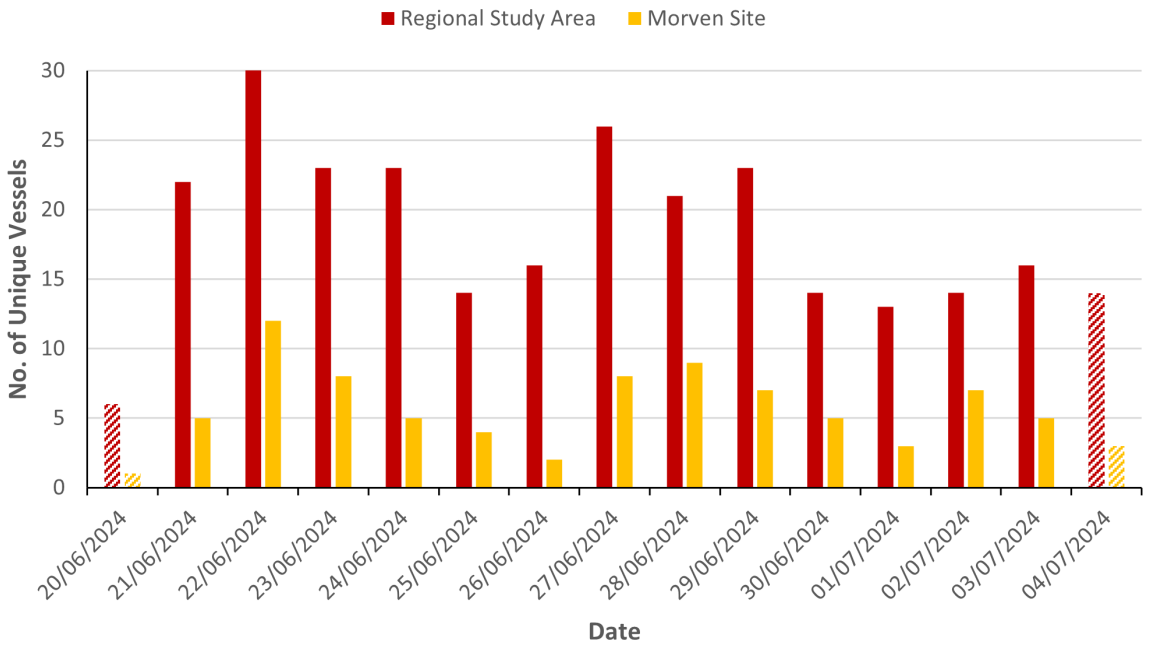


Figure 10.5: Unique vessels per day within the Regional Shipping and Navigation Study Area (Summer 2024)[5]

10.1.2.2 There was an average of 20 unique vessels recorded per day within the Regional Shipping and Navigation Study Area during the summer survey period. An average of six unique vessels per day intersected the Morven Site.

10.1.2.3 The busiest day recorded within the Regional Shipping and Navigation Study Area during the summer survey period was 22 June 2024, on which 30 unique vessels were recorded. The busiest day recorded within the Morven Site during the summer survey period was also 22 June 2024, on which 12 unique vessels were recorded.

[5] The hatched areas denote partial survey days, (i.e. the survey vessel was not on site for the full 24 hours of the day).

10.1.2.4 The quietest full day recorded within the Regional Shipping and Navigation Study Area during the summer survey period was 01 July 2024, on which 13 unique vessels were recorded. The quietest full day recorded within the Morven Site during the summer survey period was 26 June 2024, on which two unique vessels were recorded.

10.1.2.5 The daily number of unique vessels recorded within the Regional Shipping and Navigation Study Area, as well as intersecting the Morven Site, during the winter survey period is presented in Figure 10.6. Throughout the winter survey period, approximately 29% of vessel traffic recorded within the Regional Shipping and Navigation Study Area intersected the Morven Site.

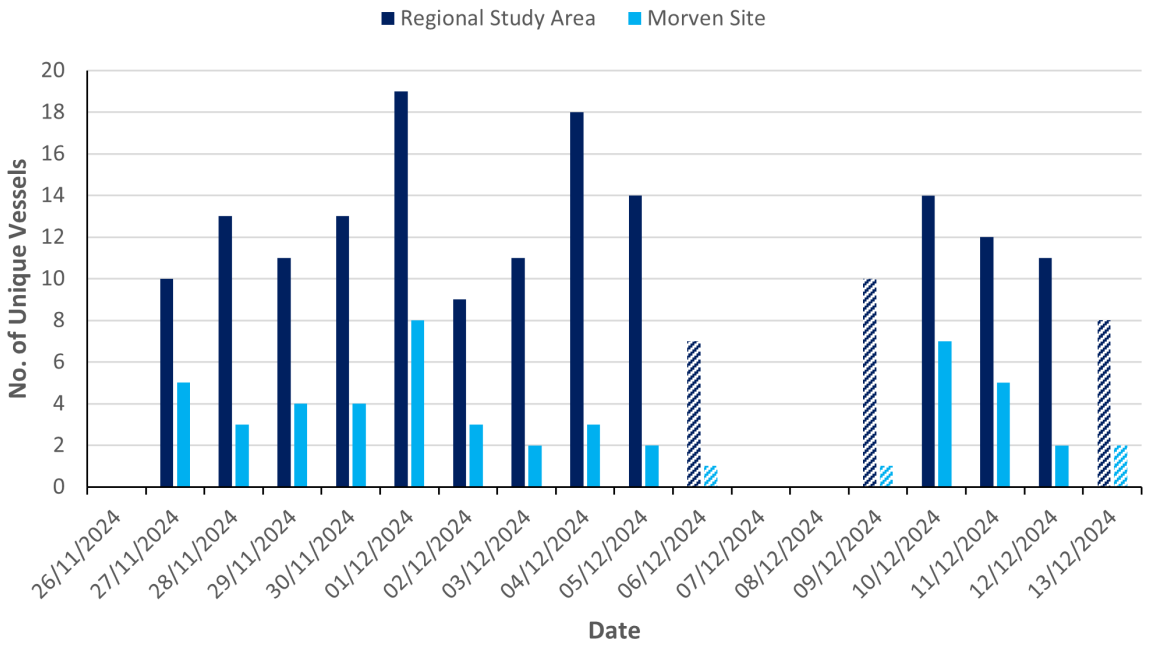


Figure 10.6: Unique vessels per day within the Regional Shipping and Navigation Study Area (Winter 2024)[6]

10.1.2.6 There was an average of 13 unique vessels recorded per day within the Regional Shipping and Navigation Study Area during the winter survey period. An average of three to four unique vessels per day intersected the Morven Site.

10.1.2.7 The busiest day recorded within the Regional Shipping and Navigation Study Area during the winter survey period was 01 December 2024, on which 19 unique

[6] The hatched areas denote partial survey days, i.e. the survey vessel was not on site for the full 24 hours of the day.

vessels were recorded. The busiest day recorded within the Morven Site during the winter survey period was also 01 December 2024, on which eight unique vessels were recorded.

10.1.2.8 The quietest full day recorded within the Regional Shipping and Navigation Study Area during the winter survey period was 02 December 2024, on which nine unique vessels were recorded. The quietest full days recorded within the Morven Site during the winter survey period were 03, 05 and 12 December 2024, on which two unique vessels were recorded each.

10.1.3 Vessel type

10.1.3.1 The distribution of the main vessel types recorded passing within the Regional Shipping and Navigation Study Area and Morven Site during the survey periods is presented in Figure 10.7.

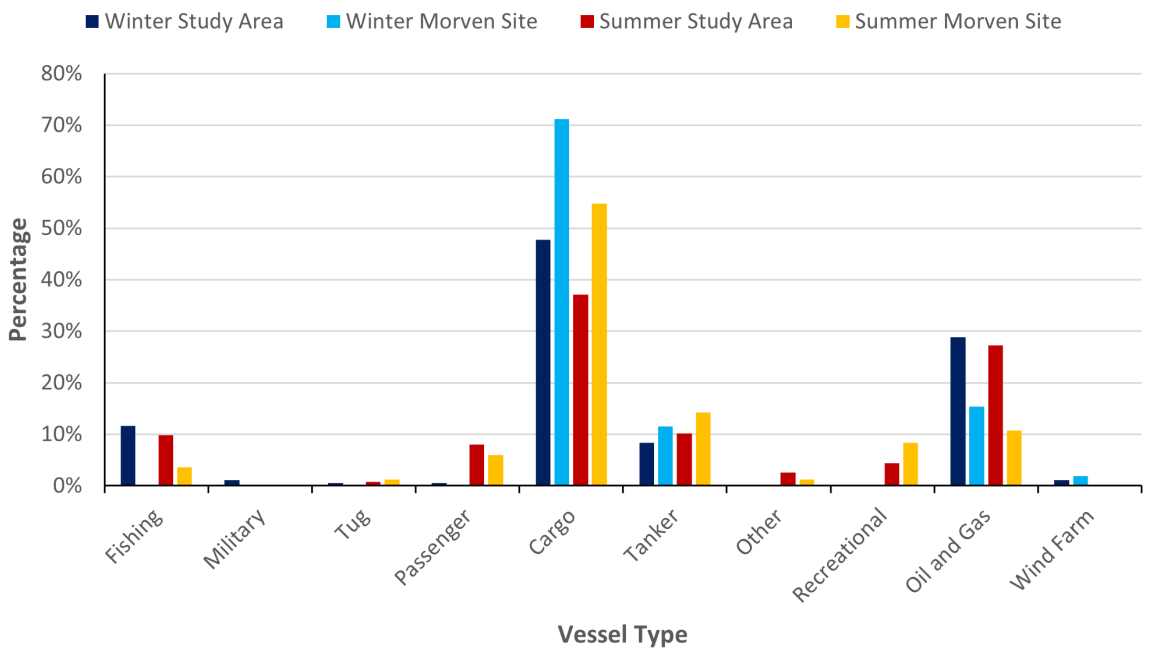


Figure 10.7: Vessel type distribution within the Regional Shipping and Navigation Study Area (summer and winter 2024)

10.1.3.2 During the summer survey period, the main vessel types within the Regional Shipping and Navigation Study Area were cargo vessels (37%), oil and gas vessels (27%), tankers (10%) and fishing vessels (10%). During the winter survey period, the main vessel types within the Regional Shipping and Navigation Study Area were cargo vessels (48%), oil and gas vessels (29%) and fishing vessels (12%).

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

Cargo vessels

10.1.3.4 The cargo vessels recorded within the Regional Shipping and Navigation Study Area during the survey periods are presented in Figure 10.8.

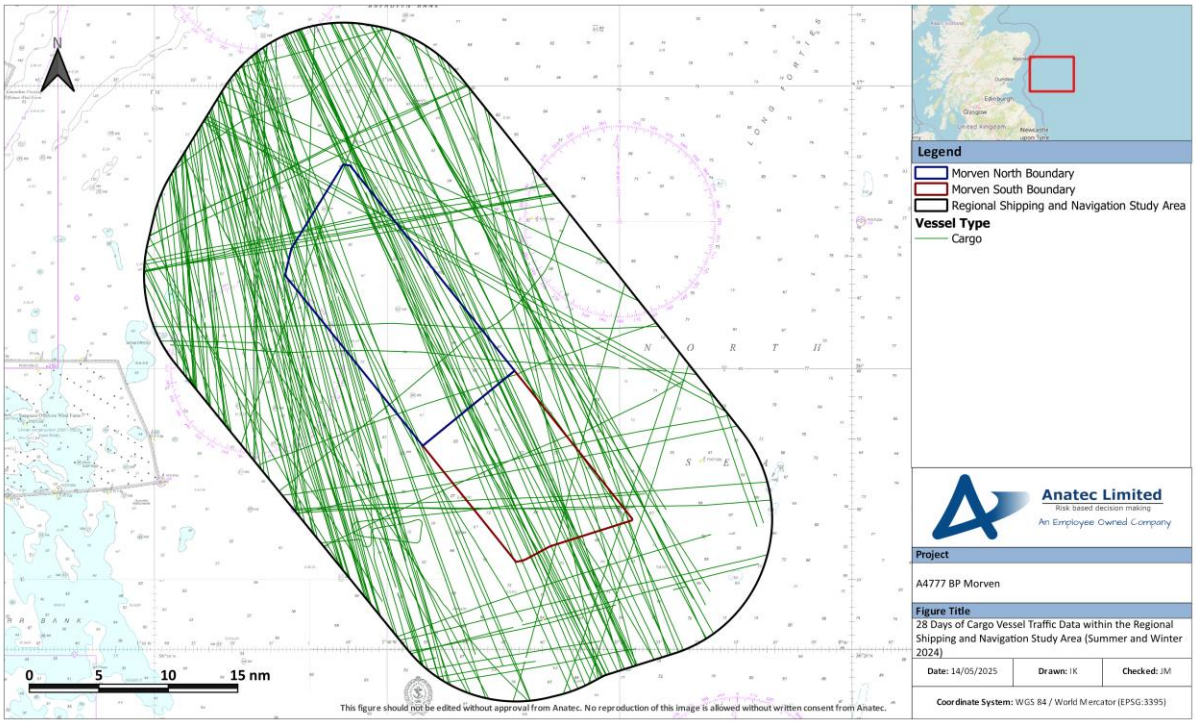


Figure 10.8: 28 days of cargo vessel traffic data within the Regional Shipping and Navigation Study Area (summer and winter 2024)

10.1.3.5 During the summer survey period, an average of seven cargo vessels per day were recorded within the Regional Shipping and Navigation Study Area, with an average of three cargo vessels per day intersecting the Morven Site. During the winter survey period, an average of six cargo vessels per day were recorded within the Regional Shipping and Navigation Study Area, with an average of two to three cargo vessels per day intersecting the Morven Site.

10.1.3.6 The majority of cargo vessels were seen transiting on a north-south bearing, with some also noted travelling east-west. Common destinations included ports such as Immingham (UK) and Grimsby (UK) within the Humber, Icelandic ports such as Reykjavik (Iceland) and Þorlákshöfn (Iceland), and Rotterdam (the Netherlands).

10.1.3.7 The majority of cargo vessels were ‘general cargo’ (56%), with bulk carriers (15%) next most common. A Roll-on/Roll-off cargo (RoRo) vessel operated by Smyril

Line was recorded making regular transits between Þorlákshöfn and Rotterdam once every two days in the summer period only within the Regional Shipping and Navigation Study Area, passing through the Morven Site and included within Route 2 (see Section 11.2).

Oil and gas vessels

10.1.3.8 The oil and gas vessels recorded within the Regional Shipping and Navigation Study Area during the survey periods are presented in Figure 10.9.

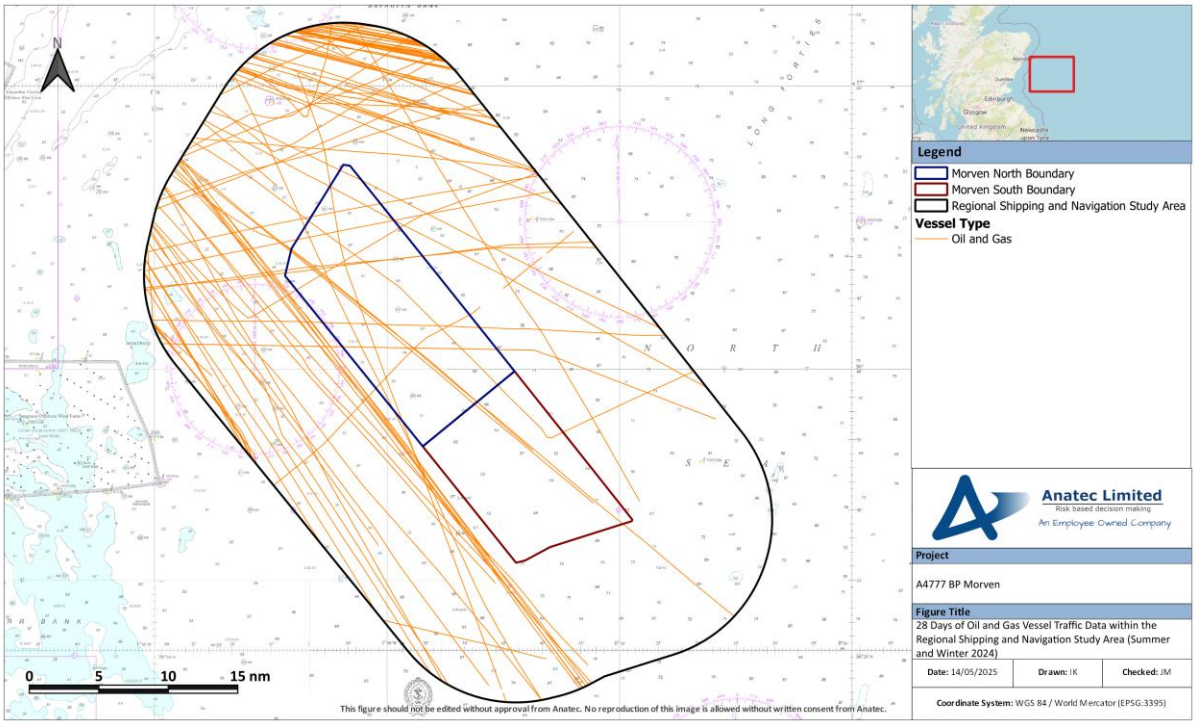


Figure 10.9: 28 days of oil and gas vessel traffic data within the Regional Shipping and Navigation Study Area (summer and winter 2024)

10.1.3.9 During the summer survey period, an average of five to six oil and gas vessels per day were recorded within the Regional Shipping and Navigation Study Area, with an average of one oil and gas vessel every two days intersecting the Morven Site. During the winter survey period, an average of three to four oil and gas vessels per day were recorded within the Regional Shipping and Navigation Study Area, with an average of one oil and gas vessel every two days intersecting the Morven Site.

10.1.3.10 The majority of oil and gas vessels were seen routeing on an east-west bearing at the northern extent of the Regional Shipping and Navigation Study Area, between Aberdeen (UK) and various oil and gas infrastructure, in fields such as Catcher, Fulmar,

and Cygnus. The remaining traffic mainly comprised northwest-southeast routeing inshore of the site to/from Aberdeen, with vessels also noted less regularly to be heading to/from Montrose (UK) as well as Peterhead (UK).

Fishing vessels

10.1.3.11 Commercial fishing vessel data was extracted from the vessel tracks recorded during the vessel traffic surveys. The fishing vessels recorded within the Regional Shipping and Navigation Study Area during the survey periods are presented in Figure 10.10.

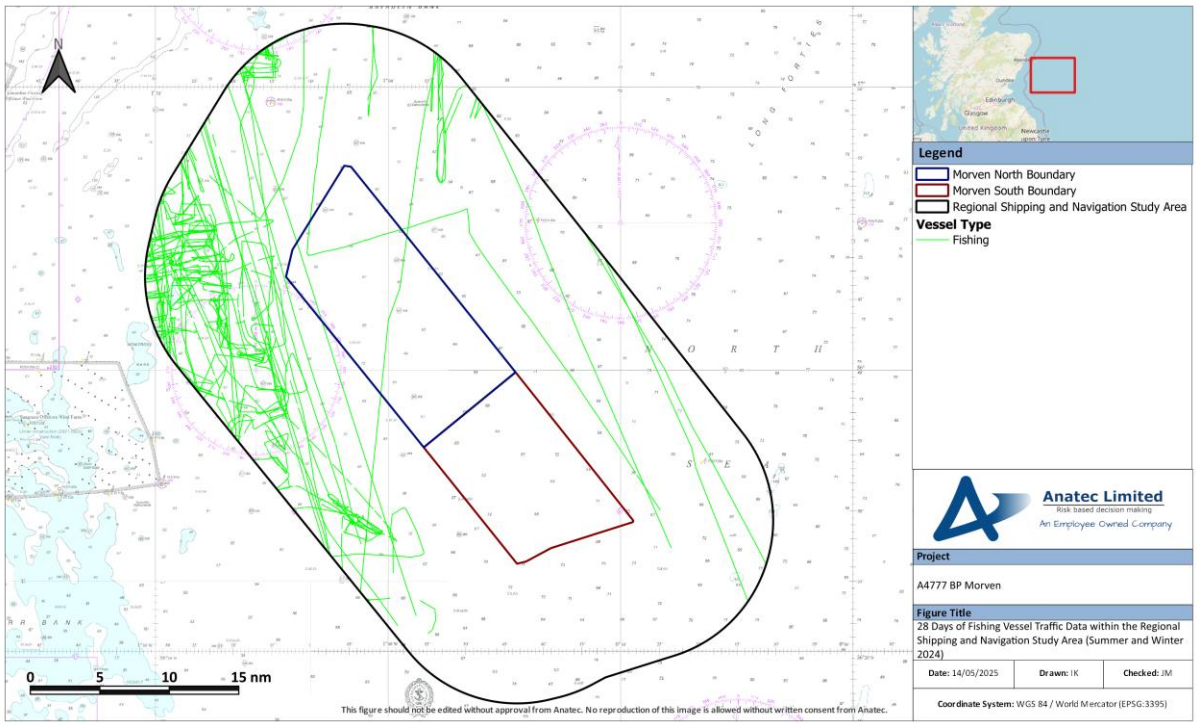


Figure 10.10: 28 days of fishing vessel traffic data within the Regional Shipping and Navigation Study Area (summer and winter 2024)

10.1.3.12 During the summer survey period, an average of two fishing vessels per day were recorded within the Regional Shipping and Navigation Study Area, with an average of one fishing vessel every five days intersecting the Morven Site. During the winter survey period, an average of one to two fishing vessels per day were recorded within the Regional Shipping and Navigation Study Area, with no fishing vessels recorded intersecting the Morven Site.

10.1.3.13 The majority of fishing vessels were recorded inshore of the Morven Site. Overall, the majority of fishing vessels were potters (57%), with demersal trawlers (23%) also frequently noted.

10.1.3.14 In the summer survey period, the majority of activity was from a single potter. Based on average speeds, track behaviour and information broadcast via AIS, this appeared to be engaged in active fishing throughout to the west of the Morven Site. In the winter survey period, two vessels were recorded likely to be actively fishing to the north. These were also both potters.

Recreational vessels

10.1.3.15 The recreational vessels recorded within the Regional Shipping and Navigation Study Area during the survey periods are presented in Figure 10.11.

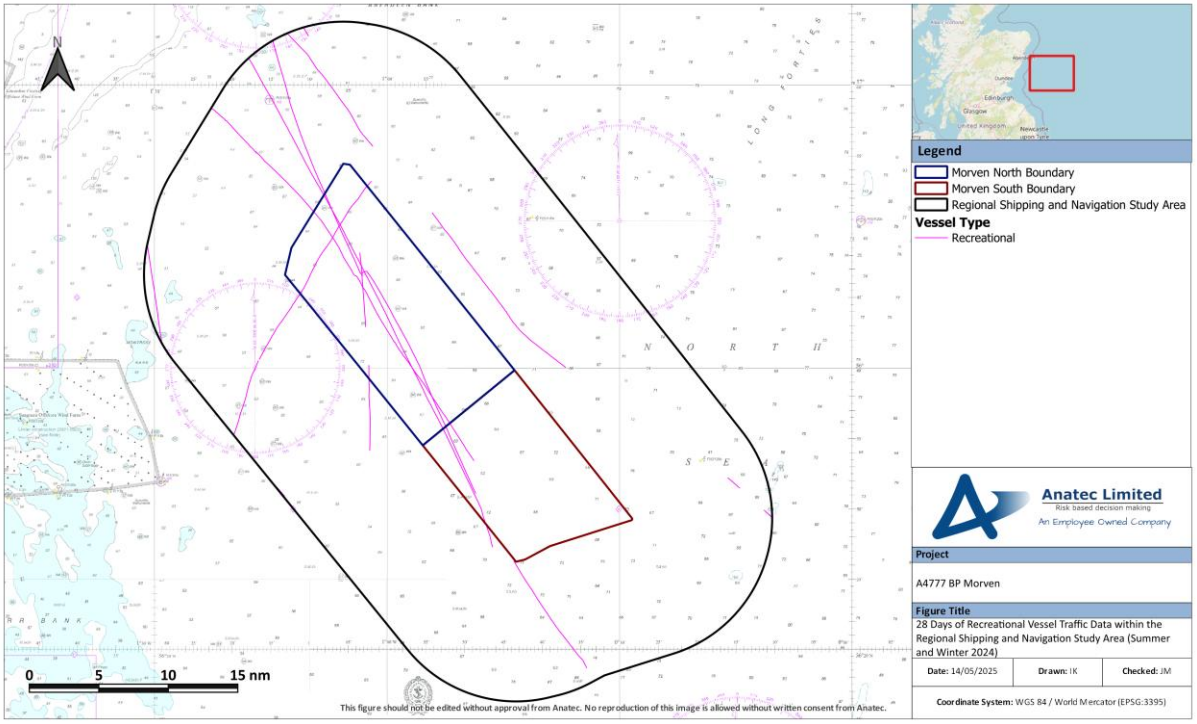


Figure 10.11: 28 days of recreational vessel traffic data within the Regional Shipping and Navigation Study Area (summer and winter 2024)

10.1.3.16 During the summer survey period, an average of one recreational vessel per day was recorded within the Regional Shipping and Navigation Study Area, with an average of one recreational vessel every two days intersecting the Morven Site. No recreational vessels were recorded within the Regional Shipping and Navigation Study Area during the winter survey period.

10.1.3.17 The majority of recreational vessels were recorded transiting northwest-southeast following the coast but activity was generally sparse given the distance offshore.

Tankers

10.1.3.18 The tankers recorded within the Regional Shipping and Navigation Study Area during the survey periods are presented in Figure 10.12.

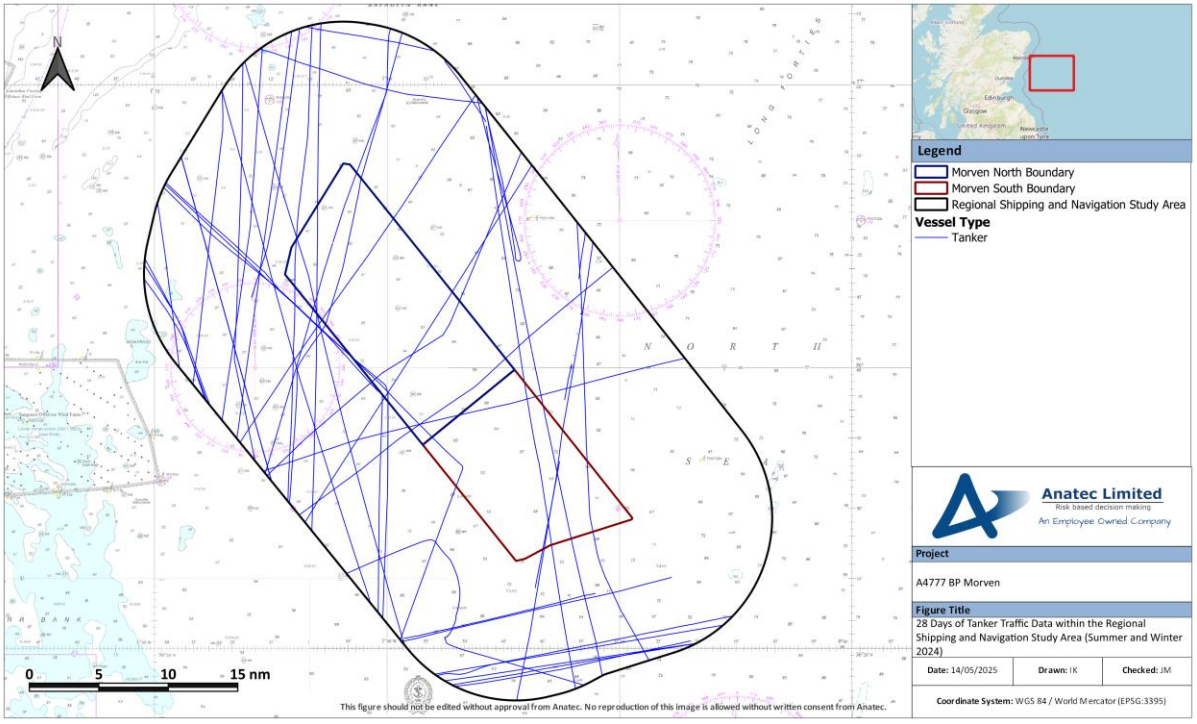


Figure 10.12: 28 days of tanker traffic data within the Regional Shipping and Navigation Study Area (summer and winter 2024)

10.1.3.19 During the summer survey period, an average of two tankers per day were recorded within the Regional Shipping and Navigation Study Area, with an average of one tanker per day intersecting the Morven Site. During the winter survey period, an average of one tanker per day was recorded within the Regional Shipping and Navigation Study Area, with an average of one tanker every two days intersecting the Morven Site.

10.1.3.20 The most commonly-recorded tanker subtype within the survey periods were oil/chemical tankers (40%), with liquefied petroleum gas (LPG) tankers (19%) and oil product tankers (16%) also frequently noted.

10.1.3.21 Tankers were recorded transiting on north-south and east-west courses. Destinations including UK ports such as Aberdeen, Grangemouth (UK) and Sullom Voe (UK), and Norwegian ports such as Floro (Norway) and Mongstad (Norway).

Passenger vessels

10.1.3.22 The passenger vessels recorded within the Regional Shipping and Navigation Study Area during the survey periods are presented in Figure 10.13.

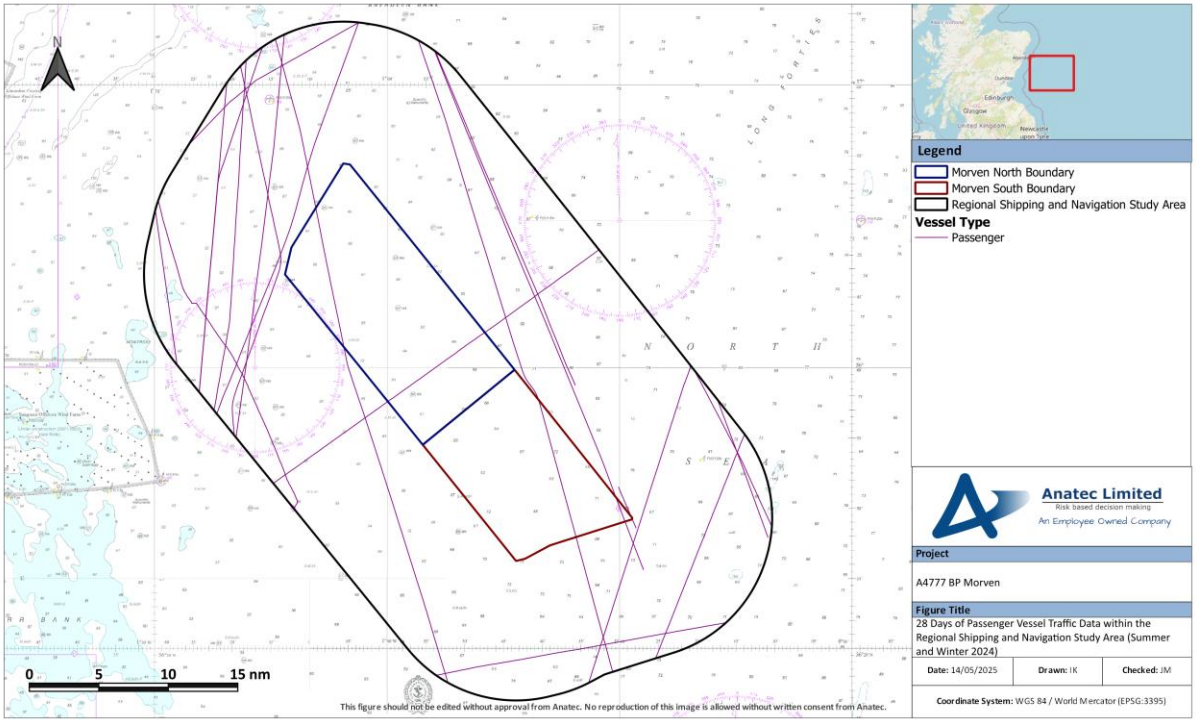


Figure 10.13: 28 days of passenger vessel traffic data within the Regional Shipping and Navigation Study Area (summer and winter 2024)

10.1.3.23 During the summer survey period, an average of one to two passenger vessels per day were recorded within the Regional Shipping and Navigation Study Area, with an average of one passenger vessel every three days intersecting the Morven Site. During the winter survey period, a total of one passenger vessel was recorded within the Regional Shipping and Navigation Study Area, and did not intersect the Morven Site.

10.1.3.24 Passenger vessels were most commonly seen to the northwest of the Morven Site, and were generally cruise liners with no Roll-on/Roll-off Passenger (RoPax) vessels noted.

10.1.4 Vessel size

Vessel length

10.1.4.1 Vessel length information was available via the AIS broadcast for all vessels recorded throughout the summer and winter survey periods.

10.1.4.2 The vessel tracks recorded within the Regional Shipping and Navigation Study Area during the survey periods are colour-coded by vessel length and presented in Figure 10.14. Following this, the distribution of these length classes is presented in Figure 10.15.

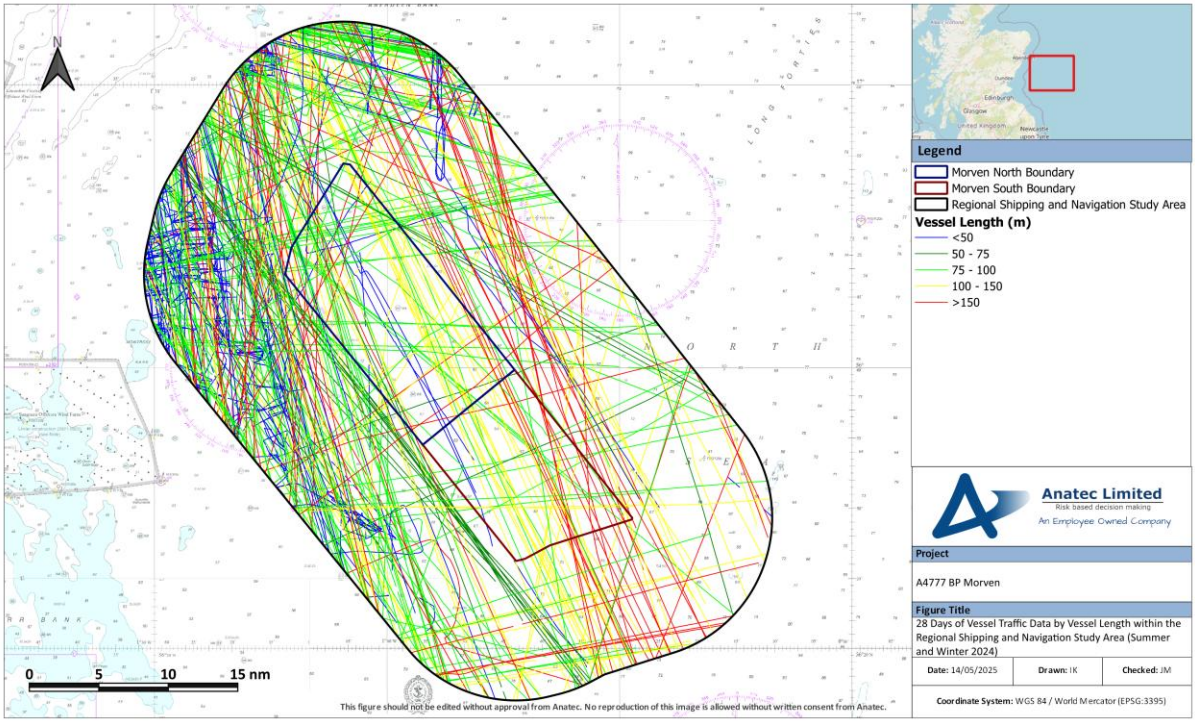


Figure 10.14: 28 days of vessel traffic data by vessel length within the Regional Shipping and Navigation Study Area (summer and winter 2024)

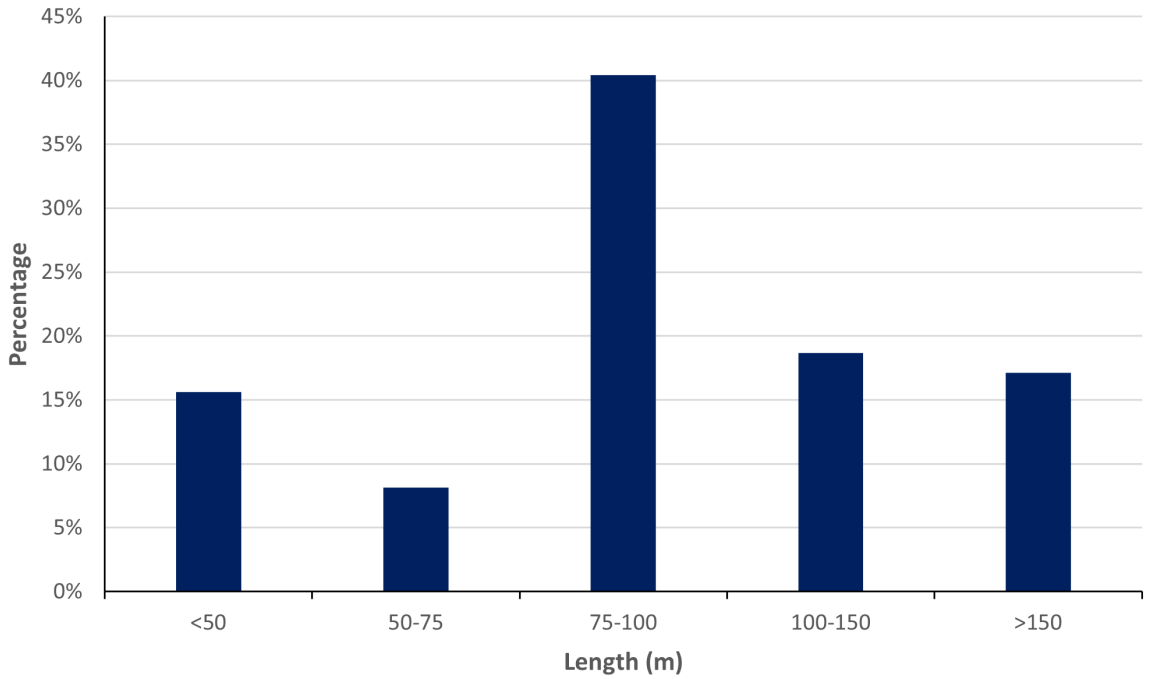


Figure 10.15: Vessel length distribution within the Regional Shipping and Navigation Study Area (summer and winter 2024)

10.1.4.3 The average length of vessels within the Regional Shipping and Navigation Study Area was 104m. Over the survey periods, vessel length ranged from 4m for a recreational vessel to 319m for a cruise liner.

Vessel draught

10.1.4.4 Vessel draught information was available via the AIS broadcast for 96% of all vessels recorded throughout the summer and winter survey periods.

10.1.4.5 The vessel tracks recorded within the Regional Shipping and Navigation Study Area during the survey periods are colour-coded by vessel draught and presented in Figure 10.16. Following this, the distribution of these draught classes is presented in Figure 10.17.

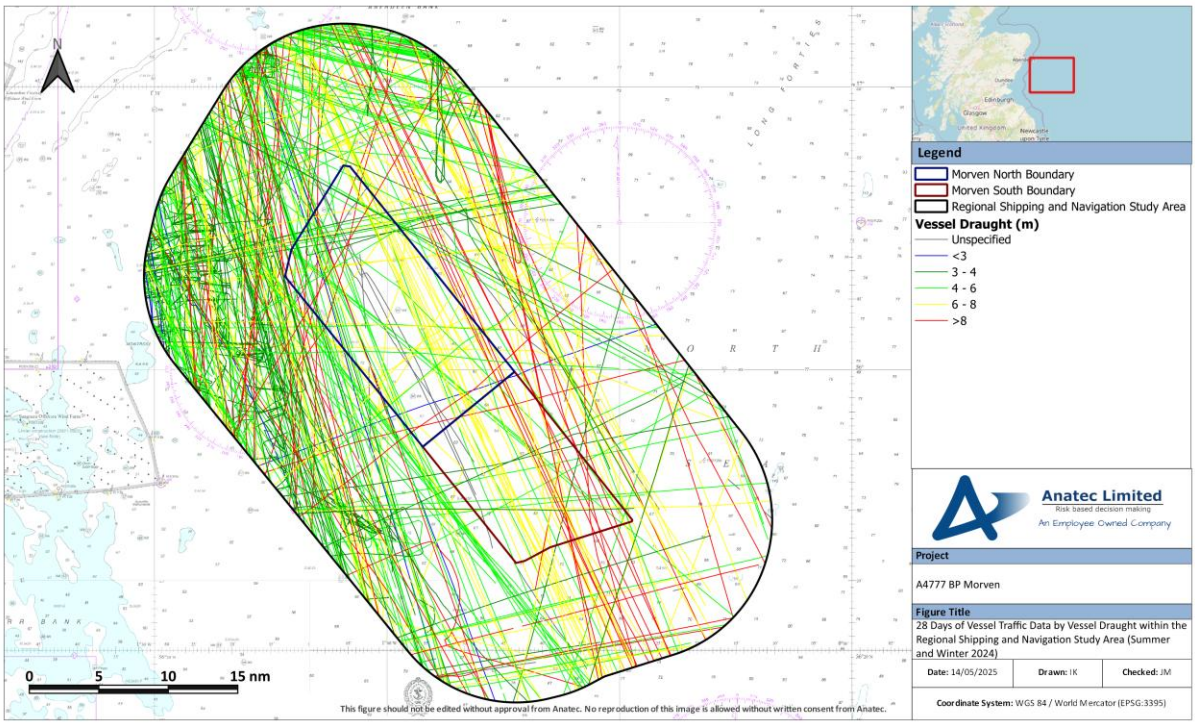


Figure 10.16: 28 days of vessel traffic data by vessel draught within the Regional Shipping and Navigation Study Area (summer and winter 2024)

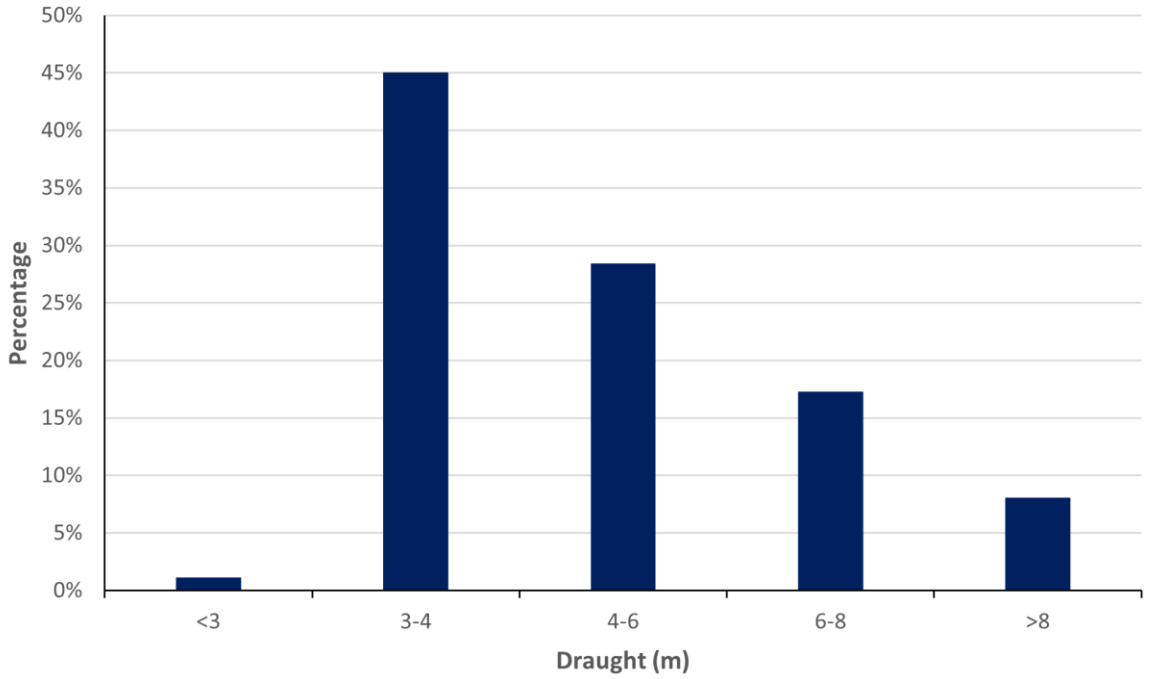


Figure 10.17: Vessel draught distribution within the Regional Shipping and Navigation Study Area (summer and winter 2024)

10.1.4.6 Excluding the proportion of vessels for which draught was not available, the average draught of vessels within the Regional Shipping and Navigation Study Area was 5.0m. Over the survey periods, vessel draught ranged from 2.2m for a tug to 13.8m for a bulk carrier.

10.1.5 Anchored vessels

10.1.5.1 Vessels which travelled at a speed of less than 1kt for more than 30 minutes are assumed to potentially be at anchor. Such cases have, therefore, been identified and checked for likely anchoring activity. After applying the criteria no vessels were deemed to be at anchor within the Regional Shipping and Navigation Study Area during the survey periods.

10.1.5.2 The long-term traffic dataset (see Appendix E) identified an average of one unique vessel every 30 days recorded likely at anchor within the Regional Shipping and Navigation Study Area. This suggests that anchoring activity likely takes place within the area, but is infrequent.

10.2 Morven North in isolation

10.2.1.1 The vessel tracks recorded during the summer survey period within the Morven North Shipping and Navigation Study Area, excluding temporary traffic, are colour-coded by vessel type and presented in Figure 10.18. Following this, the same data converted to a density heat map is presented in Figure 10.19.

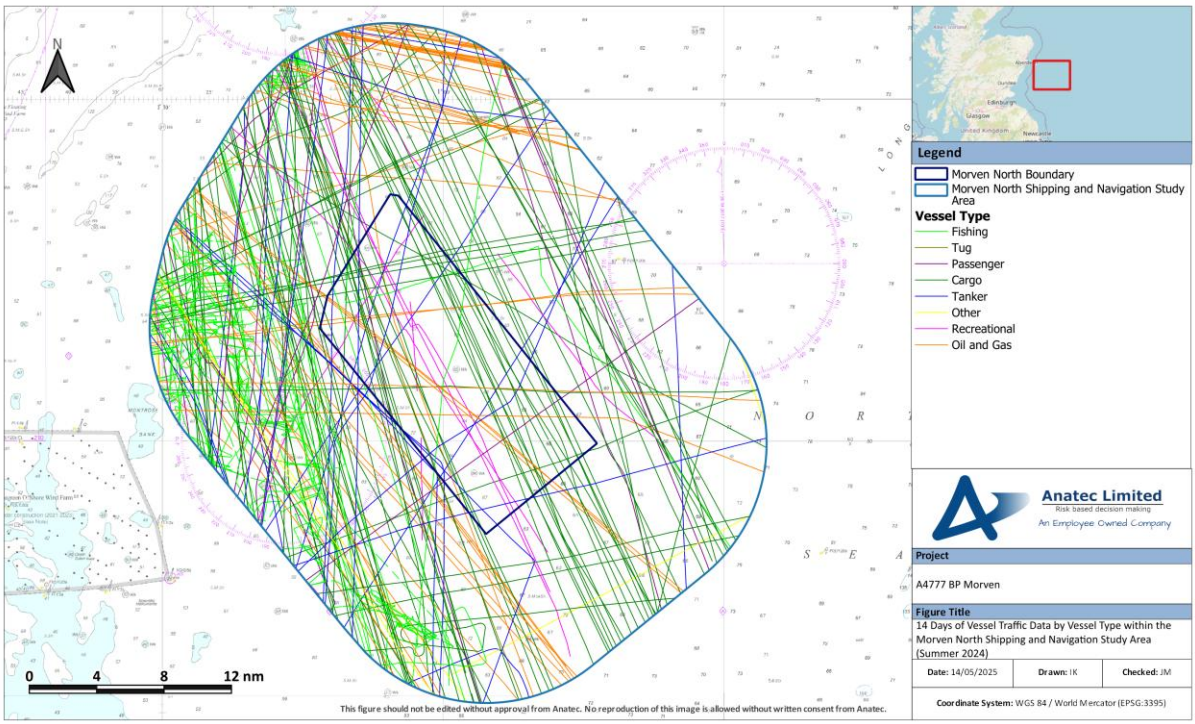


Figure 10.18: 14 days of vessel traffic data by vessel type within the Morven North Shipping and Navigation Study Area (summer 2024)

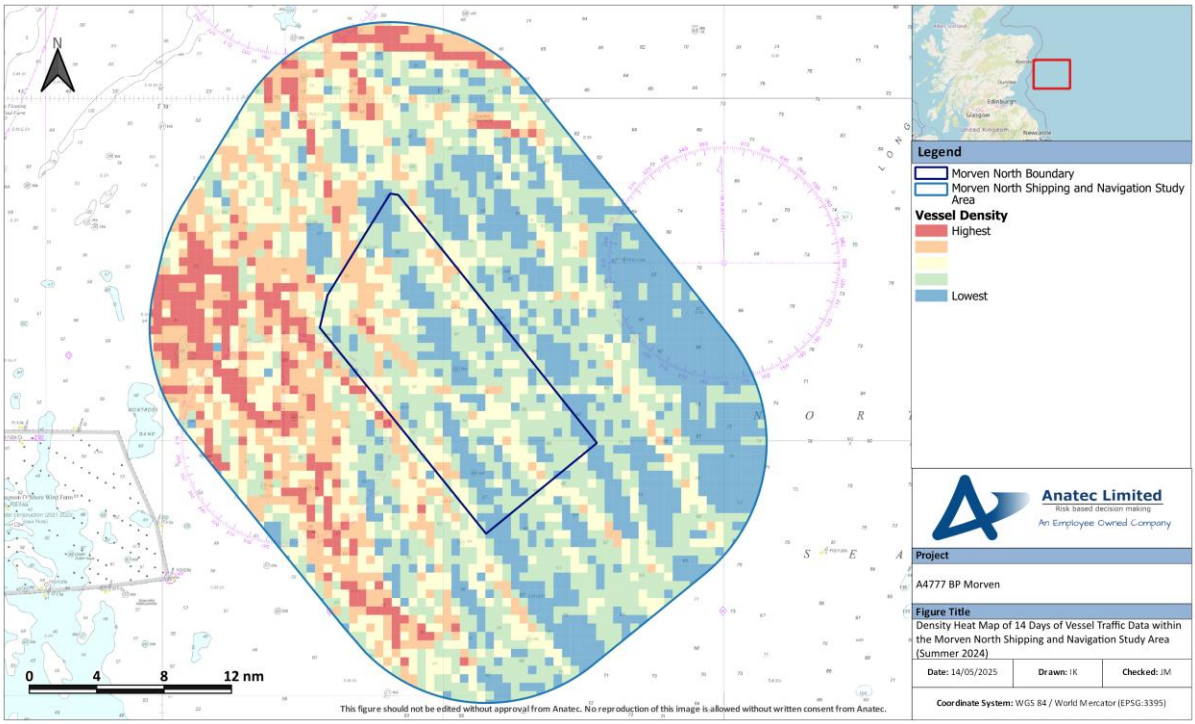


Figure 10.19 Density heat map of 14 days of vessel traffic data within the Morven North Shipping and Navigation Study Area (summer 2024)

10.2.1.2 The vessel tracks recorded during the winter survey period within the Morven North Shipping and Navigation Study Area, excluding temporary traffic, are colour-coded by vessel type and presented in Figure 10.20. Following this, the same data converted to a density heat map is presented in Figure 10.21. The density ranges used in the winter data are those of the summer data, to allow direct comparison.

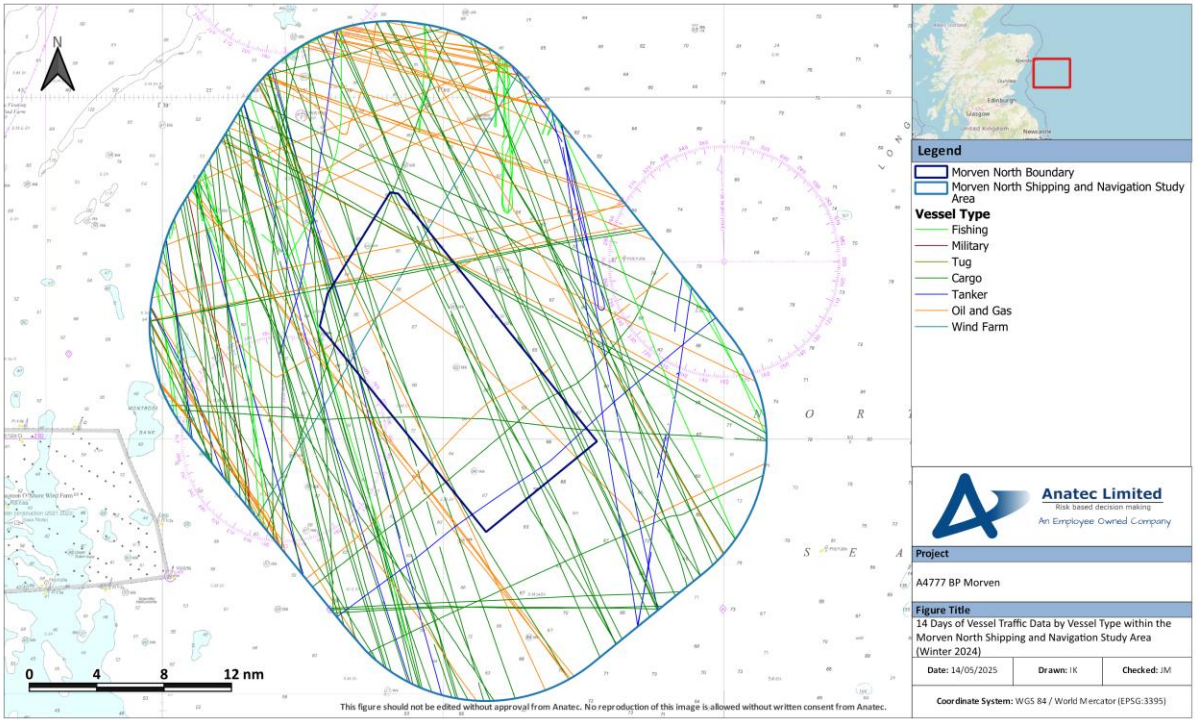


Figure 10.20: 14 days of vessel traffic data by vessel type within the Morven North Shipping and Navigation Study Area (winter 2024)

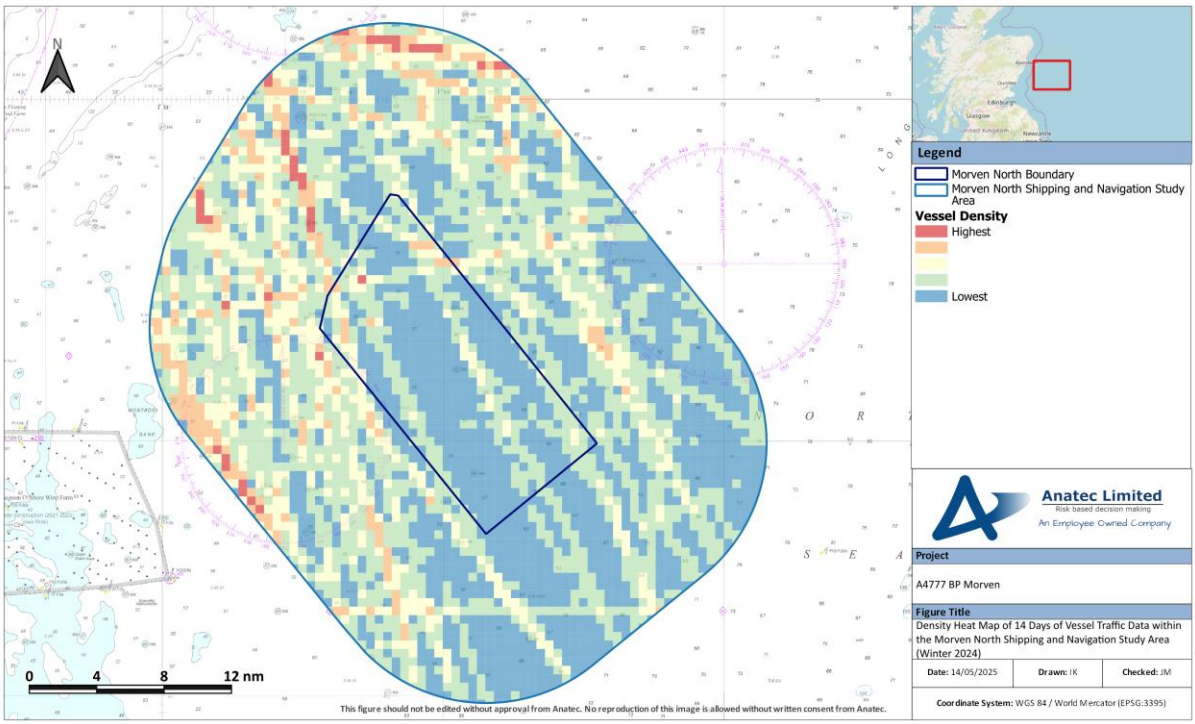


Figure 10.21 Density heat map of 14 days of vessel traffic data within the Morven North Shipping and Navigation Study Area (winter 2024)

10.2.2 Vessel count

10.2.2.1 The daily number of unique vessels recorded within the Morven North Shipping and Navigation Study Area, as well as intersecting the Morven North Boundary, during the summer survey period is presented in Figure 10.22. Throughout the summer survey period, approximately 27% of vessel traffic recorded within the Morven North Shipping and Navigation Study Area intersected the Morven North Boundary.

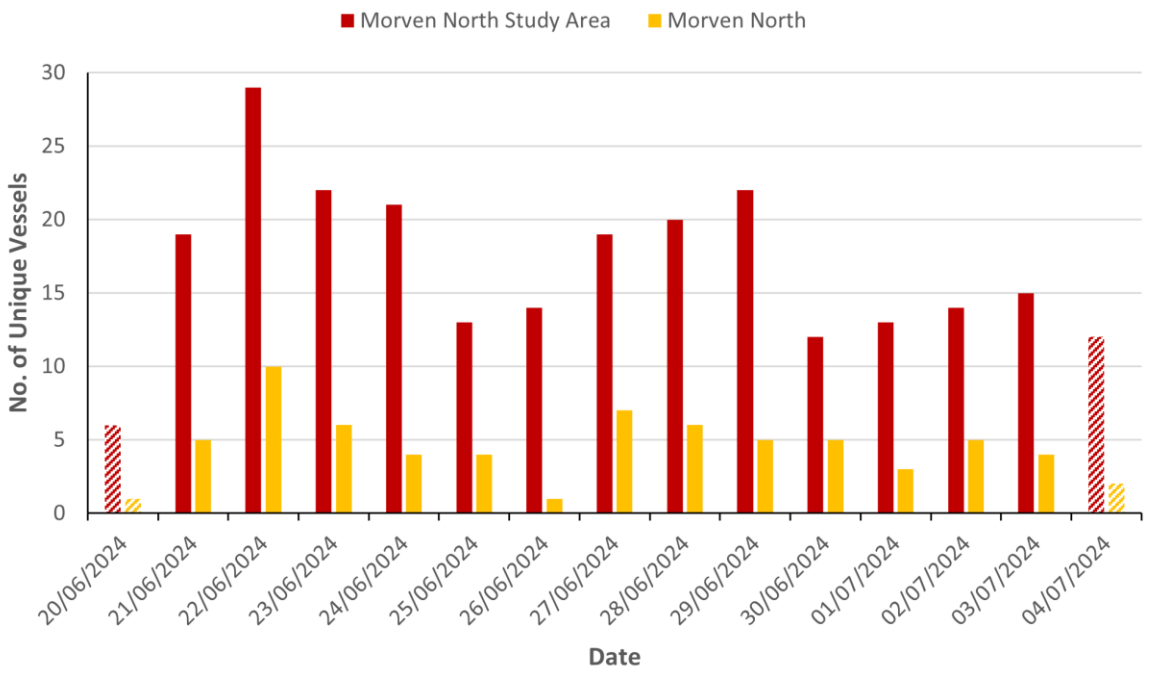


Figure 10.22: Unique vessels per day within the Morven North Shipping and Navigation Study Area (summer 2024)

10.2.2.2 There was an average of 18 unique vessels recorded per day within the Morven North Shipping and Navigation Study Area during the summer survey period. An average of five unique vessels per day intersected the Morven North Boundary itself.

10.2.2.3 The busiest day recorded within the Morven North Shipping and Navigation Study Area during the summer survey period was 22 June 2024, on which 29 unique vessels were recorded. The busiest day recorded within the Morven North Boundary itself during the summer survey period was also 22 June 2024, on which ten unique vessels were recorded.

10.2.2.4 The quietest full day recorded within the Morven North Shipping and Navigation Study Area during the summer survey period was 30 June 2024, on which 12 unique vessels were recorded. The quietest full day recorded within the Morven North Boundary itself during the summer survey period was 26 June 2024, on which one unique vessel was recorded.

10.2.2.5 The daily number of unique vessels recorded within the Morven North Shipping and Navigation Study Area, as well as intersecting the Morven North Boundary, during the winter survey period is presented in Figure 10.23. Throughout the winter survey period, approximately 22% of vessel traffic recorded within the Morven North Shipping and Navigation Study Area intersected the Morven North Boundary.

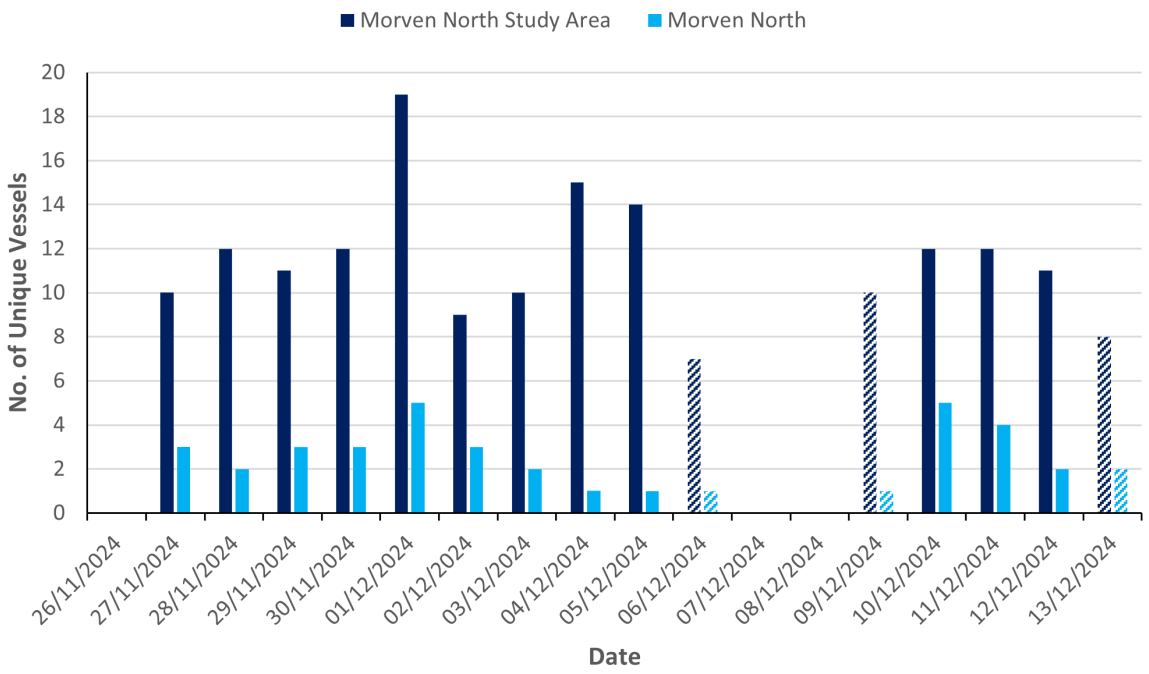


Figure 10.23: Unique vessels per day within the Morven North Shipping and Navigation Study Area (winter 2024)

10.2.2.6 There was an average of 12 unique vessels recorded per day within the Morven North Shipping and Navigation Study Area during the winter survey period. An average of two to three unique vessels per day intersected the Morven North Boundary itself.

10.2.2.7 The busiest day recorded within the Morven North Shipping and Navigation Study Area during the winter survey period was 01 December 2024, on which 19 unique vessels were recorded. The busiest days recorded within the Morven North Boundary itself during the winter survey period were 01 and 10 December 2024, on which five unique vessels were recorded each.

10.2.2.8 The quietest full day recorded within the Morven North Shipping and Navigation Study Area during the winter survey period was 02 December 2024, on which nine unique vessels were recorded. The quietest full days recorded within the Morven North Boundary itself during the winter survey period were 04 and 05 December 2024, on which one unique vessel was recorded each.

10.2.3 Vessel type

10.2.3.1 The distribution of the main vessel types recorded passing within the Morven North Shipping and Navigation Study Area and Morven North Boundary during the survey periods is presented in Figure 10.24.

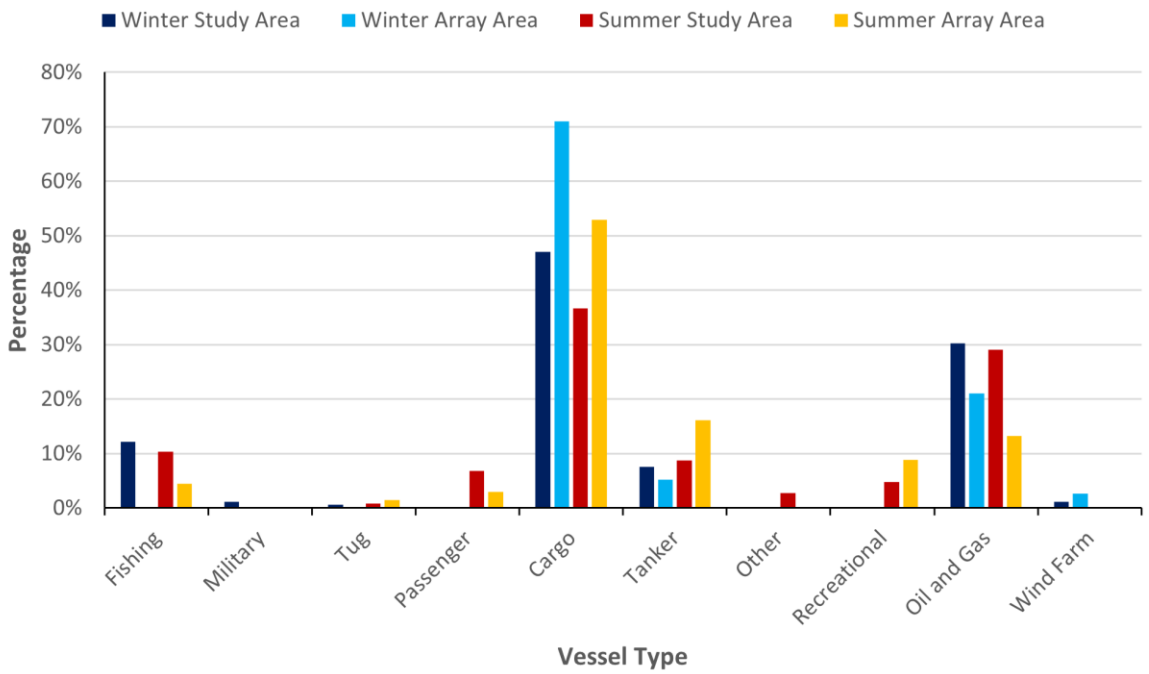


Figure 10.24: Vessel type distribution within the Morven North Shipping and Navigation Study Area (summer and winter 2024)

10.2.3.2 During the summer survey period, the main vessel types within the Morven North Shipping and Navigation Study Area were cargo vessels (37%), oil and gas vessels (29%) and fishing vessels (10%). During the winter survey period, the main vessel types within the Morven North Shipping and Navigation Study Area were cargo vessels (47%), oil and gas vessels (30%) and fishing vessels (12%).

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

Cargo vessels

10.2.3.4 The cargo vessels recorded within the Morven North Shipping and Navigation Study Area during the survey periods are presented in Figure 10.25.

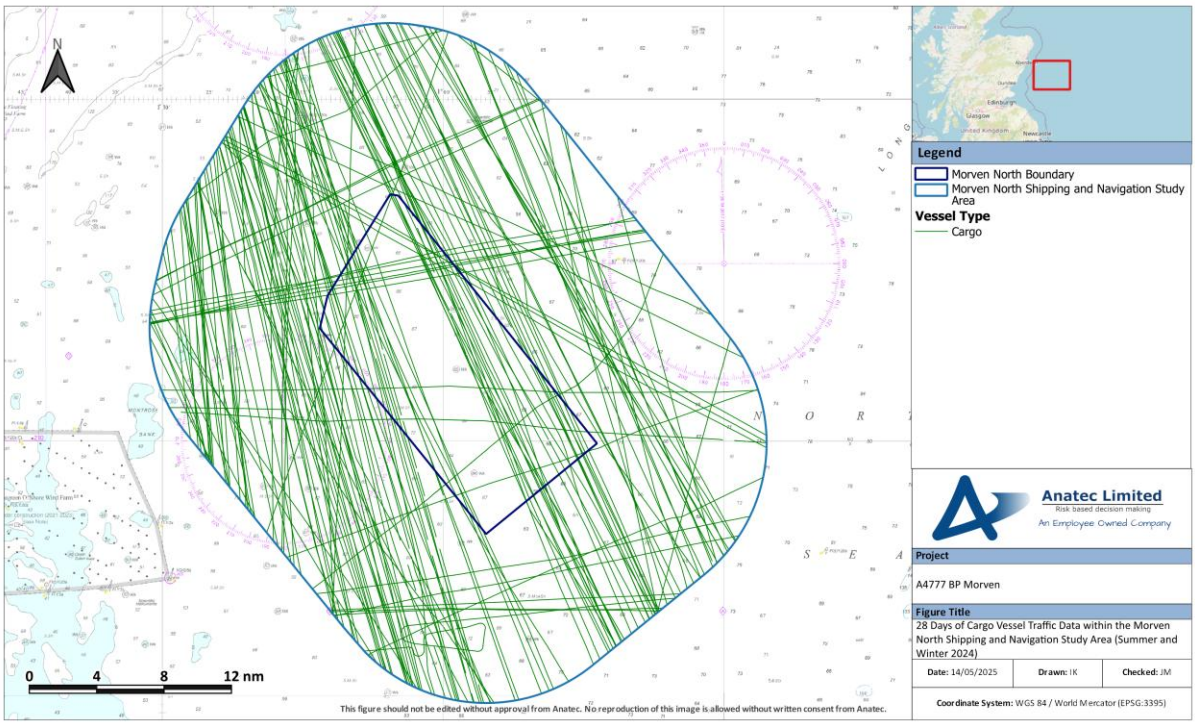


Figure 10.25: 28 days of cargo vessel traffic data within the Morven North Shipping and Navigation Study Area (summer and winter 2024)

10.2.3.5 During the summer survey period, an average of six to seven cargo vessels per day were recorded within the Morven North Shipping and Navigation Study Area, with an average of two to three cargo vessels per day intersecting the Morven North Boundary. During the winter survey period, an average of six cargo vessels per day were recorded within the Morven North Shipping and Navigation Study Area, with an average of two cargo vessels per day intersecting the Morven North Boundary.

10.2.3.6 The majority of cargo vessels were seen transiting on a north-south bearing, with some also noted travelling east-west. Common destinations included ports within the Humber such as Immingham and Grimsby, Icelandic ports such as Reykjavik and Þorlákshöfn, and Rotterdam.

10.2.3.7 The majority of cargo vessels were 'general cargo' (56%), with bulk carriers (16%) next most common. A RoRo vessel operated by Smyril Line was recorded undergoing regular transits between Þorlákshöfn and Rotterdam once every two days in the summer period only, within the Morven North Shipping and Navigation Study Area.

Oil and Gas vessels

10.2.3.8 The oil and gas vessels recorded within the Morven North Shipping and Navigation Study Area during the survey periods are presented in Figure 10.26.

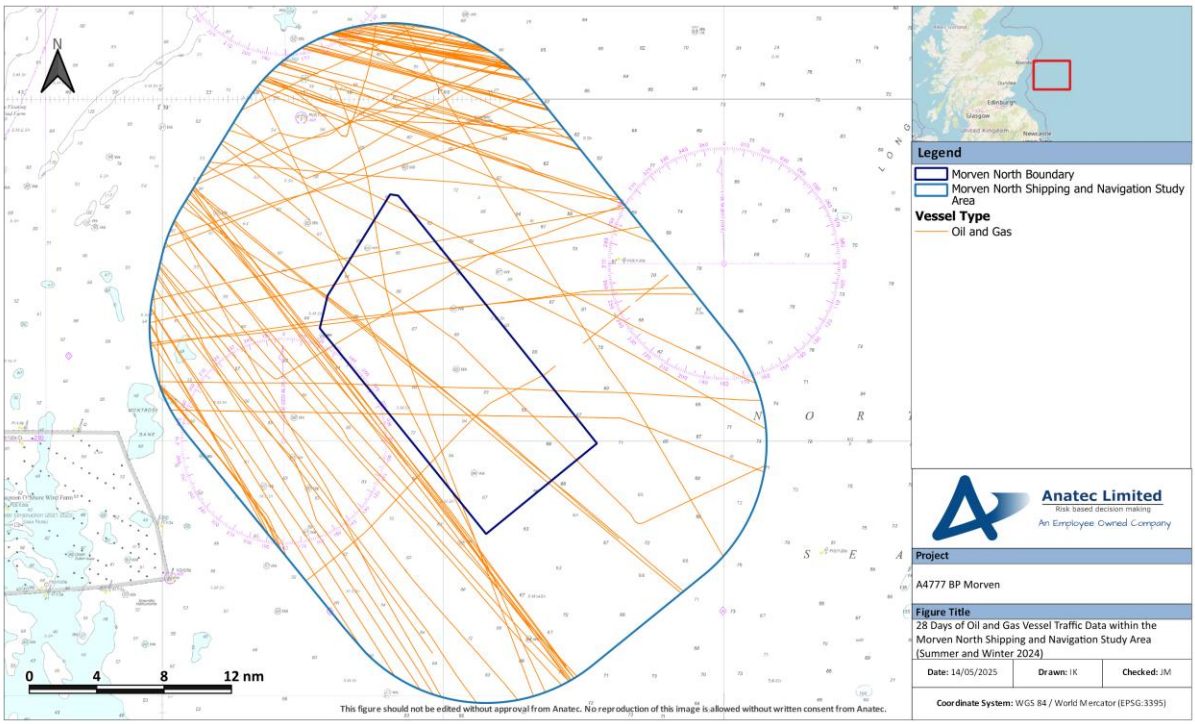


Figure 10.26: 28 Days of oil and gas vessel traffic data within the Morven North Shipping and Navigation Study Area (summer and winter 2024)

10.2.3.9 During the summer survey period, an average of five oil and gas vessels per day were recorded within the Morven North Shipping and Navigation Study Area, with an average of one oil and gas vessel every two days intersecting the Morven North Boundary. During the winter survey period, an average of three to four oil and gas vessels per day were recorded within the Morven North Shipping and Navigation Study Area, with an average of one oil and gas vessel every two days intersecting the Morven North Boundary.

10.2.3.10 The majority of oil and gas vessels were seen routeing on an east-west bearing at the northern extent of the Morven North Shipping and Navigation Study Area, between Aberdeen (UK) and various oil and gas infrastructure, in fields such as Catcher, Fulmar, and Cygnus. The remaining traffic mainly comprised northwest-southeast routeing inshore of the site to/from Aberdeen, with vessels also noted less regularly to be heading to/from Montrose as well as Peterhead. Although no rig movements were recorded within the vessel traffic data, it was noted in consultation (see Section 4) these may increase in the vicinity due to reactivation works, with rigs prevalent around the Port of Dundee.

Fishing vessels

10.2.3.11 The fishing vessels recorded within the Morven North Shipping and Navigation Study Area during the survey periods are presented in Figure 10.27.

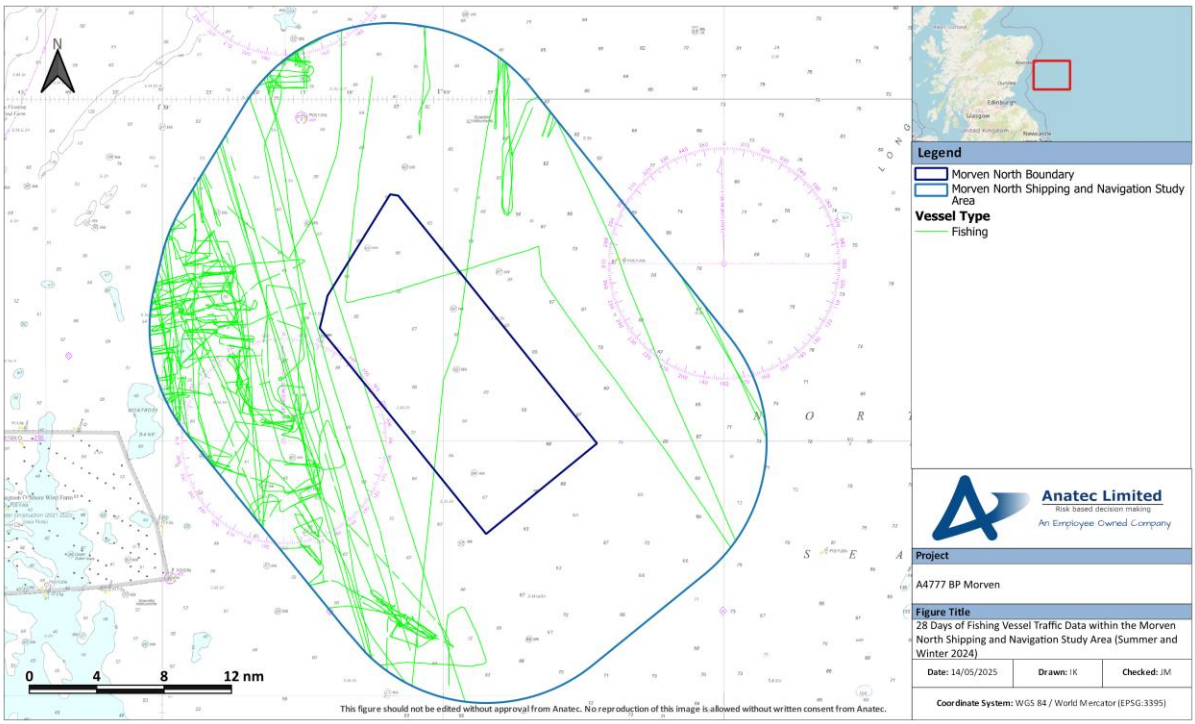


Figure 10.27: 28 days of fishing vessel traffic data within the Morven North Shipping and Navigation Study Area (summer and winter 2024)

10.2.3.12 During the summer survey period, an average of two fishing vessels per day were recorded within the Morven North Shipping and Navigation Study Area, with an average of one fishing vessel every five days intersecting the Morven North Boundary. During the winter survey period, an average of one to two fishing vessels per day were recorded within the Morven North Shipping and Navigation Study Area, with no fishing vessels recorded intersecting the Morven North Boundary.

10.2.3.13 The majority of fishing vessels were recorded inshore of the Morven North Boundary. Overall, the majority of fishing vessels were potters (58%), with demersal trawlers (21%) also frequently noted.

10.2.3.14 In the summer survey period, the majority of activity was from a single potter to the west of the Morven North Boundary. Based on average speeds, track behaviour and information broadcast via AIS, this appeared to be engaged in active fishing throughout. In the winter survey period, two vessels were recorded likely to be actively fishing to the north. These were also both potters.

Recreational vessels

10.2.3.15 The recreational vessels recorded within the Morven North Shipping and Navigation Study Area during the survey periods are presented in Figure 10.28.

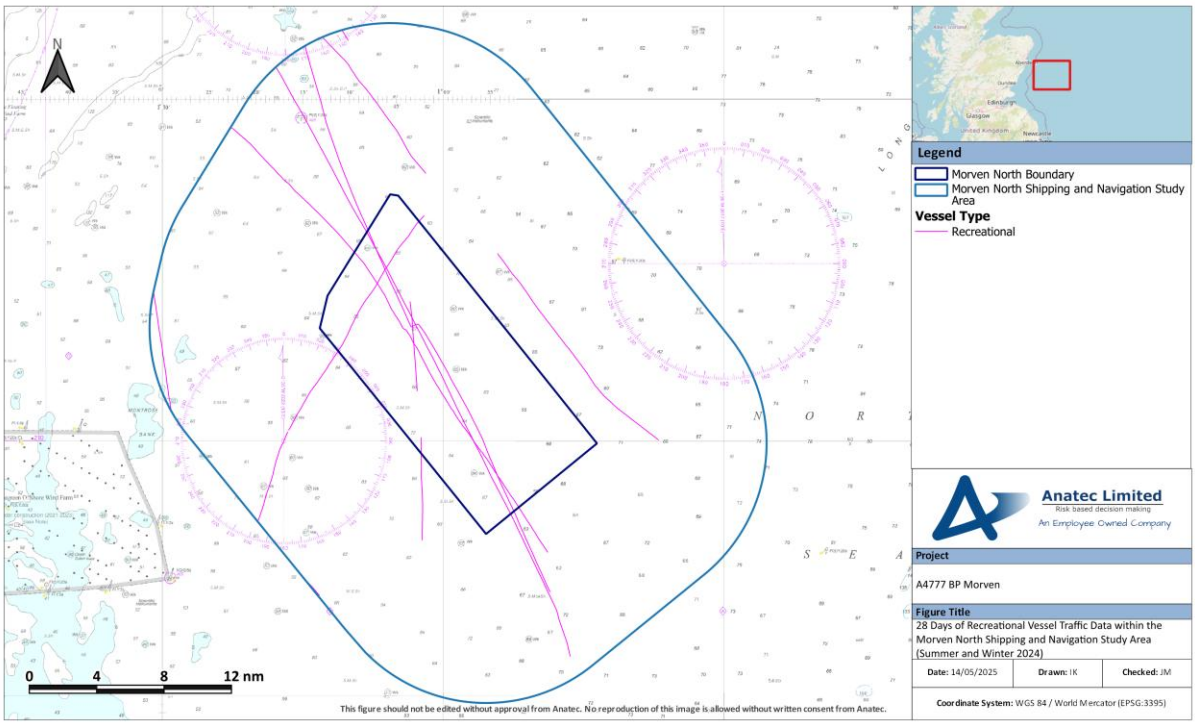


Figure 10.28: 28 days of recreational vessel traffic data within the Morven North Shipping and Navigation Study Area (summer and winter 2024)

10.2.3.16 During the summer survey period, an average of one recreational vessel per day was recorded within the Morven North Shipping and Navigation Study Area, with an average of one recreational vessel every two days intersecting the Morven North Boundary. No recreational vessels were recorded within the Morven North Shipping and Navigation Study Area during the winter survey period.

10.2.3.17 The majority of recreational vessels were recorded transiting northwest-southeast following the coast but activity was generally sparse given the distance offshore.

Tankers

10.2.3.18 The tankers recorded within the Morven North Shipping and Navigation Study Area during the survey periods are presented in Figure 10.29.

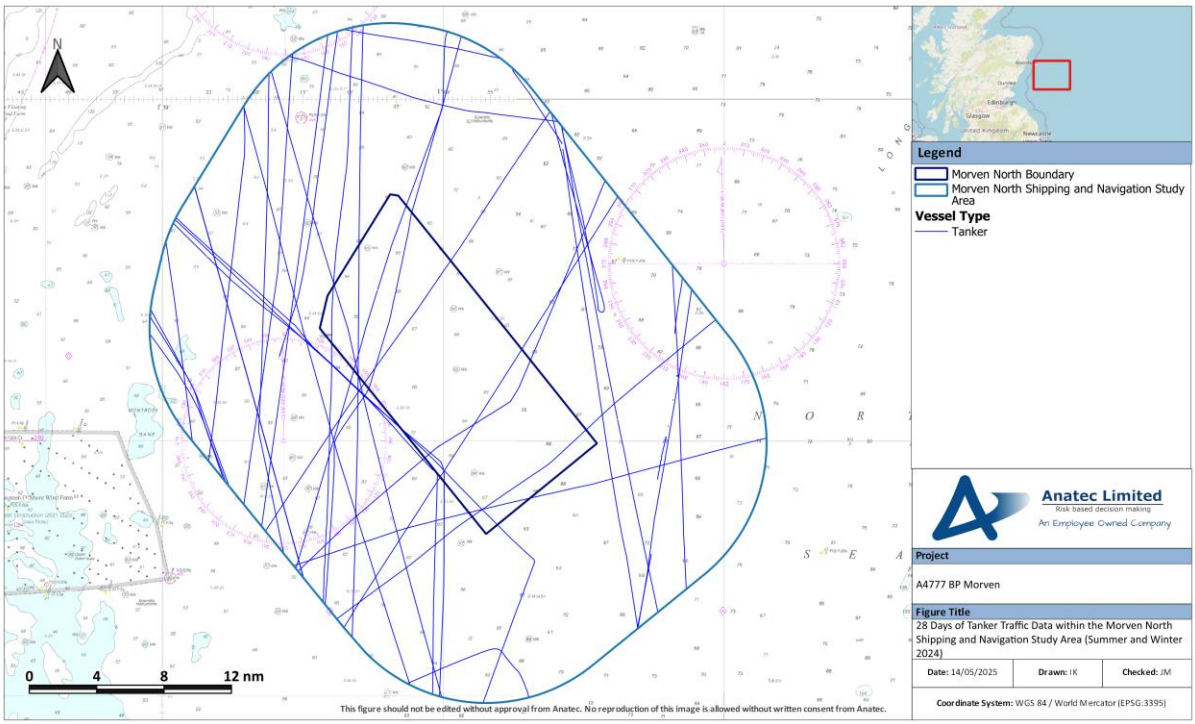


Figure 10.29: 28 days of tanker traffic data within the Morven North Shipping and Navigation Study Area (summer and winter 2024)

10.2.3.19 During the summer survey period, an average of one to two tankers per day were recorded within the Morven North Shipping and Navigation Study Area, with an average of one tanker per day intersecting the Morven North Boundary. During the winter survey period, an average of one tanker per day was recorded within the Morven North Shipping and Navigation Study Area, with an average of one tanker per week intersecting the Morven North Boundary.

10.2.3.20 The most commonly-recorded tanker subtype within the survey periods were oil/chemical tankers (43%), with oil product tankers (20%) and LPG tankers (14%) also frequently noted.

10.2.3.21 Tankers were recorded transiting on northwest-southeast and east-west courses. Destinations including UK ports such as Aberdeen, Grangemouth and Sullom Voe, and Norwegian ports such as Floro and Mongstad.

Passenger vessels

10.2.3.22 The passenger vessels recorded within the Morven North Shipping and Navigation Study Area during the survey periods are presented in Figure 10.30.

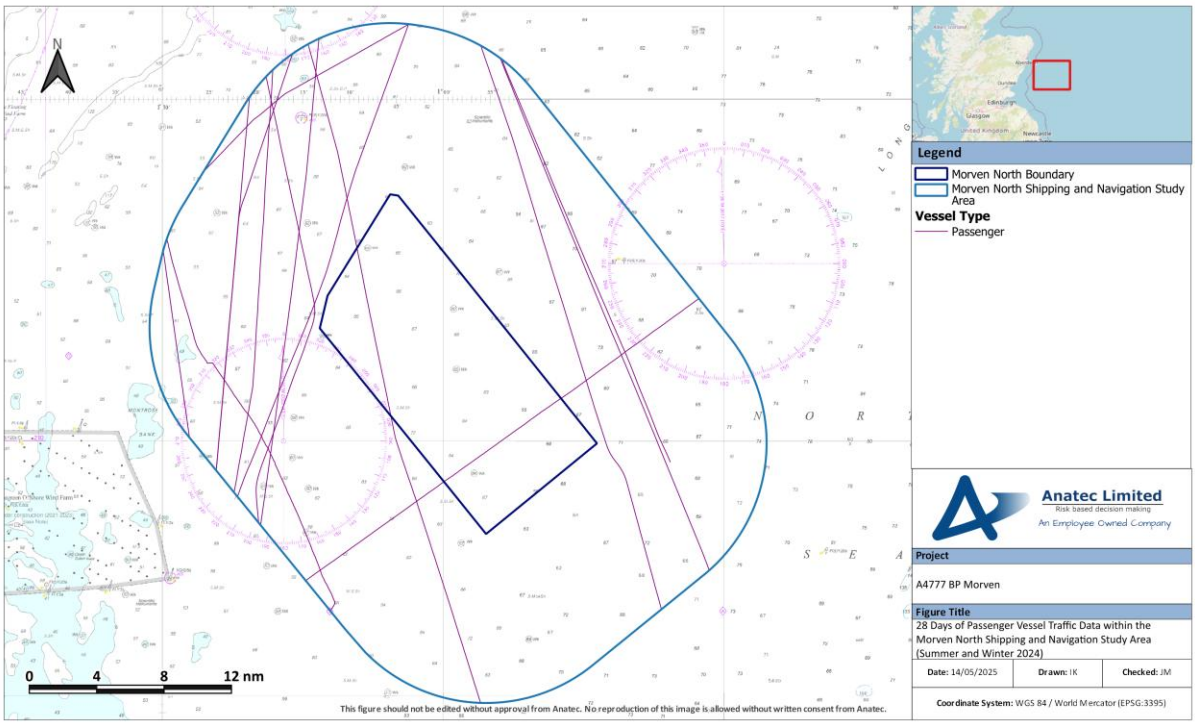


Figure 10.30: 28 days of passenger vessel traffic data within the Morven North Shipping and Navigation Study Area (summer and winter 2024)

10.2.3.23 During the summer survey period, an average of one passenger vessel per day was recorded within the Morven North Shipping and Navigation Study Area, with an average of one passenger vessel per week intersecting the Morven North Boundary. During the winter survey period, no passenger vessels were recorded within the Morven North Shipping and Navigation Study Area.

10.2.3.24 Passenger vessels were most commonly seen to the northwest of the Morven North Boundary, and were generally cruise liners with no RoPax vessels noted.

10.2.4 Vessel size

Vessel length

10.2.4.1 Vessel length information was available via the AIS broadcast for all vessels recorded throughout the summer and winter survey periods.

10.2.4.2 The vessel tracks recorded within the Morven North Shipping and Navigation Study Area during the survey periods are colour-coded by vessel length and presented in Figure 10.31. Following this, the distribution of these length classes is presented in Figure 10.32.

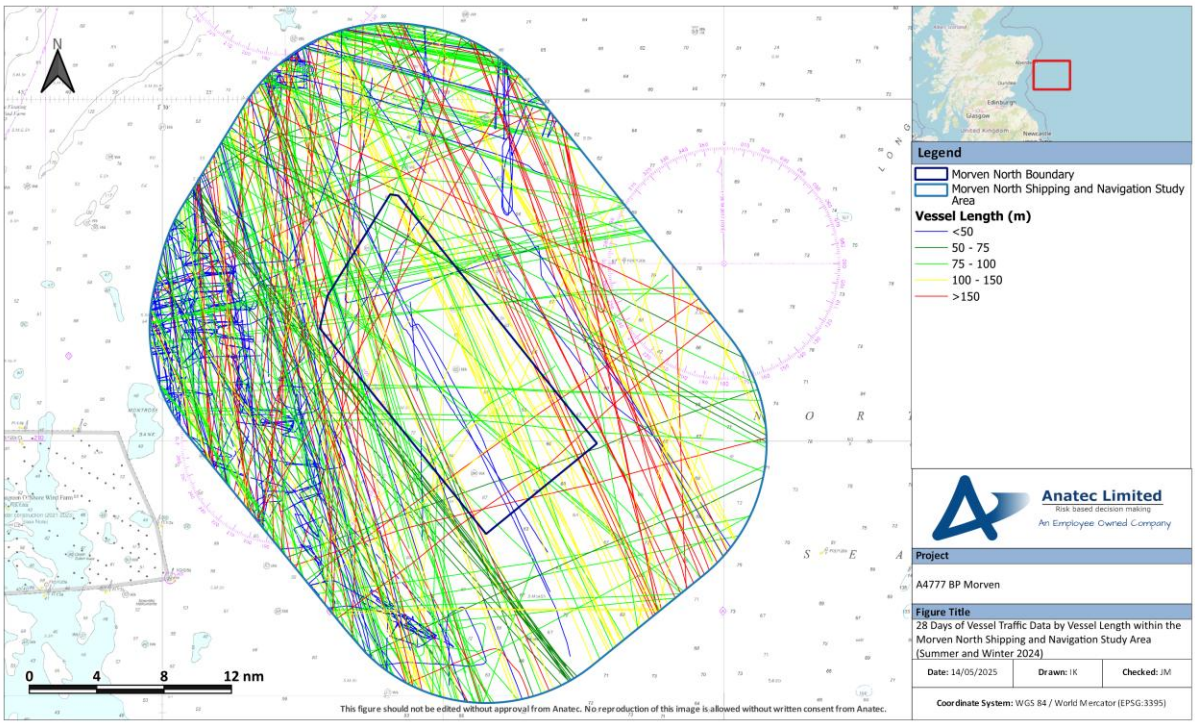


Figure 10.31: 28 days of vessel traffic data by vessel length within the Morven North Shipping and Navigation Study Area (summer and winter 2024)

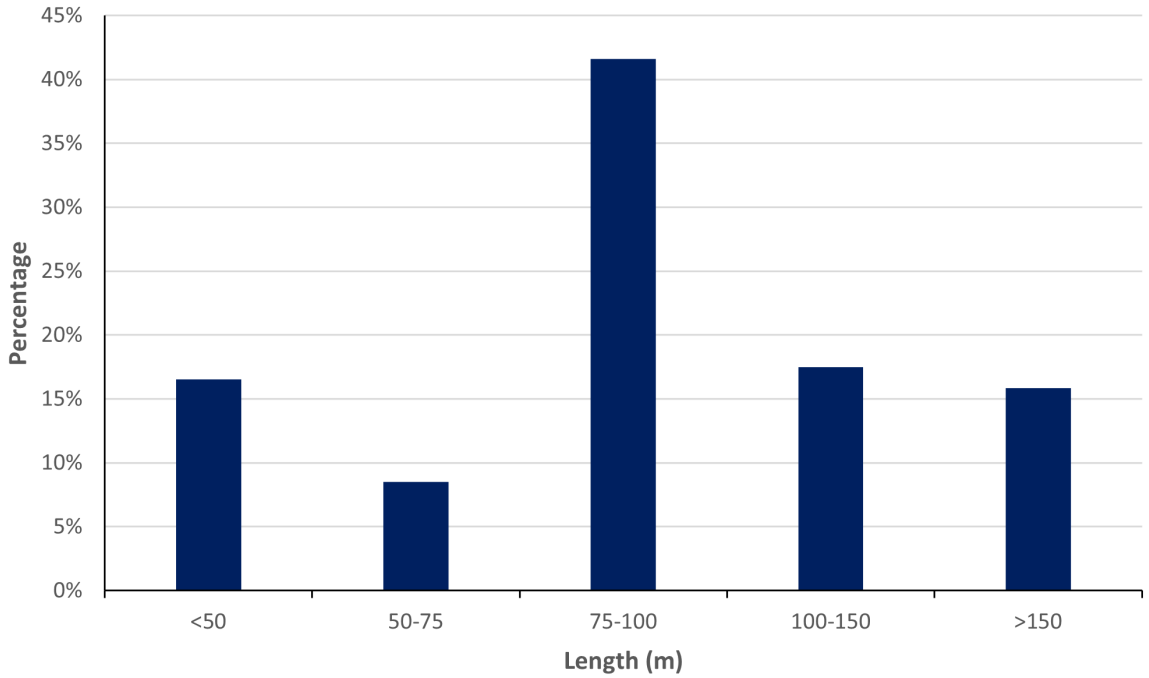


Figure 10.32: Vessel length distribution within the Morven North Shipping and Navigation Study Area (summer and winter 2024)

10.2.4.3 The average length of vessels within the Morven North Shipping and Navigation Study Area was 102m. Over the survey periods, vessel length ranged from 4m for a recreational vessel to 319m for a cruise liner.

Vessel draught

10.2.4.4 Vessel draught information was available via the AIS broadcast for 97% of all vessels recorded throughout the summer and winter survey periods.

10.2.4.5 The vessel tracks recorded within the Morven North Shipping and Navigation Study Area during the survey periods are colour-coded by vessel draught and presented in Figure 10.33. Following this, the distribution of these draught classes is presented in Figure 10.34.

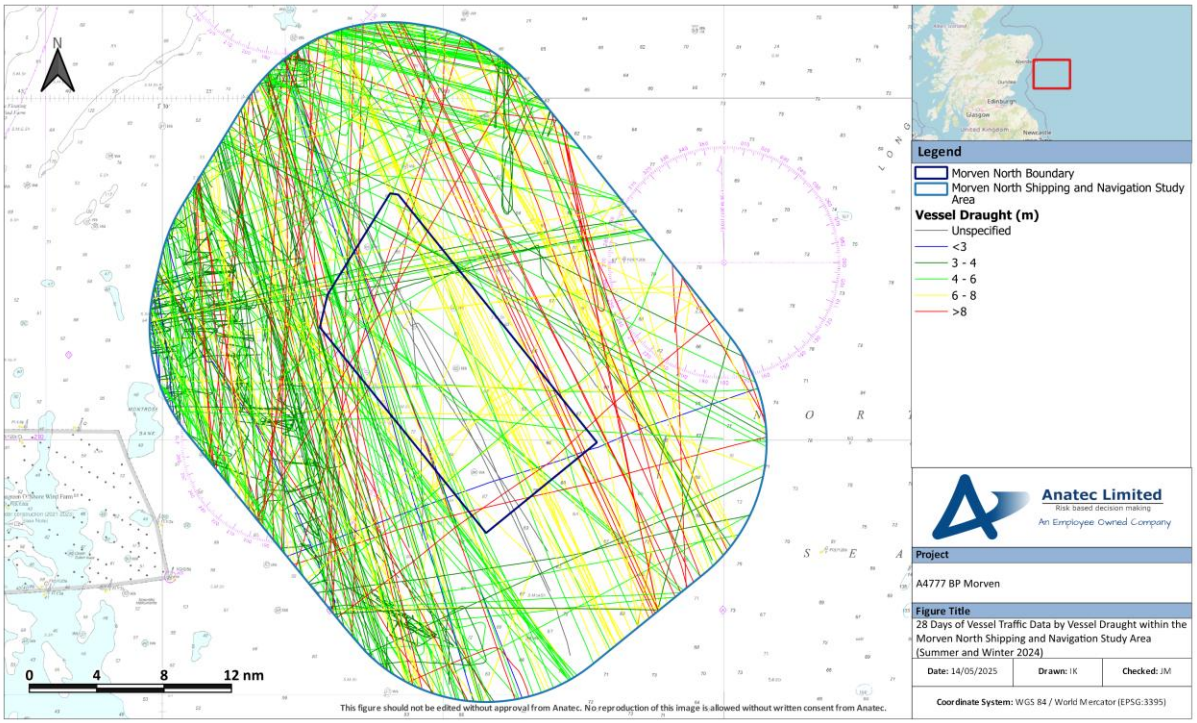


Figure 10.33: 28 days of vessel traffic data by vessel draught within the Morven North Shipping and Navigation Study Area (summer and winter 2024)

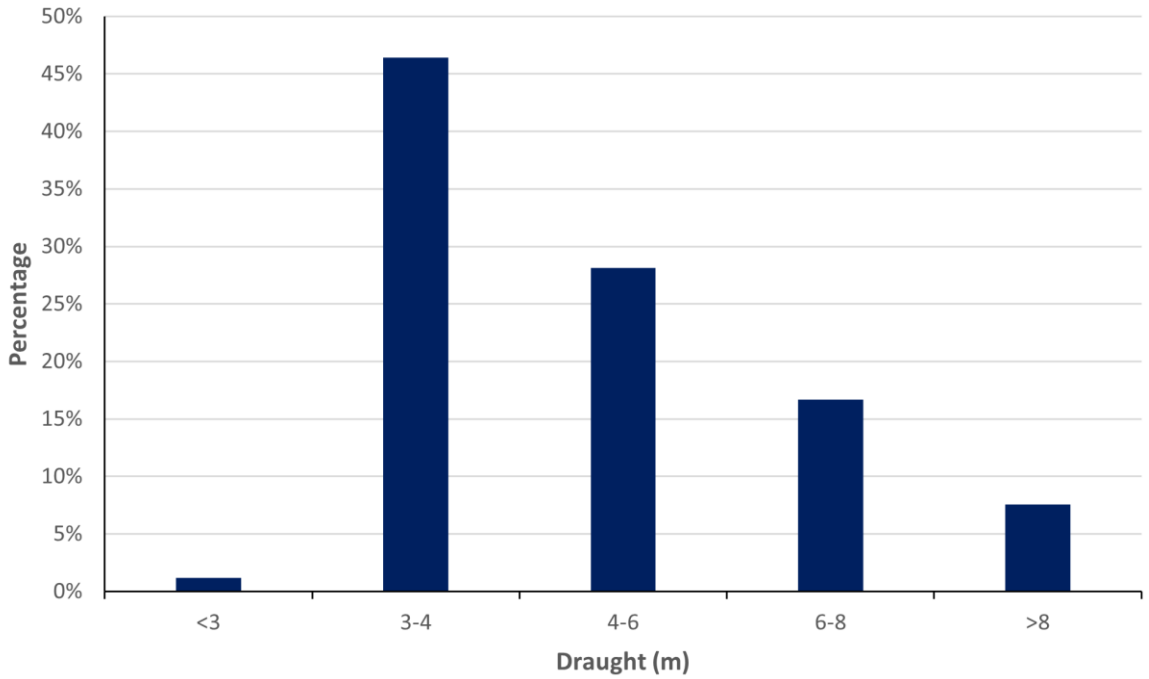


Figure 10.34: Vessel draught distribution within the Morven North Shipping and Navigation Study Area (summer and winter 2024)

10.2.4.6 Excluding the proportion of vessels for which draught was not available, the average draught of vessels within the Morven North Shipping and Navigation Study Area was 4.9m. Over the survey periods, vessel draught ranged from 2.2m for a tug to 13.8m for a bulk carrier.

10.2.5 Anchored vessels

10.2.5.1 Vessels were assessed for potential anchoring activity as per Section 10.1.5. After applying the criteria no vessels were deemed to be at anchor within the Morven North Shipping and Navigation Study Area during the survey periods.

10.3 Morven South in isolation

10.3.1.1 The vessel tracks recorded during the summer survey period within the Morven South Shipping and Navigation Study Area, excluding temporary traffic, are colour-coded by vessel type and presented in Figure 10.35. Following this, the same data converted to a density heat map is presented in Figure 10.36.

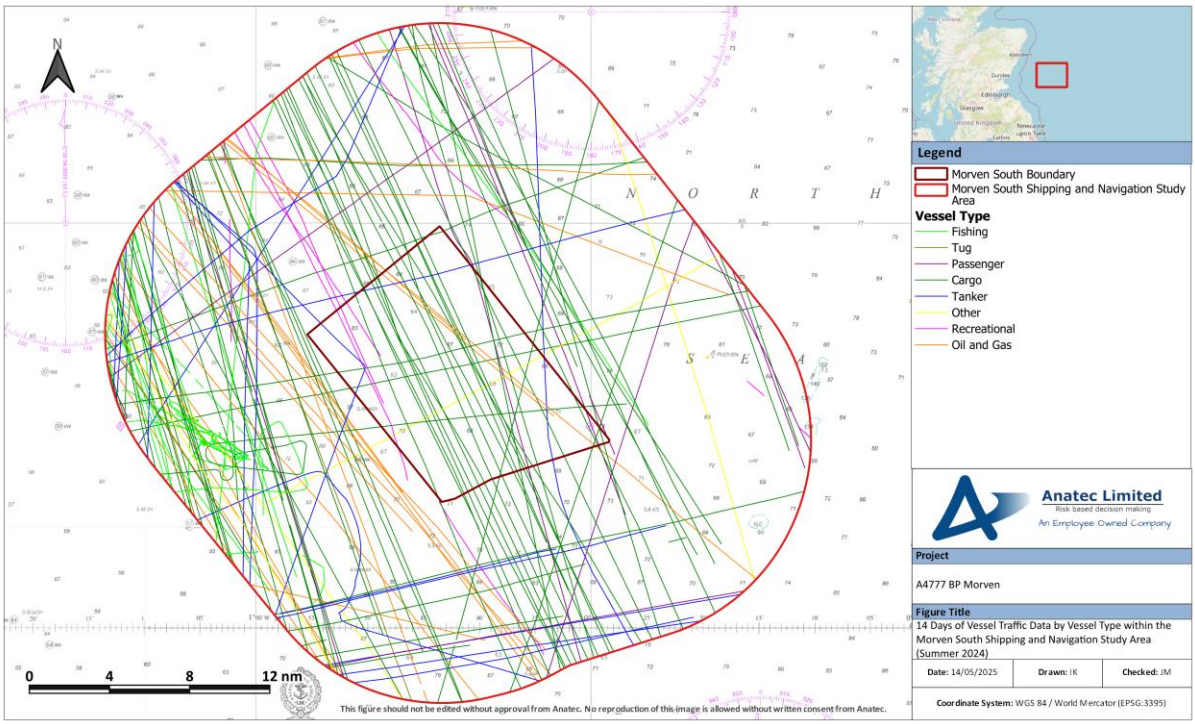


Figure 10.35: 14 days of vessel traffic data by vessel type within the Morven South Shipping and Navigation Study Area (summer 2024)

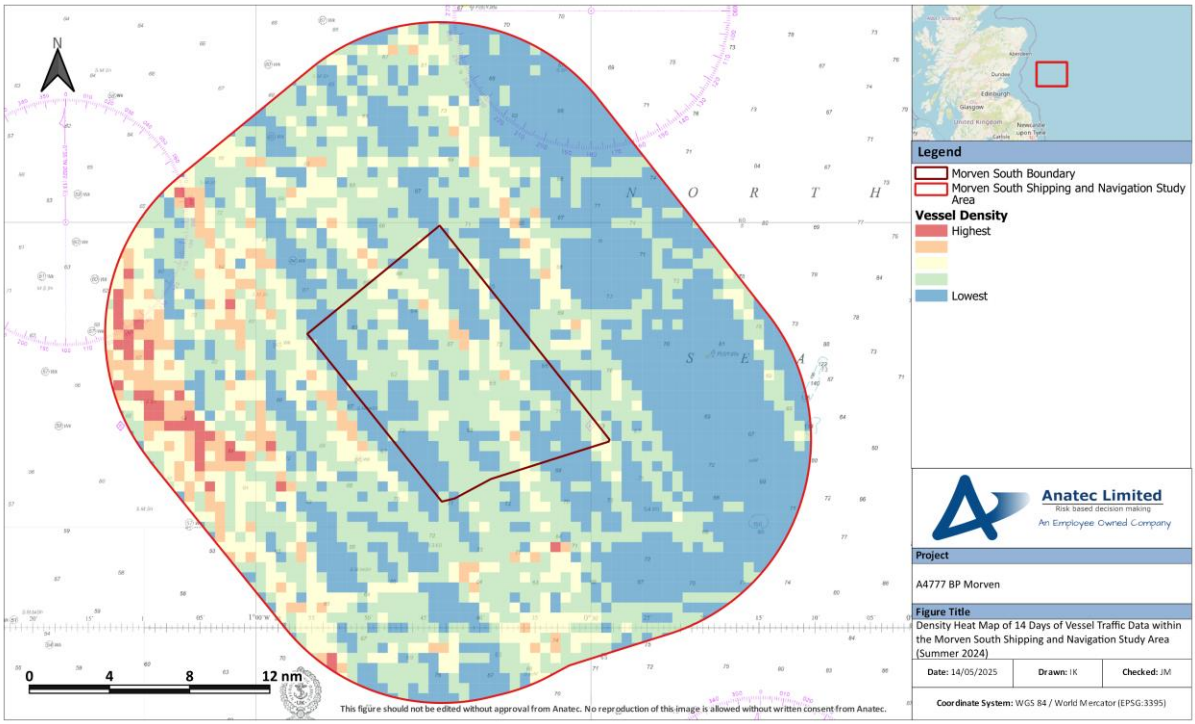


Figure 10.36: Density heat map of 14 days of vessel traffic data within the Morven South Shipping and Navigation Study Area (summer 2024)

10.3.1.2 The vessel tracks recorded during the winter survey period within the Morven South Shipping and Navigation Study Area, excluding temporary traffic, are colour-coded by vessel type and presented in Figure 10.37. Following this, the same data converted to a density heat map is presented in Figure 10.38. The density ranges used in the winter data are those of the summer data, to allow direct comparison.

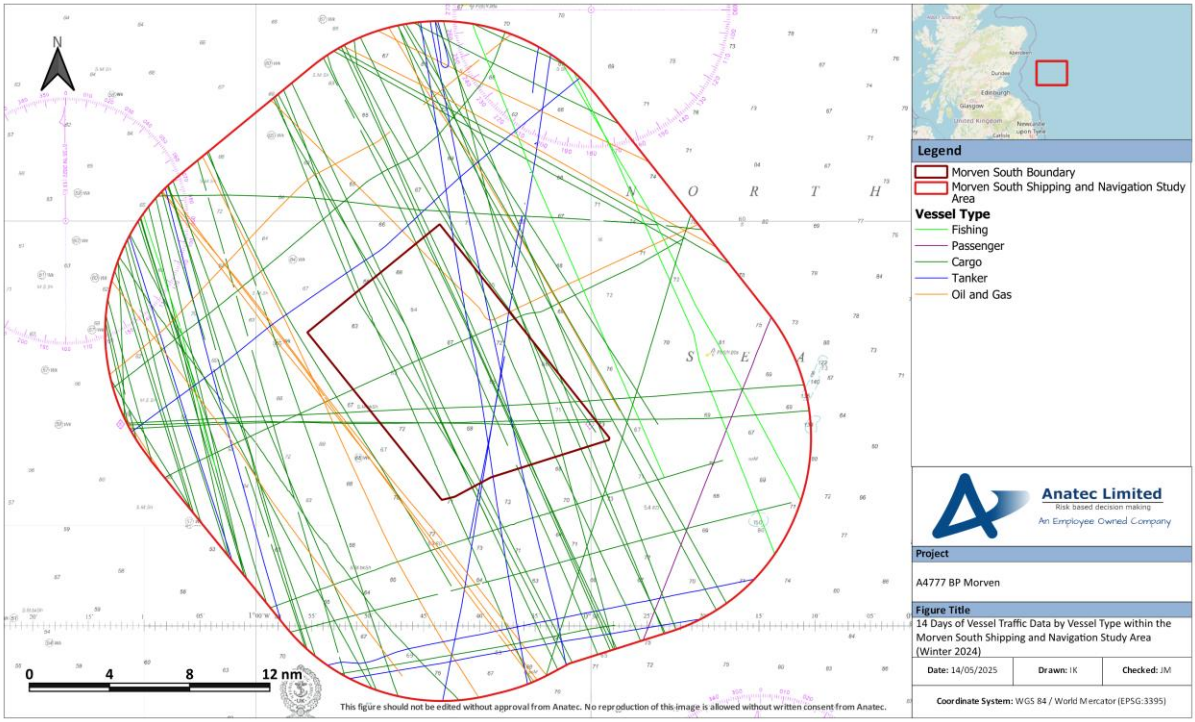


Figure 10.37: 14 days of vessel traffic data by vessel type within the Morven South Shipping and Navigation Study Area (winter 2024)

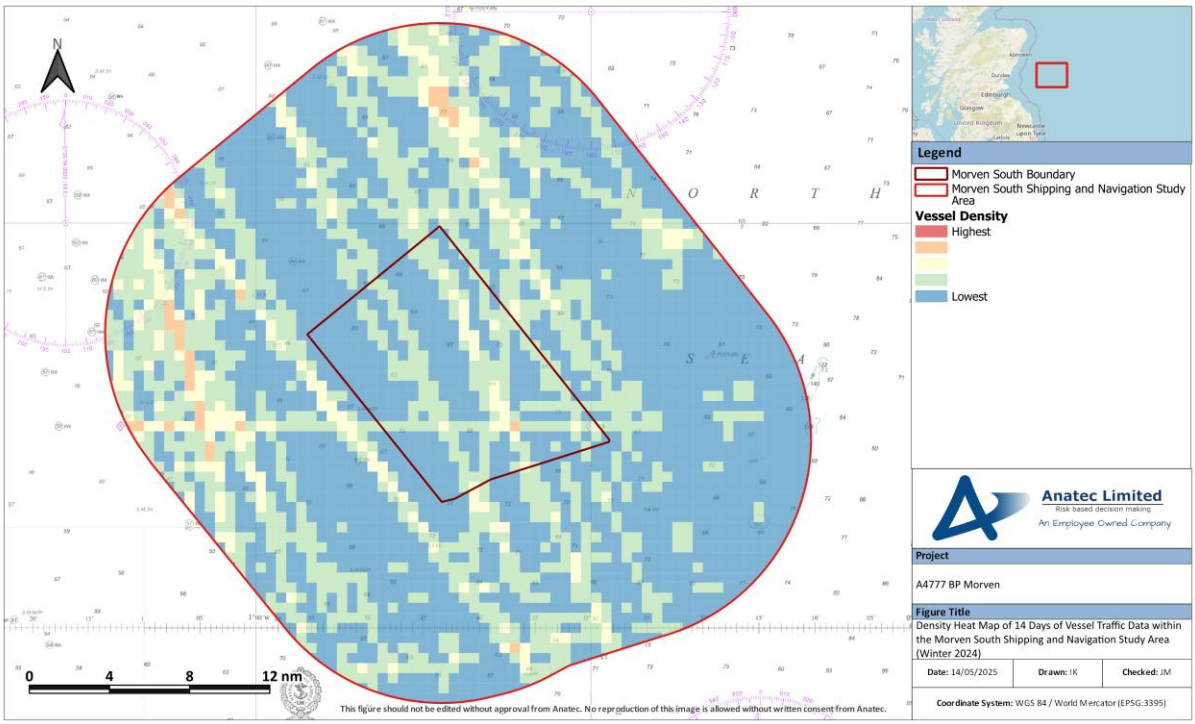


Figure 10.38 Density heat map of 14 days of vessel traffic data within the Morven South Shipping and Navigation Study Area (winter 2024)

10.3.2 Vessel count

10.3.2.1 The daily number of unique vessels recorded within the Morven South Shipping and Navigation Study Area, as well as intersecting the Morven South Boundary, during the summer survey period is presented in Figure 10.39. Throughout the summer survey period, approximately 25% of vessel traffic recorded within the Morven South Shipping and Navigation Study Area intersected the Morven South Boundary.

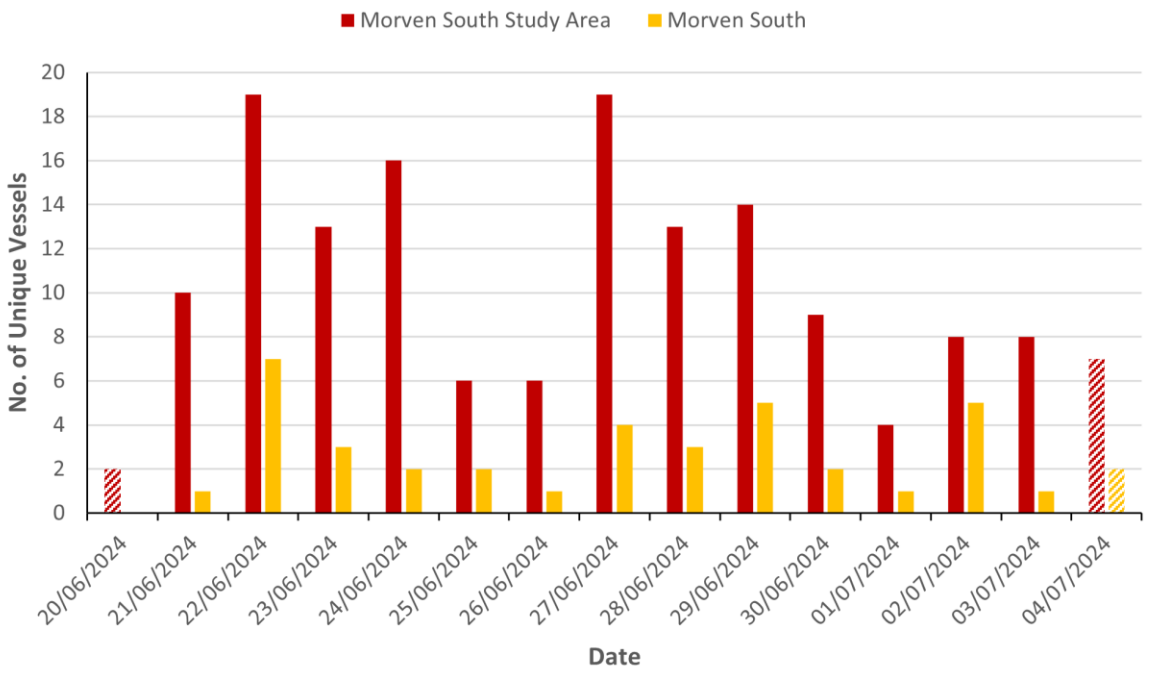


Figure 10.39: Unique vessels per day within the Morven South Shipping and Navigation Study Area (summer 2024)

10.3.2.2 There was an average of 11 unique vessels recorded per day within the Morven South Shipping and Navigation Study Area during the summer survey period. An average of three unique vessels per day intersected the Morven South Boundary itself.

10.3.2.3 The busiest day recorded within the Morven South Shipping and Navigation Study Area during the summer survey period was 22 June 2024, on which 19 unique vessels were recorded. The busiest day recorded within the Morven South Boundary itself during the summer survey period was also 22 June 2024, on which seven unique vessels were recorded.

10.3.2.4 The quietest full day recorded within the Morven South Shipping and Navigation Study Area during the summer survey period was 01 July 2024, on which four unique vessels were recorded. The quietest full days recorded within the Morven South Boundary itself during the summer survey period were 21 and 26 June 2024 and 01 and 03 July 2024, on which one unique vessel was recorded each.

10.3.2.5 The daily number of unique vessels recorded within the Morven South Shipping and Navigation Study Area, as well as intersecting the Morven South Boundary, during the winter survey period is presented in Figure 10.40. Throughout the winter survey period, approximately 27% of vessel traffic recorded within the Morven South Shipping and Navigation Study Area intersected the Morven South Boundary.

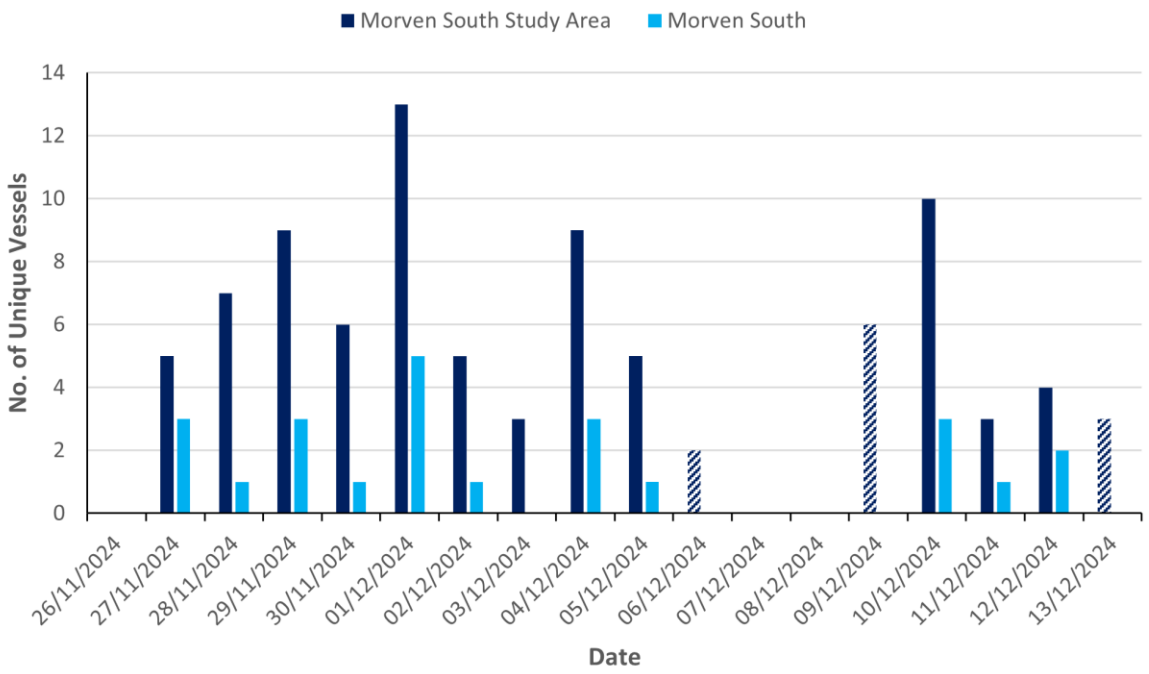


Figure 10.40: Unique vessels per day within the Morven South Shipping and Navigation Study Area (winter 2024)

10.3.2.6 There was an average of six to seven unique vessels recorded per day within the Morven South Shipping and Navigation Study Area during the winter survey period. An average of one to two unique vessels per day intersected the Morven South Boundary itself.

10.3.2.7 The busiest day recorded within the Morven South Shipping and Navigation Study Area during the winter survey period was 01 December 2024, on which 13 unique vessels were recorded. The busiest day recorded within the Morven South Boundary itself during the winter survey period was also 01 December 2024, on which five unique vessels were recorded.

10.3.2.8 The quietest full days recorded within the Morven South Shipping and Navigation Study Area during the winter survey period were 03 and 11 December 2024, on which three unique vessels were recorded each. The quietest full day recorded within the Morven South Boundary itself during the winter survey period was 03 December 2024, on which no vessels were recorded.

10.3.3 Vessel type

10.3.3.1 The distribution of the main vessel types recorded passing within the Morven South Shipping and Navigation Study Area and Morven South during the survey periods is presented in Figure 10.41.

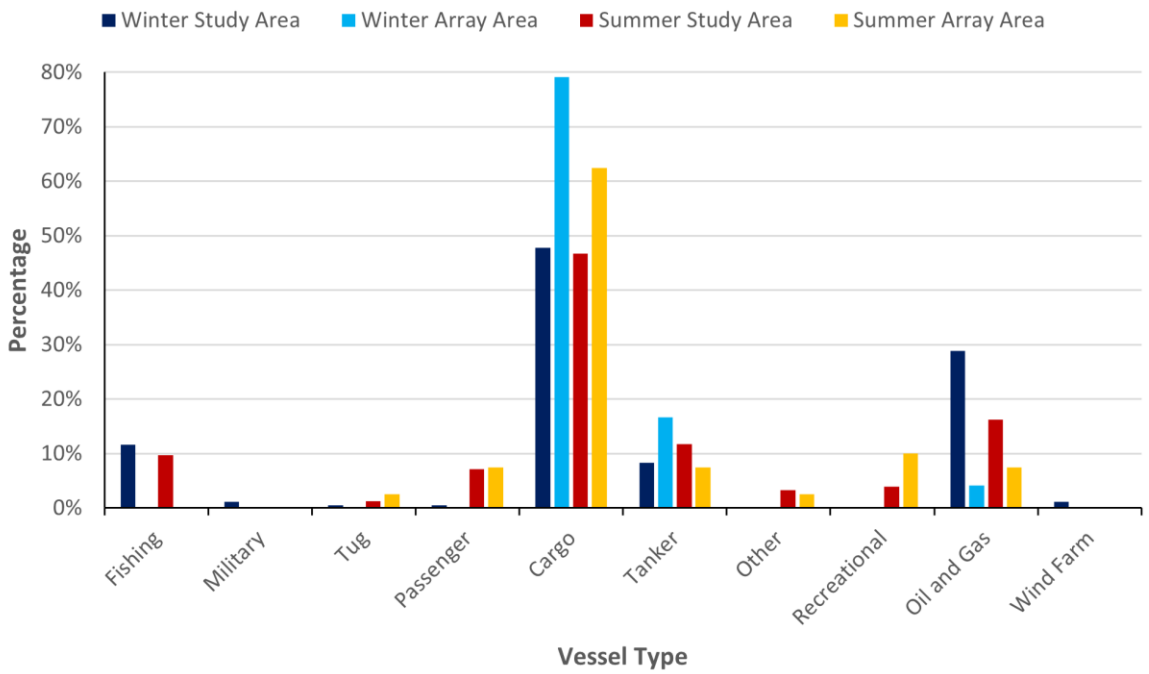


Figure 10.41: Vessel type distribution within the Morven South Shipping and Navigation Study Area (summer and winter 2024)

10.3.3.2 During the summer survey period, the main vessel types within the Morven South Shipping and Navigation Study Area were cargo vessels (47%), oil and gas vessels (16%) and tankers (12%). During the winter survey period, the main vessel types within the Morven South Shipping and Navigation Study Area were cargo vessels (48%), oil and gas vessels (29%) and fishing vessels (12%).

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

Cargo vessels

10.3.3.4 The cargo vessels recorded within the Morven South Shipping and Navigation Study Area during the survey periods are presented in Figure 10.42.

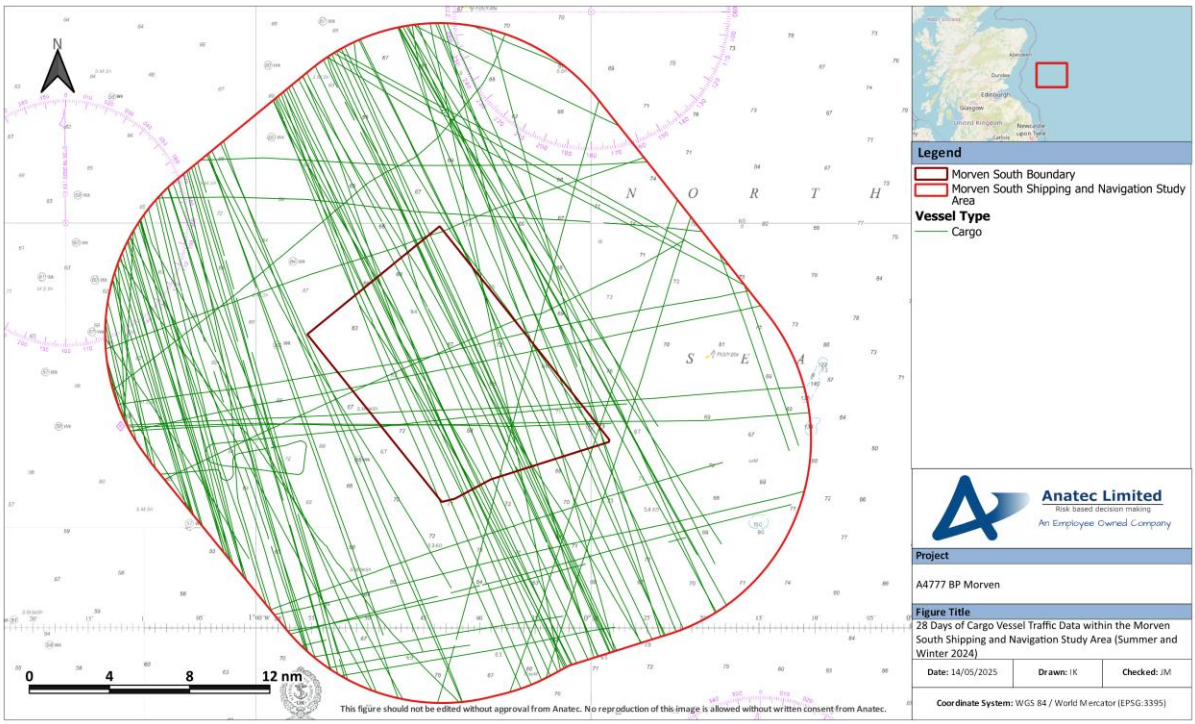


Figure 10.42: 28 days of cargo vessel traffic data within the Morven South Shipping and Navigation Study Area (summer and winter 2024)

10.3.3.5 During the summer survey period, an average of five cargo vessels per day were recorded within the Morven South Shipping and Navigation Study Area, with an average of two cargo vessels per day intersecting the Morven South Boundary. During the winter survey period, an average of six cargo vessels per day were recorded within the Morven South Shipping and Navigation Study Area, with an average of one to two cargo vessels per day intersecting the Morven South Boundary.

10.3.3.6 The majority of cargo vessels were seen transiting on a north-south bearing, with some also noted travelling east-west. Common destinations included ports within the Humber such as Immingham and Grimsby, Icelandic ports such as Reykjavik and Þorlákshöfn, and Rotterdam the Netherlands.

10.3.3.7 The majority of cargo vessels were 'general cargo' (56%), with container vessels (17%) and bulk carriers (11%) also commonly recorded. A RoRo vessel operated by Smyril Line was recorded undergoing regular transits between Þorlákshöfn and Rotterdam once every two days in the summer period only, within the Morven South Shipping and Navigation Study Area.

Oil and gas vessels

10.3.3.8 The oil and gas vessels recorded within the Morven South Shipping and Navigation Study Area during the survey periods are presented in Figure 10.43.

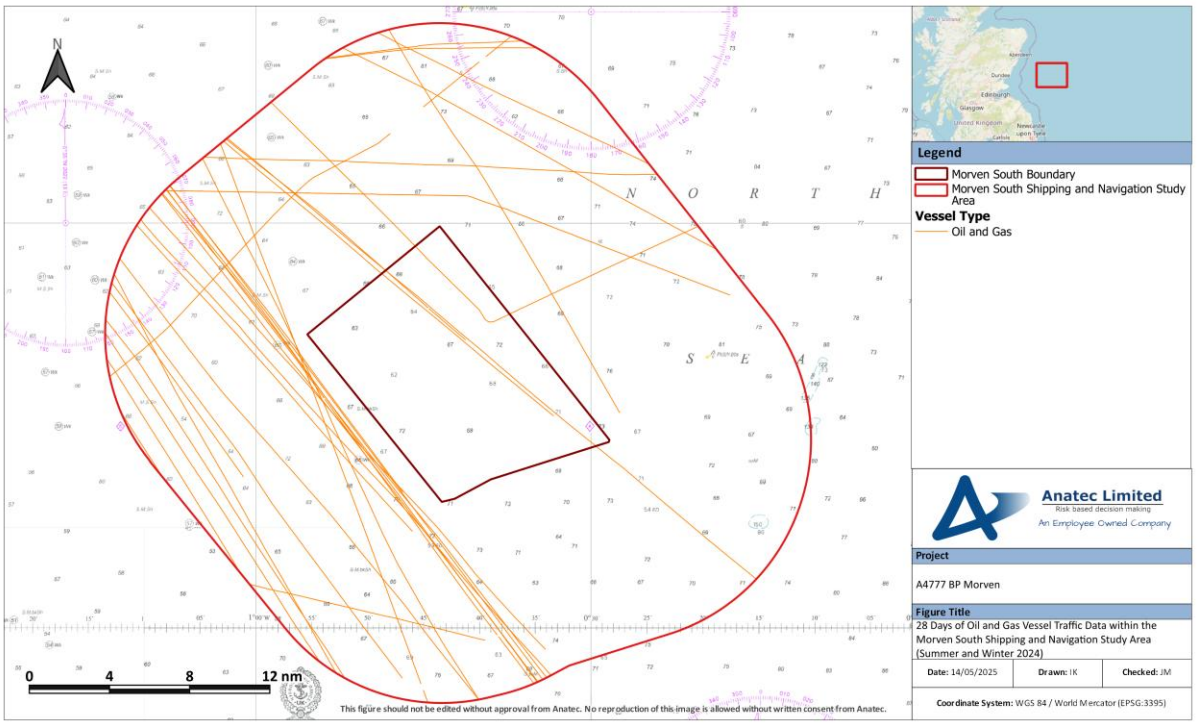


Figure 10.43: 28 days of oil and gas vessel traffic data within the Morven South Shipping and Navigation Study Area (summer and winter 2024)

10.3.3.9 During the summer survey period, an average of two oil and gas vessels per day were recorded within the Morven South Shipping and Navigation Study Area, with an average of one oil and gas vessel every five days intersecting the Morven South Boundary. During the winter survey period, an average of three to four oil and gas vessels per day were recorded within the Morven South Shipping and Navigation Study Area, with a total of one oil and gas vessel intersecting the Morven South Boundary.

10.3.3.10 The majority of oil and gas vessels were seen routeing on northwest-southeast through the west of the Morven South Shipping and Navigation Study Area, between Aberdeen (UK) and primarily the Cygnus field. Although no rig movements were recorded within the vessel traffic data, it was noted in consultation (see Section 4) these may increase in the vicinity due to reactivation works, with rigs prevalent around the Port of Dundee.

Fishing vessels

10.3.3.11 The fishing vessels recorded within the Morven South Shipping and Navigation Study Area during the survey periods are presented in Figure 10.44.

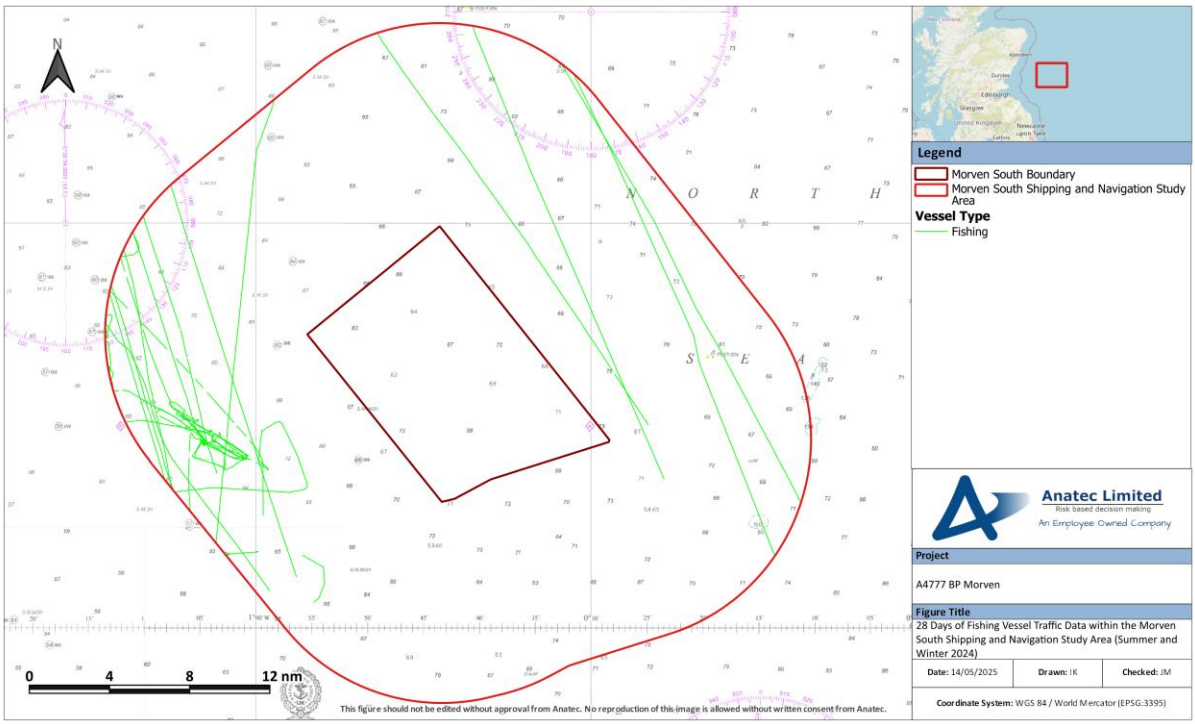


Figure 10.44: 28 days of fishing vessel traffic data within the Morven South Shipping and Navigation Study Area (summer and winter 2024)

10.3.3.12 During the summer survey period, an average of one fishing vessel per day was recorded within the Morven South Shipping and Navigation Study Area, with no fishing vessels intersecting the Morven South Boundary. During the winter survey period, an average of one to two fishing vessels per day were recorded within the Morven South Shipping and Navigation Study Area, with again no fishing vessels recorded intersecting the Morven South Boundary.

10.3.3.13 The majority of fishing vessels were recorded inshore of the Morven South Boundary. Overall, the majority of fishing vessels were potters (35%) and demersal trawlers (30%), with pelagic trawlers (20%) also frequently noted.

10.3.3.14 In the summer survey period, the majority of activity was from a single potter to the west of the Morven South Boundary. Based on average speeds, track behaviour and information broadcast via AIS, this appeared to be engaged in active fishing throughout. There were no vessels recorded as likely to be actively fishing in the Morven South Shipping and Navigation Study Area during the winter survey period.

Recreational vessels

10.3.3.15 The recreational vessels recorded within the Morven South Shipping and Navigation Study Area during the survey periods are presented in Figure 10.45.

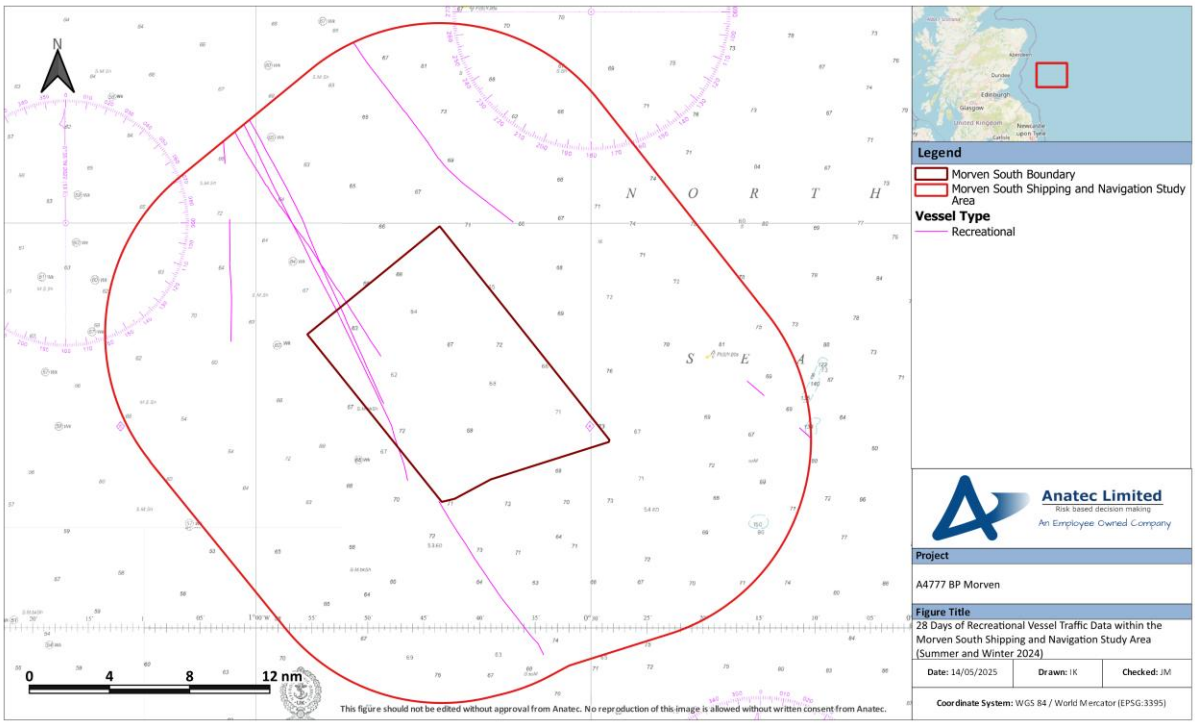


Figure 10.45: 28 days of recreational vessel traffic data within the Morven South Shipping and Navigation Study Area (summer and winter 2024)

10.3.3.16 During the summer survey period, an average of one recreational vessel every two to three days was recorded within the Morven South Shipping and Navigation Study Area, with an average of one recreational vessel every three to four days intersecting the Morven South Boundary. No recreational vessels were recorded within the Morven South Shipping and Navigation Study Area during the winter survey period.

10.3.3.17 The majority of recreational vessels were recorded transiting northwest-southeast following the coast but activity was generally sparse given the distance offshore.

Tankers

10.3.3.18 The tankers recorded within the Morven South Shipping and Navigation Study Area during the survey periods are presented in Figure 10.46.

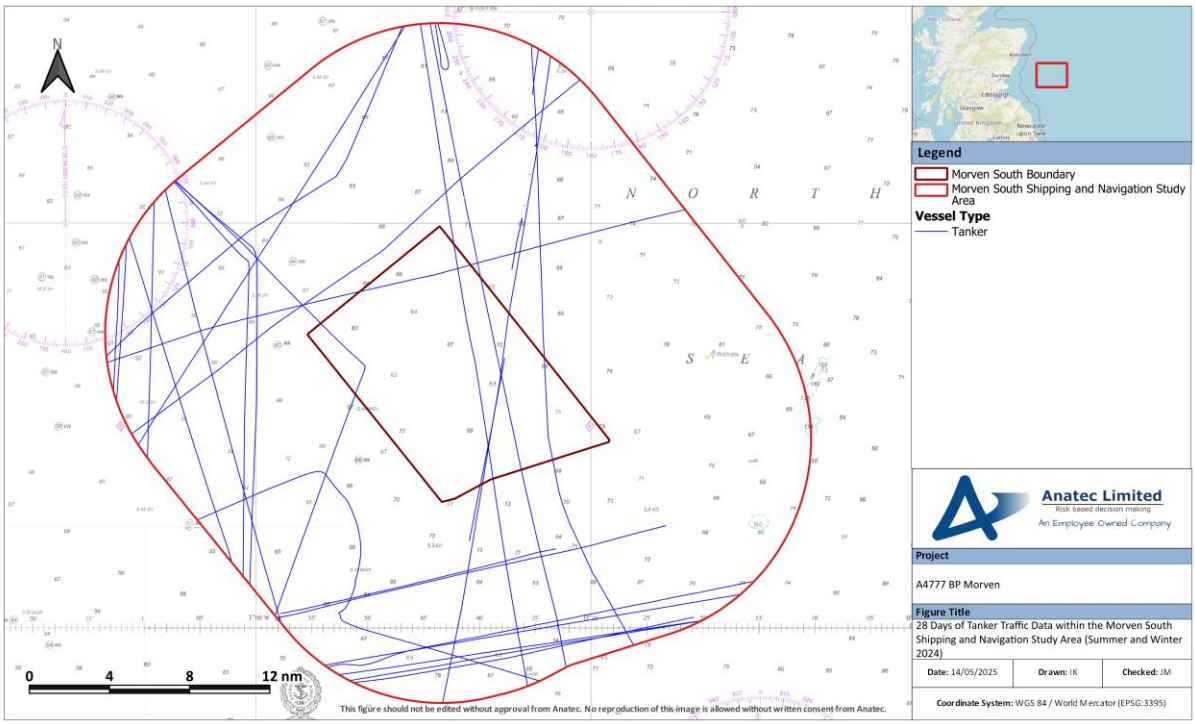


Figure 10.46: 28 days of tanker traffic data within the Morven South Shipping and Navigation Study Area (summer and winter 2024)

10.3.3.19 During the summer survey period, an average of one tanker per day was recorded within the Morven South Shipping and Navigation Study Area, with an average of one tanker every five days intersecting the Morven South Boundary. During the winter survey period, an average of one tanker per day was recorded within the Morven South Shipping and Navigation Study Area, with an average of one tanker every three to four days intersecting the Morven South Boundary.

10.3.3.20 The most commonly-recorded tanker subtype within the survey periods were oil/chemical tankers (43%), with oil product tankers (20%) and LPG tankers (14%) also frequently noted.

10.3.3.21 Tankers were recorded transiting on northwest-southeast and east-west courses. Destinations including UK ports such as Aberdeen, Grangemouth and Sullom Voe.

Passenger vessels

10.3.3.22 The passenger vessels recorded within the Morven South Shipping and Navigation Study Area during the survey periods are presented in Figure 10.47.

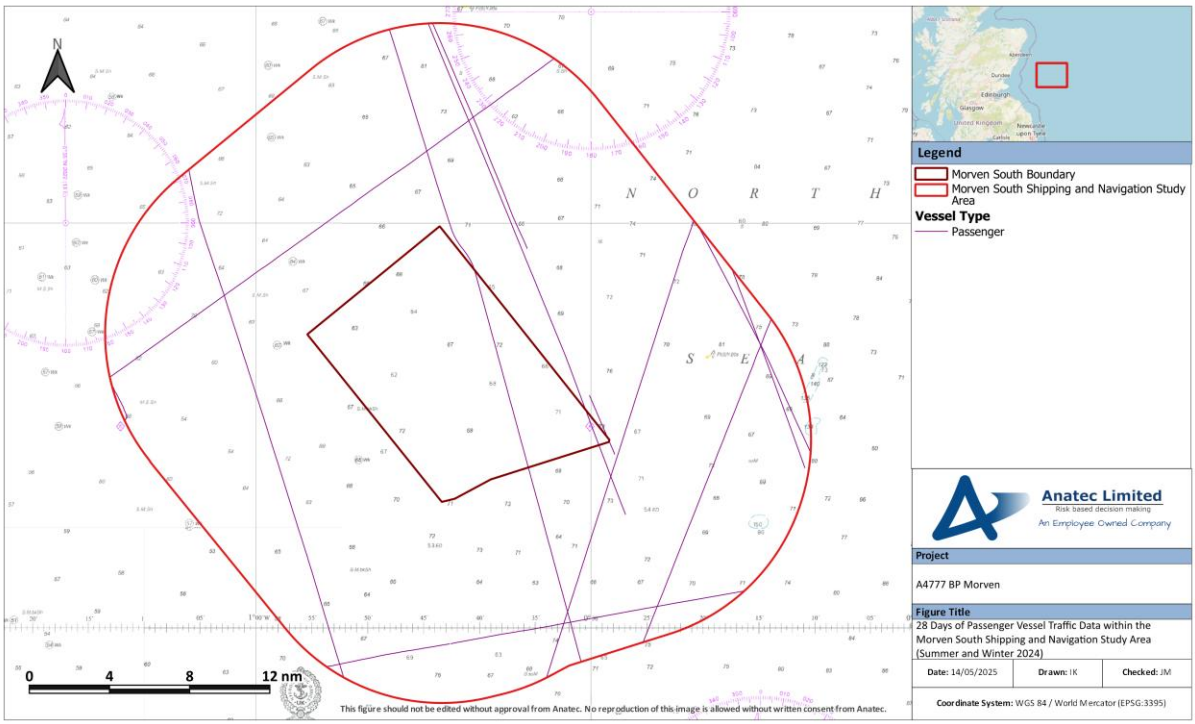


Figure 10.47: 28 days of passenger vessel traffic data within the Morven South Shipping and Navigation Study Area (Summer and Winter 2024)

10.3.3.23 During the summer survey period, an average of one passenger vessel per day was recorded within the Morven South Shipping and Navigation Study Area, with an average of one passenger vessel every four to five days intersecting the Morven South Boundary. During the winter survey period, a total of one passenger vessel was recorded within the Morven South Shipping and Navigation Study Area, with none intersecting the Morven South Boundary.

10.3.3.24 All passenger vessels recorded were cruise liners.

10.3.4 Vessel size

Vessel length

10.3.4.1 Vessel length information was available via the AIS broadcast for all vessels recorded throughout the summer and winter survey periods.

10.3.4.2 The vessel tracks recorded within the Morven South Shipping and Navigation Study Area during the survey periods are colour-coded by vessel length and presented in Figure 10.48. Following this, the distribution of these length classes is presented in Figure 10.49.

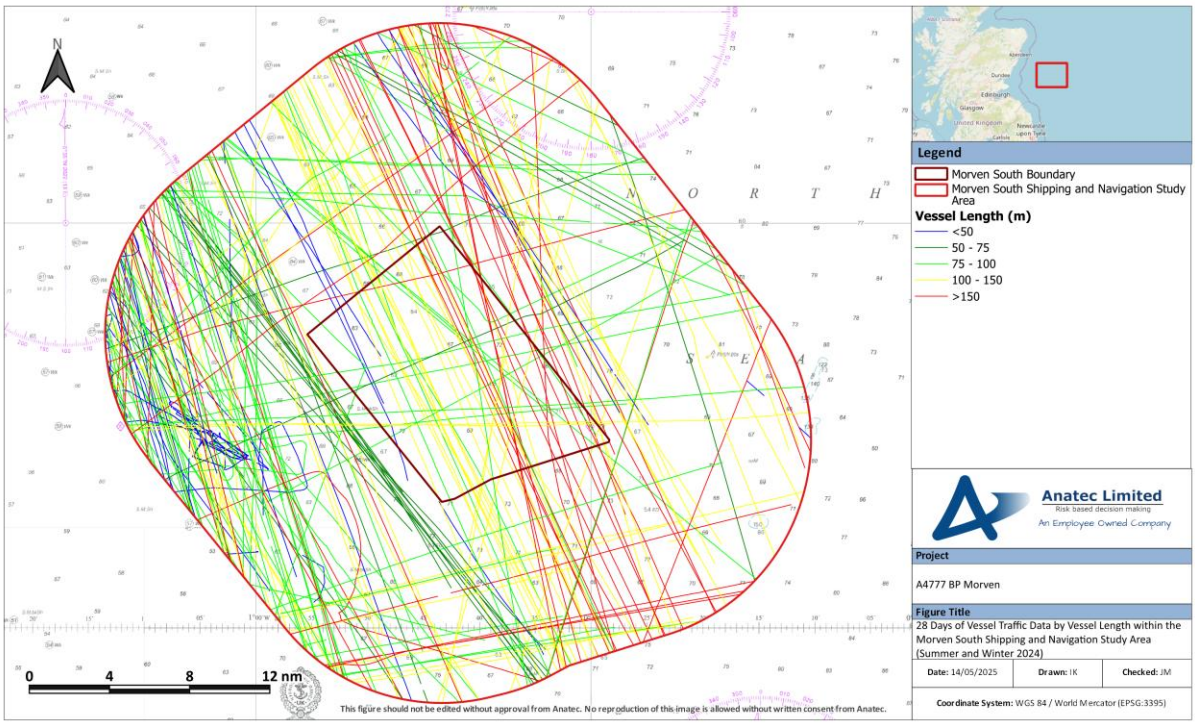


Figure 10.48: 28 days of vessel traffic data by vessel length within the Morven South Shipping and Navigation Study Area (summer and winter 2024)

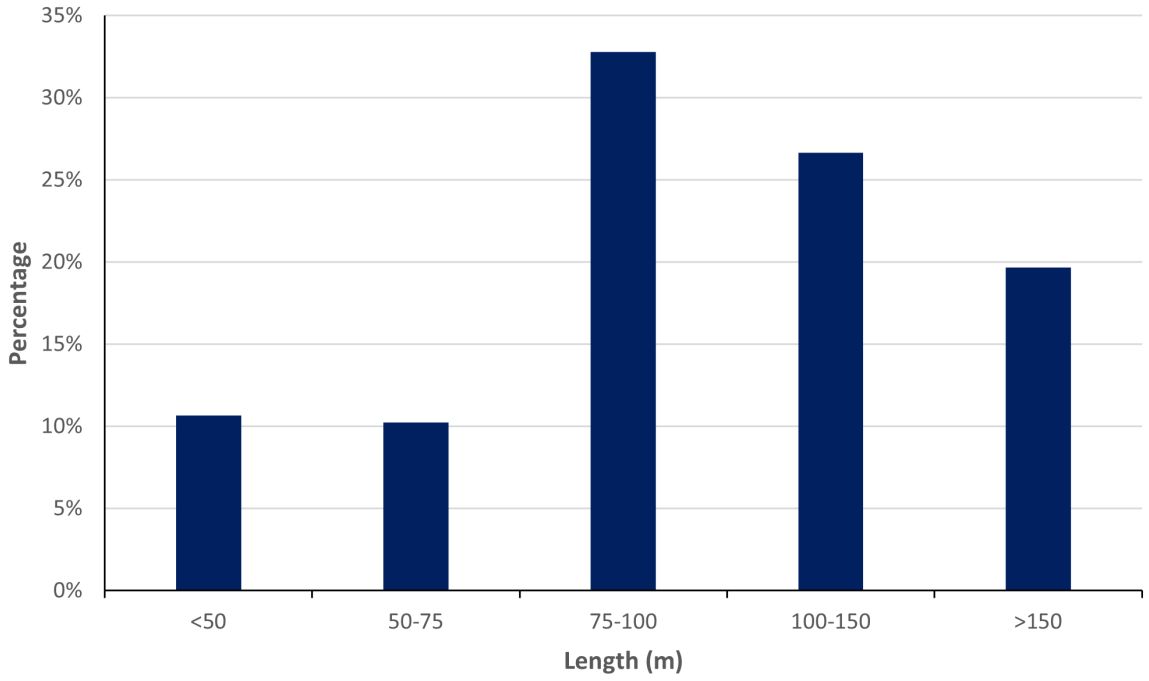


Figure 10.49: Vessel length distribution within the Morven South Shipping and Navigation Study Area (summer and winter 2024)

10.3.4.3 The average length of vessels within the Morven South Shipping and Navigation Study Area was 112m. Over the survey periods, vessel length ranged from 11m for a sailing vessel to 294m for a container vessel and a cruise liner.

Vessel draught

10.3.4.4 Vessel draught information was available via the AIS broadcast for 95% of all vessels recorded throughout the summer and winter survey periods.

10.3.4.5 The vessel tracks recorded within the Morven South Shipping and Navigation Study Area during the survey periods are colour-coded by vessel draught and presented in Figure 10.50. Following this, the distribution of these draught classes is presented in Figure 10.51.

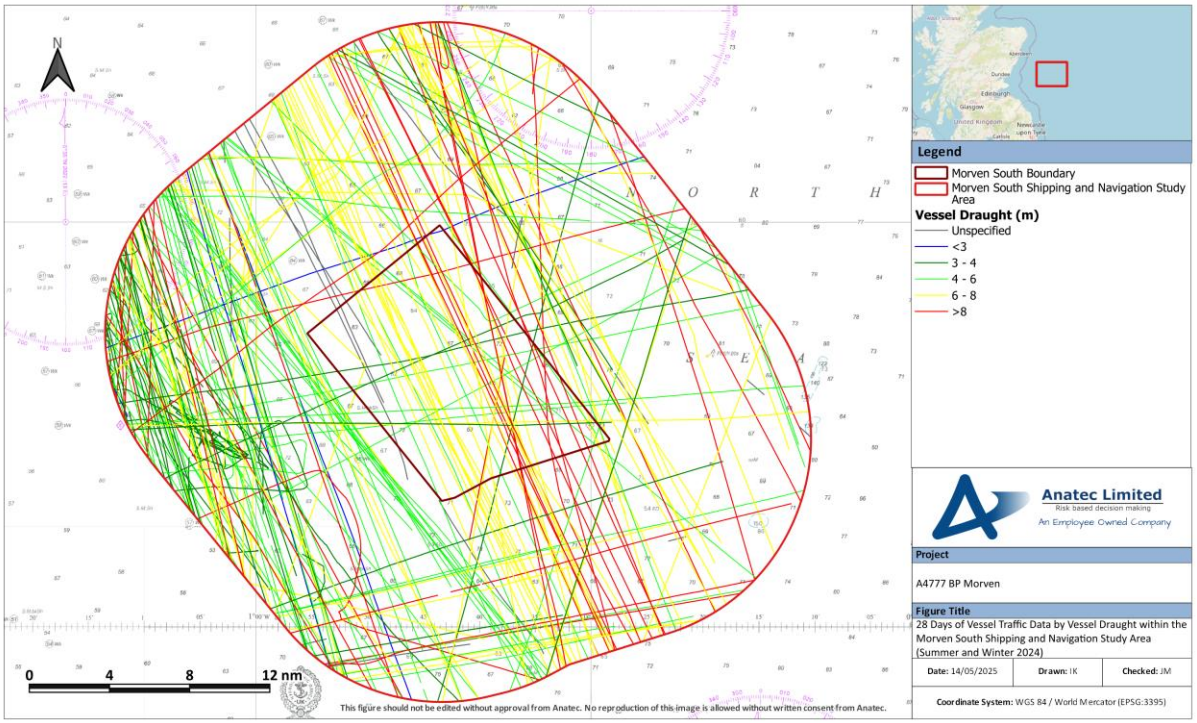


Figure 10.50: 28 days of vessel traffic data by vessel draught within the Morven South Shipping and Navigation Study Area (summer and winter 2024)

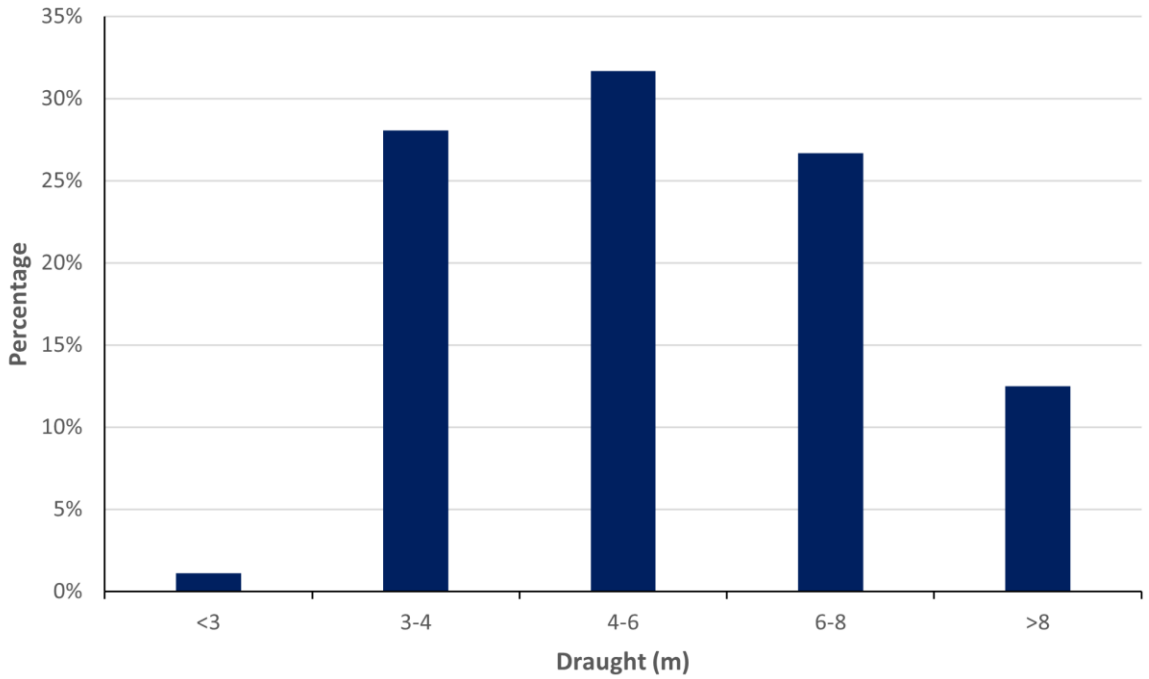


Figure 10.51: Vessel draught distribution within the Morven South Shipping and Navigation Study Area (summer and winter 2024)

10.3.4.6 Excluding the proportion of vessels for which draught was not available, the average draught of vessels within the Morven South Shipping and Navigation Study Area was 5.6m. Over the survey periods, vessel draught ranged from 2.4m for a general cargo vessel to 13.8m for a bulk carrier.

10.3.5 Anchored vessels

10.3.5.1 Vessels were assessed for potential anchoring activity as per Section 10.1.5. After applying the criteria no vessels were deemed to be at anchor within the Morven South Shipping and Navigation Study Area during the survey periods.

11 Base case vessel routeing

11.1 Definition of a main commercial route

11.1.1.1 Main commercial routes have been identified using the principles set out in MGN 654 (MCA, 2021). Vessel traffic data is assessed and vessels transiting at similar headings and locations are identified as a main route. To help identify main routes, vessel traffic data is also 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 mean position of the potential shipping route as shown in Figure 11.1.

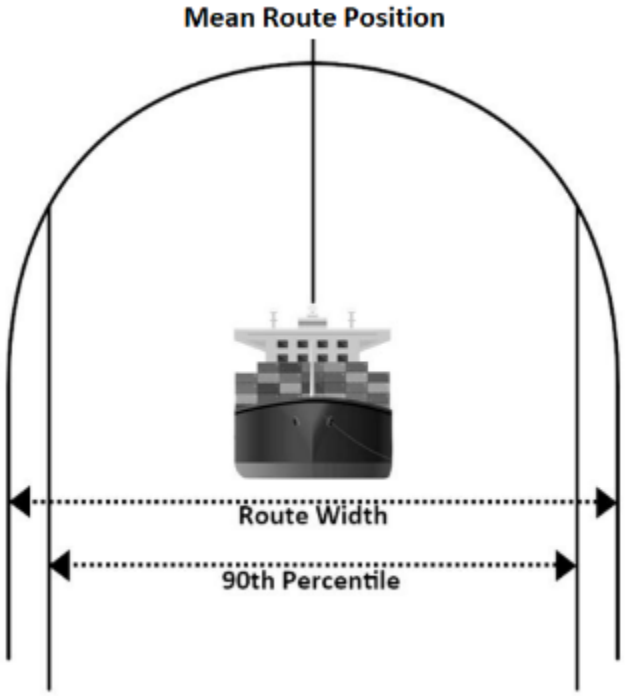


Figure 11.1: Illustration of a main route calculation

11.2 Pre-wind farm main commercial routes

11.2.1 Concurrent development scenario

11.2.1.1 A total of 17 main commercial routes within the Regional Shipping and Navigation Study Area were identified from the vessel traffic survey data, in combination with Anatec's ShipRoutes database. These main commercial routes and corresponding 90th percentiles within the Regional Shipping and Navigation Study Area are shown relative to the Morven Site in Figure 11.2. Following this, a description

of each route is provided in Table 11.1, including the average number of vessels per day, start and end locations, main vessel types and details of commercial ferry routeing (where applicable). It is noted that the start and end locations are based on the most common destinations transmitted via AIS by vessels on these routes.

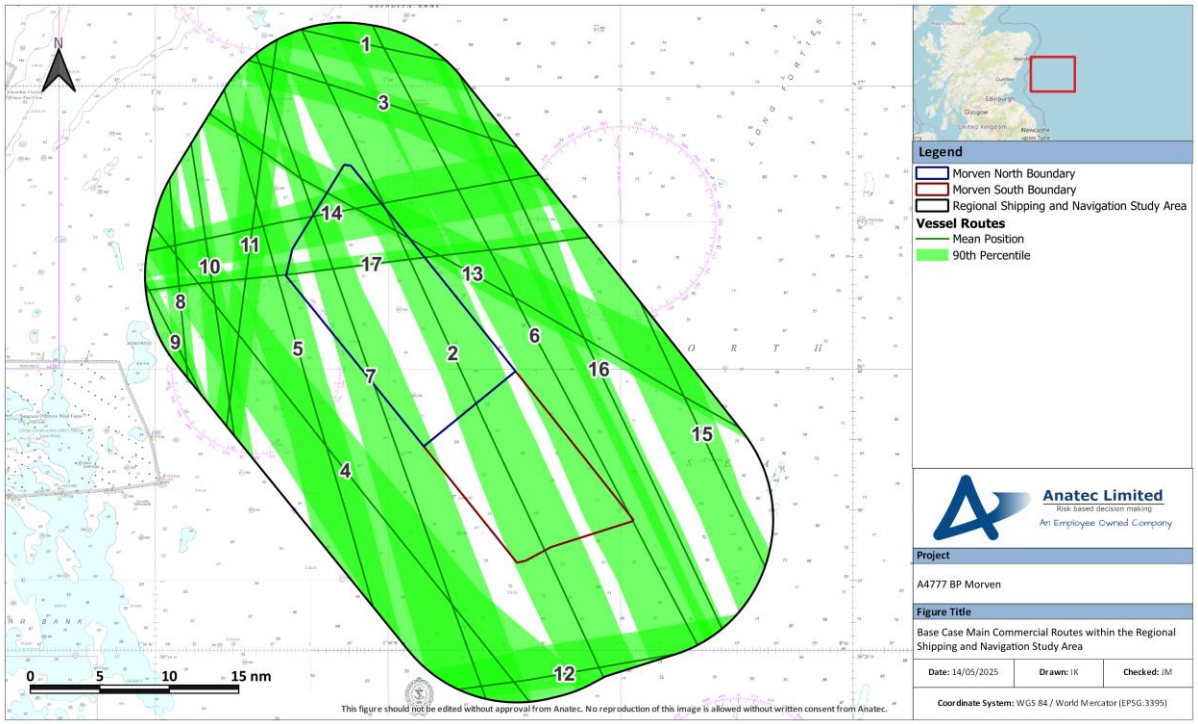


Figure 11.2: Base case main commercial routes within the Regional Shipping and Navigation Study Area

Table 11.1: Description of main commercial routes

Route Number	Average Vessels per Day	Average Vessels per Week	Description
1	2-3	16	Aberdeen – Catcher field. Comprised almost entirely of oil and gas vessels (96%).
2	1-2	10	Icelandic ports – Rotterdam. Comprised mainly of cargo vessels (90%). Includes the RoRo route operated by Smyril Line between Þorlákshöfn and Rotterdam.
3	1	7	Aberdeen – Fulmar field. Comprised mainly of oil and gas vessels (86%).
4	1	5-6	Aberdeen – Cygnus field. Comprised mainly of oil and gas vessels (76%) and cargo vessels (20%).

Route Number	Average Vessels per Day	Average Vessels per Week	Description
5	1	5-6	Reykjavik – Immingham. Comprised mainly of cargo vessels (86%) and tankers (12%).
6	1	5-6	Icelandic ports – Rotterdam. Comprised mainly of cargo vessels (77%), tankers (11%) and oil and gas vessels (10%).
7	0-1	4	Moray Firth (UK) – Rotterdam. Comprised mainly of cargo vessels (78%) and oil and gas vessels (16%).
8	0-1	2-3	Reykjavik – Rotterdam. Comprised mainly of cargo vessels (86%).
9	0-1	2-3	Aberdeen – Breagh field. Comprised of cargo vessels (45%), oil and gas vessels (39%) and tankers (17%).
10	0-1	2	Glensanda (UK) – Redcar (UK). Comprised mainly of cargo vessels (70%), tankers (13%) and oil and gas vessels (12%).
11	0-1	2	Marcus Hook (US) – Grangemouth. Comprised mainly of tankers (73%) and passenger vessels (20%).
12	0-1	2	Firth of Forth ports – Norwegian ports. Comprised mainly of tankers (64%), cargo vessels (21%) and passenger vessels (15%).
13	0-1	1-2	Aberdeen – Bremen (Germany). Comprised mainly of cargo vessels (65%) and tankers (17%).
14	0-1	1-2	Montrose – Swedish ports. Comprised of cargo vessels (75%) and oil and gas vessels (25%).
15	0-1	1-2	Icelandic ports – Rotterdam. Comprised mainly of cargo vessels (64%) and tankers (26%).
16	0-1	1	Glensanda – Amsterdam (Netherlands). Comprised mainly of cargo vessels (81%) and tankers (12%).
17	0-1	1	Montrose – Elgin field. Comprised of oil and gas vessels (85%) and cargo vessels (15%).

11.2.2 Morven North in isolation scenario

11.2.2.1 A total of 16 main commercial routes within the Morven North Shipping and Navigation Study Area were identified from the vessel traffic survey data, in combination with Anatec's ShipRoutes database. These main commercial routes and corresponding 90th percentiles within the Morven North Shipping and Navigation Study Area are shown relative to Morven North in Figure 11.3. Following this, a description of each route is provided in Table 11.2, including the average number of vessels per day, start and end locations, main vessel types and details of commercial ferry routeing (where applicable). It is noted that the start and end locations are based on the most common destinations transmitted via AIS by vessels on these routes.

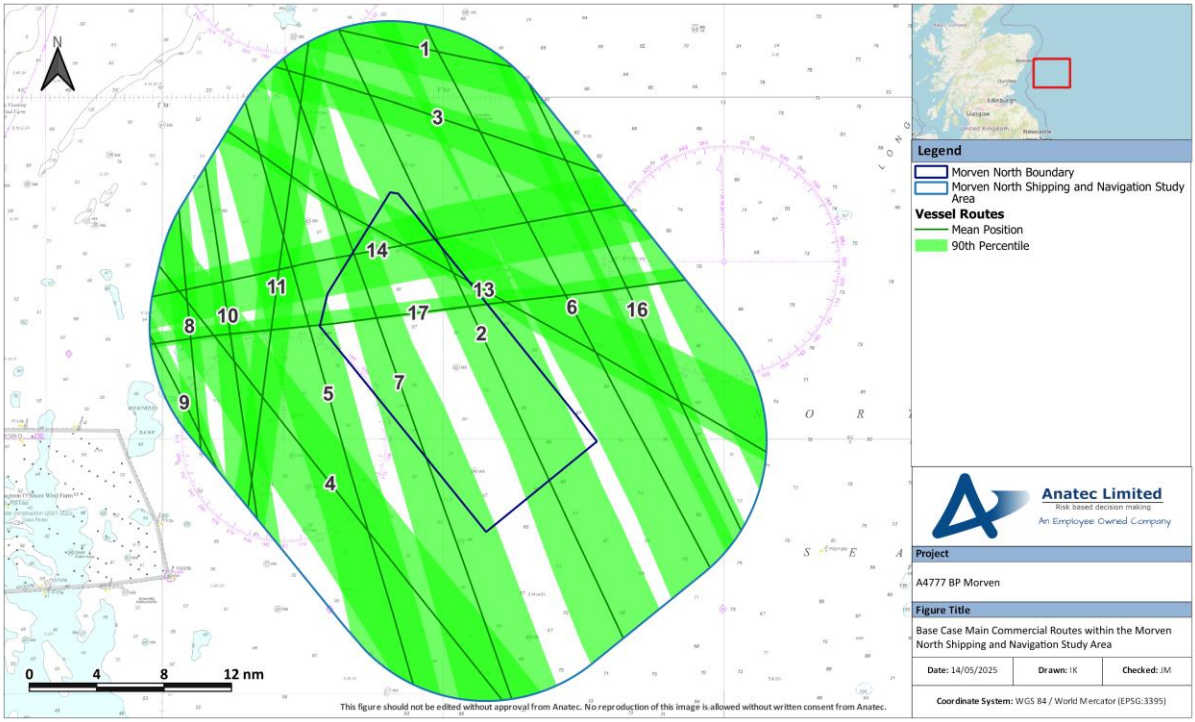


Figure 11.3: Base case main commercial routes within the Morven North Shipping and Navigation Study Area

Table 11.2: Description of main commercial routes within the Morven North Shipping and Navigation Study Area

Route Number	Average Vessels per Day	Average Vessels per Week	Description
1	2-3	16	Aberdeen – Catcher field. Comprised almost entirely of oil and gas vessels (96%).
2	1-2	10	Icelandic ports – Rotterdam. Comprised mainly of cargo vessels (90%). Includes the RoRo route operated by Smyril Line between Þorlákshöfn and Rotterdam.
3	1	7	Aberdeen – Fulmar field. Comprised mainly of oil and gas vessels (86%).
4	1	5-6	Aberdeen – Cygnus field. Comprised mainly of oil and gas vessels (76%) and cargo vessels (20%).
5	1	5-6	Reykjavik – Immingham. Comprised mainly of cargo vessels (86%) and tankers (12%).
6	1	5-6	Icelandic ports – Rotterdam. Comprised mainly of cargo vessels (77%), tankers (11%) and oil and gas vessels (10%).

Route Number	Average Vessels per Day	Average Vessels per Week	Description
7	0-1	4	Moray Firth – Rotterdam. Comprised mainly of cargo vessels (78%) and oil and gas vessels (16%).
8	0-1	2-3	Reykjavik – Rotterdam. Comprised mainly of cargo vessels (86%).
9	0-1	2-3	Aberdeen – Breagh field. Comprised of cargo vessels (45%), oil and gas vessels (39%) and tankers (17%).
10	0-1	2	Glensanda – Redcar. Comprised mainly of cargo vessels (70%), tankers (13%) and oil and gas vessels (12%).
11	0-1	2	Marcus Hook – Grangemouth. Comprised mainly of tankers (73%) and passenger vessels (20%).
13	0-1	1-2	Aberdeen – Bremen. Comprised mainly of cargo vessels (65%) and tankers (17%).
14	0-1	1-2	Montrose – Swedish ports. Comprised of cargo vessels (75%) and oil and gas vessels (25%).
15	0-1	1-2	Icelandic ports – Rotterdam. Comprised mainly of cargo vessels (64%) and tankers (26%).
16	0-1	1	Glensanda – Amsterdam. Comprised mainly of cargo vessels (81%) and tankers (12%).
17	0-1	1	Montrose – Elgin field. Comprised of oil and gas vessels (85%) and cargo vessels (15%).

11.2.3 Morven South in isolation scenario

11.2.3.1 A total of 10 main commercial routes within the Morven South Shipping and Navigation Study Area were identified from the vessel traffic survey data, in combination with Anatec's ShipRoutes database. These main commercial routes and corresponding 90th percentiles within the Morven South Shipping and Navigation Study Area are shown relative to Morven South in Figure 11.4. Following this, a description of each route is provided in Table 11.3, including the average number of vessels per day, start and end locations, main vessel types and details of commercial ferry routeing (where applicable). It is noted that the start and end locations are based on the most common destinations transmitted via AIS by vessels on these routes.

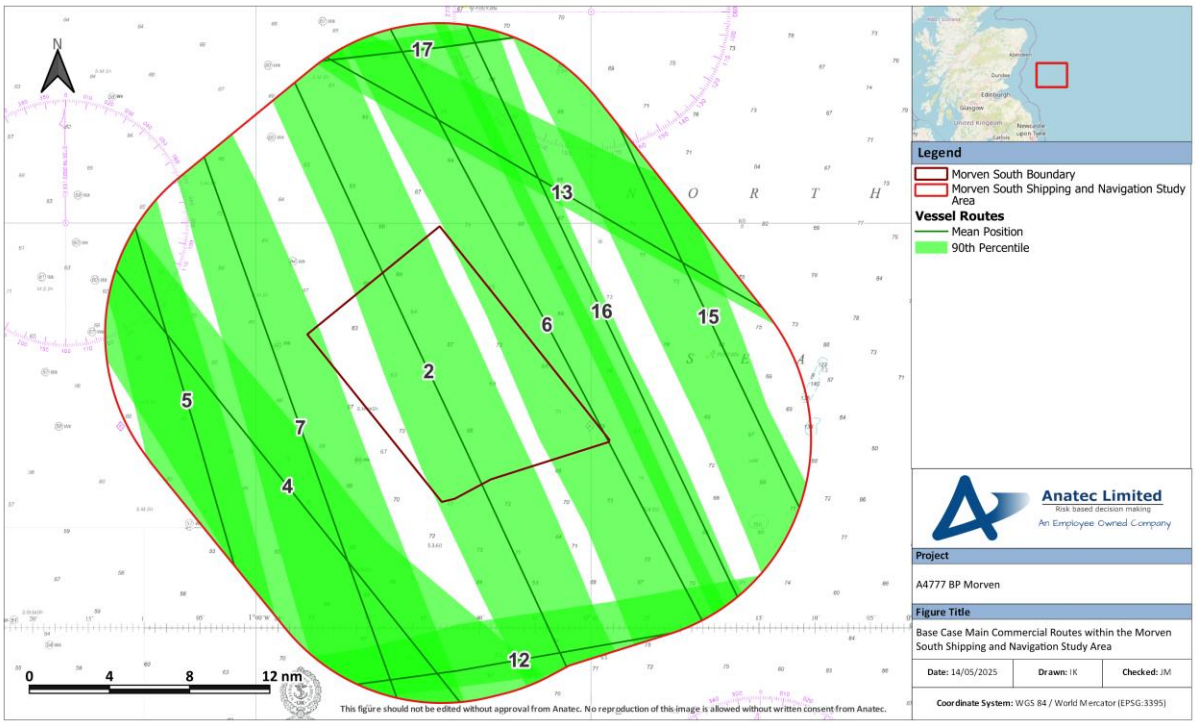


Figure 11.4: Base case main commercial routes within the Morven South Shipping and Navigation Study Area

Table 11.3: Description of main commercial routes within the Morven South Shipping and Navigation Study Area

Route Number	Average Vessels per Day	Average Vessels per Week	Description
2	1-2	10	Icelandic ports – Rotterdam. Comprised mainly of cargo vessels (90%). Includes the RoRo route operated by Smyril Line between Þorlákshöfn and Rotterdam.
4	1	5-6	Aberdeen – Cygnus field. Comprised mainly of oil and gas vessels (76%) and cargo vessels (20%).
5	1	5-6	Reykjavik – Immingham. Comprised mainly of cargo vessels (86%) and tankers (12%).
6	1	5-6	Icelandic ports – Rotterdam. Comprised mainly of cargo vessels (77%), tankers (11%) and oil and gas vessels (10%).
7	0-1	4	Moray Firth – Rotterdam. Comprised mainly of cargo vessels (78%) and oil and gas vessels (16%).
12	0-1	2	Firth of Forth – Norwegian ports. Comprised mainly of tankers (64%), cargo vessels (21%) and passenger vessels (15%).

Route Number	Average Vessels per Day	Average Vessels per Week	Description
13	0-1	1-2	Aberdeen – Bremen. Comprised mainly of cargo vessels (65%) and tankers (17%).
15	0-1	1-2	Icelandic ports – Rotterdam. Comprised mainly of cargo vessels (64%) and tankers (26%).
16	0-1	1	Glensanda – Amsterdam. Comprised mainly of cargo vessels (81%) and tankers (12%).
17	0-1	1	Montrose – Elgin field. Comprised of oil and gas vessels (85%) and cargo vessels (15%).

12 Adverse weather routeing

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

12.1.1.2 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.

12.2 Affected routes

12.2.1.1 Regular RoRo and RoPax routeing has been examined to identify routes in proximity to Morven North and Morven South that alter transits due to adverse weather. No specific adverse weather routeing was observed within the baseline data studied or raised during consultation, including via the Regular Operator outreach which specifically referenced adverse weather routeing in the list of queries (see Appendix D).

13 Navigation, communication and position-fixing equipment

13.1.1.1 This section discusses the potential effects on the use of navigation, communication and position fixing equipment of vessels that may arise due to the infrastructure associated with Morven North and Morven South.

13.2 Very High Frequency communications (including Digital Selective Calling)

13.2.1.1 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 wind turbines.

13.2.1.2 The wind turbines 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 wind turbines, then it is reasonable to assume that larger vessels with higher powered and more efficient systems would also be unaffected.

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

13.2.1.4 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 area and communications were reported as very clear, with no apparent degradation of performance. Communications with the service vessel located within the array were also fully satisfactory throughout the trial (MCA, 2005).

13.2.1.5 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).

13.2.1.6 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 Morven North and Morven South is anticipated to have no significant impact upon VHF communications.

13.3 Very High Frequency Direction Finding

13.3.1.1 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 wind turbines (within approximately 50m). 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).

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

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

13.4 Automatic Identification System

13.4.1.1 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).

13.4.1.2 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 Morven North and Morven South.

13.5 Navigational Telex System

13.5.1.1 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.

13.5.1.2 There are two NAVTEX frequencies. All transmissions on NAVTEX 518kHz, 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.

13.5.1.3 The 490kHz 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.

13.5.1.4 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 Morven North and Morven South.

13.6 Global Positioning System

13.6.1.1 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*".

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

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

13.7 Electromagnetic interference

13.7.1.1 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.

13.7.1.2 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.

13.7.1.3 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 Morven North and Morven South 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.

13.7.2 Subsea cables

13.7.2.1 As per Section 6.4, there will be inter-array cables and interconnector cables within the Morven Site. The inter-array cables will carry AC, while the interconnector cables will carry AC, other than the cable connecting the bridge-linked OSP which may carry AC or DC. Studies indicate that HVAC 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).

13.7.2.2 With regards to potential use of HVDC interconnector cables, the following key points are noted:

- Minimum water depths within the Morven Site are in excess of 60m, with vertical distance decreasing any EMF impacts;
- The maximum distance of 100m between the bridge-linked OSP will likely discourage vessels from transiting between the two, and so in range of the DC cables;
- It is considered unlikely that vessels this far offshore would be relying purely on a magnetic compass.

13.7.2.3 On this basis, electromagnetic interference associated with shipping and navigation due to cables associated with Morven North and Morven South are not considered any further.

13.7.3 Wind turbines

13.7.3.1 MGN 654 (MCA, 2021) notes that small vessels with simple magnetic steering and hand bearing compasses should be wary of using these close to wind turbines, 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 (MCA, 2021), noting lighting and marking will be agreed with NLB. As per Section 13.7.2, it is considered very unlikely that vessels this far offshore would be relying purely on a magnetic compass.

13.7.4 Experience from operational Offshore Wind Farms

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

13.8 Marine radar

13.8.1.1 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, wind turbine technology has advanced significantly, most notably in terms of the size of wind turbines available to be installed and utilised. The use of these larger wind turbines allows for a greater spacing between wind turbines than was achievable at the time of the studies being undertaken, which is beneficial in terms of Radar interference effects (and surface navigation in general) as detailed below.

13.8.2 Trials

13.8.2.1 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 wind turbines on the use and effectiveness of marine Radar.

13.8.2.2 In 2004 trials undertaken at North Hoyle (MCA, 2004) identified areas of concern regarding the potential impact on marine- and shore-based Radar systems due to the large vertical extents of the wind turbines (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).

13.8.2.3 Side lobe patterns are produced by small amounts of energy from the transmitted pulses that are radiated outside of the narrow main beam. The effects of side lobes are most noticeable within targets at short range (below 1.5nm) and with large objects. Side lobe echoes form either an arc on the Radar screen similar to range rings, or a series of echoes forming a broken arc, as illustrated in Figure 13.1.

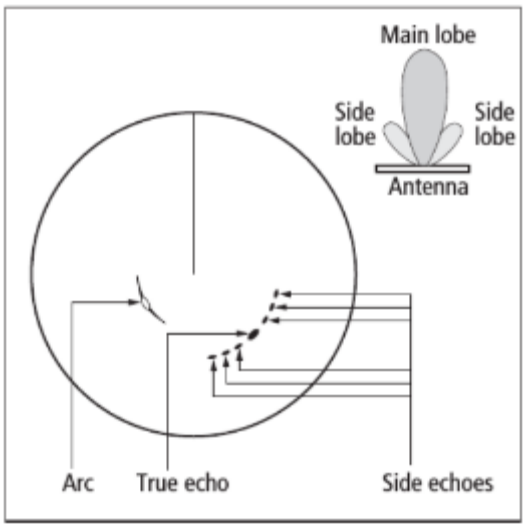


Figure 13.1: Illustration of side lobes on radar screen

13.8.2.4 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.

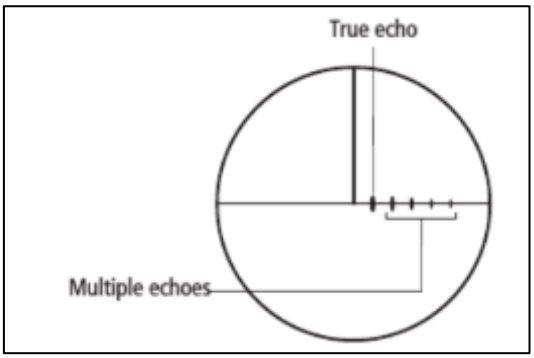


Figure 13.2: Illustration of multiple reflected echoes on radar screen

13.8.2.5 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).

13.8.2.6 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.

13.8.2.7 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 wind turbines than that considered within the early trials[7]. 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 wind turbines and safe navigation;
- Even in the worst case with Radar operator settings artificially set to be poor, there is significant clear space around each wind turbine that does not contain

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

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 wind turbines 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 wind turbines 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 wind turbines in place;
- There is potential for the performance of a vessel's ARPA to be affected when tracking targets in or near the array. Although greater vigilance is required, during the Kentish Flats trials it was shown that false targets were quickly identified as such by the mariners and then by the equipment itself.

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

13.8.2.9 The MCA has also produced guidance for mariners operating in proximity to OREIs in the UK which highlights Radar issues amongst others to be taken into account when planning and undertaking voyages in proximity to OREIs (MCA, 2008). The interference buffers presented in Table 13.1 are based on MGN 654 (MCA, 2021) and MGN 372 Amendment 1 (MCA, 2022). It is noted that technical information has also been carried forward from MGN 371 (MCA, 2008) and MGN 543 (MCA, 2016) which have been withdrawn.

Table 13.1: Distances at which impacts on marine radar occur

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

13.8.2.10 As noted in Table 13.1, the onset range from the wind turbines of false returns is approximately 1.5nm, with progressive deterioration in the Radar display as the range closes. If interfering echoes develop, the requirements of 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).

13.8.3 Experience from operational developments

13.8.3.1 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.

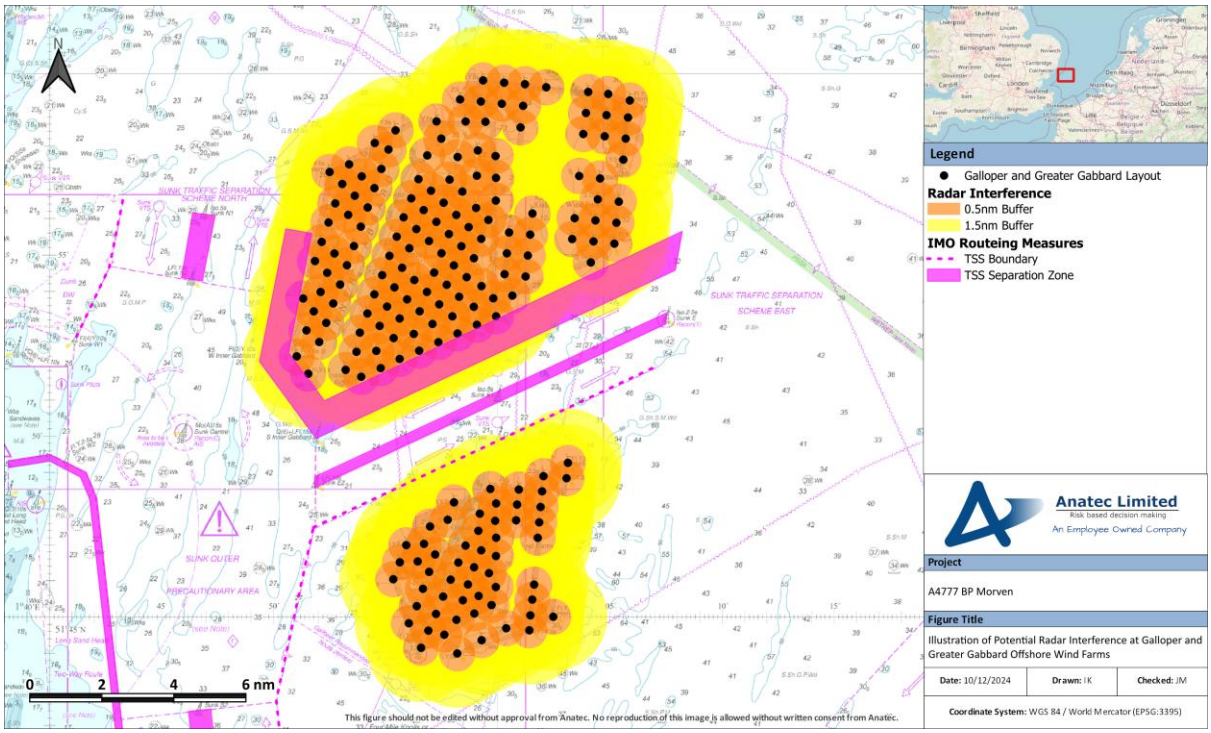


Figure 13.3: Illustration of potential radar interference at Galloper and Greater Gabbard Offshore Wind Farms

13.8.3.2 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 eight 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.

13.8.3.3 AIS information may also be used to verify the targets of larger vessels (generally vessels over 15m LOA – the minimum threshold for fishing vessel AIS carriage requirements). Approximately 3% of the vessel traffic recorded within the Regional Shipping and Navigation Study Area was under 15m in length (with this value being 3% and 2% for the Morven North Shipping and Navigation Study Area and Morven South Shipping and Navigation Study Area respectively), and throughout the vessel traffic surveys only one vessel track was recorded on Radar, indicating a high level of AIS take-up among vessels for which AIS carriage is not mandatory.

13.8.3.4 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.

13.8.4 Increased Radar returns

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

13.8.4.2 Larger wind turbines (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° to 25°) dependent upon the distance from the target and at closer distances this five-degree width would be limited much further. Therefore, increased wind turbine height in the array would not create any effects in addition to those already identified from existing operational wind farms (interfering side lobes, multiple and reflected echoes). Additionally, the level and way Radar returns occur is not expected to differ significantly for different foundation types (i.e. monopiles and jacket foundations).

13.8.4.3 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.

13.8.5 Fixed radar antenna use in proximity to an operational offshore wind farm

13.8.5.1 It is noted that 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.

13.8.6 Application to Morven North and Morven South

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

13.8.7 Concurrent development

13.8.7.1 Figure 13.4 presents an illustration of potential Radar interference due to the Morven Site. The Radar effects have been applied to the indicative worst-case layout introduced in Section 6.3.1 to maximise the extent of potential Radar interference, with the estimated future case routes (presented in Section 15.5) also provided for context.

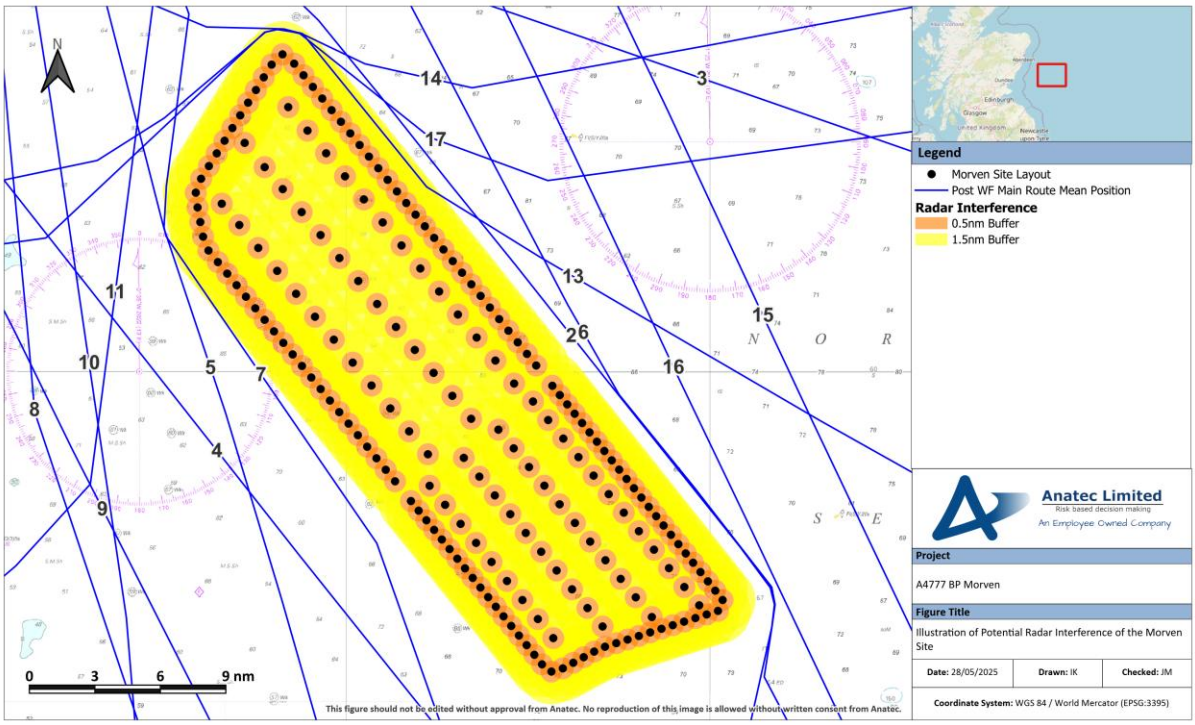


Figure 13.4: Illustration of potential radar interference of the Morven Site

13.8.7.2 Vessels passing within or in close proximity to the Morven Site would be subject to a greater level of interference with impacts becoming more substantial in close proximity to wind turbines. 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.

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

13.8.8 Morven North in isolation

13.8.8.1 Figure 13.5 presents an illustration of potential Radar interference due to Morven North. The Radar effects have been applied to the indicative worst-case layout introduced in Section 6.3.1 to maximise the extent of potential Radar interference, with the estimated future case routes (presented in Section 15.5) also provided for context.

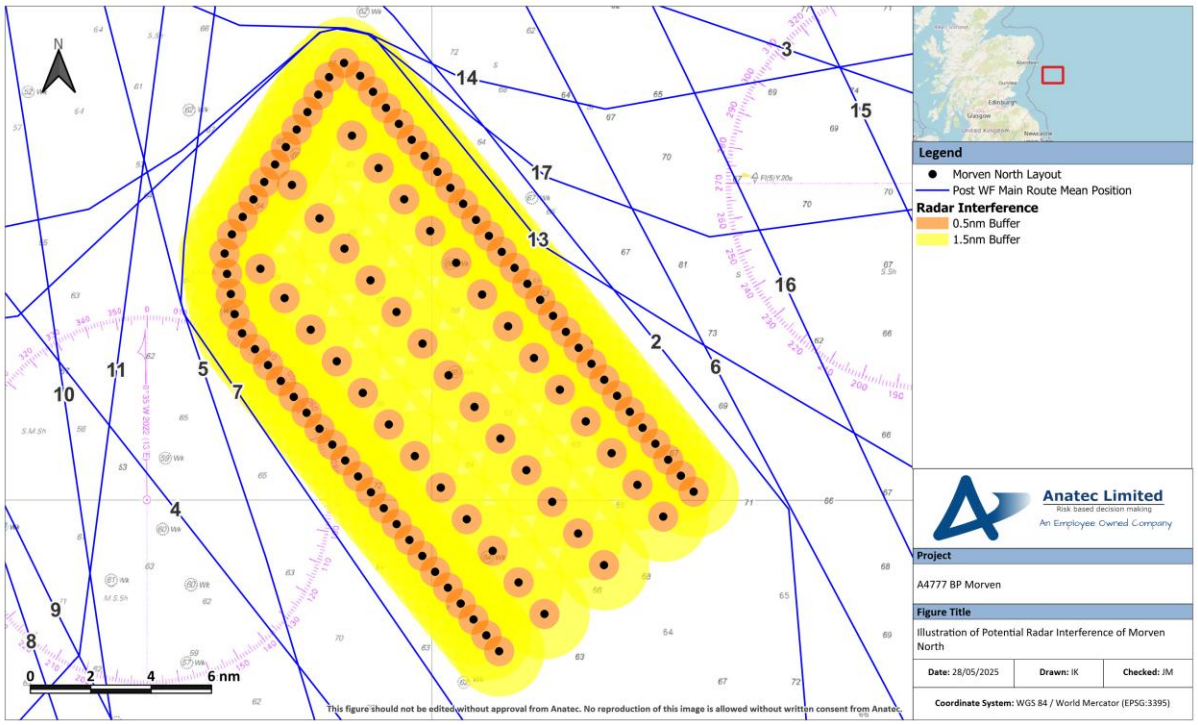


Figure 13.5: Illustration of potential radar interference of Morven North

13.8.8.2 Vessels passing within or in close proximity to the Morven North Boundary would be subject to a greater level of interference with impacts becoming more substantial in close proximity to wind turbines. 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.

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

13.8.9 Morven South in isolation

13.8.9.1 Figure 13.6 presents an illustration of potential Radar interference due to Morven South. The Radar effects have been applied to the indicative worst-case layout introduced in Section 6.3.1 to maximise the extent of potential Radar interference, with the estimated future case routes (presented in Section 15.5) also provided for context.

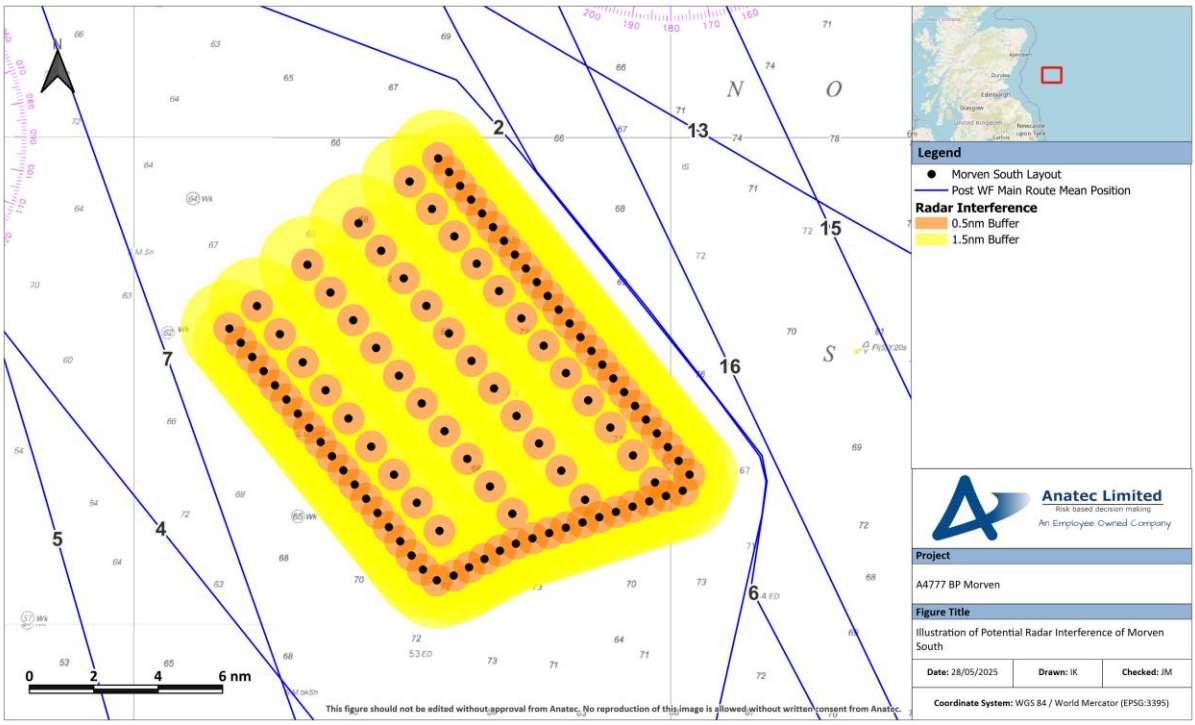


Figure 13.6: Illustration of potential radar interference of Morven South

13.8.9.2 Vessels passing within or in close proximity to the Morven South Boundary would be subject to a greater level of interference with impacts becoming more substantial in close proximity to wind turbines. 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.

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

13.9 Sound Navigation Ranging systems

13.9.1.1 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 Morven North and Morven South.

13.10 Noise

13.10.1.1 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.

13.11 Summary of potential effects on use

13.11.1.1 Based on the detailed technical assessment of the effects due to the presence of Morven North and Morven South 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. The resultant rankings are noted to be appropriate for all three base scenarios assessed (Scenarios 1a, 1b and 2).

Table 13.2: Summary of risk to navigation, communication and position-fixing equipment

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

13.11.1.2 On the basis of these findings, associated risks are screened out of the risk assessment undertaken in Sections 18 to 20, noting that as part of the SAR Checklist completed post consent, VHF trials may be undertaken to investigate effects due to larger wind turbines.

14 Cumulative and transboundary overview

14.1 Screened in other developments

14.1.1 Offshore Wind Farms

14.1.1.1 In addition to Morven North and Morven South, there are a number of other existing or planned OWF developments located in the region. Table 14.1 includes details of these OWF developments, whether they are screened into the cumulative risk assessment and the cumulative tier applied (where applicable). This then dictates which scenario(s) each OWF development is considered in the cumulative risk assessment. A summary of the scenarios and the tiers included within each is then provided in Table 14.2 (with full description provided in Table 3.4).

14.1.1.2 As per the cumulative risk assessment methodology, any development greater than 50nm from the Morven Site is not considered. Development status provided is the minimum to be considered for each Tier, with the criterion descriptors the primary factor (see Table 3.4). Therefore, even in instances where a development is at the minimum threshold for being in a specific tier based on development status, due to other factors (such as distance from Morven North and Morven South or influence on routes in the area) there is the possibility that they are not considered within that tier.

14.1.1.3 The locations of the developments screened into the cumulative risk assessment are presented alongside baseline developments in Figure 14.1.

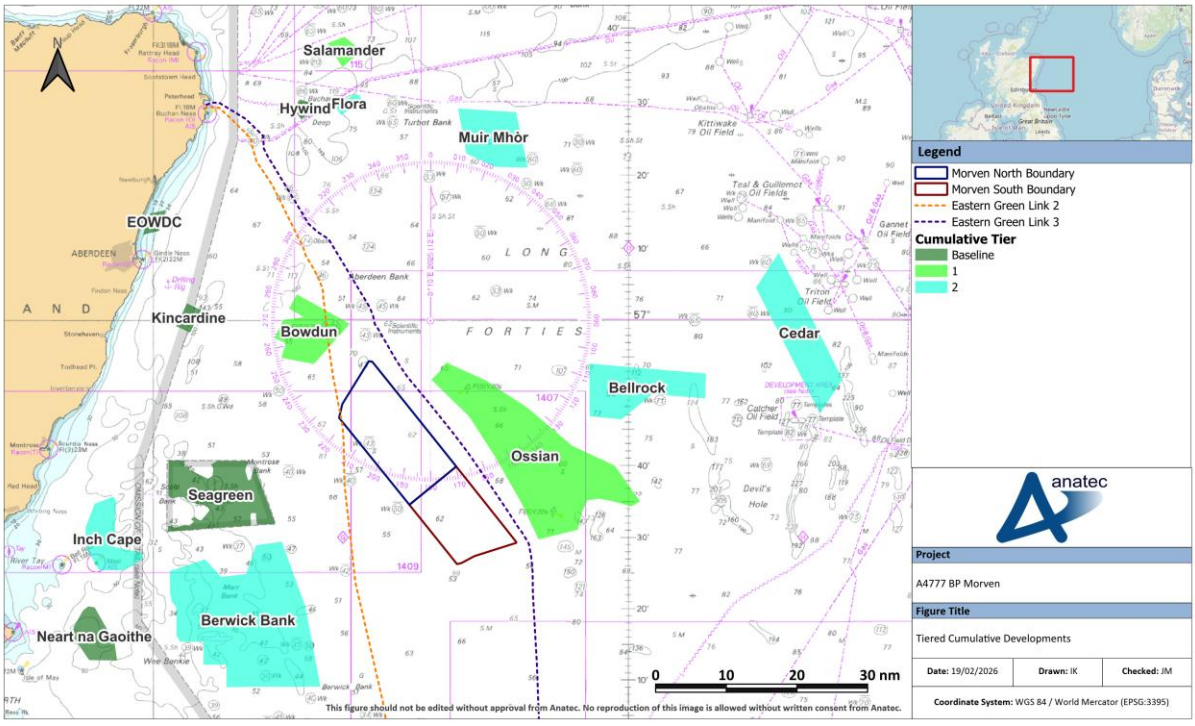


Figure 14.1: Tiered cumulative developments

14.1.1.4 It is noted that Seagreen 1A has been screened out despite being located within 50nm of the Morven Site. This is due to its location relative to the Morven Site – being part of the wider Seagreen project and located on the far side of Seagreen relative to the Morven Site reduces any additional effect anticipated for shipping and navigation users already affected by Morven North and Morven South. No concerns were raised during the Hazard Workshop on cumulative impacts from Seagreen 1A.

Table 14.1: Cumulative screening

Development	Development Type	Development Status (as of September 2025)	Closest Distance (nm)		Data Confidence	Cumulative Tier	First Risk Assessment Scenario Considered
			Morven North	Morven South			
Eastern Green Link 2	Subsea cable	Consented	0.0	8.6	High	2	4
Eastern Green Link 3	Subsea cable	In planning	2.7	1.6	High	2	4
Eastern Green Link 4	Subsea cable	In planning	37	30	High	Screened Out	N/A
Ossian	OWF	Consent application submitted	4.8	2.9	High	1	3
Bowdun	OWF	Scoped	5.4	23	High	1	3
Seagreen	OWF	Operational	13	19	High	Baseline	1
Berwick Bank	OWF	Consented	17	18	High	2	4
Bellrock	OWF	Scoped	20	19	High	2	4
Seagreen 1A	OWF	Consented	22	28	High	Screened Out	N/A
Kincardine	OWF	Operational	23	39	High	Baseline	1
Muir Mhòr	OWF	Consent application submitted	31	42	High	2	4
Inch Cape	OWF	Consented	33	38	High	2	4
Flora	OWF	In planning	34	51	High	2	4
EOWDC	OWF	Operational	34	51	High	Baseline	1
Hywind	OWF	Operational	34	52	High	Baseline	1
Salamander	OWF	Consented	40	57	High	1	3

Development	Development Type	Development Status (as of September 2025)	Closest Distance (nm)		Data Confidence	Cumulative Tier	First Risk Assessment Scenario Considered
			Morven North	Morven South			
Neart na Gaoithe	OWF	Under construction	43	46	High	Baseline	1
Cedar	OWF	In planning	48	46	High	2	4

Table 14.2: Summary of assessment scenarios

Scenario	Description
1a	Morven North in isolation.
1b	Morven South in isolation.
2	Concurrent development of Morven North and Morven South.
3a	Morven North and Tier 1 developments.
3b	Morven South and Tier 1 developments.
3c	Concurrent development and Tier 1 cumulative developments.
4	Concurrent development and Tier 1 cumulative developments and Tier 2 cumulative developments.

14.1.2 Subsea cables

14.1.2.1 Eastern Green Link 2 is a consented subsea cable which will cross Morven North and as such is screened into the cumulative risk assessment. In addition, Eastern Green Link 3 is in planning and will pass in close proximity to both Morven North and Morven South; this is therefore also screened into the cumulative risk assessment. These subsea cable developments are detailed in Table 14.1.

14.1.2.2 Eastern Green Link 4 is also in planning but is not expected to pass in close proximity to Morven North and Morven South since it will run from the Firth of Forth southward. Subsequently, no pathway through which a user may be further affected by a hazard is identified and Eastern Green Link 4 is screened out of the cumulative risk assessment.

15 Future case vessel traffic

15.1.1.1 The characterisation of vessel traffic established in the baseline (see Section 10) is used as input to the risk assessment (see Sections 18 to 20). 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 Morven North and Morven South (i.e. the post-wind farm scenario).

15.1.1.2 The following subsections provide a high-level future case scenario which has been used to inform the risk assessment.

15.2 Increases in commercial vessel activity

15.2.1.1 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 and the long-term effects of Brexit. As noted by the UK Chamber of Shipping in Section 4.2, the presence of future floating developments or rigs should be noted as there may be an increase in vessels towing rigs or floating wind turbines.

15.2.1.2 There were no instances of towing activity or rig movements within the dedicated vessel traffic surveys, although a solitary instance of a jack-up platform being towed to Dundee approximately 3nm north of the Morven Site was recorded within the long-term vessel traffic data (see Appendix E).

15.2.1.3 Therefore, two independent scenarios of potential growth in commercial vessel movements of 10% and 20% have been estimated throughout the lifetime of Morven North and Morven South.

15.3 Increases in commercial fishing vessel and recreational vessel activity

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

15.3.1.2 As referenced by RYA Scotland within Section 4.2, recreational vessels engaged on long-distance transits will likely passage plan earlier in the course, providing adequate time to deviate around Morven North and Morven South. Vessels on shorter routes will likely be undergoing coastal passage, and so will pass further from Morven North and Morven South. However, it is acknowledged that the absence of commercial vessels within the arrays may increase the likelihood of recreational vessels navigating within the array.

15.3.1.3 Therefore, a conservative potential growth in commercial fishing vessel and recreational vessel movements of 10% and 20% has been estimated throughout the lifetime of Morven North and Morven South.

15.4 Increases in traffic associated with offshore wind farms

15.4.1.1 During the construction phase up to 2,298 annual round trips to port would be made by vessels involved in the installation of Morven North and Morven South (see Section 6.5), comprised of 1,149 annual round trips to port for Morven North and 1,149 annual round trips to port for Morven South. During the O&M phase, up to 586 annual round trips to port would be made by vessels involved in the O&M of Morven North and Morven South (see Section 6.6), comprised of 293 annual round trips to port for Morven North and 293 annual round trips to port for Morven South.

15.4.1.2 In addition to these, there are likely to be vessel traffic movements in proximity associated with cumulative OWF developments, such as Ossian and Bowdun. Information on the vessel numbers involved, as well as which ports the vessels will be routeing to/from, is limited however.

15.5 Commercial traffic routeing

15.5.1 Methodology

15.5.1.1 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 1nm 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 take into count sandbanks, aids to navigation and known routeing preferences.

15.5.1.2 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”.

15.5.1.3 To date, internal and external studies undertaken by Anatec on behalf of the UK Government and individual clients show that vessels do pass consistently and safely within 1nm of established OWFs (including between distinct developments) 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 1nm off established developments. Evidence also demonstrates that commercial vessels do not transit through arrays.

15.5.1.4 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 1nm off 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 Scenario 1a

15.5.2.1 An illustration of the anticipated MDS shift in the mean positions of the main commercial routes within the Morven North Shipping and Navigation Study Area following the development of Morven North is presented in Figure 15.1. These deviations are based on Anatec's assessment of the MDS.

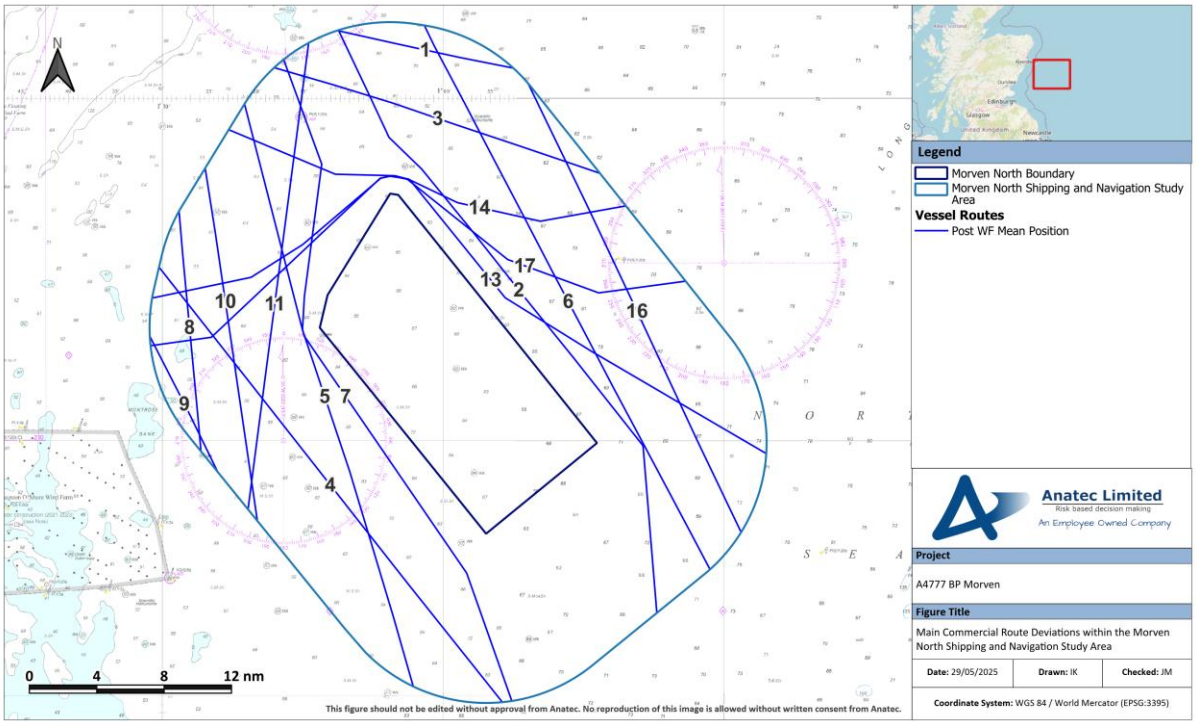


Figure 15.1: Main commercial route deviations within the Morven North Shipping and Navigation Study Area

15.5.2.2 Deviations from the pre wind farm scenario would be required for six out of the 16 main commercial routes identified, with the level of deviation varying between a marginal increase for Route 5 and a 5.5nm increase for Route 17. For the displaced routes, the increase in distance from the pre wind farm scenario is presented in Table 15.1.

Table 15.1: Summary of post wind farm main commercial route deviations within the Morven North Shipping and Navigation Study Area

Route Number	Increase in Route Length (nm)	Percentage Change in Total Route Length (%)	Nature of Deviation
2	1.8	0.2	Passing east of Morven North.
5	<0.1	<0.1	Passing slightly further west of Morven North.
7	1.6	0.3	Passing west of Morven North.
13	1.0	0.3	Passing north of Morven North.
14	2.1	0.4	Passing north of Morven North.
17	5.5	3.9	Passing north of Morven North.

15.5.3 Scenario 1b

15.5.3.1 An illustration of the anticipated MDS shift in the mean positions of the main commercial routes within the Morven South Shipping and Navigation Study Area following the development of Morven South is presented in Figure 15.2. These deviations are based on Anatec's assessment of the MDS.

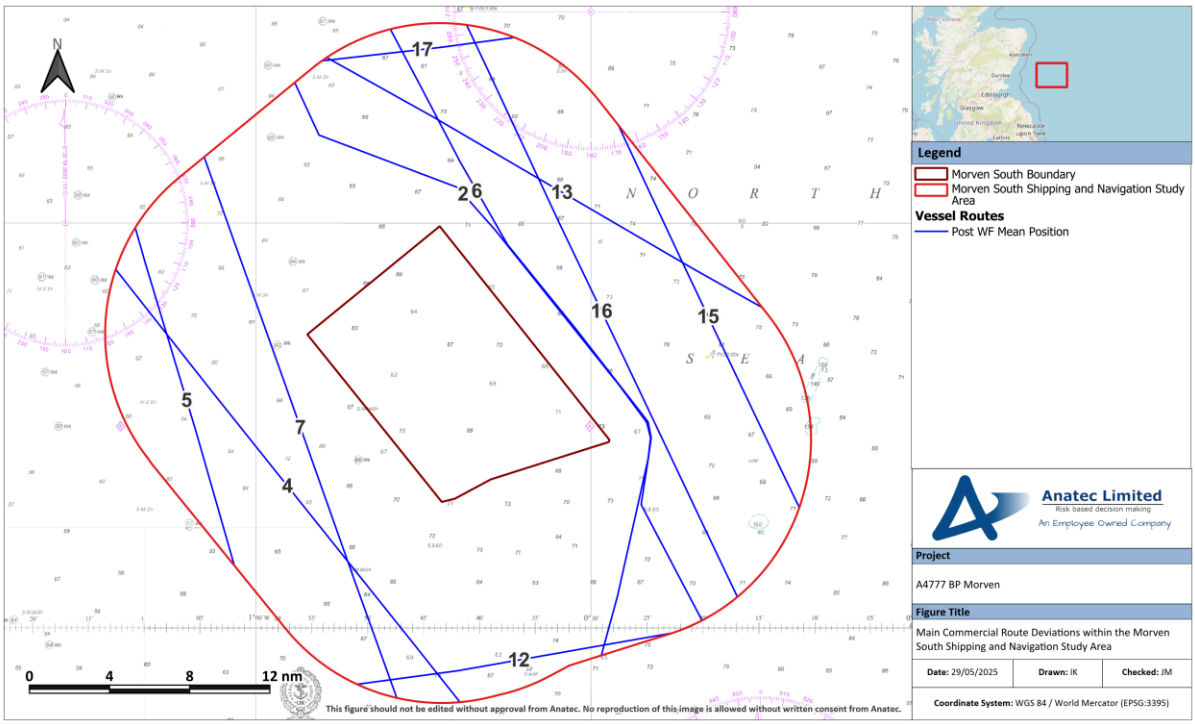


Figure 15.2: Main commercial route deviations within the Morven South Shipping and Navigation Study Area

15.5.3.2 Deviations from the pre wind farm scenario would be required for two out of the 10 main commercial routes identified, with Route 6 requiring a deviation of 0.9nm and Route 2 requiring a deviation of 5.5nm. For the displaced routes, the increase in distance from the pre wind farm scenario is presented in Table 15.2.

Table 15.2: Summary of post wind farm main commercial route deviations within the Morven South Shipping and Navigation Study Area

Route Number	Increase in Route Length (nm)	Percentage Change in Total Route Length (%)	Nature of Deviation
2	5.5	0.5	Passing east of Morven South.
6	0.9	0.1	Passing east of Morven South.

15.5.4 Scenario 2

15.5.4.1 An illustration of the anticipated MDS shift in the mean positions of the main commercial routes within the Regional Shipping and Navigation Study Area following the development of Morven North and Morven South is presented in Figure 15.3. These deviations are based on Anatec's assessment of the MDS.

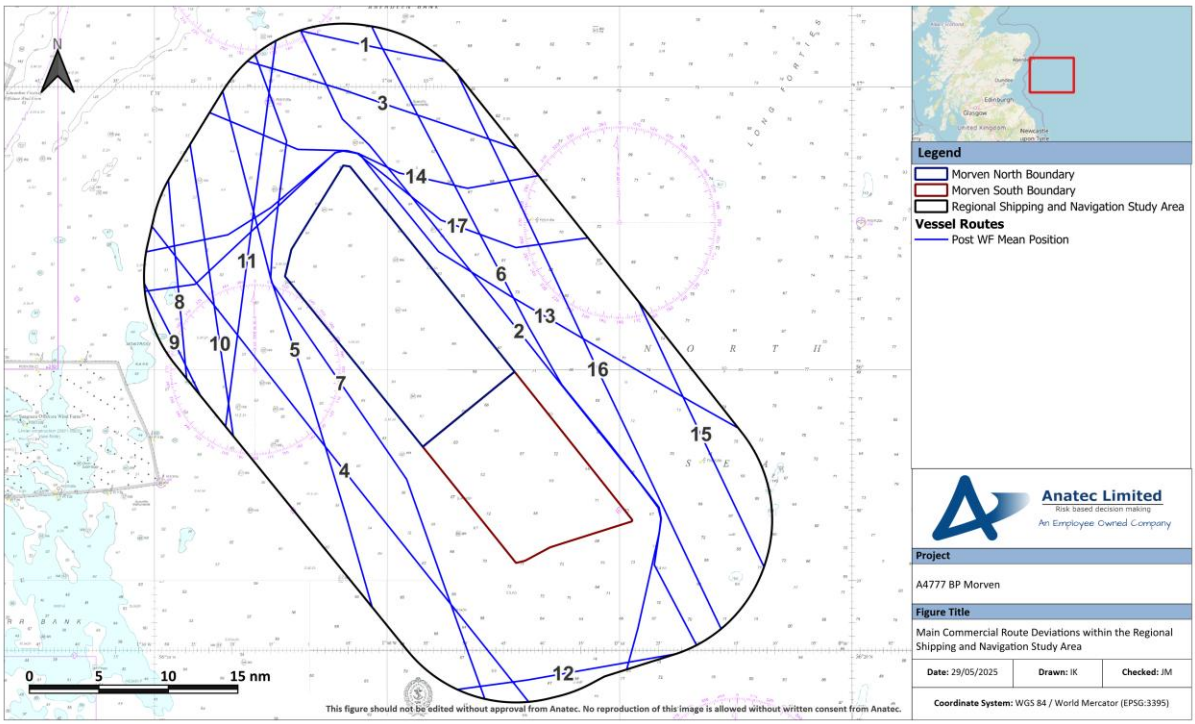


Figure 15.3: Main commercial route deviations within the Regional Shipping and Navigation Study Area

15.5.4.2 Deviations from the pre wind farm scenario would be required for seven out of the 17 main commercial routes identified, with the level of deviation varying between a marginal increase for Route 5 and a 5.5nm increase for Route 17. For the displaced routes, the increase in distance from the pre wind farm scenario is presented in Table 15.3.

Table 15.3: Summary of post wind farm main commercial route deviations within the Regional Shipping and Navigation Study Area (Concurrent Developments)

Route Number	Increase in Route Length (nm)	Percentage Change in Total Route Length (%)	Nature of Deviation
2	4.1	0.3	Passing east of the Morven Site.
5	<0.1	<0.1	Passing slightly further west of the Morven Site.
6	0.9	0.1	Passing east of the Morven Site.
7	1.6	0.3	Passing west of the Morven Site.
13	1.1	0.3	Passing north of the Morven Site.

Route Number	Increase in Route Length (nm)	Percentage Change in Total Route Length (%)	Nature of Deviation
14	2.1	0.4	Passing north of the Morven Site.
17	5.5	3.9	Passing north of the Morven Site.

15.5.5 Scenario 3a

15.5.5.1 This subsection considers each of the main commercial routes for Scenario 3a, which takes into account Morven North, baseline developments and Tier 1 cumulative developments (Ossian, Bowdun and Salamander). Main commercial routes have been grouped based on location and direction to enable a more succinct review with each group considered in the following subsections. Presented alongside the route options are equivalents from the base case, as well as the Tier 1 cumulative developments.

Aberdeen-East routeing

15.5.5.2 The available options for vessels routeing to/from Aberdeen and which transit east are presented in Figure 15.4. The routes which have been grouped here include Routes 1, 3 and 13.

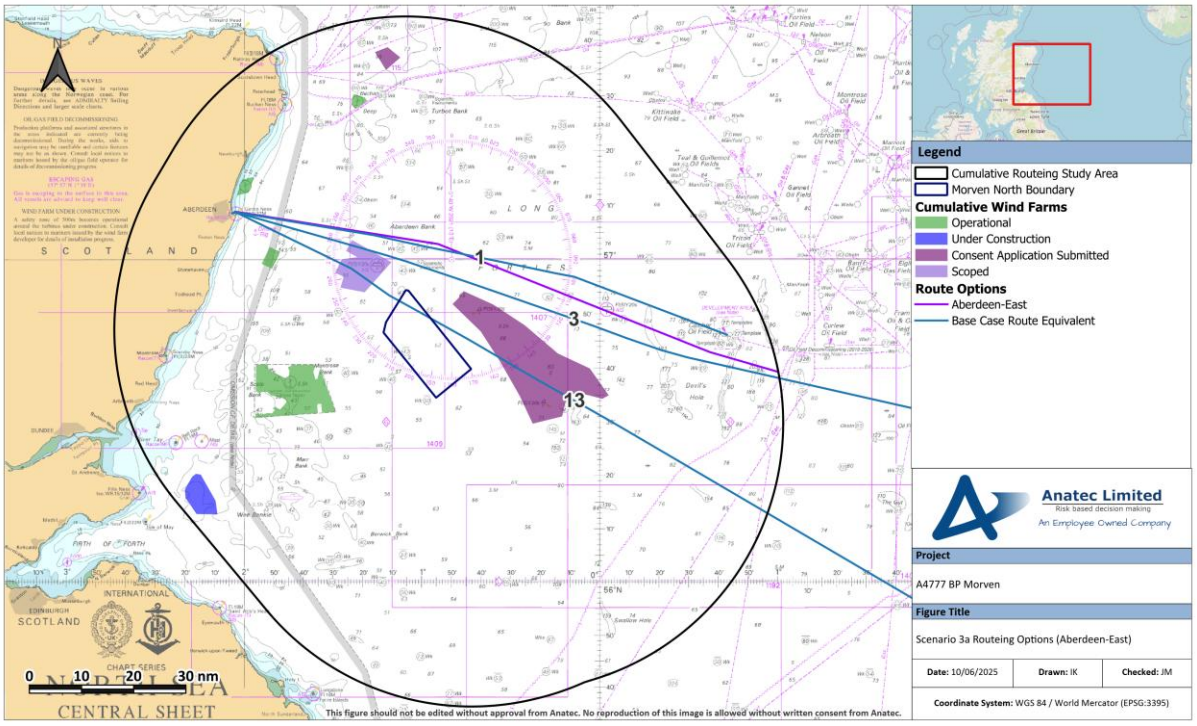


Figure 15.4: Scenario 3a routeing options (Aberdeen-East)

15.5.5.3 Two of the three routes involved (Routes 1 and 3) transit between Aberdeen and oil and gas fields, with the other between Aberdeen and Bremen (Route 13). Almost all of the vessels on these routes (97%) were under 150m in length. All three routes involve northwest-southeast travel.

15.5.5.4 Due to the presence of Bowdun to the north of the Morven North Boundary and Ossian to the east, these vessels would be required to deviate and so would likely follow a similar route to Route 1 and so path north of Bowdun as highlighted in Figure 15.4. Although it would be possible to transit between Bowdun and Kincardine to the west of the Morven North Boundary, journey times would likely be longer. In addition, there is greater available searoom to the north of Bowdun than there is between the developments to the west of the Morven North Boundary and due to available space directly east of Aberdeen, there would be fewer manoeuvres required. The deviation would result in a slight increase in passage time and distance.

15.5.5.5 Noting that Route 1 avoids the relevant developments and so will not be required to deviate, the total number of affected vessels on these routes is approximately one per day.

Aberdeen-South routeing

15.5.5.6 The available options for vessels routeing to/from Aberdeen and which transit to the south are presented in Figure 15.5. The routes which have been grouped here include Routes 4 and 9.

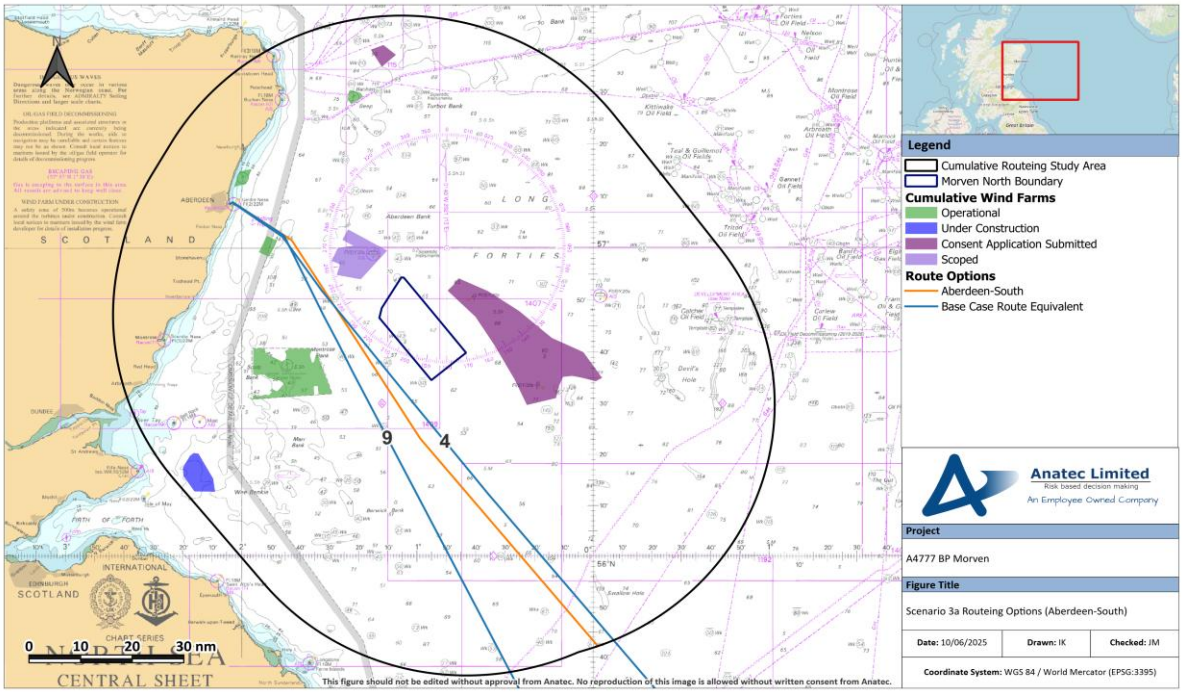


Figure 15.5: Scenario 3a routeing options (Aberdeen-South)

15.5.5.7 Both routes involved transits between Aberdeen and oil and gas fields and as such were comprised primarily of oil and gas vessels.

15.5.5.8 As these routes are not influenced by either the Morven North Boundary or any other cumulative development in Scenario 3a, it is likely that they will be able to continue current transits and therefore be unaffected in terms of passage time and distance.

Firth of Forth routeing

15.5.5.9 The available options for vessels routeing to/from the Firth of Forth are presented in Figure 15.6. The routes which have been grouped here include Routes 11 and 12.

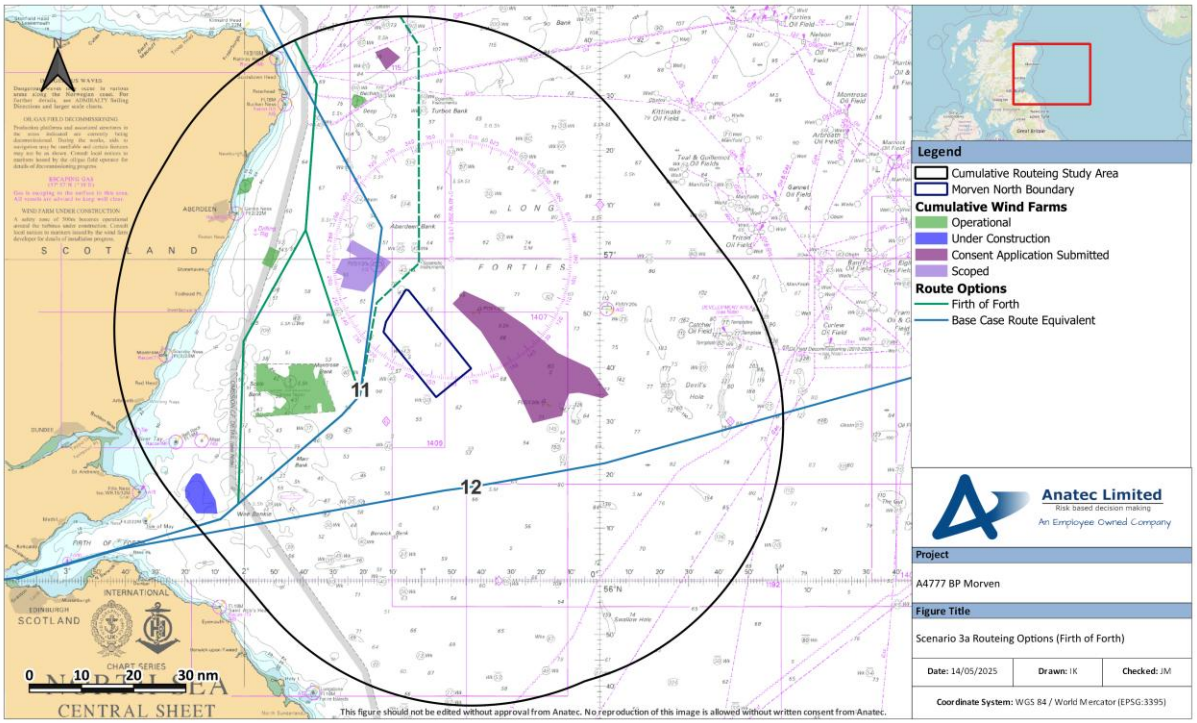


Figure 15.6: Scenario 3a routeing options (Firth of Forth)

15.5.5.10 Whereas Route 11 turns north upon leaving the Firth of Forth, heading to the US, Route 12 continues east to Norwegian ports. Vessels on both routes entail less than one transit per day and are primarily comprised of tankers. All vessels here were under 100m in length.

15.5.5.11 Vessels that are on Route 12 routeing to the east will be unaffected by either the Morven North Boundary or any other cumulative development included in Scenario 3a. Those vessels routeing north on Route 11 will be required to deviate,

however. These vessels will transit to either the east or west of Seagreen, with this decision at vessel Masters discretion. Deviations closer inshore may be influenced by the nature of the cargo onboard, although Route 11 does currently pass close to the coast when heading around Rattray Head. Those that deviate west will likely pass east of Kincardine and inshore of Hywind, whilst those passing east could either follow a similar course to the aforementioned route or, though unlikely, pass between the Morven Boundary and Bowdun (minimum separation 5.4nm). Vessels passing between the Morven North Boundary and Bowdun would likely retain an offshore passage once clear of the Morven North Boundary and Bowdun and so therefore pass east of Salamander. Whichever deviation is chosen, there is likely to be a marginal increase in passage time and distance, with this potentially greatest for passages between the Morven North Boundary and Bowdun should changes in transit speed be necessary to facilitate the additional manoeuvres (noting vessels on these routes are small).

15.5.5.12 As Route 12 will not necessitate deviation, the total number of affected vessels will be equivalent to the number of vessels on Route 11 (approximately one transit every four days).

Montrose routeing

15.5.5.13 The available options for vessels routeing to/from Montrose are presented in Figure 15.7. The routes which have been grouped here include Routes 14 and 17.

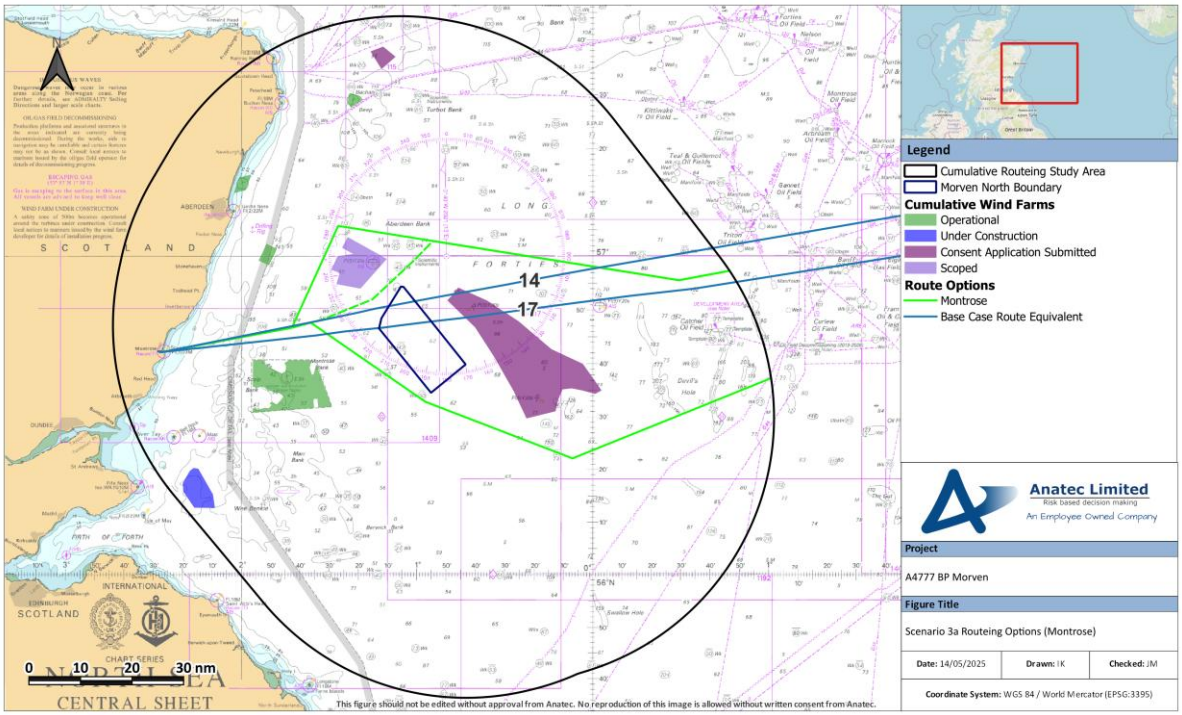


Figure 15.7: Scenario 3a routeing options (Montrose)

15.5.5.14 Both routes involve east-west bearings, with Route 14 involving transits between Montrose and Swedish ports and Route 17 between Montrose and the Elgin field. These routes are both relatively low use, with each including less than one vessel transit per day.

15.5.5.15 Both routes intersect with the northern extent of the Morven North Boundary and Ossian. Although it would be more time-efficient to pass just north of the Morven North Boundary, this would involve travelling between the Morven North Boundary and Bowdun (minimum separation 5.4nm), which vessel Masters may be less likely to do given the alternative options. These are to deviate either further north, around Bowdun, or to the south of the Morven North Boundary and Ossian. There would be an increased passage time and distance associated with these deviations.

15.5.5.16 The number of vessels involved in Montrose routeing that will require deviation cumulatively total approximately one transit every three days.

North-South routeing

15.5.5.17 The available options for vessels undergoing coastal routeing on a north-south bearing are presented in Figure 15.8. The routes which have been grouped here include Routes 2, 5, 6, 7, 8, 10, 15 and 16.

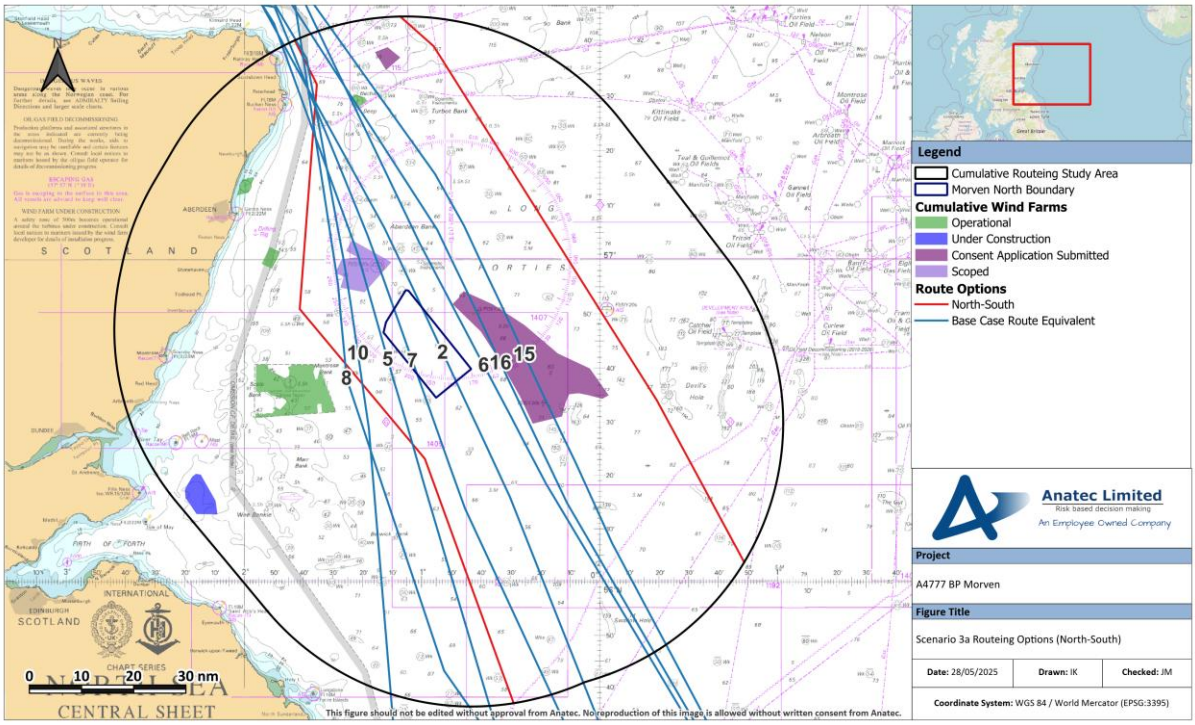


Figure 15.8: Scenario 3a routeing options (North-South)

15.5.5.18 All routes involved in north-south transits following the coast were comprised primarily of cargo vessels. These routes typically involved transit between Icelandic ports (or others further to the north) and ports in mainland Europe, such as Rotterdam.

15.5.5.19 In general, vessels on these routes will either deviate west of the 'bloc' of the Morven North Boundary, Bowdun and Ossian, or to the east, including Salamander. It was noted during consultation (see Section 4.2) that it is unlikely that vessels would choose to transit between the Morven North Boundary and Ossian and that they would instead deviate around the developments. These vessels would likely pass offshore of Salamander due both to available searoom and fewer manoeuvres being required. Vessels choosing instead to deviate west, further inshore, would transit between Bowdun and Kincardine and between the Morven North Boundary and Seagreen, noting that there is sufficient searoom to do so. The nature of the cargo onboard may influence the routeing option taken, with those vessels with hazardous cargo more likely to choose the further offshore option. Whichever option is chosen, there is likely to be an increase in passage time and distance, although with adequate passage planning (particularly for the approach to/from the northern extent of the cumulative routeing study area) any increases can be minimised.

15.5.5.20 In total, approximately four to five vessel transits per day on the north-south routeing would be required to deviate.

15.5.6 Scenario 3b

15.5.6.1 This subsection considers each of the main commercial routes for Scenario 3b, which takes into account Morven South, baseline developments and Tier 1 cumulative developments (Ossian, Bowdun and Salamander). Presented alongside the route options are equivalents from the base case, as well as the Tier 1 cumulative developments.

Aberdeen-East routeing

15.5.6.2 The available options for vessels routeing to/from Aberdeen and which transit east are presented in Figure 15.9.

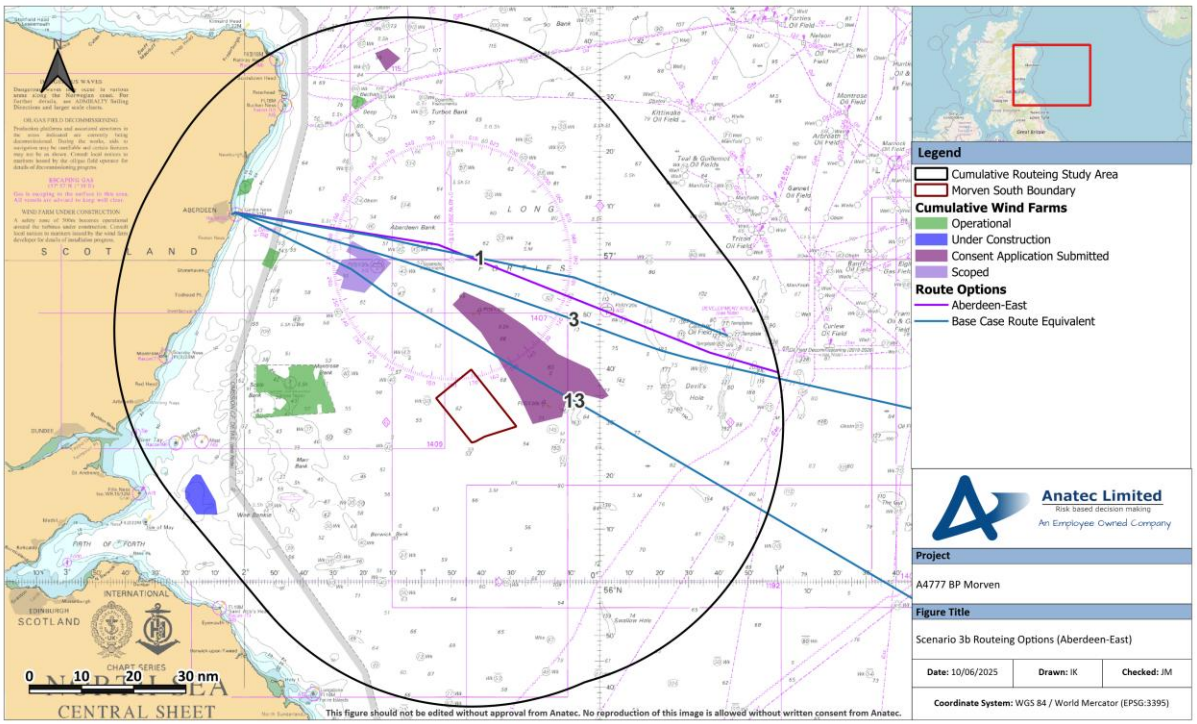


Figure 15.9: Scenario 3b routeing options (Aberdeen-East)

15.5.6.3 As with Scenario 3a, it is unlikely that Aberdeen-East vessels would route west of the Morven South Boundary in Scenario 3b and would instead pass north of Bowdun and Ossian. This is again due to the increased journey times and manoeuvres associated with passing west (and south).

Aberdeen-South routeing

15.5.6.4 The available options for vessels routeing to/from Aberdeen and which transit to the south are presented in Figure 15.10.

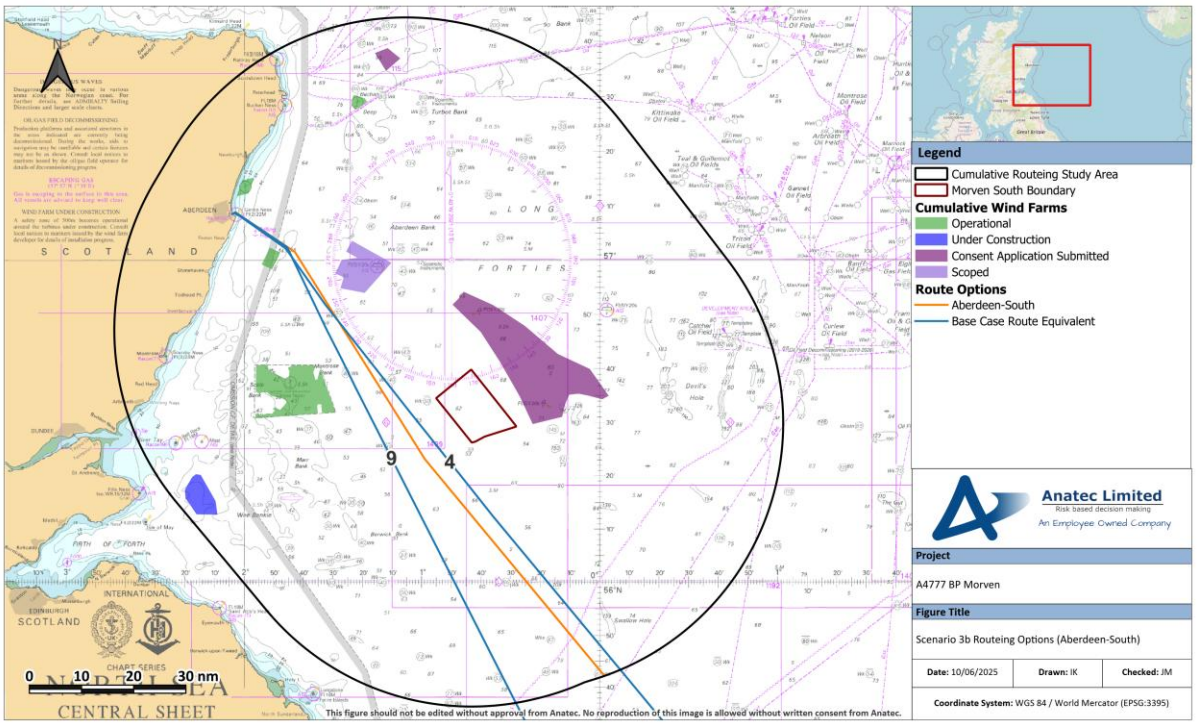


Figure 15.10: Scenario 3b routeing options (Aberdeen-South)

15.5.6.5 As with Scenario 3a, the Aberdeen-South routes will not be influenced by either the Morven South Boundary or any other cumulative development. It is likely that current transits will be able to continue with no effect on passage time and distance.

Firth of Forth routeing

15.5.6.6 The available options for vessels routeing to/from the Firth of Forth are presented in Figure 15.11.

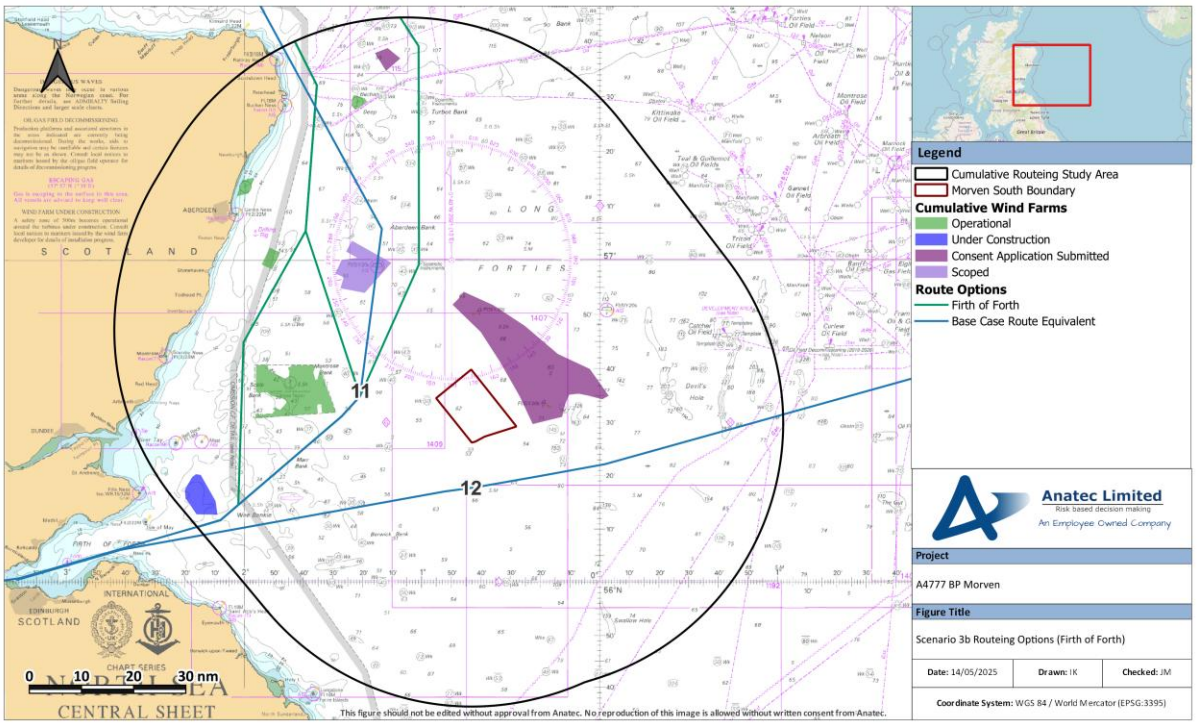


Figure 15.11: Scenario 3b routeing options (Firth of Forth)

15.5.6.7 Vessels routeing to/from the Firth of Forth will likely follow similar transits to those described in Scenario 3a. However, with the omission of the Morven North Boundary there is increased navigable searoom in the approaches to the gap between Ossian and Bowdun. Therefore, the routeing option passing between Ossian and Bowdun is more likely and suited to vessels carrying hazardous cargoes which may have a preference to pass further offshore.

Montrose routeing

15.5.6.8 The available options for vessels routeing to/from Montrose are presented in Figure 15.12.

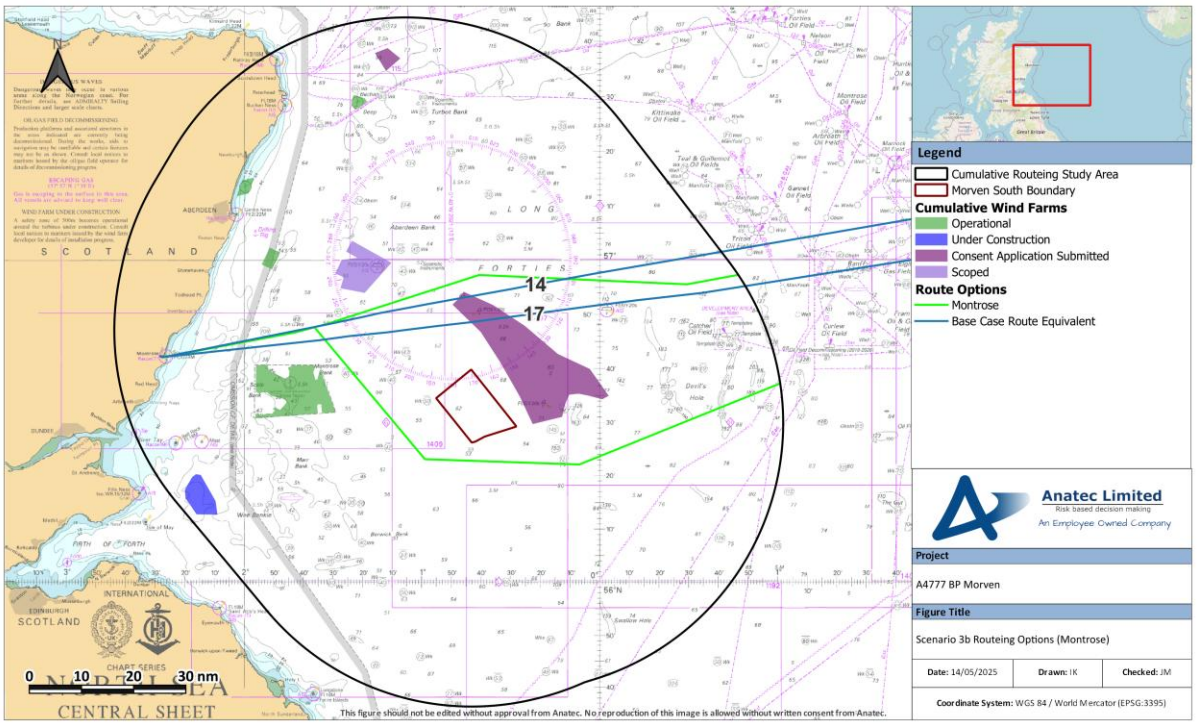


Figure 15.12: Scenario 3b routeing options (Montrose)

15.5.6.9 Similarly to Scenario 3a, vessels could pass either north or south of the Morven South Boundary and Ossian. However, with the omission of the Morven North Boundary there is increased navigable searoom in the approaches to the gap between Ossian and Bowdun. Therefore, the routeing option passing between Ossian and Bowdun is more likely, and subsequently the need for an option passing north of Bowdun (with greater implications for passage time and distance) is removed. It remains the case that the option passing south of the Morven South Boundary and Ossian would have an associated increase in passage time and distance, with this slightly greater than in Scenario 3a with the need to maintain a safe passing distance from the Morven South Boundary.

North-South routeing

15.5.6.10 The available options for vessels undergoing coastal routeing on a North-South bearing are presented in Figure 15.13.

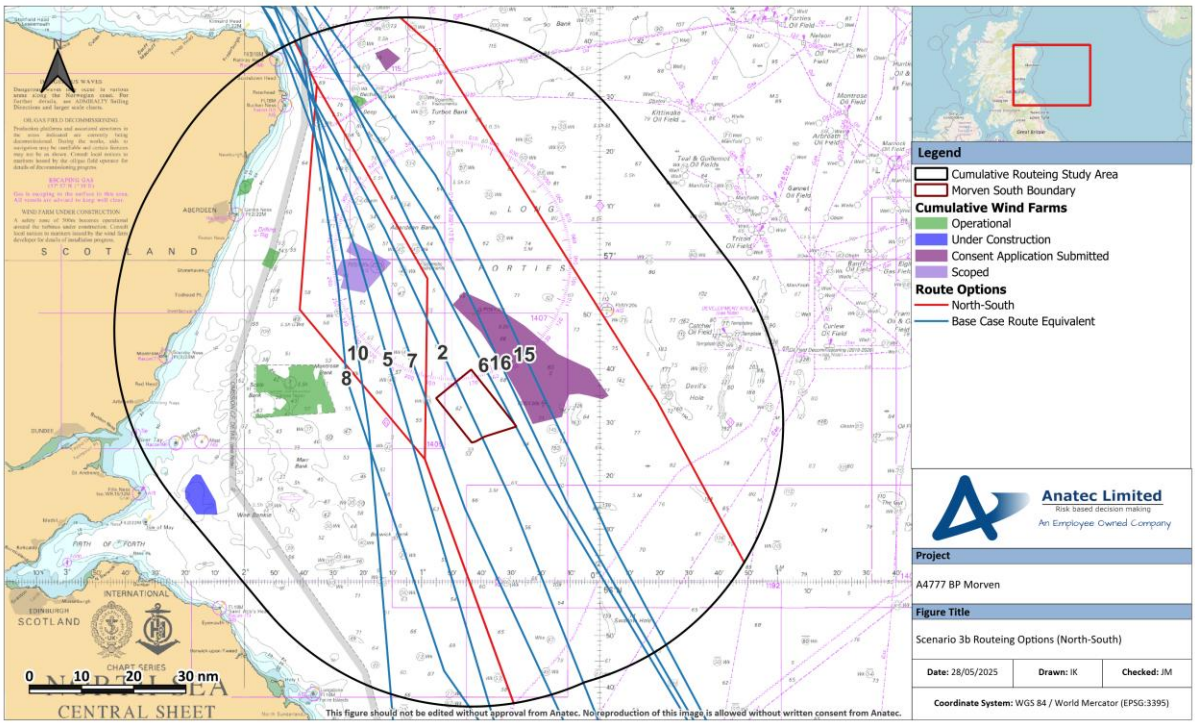


Figure 15.13: Scenario 3b routeing options (North-South)

15.5.6.11 Routeing options for Scenario 3a are maintained, namely deviating west or east of the Morven South Boundary, Bowdun and Ossian with increases in passage time and distance. However, with the omission of the Morven North Boundary the gap between Ossian and Bowdun is considered navigable and therefore offers an additional option for those vessels routeing inshore of Hywind. This option would also involve an increase in passage time and distance, although across all the options there is potential for this to be minimised with adequate passage planning.

15.5.7 Scenario 3c

15.5.7.1 This subsection considers each of the main commercial routes for Scenario 3c, which takes into account the Morven Site, baseline developments and Tier 1 cumulative developments (Ossian, Bowdun and Salamander). Presented alongside the route options are equivalents from the base case, as well as the Tier 1 cumulative developments.

Aberdeen-East routeing

15.5.7.2 The available options for vessels routeing to/from Aberdeen and which transit east are presented in Figure 15.14.

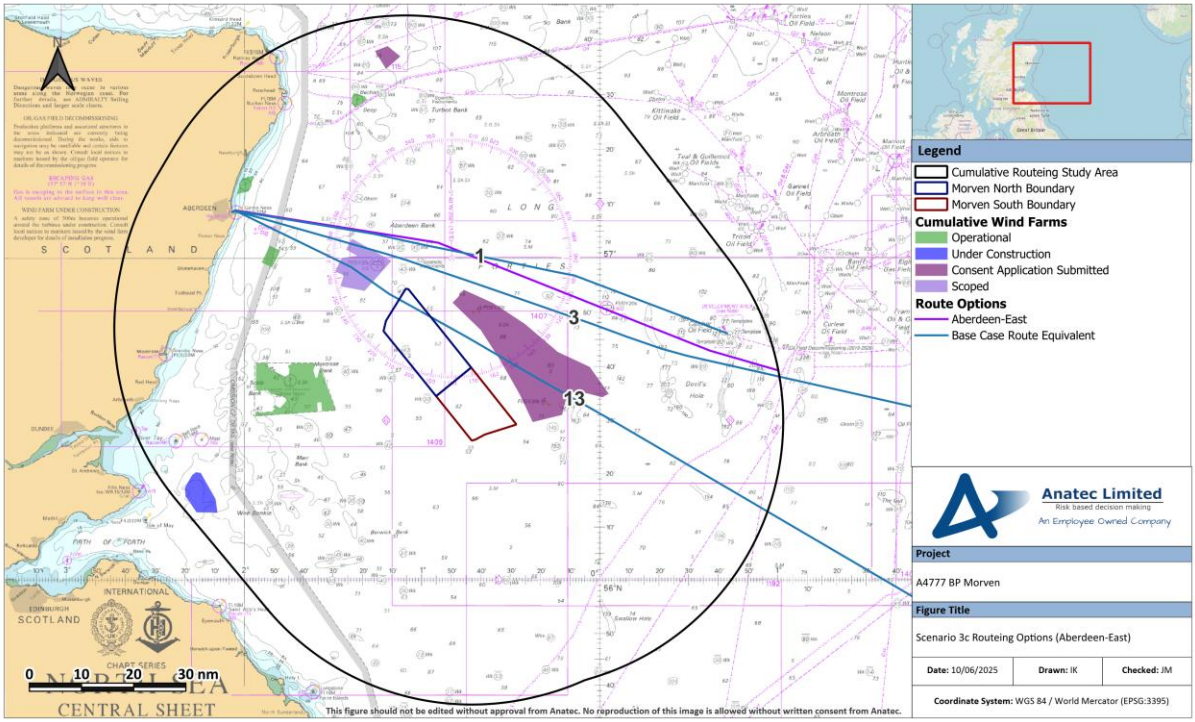


Figure 15.14: Scenario 3c routeing options (Aberdeen-East)

15.5.7.3 As with Scenario 3a and 3b, it is unlikely that Aberdeen-East vessels would route west of the Morven Site and would instead pass north of Bowdun and Ossian. This is again due to the increased journey times and manoeuvres associated with passing west (and south).

Aberdeen-South routeing

15.5.7.4 The available options for vessels routeing to/from Aberdeen and which transit to the south are presented in Figure 15.15.

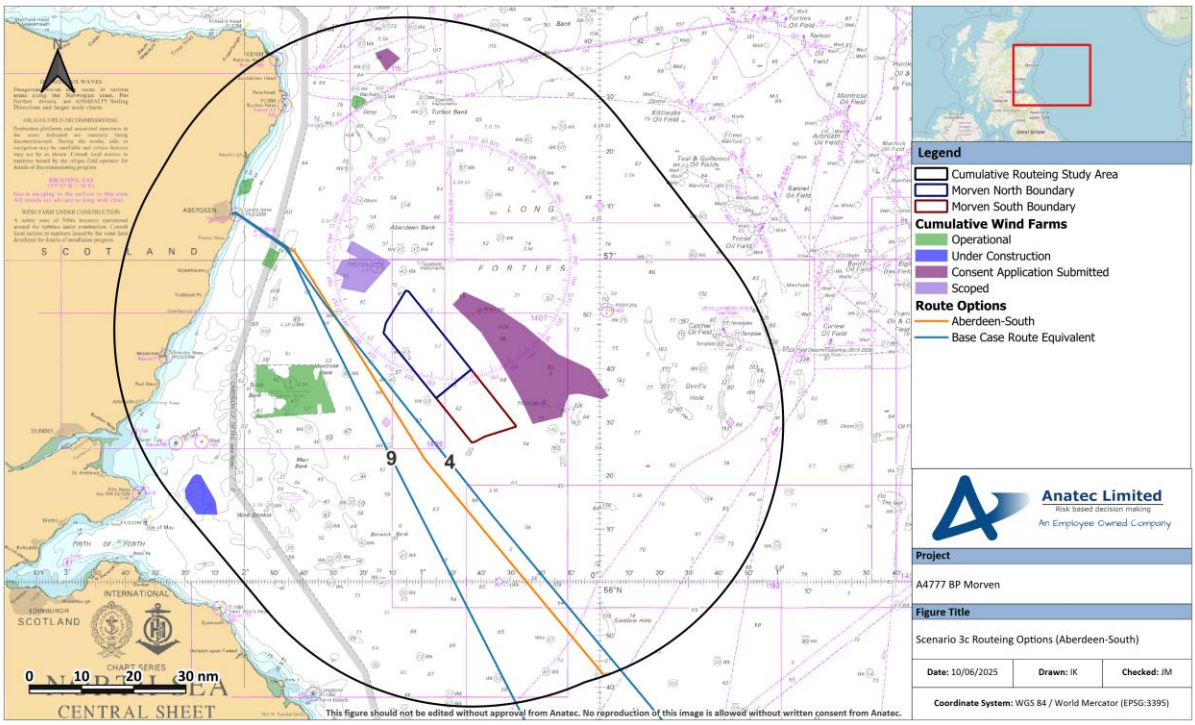


Figure 15.15: Scenario 3c routeing options (Aberdeen-South)

15.5.7.5 As with Scenarios 3a and 3b, the Aberdeen-South routes will not be influenced by the Morven Site, or any other cumulative development. It is likely that current transits will be able to continue with no effect on passage time and distance.

Firth of Forth routeing

15.5.7.6 The available options for vessels routeing to/from the Firth of Forth are presented in Figure 15.16.

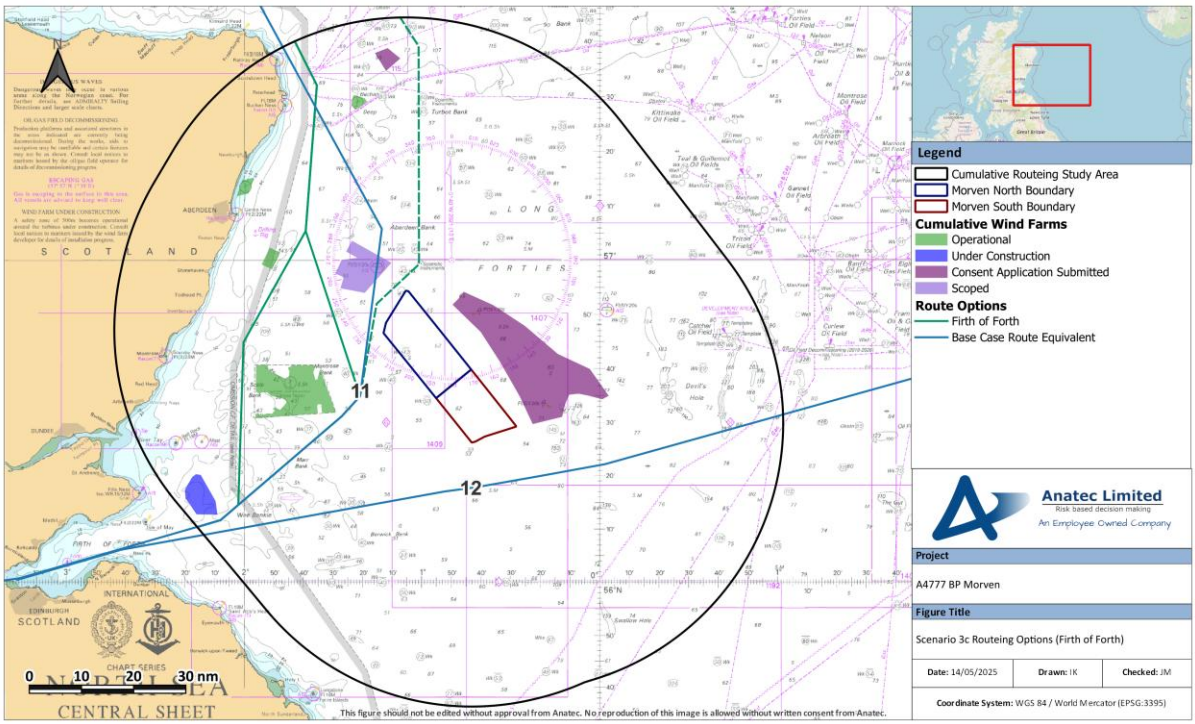


Figure 15.16 Scenario 3c routeing options (Firth of Forth)

15.5.7.7 Vessels routeing to/from the Firth of Forth will likely follow the same transits to those described in Scenario 3a and so deviate either east or west of Seagreen and between Bowdun and Kincardine. Similarly to Scenario 3a, it is possible (but unlikely due to the greater searoom associated with the alternative options) for vessels to instead transit between Bowdun and the Morven Site. Whichever deviation is chosen, there is likely to be a marginal increase in passage time and distance, with this potentially greatest for the option passing between the Morven Site and Bowdun should changes in transit speed be necessary to facilitate the additional manoeuvres.

Montrose routeing

15.5.7.8 The available options for vessels routeing to/from Montrose are presented in Figure 15.17.

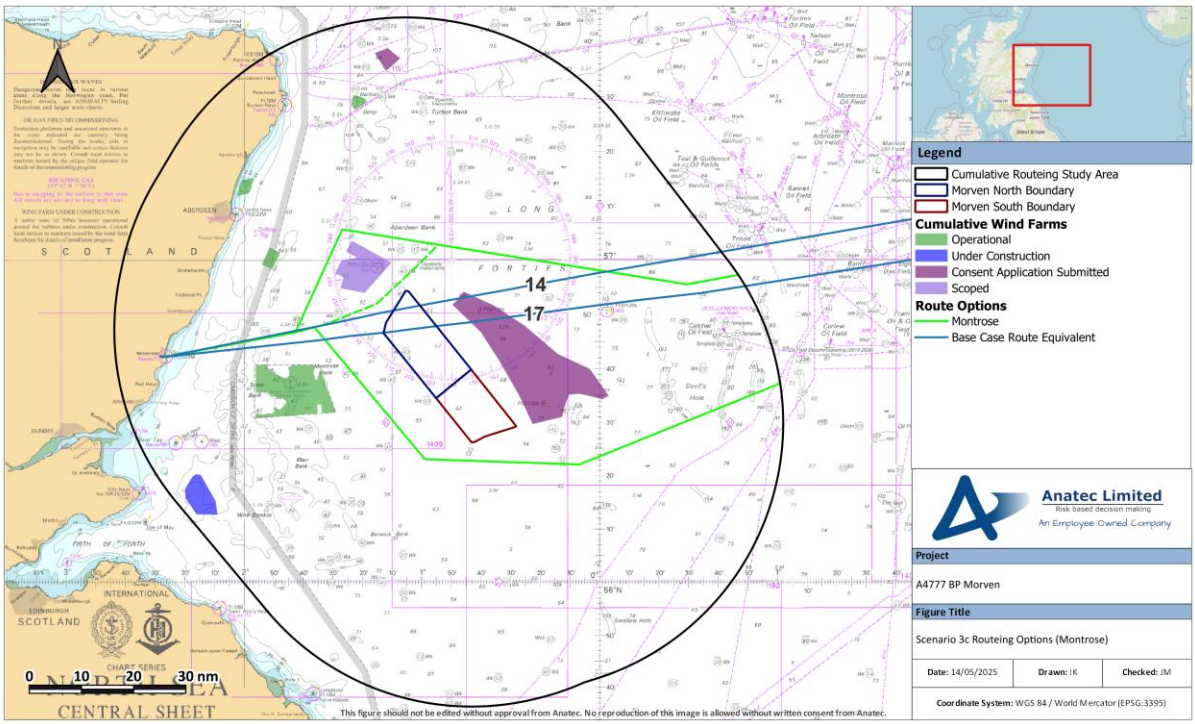


Figure 15.17: Scenario 3c routeing options (Montrose)

15.5.7.9 It is likely that vessel routeing options for Scenario 3c will be similar to those detailed for Scenario 3a, although with the option passing south of the Morven Site and Ossian featuring a slightly greater increase in passage time and distance due to the need to maintain a safe passing distance from the Morven Site (akin to Scenario 3b).

North-South routeing

15.5.7.10 The available options for vessels undergoing coastal routeing on a north-south bearing are presented in Figure 15.18.

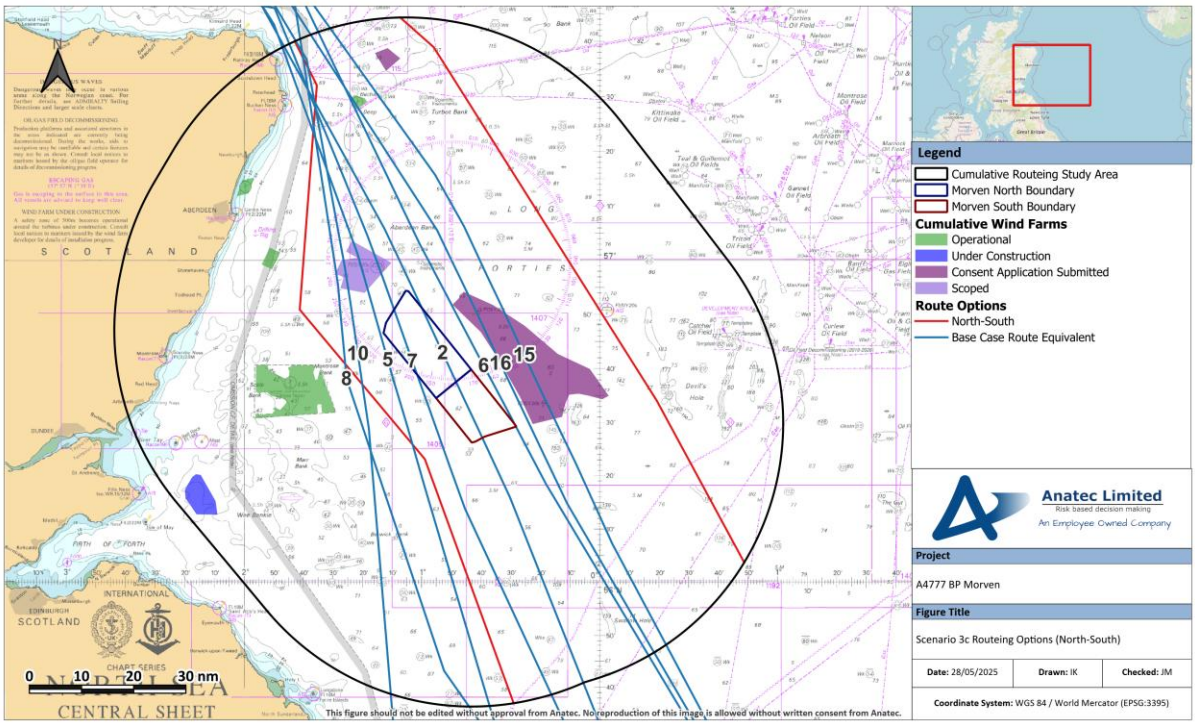


Figure 15.18: Scenario 3c routeing options (North-South)

15.5.7.11 Routeing options for Scenario 3c will be similar to those available for Scenario 3a. In particular, the additional option identified for Scenario 3b (passing between Ossian and Bowdun) would not be anticipated, with consultation feedback indicating it unlikely that vessels would choose to transit between the Morven Site and Ossian.

15.5.8 Scenario 4

15.5.8.1 This subsection considers each of the main commercial routes for Scenario 4, which takes into account the Morven Site, baseline developments, Tier 1 cumulative developments (Ossian, Bowdun and Salamander) and Tier 2 cumulative developments (Bellrock, Berwick Bank, Muir Mhòr, Flora and Cedar). Presented alongside the route options are equivalents from the base case, as well as the Tier 1 and Tier 2 cumulative developments.

Aberdeen-East routeing

15.5.8.2 The available options for vessels routeing to/from Aberdeen and which transit east are presented in Figure 15.19.

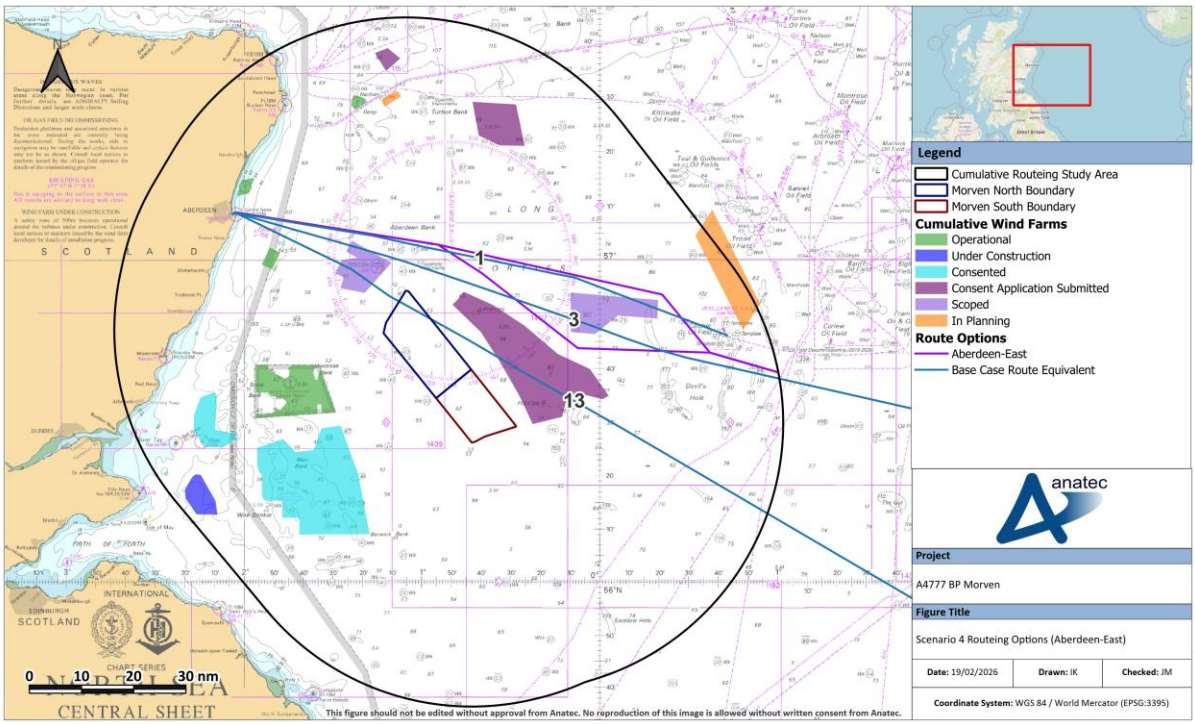


Figure 15.19: Scenario 4 routeing options (Aberdeen-East)

15.5.8.3 Similarly to Scenario 3, it is unlikely that Aberdeen-East vessels would route west of the Morven Site and would instead pass north of Bowdun and Ossian. The presence of Bellrock introduces further displacement for these vessels, although there is optionality to pass north of Bellrock (between Bellrock and Cedar) or south of Bellrock (between Bellrock and Ossian). There is slightly greater searoom to the east of Bellrock, but the preferred option would rest with the vessel Master. The deviation would result in an increase in passage time and distance greater than that applicable for Scenario 3.

Aberdeen-South routeing

15.5.8.4 The available options for vessels routeing to/from Aberdeen and which transit to the south are presented in Figure 15.20.

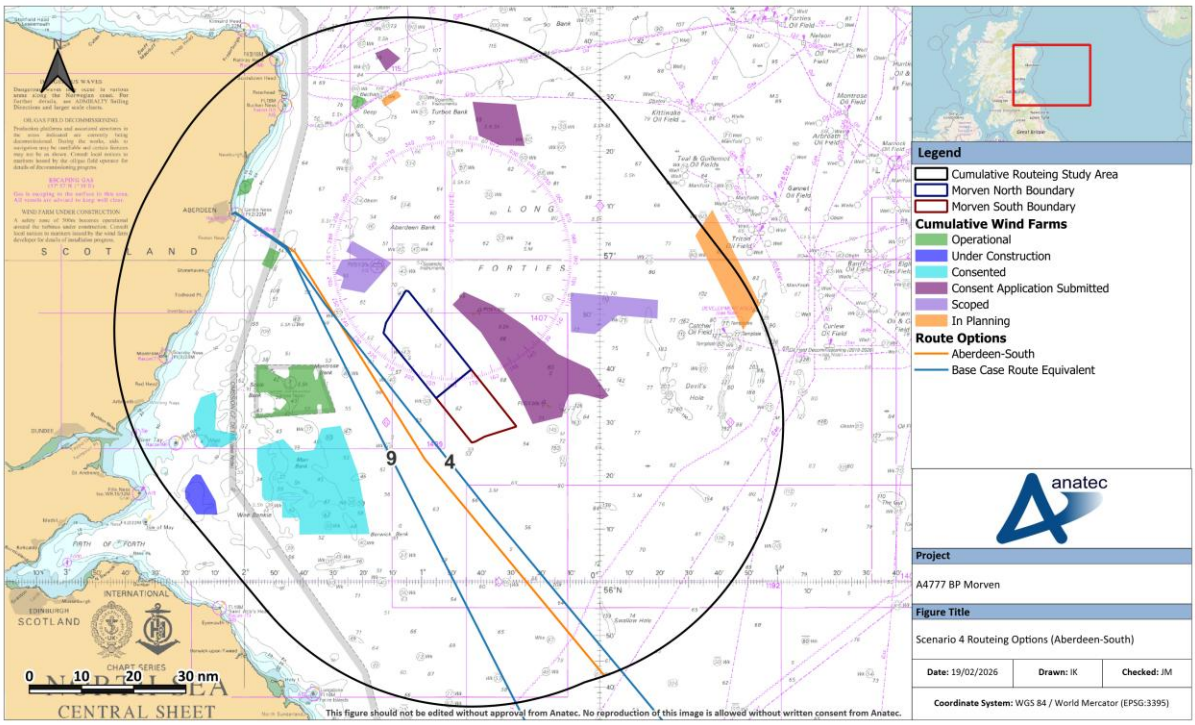


Figure 15.20: Scenario 4 routeing options (Aberdeen-South)

15.5.8.5 As with Scenario 3, the Aberdeen-South routes will not be influenced by either the Morven Site or any other cumulative development. It is likely that current transits will be able to continue with no effect on passage time and distance.

Firth of Forth routeing

15.5.8.6 The available options for vessels routeing to/from the Firth of Forth are presented in Figure 15.21.

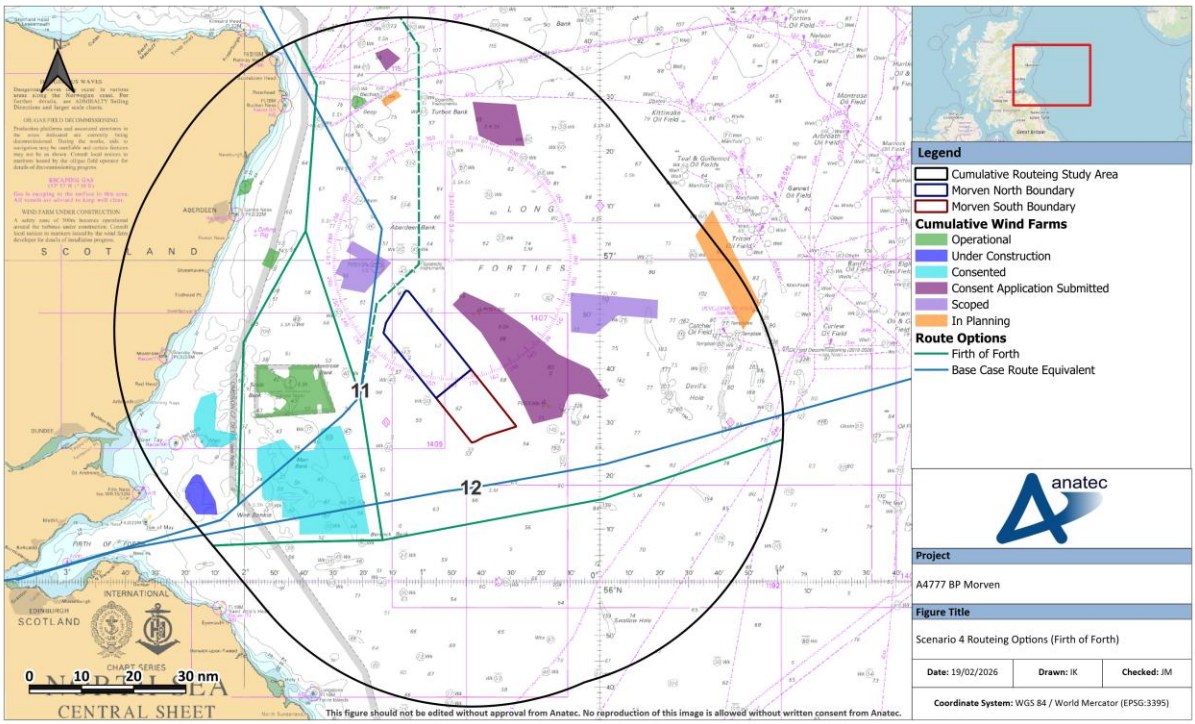


Figure 15.21: Scenario 4 routeing options (Firth of Forth)

15.5.8.7 Due to the presence of Berwick Bank, vessels on Route 11 would be required to deviate either east or west of the development. Those that deviate west would likely retain a similar route to that presented for Scenario 3, passing west of Seagreen remaining inshore for passing Bowdun and Hywind. Those that deviate east of Berwick Bank would also likely pass west of Bowdun, although there remains an unlikely option to pass between the Morven Site and Bowdun as described for Scenario 3a and 3c. Deviations closer inshore may be influenced by the nature of the cargo onboard, although Route 11 does currently pass close to the coast when heading around Rattray Head.

15.5.8.8 Vessels on Route 12 would be required to deviate to pass around Berwick Bank. This is expected to be a minor deviation to the south.

15.5.8.9 Due to Route 12 requiring deviation in this scenario only, the number of vessels affected would approximate one every two days.

Montrose routeing

15.5.8.10 The available options for vessels routeing to/from Montrose are presented in Figure 15.22.

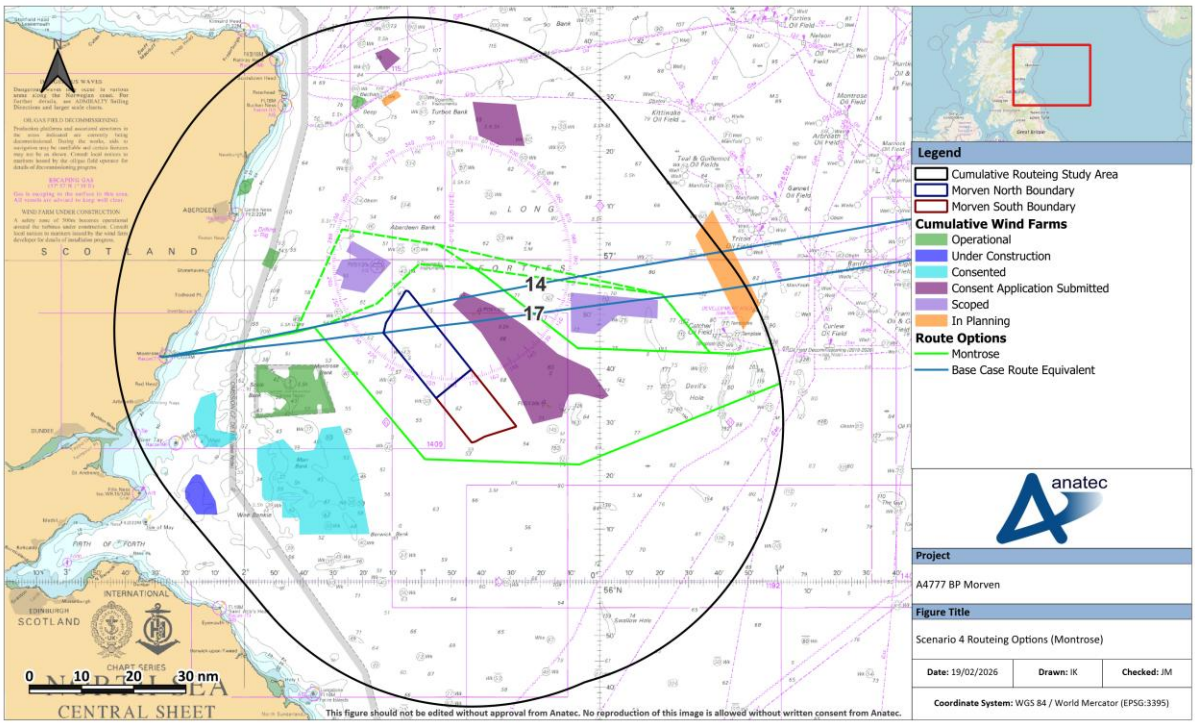


Figure 15.22: Scenario 4 routeing options (Montrose)

15.5.8.11 Similarly to Scenario 3a, vessels could pass either north or south of the Morven Site and Ossian. The presence of Bellrock introduces further displacement for these vessels, although there is optionality to pass north or south of Bellrock similarly to that described for the Aberdeen-South routeing. The deviation would result in an increase in passage time and distance greater than that applicable for Scenario 3.

15.5.8.12 Therefore, the option to pass south of the Morven Site and Ossian may be more likely in this scenario, with greater searoom available and fewer additional manoeuvres to incorporate into the passage.

North-South routeing

15.5.8.13 The available options for vessels undergoing coastal routeing on a north-south bearing are presented in Figure 15.23.

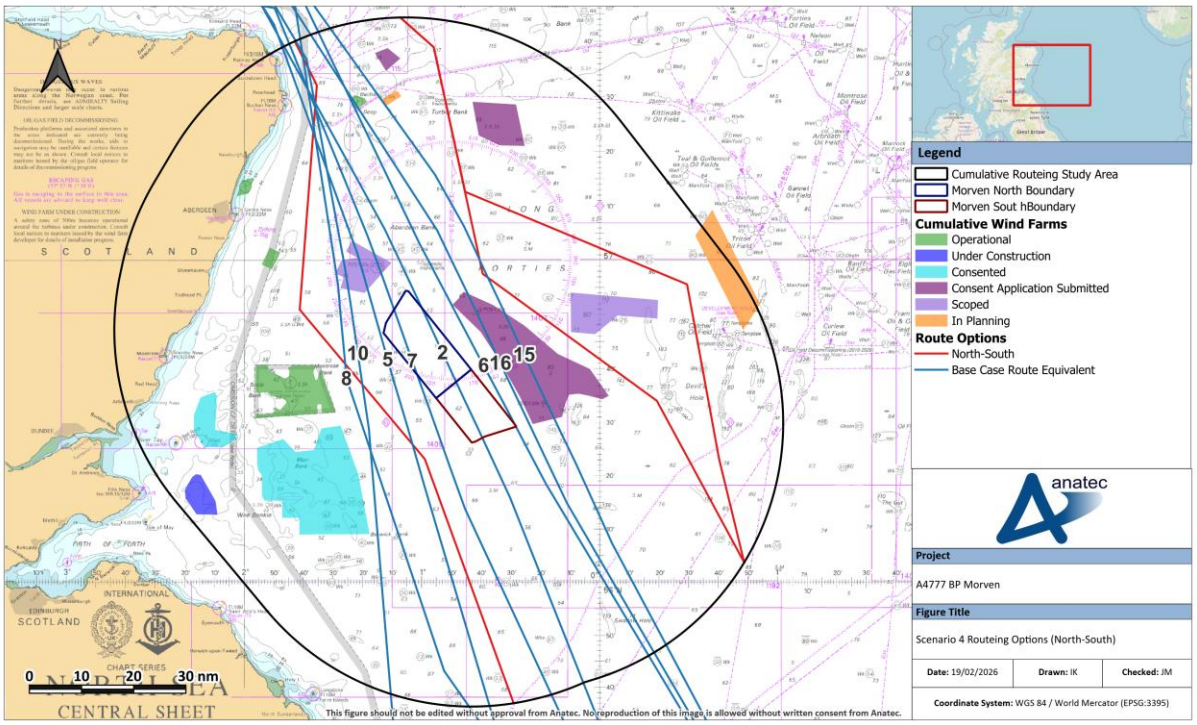


Figure 15.23: Scenario 4 routeing options (North-South)

15.5.8.14 The presence of the Tier 1 cumulative developments is key to the routeing options for Scenario 4. In particular, it remains expected that vessels on these routes will either deviate west or east of the Morven Site, Bowdun and Ossian.

15.5.8.15 The additional presence of Flora reinforces the expectation that vessels will choose an inshore or offshore route, either passing inshore of Hywind or offshore of Salamander.

15.5.8.16 The additional presence of Muir Mhòr results in a further manoeuvre, while the presence of Bellrock introduces further optionality. Vessels choosing an offshore route may choose to pass west of Bellrock (between Bellrock and Ossian) or east of Bellrock (between Bellrock and Cedar). As with the Aberdeen-East routeing, there is slightly greater searoom for vessels to the east of Bellrock, but the preferred option would rest with the vessel Master. The deviation for the offshore option would result in an increase in passage time and distance greater than that applicable for Scenario 3.

16 Collision and allision risk modelling

16.1 Overview

16.1.1.1 To inform the risk assessment (Sections 18 to 20), a quantitative assessment of some of the major hazards associated with Morven North and Morven South has been undertaken. The following subsections outline the inputs and methodology used for the collision and allision risk modelling.

16.1.2 Scenarios under consideration

16.1.2.1 Due to the potential outcomes of site development, each of the Morven North in isolation (Scenario 1a), Morven South in isolation (Scenario 1b) and concurrent development scenarios (Scenario 2) are modelled individually.

16.1.2.2 For each element of the quantitative assessment for each scenario, both a pre- and post-wind farm scenario with base and future case traffic levels have been considered. As a result, for each of the three scenarios listed above, six distinct cases 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.

16.1.3 Hazards under consideration

16.1.3.1 Hazards considered in the quantitative assessment are as follows:

- Increased vessel to vessel collision risk;
- Powered vessel to structure allision risk (post-wind farm only);
- Drifting vessel to structure allision risk (post-wind farm only);
- Fishing vessel to structure allision risk (post-wind farm only).

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

16.2 Pre-Wind Farm Modelling

16.2.1 Scenario 1a

Vessel to vessel encounters

16.2.1.1 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). The model defines an encounter as two vessels passing within 1nm of each other within the same minute. This helps to illustrate where existing shipping congestion is highest and therefore where offshore developments, such as an 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.

16.2.1.2 A heat map based upon the geographical distribution of vessel encounter tracks within a density grid is presented in Figure 16.1. Following this, Figure 16.2 illustrates the daily number of encounters recorded within both the Morven North Shipping and Navigation Study Area and Morven North Boundary itself throughout the survey periods.

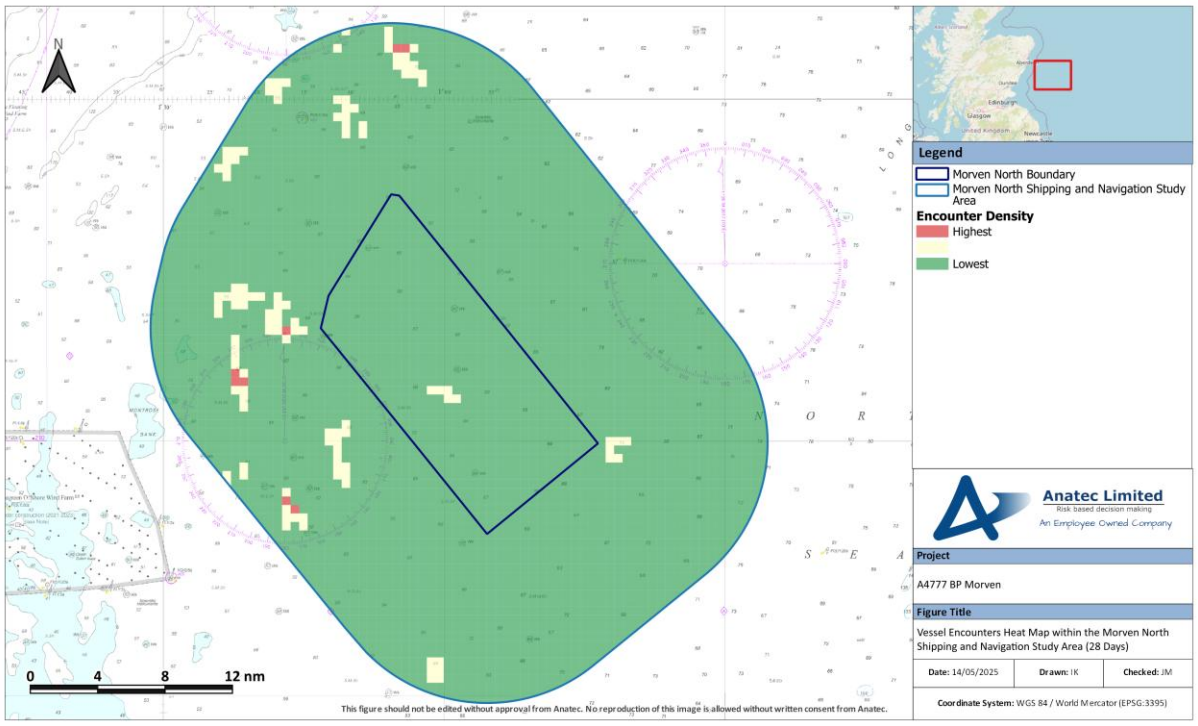


Figure 16.1: Vessel encounters heat map within the Morven North Shipping and Navigation Study Area (28 Days)

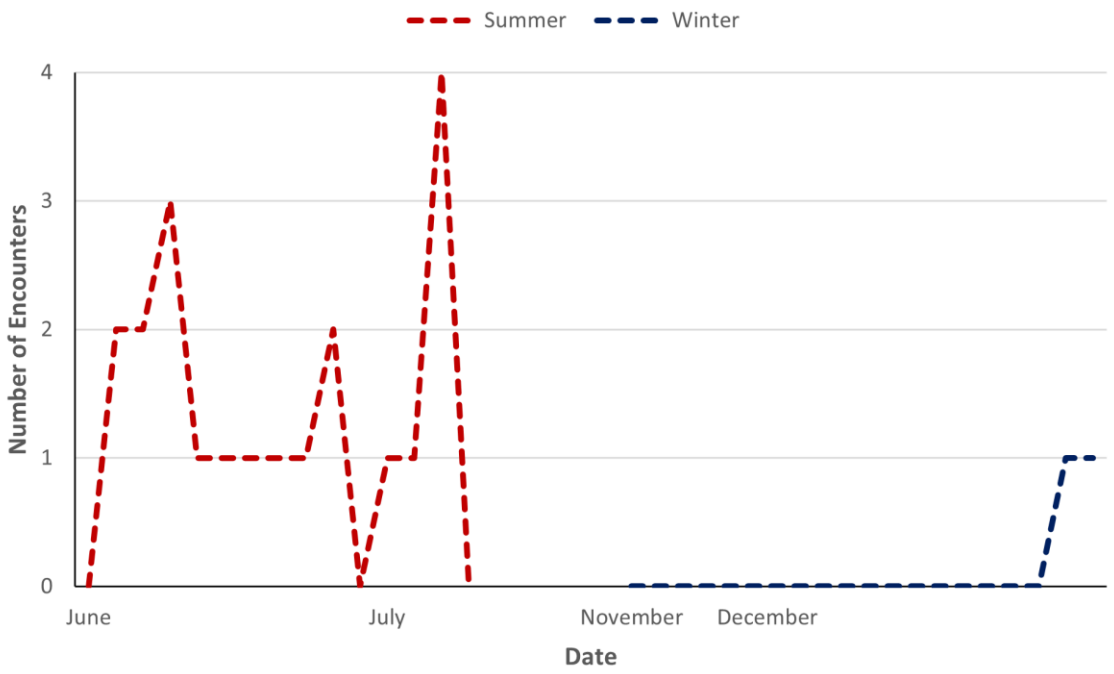


Figure 16.2: Vessel encounters within the Morven North Shipping and Navigation Study Area during Vessel Traffic Surveys (28 Days)

16.2.1.3 There was an average of one encounter per day within the Morven North Shipping and Navigation Study Area during the survey periods. The greatest number of encounters recorded in one day was four, on 03 July 2024. Encounter volumes are low relative to other assessments due to relatively low traffic volumes in the area.

16.2.1.4 The most frequent vessel types involved in encounters within the Morven North Shipping and Navigation Study Area were cargo vessels (45%) and oil and gas vessels (20%).

Vessel to vessel collision risk

16.2.1.5 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 Morven North Shipping and Navigation Study Area. The route positions and widths are based on the vessel traffic data (see Section 10).

16.2.1.6 A heat map based upon the geographical distribution of collision risk within a density grid for the pre wind farm base case is presented in Figure 16.3.

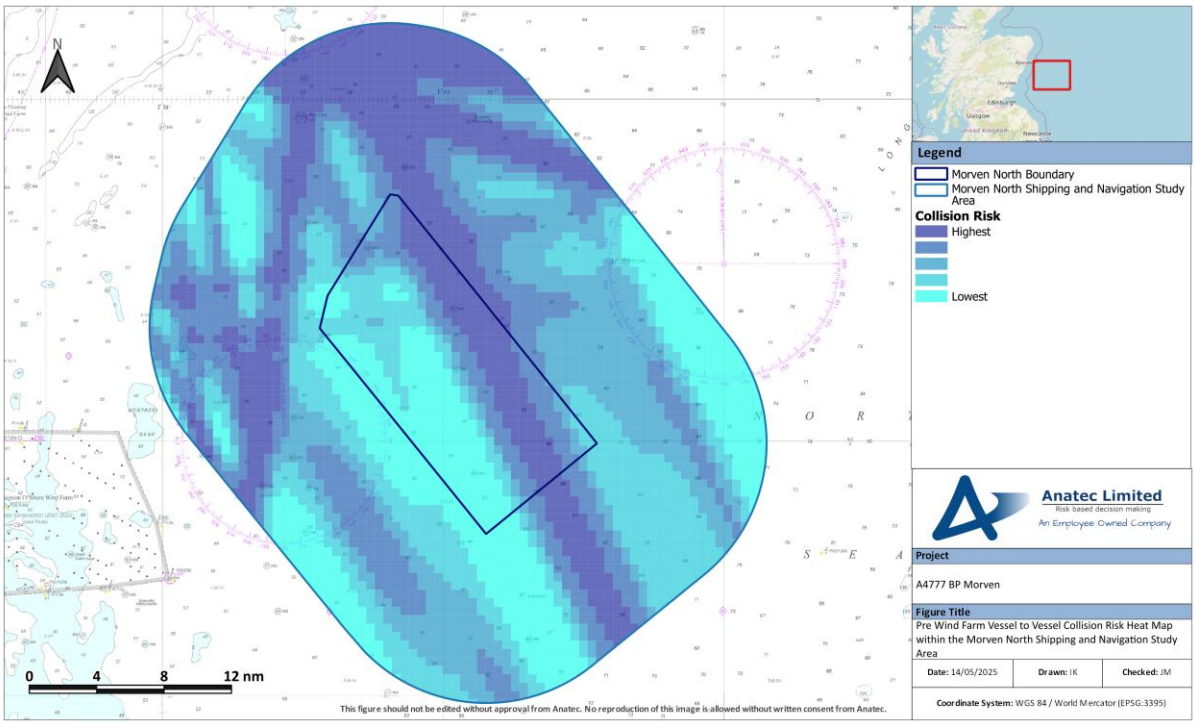


Figure 16.3: Pre wind farm vessel to vessel collision risk heat map within the Morven North Shipping and Navigation Study Area

16.2.1.7 Assuming base case vessel traffic levels, the annual collision frequency pre wind farm was estimated to be 4.27×10^{-4}, corresponding to a return period of approximately one in 2,344 years. It is noted that the model is calibrated based upon major incident data at sea which allows for benchmarking but does not cover all incidents. Other incident data, which includes minor incidents, is presented in Section 9.

16.2.2 Scenario 1b

Vessel to vessel encounters

16.2.2.1 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). The model defines an encounter as two vessels passing within 1nm of each other within the same minute. This helps to illustrate where existing shipping congestion is highest and therefore where offshore developments, such as an 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.

16.2.2.2 A heat map based upon the geographical distribution of vessel encounter tracks within a density grid is presented in Figure 16.4.

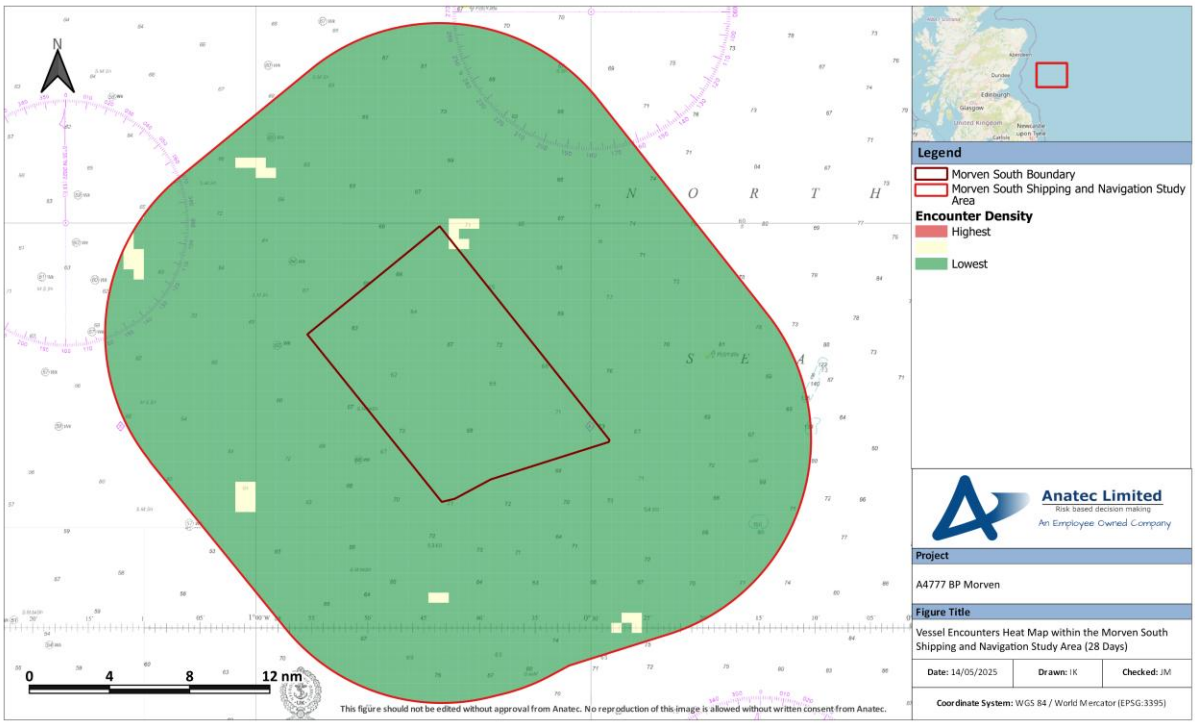


Figure 16.4: Vessel encounters heat map within the Morven South Shipping and Navigation Study Area (28 Days)

16.2.2.3 There were a total of six recorded encounters within the Morven South Shipping and Navigation Study Area during the survey periods, resulting in an average of one encounter every four to five days. Each encounter occurred on a different day. Encounter volumes are very low relative to other assessments due to relatively low traffic volumes in the area.

16.2.2.4 The most frequent vessel types involved in encounters within the Morven South Shipping and Navigation Study Area were cargo vessels (58%) and tankers (17%).

Vessel to vessel collision risk

16.2.2.5 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 Morven South Shipping and Navigation Study Area. The route positions and widths are based on the vessel traffic data (see Section 10).

16.2.2.6 A heat map based upon the geographical distribution of collision risk within a density grid for the pre wind farm base case is presented in Figure 16.5.

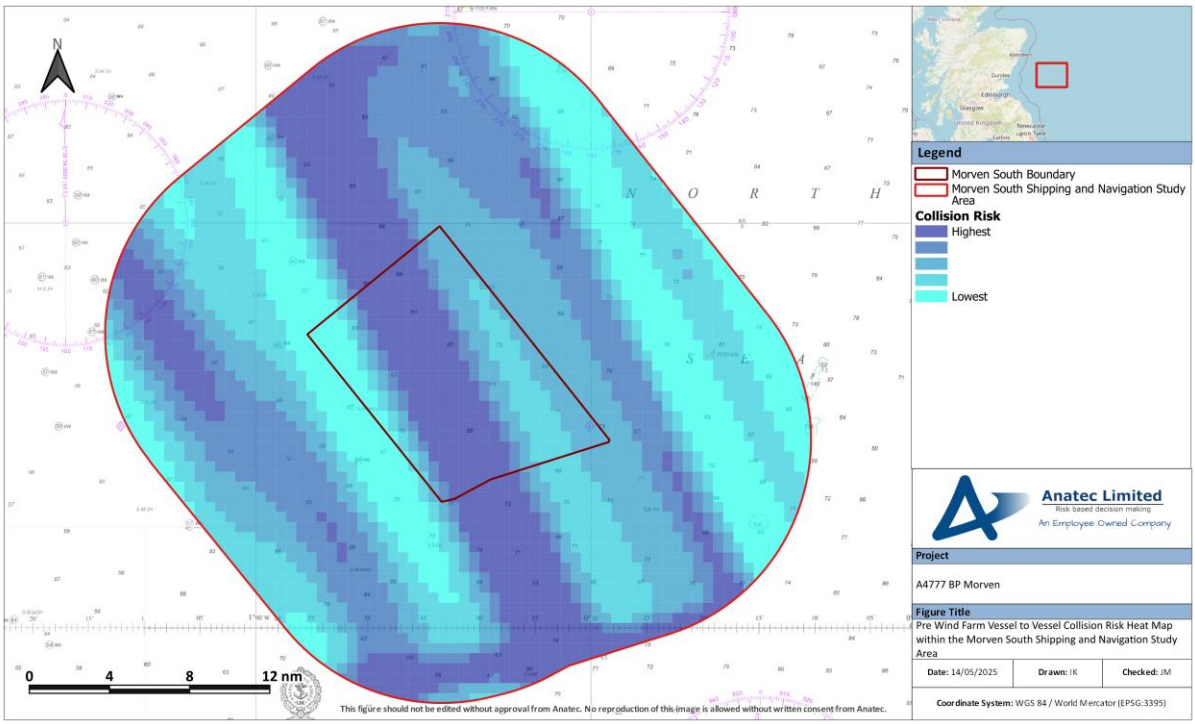


Figure 16.5: Pre wind farm vessel to vessel collision risk heat map within the Morven South Shipping and Navigation Study Area

16.2.2.7 Assuming base case vessel traffic levels, the annual collision frequency pre wind farm was estimated to be 1.89×10^{-4}, corresponding to a return period of approximately one in 5,283 years. It is noted that the model is calibrated based upon major incident data at sea which allows for benchmarking but does not cover all incidents. Other incident data, which includes minor incidents, is presented in Section 9.

16.2.3 Scenario 2

Vessel to vessel encounters

16.2.3.1 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). The model defines an encounter as two vessels passing within 1nm of each other within the same minute. This helps to illustrate where existing shipping congestion is highest and therefore where offshore developments, such as an 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.

16.2.3.2 A heat map based upon the geographical distribution of vessel encounter tracks within a density grid is presented in Figure 16.6. Following this, Figure 16.7 illustrates

the daily number of encounters recorded within both the Regional Shipping and Navigation Study Area and the Morven Site throughout the survey periods.

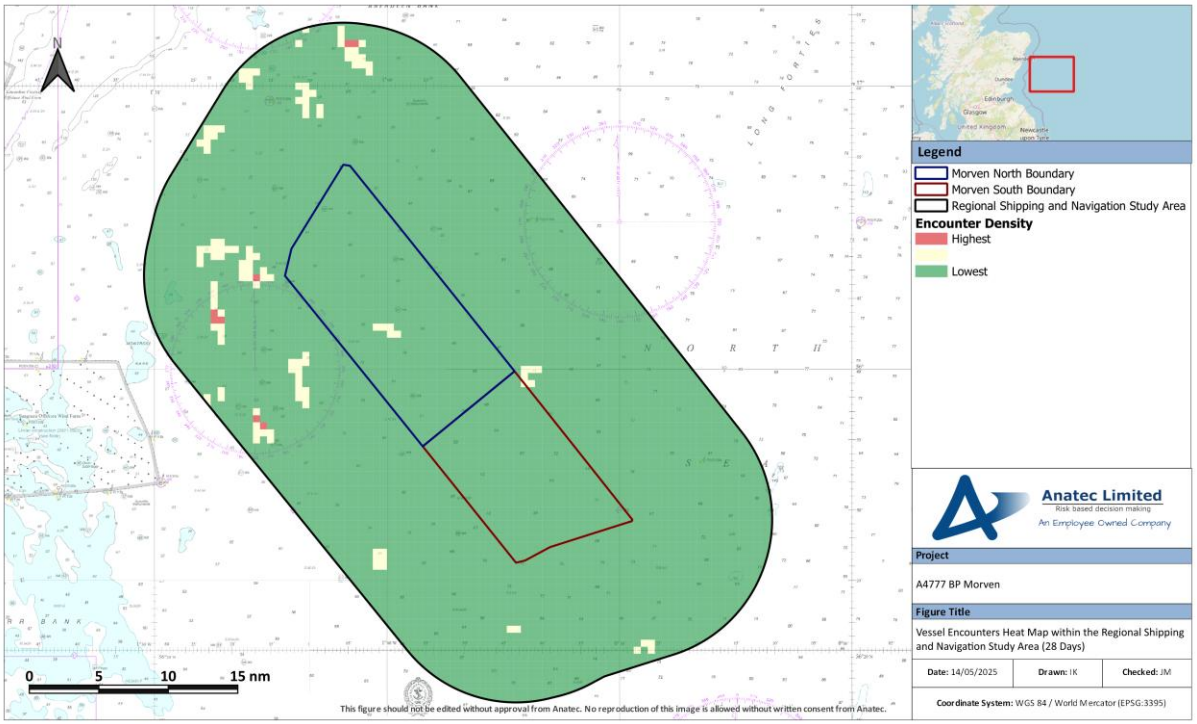


Figure 16.6: Vessel encounters heat map within the Regional Shipping and Navigation Study Area (28 Days)

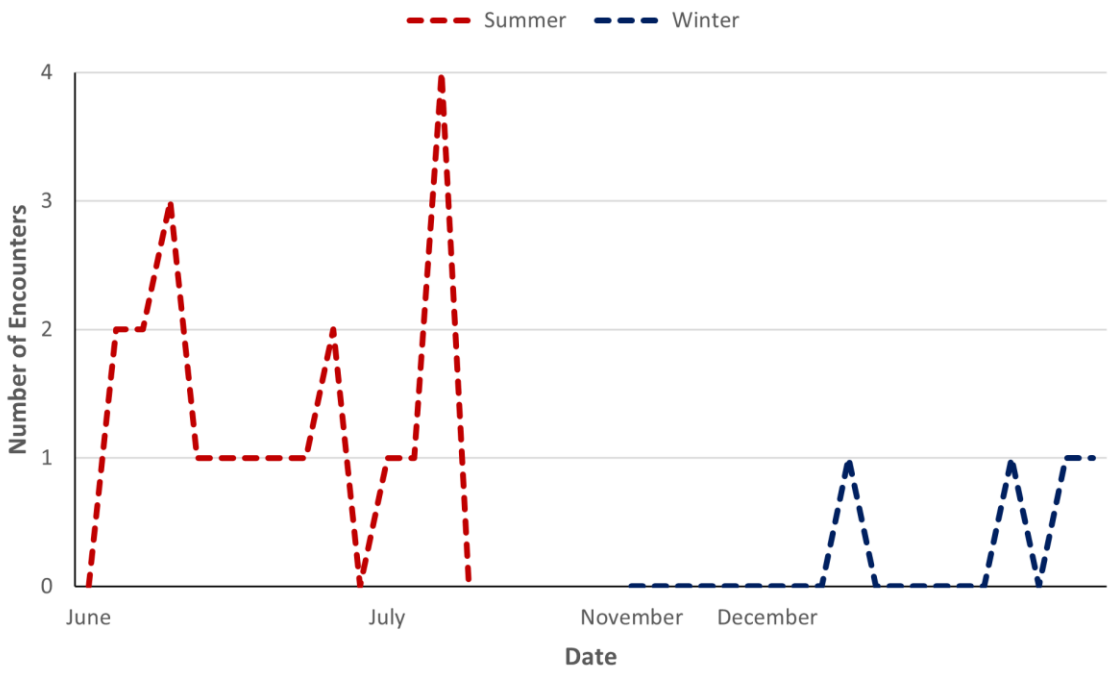


Figure 16.7: Vessel encounters within the Regional Shipping and Navigation Study Area During Vessel Traffic Surveys (28 Days)

16.2.3.3 There was an average of one encounter per day within the Regional Shipping and Navigation Study Area during the survey periods. The greatest number of encounters recorded in one day was four, on 03 July 2024. Encounter volumes are low relative to other assessments due to relatively low traffic volumes in the area.

16.2.3.4 The most frequent vessel types involved in encounters within the Regional Shipping and Navigation Study Area were cargo vessels (48%) and oil and gas vessels (19%).

Vessel to vessel collision risk

16.2.3.5 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 Regional Shipping and Navigation Study Area. The route positions and widths are based on the vessel traffic data (see Section 10).

16.2.3.6 A heat map based upon the geographical distribution of collision risk within a density grid for the pre wind farm base case is presented in Figure 16.8.

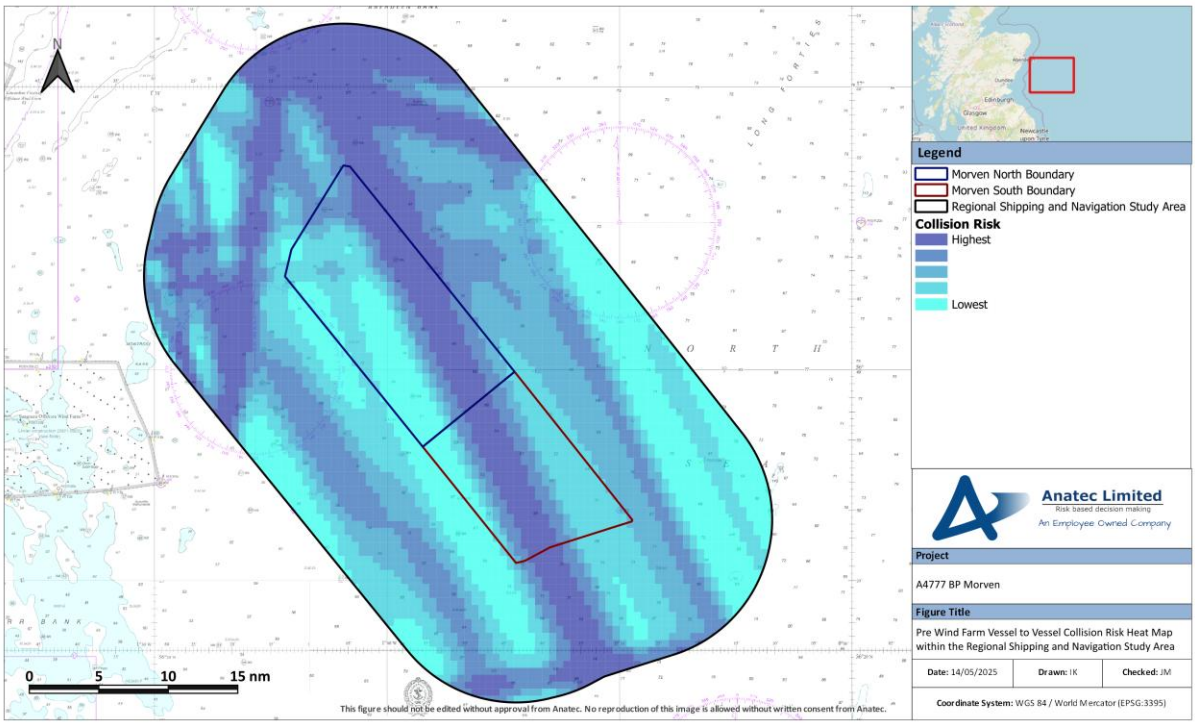


Figure 16.8: Pre wind farm vessel to vessel collision risk heat map within the Regional Shipping and Navigation Study Area

16.2.3.7 Assuming base case vessel traffic levels, the annual collision frequency pre wind farm was estimated to be 5.01×10^{-4}, corresponding to a return period of approximately one in 1,996 years. It is noted that the model is calibrated based upon major incident data at sea which allows for benchmarking but does not cover all incidents. Other incident data, which includes minor incidents, is presented in Section 9.

16.3 Post-Wind farm modelling

16.3.1 Scenario 1a

Simulated Automatic Identification System

16.3.1.1 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 Morven North Boundary. The AIS Simulator uses the mean positions of the main commercial routes identified within the Morven North Shipping and Navigation 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.

16.3.1.2 A figure of 28 days of simulated AIS (matching the total duration of the vessel traffic surveys) within the Morven North Shipping and Navigation Study Area, based on the deviated main commercial routes, is presented in Figure 16.9.

16.3.1.3 It is noted that the simulated AIS represents a MDS based on commercial routes passing at a minimum mean distance of 1nm from Morven North.

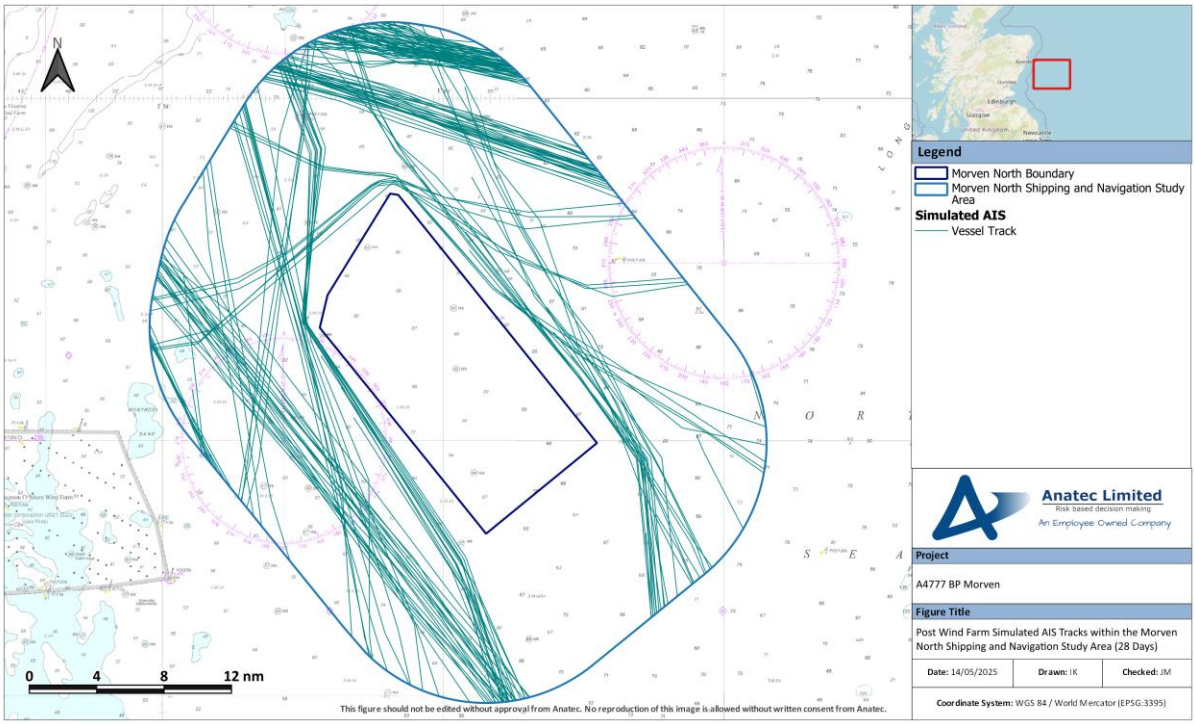


Figure 16.9: Post wind farm simulated ais tracks within the Morven North Shipping and Navigation Study Area (28 Days)

Vessel to vessel collision risk

16.3.1.4 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 Morven North Shipping and Navigation Study Area.

16.3.1.5 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 16.10.

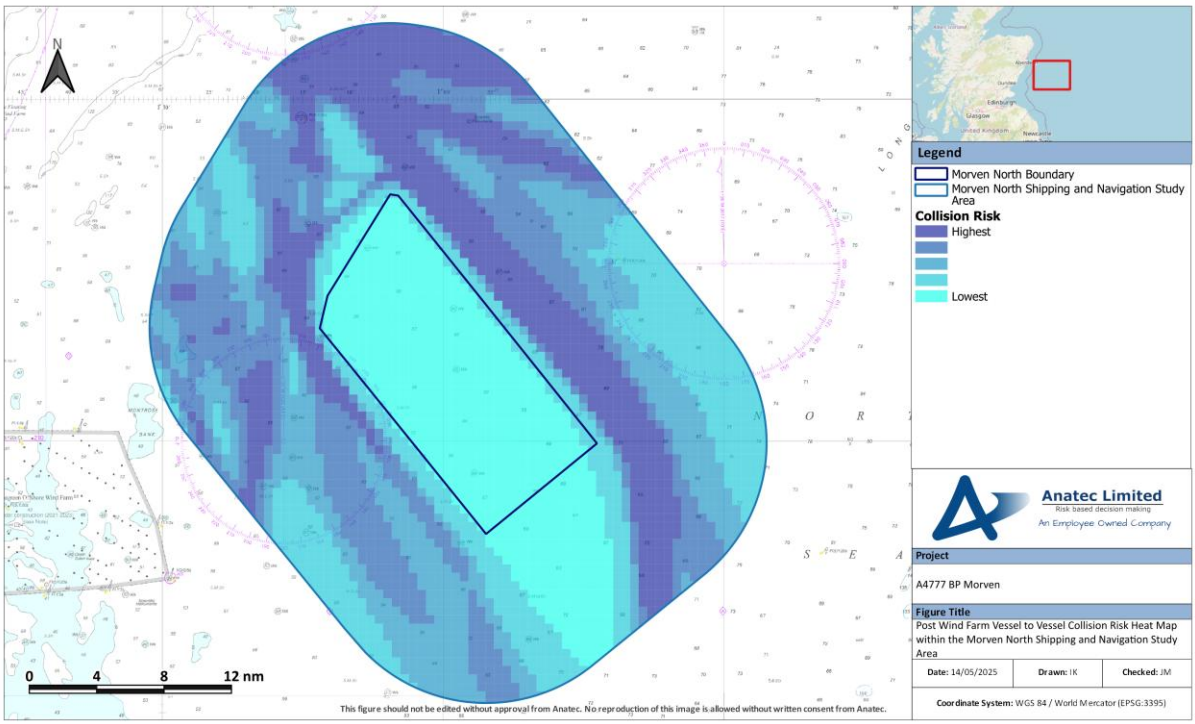


Figure 16.10: Post wind farm vessel to vessel collision risk heat map within the Morven North Shipping and Navigation Study Area

16.3.1.6 Assuming base case traffic levels, the annual collision frequency post wind farm was estimated to be 7.04×10^{-4}, corresponding to a return period of approximately one in 1,421 years. This represents an increase of 65% compared to the pre wind farm base case result, equating to an additional collision every 3,606 years. As per Section 15.5.1, conservative assumptions have been made within the MDS modelled.

16.3.1.7 Based on modelling results, the majority of collision risk is due to vessels deviating to the east of the Morven North Boundary, with increased collision risk also at the western extent of the Morven North Boundary.

Powered vessel to structure allision risk

16.3.1.8 Based upon the vessel routeing identified in the Morven North Shipping and Navigation Study Area, the anticipated re-routeing as a result of the presence of the Morven North Boundary 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 Morven North is considered to be low.

16.3.1.9 Using the post wind farm routeing as input, together with the MDS indicative worst-case 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 Morven North Boundary whilst under power. In order to maintain an MDS, the model did not consider one structure shielding another.

16.3.1.10 A plot of the annual powered allision frequency per structure for the base case is presented in Figure 16.11, with the chart background removed to increase the visibility of those structures with lower allision frequencies.

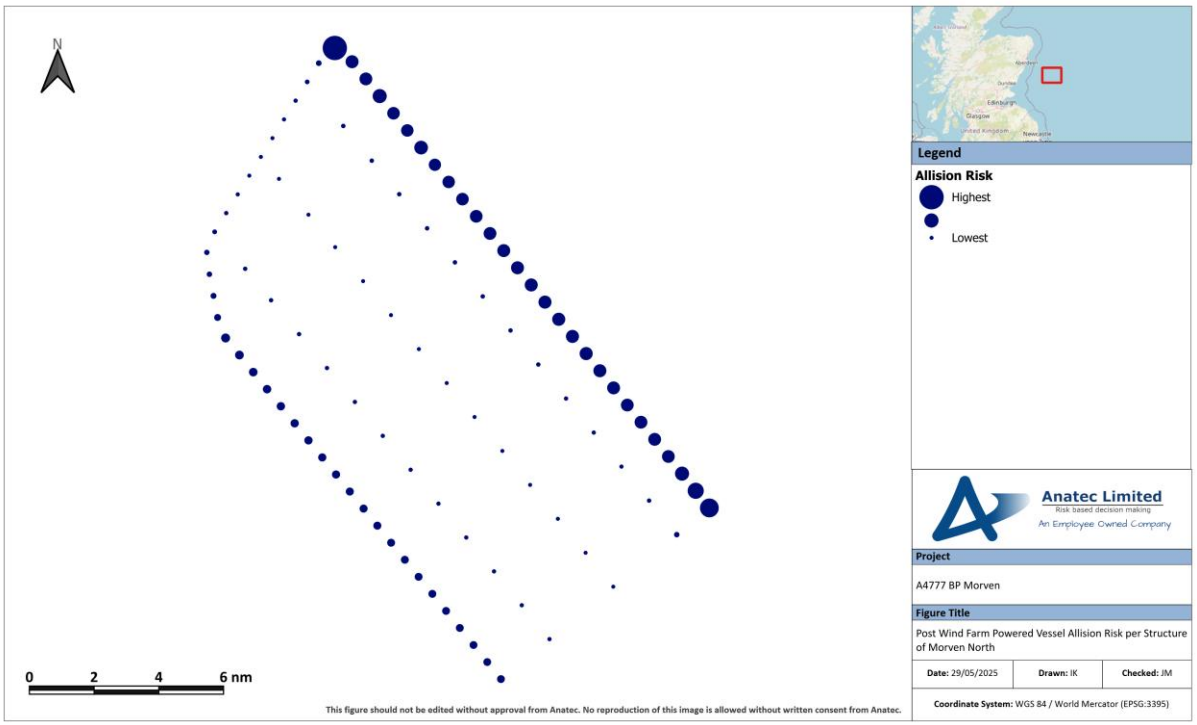


Figure 16.11: Post wind farm powered vessel allision risk per structure of Morven North

16.3.1.11 Assuming base case vessel traffic levels, the annual powered allision frequency was estimated to be 1.69×10^{-3}, corresponding to a return period of approximately one in 591 years. As per Section 15.5.1, conservative assumptions have been made within the MDS modelled.

16.3.1.12 The greatest powered vessel to structure allision risk was associated with structures on the eastern perimeter – and in particular, the northern corner. The greatest individual allision risk was associated with the bridge-linked OSP on the northeast perimeter (approximately 1.82×10^{-4} or one in 5,502 years) noting that this structure is larger than others across the array and therefore has a greater exposure to allision risk.

Drifting vessel to structure allision risk

16.3.1.13 Using the post wind farm routeing as input, together with the MDS 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 Morven North Boundary. The model is based on the premise that propulsion on a vessel must fail before drifting will occur. The model takes account of the type and size of the vessel, the number of engines and the average time required to repair but does not consider navigational errors caused by human actions.

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

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

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

16.3.1.16 After modelling the three drifting scenarios, it was established that the wind-dominated scenario produced the worst-case results. A plot of the annual drifting allision frequency per structure for the base case is presented in Figure 16.12 with the chart background removed to increase the visibility of those structures with a low allision frequency.

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

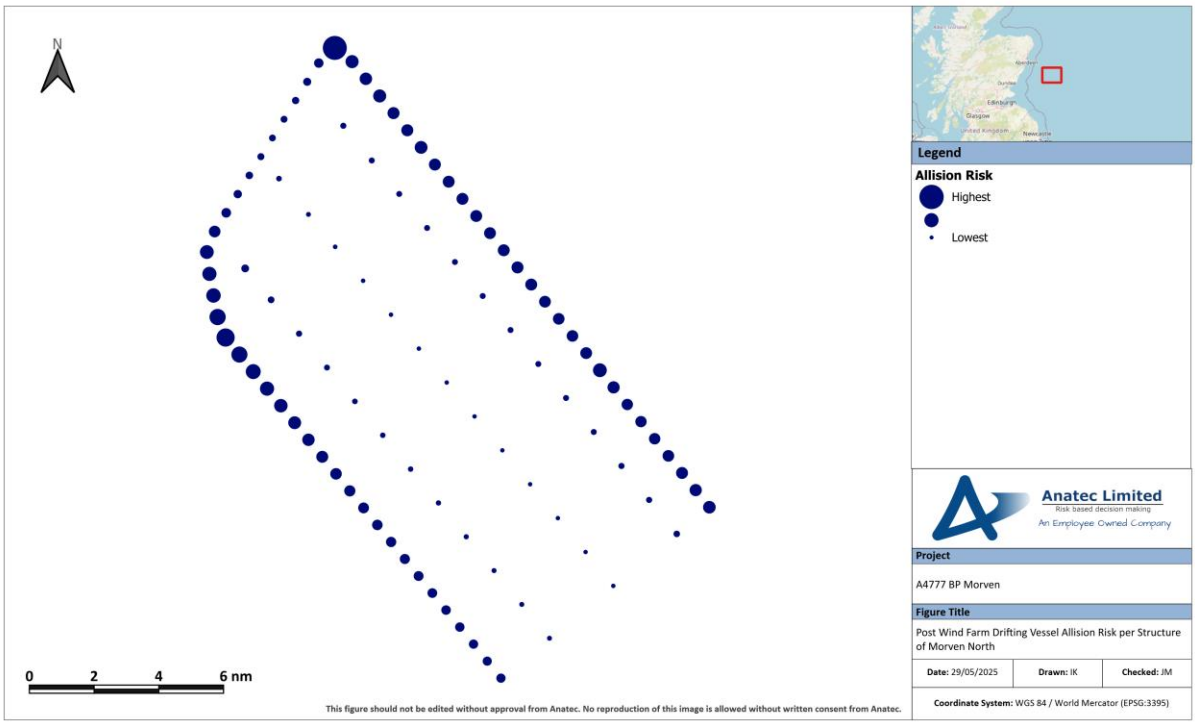


Figure 16.12: Post wind farm drifting vessel allision risk per structure of Morven North

16.3.1.18 Assuming base case vessel traffic levels, the annual drifting allision frequency was estimated to be 1.53×10^{-4}, corresponding to a return period of approximately one in 6,526 years.

16.3.1.19 The greatest drifting vessel to structure allision risk was associated with the northern and western corners. The greatest individual allision risk was again associated with the bridge-linked OSP on the northeast perimeter (approximately 1.16×10^{-5} or one in 86,005 years).

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

Fishing vessel to structure allision risk

16.3.1.21 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 Morven North Boundary.

16.3.1.22 A fishing vessel allision is classified separately from other allisions since fishing vessels may be either in transit or actively fishing within the Morven North Boundary

(unlike the transiting commercial traffic characterised by the main commercial routes). Additionally, fishing vessels could be observed internally within the Morven North Boundary (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.

16.3.1.23 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.

16.3.1.24 A plot of the annual fishing vessel allision frequency per structure for the base case is presented in Figure 16.13.

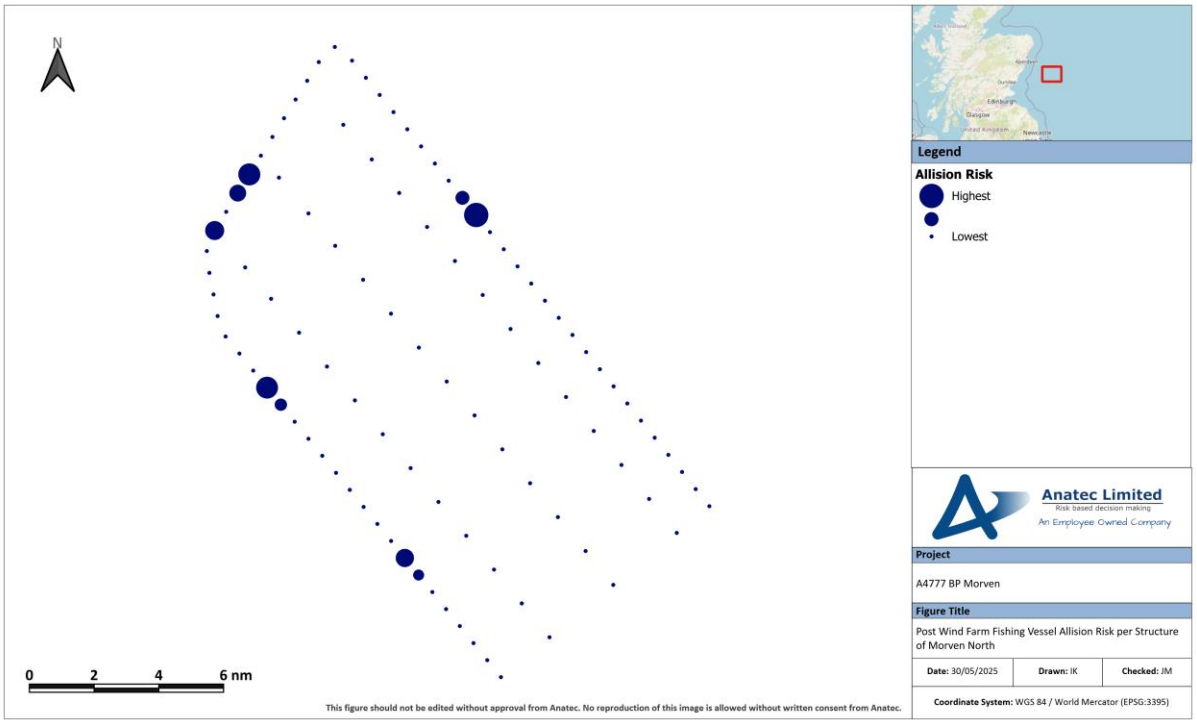


Figure 16.13: Post wind farm internal vessel allision risk per Structure of Morven North

16.3.1.25 Assuming base case traffic levels, the annual fishing vessel to structure allision frequency was estimated to be 3.60×10^{-3} corresponding to a return period of approximately one in 277 years. As detailed above, the model conservatively assumes

that there will be no change in baseline fishing vessel activity. In reality, it is likely that fishing vessels will change behaviour to account for the presence of Morven North.

16.3.1.26 The fishing vessel to structure allision risk was concentrated on the perimeter of Morven North. The greatest individual allision risk was associated with a wind turbine on the eastern boundary (approximately 7.46×10^{-4} or one in 1,340 years).

16.3.1.27 The model is calibrated against known allision incidents within UK wind farms (see Section 9.7). Most likely consequences are 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 9.7.2).

Risk results summary

16.3.1.28 The previous sections modelled two cases, namely pre and post wind farm with base case traffic levels. In order to incorporate the potential for future traffic growth, the pre and post wind farm have also been modelled for future case traffic levels (both 10% and 20% increases). Table 16.1 summarises the results of all six cases.

16.3.1.29 Overall, the base case collision and allision frequency due to the presence of Morven North in isolation was estimated to increase by approximately 5.73×10^{-3} (equating to an additional collision or allision every 175 years).

Table 16.1: Scenario 1a risk result summary

Risk	Case	Annual Frequency (Return Period)		
		Pre Wind Farm	Post Wind Farm	Change
Vessel to vessel collision	Base case	4.27×10^{-4} (1 in 2,344 years)	7.04×10^{-4} (1 in 1,421 years)	2.77×10^{-4} (1 in 3,606 years)
	Future case (10%)	5.13×10^{-4} (1 in 1,948 years)	8.49×10^{-4} (1 in 1,178 years)	3.36×10^{-4} (1 in 2,979 years)
	Future case (20%)	6.16×10^{-4} (1 in 1,625 years)	1.02×10^{-3} (1 in 984 years)	4.00×10^{-4} (1 in 2,498 years)
Powered vessel to structure allision	Base case	-	1.69×10^{-3} (1 in 591 years)	1.69×10^{-3} (1 in 591 years)
	Future case (10%)	-	1.86×10^{-3} (1 in 537 years)	1.86×10^{-3} (1 in 537 years)
	Future case (20%)	-	2.03×10^{-3} (1 in 492 years)	2.03×10^{-3} (1 in 492 years)
Drifting vessel to structure allision	Base case	-	1.53×10^{-4} (1 in 6,526 years)	1.53×10^{-4} (1 in 6,526 years)
	Future case (10%)	-	1.68×10^{-4} (1 in 5,943 years)	1.68×10^{-4} (1 in 5,943 years)

Risk	Case	Annual Frequency (Return Period)		
		Pre Wind Farm	Post Wind Farm	Change
	Future case (20%)	-	1.84×10^{-4} (1 in 5,428 years)	1.84×10^{-4} (1 in 5,428 years)
Fishing vessel to structure allision	Base case	-	3.60×10^{-3} (1 in 277 years)	3.60×10^{-3} (1 in 277 years)
	Future case (10%)	-	3.96×10^{-3} (1 in 252 years)	3.96×10^{-3} (1 in 252 years)
	Future case (20%)	-	4.32×10^{-3} (1 in 231 years)	4.32×10^{-3} (1 in 231 years)
Total	**Base case**	**4.27×10^{-4} (1 in 2,344 years)**	**6.15×10^{-3} (1 in 162 years)**	**5.73×10^{-3} (1 in 175 years)**
	Future case (10%)	**5.13×10^{-4} (1 in 1,948 years)**	**4.84×10^{-3} (1 in 146 years)**	**6.33×10^{-3} (1 in 158 years)**
	Future case (20%)	**6.16×10^{-4} (1 in 1,625 years)**	**7.56×10^{-3} (1 in 132 years)**	**6.94×10^{-3} (1 in 144 years)**

16.3.2 Scenario 1b

Simulated Automatic Identification System

16.3.2.1 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 Morven South Boundary. The AIS Simulator uses the mean positions of the main commercial routes identified within the Morven South Shipping and Navigation 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.

16.3.2.2 A figure of 28 days of simulated AIS (matching the total duration of the vessel traffic surveys) within the Morven South Shipping and Navigation Study Area, based on the deviated main commercial routes, is presented in Figure 16.14.

16.3.2.3 It is noted that the simulated AIS represents a MDS based on commercial routes passing at a minimum mean distance of 1nm from Morven South.

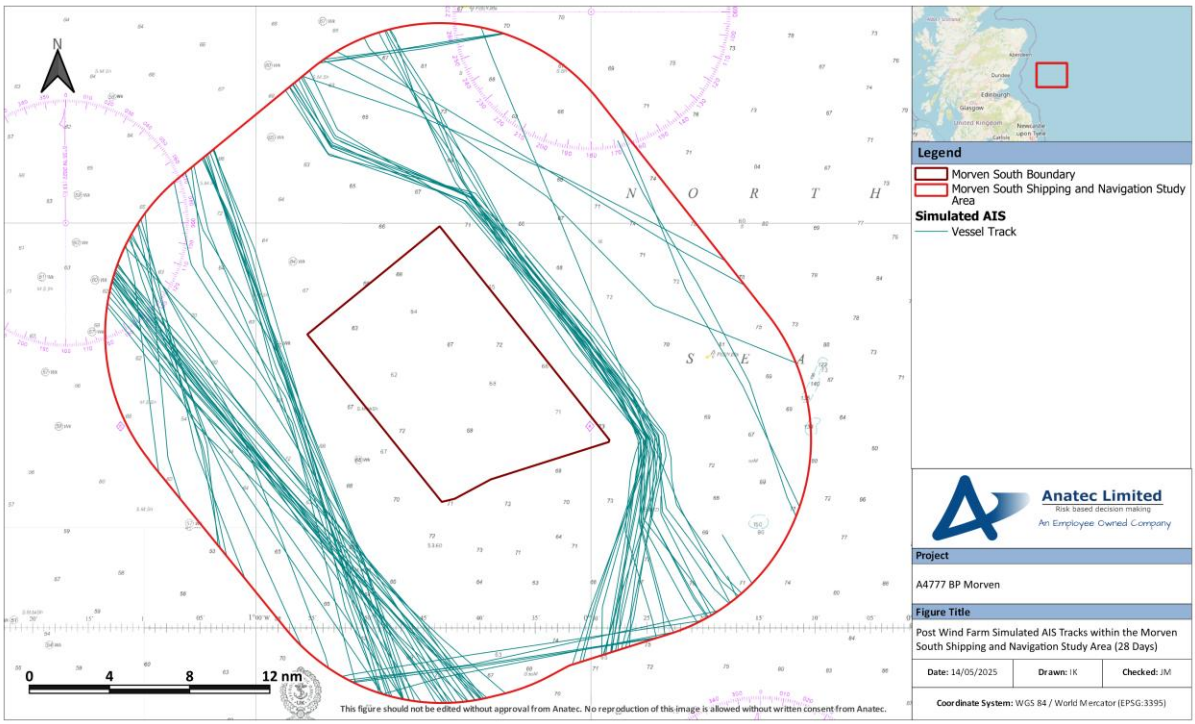


Figure 16.14: Post wind farm simulated Automatic Identification System Tracks within the Morven South Shipping and Navigation Study Area (28 Days)

Vessel to vessel collision risk

16.3.2.4 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 Morven South Shipping and Navigation Study Area.

16.3.2.5 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 16.15.

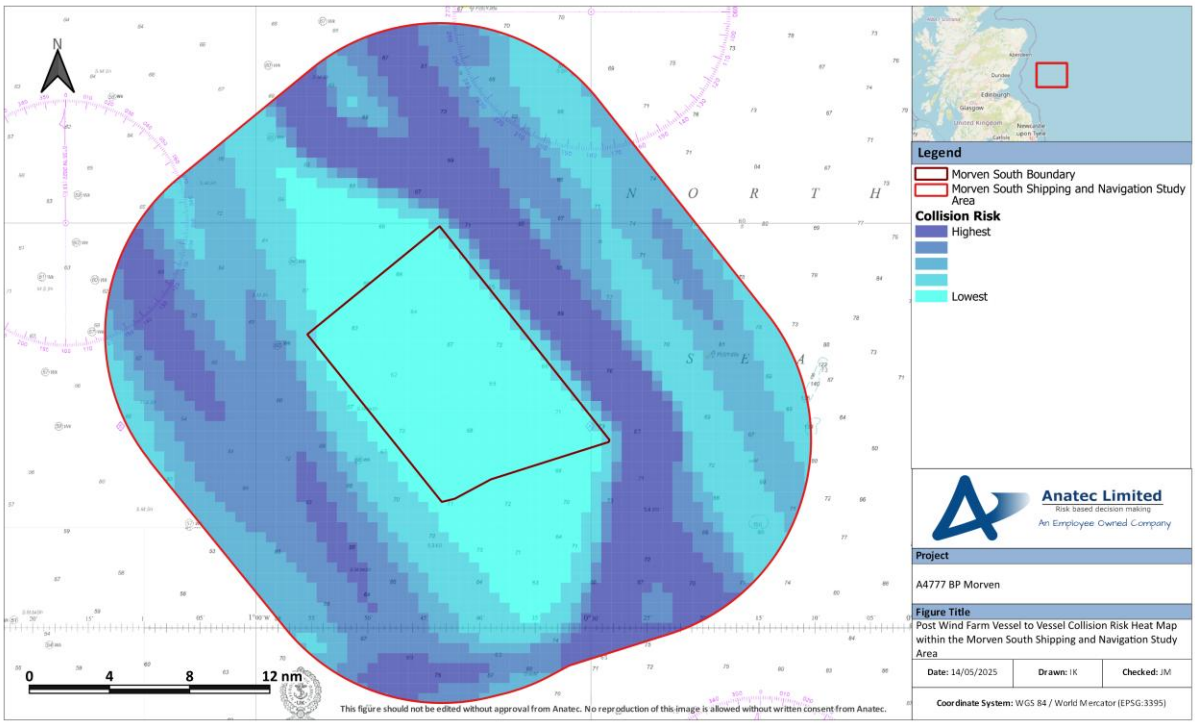


Figure 16.15: Post wind farm vessel to vessel collision risk heat map within the Morven South Shipping and Navigation Study Area

16.3.2.6 Assuming base case traffic levels, the annual collision frequency post wind farm was estimated to be 5.49×10^{-4}, corresponding to a return period of approximately one in 1,821 years. This represents an increase of 65% compared to the pre wind farm base case result equating to an additional collision every 2,780 years. As per Section 15.5.1, conservative assumptions have been made within the MDS modelled.

16.3.2.7 Based on modelling results, the majority of collision risk is due to vessels deviating to the east of the Morven South Boundary, with less pronounced collision density to the west of the Morven South Boundary.

Powered vessel to structure allision risk

16.3.2.8 Based upon the vessel routeing identified in the Morven South Shipping and Navigation Study Area, the anticipated re-routeing as a result of the presence of the Morven South Boundary 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 Morven South Boundary is considered to be low.

16.3.2.9 Using the post wind farm routeing as input, together with the MDS indicative worst-case 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 Morven South Boundary whilst under power. In order to maintain an MDS, the model did not consider one structure shielding another.

16.3.2.10 A plot of the annual powered allision frequency per structure for the base case is presented in Figure 16.16, with the chart background removed to increase the visibility of those structures with lower allision frequencies.

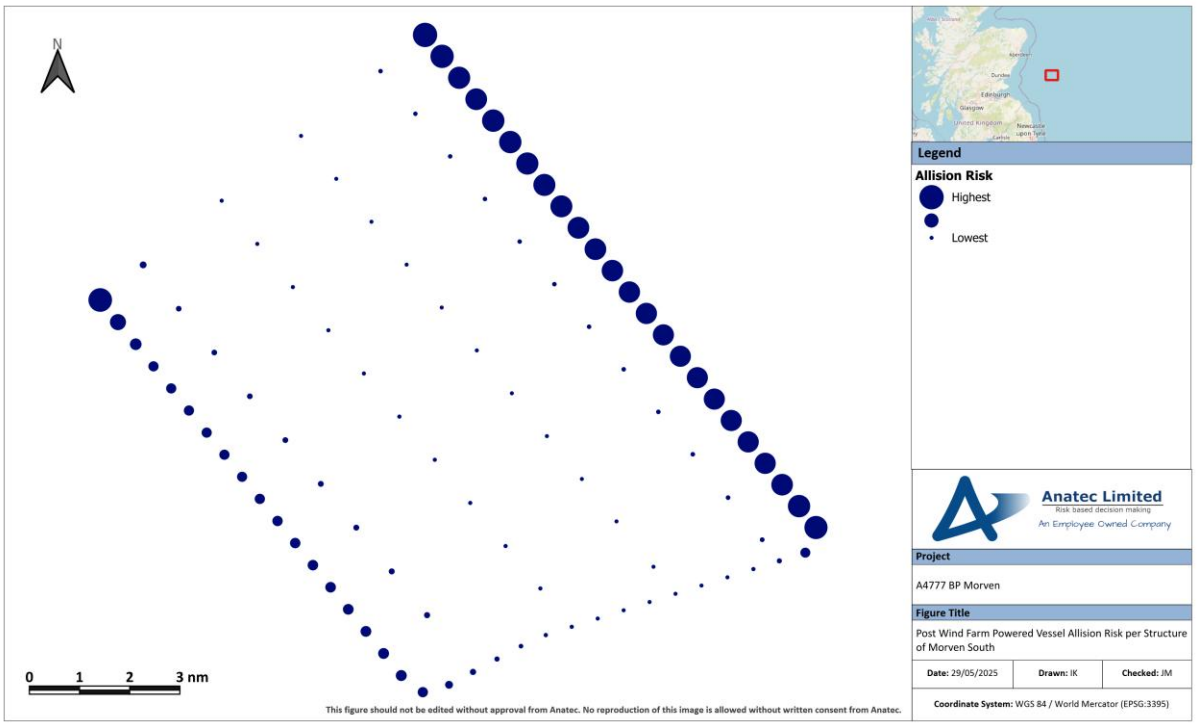


Figure 16.16: Post wind farm powered vessel allision risk per structure of Morven South

16.3.2.11 Assuming base case vessel traffic levels, the annual powered allision frequency was estimated to be 1.42×10^{-3}, corresponding to a return period of approximately one in 707 years. As per Section 15.5.1, conservative assumptions have been made within the MDS modelled.

16.3.2.12 The greatest powered vessel to structure allision risk was associated with structures on the eastern perimeter. The greatest individual allision risk was associated with a wind turbine on the northeast perimeter (approximately 6.14×10^{-4} or one in 16,294 years), with one of the busiest routes passing at a mean distance of 1nm from this corner.

Drifting vessel to structure allision risk

16.3.2.13 Using the post wind farm routeing as input, together with the MDS 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 Morven South Boundary. The model is based on the premise that propulsion on a vessel must fail before drifting will occur. The model takes account of the type and size of the vessel, the number of engines and the average time required to repair but does not consider navigational errors caused by human actions.

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

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

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

16.3.2.16 After modelling the three drifting scenarios, it was established that the wind-dominated scenario produced the worst-case results. A plot of the annual drifting allision frequency per structure for the base case is presented in Figure 16.17 with the chart background removed to increase the visibility of those structures with a low allision frequency.

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

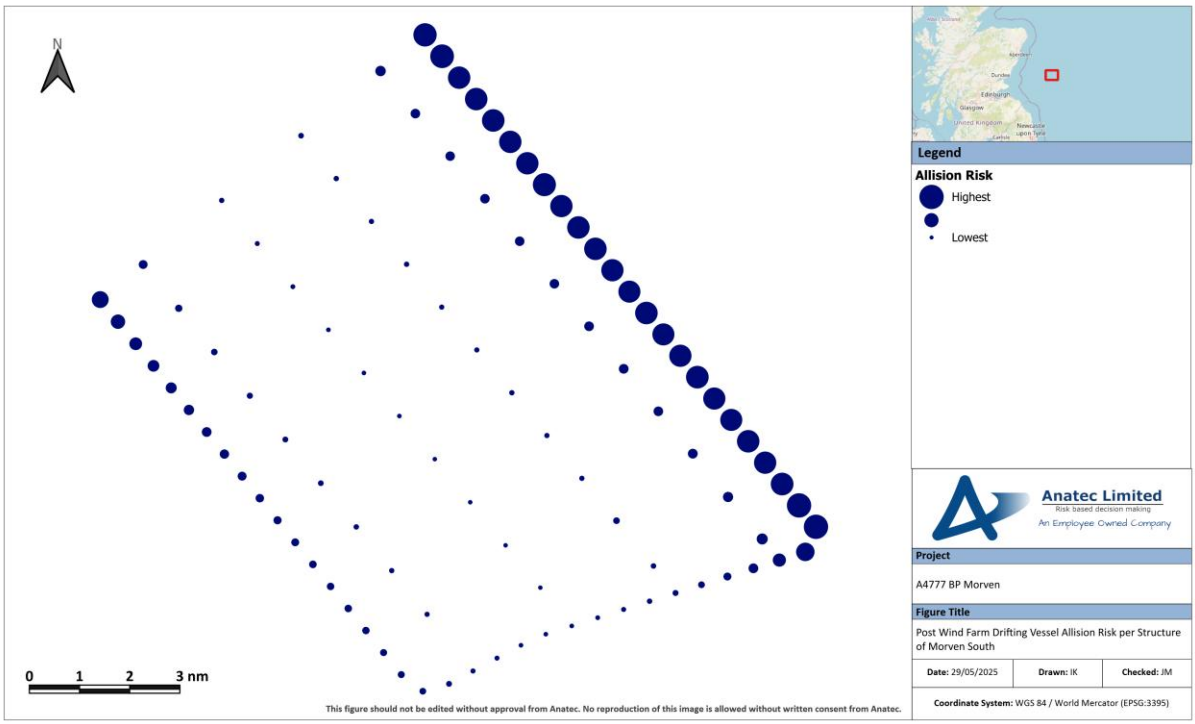


Figure 16.17: Post wind farm drifting vessel allision risk per structure of Morven South

16.3.2.18 Assuming base case vessel traffic levels, the annual drifting allision frequency was estimated to be 7.75×10^{-5}, corresponding to a return period of approximately one in 12,911 years.

16.3.2.19 The greatest drifting vessel to structure allision risk was associated with structures on the eastern perimeter. The greatest individual allision risk was associated with a wind turbine on the southeastern corner (approximately 3.43×10^{-6} or one in 291,482 years) with one of the busiest routes passing at a mean distance of 1nm from this corner.

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

Fishing vessel to structure allision risk

16.3.2.21 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 Morven South Boundary.

16.3.2.22 Assuming base case traffic levels, the annual fishing vessel-to-structure allision frequency was negligible. This is due to the negligible levels of fishing vessel activity in proximity to the Morven South structures (no fishing vessels were recorded within the Morven South Boundary – see Section 10.3.3).

Risk results summary

16.3.2.23 The previous sections modelled two cases, namely pre and post wind farm with base case traffic levels. In order to incorporate the potential for future traffic growth, the pre and post wind farm have also been modelled for future case traffic levels (both 10% and 20% increases). Table 16.2 summarises the results of all six cases.

16.3.2.24 Overall, the base case collision and allision frequency due to the presence of Morven South in isolation was estimated to increase by approximately 1.85×10^{-3} (equating to an additional collision or allision every 540 years).

Table 16.2: Scenario 1b risk result summary

Risk	Case	Annual Frequency (Return Period)		
		Pre Wind Farm	Post Wind Farm	Change
Vessel to vessel collision	Base case	1.89×10^{-4} (1 in 5,283 years)	5.49×10^{-4} (1 in 1,821 years)	3.60×10^{-4} (1 in 2,780 years)
	Future case (10%)	2.28×10^{-4} (1 in 4,378 years)	6.64×10^{-4} (1 in 1,505 years)	4.36×10^{-4} (1 in 2,294 years)
	Future case (20%)	2.73×10^{-4} (1 in 3,660 years)	7.90×10^{-4} (1 in 1,266 years)	5.16×10^{-4} (1 in 1,936 years)
Powered vessel to structure allision	Base case	-	1.42×10^{-3} (1 in 707 years)	1.42×10^{-3} (1 in 707 years)
	Future case (10%)	-	1.56×10^{-3} (1 in 642 years)	1.56×10^{-3} (1 in 642 years)
	Future case (20%)	-	1.70×10^{-3} (1 in 589 years)	1.70×10^{-3} (1 in 589 years)
Drifting vessel to structure allision	Base case	-	7.75×10^{-5} (1 in 12,911 years)	7.75×10^{-5} (1 in 12,911 years)
	Future case (10%)	-	8.53×10^{-5} (1 in 11,722 years)	8.53×10^{-5} (1 in 11,722 years)
	Future case (20%)	-	9.28×10^{-5} (1 in 10,774 years)	9.28×10^{-5} (1 in 10,774 years)
Total	**Base case**	**1.89×10^{-4} (1 in 5,283 years)**	**2.04×10^{-3} (1 in 490 years)**	**1.85×10^{-3} (1 in 540 years)**
	Future case (10%)	**2.28×10^{-4} (1 in 4,378 years)**	**2.31×10^{-3} (1 in 433 years)**	**2.08×10^{-3} (1 in 481 years)**

Risk	Case	Annual Frequency (Return Period)		
		Pre Wind Farm	Post Wind Farm	Change
	Future case (20%)	2.73×10^{-4} (1 in 3,660 years)	2.58×10^{-3} (1 in 388 years)	2.31×10^{-3} (1 in 433 years)

16.3.3 Scenario 2

Simulated Automatic Identification System

16.3.3.1 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 Morven Site. The AIS Simulator uses the mean positions of the main commercial routes identified within the Regional Shipping and Navigation 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.

16.3.3.2 A figure of 28 days of simulated AIS (matching the total duration of the vessel traffic surveys) within the Regional Shipping and Navigation Study Area, based on the deviated main commercial routes, is presented in Figure 16.18.

16.3.3.3 It is noted that the simulated AIS represents a MDS based on commercial routes passing at a minimum mean distance of 1nm from the Morven Site.

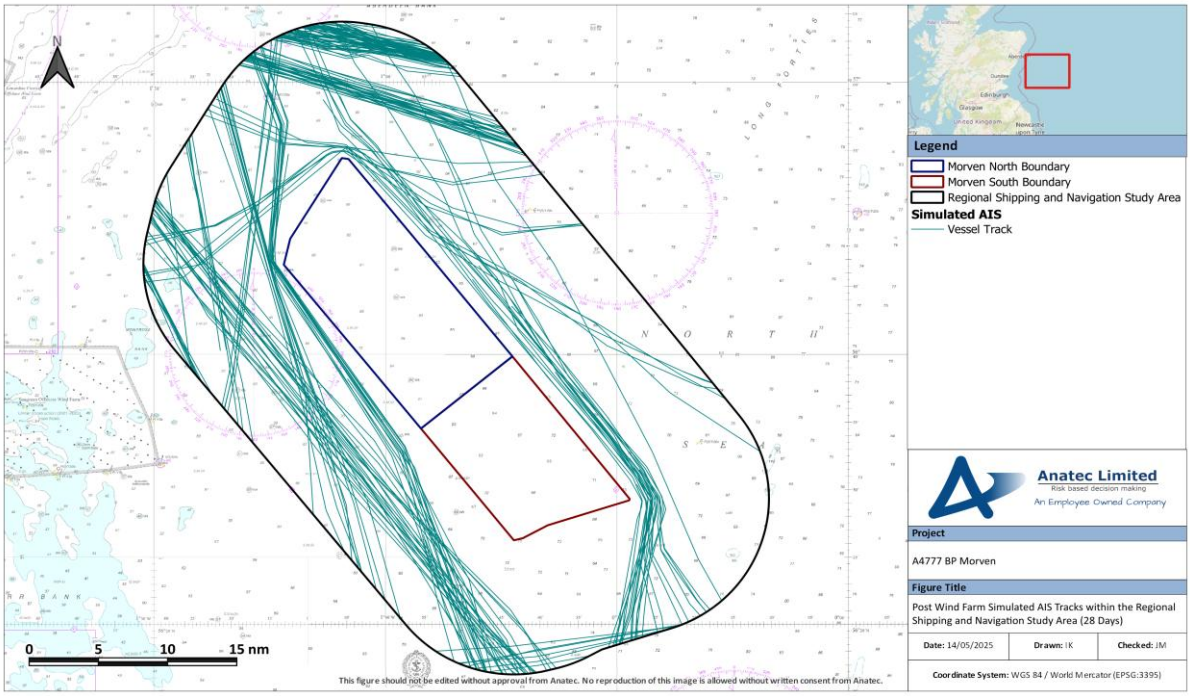


Figure 16.18: Post wind farm simulated ais tracks within the Regional Shipping and Navigation Study Area (28 Days)

Vessel to Vessel Collision Risk

16.3.3.4 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 Regional Shipping and Navigation Study Area.

16.3.3.5 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 16.19.

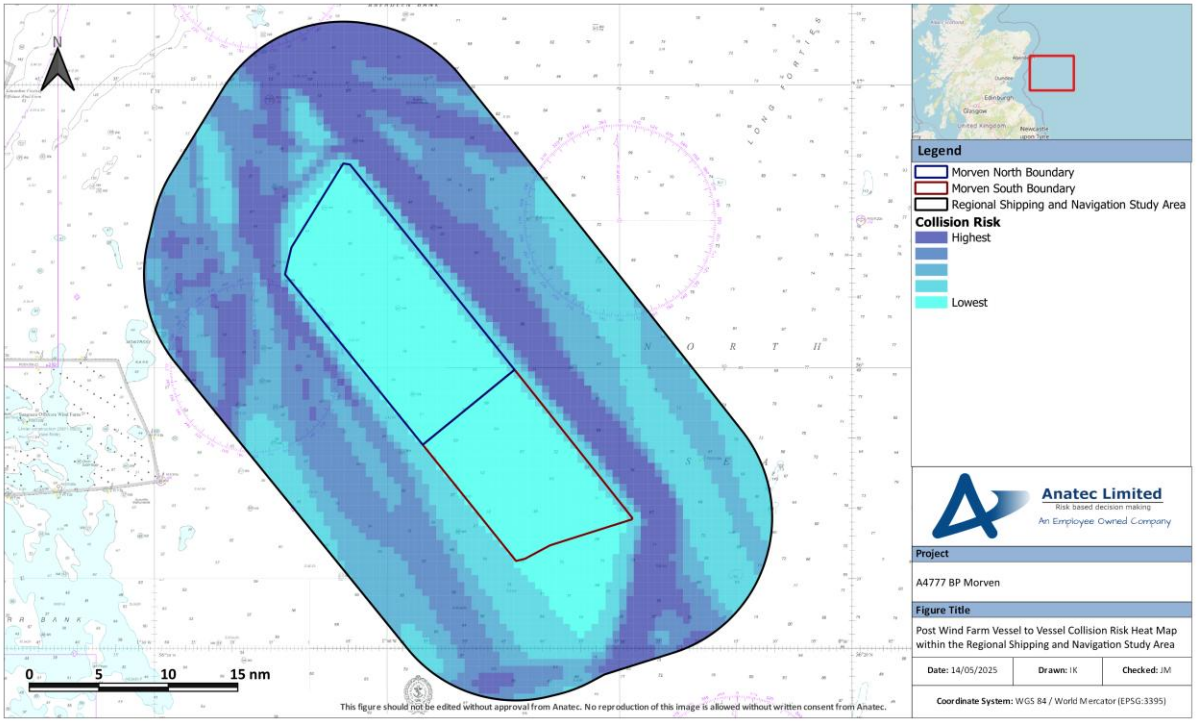


Figure 16.19: Post wind farm vessel to vessel collision risk heat map within the Regional Shipping and Navigation Study Area

16.3.3.6 Assuming base case traffic levels, the annual collision frequency post wind farm was estimated to be 1.03×10^{-3}, corresponding to a return period of approximately one in 971 years. This represents an increase of 67% compared to the pre wind farm base case result equating to an additional collision every 1,893 years. As per Section 15.5.1, conservative assumptions have been made within the MDS modelled.

16.3.3.7 Based on modelling results, the majority of collision risk is due to vessels deviating to the east of the Morven Site, with increased collision risk also at the western extent of the Morven Site.

Powered vessel to structure allision risk

16.3.3.8 Based upon the vessel routeing identified in the Regional Shipping and Navigation Study Area, the anticipated re-routeing as a result of the presence of the Morven Site 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 Morven Site is considered to be low.

16.3.3.9 Using the post wind farm routeing as input, together with the MDS indicative worst-case 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 Morven Site whilst under power. In order to maintain an MDS, the model did not consider one structure shielding another.

16.3.3.10 A plot of the annual powered allision frequency per structure for the base case is presented in Figure 16.20, with the chart background removed to increase the visibility of those structures with lower allision frequencies.

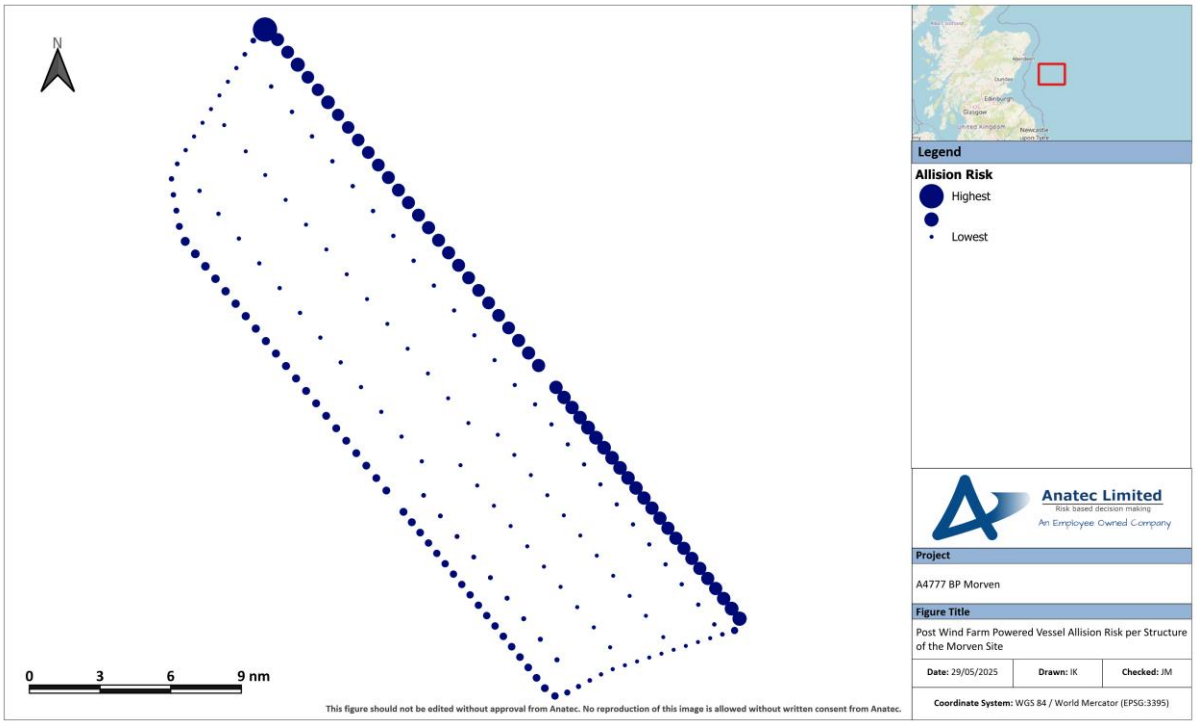


Figure 16.20: Post wind farm powered vessel allision risk per structure of the Morven Site

16.3.3.11 Assuming base case vessel traffic levels, the annual powered allision frequency was estimated to be 2.92×10^{-3}, corresponding to a return period of approximately one

in 343 years. As per Section 15.5.1, conservative assumptions have been made within the MDS modelled.

16.3.3.12 The greatest powered vessel to structure allision risk was associated with structures on the eastern perimeter. The greatest individual allision risk was associated with the bridge-linked OSP on the northeast perimeter (approximately 1.82×10^{-4} or one in 5,502 years) noting that this structure is larger than others across the array and therefore has a greater exposure to allision risk.

Drifting vessel to structure allision risk

16.3.3.13 Using the post wind farm routeing as input, together with the MDS 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 Morven Site. The model is based on the premise that propulsion on a vessel must fail before drifting will occur. The model takes account of the type and size of the vessel, the number of engines and the average time required to repair but does not consider navigational errors caused by human actions.

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

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

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

16.3.3.16 After modelling the three drifting scenarios, it was established that the wind-dominated scenario produced the worst-case results. A plot of the annual drifting allision frequency per structure for the base case is presented in Figure 16.21 with the chart background removed to increase the visibility of those structures with a low allision frequency.

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

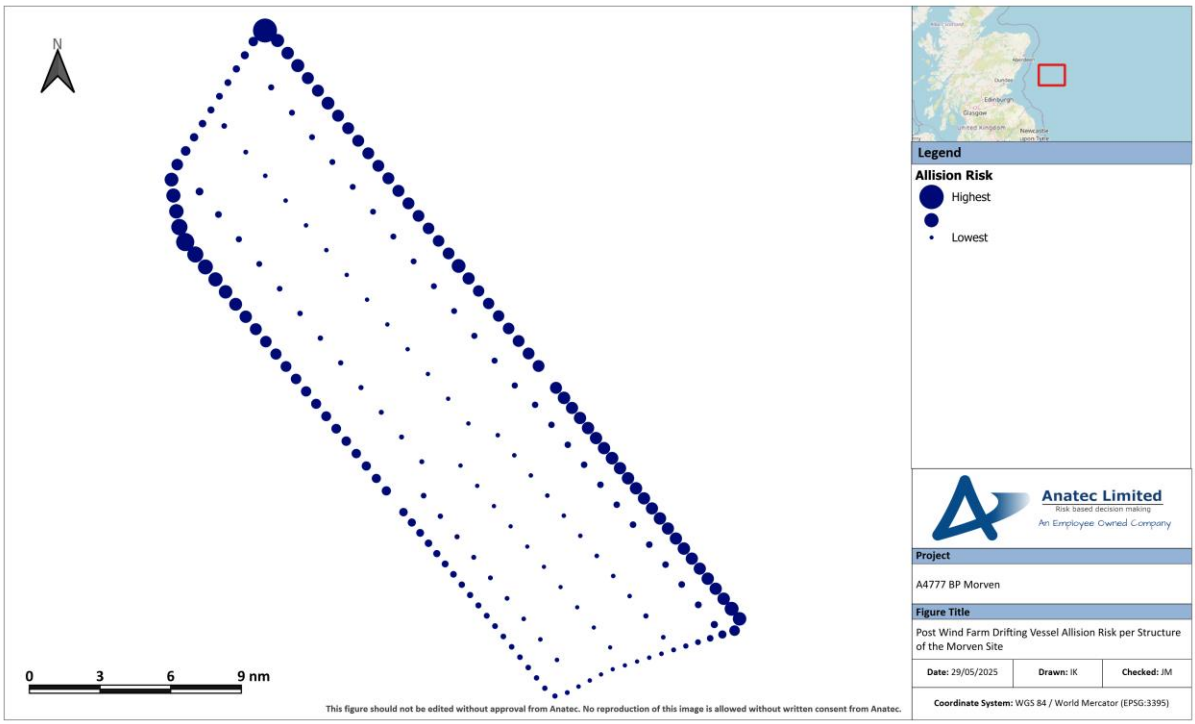


Figure 16.21: Post wind farm drifting vessel allision risk per structure of the Morven Site

16.3.3.18 Assuming base case vessel traffic levels, the annual drifting allision frequency was estimated to be 2.28×10^{-4}, corresponding to a return period of approximately one in 4,386 years.

16.3.3.19 The greatest drifting vessel to structure allision risk was associated with the eastern and western perimeters and northwest corner. The greatest individual allision risk was again associated with the bridge-linked OSP on the northeast perimeter (approximately 1.16×10^{-5} or one in 86,005 years).

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

Fishing vessel to structure allision risk

16.3.3.21 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 Morven Site.

16.3.3.22 A fishing vessel allision is classified separately from other allisions since fishing vessels may be either in transit or actively fishing within the Morven Site (unlike the transiting commercial traffic characterised by the main commercial routes). Additionally, fishing vessels could be observed internally within the Morven Site (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.

16.3.3.23 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.

16.3.3.24 A plot of the annual fishing vessel allision frequency per structure for the base case is presented in Figure 16.22.

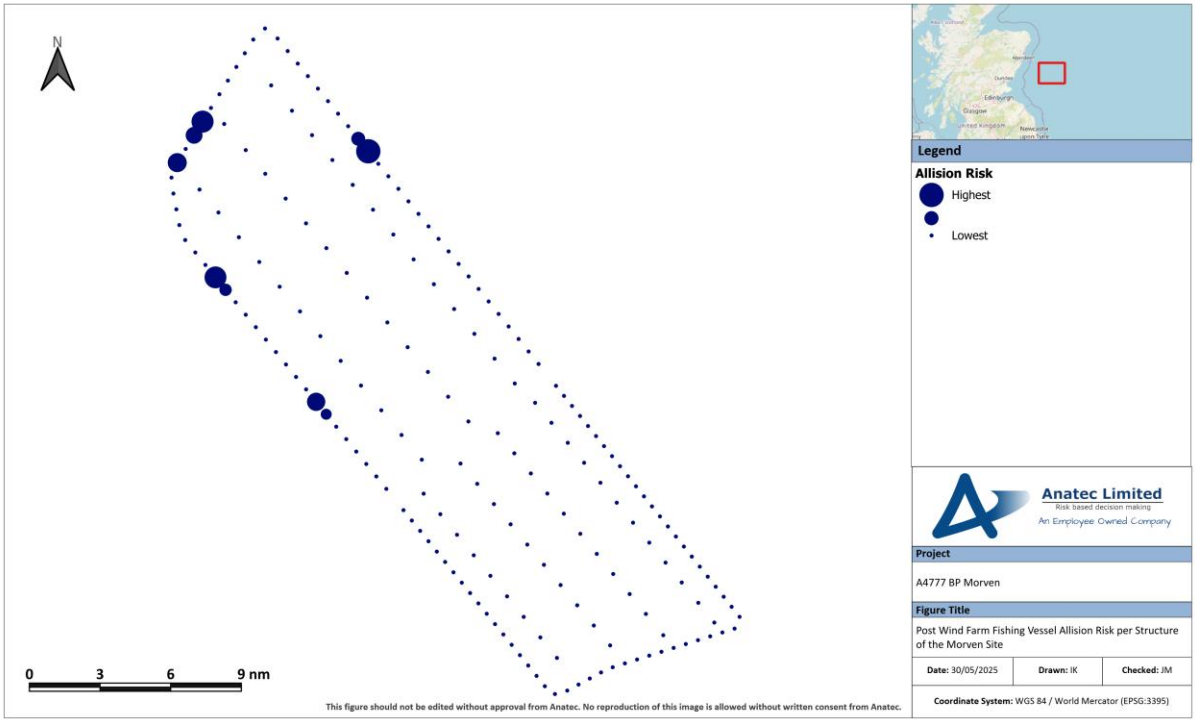


Figure 16.22: Post wind farm internal vessel allision risk per structure of the Morven Site

16.3.3.25 Assuming base case traffic levels, the annual fishing vessel to structure allision frequency was estimated to be 3.60×10^{-3} corresponding to a return period of approximately one in 277 years. As detailed above, the model conservatively assumes that there will be no change in baseline fishing vessel activity. In reality, it is likely that fishing vessels will change behaviour to account for the presence of Morven North and Morven South.

16.3.3.26 The fishing vessel to structure allision risk was concentrated on the perimeter of Morven North. The greatest individual allision risk was associated with a wind turbine on the eastern perimeter of Morven North (approximately 7.46×10^{-4} or one in 1,340 years).

16.3.3.27 The model is calibrated against known allision incidents within UK wind farms (see Section 9.7). Most likely consequences are 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 9.7.2).

Risk results summary

16.3.3.28 The previous sections modelled two cases, namely pre and post wind farm scenarios with base case traffic levels. In order to incorporate the potential for future traffic growth, the pre and post wind farm have also been modelled for future case traffic levels (both 10% and 20% increases). Table 16.3 summarises the results of all six cases.

16.3.3.29 Overall, the base case collision and allision frequency due to the presence of Morven North and Morven South was estimated to increase by approximately 7.28×10^{-3} (equating to an additional collision or allision every 137 years).

Table 16.3: Scenario 2 risk results summary

Risk	Case	Annual Frequency (Return Period)		
		Pre Wind Farm	Post Wind Farm	Change
Vessel to vessel collision	Base case	5.01×10^{-4} (1 in 1,996 years)	1.03×10^{-3} (1 in 971 years)	5.28×10^{-4} (1 in 1,893 years)
	Future case (10%)	6.03×10^{-4} (1 in 1,657 years)	1.24×10^{-3} (1 in 804 years)	6.40×10^{-3} (1 in 1,563 years)
	Future case (20%)	7.23×10^{-4} (1 in 1,383 years)	1.48×10^{-3} (1 in 674 years)	7.60×10^{-3} (1 in 1,315 years)
Powered vessel to structure allision	Base case	-	2.92×10^{-3} (1 in 343 years)	2.92×10^{-3} (1 in 343 years)
	Future case (10%)	-	3.21×10^{-3} (1 in 311 years)	3.21×10^{-3} (1 in 311 years)

Risk	Case	Annual Frequency (Return Period)		
		Pre Wind Farm	Post Wind Farm	Change
	Future case (20%)	-	3.50×10^{-3} (1 in 285 years)	3.50×10^{-3} (1 in 285 years)
Drifting vessel to structure allision	Base case	-	2.28×10^{-4} (1 in 4,386 years)	2.28×10^{-4} (1 in 4,386 years)
	Future case (10%)	-	2.50×10^{-4} (1 in 3,993 years)	2.50×10^{-4} (1 in 3,993 years)
	Future case (20%)	-	2.74×10^{-3} (1 in 3,652 years)	2.74×10^{-3} (1 in 3,652 years)
Fishing vessel to structure allision	Base case	-	3.60×10^{-3} (1 in 277 years)	3.60×10^{-3} (1 in 277 years)
	Future case (10%)	-	3.96×10^{-3} (1 in 252 years)	3.96×10^{-3} (1 in 252 years)
	Future case (20%)	-	4.32×10^{-3} (1 in 231 years)	4.32×10^{-3} (1 in 231 years)
Total	**Base case**	**5.01×10^{-4} (1 in 1,996 years)**	**7.78×10^{-3} (1 in 129 years)**	**7.28×10^{-3} (1 in 137 years)**
	Future case (10%)	**6.03×10^{-4} (1 in 1,657 years)**	**8.67×10^{-3} (1 in 115 years)**	**8.07×10^{-3} (1 in 124 years)**
	Future case (20%)	**7.23×10^{-4} (1 in 1,383 years)**	**9.59×10^{-3} (1 in 104 years)**	**8.86×10^{-3} (1 in 113 years)**

17 Embedded mitigation measures

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

17.1.1.2 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 Morven North and Morven South.

17.1.1.3 The embedded mitigation measures within the design relevant to shipping and navigation are outlined in Table 17.1.

Table 17.1: Embedded mitigation measures relevant to shipping and navigation

Embedded Mitigation Measure	Description
Application for safety zones.	An application will be made for safety zones post consent including up to 500m around ongoing activities during construction, major maintenance and decommissioning and up to 50m for installed structures pre commissioning.
Buoyed construction/ decommissioning area.	The array construction/decommissioning area will be marked by buoyage as required by NLB.
Implementation and monitoring of cable protection.	Cables will typically be buried at a target burial depth to be determined by a CBRA. Where cable burial is not possible, cable protection will be applied. This will be agreed through the Cable Specification and Installation Plan (CSIP).
Marking of all offshore infrastructure on Admiralty charts.	All infrastructure associated with Morven North and Morven South (including subsea cables) will be shown on appropriately scaled UKHO Admiralty charts.
Compliance with MGN 654 and its annexes.	The Project will be compliant with MGN 654 and its annexes including in relation to reductions of no more than 5% in under keel clearance, creation of an ERCoP and the SAR Checklist. Includes MGN 654 SAR Annex 5 (MCA, 2024).
Guard vessels as required under risk assessment.	A guard vessel(s) will be deployed where deemed appropriate by risk assessment.
Appropriate lighting and marking.	Marking and lighting of the site in agreement with NLB and in line with IALA O139 (IALA, 2021 (a)) and G1162 (IALA, 2201 (b)). This will be agreed through the LMP (Volume 4, Annex 4: Lighting and Marking Plan (Version 1)) which will include details in the management of AtoNs, with potential for the structures which are lit to depend on the phase of the arrays build out.

Embedded Mitigation Measure	Description
Marine coordination.	Marine coordination and communication will be implemented to manage Project vessel movements. This will include through the NSPVMP (Volume 4, Annex 5: Navigation Safety Plan and Vessel Management Plan (Version 1)).
Suitable blade tip clearance.	There will be a minimum blade tip clearance of at least 34m above LAT.
Pollution contingency.	A Marine Pollution Contingency Plan (MPCP) (Volume 4, Annex 1, Appendix 1.1: Marine Pollution Contingency Plan (MPCP) (Version 1)) will be developed outlining procedures to protect personnel working and to safeguard the marine environment in the event of a pollution event.
Project vessel compliance with international marine regulations	Project vessels will comply with international marine regulations as adopted by the Flag State, including COLREGs (IMO, 1972/77) and SOLAS (IMO, 1974).
Appropriate promulgation of information.	Local Notifications to Mariners and Kingfisher Bulletins will be updated and reissued at weekly intervals during construction and at least five days prior to planned maintenance works.
Development of and adherence to, a DSLP.	The DSLP will confirm the final array layout to ensure it is suitable for both surface and air based (for SAR purposes) navigation.

17.2 Marine aids to navigation

17.2.1.1 Throughout all phases, aids to navigation will be provided in accordance with NLB and MCA requirements, with consideration being given to IALA Guidance G1162 (IALA, 2021 (a)), IALA Recommendation O-139 (IALA, 2021 (b)), and MGN 654 (MCA, 2021). As noted by NLB within Section 4.2, it will be possible for lighting and marking to be phased appropriately depending on the scenario in question.

17.2.2 Marking of individual array structures

17.2.2.1 As per IALA Guideline G1162, each surface structure within Morven North and Morven South will be painted yellow from the level of HAT to at least 15m 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. 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.

17.2.2.2 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 3m above sea level and at a distance of at least 150m from the

wind turbine. The light will be either hooded or baffled so as to avoid unnecessary light pollution or confusion with navigational marks.

17.2.3 Marking of the Morven Site as a whole

17.2.3.1 The marking of Morven North and Morven South as a whole will be agreed with NLB 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 five second (flash yellow every five seconds) light of at least 5nm nominal range and omnidirectional fog signals as appropriate and where prescribed by NLB, and will be sounded at least when the visibility is 2nm 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 2nm nominal range;
- all lights will be visible to shipping through 360˚ and if more than one 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 6m above HAT and below the arc of the lowest wind turbine 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;
- all lighting will be considered cumulatively with existing AtoNs to avoid the potential for light confusion to passing traffic.

17.2.3.2 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. As noted within Section 4.2, the NLB will allow for flexibility in lighting and marking dependent on the scenarios.

17.3 Design specifications noted in Marine Guidance Note 654

17.3.1.1 The individual wind turbines 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 – Scenario 1a

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

- Vessel displacement and increased third-party vessel to vessel collision risk;
- increased third-party vessel to project vessel collision risk;
- vessel to structure allision risk (powered, drifting and internal navigation);
- reduced access to local ports and harbours;
- reduction of under keel clearance;
- anchor and fishing gear interactions with subsea cables;
- reduction of emergency response capability including SAR.

18.1.1.2 For each hazard, embedded mitigation measures which have been identified as relevant to reducing risk are listed, with full descriptions 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 3.2.

18.1.1.3 The risk control log (see Section 24) summarises the risk assessment and a concluding risk statement is provided (see Section 26).

18.2 Construction phase

18.2.1 Vessel displacement and increased third-party vessel to vessel collision risk

18.2.1.1 Construction activities associated with Morven North may displace existing vessel routes or activity, which may increase the risk of a collision between third-party vessels.

18.2.1.2 These two related elements are each considered in the subsequent assessment in terms of frequency of occurrence and severity of consequence.

Vessel displacement

18.2.1.3 Vessel traffic data collected during the summer and winter 2024 surveys has been used to establish the vessel traffic baseline, alongside 12 months of AIS collected via terrestrial receivers between October 2021 and September 2022 and three supplementary seasonal vessel traffic surveys. These vessel traffic datasets have been validated by Anatec's ShipRoutes database and analysed to identify the volume of traffic passing within or in proximity to Morven North. Additionally, main routes were recognised from these datasets using the principles set out in MGN 654 (MCA, 2021) (see Section 11.2).

18.2.1.4 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 within the buoyed construction area; therefore, some main route deviations will be required.

18.2.1.5 The full methodology for classifying main route deviations is provided in Section 15.5, noting it is in line with MGN 654 (MCA, 2021). A deviation will be required for six of the 16 main routes identified within the Morven North Shipping and Navigation Study Area, with details provided in Table 15.1.

18.2.1.6 The deviations are in general relatively low magnitude, with five of the six increasing the total route length by less than 0.5%. Route 17 is anticipated to increase distance by 5.5nm, equating to a 3.9% increase in total route length. This is the lowest volume main commercial route within the Morven North Shipping and Navigation Study Area, with an average of one vessel per week. Although the deviation is greater, it is anticipated that the extent of the deviation can be reduced with passage planning for the departure from or arrival to Montrose, with a more direct approach to the northern extent of the Morven North Boundary than has been conservatively assumed in the quantitative assessment.

18.2.1.7 There is one RoRo route (Route 2) undergoing regular transit once every two days in summer only based on the vessel traffic data. Although this route may be displaced and would be more sensitive given the timetabled nature of the service provided, the deviation involved is minor especially when compared with the total route length (increase of 0.2%) and was not raised as an issue during consultation, noting that the primary user – Smyril Line – was included in the Regular Operator outreach.

18.2.1.8 Based on experience at previously under-construction OWFs, it is anticipated that fishing vessels and recreational vessels may also 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. However, they may be more likely to do so than commercial vessels, in particular in any areas of the Morven North Boundary where active construction is not ongoing, or structures are not yet present.

18.2.1.9 For any smaller vessels that do choose to deviate, there is considered to be sufficient sea room outside of the Morven North Boundary for transits from such vessels to be accommodated.

18.2.1.10 The main consequences of vessel displacement will be increased journey times and distances for affected third party vessels, under the assumption that the buoyed construction area will be deployed around the maximum extent of Morven North. Any notable safety impacts are considered unlikely given the available sea room. Vessels are expected to comply with international and flag state regulations (including COLREGs (IMO, 1972/77) and SOLAS (IMO, 1974)) and will be able to passage plan in

advance given the promulgation of information relating to the Morven North Boundary and relevant nautical charts.

18.2.1.11 Relevant embedded mitigation measures include a buoyed construction area, adherence to an LMP and AtoNMP, marking on nautical charts and promulgation of information. These will ensure an increased awareness from third-party vessels and will also assist in passage planning to limit the extent of deviations.

Collision risk

18.2.1.12 From historical incident data, no collision incidents between third-party vessels have occurred directly as a result of a UK OWF.

18.2.1.13 In poor visibility, third-party vessels may experience limitations regarding visual identification of other third-party vessels, when passing on another side of the buoyed construction/decommissioning areas. This limitation may increase the potential for an encounter. However, this would be mitigated by the application of the COLREGs (including reduced speeds) in adverse weather conditions. Moreover, the minimum spacing between structures (1,000m) will be sufficient to ensure any visual hindrance is very short-term in nature.

18.2.1.14 Based on the pre-wind farm modelling, the baseline collision risk levels within the Morven North Shipping and Navigation Study Area are low, with an estimated vessel to vessel collision risk of one every 2,344 years. This rises to an estimate of a return period of one every 1,625 years for a future case growth of 20% in vessel traffic. This is due to the volume of traffic in the area relative to available sea space.

18.2.1.15 Post-wind farm, the collision frequency was estimated at one in 1,421 years, representing an additional collision incident every 3,606 years. This rises to an estimate of a return period of one every 984 years for a future case growth of 20% in vessel traffic. This remains a low level of collision risk, which is also reflected when considering future case traffic levels.

18.2.1.16 It is also acknowledged that a number of the higher-use routes, such as Routes 1, 3, 4 and 6, are comprised mainly of oil and gas vessels accessing nearby fields. As such, these vessels will have good familiarity and experience operating in proximity to surface structures.

18.2.1.17 Due to the necessity for deviation of routes west of the Morven North Boundary, it is possible that commercial vessels will be displaced closer to areas of the sea in which fishing vessels were recorded to actively fish. This may then lead to an increase in encounters between commercial vessels and fishing vessels. However, there is sufficient sea room to allow both activities to safely occur and with application of the COLREGs in relation to the exhibiting of appropriate lights and shapes for fishing vessels engaged in fishing, the risk is considered manageable.

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

18.2.1.19 Based on historic incident data, should an encounter develop into a collision incident, it is most likely to involve minor contact resulting in minor damage to the vessels with no harm to people and no substantial reputational risks. As a worst case with very low frequency of occurrence one of the vessels could receive substantial damage or founder with Potential Loss of Life (PLL) and pollution, with this outcome more likely where one of the vessels is a small craft (e.g. fishing vessel, recreational vessel or CTV). From the vessel traffic survey data (which incorporates Radar and visual observations in addition to AIS) regular transits by commercial fishing vessels and recreational vessels through the Morven North Boundary are infrequent.

18.2.1.20 Relevant embedded mitigation measures include marking on nautical charts, promulgation of information, a buoyed construction area, adherence to an LMP and AtoNMP, adherence to an MPCP and adherence to an ERCoP. These will ensure an increased awareness from third-party vessels and will also assist in passage planning to limit the extent of deviations.

Frequency of occurrence

18.2.1.21 The frequency of occurrence in relation to displacement of vessel traffic resulting in increased third-party collision risk during the construction phase is considered **Extremely Unlikely**.

Severity of consequence

18.2.1.22 The severity of consequence in relation to displacement of vessel traffic resulting in increased third-party collision risk during the construction phase is considered **Moderate**.

Significance of effect

18.2.1.23 Taking the frequency of occurrence as extremely unlikely and the severity of consequence as moderate, the overall effect of vessel displacement and increased third-party vessel to vessel collision risk during construction of Morven North is considered to be broadly acceptable.

18.2.1.24 The hazard is considered ALARP with embedded mitigation in place and therefore no additional mitigation is required. The hazard is therefore **Broadly Acceptable and Not Significant in EIA terms**.

18.2.2 Increased third-party vessel to project vessel collision risk

Qualification of risk

18.2.2.1 The presence of vessels associated with construction activities of Morven North may increase encounters and thus collision risk for vessels already operating in the area.

18.2.2.2 During the construction phase of Morven North there may be up to 1,149 vessel movements made by up to 41 project vessels on-site simultaneously. This will include vessels which are Restricted in Ability to Manoeuvre (RAM). It is assumed that construction vessels will be on-site throughout the entire duration of the construction phase.

18.2.2.3 Encounters and collision risk involving project vessels will be managed through the implementation of marine coordination with full details of this to be provided in the NSPVMP (Volume 4, Annex 5: Navigation Safety Plan and Vessel Management Plan (Version 1)). Project vessels will also be expected to carry AIS and comply with flag state regulations including the COLREGs (IMO, 1972/77) and SOLAS (IMO, 1974). COLREGs will remain the navigational priority for project vessels at all times.

18.2.2.4 Applications for safety zones of 500m around on-going construction activities will be sought during the construction phase and will protect deployed project vessels, especially if they are RAM. Minimum advisory passing distances and guard vessels, as defined by risk assessment, may also be implemented where safety zones do not apply, for example around cable installation vessels. Details of safety zones, minimum safe passing distances and guard vessels will be promulgated including via Notifications to Mariners and Kingfisher Bulletins.

18.2.2.5 Appropriate marine lighting and marking during construction including the buoyed construction area will be agreed with the NLB and set out in the LMP and AtoNMP (Volume 4, Annex 4: Lighting and Marking Plan (Version 1)). These navigational aids will further maximise mariner awareness when in proximity to ongoing construction works in the Morven North Boundary.

18.2.2.6 Third-party vessels may experience decreased capability to visually identify project vessels entering and exiting the Morven North Boundary during reduced visibility; however, this hazard will be mitigated by the application of the COLREGs (reduced speeds) in adverse weather conditions and the mandatory carriage of AIS by project vessels regardless of size. It is noted that the likelihood of a collision is likely to be greater in reduced visibility when the identification of project vessels entering and exiting the Morven North Boundary may be impeded.

18.2.2.7 Based on historical incident data, there has been one instance of a third-party vessel colliding with a project vessel in the UK (see Section 9.7 for further details). In this case, moderate vessel damage was reported with no harm to persons. It is noted that the incident occurred in 2011 and awareness of offshore wind developments and

application of the measures outlined above has improved and been refined considerably in the interim, with no further collision incidents reported since.

18.2.2.8 If an encounter between a project vessel and third-party vessel occurs, it is likely to be localised and short in duration. Assuming the implementation of collision avoidance action as required by the COLREGs, the most likely outcome will be any vessels involved being able to resume their respective passages or activities with no long-term consequences.

18.2.2.9 In the event of a collision, the likely consequences will be minor contact between the vessels resulting in minor damage and no injuries to persons. As an unlikely worst-case scenario, foundering could occur resulting in PLL and pollution. Other project vessels may be able to assist in the event of a collision under SOLAS obligation and the adherence to the ERCoP, noting this would be done in liaison with the MCA. If pollution were to occur in proximity to the Morven North Boundary or involving a project vessel, the MPCP (Volume 4, Annex 1, Appendix 1.1: Marine Pollution Contingency Plan (MPCP) (Version 1)) will be implemented to reduce the risks.

18.2.2.10 As noted during consultation (see Section 4), there is the potential for a construction buoy to drift off-station. However, the LMP and AtoNMP will provide mechanisms for the location and recovery in any event; and due to the requirement for buoyage to be of IALA Position Category 2 (availability of not less than 99%), loss of any buoyage will be of low likelihood.

18.2.2.11 Relevant embedded mitigation measures include application for safety zones, a buoyed construction area, guard vessels as required by risk assessment, adherence to an LMP and AtoNMP, NSPVMP, MPCP, ERCoP, promulgation of information, marine coordination and marking on nautical charts.

Frequency of occurrence

18.2.2.12 The frequency of occurrence in relation to encounters and collision risk between project vessels and third-party vessels during the construction phase is considered to be **Extremely Unlikely**.

Severity of consequence

18.2.2.13 The severity of consequence in relation to encounters and collision risk between project vessels and third-party vessels during the construction phase is considered to be **Serious**.

Significance of effect

18.2.2.14 Taking the frequency of occurrence as extremely unlikely and the severity of consequence as serious, the overall effect of encounters and collision risk between

project vessels and third-party vessels during construction of Morven North is considered to be tolerable with mitigation.

18.2.2.15 The hazard is considered ALARP with embedded mitigation in place and therefore no additional mitigation is required. The hazard is therefore **Tolerable with Mitigation and Not Significant in EIA terms**.

18.2.3 Vessel to structure allision risk

18.2.3.1 Presence of structures (including partially constructed) within the buoyed construction area will lead to creation of powered, drifting and internal allision risk for vessels.

18.2.3.2 The spatial extent of the hazard is small given that a vessel must be in close proximity to a 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.

18.2.3.3 Unlike the O&M phase, although there is the potential for a vessel to enter into the Morven North Boundary during construction, due to the presence of construction/decommissioning buoys and pre-constructed structures it is not expected that internal navigation will take place.

Qualification of risk

18.2.3.4 In addition to a vessel entering the buoyed construction/decommissioning area and alliding with a structure under its own power, there is considered to be potential for a vessel to be adrift in proximity to Morven North; this is reflected in the RNLI incident data reviewed in proximity to the Morven North Boundary which indicates that machinery failure is the most common incident type. A vessel adrift may only develop into an allision situation if in proximity to a structure. This is only the case where the adrift vessel is located in close proximity to Morven North and the direction of the wind and/or tide directs the vessel towards a structure.

18.2.3.5 In circumstances where a vessel drifts towards a structure in the Morven North Boundary, 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 a structure (i.e. by rectifying any fault). Given that vessels are expected to pass a safe distance off the buoyed construction area there is a greater duration over which regaining power may be achievable. 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).

18.2.3.6 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 (IMO, 1974). This response will be managed via HMCG 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.

18.2.3.7 Temporary marine lighting and marking will be implemented including the buoyed construction area in agreement with the NLB. Promulgation of information and marking on charts will ensure vessels can passage plan in advance to minimise risk by passing clear of the buoyed construction area. Safety zones of 50m in radius around structures will also be applied for during the construction phase up until the point of commissioning of Morven North (rising to 500m where active construction is ongoing).

18.2.3.8 Should an allision occur, the consequences will depend on multiple factors including the energy of the impact, structural integrity of the vessel and sea state at the time of the impact. Fishing vessels and recreational vessels are considered most vulnerable to the hazard given the potential for a non-steel construction. 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 founder resulting in PLL and pollution. Project vessels may assist in the event of an allision under SOLAS obligation and the adherence to the ERCoP, in line with the MCA. If pollution were to occur, then the MPCP (Volume 4, Annex 1, Appendix 1.1: Marine Pollution Contingency Plan (MPCP) (Version 1)) will be implemented to reduce the environmental risk.

18.2.3.9 Relevant embedded mitigation measures include DSLP approval, adherence to a MPCP, adherence to an LMP and AtoNMP, adherence to an NSPVMP, promulgation of information, application for safety zones, adherence to an ERCoP, guard vessels where required by risk assessment and appropriate marking via construction buoyage as well as on nautical charts.

Frequency of occurrence

18.2.3.10 The frequency of occurrence in relation to vessel to structure allision risk during the construction phase is considered to be **Extremely Unlikely**.

Severity of consequence

18.2.3.11 The severity of consequence in relation to vessel to structure allision risk during the construction phase is considered to be **Moderate**.

Significance of effect

18.2.3.12 Taking the frequency of occurrence as extremely unlikely and the severity of consequence as moderate, the overall effect of vessel to structure allision risk during construction of Morven North is considered to be broadly acceptable.

18.2.3.13 The hazard is considered ALARP with embedded mitigation in place and therefore no additional mitigation is required. The hazard is therefore **Broadly Acceptable and Not Significant in EIA terms**.

18.2.4 Reduced access to local ports and harbours

Qualification of risk

18.2.4.1 Up to 1,149 vessel movements made by construction vessels (excluding site preparation activities) may be made throughout the construction phase and will include vessels which are RAM. Project vessels will be managed by marine coordination, 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. Project vessels will also carry AIS and be compliant with flag state regulations including the COLREGs (IMO 1972/77).

18.2.4.2 The closest port or harbour to Morven North is Aberdeen, located approximately 34nm to the northwest. Given the relative distance to ports in the area and the anticipated deviations for the main commercial routes, it is not anticipated that there will be any substantial effect on vessel approaches to and from the local ports beyond the deviations already outlined for impacts on vessel displacement.

18.2.4.3 No concerns were raised during consultation over access to ports during the construction phase in relation to Morven North. However, it is acknowledged that future towage activities relating to rigs and/or floating turbines related to nearby offshore wind farm projects could be affected by the presence of the Morven North Boundary and project vessels for Morven North. It is anticipated that where such activities occur concurrently that marine coordination between the activities will be implemented to ensure the towage activity is not adversely impacted by the activities for Morven North.

18.2.4.4 The most likely consequences are increased journey times and distances, as per the vessel displacement hazard. As there are no pilot boarding stations in the vicinity of Morven North, no effect is anticipated on port related services such as pilotage.

18.2.4.5 Relevant embedded mitigation measures include clear buoyage of the construction area, adherence to an LMP and AtoNMP, adherence to an NSPVMP, marine coordination of project vessels, marking on nautical charts and promulgation of information. These mitigation measures will be particularly relevant for coordination between project vessel activities and third-party towage operations.

Frequency of occurrence

18.2.4.6 The frequency of the risk of reduced access to local ports and harbours during the construction phase is considered to be **Remote**.

Severity of consequence

18.2.4.7 The severity of consequence of the risk of reduced access to local ports and harbours during the construction phase is considered to be **Minor**.

Significance of effect

18.2.4.8 Taking the frequency of occurrence as remote and the severity of consequence as minor, the overall effect of reduced port access during construction of Morven North is considered to be broadly acceptable.

18.2.4.9 The hazard is considered ALARP with embedded mitigation in place and therefore no additional mitigation is required. The hazard is therefore **Broadly Acceptable and Not Significant in EIA terms**.

18.3 Operations and maintenance phase

18.3.1 Vessel displacement and increased third-party vessel to vessel collision risk

18.3.1.1 The presence of structures in Morven North, as well as maintenance activities associated with Morven North, may displace existing vessel routes or activity which may increase the risk of a collision between third-party vessels.

18.3.1.2 These two related elements are each considered in the subsequent assessment in terms of frequency of occurrence and severity of consequence.

Vessel displacement

18.3.1.3 Based on experience at existing operational OWFs and input during consultation, it is anticipated that the majority of commercial vessels will choose not to navigate within the Morven North Boundary and therefore some main route deviations will be required as per the respective construction phase hazard.

18.3.1.4 The nature of the deviations is expected to be similar to that discussed for the equivalent construction phase hazard, with the deviations in general relatively low magnitude and effective passage planning likely reducing the extent. One RoRo route (Route 2) is affected but was not raised as an issue during consultation, noting that the primary user – Smyril Line – was included in the Regular Operator outreach.

18.3.1.5 The minimum spacing of 1,000m between wind farm structures within the Morven North Boundary is considered sufficient to accommodate transits of smaller vessels, noting there will be no restrictions on entry into the Morven North Boundary with the exception of any active 500m major maintenance safety zones.

18.3.1.6 Based on experience at existing operational OWFs, it is anticipated that fishing vessels and recreational vessels may also choose not to routinely navigate internally within the Morven North Boundary. However, they may be more likely to do so than commercial vessels, particularly in the case of recreational vessels given the absence of commercial traffic (as raised by RYA Scotland in Section 4.2). In such instances this may reduce the level of displacement for these vessels during the O&M phase.

18.3.1.7 It is noted that displacement of active commercial fishing is assessed separately in Volume 2, Chapter 12: Commercial Fisheries of the Morven North EIA Report.

18.3.1.8 Regarding displacement as a result of project vessel activity in the vicinity, given that any maintenance activities associated with Morven North will be less frequent than during the construction phase and localised, the likelihood of vessel displacement due to these activities is considered to be low. Additionally, such activities will likely be limited to within the Morven North Boundary and therefore not impact upon commercial vessel routeing.

18.3.1.9 The main consequences of vessel displacement will be increased journey times and distances for affected third party vessels, under the assumption that the wind turbines will be built to the full extent of Morven North. Any notable safety impacts are considered unlikely given the available sea room. Vessels are expected to comply with international and flag state regulations (including COLREGs (IMO, 1972/77) and SOLAS (IMO, 1974)) and will be able to passage plan in advance given the promulgation of information relating to Morven North and relevant nautical charts.

18.3.1.10 Relevant embedded mitigation measures include DSLP approval, adherence to an LMP and AtoNMP, adherence to an NSPVMP, marking on nautical charts and promulgation of information.

Collision risk

18.3.1.11 As noted for the equivalent construction phase hazard, six of the 16 main routes will likely deviate as a result of the presence of Morven North. Post wind farm collision frequency was estimated at one every 1,421 years.

18.3.1.12 Any displacement of commercial vessels due to maintenance activities is not anticipated to affect available sea room to such an extent that the risk of a collision between third party vessels is materially increased. This is due to the lesser frequency of maintenance activities compared to during construction, spatially limited extent of the maintenance operation at any given time and the likelihood that maintenance activities are located internally with the array.

18.3.1.13 An additional factor is the potential for structures to obscure vessels from one another, thus hindering ability to comply with COLREGs (IMO, 1972/77). The minimum spacing of 1,000m between wind farm structures will likely provide sufficient sea room for visual observations, with full obstruction likely only to occur when vessels are at

opposite ends of a wind turbine row. Collision risk is likely to be low in such cases due to the distance between vessels.

18.3.1.14 In the event of an encounter between third party vessels, it is likely to be localised and short in duration, with collision avoidance action implemented by the vessels involved, as per compliance with COLREGs (IMO, 1972/77), to ensure that a collision incident does not develop.

18.3.1.15 As per the respective construction phase hazard, historical collision incident data 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 the vessels involved able to resume their respective passages and undertake a full inspection at the next port.

18.3.1.16 As with the equivalent construction phase hazard, the displacement of commercial vessels west of the Morven North Boundary may result in closer proximity to fishing vessels actively fishing. This may then lead to an increase in encounters between commercial vessels and fishing vessels but there is sufficient sea room to allow both activities to safely occur with application of the COLREGs.

18.3.1.17 As an unlikely worst-case scenario, a high impact collision event could occur. This may result in vessel foundering and subsequent PLL, as well as pollution. In such a circumstance, vessels associated with Morven North may attend the incident under SOLAS obligations and in liaison with the MCA and the procedures within the ERCoP and MPCP would be implemented.

18.3.1.18 Relevant embedded mitigation measures includes marking on nautical charts, promulgation of information, DSLP approval, adherence to an LMP and AtoNMP, adherence to an MPCP and adherence to an ERCoP.

Frequency of occurrence

18.3.1.19 The frequency of occurrence in relation to displacement of vessel traffic resulting in increased third-party collision risk during the O&M phase is considered **Extremely Unlikely**.

Severity of consequence

18.3.1.20 The severity of consequence in relation to displacement of vessel traffic resulting in increased third-party collision risk during the O&M phase is considered **Moderate**.

Significance of effect

18.3.1.21 Taking the frequency of occurrence as extremely unlikely and the severity of consequence as moderate, the overall effect of vessel displacement and increased third-party vessel to vessel collision risk during O&M of Morven North is considered to be broadly acceptable.

18.3.1.22 The hazard is considered ALARP with embedded mitigation in place and therefore no additional mitigation is required. The hazard is therefore **Broadly Acceptable and Not Significant in EIA terms**.

18.3.2 Increased third-party vessel to project vessel collision risk

Qualification of risk

18.3.2.1 The presence of vessels associated with maintenance activities of Morven North may increase encounters and thus collision risk for vessels already operating in the area.

18.3.2.2 During the O&M phase of Morven North there may be up to 293 vessel movements annually and up to 15 project vessels on-site simultaneously (during major maintenance; i.e. likely less during normal operations). This will include vessels which are RAM.

18.3.2.3 Encounter and collision risk involving project vessels will be managed through the implementation of marine coordination as will be set out in the NSPVMP (Volume 4, Annex 5: Navigation Safety Plan and Vessel Management Plan (Version 1)). Project vessels will also be expected to carry AIS and comply with flag state regulations including the COLREGs (IMO, 1972/77) and SOLAS (IMO, 1974). COLREGs will remain the navigational priority for project vessels at all times.

18.3.2.4 Applications for safety zones of 500m around major maintenance activities during O&M will be sought and will protect deployed project vessels, especially if they are RAM. Minimum advisory passing distances and guard vessels, as defined by risk assessment, may also be implemented where safety zones do not apply. Details of safety zones, minimum safe passing distances and guard vessels will be promulgated including via Notifications to Mariners and Kingfisher Bulletins.

18.3.2.5 Appropriate operational marine lighting and marking will be agreed with the NLB and set out in an LMP and AtoNMP. These navigational aids will further maximise mariner awareness when in proximity to the Morven North Boundary.

18.3.2.6 Third-party vessels may experience decreased capability to visually identify project vessels during reduced visibility, especially if visual observations are obscured by wind turbines; however, this hazard will be mitigated by the application of the COLREGs (reduced speeds) in adverse weather conditions and the mandatory carriage of AIS by project vessels regardless of size.

18.3.2.7 As discussed in the equivalent construction phase hazard, there has been one instance of a third-party vessel colliding with a project vessel in the UK. Moderate vessel damage was reported with no harm to persons. It is noted that the incident occurred in 2011 and awareness of offshore wind developments and application of the measures outlined above has improved and been refined considerably in the interim, with no further collision incidents reported since.

18.3.2.8 As per the respective construction phase hazard, if an encounter between a project vessel and third party vessel occurs, it is likely to be localised and short in duration. Assuming the implementation of collision avoidance action as required by the COLREGs, the most likely outcome will be any vessels involved being able to resume their respective passages or activities with no long-term consequences.

18.3.2.9 In the event of a collision, the likely consequences will be minor contact between the vessels resulting in minor damage and no injuries to persons. As an unlikely worst-case scenario, foundering could occur resulting in PLL and pollution. Other project vessels may be able to assist in the event of a collision under SOLAS obligation and the adherence to the ERCoP, noting this would be done in liaison with the MCA. If pollution were to occur in proximity to Morven North or involving a project vessel, the MPCP (Volume 4, Annex 1, Appendix 1.1: Marine Pollution Contingency Plan (MPCP) (Version 1)) will be implemented to reduce the risks.

18.3.2.10 Relevant embedded mitigation measures include application for safety zones, guard vessels as required by risk assessment, DSLP approval, adherence to an LMP and AtoNMP, NSPVMP, MPCP, ERCoP, promulgation of information, marine coordination and marking on nautical charts.

Frequency of occurrence

18.3.2.11 The frequency of occurrence in relation to encounters and collision risk between project vessels and third party vessels during the O&M phase is considered to be **Extremely Unlikely**.

Severity of consequence

18.3.2.12 The severity of consequence in relation to encounters and collision risk between project vessels and third party vessels during the O&M phase is considered to be **Serious**.

Significance of effect

18.3.2.13 Taking the frequency of occurrence as extremely unlikely and the severity of consequence as serious, the overall effect of encounters and collision risk between project vessels and third party vessels during O&M of Morven North is considered to be tolerable with mitigation.

18.3.2.14 The hazard is considered ALARP with embedded mitigation in place and therefore no additional mitigation is required. The hazard is therefore **Tolerable with Mitigation and Not Significant in EIA terms**.

18.3.3 Vessel to structure allision risk

18.3.3.1 Presence of structures within the Morven North Boundary will lead to creation of powered, drifting and internal allision risk for vessels during the O&M phase.

18.3.3.2 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.

Powered allision risk

Qualification and quantification of risk

18.3.3.3 The base case annual powered vessel to structure allision frequency was estimated to be 1.69×10^{-3}, corresponding to a return period of one every 591 years. This rises to an estimate of 2.03×10^{-3} for a future case growth of 20% in vessel traffic, corresponding to a return period of one every 492 years. This is reflective of the volume of traffic passing at the minimum mean distance of 1nm from the Morven North Boundary. It is also considered a conservative result given the bridge-linked OSP (modelled as a singular structure) was modelled on the northeast perimeter of the Morven North Boundary and subsequently provided the highest allision risk of all structures.

18.3.3.4 Based on historical incident data, there have been two reported instances of a third-party vessel alliding with an operational OWF structure in the UK (in the Irish Sea and Southern North Sea). Both of these incidents involved a fishing vessel. These allisions resulted in minor to moderate damage to the vessels with minor injury to crew members.

18.3.3.5 Marine lighting and marking will be implemented in agreement with the NLB and defined within the LMP and AtoNMP (Volume 4, Annex 4: Lighting and Marking Plan (Version 1)). Promulgation of information and marking on charts will ensure vessels can passage plan in advance to minimise risk.

18.3.3.6 Should an allision occur, the consequences will depend on multiple factors as discussed in relation to the equivalent construction phase hazard. Fishing vessels and recreational vessels are considered most vulnerable to the hazard and 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 founder resulting in PLL and pollution. Project vessels may assist in the event of an allision under SOLAS obligations and the adherence to the ERCoP, in liaison with the MCA. If pollution were to occur, then the MPCP (Volume 4, Annex 1, Appendix 1.1: Marine Pollution Contingency Plan (MPCP) (Version 1)) will be implemented to reduce the environmental risk.

18.3.3.7 Relevant embedded mitigation measures include DSLP approval, adherence to a MPCP, adherence to an LMP and AtoNMP, adherence to an NSPVMP, promulgation of information, application for safety zones, adherence to an ERCoP and marking on nautical charts.

Frequency of occurrence

18.3.3.8 The frequency of occurrence in relation to powered vessel to structure allision risk during the O&M phase is considered to be **Remote**.

Severity of consequence

18.3.3.9 The severity of consequence in relation to powered vessel to structure allision risk during the O&M phase is considered to be **Moderate**.

Significance of effect

18.3.3.10 Taking the frequency of occurrence as remote and the severity of consequence as moderate, the overall effect of powered vessel to structure allision risk during O&M of Morven North is considered to be tolerable with mitigation.

18.3.3.11 The hazard is considered ALARP with embedded mitigation in place and therefore no additional mitigation is required. The hazard is therefore **Tolerable with Mitigation and Not Significant in EIA terms.**

Drifting allision risk

Qualification and quantification of risk

18.3.3.12 The base case annual drifting vessel to structure allision frequency was estimated to be 1.53×10^{-4}, corresponding to a return period of one every 6,526 years. This rises to an estimate of 1.84×10^{-4} for a future case growth of 20% in vessel traffic, corresponding to a return period of one every 5,428 years. This is reflective of the volume of traffic passing at the minimum mean distance of 1nm from the Morven North Boundary and the need for a vessel to become adrift prior to a drifting allision event occurring.

18.3.3.13 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; this is reflected in the RNLI incident data reviewed in proximity to the Morven North Boundary which indicates that machinery failure is the most common incident type.

18.3.3.14 In circumstances where a vessel drifts towards a structure in the Morven North Boundary, powered vessels may be able to regain power prior to reaching Morven North (by rectifying any fault). Failing this, the vessel's emergency response procedures would be implemented which may include an emergency anchoring event or the use of thrusters (depending on availability and power supply).

18.3.3.15 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 (IMO, 1974). This response will be managed via HMCG 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.

18.3.3.16 Should an allision occur, the consequences will be similar to those noted for the equivalent construction phase hazard including the unlikely worst-case of foundering, PLL and pollution. In the highly unlikely scenario of a drifting allision incident resulting in pollution, the implementation of the MPCP (Volume 4, Annex 1, Appendix 1.1: Marine Pollution Contingency Plan (MPCP) (Version 1)) will reduce the environmental risk. Project vessels may assist in the event of an allision under SOLAS (IMO, 19742) obligation and the adherence to the ERCoP, in line with the MCA. 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.

18.3.3.17 Relevant embedded mitigation measures include adherence to an ERCoP, adherence to an MPCP and project vessel compliance with SOLAS (IMO, 1974).

Frequency of occurrence

18.3.3.18 The frequency of occurrence in relation to drifting vessel to structure allision risk during the O&M phase is considered to be **Extremely unlikely**.

Severity of consequence

18.3.3.19 The severity of consequence in relation to drifting vessel to structure allision risk during the O&M phase is considered to be **Moderate**.

Significance of effect

18.3.3.20 Taking the frequency of occurrence as extremely unlikely and the severity of consequence as moderate, the overall effect of drifting vessel to structure allision risk during O&M of Morven North is considered to be broadly acceptable.

18.3.3.21 The hazard is considered ALARP with embedded mitigation in place and therefore no additional mitigation is required. The hazard is therefore **Broadly acceptable and not significant in EIA terms.**

Internal allision risk

Qualification and quantification of risk

18.3.3.22 Based on experience at existing operational OWFs, it is anticipated that commercial vessels will be unlikely to navigate internally within the Morven North

Boundary. Fishing and recreational vessels may be more likely to transit through noting they may choose not to depending on various conditions. Additionally, the RYA Scotland indicated that the absence of commercial traffic may increase the likelihood of internal navigation (see Section 4.2).

18.3.3.23 The base case fishing vessel to structure allision frequency is estimated to be 3.60×10^{-3}, corresponding to a return period of approximately one in 277 years. This rises to an estimate of 4.32×10^{-3} for a future case growth of 20% in vessel traffic, corresponding to a return period of one every 231 years. This return period is reflective of the volume of fishing vessel traffic in the Morven North Shipping and Navigation Study Area, both in transit and engaged in active fishing. Conservative modelling has been undertaken with the assumption that fishing levels in proximity to the wind turbines will not change. In reality, as discussed within the equivalent construction phase hazard, fishing vessels will account for the presence of the wind turbines and may choose to transit or fish elsewhere (noting this aligns with consultation input).

18.3.3.24 The worst-case consequences reported for vessels involved in an allision incident involving a UK OWF has been flooding, with no life-threatening injuries to persons reported. If an allision incident were to occur, project vessels may assist under obligation of SOLAS (IMO, 1974) and adherence to the ERCoP in liaison with the MCA. Additionally, if pollution occurs as a result of an allision incident, the MPCP (Volume 4, Annex 1, Appendix 1.1: Marine Pollution Contingency Plan (MPCP) (Version 1)) would be implemented where appropriate.

18.3.3.25 If a vessel chooses to transit within the Morven North Boundary, the minimum spacing of 1,000m between wind farm structures is considered sufficient for safe internal navigation. Furthermore, operational lighting and marking and marking on nautical charts provide mitigation against internal allision risk. Any vessel planning to transit through the Morven North Boundary is expected to passage plan in advance in accordance with SOLAS Chapter V (IMO, 1974) and promulgation of information will ensure that vessels have good awareness of Morven North.

18.3.3.26 Should bridge links be used between OSPs then there is an additional allision risk should a vessel choose to navigate under the bridge link and between OSPs. A height of 14m above HAT would pose a danger for such vessels. However, given the maximum separation of 100m between OSPs joined by a bridge link it is considered highly unlikely that a vessel would choose to navigate under a bridge link, particularly given the spacing of structures across the Morven North Boundary which allow for alternative passages. Additionally, the specific lighting and marking requirements for bridge links will be agreed with NLB to ensure that allision risk for vessels (including project vessels and recreational vessels) is reduced.

18.3.3.27 Should a recreational vessel under sail enter the proximity of a wind turbine, there is also potential for effects such as wind shear, masking and turbulence to occur. As noted in the equivalent construction phase hazard, from previous studies of

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

18.3.3.28 As noted within the Hazard Workshop, due to the distance offshore of the Morven North Boundary there may be an effect of fatigue for recreational users. The operational lighting and marking will be particularly important in such circumstances to ensure recreational users are aware of the presence of Morven North. It is also expected that recreational users on long sailings will ensure there is sufficient manning to avoid the effects of fatigue influencing safe navigation.

18.3.3.29 Relevant embedded mitigation measures include application for safety zones, DSLP approval, adherence to an LMP and AtoNMP, marking on nautical charts, promulgation of information, adherence to an ERCoP and adherence to an MPCP

Frequency of occurrence

18.3.3.30 The frequency of occurrence of internal vessel to structure allision risk during the O&M phase is considered to be **Extremely Unlikely**.

Severity of consequence

18.3.3.31 The severity of consequence of internal vessel to structure allision risk during the O&M phase is considered to be **Moderate**.

Significance of effect

18.3.3.32 Taking the frequency of occurrence as extremely unlikely and the severity of consequence as moderate, the overall effect of internal vessel to structure allision risk during O&M of Morven North is considered to be tolerable with mitigation.

18.3.3.33 The hazard is considered ALARP with embedded mitigation in place and therefore no additional mitigation is required. The hazard is therefore **Broadly Acceptable and Not Significant in EIA terms**.

18.3.4 Reduced access to local ports and harbours

Qualification of risk

18.3.4.1 Up to 293 vessel movements annually by O&M vessels may be made throughout the O&M phase, which will include vessels which are RAM. Project vessels will be managed by marine coordination, including the use of traffic management procedures such as the designation of entry and exit points to and from the Morven North Boundary and designated routes to and from the base port. Project vessels will

also carry AIS and be compliant with flag state regulations including the COLREGs (IMO 1972/77).

18.3.4.2 As discussed in the baseline description and equivalent construction phase hazard, the closest port or harbour is Aberdeen, located approximately 34nm to the northwest. Given the relative distance to ports in the area and the anticipated deviations for the main commercial routes, it is not anticipated that there will be any substantial effect on vessel approaches to and from the local ports beyond the deviations already outlined for impacts on vessel displacement. However, it is acknowledged that future towage activities relating to rigs and/or floating wind turbines related to nearby offshore wind farm projects could be affected by the presence of the Morven North Boundary and project vessels for Morven North. It is anticipated that where such activities occur concurrently that marine coordination between the activities will be implemented to ensure the towage activity is not adversely impacted by the activities for Morven North.

18.3.4.3 The most likely consequences are increased journey times and distances, as per the vessel displacement hazard. As there are no pilot boarding stations in the vicinity of Morven North, no effect is anticipated on port related services such as pilotage.

18.3.4.4 Relevant embedded mitigation measures include adherence to an LMP and AtoNMP, adherence to a NSPVMP, marine coordination of project vessels, marking on nautical charts and promulgation of information. These mitigation measures will be particularly relevant for coordination between project vessel activities and third-party towage operations.

Frequency of occurrence

18.3.4.5 The frequency of the risk of reduced access to local ports and harbours during the O&M phase is considered to be **Remote**.

Severity of consequence

18.3.4.6 The severity of consequence of the risk of reduced access to local ports and harbours during the O&M phase is considered to be **Minor**.

Significance of effect

18.3.4.7 Taking the frequency of occurrence as remote and the severity of consequence as minor, the overall effect of reduced port access during O&M of Morven North is considered to be broadly acceptable.

18.3.4.8 The hazard is considered ALARP with embedded mitigation in place and therefore no additional mitigation is required. The hazard is therefore **Broadly Acceptable and Not Significant in EIA terms**.

18.3.5 Reduction of under-keel clearance

Qualification of risk

18.3.5.1 The presence of subsea cables and associated protection may reduce under keel clearance during the O&M phase of Morven North.

18.3.5.2 The minimum burial depth for all subsea cables is 0.5m, noting actual burial depth will be determined via the CBRA process which will be undertaken post consent.

18.3.5.3 Where burial is not feasible, cable protection may be used instead, which again will be determined by the CBRA. In line with MGN 654, any reduction in water depth which exceeds 5% will be discussed with the MCA to determine if additional mitigation is necessary. 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).

18.3.5.4 Given that depths within the Morven North Boundary range between 62m to 75m below LAT and that the maximum draught recorded within the vessel traffic surveys was 13.8m (see Section 10.2.4), it is not anticipated that subsea cable protection will reduce water depths over the 5% threshold. No specific concerns from stakeholders were raised during consultation including the Hazard Workshop, with MGN 654 compliance considered suitable to manage the impact, noting that only small craft are expected to navigate internally within the Morven North Boundary.

18.3.5.5 Based on expert opinion, in the event of an underwater allision the most likely consequence is minor damage. The unlikely worst-case consequence may be vessel foundering resulting in PLL and pollution, although this is considered highly improbable. Implementation of the MPCP (Volume 4, Annex 1, Appendix 1.1: Marine Pollution Contingency Plan (MPCP) (Version 1)) will mitigate against pollution, whilst adherence to an ERCoP as well as operating under the obligations of SOLAS (IMO, 1974) will mitigate against the risk of PLL.

Frequency of occurrence

18.3.5.6 The frequency of occurrence of the risk of reduced under keel clearance due to the presence of subsea cables during O&M is considered **Negligible**.

Severity of consequence

18.3.5.7 The severity of consequence of the risk of reduced under keel clearance due to the presence of subsea cables during O&M is considered to be **Minor**.

Significance of effect

18.3.5.8 Taking the frequency of occurrence as negligible and the severity of consequence as minor, the overall effect of reduced under keel clearance due to subsea cables during O&M of Morven North is considered to be broadly acceptable.

18.3.5.9 The hazard is considered ALARP with embedded mitigation in place and therefore no additional mitigation is required. The hazard is therefore **Broadly Acceptable and Not Significant in EIA terms**.

18.3.6 Anchor and fishing gear interactions with subsea cables

Qualification of risk

18.3.6.1 The presence of subsea cables within the Morven North Boundary may increase the risk of anchor and fishing gear interaction.

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

18.3.6.3 There are three anchoring scenarios which are considered for this hazard:

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

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

18.3.6.5 No anchored vessels were observed within the Morven North Shipping and Navigation Study Area during the survey periods. Risk of interaction with an inter-array cable on a planned anchoring or dragged anchoring basis is therefore anticipated to be extremely low. In terms of emergency anchoring, any areas of high traffic volume are likely to represent the areas of highest risk, particularly where there are hazards nearby (for example, structures, rocks, shallows). However, given the relatively few hazards in proximity to the Morven North Boundary, as well as the water depths, the likelihood of this scenario arising is very low.

18.3.6.6 The likelihood of anchor interaction with a subsea cable is further reduced by the burial of the cables and use of external cable protection where required, which will be informed by the CBRA process, noting this will account for traffic volumes and vessel sizes. Moreover, with all subsea cables located within the Morven North

Boundary, there is a limited pathway through which commercial vessels may be subject to this hazard.

18.3.6.7 Should an anchor interaction occur, the most likely consequence is no damage to the cable or anchor, based on previous anchor interaction incidents. As an unlikely worst-case consequence, a snagging incident could occur and the vessel's anchor as well as the cable could be damaged, resulting in a loss of stability noting this would only occur for a smaller vessel which would be less likely to penetrate deeper into the seabed than a larger vessel.

18.3.6.8 There is also a risk that fishing gear may interact with subsea cables. It is the responsibility of the fishermen to dynamically risk assess whether it is safe to undertake fishing activities within the Morven North Boundary and to make a decision as to whether or not to fish. This decision will be informed by a number of factors, which will include the charted locations of subsea cables. From vessel traffic data, the majority of fishing vessels (including those likely actively fishing but outside the Morven North Boundary) were potters, which are of limited concern to subsea cables. In addition, the presence of subsea cables and the wind farm structures may mean that trawling is less likely within the Morven North Boundary. In the event of a fishing gear interaction, the consequences would likely consist of loss of gear, or as an unlikely worst-case could include loss of stability.

18.3.6.9 Relevant embedded mitigation measures include promulgation of information, marking on nautical charts, adherence to a CBRA and vessel compliance with MGN 654 (MCA, 2021).

Frequency of occurrence

18.3.6.10 The frequency of occurrence relating to the risk of anchor and fishing gear interaction with subsea cables during O&M is considered to be **Extremely Unlikely**.

Severity of consequence

18.3.6.11 The severity of consequence relating to the risk of anchor and fishing gear interaction with subsea cables during O&M is considered to be **Moderate**.

Significance of effect

18.3.6.12 Taking the frequency of occurrence as extremely unlikely and the severity of consequence as moderate, the overall effect of anchor and fishing gear interaction with subsea cables during O&M of Morven North is considered to be broadly acceptable.

18.3.6.13 The hazard is considered ALARP with embedded mitigation in place and therefore no additional mitigation is required. The hazard is therefore **Broadly Acceptable and Not Significant in EIA terms**.

18.3.7 Reduction of emergency response capability including Search and Rescue

Qualification of risk

18.3.7.1 The presence of structures as well as increased vessel activity and personnel numbers may reduce emergency response capabilities during the O&M phase of Morven North by increasing the number of incidents, increasing consequences or reducing access for the responders.

18.3.7.2 The spatial extent of this hazard is large given the area covered by Morven North (149nm^2), as well as the distance covered by air-based SAR support (the SAR helicopter base is located at Inverness, 104nm northwest of the Morven North Boundary). It is unlikely that a SAR operation will require the entirety of the Morven North Boundary to be searched and it is probable that a search will be restricted to a smaller area in which a casualty is known to be located (accounting for assumptions on any potential drift of the casualty).

18.3.7.3 Up to 293 vessel movements may be made annually by construction vessels during the O&M phase of Morven North. It is assumed that maintenance vessels will be on-site throughout the majority of the O&M phase, although severe weather may lead to vessels being withdrawn. The presence of these vessels increase the likelihood of an incident and subsequently increase the likelihood of multiple incidents occurring simultaneously, diminishing emergency response capability. However, they may also be able to provide additional response resource in the event of an incident in liaison with the MCA.

18.3.7.4 The most likely consequence to occur would be a delay to any emergency response request. As an unlikely worst-case, this could result in a failure of emergency response to an incident resulting in PLL and pollution. However, project vessels will be managed via marine coordination and comply with flag state regulations which will reduce this risk. Additionally, the presence of project vessels themselves may mitigate this risk as they may assist at incidents involving other project vessels under the obligation of SOLAS (IMO, 1974) and adherence to an ERCoP, noting this would be undertaken with liaison with the MCA. The MPCP (Volume 4, Annex 1, Appendix 1.1: Marine Pollution Contingency Plan (MPCP) (Version 1)) will also be implemented should pollution occur.

18.3.7.5 From recent SAR data, there was a single SAR tasking recorded throughout the nine-year period within the Morven North Shipping and Navigation Study Area, at its southern perimeter. The frequency of incidents in proximity to Morven North is not anticipated to increase significantly from the current level given the measures noted above which will be in place.

18.3.7.6 The layout will be agreed with the MCA and in line with MGN 654 requirements to ensure any SAR operations that do occur within the Morven North Boundary are facilitated. The Morven North indicative worst-case layout includes a ringroad

Helicopter Refuge Area between the dense perimeter and internal grid to assist with SAR access, noting that the specific (final) layout taken forward will be agreed post consent. A SAR checklist will also be completed and agreed with the MCA as required under MGN 654.

18.3.7.7 Relevant embedded mitigation measures include DSLP approval, promulgation of information, adherence to an LMP and AtoNMP, marking on appropriate charts, marine coordination of project vessels, adherence to an ERCoP, adherence to an MPCP, adherence to a NSPVMP and compliance with MGN 654 and international marine regulations.

Frequency of occurrence

18.3.7.8 The frequency of occurrence relating to the risk of reduced emergency response capabilities during the O&M phase is considered to be **Extremely Unlikely**.

Severity of consequence

18.3.7.9 The severity of consequence relating to the risk of reduced emergency response capabilities during the O&M phase is considered to be **Serious**.

Significance of effect

18.3.7.10 Taking the frequency of occurrence as extremely unlikely and the severity of consequence as serious, the overall effect of reduced emergency response capability during O&M of Morven North is considered to be tolerable with mitigation.

18.3.7.11 The hazard is considered ALARP with embedded mitigation in place and therefore no additional mitigation is required. The hazard is therefore **Tolerable with Mitigation and Not Significant in EIA terms**.

18.4 Decommissioning phase

18.4.1 Vessel displacement and increased third-party vessel to vessel collision risk

Qualification of risk

18.4.1.1 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 stage hazard. It is noted that in the case of subsea cables sections may be left *in situ* to avoid unnecessarily disturbing the seabed. This would be confirmed through consultation and assessment to ensure the most suitable approach was taken. 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*.

18.4.1.2 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 stage hazard. By the time of decommissioning, deviations will be well established, with vessels likely to continue on their typical routeing around the buoyed decommissioning area.

18.4.1.3 Relevant embedded mitigation measures would be as per the respective construction phase.

Frequency of occurrence

18.4.1.4 The frequency of occurrence in relation to displacement of vessel traffic resulting in increased third-party collision risk during the construction phase is considered **Extremely Unlikely**.

Severity of consequence

18.4.1.5 The severity of consequence in relation to displacement of vessel traffic resulting in increased third-party collision risk during the construction phase is considered **Moderate**.

Significance of effect

18.4.1.6 Taking the frequency of occurrence as extremely unlikely and the severity of consequence as moderate, the overall effect of vessel displacement and increased third-party vessel to vessel collision risk during decommissioning of Morven North is considered to be broadly acceptable.

18.4.1.7 The hazard is considered ALARP with embedded mitigation in place and therefore no additional mitigation is required. The hazard is therefore **Broadly Acceptable and Not Significant in EIA terms**.

18.4.2 Increased third-party vessel to project vessel collision risk

Qualification of risk

18.4.2.1 The presence of vessels associated with decommissioning activities of Morven North may increase encounters and thus collision risk for vessels already operating in the area.

18.4.2.2 Since the methods used to remove structures and subsea cables are expected to be similar to those used to install them, including the vessels involved, this hazard is expected to be similar in nature to the equivalent construction phase, including the number of vessel movements by decommissioning vessels. It is noted that 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 left *in situ*.

18.4.2.3 On this basis the same assumptions made for the equivalent construction phase hazard in terms of frequency and consequence apply.

Frequency of occurrence

18.4.2.4 The frequency of occurrence in relation to encounters and collision risk between project vessels and third party vessels during the construction phase is considered to be **Extremely Unlikely**.

Severity of consequence

18.4.2.5 The severity of consequence in relation to encounters and collision risk between project vessels and third party vessels during the construction phase is considered to be **Serious**.

Significance of effect

18.4.2.6 Taking the frequency of occurrence as extremely unlikely and the severity of consequence as serious, the overall effect of encounters and collision risk between project vessels and third party vessels during decommissioning of Morven North is considered to be tolerable with mitigation.

18.4.2.7 The hazard is considered ALARP with embedded mitigation in place and therefore no additional mitigation is required. The hazard is therefore **Tolerable with Mitigation and Not Significant in EIA terms**.

18.4.3 Vessel to structure allision risk

Qualification of risk

18.4.3.1 It is likely that allision risk during decommissioning will be similar to that observed for the construction phase, noting similar scenarios on-site, including partially removed structures within a buoyed decommissioning area. On this basis the same assumptions made for the equivalent construction phase hazard in terms of frequency and consequence apply.

Frequency of occurrence

18.4.3.2 The frequency of occurrence in relation to vessel to structure allision risk during the construction phase is considered to be **Extremely Unlikely**.

Severity of consequence

18.4.3.3 The severity of consequence in relation to vessel to structure allision risk during the construction phase is considered to be **Moderate**.

Significance of effect

18.4.3.4 Taking the frequency of occurrence as extremely unlikely and the severity of consequence as moderate, the overall effect of vessel to structure allision risk during decommissioning of Morven North is considered to be broadly acceptable.

18.4.3.5 The hazard is considered ALARP with embedded mitigation in place and therefore no additional mitigation is required. The hazard is therefore **Broadly Acceptable and Not Significant in EIA terms**.

18.4.4 Reduced access to local ports and harbours

Qualification of risk

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

18.4.4.2 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, including the number of vessel movements by decommissioning vessels. It is noted that 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*.

18.4.4.3 As with the construction stage, it is not yet known from which port(s) decommissioning activity will be based for Morven North.

18.4.4.4 On this basis the same assumptions made for the equivalent construction phase hazard in terms of frequency and consequence apply.

Frequency of occurrence

18.4.4.5 The frequency of the risk of reduced access to local ports and harbours during the construction phase is considered to be **Remote**.

Severity of consequence

18.4.4.6 The severity of consequence of the risk of reduced access to local ports and harbours during the construction phase is considered to be **Minor**.

Significance of effect

18.4.4.7 Taking the frequency of occurrence as remote and the severity of consequence as minor, the overall effect of reduced port access during decommissioning of Morven North is considered to be broadly acceptable.

18.4.4.8 The hazard is considered ALARP with embedded mitigation in place and therefore no additional mitigation is required. The hazard is therefore **Broadly Acceptable and Not Significant in EIA terms**.

19 Risk assessment – Scenario 1b

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

- vessel displacement and increased third-party vessel to vessel collision risk;
- increased third-party vessel to project vessel collision risk;
- vessel to structure allision risk (powered, drifting and internal navigation);
- reduced access to local ports and harbours;
- reduction of under keel clearance;
- increased anchor/gear interaction with subsea cables;
- reduction of emergency response provision including SAR capability.

19.1.1.2 For each hazard, embedded mitigation measures which have been identified as relevant to reducing risk are listed, with full descriptions 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 3.2.

19.1.1.3 The risk control log (see Section 24) summarises the risk assessment and a concluding risk statement is provided (see Section 26).

19.2 Construction phase

19.2.1 Vessel displacement and increased third-party vessel to vessel collision risk

19.2.1.1 Construction activities associated with Morven South may displace existing vessel routes or activity, which may increase the risk of a collision between third-party vessels.

19.2.1.2 These two related elements are each considered in the subsequent assessment in terms of frequency of occurrence and severity of consequence.

Vessel displacement

19.2.1.3 Vessel traffic data collected during the summer and winter 2024 surveys has been used to establish the vessel traffic baseline, alongside 12 months of AIS collected via terrestrial receivers between October 2021 and September 2022 and three supplementary seasonal vessel traffic surveys. These vessel traffic datasets have been validated by Anatec's ShipRoutes database and analysed to identify the volume of traffic passing within or in proximity to Morven South. Additionally, main routes were recognised from these datasets using the principles set out in MGN 654 (MCA, 2021) (see Section 11.2).

19.2.1.4 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 within the buoyed construction area; therefore, some main route deviations will be required.

19.2.1.5 The full methodology for classifying main route deviations is provided in Section 15.5, noting it is in line with MGN 654 (MCA, 2021). A deviation will be required for two of the 10 main routes identified within the Morven South Shipping and Navigation Study Area, with details provided in Table 15.2.

19.2.1.6 The deviation for Route 6 is relatively low magnitude, consisting of a 0.9nm distance increase, equating to an increase in total route length of 0.1%. The deviation for Route 2 is greater, consisting of a 5.5nm distance increase. Additionally, this route includes RoRos undergoing regular transit once every two days in summer only based on the vessel traffic data, and would be more sensitive to the displacement given the timetabled nature of the service provided. However, the deviation involved is minor when compared with the total route length (increase of 0.5%) and was not raised as an issue during consultation, noting that the primary user – Smyril Line – was included in the Regular Operator outreach. Additionally, it is likely that with effective passage planning the deviation could be reduced by altering the approach to the Morven North Boundary much earlier in the transit noting the open sea room available to do so both to the north and south.

19.2.1.7 Based on experience at previously under-construction OWFs, it is anticipated that fishing vessels and recreational vessels may also 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. However, they may be more likely to do so than commercial vessels, in particular in any areas of the Morven South Boundary where active construction is not ongoing, or structures are not yet present.

19.2.1.8 For any smaller vessels that do choose to deviate, there is considered to be sufficient sea room outside of the Morven South Boundary for transits from such vessels to be accommodated.

19.2.1.9 The main consequences of vessel displacement will be increased journey times and distances for affected third party vessels, under the assumption that the buoyed construction area will be deployed around the maximum extent of Morven South. Any notable safety impacts are considered unlikely given the available sea room. Vessels are expected to comply with international and flag state regulations (including COLREGs (IMO, 1972/77) and SOLAS (IMO, 1974)) and will be able to passage plan in advance given the promulgation of information relating to the Morven South Boundary and relevant nautical charts.

19.2.1.10 Relevant embedded mitigation measures include a buoyed construction area, adherence to an LMP and AtoNMP, marking on nautical charts and promulgation of

information. These will ensure an increased awareness from third-party vessels, and will also assist in passage planning to limit the extent of deviations.

Collision risk

19.2.1.11 From historical incident data, no collision incidents between third-party vessels have occurred directly as a result of a UK OWF.

19.2.1.12 In poor visibility, third-party vessels may experience limitations regarding visual identification of other third-party vessels, when passing on another side of the buoyed construction/decommissioning areas. This limitation may increase the potential for an encounter. However, this would be mitigated by the application of the COLREGs (including reduced speeds) in adverse weather conditions. Moreover, the minimum spacing between structures (1,000m) will be sufficient to ensure any visual hindrance is very short-term in nature.

19.2.1.13 Based on the pre-wind farm modelling, the baseline collision risk levels within the Morven South Shipping and Navigation Study Area are low, with an estimated vessel to vessel collision risk of one every 5,283 years. This rises to an estimate of a return period of one every 3,660 years for a future case growth of 20% in vessel traffic. This is due to the volume of traffic in the area relative to available sea space.

19.2.1.14 Post-wind farm, the collision frequency was estimated at one in 1,821 years, representing an additional collision incident every 2,780 years. This rises to an estimate of a return period of one every 1,266 years for a future case growth of 20% in vessel traffic. This remains a low level of collision risk, which is also reflected when considering future case traffic levels.

19.2.1.15 It is also acknowledged that a number of the higher-use routes, such as Routes 1, 3, 4 and 6, are comprised mainly of oil and gas vessels accessing nearby fields. As such, these vessels will have good familiarity and experience operating in proximity to surface structures.

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

19.2.1.17 Based on historic incident data, should an encounter develop into a collision incident, it is most likely to involve minor contact resulting in minor damage to the vessels with no harm to people and no substantial reputational risks. As a worst case with very low frequency of occurrence one of the vessels could receive substantial damage or founder with PLL and pollution, with this outcome more likely where one of the vessels is a small craft (e.g. fishing vessel, recreational vessel or CTV). From the vessel traffic survey data (which incorporates Radar and visual observations in addition to AIS) regular transits by commercial fishing vessels and recreational vessels through the Morven South Boundary are infrequent.

19.2.1.18 Relevant embedded mitigation measures include marking on nautical charts, promulgation of information, a buoyed construction area, adherence to an LMP and AtoNMP, adherence to an MPCP and adherence to an ERCoP. These will ensure an increased awareness from third-party vessels and will also assist in passage planning to limit the extent of deviations.

Frequency of occurrence

19.2.1.19 The frequency of occurrence in relation to displacement of vessel traffic resulting in increased third-party collision risk during the construction phase is considered **Extremely Unlikely**.

Severity of consequence

19.2.1.20 The severity of consequence in relation to displacement of vessel traffic resulting in increased third-party collision risk during the construction phase is considered **Moderate**.

Significance of effect

19.2.1.21 Taking the frequency of occurrence as extremely unlikely and the severity of consequence as moderate, the overall effect of vessel displacement and increased third-party vessel to vessel collision risk during construction of Morven South is considered to be broadly acceptable.

19.2.1.22 The hazard is considered ALARP with embedded mitigation in place and therefore no additional mitigation is required. The hazard is therefore **Broadly Acceptable and Not Significant in EIA terms**.

19.2.2 Increased third-party vessel to project vessel collision risk

Qualification of risk

19.2.2.1 The presence of vessels associated with construction activities of Morven South may increase encounters and thus collision risk for vessels already operating in the area.

19.2.2.2 During the construction phase of Morven South there may be up to 1,149 vessel movements made by up to 41 project vessels on-site simultaneously. This will include vessels which are RAM. It is assumed that construction vessels will be on-site throughout the entire duration of the construction phase.

19.2.2.3 Encounters and collision risk involving project vessels will be managed through the implementation of marine coordination with full details of this to be provided in the NSPVMP (Volume 4, Annex 5: Navigation Safety Plan and Vessel Management Plan (Version 1)). Project vessels will also be expected to carry AIS and comply with flag state regulations including the COLREGs (IMO, 1972/77) and SOLAS (IMO, 1974). COLREGs will remain the navigational priority for project vessels at all times.

19.2.2.4 Applications for safety zones of 500m around on-going construction activities will be sought during the construction phase and will protect deployed project vessels, especially if they are RAM. Minimum advisory passing distances and guard vessels, as defined by risk assessment, may also be implemented where safety zones do not apply, for example around cable installation vessels. Details of safety zones, minimum safe passing distances and guard vessels will be promulgated including via Notifications to Mariners and Kingfisher Bulletins.

19.2.2.5 Appropriate marine lighting and marking during construction including the buoyed construction area will be agreed with the NLB and set out in the LMP and AtoNMP (Volume 4, Annex 4: Lighting and Marking Plan and Aids to Navigation Management Plan). These navigational aids will further maximise mariner awareness when in proximity to ongoing construction works in the Morven South Boundary.

19.2.2.6 Third-party vessels may experience decreased capability to visually identify project vessels entering and exiting the Morven South Boundary during reduced visibility; however, this hazard will be mitigated by the application of the COLREGs (reduced speeds) in adverse weather conditions and the mandatory carriage of AIS by project vessels regardless of size. It is noted that the likelihood of a collision is likely to be greater in reduced visibility when the identification of project vessels entering and exiting the Morven South Boundary may be impeded.

19.2.2.7 Based on historical incident data, there has been one instance of a third-party vessel colliding with a project vessel in the UK (see Section 9.7 for further details). In this case, moderate vessel damage was reported with no harm to persons. It is noted that the incident occurred in 2011 and awareness of offshore wind developments and application of the measures outlined above has improved and been refined considerably in the interim, with no further collision incidents reported since.

19.2.2.8 If an encounter between a project vessel and third-party vessel occurs, it is likely to be localised and short in duration. Assuming the implementation of collision avoidance action as required by the COLREGs, the most likely outcome will be any vessels involved being able to resume their respective passages or activities with no long-term consequences.

19.2.2.9 In the event of a collision, the likely consequences will be minor contact between the vessels resulting in minor damage and no injuries to persons. As an unlikely worst-case scenario, foundering could occur resulting in PLL and pollution. Other project vessels may be able to assist in the event of a collision under SOLAS obligation and the adherence to the ERCoP, noting this would be done in liaison with the MCA. If pollution were to occur in proximity to the Morven South Boundary or involving a project vessel, the MPCP (Volume 4, Annex 1, Appendix 1.1: Marine Pollution Contingency Plan (MPCP) (Version 1)) will be implemented to reduce the risks.

19.2.2.10 As noted during consultation (see Section 4), there is the potential for a construction buoy to drift off-station. However, the LMP and AtoNMP will provide mechanisms for the location and recovery in any event; and due to the requirement for buoyage to be of IALA Position Category 2 (availability of not less than 99%), loss of any buoyage will be of low likelihood.

19.2.2.11 Relevant embedded mitigation measures include application for safety zones, a buoyed construction area, guard vessels as required by risk assessment, adherence to an LMP and AtoNMP, NSPVMP, MPCP, ERCoP, promulgation of information, marine coordination and marking on nautical charts.

Frequency of occurrence

19.2.2.12 The frequency of occurrence in relation to encounters and collision risk between project vessels and third-party vessels during the construction phase is considered to be **Extremely Unlikely**.

Severity of consequence

19.2.2.13 The severity of consequence in relation to encounters and collision risk between project vessels and third-party vessels during the construction phase is considered to be **Serious**.

Significance of effect

19.2.2.14 Taking the frequency of occurrence as extremely unlikely and the severity of consequence as serious, the overall effect of encounters and collision risk between project vessels and third-party vessels during construction of Morven South is considered to be tolerable with mitigation.

19.2.2.15 The hazard is considered ALARP with embedded mitigation in place and therefore no additional mitigation is required. The hazard is therefore **Tolerable with Mitigation and Not Significant in EIA terms**.

19.2.3 Vessel to structure allision risk

19.2.3.1 Presence of structures (including partially constructed) within the buoyed construction area will lead to creation of powered, drifting and internal allision risk for vessels.

19.2.3.2 The spatial extent of the hazard is small given that a vessel must be in close proximity to a 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.

19.2.3.3 Unlike the O&M phase, although there is the potential for a vessel to enter into the Morven South Boundary during construction, due to the presence of construction/decommissioning buoys and pre-constructed structures it is not expected that internal navigation will take place.

Qualification and quantification of risk

19.2.3.4 In addition to a vessel entering the buoyed construction/decommissioning area and alliding with a structure under its own power, there is considered to be potential for a vessel to be adrift in proximity to Morven South; this is reflected in the RNLI incident data reviewed in proximity to the Morven South Boundary in which the only incident involved machinery failure. A vessel adrift may only develop into an allision situation if in proximity to a structure. This is only the case where the adrift vessel is located internally or in close proximity to Morven South and the direction of the wind and/or tide directs the vessel towards a structure.

19.2.3.5 In circumstances where a vessel drifts towards a structure in the Morven South Boundary, 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 Morven South Boundary (i.e. by rectifying any fault). Given that vessels are expected to pass a safe distance off the buoyed construction area there is a greater duration over which regaining power may be achievable. 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).

19.2.3.6 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 (IMO, 1974). 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.

19.2.3.7 Temporary marine lighting and marking will be implemented including the buoyed construction area in agreement with the NLB. Promulgation of information and marking on charts will ensure vessels can passage plan in advance to minimise risk. Safety zones of 50m in radius around structures will also be applied for during the construction phase up until the point of commissioning of Morven South (rising to 500m where active construction is ongoing).

19.2.3.8 Should an allision occur, the consequences will depend on multiple factors including the energy of the impact, structural integrity of the vessel and sea state at the time of the impact. Fishing vessels and recreational vessels are considered most

vulnerable to the hazard given the potential for a non-steel construction. 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 founder resulting in PLL and pollution. Project vessels may assist in the event of an allision under SOLAS obligation and the adherence to the ERCoP, in line with the MCA. If pollution were to occur, then the MPCP (Volume 4, Annex 1, Appendix 1.1: Marine Pollution Contingency Plan (MPCP) (Version 1)) will be implemented to reduce the environmental risk.

19.2.3.9 Relevant embedded mitigation measures include DSLP approval, adherence to a MPCP, adherence to an LMP and AtoNMP, adherence to an NSPVMP, promulgation of information, application for safety zones, adherence to an ERCoP, guard vessels where required by risk assessment and appropriate marking via construction buoyage as well as on nautical charts.

Frequency of occurrence

19.2.3.10 The frequency of occurrence in relation to vessel to structure allision risk during the construction phase is considered to be **Extremely Unlikely**.

Severity of consequence

19.2.3.11 The severity of consequence in relation to vessel to structure allision risk during the construction phase is considered to be **Moderate**.

Significance of effect

19.2.3.12 Taking the frequency of occurrence as extremely unlikely and the severity of consequence as moderate, the overall effect of vessel to structure allision risk during construction of Morven South is considered to be broadly acceptable.

19.2.3.13 The hazard is considered ALARP with embedded mitigation in place and therefore no additional mitigation is required. The hazard is therefore **Broadly Acceptable and Not Significant in EIA terms.**

19.2.4 Reduced access to local ports and harbours

Qualification of risk

19.2.4.1 Up to 1,149 vessel movements made by construction vessels (excluding site preparation activities) may be made throughout the construction phase and will include vessels which are RAM. Project vessels will be managed by marine coordination, 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. Project vessels will also carry AIS and be compliant with flag state regulations including the COLREGs (IMO 1972/77).

19.2.4.2 The closest port or harbour to Morven South is Aberdeen, located approximately 50nm to the northwest. Given the relative distance to ports in the area and the anticipated deviations for the main commercial routes, it is not anticipated that there will be any substantial effect on vessel approaches to and from the local ports beyond the deviations already outlined for impacts on vessel displacement.

19.2.4.3 No concerns were raised during consultation over access to ports during the construction phase in relation to Morven South. However, it is acknowledged that future towage activities relating to rigs and/or floating wind turbines related to nearby offshore wind farm projects could be affected by the presence of the Morven South Boundary and project vessels for Morven South. It is anticipated that where such activities occur concurrently that marine coordination between the activities will be implemented to ensure the towage activity is not adversely impacted by the activities for Morven South.

19.2.4.4 The most likely consequences are increased journey times and distances, as per the vessel displacement hazard. As there are no pilot boarding stations in the vicinity of Morven South, no effect is anticipated on port related services such as pilotage.

19.2.4.5 Relevant embedded mitigation measures include clear buoyage of the construction area, adherence to an LMP and AtoNMP, adherence to a NSPVMP, marine coordination of project vessels, marking on nautical charts and promulgation of information. These mitigation measures will be particularly relevant for coordination between project vessel activities and third-party towage operations.

Frequency of occurrence

19.2.4.6 The frequency of the risk of reduced access to local ports and harbours during the construction phase is considered to be **Remote**.

Severity of consequence

19.2.4.7 The severity of consequence of the risk of reduced access to local ports and harbours during the construction phase is considered to be **Minor**.

Significance of effect

19.2.4.8 Taking the frequency of occurrence as remote and the severity of consequence as minor, the overall effect of reduced port access during construction of Morven South is considered to be broadly acceptable.

19.2.4.9 The hazard is considered ALARP with embedded mitigation in place and therefore no additional mitigation is required. The hazard is therefore **Broadly Acceptable and Not Significant in EIA terms**.

19.3 Operations and maintenance phase

19.3.1 Vessel displacement and increased third-party vessel to vessel collision risk

19.3.1.1 The presence of structures in Morven South, as well as maintenance activities associated with Morven South, may displace existing vessel routes or activity which may increase the risk of a collision between third-party vessels.

19.3.1.2 These two related elements are each considered in the subsequent assessment in terms of frequency of occurrence and severity of consequence.

Vessel displacement

19.3.1.3 Based on experience at existing operational OWFs and input during consultation, it is anticipated that the majority of commercial vessels will choose not to navigate within the Morven South Boundary and therefore some main route deviations will be required as per the respective construction phase hazard.

19.3.1.4 The nature of the deviations is expected to be similar to that discussed for the equivalent construction phase hazard, with effective passage planning likely reducing the extent. One RoRo route (Route 2) is affected but was not raised as an issue during consultation, noting that the primary user – Smyril Line – was included in the Regular Operator outreach.

19.3.1.5 The minimum spacing of 1,000m between wind farm structures within the Morven South Boundary is considered sufficient to accommodate transits of smaller vessels, noting there will be no restrictions on entry into the Morven South Boundary with the exception of any active 500m major maintenance safety zones.

19.3.1.6 Based on experience at existing operational OWFs, it is anticipated that fishing vessels and recreational vessels may also choose not to routinely navigate internally within the Morven South Boundary. However, they may be more likely to do so than commercial vessels. However, they may be more likely to do so than commercial vessels, particularly in the case of recreational vessels given the absence of commercial traffic (as raised by RYA Scotland in Section 4.2). In such instances this may reduce the level of displacement for these vessels during the O&M phase.

19.3.1.7 It is noted that displacement of active commercial fishing is assessed separately in Volume 2, Chapter 12: Commercial Fisheries of the Morven South EIA Report.

19.3.1.8 Regarding displacement as a result of project vessel activity in the vicinity, given that any maintenance activities associated with Morven South will be less frequent than during the construction phase and localised, the likelihood of vessel displacement due to these activities is considered to be low. Additionally, such activities will likely be limited to within the Morven South Boundary and therefore not impact upon commercial vessel routeing.

19.3.1.9 The main consequences of vessel displacement will be increased journey times and distances for affected third party vessels, under the assumption that the wind turbines will be built to the full extent of Morven South. Any notable safety impacts are considered unlikely given the available sea room. Vessels are expected to comply with international and flag state regulations (including COLREGs (IMO, 1972/77) and SOLAS (IMO, 1974)) and will be able to passage plan in advance given the promulgation of information relating to Morven South and relevant nautical charts.

19.3.1.10 Relevant embedded mitigation measures include DSLP approval, adherence to an LMP and AtoNMP, adherence to an NSPVMP, marking on nautical charts and promulgation of information.

Collision risk

19.3.1.11 As noted for the equivalent construction phase hazard, two of the 10 main routes will likely deviate as a result of the presence of Morven South. Post wind farm collision frequency was estimated at one every 1,821 years.

19.3.1.12 Any displacement of commercial vessels due to maintenance activities is not anticipated to affect available sea room to such an extent that the risk of a collision between third party vessels is materially increased. This is due to the lesser frequency of maintenance activities compared to during construction, spatially limited extent of the maintenance operation at any given time and the likelihood that maintenance activities are located internally with the array.

19.3.1.13 An additional factor is the potential for structures to obscure vessels from one another, thus hindering ability to comply with COLREGs (IMO, 1972/77). The minimum spacing of 1,000m between wind farm structures will likely provide sufficient sea room for visual observations, with full obstruction likely only to occur when vessels are at opposite ends of a wind turbine row. Collision risk is likely to be low in such cases due to the distance between vessels.

19.3.1.14 In the event of an encounter between third party vessels, it is likely to be localised and short in duration, with collision avoidance action implemented by the vessels involved, as per compliance with COLREGs (IMO, 1972/77), to ensure that a collision incident does not develop.

19.3.1.15 As per the respective construction phase hazard, historical collision incident data 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 the vessels involved able to resume their respective passages and undertake a full inspection at the next port.

19.3.1.16 As an unlikely worst-case scenario, a high impact collision event could occur. This may result in vessel foundering and subsequent PLL, as well as pollution. In such a circumstance, vessels associated with Morven South may attend the incident under

SOLAS obligations and in liaison with the MCA and the procedures within the ERCoP and MPCP would be implemented.

19.3.1.17 Relevant embedded mitigation measures includes marking on nautical charts, promulgation of information, DSLP approval, adherence to an LMP and AtoNMP, adherence to an MPCP and adherence to an ERCoP.

Frequency of occurrence

19.3.1.18 The frequency of occurrence in relation to displacement of vessel traffic resulting in increased third-party collision risk during the O&M phase is considered **Extremely Unlikely**.

Severity of consequence

19.3.1.19 The severity of consequence in relation to displacement of vessel traffic resulting in increased third-party collision risk during the O&M phase is considered **Moderate**.

Significance of effect

19.3.1.20 Taking the frequency of occurrence as remote and the severity of consequence as moderate, the overall effect of vessel displacement and increased third-party vessel to vessel collision risk during O&M of Morven South is considered to be broadly acceptable.

19.3.1.21 The hazard is considered ALARP with embedded mitigation in place and therefore no additional mitigation is required. The hazard is therefore **Broadly Acceptable and Not Significant in EIA terms**.

19.3.2 Increased third-party vessel to project vessel collision risk

Qualification of risk

19.3.2.1 The presence of vessels associated with maintenance activities of Morven South may increase encounters and thus collision risk for vessels already operating in the area.

19.3.2.2 During the O&M phase of Morven South there may be up to 293 vessel movements annually and up to 15 project vessels on-site simultaneously (during major maintenance; i.e. likely less during normal operations). This will include vessels which are RAM.

19.3.2.3 Encounter and collision risk involving project vessels will be managed through the implementation of marine coordination as will be set out in the NSPVMP (Volume 4, Annex 5: Navigation Safety Plan and Vessel Management Plan (Version 1)). Project vessels will also be expected to carry AIS and comply with flag state regulations

including the COLREGs (IMO, 1972/77) and SOLAS (IMO, 1974). COLREGs will remain the navigational priority for project vessels at all times.

19.3.2.4 Applications for safety zones of 500m around major maintenance activities during O&M will be sought and will protect deployed project vessels, especially if they are RAM. Minimum advisory passing distances and guard vessels, as defined by risk assessment, may also be implemented where safety zones do not apply. Details of safety zones, minimum safe passing distances and guard vessels will be promulgated including via Notifications to Mariners and Kingfisher Bulletins.

19.3.2.5 Appropriate operational marine lighting and marking will be agreed with the NLB and set out in an LMP and AtoNMP. These navigational aids will further maximise mariner awareness when in proximity to the Morven South Boundary.

19.3.2.6 Third-party vessels may experience decreased capability to visually identify project vessels during reduced visibility, especially if visual observations are obscured by wind turbines; however, this hazard will be mitigated by the application of the COLREGs (reduced speeds) in adverse weather conditions and the mandatory carriage of AIS by project vessels regardless of size.

19.3.2.7 As discussed in the equivalent construction phase hazard, there has been one instance of a third-party vessel colliding with a project vessel in the UK. Moderate vessel damage was reported with no harm to persons. It is noted that the incident occurred in 2011 and awareness of offshore wind developments and application of the measures outlined above has improved and been refined considerably in the interim, with no further collision incidents reported since.

19.3.2.8 As per the respective construction phase hazard, if an encounter between a project vessel and third party vessel occurs, it is likely to be localised and short in duration. Assuming the implementation of collision avoidance action as required by the COLREGs, the most likely outcome will be any vessels involved being able to resume their respective passages or activities with no long-term consequences.

19.3.2.9 In the event of a collision, the likely consequences will be minor contact between the vessels resulting in minor damage and no injuries to persons. As an unlikely worst-case scenario, foundering could occur resulting in PLL and pollution. Other project vessels may be able to assist in the event of a collision under SOLAS obligation and the adherence to the ERCoP, noting this would be done in liaison with the MCA. If pollution were to occur in proximity to Morven South or involving a project vessel, the MPCP (Volume 4, Annex 1, Appendix 1.1: Marine Pollution Contingency Plan (MPCP) (Version 1)) will be implemented to reduce the risks.

19.3.2.10 Relevant embedded mitigation measures include application for safety zones, guard vessels as required by risk assessment, DSLP approval, adherence to an LMP and AtoNMP, NSPVMP, MPCP, ERCoP, promulgation of information, marine coordination and marking on nautical charts.

Frequency of occurrence

19.3.2.11 The frequency of occurrence in relation to encounters and collision risk between project vessels and third party vessels during the O&M phase is considered to be **Extremely Unlikely**.

Severity of consequence

19.3.2.12 The severity of consequence in relation to encounters and collision risk between project vessels and third party vessels during the O&M phase is considered to be **Serious**.

Significance of effect

19.3.2.13 Taking the frequency of occurrence as extremely unlikely and the severity of consequence as serious, the overall effect of encounters and collision risk between project vessels and third party vessels during O&M of Morven South is considered to be tolerable with mitigation.

19.3.2.14 The hazard is considered ALARP with embedded mitigation in place and therefore no additional mitigation is required. The hazard is therefore **Tolerable with Mitigation and Not Significant in EIA terms**.

19.3.3 Vessel to structure allision risk

19.3.3.1 Presence of structures within the Morven South Boundary will lead to creation of powered, drifting and internal allision risk for vessels during the O&M phase.

19.3.3.2 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.

Powered allision risk

Qualification and quantification of risk

19.3.3.3 The base case annual powered vessel to structure allision frequency was estimated to be 1.42×10^{-3}, corresponding to a return period of one every 707 years. This rises to an estimate of 1.56×10^{-3} for a future case growth of 20% in vessel traffic, corresponding to a return period of one every 589 years. This is reflective of the volume of traffic passing at the minimum mean distance of 1nm from the Morven South Boundary.

19.3.3.4 Based on historical incident data, there have been two reported instances of a third-party vessel alliding with an operational OWF structure in the UK (in the Irish Sea and Southern North Sea). Both of these incidents involved a fishing vessel. These allisions resulted in minor to moderate damage to the vessels with minor injury to crew members.

19.3.3.5 Marine lighting and marking will be implemented in agreement with the NLB and defined within the LMP and AtoNMP (Volume 4, Annex 4: Lighting and Marking Plan (Version 1)). Promulgation of information and marking on charts will ensure vessels can passage plan in advance to minimise risk.

19.3.3.6 Should an allision occur, the consequences will depend on multiple factors as discussed in relation to the equivalent construction phase hazard. Fishing vessels and recreational vessels are considered most vulnerable to the hazard and 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 founder resulting in PLL and pollution. Project vessels may assist in the event of an allision under SOLAS obligations and the adherence to the ERCoP, in liaison with the MCA. If pollution were to occur, then the MPCP (Volume 4, Annex 1, Appendix 1.1: Marine Pollution Contingency Plan (MPCP) (Version 1)) will be implemented to reduce the environmental risk.

19.3.3.7 Relevant embedded mitigation measures include DSLP approval, adherence to a MPCP, adherence to an LMP and AtoNMP, adherence to an NSPVMP, promulgation of information, application for safety zones, adherence to an ERCoP and marking on nautical charts.

Frequency of occurrence

19.3.3.8 The frequency of occurrence in relation to powered vessel to structure allision risk during the O&M phase is considered to be **Remote**.

Severity of consequence

19.3.3.9 The severity of consequence in relation to powered vessel to structure allision risk during the O&M phase is considered to be **Moderate**.

Significance of effect

19.3.3.10 Taking the frequency of occurrence as remote and the severity of consequence as moderate, the overall effect of powered vessel to structure allision risk during O&M of Morven South is considered to be tolerable with mitigation.

19.3.3.11 The hazard is considered ALARP with embedded mitigation in place and therefore no additional mitigation is required. The hazard is therefore **Tolerable with Mitigation and Not Significant in EIA terms.**

Drifting allision risk

Qualification and quantification of risk

19.3.3.12 The base case annual drifting vessel to structure allision frequency was estimated to be 7.75×10^{-5}, corresponding to a return period of one every 12,911 years. This rises to an estimate of 9.28×10^{-5} for a future case growth of 20% in vessel traffic, corresponding to a return period of one every 10,774 years. This is reflective of the volume of traffic at the minimum mean distance of 1nm from the Morven South Boundary and the need for a vessel to become adrift prior to a drifting allision event occurring.

19.3.3.13 Based on historical incident data, there have been no instances of a third-party vessel alliding with an operational OWF structure whilst NUC. However, there is considered to be potential for a vessel to be adrift; this is reflected in the RNLI incident data reviewed in proximity to the Morven South Boundary in which the only incident involved machinery failure.

19.3.3.14 In circumstances where a vessel drifts towards a structure in the Morven South Boundary, powered vessels may be able to regain power prior to reaching Morven South (by rectifying any fault). Failing this, the vessel's emergency response procedures would be implemented which may include an emergency anchoring event or the use of thrusters (depending on availability and power supply).

19.3.3.15 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 (IMO, 1974). This response will be managed via HMCG 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.

19.3.3.16 Should an allision occur, the consequences will be similar to those noted for the equivalent construction phase hazard including the unlikely worst-case of foundering, PLL and pollution. In the highly unlikely scenario of a drifting allision incident resulting in pollution, the implementation of the MPCP (Volume 4, Annex 1, Appendix 1.1: Marine Pollution Contingency Plan (MPCP) (Version 1)) will reduce the environmental risk. Project vessels may assist in the event of an allision under SOLAS (IMO, 19742) obligation and the adherence to the ERCoP, in line with the MCA. 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.

19.3.3.17 Relevant embedded mitigation measures include adherence to an ERCoP, adherence to an MPCP and project vessel compliance with SOLAS (IMO, 1974).

Frequency of occurrence

19.3.3.18 The frequency of occurrence in relation to drifting vessel to structure allision risk during the O&M phase is considered to be **Extremely Unlikely**.

Severity of consequence

19.3.3.19 The severity of consequence in relation to drifting vessel to structure allision risk during the O&M phase is considered to be **Moderate**.

Significance of Effect

19.3.3.20 Taking the frequency of occurrence as extremely unlikely and the severity of consequence as moderate, the overall effect of drifting vessel to structure allision risk during O&M of Morven South is considered to be broadly acceptable.

19.3.3.21 The hazard is considered ALARP with embedded mitigation in place and therefore no additional mitigation is required. The hazard is therefore **Broadly Acceptable and Not Significant in EIA terms.**

Internal allision risk

Qualification and quantification of risk

19.3.3.22 Based on experience at existing operational OWFs, it is anticipated that commercial vessels will be unlikely to navigate internally within the Morven South Boundary. Fishing and recreational vessels may be more likely to transit through noting they may choose not to depending on various conditions. Additionally, the RYA Scotland indicated that the absence of commercial traffic may increase the likelihood of internal navigation (see Section 4.2).

19.3.3.23 The modelled base case fishing vessel to structure allision frequency is estimated to be negligible, due to the lack of fishing vessels recorded transiting in proximity to Morven South.

19.3.3.24 The worst-case consequences reported for vessels involved in an allision incident involving a UK OWF has been flooding, with no life-threatening injuries to persons reported. If an allision incident were to occur, project vessels may assist under obligation of SOLAS (IMO, 1974) and adherence to the ERCoP in liaison with the MCA. Additionally, if pollution occurs as a result of an allision incident, the MPCP (Volume 4, Annex 1, Appendix 1.1: Marine Pollution Contingency Plan (MPCP) (Version 1)) would be implemented where appropriate.

19.3.3.25 If a vessel chooses to transit within the Morven South Boundary, the minimum spacing of 1,000m between wind farm structures is considered sufficient for safe internal navigation. Furthermore, operational lighting and marking and marking on nautical charts provide mitigation against internal allision risk. Any vessel planning to transit through the Morven South Boundary is expected to passage plan in advance in

accordance with SOLAS Chapter V (IMO, 1974) and promulgation of information will ensure that vessels have good awareness of Morven South.

19.3.3.26 Should bridge links be used between OSPs then there is an additional allision risk should a vessel choose to navigate under the bridge link and between OSPs. A height of 14m above HAT would pose a danger for such vessels. However, given the maximum separation of 100m between OSPs joined by a bridge link it is considered highly unlikely that a vessel would choose to navigate under a bridge link, particularly given the spacing of structures across the Morven South Boundary which allows for alternative passages. Additionally, the specific lighting and marking requirements for bridge links will be agreed with NLB to ensure that allision risk for vessels (including project vessels and recreational vessels) is reduced.

19.3.3.27 Should a recreational vessel under sail enter the proximity of a wind turbine, there is also potential for effects such as wind shear, masking and turbulence to occur. As noted in the equivalent construction phase hazard, from previous studies of offshore wind developments, it has been concluded that wind turbines do reduce wind velocity downwind of a wind turbine (MCA, 2022) but that no negative effects on recreational craft have been reported on the basis of the limited spatial extent of the effect and its similarity to that experienced when passing a large vessel or close to other large structures or the coastline. In addition, no practical issues have been raised by recreational users to date when operating in proximity to existing offshore wind developments.

19.3.3.28 As noted within the Hazard Workshop, due to the distance offshore of the Morven South Boundary there may be an effect of fatigue for recreational users. The operational lighting and marking will be particularly important in such circumstances to ensure recreational users are aware of the presence of Morven South. It is also expected that recreational users on long sailings will ensure there is sufficient manning to avoid the effects of fatigue influencing safe navigation.

19.3.3.29 Relevant embedded mitigation measures include application for safety zones, DSLP approval, adherence to an LMP and AtoNMP, marking on nautical charts, promulgation of information, adherence to an ERCoP and adherence to an MPCP.

Frequency of occurrence

19.3.3.30 The frequency of occurrence of internal vessel to structure allision risk during the O&M phase is considered to be **Negligible**.

Severity of consequence

19.3.3.31 The severity of consequence of internal vessel to structure allision risk during the O&M phase is considered to be **Moderate**.

Significance of effect

19.3.3.32 Taking the frequency of occurrence as negligible and the severity of consequence as moderate, the overall effect of internal vessel to structure allision risk during O&M of Morven South is considered to be broadly acceptable.

19.3.3.33 The hazard is considered ALARP with embedded mitigation in place and therefore no additional mitigation is required. The hazard is therefore **Broadly Acceptable and Not Significant in EIA terms**.

19.3.4 Reduced access to local ports and harbours

Qualification of risk

19.3.4.1 Up to 293 vessel movements annually by O&M vessels may be made throughout the O&M phase, which will include vessels which are RAM. Project vessels will be managed by marine coordination, including the use of traffic management procedures such as the designation of entry and exit points to and from the Morven South Boundary and designated routes to and from the base port. Project vessels will also carry AIS and be compliant with flag state regulations including the COLREGs (IMO 1972/77).

19.3.4.2 As discussed in the baseline description and equivalent construction phase hazard, the closest port or harbour is Aberdeen, located approximately 34nm to the northwest. Given the relative distance to ports in the area and the anticipated deviations for the main commercial routes, it is not anticipated that there will be any substantial effect on vessel approaches to and from the local ports beyond the deviations already outlined for impacts on vessel displacement. However, it is acknowledged that future towage activities relating to rigs and/or floating wind turbines related to nearby offshore wind farm projects could be affected by the presence of the Morven South Boundary and project vessels for Morven South. It is anticipated that where such activities occur concurrently that marine coordination between the activities will be implemented to ensure the towage activity is not adversely impacted by the activities for Morven South.

19.3.4.3 The most likely consequences are increased journey times and distances, as per the vessel displacement hazard. As there are no pilot boarding stations in the vicinity of Morven South, no effect is anticipated on port related services such as pilotage.

19.3.4.4 Relevant embedded mitigation measures include adherence to an LMP and AtoNMP, adherence to a NSPVMP, marine coordination of project vessels, marking on nautical charts and promulgation of information. These mitigation measures will be particularly relevant for coordination between project vessel activities and third-party towage operations.

Frequency of occurrence

19.3.4.5 The frequency of the risk of reduced access to local ports and harbours during the O&M phase is considered to be **Remote**.

Severity of consequence

19.3.4.6 The severity of consequence of the risk of reduced access to local ports and harbours during the O&M phase is considered to be **Minor**.

Significance of effect

19.3.4.7 Taking the frequency of occurrence as remote and the severity of consequence as minor, the overall effect of reduced port access during O&M of Morven South is considered to be broadly acceptable.

19.3.4.8 The hazard is considered ALARP with embedded mitigation in place and therefore no additional mitigation is required. The hazard is therefore **Broadly Acceptable and Not Significant in EIA terms**.

19.3.5 Reduction of under-keel clearance

Qualification of risk

19.3.5.1 The presence of subsea cables and associated protection may reduce under keel clearance during the O&M phase of Morven South.

19.3.5.2 The minimum burial depth for all subsea cables is 0.5m, noting actual burial depth will be determined via the CBRA process which will be undertaken post consent.

19.3.5.3 Where burial is not feasible, cable protection may be used instead, which again will be determined by the CBRA. In line with MGN 654, any reduction in water depth which exceeds 5% will be discussed with the MCA to determine if additional mitigation is necessary. 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).

19.3.5.4 Given that depths within the Morven South Boundary range between 64m to 76m below LAT and that the maximum draught recorded within the vessel traffic surveys was 13.8m (see Section 10.3.4), it is not anticipated that subsea cable protection will reduce water depths over the 5% threshold. No specific concerns from stakeholders were raised during consultation including the Hazard Workshop, with MGN 654 compliance considered suitable to manage the impact, noting that only small craft are expected to navigate internally within the Morven South Boundary.

19.3.5.5 Based on expert opinion, in the event of an underwater allision the most likely consequence is minor damage. The unlikely worst-case consequence may be vessel

foundering resulting in PLL and pollution, although this is considered highly improbable. Implementation of the MPCP (Volume 4, Annex 1, Appendix 1.1: Marine Pollution Contingency Plan (MPCP) (Version 1)) will mitigate against pollution, whilst adherence to an ERCoP as well as operating under the obligations of SOLAS (IMO, 1974) will mitigate against the risk of PLL.

Frequency of occurrence

19.3.5.6 The frequency of occurrence of the risk of reduced under keel clearance due to the presence of subsea cables during O&M is considered **Negligible**.

Severity of consequence

19.3.5.7 The severity of consequence of the risk of reduced under keel clearance due to the presence of subsea cables during O&M is considered to be **Minor**.

Significance of effect

19.3.5.8 Taking the frequency of occurrence as negligible and the severity of consequence as minor, the overall effect of reduced under keel clearance due to subsea cables during O&M of Morven South is considered to be broadly acceptable.

19.3.5.9 The hazard is considered ALARP with embedded mitigation in place and therefore no additional mitigation is required. The hazard is therefore **Broadly Acceptable and Not Significant in EIA terms**.

19.3.6 Anchor and fishing gear interactions with subsea cables

Qualification of risk

19.3.6.1 The presence of subsea cables within the Morven South Boundary may increase the risk of anchor and fishing gear interaction.

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

19.3.6.3 There are three anchoring scenarios which are considered for this hazard:

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

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

19.3.6.5 No anchored vessels were observed within the Morven South Shipping and Navigation Study Area during the survey periods. Risk of interaction with an inter-array cable on a planned anchoring or dragged anchoring basis is therefore anticipated to be extremely low. In terms of emergency anchoring, any areas of high traffic volume are likely to represent the areas of highest risk, particularly where there are hazards nearby (for example, structures, rocks, shallows). However, given the relatively few hazards in proximity to the Morven South Boundary, as well as the water depths, the likelihood of this scenario arising is very low.

19.3.6.6 The likelihood of anchor interaction with a subsea cable is further reduced by the burial of the cables and use of external cable protection where required, which will be informed by the CBRA process, noting this will account for traffic volumes and vessel sizes. Moreover, with all subsea cables located within the Morven North Boundary, there is a limited pathway through which commercial vessels may be subject to this hazard.

19.3.6.7 Should an anchor interaction occur, the most likely consequence is no damage to the cable or anchor, based on previous anchor interaction incidents. As an unlikely worst-case consequence, a snagging incident could occur and the vessel's anchor as well as the cable could be damaged, resulting in a loss of stability noting this would only occur for a smaller vessel which would be less likely to penetrate deeper into the seabed than a larger vessel.

19.3.6.8 There is also a risk that fishing gear may interact with subsea cables. It is the responsibility of the fishermen to dynamically risk assess whether it is safe to undertake fishing activities within the Morven South Boundary and to make a decision as to whether or not to fish. This decision will be informed by a number of factors, which will include the charted locations of subsea cables. From vessel traffic data, the majority of fishing vessels (including those likely actively fishing but outside the Morven South Boundary) were potters, which are of limited concern to subsea cables. In addition, the presence of subsea cables and the wind farm structures may mean that trawling is less likely within the Morven South Boundary. In the event of a fishing gear interaction, the consequences would likely consist of loss of gear, or as an unlikely worst-case could include loss of stability.

19.3.6.9 Relevant embedded mitigation measures include promulgation of information, marking on nautical charts, adherence to a CBRA and vessel compliance with MGN 654 (MCA, 2021).

Frequency of occurrence

19.3.6.10 The frequency of occurrence relating to the risk of anchor and fishing gear interaction with subsea cables during O&M is considered to be **Extremely Unlikely**.

Severity of consequence

19.3.6.11 The severity of consequence relating to the risk of anchor and fishing gear interaction with subsea cables during O&M is considered to be **Moderate**.

Significance of effect

19.3.6.12 Taking the frequency of occurrence as extremely unlikely and the severity of consequence as moderate, the overall effect of anchor and fishing gear interaction with subsea cables during O&M of Morven South is considered to be broadly acceptable.

19.3.6.13 The hazard is considered ALARP with embedded mitigation in place and therefore no additional mitigation is required. The hazard is therefore **Broadly Acceptable and Not Significant in EIA terms**.

19.3.7 Reduction of emergency response capability including Search and Rescue

Qualification of risk

19.3.7.1 The presence of structures as well as increased vessel activity and personnel numbers may reduce emergency response capabilities during the O&M phase of Morven South by increasing the number of incidents, increasing consequences or reducing access for the responders.

19.3.7.2 The spatial extent of this hazard is large given the area covered by Morven South (101nm^2), as well as the distance covered by air-based SAR support (the SAR helicopter base is located at Inverness, 118nm northwest of the Morven South Boundary). It is unlikely that a SAR operation will require the entirety of the Morven South Boundary to be searched and it is probable that a search will be restricted to a smaller area in which a casualty is known to be located (accounting for assumptions on any potential drift of the casualty).

19.3.7.3 Up to 293 vessel movements may be made annually by construction vessels during the O&M phase of Morven South. It is assumed that maintenance vessels will be on-site throughout the majority of the O&M phase, although severe weather may lead to vessels being withdrawn. The presence of these vessels increase the likelihood of an incident and subsequently increase the likelihood of multiple incidents occurring simultaneously, diminishing emergency response capability. However, they may also be able to provide additional response resource in the event of an incident in liaison with the MCA.

19.3.7.4 The most likely consequence to occur would be a delay to any emergency response request. As an unlikely worst-case, this could result in a failure of emergency response to an incident resulting in PLL and pollution. However, project vessels will be managed via marine coordination and comply with flag state regulations which will reduce this risk. Additionally, the presence of project vessels themselves may mitigate

this risk as they may assist at incidents involving other project vessels under the obligation of SOLAS (IMO, 1974) and adherence to an ERCoP, noting this would be undertaken with liaison with the MCA. The MPCP (Volume 4, Annex 1, Appendix 1.1: Marine Pollution Contingency Plan (MPCP) (Version 1)) will also be implemented should pollution occur.

19.3.7.5 From recent SAR data, there was a single SAR tasking recorded throughout the nine-year period within the Morven South Shipping and Navigation Study Area, at the southeastern extent of the Morven South Boundary. The frequency of incidents in proximity to Morven South is not anticipated to increase significantly from the current level given the measures noted above which will be in place.

19.3.7.6 The layout will be agreed with the MCA and in line with MGN 654 requirements to ensure any SAR operations that do occur within the Morven South Boundary are facilitated. The Morven South indicative worst-case layout includes a ringroad Helicopter Refuge Area between the dense perimeter and internal grid to assist with SAR access, noting that the specific (final) layout taken forward will be agreed post consent. A SAR checklist will also be completed and agreed with the MCA as required under MGN 654.

19.3.7.7 Relevant embedded mitigation measures include DSLP approval, promulgation of information, adherence to an LMP and AtoNMP, marking on appropriate charts, marine coordination of project vessels, adherence to an ERCoP, adherence to an MPCP, adherence to a NSPVMP and compliance with MGN 654 and international marine regulations.

Frequency of occurrence

19.3.7.8 The frequency of occurrence relating to the risk of reduced emergency response capabilities during the O&M phase is considered to be **Extremely Unlikely**.

Severity of consequence

19.3.7.9 The severity of consequence relating to the risk of reduced emergency response capabilities during the O&M phase is considered to be **Serious**.

Significance of effect

19.3.7.10 Taking the frequency of occurrence as extremely unlikely and the severity of consequence as serious, the overall effect of reduced emergency response capability during O&M of Morven South is considered to be tolerable with mitigation.

19.3.7.11 The hazard is considered ALARP with embedded mitigation in place and therefore no additional mitigation is required. The hazard is therefore **Tolerable with Mitigation and Not Significant in EIA terms**.

19.4 Decommissioning phase

19.4.1 Vessel displacement and increased third-party vessel to vessel collision risk

Qualification of risk

19.4.1.1 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 stage hazard. It is noted that in the case of subsea cables sections may be left *in situ* to avoid unnecessarily disturbing the seabed. This would be confirmed through consultation and assessment to ensure the most suitable approach was taken. 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*.

19.4.1.2 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 stage hazard. By the time of decommissioning, deviations will be well established, with vessels likely to continue on their typical routeing around the buoyed decommissioning area.

19.4.1.3 Relevant embedded mitigation measures would be as per the respective construction phase.

Frequency of occurrence

19.4.1.4 The frequency of occurrence in relation to displacement of vessel traffic resulting in increased third-party collision risk during the construction phase is considered **Extremely Unlikely**.

Severity of consequence

19.4.1.5 The severity of consequence in relation to displacement of vessel traffic resulting in increased third-party collision risk during the construction phase is considered **Moderate**.

Significance of effect

19.4.1.6 Taking the frequency of occurrence as remote and the severity of consequence as moderate, the overall effect of vessel displacement and increased third-party vessel to vessel collision risk during decommissioning of Morven South is considered to be broadly acceptable.

19.4.1.7 The hazard is considered ALARP with embedded mitigation in place and therefore no additional mitigation is required. The hazard is therefore **Broadly Acceptable and Not Significant in EIA terms**.

19.4.2 Increased third-party vessel to project vessel collision risk

Qualification of risk

19.4.2.1 The presence of vessels associated with decommissioning activities of Morven South may increase encounters and thus collision risk for vessels already operating in the area.

19.4.2.2 Since the methods used to remove structures and subsea cables are expected to be similar to those used to install them, including the vessels involved, this hazard is expected to be similar in nature to the equivalent construction phase, including the number of vessel movements by decommissioning vessels. It is noted that 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 left *in situ*.

19.4.2.3 On this basis the same assumptions made for the equivalent construction phase hazard in terms of frequency and consequence apply.

Frequency of occurrence

19.4.2.4 The frequency of occurrence in relation to encounters and collision risk between project vessels and third party vessels during the construction phase is considered to be **Extremely Unlikely**.

Severity of consequence

19.4.2.5 The severity of consequence in relation to encounters and collision risk between project vessels and third party vessels during the construction phase is considered to be **Serious**.

Significance of effect

19.4.2.6 Taking the frequency of occurrence as extremely unlikely and the severity of consequence as serious, the overall effect of encounters and collision risk between project vessels and third party vessels during decommissioning of Morven South is considered to be tolerable with mitigation.

19.4.2.7 The hazard is considered ALARP with embedded mitigation in place and therefore no additional mitigation is required. The hazard is therefore **Tolerable with Mitigation and Not Significant in EIA terms**.

19.4.3 Vessel to structure allision risk

Qualification of risk

19.4.3.1 It is likely that allision risk during decommissioning will be similar to that observed for the construction phase, noting similar scenarios on-site, including partially removed structures within a buoyed decommissioning area. On this basis the

same assumptions made for the equivalent construction phase hazard in terms of frequency and consequence apply.

Frequency of occurrence

19.4.3.2 The frequency of occurrence in relation to vessel to structure allision risk during the construction phase is considered to be **Extremely Unlikely**.

Severity of consequence

19.4.3.3 The severity of consequence in relation to vessel to structure allision risk during the construction phase is considered to be **Moderate**.

Significance of effect

19.4.3.4 Taking the frequency of occurrence as extremely unlikely and the severity of consequence as moderate, the overall effect of vessel to structure allision risk during decommissioning of Morven South is considered to be broadly acceptable.

19.4.3.5 The hazard is considered ALARP with embedded mitigation in place and therefore no additional mitigation is required. The hazard is therefore **Broadly Acceptable and Not Significant in EIA terms**.

19.4.4 Reduced access to local ports and harbours

Qualification of risk

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

19.4.4.2 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, including the number of vessel movements by decommissioning vessels. It is noted that 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*.

19.4.4.3 As with the construction stage, it is not yet known from which port(s) decommissioning activity will be based for Morven South.

19.4.4.4 On this basis the same assumptions made for the equivalent construction phase hazard in terms of frequency and consequence apply.

Frequency of occurrence

19.4.4.5 The frequency of the risk of reduced access to local ports and harbours during the construction phase is considered to be **Remote**.

Severity of consequence

19.4.4.6 The severity of consequence of the risk of reduced access to local ports and harbours during the construction phase is considered to be **Minor**.

Significance of effect

19.4.4.7 Taking the frequency of occurrence as remote and the severity of consequence as minor, the overall effect of reduced port access during decommissioning of Morven South is considered to be broadly acceptable.

19.4.4.8 The hazard is considered ALARP with embedded mitigation in place and therefore no additional mitigation is required. The hazard is therefore **Broadly Acceptable and Not Significant in EIA terms**.

20 Risk assessment – Scenario 2

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

- vessel displacement and increased third-party vessel to vessel collision risk;
- increased third-party vessel to project vessel collision risk;
- vessel to structure allision risk (powered, drifting and internal navigation);
- reduced access to local ports and harbours;
- reduction of under keel clearance;
- increased anchor/gear interaction with subsea cables;
- reduction of emergency response provision including SAR capability.

20.1.1.2 For each hazard, embedded mitigation measures which have been identified as relevant to reducing risk are listed, with full descriptions 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 3.2.

20.1.1.3 The risk control log (see Section 24) summarises the risk assessment and a concluding risk statement is provided (see Section 26).

20.1.1.4 Risk assessments for Morven North and Morven South in isolation are provided separately in Sections 18 and 19, respectively.

20.2 Construction phase

20.2.1 Vessel displacement and increased third-party vessel to vessel collision risk

20.2.1.1 Construction activities associated with Morven North and Morven South may displace existing vessel routes or activity, which may increase the risk of a collision between third-party vessels.

20.2.1.2 These two related elements are each considered in the subsequent assessment in terms of frequency of occurrence and severity of consequence.

Vessel displacement

20.2.1.3 Vessel traffic data collected during the summer and winter 2024 surveys has been used to establish the vessel traffic baseline, alongside 12 months of AIS collected via terrestrial receivers between October 2021 and September 2022 and three supplementary seasonal vessel traffic surveys. These vessel traffic datasets have been validated by Anatec's ShipRoutes database and analysed to identify the volume of traffic passing within or in proximity to Morven North and Morven South. Additionally,

main routes were recognised from these datasets using the principles set out in MGN 654 (MCA, 2021) (see Section 11.2).

20.2.1.4 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 within the buoyed construction area; therefore, some main route deviations will be required.

20.2.1.5 The full methodology for classifying main route deviations is provided in Section 15.5, noting it is in line with MGN 654 (MCA, 2021). A deviation will be required for seven of the 17 main routes identified within the Regional Shipping and Navigation Study Area, with details provided in Table 15.3.

20.2.1.6 The deviations are in general relatively low magnitude, with six of the seven increasing the total route length by less than 0.5%. Route 17 is anticipated to increase distance by 5.5nm, equating to a 3.9% increase in total route length. This is the lowest volume main commercial route within the Morven North Shipping and Navigation Study Area, with an average of one vessel per week. Although the deviation is greater, it is anticipated that the extent of the deviation can be reduced with passage planning for the departure from or arrival to Montrose, with a more direct approach to the northern extent of the Morven Site than has been conservatively assumed in the quantitative assessment.

20.2.1.7 There is one RoRo route (Route 2) undergoing regular transit once every two days in summer only based on the vessel traffic data. Although this route may be displaced and would be more sensitive given the timetabled nature of the service provided, the deviation involved is minor especially when compared with the total route length (increase of 0.3%) and was not raised as an issue during consultation, noting that the primary user – Smyril Line – was included in the Regular Operator outreach.

20.2.1.8 Based on experience at previously under-construction OWFs, it is anticipated that fishing vessels and recreational vessels may also 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. However, they may be more likely to do so than commercial vessels, in particular in any areas of the Morven Site where active construction is not ongoing, or structures are not yet present.

20.2.1.9 For any smaller vessels that do choose to deviate, there is considered to be sufficient sea room outside of the Morven Site for transits from such vessels to be accommodated.

20.2.1.10 The main consequences of vessel displacement will be increased journey times and distances for affected third party vessels, under the assumption that the buoyed construction area will be deployed around the maximum extent of Morven North and

Morven South. Any notable safety impacts are considered unlikely given the available sea room. Vessels are expected to comply with international and flag state regulations (including COLREGs (IMO, 1972/77) and SOLAS (IMO, 1974)) and will be able to passage plan in advance given the promulgation of information relating to the Morven Site and relevant nautical charts.

20.2.1.11 Relevant embedded mitigation measures include a buoyed construction area, adherence to an LMP and AtoNMP, marking on nautical charts and promulgation of information. These will ensure an increased awareness from third-party vessels, and will also assist in passage planning to limit the extent of deviations.

Collision risk

20.2.1.12 From historical incident data, no collision incidents between third-party vessels have occurred directly as a result of a UK OWF.

20.2.1.13 In poor visibility, third-party vessels may experience limitations regarding visual identification of other third-party vessels, when passing on another side of the buoyed construction/decommissioning areas. This limitation may increase the potential for an encounter. However, this would be mitigated by the application of the COLREGs (including reduced speeds) in adverse weather conditions. Moreover, the minimum spacing between structures (1,000m) will be sufficient to ensure any visual hindrance is very short-term in nature.

20.2.1.14 Based on the pre-wind farm modelling, the baseline collision risk levels within the Regional Shipping and Navigation Study Area are low, with an estimated vessel to vessel collision risk of one every 1,966 years. This rises to an estimate of a return period of one every 1,383 years for a future case growth of 20% in vessel traffic. This is due to the volume of traffic in the area relative to available sea space.

20.2.1.15 Post-wind farm, the collision frequency was estimated at one in 971 years, representing an additional collision incident every 1,893 years. This rises to an estimate of a return period of one every 674 years for a future case growth of 20% in vessel traffic. This is a moderate level of collision risk, and is also reflected when considering future case traffic levels. However, with effective passage planning, the potential for hot spots of collision risk in proximity to the Morven Site is reduced and given the available sea room to the north and south it is anticipated that this would be manageable.

20.2.1.16 It is also acknowledged that a number of the higher-use routes, such as Routes 1, 3, 4 and 6, are comprised mainly of oil and gas vessels accessing nearby fields. As such, these vessels will have good familiarity and experience operating in proximity to surface structures.

20.2.1.17 Due to the necessity for deviation of routes west of the Morven Site, it is possible that commercial vessels will be displaced closer to areas of the sea in which fishing vessels were recorded to actively fish. This may then lead to an increase in

encounters between commercial vessels and fishing vessels. However, there is sufficient sea room to allow both activities to safely occur and with application of the COLREGs in relation to the exhibiting of appropriate lights and shapes for fishing vessels engaged in fishing, the risk is considered manageable.

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

20.2.1.19 Based on historic incident data, should an encounter develop into a collision incident, it is most likely to involve minor contact resulting in minor damage to the vessels with no harm to people and no substantial reputational risks. As a worst case with very low frequency of occurrence one of the vessels could receive substantial damage or founder with PLL and pollution, with this outcome more likely where one of the vessels is a small craft (e.g. fishing vessel, recreational vessel or CTV). From the vessel traffic survey data (which incorporates Radar and visual observations in addition to AIS) regular transits by commercial fishing vessels and recreational vessels through the Morven Site are infrequent.

20.2.1.20 Relevant embedded mitigation measures include marking on nautical charts, promulgation of information, a buoyed construction area, adherence to an LMP and AtoNMP, adherence to an MPCP and adherence to an ERCoP. These will ensure an increased awareness from third-party vessels and will also assist in passage planning to limit the extent of deviations.

Frequency of occurrence

20.2.1.21 The frequency of occurrence in relation to displacement of vessel traffic resulting in increased third-party collision risk during the construction phase is considered **Remote**.

Severity of consequence

20.2.1.22 The severity of consequence in relation to displacement of vessel traffic resulting in increased third-party collision risk during the construction phase is considered **Moderate**.

Significance of effect

20.2.1.23 Taking the frequency of occurrence as remote and the severity of consequence as moderate, the overall effect of vessel displacement and increased third-party vessel to vessel collision risk during construction of Morven North and Morven South is considered to be tolerable with mitigation.

20.2.1.24 The hazard is considered ALARP with embedded mitigation in place and therefore no additional mitigation is required. The hazard is therefore **Tolerable with Mitigation and Not Significant in EIA terms.**

20.2.2 Increased third-party vessel to project vessel collision risk

Qualification of risk

20.2.2.1 The presence of vessels associated with construction activities of Morven North and Morven South may increase encounters and thus collision risk for vessels already operating in the area.

20.2.2.2 During the construction phase of Morven North and Morven South there may be up to 2,298 vessel movements made by up to 82 project vessels on-site simultaneously. This will include vessels which are RAM. It is assumed that construction vessels will be on-site throughout the entire duration of the construction phase.

20.2.2.3 Encounters and collision risk involving project vessels will be managed through the implementation of marine coordination with full details of this to be provided in the NSPVMP (Volume 4, Annex 5: Navigation Safety Plan and Vessel Management Plan). Project vessels will also be expected to carry AIS and comply with flag state regulations including the COLREGs (IMO, 1972/77) and SOLAS (IMO, 1974). COLREGs will remain the navigational priority for project vessels at all times.

20.2.2.4 Applications for safety zones of 500m around on-going construction activities will be sought during the construction phase and will protect deployed project vessels, especially if they are RAM. Minimum advisory passing distances and guard vessels, as defined by risk assessment, may also be implemented where safety zones do not apply, for example around cable installation vessels. Details of safety zones, minimum safe passing distances and guard vessels will be promulgated including via Notifications to Mariners and Kingfisher Bulletins.

20.2.2.5 Appropriate marine lighting and marking during construction including the buoyed construction area will be agreed with the NLB and set out in the LMP and AtoNMP (Volume 4, Annex 4: Lighting and Marking Plan (Version 1)). These navigational aids will further maximise mariner awareness when in proximity to ongoing construction works in the Morven Site.

20.2.2.6 Third-party vessels may experience decreased capability to visually identify project vessels entering and exiting the Morven Site during reduced visibility; however, this hazard will be mitigated by the application of the COLREGs (reduced speeds) in adverse weather conditions and the mandatory carriage of AIS by project vessels regardless of size. It is noted that the likelihood of a collision is likely to be greater in reduced visibility when the identification of project vessels entering and exiting the Morven Site may be impeded.

20.2.2.7 Based on historical incident data, there has been one instance of a third-party vessel colliding with a project vessel in the UK (see Section 9.7 for further details). In this case, moderate vessel damage was reported with no harm to persons. It is noted that the incident occurred in 2011 and awareness of offshore wind developments and application of the measures outlined above has improved and been refined considerably in the interim, with no further collision incidents reported since.

20.2.2.8 If an encounter between a project vessel and third-party vessel occurs, it is likely to be localised and short in duration. Assuming the implementation of collision avoidance action as required by the COLREGs, the most likely outcome will be any vessels involved being able to resume their respective passages or activities with no long-term consequences.

20.2.2.9 In the event of a collision, the likely consequences will be minor contact between the vessels resulting in minor damage and no injuries to persons. As an unlikely worst-case scenario, foundering could occur resulting in PLL and pollution. Other project vessels may be able to assist in the event of a collision under SOLAS obligation and the adherence to the ERCoP, noting this would be done in liaison with the MCA. If pollution were to occur in proximity to the Morven Site or involving a project vessel, the MPCP (Volume 4, Annex 1, Appendix 1.1: Marine Pollution Contingency Plan (MPCP) (Version 1)) will be implemented to reduce the risks.

20.2.2.10 As noted during consultation (see Section 4), there is the potential for a construction buoy to drift off-station. However, the LMP and AtoNMP will provide mechanisms for the location and recovery in any event; and due to the requirement for buoyage to be of IALA Position Category 2 (availability of not less than 99%), loss of any buoyage will be of low likelihood.

20.2.2.11 Relevant embedded mitigation measures include application for safety zones, a buoyed construction area, guard vessels as required by risk assessment, adherence to an LMP and AtoNMP, NSPVMP, MPCP, ERCoP, promulgation of information, marine coordination and marking on nautical charts.

Frequency of occurrence

20.2.2.12 The frequency of occurrence in relation to encounters and collision risk between project vessels and third-party vessels during the construction phase is considered to be **Extremely Unlikely**.

Severity of consequence

20.2.2.13 The severity of consequence in relation to encounters and collision risk between project vessels and third-party vessels during the construction phase is considered to be **Serious**.

Significance of effect

20.2.2.14 Taking the frequency of occurrence as extremely unlikely and the severity of consequence as serious, the overall effect of encounters and collision risk between project vessels and third-party vessels during construction of Morven North and Morven South is considered to be tolerable with mitigation.

20.2.2.15 The hazard is considered ALARP with embedded mitigation in place and therefore no additional mitigation is required. The hazard is therefore **Tolerable with Mitigation and Not Significant in EIA terms**.

20.2.3 Vessel to structure allision risk

20.2.3.1 Presence of structures (including partially constructed) within the buoyed construction area will lead to creation of powered, drifting and internal allision risk for vessels.

20.2.3.2 The spatial extent of the hazard is small given that a vessel must be in close proximity to a 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.

20.2.3.3 Unlike the O&M phase, although there is the potential for a vessel to enter into the Morven Site during construction, due to the presence of construction/decommissioning buoys and pre-constructed structures it is not expected that internal navigation will take place.

Qualification and quantification of risk

20.2.3.4 In addition to a vessel entering the buoyed construction/decommissioning area and alliding with a structure under its own power, there is considered to be potential for a vessel to be adrift in proximity to Morven North and Morven South; this is reflected in the RNLI incident data reviewed in proximity to the Morven Site which indicates that machinery failure is the most common incident type. A vessel adrift may only develop into an allision situation if in proximity to a structure. This is only the case where the adrift vessel is located internally or in close proximity to Morven North and Morven South and the direction of the wind and/or tide directs the vessel towards a structure.

20.2.3.5 In circumstances where a vessel drifts towards a structure in the Morven Site, 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 Morven Site (i.e. by rectifying any fault). Given that vessels are expected

to pass a safe distance off the buoyed construction area there is a greater duration over which regaining power may be achievable. 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).

20.2.3.6 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 (IMO, 1974). 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.

20.2.3.7 Temporary marine lighting and marking will be implemented including the buoyed construction area in agreement with the NLB. Promulgation of information and marking on charts will ensure vessels can passage plan in advance to minimise risk. Safety zones of 50m in radius around structures will also be applied for during the construction phase up until the point of commissioning of Morven North and Morven South (rising to 500m where active construction is ongoing).

20.2.3.8 Should an allision occur, the consequences will depend on multiple factors including the energy of the impact, structural integrity of the vessel and sea state at the time of the impact. Fishing vessels and recreational vessels are considered most vulnerable to the hazard given the potential for a non-steel construction. 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 founder resulting in PLL and pollution. Project vessels may assist in the event of an allision under SOLAS obligation and the adherence to the ERCoP, in line with the MCA. If pollution were to occur, then the MPCP (Volume 4, Annex 1, Appendix 1.1: Marine Pollution Contingency Plan (MPCP) (Version 1)) will be implemented to reduce the environmental risk.

20.2.3.9 Relevant embedded mitigation measures include DSLP approval, adherence to a MPCP, adherence to an LMP and AtoNMP, adherence to an NSPVMP, promulgation of information, application for safety zones, adherence to an ERCoP, guard vessels where required by risk assessment and appropriate marking via construction buoyage as well as on nautical charts.

Frequency of occurrence

20.2.3.10 The frequency of occurrence in relation to vessel to structure allision risk during the construction phase is considered to be **Remote**.

Severity of consequence

20.2.3.11 The severity of consequence in relation to vessel to structure allision risk during the construction phase is considered to be **Moderate**.

Significance of effect

20.2.3.12 Taking the frequency of occurrence as remote and the severity of consequence as moderate, the overall effect of vessel to structure allision risk during construction of Morven North and Morven South is considered to be tolerable with mitigation.

20.2.3.13 The hazard is considered ALARP with embedded mitigation in place and therefore no additional mitigation is required. The hazard is therefore **Tolerable with Mitigation and Not Significant in EIA terms**.

20.2.4 Reduced access to local ports and harbours

Qualification of risk

20.2.4.1 Up to 2,298 vessel movements made by construction vessels (excluding site preparation activities) may be made throughout the construction phase and will include vessels which are RAM. Project vessels will be managed by marine coordination, 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. Project vessels will also carry AIS and be compliant with flag state regulations including the COLREGs (IMO 1972/77).

20.2.4.2 The closest port or harbour to Morven North and Morven South is Aberdeen, located approximately 34nm to the northwest. Given the relative distance to ports in the area and the anticipated deviations for the main commercial routes, it is not anticipated that there will be any substantial effect on vessel approaches to and from the local ports beyond the deviations already outlined for impacts on vessel displacement.

20.2.4.3 No concerns were raised during consultation over access to ports during the construction phase in relation to Morven North and Morven South. However, it is acknowledged that future towage activities relating to rigs and/or floating wind turbines related to nearby offshore wind farm projects could be affected by the presence of the Morven Site and project vessels for Morven North and Morven South. It is anticipated that where such activities occur concurrently that marine coordination between the activities will be implemented to ensure the towage activity is not adversely impacted by the activities for Morven North and Morven South.

20.2.4.4 The most likely consequences are increased journey times and distances, as per the vessel displacement hazard. As there are no pilot boarding stations in the vicinity of Morven North and Morven South, no effect is anticipated on port related services such as pilotage.

20.2.4.5 Relevant embedded mitigation measures include clear buoyage of the construction area, adherence to an LMP and AtoNMP, adherence to a NSPVMP, marine coordination of project vessels, marking on nautical charts and promulgation of information. These mitigation measures will be particularly relevant for coordination between project vessel activities and third-party towage operations.

Frequency of occurrence

20.2.4.6 The frequency of the risk of reduced access to local ports and harbours during the construction phase is considered to be **Remote**.

Severity of consequence

20.2.4.7 The severity of consequence of the risk of reduced access to local ports and harbours during the construction phase is considered to be **Minor**.

Significance of effect

20.2.4.8 Taking the frequency of occurrence as remote and the severity of consequence as minor, the overall effect of reduced port access during construction of Morven North and Morven South is considered to be broadly acceptable.

20.2.4.9 The hazard is considered ALARP with embedded mitigation in place and therefore no additional mitigation is required. The hazard is therefore **Broadly Acceptable and Not Significant in EIA terms**.

20.3 Operations and maintenance phase

20.3.1 Vessel displacement and increased third-party vessel to vessel collision risk

20.3.1.1 The presence of structures in the Morven Site, as well as maintenance activities associated with Morven North and Morven South, may displace existing vessel routes or activity which may increase the risk of a collision between third-party vessels.

20.3.1.2 These two related elements are each considered in the subsequent assessment in terms of frequency of occurrence and severity of consequence.

Vessel displacement

20.3.1.3 Based on experience at existing operational OWFs and input during consultation, it is anticipated that the majority of commercial vessels will choose not to navigate within the Morven Site and therefore some main route deviations will be required as per the respective construction phase hazard.

20.3.1.4 The nature of the deviations is expected to be similar to that discussed for the equivalent construction phase hazard, with the deviations in general relatively low magnitude and effective passage planning likely reducing the extent. One RoRo route

(Route 2) is affected but was not raised as an issue during consultation, noting that the primary user – Smyril Line – was included in the Regular Operator outreach.

20.3.1.5 The minimum spacing of 1,000m between wind farm structures within the Morven Site is considered sufficient to accommodate transits of smaller vessels, noting there will be no restrictions on entry into the Morven Site with the exception of any active 500m major maintenance safety zones.

20.3.1.6 Based on experience at existing operational OWFs, it is anticipated that fishing vessels and recreational vessels may also choose not to routinely navigate internally within the Morven Site. However, they may be more likely to do so than commercial vessels, particularly in the case of recreational vessels given the absence of commercial traffic (as raised by RYA Scotland in Section 4.2). In such instances this may reduce the level of displacement for these vessels during the O&M phase.

20.3.1.7 It is noted that displacement of active commercial fishing is assessed separately in Volume 2, Chapter 12: Commercial Fisheries of the Morven North EIA Report and Volume 2, Chapter 12: Commercial Fisheries of the Morven South EIA Report.

20.3.1.8 Regarding displacement as a result of project vessel activity in the vicinity, given that any maintenance activities associated with Morven North and Morven South will be less frequent than during the construction phase and localised, the likelihood of vessel displacement due to these activities is considered to be very low. Additionally, such activities will likely be limited to within the Morven Site and therefore not impact upon commercial vessel routeing.

20.3.1.9 The main consequences of vessel displacement will be increased journey times and distances for affected third party vessels, under the assumption that the wind turbines will be built to the full extent of Morven North and Morven South. Any notable safety impacts are considered unlikely given the available sea room. Vessels are expected to comply with international and flag state regulations (including COLREGs (IMO, 1972/77) and SOLAS (IMO, 1974)) and will be able to passage plan in advance given the promulgation of information relating to Morven North and Morven South and relevant nautical charts.

20.3.1.10 Relevant embedded mitigation measures include DSLP approval, adherence to an LMP and AtoNMP, adherence to an NSPVMP, marking on nautical charts and promulgation of information.

Collision risk

20.3.1.11 As noted for the equivalent construction phase hazard, seven of the 17 main routes will likely deviate as a result of the presence of Morven North and Morven South. Post wind farm collision frequency was estimated at one every 971 years.

20.3.1.12 Any displacement of commercial vessels due to maintenance activities is not anticipated to affect available sea room to such an extent that the risk of a collision

between third party vessels is materially increased. This is due to the lesser frequency of maintenance activities compared to during construction, spatially limited extent of the maintenance operation at any given time and the likelihood that maintenance activities are located internally with the array.

20.3.1.13 An additional factor is the potential for structures to obscure vessels from one another, thus hindering ability to comply with COLREGs (IMO, 1972/77). The minimum spacing of 1,000m between wind farm structures will likely provide sufficient sea room for visual observations, with full obstruction likely only to occur when vessels are at opposite ends of a wind turbine row. Collision risk is likely to be low in such cases due to the distance between vessels.

20.3.1.14 In the event of an encounter between third party vessels, it is likely to be localised and short in duration, with collision avoidance action implemented by the vessels involved, as per compliance with COLREGs (IMO, 1972/77), to ensure that a collision incident does not develop.

20.3.1.15 As per the respective construction phase hazard, historical collision incident data 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 the vessels involved able to resume their respective passages and undertake a full inspection at the next port.

20.3.1.16 As with the equivalent construction phase hazard, the displacement of commercial vessels west of the Morven Site may result in closer proximity to fishing vessels actively fishing. This may then lead to an increase in encounters between commercial vessels and fishing vessels but there is sufficient sea room to allow both activities to safely occur with application of the COLREGs.

20.3.1.17 As an unlikely worst-case scenario, a high impact collision event could occur. This may result in vessel foundering and subsequent PLL, as well as pollution. In such a circumstance, vessels associated with Morven North and Morven South may attend the incident under SOLAS obligations and in liaison with the MCA and the procedures within the ERCoP and MPCP would be implemented.

20.3.1.18 Relevant embedded mitigation measures includes marking on nautical charts, promulgation of information, DSLP approval, adherence to an LMP and AtoNMP, adherence to an MPCP and adherence to an ERCoP.

Frequency of occurrence

20.3.1.19 The frequency of occurrence in relation to displacement of vessel traffic resulting in increased third-party collision risk during the O&M phase is considered **Remote**.

Severity of consequence

20.3.1.20 The severity of consequence in relation to displacement of vessel traffic resulting in increased third-party collision risk during the O&M phase is considered **Moderate**.

Significance of effect

20.3.1.21 Taking the frequency of occurrence as remote and the severity of consequence as moderate, the overall effect of vessel displacement and increased third-party vessel to vessel collision risk during O&M of Morven North and Morven South is considered to be tolerable with mitigation.

20.3.1.22 The hazard is considered ALARP with embedded mitigation in place and therefore no additional mitigation is required. The hazard is therefore **Tolerable with Mitigation and Not Significant in EIA terms**.

20.3.2 Increased third-party vessel to project vessel collision risk

Qualification of risk

20.3.2.1 The presence of vessels associated with maintenance activities of Morven North and Morven South may increase encounters and thus collision risk for vessels already operating in the area.

20.3.2.2 During the O&M phase of Morven North and Morven South there may be up to 586 vessel movements annually and up to 30 project vessels on-site simultaneously (during major maintenance; i.e. likely less during normal operations). This will include vessels which are RAM.

20.3.2.3 Encounter and collision risk involving project vessels will be managed through the implementation of marine coordination as will be set out in the NSPVMP (Volume 4, Annex 5: Navigation Safety Plan and Vessel Management Plan (Version 1)). Project vessels will also be expected to carry AIS and comply with flag state regulations including the COLREGs (IMO, 1972/77) and SOLAS (IMO, 1974). COLREGs will remain the navigational priority for project vessels at all times.

20.3.2.4 Applications for safety zones of 500m around major maintenance activities during O&M will be sought and will protect deployed project vessels, especially if they are RAM. Minimum advisory passing distances and guard vessels, as defined by risk assessment, may also be implemented where safety zones do not apply. Details of safety zones, minimum safe passing distances and guard vessels will be promulgated including via Notifications to Mariners and Kingfisher Bulletins.

20.3.2.5 Appropriate operational marine lighting and marking will be agreed with the NLB and set out in an LMP and AtoNMP. These navigational aids will further maximise mariner awareness when in proximity to the Morven Site.

20.3.2.6 Third-party vessels may experience decreased capability to visually identify project vessels during reduced visibility, especially if visual observations are obscured by wind turbines; however, this hazard will be mitigated by the application of the COLREGs (reduced speeds) in adverse weather conditions and the mandatory carriage of AIS by project vessels regardless of size.

20.3.2.7 As discussed in the equivalent construction phase hazard, there has been one instance of a third-party vessel colliding with a project vessel in the UK. Moderate vessel damage was reported with no harm to persons. It is noted that the incident occurred in 2011 and awareness of offshore wind developments and application of the measures outlined above has improved and been refined considerably in the interim, with no further collision incidents reported since.

20.3.2.8 As per the respective construction phase hazard, if an encounter between a project vessel and third party vessel occurs, it is likely to be localised and short in duration. Assuming the implementation of collision avoidance action as required by the COLREGs, the most likely outcome will be any vessels involved being able to resume their respective passages or activities with no long-term consequences.

20.3.2.9 In the event of a collision, the likely consequences will be minor contact between the vessels resulting in minor damage and no injuries to persons. As an unlikely worst-case scenario, foundering could occur resulting in PLL and pollution. Other project vessels may be able to assist in the event of a collision under SOLAS obligation and the adherence to the ERCoP, noting this would be done in liaison with the MCA. If pollution were to occur in proximity to Morven North and Morven South or involving a project vessel, the MPCP (Volume 4, Annex 1, Appendix 1.1: Marine Pollution Contingency Plan (MPCP) (Version 1)) will be implemented to reduce the risks.

20.3.2.10 Relevant embedded mitigation measures include application for safety zones, guard vessels as required by risk assessment, DSLP approval, adherence to an LMP and AtoNMP, NSPVMP, MPCP, ERCoP, promulgation of information, marine coordination and marking on nautical charts.

Frequency of occurrence

20.3.2.11 The frequency of occurrence in relation to encounters and collision risk between project vessels and third party vessels during the O&M phase is considered to be **Extremely Unlikely**.

Severity of consequence

20.3.2.12 The severity of consequence in relation to encounters and collision risk between project vessels and third party vessels during the O&M phase is considered to be **Serious**.

Significance of effect

20.3.2.13 Taking the frequency of occurrence as extremely unlikely and the severity of consequence as serious, the overall effect of encounters and collision risk between project vessels and third party vessels during O&M of Morven North and Morven South is considered to be tolerable with mitigation.

20.3.2.14 The hazard is considered ALARP with embedded mitigation in place and therefore no additional mitigation is required. The hazard is therefore **Tolerable with Mitigation and Not Significant in EIA terms**.

20.3.3 Vessel to structure allision risk

20.3.3.1 Presence of structures within the Morven Site will lead to creation of powered, drifting and internal allision risk for vessels during the O&M phase.

20.3.3.2 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.

Powered allision risk

Qualification and quantification of risk

20.3.3.3 The base case annual powered vessel to structure allision frequency was estimated to be 2.92×10^{-3}, corresponding to a return period of one every 343 years. This rises to an estimate of 3.50×10^{-3} for a future case growth of 20% in vessel traffic, corresponding to a return period of one every 285 years. This is reflective of the volume of traffic passing at the minimum mean distance of 1nm from the Morven Site. It is also considered a conservative result given the bridge-linked OSP (modelled as a singular structure) was modelled on the northeast perimeter of the Morven Site and subsequently provided the highest allision risk of all structures.

20.3.3.4 Based on historical incident data, there have been two reported instances of a third-party vessel alliding with an operational OWF structure in the UK (in the Irish Sea and Southern North Sea). Both of these incidents involved a fishing vessel. These allisions resulted in minor to moderate damage to the vessels with minor injury to crew members.

20.3.3.5 Marine lighting and marking will be implemented in agreement with the NLB and defined within the LMP and AtoNMP (Volume 4, Annex 4: Lighting and Marking

Plan (Version 1)). Promulgation of information and marking on charts will ensure vessels can passage plan in advance to minimise risk.

20.3.3.6 Should an allision occur, the consequences will depend on multiple factors as discussed in relation to the equivalent construction phase hazard. Fishing vessels and recreational vessels are considered most vulnerable to the hazard and 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 founder resulting in PLL and pollution. Project vessels may assist in the event of an allision under SOLAS obligations and the adherence to the ERCoP, in liaison with the MCA. If pollution were to occur, then the MPCP (Volume 4, Annex 1, Appendix 1.1: Marine Pollution Contingency Plan (MPCP) (Version 1)) will be implemented to reduce the environmental risk.

20.3.3.7 Relevant embedded mitigation measures include DSLP approval, adherence to a MPCP, adherence to an LMP and AtoNMP, adherence to an NSPVMP, promulgation of information, application for safety zones, adherence to an ERCoP and marking on nautical charts.

Frequency of occurrence

20.3.3.8 The frequency of occurrence in relation to powered vessel to structure allision risk during the O&M phase is considered to be **Remote**.

Severity of consequence

20.3.3.9 The severity of consequence in relation to powered vessel to structure allision risk during the O&M phase is considered to be **Moderate**.

Significance of effect

20.3.3.10 Taking the frequency of occurrence as remote and the severity of consequence as moderate, the overall effect of powered vessel to structure allision risk during O&M of Morven North and Morven South is considered to be tolerable with mitigation.

20.3.3.11 The hazard is considered ALARP with embedded mitigation in place and therefore no additional mitigation is required. The hazard is therefore **Tolerable with Mitigation and Not Significant in EIA terms.**

Drifting allision risk

Qualification and quantification of risk

20.3.3.12 The base case annual drifting vessel to structure allision frequency was estimated to be 2.28×10^{-4}, corresponding to a return period of one every 4,386 years. This rises to an estimate of 2.74×10^{-4} for a future case growth of 20% in vessel traffic, corresponding to a return period of one every 3,652 years. This is reflective of the

volume of traffic at the minimum mean distance of 1nm from the Morven Site and the need for a vessel to become adrift prior to a drifting allision event occurring.

20.3.3.13 Based on historical incident data, there have been no instances of a third-party vessel alliding with an operational OWF structure whilst NUC. However, there is considered to be potential for a vessel to be adrift; this is reflected in the RNLI incident data reviewed in proximity to the Morven Site which indicates that machinery failure is the most common incident type.

20.3.3.14 In circumstances where a vessel drifts towards a structure in the Morven Site, powered vessels may be able to regain power prior to reaching Morven North and Morven South (by rectifying any fault). Failing this, the vessel's emergency response procedures would be implemented which may include an emergency anchoring event or the use of thrusters (depending on availability and power supply).

20.3.3.15 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 (IMO, 1974). This response will be managed via HMCG 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.

20.3.3.16 Should an allision occur, the consequences will be similar to those noted for the equivalent construction phase hazard including the unlikely worst-case of foundering, PLL and pollution. In the highly unlikely scenario of a drifting allision incident resulting in pollution, the implementation of the MPCP (Volume 4, Annex 1, Appendix 1.1: Marine Pollution Contingency Plan (MPCP) (Version 1)) will reduce the environmental risk. Project vessels may assist in the event of an allision under SOLAS (IMO, 19742) obligation and the adherence to the ERCoP, in line with the MCA. 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.

20.3.3.17 Relevant embedded mitigation measures include adherence to an ERCoP, adherence to an MPCP and project vessel compliance with SOLAS (IMO, 1974).

Frequency of occurrence

20.3.3.18 The frequency of occurrence in relation to drifting vessel to structure allision risk during the O&M phase is considered to be **Extremely Unlikely**.

Severity of consequence

20.3.3.19 The severity of consequence in relation to drifting vessel to structure allision risk during the O&M phase is considered to be **Moderate**.

Significance of effect

20.3.3.20 Taking the frequency of occurrence as extremely unlikely and the severity of consequence as moderate, the overall effect of drifting vessel to structure allision risk during O&M of Morven North and Morven South is considered to be broadly acceptable.

20.3.3.21 The hazard is considered ALARP with embedded mitigation in place and therefore no additional mitigation is required. The hazard is therefore **Broadly Acceptable and Not Significant in EIA terms.**

Internal allision risk

Qualification and quantification of risk

20.3.3.22 Based on experience at existing operational OWFs, it is anticipated that commercial vessels will be unlikely to navigate internally within the Morven Site. Fishing and recreational vessels may be more likely to transit through noting they may choose not to depending on various conditions. Additionally, the RYA Scotland indicated that the absence of commercial traffic may increase the likelihood of internal navigation (see Section 4.2).

20.3.3.23 The base case fishing vessel to structure allision frequency is estimated to be 3.60×10^{-3}, corresponding to a return period of approximately one in 277 years. This rises to an estimate of 4.32×10^{-3} for a future case growth of 20% in vessel traffic, corresponding to a return period of one every 231 years. This return period is reflective of the volume of fishing vessel traffic in the Regional Shipping and Navigation Study Area, both in transit and engaged in active fishing. Conservative modelling has been undertaken with the assumption that fishing levels in proximity to the wind turbines will not change. In reality, as discussed within the equivalent construction phase hazard, fishing vessels will account for the presence of the wind turbines and may choose to transit or fish elsewhere (noting this aligns with consultation input).

20.3.3.24 The worst-case consequences reported for vessels involved in an allision incident involving a UK OWF has been flooding, with no life-threatening injuries to persons reported. If an allision incident were to occur, project vessels may assist under obligation of SOLAS (IMO, 1974) and adherence to the ERCoP in liaison with the MCA. Additionally, if pollution occurs as a result of an allision incident, the MPCP (Volume 4, Annex 1, Appendix 1.1: Marine Pollution Contingency Plan (MPCP) (Version 1)) would be implemented where appropriate.

20.3.3.25 If a vessel chooses to transit within the Morven Site, the minimum spacing of 1,000m between wind farm structures is considered sufficient for safe internal navigation. Furthermore, operational lighting and marking and marking on nautical charts provide mitigation against internal allision risk. Any vessel planning to transit through the Morven Site is expected to passage plan in advance in accordance with

SOLAS Chapter V (IMO, 1974) and promulgation of information will ensure that vessels have good awareness of Morven North and Morven South.

20.3.3.26 Should bridge links be used between OSPs then there is an additional allision risk should a vessel choose to navigate under the bridge link and between OSPs. A height of 14m above HAT would pose a danger for such vessels. However, given the maximum separation of 100m between OSPs joined by a bridge link it is considered highly unlikely that a vessel would choose to navigate under a bridge link, particularly given the spacing of structures across the Morven Site which allow for alternative passages. Additionally, the specific lighting and marking requirements for bridge links will be agreed with NLB to ensure that allision risk for vessels (including project vessels and recreational vessels) is reduced.

20.3.3.27 Should a recreational vessel under sail enter the proximity of a wind turbine, there is also potential for effects such as wind shear, masking and turbulence to occur. As noted in the equivalent construction phase hazard, from previous studies of offshore wind developments, it has been concluded that wind turbines do reduce wind velocity downwind of a wind turbine (MCA, 2022) but that no negative effects on recreational craft have been reported on the basis of the limited spatial extent of the effect and its similarity to that experienced when passing a large vessel or close to other large structures or the coastline. In addition, no practical issues have been raised by recreational users to date when operating in proximity to existing offshore wind developments.

20.3.3.28 As noted within the Hazard Workshop, due to the distance offshore of the Morven Site there may be an effect of fatigue for recreational users. The operational lighting and marking will be particularly important in such circumstances to ensure recreational users are aware of the presence of Morven North and Morven South. It is also expected that recreational users on long sailings will ensure there is sufficient manning to avoid the effects of fatigue influencing safe navigation.

20.3.3.29 Relevant embedded mitigation measures include application for safety zones, DSLP approval, adherence to an LMP and AtoNMP, marking on nautical charts, promulgation of information, adherence to an ERCoP and adherence to an MPCP.

Frequency of occurrence

20.3.3.30 The frequency of occurrence of internal vessel to structure allision risk during the O&M phase is considered to be **Extremely Unlikely**.

Severity of consequence

20.3.3.31 The severity of consequence of internal vessel to structure allision risk during the O&M phase is considered to be **Moderate**.

Significance of effect

20.3.3.32 Taking the frequency of occurrence as extremely unlikely and the severity of consequence as moderate, the overall effect of internal vessel to structure allision risk during O&M of Morven North and Morven South is considered to be broadly acceptable.

20.3.3.33 The hazard is considered ALARP with embedded mitigation in place and therefore no additional mitigation is required. The hazard is therefore **Broadly Acceptable and Not Significant in EIA terms**.

20.3.4 Reduced access to local ports and harbours

Qualification of risk

20.3.4.1 Up to 586 vessel movements annually by O&M vessels may be made throughout the O&M phase, which will include vessels which are RAM. Project vessels will be managed by marine coordination, including the use of traffic management procedures such as the designation of entry and exit points to and from the Morven Site and designated routes to and from the base port. Project vessels will also carry AIS and be compliant with flag state regulations including the COLREGs (IMO 1972/77).

20.3.4.2 As discussed in the baseline description and equivalent construction phase hazard, the closest port or harbour is Aberdeen, located approximately 34nm to the northwest. Given the relative distance to ports in the area and the anticipated deviations for the main commercial routes, it is not anticipated that there will be any substantial effect on vessel approaches to and from the local ports beyond the deviations already outlined for impacts on vessel displacement. However, it is acknowledged that future towage activities relating to rigs and/or floating wind turbines related to nearby offshore wind farm projects could be affected by the presence of the Morven Site and project vessels for Morven North and Morven South. It is anticipated that where such activities occur concurrently that marine coordination between the activities will be implemented to ensure the towage activity is not adversely impacted by the activities for Morven North and Morven South.

20.3.4.3 The most likely consequences are increased journey times and distances, as per the vessel displacement hazard. As there are no pilot boarding stations in the vicinity of Morven North and Morven South, no effect is anticipated on port related services such as pilotage.

20.3.4.4 Relevant embedded mitigation measures include adherence to an LMP and AtoNMP, adherence to a NSPVMP, marine coordination of project vessels, marking on nautical charts and promulgation of information. These mitigation measures will be particularly relevant for coordination between project vessel activities and third-party towage operations.

Frequency of occurrence

20.3.4.5 The frequency of the risk of reduced access to local ports and harbours during the O&M phase is considered to be **Remote**.

Severity of consequence

20.3.4.6 The severity of consequence of the risk of reduced access to local ports and harbours during the O&M phase is considered to be **Minor**.

Significance of effect

20.3.4.7 Taking the frequency of occurrence as remote and the severity of consequence as minor, the overall effect of reduced port access during O&M of Morven North and Morven South is considered to be broadly acceptable.

20.3.4.8 The hazard is considered ALARP with embedded mitigation in place and therefore no additional mitigation is required. The hazard is therefore **Broadly Acceptable and Not Significant in EIA terms**.

20.3.5 Reduction of under-keel clearance

Qualification of risk

20.3.5.1 The presence of subsea cables and associated protection may reduce under keel clearance during the O&M phase of Morven North and Morven South.

20.3.5.2 The minimum burial depth for all subsea cables is 0.5m, noting actual burial depth will be determined via the CBRA process which will be undertaken post consent.

20.3.5.3 Where burial is not feasible, cable protection may be used instead, which again will be determined by the CBRA. In line with MGN 654, any reduction in water depth which exceeds 5% will be discussed with the MCA to determine if additional mitigation is necessary. 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).

20.3.5.4 Given that depths within the Morven Site range between 62m to 76m below LAT and that the maximum draught recorded within the vessel traffic surveys was 13.8m (see Section 10.1.4), it is not anticipated that subsea cable protection will reduce water depths over the 5% threshold. No specific concerns from stakeholders were raised during consultation including the Hazard Workshop, with MGN 654 compliance considered suitable to manage the impact, noting that only small craft are expected to navigate internally within the Morven Site.

20.3.5.5 Based on expert opinion, in the event of an underwater allision the most likely consequence is minor damage. The unlikely worst-case consequence may be vessel

foundering resulting in PLL and pollution, although this is considered highly improbable. Implementation of the MPCP (Volume 4, Annex 1, Appendix 1.1: Marine Pollution Contingency Plan (MPCP) (Version 1)) will mitigate against pollution, whilst adherence to an ERCoP as well as operating under the obligations of SOLAS (IMO, 1974) will mitigate against the risk of PLL.

Frequency of occurrence

20.3.5.6 The frequency of occurrence of the risk of reduced under keel clearance due to the presence of subsea cables during O&M is considered **Negligible**.

Severity of Consequence

20.3.5.7 The severity of consequence of the risk of reduced under keel clearance due to the presence of subsea cables during O&M is considered to be **Minor**.

Significance of effect

20.3.5.8 Taking the frequency of occurrence as negligible and the severity of consequence as minor, the overall effect of reduced under keel clearance due to subsea cables during O&M of Morven North and Morven South is considered to be broadly acceptable.

20.3.5.9 The hazard is considered ALARP with embedded mitigation in place and therefore no additional mitigation is required. The hazard is therefore **Broadly Acceptable and Not Significant in EIA terms**.

20.3.6 Anchor and fishing gear interactions with subsea cables

Qualification of risk

20.3.6.1 The presence of subsea cables within the Morven Site may increase the risk of anchor and fishing gear interaction.

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

20.3.6.3 There are three anchoring scenarios which are considered for this hazard:

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

20.3.6.4 Although the second of these scenarios may involve limited decision-making time if drifting towards a hazard, in all three scenarios it is anticipated that the charting

of infrastructure including the subsea cables will inform the decision to anchor, as per Regulation 34 of SOLAS (IMO, 1974).

20.3.6.5 No anchored vessels were observed within the Regional Shipping and Navigation Study Area during the survey periods, with one vessel every 30 days recorded as likely to be at anchor within the long-term vessel traffic data. Risk of interaction with an inter-array cable on a planned anchoring or dragged anchoring basis is therefore anticipated to be extremely low. In terms of emergency anchoring, any areas of high traffic volume are likely to represent the areas of highest risk, particularly where there are hazards nearby (for example, structures, rocks, shallows). However, given the relatively few hazards in proximity to the Morven Site, as well as the water depths, the likelihood of this scenario arising is very low.

20.3.6.6 The likelihood of anchor interaction with a subsea cable is further reduced by the burial of the cables and use of external cable protection where required, which will be informed by the CBRA process, noting this will account for traffic volumes and vessel sizes. Moreover, with all subsea cables located within the Morven North Boundary, there is a limited pathway through which commercial vessels may be subject to this hazard.

20.3.6.7 Should an anchor interaction occur, the most likely consequence is no damage to the cable or anchor, based on previous anchor interaction incidents. As an unlikely worst-case consequence, a snagging incident could occur and the vessel's anchor as well as the cable could be damaged, resulting in a loss of stability noting this would only occur for a smaller vessel which would be less likely to penetrate deeper into the seabed than a larger vessel.

20.3.6.8 There is also a risk that fishing gear may interact with subsea cables. It is the responsibility of the fishermen to dynamically risk assess whether it is safe to undertake fishing activities within the Morven Site and to make a decision as to whether or not to fish. This decision will be informed by a number of factors, which will include the charted locations of subsea cables. From vessel traffic data, the majority of fishing vessels (including those likely actively fishing but outside the Morven Site) were potters, which are of limited concern to subsea cables. In addition, the presence of subsea cables and the wind farm structures may mean that trawling is less likely within the Morven Site. In the event of a fishing gear interaction, the consequences would likely consist of loss of gear, or as an unlikely worst-case could include loss of stability.

20.3.6.9 Relevant embedded mitigation measures include promulgation of information, marking on nautical charts, adherence to a CBRA and vessel compliance with MGN 654 (MCA, 2021).

Frequency of occurrence

20.3.6.10 The frequency of occurrence relating to the risk of anchor and fishing gear interaction with subsea cables during O&M is considered to be **Extremely Unlikely**.

Severity of consequence

20.3.6.11 The severity of consequence relating to the risk of anchor and fishing gear interaction with subsea cables during O&M is considered to be **Moderate**.

Significance of effect

20.3.6.12 Taking the frequency of occurrence as extremely unlikely and the severity of consequence as moderate, the overall effect of anchor and fishing gear interaction with subsea cables during O&M of Morven North and Morven South is considered to be broadly acceptable.

20.3.6.13 The hazard is considered ALARP with embedded mitigation in place and therefore no additional mitigation is required. The hazard is therefore **Broadly Acceptable and Not Significant in EIA terms**.

20.3.7 Reduction of emergency response capability including Search and Rescue

Qualification of risk

20.3.7.1 The presence of structures as well as increased vessel activity and personnel numbers may reduce emergency response capabilities during the O&M phase of Morven North and Morven South by increasing the number of incidents, increasing consequences or reducing access for the responders.

20.3.7.2 The spatial extent of this hazard is large given the area covered by Morven North and Morven South (250nm^2), as well as the distance covered by air-based SAR support (the SAR helicopter base is located at Inverness, 104nm northwest of the Morven Site). It is unlikely that a SAR operation will require the entirety of the Morven Site to be searched and it is probable that a search will be restricted to a smaller area in which a casualty is known to be located (accounting for assumptions on any potential drift of the casualty).

20.3.7.3 Up to 586 vessel movements may be made annually by construction vessels during the O&M phase of Morven North and Morven South. It is assumed that maintenance vessels will be on-site throughout the majority of the O&M phase, although severe weather may lead to vessels being withdrawn. The presence of these vessels increase the likelihood of an incident and subsequently increase the likelihood of multiple incidents occurring simultaneously, diminishing emergency response capability. However, they may also be able to provide additional response resource in the event of an incident in liaison with the MCA.

20.3.7.4 The most likely consequence to occur would be a delay to any emergency response request. As an unlikely worst-case, this could result in a failure of emergency response to an incident resulting in PLL and pollution. However, project vessels will be managed via marine coordination and comply with flag state regulations which will reduces this risk. Additionally, the presence of project vessels themselves may mitigate this risk as they may assist at incidents involving other project vessels under the obligation of SOLAS (IMO, 1974) and adherence to an ERCoP, noting this would be undertaken with liaison with the MCA. The MPCP (Volume 4, Annex 1, Appendix 1.1: Marine Pollution Contingency Plan (MPCP) (Version 1)) will also be implemented should pollution occur.

20.3.7.5 From recent SAR data, there was a single SAR tasking recorded throughout the nine-year period within the Regional Shipping and Navigation Study Area, at the southeastern extent of the Morven Site. The frequency of incidents in proximity to Morven North and Morven South is not anticipated to increase significantly from the current level given the measures noted above which will be in place.

20.3.7.6 The layout will be agreed with the MCA and in line with MGN 654 requirements to ensure any SAR operations that do occur within the Morven Site are facilitated. The Morven Site indicative worst-case layout includes both a ringroad Helicopter Refuge Area between the dense perimeter and internal grid and a Helicopter Refuge Area between the sites, to assist with SAR access. This has been included to address a concern raised by the MCA in relation to the size of the Morven Site. A SAR checklist will also be completed and agreed with the MCA as required under MGN 654.

20.3.7.7 Relevant embedded mitigation measures include DSLP approval, promulgation of information, adherence to an LMP and AtoNMP, marking on appropriate charts, marine coordination of project vessels, adherence to an ERCoP, adherence to an MPCP, adherence to a NSPVMP and compliance with MGN 654 and international marine regulations.

Frequency of occurrence

20.3.7.8 The frequency of occurrence relating to the risk of reduced emergency response capabilities during the O&M phase is considered to be **Extremely Unlikely**.

Severity of consequence

20.3.7.9 The severity of consequence relating to the risk of reduced emergency response capabilities during the O&M phase is considered to be **Serious**.

Significance of effect

20.3.7.10 Taking the frequency of occurrence as extremely unlikely and the severity of consequence as serious, the overall effect of reduced emergency response capability during O&M of Morven North and Morven South is considered to be tolerable with mitigation.

20.3.7.11 The hazard is considered ALARP with embedded mitigation in place and therefore no additional mitigation is required. The hazard is therefore **Tolerable with Mitigation and Not Significant in EIA terms**.

20.4 Decommissioning phase

20.4.1 Vessel displacement and increased third-party vessel to vessel collision risk

Qualification of risk

20.4.1.1 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 stage hazard. It is noted that in the case of subsea cables sections may be left *in situ* to avoid unnecessarily disturbing the seabed. This would be confirmed through consultation and assessment to ensure the most suitable approach was taken. 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*.

20.4.1.2 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 stage hazard. By the time of decommissioning, deviations will be well established, with vessels likely to continue on their typical routeing around the buoyed decommissioning area.

20.4.1.3 Relevant embedded mitigation measures would be as per the respective construction phase.

Frequency of occurrence

20.4.1.4 The frequency of occurrence in relation to displacement of vessel traffic resulting in increased third-party collision risk during the construction phase is considered **Remote**.

Severity of consequence

20.4.1.5 The severity of consequence in relation to displacement of vessel traffic resulting in increased third-party collision risk during the construction phase is considered **Moderate**.

Significance of effect

20.4.1.6 Taking the frequency of occurrence as remote and the severity of consequence as moderate, the overall effect of vessel displacement and increased third-party vessel to vessel collision risk during decommissioning of Morven North and Morven South is considered to be tolerable with mitigation.

20.4.1.7 The hazard is considered ALARP with embedded mitigation in place and therefore no additional mitigation is required. The hazard is therefore T**olerable with Mitigation and Not Significant in EIA terms**.

20.4.2 Increased third-party vessel to project vessel collision risk

Qualification of risk

20.4.2.1 The presence of vessels associated with decommissioning activities of Morven North and Morven South may increase encounters and thus collision risk for vessels already operating in the area.

20.4.2.2 Since the methods used to remove structures and subsea cables are expected to be similar to those used to install them, including the vessels involved, this hazard is expected to be similar in nature to the equivalent construction phase, including the number of vessel movements by decommissioning vessels. It is noted that 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 left *in situ*.

20.4.2.3 On this basis the same assumptions made for the equivalent construction phase hazard in terms of frequency and consequence apply.

Frequency of occurrence

20.4.2.4 The frequency of occurrence in relation to encounters and collision risk between project vessels and third party vessels during the construction phase is considered to be **Extremely Unlikely**.

Severity of consequence

20.4.2.5 The severity of consequence in relation to encounters and collision risk between project vessels and third party vessels during the construction phase is considered to be **Serious**.

Significance of effect

20.4.2.6 Taking the frequency of occurrence as extremely unlikely and the severity of consequence as serious, the overall effect of encounters and collision risk between project vessels and third party vessels during decommissioning of Morven North and Morven South is considered to be tolerable with mitigation.

20.4.2.7 The hazard is considered ALARP with embedded mitigation in place and therefore no additional mitigation is required. The hazard is therefore **Tolerable with Mitigation and Not Significant in EIA terms.**

20.4.3 Vessel to structure allision risk

Qualification of risk

20.4.3.1 It is likely that allision risk during decommissioning will be similar to that observed for the construction phase, noting similar scenarios on-site, including partially removed structures within a buoyed decommissioning area. On this basis the same assumptions made for the equivalent construction phase hazard in terms of frequency and consequence apply.

Frequency of occurrence

20.4.3.2 The frequency of occurrence in relation to vessel to structure allision risk during the construction phase is considered to be **Remote**.

Severity of consequence

20.4.3.3 The severity of consequence in relation to vessel to structure allision risk during the construction phase is considered to be **Moderate**.

Significance of effect

20.4.3.4 Taking the frequency of occurrence as remote and the severity of consequence as moderate, the overall effect of vessel to structure allision risk during decommissioning of Morven North and Morven South is considered to be tolerable with mitigation.

20.4.3.5 The hazard is considered ALARP with embedded mitigation in place and therefore no additional mitigation is required. The hazard is therefore **Tolerable with Mitigation and Not Significant in EIA terms.**

20.4.4 Reduced access to local ports and harbours

Qualification of risk

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

20.4.4.2 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, including the number of vessel movements by decommissioning vessels. It is noted that 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*.

20.4.4.3 As with the construction stage, it is not yet known from which port(s) decommissioning activity will be based for Morven North and Morven South.

20.4.4.4 On this basis the same assumptions made for the equivalent construction phase hazard in terms of frequency and consequence apply.

Frequency of occurrence

20.4.4.5 The frequency of the risk of reduced access to local ports and harbours during the construction phase is considered to be **Remote**.

Severity of consequence

20.4.4.6 The severity of consequence of the risk of reduced access to local ports and harbours during the construction phase is considered to be **Minor**.

Significance of effect

20.4.4.7 Taking the frequency of occurrence as remote and the severity of consequence as minor, the overall effect of reduced port access during decommissioning of Morven North and Morven South is considered to be broadly acceptable.

20.4.4.8 The hazard is considered ALARP with embedded mitigation in place and therefore no additional mitigation is required. The hazard is therefore **Broadly Acceptable and Not Significant in EIA terms.**

21 Cumulative risk assessment – Scenario 3a

21.1.1.1 This section provides a cumulative risk assessment (using FSA) considering Morven North alongside baseline and Tier 1 cumulative developments, for the hazards identified previously for Scenario 1a. The assessment builds upon the commentary provided for Scenario 1a in Section 18, and provides a frequency of occurrence, severity of consequence and subsequent significance of risk for each hazard; the phases considered for each hazard are as per those assessed for Scenario 1a also. As the effects of further developments are not expected to impact upon either the reduction of under keel clearance or anchor and fishing gear interaction with subsea cables past that which are assessed within Scenario 1a, these have been screened out of the cumulative risk assessment for Scenario 3a.

21.2 Vessel displacement and increased third party vessel to vessel collision risk

21.2.1.1 Cumulative routeing options have been discussed within Section 15.5. Of the scenarios presented, Scenario 3a (see Section 15.5.5) is of particular relevance for assessing Morven North cumulatively with tier 1 projects.

21.2.1.2 Based on the cumulative assessment of vessel routeing undertaken, there would be 13 routes expected to deviate on a cumulative basis considering Scenario 3a. It is noted that Route 1 comprises a much greater number of vessels than any other route and is among the routes not affected in Scenario 3a.

21.2.1.3 The affected routes have been grouped based on location and direction, and in each case there is either only a small deviation required (Aberdeen East routeing) or optionality for mariners (Firth of Forth, Montrose and north-south routeing). In all cases there are means by which vessels can continue to safely navigate within the region.

21.2.1.4 For the north-south routeing there would likely be an increase in passage time and distance, although with adequate passage planning (particularly for the approach to/from the north) any increases can be minimised.

21.2.1.5 For the Montrose routeing, there would be increased passage time and distance, although again effective passage planning may mitigate this with changes to the way that affected vessels approach/depart Montrose. There is sufficient open sea room in the approaches to Montrose to allow this.

21.2.1.6 Given the optionality available for routeing this may limit increases in collision risk resulting from the overall reduction in navigable sea room. However, it is recognised that collision risk will increase, and may be particularly relevant for encounters between commercial vessels and fishing vessels where routeing passes west of the Morven North Boundary and Bowdun.

21.2.1.7 The frequency of occurrence is considered to be **Remote** and the severity of consequence is considered to be **Moderate**. Therefore, the cumulative effect of third

party vessel to vessel collision risk is considered to be **Tolerable with Mitigation and Not Significant in EIA terms**.

21.3 Increased third party vessel to project vessel collision risk

21.3.1.1 Ossian, Bowdun and (to a lesser extent) Salamander are also within a pre-consent or pre-construction phase and as such, as highlighted within the Hazard Workshop, there is the potential for an increase in numbers of project vessels from other developments. Noting that base ports are not known for developments pre-construction, and that vessel types and numbers have not been finalised, the movements of project vessels from other developments are considered qualitatively where relevant. In addition, there is the potential that the same or similarly located base ports could be used by cumulative developments for construction, maintenance and/or decommissioning vessels.

21.3.1.2 On this basis, there may be an overall cumulative increase in project vessel presence within the general area, particularly where offshore construction periods overlap. As such there is a 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 (IMO, 1972/77) and SOLAS (IMO, 1974). This may include close liaison between the developers, particularly where sharing base ports (with liaison including with the relevant port authority(s)) and the use of specific entry/exit points for each array may be beneficial for minimising interactions with third party vessels, with this most relevant for Ossian and Bowdun as the close neighbours to the Morven North Boundary. The latter will be considered as part of the NSPVMP, as required. In addition, promulgation of information from each respective project will inform mariners of project operations.

21.3.1.3 The frequency of occurrence is considered to be **Remote** and the severity of consequence is considered to be **Serious**. Therefore, the cumulative effect of third-party vessel to project vessel collision risk is considered to be **Tolerable with Mitigation and Not Significant in EIA terms**.

21.4 Vessel to structure allision risk

21.4.1.1 The nearest screened in cumulative development is Ossian, located 4.8nm east of the Morven North Boundary. As discussed in relation to collision risk, input from the Hazard Workshop indicated there was no concern over the sea room available for deviation within a cumulative context, given that it is not expected that vessels would regularly transit through the gap between the sites. Feedback from the MCA (see Section 4) also indicated agreement that use of sea space between Morven and Ossian is unlikely given the current activity, overall length of the gap formed by the sea space between the projects, other future case developments and expert opinion. It is

unlikely that vessels will experience increased allision risk beyond the localised risk when passing any given development.

21.4.1.2 Bowdun is located 5.4nm north-west of the Morven North Boundary. Based on the Shipping Route Template in MGN 654, this distance is generally considered sufficient to allow vessels to safely navigate between the sites with minimum allision risk, noting that as per the assessment of vessel displacement there is optionality for mariners to choose whether such a passage is preferable.

21.4.1.3 No perceptible risk is identified in relation to Salamander given the distance from the Morven North Boundary.

21.4.1.4 All developments will be required to implement marine lighting and marking in agreement with NLB and in compliance with IALA G1162 (IALA, 2022). The LMP and AtoNMP (Volume 4, Annex 4: Lighting and Marking Plan (Version 1)) will include cumulative considerations as deemed appropriate by NLB. Further, all layouts will need to be agreed with the MCA and NLB, with these discussions including consideration of allision risk.

21.4.1.5 The frequency of occurrence is considered to be **Remote** and the severity of consequence is considered to be **Moderate**. Therefore, the cumulative effect of vessel to structure allision risk is considered to be **Tolerable with Mitigation and Not Significant in EIA terms**.

21.5 Reduced access to local ports and harbours

21.5.1.1 As discussed in relation to collision risk, there is the potential that the same or similarly located base ports could be used by cumulative developments for construction, maintenance and/or decommissioning vessels. This increases the number of vessels which may be RAM at any given time as well as generally increasing the number of vessels within an area.

21.5.1.2 Given the relative distance to ports in the area and the anticipated cumulative deviations for the main commercial routes, it is not anticipated that there will be any substantial effect on vessel approaches to and from local ports beyond the deviations already outlined for the vessel displacement hazard. This assumes that the duration and nature of project activities are analogous to that considered for Morven North in isolation.

21.5.1.3 In the event of temporal overlap in construction of cumulative developments, it is anticipated that the developments would coordinate activities in liaison with local ports so as to ensure that access constraints are reduced. As is the case for the assessment of Morven North in isolation, promulgation of information to allow mariners to passage plan accordingly is key.

21.5.1.4 The frequency of occurrence is considered to be **Reasonably Probable** and the severity of consequence is considered to be **Minor**. Therefore, the cumulative effect

of reduced access to ports is considered to be **Tolerable with Mitigation and Not Significant in EIA terms**.

21.6 Reduction of emergency response capability including Search and Rescue

21.6.1.1 The presence of Tier 1 developments and associated project vessels would increase the likelihood of an incident requiring emergency response. However, as with Morven North in isolation, each development will have an ERCoP in place in liaison with the MCA. Additionally, project vessels across all the developments may be able to assist in the event of an incident across the region under the obligation of SOLAS (IMO, 1974). Therefore, any strain on emergency response resources may be somewhat balanced by the additional third party resources on site.

21.6.1.2 Given the distances between the Morven North Boundary and Ossian and Bowdun, no material impact on SAR access is anticipated, i.e. there is sufficient distance to allow a SAR asset to transition a search between two sites. Nevertheless, for all developments the layout will need to be agreed with the MCA, with these discussions including consideration of SAR access.

21.6.1.3 The frequency of occurrence is considered to be **Remote** and the severity of consequence is considered to be **Serious**. Therefore, the cumulative effect of reduced emergency response capability is considered to be **Tolerable with Mitigation and Not Significant in EIA terms**.

22 Cumulative risk assessment – Scenario 3b

22.1.1.1 This section provides a cumulative risk assessment (using FSA) considering Morven South alongside baseline and Tier 1 cumulative developments, for the hazards identified previously for Scenario 1b. The assessment builds upon the commentary provided for Scenario 1b in Section 19, and provides a frequency of occurrence, severity of consequence and subsequent significance of risk for each hazard; the phases considered for each hazard are as per those assessed for Scenario 1b also. As the effects of further developments are not expected to impact upon either the reduction of under keel clearance or anchor and fishing gear interaction with subsea cables past that which are assessed within Scenario 1b, these have been screened out of the cumulative risk assessment for Scenario 3b.

22.2 Vessel displacement and increased third party vessel to vessel collision risk

22.2.1.1 Cumulative routeing options have been discussed within Section 15.5. Of the scenarios presented, Scenario 3b (see Section 15.5.6) is of particular relevance for assessing Morven South cumulatively with tier 1 projects.

22.2.1.2 Based on the cumulative assessment of vessel routeing undertaken, there would be 13 routes expected to deviate on a cumulative basis considering Scenario 3b. It is noted that Route 1 comprises a much greater number of vessels than any other route and is among the routes not affected in Scenario 3b.

22.2.1.3 The affected routes have been grouped based on location and direction, and in each case there is either only a small deviation required (Aberdeen East routeing) or optionality for mariners (Firth of Forth, Montrose and north-south routeing). In all cases there are means by which vessels can continue to safely navigate within the region.

22.2.1.4 For the north-south routeing there would likely be an increase in passage time and distance, although with adequate passage planning (particularly for the approach to/from the north) any increases can be minimised. Vessels utilising the option to pass between Ossian and Bowdun may be less affected in this manner.

22.2.1.5 For the Montrose routeing, there would be increased passage time and distance, although again effective passage planning may mitigate this with changes to the way that affected vessels approach/depart Montrose. There is sufficient open sea room in the approaches to Montrose to allow this. Vessels utilising the option to pass between Ossian and Bowdun may be less affected in this manner.

22.2.1.6 Given the optionality available for routeing this may limit increases in collision risk resulting from the overall reduction in navigable sea room. However, it is recognised that collision risk will increase, and may be particularly relevant for encounters between commercial vessels and fishing vessels where routeing passes west of the Morven South Boundary and Bowdun.

22.2.1.7 The frequency of occurrence is considered to be **Remote** and the severity of consequence is considered to be **Moderate**. Therefore, the cumulative effect of third party vessel to vessel collision risk is considered to be **Tolerable with Mitigation and Not Significant in EIA terms**.

22.3 Increased third party vessel to project vessel collision risk

22.3.1.1 Ossian, Bowdun and (to a lesser extent) Salamander are also within a pre-consent or pre-construction phase and as such, as highlighted within the Hazard Workshop, there is the potential for an increase in numbers of project vessels from other developments. Noting that base ports are not known for developments pre-construction, and that vessel types and numbers have not been finalised, the movements of project vessels from other developments are considered qualitatively where relevant. In addition, there is the potential that the same or similarly located base ports could be used by cumulative developments for construction, maintenance and/or decommissioning vessels.

22.3.1.2 On this basis, there may be an overall cumulative increase in project vessel presence within the general area, particularly where offshore construction periods overlap. As such there is a 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 (IMO, 1972/77) and SOLAS (IMO, 1974). This may include close liaison between the developers, particularly where sharing base ports (with liaison including with the relevant port authority(s)) and the use of specific entry/exit points for each array may be beneficial for minimising interactions with third party vessels, with this most relevant for Ossian as the close neighbour to the Morven South Boundary. The latter will be considered as part of the NSPVMP, as required.

22.3.1.3 The frequency of occurrence is considered to be **Remote** and the severity of consequence is considered to be **Serious**. Therefore, the cumulative effect of third-party vessel to project vessel collision risk is considered to be **Tolerable with Mitigation and Not Significant in EIA terms**.

22.4 Vessel to structure allision risk

22.4.1.1 The nearest screened in cumulative development is Ossian, located 2.9nm east of the Morven South Boundary. As discussed in relation to collision risk, input from the Hazard Workshop indicated there was no concern over the sea room available for deviation within a cumulative context, given that it is not expected that vessels would attempt to transit through the gap between the sites. Feedback from the MCA (see Section 4) also indicated agreement that use of sea space between Morven and Ossian is unlikely given the current activity, overall length of the gap formed by the sea space between the projects, other future case developments and expert opinion. It is

unlikely that vessels will experience increased allision risk beyond the localised risk when passing any given development.

22.4.1.2 No perceptible risk is identified in relation to Bowdun or Salamander given the distance from the Morven South Boundary.

22.4.1.3 All developments will be required to implement marine lighting and marking in agreement with NLB and in compliance with IALA G1162 (IALA, 2022), meaning the localised risk is managed. Further, all layouts will need to be agreed with the MCA and NLB, with these discussions including consideration of allision risk. In addition, promulgation of information from each respective project will inform mariners of project operations.

22.4.1.4 The frequency of occurrence is considered to be **Remote** and the severity of consequence is considered to be **Moderate**. Therefore, the cumulative effect of vessel to structure allision risk is considered to be **Tolerable with Mitigation and Not Significant in EIA terms**.

22.5 Reduced access to local ports and harbours

22.5.1.1 As discussed in relation to collision risk, there is the potential that the same or similarly located base ports could be used by cumulative developments for construction, maintenance and/or decommissioning vessels. This increases the number of vessels which may be RAM at any given time as well as generally increasing the number of vessels within an area.

22.5.1.2 Given the relative distance to ports in the area and the anticipated cumulative deviations for the main commercial routes, it is not anticipated that there will be any substantial effect on vessel approaches to and from local ports beyond the deviations already outlined for the vessel displacement hazard. This assumes that the duration and nature of project activities are analogous to that considered for Morven South in isolation.

22.5.1.3 In the event of temporal overlap in construction of cumulative developments, it is anticipated that the developments would coordinate activities in liaison with local ports so as to ensure that access constraints are reduced. As is the case for the assessment of Morven South in isolation, promulgation of information to allow mariners to passage plan accordingly is key.

22.5.1.4 The frequency of occurrence is considered to be **Reasonably Probable** and the severity of consequence is considered to be **Minor**. Therefore, the cumulative effect of reduced access to ports is considered to be **Tolerable with Mitigation and Not Significant in EIA terms**.

22.6 Reduction of emergency response capability including Search and Rescue

22.6.1.1 The presence of Tier 1 developments and associated project vessels would increase the likelihood of an incident requiring emergency response. However, as with Morven South in isolation, each development will have an ERCoP in place in liaison with the MCA. Additionally, project vessels across all the developments may be able to assist in the event of an incident across the region under the obligation of SOLAS (IMO, 1974). Therefore, any strain on emergency response resources may be somewhat balanced by the additional third party resources on site.

22.6.1.2 Given the distance between the Morven South Boundary and Ossian, no material impact on SAR access is anticipated, i.e. there is sufficient distance to allow a SAR asset to transition a search between two sites. Nevertheless, for all developments the layout will need to be agreed with the MCA, with these discussions including consideration of SAR access.

22.6.1.3 The frequency of occurrence is considered to be **Remote** and the severity of consequence is considered to be **Serious**. Therefore, the cumulative effect of reduced emergency response capability is considered to be **Tolerable with Mitigation and Not Significant in EIA terms**.

23 Cumulative risk assessment – Scenarios 3c and 4

23.1.1.1 This section provides a cumulative risk assessment (using FSA) for the hazards identified previously for Scenario 2. Scenario 3 considers Morven North and Morven South alongside baseline and Tier 1 cumulative developments, while Scenario 4 considers Morven North and Morven South alongside baseline, Tier 1 and Tier 2 cumulative developments. The assessment builds upon the commentary provided for Scenario 2 in Section 20, and provides a frequency of occurrence, severity of consequence and subsequent significance of risk for each hazard; the phases considered for each hazard are as per those assessed for Scenario 2 also. As the effects of further developments are not expected to impact upon either the reduction of under keel clearance or anchor and fishing gear interaction with subsea cables past that which are assessed within Scenario 2, these have been screened out of the cumulative risk assessment for Scenario 3c and 4.

23.2 Vessel displacement and increased third party vessel to vessel collision risk

23.2.1.1 Cumulative routeing options have been discussed within Section 15.5. Of the scenarios presented, Scenario 3c (see Section 15.5.7) and Scenario 4 (see Section 15.5.8) are of particular relevance for assessing Morven North and Morven South cumulatively with tier 1 and 2 projects, respectively.

23.2.2 Scenario 3c

23.2.2.1 Based on the cumulative assessment of vessel routeing undertaken, there would be 13 routes expected to deviate on a cumulative basis considering Scenario 3c. It is noted that Route 1 comprises a much greater number of vessels than any other route and is among the routes not affected in Scenario 3c.

23.2.2.2 The affected routes have been grouped based on location and direction, and in each case there is either only a small deviation required (Aberdeen East routeing) or optionality for mariners (Firth of Forth, Montrose and north-south routeing). In all cases there are means by which vessels can continue to safely navigate within the region.

23.2.2.3 For the north-south routeing there would likely be an increase in passage time and distance, although with adequate passage planning (particularly for the approach to/from the north) any increases can be minimised.

23.2.2.4 For the Montrose routeing, there would be increased passage time and distance, although again effective passage planning may mitigate this with changes to the way that affected vessels approach/depart Montrose. There is sufficient open sea room in the approaches to Montrose to allow this.

23.2.2.5 Given the optionality available for routeing this may limit increases in collision risk resulting from the overall reduction in navigable sea room. However, it is recognised that collision risk will increase, and may be particularly relevant for

encounters between commercial vessels and fishing vessels where routeing passes west of the Morven Site and Bowdun.

23.2.2.6 The frequency of occurrence is considered to be **Remote** and the severity of consequence is considered to be **Moderate**. Therefore, the cumulative effect of third party vessel to vessel collision risk is considered to be **Tolerable with Mitigation and Not Significant in EIA terms**.

23.2.3 Scenario 4

23.2.3.1 Based on the cumulative assessment of vessel routeing undertaken, there would be 15 routes expected to deviate on a cumulative basis considering Scenario 4.

23.2.3.2 Again, the affected routes have been grouped based on location and direction, and in each case there is optionality for mariners such that vessels can continue to safely navigate within the region.

23.2.3.3 For the Aberdeen East routeing, there would be increased passage time and distance, although this largely attributable to the presence of Ossian and Bellrock rather than the Morven Site.

23.2.3.4 For the north-south routeing there would likely be an increase in passage time and distance, particularly if choosing to pass east of Bellrock, although with adequate passage planning (particularly for the approach to/from the north) any increases can be minimised.

23.2.3.5 For the Montrose routeing, there would be increased passage time and distance, although again effective passage planning may mitigate this with changes to the way that affected vessels approach/depart Montrose. There is sufficient open sea room in the approaches to Montrose to allow this, while deviations further offshore are again largely attributable to the presence of Ossian and Bellrock rather than the Morven Site.

23.2.3.6 For the Firth of Forth routeing, there would be increased passage time and distance associated with the option passing offshore of Berwick Bank, although this increase is largely attributable to Berwick Bank only.

23.2.3.7 Overall, only Bellrock and Berwick Bank (of Tier 2 developments) are considered to further exacerbate passage time and distance, and these increases are again manageable through effective passage planning which will include the ability to choose from various routeing options.

23.2.3.8 Given the optionality available for routeing this may limit increases in collision risk resulting from the overall reduction in navigable sea room. However, it is recognised that collision risk will increase, and may be particularly relevant for encounters between commercial vessels and fishing vessels where routeing passes west of the Morven Site and Bowdun.

23.2.3.9 There may be an effect on routeing vessels from vessels involved in construction or maintenance of Eastern Green Link 2 and/or Eastern Green Link 3. However, any associated displacement will be temporary in nature and spatially limited to the area immediately around the vessel position (which may be supported by the application of advisory safe passing distances). Considering embedded mitigation measures such as promulgation of information, any displacement as a result of cable installation will be minor and manageable with appropriate passage planning.

23.2.3.10 The frequency of occurrence is considered to be **Reasonably Probable** and the severity of consequence is considered to be **Moderate**. Therefore, the cumulative effect of third party vessel to vessel collision risk is considered to be **Tolerable with Mitigation and Not Significant in EIA terms**.

23.3 Increased third party vessel to project vessel collision risk

23.3.1.1 A number of other OWF developments in the vicinity are also within a pre-consent phase and as such, as highlighted within the Hazard Workshop, there is the potential for an increase in vessel traffic numbers of project vessels from other developments. Noting that base ports are not known for developments pre-construction, and that vessel types and numbers have not been finalised, the movements of project vessels from other developments are considered qualitatively where relevant. In addition, there is the potential that the same ports or similarly located base ports could be used by cumulative developments for construction, maintenance and/or decommissioning vessels.

23.3.2 Scenario 3c

23.3.2.1 There may be an overall cumulative increase in project vessel presence within the general area due to Ossian, Bowdun and (to a lesser extent) Salamander, particularly where offshore construction periods overlap. As such there is a 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 (IMO, 1972/77) and SOLAS (IMO, 1974). This may include close liaison between the developers, particularly where sharing base ports (with liaison including with the relevant port authority(s)) and the use of specific entry/exit points for each array may be beneficial for minimising interactions with third party vessels, with this most relevant for Ossian and Bowdun as the close neighbours to the Morven Site. The latter will be considered as part of the NSPVMP, as required. In addition, promulgation of information from each respective project will inform mariners of project operations.

23.3.2.2 The frequency of occurrence is considered to be **Remote** and the severity of consequence is considered to be **Serious**. Therefore, the cumulative effect of third-

party vessel to project vessel collision risk is considered to be **Tolerable and Not Significant in EIA terms**.

23.3.3 Scenario 4

23.3.3.1 As with Scenario 3c, although an increase in project vessel numbers from other developments will lead to increased encounter and collision risk, the establishment of vessel management systems will ensure that any encounters are managed appropriately. Additionally, Tier 2 developments are located a sufficient distance from the Morven Site such that increased interactions are likely to be limited to where there are shared base ports, potentially putting further emphasis on liaison with the relevant port authority(s).

23.3.3.2 The frequency of occurrence is considered to be **Remote** and the severity of consequence is considered to be **Serious**. Therefore, the cumulative effect of third-party vessel to project vessel collision risk is considered to be **Tolerable and Not Significant in EIA terms**.

23.4 Vessel to structure allision risk

23.4.1.1 The nearest screened in cumulative development is Ossian OWF, located 2.9nm east of the Morven Site. As discussed in relation to collision risk, input from the Hazard Workshop indicated there was no concern over the sea room available for deviation within a cumulative context, given that it is not expected that vessels would attempt to transit through the gap between the sites. Feedback from the MCA (see Section 4) also indicated agreement that use of sea space between Morven and Ossian is unlikely given the current activity, overall length of the gap formed by the sea space between the projects, other future case developments and expert opinion. It is unlikely that vessels will experience increased allision risk beyond the localised risk when passing any given development.

23.4.1.2 Bowdun is located 5.4nm northwest of the Morven North Boundary. Based on the Shipping Route Template in MGN 654, this distance is generally considered sufficient to allow vessels to safely navigate between the sites with minimum allision risk, noting that as per the assessment of vessel displacement there is optionality for mariners to choose whether such a passage is preferable.

23.4.1.3 No perceptible risk is identified in relation to any Tier 2 developments given the distance from the Morven Site. It is acknowledged that allision risk will be increased as a result of the additional presence of these developments, but is largely attributable to those developments alone, i.e. the presence of the Morven Site does not materially influence the additional allision risk across the region as a whole.

23.4.1.4 All developments will be required to implement marine lighting and marking in agreement with NLB and in compliance with IALA G1162 (IALA, 2022). The LMP and AtoNMP (Volume 4, Annex 4: Lighting and Marking Plan (Version 1)) will include cumulative considerations as deemed appropriate by NLB. Further, all layouts will

need to be agreed with the MCA and NLB, with these discussions including consideration of allision risk.

23.4.2 Scenario 3c

23.4.2.1 The frequency of occurrence is considered to be **Remote** and the severity of consequence is considered to be **Moderate**. Therefore, the cumulative effect of vessel to structure allision risk is considered to be **Tolerable with Mitigation and Not Significant in EIA terms**.

23.4.3 Scenario 4

23.4.3.1 The frequency of occurrence is considered to be **Remote** and the severity of consequence is considered to be **Moderate**. Therefore, the cumulative effect of vessel to structure allision risk is considered to be **Tolerable with Mitigation and Not Significant in EIA terms**.

23.5 Reduced access to local ports and harbours

23.5.1.1 As discussed in relation to collision risk, 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, maintenance vessels and or decommissioning vessels. This increases the number of vessels which may be RAM at any given time as well as generally increasing the number of vessels within an area.

23.5.2 Scenario 3c

23.5.2.1 Given the relative distance to ports in the area and the anticipated cumulative 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 the deviations already outlined for hazards relating to vessel displacement. This assumes that the duration and nature of project activities are analogous to that considered for Morven North and Morven South.

23.5.2.2 In the event of temporal overlap in construction of cumulative developments, it is anticipated that the developments would coordinate activities in liaison with local ports so as to ensure that access constraints are reduced. As is the case for the assessment of Morven North and Morven South in isolation, promulgation of information to allow mariners to passage plan accordingly is key.

23.5.2.3 The frequency of occurrence is considered to be **Reasonably Probable** and the severity of consequence is considered to be **Minor**. Therefore, the cumulative effect of reduced access to ports is considered to be **Tolerable with Mitigation and Not Significant in EIA terms**.

23.5.3 Scenario 4

23.5.3.1 As with the equivalent Scenario 3c hazard, the relative distance to potential similar ports used for other developments will not lead to substantial effects beyond those addressed with vessel displacement, and in the event of any overlap, activities will be coordinated.

23.5.3.2 The frequency of occurrence is considered to be **Reasonably Probable** and the severity of consequence is considered to be **Minor**. Therefore, the cumulative effect of reduced access to ports is considered to be **Tolerable with Mitigation and Not Significant in EIA terms**.

23.6 Reduction of emergency response capability including Search and Rescue

23.6.1 Scenario 3c

23.6.1.1 The presence of Tier 1 developments and associated project vessels would increase the likelihood of an incident requiring emergency response. However, as with Morven North and Morven South in isolation, each development will have an ERCoP in place in liaison with the MCA. Additionally, project vessels across all the developments may be able to assist in the event of an incident across the region under the obligation of SOLAS (IMO, 1974). Therefore, any strain on emergency response resources may be somewhat balanced by the additional third party resources on site.

23.6.1.2 Given the distances between the Morven Site and Ossian and Bowdun, no material impact on SAR access is anticipated, i.e. there is sufficient distance to allow a SAR asset to transition a search between two sites. Nevertheless, for all developments the layout will need to be agreed with the MCA, with these discussions including consideration of SAR access.

23.6.1.3 The frequency of occurrence is considered to be **Remote** and the severity of consequence is considered to be **Serious**. Therefore, the cumulative effect of reduced emergency response capability is considered to be **Tolerable with Mitigation and Not Significant in EIA terms**.

23.6.2 Scenario 4

23.6.2.1 The presence of Tier 2 developments and associated project vessels would further increase the likelihood of an incident requiring emergency response. However, as per Scenario 3c, each development will have an ERCoP in place in liaison with the MCA and project vessels across all the developments may be able to assist in the event of an incident across the region under the obligation of SOLAS (IMO, 1974). Therefore, any strain on emergency response resources may again be somewhat balanced by the additional third party resources on site.

23.6.2.2 No further issues relating to SAR access are identified for Scenario 4 given the distances between the Morven Site and Tier 2 developments.

23.6.2.3 The frequency of occurrence is considered to be **Remote** and the severity of consequence is considered to be **Serious**. Therefore, the cumulative effect of reduced emergency response capability is considered to be **Tolerable with Mitigation and Not Significant in EIA terms**.

24 Risk control log

24.1.1.1 Table 24.1 presents a summary of the risk assessment of shipping and navigation hazards associated with Morven North and Morven South, separately, combined and cumulatively with other projects. This includes (per hazard) the proposed embedded mitigation measures, frequency of occurrence, severity of consequence and resulting significance of risk.

24.1.1.2 Any additional mitigation measures proposed are then listed per hazard alongside the residual risk.

Table 24.1: Risk control log - concurrent developments

Hazard	Scenario	Phase	Embedded Mitigation Measures	Frequency of Occurrence	Severity of Consequence	Significance of Risk	Additional Mitigation Measures	Residual Risk
Vessel Displacement and Increased Third Party Vessel to Vessel Collision Risk	1a	Construction	DSLP approval, adherence to LMP and AtoNMP and NSP, marking on nautical charts, promulgation of information.	Extremely Unlikely	Moderate	Broadly Acceptable	N/A	Broadly Acceptable, not significant
		O&M		Extremely Unlikely	Moderate	Broadly Acceptable		Broadly Acceptable, not significant
		Decommissioning		Extremely Unlikely	Moderate	Broadly Acceptable		Broadly Acceptable, not significant
	1b	Construction	DSLP approval, adherence to LMP and AtoNMP and NSP, marking on nautical charts, promulgation of information.	Extremely Unlikely	Moderate	Broadly Acceptable	N/A	Broadly Acceptable, not significant
		O&M		Extremely Unlikely	Moderate	Broadly Acceptable		Broadly Acceptable, not significant
		Decommissioning		Extremely Unlikely	Moderate	Broadly Acceptable		Broadly Acceptable, not significant

Hazard	Scenario	Phase	Embedded Mitigation Measures	Frequency of Occurrence	Severity of Consequence	Significance of Risk	Additional Mitigation Measures	Residual Risk
	2	Construction	DSLP approval, adherence to LMP and AtoNMP and NSP, marking on nautical charts, promulgation of information.	Remote	Moderate	Tolerable with Mitigation	N/A	Tolerable with Mitigation and ALARP
		O&M		Remote	Moderate	Tolerable with Mitigation		Tolerable with Mitigation and ALARP
		Decommissioning		Remote	Moderate	Tolerable with Mitigation		Tolerable with Mitigation and ALARP
	3a	Cumulative	DSLP approval, adherence to LMP and AtoNMP and NSP, marking on nautical charts, promulgation of information.	Remote	Moderate	Tolerable with Mitigation	N/A	Tolerable with Mitigation and ALARP
	3b			Remote	Moderate	Tolerable with Mitigation		Tolerable with Mitigation and ALARP
	3c			Remote	Moderate	Tolerable with Mitigation		Tolerable with Mitigation and ALARP

Hazard	Scenario	Phase	Embedded Mitigation Measures	Frequency of Occurrence	Severity of Consequence	Significance of Risk	Additional Mitigation Measures	Residual Risk
	4			Reasonably Probable	Moderate	Tolerable with Mitigation		Tolerable with Mitigation and ALARP
Increased Third Party Vessel to Project Vessel Collision Risk	1a	Construction	Application for safety zones, buoyed construction/decommissioning areas, guard vessels, DSLP approval, promulgation of information, marine coordination, marking on nautical charts, adherence to LMP and AtoNMP, NSPVMP, MPCP and ERCoP.	Extremely Unlikely	Serious	Tolerable with Mitigation	N/A	Tolerable with Mitigation and ALARP
		O&M		Extremely Unlikely	Serious	Tolerable with Mitigation		Tolerable with Mitigation and ALARP
		Decommissioning		Extremely Unlikely	Serious	Tolerable with Mitigation		Tolerable with Mitigation and ALARP
	1b	Construction	Application for safety zones, buoyed construction/decommissioning areas, guard vessels, DSLP approval, promulgation of	Extremely Unlikely	Serious	Tolerable with Mitigation	N/A	Tolerable with Mitigation and ALARP
		O&M		Extremely Unlikely	Serious	Tolerable with Mitigation		Tolerable with Mitigation and ALARP

Hazard	Scenario	Phase	Embedded Mitigation Measures	Frequency of Occurrence	Severity of Consequence	Significance of Risk	Additional Mitigation Measures	Residual Risk
		Decommissioning	information, marine coordination, marking on nautical charts, adherence to LMP and AtoNMP, NSPVMP, MPCP and ERCoP.	Extremely Unlikely	Serious	Tolerable with Mitigation		Tolerable with Mitigation and ALARP
	2	Construction	Application for safety zones, buoyed construction/decommissioning areas, guard vessels, DSLP approval, promulgation of information, marine coordination, marking on nautical charts, adherence to LMP and AtoNMP, NSPVMP, MPCP and ERCoP.	Extremely Unlikely	Serious	Tolerable with Mitigation	N/A	Tolerable with Mitigation and ALARP
		O&M		Extremely Unlikely	Serious	Tolerable with Mitigation		Tolerable with Mitigation and ALARP
		Decommissioning		Extremely Unlikely	Serious	Tolerable with Mitigation		Tolerable with Mitigation and ALARP
	3a	Cumulative	Application for safety zones, buoyed construction/decommiss	Remote	Serious	Tolerable with Mitigation	N/A	Tolerable with Mitigation and ALARP

Hazard	Scenario	Phase	Embedded Mitigation Measures	Frequency of Occurrence	Severity of Consequence	Significance of Risk	Additional Mitigation Measures	Residual Risk
	3b		ioning areas, guard vessels, DSLP approval, promulgation of information, marine coordination, marking on nautical charts, adherence to LMP and AtoNMP, NSPVMP, MPCP and ERCoP.	Remote	Serious	Tolerable with Mitigation		Tolerable with Mitigation and ALARP
	3c			Remote	Serious	Tolerable with Mitigation		Tolerable with Mitigation and ALARP
	4			Remote	Serious	Tolerable with Mitigation		Tolerable with Mitigation and ALARP
Vessel to Structure Allision Risk	1a	Construction	Application for safety zones, buoyed construction/decommissioning area, DSLP approval, marking on nautical charts, promulgation of information and adherence to LMP and AtoNMP, ERCoP and MPCP.	Extremely Unlikely	Moderate	Broadly Acceptable	N/A	Broadly Acceptable, not significant
		O&M		Remote	Moderate	Tolerable with Mitigation		Tolerable with Mitigation and ALARP
		Decommissioning		Extremely Unlikely	Moderate	Broadly Acceptable		Broadly Acceptable, not significant

Hazard	Scenario	Phase	Embedded Mitigation Measures	Frequency of Occurrence	Severity of Consequence	Significance of Risk	Additional Mitigation Measures	Residual Risk
	1b	Construction	Application for safety zones, buoyed construction/decommissioning area, DSLP approval, marking on nautical charts, promulgation of information and adherence to LMP and AtoNMP, ERCoP and MPCP.	Extremely Unlikely	Moderate	Broadly Acceptable	N/A	Broadly Acceptable, not significant
		O&M		Remote	Moderate	Tolerable with Mitigation		Tolerable with Mitigation and ALARP
		Decommissioning		Extremely Unlikely	Moderate	Broadly Acceptable		Broadly Acceptable, not significant
	2	Construction	Application for safety zones, buoyed construction/decommissioning area, DSLP approval, marking on nautical charts, promulgation of information and adherence to LMP and AtoNMP, ERCoP and MPCP.	Remote	Moderate	Tolerable with Mitigation	N/A	Tolerable with Mitigation and ALARP
		O&M		Remote	Moderate	Tolerable with Mitigation		Tolerable with Mitigation and ALARP
		Decommissioning		Remote	Moderate	Tolerable with Mitigation		Tolerable with Mitigation and ALARP

Hazard	Scenario	Phase	Embedded Mitigation Measures	Frequency of Occurrence	Severity of Consequence	Significance of Risk	Additional Mitigation Measures	Residual Risk
	3a	Cumulative	Application for safety zones, buoyed construction/decommissioning area, DSLP approval, marking on nautical charts, promulgation of information and adherence to LMP and AtoNMP, ERCoP and MPCP.	Remote	Moderate	Tolerable with Mitigation	N/A	Tolerable with Mitigation and ALARP
	3b			Remote	Moderate	Tolerable with Mitigation		Tolerable with Mitigation and ALARP
	3c			Remote	Moderate	Tolerable with Mitigation		Tolerable with Mitigation and ALARP
	4			Remote	Moderate	Tolerable with Mitigation		Tolerable with Mitigation and ALARP
Reduced Access to Local Ports and Harbours	1a	Construction	Clear buoyage of construction/decommissioning area, marine coordination of project vessels, marking on nautical charts,	Remote	Minor	Broadly Acceptable	N/A	Broadly Acceptable, not significant
		O&M		Remote	Minor	Broadly Acceptable		Broadly Acceptable, not significant

Hazard	Scenario	Phase	Embedded Mitigation Measures	Frequency of Occurrence	Severity of Consequence	Significance of Risk	Additional Mitigation Measures	Residual Risk
		Decommissioning	promulgation of information, adherence to LMP and AtoNMP and adherence to NSPVMP.	Remote	Minor	Broadly Acceptable		Broadly Acceptable, not significant
	1b	Construction	Clear buoyage of construction/decommissioning area, marine coordination of project vessels, marking on nautical charts, promulgation of information, adherence to LMP and AtoNMP and adherence to NSPVMP.	Remote	Minor	Broadly Acceptable	N/A	Broadly Acceptable, not significant
		O&M		Remote	Minor	Broadly Acceptable		Broadly Acceptable, not significant
		Decommissioning		Remote	Minor	Broadly Acceptable		Broadly Acceptable, not significant
	2	Construction	Clear buoyage of construction/decommissioning area, marine coordination of project vessels, marking on nautical charts,	Remote	Minor	Broadly Acceptable	N/A	Broadly Acceptable, not significant
		O&M		Remote	Minor	Broadly Acceptable		Broadly Acceptable, not significant

Hazard	Scenario	Phase	Embedded Mitigation Measures	Frequency of Occurrence	Severity of Consequence	Significance of Risk	Additional Mitigation Measures	Residual Risk
		Decommissioning	promulgation of information, adherence to LMP and AtoNMP and adherence to NSPVMP.	Remote	Minor	Broadly Acceptable		Broadly Acceptable, not significant
	3a	Cumulative	Clear buoyage of construction/decommissioning area, marine coordination of project vessels, marking on nautical charts, promulgation of information, adherence to LMP and AtoNMP and adherence to NSPVMP.	Reasonably Probable	Minor	Tolerable with Mitigation	N/A	Tolerable with Mitigation and ALARP
	3b			Reasonably Probable	Minor	Tolerable with Mitigation		Tolerable with Mitigation and ALARP
	3c			Reasonably Probable	Minor	Tolerable with Mitigation		Tolerable with Mitigation and ALARP
	4			Reasonably Probable	Minor	Tolerable with Mitigation		Tolerable with Mitigation and ALARP
Reduction of Under Keel Clearance	1a	O&M	Promulgation of information, marking of locations on nautical charts, adherence to MPCP and ERCoP.	Negligible	Minor	Broadly Acceptable	N/A	Broadly Acceptable, not significant

Hazard	Scenario	Phase	Embedded Mitigation Measures	Frequency of Occurrence	Severity of Consequence	Significance of Risk	Additional Mitigation Measures	Residual Risk
	1b	O&M	Promulgation of information, marking of locations on nautical charts, adherence to MPCP and ERCoP.	Negligible	Minor	Broadly Acceptable	N/A	Broadly Acceptable, not significant
	2	O&M	Promulgation of information, marking of locations on nautical charts, adherence to MPCP and ERCoP.	Negligible	Minor	Broadly Acceptable	N/A	Broadly Acceptable, not significant
Anchor and Fishing Gear Interaction with Subsea Cables	1a	O&M	Promulgation of information, marking on nautical charts, vessel compliance with MGN 654, adherence to a CBRA.	Extremely Unlikely	Moderate	Broadly Acceptable	N/A	Broadly acceptable, not significant
	1b	O&M	Promulgation of information, marking on nautical charts, vessel compliance with MGN 654, adherence to a CBRA.	Extremely Unlikely	Moderate	Broadly Acceptable	N/A	Broadly acceptable, not significant

Hazard	Scenario	Phase	Embedded Mitigation Measures	Frequency of Occurrence	Severity of Consequence	Significance of Risk	Additional Mitigation Measures	Residual Risk
	2	O&M	Promulgation of information, marking on nautical charts, vessel compliance with MGN 654 and adherence to a CBRA.	Extremely Unlikely	Moderate	Broadly Acceptable	N/A	Broadly acceptable, not significant
Reduction of SAR Capabilities	1a	O&M	SAR checklist, DSLP approval, promulgation of information, marking on appropriate charts, marine coordination of project vessels, compliance with MGN 654 and international marine regulations, adherence to LMP and AtoNMP, ERCoP, MPCP, NSPVMP.	Extremely Unlikely	Serious	Tolerable with Mitigation	N/A	Tolerable with Mitigation and ALARP
	1b	O&M	SAR checklist, DSLP approval, promulgation of information, marking on appropriate charts,	Extremely Unlikely	Serious	Tolerable with Mitigation	N/A	Tolerable with Mitigation and ALARP

Hazard	Scenario	Phase	Embedded Mitigation Measures	Frequency of Occurrence	Severity of Consequence	Significance of Risk	Additional Mitigation Measures	Residual Risk
			marine coordination of project vessels, compliance with MGN 654 and international marine regulations, adherence to LMP and AtoNMP, ERCoP, MPCP, NSPVMP.					
	2	O&M	SAR checklist, DSLP approval, promulgation of information, marking on appropriate charts, marine coordination of project vessels, compliance with MGN 654 and international marine regulations, adherence to LMP and AtoNMP, ERCoP, MPCP, NSPVMP.	Extremely Unlikely	Serious	Tolerable with Mitigation	N/A	Tolerable with Mitigation and ALARP

Hazard	Scenario	Phase	Embedded Mitigation Measures	Frequency of Occurrence	Severity of Consequence	Significance of Risk	Additional Mitigation Measures	Residual Risk
	3a	Cumulative	SAR checklist, DSLP approval, promulgation of information, marking on appropriate charts, marine coordination of project vessels, compliance with MGN 654 and international marine regulations, adherence to LMP and AtoNMP, ERCoP, MPCP, NSPVMP.	Remote	Serious	Tolerable with Mitigation	N/A	Tolerable with Mitigation and ALARP
	3b			Remote	Serious	Tolerable with Mitigation		Tolerable with Mitigation and ALARP
	3c			Remote	Serious	Tolerable with Mitigation		Tolerable with Mitigation and ALARP
	4			Remote	Serious	Tolerable with Mitigation		Tolerable with Mitigation and ALARP

25 Through life safety management

25.1.1.1 Quality, Health, Safety and Environment (QHSE) processes and documentation will be in place for Morven North and Morven South 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.

25.1.1.2 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.

25.2 Incident reporting

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

25.2.1.2 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.

25.2.1.3 All investigations shall be performed in a timely manner.

25.2.1.4 A database (lessons learnt) of 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.

25.2.1.5 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.

25.3 Review of documentation

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

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

- changes to the design of Morven North or Morven South, conditions of operation and prior to decommissioning;
- planned reviews;
- following an incident or exercise.

25.3.1.3 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.

25.4 Inspection of resources

25.4.1.1 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 aids to navigation to determine compliance with the performance standards specified by NLB.

25.5 Audit performance

25.5.1.1 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.

25.5.1.2 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.

25.6 Safety management system

25.6.1.1 The Applicant will manage the risk associated with the activities undertaken at Morven North and Morven South. An integrated Safety Management System (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 aids to navigation to ensure that if a light is faulty a quick fix can be instigated, which will allow IALA availability requirements to be met.

25.7 Cable monitoring

25.7.1.1 The subsea cables 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.

25.7.1.2 If exposed cables or ineffective protection measures are identified during post-construction monitoring, 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 employ additional temporary measures (such as a guard vessel or temporary buoyage) until such time as the risk was permanently mitigated.

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

25.8 Hydrographic surveys

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

25.9 Decommissioning plan

25.9.1.1 A Decommissioning Plan will be developed post consent. 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 Morven North and Morven South) 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.

26 Summary

26.1 Consultation

26.1.1.1 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;
- Ossian OWF;
- Bowdun OWF;
- Forth Ports;
- RYA;
- SFF;
- Rem Offshore.

26.2 Existing environment

26.2.1 Navigational features

26.2.1.1 Key navigational features in the area include a cluster of four buoys located approximately 6.8nm northwest of the Morven Site and within the Bowdun array area, deployed to measure MetOcean conditions. Four charted wrecks are located within the Morven North Boundary, with none in the Morven South Boundary. The operational Seagreen OWF is approximately 13.5nm to the west of the Morven Site, with Kincardine 23.2nm to the northwest. The closest port or harbour is Aberdeen, located approximately 34nm to the northwest of the Morven Site. Submarine exercise area X5641 and area X5641 are located approximately 24nm and 29nm southwest of the Morven North Boundary respectively.

26.2.2 Maritime incidents

26.2.2.1 From DfT SAR helicopter taskings data there was a single SAR helicopter tasking recorded between April 2015 and March 2024 within the Regional Shipping and Navigation Study Area. This was located within the Morven South Boundary and involved a search operation.

26.2.2.2 There were a total of seven recorded RNLI responses to five unique incidents within the Regional Shipping and Navigation Study Area from 2014 to 2023, corresponding to an average of one incident every two years. The most frequent incident type was machinery failure (two instances), with the majority of incidents involving recreational vessels (three instances). The Montrose RNLI station was used for four of the seven callouts. One incident was recorded within the Morven Site overall – a recreational vessel within the Morven North Boundary undergoing sail failure and responded to by the Montrose station.

26.2.2.3 There were a total of three unique incidents recorded by the MAIB within the Regional Shipping and Navigation Study Area from 2014 to 2023, corresponding to an average of one incident every three years. The most frequent incident type was accident to person with two counts, with the majority of incidents involving recreational vessels (two instances). No incidents were recorded within the Morven Site.

26.2.3 Vessel traffic movements

26.2.3.1 From the 28 days of vessel traffic survey data recorded in summer and winter 2024 within the Regional Shipping and Navigation Study Area, there was an average of 20 unique vessels per day recorded during the summer survey period, with an average of six unique vessels per day recorded within the Morven Site. During the winter survey period, an average of 13 unique vessels were recorded per day with an average of three to four unique vessels per day recorded within the Morven Site. Approximately 31% and 29% of vessel traffic intersected the Morven Site during the summer and winter periods, respectively. Traffic levels were greater in the Morven North Shipping and Navigation Study Area compared to the Morven South Shipping and Navigation Study Area, with an average of 15 unique vessels and eight to nine unique vessels per day recorded respectively throughout the survey periods.

26.2.3.2 The main vessel types within the Regional Shipping and Navigation Study Area during the summer survey period were cargo vessels (37%) and oil and gas vessels (27%). The main vessel types within the Regional Shipping and Navigation Study Area during the winter survey period were also cargo vessels (48%) and oil and gas vessels (29%). Vessel type distribution was largely similar within both the Morven North Shipping and Navigation Study Area and Morven South Shipping and Navigation Study Area, with cargo vessels and oil and gas vessels most prominent for both.

26.2.3.3 A total of 17 main commercial routes were identified from the vessel traffic data. The highest use main commercial route was between Aberdeen and the Catcher field, with an average of two and three unique vessels per day. A total of 16 main commercial routes were identified within the Morven North Shipping and Navigation Study Area, with ten routes noted within the Morven South Shipping and Navigation Study Area.

26.3 Future case vessel traffic

26.3.1.1 Of the 17 main routes identified within the Regional Shipping and Navigation Study Area, it is anticipated that seven will deviate as a result of the Morven Site. The largest percentage increase in terms of overall change in route length was to Route 17, with a 3.87% increase. The largest change on an absolute basis was also to Route 17, with a 5.53nm increase. Six of 16 main commercial routes would likely be required to deviate for Morven North in isolation, with this number being two of ten routes for Morven South.

26.4 Collision and allision risk modelling

26.4.1.1 The NRA process included quantitative modelling of the change in allision and collision frequency as a result of the Morven Site, with consideration given to future cases in terms of potential future traffic increases. These future case results are outlined in Sections 16.3.1, 0 and 16.3.3 for Scenarios 1a, 1b and 2 respectively.

26.4.1.2 It was estimated that the return period of a vessel being involved in a collision post wind farm for the Morven Site was one in 971 years assuming base case traffic levels. This represents an increase of an additional collision every 1,893 years compared to the pre wind farm base case result.

26.4.1.3 The powered allision return period post wind farm for the Morven Site was estimated at one in 343 years assuming base case traffic levels. The corresponding drifting allision return period post wind farm was estimated at one in 4,386 years. The fishing vessel allision return period was estimated at one in 277 years.

26.4.1.4 It was estimated that the return period of a vessel being involved in a collision post wind farm for Morven North was one in 1,421 years assuming base case traffic levels. This represents an increase of an additional collision every 3,606 years compared to the pre wind farm base case result.

26.4.1.5 The powered allision return period post wind farm for Morven North was estimated at one in 591 years assuming base case traffic levels. The corresponding drifting allision return period post wind farm was estimated at one in 6,526 years. The fishing vessel allision return period was estimated at one in 277 years.

26.4.1.6 It was estimated that the return period of a vessel being involved in a collision post wind farm for Morven South was one in 1,821 years assuming base case traffic levels. This represents an increase of an additional collision every 2,780 years compared to the pre wind farm base case result.

26.4.1.7 The powered allision return period post wind farm for Morven South was estimated at one in 707 years assuming base case traffic levels. The corresponding drifting allision return period post wind farm was estimated at one in 12,911 years. The fishing vessel allision return period was negligible.

26.5 Risk statement

26.5.1.1 Using the baseline data, quantitative modelling, expert opinion, outputs of the Hazard Workshop, and lessons learnt from existing offshore developments, shipping and navigation hazards have been identified and assessed in line with the FSA methodology for all of the relevant scenarios. These include each of Morven North and Morven South in isolation, the Morven Site, and cumulative scenarios featuring relevant future projects and plans. The full risk control log including details of hazards, mitigation measures, and significant of risk is presented in Section 23.4.1.4.

26.5.1.2 The significance of risk has been determined as either Broadly Acceptable or Tolerable with Mitigation for all shipping and navigation hazards assessed, assuming the embedded and additional mitigation identified is in place. Therefore, all risks highlighted have been assessed as ALARP.

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Appendix A Marine Guidance Note 654 checklist

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

27.1.1.2 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

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 Morven North Boundary, Morven South Boundary and Morven Site.
At least 28 days duration, within either 12 or 24 months prior to submission of the ES.	✓	**Section 5.3: Vessel Traffic Surveys** A total of 28 full days of vessel traffic survey data from June to July 2024 and from November to December 2024 has been assessed within the Regional Shipping and Navigation Study Areas.
Multiple data sources	✓	**Section 5.3: 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 5.3: Vessel Traffic Surveys** A total of 28 full days of vessel traffic survey data from June to July 2024 and from November to December 2024 has

Issue	Compliance	Reference and Notes
		been assessed within the Regional Shipping and Navigation Study Areas. **Section 5: Data Sources** Additional long term data sources including the long-term AIS data have also been considered.
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** The CA, RYA Scotland, SFF and the Scottish White Fish Production Association were invited to provide feedback through the Hazard Workshop.
Port and navigation authorities consultation, as appropriate	✓	**Section 4: Consultation** Local ports including Forth Ports, the Port of Aberdeen, Montrose Port, Arbroath Port, Peterhead Port, the Major Ports Group and the British Ports Association were invited to provide feedback 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 Morven North Boundary, Morven South Boundary and Morven Site has been analysed.
ii. Numbers, types and sizes of vessels presently using such areas.	✓	**Section 10: Vessel Traffic Movements** Vessel traffic data in proximity to the Morven North Boundary, Morven South Boundary and Morven Site 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 Morven North Boundary, Morven South Boundary and Morven Site. **Section 10: Vessel Traffic Movements** Non-transit users were identified in the vessel traffic survey data and included fishing vessels engaged in fishing activities.
iv. Whether these areas contain transit routes used by coastal or deep-draught or	✓	**Section 11: Base Case Vessel Routeing** Main routes have been identified using the principles set out in MGN 654 in proximity to the Morven North

Issue	Compliance	Reference and Notes
international scheduled vessels on passage.		Boundary, Morven South Boundary and Morven Site, 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** There are no IMO routeing measures in proximity to the Morven North Boundary, Morven South Boundary and Morven Site.
vi. Whether the nearby area contains prescribed routeing schemes or precautionary areas.	✓	**Section 7: Navigational Features** There are no such areas in proximity to the Morven North Boundary, Morven South Boundary and Morven Site.
vii. Proximity of the site to areas used for anchorage (charted or uncharted), safe haven, port approaches and pilot boarding or landing areas.	✓	**Section 7: Navigational Features** Section 7.5 identifies nearby ports and harbours, noting that the Morven North Boundary, Morven South Boundary and Morven Site are located well offshore. There are no anchorage areas or port related features in proximity.
viii. Whether the site lies within the jurisdiction of a port and/or navigation authority.	✓	**Section 7: Navigational Features** Section 7.5 identifies nearby ports and harbours. The Morven North Boundary, Morven South Boundary and Morven Site do 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 and in proximity to the Morven North Boundary, Morven South Boundary and Morven Site.
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 practice and exercise areas in proximity to Morven North and Morven South.
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 7.3 identifies charted wrecks in proximity to Morven North and Morven South. **Section 14: Cumulative and Transboundary Overview** Planned submarine cables are identified in Section 14.1.
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** Baseline OREIs are considered in Section 7.4. **Section 14: Cumulative and Transboundary Overview** Planned nearby OREIs presented are shown in Section 14.1 based on a 50nm buffer of the Morven Site.

Issue	Compliance	Reference and Notes
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 in proximity to Morven North and Morven South.
xiv. Proximity of the site to aids to navigation and/or VTS in or adjacent to the area and any impact thereon.	✓	**Section 7: Navigational Features** Section 7.1.1.2 identifies aids to navigation in proximity to Morven North and Morven South.
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 and allision risk modelling has been undertaken for Morven North and Morven South.
xvi. With reference to xv. above, the number and type of incidents to vessels which have taken place in or near to the proposed site of the OREI to assess the likelihood of such events in the future and the potential impact of such a situation.	✓	**Section 9: Emergency Response and Incident Overview** Historical vessel incident data published by the MAIB (Section 9.6), RNLI (Section 9.3) and DfT (Section 9.2) in proximity to the Morven North Boundary, Morven South Boundary and Morven Site has been considered alongside historical OWF incidents throughout the UK (Section 9.7).
xvii. Proximity of the site to areas used for recreation which depend on specific features of the area.	✓	**Section 10: Vessel Traffic Movements** Non-transit users were identified in the vessel traffic survey data and included limited recreational activity.
Predicted effect of OREI on traffic and interactive boundaries. Where appropriate, the following should be determined:		
a. The safe distance between a shipping route and OREI boundaries.	✓	**Section 15: Future Case Vessel Traffic** A methodology for post wind farm routeing is outlined and includes a minimum mean distance of 1nm from OREIs.
b. The width of a corridor between sites or OREIs to allow safe passage of shipping.	✓	**Section 4: Consultation** Consultation with key stakeholders including the MCA, NLB and UK Chamber of Shipping has confirmed that the gap formed by the sea space between the Morven Site and Ossian is unlikely to be used for navigation. **Section 15: Future Case Vessel Traffic** Post wind farm routeing takes account of the distances between cumulative OREIs when identifying optionality.

Issue	Compliance	Reference and Notes
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 Morven North Boundary, Morven South Boundary and Morven Site. **Section 18 to 20: Risk Assessment** The impact of Morven North and Morven South on emergency response capability has been assessed for each phase.
b. Clearances of fixed or floating wind turbine blades above the sea surface are not less than 22m (above Mean High Water Springs (MHWS) for fixed). Floating wind turbines allow for degrees of motion.	✓	**Section 6: Project Description Relevant to Shipping and Navigation** The minimum blade tip height above LAT is 34m and included in the MDS.
c. Underwater devices: i. Changes to charted depth; ii. Maximum height above seabed; iii. Under keel clearance.	✓	**Section 6: Project Description Relevant to Shipping and Navigation** Inter-array and interconnector cable specifications are included in the MDS for cables.
d. Whether structure block or hinder the view of other vessels or other navigational features.	✓	**Section 18 to 20: Risk Assessment** The hazards due to Morven North and Morven South have been assessed for each phase and include consideration of the potential for vessels navigating in proximity to structures to be visually obscured.

Issue	Compliance	Reference and Notes
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 6.2: Morven Site** The range of water depths within the Morven Site is provided. **Section 8: Meteorological Ocean Data** Various states of the tide local to Morven North and Morven South are provided. **Section 10: Vessel Traffic Movements** Vessel traffic data in proximity to Morven North and Morven South has been analysed. **Section 16: Collision and Allision Risk Modelling** Collision and allision risk models take into account tidal conditions.
b. The set and rate of the tidal stream, at any state of the tide, has a significant effect on vessels in the area of the OREI site.	✓	**Section 8: Meteorological Ocean Data** Various states of the tide local to Morven North and Morven South are provided. **Section 16: Collision and Allision Risk Modelling** Collision and allision risk models take into account tidal conditions.
c. The maximum rate tidal stream runs parallel to the major axis of the proposed site layout and, if so, its effect.	✓	
d. The set is across the major axis of the layout at any time and, if so, at what rate.	✓	
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 Morven North and Morven South are provided and it is noted that hazards are not anticipated. **Section 16: Collision and Allision Risk Modelling** The drifting allision risk model takes into account tidal conditions and assesses whether machinery failure could cause vessels to be set into danger.
f. The structures themselves could cause changes in the set and rate of the tidal stream.	✓	**Section 8: Meteorological Ocean Data** Provides meteorological data in proximity to Morven North and Morven South 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	✓	**Section 8: Meteorological Ocean Data** Provides meteorological data in proximity to Morven North and Morven South relating to various states of the tide.

Issue	Compliance	Reference and Notes
depths in the wind farm area or adjacent to the area.		**Section 18 to 20: Risk Assessment** The impact of Morven North and Morven South on under-keel clearance has been assessed.
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 Morven North and Morven South is provided. **Section 10: Vessel Traffic Movements** Vessel traffic data in proximity to the Morven North Boundary, Morven South Boundary and Morven Site has been analysed including recreational vessels. **Section 12: Adverse Weather Vessel Traffic Movements** Alternative routeing used by Regular Operators during periods of adverse weather have been identified.
i. The structures could create problems in the area for vessels under sail, such as wind masking, turbulence or sheer.	✓	**Section 18 to 20: Risk Assessment** The hazards due to Morven North and Morven South 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 takes into account weather and tidal conditions and assesses whether machinery failure could cause vessels to be set into danger.
Assessment of access to and navigation within, or close to, an OREI. To determine the extent to which navigation would be feasible within the OREI site itself by assessing whether:		
a. Navigation within or close to the site would be safe:		
i. For all vessels.	✓	**Section 4: Consultation** Section 4.1 outlines Regular Operator consultation undertaken based on the findings of 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 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.	✓	

Issue	Compliance	Reference and Notes
ii. In respect of specific activities.	✓	**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 Morven North Boundary, Morven South Boundary and Morven Site and includes use of post wind farm routeing which assumes commercial vessel traffic avoids the respective arrays. **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.
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 Morven North Boundary, Morven South Boundary and Morven Site and includes use of post wind farm routeing which assumes commercial vessel traffic avoids the respective arrays. **Section 18 to 20: Risk Assessment** The impact of Morven North and Morven South on emergency response capability has been assessed for each phase.
d. Guidance on the calculation of safe distance of OREI boundaries from shipping routes has been considered.	✓	**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 Annex 1 of MGN 654 (see Section 15.5.1).
SAR, maritime assistance service, counter pollution and salvage incident response.		
The MCA, through HMCG, 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: Embedded 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*	✓	**Section 17: Embedded 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.

Issue	Compliance	Reference and Notes
Considerations for Search and Rescue and Emergency Response (MCA, 2021) for the design, equipment and operation requirements will be followed.		
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: Embedded 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: Embedded Mitigation Measures** Embedded mitigation measures have been proposed and are summarised in Section 17 including compliance with MGN 654, which requires the specified hydrographic surveys to be completed.
ii. On a pre-established periodicity during the life of the development.	✓	
iii. Post construction: Cable route(s).	✓	
iv. Post decommissioning of all or part of the development: the installed generating assets area and cable route.	✓	
Communications, Radar and positioning systems. To provide researched opinion of a generic and, where appropriate, site specific nature concerning whether:		
a. The structures could produce radio interference such as shadowing, reflections or phase changes and emissions with respect to any frequencies used for marine positioning, navigation and timing (PNT) or communications, including GMDSS and AIS, whether ship borne ashore or fitted to any of the proposed structures, to:		
i. Vessels operating at a safe navigational distance.	✓	**Section 13: Navigation, Communication and Position Fixing Equipment** 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.	✓	

Issue	Compliance	Reference and Notes
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. Radar beacons (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 13.9 assesses the potential risk of SONAR interference due to Morven North and Morven South.
d. The site might produce acoustic noise which could mask prescribed sound signals.	✓	**Section 13: Navigation, Communication and Position Fixing Equipment** Section 13.10 assesses the potential risk of noise due to Morven North and Morven South.
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 13.7 assesses the potential risk of electromagnetic interference due to Morven North and Morven South.
Risk mitigation measures recommended for OREI during construction, operation and decommissioning.		
Mitigation and safety measures will be applied to the OREI development appropriate to the level and type of risk determined during the EIA. The specific measures to be employed will be selected in consultation with the MCA and will be listed in the developer's Environmental Impact Assessment Report (EIAR). 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: Embedded 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: Embedded 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	✓	**Section 17: Embedded Mitigation Measures** Embedded mitigation measures have been proposed and are summarised in Section 17 including use of safety zones.

Issue	Compliance	Reference and Notes
application to specified vessels[8].		
iv. Designation of the site as an Area to be Avoided (ATBA)	✓	**Section 6: Project Description Relevant to Shipping and Navigation** It is not planned to designate the Morven North Boundary, Morven South Boundary and Morven Site as an ATBA (see Section 6).
v. Provision of aids to navigation as determined by the GLA.	✓	**Section 17: Embedded Mitigation Measures** Embedded mitigation measures have been proposed and are summarised in Section 17 including the provision of aids to navigation 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 Morven North and Morven South.
vii. Monitoring by Radar, AIS, Closed Circuit Television (CCTV) or other agreed means.	✓	**Section 17: Embedded 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.
ix. Creation of an ERCoP with the MCA's SAR branch for the construction phase onwards.	✓	**Section 17: Embedded 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: Embedded Mitigation Measures** Embedded mitigation measures have been proposed and are summarised in Section 17 including the use of guard vessels where appropriate.
xi. Update NRAs every two years, e.g. at testing sites.	✓	Not applicable to Morven North and Morven South.
xii. Device-specific or array-specific NRAs.	✓	**Section 18 to 20: Risk Assessment** A risk assessment has been undertaken for each of the Morven North Boundary, Morven South Boundary and Morven Site.
xiii. Design of OREI structures to minimise risk to contacting vessels or craft.	✓	**Section 6: Project Description Relevant to Shipping and Navigation** The minimum blade tip height above LAT is 34m and included in the MDS.

[8] 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
xiv. Any other measures and procedures considered appropriate in consultation with other stakeholders.	✓	**Section 17: Embedded Mitigation Measures** Embedded mitigation measures have been proposed and are summarised in Section 17.

Table A.2 Marine Guidance Note 654 Annex 1 checklist

Item	Compliance	Comments
A risk claim is included that is supported by a reasoned argument and evidence.	✓	**Section 18 to 20: Risk Assessment** The risk assessment provides a risk claim for a range of hazards based on a number of inputs including baseline data, expert opinion, stakeholder concerns and lessons learnt from existing offshore developments.
Description of the marine environment.	✓	**Section 7: Navigational Features** Navigational features in proximity to the Morven North Boundary, Morven South Boundary and Morven Site have been described including (but not limited to) other OWF developments, key aids to navigation and charted wrecks. **Section 14: Cumulative and Transboundary 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 Morven Site. Developments screened include other OWFs and sub-sea cables.
SAR overview and assessment.	✓	**Section 9: Emergency Response and Incident Overview** Existing SAR resources in proximity to the Morven North Boundary, Morven South Boundary and Morven Site 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 Relevant to Shipping and Navigation** The maximum extent of Morven North and Morven South for which any shipping and navigation hazards are assessed is provided including a description of associated infrastructure, construction phase programme and indicative vessel and helicopter numbers during the construction and O&M phases. The future marine environment post-wind farm is addressed in relation to decommissioning activities.

Item	Compliance	Comments
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 Morven North and Morven South 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 Morven North and Morven South 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.
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 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 presence of the Morven North Boundary, Morven South Boundary and Morven Site with the results outlined numerically and graphically, where appropriate.
Risk control log	✓	**Section 23.4.1.4: 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

27.1.1.3 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	Phase (C/O/D)	Embedded Mitigation Measures	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			
Displacement from Routeing																					
Commercial vessels	C/D	• Buoyed construction/ decommissioning area. • Marking of all offshore infrastructure on Admiralty charts. • Compliance with MGN 654 and its annexes. • Appropriate promulgation of information.	• Presence of buoyed construction/ decommissioning areas for Morven and cumulative wind farms. • Construction/ decommissioning vessels which are RAM. • Adverse weather.	Displacement with manageable effects on schedules.	5	1	2	1	1	1.3	Tolerable with Mitigation	Displacement with effects on schedule, including due to cumulative developments.	5	1	3	1	3	2.0	Tolerable with Mitigation		Relevant cumulative developments include Ossian, Bowdun, Bellrock, Berwick Bank, Salamander and Flora. The MCA confirmed that, based on discussions with the Morven and Ossian projects, commercial vessels will likely deviate either east or west of Morven and Ossian, rather than using the gap between the two.
	O	• Marking of all offshore infrastructure on Admiralty charts. • Compliance with MGN 654 and its annexes. • Appropriate promulgation of information.	• Presence of surface structures for Morven and cumulative wind farms. • Maintenance vessels which are RAM. • Adverse weather.		5	1	2	1	1	1.3	Tolerable with Mitigation		5	1	3	1	3	2.0	Tolerable with Mitigation		
Commercial fishing vessels in transit	C/D	• Buoyed construction/ decommissioning area. • Marking of all offshore infrastructure on Admiralty charts. • Compliance with MGN 654 and its annexes. • Appropriate promulgation of information.	• Presence of buoyed construction/ decommissioning areas for Morven and cumulative wind farms. • Construction/ decommissioning vessels which are RAM. • Adverse weather.	Displacement with manageable effects on routine.	5	1	1	1	1	1.0	Tolerable with Mitigation	Displacement with effects on routine, including due to cumulative developments.	5	1	1	1	2	1.3	Tolerable with Mitigation		Relevant cumulative developments include Ossian, Bowdun, Bellrock, Berwick Bank, Salamander and Flora.

User	Phase (C/O/D)	Embedded Mitigation Measures	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)	O	• Marking of all offshore infrastructure on Admiralty charts. • Compliance with MGN 654 and its annexes. • Appropriate promulgation of information.	• Presence of surface structures for Morven and cumulative wind farms. • Maintenance vessels which are RAM. • Adverse weather.	Displacement with manageable effects on routine.	5	1	1	1	1	1.0	Tolerable with Mitigation	Displacement with effects on routine, including due to cumulative developments.	5	1	1	1	2	1.3	Tolerable with Mitigation		Relevant cumulative developments include Ossian, Bowdun, Bellrock, Berwick Bank, Salamander and Flora. RYA Scotland noted that recreational vessels on longer transits will be more likely to passage plan to deviate around the Morven Array.
	C/D	• Buoyed construction/ decommissioning area. • Marking of all offshore infrastructure on Admiralty charts. • Compliance with MGN 654 and its annexes. • Appropriate promulgation of information.	• Presence of buoyed construction/ decommissioning areas for Morven and cumulative wind farms. • Construction/ decommissioning vessels which are RAM. • Adverse weather.		4	1	1	1	1	1.0	Broadly Acceptable		4	1	1	1	1	1.0	Broadly Acceptable		
	O	• Marking of all offshore infrastructure on Admiralty charts. • Compliance with MGN 654 and its annexes. • Appropriate promulgation of information.	• Presence of surface structures for Morven and cumulative wind farms. • Maintenance vessels which are RAM. • Adverse weather.		4	1	1	1	1	1.0	Broadly Acceptable		4	1	1	1	1	1.0	Broadly Acceptable		
Increased Vessel to Vessel Collision Risk (Third-Party Vessels)																					
Commercial vessels	C/D	• Application for safety zones. • Buoyed construction/ decommissioning area. • Marking of all offshore infrastructure on Admiralty charts. • Compliance with	• Presence of buoyed construction/ decommissioning areas for Morven and cumulative wind farms. • Adverse weather. • Construction/ decommissioning	Displacement results in increased encounters and potential for low impact	3	2	2	3	3	2.5	Broadly Acceptable	Displacement results in increased encounters and high impact collision occurs involving vessel damage, PLL	2	4	4	4	4	4.0	Tolerable with Mitigation		NLB recommended that Eastern Green Link 3 be considered a cumulative development, as it runs between Morven and Ossian.

User	Phase (C/O/D)	Embedded Mitigation Measures	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			
		MGN 654 and its annexes. • Guard vessels as required under risk assessment. • Creation of and adherence to, a MPCP. • Appropriate promulgation of information.	vessels which are RAM. • Reduction of navigable sea room. • Vessels involved in Eastern Green Link 3.	collision to occur.								and/or pollution.									
	O	• Application for safety zones. • Marking of all offshore infrastructure on Admiralty charts. • Compliance with MGN 654 and its annexes. • Guard vessels as required under risk assessment. • Creation of and adherence to, a MPCP). • Appropriate promulgation of information.	• Presence of surface structures for Morven and cumulative wind farms. • Adverse weather. • Construction/ decommissioning vessels which are RAM. • Reduction of navigable sea room. • Vessels involved in Eastern Green Link 3.		3	2	2	3	3	2.5	Broadly Acceptable		2	4	4	4	4	4.0	Tolerable with Mitigation		
Commercial fishing vessels in transit	C/D	• Application for safety zones. • Buoyed construction/ decommissioning area. • Marking of all offshore infrastructure on Admiralty charts. • Compliance with MGN 654 and its annexes.	• Presence of buoyed construction/ decommissioning area for Morven and cumulative wind farms. • Adverse weather. • Construction/ decommissioning vessels which are RAM. • Reduction of	Displacement results in increased encounters and potential for low impact collision to occur.	2	3	2	3	2	2.5	Broadly Acceptable	Displacement results in increased encounters and high impact collision occurs involving vessel damage, PLL	1	5	3	5	3	4.0	Broadly Acceptable		NLB recommended that Eastern Green Link 3 be considered a cumulative development, as it runs between Morven and Ossian.

User	Phase (C/O/D)	Embedded Mitigation Measures	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			
		• Guard vessels as required under risk assessment. • Creation of and adherence to, a MPCP. • Appropriate promulgation of information.	navigable sea room. • Vessels involved in Eastern Green Link 3.									and/or pollution.									
	O	• Application for safety zones. • Marking of all offshore infrastructure on Admiralty charts. • Compliance with MGN 654 and its annexes. • Guard vessels as required under risk assessment. • Creation of and adherence to, a MPCP. • Appropriate promulgation of information.	• Presence of surface structures for Morven and cumulative wind farms. • Adverse weather. • Construction/ decommissioning vessels which are RAM. • Reduction of navigable sea room. • Vessels involved in Eastern Green Link 3.		2	3	2	3	2	2.5	Broadly Acceptable		1	5	3	5	3	4.0	Broadly Acceptable		
Recreational vessels (2.5 to 24m length)	C/D	• Application for safety zones. • Buoyed construction/ decommissioning area. • Marking of all offshore infrastructure on Admiralty charts. • Compliance with MGN 654 and its annexes. • Guard vessels as required under risk assessment. • Creation of and adherence to, a MPCP. • Appropriate	• Presence of buoyed construction/ decommissioning area for Morven and cumulative wind farms. • Adverse weather. • Construction/ decommissioning vessels which are RAM. • Reduction of navigable sea room. • Vessels involved in Eastern Green Link 3.	Displacement results in increased encounters and potential for low impact collision to occur.	2	3	1	3	1	2.0	Broadly Acceptable	Displacement results in increased encounters and high impact collision occurs involving vessel damage, PLL and/or pollution.	1	5	2	5	1	3.3	Broadly Acceptable		NLB recommended that Eastern Green Link 3 be considered a cumulative development, as it runs between Morven and Ossian.

User	Phase (C/O/D)	Embedded Mitigation Measures	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			
		promulgation of information.																			
	O	• Application for safety zones. • Marking of all offshore infrastructure on Admiralty charts. • Compliance with MGN 654 and its annexes. • Guard vessels as required under risk assessment. • Creation of and adherence to, a MPCP. • Appropriate promulgation of information.	• Presence of surface structures for Morven and cumulative wind farms. • Adverse weather. • Construction/ decommissioning vessels which are RAM. • Reduction of navigable sea room. • Vessels involved in Eastern Green Link 3.		2	3	1	3	1	2.0	Broadly Acceptable		1	5	2	5	1	3.3	Broadly Acceptable		
Increased Vessel to Vessel Collision Risk (Third-Party Vessel to Project Vessel)																					
Commercial vessels	C/D	• Application for safety zones. • Marking of all offshore infrastructure on Admiralty charts. • Guard vessels as required under risk assessment. • Marine coordination and communication to manage Project vessel movements. • Creation of and adherence to, an MPCP.	• Project vessels (Morven and cumulative wind farms) in transit. • Vessels involved in Eastern Green Link 3. • Lack of third-party awareness of ongoing works.	Increased encounters resulting in increased alertness but no safety risks.	3	2	2	3	3	2.5	Broadly Acceptable	Collision event occurs involving vessel damage, injury to person and/or pollution.	2	4	4	4	4	4.0	Tolerable with Mitigation		NLB recommended that Eastern Green Link 3 be considered a cumulative development, as it runs between Morven and Ossian. SFF noted that the cumulative presence of wind farms will lead to wind farm-related traffic increases.

User	Phase (C/O/D)	Embedded Mitigation Measures	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 of project vessels with international marine regulations as adopted by the Flag State. • Appropriate promulgation of information.			2	2	2	3	3	2.5	Broadly Acceptable		1	4	4	4	4	4.0	Broadly Acceptable		
Commercial fishing vessels in transit	C/D	• Application for safety zones. • Marking of all offshore infrastructure on Admiralty charts. • Guard vessels as required under risk assessment. • Marine coordination and communication to manage Project vessel movements. • Creation of and adherence to, a MPCP. • Compliance of project vessels with international marine regulations as adopted by the Flag State. • Appropriate promulgation of information.	• Project vessels (Morven and cumulative wind farms) in transit. • Vessels involved in Eastern Green Link 3. • Lack of third-party awareness of ongoing works.	Increased encounters resulting in increased alertness but no safety risks.	2	3	2	3	2	2.5	Broadly Acceptable	Collision event occurs involving vessel damage, injury to person and/or pollution.	1	5	3	5	3	4.0	Broadly Acceptable		NLB recommended that Eastern Green Link 3 be considered a cumulative development, as it runs between Morven and Ossian. SFF noted that the cumulative presence of wind farms will lead to wind farm-related traffic increases.
	O				1	3	2	3	2	2.5	Broadly Acceptable		1	5	3	5	3	4.0	Broadly Acceptable		

User	Phase (C/O/D)	Embedded Mitigation Measures	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)	C/D	• Application for safety zones. • Marking of all offshore infrastructure on Admiralty charts. • Guard vessels as required under risk assessment. • Marine coordination and communication to manage Project vessel movements. • Creation of and adherence to, a MPCP. • Compliance of project vessels with international marine regulations as adopted by the Flag State. • Appropriate promulgation of information.	• Project vessels (Morven and cumulative wind farms) in transit. • Vessels involved in Eastern Green Link 3. • Lack of third-party awareness of ongoing works.	Increased encounters resulting in increased alertness but no safety risks.	1	3	1	3	1	2.0	Broadly Acceptable	Collision event occurs involving vessel damage, injury to person and/or pollution.	1	5	2	5	1	3.3	Broadly Acceptable		NLB recommended that Eastern Green Link 3 be considered a cumulative development, as it runs between Morven and Ossian. SFF noted that the cumulative presence of wind farms will lead to wind farm-related traffic increases.
	O				1	3	1	3	1	2.0	Broadly Acceptable		1	5	2	5	1	3.3	Broadly Acceptable		
Vessel to Structure Allision Risk																					
Commercial vessels	C/D	• Application for safety zones. • Marking of all offshore infrastructure on Admiralty charts. • Compliance with MGN 654 and its annexes. • Marking and lighting of the site in agreement with NLB and in line with IALA O139/G1162. • Marine coordination and communication to manage Project vessel movements. • Creation of and	• Presence of partially commissioned surface structures for Morven and cumulative wind farms. • Human/ navigation error. • Mechanical/ technical failure. • Adverse weather. • Aid to navigation failure.	Vessel passes in close proximity resulting in a need to make a late adjustment to course/speed.	4	1	1	1	1	1.0	Broadly Acceptable	Allision event occurs involving vessel damage, injury to person and/or pollution.	3	3	3	3	3	3.0	Tolerable with Mitigation		

User	Phase (C/O/D)	Embedded Mitigation Measures	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			
		adherence to, an MPCP. • Appropriate promulgation of information. • Development of and adherence to, a DSLP.																			
	O	• Marking of all offshore infrastructure on Admiralty charts. • Compliance with MGN 654 and its annexes. • Marking and lighting of the site in agreement with NLB and in line with IALA O139/G1162. • Marine coordination and communication to manage Project vessel movements. • Creation of and adherence to, an MPCP. • Appropriate promulgation of information. • Development of and adherence to, a DSLP.	• Presence of surface structures for Morven and cumulative wind farms. • Human/ navigation error. • Mechanical/ technical failure. • Adverse weather. • Aid to navigation failure.		4	1	1	1	1	1.0	Broadly Acceptable		3	3	3	3	3	3.0	Tolerable with Mitigation		

User	Phase (C/O/D)	Embedded Mitigation Measures	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	C/D	• Application for safety zones. • Marking of all offshore infrastructure on Admiralty charts. • Compliance with MGN 654 and its annexes. • Marking and lighting of the site in agreement with NLB and in line with IALA O139/G1162. • Marine coordination and communication to manage Project vessel movements. • Creation of and adherence to, an MPCP. • Appropriate promulgation of information. • Development of and adherence to, a DSLP.	• Presence of partially commissioned surface structures for Morven and cumulative wind farms. • Human/ navigation error. • Mechanical/ technical failure. • Adverse weather. • Aid to navigation failure.	Vessel passes in close proximity resulting in a need to make a late adjustment to course/speed.	4	1	1	1	1	1.0	Broadly Acceptable	Allision event occurs involving vessel damage, injury to person and/or pollution.	3	4	2	4	2	3.0	Tolerable with Mitigation		SFF noted that active fishing currently takes place within the Morven Array.
	O	• Marking of all offshore infrastructure on Admiralty charts. • Compliance with MGN 654 and its annexes. • Marking and lighting of the site in agreement with NLB and in line with IALA O139/G1162. • Marine coordination and communication to manage Project vessel movements. • Creation of and adherence to, an MPCP.	• Presence of surface structures for Morven and cumulative wind farms. • Human/ navigation error. • Mechanical/ technical failure. • Adverse weather. • Aid to navigation failure.		4	1	1	1	1	1.0	Broadly Acceptable		3	4	2	4	2	3.0	Tolerable with Mitigation		

User	Phase (C/O/D)	Embedded Mitigation Measures	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			
		• Appropriate promulgation of information. • Development of and adherence to, a DSLP.																			
Recreational vessels (2.5 to 24m length)	C/D	• Application for safety zones. • Marking of all offshore infrastructure on Admiralty charts. • Compliance with MGN 654 and its annexes. • Marking and lighting of the site in agreement with NLB and in line with IALA O139/G1162. • Marine coordination and communication to manage Project vessel movements. • Creation of and adherence to, an MPCP. • Appropriate promulgation of information. • Development of and adherence to, a DSLP.	• Presence of partially commissioned surface structures for Morven and cumulative wind farms. • Human/ navigation error. • Mechanical/ technical failure. • Adverse weather. • Aid to navigation failure.	Vessel passes in close proximity resulting in a need to make a late adjustment to course/speed.	3	1	1	1	1	1.0	Broadly Acceptable	Allision event occurs involving vessel damage, injury to person and/or pollution.	2	4	2	2	1	2.3	Broadly Acceptable		

User	Phase (C/O/D)	Embedded Mitigation Measures	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	• Marking of all offshore infrastructure on Admiralty charts. • Compliance with MGN 654 and its annexes. • Marking and lighting of the site in agreement with NLB and in line with IALA O139/G1162. • Marine coordination and communication to manage Project vessel movements. • Creation of and adherence to, an MPCP. • Appropriate promulgation of information. • Development of and adherence to, a DSLP.	• Presence of surface structures for Morven and cumulative wind farms. • Human/ navigation error. • Mechanical/ technical failure. • Adverse weather. • Aid to navigation failure.		3	1	1	1	1	1.0	Broadly Acceptable		2	4	2	2	1	2.3	Broadly Acceptable		
Reduced Access to Local Ports and Harbours																					
Commercial vessels	C/D	• Compliance with MGN 654 and its annexes. • Marine coordination and communication to manage Project vessel movements. • Appropriate	• Adverse weather. • Construction/ decommissioning vessels for Morven and cumulative wind farms located in close proximity to local ports and harbours. • Shared construction/ decommissioning ports	Limited disruption to port schedule.	2	1	1	1	2	1.3	Broadly Acceptable	Disruption with effects on port schedule.	1	1	1	1	3	1.5	Broadly Acceptable		

User	Phase (C/O/D)	Embedded Mitigation Measures	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			
		promulgation of information.	for Morven and cumulative wind farms.																		
	O		• Adverse weather. • Maintenance vessels for Morven and cumulative wind farms located in close proximity to local ports and harbours. • Shared maintenance ports for Morven and cumulative wind farms.		2	1	1	1	2	1.3	Broadly Acceptable		1	1	1	1	3	1.5	Broadly Acceptable		
Commercial fishing vessels in transit	C/D	• Compliance with MGN 654 and its annexes. • Marine coordination and communication to manage Project vessel movements. • Appropriate promulgation of information.	• Adverse weather. • Construction/ decommissioning vessels for Morven and cumulative wind farms located in close proximity to local ports and harbours. • Shared construction/ decommissioning ports for Morven and cumulative wind farms.	Limited disruption to port schedule.	1	1	1	1	2	1.3	Broadly Acceptable	Disruption with effects on port schedule.	1	1	1	1	2	1.3	Broadly Acceptable		

User	Phase (C/O/D)	Embedded Mitigation Measures	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)	O	• Compliance with MGN 654 and its annexes. • Marine coordination and communication to manage Project vessel movements. • Appropriate promulgation of information.	• Adverse weather. • Maintenance vessels for Morven and cumulative wind farms located in close proximity to local ports and harbours. • Shared maintenance ports for Morven and cumulative wind farms.	Limited disruption to port schedule.	1	1	1	1	2	1.3	Broadly Acceptable	Disruption with effects on port schedule.	1	1	1	1	2	1.3	Broadly Acceptable		
	C/D		• Adverse weather. • Construction/ decommissioning vessels for Morven and cumulative wind farms located in close proximity to local ports and harbours. • Shared construction/ decommissioning ports for Morven and cumulative wind farms.		1	1	1	1	1	1.0	Broadly Acceptable		1	1	1	1	1	1.0	Broadly Acceptable		
	O		• Adverse weather. • Maintenance vessels for Morven and cumulative wind farms located in close proximity to local ports and harbours. • Shared maintenance ports for Morven and cumulative wind farms.		1	1	1	1	1	1.0	Broadly Acceptable		1	1	1	1	1	1.0	Broadly Acceptable		
Reduction of Under-Keel Clearance																					

User	Phase (C/O/D)	Embedded Mitigation Measures	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			
Fishing and recreational vessels	O	• Implementation and monitoring of cable protection. • Compliance with MGN 654 and its annexes. • Creation of and adherence to, an MPCP. • Guard vessels as required under risk assessment.	• Reduced depth due to cable protection associated with inter-array cables.	Vessel transits over an area of reduced under keel clearance but no contact occurs.	3	1	1	1	1	1.0	Broadly Acceptable	Grounding on cable protection resulting in vessel damage and pollution.	1	1	3	3	4	2.8	Broadly Acceptable		It is assumed that commercial vessels will not navigate internally within the Array.
Navigational Safety Concerns Related to Anchor and Fishing Gear Snagging																					
Commercial vessels	O	• Implementation and monitoring of cable protection. • Marking of all offshore infrastructure on Admiralty charts. • Compliance with MGN 654 and its annexes. • Appropriate promulgation of information.	• Presence of subsea cables associated with Morven and Eastern Green Link 3. • Human/ navigation error. • Mechanical/ technical failure. • Adverse weather.	Vessel anchors on or drags anchor over a cable/ protection but no interaction occurs.	1	1	1	1	1	1.0	Broadly Acceptable	Vessel anchors on or drags anchor over a cable/ protection resulting in damage to the cable/ protection and/or anchor.	1	1	1	2	2	1.5	Broadly Acceptable		NLB recommended that Eastern Green Link 3 be considered a cumulative development, as it runs between Morven and Ossian.

User	Phase (C/O/D)	Embedded Mitigation Measures	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	O	• Implementation and monitoring of cable protection. • Marking of all offshore infrastructure on Admiralty charts. • Compliance with MGN 654 and its annexes. • Appropriate promulgation of information.	• Presence of subsea cables associated with Morven and Eastern Green Link 3. • Human/ navigation error. • Mechanical/ technical failure. • Adverse weather.	Vessel anchors on or drags anchor/ fishing gear over a cable/protection but no interaction occurs.	2	2	1	1	3	1.8	Broadly Acceptable	Vessel anchors on, drags anchor over, or drags fishing gear over a cable/ protection resulting in damage to the cable/ protection, anchor and/or fishing gear.	1	2	3	3	3	2.8	Broadly Acceptable		NLB recommended that Eastern Green Link 3 be considered a cumulative development, as it runs between Morven and Ossian.
Recreational vessels (2.5 to 24m length)	O	• Implementation and monitoring of cable protection. • Marking of all offshore infrastructure on Admiralty charts. • Compliance with MGN 654 and its annexes. • Appropriate promulgation of information.	• Presence of subsea cables associated with Morven and Eastern Green Link 3. • Human/ navigation error. • Mechanical/ technical failure. • Adverse weather.	Vessel anchors on or drags anchor over a cable/ protection but no interaction occurs.	1	1	1	1	1	1.0	Broadly Acceptable	Vessel anchors on or drags anchor over a cable/protection resulting in damage to the cable/protection and/or anchor.	1	1	1	2	1	1.3	Broadly Acceptable		NLB recommended that Eastern Green Link 3 be considered a cumulative development, as it runs between Morven and Ossian.
Interference with Marine Navigation, Communication and Position Fixing Equipment																					
All vessels	O	• Compliance with MGN 654 and its annexes. • Appropriate promulgation of information.	• Human error relating to adjustment of Radar controls. • Presence of surface structures for Morven and cumulative wind farms.	Structures have no effect upon the Radar, communications and navigation equipment on a vessel.	4	1	1	1	1	1.0	Broadly Acceptable	Minor level of Radar interference due to the structures.	3	1	1	1	1	1.0	Broadly Acceptable		

User	Phase (C/O/D)	Embedded Mitigation Measures	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			
Reduction in Emergency Response Capability																					
Emergency response vessels	O	• Compliance with MGN 654 and its annexes. • Marking and lighting of the site in agreement with NLB and in line with IALA O139/G1162. • Marine coordination and communication to manage Project vessel movements. • Creation of and adherence to, an MPCP. • Compliance of project vessels with international marine regulations as adopted by the Flag State. • Development of and adherence to, a DSLP.	• Presence of surface structures for Morven and cumulative wind farms. • Array does not facilitate responder access. • Limited resource capability. • Adverse weather.	Delay to emergency response request.	2	2	1	1	1	1.3	Broadly Acceptable	Delay to response request leading to injury to person or loss of life.	1	5	3	3	3	3.5	Broadly Acceptable		

Appendix C Consequences assessment

27.1.1.4 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 Morven North and Morven South.

27.1.1.5 The significance of the impact due to the presence of Morven North and Morven South is also assessed based on risk evaluation criteria and comparison with historical incident data in UK waters[9].

C.1 Risk evaluation criteria

C.1.1 Risk to people

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

- individual risk;
- societal risk.

C.1.1.1 Individual risk

27.1.1.7 Individual risk considers whether the risk from an incident to a particular individual changes significantly due to the presence of Morven North and Morven South. 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.

27.1.1.8 The purpose of estimating the individual risk is to ensure that individuals who may be affected by the presence of Morven North and Morven South are not exposed to excessive risks. This is achieved by considering the significance of the change in individual risk resulting from the presence of Morven North and Morven South relative to the UK background individual risk levels.

27.1.1.9 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.

[9] For the purposes of this assessment, UK waters is defined as the UK Exclusive Economic Zone (EEZ) and UK territorial waters refers to the 12nm limit from the British Isles, excluding the Republic of Ireland.

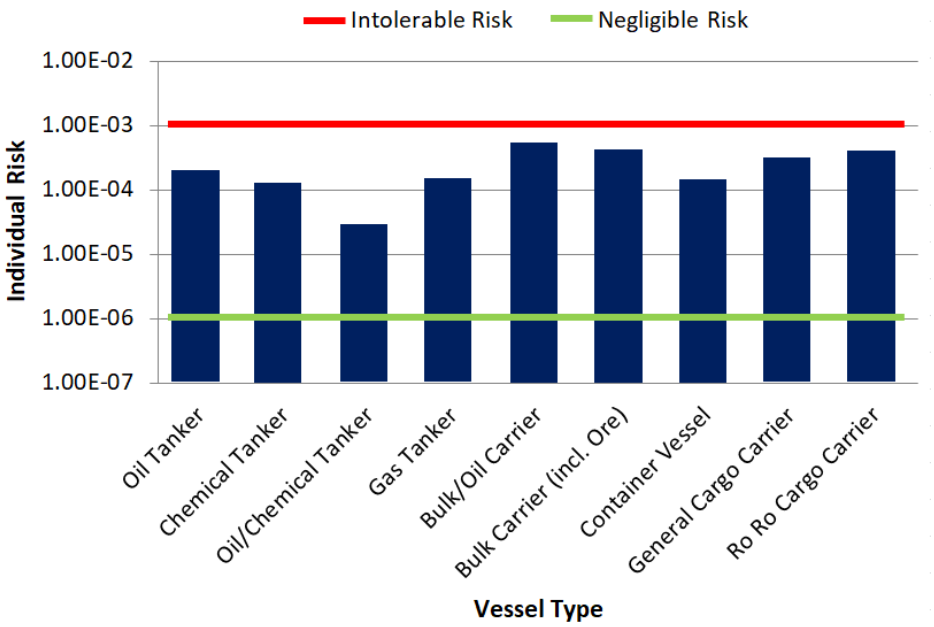


Figure C.1 Individual risk levels and acceptance criteria per vessel type

27.1.1.10 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 As Low as Reasonably Practicable criteria

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

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

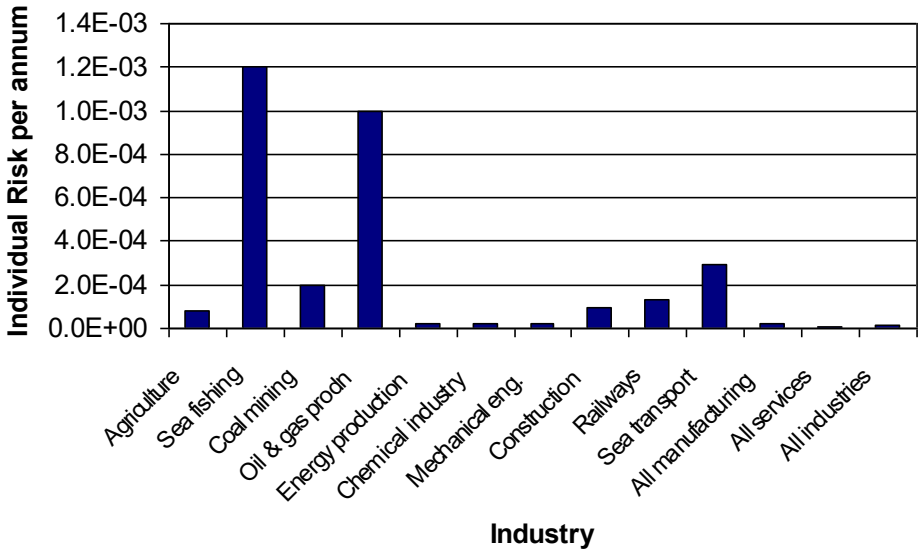


Figure C.2 : Individual risk per year for various United Kingdom industries

27.1.1.12 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.1.1.2 Societal risk

27.1.1.13 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.

27.1.1.14 Within this assessment, societal (navigation based) risk can be assessed for Morven North and Morven South, giving account to the change in risk associated with each incident scenario caused by the introduction of the wind farm structures. Societal risk may be expressed as:

- Annual fatality rate where frequency and fatality are combined into a convenient one-dimensional measure of societal risk (also known as PLL);
- F-N diagrams showing explicitly the relationship between the cumulative frequency of an accident and the number of fatalities in a multi-dimensional diagram.

27.1.1.15 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.1.2 Risk to environment

27.1.1.16 For risk to the environment the key criteria considered in terms of the risk due to Morven North and Morven South is the potential quantity of oil spilled from a vessel involved in an incident.

27.1.1.17 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 Morven North and Morven South compared to UK background pollution risk levels.

C.2 Marine Accident Investigation Branch incident data

C.2.1 All incidents in United Kingdom waters

27.1.1.18 All British flagged commercial vessels are required to report incidents to the MAIB. Non-British flagged vessels do not have to report an incident to the MAIB unless located at a UK port or within 12nm territorial waters and carrying passengers to a UK port. There are no requirements for non-commercial recreational craft to report incidents to the MAIB; however, a significant proportion of such incidents are reported to and investigated by the MAIB.

27.1.1.19 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.

27.1.1.20 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 Morven North and Morven South.

27.1.1.21 Accounting for these criteria, a total of 11,773 accidents, injuries and hazardous incidents were reported to the MAIB in the 20-year period between 2002 and 2021 involving 13,415 vessels (some incidents, such as collisions, involved more than one vessel).

27.1.1.22 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.

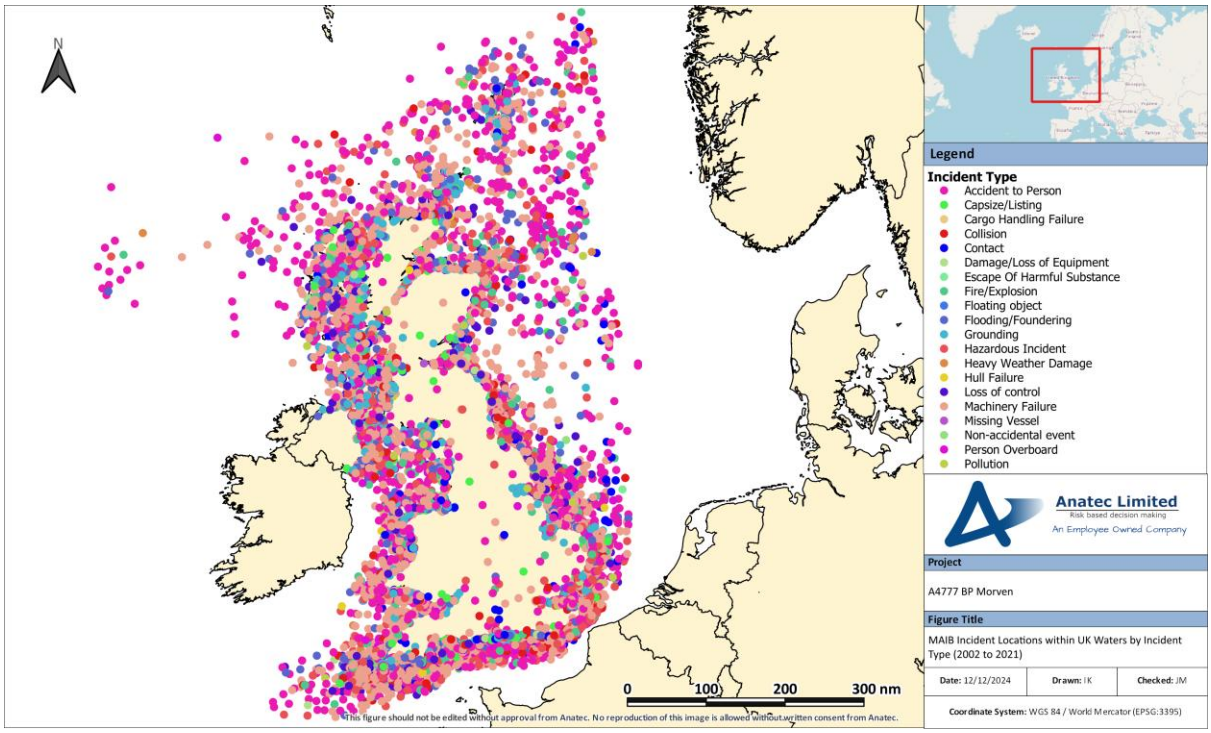


Figure C.3 Marine Accident Investigation Branch incident locations by incident type within United Kingdom waters (2002 to 2021)

27.1.1.23 The distribution of incidents by year in UK waters is presented in Figure C.4.

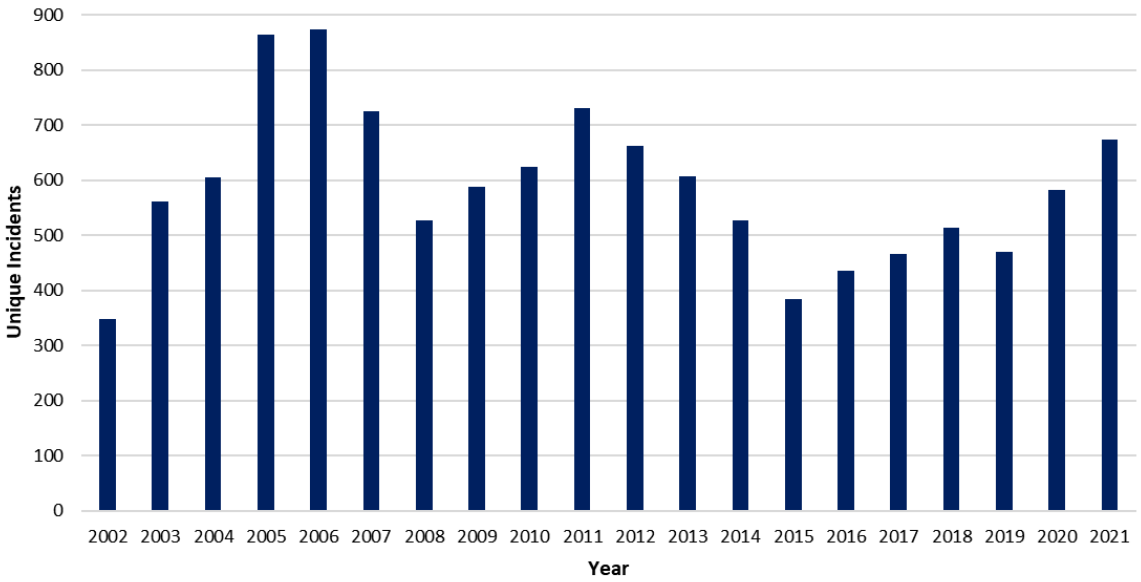


Figure C.4 Marine Accident Investigation Branch unique incidents per year within United Kingdom waters (2002 to 2021)

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

27.1.1.25 The distribution of incidents in UK waters by incident type is presented in Figure C.5.

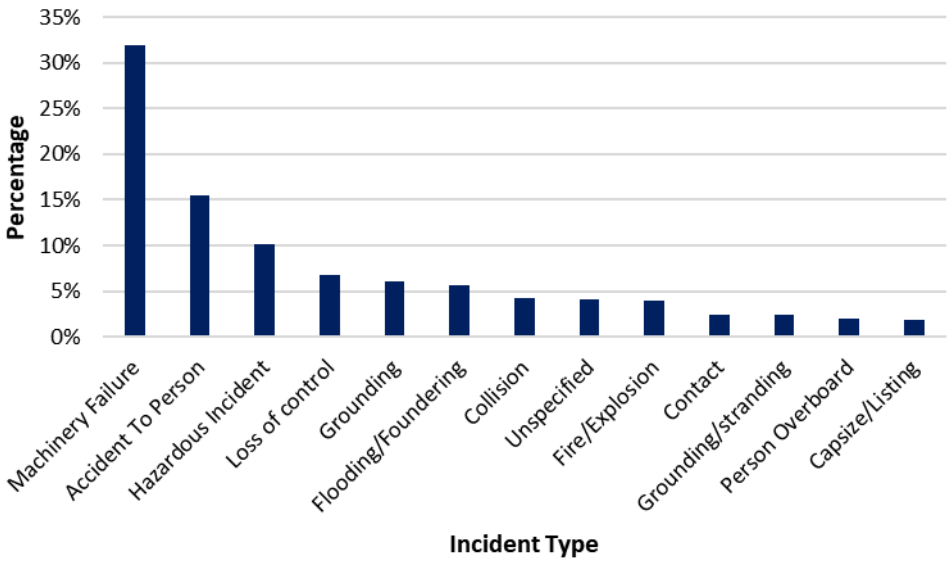


Figure C.5 Marine Accident Investigation Branch incident types breakdown within United Kingdom waters (2002 to 2021)

27.1.1.26 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.

27.1.1.27 The distribution of incidents in UK waters by vessel type is presented in Figure C.6.

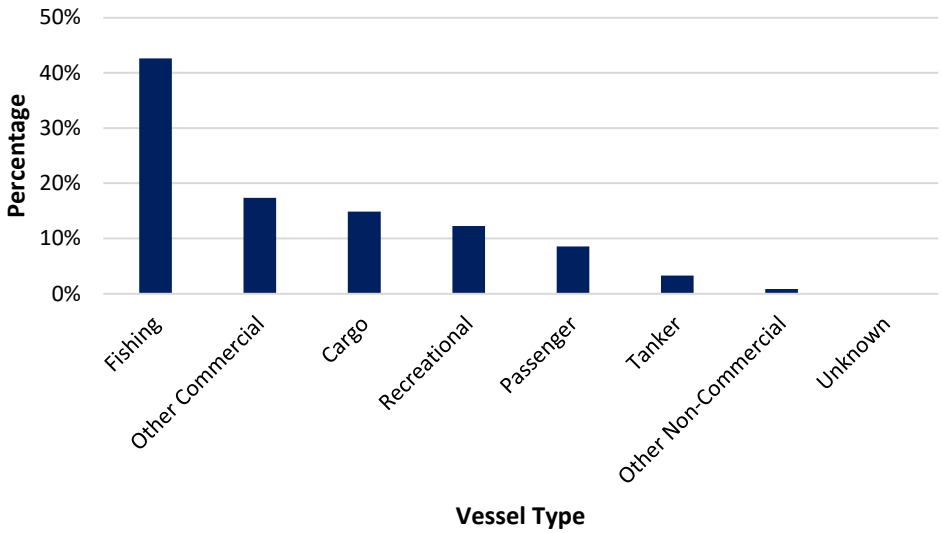


Figure C.6 Marine Accident Investigation Branch vessel types breakdown within United Kingdom waters (2002 to 2021)

27.1.1.28 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%).

27.1.1.29 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.

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

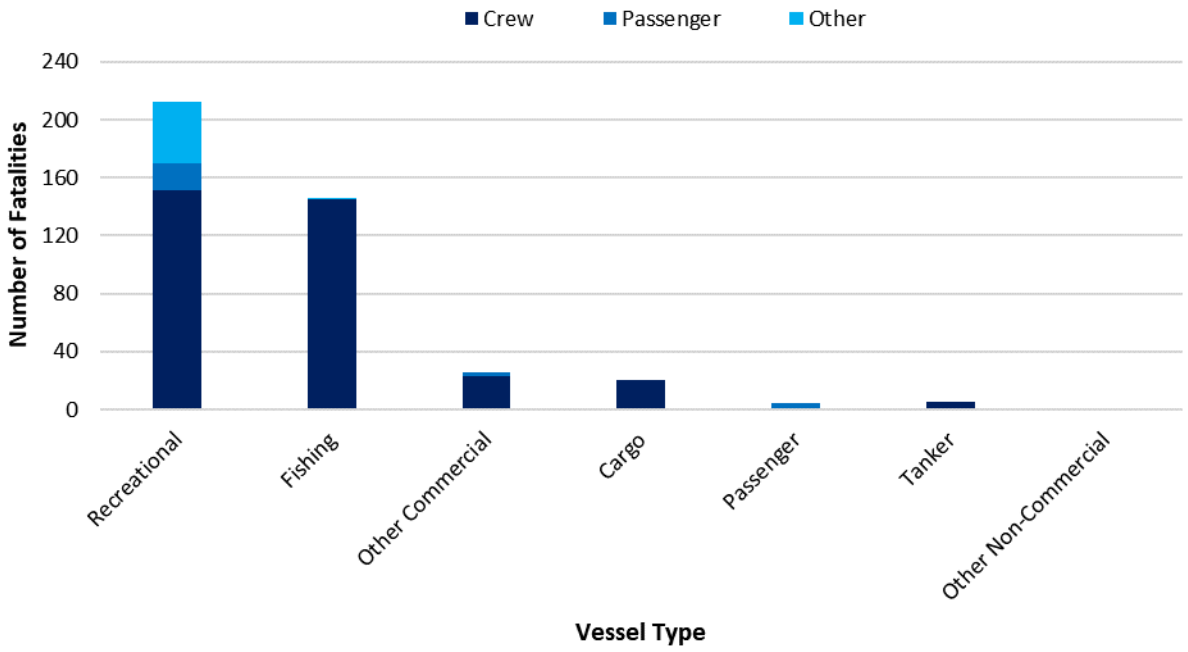


Figure C.7 Marine Accident Investigation Branch fatalities by vessel type within United Kingdom waters (2002 to 2021)

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

C.2.2 Collision incidents

27.1.1.32 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).

27.1.1.33 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).

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

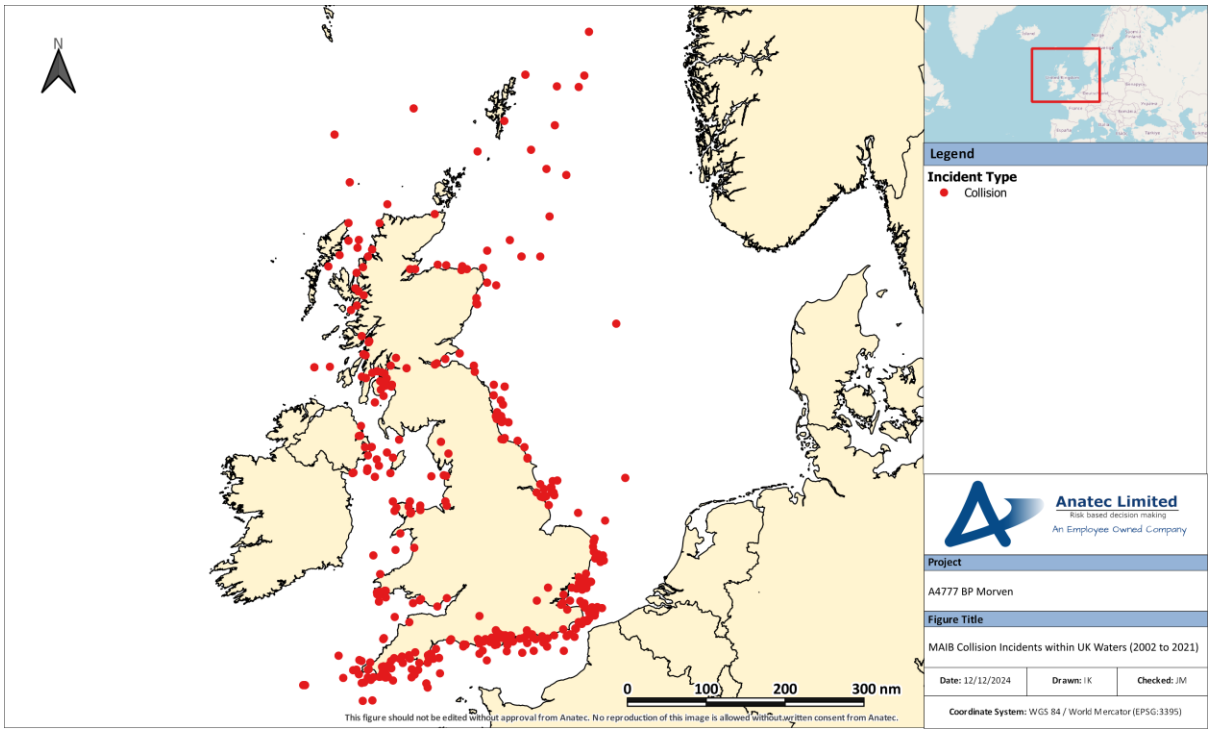


Figure C.8 Marine Accident Investigation Branch collision incident locations within United Kingdom waters (2002 to 2021)

27.1.1.35 The distribution of collision incidents per year is presented in Figure C.9.

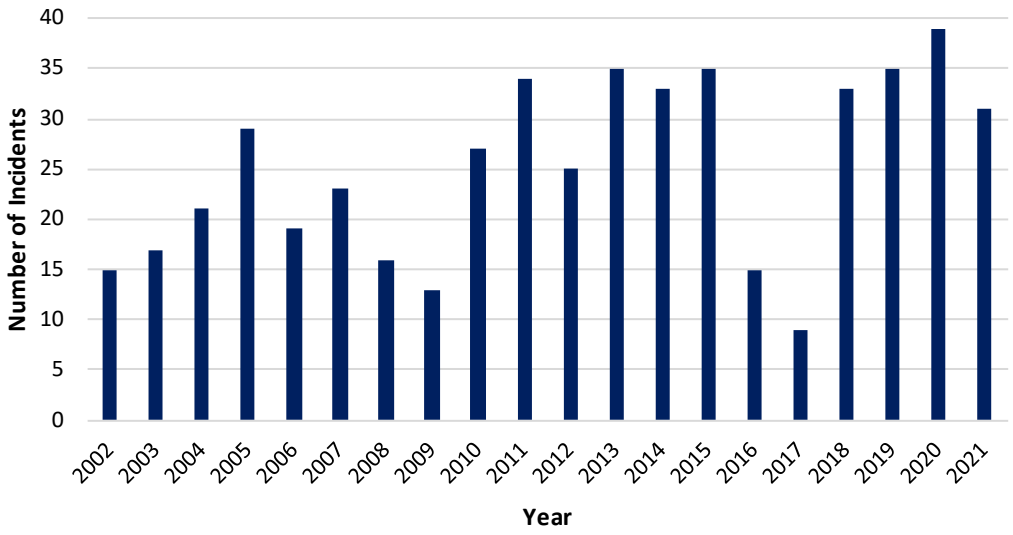


Figure C.9 Marine Accident Investigation Branch annual collision incidents within United Kingdom waters (2002 to 2021)

27.1.1.36 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.

27.1.1.37 The distribution of vessel types involved in collision incidents is presented in Figure C.10.

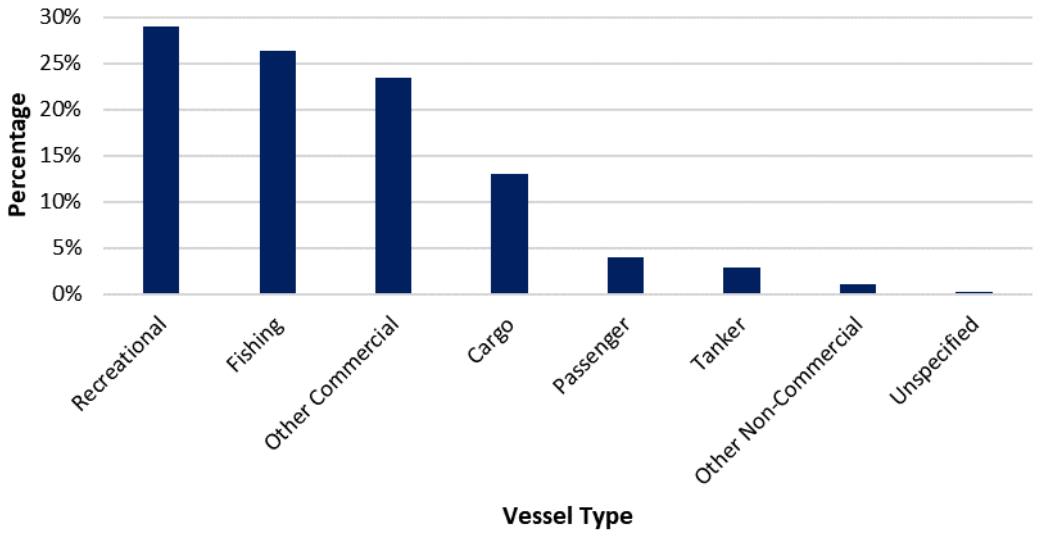


Figure C.10 Marine Accident Investigation Branch collision incidents by vessel type within United Kingdom waters (2002 to 2021)

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

27.1.1.39 A total of five fatalities were reported in MAIB collision incidents within UK waters between 2002 and 2021. Details of each of these fatal incidents reported by the MAIB are presented in Table C.2.

Table C.2 Description of fatal Marine Accident Investigation Branch collision incidents (2002 to 2021)

Date	Description	Fatalities
July 2005	Collision between two powerboats at night. Both vessels were unlit and both helmsmen had consumed alcohol. One of the helmsmen died.	1
October 2007	Collision between fishing vessel and coastal general cargo vessel following failure to keep an effective lookout. Fishing vessel sank with three of the four crew members abandoning ship into a life raft but the fourth crew member was not recovered.	1
August 2010	Collision between passenger ferry and fishing vessel. Fishing vessel sank with one of the two crew members recovered from the sea but the other member was not recovered despite an extensive search.	1
June 2015	Collision between RIB and yacht. Believed that around a dozen persons were onboard the motorboat with the majority taken ashore by lifeboat. One person seriously injured and airlifted to hospital before being pronounced dead later.	1

Date	Description	Fatalities
June 2018	Collision between power boats during a race. One of the vessels overturned with the pilot pronounced dead at the scene.	1

C.2.3 Allision incidents

27.1.1.40 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.

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

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

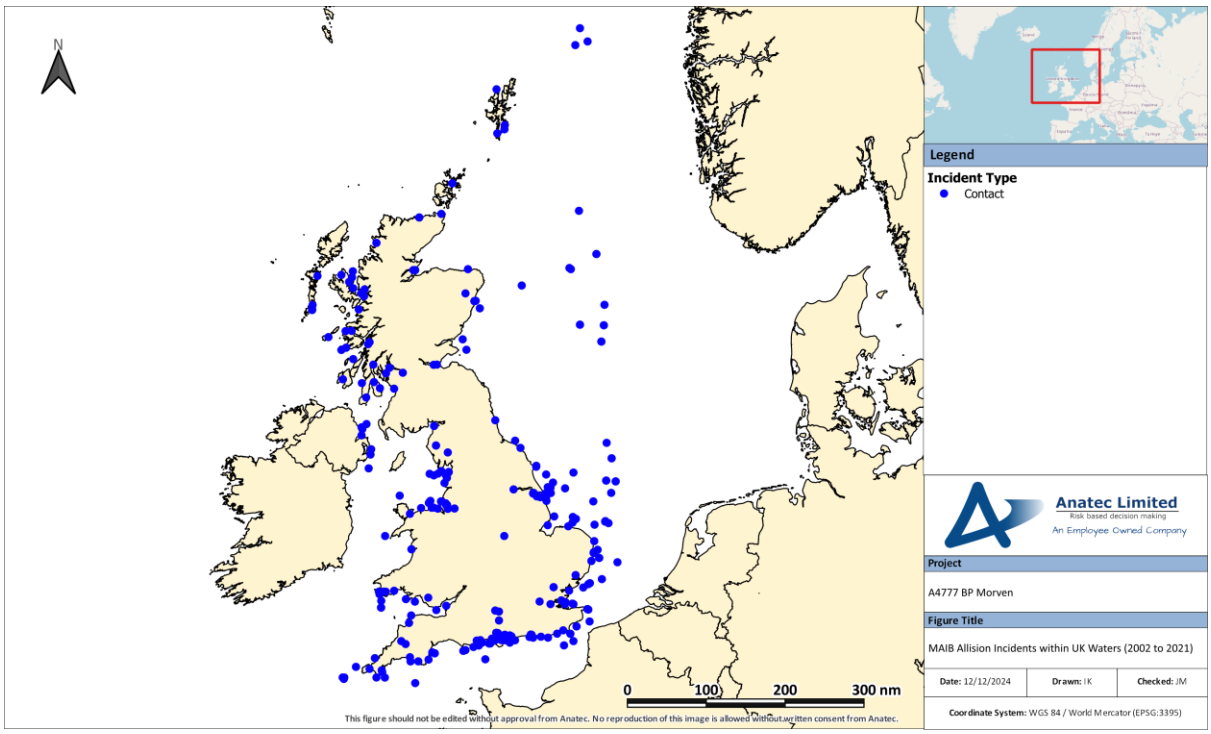


Figure C.11 Marine Accident Investigation Branch allision incident locations within United Kingdom waters (2002 to 2021)

27.1.1.43 The distribution of allision incidents per year is presented in Figure C.12.

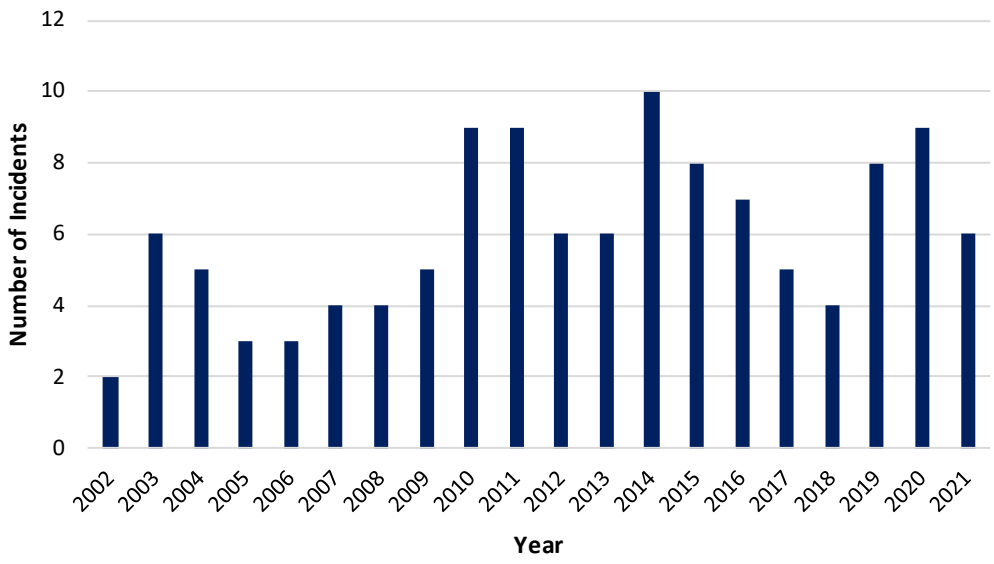


Figure C.12 Marine Accident Investigation Branch allision incidents per year within United Kingdom waters (2002 to 2021)

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

27.1.1.45 The distribution of vessel types involved in allision incidents is presented in Figure C.13.

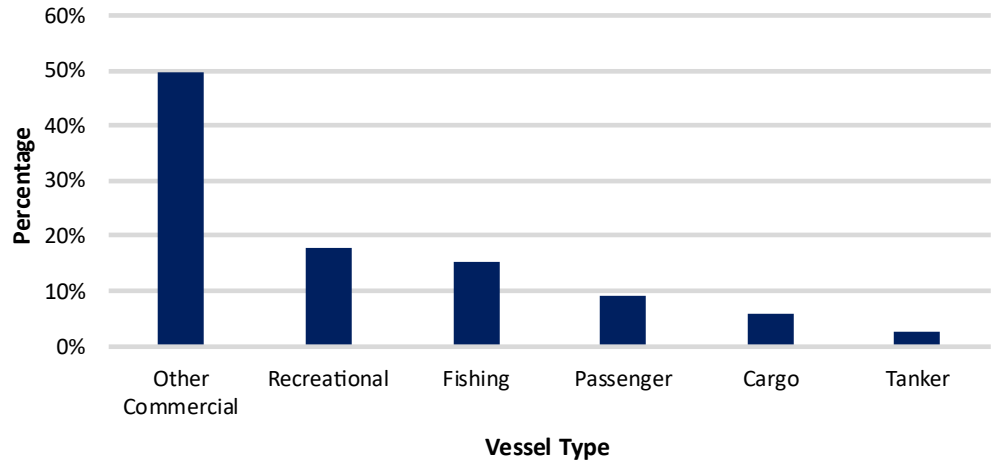


Figure C.13 Marine Accident Investigation Branch allision incidents by vessel type within United Kingdom waters (2002 to 2021)

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

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

C.3 Fatality risk – Scenario 1a

C.3.1 Incident data

27.1.1.48 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 Morven North.

27.1.1.49 Morven North 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.

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

27.1.1.51 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.2.3). Additionally, none of the allision incidents reported by the MAIB between 2002 and 2021 resulted in a fatality.

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

C.3.2 Fatality probability

27.1.1.53 Five of the 504 collision incidents reported by the MAIB within UK waters between 2002 and 2021 resulted in one or more fatalities. This gives a 0.99% probability that a collision incident will lead to a fatal accident.

27.1.1.54 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 Morven North. 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 People on Board by vessel category

Vessel Category	Sub Categories	Source of Estimated Average POB	Estimated Average POB
Cargo/freight	Dry cargo, other commercial, service ship, etc.	MAIB incident data	15
Tanker	Tanker/combination carrier	MAIB incident data	23
Passenger	RoRo passenger, cruise liner, etc.	Vessel traffic survey data/online information	2,120
Fishing	Trawler, potter, dredger, etc.	MAIB incident data	3.3
Recreational	Yacht, small commercial motor yacht, etc.	MAIB incident data	3.3

27.1.1.55 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.

27.1.1.56 Using the average POB, along with the vessel type information involved in collision incidents reported by the MAIB (see Section C.2.2), there was an estimated 93,790 POB the vessels involved in the collision incidents.

27.1.1.57 Based upon five fatalities during the period 2002 to 2021, the overall fatality probability in a collision for any individual onboard is approximately 1.09×10^{-5} per collision.

27.1.1.58 It is considered inappropriate to apply this rate uniformly as the statistics indicate that the fatality probability associated with smaller craft, such as fishing vessels and recreational vessels, is higher. Therefore, the fatality probability has been subdivided into three categories of vessel as presented in Table C.4. In addition, due to zero fatalities resulting from commercial vessel collisions between 2002 and 2021, the time period used to assess the fatality probability for commercial vessels has been extended by five years to ensure a meaningful probability is captured.

Table C.4 Collision incident fatality probability by vessel category

Vessel Category	Sub Categories	Fatalities	People Involved	Fatality Probability	Time Period
Commercial	Dry cargo, passenger, tanker, etc.	1	55,573	1.80×10^{-5}	1997 to 2021 (25 years)
Fishing	Trawler, potter, dredger, etc.	2	927	2.2×10^{-3}	2002 to 2021 (20 years)
Recreational	Yacht, small commercial motor yacht, etc.	3	1,023	2.9×10^{-3}	2002 to 2021 (20 years)

C.3.3 Fatality risk due to Morven North

27.1.1.59 The base case and future case annual collision frequency levels pre and post wind farm for Morven North are summarised in Table C.5.

Table C.5 Summary of annual collision and allision risk results

Risk	Scenario	Annual Frequency (Return Period)		
		Pre Wind Farm	Post Wind Farm	Change
Vessel to vessel collision	Base case	4.27×10^{-4} (1 in 2,344 years)	7.04×10^{-4} (1 in 1,421 years)	2.77×10^{-4} (1 in 3,606 years)
	Future case (10%)	5.13×10^{-4} (1 in 1,948 years)	8.49×10^{-4} (1 in 1,178 years)	3.36×10^{-4} (1 in 2,979 years)
	Future case (20%)	6.16×10^{-4} (1 in 1,625 years)	1.02×10^{-3} (1 in 984 years)	4.00×10^{-4} (1 in 2,498 years)
Powered vessel to structure allision	Base case	-	1.69×10^{-3} (1 in 591 years)	1.69×10^{-3} (1 in 591 years)
	Future case (10%)	-	1.86×10^{-3} (1 in 537 years)	1.86×10^{-3} (1 in 537 years)
	Future case (20%)	-	2.03×10^{-3} (1 in 492 years)	2.03×10^{-3} (1 in 492 years)
Drifting vessel to structure allision	Base case	-	1.53×10^{-4} (1 in 6,526 years)	1.53×10^{-4} (1 in 6,526 years)
	Future case (10%)	-	1.68×10^{-4} (1 in 5,943 years)	1.68×10^{-4} (1 in 5,943 years)
	Future case (20%)	-	1.84×10^{-4} (1 in 5,428 years)	1.84×10^{-4} (1 in 5,428 years)

Risk	Scenario	Annual Frequency (Return Period)		
		Pre Wind Farm	Post Wind Farm	Change
Fishing vessel to structure allision	Base case	-	3.60×10^{-3} (1 in 277 years)	3.60×10^{-3} (1 in 277 years)
	Future case (10%)	-	3.96×10^{-3} (1 in 252 years)	3.96×10^{-3} (1 in 252 years)
	Future case (20%)	-	4.32×10^{-3} (1 in 231 years)	4.32×10^{-3} (1 in 231 years)
Total	**Base case**	**4.27×10^{-4} (1 in 2,344 years)**	**6.15×10^{-3} (1 in 162 years)**	**5.73×10^{-3} (1 in 175 years)**
	Future case (10%)	**5.13×10^{-4} (1 in 1,948 years)**	**4.84×10^{-3} (1 in 146 years)**	**6.33×10^{-3} (1 in 158 years)**
	Future case (20%)	**6.16×10^{-4} (1 in 1,625 years)**	**7.56×10^{-3} (1 in 132 years)**	**6.94×10^{-3} (1 in 144 years)**

27.1.1.60 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 Morven North for the base case and future case are presented in Figure C.14.

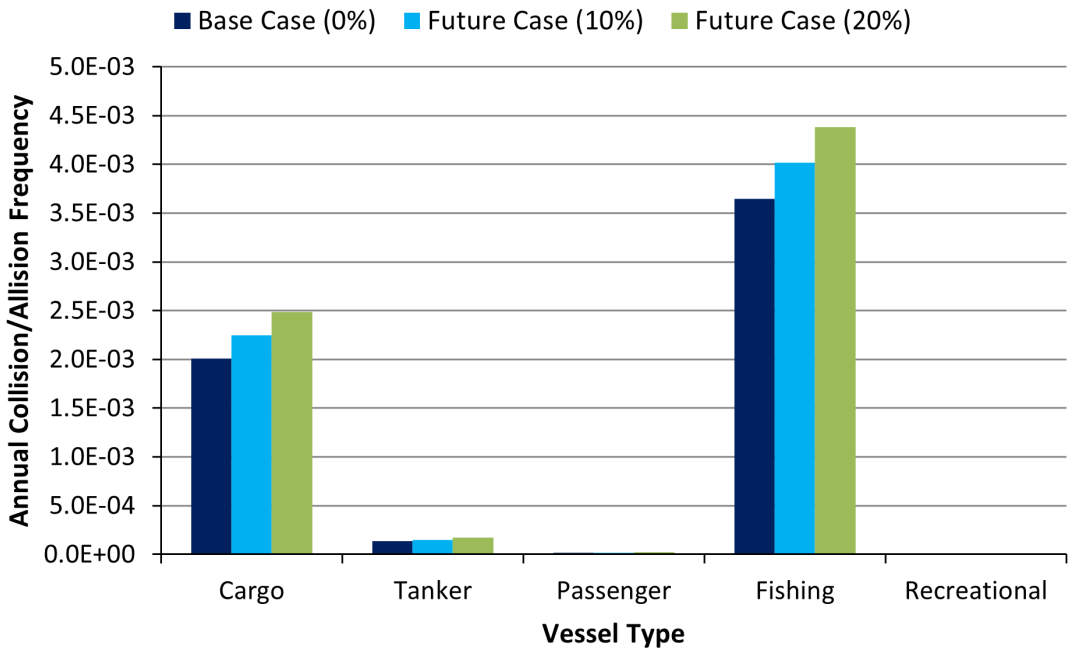


Figure C.14 Estimated change in annual collision and allision frequency by vessel type

27.1.1.61 It is seen that the majority of change in collision and allision frequency is associated with fishing vessels, due to the level of internal fishing activity. Cargo vessels are also noted to have a large proportion of collision and allision frequency, likely due to their abundance within the vessel traffic dataset.

27.1.1.62 Combining the annual collision and allision frequency (see Table C.5), estimated number of POB for each vessel type (see Table C.3) and the estimated fatality probability for each vessel type category (see Table C.4), the annual increase in PLL due to the presence of Morven North in the base case is estimated to be 2.56×10^{-5}, equating to one additional fatality every 39,044 years.

27.1.1.63 The estimated incremental increases in PLL due to Morven North, distributed by vessel type and for the base case and future case, are presented in Figure C.15.

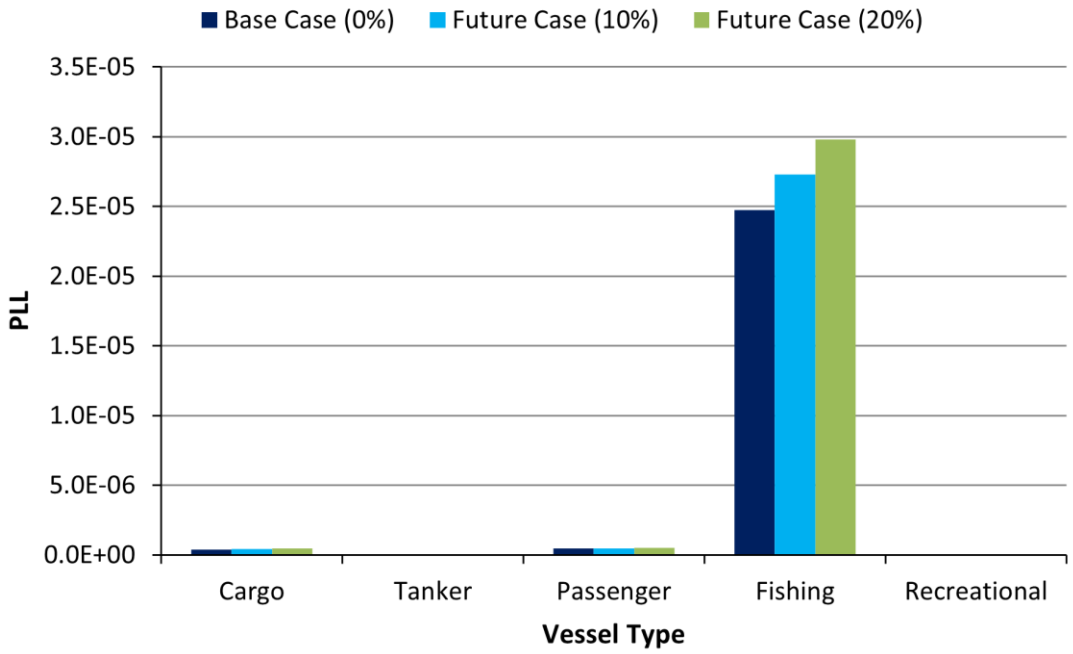


Figure C.15 Estimated change in annual Potential Loss of Life by vessel type

27.1.1.64 It can be seen that the majority of the change in annual PLL is associated with fishing vessels.

27.1.1.65 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.

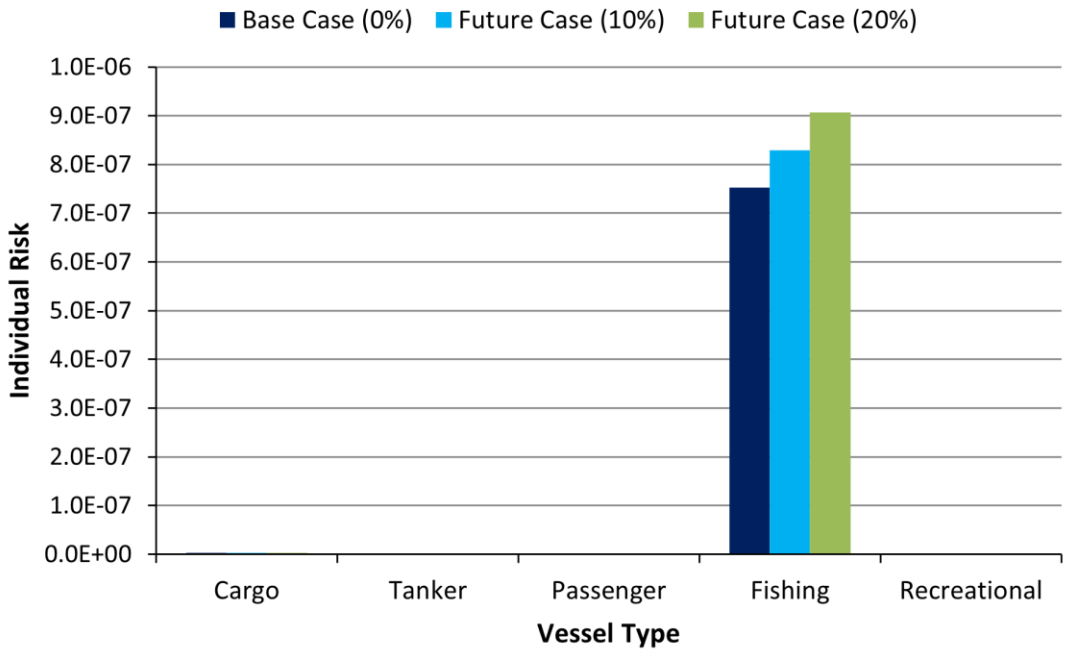


Figure C.16 Estimated change in individual risk by vessel type

27.1.1.66 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, as well as the level of internal fishing activity.

C.3.4 Significance of increase in fatality risk

27.1.1.67 In comparison to MAIB statistics, which indicate an average of 18 to 19 fatalities per year in UK territorial waters during the 20-year period between 2002 and 2021, the overall increase for the base case in PLL of one additional fatality per 39,044 years represents a low change.

27.1.1.68 In terms of individual risk to people, the change for commercial vessels attributed to Morven North (approximately 2.70×10^{-9} 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.

27.1.1.69 For fishing vessels, the change in individual risk attributed to Morven North (approximately 7.52×10^{-7} 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.4 Pollution risk – Scenario 1a

C.4.1 Historical analysis

27.1.1.70 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).

27.1.1.71 Two types of oil spill are considered in this assessment:

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

27.1.1.72 The research undertaken as part of the DfT's MEHRAs project (DfT, 2001) has been used as it was comprehensive and based upon worldwide marine oil spill data analysis. From this research, the overall probability of a spill per incident was calculated based upon historical incident data for each incident type as presented in Figure C.17.

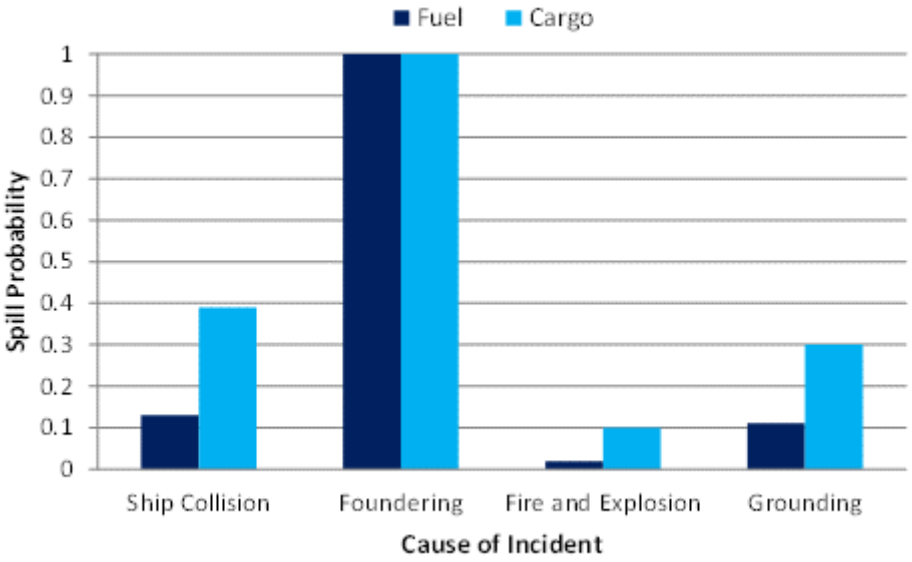


Figure C.17 Probability of an oil spill resulting from an accident

27.1.1.73 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.

27.1.1.74 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.

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

27.1.1.76 For cargo spills from laden tankers, the spill size can vary significantly. The ITOPF reported the following spill size distribution for tanker collisions between 1974 and 2004:

- 31% of spills below seven tonnes;
- 52% of spills between seven and 700 tonnes;
- 17% of spills greater than 700 tonnes.

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

27.1.1.78 For fishing vessel collisions, comprehensive statistical data is not available. Consequently, it is conservatively assumed that 50% of all collisions involving fishing vessels will lead to oil spill with the quantity spilled being on average five tonnes. Similarly for recreational vessels, due to a lack of data 50% of collisions are conservatively assumed to lead to a spill with an average size of one tonne.

C.4.2 Pollution risk due to Morven North

27.1.1.79 Applying the above probabilities to the annual collision and allision frequency by vessel type presented in Table C.5 and the average spill size per vessel, the amount of oil spilled per year due to the impact of Morven North is estimated to be 0.06 tonnes per year for the base case and 0.06 tonnes and 0.07 tonnes per year for the future cases of 10% and 20% vessel traffic increases respectively.

27.1.1.80 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.

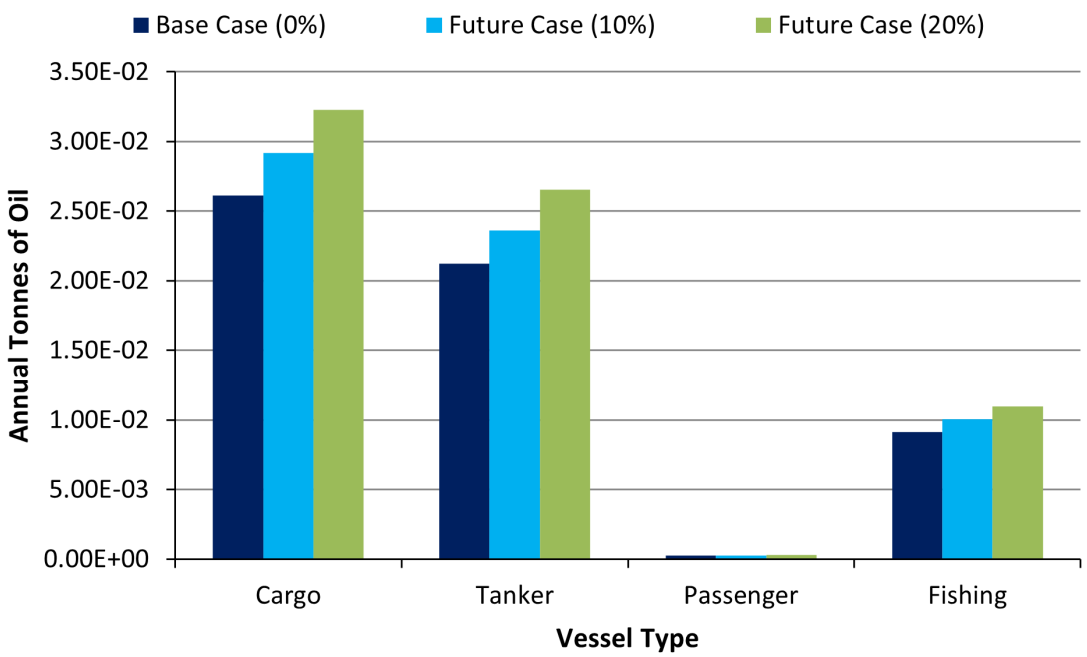


Figure C.18 Estimated change in pollution by vessel type

27.1.1.81 The majority of annual oil spill results are associated with cargo vessels, tankers and fishing vessels - due to the annual allision/collision frequency associated with cargo and fishing vessels and large spill size for tankers in the event an incident occurs.

C.4.3 Significance of increase in pollution risk

27.1.1.82 To assess the significance of the increased pollution risk from vessels caused by Morven North historical oil spill data for the UK has been used as a benchmark.

27.1.1.83 From the MEHRAs research, the annual average tonnes of oil spilled in UK waters due to maritime incidents in the 10-year period from 1989 to 1998 was 16,111. This is based upon a total of 146 reported oil pollution incidents of greater than one tonne (smaller spills are excluded as are incidents which occurred within port or harbour areas or resulting from operational errors or equipment failure). Commercial vessel spills accounted for approximately 99% of the total while fishing vessel incidents accounted for less than 1%.

27.1.1.84 The overall increase in pollution estimated due to Morven North of 0.06 tonnes for the base case represents a 0.0004% increase compared to the historical average pollution quantities from maritime incidents in UK waters.

C.5 Fatality risk – Scenario 1b

C.5.1 Incident data

27.1.1.85 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 Morven South.

27.1.1.86 Morven South 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.

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

27.1.1.88 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.2.3). Additionally, none of the allision incidents reported by the MAIB between 2002 and 2021 resulted in a fatality.

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

C.5.2 Fatality probability

27.1.1.90 Five of the 504 collision incidents reported by the MAIB within UK waters between 2002 and 2021 resulted in one or more fatalities. This gives a 0.99% probability that a collision incident will lead to a fatal accident.

27.1.1.91 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.6 presents the average number of POB estimated for each category of vessel navigating in proximity to Morven South. 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.6 Estimated average People on Board by vessel category

Vessel Category	Sub Categories	Source of Estimated Average POB	Estimated Average POB
Cargo/freight	Dry cargo, other commercial, service ship, etc.	MAIB incident data	15
Tanker	Tanker/combination carrier	MAIB incident data	23
Passenger	RoRo passenger, cruise liner, etc.	Vessel traffic survey data/online information	1,442
Fishing	Trawler, potter, dredger, etc.	MAIB incident data	3.3
Recreational	Yacht, small commercial motor yacht, etc.	MAIB incident data	3.3

27.1.1.92 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.

27.1.1.93 Using the average POB, along with the vessel type information involved in collision incidents reported by the MAIB (see Section C.2.2), there was an estimated 65,297 POB the vessels involved in the collision incidents.

27.1.1.94 Based upon five fatalities during the period 2002 to 2021, the overall fatality probability in a collision for any individual onboard is approximately 7.66×10^{-5} per collision.

27.1.1.95 It is considered inappropriate to apply this rate uniformly as the statistics indicate that the fatality probability associated with smaller craft, such as fishing vessels and recreational vessels, is higher. Therefore, the fatality probability has been subdivided into three categories of vessel as presented in Table C.7. In addition, due to zero fatalities resulting from commercial vessel collisions between 2002 and 2021, the time period used to assess the fatality probability for commercial vessels has been extended by five years to ensure a meaningful probability is captured.

Table C.7 Collision incident fatality probability by vessel category

Vessel Category	Sub Categories	Fatalities	People Involved	Fatality Probability	Time Period
Commercial	Dry cargo, passenger, tanker, etc.	1	55,573	1.80×10^{-5}	1997 to 2021 (25 years)
Fishing	Trawler, potter, dredger, etc.	2	927	2.2×10^{-3}	2002 to 2021 (20 years)
Recreational	Yacht, small commercial motor yacht, etc.	3	1,023	2.9×10^{-3}	2002 to 2021 (20 years)

C.5.3 Fatality risk due to Morven South

27.1.1.96 The base case and future case annual collision frequency levels pre and post wind farm for Morven South are summarised in Table C.8.

Table C.8 Summary of annual collision and allision risk results

Risk	Scenario	Annual Frequency (Return Period)		
		Pre Wind Farm	Post Wind Farm	Change
Vessel to vessel collision	Base case	1.89×10^{-4} (1 in 5,283 years)	5.49×10^{-4} (1 in 1,821 years	3.60×10^{-4} (1 in 2,780 years
	Future case (10%)	2.28×10^{-4} (1 in 4,378 years)	6.64×10^{-4} (1 in 1,505 years	4.36×10^{-4} (1 in 2,294 years
	Future case (20%)	2.73×10^{-4} (1 in 3,660 years)	7.90×10^{-4} (1 in 1,266 years	5.16×10^{-4} (1 in 1,936 years
Powered vessel to structure allision	Base case	-	1.42×10^{-3} (1 in 707 years	1.42×10^{-3} (1 in 707 years
	Future case (10%)	-	1.56×10^{-3} (1 in 642 years	1.56×10^{-3} (1 in 642 years
	Future case (20%)	-	1.70×10^{-3} (1 in 589 years	1.70×10^{-3} (1 in 589 years
Drifting vessel to structure allision	Base case	-	7.75×10^{-5} (1 in 12,911 years	7.75×10^{-5} (1 in 12,911 years
	Future case (10%)	-	8.53×10^{-5} (1 in 11,722 years	8.53×10^{-5} (1 in 11,722 years
	Future case (20%)	-	9.28×10^{-5} (1 in 10,774 years	9.28×10^{-5} (1 in 10,774 years

Risk	Scenario	Annual Frequency (Return Period)		
		Pre Wind Farm	Post Wind Farm	Change
Total	Base case	1.89×10^{-4} (1 in 5,283 years)	2.04×10^{-3} (1 in 490 years)	1.85×10^{-3} (1 in 540 years)
	Future case (10%)	2.28×10^{-4} (1 in 4,378 years)	2.31×10^{-3} (1 in 433 years)	2.08×10^{-3} (1 in 481 years)
	Future case (20%)	2.73×10^{-4} (1 in 3,660 years)	2.58×10^{-3} (1 in 388 years)	2.31×10^{-3} (1 in 433 years)

27.1.1.97 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 Morven South for the base case and future case are presented in Figure C.19.

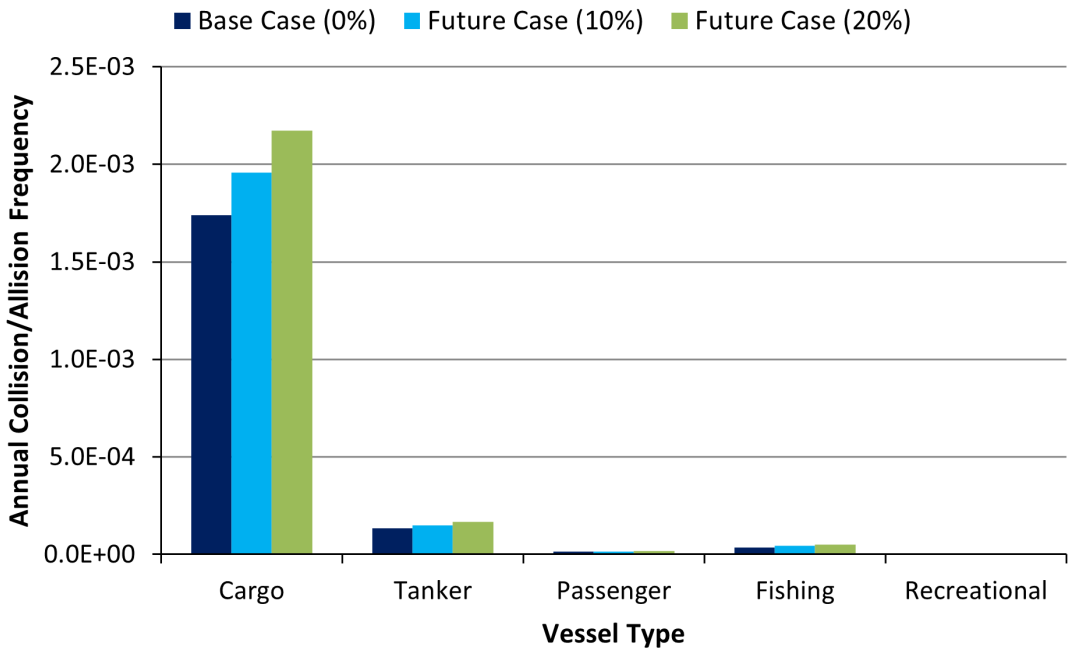


Figure C.19 Estimated change in annual collision and allision frequency by vessel type

27.1.1.98 It is seen that the majority of change in collision and allision frequency is associated with cargo vessels due to their abundance within the vessel traffic dataset.

27.1.1.99 Combining the annual collision and allision frequency (see Table C.8), estimated number of POB for each vessel type (see Table C.6) and the estimated fatality

probability for each vessel type category (see Table C.7), the annual increase in PLL due to the presence of Morven South in the base case is estimated to be 1.41×10^{-6}, equating to one additional fatality every 708,200 years.

27.1.1.100 The estimated incremental increases in PLL due to Morven South, distributed by vessel type and for the base case and future case, are presented in Figure C.20.

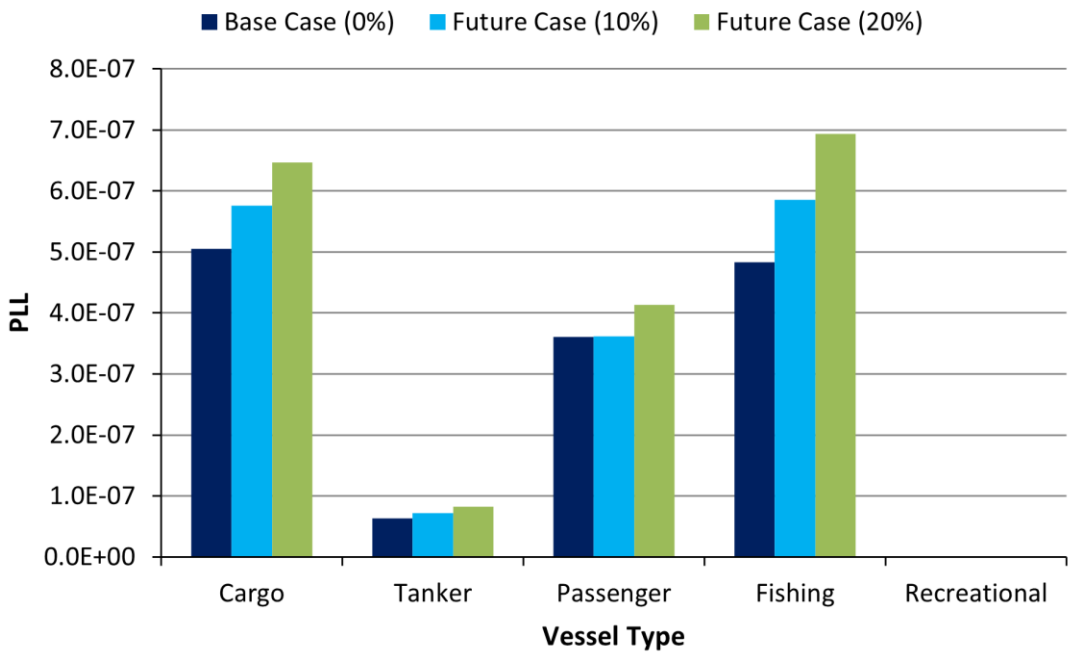


Figure C.20 Estimated change in annual Potential Loss of Life by vessel type

27.1.1.101 It can be seen that the majority of the change in annual PLL is associated with fishing, cargo and passenger vessels.

27.1.1.102 Converting the PLL to individual risk based upon the average number of people exposed by vessel type, the results are presented in Figure C.21.

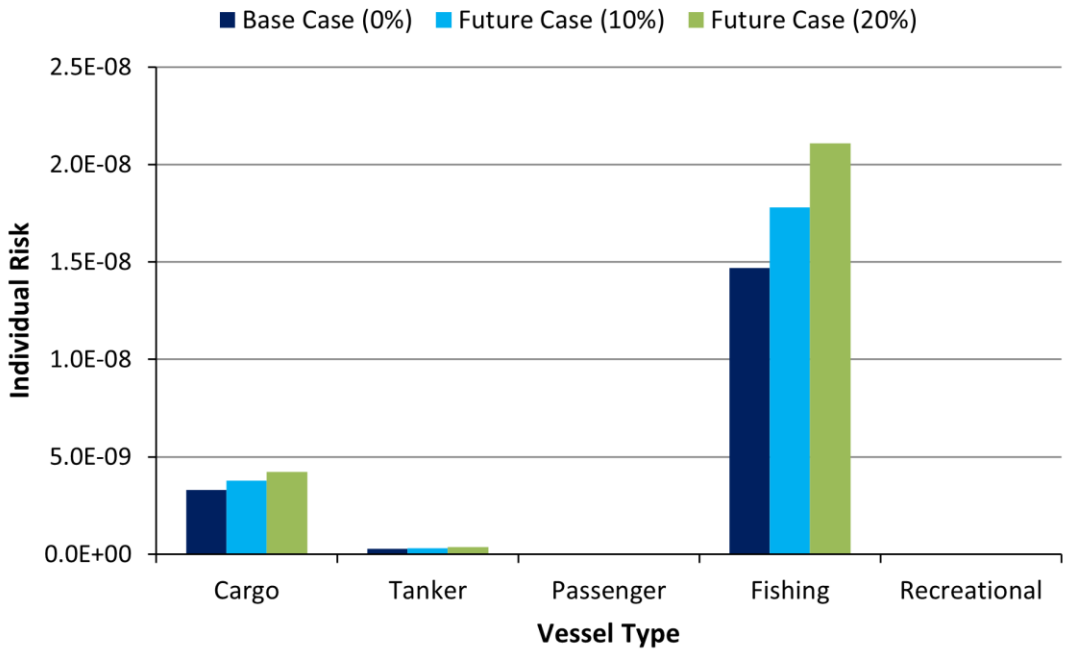


Figure C.21 Estimated change in individual risk by vessel type

27.1.1.103 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.5.4 Significance of increase in fatality risk

27.1.1.104 In comparison to MAIB statistics, which indicate an average of 18 to 19 fatalities per year in UK territorial waters during the 20-year period between 2002 and 2021, the overall increase for the base case in PLL of one additional fatality per 708,200 years represents a low change.

27.1.1.105 In terms of individual risk to people, the change for commercial vessels attributed to Morven South (approximately 3.61×10^{-9} 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.

27.1.1.106 For fishing vessels, the change in individual risk attributed to Morven South (approximately 1.47×10^{-8} 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.6 Pollution risk – Scenario 1b

C.6.1 Historical analysis

27.1.1.107 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).

27.1.1.108 Two types of oil spill are considered in this assessment:

- fuel oil spills from bunkers (all vessel types);
- cargo oil spills (laden tankers).

27.1.1.109 The research undertaken as part of the DfT's MEHRAs project (DfT, 2001) has been used as it was comprehensive and based upon worldwide marine oil spill data analysis. From this research, the overall probability of a spill per incident was calculated based upon historical incident data for each incident type as presented in Figure C.22.

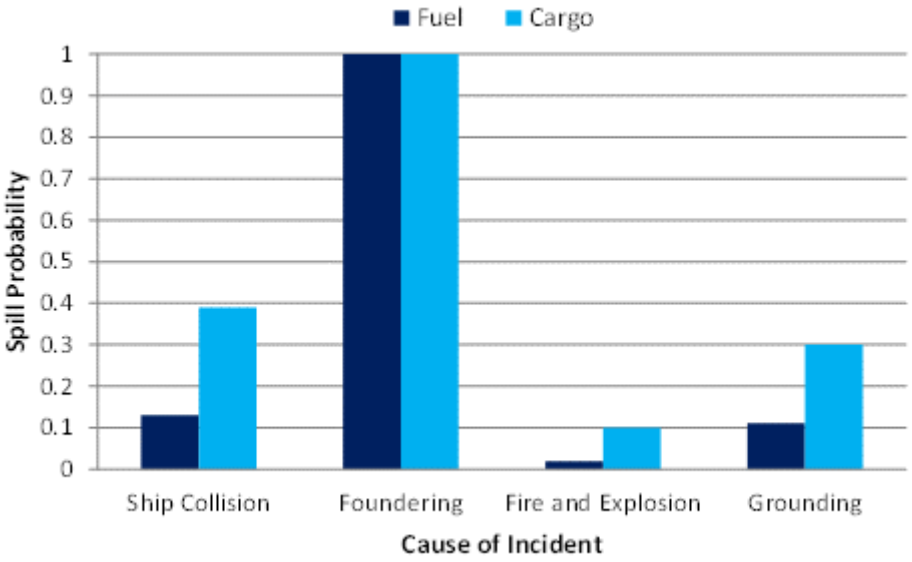


Figure C.22 Probability of an oil spill resulting from an accident

27.1.1.110 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.

27.1.1.111 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.

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

27.1.1.113 For cargo spills from laden tankers, the spill size can vary significantly. The ITOPF reported the following spill size distribution for tanker collisions between 1974 and 2004:

- 31% of spills below seven tonnes;
- 52% of spills between seven and 700 tonnes;
- 17% of spills greater than 700 tonnes.

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

27.1.1.115 For fishing vessel collisions, comprehensive statistical data is not available. Consequently, it is conservatively assumed that 50% of all collisions involving fishing vessels will lead to oil spill with the quantity spilled being on average five tonnes. Similarly for recreational vessels, due to a lack of data 50% of collisions are conservatively assumed to lead to a spill with an average size of one tonne.

C.6.2 Pollution risk due to Morven South

27.1.1.116 Applying the above probabilities to the annual collision and allision frequency by vessel type presented in Table C.8 and the average spill size per vessel, the amount of oil spilled per year due to the impact of Morven South is estimated to be 0.04 tonnes per year for the base case and 0.05 tonnes and 0.05 tonnes per year for the future cases of 10% and 20% vessel traffic increases respectively.

27.1.1.117 The estimated increase in tonnes of oil spilled, distributed by vessel type, for the base case and future case are presented in Figure C.23.

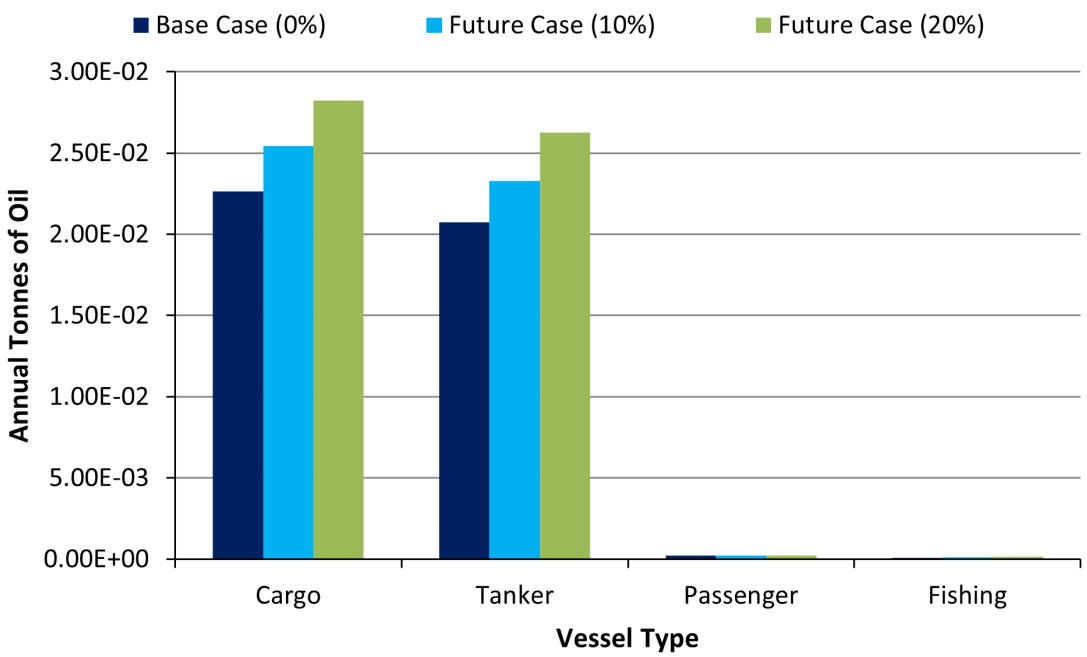


Figure C.23 Estimated change in pollution by vessel type

27.1.1.118 The majority of annual oil spill results are associated with cargo vessels and tankers, due to the annual allision/collision frequency associated with cargo vessels and large spill size for tankers in the event an incident occurs.

C.6.3 Significance of increase in pollution risk

27.1.1.119 To assess the significance of the increased pollution risk from vessels caused by Morven South historical oil spill data for the UK has been used as a benchmark.

27.1.1.120 From the MEHRAs research, the annual average tonnes of oil spilled in UK waters due to maritime incidents in the 10-year period from 1989 to 1998 was 16,111. This is based upon a total of 146 reported oil pollution incidents of greater than one tonne (smaller spills are excluded as are incidents which occurred within port or harbour areas or resulting from operational errors or equipment failure). Commercial vessel spills accounted for approximately 99% of the total while fishing vessel incidents accounted for less than 1%.

27.1.1.121 The overall increase in pollution estimated due to Morven South of 0.04 tonnes for the base case represents a 0.0003% increase compared to the historical average pollution quantities from maritime incidents in UK waters.

C.7 Fatality risk – Scenario 2

C.7.1 Incident data

27.1.1.122 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 Morven North and Morven South.

27.1.1.123 Morven North and Morven South 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.

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

27.1.1.125 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.2.3). Additionally, none of the allision incidents reported by the MAIB between 2002 and 2021 resulted in a fatality.

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

C.7.2 Fatality probability

27.1.1.127 Five of the 504 collision incidents reported by the MAIB within UK waters between 2002 and 2021 resulted in one or more fatalities. This gives a 0.99% probability that a collision incident will lead to a fatal accident.

27.1.1.128 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.9 presents the average number of POB estimated for each category of vessel navigating in proximity to Morven North and Morven South. 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.9 Estimated average People on Board by vessel category

Vessel Category	Sub Categories	Source of Estimated Average POB	Estimated Average POB
Cargo/freight	Dry cargo, other commercial, service ship, etc.	MAIB incident data	15
Tanker	Tanker/combination carrier	MAIB incident data	23
Passenger	RoRo passenger, cruise liner, etc.	Vessel traffic survey data/online information	1,957
Fishing	Trawler, potter, dredger, etc.	MAIB incident data	3.3
Recreational	Yacht, small commercial motor yacht, etc.	MAIB incident data	3.3

27.1.1.129 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.

27.1.1.130 Using the average POB, along with the vessel type information involved in collision incidents reported by the MAIB (see Section C.2.2), there was an estimated 86,940 POB the vessels involved in the collision incidents.

27.1.1.131 Based upon five fatalities during the period 2002 to 2021, the overall fatality probability in a collision for any individual onboard is approximately 5.75×10^{-5} per collision.

27.1.1.132 It is considered inappropriate to apply this rate uniformly as the statistics indicate that the fatality probability associated with smaller craft, such as fishing vessels and recreational vessels, is higher. Therefore, the fatality probability has been subdivided into three categories of vessel as presented in Table C.10. In addition, due to zero fatalities resulting from commercial vessel collisions between 2002 and 2021, the time period used to assess the fatality probability for commercial vessels has been extended by five years to ensure a meaningful probability is captured.

Table C.10 Collision incident fatality probability by vessel category

Vessel Category	Sub Categories	Fatalities	People Involved	Fatality Probability	Time Period
Commercial	Dry cargo, passenger, tanker, etc.	1	55,573	1.80×10^{-5}	1997 to 2021 (25 years)
Fishing	Trawler, potter, dredger, etc.	2	927	2.2×10^{-3}	2002 to 2021 (20 years)
Recreational	Yacht, small commercial motor yacht, etc.	3	1,023	2.9×10^{-3}	2002 to 2021 (20 years)

C.7.3 Fatality risk due to Morven North and Morven South

27.1.1.133 The base case and future case annual collision frequency levels pre and post wind farm for Morven North and Morven South are summarised in Table C.11.

Table C.11 Summary of annual collision and allision risk results

Risk	Scenario	Annual Frequency (Return Period)		
		Pre Wind Farm	Post Wind Farm	Change
Vessel to vessel collision	Base case	5.01×10^{-4} (1 in 1,996 years)	1.03×10^{-3} (1 in 971 years)	5.28×10^{-4} (1 in 1,893 years)
	Future case (10%)	6.03×10^{-4} (1 in 1,657 years)	1.24×10^{-3} (1 in 804 years)	6.40×10^{-3} (1 in 1,563 years)
	Future case (20%)	7.23×10^{-4} (1 in 1,383 years)	1.48×10^{-3} (1 in 674 years)	7.60×10^{-3} (1 in 1,315 years)
Powered vessel to structure allision	Base case	-	2.92×10^{-3} (1 in 343 years)	2.92×10^{-3} (1 in 343 years)
	Future case (10%)	-	3.21×10^{-3} (1 in 311 years)	3.21×10^{-3} (1 in 311 years)
	Future case (20%)	-	3.50×10^{-3} (1 in 285 years)	3.50×10^{-3} (1 in 285 years)
Drifting vessel to structure allision	Base case	-	2.28×10^{-4} (1 in 4,386 years)	2.28×10^{-4} (1 in 4,386 years)
	Future case (10%)	-	2.50×10^{-4} (1 in 3,993 years)	2.50×10^{-4} (1 in 3,993 years)
	Future case (20%)	-	2.74×10^{-3} (1 in 3,652 years)	2.74×10^{-3} (1 in 3,652 years)

Risk	Scenario	Annual Frequency (Return Period)		
		Pre Wind Farm	Post Wind Farm	Change
Fishing vessel to structure allision	Base case	-	3.60×10^{-3} (1 in 277 years)	3.60×10^{-3} (1 in 277 years)
	Future case (10%)	-	3.96×10^{-3} (1 in 252 years)	3.96×10^{-3} (1 in 252 years)
	Future case (20%)	-	4.32×10^{-3} (1 in 231 years)	4.32×10^{-3} (1 in 231 years)
Total	**Base case**	**5.01×10^{-4} (1 in 1,996 years)**	**7.78×10^{-3} (1 in 129 years)**	**7.28×10^{-3} (1 in 137 years)**
	Future case (10%)	**6.03×10^{-4} (1 in 1,657 years)**	**8.67×10^{-3} (1 in 115 years)**	**8.07×10^{-3} (1 in 124 years)**
	Future case (20%)	**7.23×10^{-4} (1 in 1,383 years)**	**9.59×10^{-3} (1 in 104 years)**	**8.86×10^{-3} (1 in 113 years)**

27.1.1.134 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 Morven North and Morven South for the base case and future case are presented in Figure C.24.

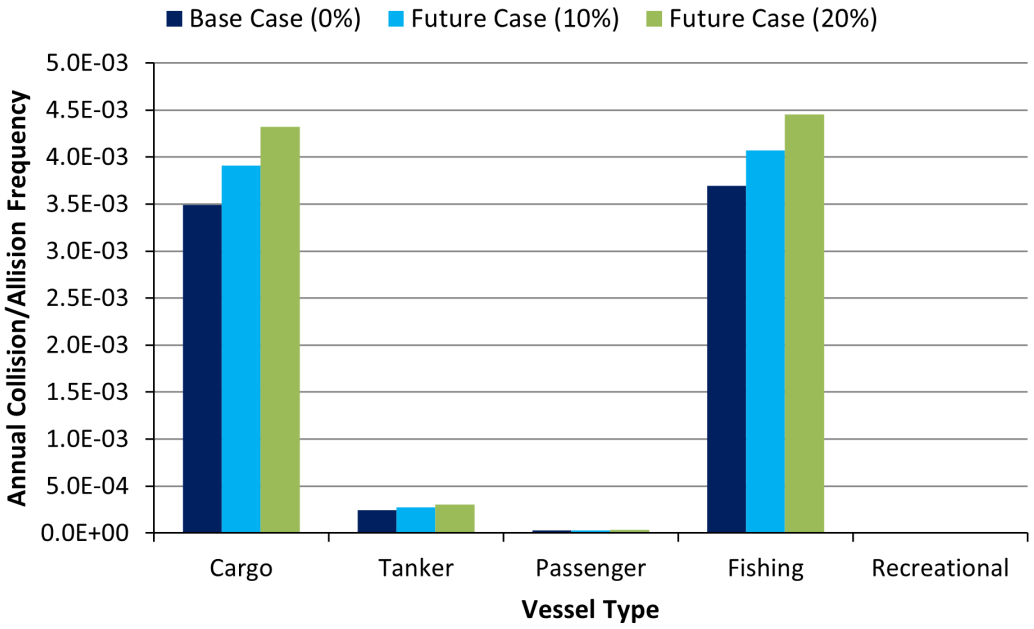


Figure C.24 Estimated change in annual collision and allision frequency by vessel type

27.1.1.135 It is seen that the majority of change in collision and allision frequency is associated with fishing vessels, due to the level of internal fishing activity and cargo vessels, due to their abundance within the vessel traffic dataset.

27.1.1.136 Combining the annual collision and allision frequency (see Table C.11), estimated number of POB for each vessel type (see Table C.9) and the estimated fatality probability for each vessel type category (see Table C.10), the annual increase in PLL due to the presence of Morven North and Morven South in the base case is estimated to be 2.69×10^{-5}, equating to one additional fatality every 37,202 years.

27.1.1.137 The estimated incremental increases in PLL due to Morven North and Morven South, distributed by vessel type and for the base case and future case, are presented in Figure C.25.

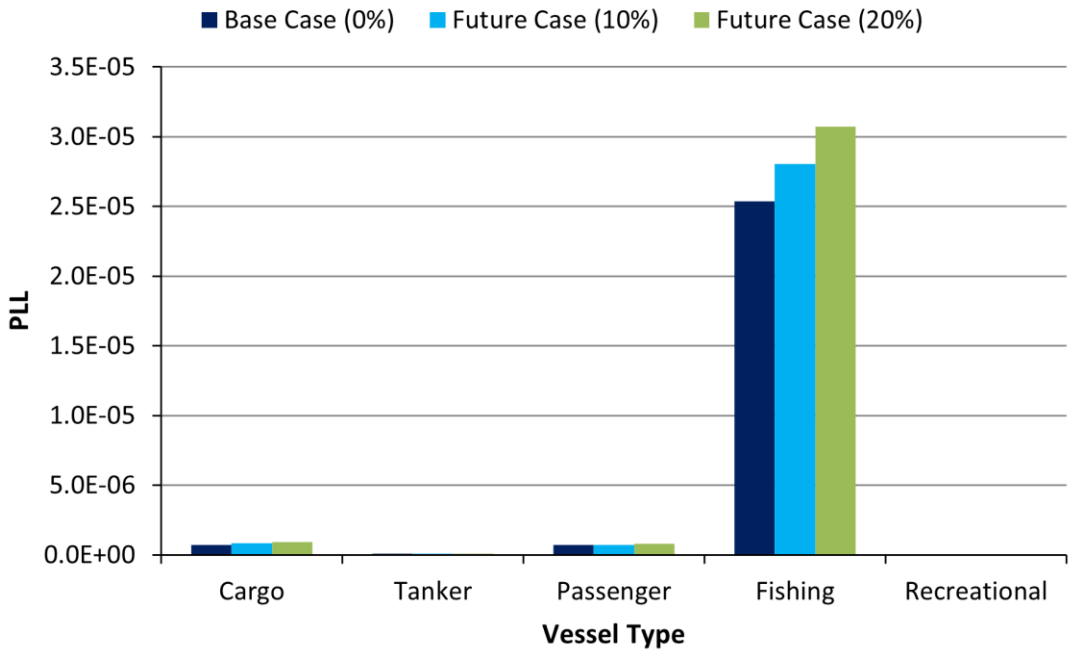


Figure C.25 Estimated change in annual Potential Loss of Life by vessel type

27.1.1.138 It can be seen that the majority of the change in annual PLL is associated with fishing vessels.

27.1.1.139 Converting the PLL to individual risk based upon the average number of people exposed by vessel type, the results are presented in Figure C.26.

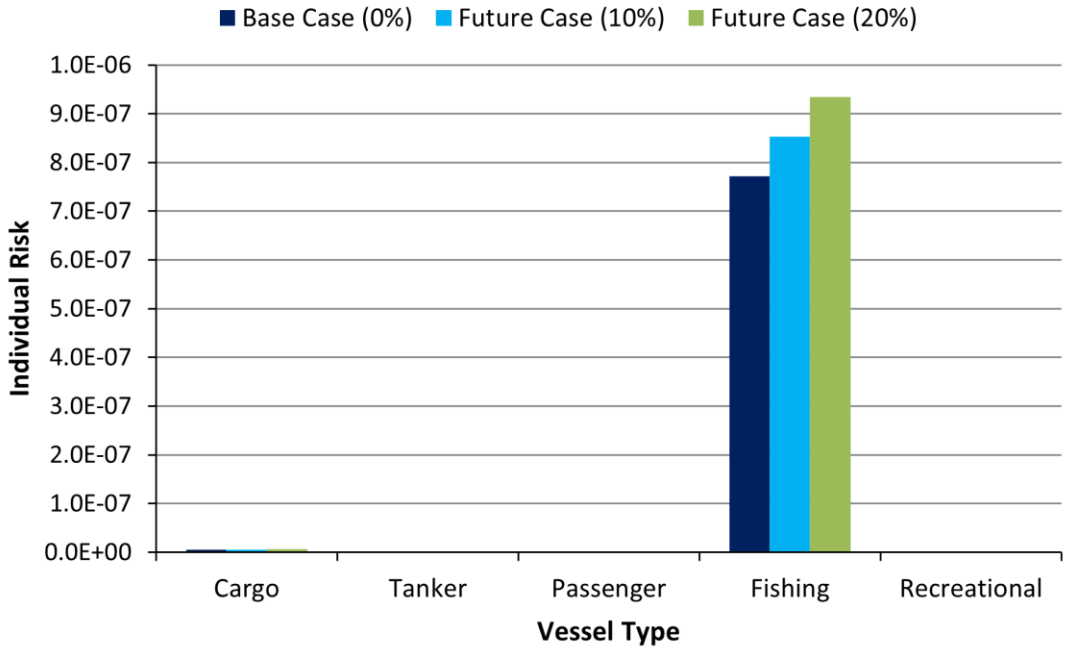


Figure C.26 Estimated change in individual risk by vessel type

27.1.1.140 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, as well as the level of internal fishing activity.

C.7.4 Significance of increase in fatality risk

27.1.1.141 In comparison to MAIB statistics, which indicate an average of 18 to 19 fatalities per year in UK territorial waters during the 20-year period between 2002 and 2021, the overall increase for the base case in PLL of one additional fatality per 37,202 years represents a low change.

27.1.1.142 In terms of individual risk to people, the change for commercial vessels attributed to Morven North and Morven South (approximately 5.15×10^{-9} 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.

27.1.1.143 For fishing vessels, the change in individual risk attributed to Morven North and Morven South (approximately 7.71×10^{-7} for the base case) is also low compared to the background risk level for the UK sea fishing industry of 1.2×10^{-3} per year.

C.8 Pollution risk – Scenario 2

C.8.1 Historical analysis

27.1.1.144 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).

27.1.1.145 Two types of oil spill are considered in this assessment:

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

27.1.1.146 The research undertaken as part of the DfT's MEHRAs project (DfT, 2001) has been used as it was comprehensive and based upon worldwide marine oil spill data analysis. From this research, the overall probability of a spill per incident was calculated based upon historical incident data for each incident type as presented in Figure C.27.

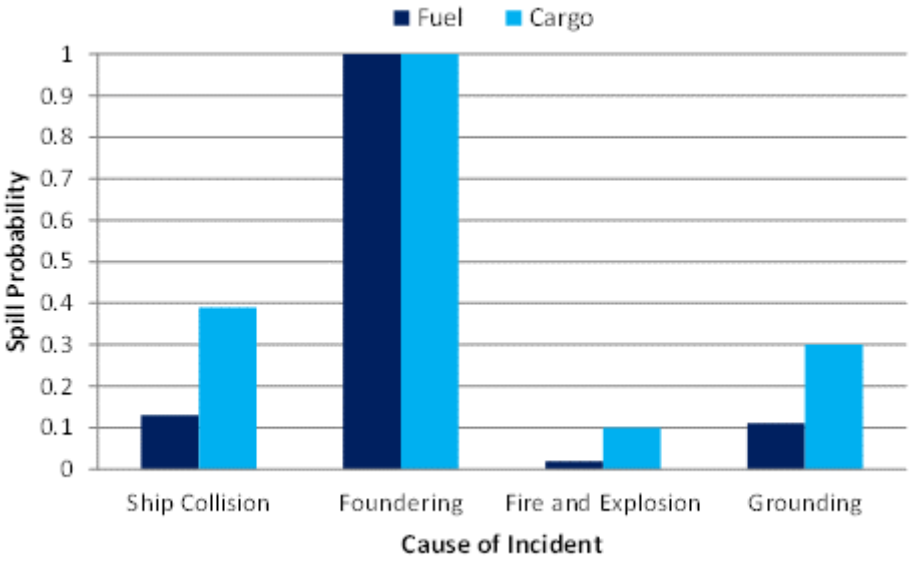


Figure C.27 Probability of an oil spill resulting from an accident

27.1.1.147 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.

27.1.1.148 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.

27.1.1.149 For the types and sizes of vessels exposed to Morven North and Morven South, an average spill size of 100 tonnes of fuel oil is considered a conservative assumption.

27.1.1.150 For cargo spills from laden tankers, the spill size can vary significantly. The ITOPF reported the following spill size distribution for tanker collisions between 1974 and 2004:

- 31% of spills below seven tonnes;
- 52% of spills between seven and 700 tonnes;
- 17% of spills greater than 700 tonnes.

27.1.1.151 Based upon this data and the tankers transiting in proximity to Morven North and Morven South, an average spill size of 400 tonnes is considered a conservative assumption.

27.1.1.152 For fishing vessel collisions, comprehensive statistical data is not available. Consequently, it is conservatively assumed that 50% of all collisions involving fishing vessels will lead to oil spill with the quantity spilled being on average five tonnes. Similarly for recreational vessels, due to a lack of data 50% of collisions are conservatively assumed to lead to a spill with an average size of one tonne.

C.8.2 Pollution risk due to Morven North and Morven South

27.1.1.153 Applying the above probabilities to the annual collision and allision frequency by vessel type presented in Table C.11 and the average spill size per vessel, the amount of oil spilled per year due to the impact of Morven North and Morven South is estimated to be 0.09 tonnes per year for the base case and 0.10 tonnes and 0.12 tonnes per year for the future cases of 10% and 20% vessel traffic increases respectively.

27.1.1.154 The estimated increase in tonnes of oil spilled, distributed by vessel type, for the base case and future case are presented in Figure C.28.

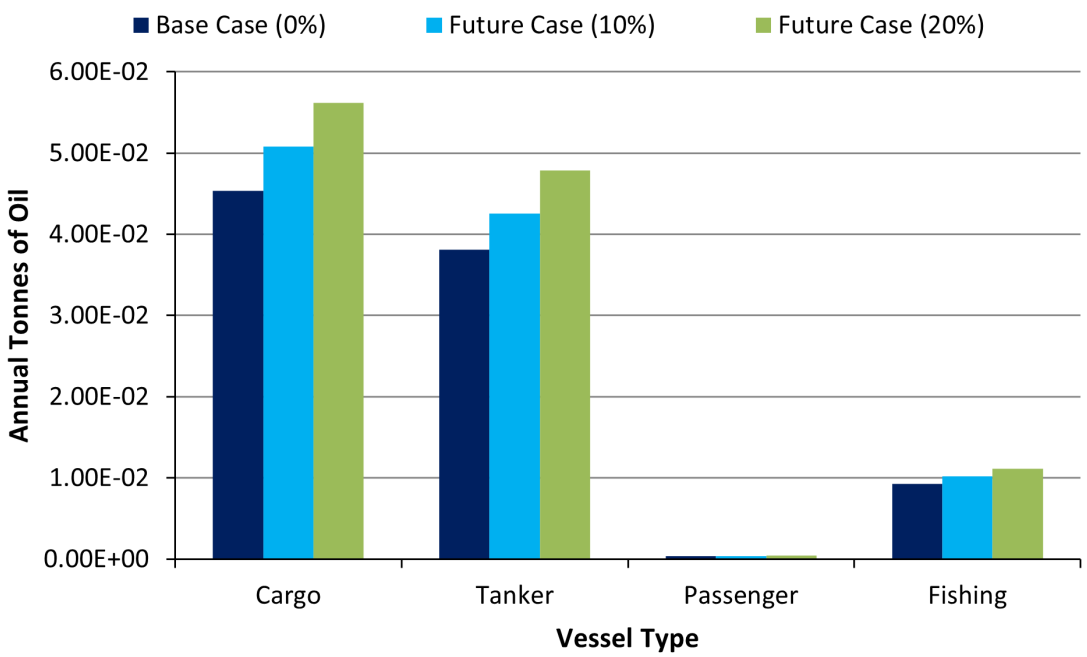


Figure C.28 Estimated change in pollution by vessel type

27.1.1.155 The majority of annual oil spill results are associated with cargo vessels and tankers, due to the annual allision/collision frequency associated with cargo vessels and large spill size for tankers in the event an incident occurs.

C.8.3 Significance of increase in pollution risk

27.1.1.156 To assess the significance of the increased pollution risk from vessels caused by Morven North and Morven South historical oil spill data for the UK has been used as a benchmark.

27.1.1.157 From the MEHRAs research, the annual average tonnes of oil spilled in UK waters due to maritime incidents in the 10-year period from 1989 to 1998 was 16,111. This is based upon a total of 146 reported oil pollution incidents of greater than one tonne (smaller spills are excluded as are incidents which occurred within port or harbour areas or resulting from operational errors or equipment failure). Commercial vessel spills accounted for approximately 99% of the total while fishing vessel incidents accounted for less than 1%.

27.1.1.158 The overall increase in pollution estimated due to Morven North and Morven South of 0.09 tonnes for the base case represents a 0.0006% increase compared to the historical average pollution quantities from maritime incidents in UK waters.

C.9 Conclusion

27.1.1.159 This appendix has quantitively assessed the fatality and pollution risk associated with Morven North and Morven South in the event of a collision or allision incident occurring. The assessment indicates that the fatality and pollution risk associated with the concurrent developments scenario is greatest.

27.1.1.160 Overall, the impact of Morven North and Morven South on people and the environment is relatively low compared to the existing background risk levels in UK waters, irrespective of the scenario assessed. However, this is the localised impact of a single OWF development and there will be additional maritime risks associated with other OWF developments.

27.1.1.161 Discussion of relevant mitigation measures and monitoring is provided in Section 17 of the NRA.

Appendix D Regular Operator consultation

27.1.1.162 As part of the consultation process for Morven North and Morven South, 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 Morven Site were consulted via email. An example of the correspondence sent to the Regular Operators (which shows the extent of Morven North and Morven South at that time as a single entity) is presented below.

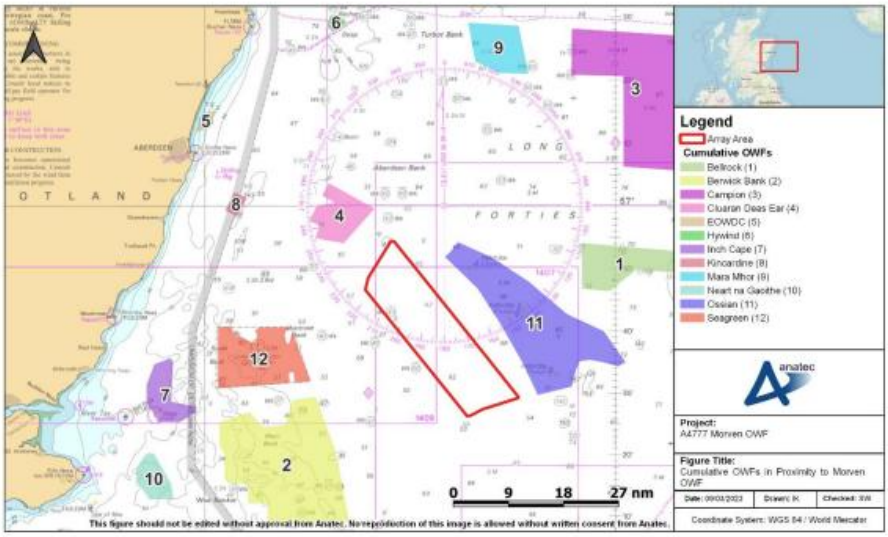
Anatec Ltd.
Cain House
10 Exchange Street
Aberdeen AB11 6PH
Tel: 01224 253700
Email: aberdeen@anatec.com
Web: www.anatec.com

Date: 10/03/2023

Dear Stakeholder,

Stakeholder Consultation on Impacts Relating to Shipping and Navigation for the Proposed Morven Offshore Wind Farm

As you may be aware, bp/EnBW is developing Project Morven, an Offshore Wind Farm (OWF) located off the east coast of Scotland consisting of offshore wind turbines and associated infrastructure, as well as export cables to shore, and an onshore grid connection. The location and proximity of the Morven OWF Project to other operational, consented and potential offshore wind farms is presented below.



The Morven OWF Site is located approximately 33nm (61km) east of the Scottish coast and covers an area of approximately 250nm² (860km²). Other future offshore wind farms in the area in the early planning/pre-scoping stage include the Bellrock, Cluaran Deas Ear and Ossian OWFs.

Further information relating to Project Morven is available here.

Project Morven's generation and transmission aspects are being consented separately, with two applications submitted, each supported by an Environmental Impact Assessment (EIA):

- one for the OWF relating to the wind turbines, foundations, inter-array and connector cables and offshore substation platforms (OSPs); and
- one for the grid connection, including the offshore transmission assets and associated infrastructure.

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

The Environmental Impact Assessment (EIA) Report process requires bp/EnBW to identify impacts that the OWF Project may potentially have upon shipping and navigation, and to ensure comprehensive consultation with relevant stakeholders is carried out. In order to analyse shipping movements within, and in the vicinity of, the OWF Site, Automatic Identification System (AIS) and Radar data, along with visual observations obtained from vessel-based surveys undertaken in winter 2022, has been collected and assessed. Additionally, a 12-month AIS dataset covering 2021/2022 has been considered to ensure seasonal variation is accounted for. All the data will feed into the Navigational Risk Assessment (NRA) required by the Maritime and Coastguard Agency (MCA).

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

In particular, we are keen to receive comments on the following:

1. Whether the proposal to construct the OWF Project is likely to impact the routeing of any specific vessels, including how it might impact your transits;
2. Whether any aspect of the OWF Project **by itself** poses any safety concerns to your vessels, including any adverse weather routeing;
3. Whether your responses to questions 1 and 2 above change when considering the **cumulative scenario** with the other developments including Cluaran Deas Ear, Ossian, and Bellrock;
4. Whether you would choose to make passage internally through the OWF Site; and
5. Whether you wish to be retained on our list of marine stakeholders and consulted throughout the assessment process.

Responses should be sent via email to [redacted] by Friday the 7th of April 2023. Should you have any queries about the published information or require any further information to support your review, please do not hesitate to contact us.

Yours sincerely,

[redacted]

Anatec Ltd.

Appendix E Long-term vessel traffic movements

E.1 Introduction

27.1.1.163 This appendix assesses the additional long-term vessel traffic data for Morven North and Morven South. The NRA considers 28 days of AIS, Radar and visual observation data as the primary vessel traffic data source. However, it should be considered that studying a 28-day period in isolation may exclude certain activities or periods of pertinence to shipping and navigation.

27.1.1.164 Therefore, in line with good practice assessment procedures, this NRA has also considered a longer-term dataset covering 12-months from 01 October 2021 to 30 September 2022 to ensure a comprehensive characterisation of vessel traffic movements can be established including the capture of any seasonal variation.

E.2 Methodology

E.2.1 Study area

27.1.1.165 This appendix has assessed the long-term vessel traffic data within the Regional Shipping and Navigation Study Area introduced in Section 3.4.

E.2.2 Data period and temporary vessel traffic

27.1.1.166 The long-term vessel traffic data was collected from terrestrial AIS receivers for the 12-month period between 01 October 2021 and 30 September 2022.

27.1.1.167 As per the vessel traffic surveys, a number of vessel tracks recorded during the data period were classified as temporary (non-routine) and have been excluded from the characterisation of the vessel traffic baseline, including vessels associated with Seagreen 1 which was still under construction at the time of data collection.

27.1.1.168 Temporary traffic that has been filtered out of the rest of the analysis is presented in Figure E.1. There were three uncrewed vessels recorded within the Morven Site from 25 June to 13 July 2022.

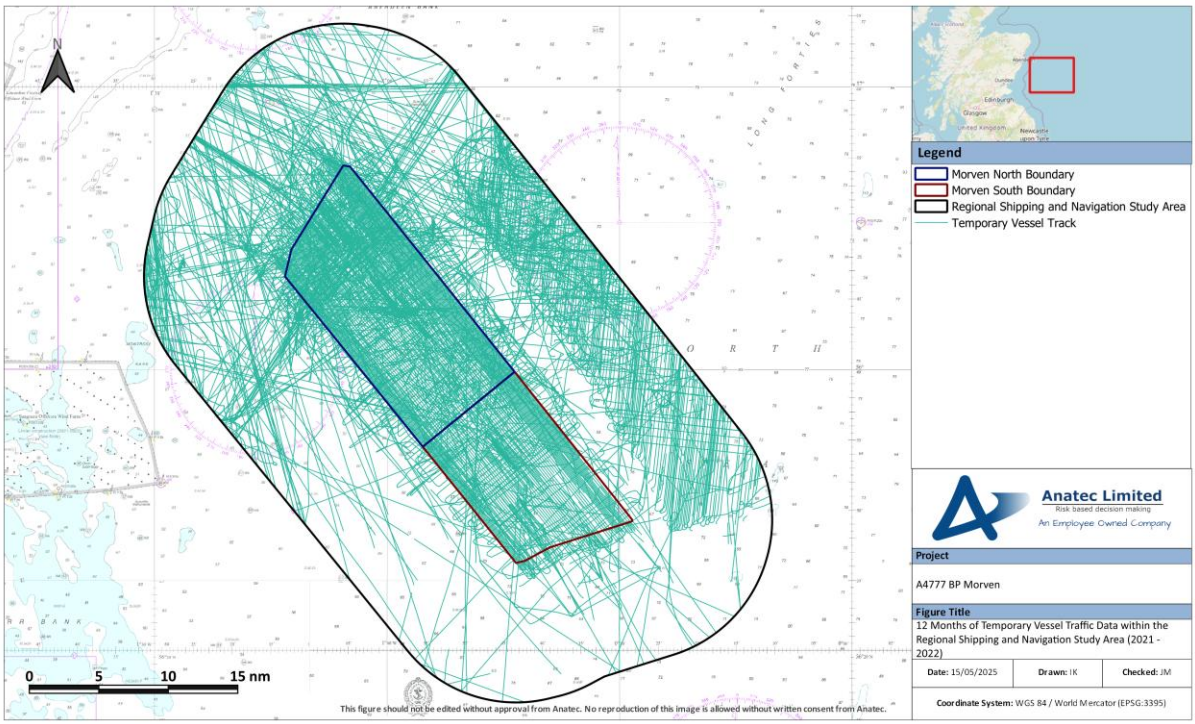


Figure E.1 12 Months of temporary vessel traffic data within the Regional Shipping and Navigation Study Area (2022)

E.2.3 AIS Carriage

27.1.1.169 General limitations associated with the use of AIS data (for example carriage requirements) are discussed in full within Section 5.4.1.

E.3 Long-term vessel traffic movements

27.1.1.170 The vessel tracks recorded within the Regional Shipping and Navigation Study Area during the data period are colour-coded by vessel type (excluding temporary traffic) and presented in Figure E.2.

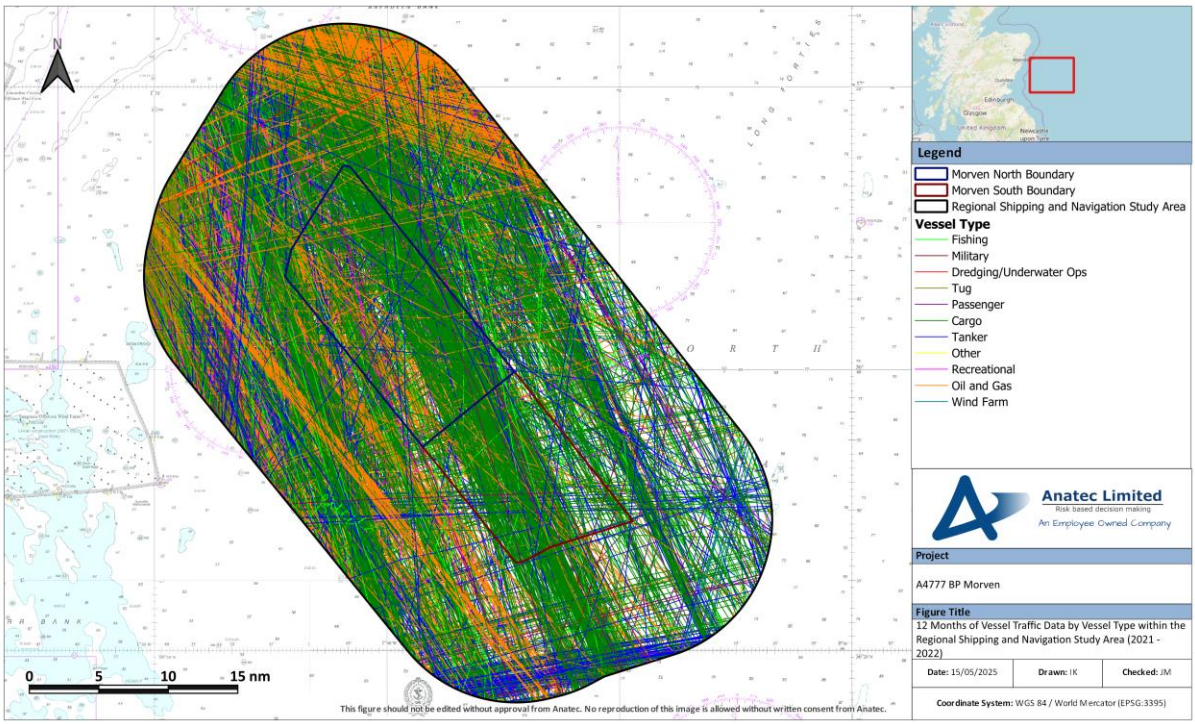


Figure E.2 12 months of vessel traffic data by vessel type within the Regional Shipping and Navigation Study Area (2022)

E.3.2 Vessel count

27.1.1.171 The average daily number of vessels within the Regional Shipping and Navigation Study Area for each month of the 12-month data periods are presented in Figure E.3.

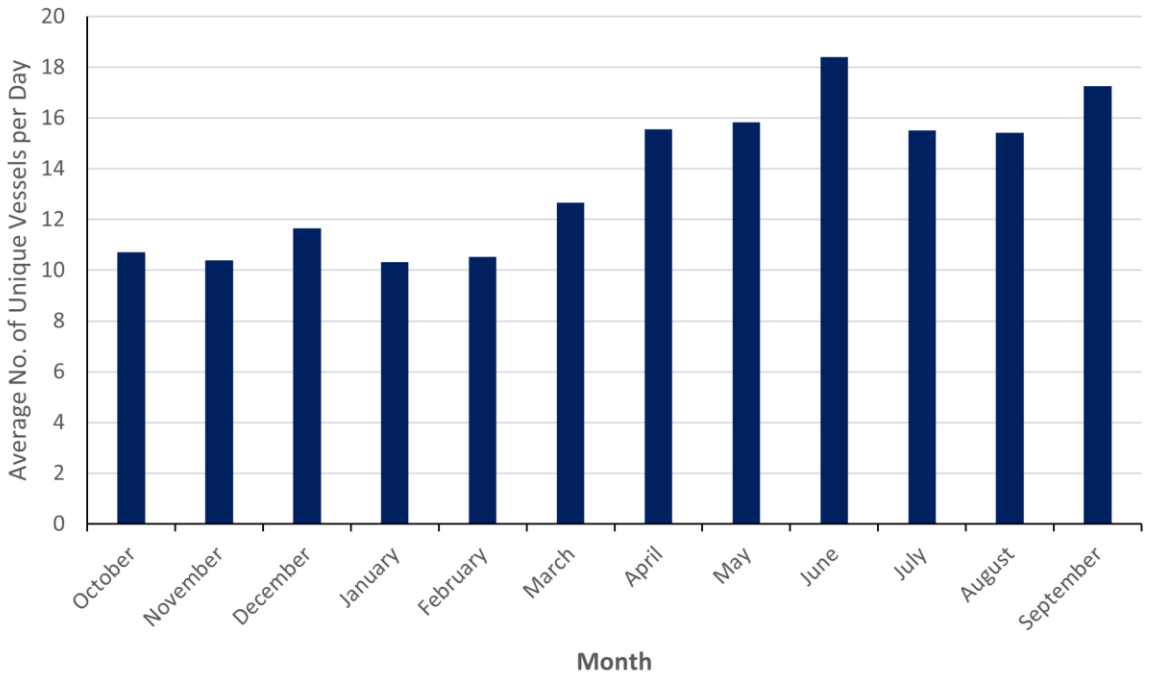


Figure E.3 Unique vessels per day within the Regional Shipping and Navigation Study Area (2022)

27.1.1.172 There was an average of 14 unique vessels per day recorded within the Regional Shipping and Navigation Study Area during the study period. The busiest month was June, with approximately 18 unique vessels per day recorded. The quietest month was January, with approximately 10 unique vessels per day recorded. Overall, summer months (April to September) had higher vessel counts compared to the winter months (October to February). There was not considered to be any other notable fluctuation in traffic volumes over the study period within the Regional Shipping and Navigation Study Area.

27.1.1.173 In total, approximately 31% of all vessels recorded within the Regional Shipping and Navigation Study Area during the data period intersected the Morven Site.

E.3.3 Vessel type

27.1.1.174 The distribution of the main vessel types recorded during the data period are presented in Figure E.4. Vessel types accounting for less than 1% of the overall activity during the data period (including military and marine aggregate dredging vessels) have been incorporated into the 'other' vessel category.

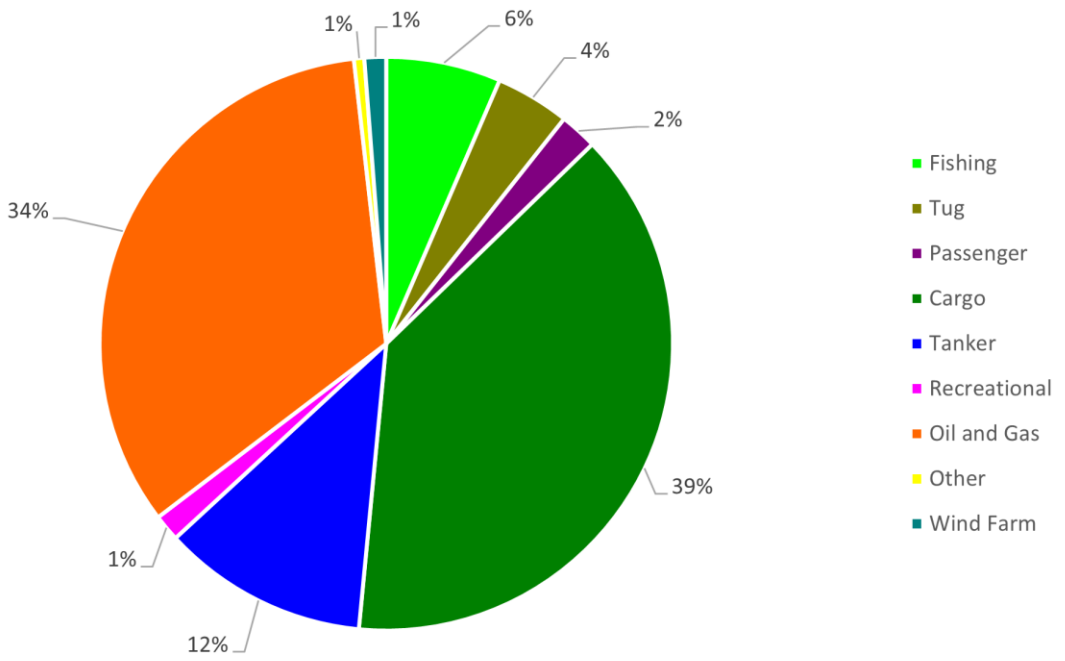


Figure E.4 Vessel type distribution within the Regional Shipping and Navigation Study Area (2022)

27.1.1.175 The most common vessel types recorded within the Regional Shipping and Navigation Study Area during the 12-month period were cargo (39%), oil and gas (34%), tanker (12%) and fishing (6%).

E.3.4 Commercial vessels

27.1.1.176 The commercial vessels (in this instance relating to cargo vessels, tankers and passenger vessels) recorded within the shipping and navigation Study Area during the study period are presented in Figure E.5. It is noted that oil and gas vessels are considered separately in Section E.3.5.

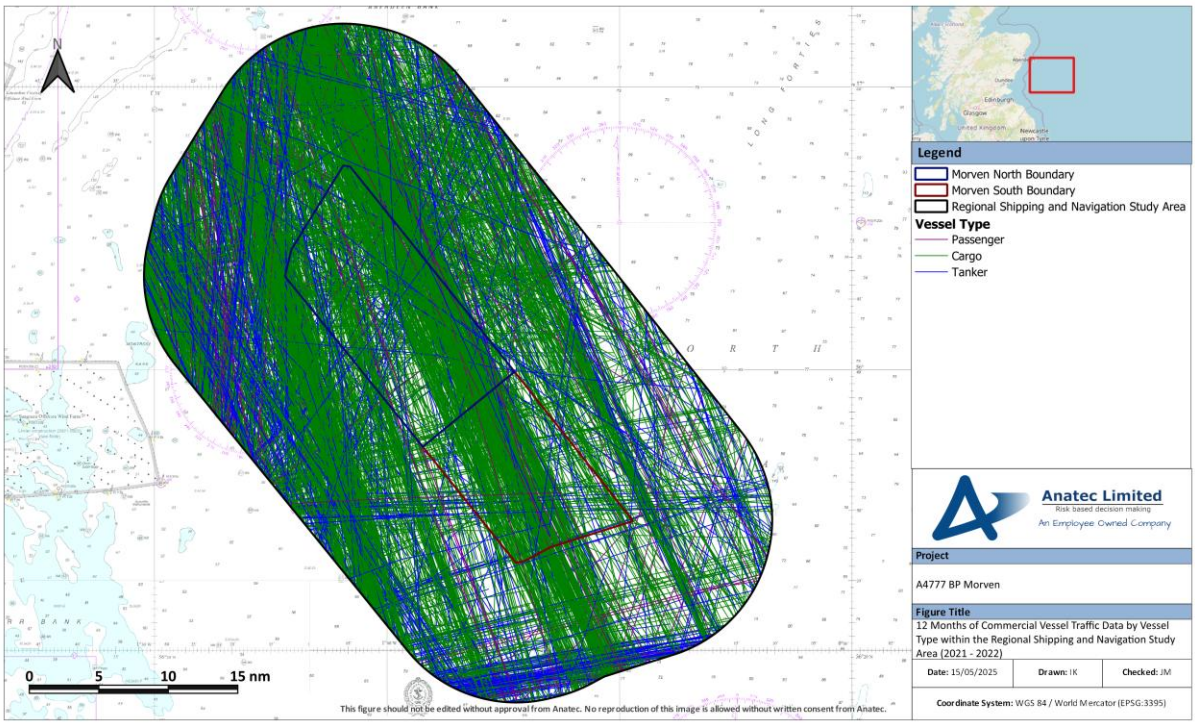


Figure E.5 12 months of commercial vessel traffic data by vessel type within the Regional Shipping and Navigation Study Area (2022)

27.1.1.177 An average of approximately seven unique commercial vessels per day were recorded within the Regional Shipping and Navigation Study Area during the study period.

27.1.1.178 The cargo vessels and majority of tankers recorded were noted on routes through the Morven Site both in the northwest-southeast and east-west orientation. Some tankers were also recorded on routes west of the Morven Site in the northeast-southwest orientation. Cargo vessels and tankers were on routes primarily between ports Humber, Tees and Tyne (UK) and mainland Europe ports such as Reykjavik and Straumsvik (Iceland), as well as Amsterdam and Rotterdam.

27.1.1.179 Passenger vessels were recorded on routes within the UK; primarily between Newhaven and Invergordon, Newcastle and Queensferry and between Tyne and Rosyth, operated by cruise liners.

27.1.1.180 The number of unique cargo, tanker and passenger vessels recorded per day for each month within the Regional Shipping and Navigation Study Area and Morven Site are presented in Table E.1.

Table E.1 Commercial vessel count summary

Vessel Type	Study Area (per Day)			Morven Site (per Day)		
	Quietest	Busiest	Average	Quietest	Busiest	Average
Passenger	0	1	<1	0	<1	<1
Cargo	4	7	5	2	3	3
Tanker	1	2	2	<1	1	<1

27.1.1.181 The fluctuation of the unique number of cargo, tanker and passenger vessels per day per month recorded within the Regional Shipping and Navigation Study Area and Morven Site was minimal during the 12-month period, with higher counts from April to September.

E.3.5 Oil and gas vessels

27.1.1.182 Vessel tracks of the oil and gas vessels recorded within the Regional Shipping and Navigation Study Area during the study period are presented in Figure E.6.

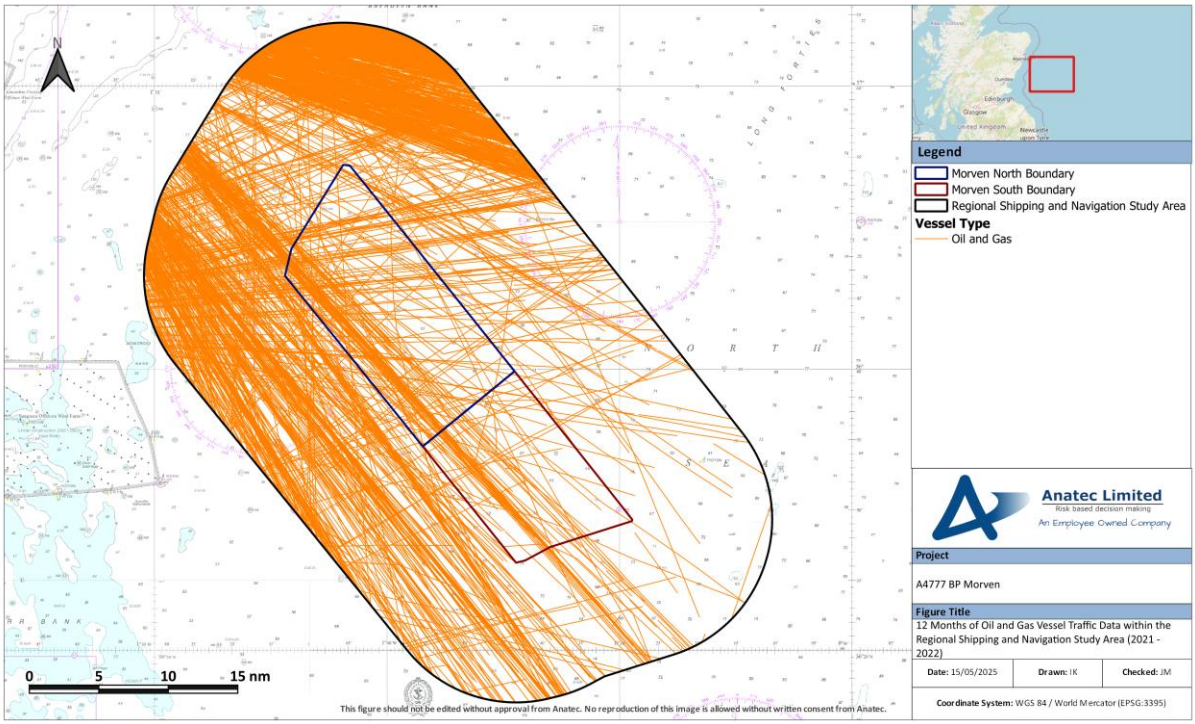


Figure E.6 12 months of oil and gas vessel traffic data within the Regional Shipping and Navigation Study Area (2022)

27.1.1.183 There were an average of five unique oil and gas vessels per day recorded within the Regional Shipping and Navigation Study Area during the 12-month study period. The majority of these vessels were broadcasting their destination on routes between Aberdeen and oil and gas platforms, (e.g., Montrose, Elgin, Fulmar and Cygnus etc). No vessels were recorded to be engaged in on-station activity as there are no oil and gas platforms within the Regional Shipping and Navigation Study Area.

27.1.1.184 Rig movement was recorded on one occasion during the 12-month study period, in which a jackup platform was towed to Dundee approximately 3nm north of the Morven Site.

E.3.6 Commercial fishing vessels

27.1.1.185 The fishing vessels recorded within the Regional Shipping and Navigation Study Area during the study period are presented in Figure E.7. It should be considered that as this assessment is via AIS only, it is likely to under-represent the number of fishing vessels.

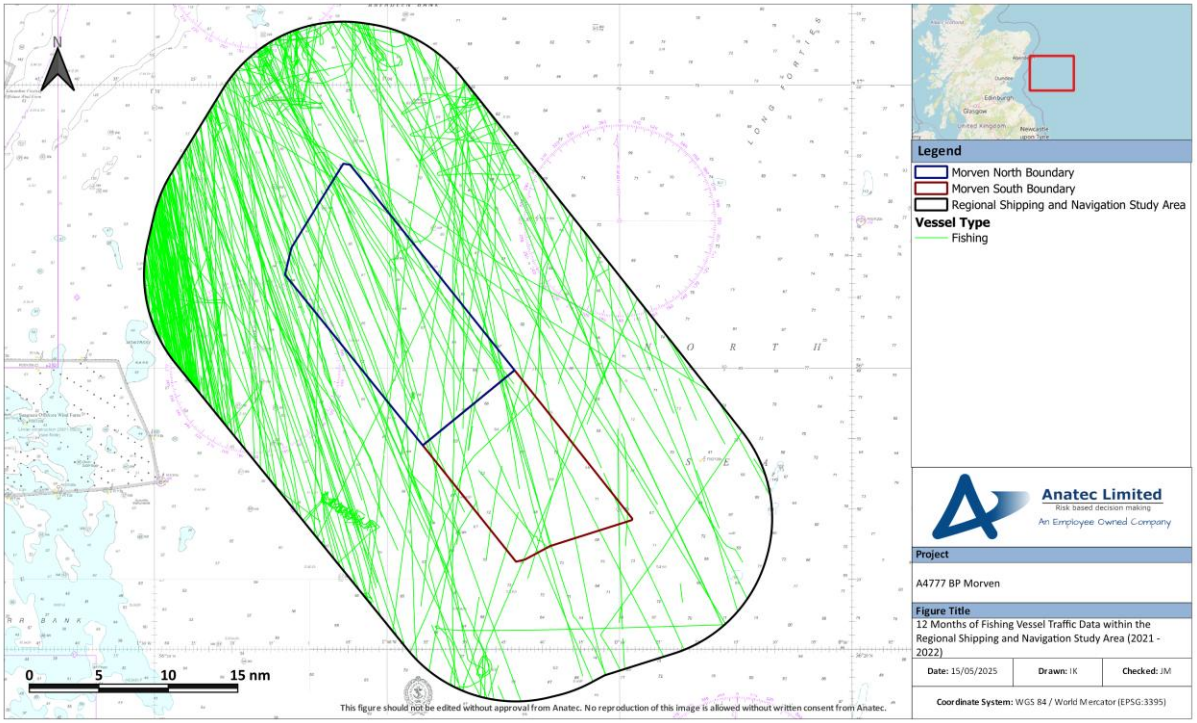


Figure E.7 12 months of fishing vessel traffic data within the Regional Shipping and Navigation Study Area (2022)

27.1.1.186 An average of one unique fishing vessel per day was recorded within the Regional Shipping and Navigation Study Area during the study period.

27.1.1.187 Analysis of vessel speed and movement was undertaken to determine the likely status of fishing vessel behaviour within the Regional Shipping and Navigation Study Area (i.e. actively fishing or in transit).

27.1.1.188 The results of this assessment are colour-coded by fishing vessel behaviour and presented in Figure E.8. It is noted that the same vessel may be represented multiple times if it changed behaviour whilst in the Regional Shipping and Navigation Study Area. Following this, the average number of fishing vessels engaged in fishing and exclusively transiting per day for each month within the Regional Shipping and Navigation Study Area are summarised in Figure E.9.

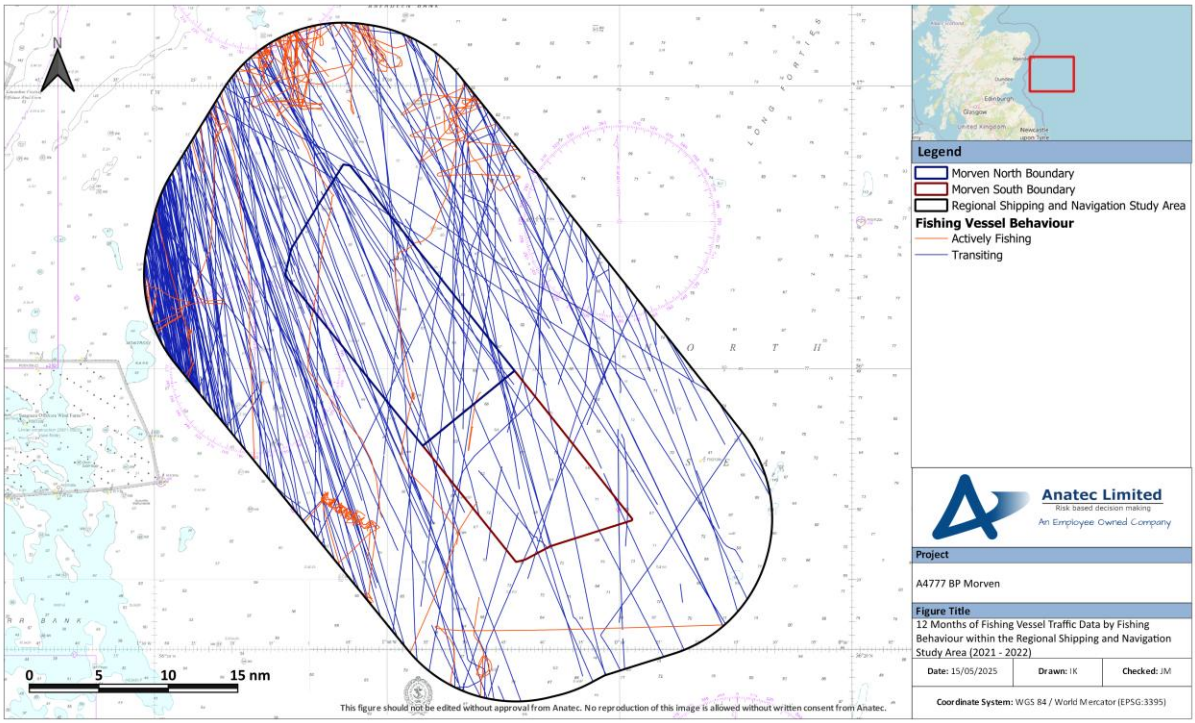


Figure E.8 12 Months of fishing vessel traffic data by behaviour within the Regional Shipping and Navigation Study Area (2022)

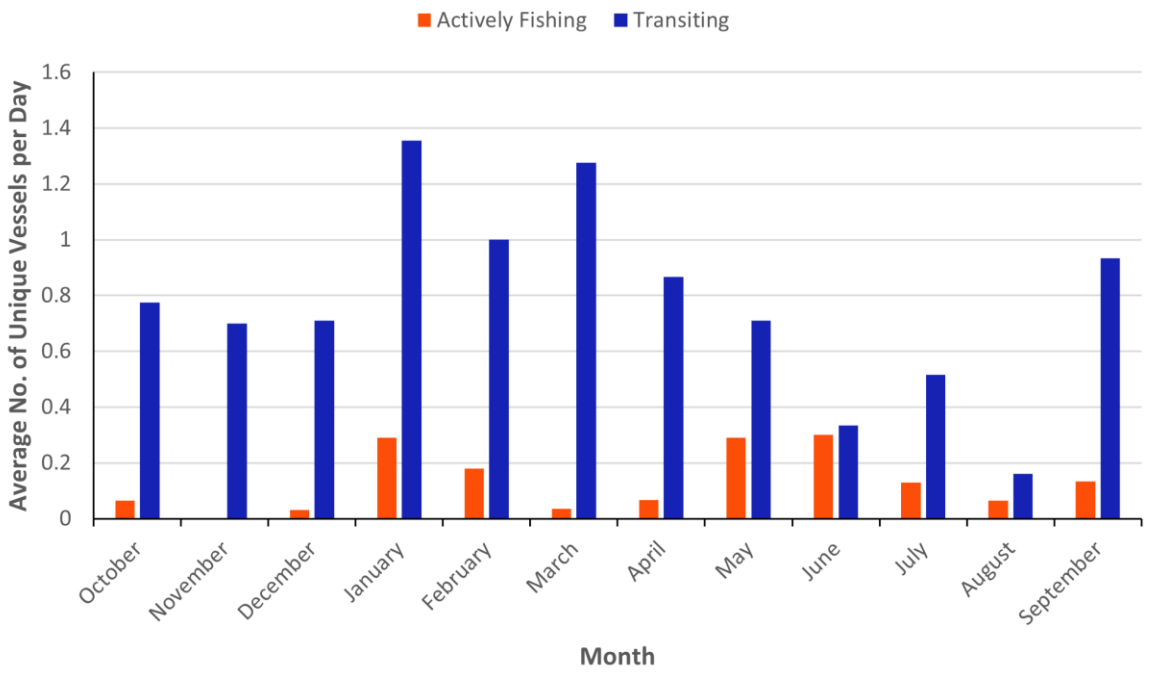


Figure E.9 Number of fishing vessels by behaviour

27.1.1.189 Active fishing was mostly prominent in the north and west of the Regional Shipping and Navigation Study Area, with minimal tracks within the Morven Site and east of the Regional Shipping and Navigation Study Area. Overall, transiting fishing vessel numbers peaked in January, although this trend was not recorded for vessels actively fishing.

E.3.7 Wind farm vessels

27.1.1.190 The wind farm vessels recorded within the Regional Shipping and Navigation Study Area during the study period are presented in Figure E.10.

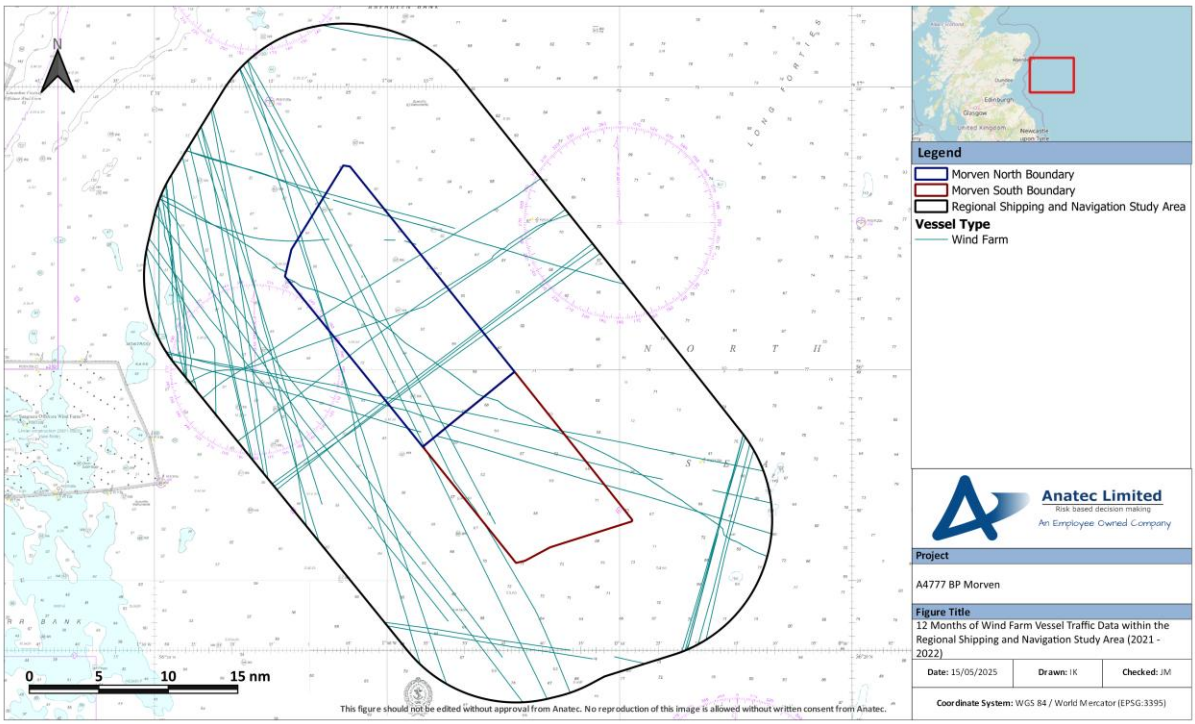


Figure E.10 12 months of wind farm vessel traffic data within the Regional Shipping and Navigation Study Area (2022)

27.1.1.191 There was an average of one unique wind farm vessel every six days recorded within the Regional Shipping and Navigation Study Area. The majority of wind farm vessels recorded were associated with Kincardine OWF, with some associated with EOWDC, Hornsea Project Two and the Dogger Bank OWFs.

E.3.8 Recreational vessels

27.1.1.192 The recreational vessels recorded within the Regional Shipping and Navigation Study Area during the study period are presented in Figure E.11. Recreational vessels in this context refer to vessels with a capacity of less than twelve passengers and length of less than 24m. It is noted that recreational vessels also include small privately chartered fishing excursions (transiting only). Similarly to the fishing vessels recorded, as this assessment is via AIS only, it is likely to under-represent actual recreational vessels.

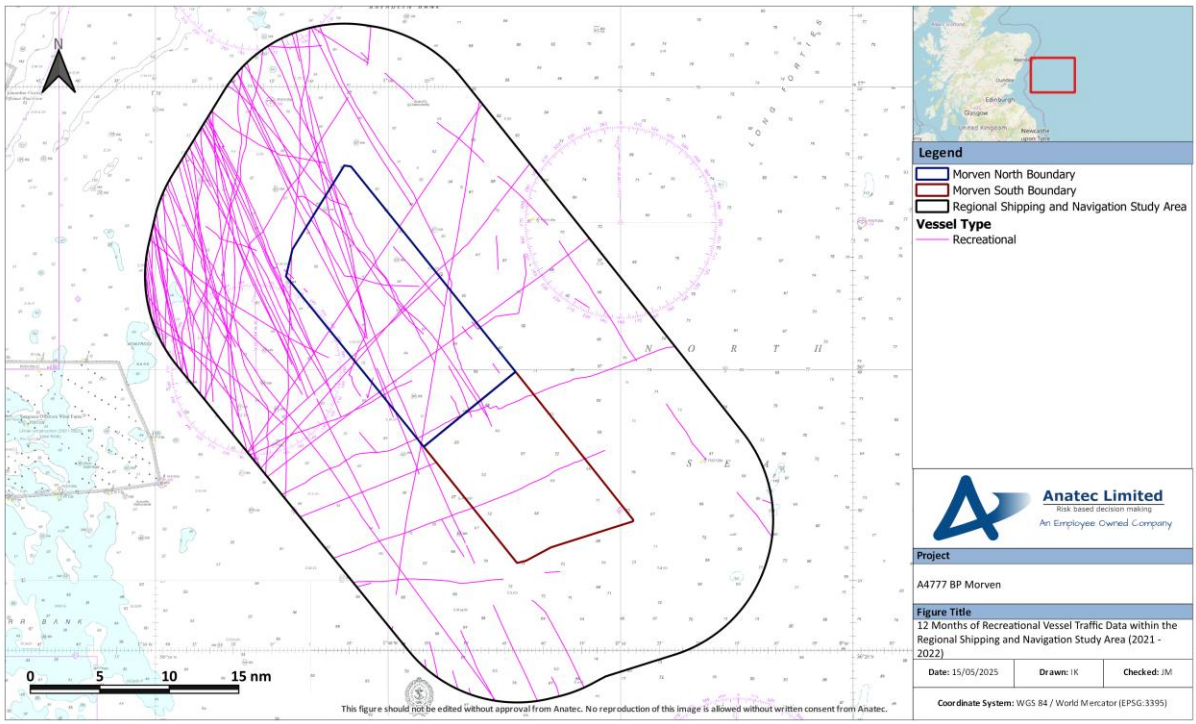


Figure E.11 12 months of recreational vessel traffic data within the Regional Shipping and Navigation Study Area (2022)

27.1.1.193 There was an average of one unique recreational vessel every five days recorded within the Regional Shipping and Navigation Study Area during the study period. Recreational vessels showed high degree of seasonality, with approximately 85% of recreational vessel tracks recorded in the four-month period between 01 May and 31 August 2022. The majority of recreational vessels were recorded in northwest of the Regional Shipping and Navigation Study Area.

E.3.9 Anchored vessels

27.1.1.194 Speed analysis was performed on the 12 months of data to identify vessels at anchor within the Regional Shipping and Navigation Study Area. This analysis has identified likely anchored vessels as those transiting at less than 1kt for a period of 30 minutes or longer. Based on this, vessel behaviour patterns and navigational status broadcast through AIS, the vessels identified as likely being at anchor within the Regional Shipping and Navigation Study Area during the study period are colour-coded by vessel type and presented in Figure E.12.

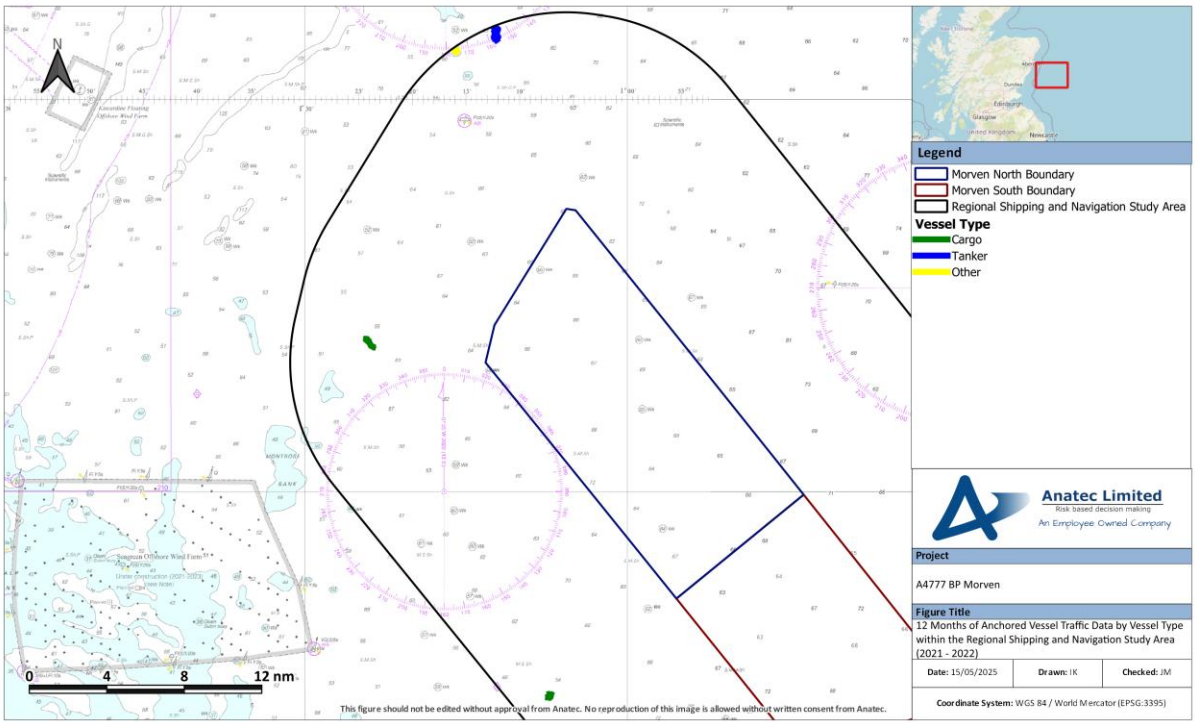


Figure E.12 12 months of anchored vessel traffic data by vessel type within the Regional Shipping and Navigation Study Area (2022)

27.1.1.195 There was an average of one unique vessel every 30 days recorded likely at anchor within the Regional Shipping and Navigation Study Area during the study period. This value being low is expected due to the water depths and distance offshore. The majority of vessel tracks likely at anchor belonged to a tanker (six instances), with four instances recorded for two cargo vessels and two instances for fisheries research vessel.

E.4 Survey data comparison

27.1.1.196 A comparison of the average number of each main vessel type analysed in the previous sections recorded throughout the long-term data period against the average number of each vessel type recorded throughout the two vessel traffic surveys are presented in Table E.2.

Table E.2 Vessel count comparison with long-term data

Vessel type	Long-Term AIS Data (per Day)			Summer Survey	Winter Survey
	Busiest Month	Quietest Month	Average Vessels	Average Vessels per Day	Average Vessels per Day
Cargo vessels	7	4	5	7	6
Tankers	2	1	2	2	1
Oil and gas vessels	7	2	5	5	3-4
Fishing vessels	2	<1	1	2	1-2
Wind farm vessels	<1	<1	<1	0	<1
Recreational vessels	1	0	<1	1	0

27.1.1.197 There were no notable differences between the long-term AIS and the vessel traffic surveys in terms of vessel types and counts.

E.5 Conclusion

27.1.1.198 A year of AIS data from 2021 to 2022 has been analysed to validate the vessel traffic survey data recorded within the Regional Shipping and Navigation Study Area and forming the baseline for the characterisation of vessel traffic in Section 10.

27.1.1.199 The main type of vessels detected within the Regional Shipping and Navigation Study Area during the long-term study period were cargo vessels (39%), oil and gas vessels (34%) and tankers (12%). Similarly, the main type of vessels detected during the summer 2024 survey within the Regional Shipping and Navigation Study Area were cargo vessels (37%), oil and gas vessels (27%), tankers (10%) and fishing vessels (10%); and during the winter 2024 survey within the Regional Shipping and Navigation Study Area were cargo vessels (48%), oil and gas vessels (29%) and fishing vessels (12%). Overall, the vessel types detected within the Regional Shipping and Navigation Study Area were similar between the vessel traffic survey data and long-term vessel traffic data.

27.1.1.200 The average number of vessels per day within the Regional Shipping and Navigation Study Area were also similar between the two datasets.

Appendix F Winter 2022 vessel traffic survey

F.1 Introduction

27.1.1.201 This appendix presents analysis of a vessel traffic survey that was undertaken in winter 2022.

F.2 Methodology

F.2.1 Study area

27.1.1.202 This appendix has assessed the vessel traffic data within the same Regional Shipping and Navigation Study Area for the Morven Site as introduced in Section 3.4.

F.2.2 Data period and temporary vessel traffic

27.1.1.203 The vessel traffic data assessed in this appendix was collected from 21 November 2022 to 05 December 2022 (see Section 5.2).

27.1.1.204 In addition to the survey vessel itself, a number of vessel tracks recorded during the data period were classified as temporary (non-routine) and have been excluded from the characterisation of the vessel traffic baseline. These tracks are presented in Figure F.1.

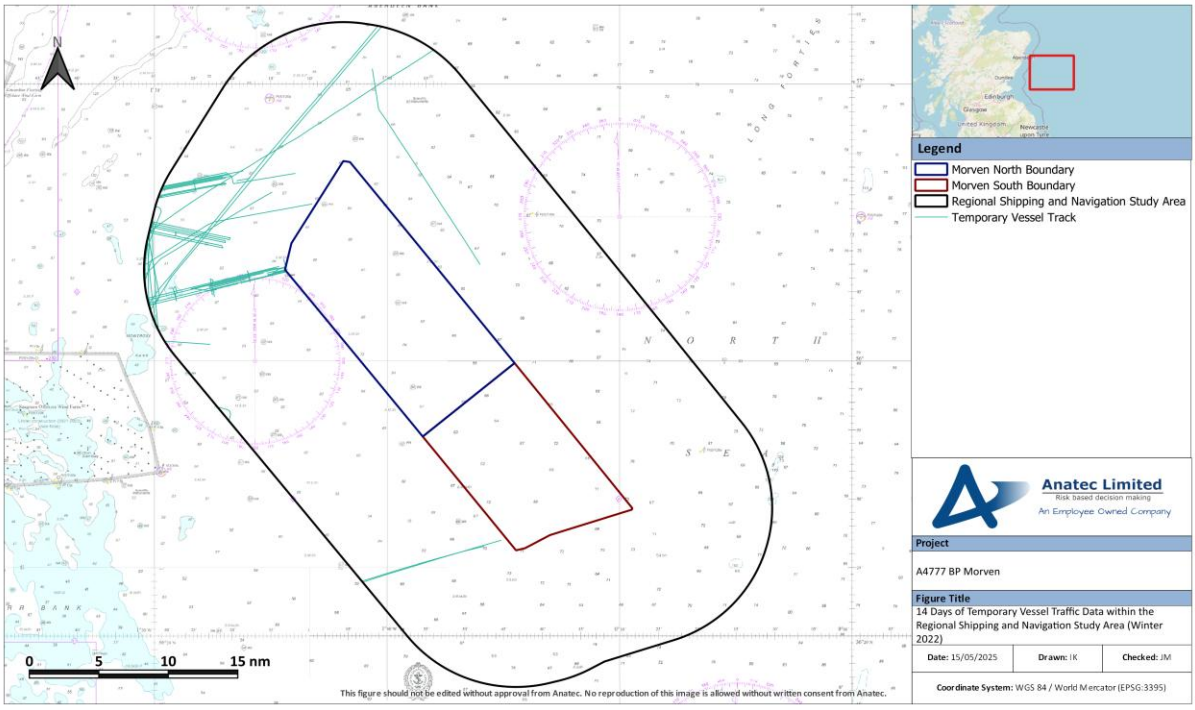


Figure F.1 14 days of temporary vessel traffic data within the Regional Shipping and Navigation Study Area (winter 2022)

F.2.3 Automatic Identification System carriage

27.1.1.205 General limitations associated with the use of AIS data (for example, carriage requirements) are discussed in full within Section 5.4.1.

27.1.1.206 The AIS and Radar systems tracked targets 24 hours per day throughout the survey period. The range of Radar depends on the size of target and weather conditions but coverage can be expected to typically be in the range of 12nm to 16nm, which provides coverage of any non-AIS vessels passing within or near the Morven Site and Study Area. A visual lookout was also maintained at all times, subject to the prevailing visibility at the time.

F.3 Analysis

27.1.1.207 This section presents analysis of vessel tracks recorded within the Regional Shipping and Navigation Study Area during the winter 2022 survey period. All vessels were recorded on AIS, with the exception of an uncrewed vessel identified via visual sightings within the site.

F.3.1 Vessel count

27.1.1.208 The number of vessels recorded within the Regional Shipping and Navigation Study Area per day during the winter 2022 survey period are presented in Figure F.2. It is noted that 21 November 2022 and 05 December 2022 were partial survey days.

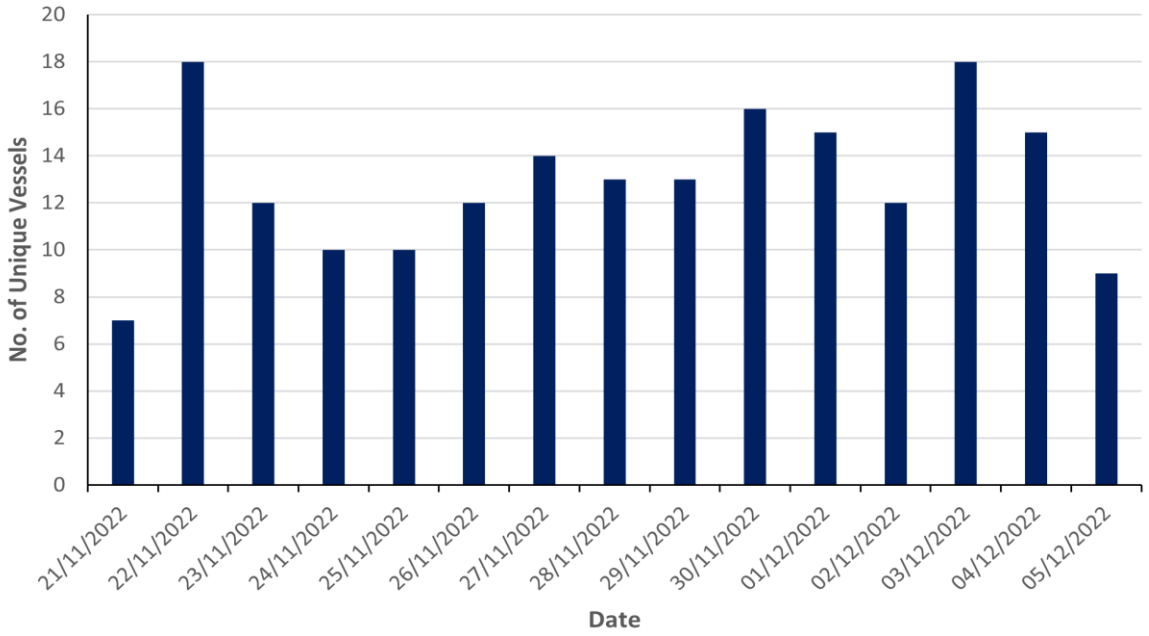


Figure F.2 Unique vessels per day within the Regional Shipping and Navigation Study Area (winter 2022)

27.1.1.209 An average of 14 unique vessels per day were recorded within the Regional Shipping and Navigation Study Area during the winter 2022 survey period. The busiest days were 22 November 2022 and 03 December 2022, on which 18 unique vessels were recorded each. The quietest full days were 24 and 25 November 2022, on which 10 unique vessels were recorded each.

F.3.2 Vessel type

27.1.1.210 The vessels recorded within the Regional Shipping and Navigation Study Area during the survey period are colour-coded by vessel type and presented in Figure F.3.

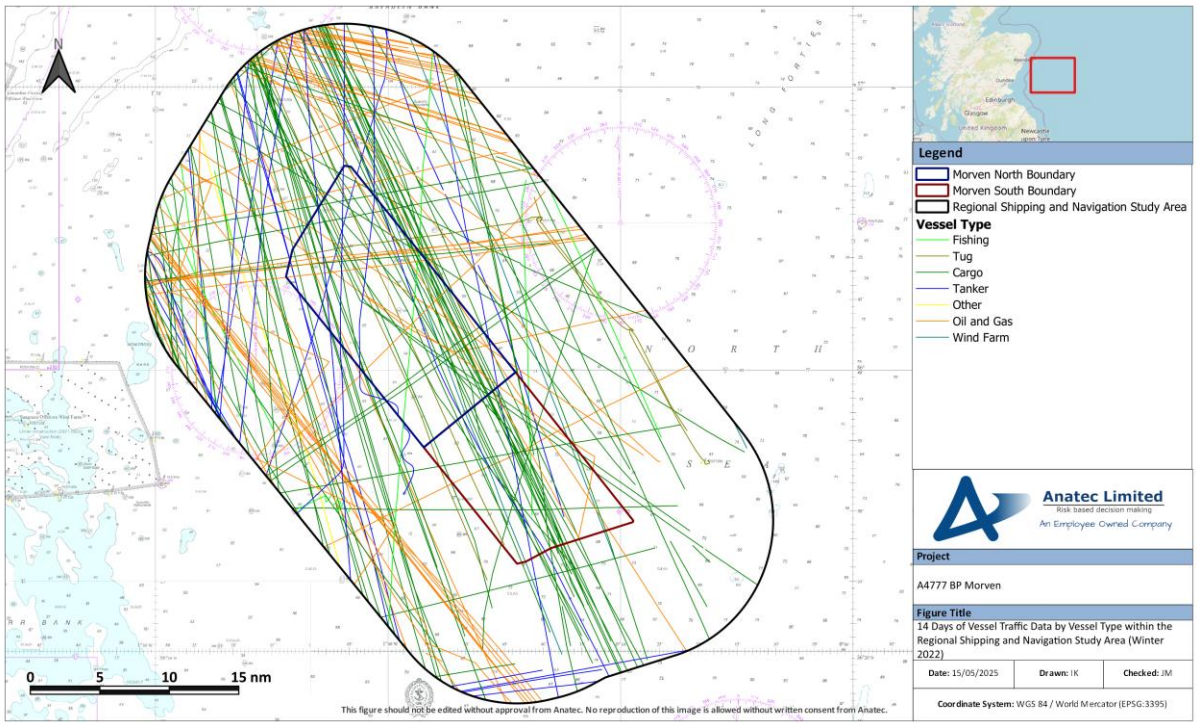


Figure F.3 14 days of vessel traffic data by vessel type within the Regional Shipping and Navigation Study Area (winter 2022)

27.1.1.211 Cargo vessels were commonly recorded within the Regional Shipping and Navigation Study Area and also within the Morven Site, with oil and gas vessels also being common.

27.1.1.212 The distribution of vessel types is presented in Figure F.4. The 'other' category consisted of a single fisheries patrol vessel.

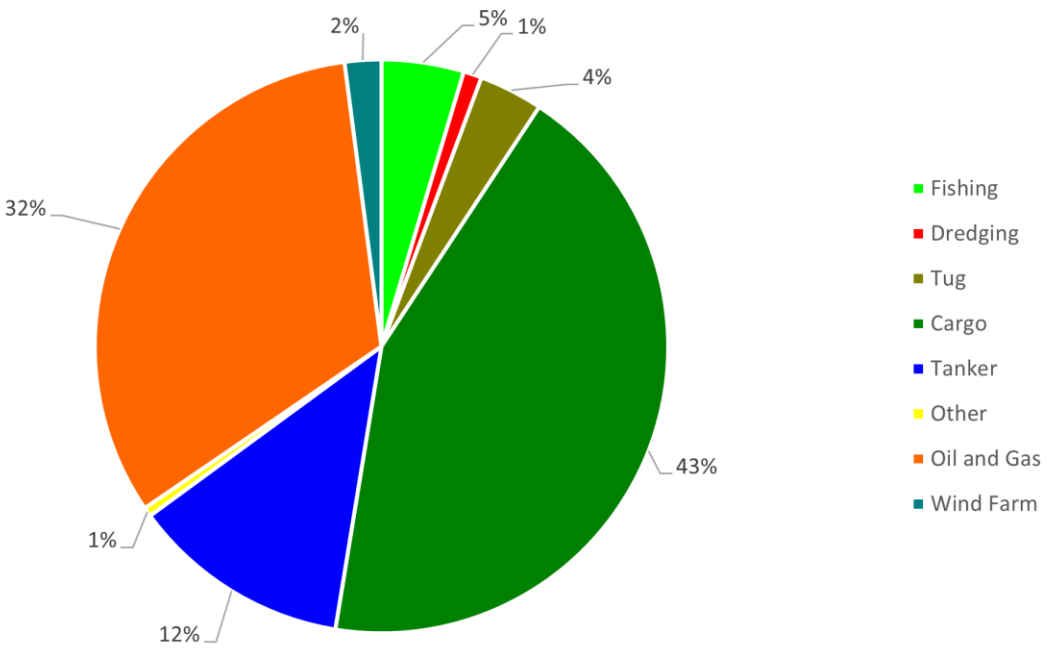


Figure F.4 Vessel type distribution within the Regional Shipping and Navigation Study Area (winter 2022)

27.1.1.213 The majority of the vessels recorded within the Regional Shipping and Navigation Study Area during the survey period were either cargo vessels or oil and gas vessels, which accounted for approximately 43% and 32%, respectively. The remainder consisted of tankers (12%), fishing vessels (5%), tugs (4%), wind farm vessels (2%), marine aggregate dredgers (1%) and 'other' vessels (1%).

F.3.2.2 Cargo Vessels

27.1.1.214 The cargo vessels recorded within the Regional Shipping and Navigation Study Area during the winter 2022 survey period are presented in Figure F.5.

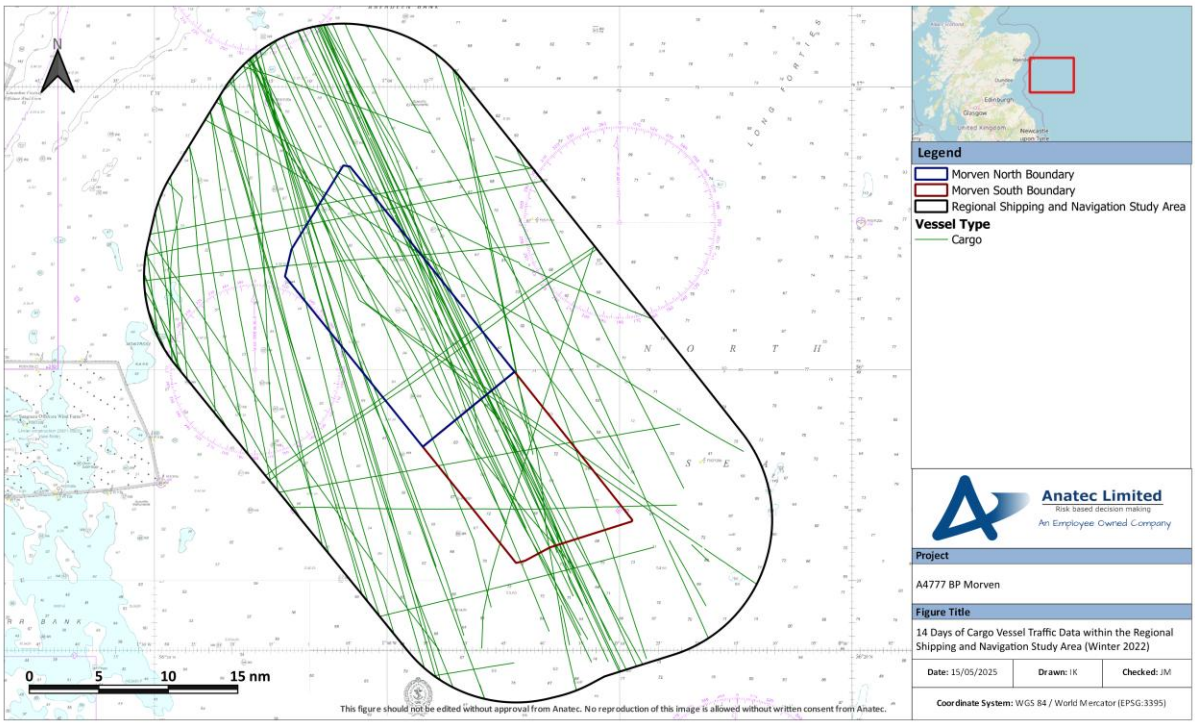


Figure F.5 14 days of cargo vessel traffic data within the Regional Shipping and Navigation Study Area (winter 2022)

27.1.1.215 Throughout the winter 2022 survey period, an average of six unique cargo vessels per day were recorded within the Regional Shipping and Navigation Study Area.

F.3.2.3 Oil and gas vessels

27.1.1.216 The oil and gas vessels recorded within the Regional Shipping and Navigation Study Area during the winter 2022 survey period are presented in Figure F.6.

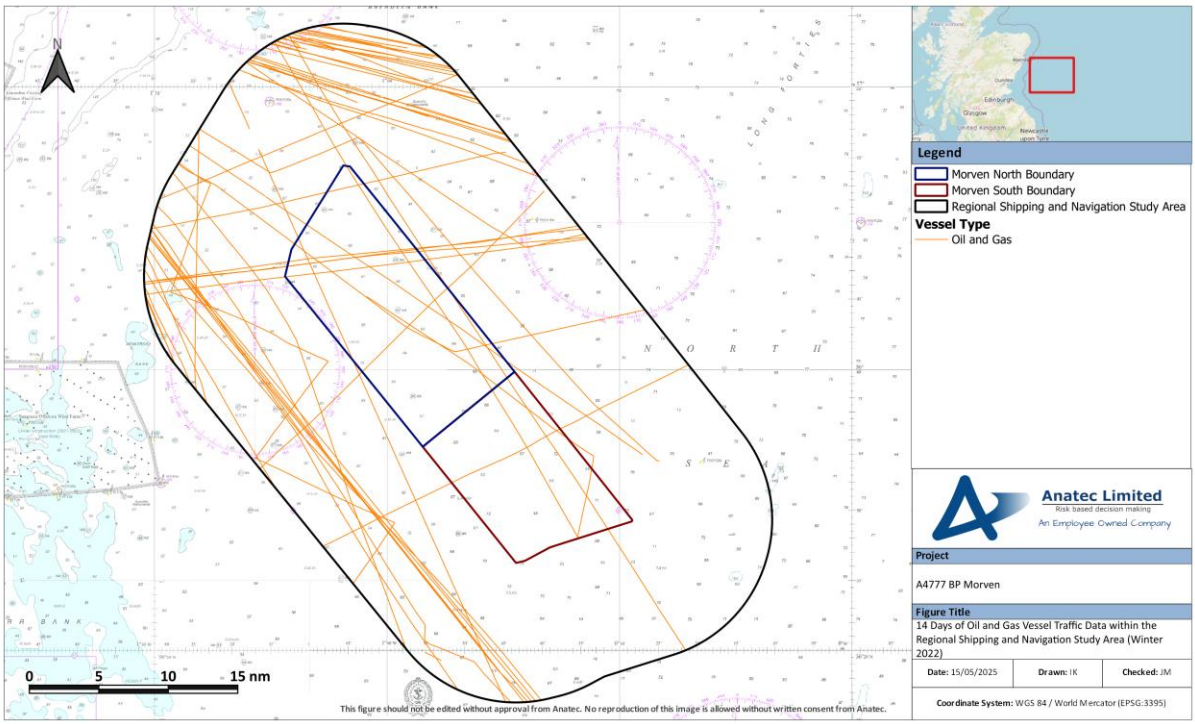


Figure F.6 14 days of oil and gas vessel traffic data within the Regional Shipping and Navigation Study Area (winter 2022)

27.1.1.217 Throughout the winter 2022 survey period, an average of four to five unique oil and gas vessels per day were recorded within the Regional Shipping and Navigation Study Area.

F.3.2.4 Tankers

27.1.1.218 The tankers recorded within the Regional Shipping and Navigation Study Area during the winter 2022 survey period are presented in Figure F.7.

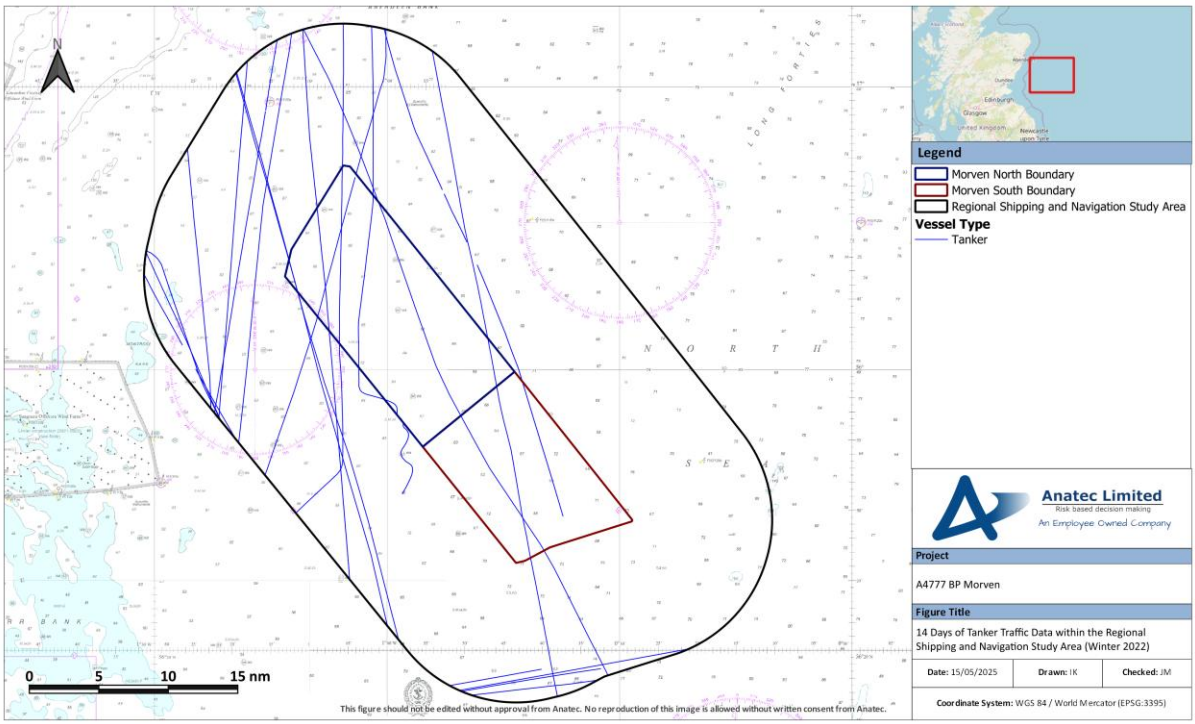


Figure F.7 14 days of tanker traffic data within the Regional Shipping and Navigation Study Area (winter 2022)

27.1.1.219 Throughout the winter 2022 survey period, an average of one to two unique tankers per day were recorded within the Regional Shipping and Navigation Study Area.

F.3.2.5 Fishing vessels

27.1.1.220 The fishing vessels recorded within the Regional Shipping and Navigation Study Area during the winter 2022 survey period are presented in Figure F.8.

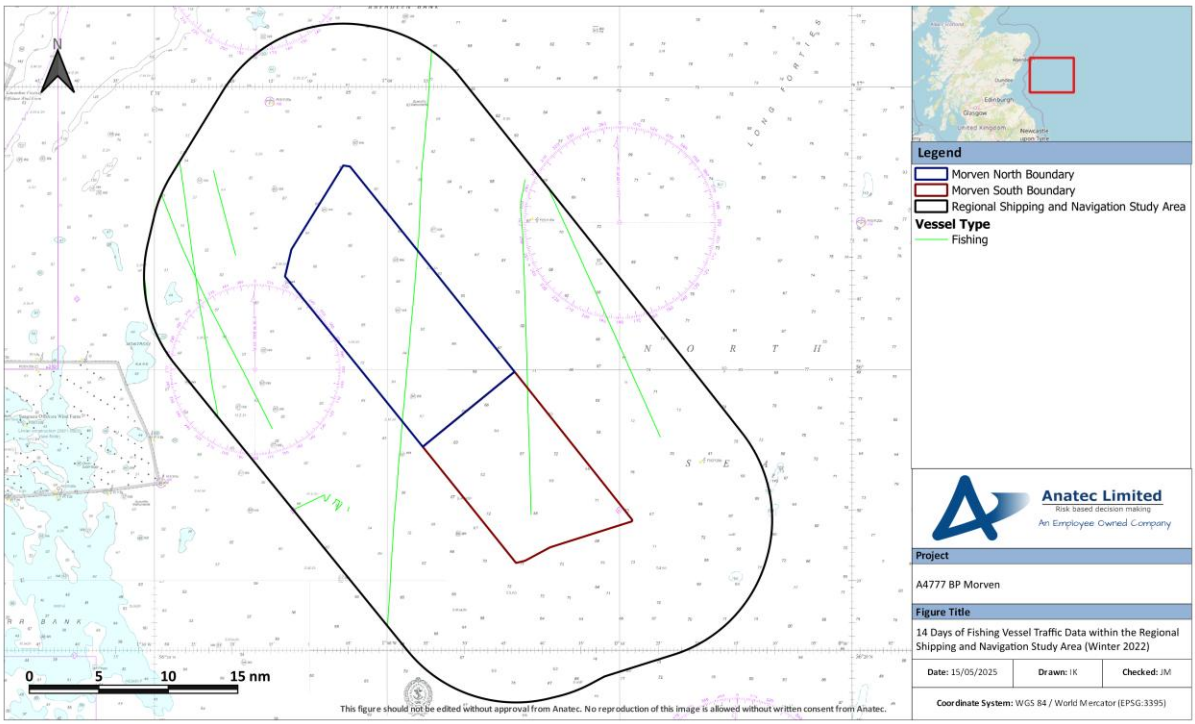


Figure F.8 14 days of fishing vessel traffic data within the Regional Shipping and Navigation Study Area (winter 2022)

27.1.1.221 Throughout the winter 2022 survey period, an average of one unique fishing vessel every one to two days was recorded within the Regional Shipping and Navigation Study Area.

F.4 Survey data comparison

27.1.1.222 This subsection provides comparison of the 28-day survey period (summer and winter 2024 combined) against the winter 2022 survey data.

27.1.1.223 A comparison of the average number of each main vessel type recorded during the winter 2022 survey data period and the primary vessel traffic data is presented in Table F.1.

Table F.1 Vessel count comparison with winter 2022 data (per day)

Vessel Type	Winter 2022	Summer 2024	Winter 2024
Cargo	6	7	6
Oil and Gas	4-5	5-6	3-4
Tanker	1-2	2	1
Fishing	<1	2	1-2

27.1.1.224 The average daily vessel count within the winter 2022 survey data was broadly similar to the winter 2024 survey data with slightly higher tanker and oil and gas vessel counts; and slightly lower fishing vessel counts. There were consistently lower counts for each vessel type compared to the summer 2024 survey data.

F.5 Summary

27.1.1.225 A total of 14 days of AIS, Radar and visual observation data during winter 2022 has been analysed to validate the summer and winter 2024 vessel traffic survey data recorded within the Regional Shipping and Navigation Study Area.

27.1.1.226 Overall, the vessel types and counts detected within the Regional Shipping and Navigation Study Area were similar between the vessel traffic survey data and winter 2022 data.

Appendix G Summer 2023 vessel traffic survey

G.1 Introduction

27.1.1.227 This appendix presents analysis of a vessel traffic survey that was undertaken in summer 2023.

G.2 Methodology

G.2.1 Study area

27.1.1.228 This appendix has assessed the vessel traffic data within the same Regional Shipping and Navigation Study Area for the Morven Site as introduced in Section 3.4.

G.2.2 Data period and temporary vessel traffic

27.1.1.229 The vessel traffic data assessed in this appendix was collected from 01 to 16 June 2023 (see Section 5.2).

27.1.1.230 In addition to the survey vessel itself, a number of vessel tracks recorded during the data period were classified as temporary (non-routine) and have been excluded from the characterisation of the vessel traffic baseline. These tracks are presented in Figure G.1.

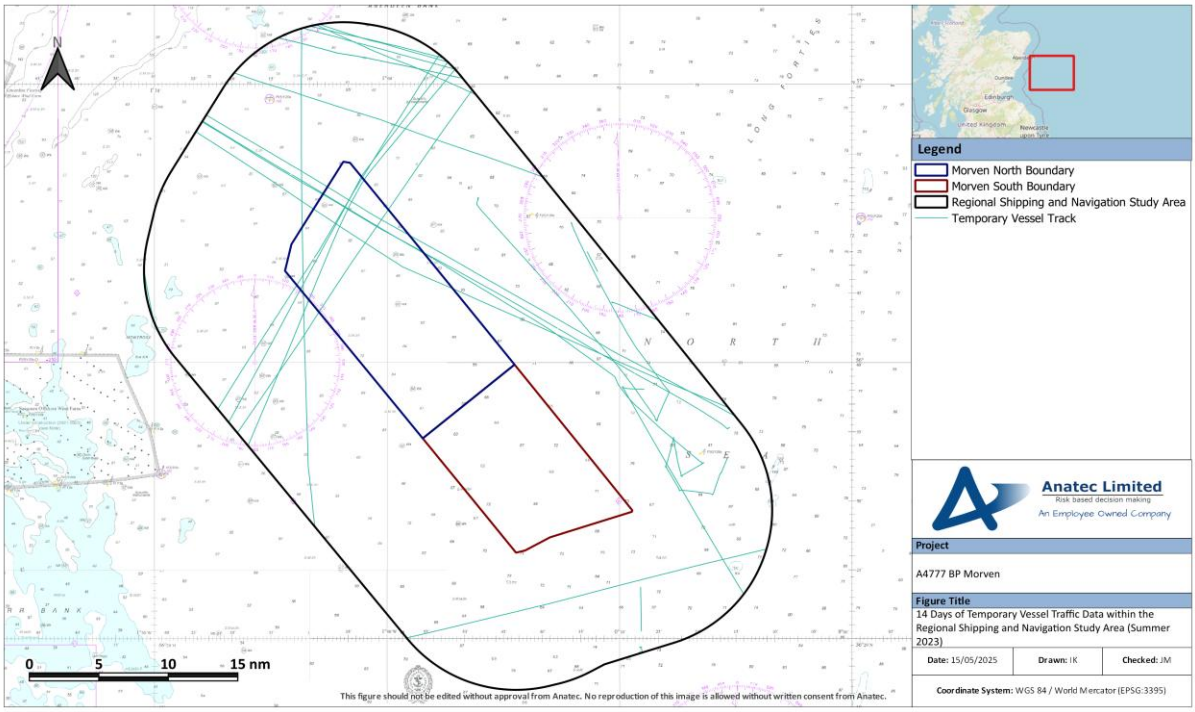


Figure G.1 14 days of temporary vessel traffic data within the Regional Shipping and Navigation Study Area (summer 2023)

G.2.3 Automatic Identification System carriage

27.1.1.231 General limitations associated with the use of AIS data (for example, carriage requirements) are discussed in full within Section 5.4.1.

27.1.1.232 The AIS and radar systems tracked targets 24 hours per day throughout the survey period. The range of radar depends on the size of target and weather conditions but coverage can be expected to typically be in the range of 12nm to 16nm, which provides coverage of any non-AIS vessels passing within or near the Morven Site and Study Area. A visual lookout was also maintained at all times, subject to the prevailing visibility at the time.

G.3 Analysis

27.1.1.233 This section presents analysis of vessel tracks recorded within the Regional Shipping and Navigation Study Area during the summer 2023 survey period. All vessels were recorded on AIS, with the exception of a fishing vessel tracked using Radar in the centre of the site.

G.3.1 Vessel count

27.1.1.234 The number of vessels recorded within the Regional Shipping and Navigation Study Area per day during the summer 2023 survey period are presented in Figure G.2. It is noted that 01, 05, 06 and 16 June 2023 were partial survey days.

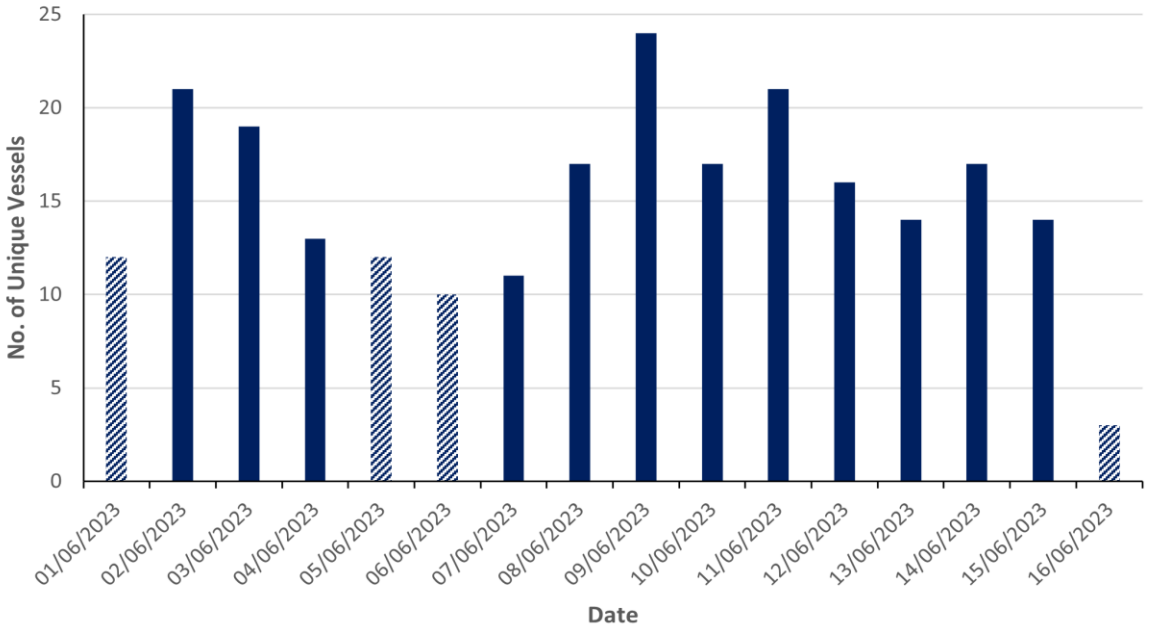


Figure G.2 Unique vessels per day within the Regional Shipping and Navigation Study Area (summer 2023)

27.1.1.235 An average of 17 unique vessels per day were recorded within the Regional Shipping and Navigation Study Area during the summer 2023 survey period. The busiest day was 09 June 2023, on which 24 unique vessels were recorded. The quietest full day was 07 June 2023, on which 11 unique vessels were recorded.

G.3.2 Vessel type

27.1.1.236 The vessels recorded within the Regional Shipping and Navigation Study Area during the survey period are colour-coded by vessel type and presented in Figure G.3.

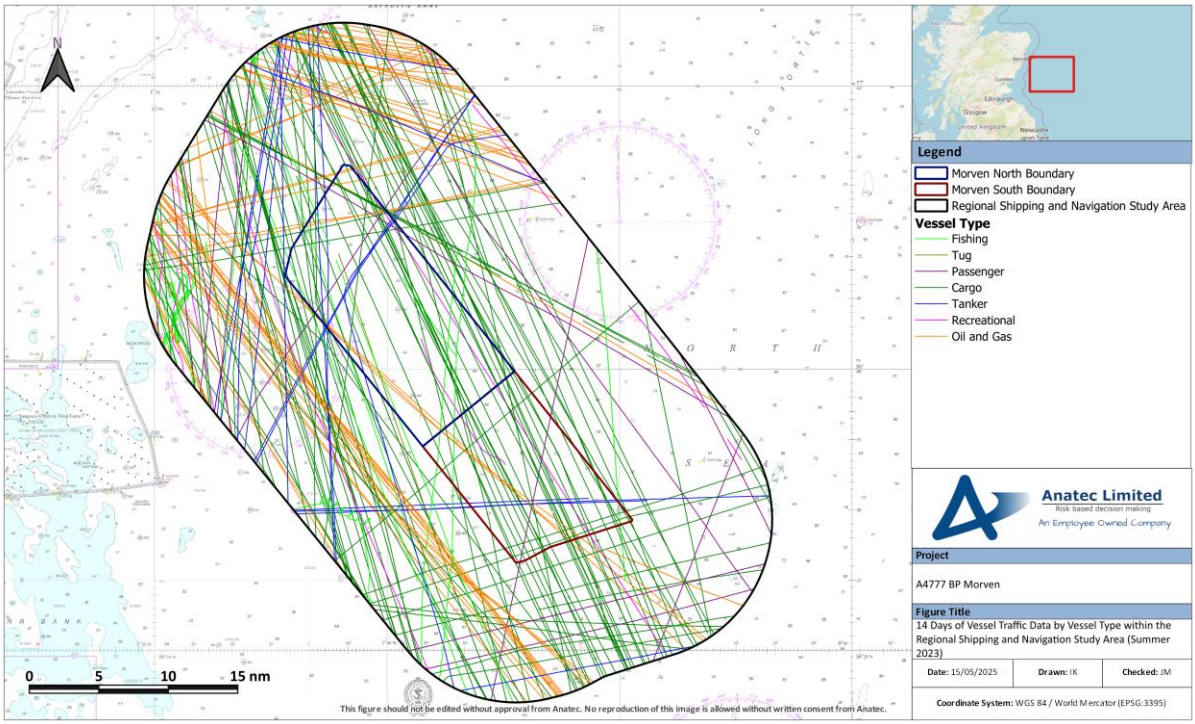


Figure G.3 14 days of vessel traffic data by vessel type within the Regional Shipping and Navigation Study Area (summer 2023)

27.1.1.237 The distribution of vessel types is presented in Figure G.4.

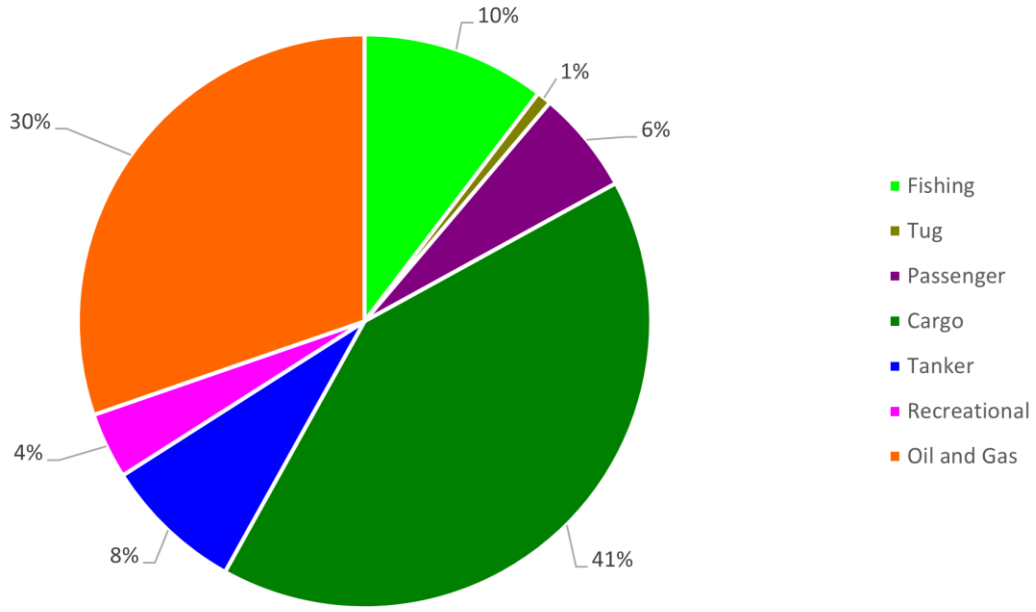


Figure G.4 Vessel type distribution within the Regional Shipping and Navigation Study Area (summer 2023)

27.1.1.238 The most frequently recorded vessel types within the Regional Shipping and Navigation Study Area during the survey period were cargo vessels (41%), oil and gas vessels (30%), and fishing vessels (10%).

G.3.2.1 Cargo vessels

27.1.1.239 The cargo vessels recorded within the Regional Shipping and Navigation Study Area during the summer 2023 survey period are presented in Figure G.5.

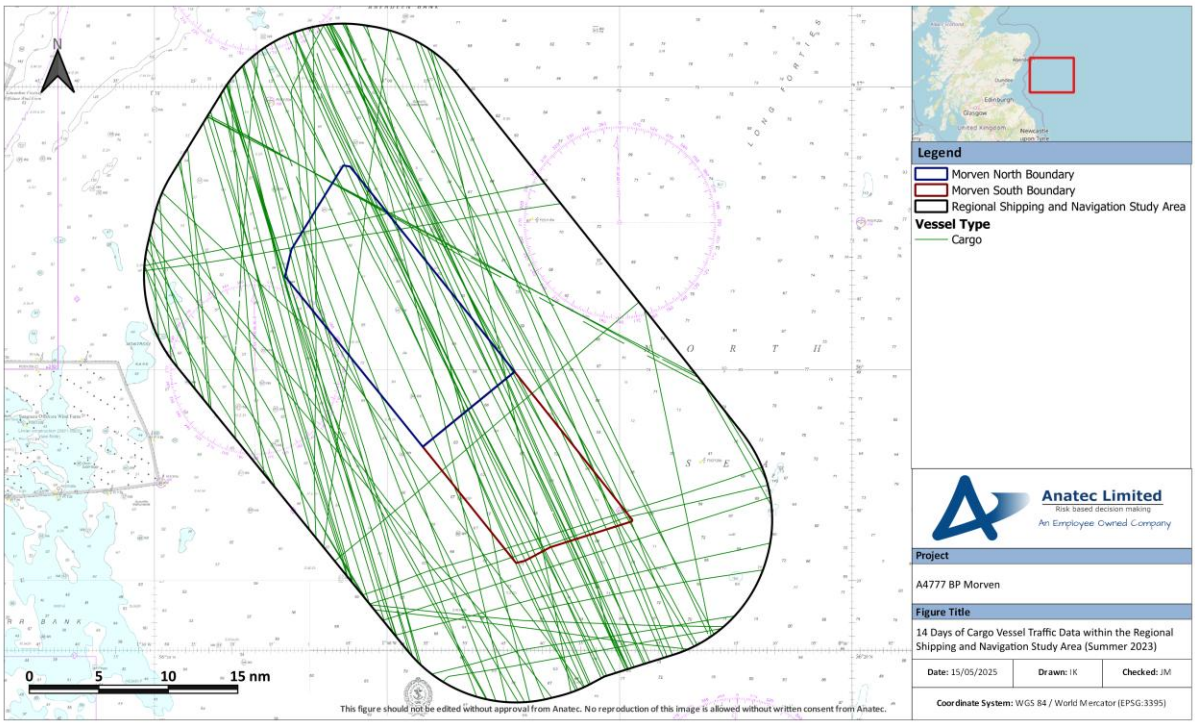


Figure G.5 14 days of cargo vessel traffic data within the Regional Shipping and Navigation Study Area (summer 2023)

27.1.1.240 Throughout the summer 2023 survey period, an average of seven unique cargo vessels per day were recorded within the Regional Shipping and Navigation Study Area.

G.3.2.2 Oil and gas vessels

27.1.1.241 The oil and gas vessels recorded within the Regional Shipping and Navigation Study Area during the summer 2023 survey period are presented in Figure G.6.

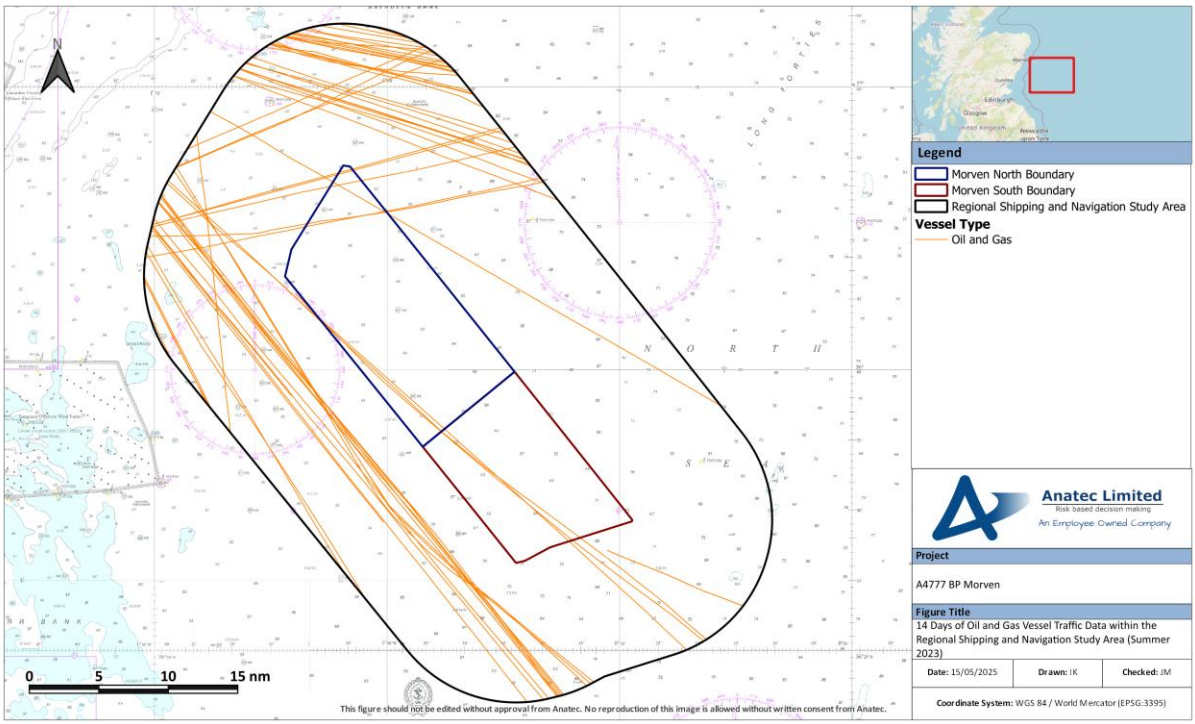


Figure G.6 14 days of oil and gas vessel traffic data within the Regional Shipping and Navigation Study Area (summer 2023)

27.1.1.242 Throughout the summer 2023 survey period, an average of five unique oil and gas vessels per day were recorded within the Regional Shipping and Navigation Study Area.

G.3.2.3 Fishing vessels

27.1.1.243 The fishing vessels recorded within the Regional Shipping and Navigation Study Area during the summer 2023 survey period are presented in Figure G.7.

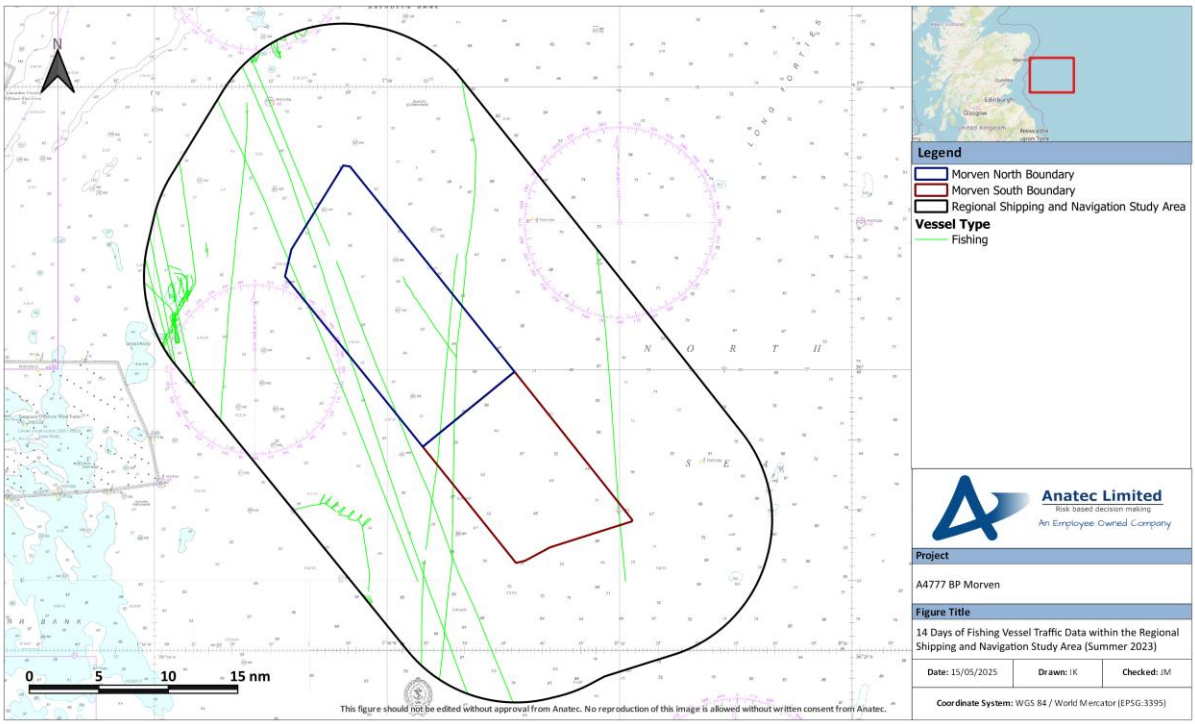


Figure G.7 14 days of fishing vessel traffic data within the Regional Shipping and Navigation Study Area (summer 2023)

27.1.1.244 Throughout the summer 2023 survey period, an average of one to two unique fishing vessels per day were recorded within the Regional Shipping and Navigation Study Area.

G.3.2.4 Tankers

27.1.1.245 The tankers recorded within the Regional Shipping and Navigation Study Area during the summer 2023 survey period are presented in Figure G.8.

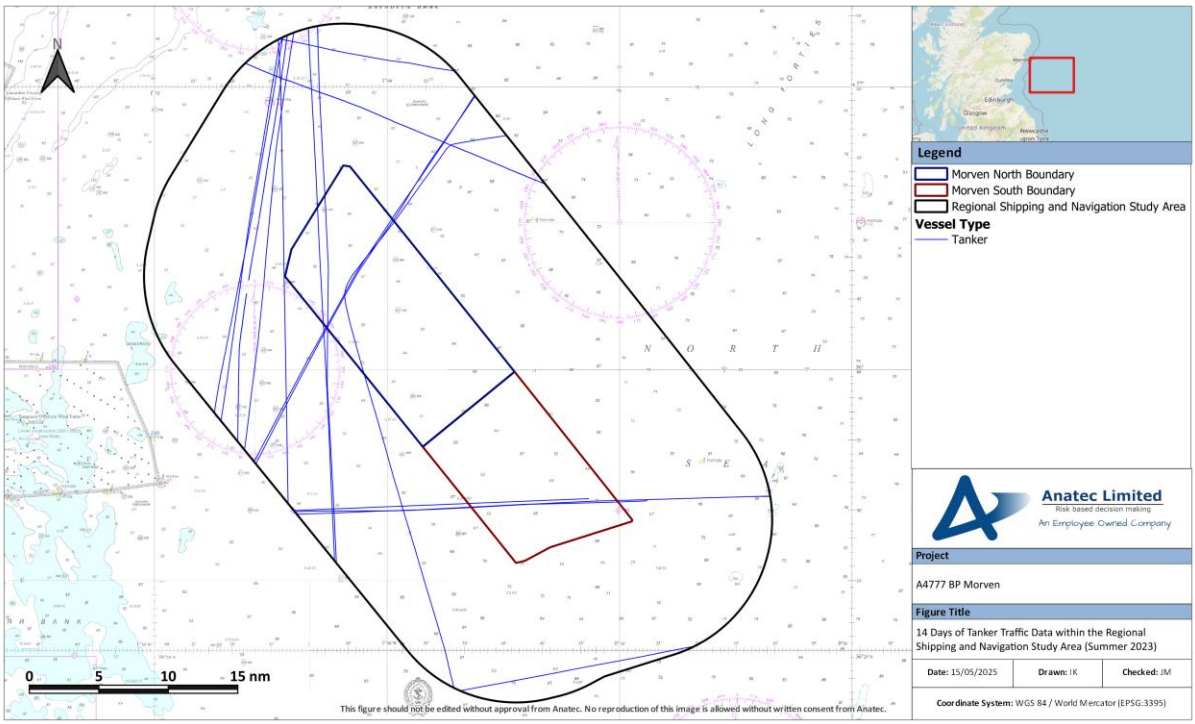


Figure G.8 14 days of tanker traffic data within the Regional Shipping and Navigation Study Area (summer 2023)

27.1.1.246 Throughout the summer 2023 survey period, an average of one unique tanker per day was recorded within the Regional Shipping and Navigation Study Area.

G.3.2.5 Passenger vessels

27.1.1.247 The passenger vessels recorded within the Regional Shipping and Navigation Study Area during the summer 2023 survey period are presented in Figure G.9.

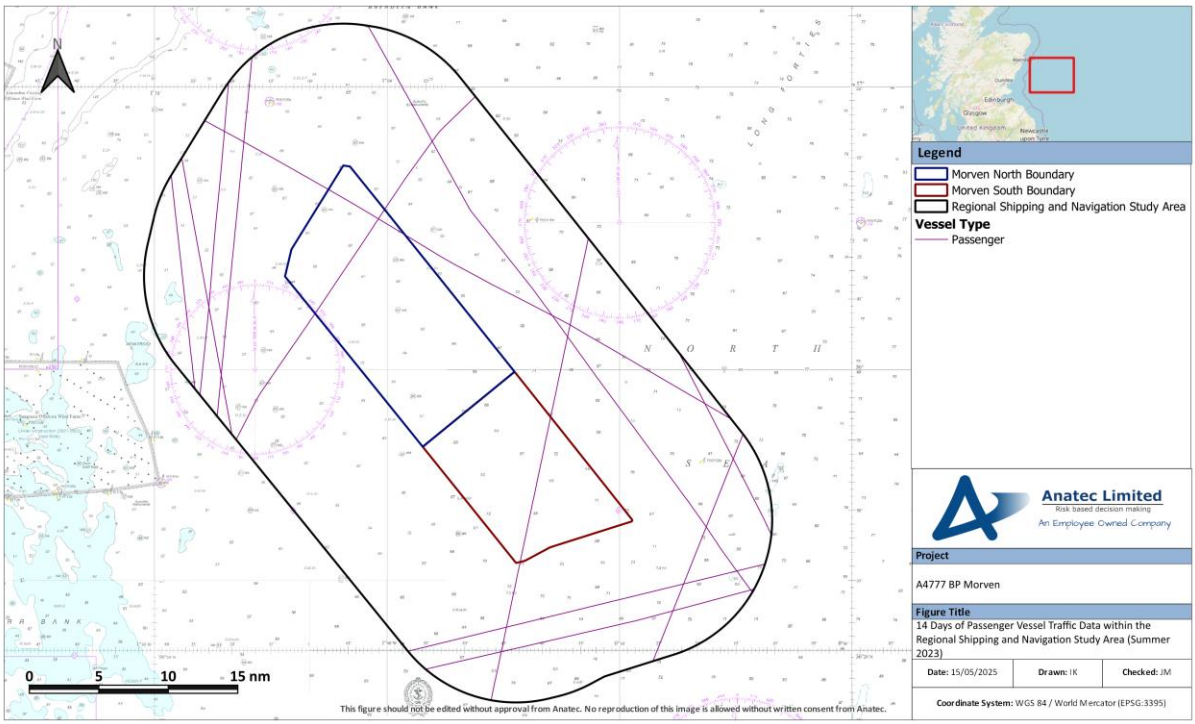


Figure G.9 14 days of passenger vessel traffic data within the Regional Shipping and Navigation Study Area (summer 2023)

27.1.1.248 Throughout the summer 2023 survey period, an average of one unique passenger vessel per day was recorded within the Regional Shipping and Navigation Study Area.

G.3.2.6 Recreational vessels

27.1.1.249 The recreational vessels recorded within the Regional Shipping and Navigation Study Area during the summer 2023 survey period are presented in Figure G.10.

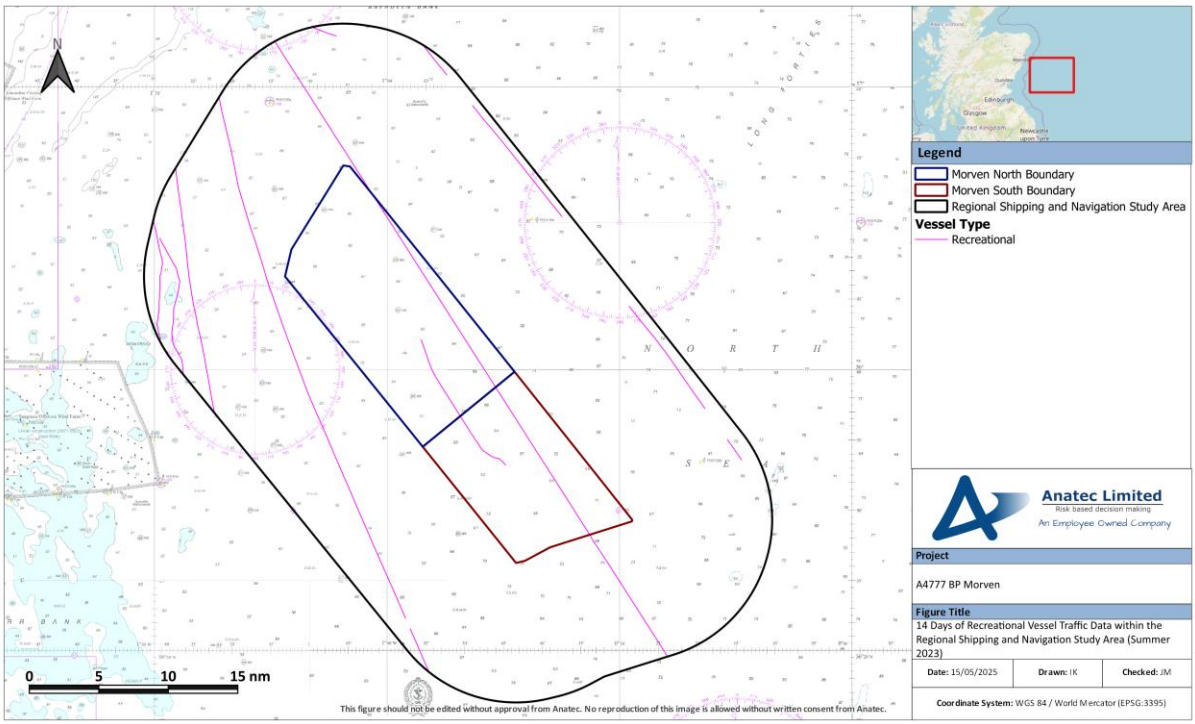


Figure G.10 14 days of recreational vessel traffic data within the Regional Shipping and Navigation Study Area (summer 2023)

27.1.1.250 Throughout the summer 2023 survey period, an average of one unique recreational vessel every two days was recorded within the Regional Shipping and Navigation Study Area.

G.4 Survey data comparison

27.1.1.251 This subsection provides comparison of the 28-day survey period (summer and winter 2024 combined) against the summer 2023 survey data.

27.1.1.252 A comparison of the average number of each main vessel type recorded during the summer 2023 survey data period and the primary vessel traffic data is presented in Table G.1.

Table G.1 Vessel count comparison with summer 2023 data (per day)

Vessel Type	Summer 2023	Summer 2024	Winter 2024
Cargo	7	7	6
Oil and Gas	5	5-6	3-4
Fishing	1-2	2	1-2

Vessel Type	Summer 2023	Summer 2024	Winter 2024
Tanker	1	2	1
Passenger	1	1-2	<1
Recreational	<1	1	0

27.1.1.253 The average daily vessel count within the summer 2023 survey data was comparable, but slightly lower for most vessel types compared with the summer 2024 survey data. Slightly higher counts for each vessel type were noted compared to the winter 2024 survey data.

G.5 Summary

27.1.1.254 A total of 14 days of AIS, Radar and visual observation data during summer 2023 has been analysed to validate the summer and winter 2024 vessel traffic survey data recorded within the Regional Shipping and Navigation Study Area.

27.1.1.255 Overall, the vessel types and counts detected within the Regional Shipping and Navigation Study Area were similar between the vessel traffic survey data and summer 2023 data.

Appendix H Winter 2023 vessel traffic survey

H.1 Introduction

27.1.1.256 This appendix presents analysis of a vessel traffic survey that was undertaken in winter 2023.

H.2 Methodology

H.2.1 Study area

27.1.1.257 This appendix has assessed the vessel traffic data within the same Regional Shipping and Navigation Study Area for the Morven Site as introduced in Section 3.4.

H.2.2 Data period and temporary vessel traffic

27.1.1.258 The vessel traffic data assessed in this appendix was collected from 15 November 2023 to 02 December 2023 (see Section 5.2).

27.1.1.259 In addition to the survey vessel itself, a number of vessel tracks recorded during the data period were classified as temporary (non-routine) and have been excluded from the characterisation of the vessel traffic baseline. These tracks are presented in Figure H.1.

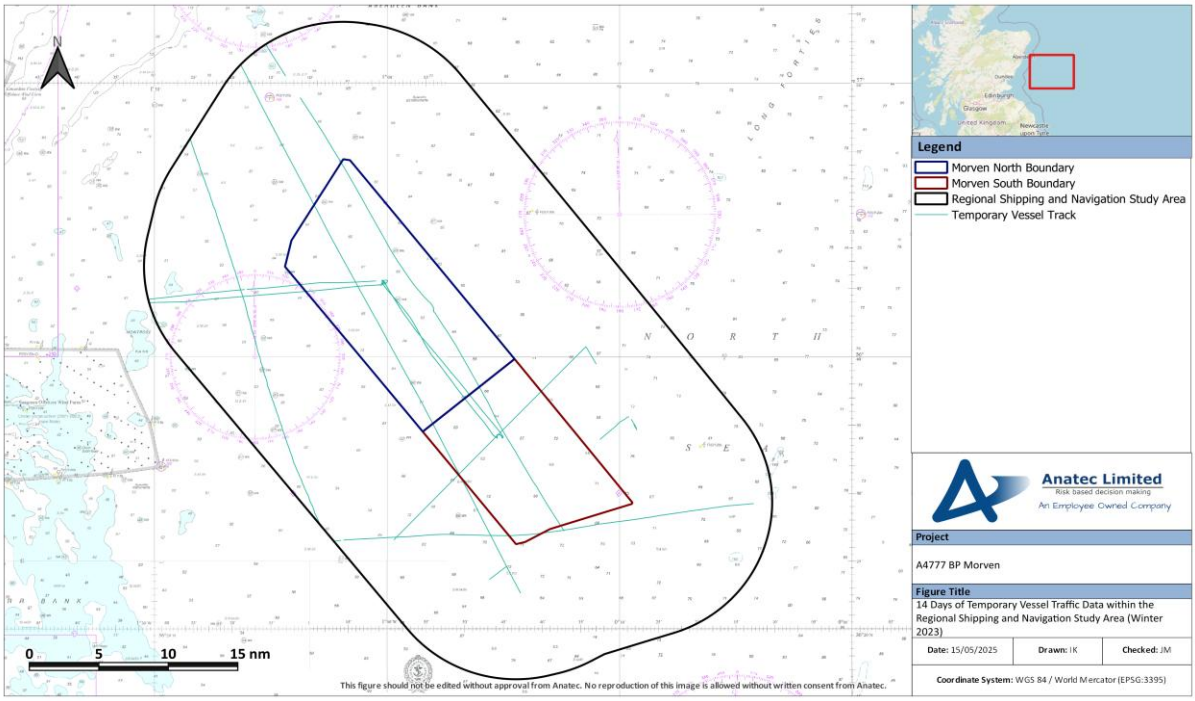


Figure H.1 14 days of temporary vessel traffic data within the Regional Shipping and Navigation Study Area (winter 2023)

H.2.3 Automatic Identification System carriage

27.1.1.260 General limitations associated with the use of AIS data (for example, carriage requirements) are discussed in full within Section 5.4.1.

27.1.1.261 The AIS and radar systems tracked targets 24 hours per day throughout the survey period. The range of radar depends on the size of target and weather conditions but coverage can be expected to typically be in the range of 12nm to 16nm, which provides coverage of any non-AIS vessels passing within or near the Morven Site and Study Area. A visual lookout was also maintained at all times, subject to the prevailing visibility at the time.

H.3 Analysis

27.1.1.262 This section presents analysis of vessel tracks recorded within the Regional Shipping and Navigation Study Area during the winter 2023 survey period. All vessels were recorded on AIS.

H.3.1 Vessel count

27.1.1.263 The number of vessels recorded within the Regional Shipping and Navigation Study Area per day during the winter 2023 survey period are presented in Figure H.2. It is noted that 15, 22 and 25 November 2023 and 02 December 2023, were partial survey days (with the survey vessel off-site on 23 and 24 November 2023).

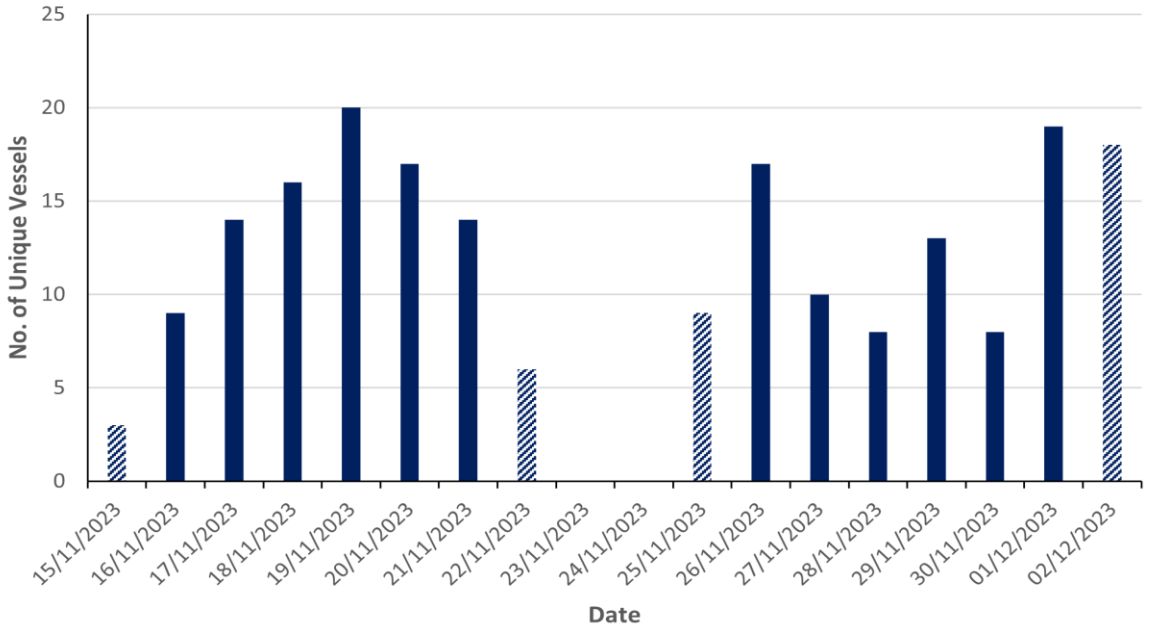


Figure H.2 Unique vessels per day within the Regional Shipping and Navigation Study Area (winter 2023)

27.1.1.264 An average of 14 to 15 unique vessels per day were recorded within the Regional Shipping and Navigation Study Area during the winter 2023 survey period. The busiest day was 19 November 2023, on which 20 unique vessels were recorded. The quietest full days were 28 and 30 November 2023, on which eight unique vessels were recorded each.

H.3.2 Vessel type

27.1.1.265 The vessels recorded within the Regional Shipping and Navigation Study Area during the survey period are colour-coded by vessel type and presented in Figure H.3.

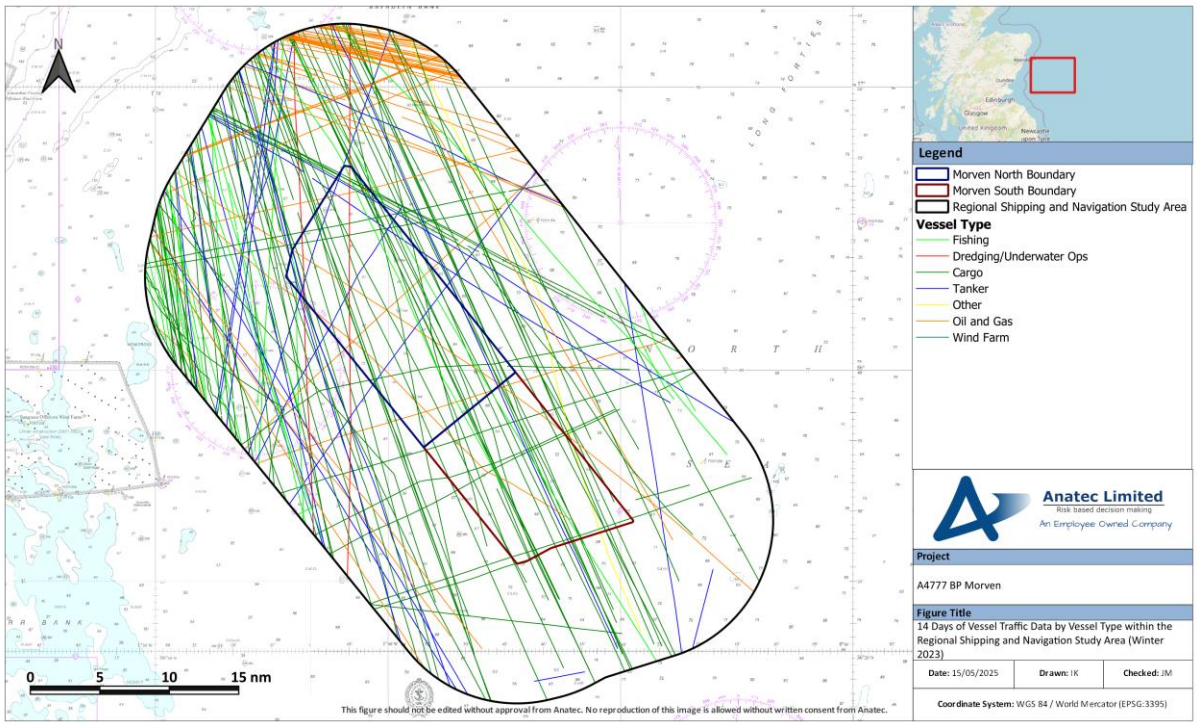


Figure H.3 14 days of vessel traffic data by vessel type within the Regional Shipping and Navigation Study Area (summer 2023)

27.1.1.266 The distribution of vessel types is presented in Figure H.4.

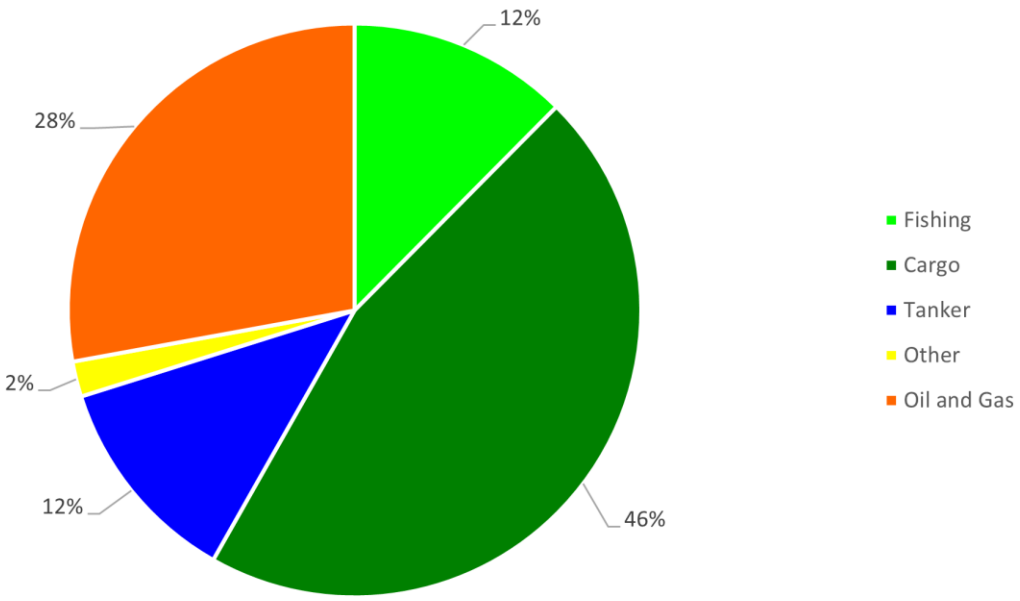


Figure H.4 Vessel type distribution within the Regional Shipping and Navigation Study Area (summer 2023)

27.1.1.267 The most frequently recorded vessel type within the Regional Shipping and Navigation Study Area during the survey period were cargo vessels (46%) and oil and gas vessels (28%).

H.3.2.1 Cargo vessels

27.1.1.268 The cargo vessels recorded within the Regional Shipping and Navigation Study Area during the winter 2023 survey period are presented in Figure H.5.

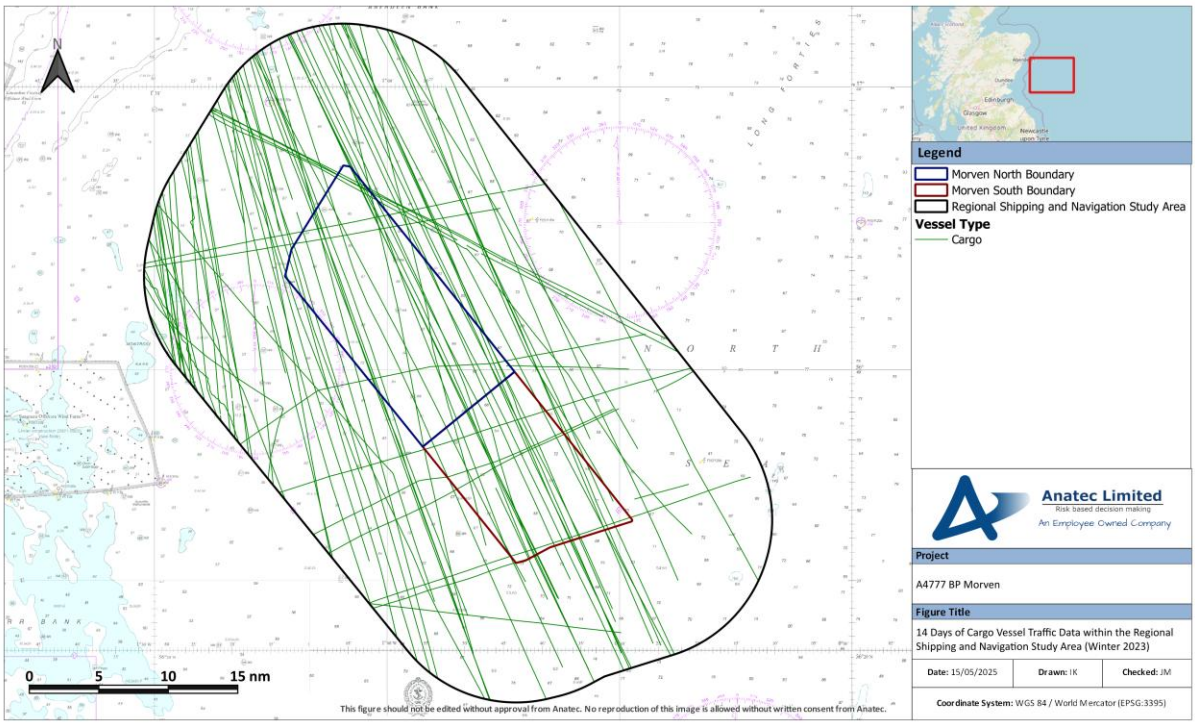


Figure H.5 14 days of cargo vessel traffic data within the Regional Shipping and Navigation Study Area (winter 2023)

27.1.1.269 Throughout the winter 2023 survey period, an average of six to seven unique cargo vessels per day were recorded within the Regional Shipping and Navigation Study Area.

H.3.2.2 Oil and gas vessels

27.1.1.270 The oil and gas vessels recorded within the Regional Shipping and Navigation Study Area during the winter 2023 survey period are presented in Figure H.6.

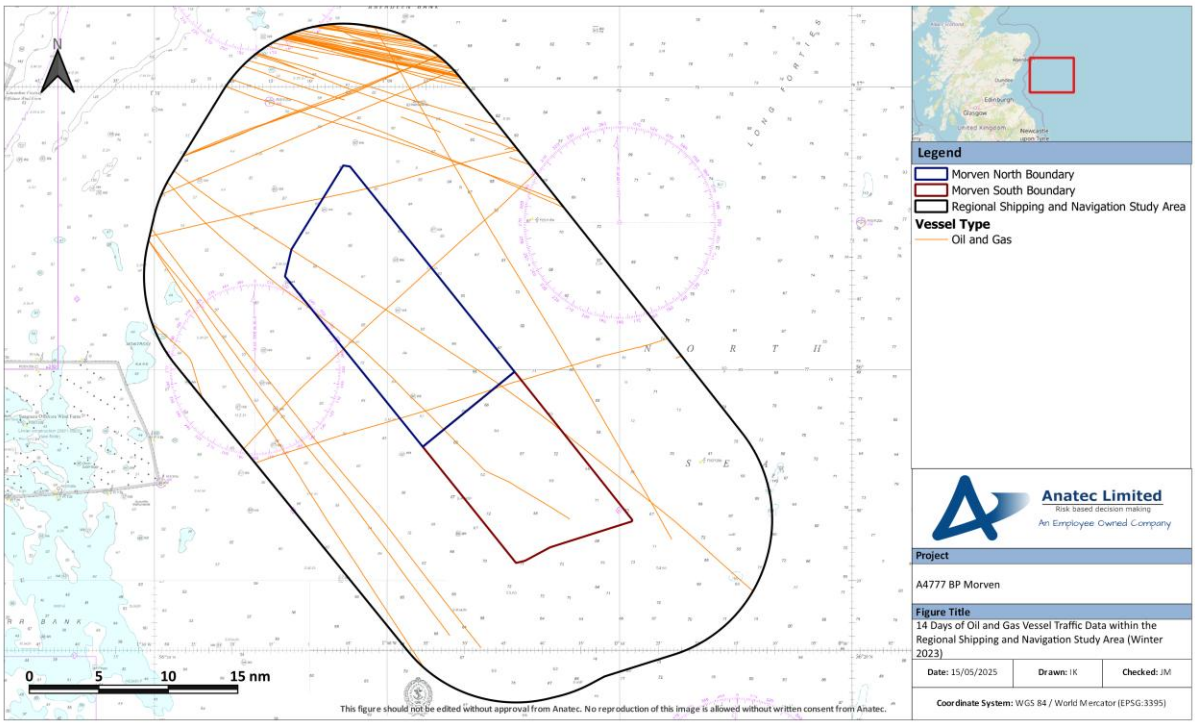


Figure H.6 14 days of oil and gas vessel traffic data within the Regional Shipping and Navigation Study Area (winter 2023)

27.1.1.271 Throughout the winter 2023 survey period, an average of four unique oil and gas vessels per day were recorded within the Regional Shipping and Navigation Study Area.

H.3.2.3 Fishing vessels

27.1.1.272 The fishing vessels recorded within the Regional Shipping and Navigation Study Area during the winter 2022 survey period are presented in Figure H.7.

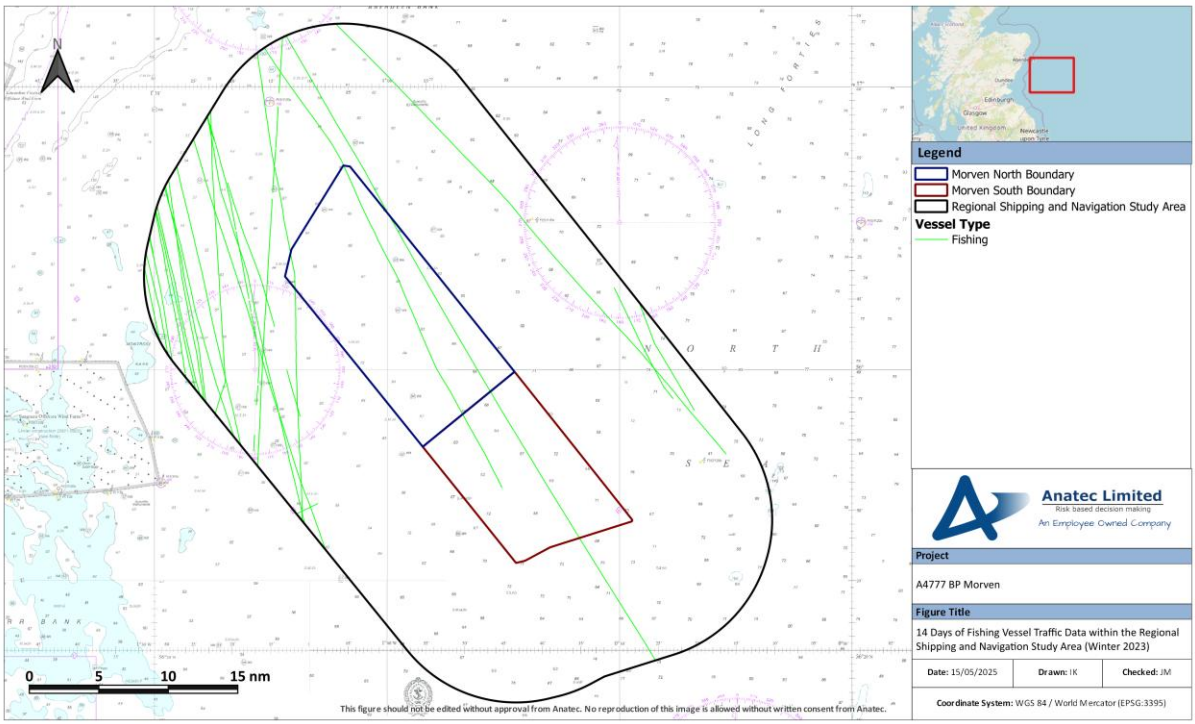


Figure H.7 14 days of fishing vessel traffic data within the Regional Shipping and Navigation Study Area (winter 2023)

27.1.1.273 Throughout the winter 2022 survey period, an average of one to two unique fishing vessels per day were recorded within the Regional Shipping and Navigation Study Area.

H.3.2.4 Tankers

27.1.1.274 The tankers recorded within the Regional Shipping and Navigation Study Area during the winter 2023 survey period are presented in Figure H.8.

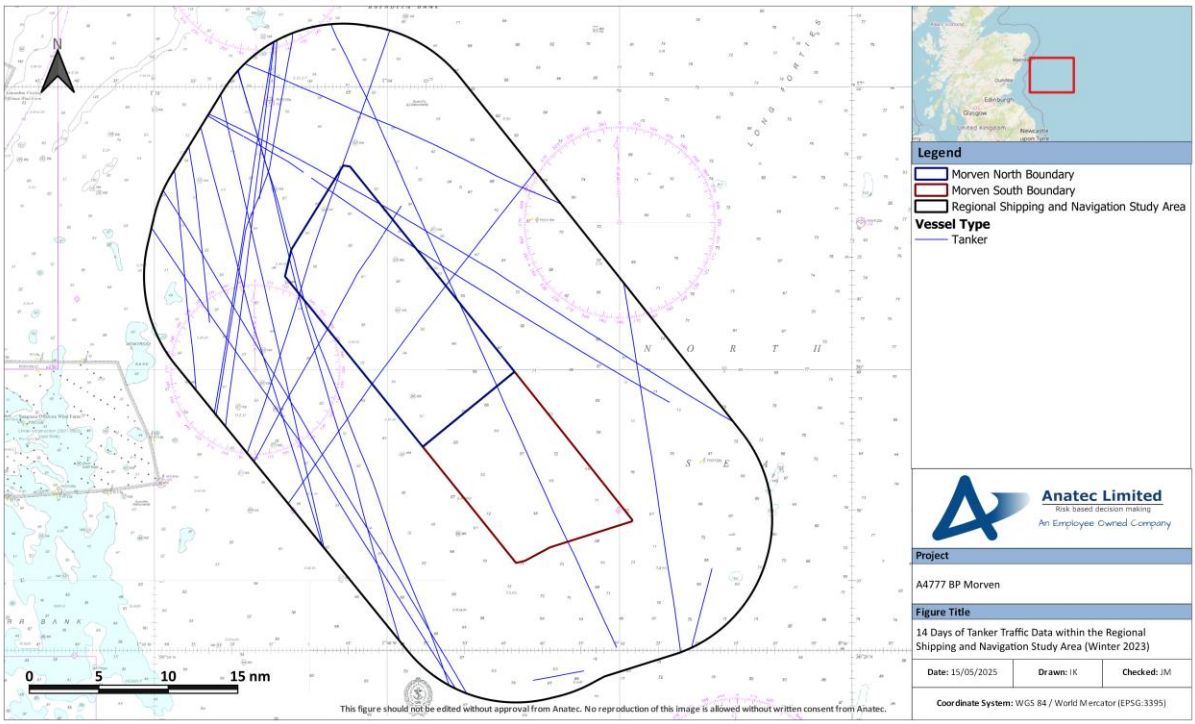


Figure H.8 14 days of tanker traffic data within the Regional Shipping and Navigation Study Area (winter 2023)

27.1.1.275 Throughout the winter 2023 survey period, an average of one to two unique tankers per day were recorded within the Regional Shipping and Navigation Study Area.

H.4 Survey data comparison

27.1.1.276 This subsection provides comparison of the 28-day survey period (summer and winter 2024 combined) against the summer 2023 survey data.

27.1.1.277 A comparison of the average number of each main vessel type recorded during the summer 2023 survey data period and the primary vessel traffic data is presented in Table H.1.

Table H.1 Vessel count comparison with summer 2023 data (per day)

Vessel Type	Winter 2023	Summer 2024	Winter 2024
Cargo	6-7	7	6
Oil and Gas	4	5-6	3-4
Fishing	1-2	2	1-2

Vessel Type	Winter 2023	Summer 2024	Winter 2024
Tanker	1-2	2	1

27.1.1.278 The average daily vessel count within the winter 2023 survey data was broadly similar to the winter 2024 survey data, with consistently lower counts for each vessel type compared to the summer 2024 survey data.

H.5 Summary

27.1.1.279 A total of 14 days of AIS, Radar and visual observation data during winter 2023 has been analysed to validate the summer and winter 2024 vessel traffic survey data recorded within the Regional Shipping and Navigation Study Area.

27.1.1.280 Overall, the vessel types and counts detected within the Regional Shipping and Navigation Study Area were similar between the vessel traffic survey data and winter 2023 data.