Partners in UK offshore wind

MORGAN OFFSHORE WIND PROJECT: GENERATION ASSETS

Environmental Statement

Volume 4, Annex 7.1: Navigational Risk Assessment

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Image of an offshore wind farm

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Errata

Errata reference number	Deadline included	Document number	Volume and chapter	Paragraph/ Table/ Figure	Description of errata	Correction
22	D2	APP-060	Volume 4, Annex 7.1 Navigational risk assessment	Paragraph 1.9.3.6	Paragraph states that 'Hazards are then defined as either Broadly Acceptable, with existing mitigation, or Unacceptable'. This is a typographic error and as per Table 1.33 of Volume 4, Annex 7.1: Navigational Risk Assessment (APP-060), hazards were scored against three levels (Broadly Acceptable, Tolerable (if ALARP), and Unacceptable/In tolerable).	The paragraph should read as follows: 'Hazards are then defined as either Broadly Acceptable, Tolerable (if ALARP), and Unacceptable/In tolerable. MGN654 Annex 1 (MCA, 2021b) states that where risks are scored as Medium Risk, '*Further risk control options must be considered to the point where further risk control is grossly disproportionate (i.e. the ALARP principle) and an ALARP justification and declaration made*.' Therefore, hazards scored as Medium Risk can only be Tolerable if ALARP is met'.

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Glossary

Term	Meaning
Adverse weather	Severe weather that creates potentially unsafe conditions for vessel transits.
Aids to Navigation	Any sort of signal or marker to support vessel navigation including buoys, beacons or lights.
Air draught	The distance from the surface of the water to the highest point of the vessel.
Allision	Vessel makes contact with a fixed or floating object such as wind turbine.
Anchorage	A designated area where ships lower their anchors to remain in position.
As Low as Reasonably Practical	The principle that risk should be reduced as far as possible before further reduction is disproportionate to the costs of doing so.
Automatic Identification System	An automatic tracking system carried by ships that broadcasts their position and identity to other nearby vessels.
Beam	Side or width of a vessel.
Berth	The specific location within a port or harbour where a vessel is moored, usually for the purposes of loading or unloading.
Bow	The front of a vessel.
Bridge	The principal control centre from a vessel where it is navigated.
Cardinal mark	A sea mark used in maritime pilotage to indicate the position of a hazard and the direction of safe water.
Cargo shift	The dangerous movement of goods aboard a vessel, typically resulting in damage.
Chart Datum	The water level surface shown on nautical charts, approximately the lowest level due to astronomical effects.
Closest Point of Approach	The estimated point and distance at which two vessels or objects will reach their minimum value.
Collision	Coming together of two vessels underway.
Draught	The maximum depth of any part of a vessel.
Fog	Where visibility is less than 1,000 m.
Gale	Winds in excess of 34 knots.
Grounding	Vessel makes contact with the seabed/shoreline or underwater assets.
Hydrography	The science and measurement of the physical features of the seabed.
Lee	The area of water downwind of an obstacle, such as a landmass.
Master	The designated person in charge of a ship, its crew, passengers and cargo.
Morgan Potential Array Area	The area that was presented in the Morgan Generation Assets PEIR as the area within which the wind turbines, foundations, inter-array cables, interconnector cables and offshore substation platforms (OSPs) forming the Morgan Generation Assets. This area was the boundary consulted on during statutory consultation and subsequently refined for the application for Development Consent.

Term	Meaning
Nautical charts	A graphic representation of a sea area and adjacent coastal regions.
Overcarried	The act of a pilot not disembarking at a port's pilot station and staying onboard the vessel until another destination.
Passage plan	A detailed description of a vessel's voyage from start to finish, including the route and hazards likely to be encountered along the way.
Pilot	Professional seafarers with detailed knowledge of a port or sea area and expertise in ship manoeuvring.
Port	The left side of a vessel when looking towards the bow.
Port or Harbour	A maritime facility compromising of one or more wharves or loading areas where ships load and discharge cargo or passengers.
Roll on Roll off (Ro-Ro)	Ships designed to carry wheeled cargo such as cars or trucks.
Routeing	The path taken by a vessel.
Significant wave height	The average wave height from trough to crest of the highest one-third of waves.
Snagging	Fishing Gear or anchors coming fast on subsurface infrastructure such as cables.
Starboard	The right side of a vessel when looking towards the bow.
Stern	The rear of a vessel.
Twenty Foot Equivalent Units	A measure of the cargo capacity of vessels, nominally those carrying containers.
Tonnage	The weight in tons of cargo or freight.
Traffic Separation Scheme	A routeing measures aimed at the separation of opposing streams or traffic by appropriate means and by the establishment of traffic lanes.
Turnaround	The process and activities necessary between the arrival of a vessel in port and its departure, including unloading and loading of passengers or cargo.
Under Keel Clearance	The vertical distance between the bottom of a ship and the seabed.
Vessel Monitoring System	Satellite tracking system using a device on vessel which transmits the location, speed and course of the vessel.
Vessel Traffic Services	A marine traffic monitoring system established by port authorities to manage vessel movements and safety.

Acronyms

Acronym	Description
AIS	Automatic Identification System
ALARP	As Low as Reasonably Practicable
ANMP	Aids to Navigation Management Plan
AtoN	Aids to Navigation
BEIS	Department for Business, Energy and Industrial Strategy (now called Department for Energy Security and Net Zero)

Acronym	Description
CBRA	Cable Burial Risk Assessment
CEFAS	Centre for Environment, Fisheries and Aquaculture Science
CP	Construction Plan
CPA	Closest Point of Approach
COLREGS	Convention on the International Regulations for Preventing Collisions at Sea
CRNRA	Cumulative Regional Navigation Risk Assessment
CSIP	Cable Specification and Installation Plan
CTVs	Crew Transfer Vessels
DCO	Development Consent Order
DfT	Department for Transport
DP	Design Plan
EC-MWF	European Centre for Medium-Range Weather Forecasts
EIA	Environmental Impact Assessment
EnBW	Energie Baden-Württemberg AG
ERA5	5th Generation of the ECMWF Reanalysis
ERCoP	Emergency Response and Co-operation Plan
ETV	Emergency Towage Vessel
FIR	Fishing Industry Representative
FLCP	Fisheries Liaison and Co-existence Plan
FSA	Formal Safety Assessment
GNSS	Global Navigation Satellite System
GPS	Global Positioning System
HAT	Highest Astronomical Tide
HMCG	His Majesty's Coastguard
Hs	Significant Wave Height
IALA	International Association of Lighthouse Authorities
IoM	Isle of Man
IMO	International Maritime Organisation
IoMSPC	Isle of Man Steam Packet Company
IWRAP	IALA Waterway Risk Assessment Program
LAT	Lowest Astronomical Tide
LOA	Length Overall
LYC	Liverpool Yacht Club
MAIB	Marine Accident Investigation Branch
MARPOL	International Convention for the Prevention of Pollution from Ships
MCA	Maritime and Coastguard Agency

Acronym	Description
MCAA	Marine and Coastal Access Act
MDS	Maximum Design Scenario
MHWS	Mean High Water Springs
MGN	Marine Guidance Note
MMO	Marine Management Organisation
MNEF	Marine Navigation Engagement Forum
MPCP	Marine Pollution Contingency Plan
NFFO	National Federation of Fishermen's Organisations
NPS	National Policy Statement
NRA	Navigation Risk Assessment
NRW	Natural Resource Wales
NSIP	Nationally Significant Infrastructure Project
O&M	Operations and Maintenance
OCMS	Offshore Construction Method Statement
OEMP	Offshore Environmental Management Plan
OREI	Offshore Renewable Energy Installations
OTNR	Offshore Transmission Network Review
PDE	Project Design Envelope
PEIR	Preliminary Environmental Impact Report
PEXA	Practice and Exercise Areas
RNLI	Royal National Lifeboat Institute
RYA	Royal Yachting Association
SAR	Search and Rescue
SIRA	Simplified IALA Risk Assessment
SOLAS	International Convention for the Safety of Life at Sea
TSS	Traffic Separation Scheme
UKC	Under Keel Clearance
UKHO	United Kingdom Hydrographic Office
UN	United Nations
UNCLOS	United Nations Convention on the Law of the Sea
VHF	Very High Frequency
VMS	Vessel Monitoring System
VTMP	Vessel Traffic Management Plan
VTS	Vessel Traffic Services

Units

Unit	Description
%	Percentage
€	Euros
£	Pound sterling
cd	Candela
GT	Gross Tonnage
Hs	Significant wave height
km	Kilometre
km^2	Square kilometres
knot	Nautical miles per hour
m	Metres
m/s	Metres per Second
MW	Mega Watts
nm	Nautical miles (1,852 meters)

1 Navigational risk assessment

1.1 Introduction

1.1.1 Background

1.1.1.1 Morgan Offshore Wind Limited (the Applicant), a joint venture of bp Alternative Energy Investments Ltd. (hereafter referred to as bp) and Energie Baden-Württemberg AG (hereafter referred to as EnBW) is developing the Morgan Offshore Wind Project: Generation Assets (hereafter Morgan Generation Assets). The Applicant entered into an agreement for lease for the Morgan Generation Assets in early 2023. The Morgan Array Area is 280 km^2 located 20.1 nautical miles (nm) from the northwest coast of England and 12 nm from the Isle of Man. The Morgan Generation Assets are a Nationally Significant Infrastructure Project (NSIP) requiring a Development Consent Order (DCO) under the Planning Act 2008.

1.1.1.2 NASH Maritime Ltd (NASH) has been commissioned to undertake a Navigation Risk Assessment (NRA) for the Morgan Generation Assets. The scope of this NRA includes the wind turbines, offshore substation platforms, inter-array and interconnector cables, and associated construction, maintenance and decommissioning activities.

1.1.1.3 The Morgan Generation Assets has been scoped into the Pathways to 2030 workstream under the Offshore Transmission Network Review (OTNR). The output of this process concluded that the Morgan Generation Assets will share a grid connection location at Penwortham in Lancashire with the Round 4 Morecambe Offshore Windfarm, also located in the east Irish Sea. A separate DCO application will be submitted for the construction, operations and maintenance and decommissioning of the transmission assets required to enable the export of electricity from both the Morgan Generation Assets and the Morecambe Offshore Windfarm to the National Grid entry point at Penwortham (see Volume 1, Chapter 1: Introduction of the Environmental Statement).

1.1.2 Description of NRA

1.1.2.1 Offshore developments have the potential to have negative impacts on the navigation and safety of maritime users. In order to understand the likelihood and magnitude of these impacts, an NRA is required. The Maritime and Coastguard Agency's (MCA) Marine Guidance Note (MGN) 654 (MCA, 2021a) describes the necessary input requirements and assessment methodology in order to properly assess these impacts. The legislation and guidance relevant to the methodological basis of this NRA are described in section 1.2.

1.1.2.2 The NRA has been developed to account for the impacts during construction, operations and maintenance and decommissioning of the Morgan Generation Assets. The assessment is based on a Maximum Design Scenario (MDS), a conservative assumption on the design characteristics likely to have the greatest impact upon shipping and navigation receptors. Details of the MDS are presented in section 1.4.

1.1.2.3 This document describes the inputs, methodology and results of the NRA. The output of this assessment is used to inform the shipping and navigation assessment contained within the Environmental Statement (Volume 2, Chapter 7: Shipping and navigation of the Environmental Statement) and supersedes that published as part of the Preliminary Environmental Information Report (PEIR).

Summary of PEIR NRA and Array Evolution

1.1.2.4 As part of the PEIR, an NRA was progressed on the Morgan Potential Array Area and a cumulative assessment undertaken with the adjacent Mona Offshore Wind Project and Morecambe Offshore Windfarm: Generation Assets (hereafter referred to as Morecambe Generation Assets). The PEIR NRA concluded that both individually and cumulatively, the Morgan Generation Assets would result in unacceptable risks to navigation and significant impacts to lifeline ferry schedules.

1.1.2.5 The Mona Offshore Wind Project, Morgan Generation Assets and Morecambe Generation Assets collectively made a number of changes to address these unacceptable risks. The commitments made by the Morgan Generation Assets to reduce these impacts were as follows:

- Reduction in extent and tapering of the northeastern boundary of the Morgan Potential Array Area
- Increasing the distance between the Morgan Potential Array Area and the Walney and Walney Extension offshore wind farms from between 2.7 to 4.1 nm distance to 4.3 to 5.3 nm distance
- Commitment to two lines of orientation in the layout of surface structures within the Morgan Array Area.

1.1.2.6 This document updates the NRA published as part of the PEIR to assess whether all risks have been reduced to either Broadly Acceptable or As Low as Reasonably Practicable (ALARP) (see section 1.9).

Document structure

1.1.2.7 This NRA consists of the following chapters and sections:

- Section 1: Introduction and background
- Section 1.2: Policy, guidance and legislation
- Section 1.3: NRA methodology
- Section 1.4: Project description and maximum design scenario
- Section 1.5: Description of marine environment
- Section 1.6: Description of existing marine activities
- Section 1.7: Future case traffic profile
- Section 1.8: Impact assessment
- Section 1.9: Navigational risk assessment
- Section 1.10: Cumulative assessment
- Section 1.11: Conclusions and recommendations
- Appendix A: Hazard log
- Appendix B: Hazard workshop summary
- Appendix C: MGN654 checklist
- Appendix D: 2023 vessel traffic survey addendum
- Appendix E: Cumulative regional navigation risk assessment.

1.2 Policy, guidance and legislation

1.2.1 Legislation and national policy

International obligations

1.2.1.1 The United Nations (UN) Convention on the Law of the Sea (UNCLOS) (UN, 1982) is an international agreement that establishes a legal framework for all marine and maritime activities. Article 60 concerns artificial islands, installations and structures in the exclusive economic zone. Article 60(7) states that '*Artificial islands, installations and structures and the safety zones around them may not be established where interference may be caused to the use of recognized sea lanes essential to international navigation*.' As per Article 22(4), '*The coastal state shall clearly indicate such sea lanes and Traffic Separation Schemes (TSS) on charts to which due publicity shall be given'*.

1.2.1.2 Vessels navigating must also adhere to requirements under the Safety of Life at Sea (SOLAS), Marine Pollution (MARPOL) and Standards of Training, Certification and Watchkeeping for Seafarers conventions. Furthermore, vessels will navigate in accordance with the Convention on the International Regulations for Preventing Collisions at Sea, 1972 (COLREGs).

National Policy Statement

1.2.1.3 This NRA has been undertaken in accordance with the instructions and guidance provided within the National Policy Statement (NPS) for Renewable Energy Infrastructure (EN-3) (Department for Energy Security & Net Zero, 2023). Table 1.1 provides a summary of the guidance provided by NPS EN-3 that is relevant to shipping and navigation. Table 1.2 presents the relevant shipping and navigation decision making requirements.

Table 1.1: Relevant shipping and navigation assessment requirements from NPS EN-3.

NPS Requirement	NRA Reference
Offshore wind farms and offshore transmission will occupy an area of the sea or sea bed. For offshore wind farms in particular it is inevitable that there will be an impact on navigation in and around the area of the site. This is relevant to both commercial and recreational users of the sea who may be affected by disruption or economic loss because of the proposed offshore wind farm and/or offshore transmission. [Paragraph 2.8.178]	Impact on vessel routeing in section 1.8.3 and section 1.8.4 for ferries and other commercial shipping respectively. This includes routeing in typical and adverse weather conditions. Impacts on recreational craft are described throughout section 1.8, 1.9 and 1.10.
To ensure safety of shipping applicants should reduce risks to navigational safety to ALARP, as described in Section 2.8.321. [Paragraph 2.8.179]	Impacts to navigation are described in section 1.8 and the guidance and process for producing this NRA set out in section 1.9. The NRA for the Morgan Generation Assets has concluded that there are no unacceptable risks and that all risks have been reduced to Broadly Acceptable or ALARP.
There is a public right of navigation over navigable tidal waters and in International Law, foreign vessels have the right of innocent passage through the UK's territorial waters. [Paragraph 2.8.180]	A summary of key legislation and policy is contained in section 1.2.

NPS Requirement	NRA Reference
Beyond the seaward limit of the territorial sea, shipping has the freedom of navigation although offshore infrastructure and the imposition of safety zones can hinder this. [Paragraph 2.8.181]	A summary of key legislation and policy is contained in section 1.2. Applied risk controls, including safety zones, are described in section 1.4.8. Additional risk control options are identified in section 1.9.7.
Impacts on navigation can arise from the wind farm or other infrastructure and equipment creating a physical barrier during construction and operation. [Paragraph 2.8.182]	Impact on vessel routeing in section 1.8.3 and section 1.8.4 for ferries and other commercial shipping respectively. Section 1.8.5 describes the impact on small craft navigation.
There may be some situations where reorganisation of shipping traffic activity might be both possible and desirable when considered against the benefits of the wind farm and/or offshore transmission application and such circumstances should be discussed with the Government officials, including Secretary of State and MCA, and other stakeholders, including Trinity House, as The General Lighthouse Authority consultee, and the commercial shipping sector. It should be recognised that alterations might require national endorsement and international agreement and that the negotiations involved may take considerable time and do not have a guaranteed outcome. [Paragraph 2.8.183]	Significant consultation has been undertaken through the Marine Navigation Engagement Forum (MNEF), individual meetings, hazard workshops and written correspondence which are summarised in section 1.3.5 and section 1.9.4. Through this engagement, feedback has been received on the impacts of the Morgan Generation Assets on different receptors, and as a result, substantial alterations were made to the Morgan Generation Assets design to minimise these impacts.
Applicants should engage with interested parties in the navigation sector early in the pre-application phase of the proposed offshore wind farm or offshore transmission to help identify mitigation measures to reduce navigational risk to ALARP, to facilitate proposed offshore wind development. This includes the Marine Management Organisation (MMO) or Natural Resource Wales (NRW) in Wales, MCA, the relevant General Lighthouse Authority, such as Trinity House, the relevant industry bodies (both national and local) and any representatives of recreational users of the sea, such as the Royal Yachting Association (RYA), who may be affected. This should continue throughout the life of the development including during the construction, operation and decommissioning phases. [Paragraph 2.8.184]	
Engagement should seek solutions that allow offshore wind farms, offshore transmission and navigation and shipping users of the sea to successfully co-exist. [Paragraph 2.8.185]	
The presence of the wind turbines can also have impacts on communication and shipborne and shore-based radar systems. See section 5.5 in EN-1 for further guidance. [Paragraph 2.8.186]	Impacts on shipborne and shore based navigation, communications and positioning systems are described in section 1.8.12.
Prior to undertaking assessments applicants should consider information on internationally recognised sea lanes, which is publicly available. [Paragraph 2.8.187]	Location of sea lanes are presented in section 1.5.1 and impact on vessel routeing measures in section 1.8.2. The assessment concludes that there is no significant effect on ship routeing schemes from the Morgan Generation Assets.
Applicants should refer in assessments to any relevant, publicly available data available on the Maritime Database. [Paragraph 2.8.188]	Datasets used to undertake this assessment are described in section 1.3.5.

NPS Requirement	NRA Reference
Applicants must undertake a Navigational Risk Assessment (NRA) in accordance with relevant government guidance prepared in consultation with the MCA and the other navigation stakeholders listed above. [Paragraph 2.8.189]	The guidance and process followed in producing this NRA is described in section 1.9**Error! Reference s ource not found.**. The NRA concludes that all risks have been reduced to Broadly Acceptable or ALARP.
The navigation risk assessment will for example necessitate: • A survey of vessel traffic in the vicinity of the proposed wind farm • A full NRA of the likely impact of the wind farm on navigation in the immediate area of the wind farm in accordance with the relevant marine guidance • Cumulative and in-combination risks associated with the development and other developments (including other wind farms) in the same area of sea. [Paragraph 2.8.190]	Four 14 day vessel traffic surveys were conducted between 2021 and 2023 in compliance with the requirements under MGN654, survey findings are presented in section 1.6 and Appendix D. This included a summer, winter, fishing and top-up survey. The NRA is presented in section 1.9 and has been produced in accordance with MGN654. The cumulative impacts of the Morgan Generation Assets on vessel routeing, collision and contact, in combination with multiple developments, are examined in section 1.10 and Appendix E.
In some circumstances, applicants may seek declaration of a safety zone around wind turbines and other infrastructure. Although these might not be applied until after consent to the wind farm has been granted. [Paragraph 2.8.191]	Applied risk controls, including safety zones, are described in section 1.4.8. Additional risk control options are identified in section 1.9.7.
The declaration of a safety zone excludes or restricts activities within the defined sea areas including navigation and shipping. [Paragraph 2.8.192]	
Where there is a possibility that safety zones will be sought applicant assessments should include potential effects on navigation and shipping. [Paragraph 2.8.193]	
Where the precise extents of potential safety zones are unknown, a realistic worst-case scenario should be assessed. Applicants should consult the MCA for advice on maritime and safety and refer to the government guidance on safety zones as a part of this process. [Paragraph 2.8.194]	
Applicants should undertake a detailed NRA, which includes Search and Rescue Response Assessment and emergency response assessment prior to applying for consent. The specific Search and Rescue requirements will then be discussed and agreed post-consent. [Paragraph 2.8.195]	Impacts on Search and Rescue (SAR) are described in section 1.8.10.

Table 1.2: Relevant shipping and navigation decision making requirements from NPS EN-3.

NPS Requirement	NRA Reference
The Secretary of State should not grant development consent in relation to the construction or extension of an offshore wind farm if it considers that interference with the use of recognised sea lanes essential to international navigation is likely to be caused by the development. [Paragraph 2.8.326]	Relevant International Maritime Organisation (IMO) routeing measures, including the Liverpool Bay TSS, are considered in relation to the Morgan Array Area are presented in section 1.5.1 and impact on vessel routeing measures in section 1.8.2 and shows that there would be no significant adverse impact on this route.
The use of recognised sea lanes essential to international navigation means: a) anything that constitutes the use of such a sea lane for the purposes of article 60(7) of the United Nations Convention on the Law of the Sea 1982 b) any use of waters in the territorial sea adjacent to Great Britain that would fall within paragraph (a) if the waters were in a Renewable Energy Zone . [Paragraph 2.8.327]	
The Secretary of State should be satisfied that the site selection has been made with a view to avoiding or minimising disruption or economic loss to the shipping and navigation industries with particular regard to approaches to ports and to strategic routes essential to regional, national and international trade, lifeline ferries and recreational users of the sea. [Paragraph 2.8.328]	Impact on vessel routeing is discussed in section 1.8.3 and section 1.8.4 for ferries and other commercial shipping respectively. This includes routeing in typical and adverse weather conditions. These sections show that the Morgan Array Area is clear of the majority of key shipping routes
Where after carrying out a site selection, a proposed development is likely to adversely affect major commercial navigation routes, for instance by causing appreciably longer transit times, the Secretary of State should give these adverse effects substantial weight in its decision making. [Paragraph 2.8.329]	
Where a proposed offshore wind farm is likely to affect less strategically important shipping routes, the Secretary of State should take a pragmatic approach to considering proposals to minimise negative impacts. [Paragraph 2.8.330]	
The Secretary of State should be satisfied that risk to navigational safety is ALARP. It is Government policy that wind farms and all types of offshore transmission should not be consented where they would pose unacceptable risks to navigational safety after mitigation measures have been adopted. [Paragraph 2.8.331]	Impacts to navigation are described in section 1.8 and the guidance and process for producing this NRA set out in section 1.9. It is demonstrated that there are no unacceptable risks to navigation and all hazards have been reduced to ALARP.
The Secretary of State should be satisfied that the scheme has been designed to minimise the effects on recreational craft and that appropriate mitigation measures, such as buffer areas, are built into applications to allow for recreational use outside of commercial shipping routes. [Paragraph 2.8.332]	Impacts on recreational craft are described throughout section 1.8, 1.9 and 1.10 and shown to be small in nature.
In view of the level of need for energy infrastructure, where an adverse effect on the users of recreational craft has been identified, and where no reasonable mitigation is feasible, the Secretary of State should weigh the harm caused with the benefits of the scheme. [Paragraph 2.8.333]	
The Secretary of State should make use of advice from the MCA, who will use the NRA described in paragraphs 2.8.179 and 2.8.180 above. [Paragraph 2.8.334]	Relevant stakeholders have been consulted throughout, including the MCA. A summary of the key matters raised during consultation activities, the consultee and the consultation

NPS Requirement	NRA Reference
	activity undertaken is provided in section 1.3.5. An MNEF was established for project (see section 1.3.5). A hazard workshop was undertaken and is described in section 1.9.4. Impacts to navigation are described in section 1.8 and the guidance and process for producing this NRA set out in section 1.9. Stakeholder consultation is summarised in section 1.3.5. An MNEF was established for project (see section 1.3.5). Two hazard workshops were undertaken and is described in section 1.9.4.
The Secretary of State should have regard to the extent and nature of any obstruction of or danger to navigation which (without amounting to interference with the use of such sea lanes) is likely to be caused by the development in determining whether to grant consent for the construction, or extension, of an offshore wind farm, and what requirements to include in such a consent. [Paragraph 2.8.335]	Impacts to navigation are described in section 1.8 and the guidance and process for producing this NRA set out in section 1.9 and concludes there is no underwater obstruction to navigation.
The Secretary of State may include provisions, compliant with national maritime legislation and UNCLOS, within the terms of a development consent as respects rights of navigation so far as they pass through waters in or adjacent to Great Britain which are between the mean low water mark and the seaward limits of the territorial sea. [Paragraph 2.8.336]	Applied risk controls, including safety zones, are described in section 1.4.8. Additional risk control options are identified in section 1.9.7.
The provisions may specify or describe rights of navigation which: • Are extinguished • Are suspended for the period that is specified in the DCO • Are suspended until such time as may be determined in accordance with provisions contained in the DCO • Are exercisable subject to such restrictions or conditions, or both, as are set out in the DCO. [Paragraph 2.8.337]	
The Secretary of State should specify the date on which any such provisions are to come into force, or how that date is to be determined. [Paragraph 2.8.338]	
The Secretary of State should require the applicant to publish any provisions that are included within the terms of the DCO, in such a manner as appears to the Secretary of State to be appropriate for bringing them, as soon as is reasonably practicable, to the attention of persons likely to be affected by them. [Paragraph 2.8.339]	
The Secretary of State should include provisions as respects rights of navigation within the terms of a DCO only if the applicant has requested such provision be made as part of their application for development consent. [Paragraph 2.8.340]	

Marine Plans and Marine Policy Statements

1.2.1.4 The 2009 Marine and Coastal Access Act (MCAA) requires all public authorities taking authorisation or enforcement decisions that affect or might affect the UK marine area, to do so in accordance with the 2011 UK Marine Policy Statement and the relevant marine plans (HMG, 2011).

1.2.1.5 The North West Marine Plan (MMO, 2021) has been prepared for the purposes of section 51 of the MCAA 2009. Relevant policies of this plan for shipping and navigation are described in Table 1.3.

Table 1.3: North West Marine Policies relevant to shipping and navigation.

Policy	Reference	NRA Reference
Only proposals demonstrating compatibility with current port and harbour activities will be supported. Proposals within statutory harbour authority areas or their approaches that detrimentally and materially affect safety of navigation, or the compliance by statutory harbour authorities with the Open Port Duty or the Port Marine Safety Code, will not be authorised unless there are exceptional circumstances. Proposals that may have a significant adverse impact upon future opportunity for sustainable expansion of port and harbour activities, must demonstrate that they will, in order of preference: a) avoid, b) minimise, c) mitigate adverse impacts so they are no longer significant. If it is not possible to mitigate significant adverse impacts, proposals should state the case for proceeding.	NW-PS-1	Impacts on navigational safety are presented in section 1.8 and section 1.9.
Proposals that require static sea surface infrastructure or that significantly reduce under-keel clearance must not be authorised within or encroaching upon International Maritime Organization routeing systems unless there are exceptional circumstances.	NW-PS-2	Location of sea lanes are presented in section 1.5.1 and impact on vessel routeing measures in section 1.8.2. The assessment demonstrates that the Morgan Generation Assets does not encroach upon routeing schemes such as TSS.
Proposals that require static sea surface infrastructure or that significantly reduce under-keel clearance which encroaches upon high density navigation routes, strategically important navigation routes, or that pose a risk to the viability of passenger services, must not be authorised unless there are exceptional circumstances.	NW-PS-3	The export cable corridor is not included within the Morgan Generation Assets NRA (see section 1.1). Inter-array and interconnector cables within the Morgan Array Area would be in sufficiently deep water that any cable protection would not compromise the clearances required for deep draught vessels.
Proposals promoting or facilitating sustainable coastal and/or short sea shipping as an alternative to road, rail or air transport will be supported where appropriate.	NW-PS-4	N/A

1.2.2 Primary guidance

MGN654

1.2.2.1 The principal guidance document for NRAs is the MCA's MGN654 (2021a). MGN654 describes the potential shipping and navigation issues which should be considered by developers when proposing Offshore Renewable Energy Installations (OREIs). Annex 1 (2021b) of the MGN provides a detailed methodology for assessing the marine navigational safety risks of OREIs. In particular, by following the methodology, the NRAs:

- Are proportionate to the scale of the development and magnitude of risks
- Are based on the risk assessment approach of the Formal Safety Assessment (FSA)
- Are capable of utilising techniques and methods which produce results, which are acceptable to the government
- Compare the base case and future case risks in the study area before predicting the impacts of the OREIs on that risk through a hazard log
- Determine which risk controls should be put in place to minimise the risks to ALARP.

1.2.2.2 MGN654 Annex 1 provides a standardised format of submission which is described in Table 1.4 (MCA, 2021b). Annex 2 provides guidance on wind farm-shipping route interactions. Annex 3 provides guidance on Under Keel Clearance (UKC). Annex 4 provides hydrography guidelines. Annex 5 contains guidance on requirements, guidance and operational considerations for SAR and emergency response (MCA, 2021c).

1.2.2.3 A checklist is provided in Annex 6 of the MGN654, which has been completed for this NRA within Appendix C.

Table 1.4: MGN654 Annex 1 Methodology for Assessing the Marine Navigational Safety & Emergency Response Risks of Offshore Renewable Energy Installations.

The following content is included:	Compliant Yes/No	NRA Reference
A risk claim is included supported by a reasoned argument and evidence	Yes	The risk assessment conducted in section 1.9 and is supported by data analysis (section 1.6), consultation (section 1.3.5) and a review and discussion of impacts (section 1.8). Therefore, a risk claim is made in section 1.11.
Description of the marine environment	Yes	A description of the baseline marine environment is provided in section 1.4.8.
Description of the OREI development and how it changes the marine environment	Yes	A description of the OREI development is provided in section 1.4. Potential impacts are described in section 1.8.
Analysis of the marine traffic	Yes	A detailed analysis of the baseline vessel traffic is provided in section 1.6. Section 1.7 presents the future baseline traffic profile. The impacts of the OREIs on that traffic is contained within section 1.8.
Status of the hazard log	Yes	The navigational risk assessment is provided in section 1.9. The hazard log is provided in Appendix A.

The following content is included:	Compliant Yes/No	NRA Reference
Navigation Risk Assessment	Yes	The NRA is provided in section 1.9.
Search and rescue overview and assessment	Yes	Existing SAR provision is described in section 1.5.4. An assessment of impacts of the Morgan Generation Assets to SAR is provided in section 1.8.10.
Emergency response overview and assessment	Yes	
Status of risk control log	Yes	Applied risk controls, including safety zones, are described in section 1.4.8. Additional risk control options are identified in section 1.9.7.
Major hazards summary	Yes	A summary of the principal impacts of the Morgan Generation Assets are contained within section 1.8 and an NRA reported in section 1.9.
Statement of limitation	Yes	Any limitations or assumptions of this assessment are reported in their relevant sections.
Through life safety management	Yes	Applied risk controls, including safety zones, are described in section 1.4.8. Additional risk control options are identified in section 1.9.7.

Formal Safety Assessment (FSA)

1.2.2.4 The IMO FSA process has been applied within this NRA. The guidelines for FSA were approved in 2002 and were most recently amended in 2018 by MSC-MEPC.2/Circ.12/Rev.2 (IMO, 2018). This NRA has been conducted utilising this methodology, as per recommendations from MGN654.

1.2.2.5 The FSA is a structured and systematic methodology, aimed at enhancing maritime safety, including protection of life, health, the marine environment and property, by using risk analysis and, if appropriate, cost-benefit assessment. The IMO FSA guidance define a hazard as '*a potential to threaten human life, health, property or the environment*', the realisation of which results in an incident or accident. The potential for a hazard to be realised (i.e. likelihood) can be combined with an estimated or known consequence of outcome and this combination is termed risk. There are five steps within the FSA process:

- Step 1: Identification of hazards
- Step 2: Risk analysis
- Step 3: Risk control options
- Step 4: Cost-benefit assessment (if applicable)
- Step 5: Recommendations for decision making.

1.2.3 Additional guidance and lessons learnt

1.2.3.1 Significant additional guidance is available which has been used to inform this NRA, which are described in Table 1.5 and Table 1.6.

Table 1.5: Summary of additional relevant guidance.

Guidance	Description
MGN372: OREIs: Guidance to Mariners Operating in the Vicinity of UK OREIs (MCA, 2022).	Issues to be taken into account when planning and undertaking voyages near offshore renewable energy installations off the UK coast.
International Association of Lighthouse Authorities (IALA) G1162 The Marking of Offshore Man-Made Structures (IALA, 2021).	Guidance on the lighting and marking arrangements for offshore wind farms.
RYA Position of Offshore Renewable Energy Developments: Wind Energy (RYA, 2019).	Describes key impacts of offshore wind farms on recreational activities.
PIANC WG161 Interaction Between Offshore Wind Farms and Maritime Navigation (PIANC, 2018).	Provides guidelines and recommendations on impacts on mitigations for shipping routes near offshore wind farms.
Nautical Institute (2013) The Shipping Industry and Marine Spatial Planning	Guidance on benefits and risks of marine spatial planning for shipping and navigation.
G+ IOER (2019) Good practice guidelines for offshore renewable energy developments	Guidance on emergency response for offshore wind farms.

Table 1.6: Lessons learnt and supporting studies.

Guidance	Description
MCA and QinetiQ (2004) Results of the electromagnetic investigations and assessments of marine radar, communications and positioning systems undertaken at the North Hoyle wind farm by QinetiQ and the MCA.	Reporting of trial on impacts of offshore wind farms on shipboard equipment.
MCA (2005) Offshore Wind Farm Helicopter Search and Rescue Trials Undertaken at the North Hoyle Wind Farm.	Reporting of trial on impacts of offshore wind farms on SAR equipment and activities.
BWEA (2007). Investigation of Technical and Operational Effects on Marine Radar Close to Kentish Flats Offshore Wind Farm.	Reporting of trial on impacts of offshore wind farms on shipboard equipment.
MCA (2019) MCA report following aviation trials and exercises in relation to offshore windfarms.	Reporting of trial on impacts of offshore wind farms on SAR equipment/activities and the implications on offshore wind farm design.
Rawson and Brito (2022) Assessing the validity of navigation risk assessments: a study of offshore wind farms in the UK.	Analysis of historical incidents in UK offshore wind farms.
Walney Extension Offshore Wind Farm Application (c.2013)	Documents associated with application for Walney Extension Offshore Wind Farm.
Rhiannon Offshore Wind Farm Scoping Report (2012)	Documents associated with Rhiannon Offshore Wind Farm.
Awel y Môr Offshore Wind Farm Application (2021 to 2023)	Documents associated with application for Awel y Môr Offshore Wind Farm.
Anatec (2016). Influence of UK Offshore Wind Farm Installation on Commercial Vessel Navigation.	Analysis of impact of offshore wind farms on ship routes from historical data.

1.3 NRA methodology

1.3.1 Overview

1.3.1.1 The NRA has been produced in accordance with MGN654 (see section 1.2.2) and follows the IMO's FSA (section 1.9). This assessment considers all identified impacts of the Morgan Generation Assets on shipping and navigation receptors. The FSA defines a risk as '*the combination of frequency and the severity of the consequence*' (IMO, 2018). The likelihood and consequence of these impacts are therefore assessed through the collection of significant datasets and consultation. Details on the risk criteria and matrix methodology are contained within section 1.9.

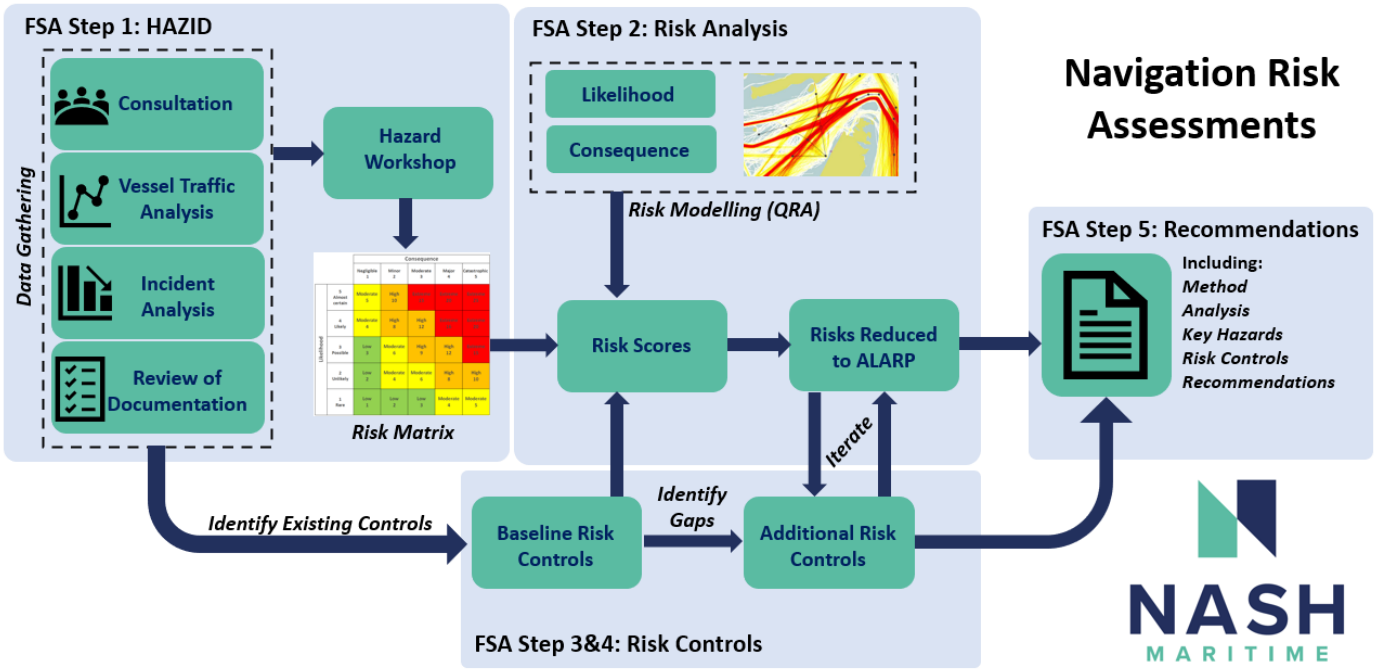

Figure 1.1: NRA methodology.

1.3.2 Definition of shipping and navigation study area

1.3.2.1 The shipping and navigation study area for the Environmental Statement is defined as an area 10 nm from the Morgan Array Area (see Figure 1.2).

1.3.2.2 This shipping and navigation study area has been agreed with consultees and is consistent with industry best practice for NRAs. The proposed shipping and navigation study area exceeds the MGN654 interactive boundaries distance of '*Very Low*' risk of 5 nm and it can therefore be concluded that impacts to shipping and navigation receptors more than 10 nm from the Morgan Array Area are negligible.

1.3.3 International Association of Lighthouse Authorities risk management tools

Qualitative risk assessment – SIRA

1.3.3.1 The Simplified IALA Risk Assessment method (SIRA) follows the FSA process and allows organisations to assess maritime and navigation risk in their waters so that they

can meet their obligations for the management of navigation safety (e.g. obligations under international conventions such as SOLAS, national domestic legislation, etc.). The principles of the SIRA approach have been used to conduct the risk assessment.

1.3.3.2 Details of the overarching methodology are provided in the following IALA Guidance:

- IALA (2022) Guideline 1018 - Risk Management
- IALA (2017) Guideline 1138 - The Use of the Simplified IALA Risk Assessment Method (SIRA).

Quantitative risk modelling – IWRAP

1.3.3.3 The IALA Waterway Risk Assessment Program (IWRAP Mk II) is a quantitative tool for calculating the frequency of collisions, groundings and allisions for navigating vessels in a given waterway. The tool was developed by IALA to support coastal states in conducting risk assessments to address obligations under SOLAS Chapter V. The tool has been presented at the IMO (e.g. NAV 52/17/2 and SN.1/Circ.296) and used by Coastal States (including UK, Denmark and Sweden) to support the assessment of new routeing measures (e.g. NCSR 5/INF.3). The tool has also had widespread use in assessing risk, both in the UK, Norway and elsewhere.

1.3.3.4 IALA (2017) Guideline G1123 contains guidance on implementing the tool and the underlying mechanics are presented in Friis-Hansen (2008).

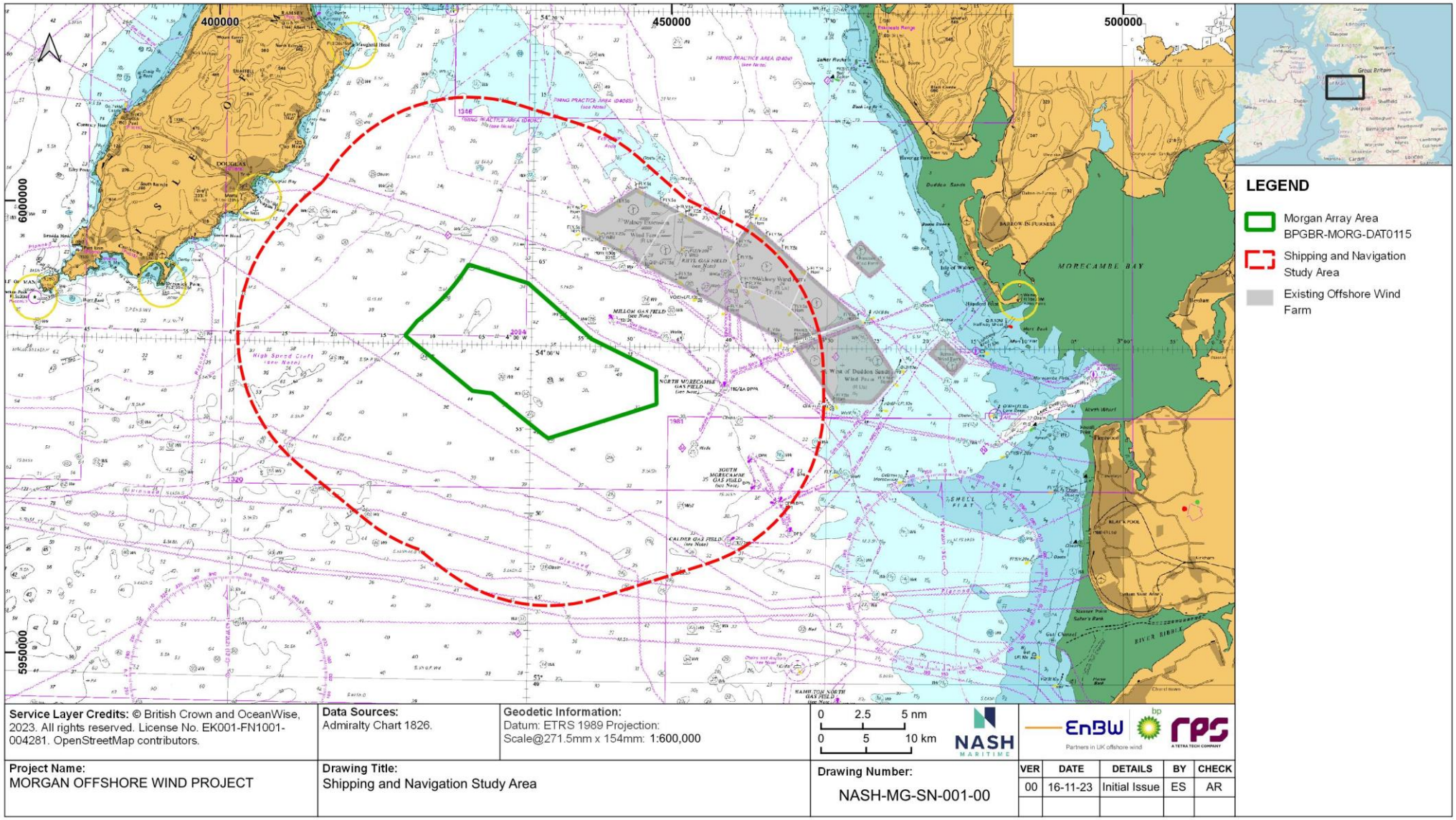

Figure 1.2: Shipping and navigation study area.

1.3.4 Cumulative NRA approach

1.3.4.1 A separate Cumulative Regional NRA (CRNRA) has been produced in collaboration between the developers of the Morgan Generation Assets, the Mona Offshore Wind Project and the Morecambe Generation Assets (Appendix E). The objective of the CRNRA is to enable stakeholders to engage with and understand the potential cumulative effects of the three proposed projects. A regional (collaborative) approach to assessment was adopted to enable individual projects to quantify and manage the cumulative impacts in a coordinated, consistent and efficient manner. This assessment dovetails with the individual NRAs undertaken for each of the three offshore wind farm projects.

1.3.4.2 The CRNRA primarily assesses the impacts of the operations and maintenance of the three project array areas on vessel navigation and safety. The focus of the CRNRA was to enable a detailed assessment of the key concerns of stakeholders, principally the formation of routes between the three project array areas and existing offshore wind farms due to the placement of infrastructure.

1.3.4.3 The findings of this CRNRA are summarised in section 1.10 and the full report available in Appendix E.

1.3.5 Summary of data sources and information gathering

Consultation and engagement

1.3.5.1 Consultation has been undertaken with stakeholders prior to and during the NRA to interface with various regulators and stakeholders at an early stage and as part of assessing risk. Table 1.7 describes the engagement which has included a range of forums:

- MNEF (2021 to 2024), a shipping and navigation engagement forum was established in 2021. The purpose was to enable developers to regularly update stakeholders on plans and progress of the Morgan Generation Assets, Morecambe Generation Assets, Morgan and Morecambe Offshore Wind Farms: Transmission Assets and Mona Offshore Wind Project, and for stakeholders to express views or concern on the impacts of the projects for discussion and, where possible, find a resolution. The MNEF is also a forum for engagement by the applicants of projects who have worked collaboratively to ensure there has been ongoing engagement on the cumulative impacts associated with these projects
- Specific meetings with stakeholders through 2021 to 2024 (see Table 1.7 for summary)
- Visit aboard the Isle of Man (IoM) Steam Packet Company's (IoMSPC) Ben-my-Chree between Douglas and Heysham (05 April 2022) to experience navigation through the shipping and navigation study area from the Master's perspective
- Hazard workshops held in Liverpool on 11 October 2022 and 29 September 2023 (details of which are summarised in section 1.9.4 and Appendix B)
- Full bridge simulator sessions conducted with ferry operators at HR Wallingford throughout 2022 and 2023 (details of which are contained in Appendix E)
- Scoping Report submission (14 June 2022)
- Scoping Opinion responses (22 July 2022)

- PEIR submission (April 2023)
- Section 42 consultation responses (June 2023).

Table 1.7: Summary of key matters raised during consultation activities undertaken for the Morgan Generation Assets relevant to Shipping and Navigation.

Date	Consultee and type of response	Comment	Response to comment raised and/or where considered in this NRA
14 October 2021	MCA Consultation Meeting.	Project introduction and proposed approach. Data collection strategy (incl. survey timings).	Survey details contained within section 1.6.1.
10 November 2021	MNEF Members MNEF 1 Meeting.	Project introduction and proposed approach. Site selection in relation to shipping and navigation constraints. Impacts of COVID-19 on data collection. Impacts to Ferry Operators (Safety and Commercial). Relation of impacts on ferry routes with regulation and guidance. Sensitivity of ferry operator schedules.	Data collection strategy is provided in section 1.3.5 and section 6.1. Commercial impacts to ferry operators are described in section 1.8.3. Safety impacts to ferry routes are described throughout the impact assessment within section 1.8 and the risk assessment within section 1.9.
01 February 2022	MCA & Trinity House Consultation Meeting.	Methodological Engagement. Update on proposed approach for assessment. Status of NPS updates. Requirement for cumulative assessment. Adverse ship routeing assessment. Consenting of Walney Extension and assessment of gap with the North East Potential Development Area. Modelling to reflect local navigational conditions.	Relevant methodology and guidance are given in section 1.2 and section 1.9.1. Cumulative impacts are described in a separate NRA but are summarised in section 1.10. Safety impacts to ferry routes are described throughout the impact assessment within section 1.8 and the risk assessment within section 1.9.

Date	Consultee and type of response	Comment	Response to comment raised and/or where considered in this NRA
09 February 2022	Department for Business, Energy and Industrial Strategy (BEIS) (now Department for Energy Security and Net Zero) Consultation Meeting.	Methodological Engagement. Introduction to project and proposed approach for assessment. Status of NPS updates and role of BEIS. Engagement with wider stakeholders.	Relevant methodology and guidance are given in section 1.2 and section 1.9.1. Consultation strategy is described in section 1.3.5.
14 February 2022	Chamber of Shipping Seatruck Ferries Stena Line IoMSPC MCA Consultation Meeting.	Methodological Engagement. Relation of impacts on ferry routes with regulation and guidance. Site selection in relation to shipping and navigation constraints. Impacts to Ferry Operators (Safety and Commercial). Need for a cumulative assessment. Adverse weather routeing decision making. Need for collaborative engagement in assessment.	Commercial impacts to ferry operators are described in section 1.8.3. Safety impacts to ferry routes are described throughout the impact assessment within section 1.8 and the risk assessment within section 1.9. Cumulative impacts are described in a separate NRA but are summarised in section 1.10. Adverse weather routeing impacts are described in section 1.8.3.
15 March 2022	Seatruck Ferries Stena Line IoMSPC P&O Questionnaire.	Request for Info Letter. Questionnaire issued to operators requesting details of existing operational details and constraints in normal and adverse weather.	Commercial impacts to ferry operators are described in section 1.8.3. Safety impacts to ferry routes are described throughout the impact assessment within section 1.8 and the risk assessment within section 1.9.

Date	Consultee and type of response	Comment	Response to comment raised and/or where considered in this NRA
04 April 2022	IoMSPC Consultation Meeting.	Baseline Data Gathering. Review of current operations and constraints. Review of impacts and decision making in adverse weather. Review of future changes to operations. Significance and potential impacts to IoMSPC and Isle of Man.	Commercial impacts to ferry operators are described in section 1.8.3. Safety impacts to ferry routes are described throughout the impact assessment within section 1.8 and the risk assessment within section 1.9.
05 April 2022	IoMSPC Consultation Meeting.	Crossing from Douglas to Heysham aboard Ben-my-Chree. Discussions with Master on navigational decision making and passage planning.	Morgan Generation Assets not discussed.
05 April 2022	Seatruck Ferries Consultation Meeting.	Baseline Data Gathering. Site selection and shipping and navigation constraints. Potential impacts of projects on safety and commercial operations for Seatruck. Review of current operations and constraints. Review of impacts and decision making in adverse weather. Review of future changes to operations.	Commercial impacts to ferry operators are described in section 1.8.3. Safety impacts to ferry routes are described throughout the impact assessment within section 1.8 and the risk assessment within section 1.9. Future case scenario development is described in section 1.7.
14 April 2022	Stena Consultation Meeting.	Baseline Data Gathering. Potential impacts of projects on safety and commercial operations for Stena. Review of current operations and constraints. Review of impacts and decision making in adverse weather. Review of future changes to operations.	Commercial impacts to ferry operators are described in section 1.8.3. Safety impacts to ferry routes are described throughout the impact assessment within section 1.8 and the risk assessment within section 1.9. Future case scenario development is described in section 1.7.
20 April 2022	Spirit Energy Consultation Meeting.	Impacts to Spirit Energy. Impacts to marine and aviation movements to offshore platforms and rigs. Requirement for safe passing distances and exclusion areas. Increased traffic flow and collision risk.	Oil and gas activities are described in section 1.5.2 and section 1.8.11. Safety impacts to oil and gas operations are described throughout the impact assessment within section 1.8 and the risk assessment within section 1.9.

Date	Consultee and type of response	Comment	Response to comment raised and/or where considered in this NRA
21 April 2022	RYA Consultation Meeting.	RYA Consultation and Survey Strategy. Introduction to project and assessment approach. Availability of RYA Recreational Atlas. Summer survey strategy. Further engagement opportunities.	Data collection strategy is provided in section 1.3.5 and section 1.6.1 Impacts to recreational users are considered throughout section 1.8 and section 1.9.
05 May 2022	Harbour Energy Consultation Meeting.	Impacts to Harbour Energy Decommissioning Plan for Millom West. Impacts to marine and aviation movements to offshore platforms and rigs. Requirement for safe passing distances and exclusion areas. Increased traffic flow and collision risk.	Oil and gas activities are described in section 1.5.2 and section 1.8.11. Safety impacts to oil and gas operations are described throughout the impact assessment within section 1.8 and the risk assessment within section 1.9.
06 May 2022	MNEF Members MNEF 2 Meeting.	Project update. Cumulative impacts of multiple projects on ferry operations. How the cumulative impacts will be assessed or examined. Impacts of projects on Isle of Man economy/society. Extent of incident data. Safety of navigating in gaps. Consequences of allisions with wind turbines.	Cumulative impacts are described in a separate NRA but are summarised in section 1.10. Data collection strategy is provided in section 1.3.5 and section 1.6.1. Impacts of project, including consequences, are described in section 1.8 and the risk assessment within section 1.9.
23 May 2022	Trinity House Scoping Opinion.	Assessment Approach MGN654 Compliance. Cumulative Impacts to be Assessed. Additional and impacts to existing Aids to Navigation (AtoNs). Decommissioning Plan. Export Cable corridor marking and protection.	Relevant methodology and guidance are given in section 1.2 and section 1.9.1. Cumulative impacts are described in a separate NRA but are summarised in section 1.10. Applied risk controls are described in section 1.4.8. The export cable will be assessed as part of the separate Morgan and Morecambe Offshore Wind Farms: Transmission Assets DCO application.

Date	Consultee and type of response	Comment	Response to comment raised and/or where considered in this NRA
30 May 2022	MCA Scoping Opinion.	Assessment Approach MGN654 Compliance. Impacts on vessel routeing and adverse weather routeing. Cumulative Impacts to be Assessed. Turbine layouts to comply with MGN654. Export Cable corridor marking and protection.	Relevant methodology and guidance are given in section 1.2 and section 1.9.1. Cumulative impacts are described in a separate NRA but are summarised in section 1.10. Impacts on vessel routeing are described in section 1.8.2/1.8.3/1.8.4. Applied risk controls are described in section 1.4.8. The export cable will be assessed as part of the separate Morgan Offshore Wind Project and Morecambe Offshore Wind Farm: Transmission Assets DCO application.
31 May 2022	Isle of Man Government Scoping Opinion.	Cumulative impacts of multiple developments. Inclusion of Isle of Man Orsted Offshore Wind Farm proposal. Impacts on IoMSPC routes into Douglas. Impacts to adverse weather routeing and safe shelter. Impacts to Search and Rescue capabilities.	Cumulative impacts are described in a separate NRA but are summarised in section 1.10. Commercial impacts to ferry operators are described in section 1.8.3. Safety impacts to ferry routes are described throughout the impact assessment within section 1.8 and the risk assessment within section 1.9. Impacts to SAR are described in section 1.8.10.
15 June 2022	Planning Inspectorate Scoping Opinion	Assessment approach and study area.	Relevant methodology and guidance are given in section 1.2 and section 1.9.1. The shipping and navigation study area is described in section 1.3.2.
30 June 2022	Seatruck Consultation Meeting.	Bridge Simulations Preparations for the Morgan Potential Array Area to inform PEIR. Determination of routes for assessment. Review of weather conditions and constraints. Definition of traffic and emergency scenarios. Assessment criteria and run order.	Section 1.3.5 provides a high-level summary of the navigational simulations with the technical report contained in Appendix E.

Date	Consultee and type of response	Comment	Response to comment raised and/or where considered in this NRA
20 July 2022 21 July 2022	IoMSPC Bridge Simulations.	Bridge Simulations Preparations for the Morgan Potential Array Area to inform PEIR. Determination of routes for assessment. Review of weather conditions and constraints. Definition of traffic and emergency scenarios. Assessment criteria and run order.	Section 1.3.5 provides a high-level summary of the navigational simulations with the technical report contained in Appendix E.
11 August 2022 12 August 2022	Stena Line Bridge Simulations.	Bridge Simulations Preparations for the Morgan Potential Array Area to inform PEIR. Determination of routes for assessment. Review of weather conditions and constraints. Definition of traffic and emergency scenarios. Assessment criteria and run order.	Section 1.3.5 provides a high-level summary of the navigational simulations with the technical report contained in Appendix E.
17 August 2022 18 August 2022 19 August 2022	IoMSPC Bridge Simulations.	Bridge simulations for the Morgan Potential Array Area to inform PEIR. Safety of transits in adverse weather and traffic through Morgan Array Area and Walney offshore wind farm route.	Section 1.3.5 provides a high-level summary of the navigational simulations with the technical report contained in Appendix E. Safety impacts to ferry routes are described throughout the impact assessment within section 1.8 and the risk assessment within section 1.9.
23 August 2022 24 August 2022 25 August 2022	Stena Line Bridge Simulations.	Bridge simulations for the Morgan Potential Array Area to inform PEIR. Safety of transits in adverse weather and traffic through Mona-Morgan/Mona-Morecambe routes.	Section 1.3.5 provides a high-level summary of the navigational simulations with the technical report contained in Appendix E. Safety impacts to ferry routes are described throughout the impact assessment within section 1.8 and the risk assessment within section 1.9.
08 September 2022 09 September 2022	Seatruck Bridge Simulations.	Bridge simulations for the Morgan Potential Array Area to inform PEIR. Safety of transits in adverse weather and traffic through Mona-Morgan routes.	Section 1.3.5 provides a high-level summary of the navigational simulations with the technical report contained in Appendix E. Safety impacts to ferry routes are described throughout the impact assessment within section 1.8 and the risk assessment within section 1.9.

Date	Consultee and type of response	Comment	Response to comment raised and/or where considered in this NRA
03 October 2022	Various Consultation Meeting.	Webinar to prepare for hazard workshops of the Morgan Potential Array Area to inform PEIR.	Section 1.9 describes the findings of the hazard workshop.
10 October 2022	MNEF Members MNEF 3 Meeting.	Project update. Application process. Approach to cumulative assessment. Introduction to Morgan and Morecambe Offshore Wind Farms: Transmission Assets.	Section 1.2 describes the relevant legislation and policies.
10 October 2022	Shipping and navigation stakeholders including, statutory consultees, commercial operators, fishing industry, other sea users etc. Hazard Workshop.	Cumulative Hazard Workshop of the Morgan Potential Array Area to inform PEIR.	Section 1.9 describes the findings of the hazard workshop.
11 October 2022	Shipping and navigation stakeholders including, statutory consultees, commercial operators, fishing industry, other sea users etc. Hazard Workshop.	Hazard Workshops of the Morgan Potential Array Area to inform PEIR.	Section 1.9 describes the findings of the hazard workshop.

Date	Consultee and type of response	Comment	Response to comment raised and/or where considered in this NRA
19 October 2022	Isle of Man Government Consultation Meeting.	Impacts on Isle of Man economy. Status of future Isle of Man offshore developments.	Safety impacts to ferry routes are described throughout the impact assessment within section 1.8 and the risk assessment within section 1.9. Cumulative impacts are described in a separate NRA but are summarised in section 1.10.
20 October 2022	Orsted Consultation Meeting.	Update on Isle of Man Offshore Wind Farm.	Cumulative impacts are described in a separate NRA but are summarised in section 1.10.
18 January 2023	MNEF members MNEF 4 Meeting.	Project update on boundary amendments and commitments post PEIR.	A summary of the NRA results following boundary amendments are contained in section 1.9.
S42 Responses	Shipping and navigation stakeholders including, statutory consultees, commercial operators, fishing industry, other sea users, members of the public. S42 Responses	Cumulative impacts on IoM's ferry and freight services and important sectors on the IoM. Increase in navigation risk. Concerns over safety of ferries in adverse weather. Concern over additional fuel and carbon emissions.	This NRA has been updated to reflect comments received during the S42 consultation on the Morgan Generation Assets PEIR. S42 consultation responses are listed in full within the Consultation report (Document Reference E3)
23 May 2023 24 May 2023 25 May 2023	Stena Line Bridge Navigation Simulations	Update to navigation bridge simulations of the Morgan Array Area to inform Environmental Statement.	A summary of the navigation simulations is provided in section 1.3.5.

Date	Consultee and type of response	Comment	Response to comment raised and/or where considered in this NRA
22 June 2023 23 June 2023	Seatruck Bridge Navigation Simulations	Update to navigation bridge simulations of the Morgan Array Area to inform Environmental Statement.	A summary of the navigation simulations is provided in section 1.3.5.
13 September 2023 14 September 2023 15 September 2023	IoMSPC Bridge Navigation Simulations	Update to navigation bridge simulations of the Morgan Array Area to inform Environmental Statement.	A summary of the navigation simulations is provided in section 1.3.5.
21 September 2023	MNEF Members MNEF 5 Meeting	Project update and review of boundary changes.	Project details for assessment in the Environmental Statement are defined in section 1.4.
28 September 2023	Shipping and navigation stakeholders including, statutory consultees, commercial operators, fishing industry and other sea users. Hazard Workshop	Cumulative NRA hazard workshop of the Morgan Array Area to inform Environmental Statement.	Section 1.9 describes the findings of the hazard workshop.

Date	Consultee and type of response	Comment	Response to comment raised and/or where considered in this NRA
29 September 2023	Shipping and navigation stakeholders including, statutory consultees, commercial operators, fishing industry and other sea users. Hazard Workshop	Morgan Generation Assets hazard workshop to inform Environmental Statement.	Section 1.9 describes the findings of the hazard workshop.
07 December 2023	Seatruck Consultation Meeting	Review of engagements and assessments to date Identification of potential increases in risk to vessels Identification of residual impacts on commercial operations Cumulative impacts associated with Mooir Vannin Offshore Wind Farm.	A summary of engagement is included in section 1.3.5. Impacts to navigational safety are described in section 1.8 and an NRA is undertaken within section 1.9. Impacts to ferry routes are described in section 1.8.3. Cumulative impacts are assessed within the CRNRA in Appendix E and summarised in section 1.10.
11 December 2023	IoMSPC Isle of Man Government Consultation Meeting	Review of engagements and assessments to date Identification of potential increases in risk to vessels Identification of residual impacts on commercial operations Cumulative impacts associated with Mooir Vannin Offshore Wind Farm.	A summary of engagement is included in section 1.3.5. Impacts to navigational safety are described in section 1.8 and an NRA is undertaken within section 1.9. Impacts to ferry routes are described in section 1.8.3. Cumulative impacts are assessed within the CRNRA in Appendix E and summarised in section 1.10.
14 December 2023	Stena Line Consultation Meeting	Review of engagements and assessments to date Identification of potential increases in risk to vessels Identification of residual impacts on commercial operations Cumulative impacts associated with Mooir Vannin Offshore Wind Farm.	A summary of engagement is included in section 1.3.5. Impacts to navigational safety are described in section 1.8 and an NRA is undertaken within section 1.9. Impacts to ferry routes are described in section 1.8.3. Cumulative impacts are assessed within the CRNRA in Appendix E and summarised in section 1.10.

Date	Consultee and type of response	Comment	Response to comment raised and/or where considered in this NRA
18 December 2023	Trinity House Consultation Meeting	Review of engagements and assessments to date Review of findings of shipping and navigation assessments Review of Morgan Generation Assets mitigation measures Cumulative impacts associated with Mooir Vannin Offshore Wind Farm.	A summary of engagement is included in section 1.3.5. Impacts to navigational safety are described in section 1.8 and an NRA is undertaken within section 1.9. Applied risk controls are described within section 1.4.8. Cumulative impacts are assessed within the CRNRA in Appendix E and summarised in section 1.10.
19 December 2023	MCA Consultation Meeting	Review of engagements and assessments to date. Review of findings of shipping and navigation assessments Cumulative impacts associated with Mooir Vannin Offshore Wind Farm.	A summary of engagement is included in section 1.3.5. Impacts to navigational safety are described in section 1.8 and an NRA is undertaken within section 1.9. Cumulative impacts are assessed within the CRNRA in Appendix E and summarised in section 1.10.
08 February 2024	MNEF Members MNEF 6 Meeting	Review of engagements and assessments to date. Review of findings of shipping and navigation assessments Cumulative impacts associated with Mooir Vannin Offshore Wind Farm.	A summary of engagement is included in section 1.3.5. Impacts to navigational safety are described in section 1.8 and an NRA is undertaken within section 1.9. Cumulative impacts are assessed within the CRNRA in Appendix E and summarised in section 1.10.

Vessel traffic datasets

1.3.5.2 Vessel traffic data from several sources was utilised to determine baseline conditions:

- High fidelity Automatic Identification System (AIS) data for 2019 and 2022 for whole Irish Sea procured on behalf of the Morgan Generation Assets
- Vessel traffic survey:
  - 14 day winter vessel traffic survey (21 November 2021 to 05 December 2021) collecting AIS, radar and visual observations
  - 14 day summer vessel traffic survey (15 July 2022 to 29 July 2022) collecting AIS, radar and visual observations
  - A top-up survey was undertaken in May 2023 to better capture activity to the northwest of the Morgan Array Area
  - A second top-up vessel traffic survey was undertaken in November 2023 to ensure compliance with MGN654 survey data recency requirements (see Appendix D).
- MMO 2019 anonymised AIS data
- EMODNet 2021 vessel density grids
- RYA Coastal Atlas
- UK Vessel Monitoring System (VMS) 2019 data
- OISPAR EU VMS 2017 data
- Department for Transport (DfT) shipping statistics (2022).

Incident data

1.3.5.3 Four accident datasets were utilised to support this assessment:

- Marine Accident Investigation Branch (MAIB) accidents database (1992 to 2021)
- Royal National Lifeboat Institute (RNLI) incident data (2008 to 2022)
- DfT SAR helicopter taskings (2021)
- G+ Accident Data (2013 to 2021).

Other data sources

1.3.5.4 Other datasets were utilised to support this assessment:

- Marine aggregate dredging licences (Crown Estate, 2022)
- Offshore renewables (Crown Estate, 2022)
- Industrial infrastructure (wind turbines, oil and gas, cables etc.) (Oceanwise, 2022)
- Oil and gas activity (Oil and Gas Authority, 2022)
- Admiralty charts (2022)
- Admiralty Sailing Directions (2022)
- Passage plans and vessel information provided by ferry operators (2022)

- Tidal data (Admiralty Total Tide)
- MetOcean data (provided by Applicant).

Full bridge simulations

1.3.5.5 Full bridge simulations of ferry passages through the Irish Sea were commissioned by bp/EnBW. The aim of the simulations was to understand, in more detail, potential navigation impacts of the Morgan Generation Assets, Mona Offshore Wind Project, and Morecambe Offshore Windfarm on existing commercial ferries and to test the viability and safety of commercial ferry transits between the offshore wind farms in normal and adverse weather conditions. A series of simulations were undertaken during 2022 on the Potential Array Areas of the Morgan Generation Assets, Mona Offshore Wind Project, and Morecambe Generation Assets and used to inform the PEIR. A second series of simulations were undertaken to review the effects that changes to the three array areas made post-PEIR would have on navigation safety. A detailed report of the findings of the simulations undertaken to inform the Environmental Statement has been produced (Appendix E).

1.3.5.6 The simulations were administered by HR Wallingford at their UK Ship Simulation Centre following initial engagement in which the scope of the simulations, simulation scenarios and assessment criteria were agreed together with verification of the ship models being tested. Each simulation session was attended by ferry Masters and officers and is summarised in Table 1.8.

1.3.5.7 The assessment criteria and simulation scenarios used within the simulations were developed and agreed with the ferry companies prior to each simulator run. Realistic traffic scenarios, emergency situations and normal/adverse weather conditions were determined based off the analysis contained within this NRA, and consultation with ferry operators.

Table 1.8: Simulation sessions.

Operator	Model Verification Session	PEIR Session	Environmental Statement Session
IoMSPC	21 to 22 July 2022	16 to 19 August 2022	12 to 14 June 2023 (Applicant's project team only) 13 to 15 September 2023
Stena Line	11 to 12 August 2022	23 to 25 August 2022	23 to 25 May 2023
Seatruck Ferries	Previously agreed with HRW	08 to 09 September 2022	22 to 23 June 2023
P&O (Applicant's project team only)	N/A	26 August 2022	N/A

1.3.5.8 The navigation simulations undertaken on the proposed Morgan Potential Array Area for the PEIR resulted in numerous failed runs, particularly during adverse weather and with complex traffic situations. As part of the CRNRA with the amended project boundaries post-PEIR, including the Morgan Array Area, the navigation simulations were repeated between May and September 2023 with a total of 35 additional runs carried out. The key findings of the updated navigation simulations are as follows (see Appendix E):

- The changes to the Morgan Array Area significantly improved navigation over the Morgan Potential Array Area, which was assessed at PEIR

- Collision risk whilst navigating between and around the array areas for the three projects was manageable with existing operational procedures in complex, worst credible traffic situations. These were in full compliance with COLREGs and the practice of good seamanship
- Routes remain susceptible to adverse weather which necessitate longer deviations with the three projects in place
- Vessels operating near or within the offshore wind farms were apparent by radar and visual means and any collision risk situation could be determined by the passing ferries
- During emergency situations there remained some optionality for Masters to best position their vessel to respond
- None of the simulated scenarios were appreciably more challenging at night than during the day.

1.3.5.9 The full findings of the Environmental Statement simulations are reported in Appendix E.

1.4 Project description and maximum design scenario

1.4.1 Introduction

1.4.1.1 The Project Design Envelope (PDE) approach has been adopted for the Environmental Impact Assessment (EIA) of the Morgan Generation Assets, in accordance with industry good practice. Volume 1, Chapter 3: Project description of the Environmental Statement sets out the design assumptions and parameters from which the realistic MDS is drawn for the Morgan Generation Assets EIA.

1.4.1.2 When undertaking assessments on projects a number of years ahead of the time of construction, the assessment can consider what impacts might be significant based on the maximum design principals and assumptions.

1.4.1.3 The MDS relevant to shipping and navigation receptors is described within this section. This considers:

- The largest extent of the development
- The longest duration of activities
- The most vessel movements undertaken in relation to Morgan Generation Assets
- The maximum number of structures
- The minimum spacing between structures
- The longest lengths of inter-array and interconnector cables
- The minimum cable burial
- The maximum height and length of cable protection.

1.4.1.4 The elements included within the scope of this Morgan Generation Assets NRA are:

- Offshore wind turbines
- Foundations and support structures
- Inter-array cables
- Interconnector cables
- Offshore substation platforms.

1.4.2 Project boundaries and location

1.4.2.1 The Morgan Array Area is 280 km^2 in area and is located in the east Irish Sea, 37.13 km (20.1 nm) from the northwest coast of England and 22.22 km (12 nm) from the Isle of Man (when measured from Mean High Water Springs (MHWS)).

1.4.2.2 The water depths within the Morgan Array Area are between 49 m and 22 m below Lowest Astronomical Tide (LAT).

1.4.2.3 The final layout of the Morgan Generation Assets is subject to assessment of all constraints and engineering/design determination and will be subject to approval by the MMO in consultation with the MCA and Trinity House and secured within the deemed marine licences within the DCO.

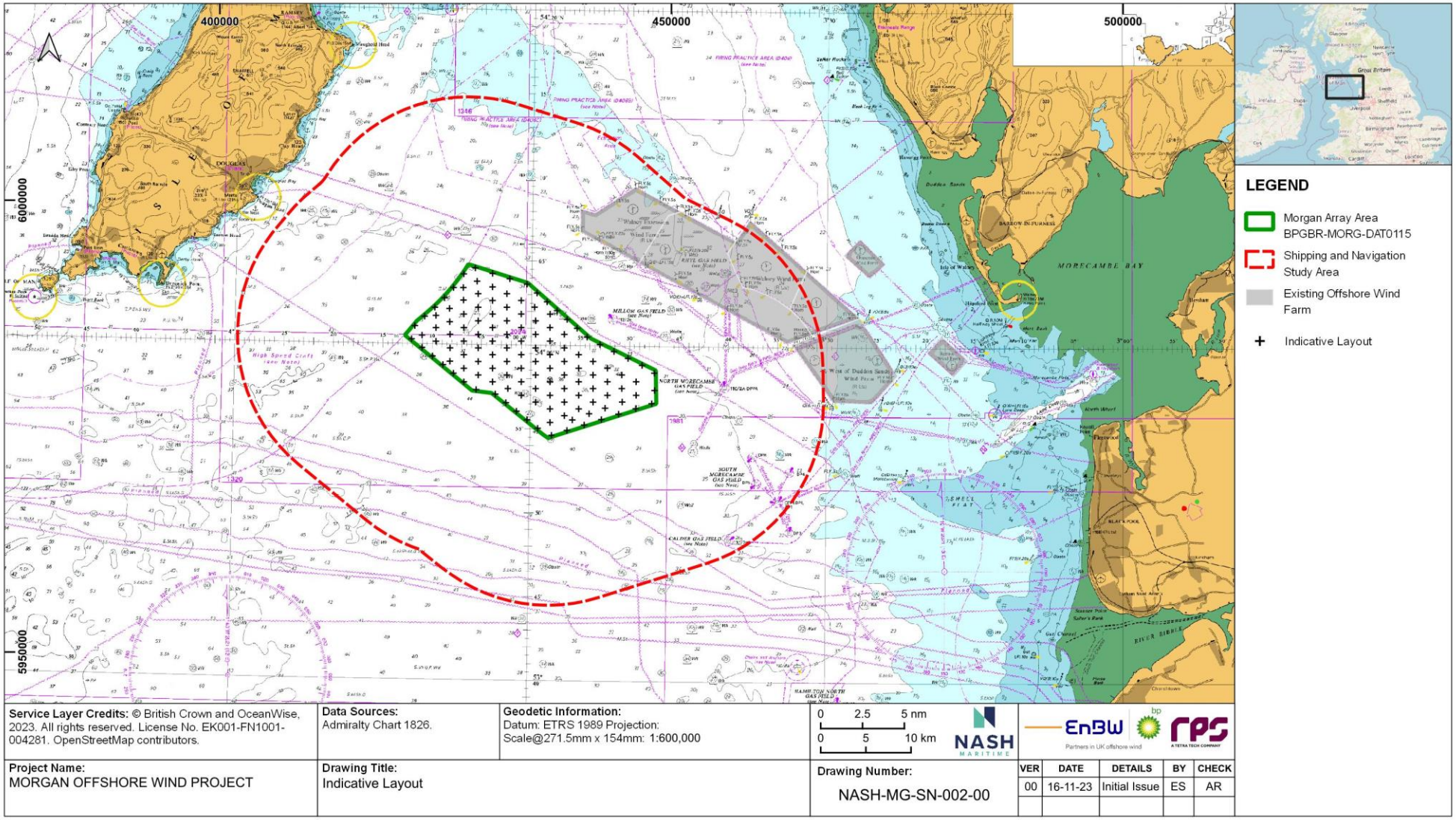

Figure 1.3: MDS indicative layout.

1.4.3 Generation infrastructure

1.4.3.1 The Morgan Generation Assets infrastructure could consist of (see Figure 1.4):

- Up to 96 wind turbines
- Up to four offshore substation platforms.

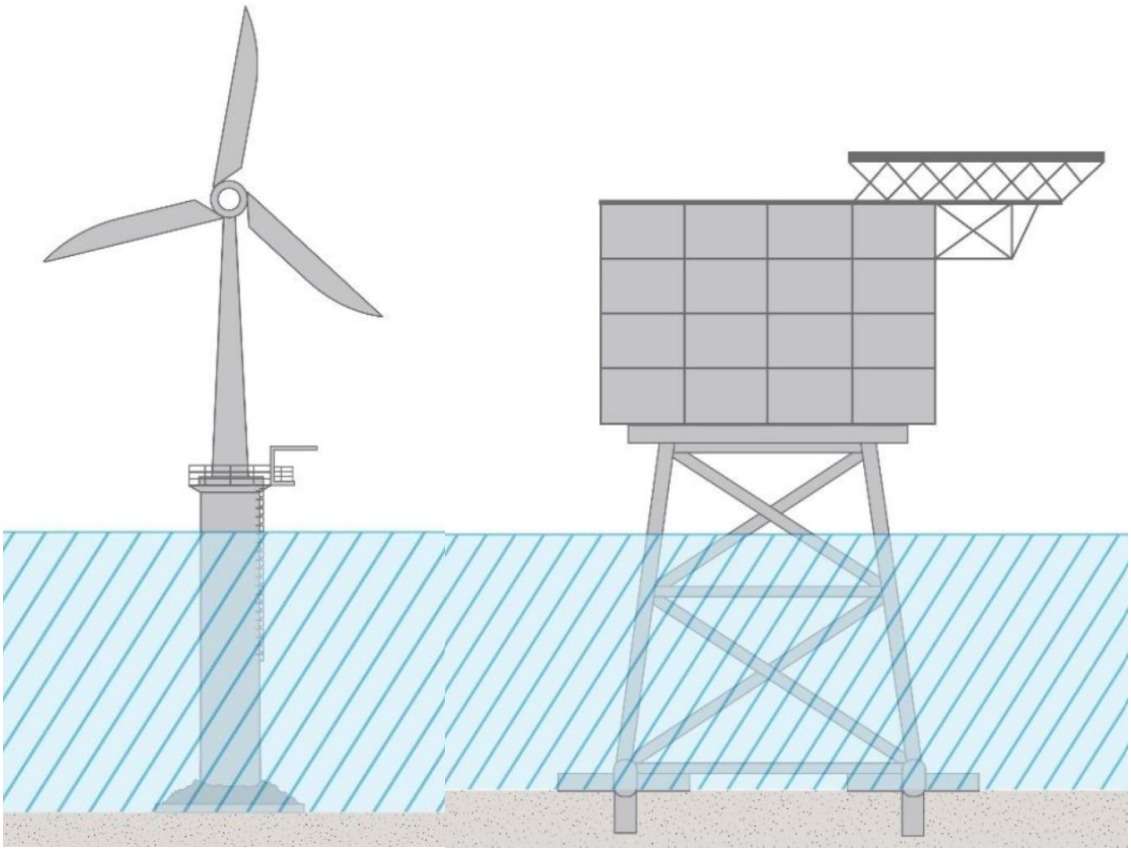

Figure 1.4: Illustrative wind turbine and substation design.

Wind turbines

1.4.3.2 Up to 96 wind turbines will be installed within the Morgan Array Area. The hub height will be 168 m or more above LAT.

1.4.3.3 The minimum and maximum blade tip height above LAT will be 34 m and 364 m respectively. The maximum rotor diameter will be 320 m.

1.4.3.4 The minimum spacing between wind turbines and offshore substation platforms will be 1,400 m.

1.4.3.5 Various foundation options are under investigation; however, all options are for fixed rather than floating structures. These include gravity based foundations, jackets on pin-piles or jackets on suction buckets. The largest wind turbine structure would be a three leg jacket with 40 m spacing between jacket legs at the water surface level.

1.4.3.6 Scour protection may be required for up to 23 m from each structure to a height of 2.6 m.

Offshore substation platforms

1.4.3.7 Up to four OSPs may be required to transform electricity generated by the wind turbines to a higher voltage to allow power to be more efficiently transmitted to shore.

1.4.3.8 The maximum dimensions of the four substations will be 65 m x 45 m up to a height of 75 m to the top of antenna structure.

1.4.4 Inter-array and interconnector cables

1.4.4.1 Inter-array cables will be installed to carry electrical current produced by the wind turbines to the OSPs. These will be up to 390 km in length with a minimum burial depth of 0.5 m. Cable protection may be required over a maximum of 39 km of the cable with a height of up to 3 m. Up to 10 cable crossings, each cable crossing has a length of up to 80 m and a height of up to 4 m.

1.4.4.2 Interconnector cables connect the OSPs to each other in order to provide redundancy in the case of cable failure. Up to three cables will be installed with a maximum total length of 60 km and a minimum burial depth of 0.5 m. Cable protection will be laid over a maximum of 12 km with a height of up to 3 m.

1.4.4.3 Cable protection if required would consist of steel armour wire, rock or mattressing.

1.4.4.4 The export cable and associated booster stations are not included within this NRA as described in section 1.1.

1.4.5 Construction and decommissioning activities

1.4.5.1 Construction is anticipated to take up to four years in duration. Foundation structures, OSP topsides, cabling and wind turbines will be transported to the installation site by vessel from the preassembly harbour or from the fabrication yard. Each individual wind turbine tower, nacelle and blades will be installed on top of the wind turbine foundations. The blades are likely to be installed one at a time, or alternatively may be transported and installed as pre-assembled rotor stars (hub with blades attached). OSP foundations will be installed and then a pre-commissioned OSP top side will be transported to site and installed on top of the foundations. Cable installation could be achieved through burial using prelay plough, plough, trenching or jetting.

1.4.5.2 Following installation of the wind turbines and connection to the necessary cabling, a process of testing and commissioning will be undertaken.

1.4.5.3 Construction will require additional vessel movements undertaking work in the Morgan Array Area. The maximum construction vessel movements will be 1,929 per year. This may include a variety of different vessel types, including:

- Main Installation/Support Vessels
- Tug/Anchor Handlers
- Cable Lay Vessels
- Guard Vessels
- Survey Vessels
- Seabed Preparation Vessels
- Crew Transfer Vessels (CTVs)
- Scour Protection Installation Vessels

- Cable Protection Installation Vessels.

1.4.5.4 Following the operational lifetime of the Morgan Offshore Wind Project, the Morgan Generation Assets will be decommissioned or repowered in line with the regulations, requirements, guidance and best practices relevant at the time. It is anticipated that all foundations would likely be cut below the seabed to a level that means they will not create a hazard for fishing or shipping, but that offshore cables may be left in situ. The project position is that scour protection will preferably be left in situ. A decommissioning plan will be prepared prior to construction.

1.4.5.5 The duration of the decommissioning programme is anticipated to be the same as for construction. During the decommissioning phase the changes would gradually decrease from the operational MDS as the need for project-related vessels is reduced and structures are removed and cut below the seabed.

1.4.6 Operations and maintenance activities

1.4.6.1 The operational lifetime of the Morgan Generation Assets is anticipated to be up to 35 years.

1.4.6.2 Operations and maintenance will require additional vessel movements undertaking work in the Morgan Array Area. The maximum number of operations and maintenance vessel movements will be 719 per year. This may include a variety of different vessel types, including:

- CTVs
- Jack-Ups
- Cable Repair Vessels
- Service Operation Vessels
- Excavators/Backhoe Dredgers.

1.4.6.3 Routine maintenance activities offshore may include inspections, removal of marine growth build up, minor repairs, cleaning activities, and replacement of consumables and corrosion protection systems. Non-routine major maintenance activities may include component exchanges (e.g. wind turbine blades, gearboxes), cable reburial and cable repair activities.

1.4.6.4 Routine operations and maintenance activities may be carried out from CTVs or Service Operation Vessels, with major maintenance activities (such as component exchanges) requiring jack-up vessels, heavy lift vessels or specialist vessels such as cable repair and cable laying vessels. Occasionally, helicopters may also be used to transport personnel and equipment.

1.4.7 Marking and lighting

1.4.7.1 The Morgan Generation Assets will be designed and constructed in accordance with relevant guidance and advice from Trinity House and the MCA:

- Trinity House Provision and Maintenance of Local Aids to Navigation Marking Offshore Renewable Energy Installations
- Civil Aviation Authority Policy and Guidelines on Wind Turbines
- IALA Recommendation G1162 on the Marking of Man-Made Offshore Structures

- MCA Offshore Renewable Energy Installations: Requirements, Guidance and Operational Considerations for Search and Rescue and Emergency Response.

1.4.7.2 Appropriate marking, lighting and AtoNs will be employed during the construction, operations and maintenance, and decommissioning phases as appropriate to ensure the safety of all parties. The nacelles, blades and towers will be painted light grey (RAL 7035) and the foundation structures, not less than 15 m from Highest Astronomical Tide (HAT), will be traffic light yellow (RAL 1023).

1.4.7.3 Appropriate lighting, in line with MCA (2018) guidance, will ensure the offshore structures are visible for SAR and emergency response procedures. In addition, Morgan Generation Assets lighting will conform to the following:

- Red, medium intensity aviation warning lights (of variable brightness between a maximum of 2000 candela (cd)) to a minimum of 10% of the maximum which would be 200 cd) will be located on either side of the nacelle of significant peripheral wind turbines. These lights will flash simultaneously with a Morse W flash pattern and will also include an infra-red component
- All aviation warning lights will flash synchronously throughout the Morgan Array Area and be able to be switched on and off by means of twilight switches (which activate when ambient light falls below a pre-set level)
- Aviation warning lights will allow for reduction in lighting intensity at and below the horizon when visibility from every wind turbine is more than 5 km (to a minimum of 10% of the maximum, i.e. 200 cd)
- SAR lighting of each of the non-periphery wind turbines will be combi infra-red/200 cd steady red aviation hazard lights, individually switchable from the control centre at the request of the MCA (i.e. when conducting SAR operations in or around the Morgan Array Area)
- All wind turbines will be fitted with a low intensity light for the purpose of helicopter winching (green hoist lamp). All wind turbines will also be fitted with suitable illumination (minimum one 5 cd light) for ID signs
- Marine navigational lights will be fitted at the platform level on significant peripheral structures. These lights will be synchronized to display simultaneously an IALA '*special mark*' characteristic, flashing yellow, with a range of not less than 5 nm.

1.4.7.4 The location of all infrastructure (including wind turbines, substations and cables) will be communicated to the UK Hydrographic Office (UKHO) so that they can be incorporated into Admiralty Charts and the Notice to Mariners procedures.

1.4.7.5 A Marking and Lighting Plan will be submitted to the MCA and Trinity House for review prior to construction.

1.4.7.6 Further details on marking and lighting arrangements are included within the applied mitigation of the Morgan Generation Assets within section 1.4.8.

1.4.8 Applied mitigations

1.4.8.1 Table 1.9 describes risk controls committed to by Morgan Offshore Wind Limited and therefore are included within the NRA.

1.4.8.2 Commitments made by the Applicant following Section 42 consultation on the PEIR (as described in section 1) are included within the assessment as applied mitigations.

Table 1.9: Applied mitigation measures.

Measures adopted as part of the Morgan Generation Assets	Justification	How the measure will be secured
Development of and adherence to a Design Plan (DP) that will be prepared in accordance with the layout principles, which will be agreed with the MMO, in consultation with the Maritime Coastguard Agency (MCA) and Trinity House	A Design Plan, including a plan of the Morgan Array Area, will be prepared and submitted to the MCA and Trinity House post-consent but before construction commences. Wind turbine layout plan to be agreed with MCA and Trinity House prior to construction and maintain two lines of orientation for navigation and SAR access within the Morgan Array Area. The Applicant has increased the minimum spacing between infrastructure within the array area, increasing the spacing from 1,000 m between rows of wind turbines and 875 m between each wind turbine in a row to proposed minimum spaces of 1,400 m both within and between rows, in order to provide additional space for continued fishing and transit by commercial fishing vessels between and around the Morgan Array Area.	The need for a Design Plan to be approved is secured within the deemed marine licences within the Draft DCO (Document Reference C1). The minimum spacing between infrastructure and two lines of orientation is secured through a requirement of the Draft DCO and within the deemed marine licences within the Draft DCO (Document Reference C1).
Development of and adherence to an Aids to Navigation Management Plan (ANMP) to ensure adequate navigational markers (including lighting and a buoyed construction area), in accordance with the most recent relevant industry guidance as advised by Trinity House and MCA and agreed prior to commencement of offshore construction	To ensure navigational safety and minimise risk, suitable AtoN lighting and marking of the Morgan Array Area shall be undertaken complying with IALA Recommendations G1162 (IALA, 2021), to be finalised and approved in consultation with MCA and Trinity House through the preparation of an ANMP. Fog horns to alert vessels to the position of structures when visibility is poor. Wind turbine informal naming/associated markings shall not interfere with formal AtoN's. AIS transponders to be placed on periphery corner wind turbines. To ensure navigational safety and minimise risk, buoys will be deployed around construction work in Morgan Array Area in line with Trinity House requirements and may include a combination of cardinal and/or safe water marks. To be finalised and approved in consultation with MCA and Trinity House prior to construction through an Aids to Navigation Management Plan.	The need to display Aids to Navigation as directed by Trinity House is secured within the deemed marine licences within the Draft DCO (Document Reference C1).
The Applicant has committed to a minimum lower blade tip height (air draught clearance) of 34 m above LAT	Wind turbine blades will have 34 m clearance above MHWS. This is in line with MCA recommendations of at least 22 m clearance above MHWS as per MGN654 to reduce risk of allision and contact with structures.	Secured as a requirement of the Draft DCO (Document Reference C1) and through a condition in the deemed marine licences within the Draft DCO.

Measures adopted as part of the Morgan Generation Assets	Justification	How the measure will be secured
Development of and adherence to an Offshore Environmental Management Plan (OEMP) that includes a Fisheries Liaison and Co-existence Plan (FLCP)	The use of guard vessels, as required, will be set out in FLCP. Where cable exposures exist during the operational and maintenance phase, which could result in significant risk, guard vessels will be used where appropriate until the risk has been mitigated by burial and/or other protection methods, ensuring navigational safety and minimising the potential risk of gear snagging. Guard vessels facilitate engagement with commercial fisheries stakeholders during specific project works, maximising awareness of temporary hazards and reducing potential for interactions between the commercial fishing activity and the Morgan Generation Assets. Provision of detailed project information to fishermen to aid co-existence, such as site location for upload into fish plotters. An outline plan has been submitted as part of the Application (Document Reference J10).	A FLCP as part of an OEMP secured within the deemed marine licences within the Draft DCO (Document Reference C1).
Development and adherence to an Offshore Construction Method Statement (OCMS) which includes a Cable Specification and Installation Plan (CSIP) and details of cable monitoring to ensure UKC is maintained and no more than a 5% reduction in water depth (referenced to Chart Datum) will occur as a result of cable protection at any point over cables without prior written approval from the Licensing Authority	To ensure navigational safety and minimise risk of gear snagging, a CSIP will be prepared (in line with consent conditions) prior to installation of the Morgan Generation Assets. This will include a detailed cable laying plan, including geotechnical data, cable laying techniques, cable protection, monitoring of cables. This will be informed by a Cable Burial Risk Assessment (CBRA), which will include details on minimum target burial depths to be undertaken pre-construction, including consideration of UKC. All subsea cables will be either fully buried at least 0.5 m (where ground conditions permit and burial tool performance allows), partially buried (buried but not to target depth) with rock protection, or surface laid with cable protection. Selected methods will be based on the risk assessment and the protection will be periodically monitored and maintained as practicable. Information distribution will be aimed to be provided no less than three days for notification of buried cables becoming exposed on or above the seabed to regional fisheries contacts and 24 hours for notification of damage to the Morgan Generation Assets. The CSIP will include the technical specification of offshore electrical circuits, and a desk-based assessment of attenuation of electro-magnetic field strengths, shielding and cable burial depth in accordance with industry good practice.	A CSIP as part of the CMS secured within the deemed marine licences within the Draft DCO (Document Reference C1).

Measures adopted as part of the Morgan Generation Assets	Justification	How the measure will be secured
Notification of construction, maintenance and decommissioning activities through the use of Notice to Mariners (NtMs)	To ensure that the appropriate authorities and stakeholders are informed of works being carried out in waters adjacent to the Morgan Generation Assets. To include: • UK Hydrographic Office (UKHO) • MCA • Kingfisher • Trinity House • Northern Lighthouse Board • RYA • Local Ports and Harbours • Oil and Gas operators • MMO.	NtMs is secured within the deemed marine licenses within the Draft DCO (Document Reference C1).
Development of, and adherence to, a Vessel Traffic Management Plan (VTMP), to ensure coordination of passage plans, setting out vessel standards, setting out vessel health and safety requirements	To ensure navigational safety and minimise risk, a VTMP will be prepared to ensure the coordination of Morgan Generation Assets vessels during construction and operations and maintenance by the Morgan Generation Assets Marine Co-ordination Centre. This could include specified crossing points, dissemination practices, restricted visibility protocols and coordination with other cumulative developers. To ensure project vessels to not present unacceptable risks to each other or third parties. Morgan Generation Assets marine traffic coordination plans to be made available to all maritime users. Information and warnings will be distributed via Notices to Mariners and other appropriate media (e.g. Admiralty Charts and fishermen's awareness charts) to enable vessels and operators to navigate around the Morgan Array Area effectively and safely. All work vessels operating on behalf of the Morgan Generation Assets will have: • MCA Vessel Coding (e.g. Small Commercial Vessel Code) • Appropriate insurance • Crewed by suitably trained/qualified personnel • AIS (Class A/B) • VHF (Ch16)	A VTMP secured within the deemed marine licences within the Draft DCO (Document Reference C1).

Measures adopted as part of the Morgan Generation Assets	Justification	How the measure will be secured
	• Appropriate mooring arrangements As industry standard mitigation, the Applicant will ensure that all project related vessels meet both IMO conventions for safe operation as well as Health, Safety and Environment requirements, where applicable. This shall include the following good practice: • Wind farm associated vessels will comply with International Maritime Regulations • All vessels, regardless of size, will be required to carry AIS equipment on board • All vessels engaged in activities will comply with relevant regulations for their size and class of operation and will be assessed on whether they are 'fit for purpose' for activities they are required to carry out • All marine operations will be governed by operational limits, tidal conditions, weather conditions and vessel traffic information • Walk to work solutions will be utilised where possible. An outline VTMP has been submitted as part of the Application (Document Reference J16).	
Site marking and charting	Site is marked on nautical charts including an appropriate chart note to facilitate safe passage planning around the Morgan Generation Assets.	Secured within the deemed marine licences within the Draft DCO (Document Reference C1).
Use of advisory clearance distances (around cable installation vessels) and safety zones (OSP/wind turbine) during construction and periods of maintenance, as per the Safety Zone Statement	To ensure navigational safety and minimise risk, 500 m safety zones will be implemented around wind turbines and OSPs during their construction. 50 m safety zones will also be implemented around each item of infrastructure during the construction phase, where no construction works are taking place on that infrastructure (for example, where a wind turbine generator is incomplete or is in the process of being tested before commissioning). During the maintenance phase, 500 m safety zones will also be implemented around any vessel involved in major maintenance works. Whilst no formal application for a safety zone around cable laying operations is possible under Section 95 of the Energy Act 2004, where possible, it is the Applicant's intention to propose rolling advisory safety zones of up to 500 m around vessels installing inter-array	An application for safety zones will be made under the Energy Act 2004, as set out in the Safety Zone Statement (Document Reference J5).

Measures adopted as part of the Morgan Generation Assets	Justification	How the measure will be secured
	cables and interconnector cables in the interests of the safety of all users of the sea, and to provide clearance of 500 m from laid cables until burial is confirmed in case of interaction with anchors or fishing gear. Application and use of safety zones in accordance with the Safety Zone Statement (Document Reference J5).	
Development and adherence to a Vessel Traffic Management Plan (VTMP) requiring continuous watch by multi-channel Very High Frequency (VHF), including Digital Selective Calling	Continuous watch to monitor vessel activities, reducing the risk of incidents and improving response.	A VTMP secured within the deemed marine licences within the Draft DCO (Document Reference C1).
Development and adherence to an Emergency Response and Cooperation Plan (ERCoP), which sets out details of periodic exercises to reduce the consequences of incidents	ERCoP, agreed with MCA prior to construction and aligned with MGN654 'Offshore Renewable Energy Installations (OREIs) – Guidance on UK Navigational Practice, Safety and Emergency Response Issues' Periodic emergency management and response exercises will be run by developer, in conjunction with SAR, as detailed in the ERCoP.	ERCoP secured within the deemed marine licences within the Draft DCO (Document Reference C1).
Development and adherence to an OEMP, which includes a Marine Pollution Contingency Plan (MPCP) to minimise and manage the risk of marine pollution events	Development of an OEMP that details minimum environmental management requirements expected of the Applicant and all contractors and subcontractors, to ensure accidental pollution into the marine environment is minimised, through the development and adherence of a Marine Pollution Contingency Plan, for approval prior to commencement of construction. Measures will be adopted to ensure that the potential for release of pollutants from construction, and operations and maintenance, and decommissioning activities is minimised, which will include accidental spills planning, response and notification requirements.	A MPCP as part of an OEMP secured within the deemed marine licences within the Draft DCO (Document Reference C1).
Incident investigation and reporting	Risk assessments to be reviewed following incidents, and additional risk controls identified if appropriate to reduce the likelihood of recurrence. Lessons learnt will be disseminated to improve safety record of Morgan Generation Assets operations.	Incident reporting requirements and expectations including: • MAIB (Merchant Shipping Act) • Health and Safety Executive (RIDDOR) • Harbour Authority under Port Marine Safety Code.

Measures adopted as part of the Morgan Generation Assets	Justification	How the measure will be secured
Hydrographic surveys to reduce the risk of grounding or snagging of cables	MGN654 and its annexes requires that hydrographic surveys should fulfil the requirements of the International Hydrographic Organisation Order 1a standard, with the final data supplied as a digital full density data set, and survey report to the MCA Hydrography Manager and the UKHO.	Secured within the deemed marine licences within the Draft DCO (Document Reference C1).
Development and adherence to an OCMS and development and adherence to a Construction Programme (CP)	Offshore Construction Method Statement and Construction Programme to be approved by MMO in consultation MCA and Trinity House. Where possible, construction to follow linear progression avoiding disparate construction sites across development area.	An OCMS and CP secured within the deemed marine licences within the Draft DCO (Document Reference C1).
Personal Protective Equipment (PPE)	To maintain the safety of those working at the Morgan Generation Assets, all personnel will wear the correct PPE suitable for the location and role at all times, as defined by the relevant Quality, Health, Safety and Environment documentation. This will include the use of Personal Locator Beacons.	Industry best practice.
Inspection and maintenance programme	To ensure the safe operation of the Morgan Generation Assets, regular maintenance regime by developer to check the Morgan Generation Assets infrastructure, its fittings and any signs of wear and tear. This should identify any defects which might cause a failure.	Industry best practice.
Training and site inductions	To maintain the safety of those working at the Morgan Generation Assets, the Applicant is responsible for ensuring that all staff engaged on operations are competent to carry out the allocated work and have completed a site induction.	Industry best practice.
Compliance with International, UK and Flag State Regulations inc. IMO conventions	To ensure navigational safety, compliance from all vessels associated with the proposed project with international maritime regulations as adopted by the relevant flag state such as Convention on the International Regulations for Preventing Collisions at Sea (IMO, 1972) and Safety of Life at Sea Convention (SOLAS) (IMO, 1974).	Statutory requirement.
Continued engagement of the MNEF, post consent	Maintain the MNEF to facilitate information sharing and management/identification of additional risk controls: • Identify near misses and investigate incidents, disseminating learnings. • Coordinate construction activities.	Secured through the Mitigation and Monitoring Schedule (Document Reference J6).

Measures adopted as part of the Morgan Generation Assets	Justification	How the measure will be secured
Development of and adherence to a Navigation Monitoring Strategy setting out vessel traffic monitoring and post construction monitoring to identify unanticipated project impacts	Continuous AIS monitoring during construction and immediate period post construction to MCA approval as set out in the Offshore In-principle Monitoring Plan (Document Reference J11).	Navigation Monitoring Strategy secured within the deemed marine licences within the Draft DCO (Document Reference C1).

1.5 Description of the marine environment

1.5.1 Principal navigational features

1.5.1.1 Key relevant features relevant to the Morgan Generation Assets and features relating the management of vessels and safety of navigation are described in this section.

1.5.1.2 Principle navigational features relevant to the Morgan Generation Assets have been identified using the appropriate UKHO Admiralty charts and UKHO Admiralty Sailing Directions appropriate to the area. Principle navigational features in proximity to the Morgan Generation Assets are shown in Figure 1.5. Details of these navigational features are described in the following sections.

Responsible Authorities - MCA

1.5.1.3 The shipping and navigation study area is in a region of general navigation in UK waters with the MCA as the responsible authority for safe navigation.

IMO routeing schemes, reporting measures and recommended channels

1.5.1.4 There are two IMO adopted routeing measures located within the Irish Sea. The Liverpool Bay TSS is located approximately 22 nm southeast of the Morgan Array Area, as shown in Figure 1.5. The Off Skerries TSS is located 27 nm southwest of the Morgan Array Area.

1.5.1.5 The area surrounding the Douglas Oil Field infrastructure is charted on Admiralty Chart 1826 as an Area to be Avoided with the accompanying note: 'The IMO-adopted Area to be Avoided should only be entered by authorised vessels to access the Douglas Oil Field'.

1.5.1.6 There are no reporting measures within the shipping and navigation study area.

Aids to navigation (AtoN)

1.5.1.7 AtoNs located in the shipping and navigation study area are shown in Figure 1.5. There are no AtoNs within the Morgan Array Area.

1.5.1.8 Two north cardinal marks lie to the north and two south cardinals lie to the south of the Walney offshore wind farm and within the shipping and navigation study area. The Duddon Sands SW south cardinal mark lies just outside the shipping and navigation study area to the west.

1.5.1.9 All other AtoNs within the shipping and navigation study area are fixed on offshore structures such as oil and gas platforms and wind turbines.

Pilot boarding stations

1.5.1.10 Pilot boarding stations are shown on Figure 1.5. These include- Douglas, Liverpool, Mostyn, Mostyn Outer, Point Lynas (Liverpool) and Menai Strait. None of these stations fall within the shipping and navigation study area.

Practice and Exercise Area schemes

1.5.1.11 There is a firing Practice and Exercise Area (PEXA) (D406) located approximately 3.5 nm to the north of the Morgan Array Area. No restrictions are placed on the right to transit the firing practice areas at any time. The firing practice area is operated using

a clear range procedure, meaning that firing only takes place when the area is confirmed as being clear of all shipping.

Anchorages and waiting areas

1.5.1.12 Two charted anchorages are located within the Port of Liverpool Statutory Harbour Authority Area. One of these lies to the south of the approaches to Liverpool between the Burbo Bank Extension and Gwynt y Mór offshore wind farms (26 nm to the south of the Morgan Array Area). The other anchorage is to the north of the approaches to the Mersey (29 nm to the south of the Morgan Array Area).

1.5.1.13 Douglas Bay is used as an anchorage for vessels waiting to enter the Port of Douglas and for cruise vessels when undertaking tendering operations.

1.5.1.14 Whilst not charted, analysis of vessel traffic data identified a commercial ship anchorage located to the east of Anglesey, by Point Lynas, that offers good shelter in westerly winds (see section 1.6.2).

Spoil and disposal grounds

1.5.1.15 No active spoil or disposal grounds are present in the shipping and navigation study area.

Wrecks

1.5.1.16 There are over 1,300 charted wrecks in the Irish Sea. These are identified on navigational charts.

1.5.2 Existing infrastructure

Ports and harbours

1.5.2.1 There are no ports or harbours within the shipping and navigation study area. Table 1.10 lists the key ports and harbours within the Irish Sea.

1.5.2.2 The Douglas Harbour Control Limit intersects the extreme northwest of the shipping and navigation study area.

Table 1.10: Principal ports and harbours.

Name	Harbour area relative to Morgan Array Area
Port of Liverpool (England)	25 nm southeast
Douglas Port (Isle of Man)	9 nm northwest
Heysham Port (England)	27 nm east
Belfast Port (Northern Ireland)	71 nm northwest
Dublin Port (Ireland)	83 nm southwest

Other offshore wind projects

1.5.2.3 Existing offshore wind infrastructure within the east Irish Sea is listed in Table 1.11. The Walney 1, Walney 2, Walney Extension and West of Duddon Sands offshore wind farms lie within the shipping and navigation study area.

Table 1.11: Offshore wind.

Name	Type	Location Relative to Morgan Array Area	Status
Within the shipping and navigation study area			
Walney Offshore Wind Farm (including extensions)	Group of operational wind farms (total capacity of 1026 MW)	4.4 nm northeast	Operational since 2011, with extensions operational in 2012 and 2018
West of Duddon Sands Offshore Wind Farm	Operational wind farm (389 MW capacity)	8.3 nm east	Operational since 2014
Outside the shipping and navigation study area			
Ormonde Offshore Wind Farm	Operational wind farm (150 MW capacity)	13.2 nm north	Operational since 2012
Barrow Offshore Wind Farm	Operational wind farm (90 MW capacity)	16.2 nm east	Operational since 2006
Gwynt y Môr Offshore Wind Farm	Operational wind farm (576 MW capacity)	27.7 nm southeast	Operational since 2015
Burbo Bank Offshore Wind Farm (including extensions)	Operational wind farm (90 MW plus 258 MW extension)	30.2 nm southeast	Operational since 2007, extension operational since 2017
Rhyl Flats Offshore Wind Farm	Operational wind farm (90 MW capacity)	32.7 nm southeast	Operational since 2009
North Hoyle Offshore Wind Farm	Operational wind farm (60 MW capacity)	33 nm southeast	Operational since 2004

Oil and gas

1.5.2.4 Oil and gas infrastructure within the east Irish Sea is listed in Table 1.12 and shown in Figure 1.5. The nearest oil and gas infrastructure to the Morgan Array Area include the Millom Gas Field and North Morecambe Gas Fields.

Table 1.12: Oil and gas Infrastructure.

Name	Type	Location relative to Morgan Array Area	Status
Within the shipping and navigation study area			
Millom Gas Field	Normally unmanned	1 nm north	Producing
North Morecambe Gas Field	Manned	4 nm east	Producing
South Morecambe Gas Field	Manned	7 nm southeast	Producing. Decommissioning of two drilling platforms commenced in 2021. DP3 and DP4 decommissioned as of 2023.
Calder Gas Field	Normally unmanned	9 nm southeast	Producing
Outside the shipping and navigation study area			
Conwy Oil Field	Manned	19 nm southeast	Producing

Name	Type	Location relative to Morgan Array Area	Status
*Hamilton North Gas Field	Normally unmanned	21 nm southeast	Producing
Douglas Oil Field	Manned	26 nm southeast	Producing
Hamilton Gas Field	Normally unmanned	26 nm southeast	Producing
Lennox Oil and Gas Field	Normally unmanned	28 nm southeast	Producing

*Infrastructure planned for repurposing from 'Oil and Gas' to 'Carbon Capture and Storage' as part of Hynet North West Project

Submarine cables

1.5.2.5 One cable passes within 830m of the Morgan Array Area, as shown in Figure 1.5. This is the Isle of Man to England Interconnector (E-LLAN) used for importing and exporting electricity between the Isle of Man and the mainland.

1.5.2.6 Adjacent to the Morgan Array Area are two telecommunications cables, operated by Vodafone to the south (Lanis 1) and BT to the north (BT-MT1).

1.5.2.7 In addition, there are multiple other cables within the shipping and navigation study area, both international and associated with the existing offshore wind farms.

Aggregates

1.5.2.8 Aggregate and extraction areas are shown in Figure 1.5 and listed in Table 1.13, none of which are within the shipping and navigation study area.

Table 1.13: Aggregate and extraction areas.

Name	Type	Location relative to the Morgan Array Area
Area 457: Liverpool Bay	Extraction Area	19 nm southeast
Area 392/393: Hilbre Swash	Extraction Area	29 nm southeast
Area 1808 Liverpool Bay	Exploration and Option Area	27 nm southeast

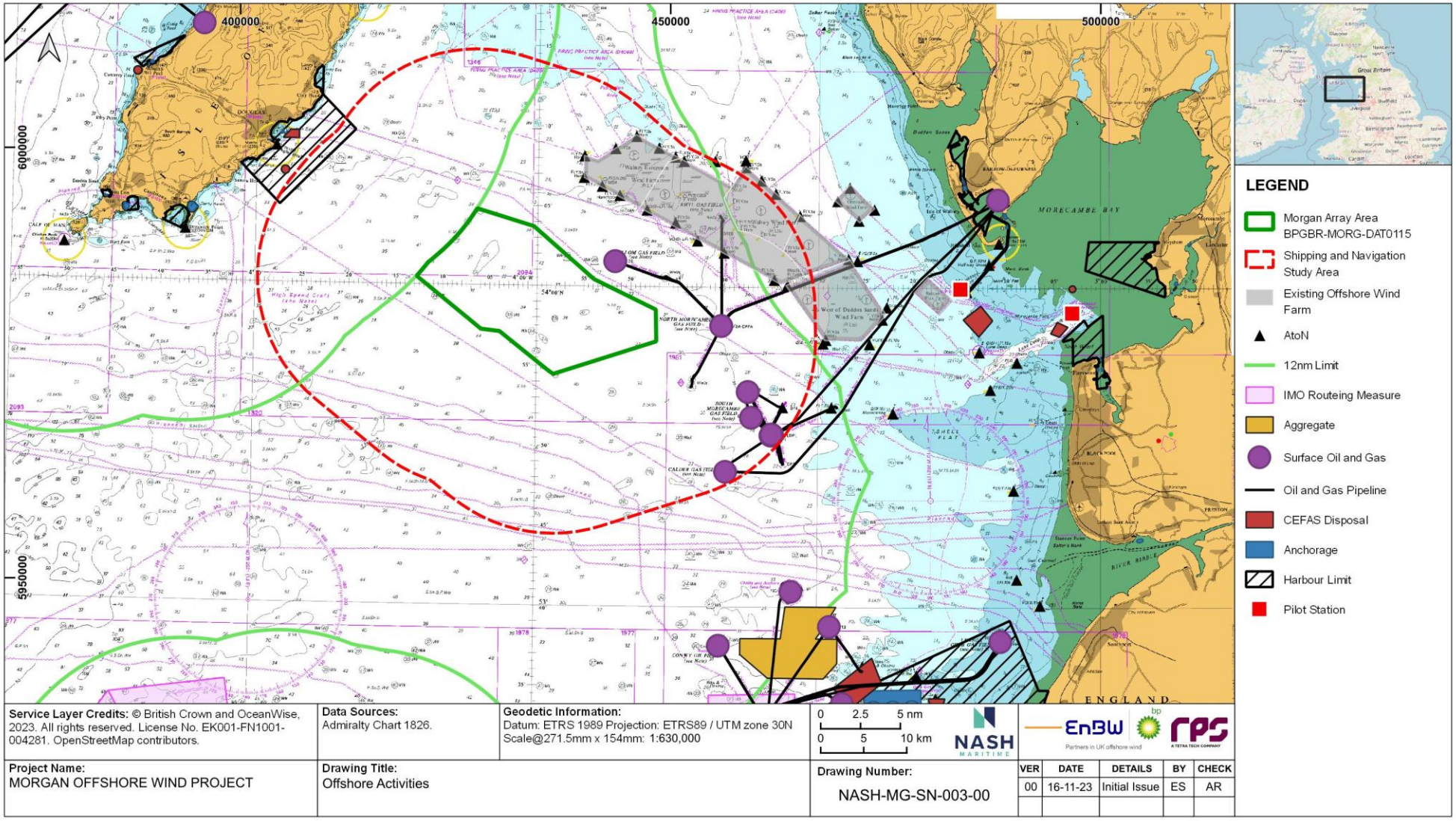

Figure 1.5: Offshore activities.

1.5.3 MetOcean conditions

1.5.3.1 In this section, MetOcean conditions are described for the shipping and navigation study area for the wind and wave climate, tide and currents, and visibility. Additional work was undertaken by HR Wallingford, to underpin the bridge navigation simulations which is reported in detail within Appendix E and summarised here together with information provided within Admiralty Sailing Directions West Coasts of England and Wales Pilot, NP37, 21st Edition, 2022.

Wind and wave

1.5.3.2 Figure 1.6 shows the modelled wind speeds and directions within the centre of the shipping and navigation study area for the years 1988 to 2018. The predominant wind direction is from the southwest, and accounts for the greatest proportion of strong wind events. The Admiralty Sailing Directions state that gales are reported between 12 days/year (at Walney) and 30 days/year (at Ronaldsway).

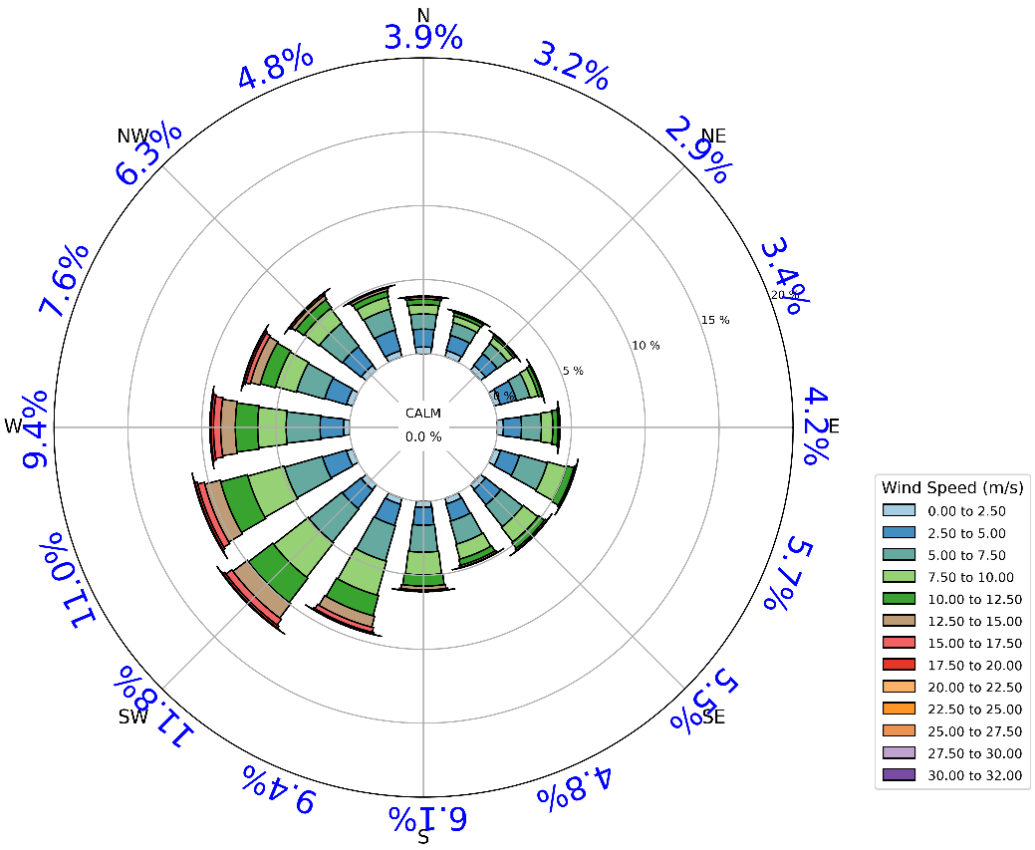

Figure 1.6: Annual average wind rose at surface level. Source: Morgan Offshore Wind Project (1988 to 2018). Analysed by HR Wallingford.

1.5.3.3 The Met Office North West Shelf Reanalysis Hindcast covers the period 1980 to 2021 and is based on coupled NEMO and WaveWatchIII hydrodynamics and wave models, with the wave model forced with ECMWF ERA5 model winds. The wave model's horizontal resolution is between 3 km to 1.5 km in coastal waters. Model wave data was downloaded for the southeast Irish Sea and a subset of model points were extracted and analysed by HR Wallingford.

1.5.3.4 Annual average wave conditions at a point (53.8°N, -4.0°E) within the area of interest is shown in Figure 1.7. These demonstrate that wave conditions are predominantly southwesterly and account for the majority of wave conditions greater than 2.5 m significant wave height (Hs). Table 1.14 demonstrates the extreme wave conditions within the shipping and navigation study area, with 4.2 m Hs and 50 knot winds from the southwest the typical annual extreme.

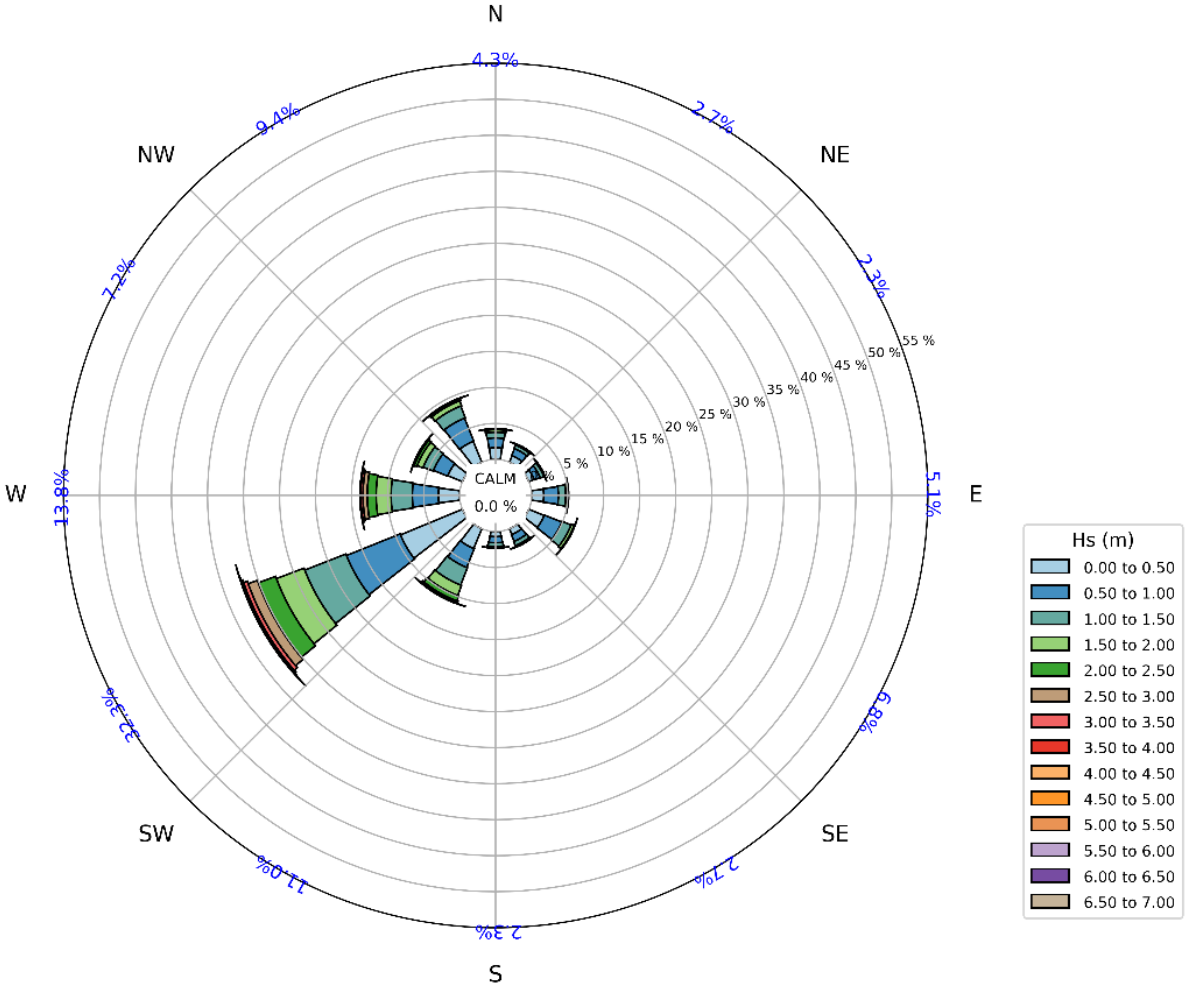

Figure 1.7: Annual average wave rose (53.8N, -4.0E) Source: Met Office NWS model (1980 to 2021). Analysed by HR Wallingford.

Table 1.14: Summary of wave extremes. Source: Met Office NWS model (1980 to 2021). Analysed by HR Wallingford.

Return Period	Significant wave height Hs (m)	Wave direction	Corresponding approximate wind speed (knots)
Weekly (1 in 50)	1.6	232	15
Monthly (1 in 10)	2.9	264	30
Yearly (one in one)	4.2	227	50
One in five years	4.6	236	-
1 in 10 years	5.4	240	-

Tidal

1.5.3.5 Flow modelling for a spring tide by HR Wallingford for the Irish Sea is shown Figure 1.8. The maximum flow speeds in the shipping and navigation study area are there for less than 1.5 m/s.

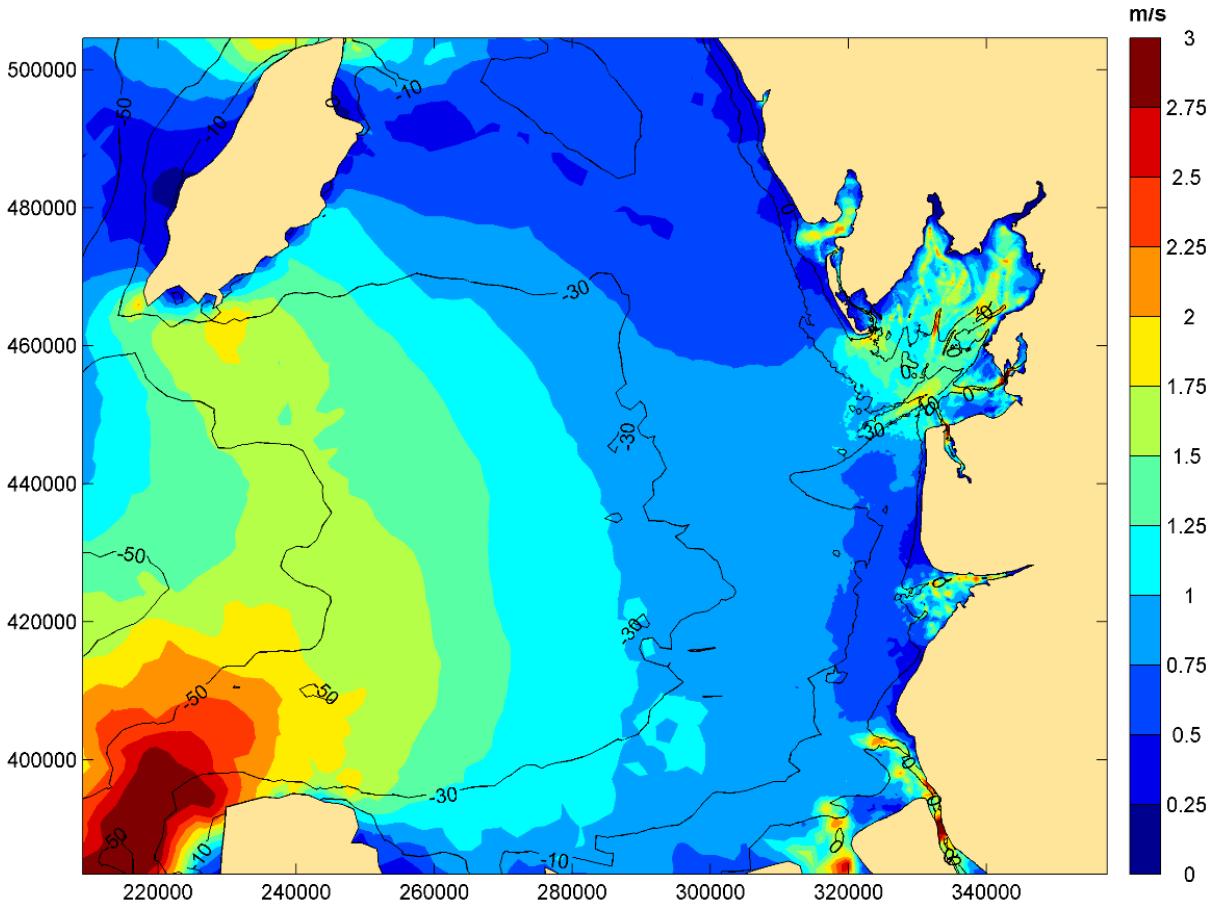

Figure 1.8: Maximum current flow speeds (m/s) for spring tide. Source: HR Wallingford in Appendix E.

Visibility

1.5.3.6 The Admiralty Sailing Directions report fog between 12 days/year (at Crosby) and 24 days/year (at Ronaldsway).

1.5.4 Search and rescue

His Majesty's Coastguard

1.5.4.1 His Majesty's Coastguard (HMCG) is responsible for requesting and coordinating SAR activities within the UK's SAR region. The local coastguard base for the region is Holyhead Coastguard Operations Centre.

1.5.4.2 The nearest HMCG helicopter base is located at Caernarfon Airport, Gwynedd, as shown in Figure 1.9. The Caernarfon Facility provides a 24-hour SAR service, with two Sikorsky S-92 helicopters.

RNLI

1.5.4.3 There are 19 RNLI lifeboat stations within the region, as detailed in Table 1.15 and shown in Figure 1.9. The nearest lifeboat station is Douglas, situated 12 nm northwest of the Morgan Array Area and equipped with a Mersey class all-weather lifeboat.

Table 1.15: RNLI stations.

Name	Type	Location relative to Morgan Array
Douglas	Mersey class lifeboat.	12 nm northwest
Port St Mary	Trent class and D class lifeboats.	19 nm west
Port Erin	B class lifeboat.	20 nm west
Barrow	Tamar class and D class lifeboats.	23 nm east
Blackpool	Three inshore lifeboats, including an Atlantic 85 and two D class lifeboats.	27 nm southeast
Fleetwood	Shannon and D class lifeboats.	28 nm east
Lytham St Annes	Shannon class all-weather lifeboat and a D class inshore boat. Lifeboats are housed in Lytham and St Annes.	29 nm southeast
Morecambe	D class and Hover class lifeboats.	33 nm east
Moelfre	Tamar class and D class lifeboats.	35 nm south
Llandudno	Shannon class all-weather lifeboat and a D class inshore boat.	36 nm south
Conwy	D class lifeboat.	38 nm south
Beaumaris	B class lifeboat.	39 nm south
Hoylake	Shannon class lifeboat.	39 nm southeast
Rhyl	Shannon class all-weather lifeboat and a D class inshore boat.	39 nm southeast
New Brighton	B class Atlantic 85 lifeboat.	40 nm southeast
West Kirby	D class lifeboat.	41 nm southeast
Holyhead	Severn class and D class lifeboats.	43 nm southwest
Trearddur	B class and D class lifeboats.	44 nm southwest
Flint	D class lifeboat.	48 nm southeast

Other assets

1.5.4.4 All vessels have an obligation under the SOLAS convention to render assistance to persons or vessels in distress, including CTVs or other project craft.

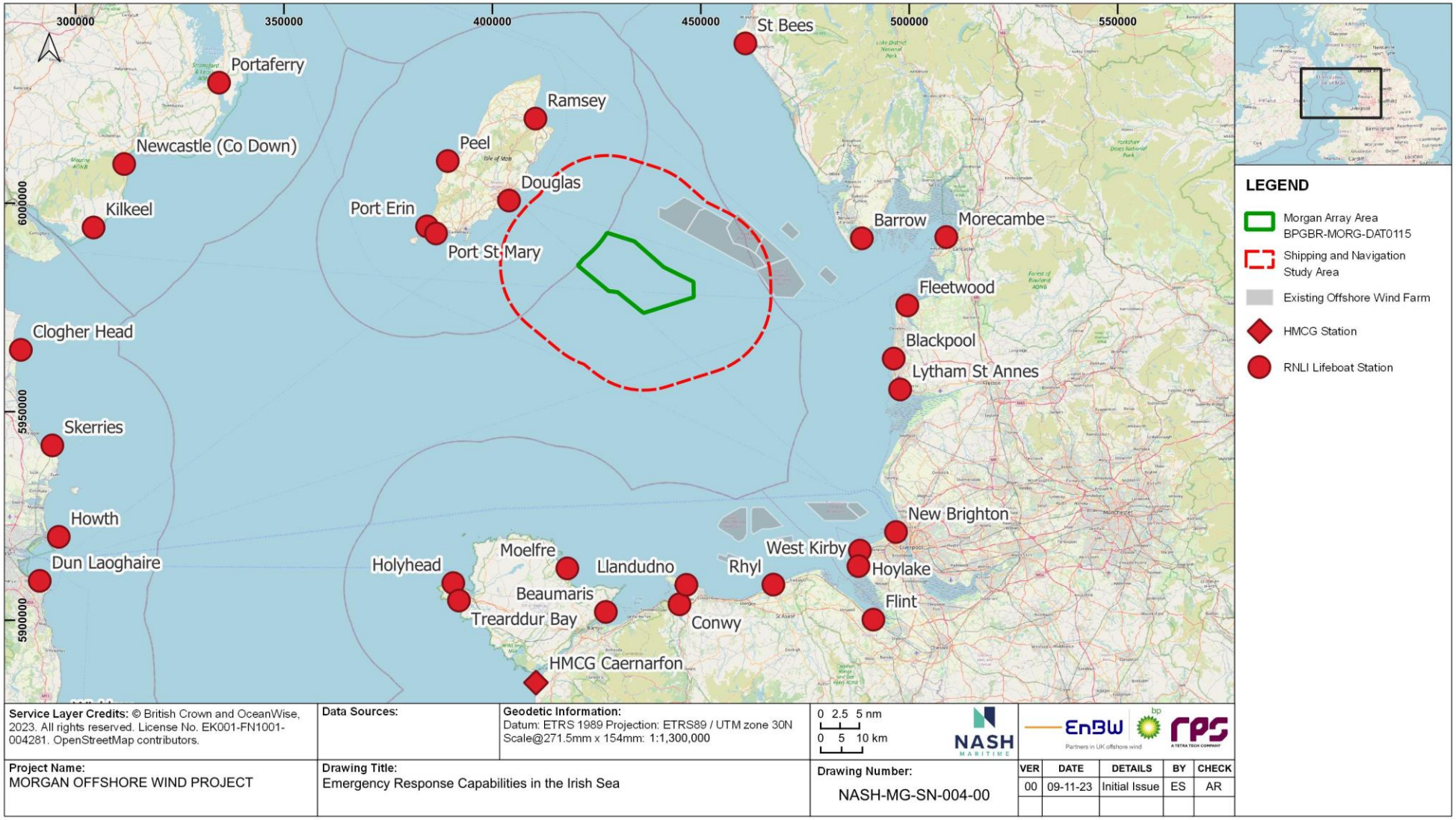

Figure 1.9: Emergency response capabilities in the Irish Sea.

1.6 Description of existing maritime activities

1.6.1 Introduction and data sources

1.6.1.1 A description of existing marine activities in the shipping and navigation study area is presented based on the data collected as listed in section 1.3.5. The following section includes:

- Description of effects of COVID-19
- Details of the vessel traffic surveys
- Analysis of vessel traffic by:
  - Traffic types
  - Determination of vessel routes
  - During adverse weather
  - Non-transit activity
- Analysis of historical maritime incidents.

Effects of COVID-19

1.6.1.2 Since early 2020, the COVID-19 pandemic has substantially impacted recreational and commercial vessel movements both globally and locally. It is therefore possible that data collected between 2020 and 2022 may be influenced by the pandemic although vessel traffic is expected to have largely returned to pre-pandemic levels. As such, where appropriate, datasets have been used that precede the pandemic (including AIS data for 2019 for the whole Irish Sea). In addition, following the PEIR, a 2022 AIS dataset has been obtained to provide greater recency for the analysis.

Vessel traffic survey

1.6.1.3 As per MGN654 (MCA, 2021a), two 14-day vessel based traffic surveys were conducted at the Morgan Array Area (see Figure 1.10). To account for seasonality, a winter (November to December 2021) and summer (July 2022) survey was undertaken. To ensure that maximum coverage of all vessel transits through the shipping and navigation study area, information was collected from the following sources:

- Commercial vessel traffic that are required to carry AIS under SOLAS
- Recreational and fishing captured through AIS for those vessels that choose to do so and through radar for those that do not
- Visual observations to identify non-AIS vessel types.

1.6.1.4 During consultation, it was noted that these two survey periods did not include some of the peak fishing seasons that are known to be active around the Morgan Array Area. In May 2023, a third survey was therefore undertaken to look at fisheries activity to the northwest of the Morgan Array Area.

1.6.1.5 A summary of each of the three surveys is shown in Table 1.16.

1.6.1.6 MGN654 specifies that vessel traffic surveys should be undertaken within two years of Application (MCA, 2021a). As the December 2021 survey was outside this two year window, an additional 14-day top-up survey as per MGN654 4.6b was undertaken to

extend the data validity for a further 12 month period. This survey is reported in Appendix D to benchmark the NRA results with the top-up survey.

Table 1.16: Summary of vessel traffic surveys.

Attributes	Winter	Summer	Fishing Survey
Vessel	Karelle (28 m Fishing Vessel)	Morning Star (23 m Fishing Vessel)	Karelle (28 m Fishing Vessel)
Dates	00:00 21 November 2021 to 00:00 05 December 2021	17:00 15 July 2022 to 17:00 29 July 2022	03:25 04 May 2023 to 03:25 18 May 2023
Downtime	None	None	None
Survey Area	Array Area + 10 nm	Array Area + 10 nm	Array Area + 10 nm
Total Vessels Recorded (Array Area + 10 nm)	649 (46.4/day)	426 (30.4/day)	510 (36.4/day)
Total Vessels Recorded (Array Area)	150 (10.7/day)	193 (13.8/day)	163 (11.6/day)
Cargo	**Array + 10 nm**: 29 (2.1/day) **Array**: 12 (0.9/day)	**Array + 10 nm**: 20 (1.4/day) **Array**: 7 (0.5/day)	**Array + 10 nm**: 23 (1.6/day) **Array**: 8 (0.6/day)
Fishing	**Array + 10 nm**: 220 (15.7/day) **Array**: 18 (1.3/day)	**Array + 10 nm**: 43 (3.1/day) **Array**: 30 (2.1/day)	**Array + 10 nm**: 135 (9.6/day) **Array**: 23 (1.6/day)
Passenger	**Array + 10 nm**: 150 (10.7/day) **Array**: 88 (6.3/day)	**Array + 10 nm**: 206 (14.7/day) **Array**: 129 (9.2/day)	**Array + 10 nm**: 215 (15.4/day) **Array**: 119 (8.5/day)
Recreational	None	**Array + 10 nm**: 20 (1.4/day) **Array**: 14 (1/day)	**Array + 10 nm**: 16 (1.1/day) **Array**: 1 (0.1/day)
Tanker	**Array + 10 nm**: 24 (1.7/day) **Array**: 4 (0.3/day)	**Array + 10 nm**: 11 (0.8/day) **Array**: 4 (0.3/day)	**Array + 10 nm**: 3 (0.2/day) **Array**: 2 (0.1/day)
Tug and Service	**Array + 10 nm**: 225 (16.1/day) **Array**: 28 (2.0/day)	**Array + 10 nm**: 124 (8.9/day) **Array**: 8 (0.6/day)	**Array + 10 nm**: 114 (0.8/day) **Array**: 11 (0.8/day)

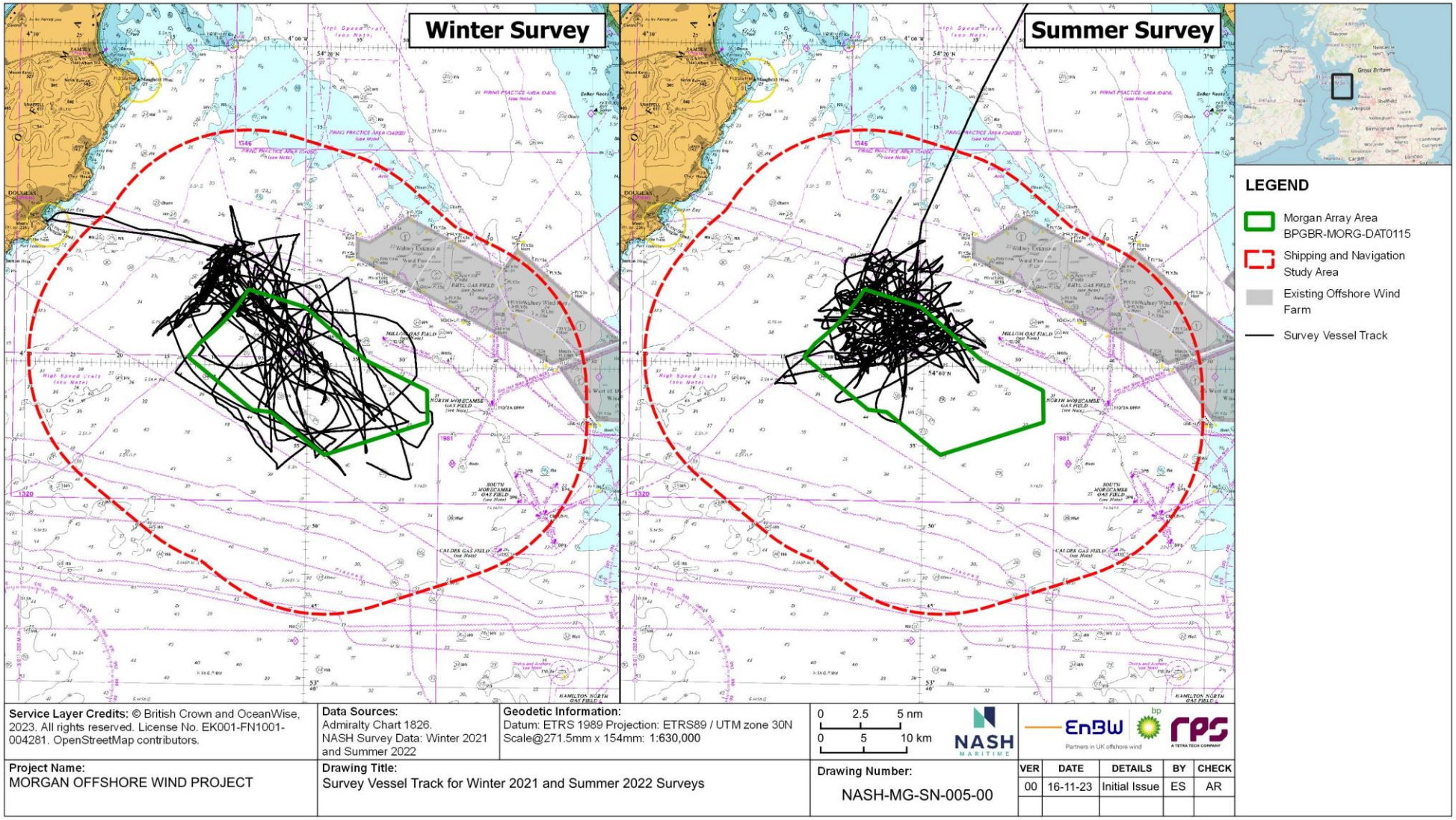

Figure 1.10: Survey vessel track for winter 2021 and summer 2022 surveys (Source: vessel traffic surveys).

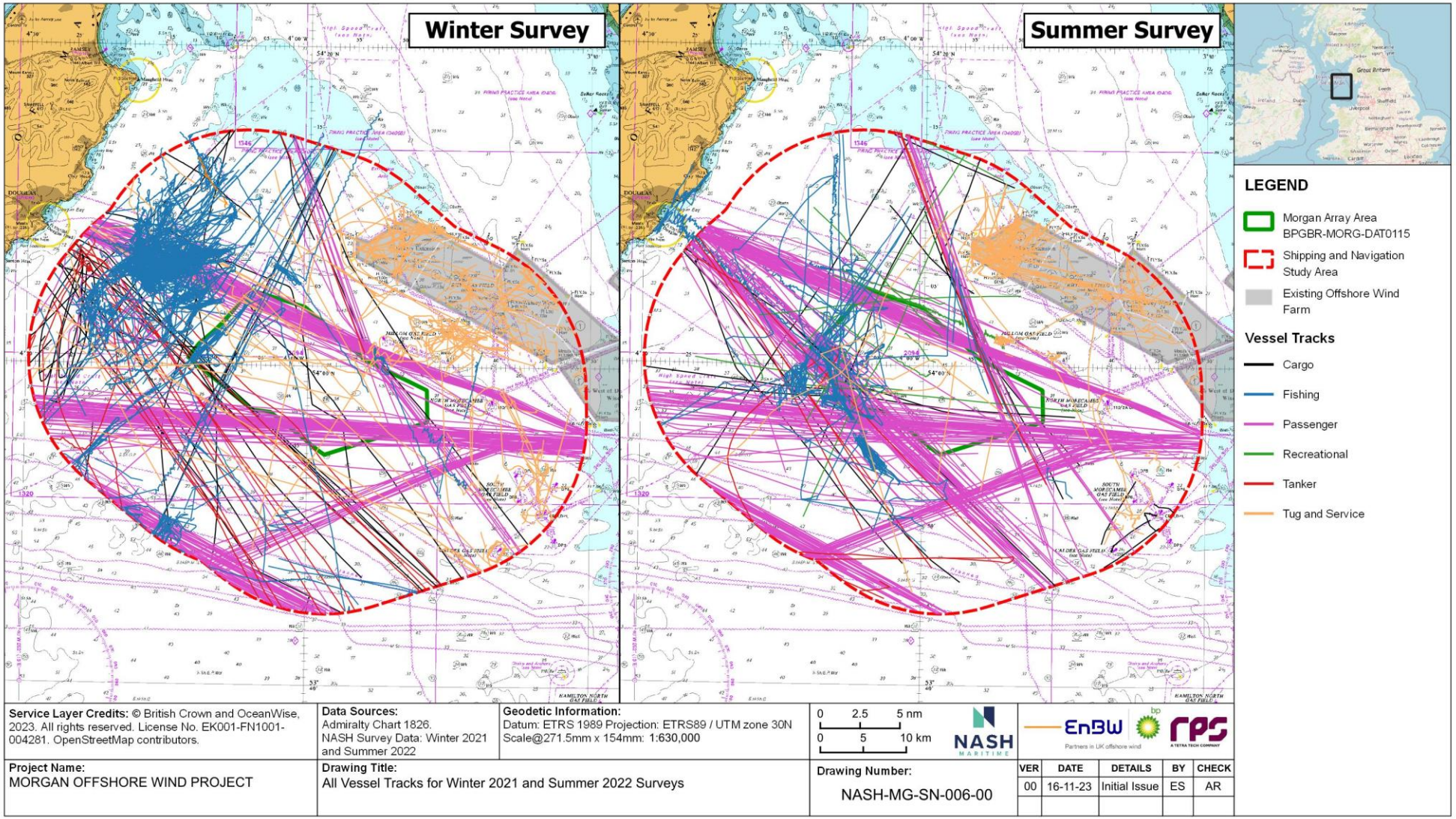

Figure 1.11: All vessel tracks for winter 2021 and summer 2022 surveys (Source: vessel traffic surveys).

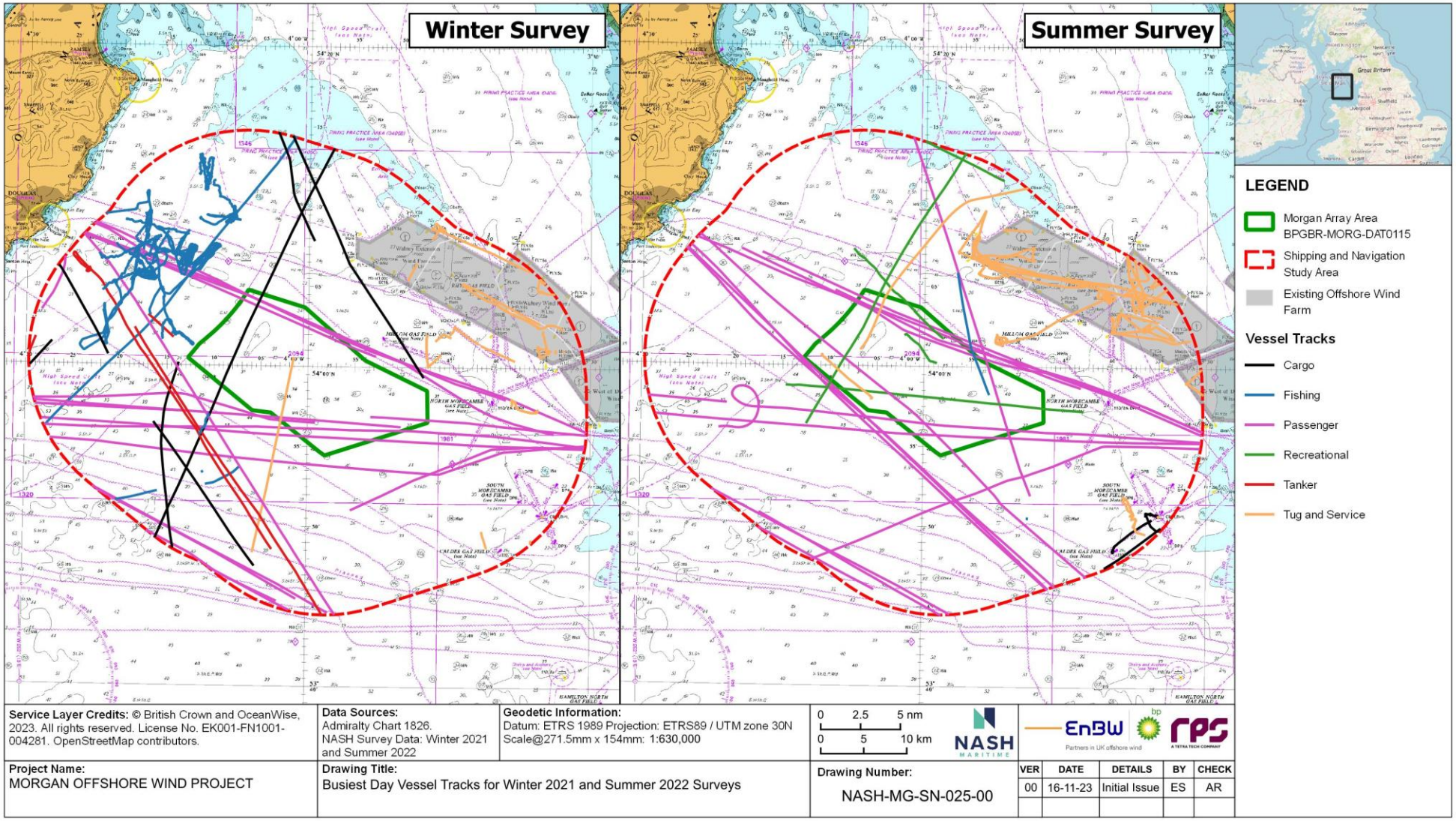

Figure 1.12: Vessel traffic survey – busiest day vessel tracks for winter 2021 and summer 2022 surveys (Source: vessel traffic surveys).

1.6.2 Vessel traffic analysis

Overview

1.6.2.1 Figure 1.13 shows the Morgan Array Area in relation to the general shipping routes within the Irish Sea. Annualized vessel traffic density in Figure 1.13, which presents the number of vessel transits through each grid cell, shows that:

- There are several high density routes through the shipping and navigation study area, largely associated with ferry routes between Douglas, Heysham, Liverpool and the island of Ireland
- High density vessel activity within the east of the shipping and navigation study area is associated with the existing offshore wind farms and CTV movements, as well as oil and gas infrastructure and ancillary vessels
- The central portion of the Morgan Array Area has relatively low traffic density, although routes run adjacent to all boundaries of the Morgan Array Area.

1.6.2.2 Figure 1.14 shows all vessel tracks in 2022 by vessel draught. Vessels with a draught over 11 m infrequently navigate within the shipping and navigation study area but are not generally on passage, likely loitering in the lee of the Isle of Man or conducting pilotage transfers at Douglas. Vessel traffic within the Morgan Array Area largely comprises of vessel with a draught under 8 m.

1.6.2.3 Figure 1.15 shows all 2022 vessel tracks by vessel length. The majority of large vessels within the Irish Sea are bound for the Port of Liverpool, typically passing to the southwest of the shipping and navigation study area. The largest vessels transit south of the shipping and navigation area, between the Liverpool TSS and the Off Skerries TSS and include the 306 m Length Overall (LOA) Cruise Ship *Celebrity Apex,* and the 304 m LOA Cargo/Container Ship *MSC Loretta.* The occasional passage of vessels over 200 m in length and over 10 m in draught that cross into the shipping and navigation study area are largely Cargo and Tanker vessels, including the largest vessel at 349 m in length, the Container Ship *APL Gwangyang*. Almost all vessels over 100 m in length through the shipping and navigation study area are ferries on well-defined routes. Small craft, including fishing vessels and tug and service vessels, are located throughout the shipping and navigation study area, but largely concentrated around the offshore wind farms and oil and gas infrastructure to the east.

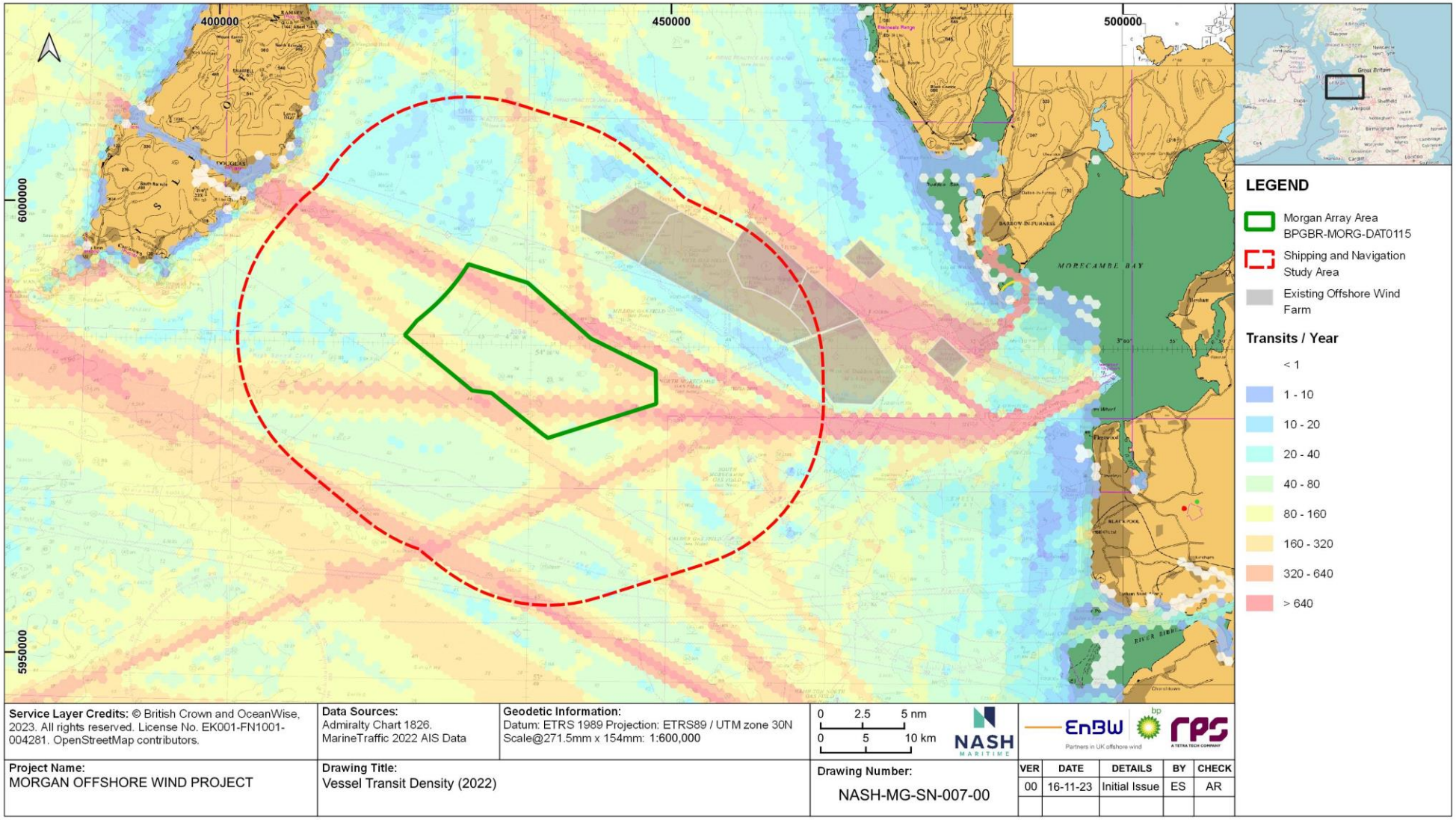

Figure 1.13: Vessel traffic density (Source: MarineTraffic, 2022).

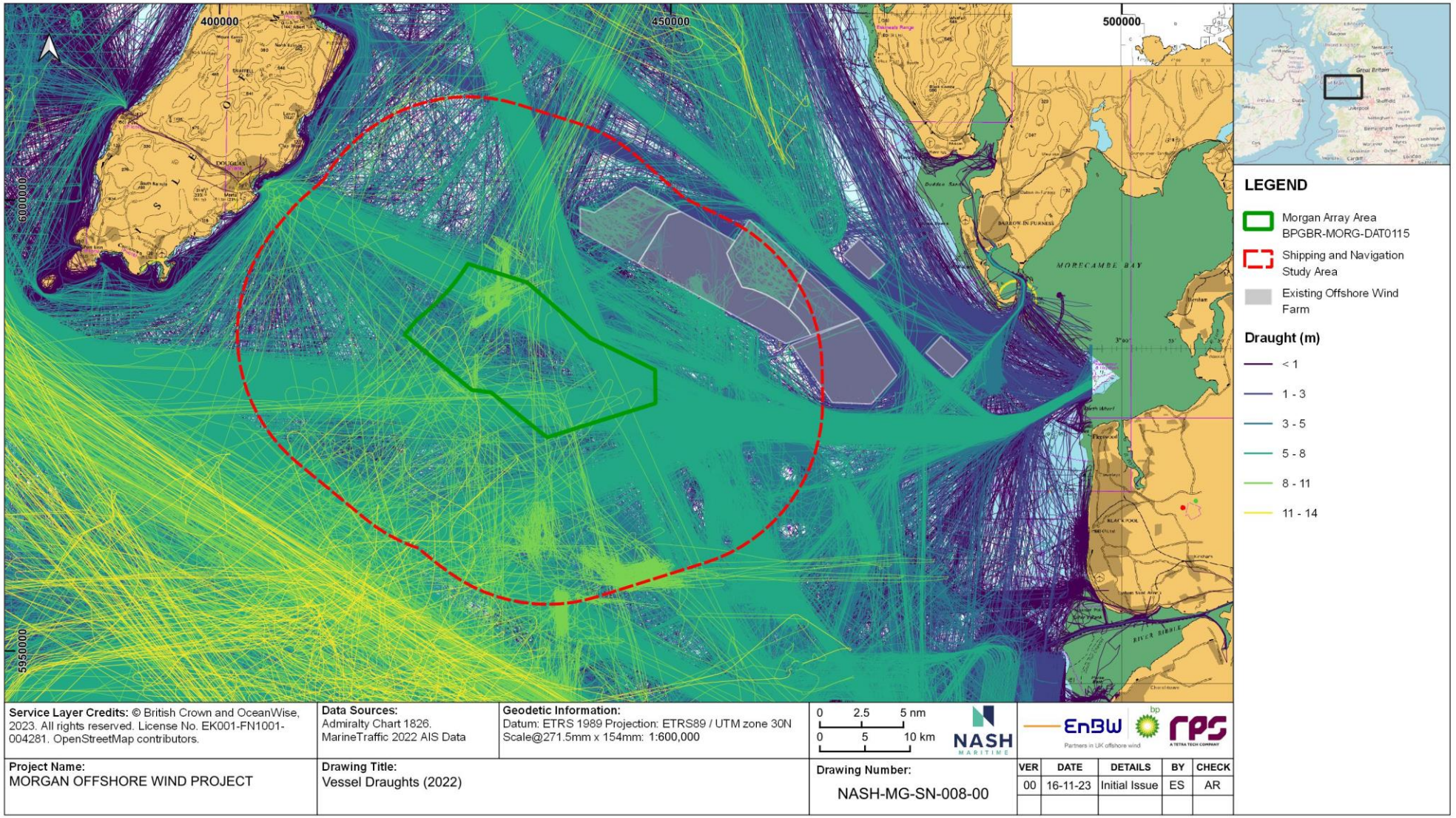

Figure 1.14: Vessels by draught (Source: MarineTraffic, 2022).

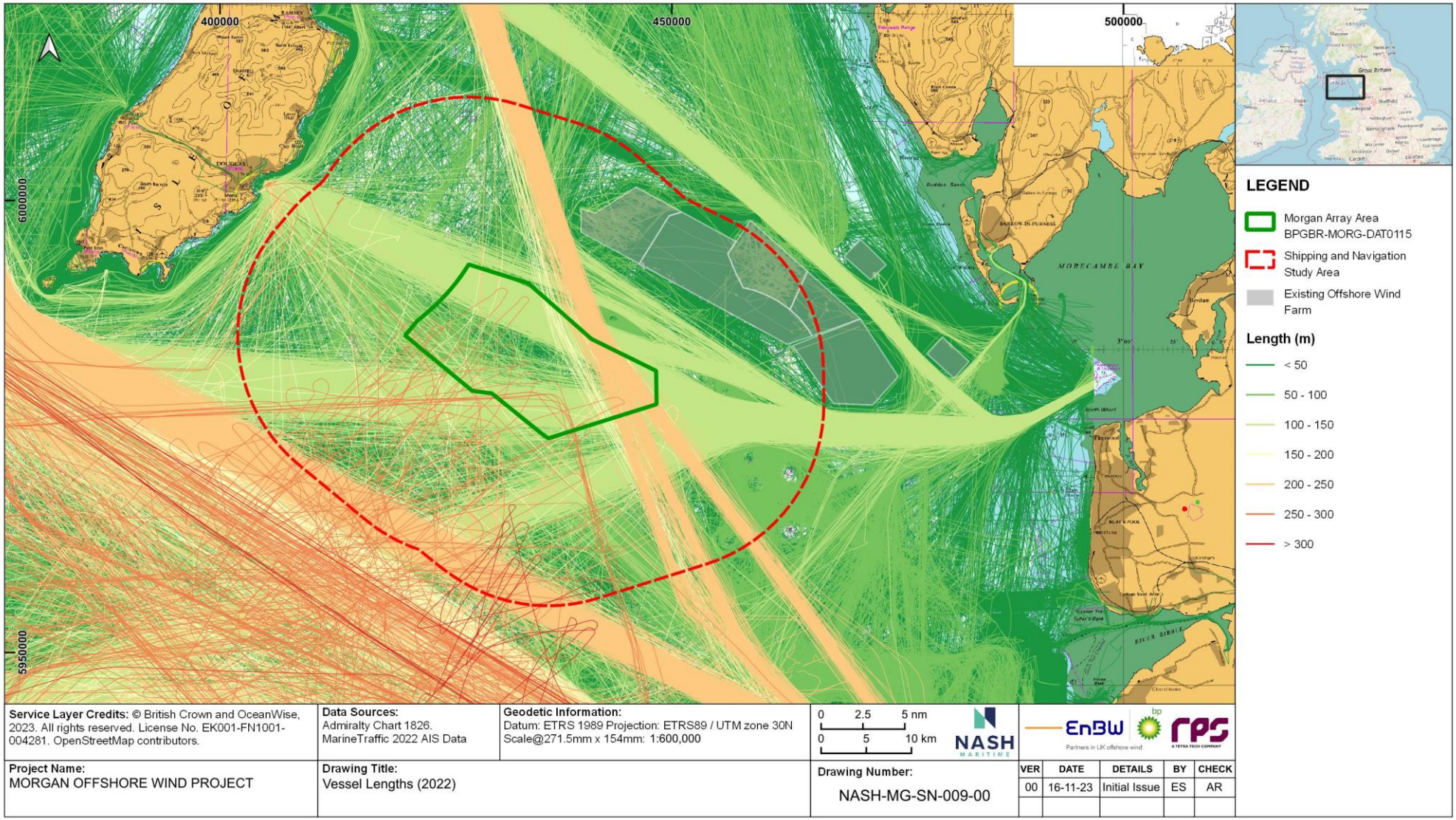

Figure 1.15: Vessels by length (Source: MarineTraffic, 2022).

Vessel tracks by type

Cargo/tanker

1.6.2.4 The tracks of cargo/tanker vessels, namely dry cargo vessels and liquid tankers, are shown in Figure 1.16 and Figure 1.17 respectively.

1.6.2.5 There were 452 cargo ship transits through the 10 nm shipping and navigation study area during 2022, of which 138 passed through the Morgan Array Area, less than one per day. These are mostly general cargo vessels of less than 100 m in length. The majority of cargo ship transits are shown to be between the west of the Isle of Man and Liverpool, passing outside of the shipping and navigation study area. These tend to include larger vessels such as container ships and bulk carriers.

1.6.2.6 Tanker vessel tracks are shown in Figure 1.17 and are largely consistent with the shipping routes identified for cargo ships, albeit with less frequency with 157 transits through the 10 nm shipping and navigation study area in 2022 and 67 through the Morgan Array Area. Of these, the 274 m *Aura M,* 77 m Keewhit, and various 90m to 100 m Stolt vessels account for the majority. The smaller of these vessels are operating between Liverpool, Douglas and Belfast, with the larger crude oil tanker loitering largely to the southwest of the Morgan Array Area.

1.6.2.7 Detailed analysis of cargo/tanker shipping routes is contained in section 1.6.2.

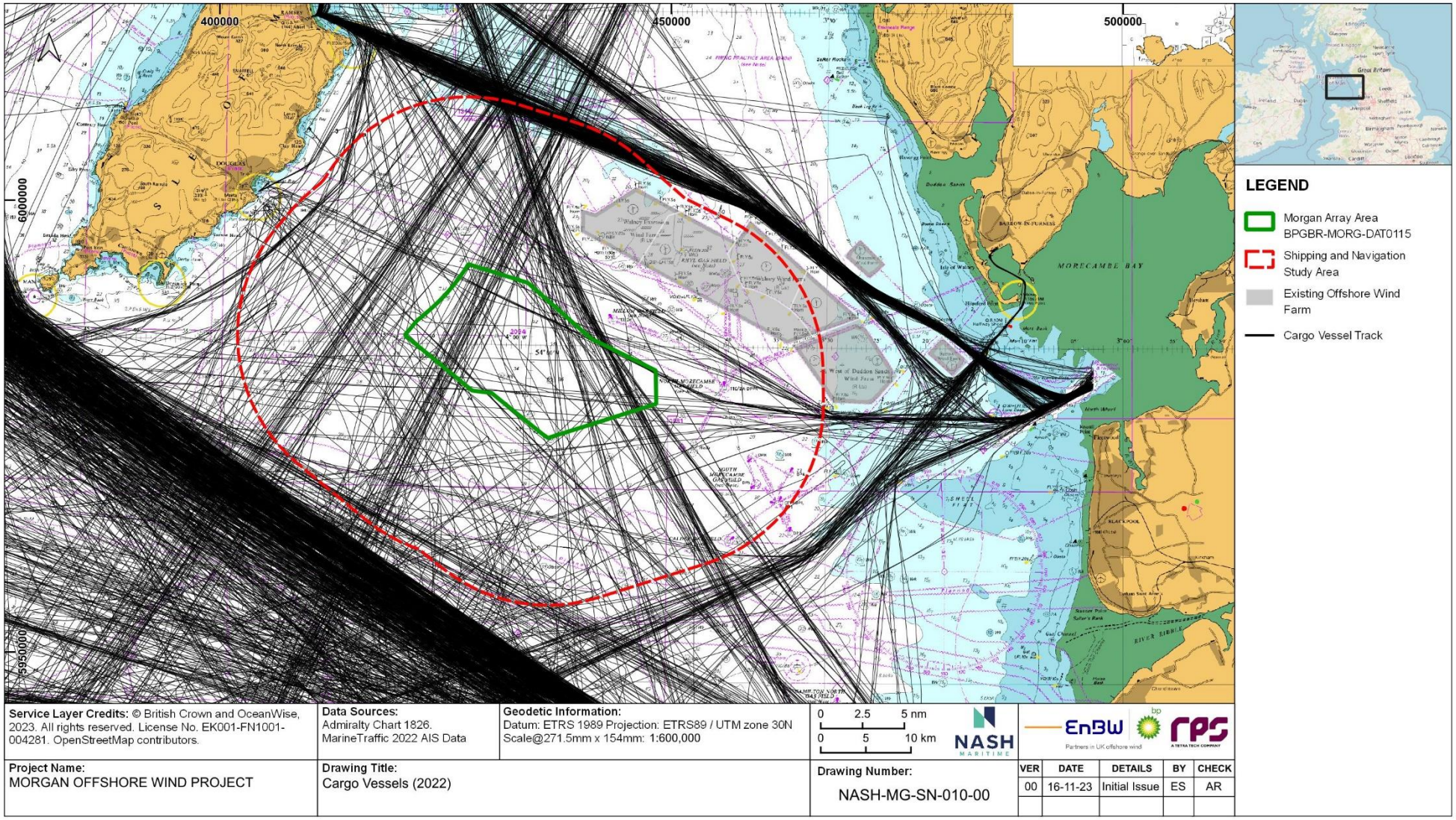

Figure 1.16: Cargo vessels (Source: MarineTraffic, 2022).

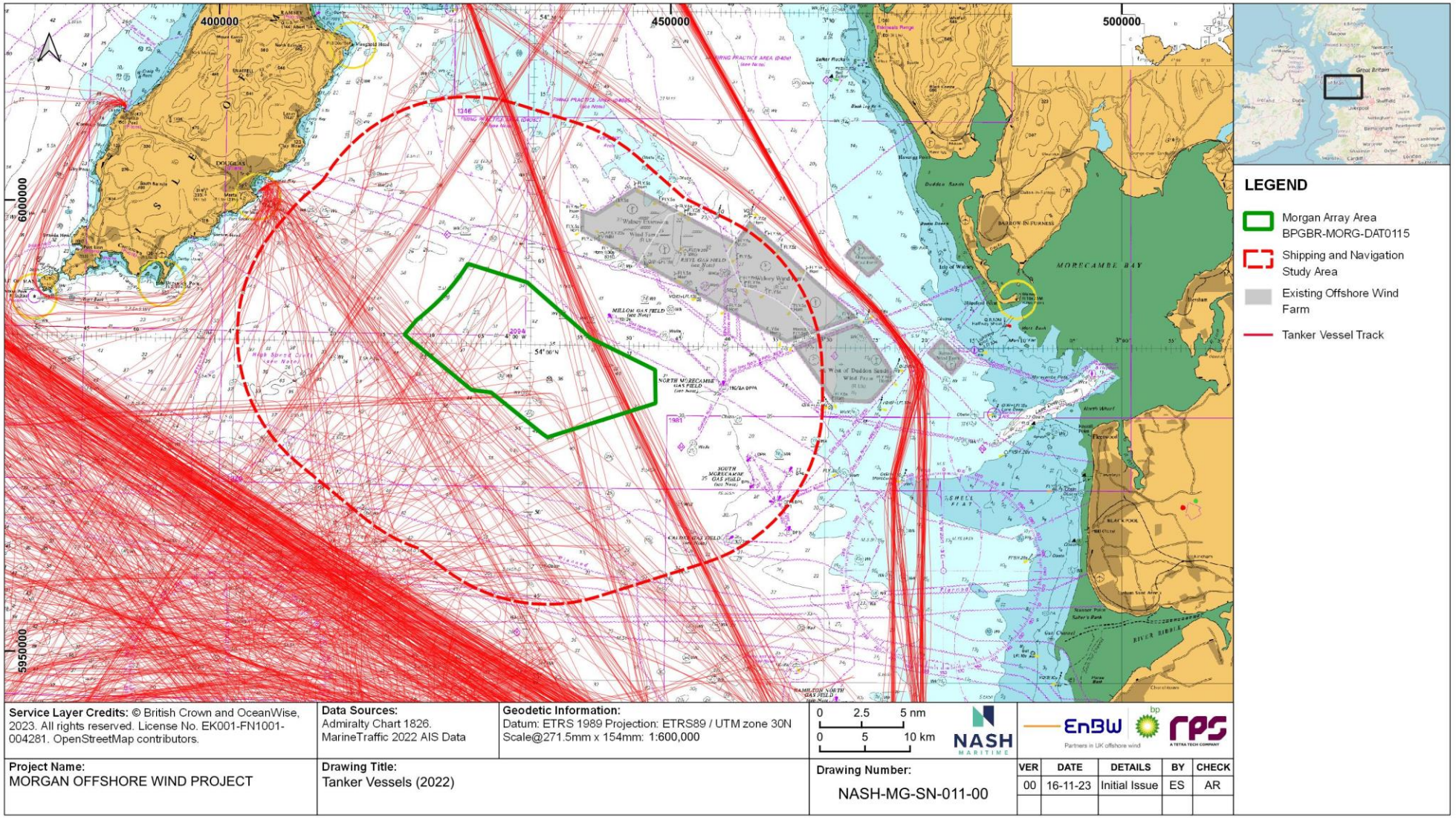

Figure 1.17: Tanker vessels (Source: MarineTraffic, 2022).

Ferries

1.6.2.8 The tracks of ferries are shown in Figure 1.18, including passenger and freight services. On average, 14 to 15 ferry transits per day passed through the 10 nm shipping and navigation study area, a total of 5,304 in 2022. 3,323 of these passed through the Morgan Array Area, a rate of 9.1 per day. Four principal operators have been identified in the east Irish Sea. The IoMSPC operate between Douglas, Liverpool and Heysham. Seatruck operate between Heysham, Liverpool, Warrenpoint and Dublin. Stena operate between Liverpool, Heysham and Belfast. Finally, P&O operate between Liverpool and Dublin.

1.6.2.9 Detailed analysis of these routes is contained within section 1.8.3.

Cruise ships

1.6.2.10 The tracks of cruise ships are shown in Figure 1.19, with 31 transits recorded within the 10 nm shipping and navigation study area, of which 14 passed through the Morgan Array Area during 2022. Nine of these 14 transits were the 89 m LOA *Corinthian,* on two main routes from Barrow-in-Furness to Douglas or Belfast. The other five transits through the Morgan Array Area were vessels ranging from 119 m to 289 m LOA and were mainly from Liverpool to Douglas. The majority of cruise ships in the Irish Sea are bound for Liverpool and pass outside of the shipping and navigation study area, principally between April and September.

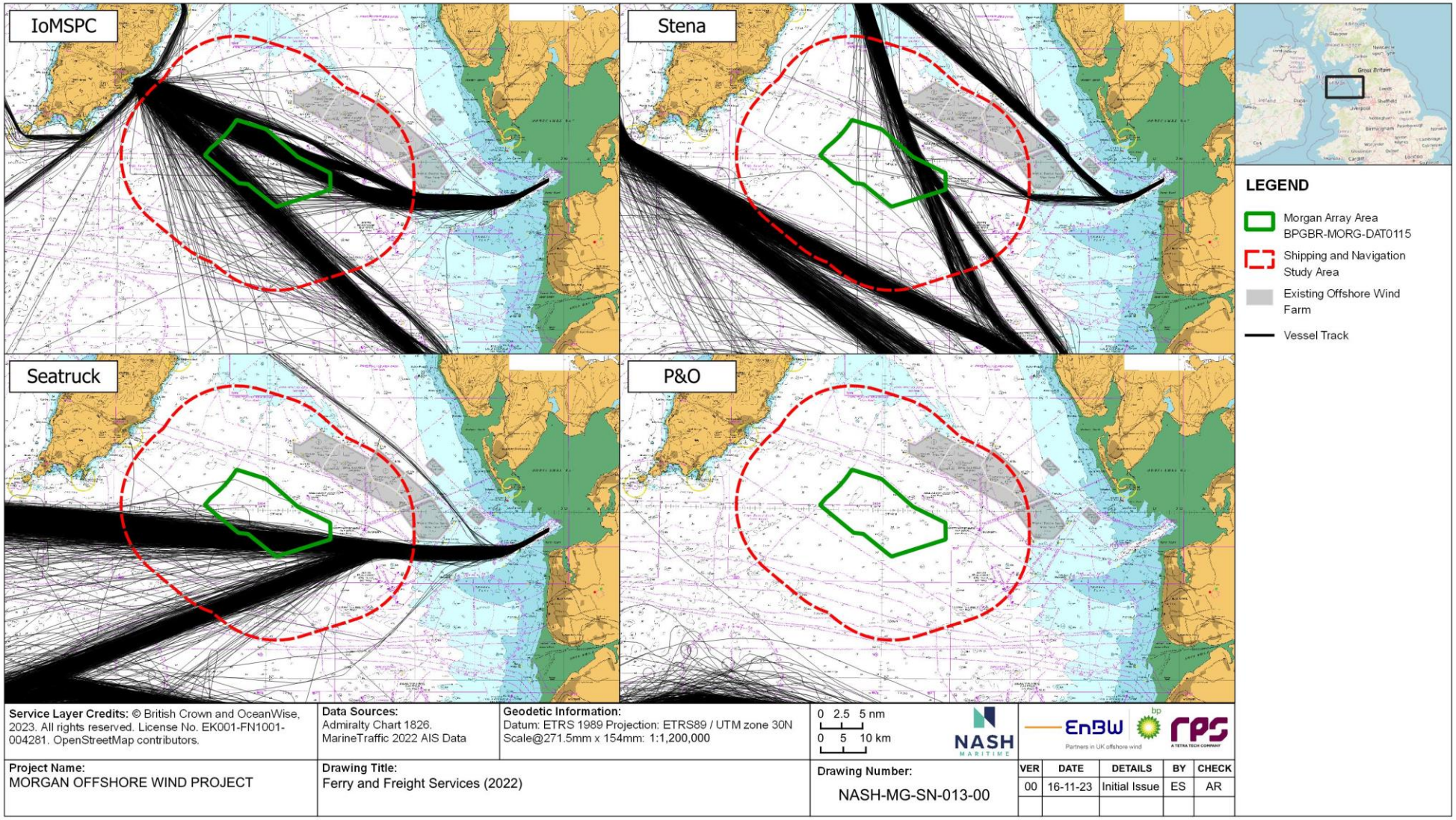

Figure 1.18: Ferry and freight services (Source: MarineTraffic, 2022).

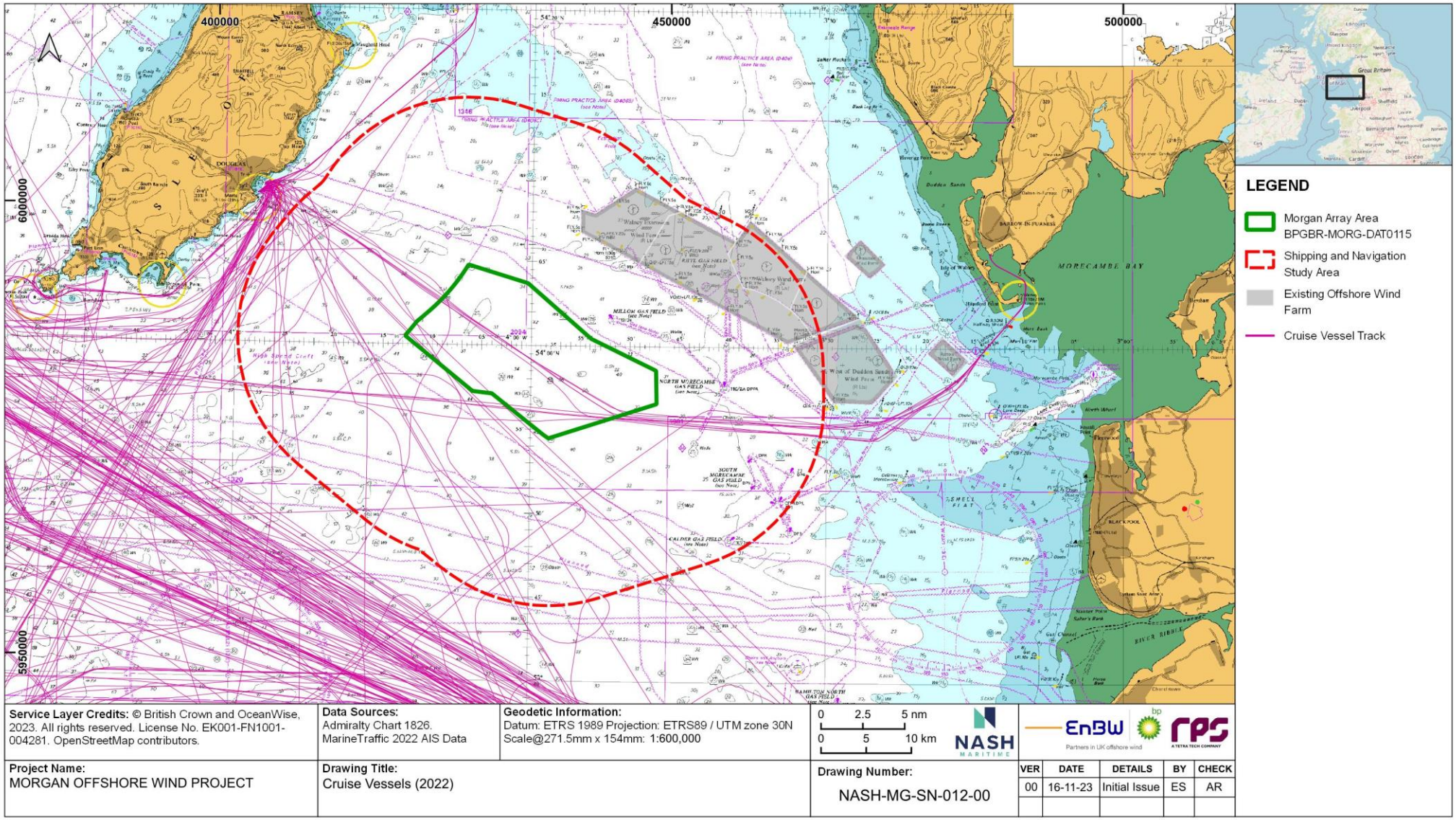

Figure 1.19: Cruise vessel transits (Source: MarineTraffic, 2022).

Recreational activity

1.6.2.11 The intensity of recreational activity within the study area is shown in Figure 1.20 and Figure 1.21. Historical AIS data for 2019 and 2022, along with the RYA Coastal Atlas, were combined to identify areas of increased recreational activity. The Morgan Array Area site is characterised by relatively sparse recreational activity, with the exception of the north section of the Morgan Array Area that shows low to moderate recreational activity. Most recreational vessels remain predominantly along the coast, particularly along the entrance to Liverpool, and around Holyhead, Douglas, and Rhyl. In shore cruising routes are clear of the Morgan Array Area. Low to moderate intensity is also evident within the shipping and navigation study area, notably northwest of the Morgan Array Area around Douglas.

1.6.2.12 Offshore cruising routes are present between Liverpool, Douglas, Menai Straits, and Morecambe Bay, running adjacent to, and sometimes crossing, the Morgan Array Area. Relatively few yachts were recorded during the 2021/2022 vessel traffic surveys, with less than one per day during the summer survey and none at all recorded during the winter survey. This suggests significant seasonality in recreational movements through the shipping and navigation study area.

1.6.2.13 The cruising route Liverpool to Douglas runs adjacent to the southwest boundary of the Morgan Array Area. This route is also used by vessels participating in the Isle of Man Midnight Race, organised by the Liverpool Yacht Club (LYC), which is the only relevant yacht race that crosses the study area with approximately 10 vessels participating each year (there were 40 vessels in 2019 due to 100th anniversary of race). Nevertheless, 75% of recreational vessels detected along this route did not sail through the proposed Morgan Array Area. However, 69% of vessels sailing between Whitechapel and Anglesey did cross the Morgan Array Area. All vessels detected sailing along the other identified routes (i.e. Conwy to Morecambe and Conwy to Douglas) did not cross the Morgan Array Area.

1.6.2.14 Existing offshore wind farms can also serve as a reference for understanding how recreational crafts respond when their routes intersect with proposed offshore wind farms. For example, the route between Morecambe and Douglas is intersected by two offshore wind farms (Walney and West of Duddon Sands). About 79% of cruising vessels sailing along this route opted for a longer passage to avoid crossing the existing wind farms. The majority of crafts chose a southerly route around the wind farms, extending the shortest possible passage of 46 nm by an additional 4 nm, which can add up to one hour of passage time (depending on the vessel type and weather conditions). However, during consultation with the RYA, it was noted that recent evidence from AIS data suggests that yachts avoid transiting through an offshore wind farm less than previously thought based on responses to surveys.

1.6.2.15 A challenge in analysing recreational vessel patterns using AIS data is that not all vessels, particularly the smaller crafts, transmit AIS signals. A 2014 RYA survey found that 37% of recreational vessels around the UK transmit AIS signals. This survey showed a potential bias, as vessel owners were more likely to participate in an AIS survey if already using AIS on their crafts. Previous RYA studies have concluded that between 10 to 30% of recreational crafts are transmitting AIS signals in the UK, though this varies greatly depending on the specific location. For comparison, 63% of vessels participating in the LYC Isle of Man Midnight Race in 2022 were transmitting AIS signals (81% in 2019).

Fishing activity

1.6.2.16 Commercial fishing in the east Irish Sea region has a wide spatial distribution and targets a number of valuable fisheries for demersal, pelagic and shellfish species. Key shellfish species include king scallop, and queen scallop which are targeted by dredges; and whelk, lobster and crab, which are targeted by pots. The most important demersal target species include bass, sole, thornback ray and plaice, which are typically caught by beam and otter trawlers. Pelagic fish landings from this area are mainly of herring and mackerel, which are predominantly caught by pelagic trawls. Fishing ports in the region with the highest fishing efforts are Amlwch, Conwy, Holyhead and Fleetwood. Fishing vessels are also active from Annan, Douglas, Kilkeel, Kirkudbright, Maryport and Peel. In addition, Belgian trawlers are known to operate throughout the shipping and navigation study area.

1.6.2.17 The tracks of fishing vessels are shown in Figure 1.22, a combination of AIS data with VMS data. There is considerable fishing activity within and near the Morgan Array Area, including amongst vessels up to 40 m in length engaged in mobile and static gear fishing. However, some fishing vessels are engaged in guard vessel duties or other survey works and account for some of the concentrations around oil and gas installations, as well as within the Morgan Array Area (such as *Havilah*). On average, 1.3 fishing vessels per day were recorded navigating or fishing within the Morgan Array Area during the winter vessel traffic survey as opposed to 2.1 per day during the summer vessel traffic survey.

1.6.2.18 Significant fishing activity was recorded during the winter vessel traffic survey to the northwest of the Morgan Array Area, associated with the Isle of Man Queen Scallop fishing season. At times, up to 10 concurrent fishing boats were working these waters (see section 1.6.1). In contrast to the numbers of fishing vessels within the Morgan Array Area, significantly more were recorded within the shipping and navigation study area during winter (at 15.7 per day) as opposed to the summer survey (at 3.1 per day).

1.6.2.19 Analysis of fishing vessel activity in the shipping and navigation study area showed that some fishing routinely takes place within the existing Irish Sea offshore wind farms, namely Walney Extension and Gwynt y Mór, both of which have significantly smaller spacing between wind turbines compared to the Morgan Generation Assets (under 1,000 m compared to 1,400 m).

1.6.2.20 Additional data on fishing activity is contained within the Morgan Generation Assets fisheries chapter (Volume 2, Chapter 6: Commercial fisheries of the Environmental Statement).

Tug and service

1.6.2.21 The tracks of tug and service vessels in 2022 are shown in Figure 1.23. These have been subdivided into key categories:

- CTVs – these vessels are operating between operations and maintenance bases and the existing offshore wind farms and are mostly clear of the Morgan Array Area and the shipping and navigation study area
- Oil and gas associated supply ships and standby safety vessels – these vessels have a high intensity to the east of the shipping and navigation study area and Morgan Array Area where the platforms are located. In particular, the Millom and South Morecambe Gas Fields
- Dredgers and pilot vessels - the activities of these vessels are largely clear of the shipping and navigation study area, being concentrated to the southeast of

the area. SAR vessels are dispersed throughout the shipping and navigation study area but concentrated mostly in coastal waters. The few SAR vessels that pass through the Morgan Array Area are mainly RNLI lifeboats on route between Fleetwood and either Douglas or Port St Mary

- Other vessel types, including survey vessels and tugs – these vessels are mainly concentrated inshore, but still with several hundred intersecting the Morgan Array Area.

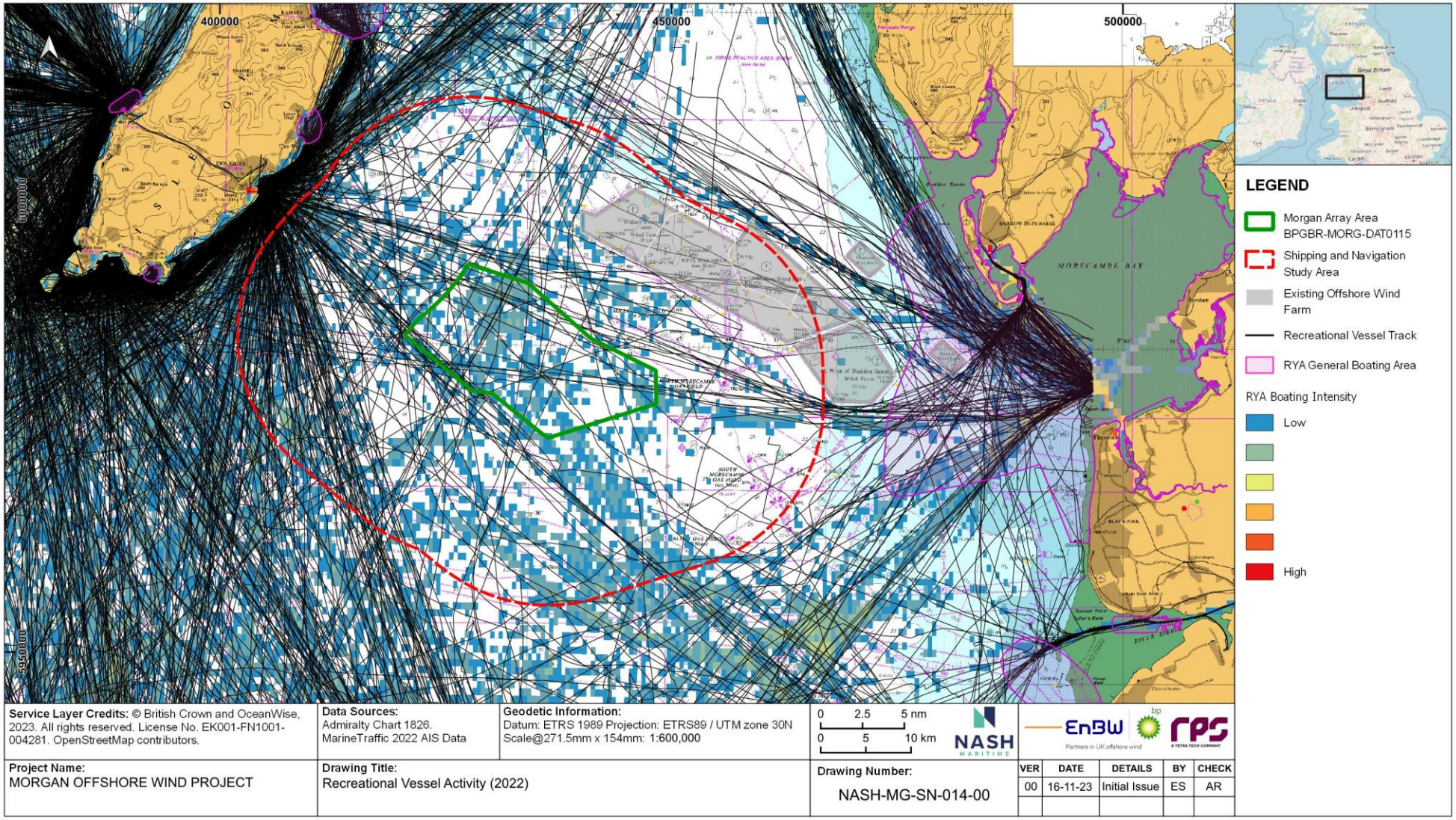

Figure 1.20: Recreational vessel activity (Source: MarineTraffic, 2022 and RYA Coastal Atlas).

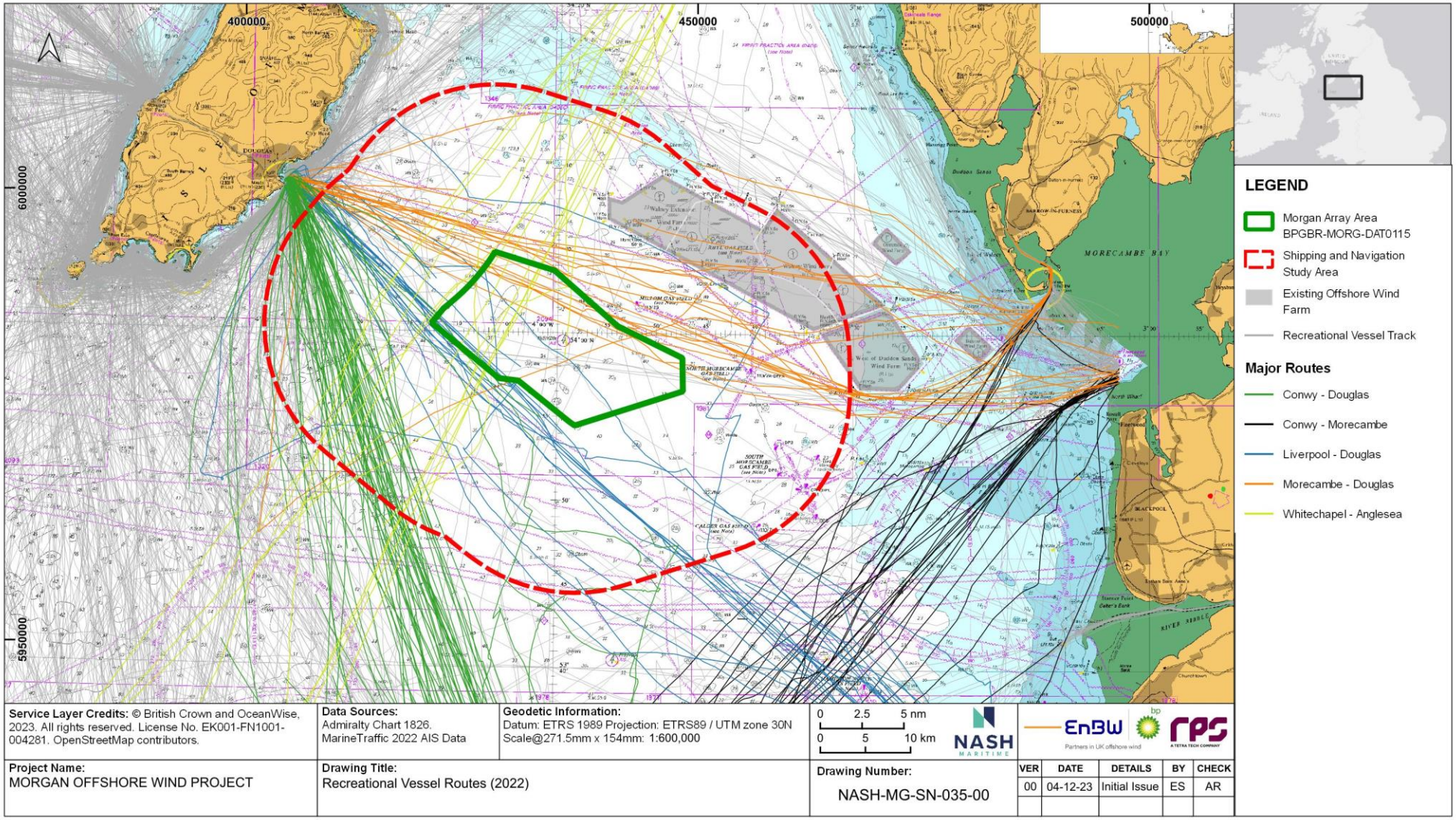

Figure 1.21: Recreational vessel routes (Sources: MarineTraffic, 2022).

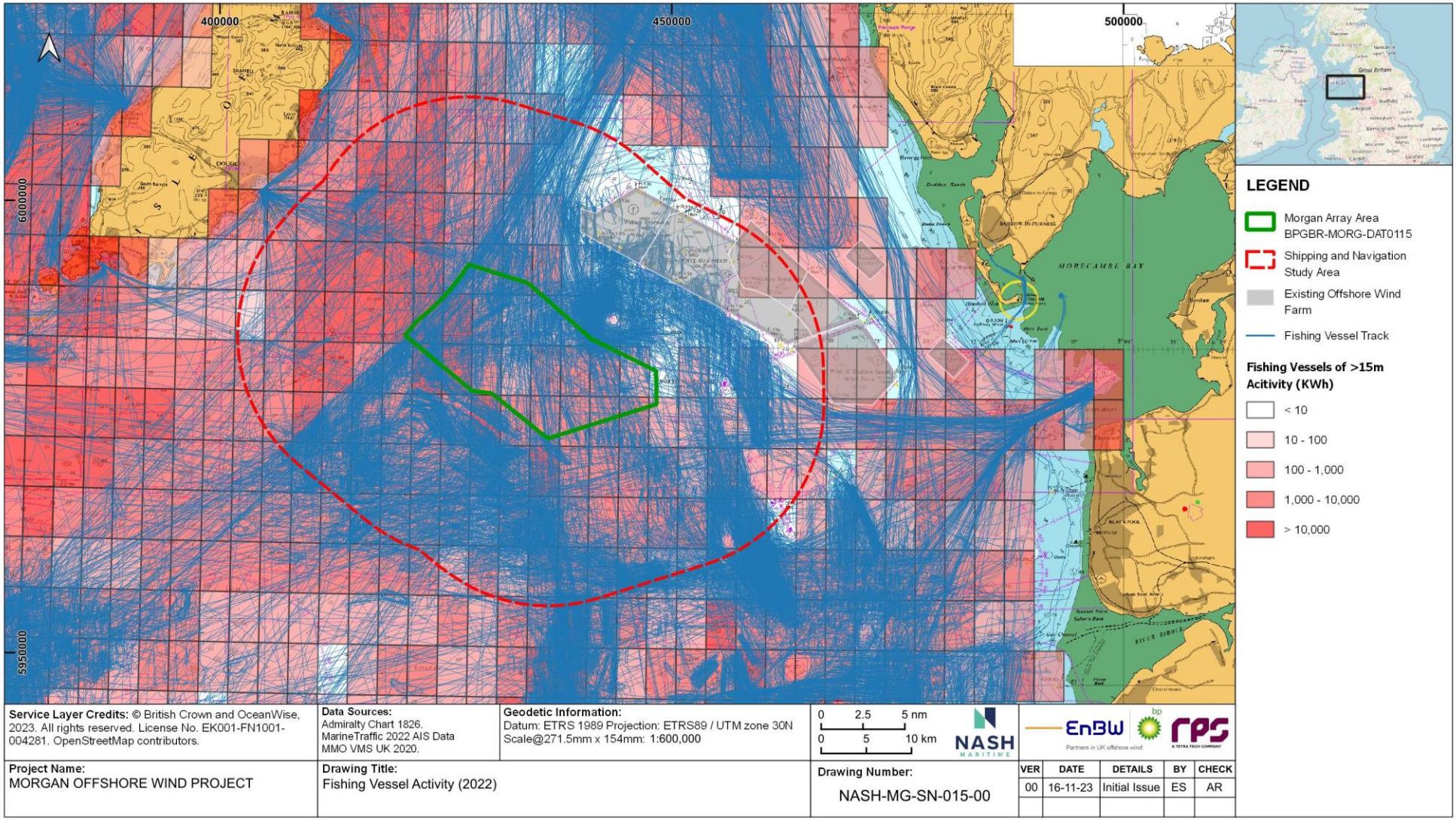

Figure 1.22: Fishing vessel activity (Source: MarineTraffic, 2022 and MMO VMS 2020 Data).

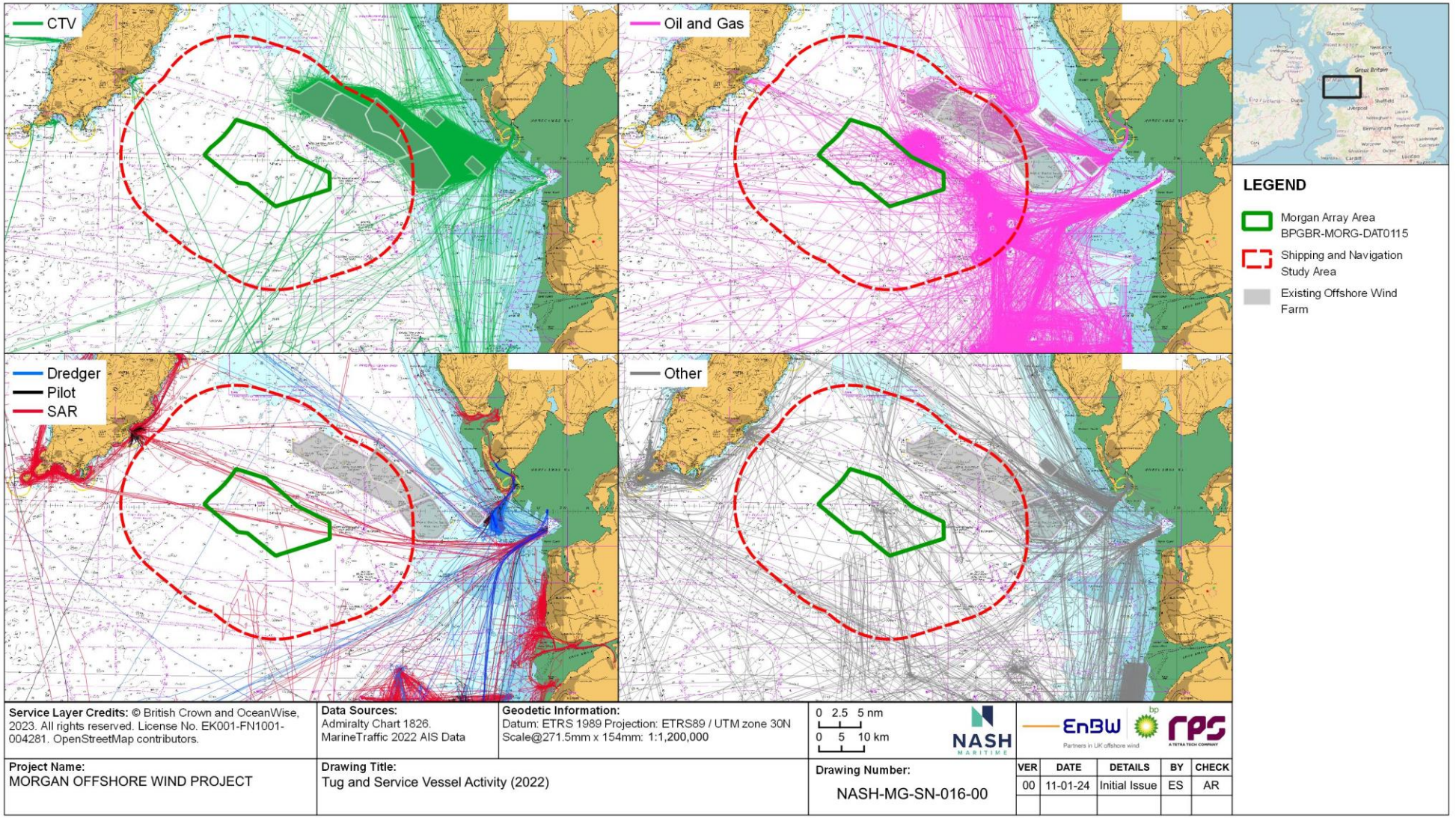

Figure 1.23: Tug and service vessel activity (Source: MarineTraffic, 2022).

Vessel traffic counts and seasonality

Count by vessel type

1.6.2.22 Figure 1.24 shows the number of vessel transits through both the Morgan Array Area and shipping and navigation study area from analysis of 2022 AIS data. Approximately 4,239 vessels in total pass through the Morgan Array Area in 2022, a rate of 12 per day. Passenger vessels are responsible for the majority of this activity, representing 78% of vessel traffic. This is mostly the Stena, IoMSPC and Seatruck routes which pass through or immediately adjacent to the site.

1.6.2.23 138 cargo and 67 tankers passed through the Morgan Array Area in 2022, a total rate of one every two days. The density of cargo/tanker vessel traffic through the Morgan Array Area is therefore low.

1.6.2.24 Whilst not all fishing or recreational vessels carry AIS, they account for 337 transits (< 1 per day) and 48 transits (one per week) respectively through the Morgan Array Area. Tug and service vessels also account for less than one transit per day.

1.6.2.25 The shipping and navigation study area has a vessel count at 12,593 vessels in 2022, or 35 per day. Given that the shipping and navigation study area includes several oil and gas platforms and the existing offshore wind farms, the contribution of tug and service to the total is substantial, with 15 per day or 43% of the total.

1.6.2.26 Numerous passenger routes pass within the shipping and navigation study area, with 15 transits per day on average. Cargo/tanker and recreational vessel transits remain low within the 10 nm shipping and navigation study area, with 1.7 and less than one transit per day respectively. 951 fishing transits were recorded within the shipping and navigation study area, a rate of 2.6 per day.

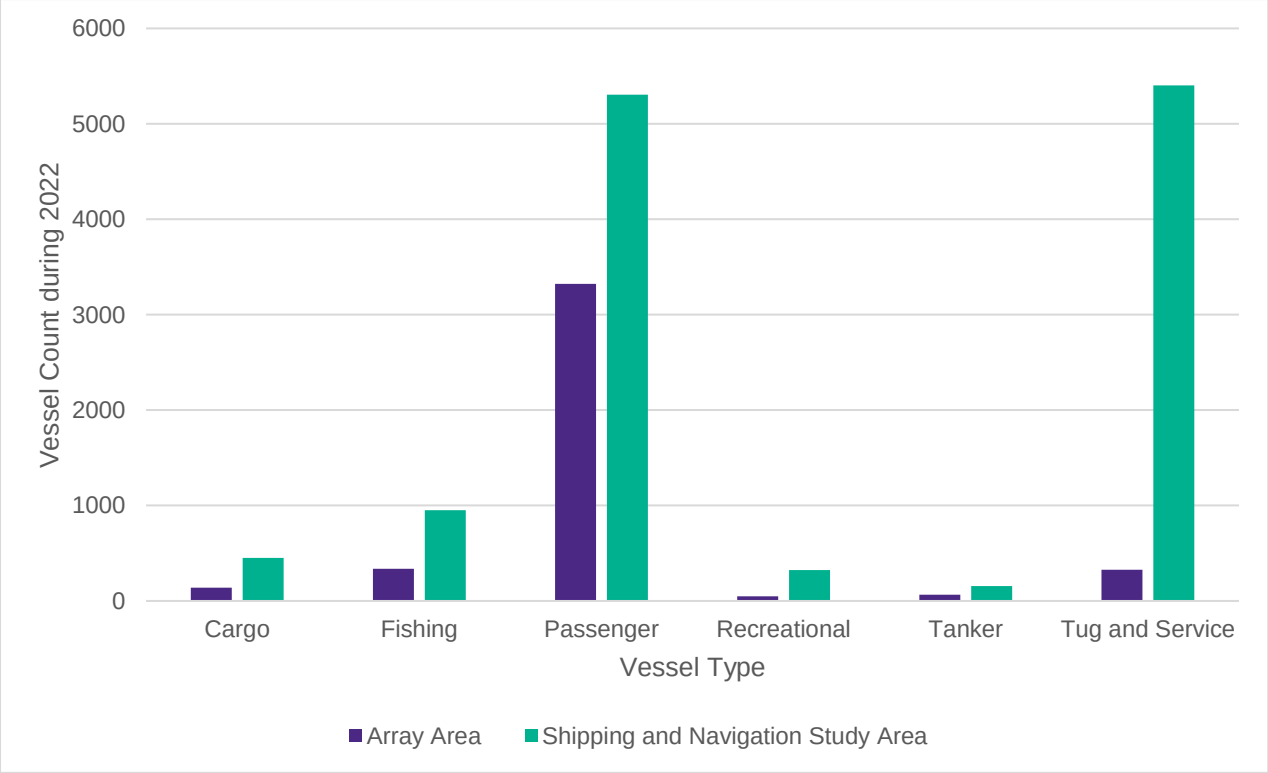

Figure 1.24: Vessel count per year by vessel type for Morgan Array Area and shipping and navigation study area (Source: MarineTraffic, 2022).

Count by vessel size

1.6.2.27 Figure 1.25 shows that whilst there is a great range of vessel sizes intersecting the Morgan Array Area, vessels between 100 m and 150 m are the most common vessel size intersecting the Morgan Array Area, reflecting the greater proportion of ferry transits shown in Figure 1.24. Vessels less than 50 m account for the majority of transits within the 10 nm shipping and navigation study area, due to the dominance of tug and service and fishing vessel types.

1.6.2.28 The largest vessel navigating through the Morgan Array Area was the 289 m *Emerald Princess*, which is seen departing Liverpool, transiting up to Douglas before heading southwest into the Irish Sea.

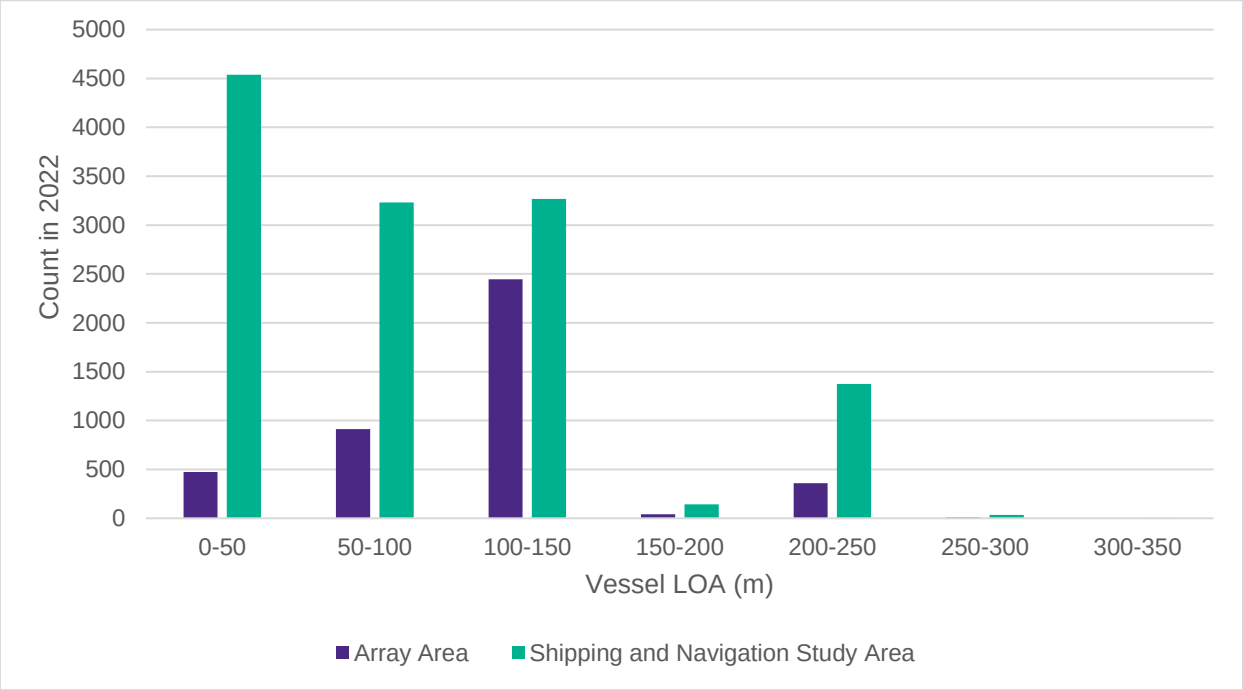

Figure 1.25: Vessel count per year by vessel length over all (LOA) (m) for Morgan Array Area (Source: MarineTraffic, 2022).

Monthly count

1.6.2.29 Figure 1.26 shows a seasonal trend of vessel movements that peaks over the summer months (May to August) and decreases in the winter months (November to February). Within the Morgan Array Area, this is primarily due to an increase in ferry service operations, recreational and fishing activity. Within 10 nm, the increase is more associated with an increase in tug and service vessel activity in addition to fishing.

1.6.2.30 Figure 1.26 is determined based on analysis of 2022 AIS data and therefore underrepresents small craft activity, particularly fishing and recreational movements. It is notable that during the winter vessel traffic survey, significantly more fishing vessel activity was recorded to the northwest of the Morgan Array Area, of which relatively few had AIS (see section 1.6.1).

Figure 1.26: Vessel count per month through Morgan Array Area (top) and within 10 nm (bottom) (Source: MarineTraffic, 2022).

Identification of vessel routes

1.6.2.31 MGN654 and its annexes (MCA, 2021a) provides guidance regarding the definition of shipping routes in order to inform offshore wind farm assessments. To account for variation of tracks taken by vessels, the guidance note establishes the 90th percentile corridor principles, the central portion of traffic on a route containing the majority of vessel traffic. The 90th percentile concept considers that as vessels navigate between specific locations, they may take a variety of routes due to avoiding other traffic or as a result of leeway from wind or waves. To minimise any anomalous tracks and therefore mark the width of a specified route, the MCA advise using the centre 90th percentile of the determined total route width (see Figure 1.27) around the assumed

median or centre line, for all vessels engaged on passage between the same two points.

1.6.2.32 To identify the 90th percentile routes, the following data processing steps were undertaken:

1. Vessel tracks filtered to commercial only (cargo, tanker & passenger)
2. Tracks along a defined route selected
3. Gate transects constructed along the length of the route (ensuring transects at course changes are included)
4. Calculate number of tracks through cross track transect subsections
5. Calculate location of 90th percentile through transect
6. Draw polygon capturing all 90th percentile locations on each transect.

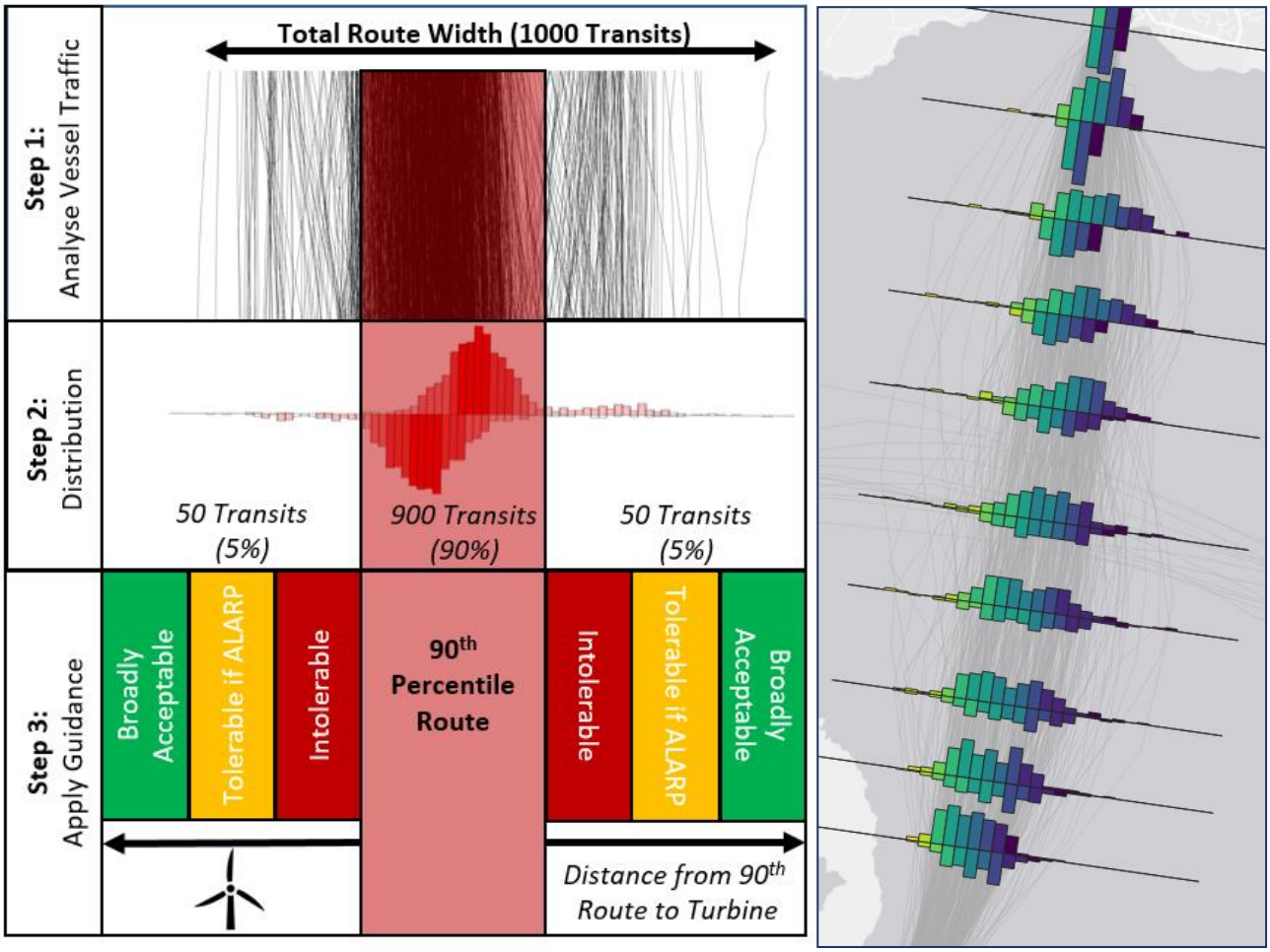

Figure 1.27: Identification of 90th percentile routes.

Cargo/tanker routeing

1.6.2.33 The cargo/tanker vessel routes have been identified in Table 1.17 and Figure 1.28 which also shows the number of vessel movements per day from analysis of 2022 AIS data. All routes with more than one vessel movement per day are to/from the Port of Liverpool from the Irish Sea and are outside of the shipping and navigation study area.

1.6.2.34 There are numerous cargo/tanker routes with less than one vessel per day passing through or adjacent to the Morgan Array Area. These include routes into Heysham and Douglas and alternative routes to/from Liverpool from the east of the Isle of Man. Most of these routes have less than one cargo/tanker vessel transit per week.

Table 1.17: Statistics of cargo/tanker vessel routes in the shipping and navigation study area (highlighted rows indicate an intersect with Morgan Array Area).

ID	Route	Approximate Annual Crossings (2022)	Baseline Distance (nm)
7a	Off Skerries TSS to Barrow (W)	4	72.7
14	E IoM to Heysham	184	49.2
15a	Liverpool to E IoM - West	10	77.6
15b	Liverpool to E IoM - Central	54	70.5
15c	Liverpool to E IoM - East	14	68.0
16	Douglas to Heysham	6	48.7
18	Liverpool to W IoM	153	61.0
19	Douglas to Liverpool TSS (E)	9	51.7
20	Southern Irish Sea to Solway Firth	60	69.8
21	Off Skerries TSS to Solway Firth	42	74.6
22	Douglas to Liverpool TSS	8	51.1

Ferry routeing

1.6.2.35 The ferry routes in the shipping and navigation study area are presented in Figure 1.28 and Table 1.18 along with a count of the crossings during 2022. Figure 1.29 shows the passage plans as provided by the operators as solid lines for a typical passage plan or hatched for adverse weather passage plans, where available.

1.6.2.36 The IoMSPC ferries operate between Douglas on the Isle of Man, and either Heysham or Liverpool. The Heysham/Douglas route is the most frequently run route with 1,451 transits in 2022 (4/day) and passes east/west between South Morecambe Gas Field and West of Duddon Sands and Walney offshore wind farms, before passing west of the Millom Gas Field. This route passes through the Morgan Array Area.

1.6.2.37 The IoMSPC Liverpool/Douglas route has 593 transits in 2022 (up to 4 per day seasonally), passing northwest/southeast through the shipping and navigation study area. The passage plan for the route traverses through the west portion of the Morgan Array Area. The vessel Manannan runs a seasonal service with four transits/day in summer. The route runs primarily west of the single buoy mooring to the north of Liverpool, passing 1.5 nm from the structure. A small proportion of vessels on this route transit east of the Hamilton North Gas Field (53 transits/year, <1day), principally northbound to avoid congestion in Liverpool Bay TSS (thereby exiting the TSS earlier).

1.6.2.38 Stena Line operates routes between Belfast and Liverpool. Vessels using the route between Belfast and Liverpool pass east or west of the Isle of Man dependent on prevailing metocean conditions. The majority of these trips, with 1,098 transits in 2022 (three vessels/day), pass to the west of the Isle of Man and pass through the most

southwest boundary of the shipping and navigation study area. Ferries passing east of the Isle of Man transit northwest/southeast on two planned routes, both of which intersect the Morgan Array Area. One route passes to the west of the Calder platform (194 transits in 2022), 80% of traffic used on this route is southbound traffic. The second route passes to the east of Calder and is utilised by northbound traffic exiting Liverpool Bay TSS (196 transits in 2022, <1 vessel/day). A third Stena route between Heysham and Belfast passes east of the West of Duddon Sands offshore wind farm during normal weather conditions and is outside of the shipping and navigation study area.

1.6.2.39 Seatruck operates two east-west routes through the shipping and navigation study area. Heysham to Warrenpoint passes through the Morgan Array Area with 1099 transits in 2022 (3/day). Vessels depart Heysham before heading due west once clearing the West of Duddon Sands offshore wind farm, without further obstruction. The Heysham to Dublin route passes 3.2 nm south of the Morgan Array Area. Seatruck also operates a route between Liverpool to Dublin south of the shipping and navigation study area (1,800 transits/year, 5/day).

1.6.2.40 P&O ferries operate a route between Liverpool and Dublin which passes south of the shipping and navigation study area with 1,600 transits/year (5/day).

Table 1.18: Ferry routes and annual crossings by operator.

Operator	Route	Example Vessels (2019 to 2022)	Approximate Annual Crossings (2022)
IoMSPC	HEY – DOUG	Ben-my-Chree	1,451
	LIV – DOUG	Manannan	590
Stena	LIV – BEL W IoM	Stena Edda, Stena Embla, Stena Mersey, Stena Horizon, Stena Lagan, Stena Forecaster, Stena Forerunner	1,442
	LIV – BEL E IoM West of CALDER		194
	LIV – BEL E IoM East of CALDER		196
	HEY – BEL	Stena Hibernia, Stena Scotia	1,094
Seatruck	HEY – WAR	Seatruck Performance, Seatruck Precision	1,099
	HEY – DUB	Seatruck Pace, Seatruck Panorama	606
	LIV – DUB	Seatruck Pace, Seatruck Power, Seatruck Panorama, Seatruck Progress	1,627
P&O	LIV – DUB	Mistral, Norbay, Norbank	1,625

Adverse weather routeing

Cargo/tanker routeing

1.6.2.41 Analysis of 2022 vessel tracks during MetOffice named storm events did not identify any repeatable adverse weather routeing behaviours taken by cargo/tanker shipping. During strong southwesterlies, the anchorage to the east of Anglesey was in greater demand by vessels.

Ferries routeing

1.6.2.42 Figure 1.30 shows the non-typical routes taken by ferries, including during adverse weather conditions. Prevailing southwesterlies result in vessels taking a more southwesterly transit in order to both control the course relative to the conditions and take advantage of the lee from the shore. This minimises dangerous motions aboard the vessel and improves passenger comfort.

1.6.2.43 During adverse weather, the IoMSPC take routes to the southwest of their typical route. For the Liverpool to Douglas route, this takes vessels clear of the Morgan Array Area as opposed to their usual passage plan passing through its west boundary. The Heysham to Douglas route is similarly deviated more southwesterly, taking vessels more frequently south of the North Morecambe Gas Field and through the south and east portions of the Morgan Array Area.

1.6.2.44 The Stena route to the west of the Isle of Man between Liverpool and Belfast similarly is deviated further southwest, and therefore outside of the shipping and navigation study area. There is little evidence of significant deviations from existing routes during adverse weather routeing for Stena transits to the east of the Isle of Man, albeit some transits do pass further west than their normal route.

1.6.2.45 During adverse weather, Stena vessels operating between Heysham and Belfast may choose not to pass between Barrow offshore wind farm and West of Duddon Sands offshore wind farm, given the navigable width is 2 nm this route carries greater risk. Vessels may therefore choose to pass to the west of the existing offshore wind farms, where there is greater searoom and more ability to weather route, thereby passing through the Morgan Array Area.

1.6.2.46 The Seatruck adverse weather routes between Heysham to Dublin/Warrenpoint are more evident to the southwest of the Morgan Array Area.

1.6.2.47 Further discussion on adverse routeing of ferries is contained in section 1.8.4.

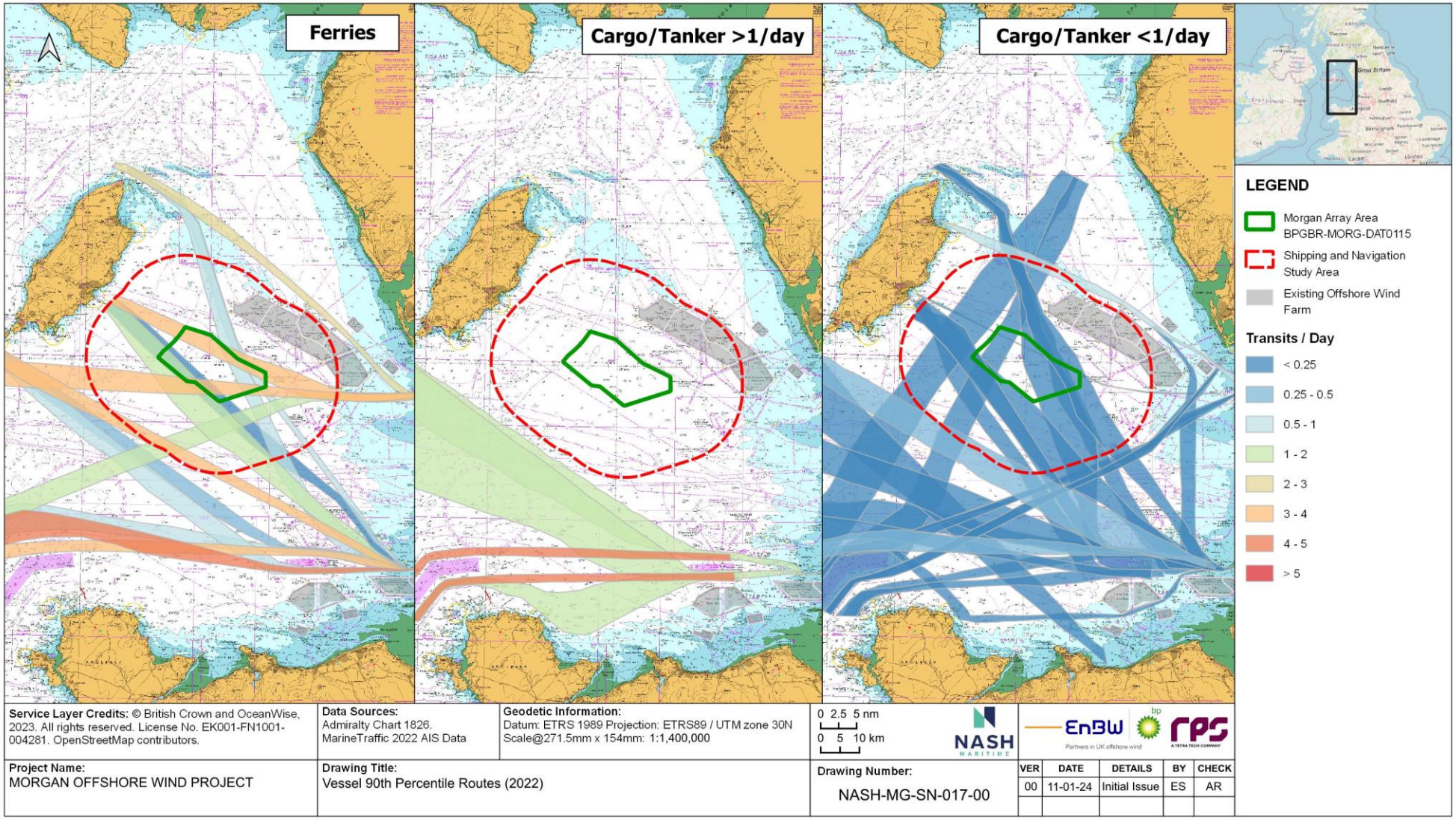

Figure 1.28: Vessel 90th percentile routes (2022).

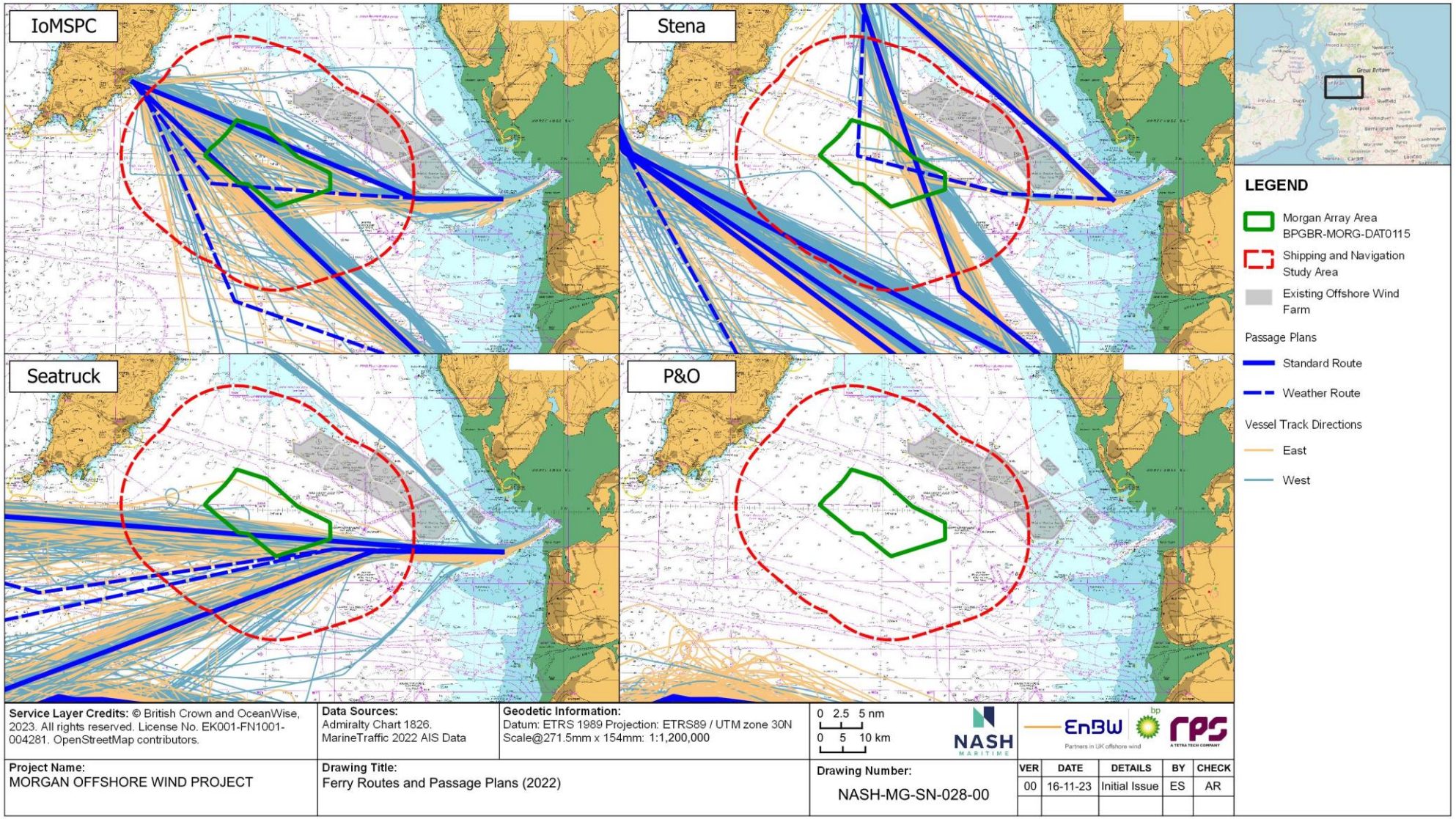

Figure 1.29: Ferry route and passage plans (Source: MarineTraffic, 2022).

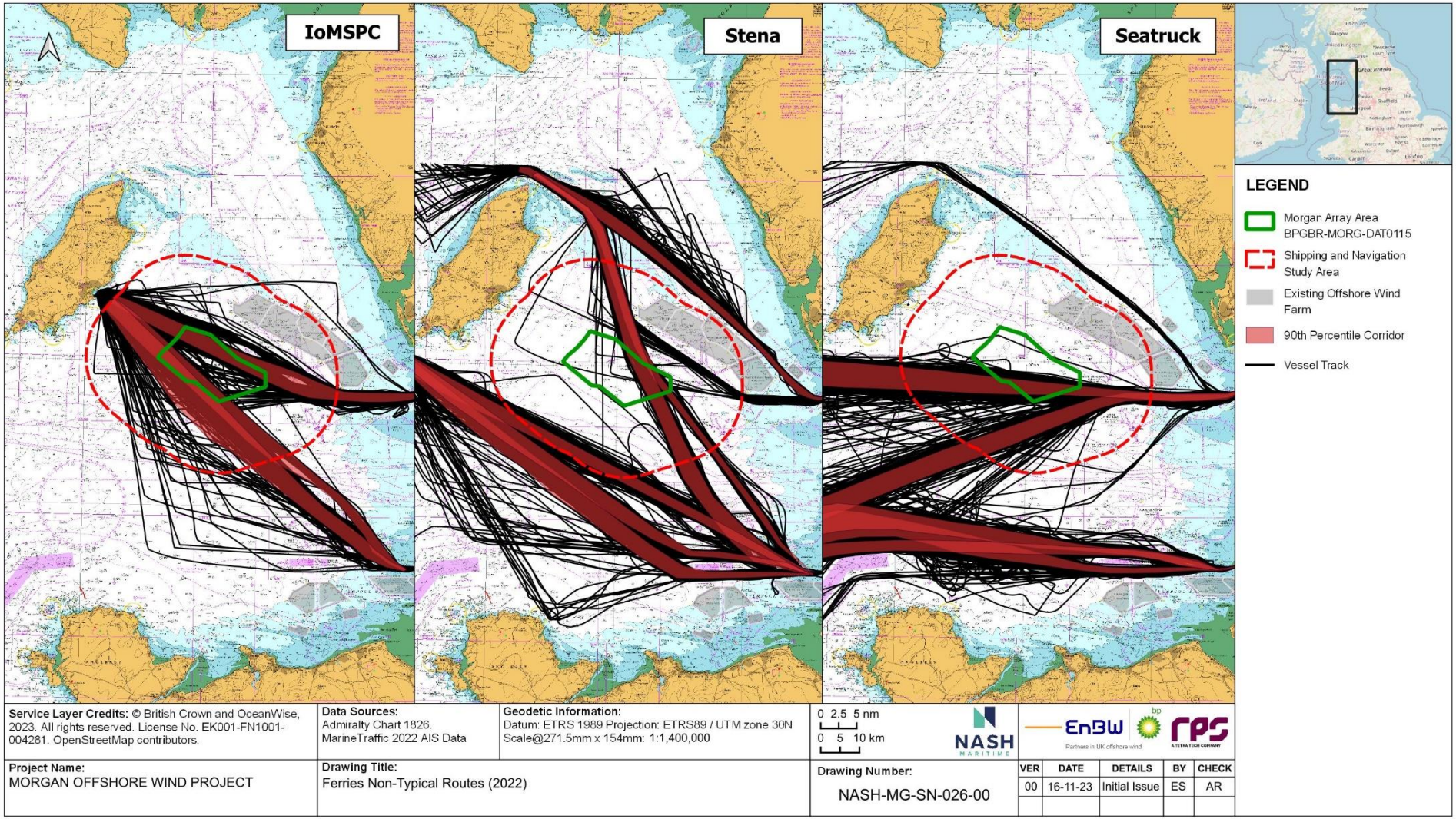

Figure 1.30: Ferries non-typical routes (Source: MarineTraffic, 2022).

Non-transit activity

1.6.2.48 Anchored or vessels not in transit are shown in Figure 1.31. The intensity of anchoring has been identified by extracting AIS positions with speeds of less than 0.5 knots for vessels over 100 m in length. Non-transit tracks have been extracted manually through identifying vessels which are not navigating directly between two locations.

1.6.2.49 The principal anchorages in the east Irish Sea are located adjacent to the Port of Liverpool and Anglesey, where there is better shelter from the prevailing southwesterlies.

1.6.2.50 There is also some anchoring immediately offshore of Douglas Harbour. Very few anchorages are located within the Morgan Array Area.

1.6.2.51 There are extensive non-transit vessel tracks to the southwest of the shipping and navigation study area, such as vessel loitering awaiting orders or available berth. This does not tend to occur within the Morgan Array Area.

1.6.2.52 During consultation with the IoMSPC, it was identified that during strong north westerlies, it was common for vessels to undertake pilotage transfers in the lee of the Isle of Man at Douglas, rather than at Liverpool. A letter from Laxey Towing Company explained that on average 175 ships per year are attended to, although during 2022 this was 76. Through correlation with the 2022 AIS data, Figure 1.32 shows the tracks of those considered to have conducted this behaviour, including six over 200 m in length, 50 tankers, eight cruise ships and 18 cargo ships. It is notable that during significant adverse weather events, these transfers can result in convoys of vessels navigating between Liverpool and Douglas. For example, on the 14 February 2022, three tanker vessels departed Liverpool and a cargo vessel departed the Anglesey anchorage, meeting at Douglas to conduct transfers within the same hour.

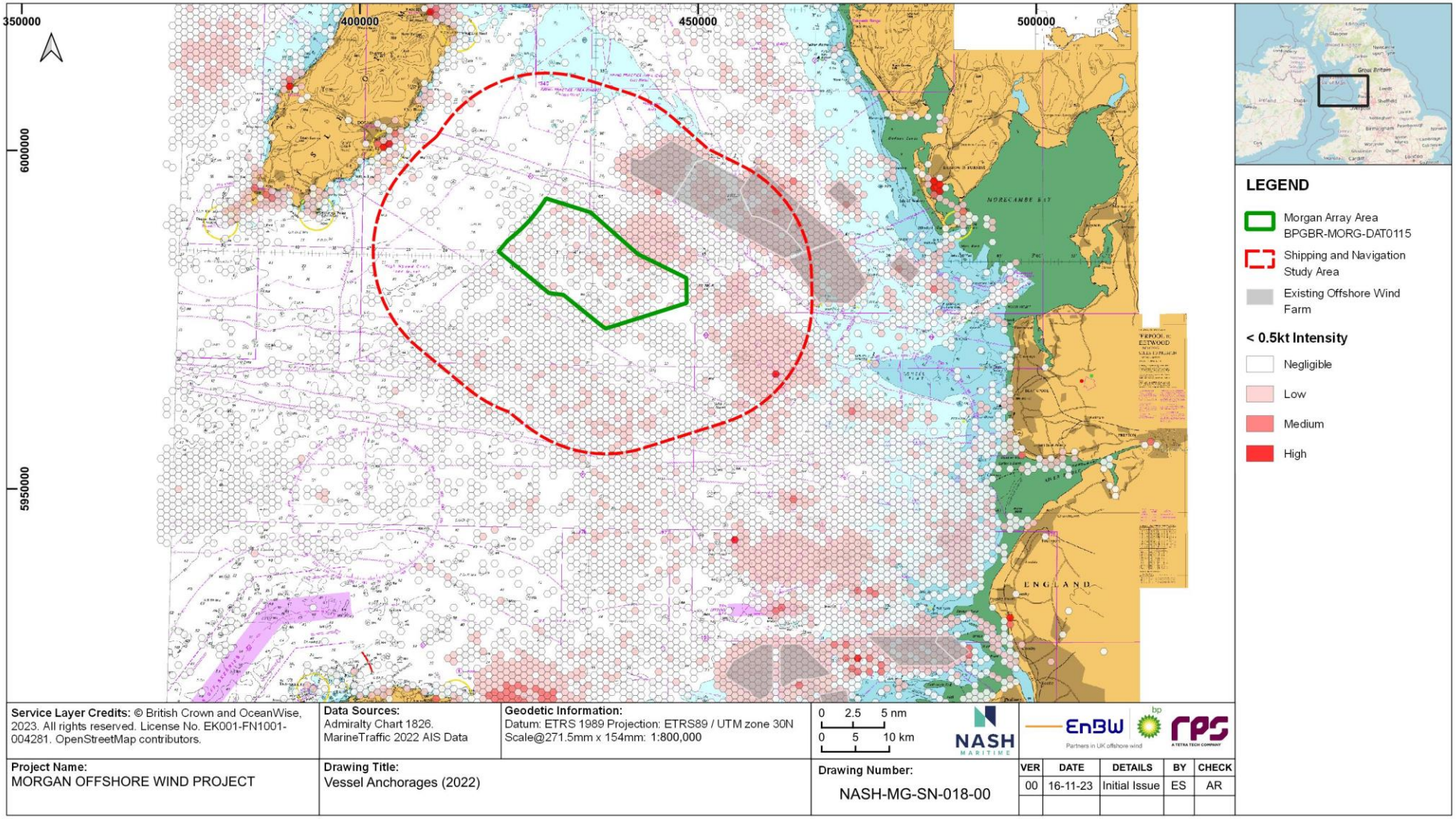

Figure 1.31: Vessel anchorages (Source: MarineTraffic, 2022).

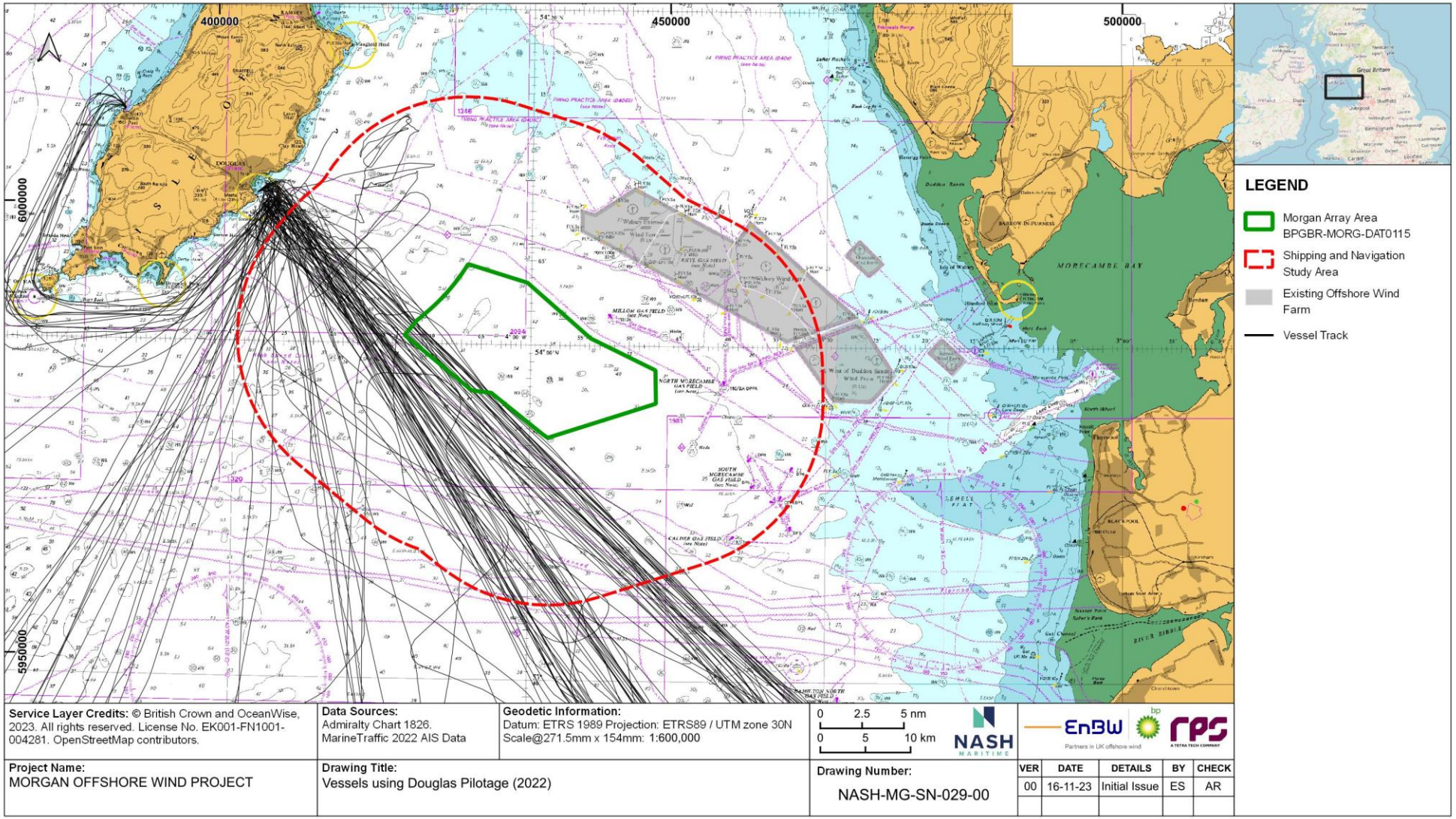

Figure 1.32: Vessels using Douglas pilotage (Source: MarineTraffic, 2022).

1.6.3 Incident analysis

Incidents associated with other offshore wind farms

1.6.3.1 To better understand the types and frequency at which navigational incidents might occur with the proposed Morgan Generation Assets, analysis was conducted of historical accidents associated with UK operational offshore wind farms. Analysis was conducted of the MAIB database (2010 to 2019), RNLI databases (2008 to 2019), MAIB reports and news reports.

1.6.3.2 In total, 69 incidents were identified between 2010 and 2019 (see Table 1.19). This includes six collisions between vessels, 29 allisions of a vessel with a fixed structure, 21 groundings and 13 near misses. Where the information is available, 36% occurred within the array boundary, 43% occurred within ports or harbours and 20% occurred on-transit between the two. 82% of incidents involved project craft (such as CTVs or construction vessels). Few allisions are recorded by a non-project vessel, however, anecdotally there have been more allisions involving fishing and recreational vessels which are not reported in the dataset.

Table 1.19: Incident frequency for offshore wind farm relevant incidents between 2010 to 2019 in UK.

Vessel	Allision	Grounding	Collision	Near miss
Project Vessel	27	21	9	15
Fishing	2	0	0	2
Recreational	0	0	2	4
Other	0	0	1	5

1.6.3.3 From the historical incident record and using an estimate of the number of years of operation for UK offshore wind farms, incident rates per an average project are derived (see Table 1.20) (see Rawson and Brito, 2022). The accident return rates are generally low, between 10 and 45 operational years between incidents, the majority accounted for by project vessels and all have a low consequence, without loss of life or serious pollution. Over a typical 25 to 35 year operational duration it would therefore be expected that a typical project would experience three allisions, two groundings and one collision or near miss. It is notable that there are no recorded accidents involving large commercial shipping and offshore wind farms in the UK.

Table 1.20: Average incident rate per project between 2010 to 2019 in UK.

Incident type	N	Rate per year	Return period
Collision	6	0.022	45.4
Grounding	21	0.077	13.0
Near Miss	13	0.048	20.9
Total Allision	29	0.107	9.4
CTV Allisions	27	0.099	10.1
Fishing Allisions	2	0.007	136.9
Total	69	0.254	3.9

Incidents within shipping and navigation study area

1.6.3.4 Figure 1.33 shows navigational incidents recorded in the shipping and navigation study area between the MAIB (1992 to 2021) and RNLI (2008 to 2022) databases. In processing the incidents, non-navigationally significant incidents have been removed, such as shore based activities (e.g. people cut off by the tide or swimmers in distress). Furthermore, duplicate values recorded in both databases have been removed.

1.6.3.5 Eight incidents were recorded within the Morgan Array Area between 1992 and 2022. These include:

- Two fire/explosions aboard a fishing vessel and passenger vessel
- Three mechanical/damage incidents (such as fouled propellor) aboard fishing and recreational vessels
- A near miss involving a passenger vessel
- Two personal injuries aboard tug and service/fishing vessels.

1.6.3.6 Within the 10 nm shipping and navigation study area 98 incidents were recorded. The majority of which are non-navigationally significant hazards such as 37 mechanical failures and 22 personal injuries. The most notable include:

- Three collisions, typically involving fishing and tug and service vessels
- Three contacts, including with the existing offshore wind farms
- Capsize of the fishing vessel Solway Harvester in January 2000 in bad weather to the northwest of the Morgan Array Area with the loss of seven lives (MAIB Report 1/2006).

1.6.3.7 In addition, near to the shipping and navigation study area, the grounding and loss of the Riverdance occurred on 31 January 2008. A 116 m Seatruck Ferries Ro-Ro sustained a severe list to port in heavy seas off Lune Deep causing the vessel to drift and subsequently run aground off Blackpool. There were no injuries but as salvage attempts failed it was declared a total constructive loss and broken up for removal.

1.6.3.8 For the most recent years of data (2008 to 2022), accident rates per year have been calculated per vessel type within the shipping and navigation study area. These are shown in Table 1.21. These show very low incident rates, particularly for larger commercial vessels.

Table 1.21: MAIB/RNLI incident frequencies within 10 nm of Morgan Array Area per year (2008 to 2022).

Incident Type	Cargo	Fishing	Passenger	Recreational	Tanker	Tug and Service	Total
Collision	0.00	0.07	0.00	0.00	0.00	0.13	0.2
Contact	0.00	0.07	0.00	0.00	0.00	0.13	0.2
Grounding	0.00	0.00	0.00	0.07	0.00	0.00	0.07
Other	0.07	2.4	0.2	2.07	0.00	0.8	5.54
Total	0.07	2.54	0.2	2.14	0.00	1.06	6.01

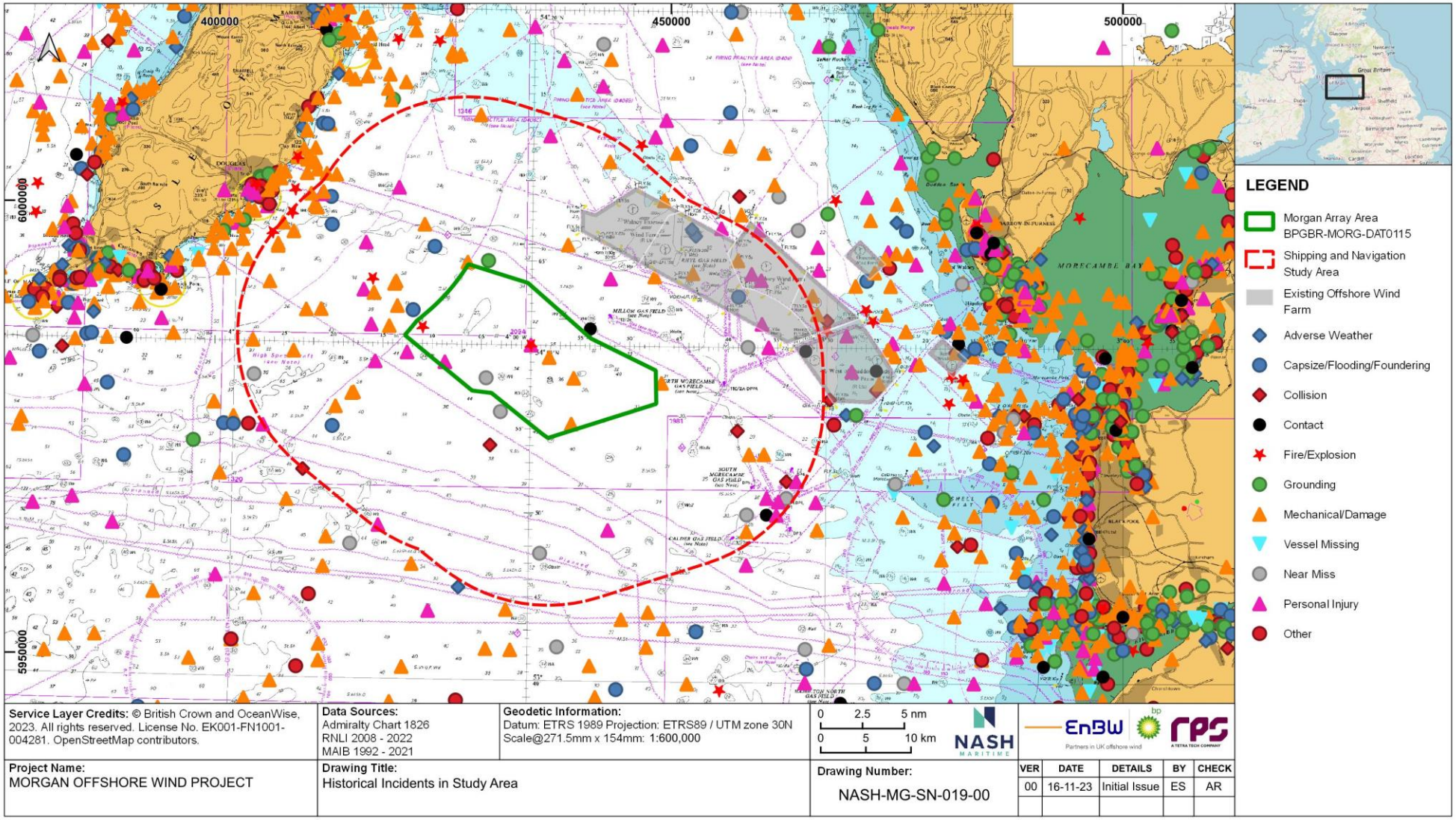

Figure 1.33: Historical incidents in study area (Source: MAIB and RNLI datasets).

Consequences of collision

1.6.3.9 International studies have explored the consequences of collision between large vessels. The European Maritime Safety Agency (2015) collision risk model developed for their FSA based on historical incidents estimated that 33% of struck RoPax vessels would result in water ingress and 14% of those would result in sinking (joint probability of 4.6%). The MSC 85-17-2 FSA gives probabilities of 16% of collisions being a serious casualty of which 50% of struck vessels would flood, of which 22% would sink and a further 50% split between gradual sinking or rapid capsize (joint probability of the latter being 0.8%).

1.6.3.10 Analysis of MAIB data suggests that approximately 1% of collisions would result in loss of life. However, it is likely as most collisions occur within ports and harbours, vessels are navigating at slower speeds than they may do in open sea. Furthermore, there are relatively few incidents in UK waters of significant loss of life following collisions or allisions involving large commercial shipping including ferries. Collisions between commercial vessels, even at speed, often result in only damage and no pollution or injuries (MAIB 7/2018, 28/2015, 3/2017, 15/2013).

1.6.3.11 Several consultees noted that a collision between a large commercial ship including ferry with a small craft such as fishing boat would likely to result in the loss of the small craft and multiple fatalities (7/2007, 10/2015). However, a more likely outcome as per the data is serious damage to the small craft and either no or minor injuries/pollution (MAIB 4/2019, 16/2015, 20/2011, 17/2011).

1.6.3.12 During the hazard workshops, some consultees made reference to the relatively fragile nature of the Manannan high speed ferries structural integrity, having been designed for high-speed transit and therefore with aluminium build. Any collision involving this vessel could therefore have a higher potential consequence.

Consequences of allision

1.6.3.13 Given the infrequency at which vessels have collided with wind turbines, there is some uncertainty to the degree of damage that would result from an allision. The degree of damage depends on the vessel characteristics, the type of allision (at speed or drifting), angle of allision (broadside or head on) and the engineering of the wind turbines. Several academic studies using finite element modelling have sought to explore this, including Biehl and Lehmann (2006), VINDPILOT (2008), Dai *et al*. (2013), Moulas *et al.* (2017) and Presencia and Shafiee (2018).

1.6.3.14 These studies suggest that:

- Ship allisions, even at low speeds, can cause significant damage to wind turbines including deformation and buckling
- Some studies of in-field construction/maintenance vessels (up to 4,000 tons), with allisions at high speeds, did not result in wind turbine collapse
- Modelling of allisions with large commercial ships could result in holing of the vessels hull and cargo release
- Larger vessels (30,000 deadweight tonnage) alliding with the wind turbine might typically result in the tower collapsing away from the vessel
- However, some studies suggested that large commercial ships could result in the tower collapsing towards the vessel, with the damage likely to penetrate the deck.

1.6.3.15 To better understand the potential consequences of ship allision with wind turbines, Table 1.22 presents some case studies of past incidents and the resulting impacts to people, property and the environment. These have been collated from accident reports or news articles. It can be concluded that where incidents have occurred, they have been at low speed, involve in-field project vessels and typically result in only minor damage or injuries. However, it is feasible that a serious allision with an offshore wind farm might result in wind turbine collapse, holing and eventual flooding of a vessel and potential loss of life.

Table 1.22: Case studies of allision.

Date	Site	Vessel	Description
25 April 2023	Gode Wind (Germany)	Petra L – 74 m, 1,162 Gross Tonnes (GT) General Cargo	Vessel missed a turn and collided with a wind turbine causing significant damage. There were no injuries.
31 January 2022	Hollandse Kust Zuid	Julietta D – 190 m 24,196 GT Bulk Carrier	Disabled vessel in a storm struck the foundation of a substation jacket that result in minor damage to both the vessel and jacket. There were no injuries or pollution.
23 April 2020	Borkrum Riffgrund	Njord Forseti – 24 m 137 GT	Vessel skipper not keeping proper lookout collided with wind turbine at speed. Resulted in three injuries (one seriously) and significant flooding of CTV through 0.5 m crack in bow.
10 April 2018	AOWF (Baltic)	Vos Stone – 80 m 4,956 GT Offshore Supply Vessel	Construction vessel casting off from a wind turbine lost control and was forced against the wind turbine due to adverse weather. Resulted in three minor injuries, dry dock to the vessel and minor damage to platform. There was no pollution.
14 August 2014	Walney	OMS Pollux – Stand by Safety Vessel	Whilst conducting inspection work, the vessel collided with a wind turbine that resulted in no injuries, and minor leaking of marine gas.
21 November 2012	Sheringham Shoal	Island Panther – 17 m 22 GT CTV	CTV made heavy contact with unlit transition piece. Resulted in five injuries and damage to the vessels bow.
06 October 2006	Scroby Sands	Jack up	Large jackup barge collided with a wind turbine resulting in damage to a wind turbine blade

1.7 Future case traffic profile

1.7.1 Introduction

1.7.1.1 This section presents the predicted future case traffic profile within the shipping and navigation study area for cargo/tanker, ferries, oil and gas, fishing and recreational vessel traffic.

1.7.2 Cargo/tanker traffic

1.7.2.1 DfT data on UK port trade is presented in Figure 1.34 and Figure 1.35 and shows a decline in port freight in 2020 at both the national and port level, respectively. The DfT report that UK ports were affected by measures to prevent and reduce the global spread of COVID-19 throughout 2020, as well as the UK exiting the European Union at the end of 2020. The DfT report a 9% decrease in tonnage handled by UK ports in 2020 compared to 2019. However, given the lifting of COVID-19 related restrictions, it is anticipated that port freight will continue to return to pre-pandemic levels. As of 2022, freight tonnage remained below pre-pandemic levels.

1.7.2.2 Port freight activity at the Port of Liverpool steadily increased between 2014 and 2019, before undergoing a significant reduction in 2020, likely due to pandemic related restrictions. It should be noted that an increase in tonnage does not necessarily correlate with an increase in vessels. New build vessels are often larger, capable of carrying more cargo, and ports such as Liverpool have invested in shoreside infrastructure to better handle these larger vessels.

1.7.2.3 Figure 1.36 shows projected freight traffic into UK major ports, produced by the DfT in 2019. Overall, port traffic is forecast to remain relatively flat in the short term but grow in the long term, with tonnage 39% higher in 2050 compared to 2016. This equates to approximately a 15% increase in national freight tonnage by 2035.

1.7.2.4 The long-term growth in port traffic is driven by increases in unitised freight traffic, which compensates for decreases in other freight in the short term. Liquid bulk traffic (principally crude oil) has the largest forecasted decreases, continuing a historical trend. Similarly, general cargo is forecast to decrease, in line with the historic decreasing trend, which is likely driven by increased containerisation of goods. Dry bulk traffic is forecast to have a relatively large decrease in the short term, driven primarily by demand for coal being projected to fall. In the long term, dry bulk traffic is forecast to increase, with other dry bulk, the largest category, continuing to increase as it has done historically (principally biomass). Motor vehicles, Twenty Foot Equivalent Units forecast for Load-on/Load-off and the unit forecast for Roll-on/Roll-off are all forecast to grow strongly, driven by economic growth.

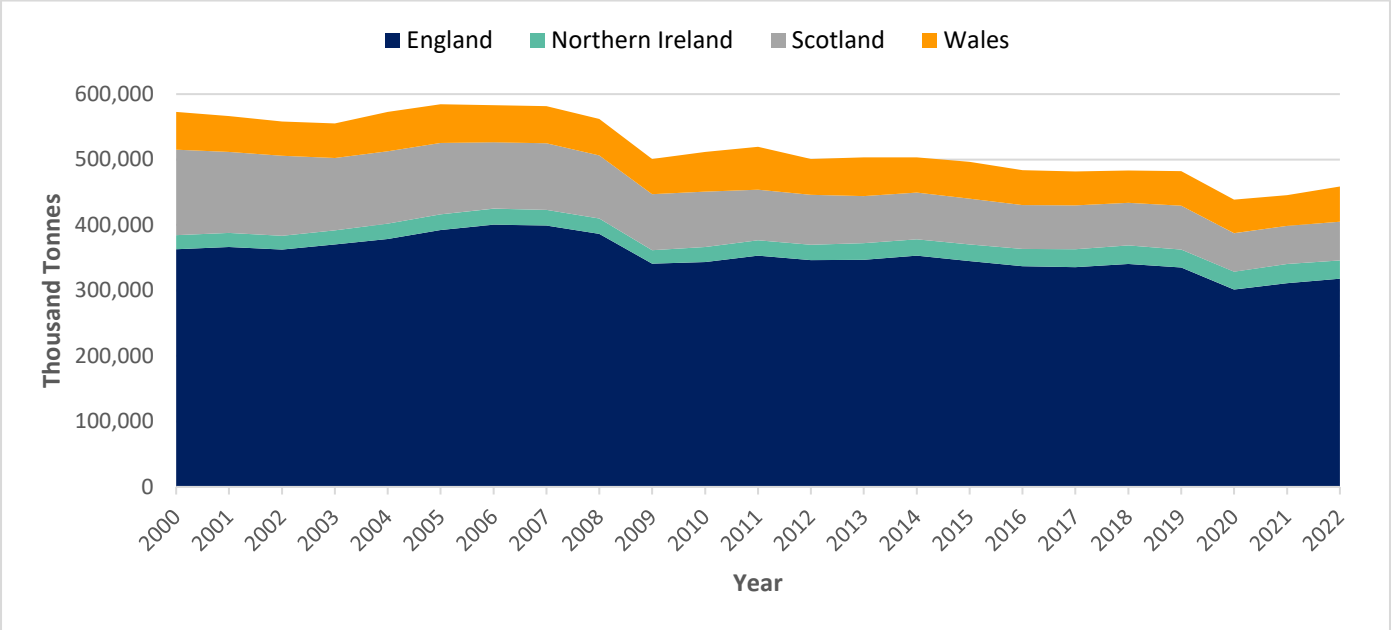

Figure 1.34: UK major port freight.

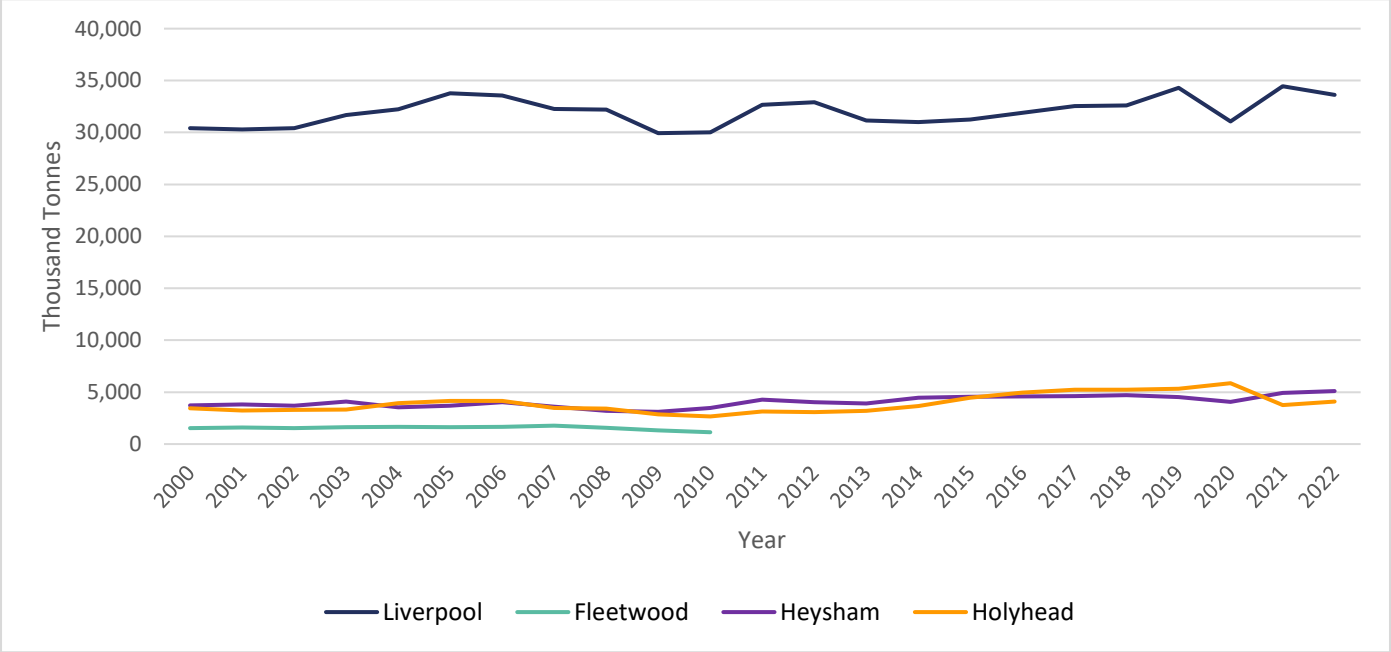

Figure 1.35: Port freight for UK major ports (Fleetwood ferry service closed at the end of 2010).

1.7.2.5 It is also noted that the Douglas Harbour Master Plan (Isle of Man Government, 2017) considers the potential for development of a day-call cruise ship berth, which might increase the number of cruise ship calls to the Isle of Man.

1.7.2.6 Other future changes that might occur by 2035 could include the increased operation of autonomous vessels within UK waters. During the course of the NRA, autonomous or remote-controlled survey vessels were active within the Morgan Array Area and no incidents were recorded. Regulatory bodies have insisted that any introduction of autonomous vessels into UK waters would have equivalent safety standards as conventional crewed vessels.

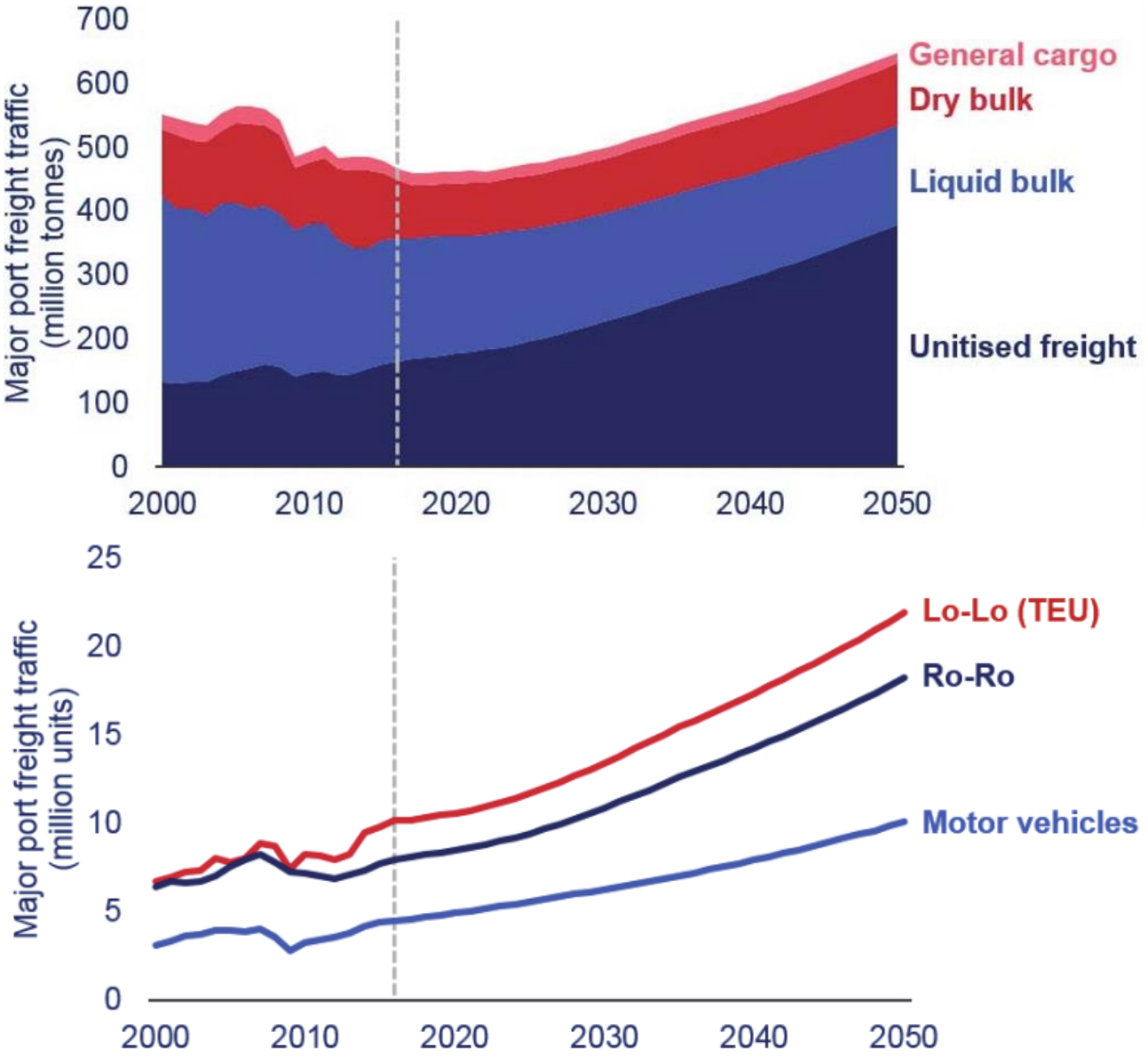

Figure 1.36: UK port freight projections (DfT, 2019).

1.7.3 Ferries

1.7.3.1 Freight and passenger ferries account for a large proportion of vessel movements within the shipping and navigation study area. These routes are subject to change both in terms of schedule, vessels and the addition of new routes in order to meet market demand. For example, between the 2019 AIS analysis and the 2022 NRA, Stena replaced several of their ferries with the new E-flex class. During consultation, each operator was asked on any potential future changes, noting that these were subject to change.

1.7.3.2 Seatruck have showed significant growth in demand, in 2018, Seatruck reported a 30% increase in volumes since 2015, with a 10% increase in 2017 alone[1]. The increase in unaccompanied trailer volumes between 2007 and 2018 was reportedly

[1] https://www.seatruckferries.com/news/seatruck-surge-continues.

250% (Seatruck Ferries, 2018). A €100 million investment by Seatruck in 2018 was announced to increase capacity on the Warrenpoint to Heysham route by 30%.

1.7.3.3 Both of the IoMSPC vessels are twenty years old and will require replacement before 2035. In 2023, the IoMSPC new ferry Manxman started operating between Heysham and Douglas and it is anticipated that this vessel will also start operating between Liverpool and Douglas all year round. Consultation with IoMSPC determined that it is reasonable to assume that the Ben-my-Chree and Manxman will have similar handling and endurance capabilities. The Manannan is due for replacement before 31 December 2026 (Isle of Man Government, 2019) and therefore prior to construction of the Morgan Generation Assets. This may be replaced by either a new fast craft or a fast conventional ferry.

1.7.3.4 Trends for passenger numbers are shown in Figure 1.37 and show a gradual increase in passenger numbers across most routes (noting the exception of those figures impacted by COVID-19). Liverpool-Dublin has had a steady decline, meanwhile Liverpool-Belfast has experienced an increase, this is especially the case in the years since the impact of COVID-19 during which time Stena Line replaced ferries with the new E-flex class. Notably, the Liverpool-Belfast passenger number were the least affected of these routes by COVID-19. Predicting how this trend may influence vessel schedules and routes is uncertain. In the absence of definitive information, an assumption is therefore made that vessel routes and schedules will be similar in 2035 to the existing baseline but with a likely increase in services.

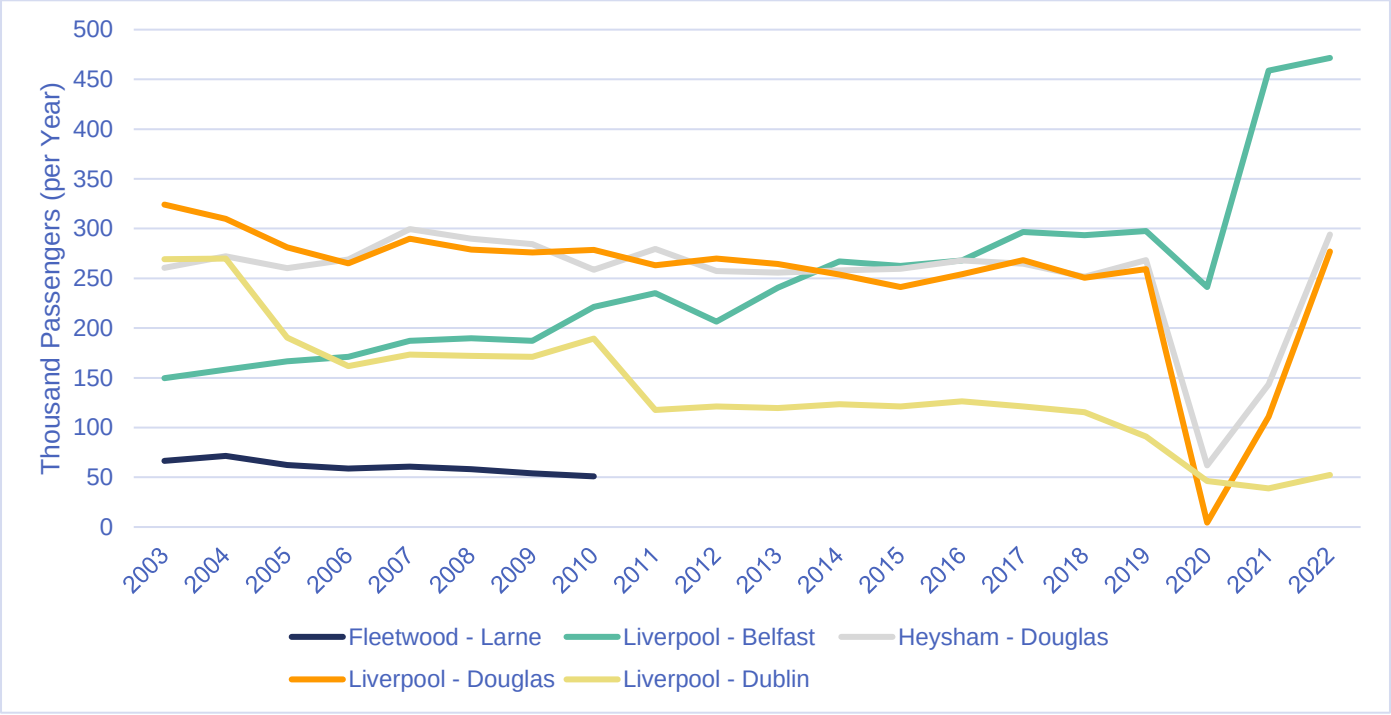

Figure 1.37: Passenger numbers (Fleetwood ferry service closed at the end of 2010). 2020 figures heavily impacted by COVID-19.

1.7.4 Oil and gas

1.7.4.1 Irish Sea oil and gas platforms are reaching end of life and it is understood that some platforms may be decommissioned. Others may be repurposed for Carbon Capture and Storage. Details of which platforms and when have not been fully ascertained by

the Applicant but some details have been provided in consultee Section 42 responses. It is assumed that:

- Millom West (Harbour Energy) is undergoing decommissioning with the platform anticipated to be removed by 2030
- The South Morecambe gas field platforms are expected to cease production in 2027 (+/-2 years) (Spirit Energy, 2019). The field includes the platforms DP3, DP4, DP6, DP8 and CPP1 and associated cable, pipeline and umbilical infrastructure. It is understood that DP3 and DP4 were removed in 2021 and decommissioning of CA1 is also scheduled to complete in 2027 onwards.

1.7.4.2 It is noted that the International Guidance for Offshore Marine Operations section 8.15 recommends that courses are planned so that, where practical, the vessel passes at the distance of at least 1 nm from each facility. However, the familiarity and manoeuvrability of offshore supply ships or emergency rescue and recovery vessels may facilitate navigation within large offshore wind farms. This assessment has assumed that there is sufficient space, in suitable conditions, for in-field navigation to take place.

1.7.5 Fishing activity

1.7.5.1 Fishing within the Irish Sea is important for both the UK, Isle of Man, Irish and Belgium fisheries. There is limited information available for future fishing vessel activity on which reliable assumptions can be made. (Volume 2, Chapter 6: Commercial fisheries of the Environmental Statement).

1.7.5.2 Within the shipping and navigation study area, UK fisheries primarily target non-quota shellfish species. Fishing fleets are unlikely to be impacted by quota transfers following the UK's withdrawal from the European Union. Market changes have the potential to impact fishing activity in the shipping and navigation study area. However, fishing activity in the area is not anticipated to change significantly, with both local and foreign vessels continuing fishing activity in the area.

1.7.6 Recreational activity

1.7.6.1 The RYA Water Sports Participation Survey conducted in 2019 found that the proportion of adults participating in recreational boating activities has fluctuated between 6% and 8% between 2002 and 2018 (RYA, 2019; 2021). Between 2008 and 2018, the proportion participating in yacht cruising, motor boating and power boating have remained consistent at 0.8%, 1.1% and 0.7% respectively. More recent data published in the 2021 Water Sports Participation Survey is significantly influenced by COVID-19 with a significant variation between 2021 and 2022 due to national/local lockdowns.

1.7.6.2 Therefore, it is unlikely that there will be a significant change in the number of recreational users due to macro trends.

1.7.7 Project vessel movements

1.7.7.1 Details of vessel numbers associated with the Morgan Generation Assets are described in section 1.4. The operations and maintenance base for Morgan Generation Assets has not yet been determined, however, the MDS assumes that operations and maintenance vessel movements are up to 719 per year (approximately two per day).

1.7.7.2 Major or significant maintenance will be managed in line with developer operating procedures and the risk control measures as documented in section 1.4.8.

1.8 Impact assessment

1.8.1 Impact identification

1.8.1.1 Following consultation with stakeholders, analysis of data and a review of guidance, 12 potential impacts of the Morgan Generation Assets were identified on shipping and navigation as documented in Table 1.23.

Table 1.23: Potential impact identification.

ID	Potential Impact	Description
1	Impact to recognised sea lanes essential to international navigation	The Morgan Generation Assets could impede access into major international sea lanes.
2	Impact to ferry vessel routeing	The Morgan Generation Assets could necessitate deviations to ferry routeing increasing distances resulting in additional cost and time for the passage. This includes in typical conditions and adverse weather.
3	Impact to cargo/tanker routeing	The Morgan Generation Assets could adversely impact routeing of cargo/tanker vessels, making services unviable. This includes in typical conditions and adverse weather.
4	Impact to small craft navigation and safety	The Morgan Generation Assets could interfere with the activities and safety of small craft navigation such as cruising.
5	Impact on compliance with guidance and best practice	The Morgan Generation Assets could result in routes between infrastructure that fail to meet guidance or industry best practice with respect to available sea room.
6	Impact on vessel encounters and collision avoidance	The Morgan Generation Assets could result in greater frequency at which vessels meet one another.
7	Impact on modelled risk of collision and allision	The presence of the Morgan Generation Assets could increase the risk of collision between navigating vessels or allision with infrastructure, such as through the creation of choke points, reduced sea room or increased vessel movements.
8	Impact to vessel emergency response	The Morgan Generation Assets could adversely impact a vessels ability to respond to an emergency.
9	Impact to search and rescue	The Morgan Generation Assets design could inhibit SAR access for vessels or aircraft during an emergency.
10	Impact to oil and gas activities and safety	The Morgan Generation Assets could disrupt or impede oil and gas activities or safety of installations or vessels.
11	Impact on communications, radar and positioning systems	The Morgan Generation Assets infrastructure could interfere with shipboard or land-based equipment essential to communications or positioning.
12	Impact on risk of snagging	Subsurface infrastructure could pose a risk of snagging of fishing gear or ship anchors.

1.8.1.2 Furthermore, three other impacts were identified by stakeholders during PEIR consultation, which are not considered within the scope of the NRA as described below.

1.8.1.3 Socio-economic impacts due to disruption of ferry or other commercial services. Several stakeholders raised concerns on how cancellation or disruption to services as a result of increased steaming time could impact the Isle of Man through the transport of goods in a 'just-in-time' economy, medical supplies and tourists or business travellers amongst others. The socio-economics assessment and approach for considering potential impacts of the Morgan Generation Assets on the Isle of Man is set out within Volume 2, Chapter 13: Socio-economics of the Environmental Statement.

1.8.1.4 The presence of the Morgan Generation Assets increases the travel distance of vessels which increases their fuel consumption and emissions of greenhouse gases. Measures such as the Energy Efficiency Existing ship Index introduced by the IMO could therefore be impacted. The climate change assessment and approach for considering potential impacts of the Morgan Generation Assets is set out within Volume 2, Chapter 12: Climate change of the Environmental Statement.

1.8.1.5 The presence of the Morgan Generation Assets reduces the opportunities for operators to develop new routes where market conditions allow, by increasing the transit distance and makes them less competitive. The socio-economics assessment and approach for considering potential impacts of the Morgan Generation Assets on commercial operators is set out within Volume 2, Chapter 13: Socio-economics of the Environmental Statement.

1.8.2 Impact to recognised sea lanes essential to international navigation

1.8.2.1 As referenced in section 1.2.1, UNCLOS Article 60 and NPS EN-3 recognise that offshore wind farms should not interfere with the use of recognised sea lanes essential to international navigation.

1.8.2.2 The TSS Liverpool Bay and TSS Off Skerries are charted IMO routeing measures and provide the only route for large ships into Liverpool so would meet the definitions as sea lanes essential to international navigation. The Morgan Array Area is located more than 20 nm from the TSSs and therefore no impact is identified.

1.8.2.3 During consultation, several stakeholders asserted that historic routes between any two ports are necessarily '*recognised sea lanes*' and therefore could not be impacted. A review of UNCLOS Article 22 determines that: '*4. The coastal State shall clearly indicate such sea lanes and TSS on charts to which due publicity shall be given*'. Therefore, the onus is on the MCA to put forward a proposed sea lane to IMO who would formally designate it. Given that this has not occurred, and no such routes are indicated on charts, Article 60 and NPS EN-3 Paragraph 2.8.326 and Paragraph 2.8.327. would not apply. Furthermore, given that alternative routes exist around the Morgan Array Area, albeit at a greater transit distance (see section 1.8.3 and 1.8.4), they do not provide unique access and so cannot be regarded as '*essential*'. These principals were set out in legal advice concerning the Thanet Extension Offshore Wind Farm and were reaffirmed by the Examining Authority in their Recommendation Report (Thanet Extension, 2019).

1.8.3 Impact to ferry vessel routeing

1.8.3.1 Offshore wind farms can impact on vessel routeing by creating an obstacle in otherwise navigable waters that requires a deviation of their route. For regular runners such as ferries, this has the potential to result in an increase in costs or make schedules unviable. Furthermore, impacts on routeing may result in increased risks of collision or allision, which are considered elsewhere in section 1.8. During

consultation, ferry operators raised several existing operational constraints which should be considered in conjunction with the increased distance to clear an offshore wind farm:

- Schedules: Existing schedules are developed to maintain consistent arrival and departure times per 24-hour period. This may not be achievable with increased transit time on some routes
- Increased fuel: Increased transit distance necessitates an increase in fuel burn which has a direct additional cost to operators. Furthermore, this would increase the environmental impact of their operations through increased emissions
- Hours of Rest: The Maritime Labour Convention requires 10 hours of rest in any 24-hour period, in a maximum of two periods, of which at least six hours must be uninterrupted. Existing schedules enable this requirement to be met, but increased transit duration could make compliance with the convention impossible without compromising schedules or hiring additional crew
- Turn-around times: Turn around times within ports are constrained to enable safe loading and unloading. During busy periods, it may not be possible to reduce this duration to make up lost time due to increased transit duration
- Berth/port constraints are also an additional constraint. Several ports have clear operational constraints where delays might result in missing crucial arrival windows:
  - Heysham – Has a tight entrance, which in combination with strong tides and wind conditions, makes berthing challenging. The harbour is also dredged but occasionally arrival at spring low tides is not achievable with sufficient UKC, requiring amendments to timetables
  - Douglas – Berthing in certain wind conditions is challenging and may result in cancellations. The harbour is also dredged but occasionally arrival at spring low tides is not achievable with sufficient UKC, requiring amendments to timetables
  - Warrenpoint – Is tidally constrained
  - Belfast – There is a limitation on berths given the number of vessels operating on this route
  - Liverpool – Constrained by lock timings and other vessel movements
  - Dublin – Relocation of freight terminals further from the seaward entrance would increase transit duration.

Ferry routeing in normal conditions

1.8.3.2 Passenger or freight ferry services have been identified operating within the shipping and navigation study area (see section 1.6.2). Where these routes intersect the Morgan Array Area, deviations would therefore be necessary. It is recognised that previous offshore wind projects in the Irish Sea (Barrow, Ormonde, Walney, West of Duddon Sands) have each impacted upon ferry routeing since 2004 (Anatec, 2016). Operators have necessarily had to adjust their passage plans to accommodate previous projects and the nature of these projects has not made any existing routes unviable.

1.8.3.3 During navigation simulations, it was demonstrated that the waters around the Morgan Array Area could be safely navigated in typical weather conditions and in the absence

of other traffic (Appendix E). However, it was recognised that additional transit time was necessary as a result of deviated passage plans.

1.8.3.4 Figure 1.38 shows the anticipated outline routes that operators would take with the Morgan Array Area in place. These were developed following a review of the current passage plans provided by each operator and a review of the potential impacts of the Morgan Array Area upon them. Each revised passage plan was developed by the NASH project team, including Master Mariners, and incorporate existing decision-making principles (such as passing at least 1.5 nm from a wind turbine) that were obtained during consultation with operators and the navigation simulation sessions.

1.8.3.5 Based on these anticipated routes, Table 1.24 summarises the additional transit distance and time as a result of passing clear of the Morgan Array Area. This is based on average vessel speed taken from the 2022 AIS data. Three of the four Irish Sea ferry operators have routes which intersect or pass immediately adjacent to the Morgan Array Area, with only the P&O and Seatruck Liverpool to Dublin routes passing outside of the shipping and navigation study area.

1.8.3.6 The IoMSPC operate a route between Heysham and Douglas which directly intersects the north corner of the Morgan Array Area. Vessels departing Heysham would transit to the west, passing approximately 1.2 nm from the southwest of West of Duddon Sands Offshore Wind Farm (though noting that they often pass closer), before turning northwesterly and passing either side of the North Morecambe Gas Field and then typically to the west of the Millom Gas Field. A revised passage plan was developed that passes between the Morgan Array Area and the Walney offshore wind farm. These vessels would likely turn at the same waypoint at West of Duddon Sands, before taking a central route between the Morgan Array Area and Walney offshore wind farm (noting that the Millom West Platform will have been decommissioned prior to the completion of construction of the Morgan Array Area), turning west-northwest towards Douglas once clear of the north tip of the Morgan Array Area.

1.8.3.7 Given this passage plan, vessels on the IoMSPC route between Heysham and Douglas would necessarily transit an additional 0.5 nm and 1.6 minutes. The advertised service is 3 hours 45 minutes, with AIS analysis suggesting that the average crossing duration is 175 minutes. There is some variation in transit time but 80% of 2022 trips were within 20 minutes of the average. Therefore, given the crossing duration of several hours, a natural variation in crossing of up to 20 minutes and natural variation in turnaround times within port, a less than two minute deviation is not considered to render this service unviable but could increase operational pressures and fuel consumption.

1.8.3.8 The IoMSPC Liverpool to Douglas route also directly intersects the Morgan Array Area, but through the most western corner. A revised passage plan was developed that passes just over 1.5 nm to the west of the Morgan Array Area. Vessels departing Liverpool would likely do so in a similar fashion, altering course slightly to port once clear of the Hamilton North Gas Field to provide sufficient clearance from the Morgan Array Area.

1.8.3.9 Given this passage plan, vessels on the IoMSPC route between Liverpool and Douglas would necessarily transit an additional 0.3 nm and 0.4 minutes. The advertised service is 2 hours 45 minutes, with AIS analysis suggesting that the average crossing duration is 135 minutes. There is some variation in transit time but nearly 90% of 2022 trips were within 15 minutes of the average. Therefore, given the crossing duration of several hours, a natural variation in crossing of up to 15 minutes and natural variation in turnaround times, less than an additional 30 seconds of transit time is not considered

to render this service unviable but could increase operational pressures and fuel consumption.

1.8.3.10 Stena Line operate a route between Liverpool and Belfast which has numerous options for departing Liverpool and passing either side of the Isle of Man. The route that passes to the east of the Isle of Man intersects the Morgan Array Area and all routes that pass to the west of the Isle of Man are not impacted. The existing passage plans for the east of Isle of Man route show two routes, namely to the west and east of the Calder Gas Field. The route to the west with the Morgan Array Area in place would require vessels to turn more northerly once clearing the Calder Gas Field, maintaining safe distance to the Morgan Array Area, before transiting between the Morgan Array Area and Walney offshore wind farm. The route to the east of Calder Gas Field is largely taken by northbound vessels, having left the approaches to Liverpool early to take a shorter route through the oil and gas fields. This route would require deviation towards the North Morecambe Gas Field before also transiting through the centre of the route between the Morgan Array Area and Walney offshore wind farm, and then turning north to northwest toward the Isle of Man.

1.8.3.11 Given this passage plan, passing east of Calder Gas Field, vessels on the Stena route between Liverpool and Belfast to the east of the Isle of Man would necessarily transit a further 0.7 nm, and therefore an additional 2.3 minutes. If vessels were to choose to pass west of the Calder Gas Field and then east of the Morgan Array Area, this would necessitate an additional 2.5 nm, and therefore an additional 7.9 minutes. The advertised service is eight hours, with AIS analysis suggesting that the average crossing duration (limited to the extent of the east Irish Sea) is 260 minutes. There is some variation in transit time but 72% of 2022 trips were within 20 minutes of the average. Therefore, given the crossing duration of several hours, a natural variation in crossing of up to 20 minutes and natural variation in turnaround times, less than eight minutes additional transit time is not considered to render this service unviable but could increase operational pressures and fuel consumption.

1.8.3.12 The Seatruck route between Heysham and Warrenpoint would necessitate a minor deviation to pass to the south of the Morgan Array Area. Vessels would depart Heysham as they currently do, passing north of the South Morecambe Gas Field before making a small alteration of course southwest to pass clear of the Morgan Array Area, before turning northwest towards Carlingford Lough.

1.8.3.13 Given this passage plan, vessels on the Seatruck route between Heysham and Warrenpoint which would necessarily transit an additional 0.5 nm and require an additional 2.0 minutes of transit time. The advertised service is eight hours, with AIS analysis suggesting that the average crossing duration (limited to the extent of the east Irish Sea) is 264 minutes. There is a large variation in transit time with only 55% of 2022 trips within 25 minutes of the average. Therefore, given the crossing duration of several hours, a natural variation in crossing of up to 25 minutes and natural variation in turnaround times, an additional two minutes of transit time is not considered to render these services unviable but could increase operational pressures and fuel consumption.

1.8.3.14 All other ferry routes pass more than 1.5 nm clear of the Morgan Array Area in typical conditions.

Table 1.24: Impact on ferry routeing.

Parameter	IoMSPC HEY-DOUG	IoMSPC LIV-DOUG	Stena LIV-BEL-E	Seatruck HEY-WAR
Example Vessels (2019 to 2022)	Ben-my-Chree	Manannan	Stena Edda, Stena Embla, Stena Mersey, Stena Horizon, Stena Lagan, Stena Forecaster, Stena Forerunner	Seatruck Precision, Seatruck Performance
Approximate Annual Crossings (2022)	1,451	593	390	1,099
Baseline Distance (nm)	46.8	56.9	113.9 E of Calder 114.9 W of Calder	100.2
Baseline Time (Minutes)	225	165	480	480
Service Speed (Knots)	17.2	28.8	18.7	15.4
Total Distance due to Morgan Array Area (nm)	47.3 (+0.5 nm)	57.1 (+0.3 nm)	114.6 E of Calder (0.7 nm) 117.4 W of Calder (+2.5 nm)	100.8 (+0.6 nm)
Additional Time with Morgan Generation Assets (Minutes)	+1.7	+0.4	+2.3 E of Calder +7.9 W of Calder	+2.0

Ferry routeing in adverse weather

1.8.3.15 Where significant adverse weather is encountered, ferries take less direct routes to take advantage of lees from land masses, avoiding dangerous sea states or minimising the motions onboard. The navigation simulations demonstrated that without being able to adequately weather route, excessive roll was experienced that posed a hazard to the vessel and made controlling the vessel more challenging (Appendix E).

1.8.3.16 Figure 1.39 shows anticipated adverse weather routeing with and without the Morgan Array Area in situ. The 2022 AIS data has been used to estimate the impact on vessel routes in adverse weather (Table 1.25). Each revised passage plan was developed by the project team, including Master Mariners, and incorporates existing decision-making principles and passage plans provided by operators (such as passing at least 1.5 nm from a wind turbine) that were obtained during consultation with operators and the navigation simulation sessions.

1.8.3.17 The IoMSPC Heysham to Douglas route has been operated by the Ben-my-Chree and more recently the Manxman. These vessels are constrained in heavy seas on the beam, which can cause large roll motions. During navigation simulations it was determined that with significant wave heights of approximately 3 m on the beam, the roll could exceed 10 degrees and occasionally 30-degree motions, which would be unsafe for passengers and cargo. Analysis of 2022 AIS data, confirmed through navigation simulations, showed that Masters deviated their vessels from their usual course towards the southwest to minimise roll. This accounted for approximately 10 to 23 minutes of additional journey time per crossing, albeit with significant variation in crossing duration. Given that the presence of the Morgan Array Area prevents this

action being taken when passing between it and the Walney offshore wind farm, the navigation simulations concluded that in conditions greater than approximately 2.5 m Hs (equating to monthly summer and fortnightly winter conditions) the Master would choose to pass south of the Morgan Array Area rather than between Morgan Array Area and Walney offshore wind farm to provide greater optionality for routeing in adverse weather.

1.8.3.18 A revised passage plan was developed for the Heysham to Douglas route which passes south of the Morgan Array Area, continuing to the west before turning north up to Douglas on a more stable angle. This would necessitate an additional 5.7 nm of steaming and a further 21.5 minutes of transit time. This would be in addition to existing delays of approximately between 10 and 23 minutes to total delay of at least 31.5 minutes per crossing.

1.8.3.19 The Stena Line ferries are large vessels with good seakeeping abilities but can be susceptible to excessive roll motions with seas in excess of 3 m Hs on the beam (occurring approximately monthly on average during winter months), posing a risk to passengers and crew. The Stena Line Liverpool to Belfast route have multiple adverse weather options, predominately departing Liverpool to the west using the lee of the Welsh coast and Anglesey before turning north towards Belfast. An alternative route is to the east of the Isle of Man which intersects the Morgan Array Area. Analysis of historical AIS data showed a negligible deviation in these routes from their typical path and a negligible change in journey durations. In adverse weather, it was assumed that Masters would choose to pass west of the Morgan Array Area should they prefer to pass east of the Isle of Man.

1.8.3.20 A revised passage plan was developed for the Liverpool to Belfast route which passes west of the Morgan Array Area, and continues towards the Isle of Man to take advantage of any lee in the conditions, before turning northeast to pass east of the Isle of Man. This would necessitate an additional 19.9 nm of steaming (within the Irish Sea) and a further 68 minutes of transit time. Given that this route is more than 15 nm longer than their alternative adverse weather route to the west of the Isle of Man, it is considered unlikely that Masters would routinely choose it.

1.8.3.21 The Stena Line Heysham to Belfast routes are similarly constrained in seas on the beam in seas with significant wave heights of between 3.0 and 3.5 m. Their existing passages takes them between the West of Duddon Sands offshore wind farm and Barrow offshore wind farm which is constrained in its width. Therefore, to offer greater searoom and optionality they routinely pass to the west of West of Duddon Sands offshore wind farm and Walney offshore wind farm before continuing to the east of the Isle of Man. This route necessitates an additional 40 to 70 minutes of transit time. This route would be constrained by the presence of the Morgan Array Area as there would be limited searoom to manoeuvre between the two array areas or maintain the desired heading relative to the prevailing conditions. During the navigation simulations it was concluded that Masters may choose to pass south and west of the Morgan Array Area. This is estimated to incur a further increase in transit times of 61 minutes, to a total delay of 101 to 131 minutes on the typical route. Alternatively, Masters may choose to continue west and pass west of the Isle of Man which would be a shorter route passage but offers less shelter.

1.8.3.22 The median adverse weather routes used by Seatruck pass immediately adjacent to the south of the Morgan Array Area and therefore have only minor deviations within the revised passage plans to increase the passing distance from the wind farm to at least 1.5 nm. This is anticipated to have a negligible impact on journey times.

Table 1.25: Number of non-typical vessel transits (outside 95th/99th percentiles) and increased transit duration.

Parameter	IoMSPC HEY-DOUG	Stena LIV-BEL-E	Stena HEY-BEL
Principal Vessels (2019 to 2022)	Ben-my-Chree	Stena Edda, Stena Embla, Stena Mersey, Stena Horizon, Stena Lagan, Stena Forecaster, Stena Forerunner	Stena Hibernia, Stena Scotia
Approximate Annual Crossings with Significant Deviation (2022)	20 of c.1,450	10 of c.400	24 (2019) to 52 (2022) of c.1,100
Baseline Distance (nm)	50.1	114.0 (W of Calder) 114.5 (E of Calder)	106.9
Total Delay Baseline (Minutes)	+10 to +23	Neg.	+40 to +70
Total Distance due to Morgan Array Area (nm)	55.8 (+5.7 nm)	134.4 (+20.4 nm)	123.2 (+16.3 nm)
Minimum Additional Time due to Morgan Array Area (Minutes)	+21.5	+68.2	+61.1
Total Delay with Morgan Array Area (Minutes)	+31.5 to +44.5	+68.2	+101.1 to +131.1

1.8.3.23 During adverse weather, some sailings are delayed or inevitably cancelled irrespective of the presence of the Morgan Array Area. However, with it in situ, where sailings are safe to take place, they may be required to route a greater distance and duration (Table 1.25). Over the course of a day, the aggregation of these delays would result in the potential for additional sailings to be cancelled where constraints such as hours of rest are exceeded. Such effects are already experienced by operators, but the presence of the Morgan Array Area could exacerbate this.

Summary

1.8.3.24 The assessment of impacts on ferry vessel routing has concluded that the impact of the Morgan Array Area is not considered to make existing services unviable in normal weather conditions. However, in adverse weather, the reduced sea room and increased duration would necessitate additional operational constraints and potential additional cancellations to these services.

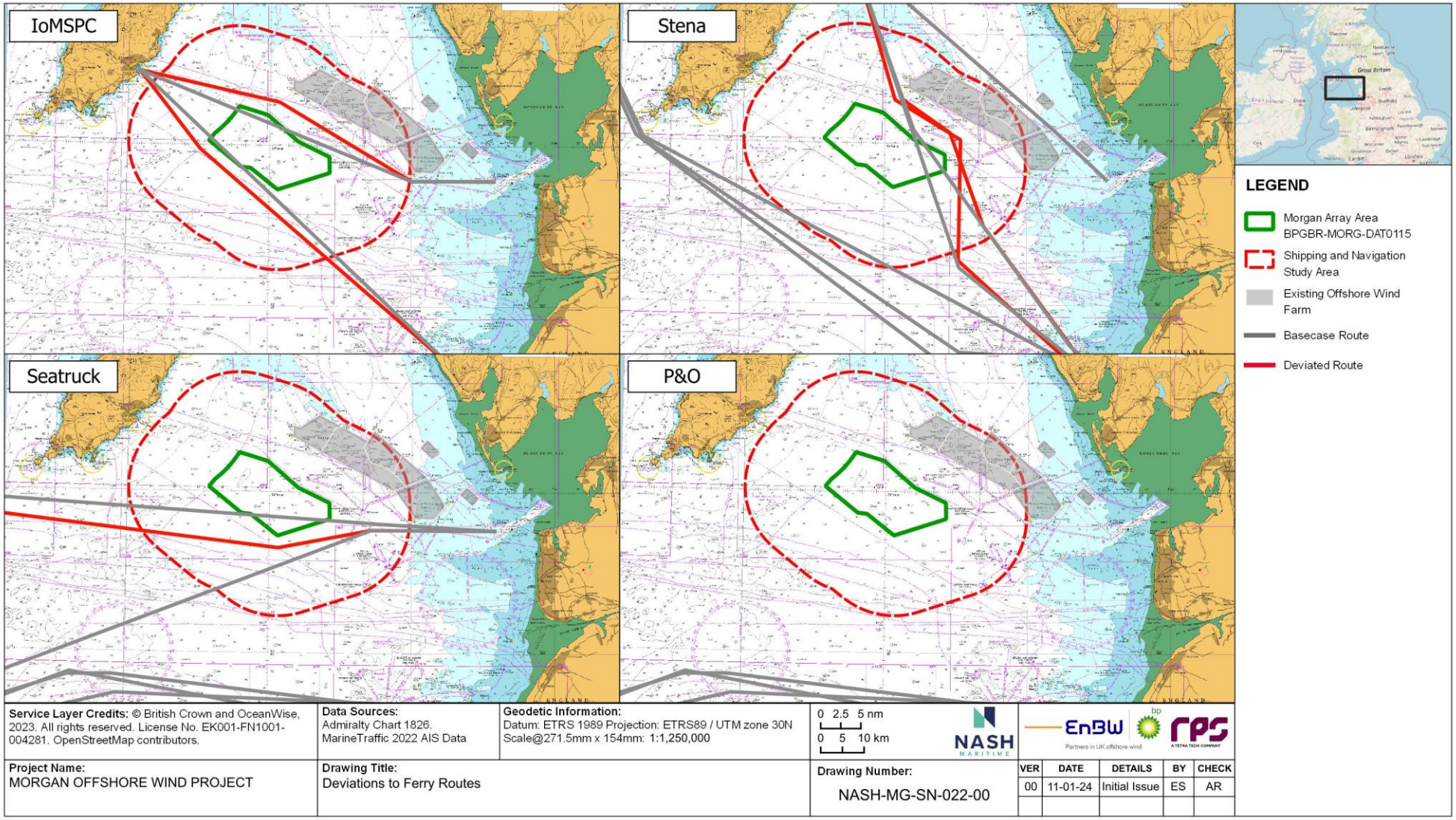

Figure 1.38: Deviations to ferry routes in normal conditions.

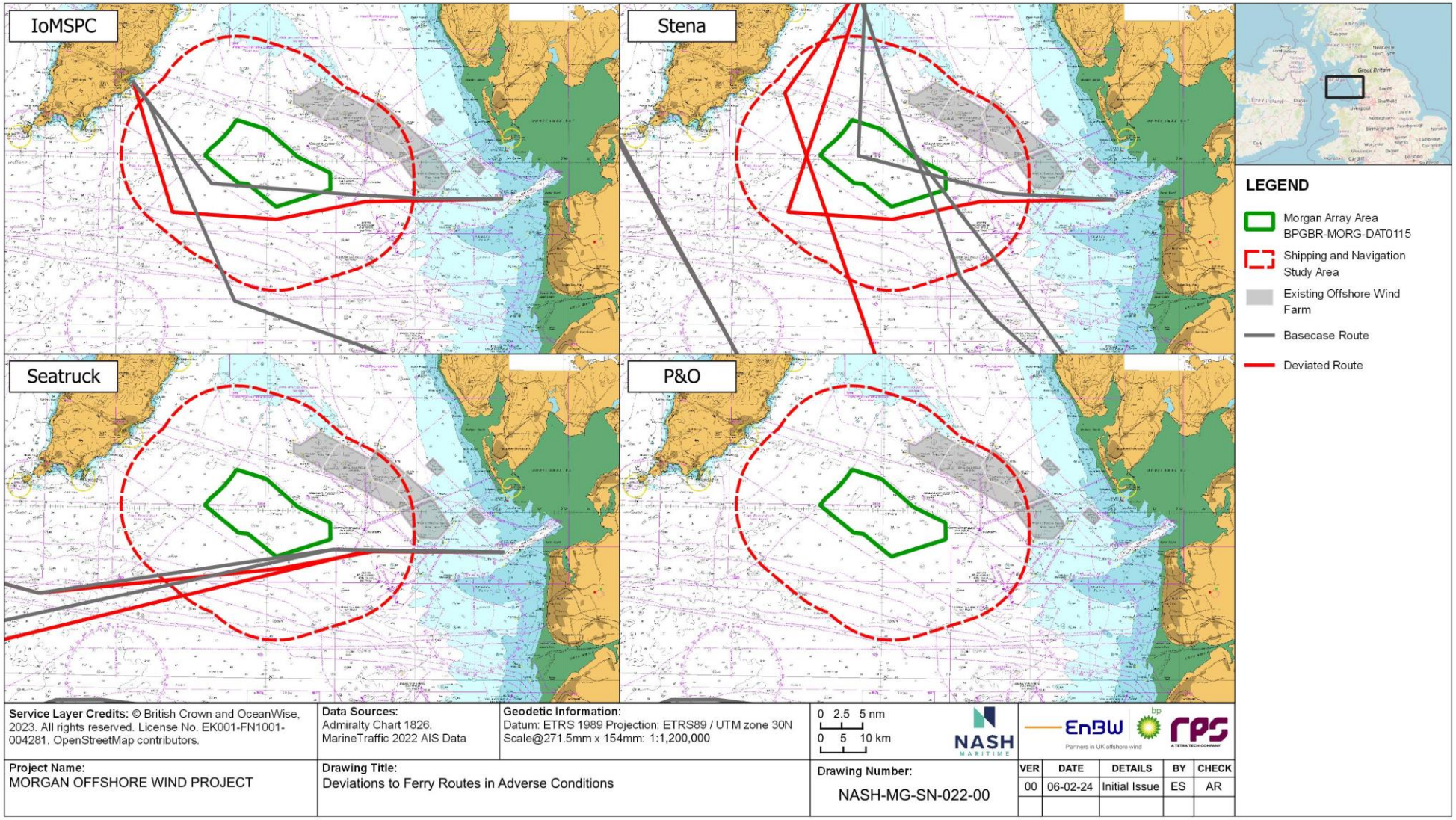

Figure 1.39: Deviations to ferry routes in adverse weather.

1.8.4 Impact to cargo/tanker vessel routeing

1.8.4.1 Offshore wind farms can impact on vessel routeing by creating an obstacle in otherwise navigable waters that requires a deviation of their route. For cargo/tanker vessels this has the potential to result in a significant increase in costs or make schedules unviable. Furthermore, impacts on routeing may result in increased risks of collision or allision, which are considered elsewhere in section 1.8.

Cargo/tanker routeing in normal conditions

1.8.4.2 Figure 1.40 show the anticipated changes in cargo/tanker ship routeing. Table 1.26 shows the increased distance transited for each of the identified routes in order to clear the Morgan Array Area. Each revised passage plan was developed by the NASH project team, including Master Mariners, and account for existing decision making principals (such as passing at least 1.5 nm from a wind turbine).

1.8.4.3 The most significant shipping routes in the shipping and navigation study area (>1 vessel per day) are into or from the Port of Liverpool from or to the Off Skerries TSS or west of the Isle of Man and are well clear of the Morgan Array Area and therefore no impact is anticipated.

1.8.4.4 Less trafficked routes are more dispersed within the shipping and navigation study area and therefore greater deviations are encountered in response to the Morgan Array Area. The majority of other affected routes are of similarly low intensity and typically are routeing to the south of the Morgan Array Area into Heysham.

1.8.4.5 Given the low intensity of the most impacted routes, their greater distance travelled and the lower criticality of their schedules, these impacts are unlikely to make their operations unviable.

Table 1.26: Increase in distance for impacted cargo/tanker routes.

Route	Approximate annual crossings (2022)	Baseline distance (nm)	Deviated distance (nm)	Additional deviated distance (nm)	Total additional distance/year
Liverpool to E IoM – West	10	77.7	81.0	+3.3	+32.6
Liverpool to E IoM – Central	54	72.4		+8.6	+464.1
Liverpool to E IoM – East	14	70.1	71.8	+1.7	+23.5
Douglas to Heysham	6	50.0	50.8	+0.8	+4.5
Off Skerries TSS to Solway Firth	42	72.7	73.6	+0.9	+39.0
Douglas to Liverpool Bay TSS	8	61.0	61.0	0.0	+0.1
Douglas to Liverpool	6	58.3	58.4	+0.1	+0.8

Cargo/tanker routeing in adverse weather

1.8.4.6 Analysis of adverse weather routeing in section 1.6.2 during 2019 named storms did not identify any particular changes to typical routes. There was a greater demand for the anchorages along the Welsh coast, and no discernible impacts of the Morgan Generation Assets are identified for the availability of anchorages for vessels to seek shelter in adverse weather. Some vessels were recorded loitering both to the west and within the Morgan Array Area, likely riding the conditions before they could berth. There is sufficient clear sea room to the west of the Morgan Array Area for this practice to continue.

Adverse weather pilotage

1.8.4.7 During strong north westerlies, pilots may be overcarried or boarded at Douglas on the Isle of Man using the lee of the island as detailed in section 1.6.2. This activity can result in convoys of multiple cargo/tanker vessels navigating between Douglas and Liverpool. If cargo/tanker vessels were to navigate through the TSS and therefore to the west of the Morgan Array Area, there would be no impact. For those vessels that depart Liverpool and do not use the TSS, an increase in distance of less than 0.5 nm would be required and the impact on pilot availability would be negligible.

Summary

1.8.4.8 Major cargo/tanker shipping routes are concentrated into the Port of Liverpool, but other routes into Douglas and Heysham would require minor deviations around the Morgan Array Area. However, these routes have fewer than three vessels per week and would have minimal deviations which is not considered to make such operations unviable.

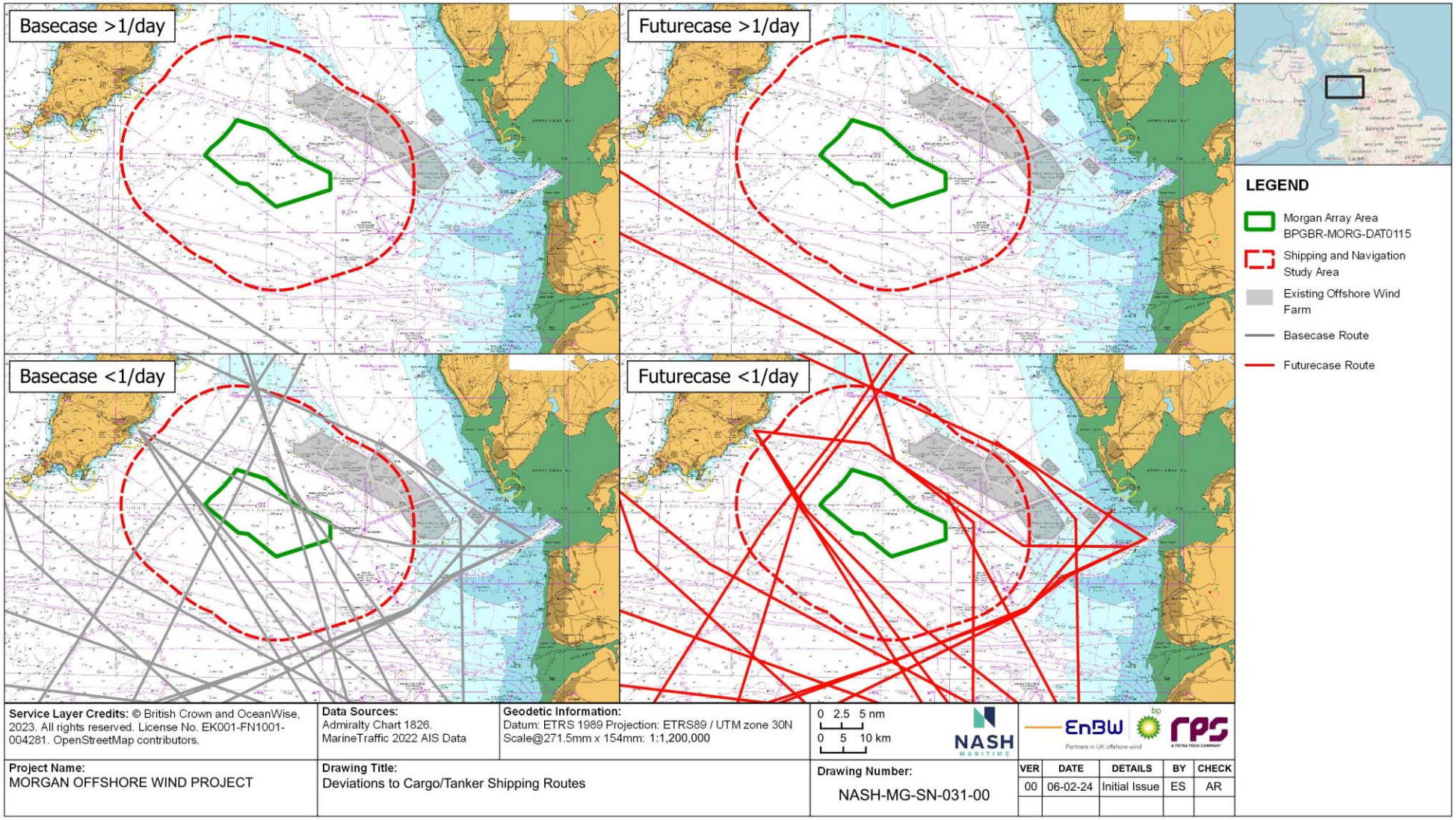

Figure 1.40: Deviations to cargo/tanker shipping routes.

1.8.5 Impact to small craft navigation and safety

Recreational

1.8.5.1 The analysis of recreational vessel transits presented in section 1.6.2 identified relatively few cruising routes running across or adjacent to the Morgan Array Area; most are concentrated near shore and/or clear of the Morgan Array Area. The shipping and navigation study area also shows a low density of AIS tracks compared to adjacent waters, with the exception of a northwest section of the study area towards Douglas.

1.8.5.2 During consultation with the RYA, it was noted that recent evidence from AIS data suggests that yachts avoid transiting through an offshore wind farm less than previously thought based on responses to surveys. The 2022 AIS data show that 79% of cruising vessels that sail between Morecambe and Douglas avoided transiting through the existing offshore wind farms (Walney and West of Duddon Sands) by taking a longer southerly route. Much of this evidence has been collected from earlier Round 1 and 2 offshore wind farms, where wind turbines were generally closer together. The Morgan Generation Assets turbine spacing parameters will be greater, at least 1,400 m between turbines, and so may promote increased navigation of recreational vessels through the Morgan Array Area.

1.8.5.3 Vessels sailing along the identified offshore routes (such as between Morecambe and Douglas) would be able to avoid transiting through the Morgan Array Area without significantly increasing the passage time or distance. However, this may increase the number of recreational crafts navigating through busier commercial routes, albeit that the density of recreational traffic near to the Morgan Array Area is low. The wind turbine and OSP structures could interfere with the annual LYC Isle of Man Midnight race from Liverpool to Douglas, which usually has around 10 vessels participating, but had 40 vessels in 2019 (100th anniversary of race).

Fishing

1.8.5.4 A number of commercial fisheries operate within the shipping and navigation study area, with boats based across Welsh, English, Scottish, Northern Irish, Irish and Isle of Man harbours, as well as several internationally based vessels (see section 1.6.2 and Volume 4, Annex 6.1: Commercial fisheries technical report of the Environmental Statement). Key commercial fisheries within the shipping and navigation study area are dredging and trawling for king scallop and queen scallop, potting for whelk, crab and lobster and trawling for flatfish, herring and other demersal finfish.

1.8.5.5 A recent study by the National Federation of Fishermen's Organisations (NFFO) and Scottish Fishermen's Federation (SFF) has highlighted the potential loss of fishing grounds which offshore wind farms might cause, referred to as '*Spatial Squeeze*' (NFFO, 2022). Such an effect may result in boats currently fishing within the footprints of the Morgan Generation Assets being offset into the adjacent routes, interacting with other passing traffic and increasing the risk of collision.

1.8.5.6 Fishing boats operating in the shipping and navigation study area of greater than 10 m in length are generally small enough to transit through the Morgan Array Area with at least 1,400 m wind turbine spacing when on passage to fishing grounds, as evidenced by their existing passages between wind turbines in operational wind farms within the Irish Sea. The 2022 AIS data demonstrated fishing activity within both the Walney Extension and Gwynt y Mór (Figure 1.22) which have less searoom between wind turbines (approximately 1,100 m and 720 m respectively). This may offer greater potential for fishermen to work mobile gear within the Morgan Array Area than has

been the case historically. Except during construction or major maintenance, whereby Safety Zones are required, there is no restriction on the ability of fishermen to use mobile or static gear within an offshore wind farm. Skippers would need to consider any hazards, particularly snagging of subsea cables, or risk of allision with wind turbines or collision with CTVs.

1.8.5.7 Current fishing activity described in section 1.6.2 is reflective of where the most favourable fishing areas are located. Fishermen strategically target known fish-rich areas in order to optimise their catch potential and ensure efficient utilization of their time and resources. Upon the completion of the wind farm projects, it is expected that fishermen will continue to fish within the Morgan Array Area. The Applicant has made a commitment to maintaining an area free of wind turbines and offshore substation platforms (OSPs) over an area of core scallop grounds within the Morgan Array Area, termed the Scallop Mitigation Zone. This has been supported through consultation with fishing representatives. If fishing activities are displaced from the wind farm areas, it is unlikely that fishermen will concentrate their efforts adjacent to the Morgan Array Area, as these locations are already being targeted and there is a need not to overfish the stocks. Furthermore, for static fishermen, placing gear in navigational routes may result in greater loss of gear which is costly to replace.

1.8.5.8 Fishing activities in areas adjacent to the Morgan Array Area is anticipated to remain low, with limited numbers of vessels operating at a low speed (i.e. less than 2 knots). Furthermore, it has been demonstrated through navigation simulations that there would be sufficient sea room to enable passing distances of more than 1 nm (1,852 m) from fishing vessels. As a result, there is abundant space available for other marine users, in particular ferries, to navigate and avoid potential conflicts with the fishing operations in these areas.

1.8.5.9 The Morgan Offshore Wind Project is working with fishermen to develop mitigation and design principles to facilitate co-existence with the Morgan Generation Assets as a result (see Outline fisheries liaison and co-existence plan (Document reference J10)). Furthermore, the Morgan Generation Assets has made a number of changes and commitments following PEIR consultation to minimise the impacts on fishing activities (Volume 2, Chapter 6, Commercial fisheries of the Environmental Statement).

Tug and Service

1.8.5.10 Vessels operating between operations and maintenance bases and oil /gas platforms may pass near to the Morgan Array Area. In most cases, with the exception of where decommissioning activities will take place, there is at least 1 nm of suitable clearance between wind turbines and platforms such that the Morgan Generation Assets does not impede this activity. The Millom West Gas Field is within 1.6 nm of the Morgan Array Area, but this is anticipated to be decommissioned prior to the completion of construction of the Morgan Generation Assets.

1.8.5.11 A clear additional risk of the Morgan Generation Assets are the additional vessel movements supporting operations and maintenance and their interaction with other traffic. In particular, it is likely that multiple CTVs will cross between the Morgan Generation Assets and interact with other passing traffic, including ferries and fishing boats. These can be managed through the implementation of a Vessel Traffic Management Plan and other applied risk controls (see section 1.4.8). An outline of Vessel Traffic Management Plan has been submitted as part of the Application (Document J16)

1.8.6 Impact on compliance with guidance and best practice

1.8.6.1 The presence of the Morgan Generation Assets and the Walney offshore wind farm would create an approximately rectangular area of sea that is 11.4 nm in length and at least 4.4 nm in width. Analysis of vessel traffic data suggests that there would be in the region of 2,000 vessel transits per year through this route, with an average vessel size of 132 m and a maximum vessel size of 215 m.

1.8.6.2 During consultation and the navigation simulations, ferry operators raised concerns on the safety of navigation through this route, particularly during adverse weather and with realistic traffic conditions. This section assesses the geometry of the route against principal guidance documents and precedent within the UK. Impacts associated with this route, such as collision risk and adverse weather routeing, are considered in the following sections.

1.8.6.3 Two principal guidance documents describe how geometries between offshore wind farms should be developed (see Figure 1.41). Firstly, MGN654 proposes a 20-degree rule, namely that during transit in adverse weather conditions, vessels could be deviated by up to 20 degrees from their route. A corridor of 10 nm in length would therefore require a width of at least 3.6 nm. As such, the route between the Walney offshore wind farm and Morgan Generation Assets at 4.4 nm meets the MGN654 width requirements.

1.8.6.4 Secondly, the PIANC WG161 guidance stipulates a route between two offshore wind farms should consist of:

- A traffic lane that is between 4x ship lengths and 8x ship lengths depending on traffic volume
- Sufficient space to perform a round turn in an emergency manoeuvre which is given as 6x ship lengths plus 0.3 nm
- 500 m safety distance zones from infrastructure.

1.8.6.5 For a design vessel size of 200 m, with less than 4,400 movements per year, the PIANC guidance stipulates a design width of 2.9 nm. As such, the route between the Morgan Array Area and Walney offshore wind farm would meet the PIANC design width guidance.

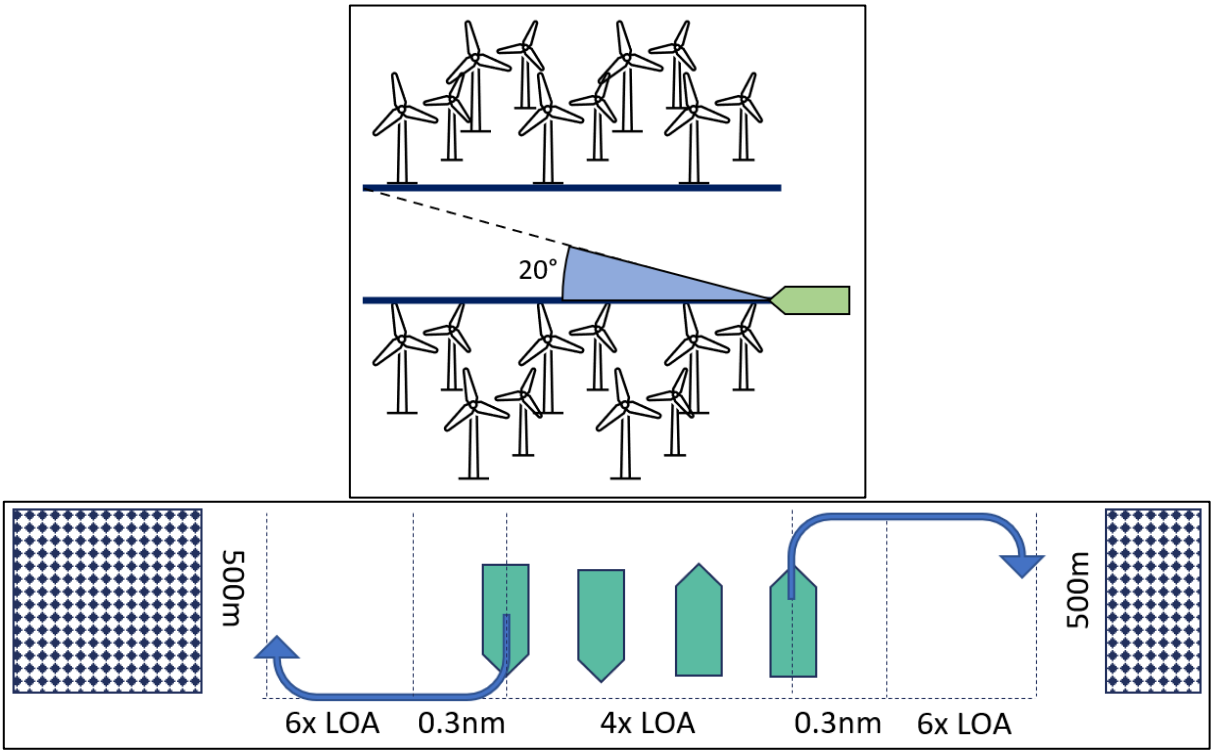

Figure 1.41: Comparison of MGN654 (top) and PIANC WG161 (bottom) guidance.

1.8.6.6 There are several routes between offshore wind farms elsewhere in the UK which are comparable to the Morgan-Walney route:

- Ormonde/Barrow to Walney/West of Duddon Sands:
  - Navigable width of 2.2 nm is less than half of Morgan-Walney (4.4 to 5.3 nm), but of a shorter length
  - Approximately 66% of the Morgan-Walney traffic volume, with similar vessel sizes
  - Route is crossed by CTVs and small craft as would likely be the case for Morgan-Walney
- Hornsea Three to Hornsea One:
  - Navigable width of 3.9 nm is less than Morgan-Walney
  - Anticipated to have a similar number of transits but would likely include larger vessels up to 300 m
- Hornsea Four to Hornsea Two:
  - Bow tie geometry with a navigable width of between 10.9 nm, 2.2 nm and 4.4 nm
  - Anticipated to have a similar number of transits but would likely include larger vessels
- Vanguard-Boreas:
  - Navigable width of 6.8 nm is greater than Morgan-Walney
  - Anticipated to have more than twice as much traffic including the largest vessels up to 400 m
  - Route is managed through a Deep Water Route and AtoNs.

1.8.6.7 Therefore, the route between Morgan Array Area and Walney offshore wind farm meets primary UK guidance and would be wider than similar consented routes between wind farms elsewhere in the UK.

1.8.7 Impact on vessel encounters and collision avoidance

Development of realistic traffic scenarios

1.8.7.1 Given the passage plans, consultation and vessel traffic surveys, realistic traffic scenarios have been developed to inform the risk assessment in Table 1.27. These were used as inputs to the navigation simulations and help inform the likelihood that two vessels might meet one another.

Commercial vessel meeting situations

1.8.7.2 A key factor in the risk of collision is the frequency at which two vessels would meet within the same areas of sea at the same time, necessitating some action to be taken by the vessels. By modelling how vessel routes may change with the Morgan Array Area in place, and taking into account vessel timetables, the concurrent frequency of two commercial vessels meeting can be calculated. For example, were a vessel to depart Heysham, the presence of the Morgan Array Area could require a deviation to the northeast, resulting in new meeting situations which would not have previously occurred.

1.8.7.3 The analysis is conducted for the waters between the Walney offshore wind farm and the Morgan Array Area. Given the low proportion of fishing and recreational vessels which carry AIS, only cargo, tanker and passenger vessels (including ferries) have been included in this analysis. Furthermore, as this analysis concentrates on ship routes, non-direct transits such as loitering or pilot boarding cannot be captured.

1.8.7.4 All commercial vessel tracks within the 2022 AIS data were processed and deviated around the Morgan Array Area. For every minute of the year, a count was performed of the number of vessels present in the region northeast of the Morgan Array Area. Over the total year, the percentage of time in which zero, one, two or more vessels were counted is then given.

1.8.7.5 For the sea area between the Morgan Array Area and Walney offshore wind farm, there were no commercial vessels navigating this route for 80% of the year and a single vessel present for 19% of the year. For 0.6% of the year there would be two or more vessels navigating this route. With between a 4.4 nm and 5.3 nm separation, with a low frequency of vessel encounters, the risk of collision is likely to be low. Furthermore. the majority of these vessels would be ferries (specifically Stena and IoMSPC) who are familiar with the route and the passage plans with other vessels so could plan accordingly.

1.8.7.6 Based on the 2022 analysis of their timetables, and the predicted routeing impacts as a result of the Morgan Array Area, the analysis suggests a low probability of two vessels meeting within this area of sea.

Table 1.27: Realistic traffic scenarios.

Area	Scenario	Potential traffic situation	Justification
Morgan-Walney	Reasonable Day to Day Situation (<50% transits)	1 Ferry, 1 Service and 1 Fishing	Ferries: Unlikely to meet another ferry (IoMSPC vs Stena), given Stena's relatively infrequent transit to east of Isle of Man. Cargo/tanker: AIS analysis showed minimal passage to west of Walney Offshore Wind Farm (less than once per day). Tug and Service: Repositioning of standby vessels possible and loitering around existing Millom Field. Fishing: Occasional fishing around Morgan Array Area. Radar survey recorded up to two fishing boats during summer survey in Morgan Array Area. Greater density within Isle of Man waters to northwest of Morgan Array Area. Recreational: Radar surveys showed relatively little recreational in shipping and navigation study area. Up to two recreational craft crossing through Morgan Array Area per day from summer surveys (noting negligible during winter survey). Morgan Generation Assets CTVs likely to cross Morgan-Walney route or transit through it, generally together or in a convoy. Likely that passage of a third party vessel does not coincide with this activity.
	Unlikely but Occasional Situation (<10% transits)	2 Ferry, 1 Tug and Service, 1 Fishing, 1 Recreational	
	Reasonable Worst Credible (<1% transits)	2 Ferry, 1 Cargo/Tanker, 1 Tug and Service, 2 Fishing, 2 Recreational and 6 Project Vessels Crossing	
South of Morgan Array Area	Reasonable Day to Day Situation (<50% transits)	2 Ferry and 1 Fishing	Ferries: Reasonable likelihood of meeting another ferry (Seatruck/IoMSPC/Stena). Potential for up to three ferries to converge. Cargo/tanker: Anticipated to take TSS and pass southwest of Morgan Array Area. Some small general cargo <150 m may occasionally navigate to the east of Morgan Array Area, but infrequently. Some small shipping is bound for Heysham and Douglas. Tug and Service: Repositioning of standby vessels possible. Fishing: Occasional fishing within Morgan Array Area. Radar survey recorded up to two fishing boats during summer survey in Morgan Array Area. Recreational: Radar surveys showed relatively little recreational in central Irish Sea. Up to two recreational craft crossing through Morgan Array Area per day from summer surveys (noting negligible during winter survey). Morgan Generation Assets Vessels: Not anticipated.
	Unlikely but Occasional Situation (<10% transits)	2 Ferry, 1 Tug and Service, 1 Fishing	
	Reasonable Worst Credible (<1% transits)	3 Ferries, 1 Cargo/Tanker, 1 Tug and Service, 2 Fishing, 2 Recreational	

Increased vessel encounters

1.8.7.7 Encounter modelling was undertaken to compare the number of meeting situations before and after the construction of the Morgan Array Area. A key advantage of encounter modelling is including the temporal element to vessel timetables that are not normally assessed in conventional quantitative maritime risk models. The model uses the concept of a '*ship domain*', an area of water around a vessel which the Master wishes to keep clear. Where a vessel breaches this domain, an encounter occurs, and whilst not necessarily a near miss, could reasonably interpreted to indicate a potential risk of collision. By comparing the number of encounters before and after the construction of an offshore wind farm, an appreciation of the greater frequency of meeting situations is derived.

1.8.7.8 The ship domain model was developed based on a combination of academic research and a review of existing passing arrangements between vessels within the shipping and navigation study area. A dynamic domain was developed that included speed and vessel length. A vessel travelling faster would maintain a greater area clear ahead to respond to a collision situation. A larger vessel may be less manoeuvrable so would maintain a greater clearance from other vessels to give adequate time to respond.

1.8.7.9 The domain was formed of an oval consisting of a forward domain of three minutes modified by vessel size and a port/starboard/aft domain of a function of both speed and length.

1.8.7.10 Figure 1.42 shows an example of the base case encounter model, with different sized domains reflective of different vessel sizes and speeds. For example, a 187 m ferry travelling at 18 knots would have a domain of 2.3 nm by 0.7 nm whereas a small workboat travelling at a similar speed would have a domain of 0.5 nm by 0.1 nm. A stationary vessel has a domain equal to twice the vessel length.

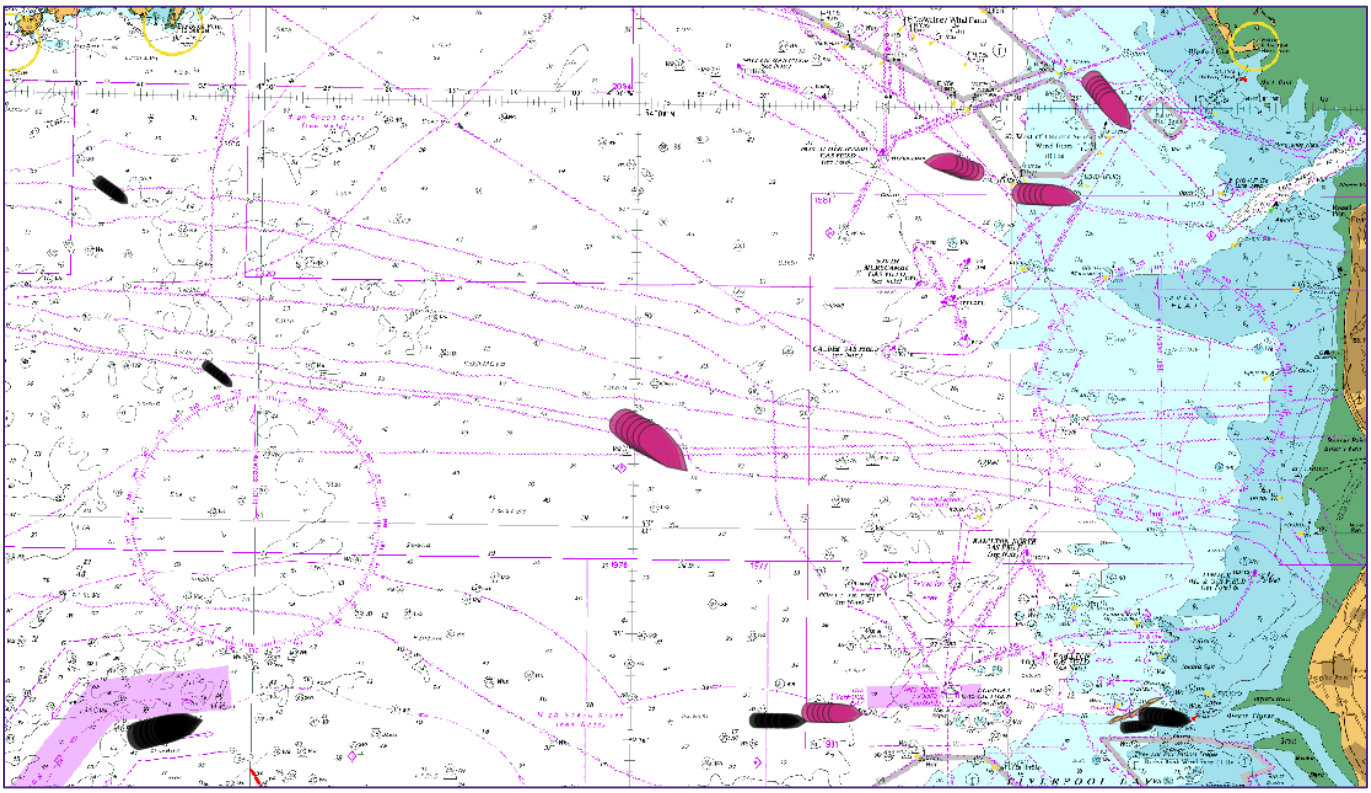

Figure 1.42: Example ship domain model.

1.8.7.11 Many encounter situations between vessels, such as overtaking, may occur over several minutes. To avoid multiple counting of the same encounter event, only the position at which the encounter with the Closest Point of Approach (CPA) was retained. The modelling was limited to the shipping and navigation study area of 10 nm around the Morgan Array Area, and therefore excludes the constrained waterways in harbours/approach channels where vessels naturally come close together.

1.8.7.12 For the base case scenario, without the Morgan Array Area in place, the model was undertaken and the number of encounters between vessels assessed. Future case route modelling was used to develop the future case scenario and the assessment repeated. All modelling was conducted on 2022 AIS data and therefore has the potential to underrepresent collision risk with small craft which often don't have AIS transmitters. Further discussions of collision risk involving small craft is contained in section 1.8.5.

1.8.7.13 Across the shipping and navigation study area, in total, 791 encounters of all vessel types were recorded during the 2022 base case (2.2/day) and 970 encounters during the future case with the Morgan Array Area (2.7/day). This equates to an increase of 23% in the total number of encounters. By vessel type:

- Ferry encountering ferry/cargo/tanker exhibited a 29% increase
- Cargo/tanker encountering cargo/tanker recorded a negligible number of encounters
- Ferry/cargo/tanker encountering a small craft exhibited a 28% increase
- Small craft encountering small craft exhibited a 0% increase.

1.8.7.14 The modelling shows that there is a negligible number of encounters between commercial shipping vessels near to the Morgan Array Area, as evidenced by the majority of commercial routes passing to the southwest. An increase in encounters between ferries and other vessels is predicted, due to the concentration of routes used by Seatruck to the south of the Morgan Array Area, or concentration within the sea area between the Morgan Array Area and Walney offshore wind farm. A similar increase is predicted for encounters between ferry/cargo/tanker vessels and other small craft such as fishing, tug/service or recreational vessels. Many of these encounters involve vessels supporting the Millom West platform which will likely be decommissioned prior to the operational phase of the Morgan Generation Assets.

1.8.7.15 As shown in Figure 1.43, at present, encounters are concentrated to the east of the shipping and navigation study area, as vessels converge south of the West of Duddon Sands offshore wind farm and South Morecambe Gas Field or occur within the Walney offshore wind farm. It is notable that the majority of base case encounters occur on the ferry routes, demonstrating that it is routine for ferries to encounter other vessels, even in an area of open sea and for this not to be a concern of collision risk.

1.8.7.16 Whilst those encounters within the existing offshore wind farms would be largely unaffected, the Morgan Array Area would necessarily offset ferry traffic that changes the distribution of encounters. Routes to the south of the Morgan Array Area would be offset, with relatively little change in the total number of encounters in this region. For vessel traffic between the Morgan Array Area and Walney offshore wind farm, the creation of this route results in a concentration of traffic which increases the number of encounters.

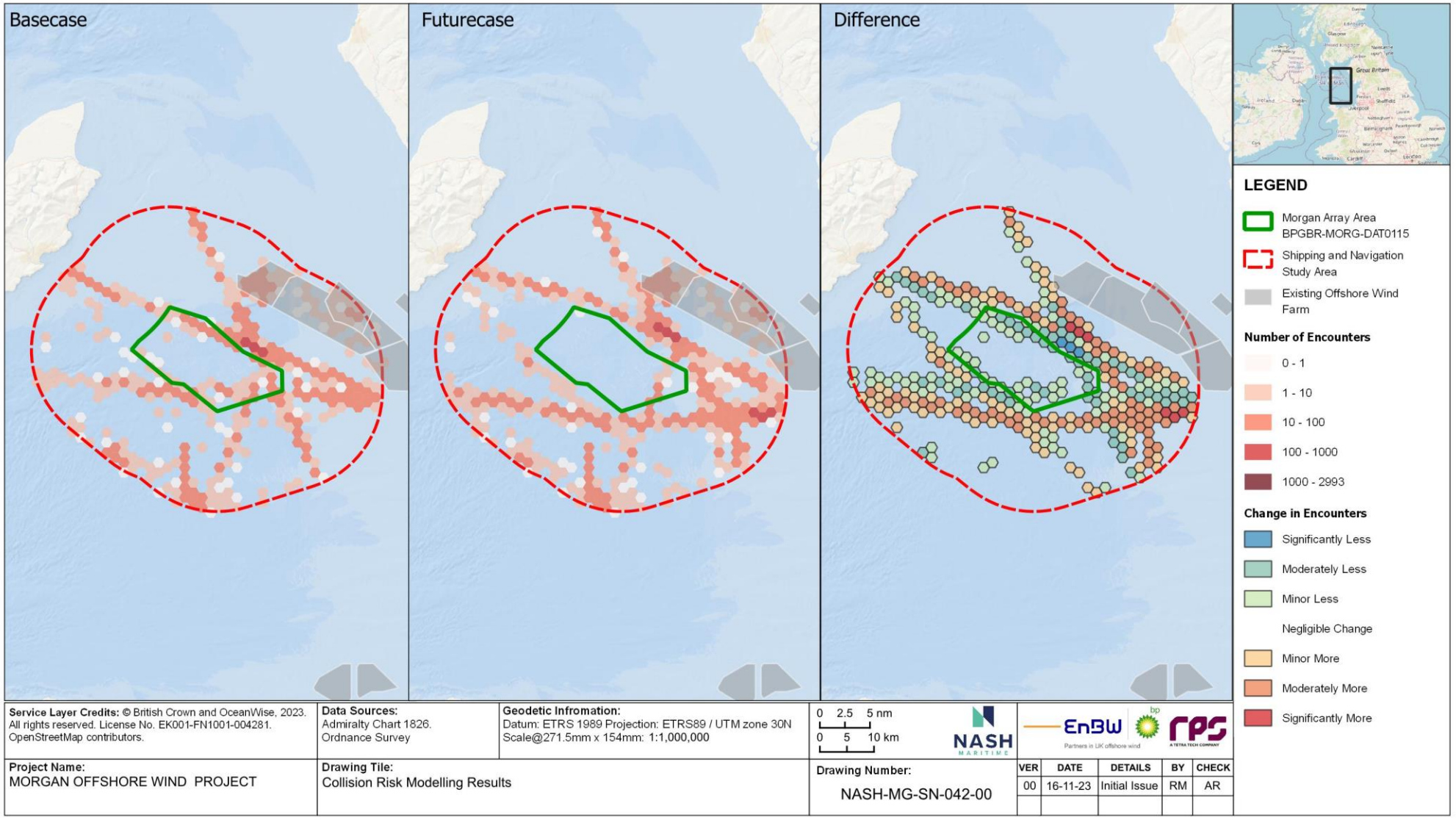

Figure 1.43: Collision risk modelling results.

Impacts of project on visual navigation and collision avoidance

1.8.7.17 MGN654 notes that an offshore wind farm could block or hinder the view of other vessels or any navigational feature such as the coastline or AtoNs. This may result in '*blind spots*' between vessels which could increase the risk of collision by reducing the capability for early and effective collision avoidance.

1.8.7.18 Firstly, each individual wind turbine foundation is at least 20 m in diameter at the sea surface and whilst vessels transit past the site, any two vessels may come in and out of visibility temporarily. Furthermore, there may be challenges identifying the vessels through radar (see section 1.8.12) and targets would be visually less distinct amongst the wind turbines.

1.8.7.19 Assuming that most prudent mariners would pass more than 1 nm from the boundary of an offshore wind farm, the likely meeting situations are described in Figure 1.44. For a small craft, such as fishing boat or yacht transiting at 6 knots, from emergence from the offshore wind farm, it would take 10 minutes for the vessels to meet. For a high-speed craft such as CTV, transiting at 25 knots, this is less than 3 minutes. The latter vessel type are highly likely to carry AIS which will improve their visibility to other vessels. This would provide some opportunity to avoid a collision, however, would be significantly reduced beyond what would be the case pre-construction in open sea. Such challenges currently exist for the established Irish Sea offshore wind farms but are being successfully managed with no reported collisions as a direct result of reduced visibility of emerging vessels.

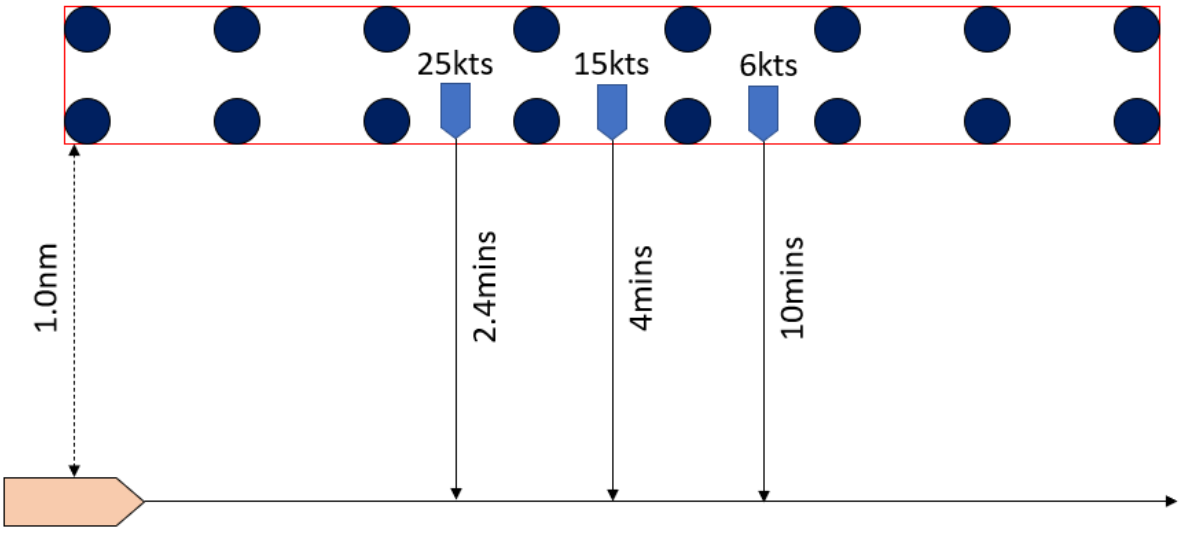

Figure 1.44: Calculated meeting times for vessels emerging from an offshore wind farm.

1.8.7.20 Secondly, the geometries of the offshore wind farms could reduce the visible appreciation of other vessels, particularly where routes converge or the corners of sites. For example, two vessels proceeding north to the east and west of the Morgan Array Area might not have visual sight of one another until they meet at the north of the Morgan Array Area. The COLREGs describe obligations for collision avoidance and the appreciation of navigational lights (port/starboard) are necessary in determining the correct response to crossing, overtaking and head-on situations. However, larger vessels would be identifiable from AIS and therefore passing arrangements could be agreed.

1.8.7.21 Thirdly, concerns were raised by stakeholders about collision appreciation during night navigation, particularly as a result of vessel navigational lights lost amongst the wind turbine backscatter. Rule 22 of the COLREGs describe the minimum visibility of lights with vessels under 12 m requiring masthead/sternlights of greater than 2 nm and for vessels over 12 m (but less than 50 m) having 5 nm and 2 nm respectively. Therefore, it is reasonable that vessels within an offshore wind farm that would have previously been visible to passing vessels may be obscured or would be less prominent amongst the offshore wind farm lighting (see section 1.4.7). In particular, masthead lights for approaching vessels, or single red lights displayed on yachts may be less conspicuous amongst white AtoNs fixed to the wind turbines, and this may to some extent contribute to an increased risk of collision. This impact was tested through the navigation simulations which demonstrated that vessels could still be identified within and adjacent to the Morgan Array Area. Such impacts have been successfully managed at existing offshore wind farms, elsewhere in the UK, with similar passing vessel numbers and vessels would still be identifiable through other means.

1.8.8 Impact on modelled collision and allision risk

Introduction and methodology

1.8.8.1 The presence of the Morgan Array Area could result in increased vessel meeting situations or transits closer to infrastructure which would increase the risk of collision and allision respectively. These risks have been quantitatively assessed in this section.

1.8.8.2 The IALA IWRAP Mk II is a quantitative tool for calculating the frequency of collisions, groundings and allisions for navigating vessels in a given waterway. The tool was developed by IALA to support coastal states in conducting risk assessments to address obligations under SOLAS Chapter V. The tool has been presented at the IMO (e.g. NAV 52/17/2 and SN.1/Circ.296) and used by Coastal States (including UK, Denmark and Sweden) to support the assessment of new routeing measures (e.g. NCSR 5/INF.3). The tool has also had widespread use in assessing risk, both in the UK, Norway and elsewhere. IALA (2017) Guideline G1123 contains guidance on implementing the tool and the underlying mechanics are presented in Friis-Hansen (2008).

1.8.8.3 IWRAP modelling has a number of stages:

- Data preparation:
  - Vessel traffic legs are created that represent shipping routes and data is used to determine the volume and types of traffic, and distribution across that leg
  - These legs are connected into a network with waypoints where legs cross or join together
  - Other hazards, such as bathymetry and fixed installations are inputted into the model
- Risk calculation:
  - Where these legs intersect with one another or obstructions (such as wind turbines), the proportion of traffic on that leg which might interact with the obstacle is calculated
  - To account for the ability of the crew to avoid these hazards, a causation factor is used (in the order of 1 in 10,000) to represent the probability of human error or mechanical failure leading to an incident. The default causation probabilities which are lower for passenger vessels have been changed to consistent

values allow a direct comparison between ferries and other commercial vessels, reflecting a more precautionary approach given the stringent standards to which passenger vessels must operate and their enhanced redundancy.

1.8.8.4 The IWRAP risk modelling tool has been utilised to assess the likelihood of collision and allision within the shipping and navigation study area. Table 1.28 and Figure 1.45 show the modelling results. Given future traffic projections discussion in section 1.7, the likelihood with a 15% estimated increase in traffic is given.

Results

1.8.8.5 The 2022 AIS data was used to develop the base case (with existing routes and infrastructure) and future case (with modified routes and additional structures) models. Table 1.28 and Figure 1.45 summarise the modelling results for both collision and allision. Collisions in IWRAP are modelled as head-on or overtaking collisions on legs, or crossing collisions where legs meet. The likelihood of collision increases where routes are compressed between obstructions or where more traffic is added to legs, both of which increase the frequency at which vessels meet and therefore collision.

1.8.8.6 It should be noted that IWRAP models the likelihood of a collision or allision, and as noted in section 1.6.3, the majority of these would result in minor consequences. Furthermore, given underrepresentation of small craft using AIS, these respective return periods have not been presented on an individual basis and are discussed in section 1.8.5.

1.8.8.7 The modelling indicates that within the shipping and navigation study area the total risk of collision would increase from once 1,416 years to once in 1,294 years. The increase in ferry to ferry collisions, from once in 1,823 to once in 1,698 years, is driven by the conflation of ferry routes as they route between the Morgan Array Area and Walney offshore wind farm which increase the likelihood of meeting situations. Given the relative infrequency at which cargo/tanker vessels navigate around the Morgan Array Area, the modelling likelihoods of collision for collisions involving these vessels is given as less than once in 10,000 years.

1.8.8.8 Figure 1.45 shows the distribution of collision likelihood in the future case scenario. It is noted that the areas of highest collision probabilities in both the base case and future case models were located in the approaches to Heysham where vessels navigate between the gas fields and were relatively unaffected by the impacts of the Morgan Array Area.

1.8.8.9 Allisions can occur in one of two ways. Firstly, due to mechanical breakdown such as steering or engine failure a vessel may become disabled and drift towards the turbines. For a vessel in the centre of a 5 nm route, this would allow a 2.5 nm drift before an allision would occur. High side vessels such as ferries could drift in excess of 2 knots and therefore there would be less than an hour to take action. This could include conducting repairs or deploying an anchor. Such hazards exist for vessel routes adjacent to pre-existing offshore wind farms such as Walney, West of Duddon Sands and Gwynt y Mór amongst others. Secondly, due to human error with vessels failing to appreciate the available sea room in proximity to the wind turbines due to fatigue or failing to keep a proper lookout. For larger vessels, and in particular ferries where Masters would have significant experience of operating these routes, this is less likely than might be the case for smaller craft. Allisions between small craft (such as yachts and fishing boats) with wind turbines is known to occur on other project sites, with these vessel types potentially less familiar with the hazards. Whilst the Morgan

Generation Assets does not necessarily increase the risk of human error, the greater number of turbines provide more obstacles for which an allision could occur.

1.8.8.10 The IWRAP modelling suggests that the likelihood of allision could increase from once in 676 years to once in 592 years. The increase in cargo/tanker allision risk is greater than other vessel types as the presence of the Morgan Array Area necessarily routes these vessels through areas of sea with multiple structures, but the overall modelled likelihood is less than 4,500 years. The model results show a reduction in the risk of allision for ferries. This is the result of alterations of ferry passage plans which increase the passing distance from the existing oil and gas infrastructure at which they currently pass in order to pass clear of the Morgan Array Area.

1.8.8.11 Figure 1.45 shows the distribution of allision probability within the future case scenarios. The results show that the highest allision risk is with the isolated oil and gas structures which are located closer to the existing shipping routes than the Morgan Array Area. It is noted that the Millom West platform will be decommissioned and therefore these risk results are conservative. Within the Morgan Array Area, the relatively higher risk is located to the west of the Morgan Array Area, close to the Liverpool to Douglas route, and to the south as vessels bound for Heysham pass south of the Morgan Array Area.

1.8.8.12 With an estimated 15% increase in traffic (see section 1.7), the resultant likelihoods increased from once in 1,416 to once in 1,125 years for collision and once in 676 to once in 515 years for allision. Therefore, it is concluded that the risk of collision and allision following the construction of the Morgan Array Area remains low.

Table 1.28: IWRAP modelling results (return periods in years).

Hazard	Vessel	Base case	With Morgan Array Area	With 15% traffic uplift
Collision	Ferries vs Ferries	One in 1,823 years	1,698	1,476
	Cargo/tanker vs Ferries	<10,000	<10,000	<10,000
	Cargo/tanker vs Cargo/tanker	<10,000	<10,000	<10,000
	Total	1,416	1,294	1,125
Allision	Ferries	815	895	779
	Cargo/tanker	<10,000	4,641	4,036
	Total	676	592	515

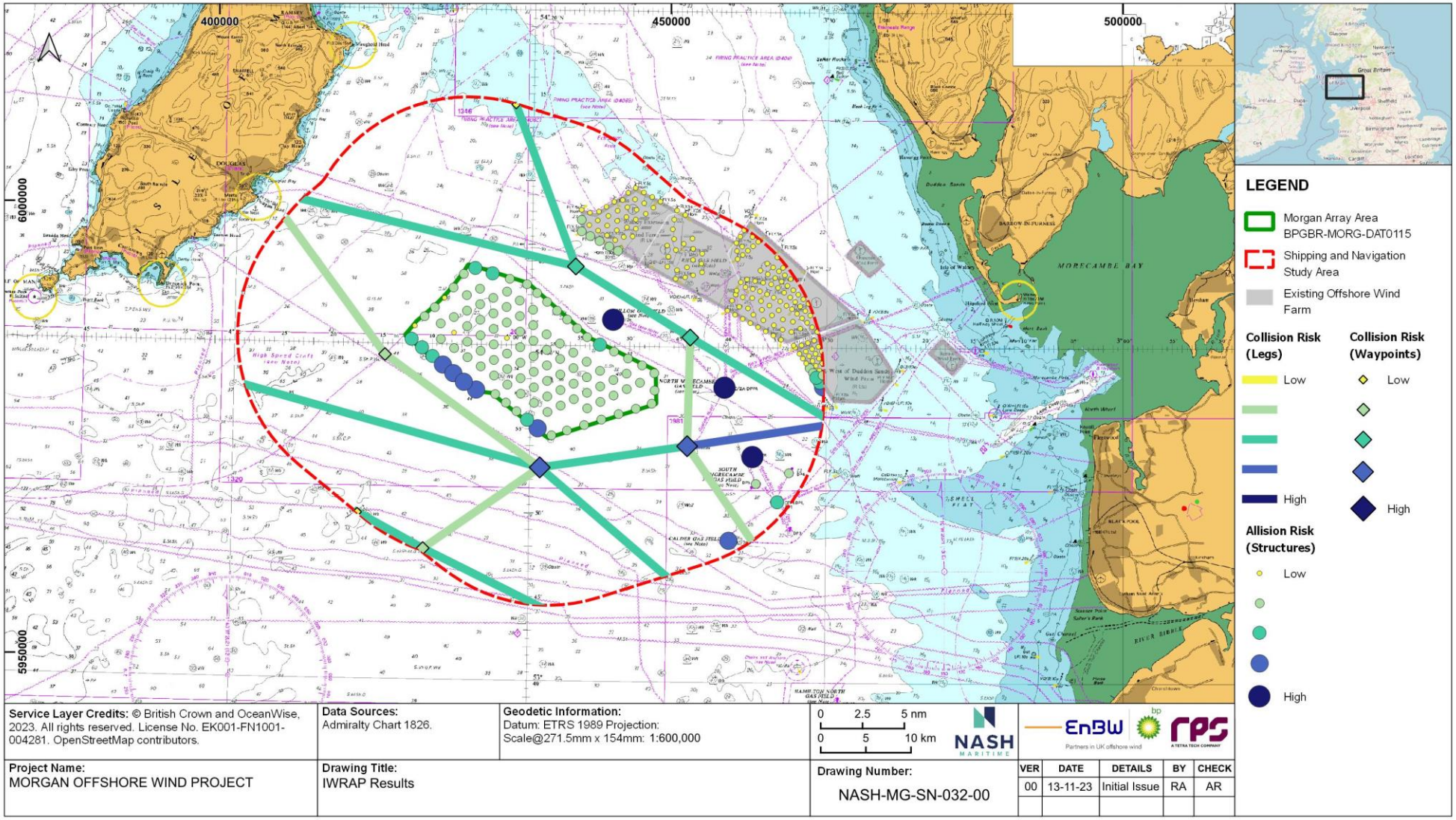

Figure 1.45: IWRAP results.

1.8.9 Impact to vessel emergency response

1.8.9.1 Impacts of the Morgan Generation Assets on vessel emergency response were identified amongst consultees, such as the ability to manage cargo shift scenarios, fire or man overboard situations.

Adverse vessel motions

1.8.9.2 During adverse weather, with large waves and strong winds, vessels can roll so excessively as to cause cargo to break free from its securing's and injuries to passenger or crew. This is particularly the case when the seas are directly on the vessel's beam, hence the requirement for variation in vessel course observed in section 1.8.3 to mitigate the ship's heading to the seas. With the Morgan Array Area in place, the capability for vessels to alter course to safely manage this could be reduced.

1.8.9.3 The navigation simulations (see Appendix E) tested the safety of transits in adverse weather. It was noted that the prevailing southwesterlies necessitated near beam on navigation across the conditions given the orientation of routes between Liverpool and the northwest. As a result, without undertaking weather routeing, in several runs Marginal or Fail scores were reached in gale and storm force conditions due to excessive rolling, exceeding 20 degrees. This was considered both uncomfortable and hazardous to passengers, but also have the potential to shift cargo and cause damage.

1.8.9.4 Given this conclusion, it would be reasonable to expect ferries to take a more circuitous route around the Morgan Array Area rather than passing on a more constrained route, as described in section 1.8.3. However, in marginal conditions where a Master does not choose to take an adverse weather route, were the conditions to deteriorate, there is less opportunity for the Master to mitigate those conditions. Therefore, as excessive roll starts to be experienced, the Master may for instance turn into wind, but in doing so will increase the risk of allision with the offshore wind farm.

1.8.9.5 Cargo shift situations have occurred within the shipping and navigation study area, most notably the ro-ro cargo vessel Riverdance in January 2008. This occurred in adverse weather and resulted in the grounding on the Shell Flats and total constructive loss but without injuries.

Responding to vessel emergencies

1.8.9.6 Concerns were raised by stakeholders relating to the ability of vessels to conduct emergency manoeuvres around the Morgan Array Area. During the navigation simulations, two types of scenarios were tested and discussed with ferry Masters. Firstly, medical emergencies are relatively common on-board passenger ferries and there may be a requirement for a vessel to conduct a helicopter transfer which necessitates the vessel taking a defined course for a period of time. It was concluded that the minimum time between launching an HMCG helicopter and arriving on scene, was significantly greater than the transit time a vessel would spend in the vicinity of the Morgan Array Area. Furthermore, the likely first course of action of the Master would be to make best speed towards the closest harbour given that it is not guaranteed that an HMCG helicopter would be available to respond. This gives the Master the opportunity to reposition the vessel clear of any hazards.

1.8.9.7 Secondly, some emergencies on board, particularly fire or a man overboard, require immediate action by the bridge teams. For example, during fire, it may be necessary to turn the vessel into the wind such that the smoke does not blow across the

passenger decks, or action may be needed to reduce the roll of the vessel to make it easier for the crew to respond. Whilst the Morgan Array Area does not necessarily impact upon the likelihood that fire may occur, their presence constricts the searoom to perform these manoeuvres, and may increase the resulting consequences. The ability to hold a heading may be hampered in adverse weather conditions such as a large sea state or wind speed, particularly where the vessel needs to maintain a minimum speed to ensure steerage or control.

1.8.9.8 Consultation has identified that these incidents infrequently occur on board ferries in the shipping and navigation study area (in the order of less than once a year to once in ten years). The likelihood of these incidents occurring, during strong adverse weather and it also occurring during a temporary transit of the routes (which makes up less than 5% of most routes), is highly unlikely. Furthermore, whilst the searoom is reduced, at least several nautical miles would exist to undertake some degree of mitigation, greater than vessels would have available elsewhere such as the approaches to ports for example. In addition, the vessels could in an emergency enter the Morgan Array Area given that there is at least 1,400 m spacing between wind turbines which may offer a contingency of last resort.

1.8.10 Impacts to search and rescue

1.8.10.1 In the unlikely event of an incident, SAR assets are required to access the site or surrounding area without risk to themselves. In particular, wind turbines can pose a hazard to SAR helicopters and therefore the design of the wind farm should be such to enable helicopter access and therefore safeguard HMCG obligations to SAR within the UK SAR Region. An ERCoP is required to facilitate information sharing regarding the offshore wind farm and SAR organisations. The principals of SAR access for offshore wind farms are contained in MGN654 Annex 5 (MCA, 2021c), and can be summarised as:

- Lines of Orientation – developers should maintain two lines of orientation unless a safety case is produced, and additional mitigation is proposed, that one line of orientation is tolerable. This allows multiple directions for aircraft entry and improves access, whilst a linear regular grid is both more efficient and safer for conducting SAR
- SAR Lanes – to be of sufficient width to enable safe transit of an SAR helicopter between the wind turbines. MGN654 Annex 5 recommends turbine spacing (blade tips to blade tips) of greater than 500 m
- Helicopter Refuge Areas – in larger developments (>10 nm width), a refuge area clear of wind turbines may be required to enable aircrews to reorientate themselves and change direction safely
- Turbine Preparation – to support winching of a casualty, the wind turbine needs to be configured to a specific position as requested by the SAR crew. This might include rotating the nacelle to 90 degrees from the wind, and both locking and positioning the blades to facilitate SAR access (e.g. Y configuration - see MGN654 Annex 5).

1.8.10.2 Several trials have been conducted by HMCG and MCA in SAR at offshore wind farms (see MCA, 2005; 2019). They found that searching within an offshore wind farm is more complex than in open sea and there may be a delay for entry into an offshore wind farm whilst the crew familiarise themselves with the site and layouts. During poor visibility, the importance of linear SAR lanes of sufficient width was identified as of significant importance. When transiting through an offshore wind farm, all

communications and navigation equipment was reported to be operated successfully with wind turbines identifiable through radar. Unfamiliarity with transiting and winching in vicinity of wind turbines results in slower speeds and delays which increases fuel consumption and may make searches less effective. Concerns have also been raised regarding visual identification of casualties as wind turbines block the view, particularly during rough weather.

1.8.10.3 The Morgan Generation Assets has committed to two lines of orientation and wind turbine and OSP spacing of a minimum of 1,400 m. Therefore, there would be sufficient space for SAR helicopters to navigate through the sites. The Morgan Generation Assets design should also enable surface SAR assets (such as RNLI lifeboats) to safely navigate through the site and between the wind turbines. These commitments are secured through the deemed marine licence of the DCO and in particular the requirement for a layout plan to be submitted to the MCA and Trinity House.

1.8.10.4 A review of DfT SAR helicopter data between 2015 and 2023 showed that the SAR base at HMCG Caernafron responded to 90% of all incidents recorded within the shipping and navigation study area, although HMCG helicopters from other regions were recorded on occasion in the area. Assuming a 30 minute response time (to raise the alarm and launch the SAR asset), and the S-92 SAR helicopters transit speed, it would take approximately 55 minutes for the SAR helicopter to reach the Morgan Array Area.

1.8.10.5 Similarly, a review of the RNLI data between 2008 and 2022 showed that incidents within Morgan Array Area were responded to by the Douglas RNLI station. This has a Mersey Class all-weather lifeboat capable of transiting at 25 knots. Assuming a 30 minute mobilisation time (to raise the alarm and launch the SAR asset), and the estimated time to reach a casualty within the Morgan Array Area, it could take between 80 and 90 minutes before a RNLI lifeboat could be on scene to assist a casualty.

1.8.10.6 Given the above, it should be noted that the Morgan Array Area is a considerable distance from shore and so the response time from conventional SAR assets is likely to be longer than from other vessels within the Irish Sea. Therefore, in many cases it is likely that the first responders to any casualty will be from the Morgan Generation Assets (such as O&M vessels) which are well equipped with rescue apparatus and therefore may offer immediate casualty care until other SAR assets arrive on scene.

1.8.11 Impact to oil and gas activities

1.8.11.1 The Morgan Array Area is located near to several gas platforms. The Morgan Generation Assets could impact the risk to these operations, such as altering traffic flows and increasing the risk of allision. A contact between a ferry or other large vessel and a platform carries the potential for a far greater consequence than with a wind turbine. Some platforms are manned which increases the potential for loss of life but also the potential pollution outcomes.

1.8.11.2 For the North Morecambe Gas Field, the existing Heysham to Douglas route passes between 0.4 nm to the north of this platform already. The presence of the Morgan Array Area would necessitate vessels passing further to the north to clear the Morgan Array Area. Furthermore, the routes to the west from Heysham would need to pass further south to clear the Morgan Array Area. Therefore, the risk of allision is likely reduced.

1.8.11.3 For the South Morecambe Gas Field, all existing routes from Heysham pass clear to the north of this field. The presence of the Morgan Array Area may constrict traffic further south which may increase the risk of allision.

1.8.11.4 For the Millom Gas Field, this is anticipated to be decommissioned in 2032 (with the Millom West platform removed by 2030) and there would be minimal overlap in activities. The existing Heysham-Douglas route regularly passes within 1 nm of the platform and the presence of the Morgan Array Area would likely offset this traffic further northeast reducing the allision risk.

1.8.11.5 All other platforms are of sufficient distance that the direct impacts of the Morgan Generation Assets are minimal, with sufficient searoom to enact collision avoidance.

1.8.12 Impacts of project on communications, radar and positioning systems

1.8.12.1 MGN654 and its annexes notes that an offshore wind farm may have adverse impacts on the equipment used for navigation, collision avoidance or communications (MCA, 2021a). A significant body of work has been conducted to examine these impacts in detail, and reference is made to the following studies:

- MCA and QinetiQ (2004). Results of the electromagnetic investigations and assessments of marine radar, communications and positioning systems undertaken at the North Hoyle wind farm by QinetiQ and the MCA
- BWEA (2007). Investigation of Technical and Operational Effects on Marine Radar Close to Kentish Flats Offshore Wind Farm
- Ocean Studies Board's Division on Earth and Life Studies (2022). Wind Turbine Generator Impacts to Marine Vessel Radar.

1.8.12.2 Table 1.29 provides a summary of these potential impacts, with further consideration of the impacts on marine radar explored below.

Table 1.29: Summary of impacts on equipment.

Impact on	Overview
VHF	VHF is essential for the communication between vessels and shore. VHF radio waves could be blocked or interfered with by the presence of wind turbines. The 2004 QinetiQ study found no noticeable effect on VHF communications both ship-shore and ship-ship within or adjacent to the wind farm. A trial aboard SAR helicopters (MCA, 2005) also determined no significant impact on VHF direction finding capabilities. Therefore, no significant impact on VHF communications is anticipated.
AIS	AIS enhances the identification between vessels for collision avoidance. AIS signal could be blocked or interfered with by the presence of wind turbines. The QinetiQ study found no noticeable effect on AIS reception. Therefore, no significant impact on AIS communications is anticipated.
GNSS	Global Navigation Satellite Systems (GNSS) such as the Global Positioning System (GPS) is used for satellite positioning systems and navigation. Satellite reception could be impacted by the presence of wind turbines. The QinetiQ study found no noticeable effect on GPS reception, even in very close proximity to the wind turbines. Therefore, no significant impact on GPS is anticipated.
Shore Radar	Similar to marine radars, shore radars could be impacted by the wind turbines. Morgan Array Area is clear of any ports and harbours, and any Vessel Traffic Services (VTS) coverage.
Noise	The sound generated by the wind turbines could mask navigational sound signals from vessels or AtoNs. Whilst wind turbines make an audible sound whilst rotating, the low density of shipping and distance to other navigational marks makes this potential impact negligible. Furthermore, maritime regulations for audibility of a ship's whistle are well in excess of the typical wind turbine sound emissions even at very close range. Therefore, no significant impact on navigation safety from increased noise is anticipated.

Impact on	Overview
Compass	Compasses are used for vessel navigation. These are potentially impacted by electromagnetic interference from the wind turbines or cables. The degree of this impact is related to the depth of water, cable design and alignment with the earth's magnetic field. Given the depth of water and minimal extent of effect, no significant impact on navigation safety from electromagnetic interference is anticipated.

Marine radar interference

1.8.12.3 Marine radar is used for both collision avoidance and vessel navigation. Wind turbines, like other structures, can result in spurious returns such as side lobes, echoes, reflections and blanketing. These effects were studied extensively in both the QinetiQ (2004) and BWEA (2006) studies. Both studies determined that the reduced capability to track small vessels within offshore wind farms and the risk of losing acquired targets should be considered by mariners navigating adjacent to offshore wind farms. Some of these effects can also be mitigated by careful adjustment of radar controls, such as Gain.

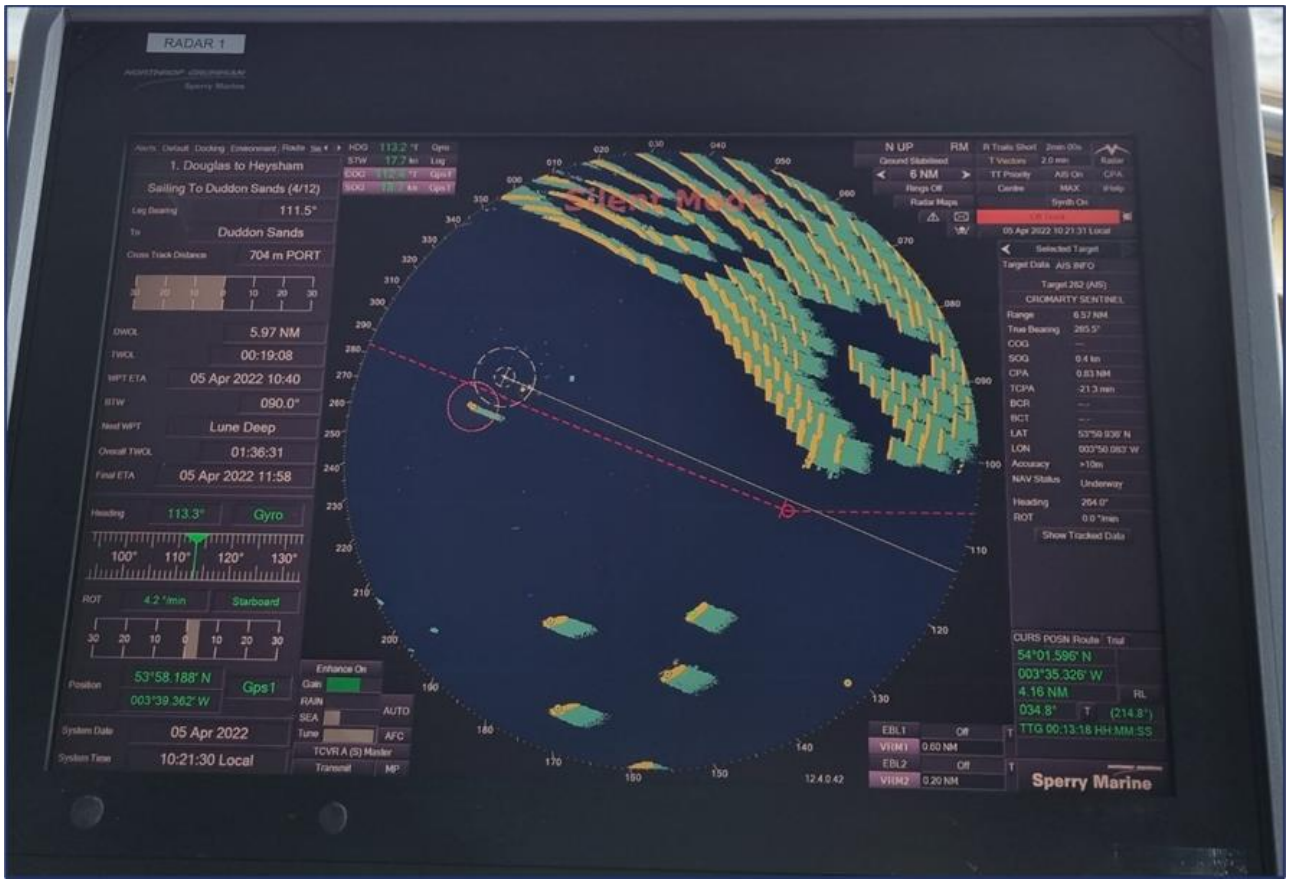

Figure 1.46: Radar screen of the Ben My Chree (source: project team 05 April 2022).

1.8.12.4 Based on this, the MCA (2021a) developed a shipping route template (MGN654) that placed the extent of these effects at up to 1.5 nm, increasing as the vessels transit closer to the wind turbines. Intolerable impacts may be experienced up to 0.5 nm from the offshore wind farm. Historical evidence suggests that most vessels pass more than

0.5 nm from an offshore wind farm and therefore these effects are lessened. Figure 1.47 shows how the Morgan Array Area relate to the region of potential radar effects.

1.8.12.5 Cargo/tanker and ferry routes from Heysham and Liverpool could pass within 1.5 nm of the Morgan Array Area and therefore this could impact the risk of collision. However, existing routes pass as close to other existing offshore wind farms such as West of Duddon Sands and Gwynt y Mór. Therefore, regular runners should be familiar with these effects.

1.8.12.6 The Morgan Array Area is outside of all port limits, VTS and pilotage areas and therefore whilst shore-based radar may have partial coverage of the sites, it would not be actively monitored. Therefore, the presence of Morgan Array Area would not compromise vessel traffic monitoring obligations.

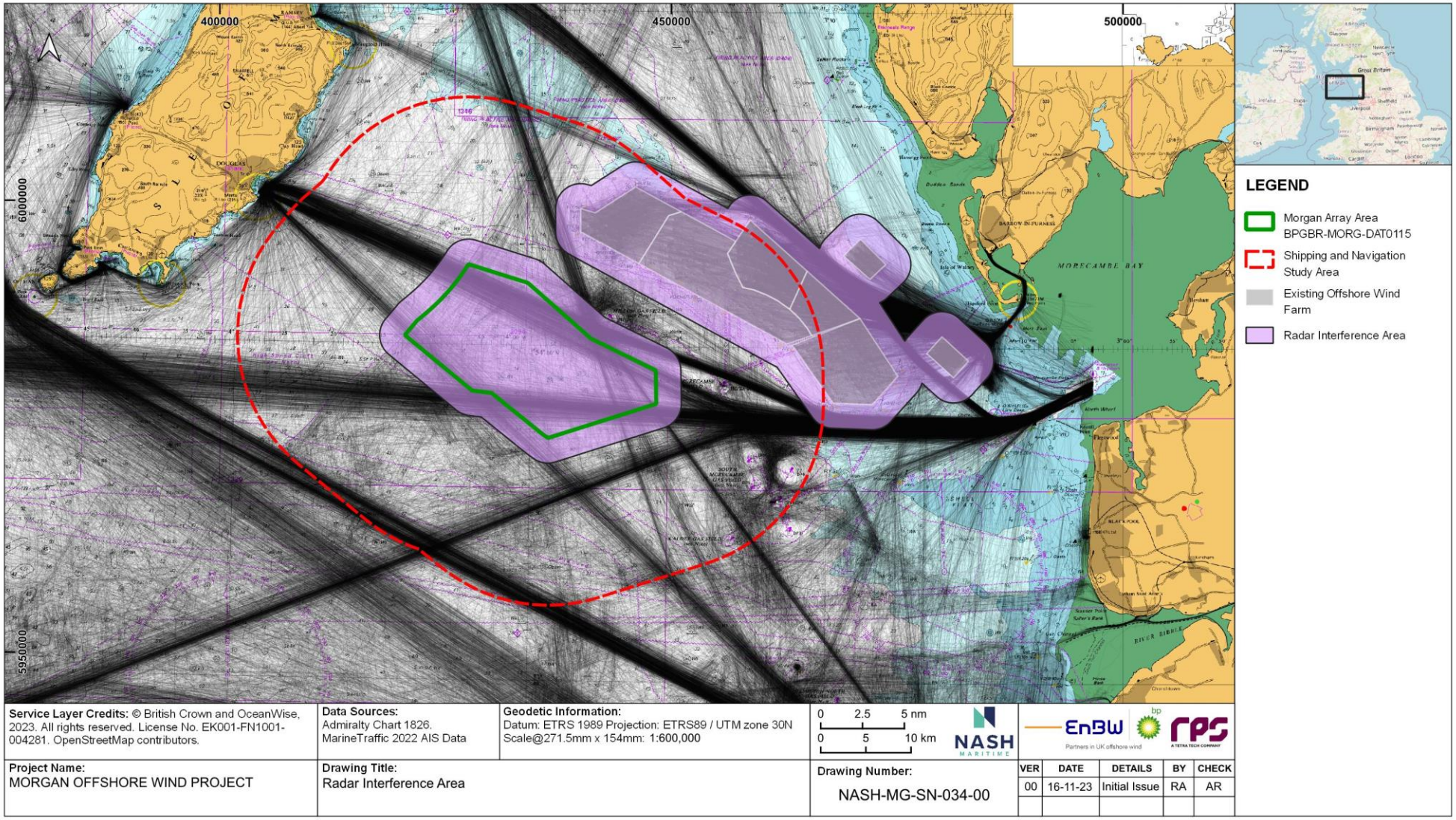

Figure 1.47: Radar interference areas.

1.8.13 Impact on risk of snagging

1.8.13.1 The cables within the boundaries of the Morgan Array Area pose a risk of snagging to fishing gear and ships anchors.

1.8.13.2 The cables are intended to be buried, to a depth of at least 0.5 m, to mitigate the risk of snagging. Where burial is not possible, cable protection may be required up to a height of 3 m. A CBRA will be undertaken to determine the appropriate level of protection and the cables periodically inspected once installed.

1.8.13.3 Analysis of anchoring activity is contained within section 1.6.2. There are no designated or customary anchorages in the shipping and navigation study area. Commercial ships may choose to deploy an anchor in an emergency, and whilst uncommon, this could result in cable snagging.

1.8.13.4 Fishing by static and mobile gears is shown throughout the Morgan Array Area. Where conditions allow, these vessels may continue to fish within the Morgan Array Area during operations and gear could interact with subsea cables. A fisheries co-existence plan will be developed to minimise the risk of gear snagging (see Outline fisheries liaison and coexistence plan (Document Reference J10)).

1.9 Navigational Risk Assessment

1.9.1 Introduction

1.9.1.1 The NRA has been produced in accordance with MGN654 and follows the IMO's FSA (see section 1.2.2). The MGN654 requires that the NRA contain a hazard log of shipping and navigation hazards caused or changed by the Morgan Generation Assets which includes an assessment of risk with applied risk controls in place (those controls designed and included in the Morgan Generation Assets which are commonly accepted as industry good practice - see section 4.8 for a list of applied risk controls), and an assessment of risk for the Morgan Generation Assets with possible additional risk controls in place if they are warranted (section 1.9.7).

1.9.1.2 The development of the NRA, hazard log and associated risk scoring process is based on the following data, analysis, modelling and expertise of the project team:

- Project description (see section 1.4)
- Overview of baseline environment (see section 1.5)
- Description of existing marine activities (see section 1.6)
- Future case vessel traffic profiles (see section 1.7)
- Potential impact assessment (see section 1.8).

1.9.1.3 In addition to the above, a key component of the NRA is engagement with regulators and local stakeholders to confirm baseline shipping and navigation characteristics and elicit judgement on the levels of navigation risk with the Morgan Generation Assets in place.

1.9.1.4 The risk assessment methodology employed for the Morgan Generation Assets is the IALA SIRA process, which follows both the MCA MGN654 guidance (MCA, 2021a) and is also endorsed by the IMO via SN.1/Circ.296 in December 2010. The following sections outline:

- The overarching methodology of the risk assessment

- Provides details on the hazard workshop
- Details the process of hazard identification
- Specifies risk control measures (applied or designed in)
- Provides results of the assessment of risk with the applied risk controls in place
- Details possible additional risk control measures if required to reduce risk to acceptable levels.

1.9.1.5 The risk assessment project methodology follows the IMO FSA and is based on the principles set out in IALA Guidelines 1018 and 1138 which are endorsed by the IMO in SN.1/Circ.296 and the IMO's FSA and is as shown in Figure 1.1. Navigation hazards are identified through, consultation and data analysis, before being assessed in terms of their likelihood and consequence. A risk matrix is then utilised to identify the significance of each hazard with possible additional risk controls identified based on the resultant risk score to reduce the risks to acceptable levels.

1.9.1.6 A description of the FSA process is as follows:

1. FSA Step 1: HAZID: The project team identifies navigation hazards related to defined and agreed assessment parameters, such as geographic areas, marine operation, or vessel type. This is achieved using a suite of quantitative (e.g. statistical vessel traffic analysis) and qualitative (e.g. consultation with stakeholders) techniques which enables an evidentially robust identification of navigation hazards
2. FSA Step 2: Risk Analysis: A detailed investigation of the causes, including the initiating events, and consequences of the hazards identified in Step 1 is undertaken. This is completed using a risk matrix, and enables ranking of hazards based on navigation risk, and a determination of hazard acceptability tolerability. This process allows attention to be focused upon higher-risk hazards enabling identification and evaluation of factors which influence the level of risk
3. FSA Step 3 & 4: Risk Controls: The identification of existing risk controls measures (which are assumed to be included in the assessment of navigation risk), and the identification of possible additional risk controls, not currently in place for the assessment parameters is undertaken. Possible additional risk control measures are identified based on prioritising mitigation of higher-risk hazards. During this stage risk control measures may be grouped into a defined and thought-out risk mitigation strategy
4. FSA Step 5: Findings: The assessment findings are developed and documented into a technical report and then presented to the relevant decision makers in an auditable and traceable manner. The findings are based upon a comparison and a ranking of all hazards and their underlying causes; the comparison and ranking of possible additional risk control options as a function of associated costs and benefits; and the identification of those options which mitigate hazards to acceptable or ALARP.

1.9.2 Scoring criteria

1.9.2.1 Having identified all relevant impacts and hazards as a result of the Morgan Generation Assets, a hazard log is constructed as described in MGN654 Annex 1 (MCA, 2021b). Whilst there is no generally accepted standard for risk matrices, the following is

proposed as suitable for the Morgan Generation Assets as it meets IMO and IALA guidance and is consistent with industry best practice.

1.9.2.2 Each hazard is scored based on its predicted frequency of occurrence (Table 1.30) and consequence (Table 1.31) for two scenarios, the 'most likely' and 'worst credible. Severity of consequence with each hazard under both scenarios is considered in terms of damage to:

- People – hazards may result in injuries or fatalities
- Property – hazards may result in damage or loss of vessels or structures
- Environment – hazards may result in environmental pollution such as oil spills
- Commercial and reputation – hazards may result in loss of economic output, impact on vessel routes, interruption of supply/generation capacity and adverse media coverage.

1.9.2.3 This NRA assumes that vessels will be compliant with international (e.g. COLREGs and Standards of Training, Certification and Watchkeeping for Seafarers), and National regulations and Guidance (e.g. UK Merchant Shipping Act 1995, and MCA MGNs) regulations.

Table 1.30: Frequency of occurrence criteria.

Rank	Title	Description	Definition
1	Remote	Remote probability of occurrence at project site and few examples in wider industry.	<1 occurrence per 10,000 years
2	Extremely unlikely	Extremely unlikely to occur at project site and has rarely occurred in wider industry.	1 per 100 to 10,000 years
3	Unlikely	Unlikely to occur at project site during project lifecycle and has occurred at other offshore wind farms.	1 per 10 to 100 years
4	Reasonably probable	May occur once or more during offshore wind farm lifecycle.	1 per 1 to 10 years
5	Frequent	Likely to occur multiple times during offshore wind farm lifecycle.	Yearly

Table 1.31: Severity of consequence categories and criteria.

Rank	Description	People	Property	Environment	Business
1	Negligible	Minor injury.	Less than £10,0000	Minor spill no assistance required.	Minimal impact on activities.
2	Minor	Multiple minor injuries.	£10,000-£100,000	Tier 1 Local assistance required	Local negative publicity. Short term loss of revenue or interruption of services to ports/ offshore wind farm/oil and gas/ferries and other marine users.
3	Moderate	Multiple major injuries.	£100,000-£1million	Tier 2 Limited external assistance required	Widespread negative publicity. Temporary suspension of activities to ports/offshore wind farm/oil and gas/ferries and other marine users.

Rank	Description	People	Property	Environment	Business
4	Serious	Fatality.	£1million-£10million	Tier 2 Regional assistance required	National negative publicity. Prolonged closure or restrictions to ports/offshore wind farm/oil and gas/ferries and other marine users.
5	Major	Multiple fatalities.	> £10million	Tier 3 National assistance required	International negative publicity. Serious and long-term disruption to ports/offshore wind farm/oil and gas/ferries and other marine users.

1.9.3 Risk matrix

1.9.3.1 The combination of the frequency and consequence scores for each scenario are then combined to produce an overall risk score, which is used to assign hazard risk rating in the risk matrix (Table 1.32). The methodology utilised was discussed with stakeholders during the hazard workshop and is consistent with other NRAs submitted for other offshore wind farms in the UK.

1.9.3.2 The assessment of risk is calculated eight times for each identified hazard; four times for the '*realistic most likely*' occurrence for each consequence category and four times for the '*realistic worst credible*' outcome for each consequence category. An overall risk score is then calculated using an averaging function weighted to the highest risk score for the '*realistic most likely*' and the highest risk score for the '*realistic worst credible*'. The weighted averaging calculation is an average of:

- Average of all the '*realistic most likely*' risk scores
- Average all the '*realistic worst credible*' risk scores
- Highest individual score from the '*realistic most likely*' scores
- Highest individual score from the '*realistic worst credible*' scores.

1.9.3.3 The tolerability of these hazard risk scores with regards to significance and acceptability with or without further action are shown in Table 1.33.

1.9.3.4 MGN654 Annex 1 (MCA, 2021b) notes that '*There is no generally accepted standard for a risk matrix therefore developers will be expected to define the following as appropriate to the OREI development:*

- *Likelihood/frequency of incident scenarios*
- *Severity/consequence of incident scenarios*
- *Risk matrix*
- *Tolerability matrix scores*.'

1.9.3.5 The assessment criteria, including frequency and consequence bandings, are consistent with previous offshore wind farm NRAs submitted and approved by the MCA. Furthermore, reference has been made to Intolerable/ALARP/Negligible bandings defined in IMO FSA studies, such as the FSA for RoPax Vessels (MSC 85 INF3). For example, a fatality every 10 years, or multiple fatalities every 100 years within the RoPax FSA was defined as the threshold between Unacceptable and Tolerable if ALARP, this translates to a score between 12 to 16 and 10 to 15 respectively on the risk matrix. Similarly, the same study determined that a fatality every 1,000 years, or multiple fatalities every 10,000 years was defined as the

threshold between Tolerable if ALARP and Negligible, this translates to a score between 4 to 8 and 5 to 10 respectively on the risk matrix. The risk matrix presented in Table 1.32 is therefore consistent with the FSA for RoPax Vessels (MSC 85 INF3).

1.9.3.6 Hazards are then defined as either Broadly Acceptable, with existing mitigation, or Unacceptable. MGN654 Annex 1 (MCA, 2021b) states that were risks are scored as Medium Risk, '*Further risk control options must be considered to the point where further risk control is grossly disproportionate (i.e. the ALARP principle) and an ALARP justification and declaration made.*' Therefore, hazards scored as Medium Risk can only be Tolerable if ALARP is met.

Table 1.32: Risk matrix.

Risk Matrix							
Severity of consequences	Major	5	5	10	15	20	25
	Serious	4	4	8	12	16	20
	Moderate	3	3	6	9	12	15
	Minor	2	2	4	6	8	10
	Negligible	1	1	2	3	4	5
			1	2	3	4	5
			Remote	Extremely unlikely	Unlikely	Reasonably probable	Frequent
			Likelihood of Occurrence				

Table 1.33: Tolerability and risk ratings.

Hazard Score	Tolerability	Description
Negligible Risk (1 to 4)	Broadly Acceptable	Generally regarded as not significant and adequately mitigated. Additional risk reduction should be implemented if reasonably practicable and proportionate.
Low Risk (4.1 to 6)		
Medium Risk (6.1 to 12)	Tolerable if ALARP	Generally regarded as within a zone where the risk may be tolerable in consideration of the Morgan Generation Assets. Requirement to properly assess risks, regularly review and implement risk controls to maintain risks to within ALARP where possible.
High Risk (12.1 to 20)	Unacceptable	Generally regarded as significant and unacceptable for project to proceed without further risk controls.
Extreme Risk (20.1 to 25)		

1.9.4 Hazard workshop

1.9.4.1 The first hazard workshop conducted for the PEIR was held in Liverpool on 11 October 2022 to review the navigational hazards of the Morgan Generation Assets. It was attended by representatives from ferry operators, regulators, cargo/freight operators, oil and gas, ports, fishing community and recreational users.

1.9.4.2 All stakeholders were provided with a pre-read pack that described the existing marine environment, Project description, predicted impacts of the Morgan Generation Assets and NRA methodology. In addition, copies of the draft risk assessment produced by the project team were provided to each stakeholder in advance of the hazard workshop

who were invited to review and pre-score the hazards. A webinar was undertaken on 03 October 2022 to discuss the pre-read material.

1.9.4.3 At the workshop, the project team introduced the material and methodology before stakeholders were invited to describe their key concerns regarding the Morgan Generation Assets. From this, the NRA team identified hazards to focus the hazard workshop discussions. These generally relate to collisions between ferries and other ships as well as collisions with small craft, although other hazards such as allisions were discussed. For each hazard, stakeholders were provided an opportunity to discuss the hazards in small groups and provide scorings, and then a discussion was held in the wider room about the variation in scoring for each hazard and where differences lay. Stakeholders were encouraged to fill out the comments section of each hazard to provide a higher level of description regarding their scores. At the end of the day, a summary was held to discuss the key impacts identified and some potential mitigation options. The hazard scores were updated after the workshop by the project team to reflect stakeholder comments for inclusion within the NRA.

1.9.4.4 At the first hazard workshop to inform the PEIR, it was concluded that there was insufficient searoom between the Morgan Generation Assets and the existing West of Duddon Sands and Walney offshore wind farms and therefore that unacceptable risks to navigation existed. In particular, the workshop concluded that unacceptable risks to navigation were found due to insufficient searoom around the Morgan Potential Array Area. The findings of the first workshop and associated NRA for the PEIR can be found within the PEIR document (Morgan Offshore Wind Limited, 2023).

1.9.4.5 Boundary changes were made post-PEIR to the Morgan Potential Array Area, and a second hazard workshop was undertaken in Liverpool on the 29 September 2023 in order to inform the Environmental Statement. This workshop followed an identical structure and methodology to the workshop that was held to inform the PEIR and was attended by many of the same stakeholder groups. A detailed summary of this workshop is available in Appendix B. In total, 14 hazards were reviewed as part of the Morgan Generation Assets workshop relevant to both the alone and cumulative assessment.

1.9.4.6 A full summary of the workshop to inform the Environmental Statement is available in Appendix B.

1.9.4.7 During the hazard workshop, consensus was not reached on the specific scoring of several hazards, with a range of scores provided between the stakeholders and project team. However, a consensus was reached that all hazards associated with the Morgan Generation Assets previously identified as High Risk – Unacceptable at the PEIR stage had been reduced to Medium Risk – Tolerable if ALARP following the changes that had been made to the Morgan Potential Array Area boundary. To derive the final scores for this NRA, the findings of the workshop were considered together with the analysis and wider assessment undertaken by the Applicant's project team (see Appendix A).

1.9.5 Hazard identification

1.9.5.1 An NRA should consider all identified hazards of the Morgan Generation Assets on shipping and navigation receptors. In developing the hazard log, consideration was given to project phases, areas, hazard types and vessel types.

1.9.5.2 Six hazard types were assessed:

- Collision - collision between two vessels underway (also includes striking of an anchored or moored vessel)

- Allision - vessel makes contact with Fixed or Floating Object (FFO) (e.g. wind turbines/substation etc.). A separate hazard was included following the hazard workshop for oil and gas allisions
- Grounding - vessel makes contact with the seabed/shoreline or underwater assets
- Snagging – fishing gear or anchors coming fast on subsurface infrastructure such as cables
- Vessel Emergency – emergency onboard vessel that requires SAR response. This could include fire, explosion, flooding or capsize
- Adverse Vessel Motions – vessel experiences a dangerous degree of roll or other motions that cause damage to cargo or injuries.

1.9.5.3 Seven vessel types were identified (see Table 1.34).

1.9.5.4 Two areas were identified:

- Within 10 nm of Morgan Array Area
- Route from operations and maintenance (O&M) base to offshore wind farm.

1.9.5.5 Three phases were considered, construction (C), operations and maintenance (O), and decommissioning (D). To be concise, and reflect similar impacts during construction and decommissioning, these two categories were combined in all cases. Similarly, where hazards were deemed to have similar risk scores between construction and, operations and maintenance, they were combined into a single hazard.

Table 1.34: Vessel types.

ID	Description	Definition
1	Ferry or Passenger Vessel	Passenger Ferry/Freight Ferry/Cruise Ship
2	Cargo Vessel or Tanker	Cargo (Container, Bulk, Reefer, General etc.)/Tanker (Oil, Chemical etc.)
3	Tug and Service Vessels	Tugs/Offshore Supply Ships/Standby Rescue Vessels/Pilot Boats/Non-Project CTVs/Other Service Vessels
4	Fishing	Trawlers/Fishing Boats
5	Recreational	Yachts/Pleasure Boats
6	Small Project Vessels	CTVs/Survey Vessels/Workboats
7	Large Project Vessels	Jackup Barges/Cable Layer/Heavy Lift Vessels

1.9.5.6 Based on the Morgan Generation Assets phases, vessel types, hazard types and hazard areas, a total of 25 hazards were identified.

1.9.6 Results

Risk assessment summary

1.9.6.1 The results of the NRA, based on the approach as described above shows that in total:

- No hazards were assessed as High Risk – Unacceptable
- 16 hazards were assessed as Medium Risk – Tolerable (if ALARP)

- Nine hazards were assessed as Low Risk – Broadly Acceptable.

1.9.6.2 The full hazard log is available in Appendix A. Table 1.35 describes the top 10 hazards identified in this NRA.

Table 1.35: Top 10 hazards.

ID	Rank	Phase	Area	Hazard Title	Score	Rating
5	1	C/O/D	Morgan Array Area + 10 nm	Allision - Ferry/Passenger	10.0	Medium Risk - Tolerable (if ALARP)
8	2	C/O/D	Morgan Array Area + 10 nm	Allision - Fishing	9.6	Medium Risk - Tolerable (if ALARP)
3	3	C/O/D	Morgan Array Area + 10 nm	Collision - Ferry/Passenger or Cargo/Tanker ICW. Small Craft	8.8	Medium Risk - Tolerable (if ALARP)
24	4	C/O/D	Morgan Array Area +10 nm	Adverse Vessel Motions - Ferry/Passenger or Cargo/Tanker	8.8	Medium Risk - Tolerable (if ALARP)
25	4	C/O/D	Morgan Array Area + 10 nm/O&M	Allision (Oil and Gas) - Ferry/Passenger or Cargo/Tanker or Large Project Vessel	8.8	Medium Risk - Tolerable (if ALARP)
18	6	C/O/D	Morgan Array Area + 10 nm	Vessel Emergency - Ferry/Passenger or Cargo/Tanker or Large Project Vessel	7.8	Medium Risk - Tolerable (if ALARP)
1	7	C/O/D	Morgan Array Area + 10 nm	Collision - Ferry/Passenger ICW. Cargo/Tanker or Ferry/Passenger	7.8	Medium Risk - Tolerable (if ALARP)
7	8	C/O/D	Morgan Array Area + 10 nm	Allision - Tug/Service & Small Project Vessels	7.6	Medium Risk - Tolerable (if ALARP)
19	9	C/O/D	Morgan Array Area + 10 nm/O&M	Vessel Emergency - Fishing or Recreational or Tug/Service or Small Project Vessel	7.4	Medium Risk - Tolerable (if ALARP)
14	10	O	O&M Route	Collision - Small Project Vessel ICW. Cargo/Tanker or Ferry/Passenger	7.4	Medium Risk - Tolerable (if ALARP)

Risk of collision

1.9.6.3 The highest scoring collision hazard relates to a Ferry/Passenger or a Cargo/Tanker in collision with a small craft such as a fishing vessel, recreational vessel or CTV. The compression of traffic between the Morgan Array Area and Walney offshore wind farm, transited by large vessels with small fishing boats and other small vessels within them, reduces the ability to avoid a collision. Furthermore, emergence of small craft from the offshore wind farm array areas, if there is reduced visibility due to radar interference or visual obscuration, could exacerbate these risks (section 1.8.12/1.8.7). This is of particular risk for CTVs which may be operating at higher speeds. The loss of the small craft with multiple loss of life was agreed as a worst credible outcome, however, comparative historical incidents suggest this is unlikely, with injury rather than loss of life a more likely outcome (section 1.6.3).

1.9.6.4 At the time of the first hazard workshop undertaken to inform the PEIR, the absolute numbers of small craft within this area could not be fully quantified and it was agreed to score this in a precautionary fashion which resulted in a high risk unacceptable risk score. Following additional data gathering and assessment on the impacts on fishing, including through the navigation simulations undertaken to inform the Environmental

Statement, consensus was reached at the second hazard workshop, undertaken to inform this NRA for the Environmental Statement, that suitable amendments had been made to the boundaries of the Morgan Array Area which reduced the likelihood of this hazard occurring. In particular, it was demonstrated that there was sufficient searoom to avoid realistic numbers of small craft between Morgan Array Area and Walney offshore wind farm. Furthermore, the high density of seasonal day boat scallop fishing activity observed to the northwest of the Morgan Array Area was sufficiently offset from the Morgan Array Area/Walney route that there was unlikely to be a substantially greater risk of collision than current operational practices. The hazard was therefore scored as Medium Risk.

1.9.6.5 The second highest collision hazard relates to a collision between a Ferry/Passenger vessel with another Ferry/Passenger or Cargo/Tanker. During consultation, this was raised as a key concern amongst some stakeholders. The analysis undertaken in section 1.8.3, 1.8.4 and 1.8.6 suggest that less than one cargo/tanker ship per day transits the Morgan to Walney route, and the majority of ferry transits are a single IoMSPC ferry with infrequent Stena transits, therefore, concurrent transits by large commercial vessels is low. Furthermore, the navigation simulations demonstrated that given a route with greater than a 4 nm width would allow two commercial ships to pass maintaining 1 nm CPA from each other and wind turbines. The waters to the south of Morgan Array Area have greater traffic but are less constrained, enabling adequate searoom for collision avoidance.

1.9.6.6 These vessels include ferries and other large commercial ships travelling up to 20 knots and therefore there was a relatively high potential for injuries and major damage were a collision to occur. Furthermore, the consequences of collisions involving ferries could result in multiple loss of life, and that the most likely consequences could involve multiple major injuries (see section 1.6.3). As a result, this hazard was assessed as Medium Risk.

1.9.6.7 The risk of collision between small craft was scored as Medium Risk. These include fishing boats, recreational craft, tug and service or CTVs. The presence of the Morgan Array Area could increase the likelihood of this occurrence by concentrating or offsetting small craft traffic into more dense areas (section 1.8.5). Collisions involving small craft occur routinely throughout the UK and it is rare that a fatality occurs (see section 1.6.3), however, this is still considered a realistic worst-case scenario. Small craft inherently have a lower potential for damage and pollution is inherently lower than for other large vessels, and the scoring reflects this.

1.9.6.8 Given the low predicted frequency of two Cargo/Tankers meeting and colliding within the route between the Morgan Array Area and Walney offshore wind farm, and the relatively low cargo/tanker density elsewhere around the Morgan Array Area, this hazard was assessed as Low Risk.

1.9.6.9 Several risk controls have been applied by the Morgan Offshore Wind Project to mitigate the risks of collision (see section 1.4.8):

- Promulgation such as Notice to Mariners and site marking and charting issued to warn vessels of the presence of the Morgan Generation Assets and facilitate passage planning
- Marine operating guidelines and standards for Morgan Generation Assets vessels
- Outline Vessel traffic management plan to manage vessel movements (Document Reference J16)

- Emergency response capabilities including an ERCoP, marine pollution contingency plan, periodic exercises to minimise the consequences of any incident.

Table 1.36: Risks of collision during all phases.

ID	Rank	Phase	Area	Hazard Title	Score	Rating
3	3	C/O/D	Array Area + 10 nm	Collision – Ferry/Passenger or Cargo/Tanker ICW. Small Craft	8.8	Medium Risk – Tolerable (if ALARP)
1	7	C/O/D	Array Area + 10 nm	Collision – Ferry/Passenger ICW. Cargo/Tanker or Ferry/Passenger	7.8	Medium Risk – Tolerable (if ALARP)
4	11	C/O/D	Array Area + 10 nm	Collision – Small Craft ICW. Small Craft	6.7	Medium Risk – Tolerable (if ALARP)
2	20	C/O/D	Array Area + 10 nm	Collision – Cargo/Tanker ICW. Cargo/Tanker	5.1	Low Risk – Broadly Acceptable

Risk of allision

1.9.6.10 The highest hazard relates to an allision between a navigating Ferry/Passenger ship and a wind turbine or substation. Avoidance of other traffic, mechanical failure or human error could all result in an allision, with the risks heightened where routes pass immediately adjacent to an offshore wind farm. Routes operated by Stena, Seatruck and IoMSPC all pass adjacent to the Morgan Array Area. There are few historical examples of ship allisions with wind turbines (section 1.6.3), and none involving existing offshore wind farms in the shipping and navigation study area, even where these same routes pass existing offshore wind farms. The navigation simulations (Appendix E) demonstrated that amended passage plans would enable similar or greater passing distances to be achieved from the Morgan Array Area than existing offshore wind farms in the shipping and navigation study area.

1.9.6.11 Whilst ferries have high redundancy and familiarity with the shipping and navigation study area, there is a greater potential for mass loss of life in comparison to other vessel types. The historical data, research and stakeholder responses suggested that the consequences of an allision may be less severe than a collision. Multiple injuries, damage and minor pollution would be a more likely outcome, but a worst credible result could include severe damage to the ferry with fatalities and the collapse of a wind turbine. Through both the modelling results (section 1.8.8) and hazard workshop it was agreed that such incidents were unlikely and therefore was scored as Medium Risk.

1.9.6.12 The second highest hazard overall was an allision between a fishing boat and a wind turbine or an OSP within the Morgan Array Area plus 10 nm. It was recognised that fishing activity around and likely within the Morgan Array Area would be relatively high, and with minimum spacing between wind turbines of 1,400 m, it is likely that fishing will continue within the Morgan Array Area. For any vessel operating in close proximity to infrastructure, there is a risk of human error or mechanical failure which might result in an allision. Such incidents have occurred in other offshore wind farms in the UK but have resulted in minor consequences. The worst credible outcome envisaged was if a fishing vessel was to become heavily damaged or capsize resulting in loss of life.

1.9.6.13 Allision risks between a large ship and an oil and gas facility were also assessed due to the potential need for vessels to deviate their routes. The Morgan Array Area is located near to several manned and unmanned platforms. Whilst the Morgan Array Area would alter shipping routes, it would do so to increase the separation with existing

oil and gas infrastructure, and therefore the risk of allision is not anticipated to increase. Unlike the risks involving wind turbines, an allision with an oil platform carries a far greater risk of catastrophic consequences both in terms of loss of life and pollution. Oil and gas infrastructure also has additional risk controls in place to manage navigation safety around them.

1.9.6.14 The allisions of other small craft including recreational and tug/service vessels was scored as Medium Risk and is consistent with the majority of stakeholder feedback. Within the central Irish Sea, there are relatively few recreational routes (section 1.6.2), but fishing, and tug and service activity can be prolific. The minimum spacing between wind turbines of the Morgan Generation Assets will be 1,400 m and there is an expectation that some small craft will continue to be able to transit through. This close navigation raises the likelihood of allision due to human error or mechanical failure. This is likely to result in damage and minor injuries, but the loss of a small craft with fatalities is credible.

1.9.6.15 Given the much lower frequency at which Cargo/Tankers navigate the area, and the lower potential loss of life, this risk has been scored as Low Risk.

1.9.6.16 Several risk controls have been applied by the Morgan Generation Assets to mitigate the risks of allision (see section 1.4.8):

- Promulgation such as Notice to Mariners and site marking and charting issued to warn vessels of the presence of the Morgan Generation Assets
- Design of the structures including installation of AtoNs, lines of orientation and air draught clearances
- Outline Vessel traffic management plan to manage vessel movements (Document Reference J16)
- Emergency response capabilities including an ERCoP, marine pollution contingency plan, periodic exercises to minimise the consequences of any incident.

Table 1.37: Risks of allision during all phases.

ID	Rank	Phase	Area	Hazard Title	Score	Rating
5	1	C/O/D	Array Area + 10 nm	Allision - Ferry/Passenger	10.0	Medium Risk - Tolerable (if ALARP)
8	2	C/O/D	Array Area + 10 nm	Allision - Fishing	9.6	Medium Risk - Tolerable (if ALARP)
25	4	C/O/D	Array Area + 10 nm/Operations and maintenance	Allision (Oil and Gas) - Ferry/Passenger or Cargo/Tanker or Large Project Vessel	8.8	Medium Risk - Tolerable (if ALARP)
7	8	C/O/D	Array Area + 10 nm	Allision - Tug/Service & Small Project Vessels	7.6	Medium Risk - Tolerable (if ALARP)
9	11	C/O/D	Array Area + 10 nm	Allision - Recreational	6.7	Medium Risk - Tolerable (if ALARP)
6	22	C/O/D	Array Area + 10 nm	Allision - Cargo/Tanker	5.0	Low Risk - Broadly Acceptable

Risk of snagging

1.9.6.17 Snagging of inter-array or interconnector cables by fishing gear are scored as a Medium Risk. Fishing using mobile and static gear is shown to occur throughout the

shipping and navigation study area and therefore there is potential for these activities to occur in the future both within the Morgan Array Area. Cable burial or protection, in combination with promulgation and marking of the routes would mitigate this risk. Snagging of gear is likely to result in gear damage in the most likely instance but could result in the vessel coming fast and capsizing with the potential for loss of life. A Medium Risk score has therefore been assessed.

1.9.6.18 Snagging by ship anchors is less likely, but could carry a greater potential for damage, particularly by commercial ship anchors which have far greater penetration depths and potential for damage. Anchors may also be deployed in an emergency although this is relatively unlikely, but the potential would be greatest where the density of shipping is greatest which is outside of the Morgan Array Area. The consequences of snagging are relatively low for the vessel but would result in a significant commercial impact to the Morgan Generation Assets.

1.9.6.19 Snagging by small craft anchors is unlikely to cause significant damage and given the depth of water at the Morgan Array Area, this is not likely to occur, and therefore resulted in Low Risk scores.

1.9.6.20 Several risk controls have been applied by the Morgan Generation Assets to mitigate the risks of snagging or grounding (see section 1.4.8):

- Promulgation such as Notice to Mariners and site marking and charting issued to warn vessels of the presence of the Morgan Generation Assets
- Fisheries liaison and co-existence plan
- Emergency response capabilities including an ERCoP, marine pollution contingency plan, periodic exercises to minimise the consequences of any incident
- A CBRA will ensure adequate cable burial or protection.

Table 1.38: Risks of snagging.

ID	Rank	Phase	Area	Hazard Title	Score	Rating
10	14	C/O/D	Array Area	Snagging - Fishing	6.6	Medium Risk - Tolerable (if ALARP)
13	15	C/O/D	Array Area	Snagging - Project Vessel	6.3	Medium Risk - Tolerable (if ALARP)
12	24	C/O/D	Array Area	Snagging - Cargo/Tanker or Ferry/Passenger	4.1	Negligible Risk - Broadly Acceptable
11	25	C/O/D	Array Area	Snagging - Recreational or Tug/Service	3.6	Negligible Risk - Broadly Acceptable

Risks due to vessel motions or emergency response

1.9.6.21 As described in section 1.8.3, during adverse weather ferries will route to maintain a comfortable heading to the conditions and take advantage of any available lee from the shore. A passage to the east of the Morgan Array Area would require vessels to navigate beam on to the prevailing conditions, which is not considered seamanlike in adverse weather. This may result in cargo shift occurrence that causes minor injuries and property damage, a finding that was supported during the navigation simulations (Appendix E). On occasions, cargo shift can be more significant and a fatality with significant damage to the vessel is possible. Whilst it is likely that in extreme

conditions, Masters would choose to route to the west of the Morgan Array Area and avoid passing the less favourable side, in marginal conditions, they may be committed to such passage but unable to weather route. This may result in cargo shift occurrence that causes minor injuries and property damage.

1.9.6.22 Section 1.8.8 and section 1.8.10 describe the potential impacts of the Morgan Array Area on SAR and vessel emergency response. It is noted that the presence of the wind turbines could reduce both the ability to alter course in an emergency, such as a fire, but also reduce SAR effectiveness to conduct a rescue. It was demonstrated during the navigation simulations that the likelihood of having to take action was low and that there remained numerous actions that a Master could take to mitigate this scenario. The Morgan Generation Assets design (in particular to two lines of orientation) is such that recommendations on SAR access will be maintained, with minimal loss of effectiveness.

Table 1.39: Risks due to vessel motions or emergency response.

ID	Rank	Phase	Area	Hazard Title	Score	Rating
24	4	C/O/D	Array Area +10 nm	Adverse Vessel Motions - Ferry/Passenger or Cargo/Tanker	8.8	Medium Risk - Tolerable (if ALARP)
18	6	C/O/D	Array Area + 10 nm	Vessel Emergency - Ferry/Passenger or Cargo/Tanker or Large Project Vessel	7.8	Medium Risk - Tolerable (if ALARP)
19	9	C/O/D	Array Area + 10 nm/operations and maintenance route	Vessel Emergency - Fishing or Recreational or Tug/Service or Small Project Vessel	7.4	Medium Risk - Tolerable (if ALARP)

Risks specific to construction and decommissioning

1.9.6.23 During construction and decommissioning, additional large vessels will be present within and navigating to the Morgan Array Area. These could include jack-ups and heavy lift vessels. Their necessary proximity to constructed and partially constructed wind turbines increases the risk of allision and damage, albeit likely to occur at lower speed and therefore the realistic worst credible scenario would not be as significant as for other commercial shipping.

1.9.6.24 Whilst the consequences of collision could be similar to other commercial vessel types, the relative infrequent movements of large construction vessels result in a lower likelihood of collision and therefore a lower risk score.

1.9.6.25 Snagging by construction vessels of a partially laid or unburied cable could occur, however, both the consequences and likelihood are considered to be relatively low.

1.9.6.26 Several risk controls have been applied by the Morgan Generation Assets to mitigate the risks during construction and decommissioning (see section 1.4.8):

- Promulgation such as Notice to Mariners and site marking and charting issued to warn vessels of the presence of the Morgan Generation Assets
- Use of 500 m safety zones from platforms/wind turbines as required
- A buoyed construction area using cardinal marks
- Guard vessels as required
- Operational management of Morgan Generation Assets vessels including guidelines, standards, training and compliance

- Outline Vessel traffic management plan to manage vessel movements (Document Reference J16)
- Emergency response capabilities including an ERCoP, marine pollution contingency plan, periodic exercises to minimise the consequences of any incident
- Marine coordination of site activities including site monitoring (continuous watch and vessel traffic monitoring).

Table 1.40: Risks specific to construction and decommissioning.

ID	Rank	Phase	Area	Hazard Title	Score	Rating
13	15	C/D	Array Area	Snagging - Project Vessel	6.3	Medium Risk - Tolerable (if ALARP)
23	16	C/D	Array Area + 10 nm/O&M	Allision - Large Project Vessel	6.2	Medium Risk - Tolerable (if ALARP)
20	19	C/D	Array Area + 10 nm/O&M	Collision - Large Project Vessel ICW. Ferry/Passenger	5.3	Low Risk - Broadly Acceptable
21	20	C/D	Array Area + 10 nm/O&M	Collision - Large Project Vessel ICW. Cargo/Tanker	5.1	Low Risk - Broadly Acceptable
22	23	C/D	Array Area + 10 nm/O&M	Collision - Large Project Vessel ICW. Fishing or Recreational or Tug/Service	4.1	Low Risk - Broadly Acceptable

Risks involving operations and maintenance activities

1.9.6.27 The operations and maintenance route used by vessels is not yet known for the Morgan Generation Assets, however, assumptions are made that the route is likely to cross busy shipping lanes. Therefore, there is a risk of collision between project vessels, namely CTVs, and other navigating vessels. This is exacerbated where they may emerge from within an offshore wind farm at high speed, on a boundary that is immediately adjacent to a shipping route (see section 1.8.7). CTVs carry multiple persons and a realistic worst credible hazard outcome could involve multiple loss of life. Furthermore, given the high transit speeds, most likely outcomes could result in multiple major injuries.

1.9.6.28 Consultees referred to previous near misses occurring with Irish Sea offshore wind farm CTVs, although no collision has been reported or documented. Furthermore, allision or grounding of these vessels, particularly within the operations and maintenance base harbour occurs for other UK offshore wind farms and therefore is reasonably probable to occur in the shipping and navigation study area, albeit likely to have a lower consequence. Assumptions regarding CTV movements and risk profile will be reviewed following finalisation of the proposed passage plans.

1.9.6.29 Several risk controls have been applied by the Morgan Generation Assets to mitigate the risks during operations and maintenance activities (see section 1.4.8) such as operational management of Morgan Generation Assets vessels including guidelines, standards, training and compliance and emergency response capabilities.

Table 1.41: Risks involving operations and maintenance activities.

ID	Rank	Phase	Area	Hazard Title	Score	Rating
14	10	O	Operations and maintenance route	Collision - Small Project Vessel ICW. Cargo/Tanker or Ferry/Passenger	7.4	Medium Risk - Tolerable (if ALARP)
15	11	O	Operations and maintenance route	Collision - Small Project Vessel ICW. Fishing or Recreational or Tug/Service	6.7	Medium Risk - Tolerable (if ALARP)
16	17	O	Operations and maintenance route	Allision - Small Project Vessel	5.8	Low Risk - Broadly Acceptable
17	17	O	Operations and maintenance route	Grounding - Small Project Vessel	5.8	Low Risk - Broadly Acceptable

1.9.7 Potential additional risk control options

1.9.7.1 During the hazard workshop to inform the PEIR, a number of potential, additional risk control options were identified for further reducing the risk scores and their effectiveness discussed. Many of these risk controls were proposed in the context of the cumulative effects of the Morgan Generation Assets, Mona Offshore Wind Project and Morecambe Generation Assets projects. Some of these were subsequently adopted by the Morgan Generation Assets for inclusion in this NRA, including boundary changes, lines of orientation and vessel traffic management (see Table 1.42).

1.9.7.2 These risk controls were then reviewed at the hazard workshop for the Environmental Statement in September 2023 and two additional risk controls were proposed by participants. A consensus was reached that neither of these two additional proposed controls were justified or proportionate to the benefit they would achieve. As such they were not adopted for the Morgan Generation Assets.

1.9.7.3 The details of all proposed additional risk controls and their status are described in Table 1.42.

Table 1.42: Potential additional risk control options.

ID	Title	Description	Status
Proposed at October 2022 workshop			
1	Layout design	To increase manoeuvring space and reduce impact on operators, revision of the boundaries of the Morgan Potential Array Area.	Adopted by Morgan Generation Assets and assessed within this Environmental Statement.
2	Ship routeing	Extension of the Liverpool Bay TSS to the west, enabling a direct route for traffic from the west of the Isle of Man to the Liverpool TSS.	Not adopted - this was discussed at both hazard workshops, and it was concluded by the participants that these were not required as they would offer little benefit for organizing traffic and the high complexity of establishing new ship routeing measures would be disproportionate.
3	Layout principles	Two lines of orientation to support internal navigation (and reduce the likelihood of small traffic displacement into the routes/areas outside of the offshore wind farm's) and SAR.	Adopted by Morgan Generation Assets (Two Lines of Orientation).
4	CTV passage planning	Develop coordinated passage plans for CTVs that minimises the impact on other traffic. This could include: • Specified crossing points • Agreed passing protocols/CPA for interactions with commercial shipping • Crossing protocols to be established prior to crossing traffic routes • Dissemination of information and liaison with regular runners and ferry services • Restricted visibility and night time protocols.	Adopted by Morgan Generation Assets through Outline vessel traffic management plan (Document Reference J16).
5	Continued engagement	Maintain a marine navigation engagement forum to facilitate information sharing and management/identification of additional risk controls: • Identify near misses and investigate incidents, disseminating learnings • Coordinate construction activities.	Adopted by Morgan Generation Assets (through continuation of MNEF).
6	Reporting notification	Consider reporting procedures for vessels navigating adjacent to the Morgan Array Area. VHF Channel 16 broadcasts of vessel details and direction of travels.	Not adopted - this was discussed at both hazard workshops, and it was concluded by the participants that these could not be implemented under existing legislation, could not be easily managed and would therefore not be appropriate.

ID	Title	Description	Status
7	Master training	Provision of enhanced Master training, such as simulator sessions, for safe navigation adjacent to Morgan Array Area.	Not adopted - this was discussed at both hazard workshops, and it was concluded by the participants that Master training was sufficient to appropriately manage navigation safety with the revised boundaries.
8	Construction scheduling	Managing construction activities to deconflict with other marine activities.	Adopted by Morgan Generation Assets through Outline vessel traffic management plan (Document Reference J16).
Proposed at September 2023 workshop			
9	Exclusion from the Morgan Array Area	Exclusion of non-project vessel traffic from the Morgan Array Area, as is the case elsewhere in the world to minimize the risk of allision and collision with project vessels.	Not adopted - this was discussed at both hazard workshops, and it was concluded by the participants that this would adversely impact freedom of navigation, could increase risk by offsetting small craft into adjacent shipping lanes and was inconsistent with the approach taken by the MCA.
10	Emergency Towage Vessel (ETV)	Introduction of an ETV in the Irish Sea to respond to any disabled vessel which was drifting towards the Morgan Array Area. Existing towage in the Irish Sea would be ill suited to respond to such an emergency and therefore a dedicated ETV, as is more commonly the case in Europe could respond to these situations.	Not adopted - this was discussed at both hazard workshops and given that vessel allisions were scored as Medium Risk and relatively unlikely, therefore the very high cost of procuring and operating at ETV was disproportionate.

1.9.8 Summary

1.9.8.1 This NRA has brought together significant analysis, consultation, navigation simulations and the findings of both hazard workshops to determine the navigational risks associated with the Morgan Generation Assets. The study has concluded that following the changes to the Morgan Potential Array Area made post-PEIR, all hazards associated with the Morgan Generation Assets have been reduced to either Medium Risk – Tolerable if ALARP or Broadly Acceptable. Whilst it was recognised that the construction of an offshore wind farm in otherwise navigable waters would increase the risks of collision and allision for navigating vessels, a consensus was reached with stakeholders that these risks were Tolerable if ALARP or Broadly Acceptable. In particular, the increase in searoom around the Morgan Array Area following changes to the project boundary provides sufficient space for vessels to safely manoeuvre in complex realistic traffic situations and adverse weather in full compliance with the COLREGs and the practice of good seamanship. The results of the cumulative risk assessment are presented in section 1.10.

1.9.8.2 Appropriate risk controls have been embedded in the Morgan Generation Asset's design and whilst additional risk control options were discussed at the hazard workshops (such as ship routeing or ETVs), it was agreed at the hazard workshop to inform the Environmental Statement that these were disproportionate to the reduction in risk they might achieve. Therefore the NRA has also concluded that, where risks are scored as Medium, they can be considered ALARP and therefore Tolerable without the need for further risk control measures.

1.10 Cumulative assessment

1.10.1 Introduction

1.10.1.1 During early consultation for the Morgan Generation Assets, stakeholders raised concerns regarding the potential cumulative impacts of the Morgan Generation Assets, Mona Offshore Wind Project and the Morecambe Generation Assets (the Projects). In particular, it was noted that the presence of all three array areas would result in routes between them that had greater impacts on navigational safety and commercial operations than each array area would have in isolation.

1.10.1.2 In reference to this, the developers (EnBW, bp, Cobra Instalaciones Servicios, S.A. and Flotation Energy plc) jointly commissioned the development of a Cumulative Regional NRA (CRNRA) (Appendix E). The objective of the CRNRA was to enable stakeholders to engage with and understand the potential cumulative effects of the Projects. Adopting a regional (collaborative) approach to assessment enabled individual projects to quantify and manage the cumulative impacts in a coordinated, consistent and efficient manner. This was undertaken at an earlier stage in the assessment than usual to ensure that the potential impacts of the Projects are understood as early in the process as possible.

1.10.1.3 The objectives of the CRNRA were tailored to address stakeholder concerns, namely, the formation of routes between the three array areas during the operation and maintenance phases of the Projects. Other cumulative impacts associated with different project phases or the transmission assets were not directly considered within the CRNRA but it was concluded that this did not undermine the assessment. The potential impacts of the construction and decommissioning phases are assessed within the Environmental Statement chapters for the respective projects and are largely consistent with operational impacts given the necessary exclusion of traffic from

the construction areas. The transmission assets (such as the export cables) have not been included within the CRNRA. Export cables have minimal impact on surface navigation, impacts are highly localised to the specific cable routes and rarely have significant cumulative effects on shipping and navigation receptors. The potential impact of transmission assets on shipping and navigation is considered separately within the assessment chapters for the individual projects.

1.10.1.4 The shipping and navigation study area of the CRNRA is defined as the region of the east Irish Sea bounded by the Isle of Man to the northwest and the Welsh and English coasts to the south and east respectively (Figure 1.48).

1.10.1.5 The CRNRA assumed the consenting and construction of the Awel y Môr offshore wind farm and decommissioning of some oil and gas structures. Due to insufficient information at the time of the assessment given the early stage in development, the Isle of Man offshore wind farm (subsequently named Mooir Vannin) is not included in the main body of the CRNRA but is assessed at a higher level within an addendum.

1.10.1.6 The CRNRA that accompanied the PEIR concluded that there was insufficient searoom between the Projects' three array areas and existing offshore wind farms in the Irish Sea for safe navigation and therefore unacceptably high risks would result. In particular, collision risk was shown to be high for ferries in collision with other large commercial vessels and with small craft operating between the Projects' three array areas and existing offshore wind farms in the Irish Sea. Furthermore, it was concluded that the Projects would necessitate appreciably large deviations during normal and adverse weather conditions to impact on operator schedules and timetables.

1.10.1.7 Following a review of these findings together with feedback from the Section 42 consultation undertaken on the PEIR, the Projects made commitments to address these impacts. Key changes included revisions to the Projects array area boundaries and layout design. The CRNRA for this Environmental Statement was updated from the PEIR by undertaking additional data collection, navigation simulations and hazard workshops which considered and assessed these changes. The CRNRA is presented in a separate report (Appendix E). A high-level summary of the key findings is presented below.

1.10.2 Summary of cumulative impact on vessel routeing

1.10.2.1 The CRNRA noted additional cumulative impacts on ferry routeing above those described in section 1.8.3.

1.10.2.2 With regards to the IoMSPC routes, minor deviations of less than two minutes would be required to pass clear of both the Mona and Morgan Array Areas. During adverse weather, the presence of the Mona Array Area would impact upon the Liverpool to Douglas route (see Appendix E), increasing transit time by a further 13 minutes on top of an existing delay of between 10 and 23 minutes. The Morgan Array Area would impact upon on the Heysham to Douglas route, increasing transit time by a further 24 minutes on top of an existing delay of between 10 and 33 minutes. Neither adverse weather route is substantially impacted by the Projects collectively, as opposed to the impacts of each project in isolation.

1.10.2.3 With regards to the Seatruck routes between Heysham and Ireland, the presence of the Mona and Morgan Array Areas would compress traffic through this gap. The impact on the Heysham to Dublin route was negligible and on the Heysham to Warrenpoint route, a deviation of less than five minutes would be required. During adverse weather routeing, which typically occurs further west at present, the impacts would be negligible.

1.10.2.4 With regards to the Stena routes between Liverpool and Belfast, the route to the west of the Isle of Man would be impacted by the Mona Array Area, and the route east of the Isle of Man would be impacted by the Morgan Array Area and Morecambe Array Areas. The passage to the east of the Isle of Man would, however, necessitate a route around both the Morecambe Generation Assets and Morgan Generation Assets. During adverse weather, this would necessitate an additional 70 minutes of transit between the three Projects, likely making the east route less favourable.

1.10.2.5 Impacts on the P&O route between Liverpool and Dublin were assessed as negligible given that they pass clear of the Projects.

1.10.2.6 The CRNRA concluded that the cumulative impacts of the Projects on ferry passage planning in normal weather conditions was minor, given the total transit time, existing variation in timetables and turnaround times in port was significantly greater than the necessary deviations around the Projects. However, during infrequent adverse weather, the additional deviations around the Projects to maintain safe transit would increase the number of cancellations as services would be materially impacted.

1.10.2.7 The impacts on cargo/tanker vessel routeing were less than those of ferries. The principal routes in the Irish Sea into Liverpool would route to the southwest of the Mona Array Area and impacts to less trafficked cargo/tanker routes were assessed in a similar manner between the individual assessment and cumulative assessments (section 1.8.4). Minor cargo/tanker routes with less than one vessel a day would be deviated through the routes between the Projects, but the increase in distance would not be large given the length of voyages these vessels undertake.

1.10.2.8 The impacts on small craft routeing would be greater where their activities are offset from the three array areas were they to choose not to navigate through the wind farms. However, the spacing between wind turbines in the Projects is likely to be sufficient to enable safe internal navigation by small craft.

1.10.3 Summary of cumulative impact on navigation safety

1.10.3.1 It was noted that the Projects increased the constraint on routes between them, but that each route was of sufficient width to comply with guidance:

- Morgan Array Area and Walney offshore wind farm route at between 4.4 nm and 5.3 nm wide by 11.5 nm in length
- Mona Array Area and Morgan Array Area route at 6.0 nm wide by 5.5 nm in length
- Mona Array Area and Morecambe Array Area route at 5.7 nm wide by 5.0 nm in length.

1.10.3.2 Analysis of vessel concurrency demonstrated that, with the exception of the route south of the Mona Array Area, the likelihood of two commercial vessels meeting between the three array areas was relatively low (<25% of transits). More than two vessels meeting was modelled to be less than 3% for all routes. Whilst there was shown to be an increase in meeting situations, this was not judged to be significant.

1.10.3.3 Through additional navigation simulation sessions conducted with the Irish Sea ferry companies during 2023, the amendments to the boundaries of the three array areas was tested. It was concluded that collision risk whilst navigating between and around the Projects was manageable with existing operational procedures in complex, worst credible traffic situations. Vessels could maintain desired CPAs from other vessels and structures.

1.10.3.4 Other impacts such as to emergency response, visual navigation, shipboard equipment, and oil and gas are largely consistent with the findings contained within the Morgan Generation Assets NRA and described above.

1.10.3.5 A cumulative hazard workshop was held on the 29 September 2023 and attended by representatives from ferry companies, regulators, commercial bodies, oil and gas operators, ports and the fishing community. The methodology and attendees were largely the same as that described in section 1.9. However, the assessment concentrated on the risks associated with the routes between the array areas of the three projects and existing offshore wind farms, particularly collision and allision risks. By scoring hazards differently between areas, and focusing on key hazard types, a total of 56 hazards were highlighted.

1.10.3.6 A consensus was reached that all of these hazards were either Medium Risk – Tolerable if ALARP or Low Risk – Broadly Acceptable.

1.10.3.7 The highest scoring hazards related to allisions involving ferry/passenger vessels between Morgan-Walney and Mona-Morgan, and allisions involving fishing boats. The navigation simulations demonstrated that changes to the boundaries had significantly mitigated the collision risk for vessels transiting between the Projects.

1.10.3.8 Whilst additional risk control measures were identified, some of these (such as ship routeing or emergency towing vessels) were not adopted as it was concluded they were disproportionate to the risk reduction and therefore all hazards could be determined to be ALARP without the need for additional mitigation.

1.10.4 Cumulative impacts on navigation safety with Mooir Vannin Offshore Wind Farm

1.10.4.1 An addendum to the CRNRA (Appendix E) was produced which considered how the addition of the Mooir Vannin Offshore Wind Farm might impact upon the cumulative risk to vessel traffic identified within the CRNRA undertaken to inform the Environmental Statement.

1.10.4.2 At the time of drafting the CRNRA to inform the PEIR, it was noted that an agreement for lease had been awarded to Orsted (subsequently Mooir Vannin Offshore Wind Farm Limited) in 2015 for an area of seabed in Isle of Man territorial waters, approximately 6 nm to the east of the Isle of Man. No further information or scoping report had been issued publicly for the proposed development and therefore due to uncertainty it was not incorporated into the drafting of the CRNRA.

1.10.4.3 The PEIR response provided by Orsted (Mooir Vannin Offshore Wind Limited) in June 2023 to Morgan Generation Assets stated that a scoping report would be published in September or October 2023, which was done so on 18 October 2023 (Mooir Vannin Offshore Wind Limited, 2023). This occurred after the completion of the navigation simulations, risk modelling, hazard workshop and drafting of the CRNRA. However, Mooir Vannin Offshore Wind Limited did provide the Projects with pre-scoping information on 01 September 2023. This information was used to inform a desk-based assessment and discussion at the hazard workshop to elicit the potential impacts were Mooir Vannin Offshore Wind Limited to also be constructed within the Irish Sea.

1.10.4.4 At its closest point, the Mooir Vannin Offshore Wind Farm Scoping Boundary is 2.6 nm from the Morgan Array Area and this would create a much narrower passage than was assessed within the CRNRA undertaken to inform the Environmental Statements. The distance between the Mooir Vannin Offshore Wind Farm Scoping Boundary and the Walney Extension offshore wind farm is 4.7 nm, and whilst considered navigable in

most conditions with realistic traffic numbers, would necessarily increase the risk of collision and allision in this sea area when considered with the Morgan Array Area.

1.10.4.5 The Mooir Vannin Offshore Wind Farm Scoping Boundary, in combination with the Projects and existing operational offshore wind farms, will require deviations to regular commercial vessel routes in typical and adverse conditions.

1.10.4.6 This includes the IoMSPC route between Heysham and Douglas and the Stena Line route between Liverpool and Belfast east of the Isle of Man. The shallow water to the northwest of the Mooir Vannin Offshore Wind Farm Scoping Boundary would likely result in a greater number of vessels routeing between the Mooir Vannin Offshore Wind Farm Scoping Boundary, Walney Extension offshore wind farm and the Morgan Array Area.

1.10.4.7 The assessment within the addendum found that the cumulative impact on vessel routeing when including the Mooir Vannin Offshore Wind Farm Scoping Boundary would be to adversely affect the viability of the IoMSPC and Stena Line routes in both typical and adverse weather conditions. Primarily, the Stena Line route between Liverpool and Belfast, east of the Isle of Man, would require such deviations that this route may no longer be viable, and therefore all traffic would pass west of the Isle of Man. The Stena Line service between Heysham and Belfast in adverse weather may require passages to the west of the Isle of Man rather than the east as is currently the case. Furthermore, the impact on the IoMSPC route between Heysham and Douglas would require greater frequency of adverse weather routeing to the south of the Morgan Array Area to avoid the constrained 2.6 nm waters between the Morgan Array Area and the Mooir Vannin Offshore Wind Farm Scoping Boundary. Furthermore, it was unclear how the Silver River regular service between Ramsey and Glasson would continue to operate.

1.10.4.8 The assessment within this addendum concluded that the sea room between the Mooir Vannin Offshore Wind Farm Scoping Boundary and Morgan Array Area was inadequate for safe navigation given the expected traffic density and prevailing meteorological conditions. Vessels would be unable to maintain the desired 1.0 nm CPA from other vessels and structures.

1.10.4.9 A desktop review of the following two hazards was completed as part of the NRA:

1. The risk of a ferry or passenger vessel in an allision with an offshore wind turbine or OSP
2. A collision between a ferry, cargo or tanker in collision with a small craft.

1.10.4.10 Both of these hazards have the potential to result in multiple fatalities in the realistic, worst credible scenario. The hazards have been identified with regard to transits between the Morgan Array Area, Walney Offshore Wind Farm and Mooir Vannin Offshore Wind Farm Scoping Boundary.

1.10.4.11 A consensus was reached at the CRNRA hazard workshop that these risks were deemed to be Medium Risk and ALARP without Mooir Vannin Offshore Wind Farm. However, with the addition of the Moor Vannin Offshore Wind Scoping Boundary the risks were deemed to be High Risk – Unacceptable. This information was used to inform the Environmental Statement.

1.10.4.12 It was concluded that with the addition of Mooir Vannin Offshore Wind Farm Scoping Boundary, there were likely to be further impacts on ferry routes in typical and adverse conditions and unacceptable risk to navigation safety.

1.10.4.13 It is noted in Mooir Vannin Offshore Wind Farm Limited (2023) that the Shipping and Navigation impact assessment will be undertaken in line with the MCA Marine

Guidance Note (MGN) 654 and its 'Methodology for Assessing Marine Navigational Safety and Emergency Response Risks' '*14.7.2.4 To inform the NRA, proportional quantitative modelling, including collision and allision risk modelling will be undertaken to assess the risk of the Proposed Development (Mooir Vannin Offshore Wind Farm Limited) to vessels transiting the area. This will include modelling to assess the impacts as discussed in section 14.5.3. Modelling will account for the maximum design scenario to establish the worst-case impact on shipping and navigation, to allow for design changes within the design envelope to be taken at a later date*.' It is therefore assumed that potential cumulative impacts will be addressed by Mooir Vannin Offshore Wind Farm through the planning process.

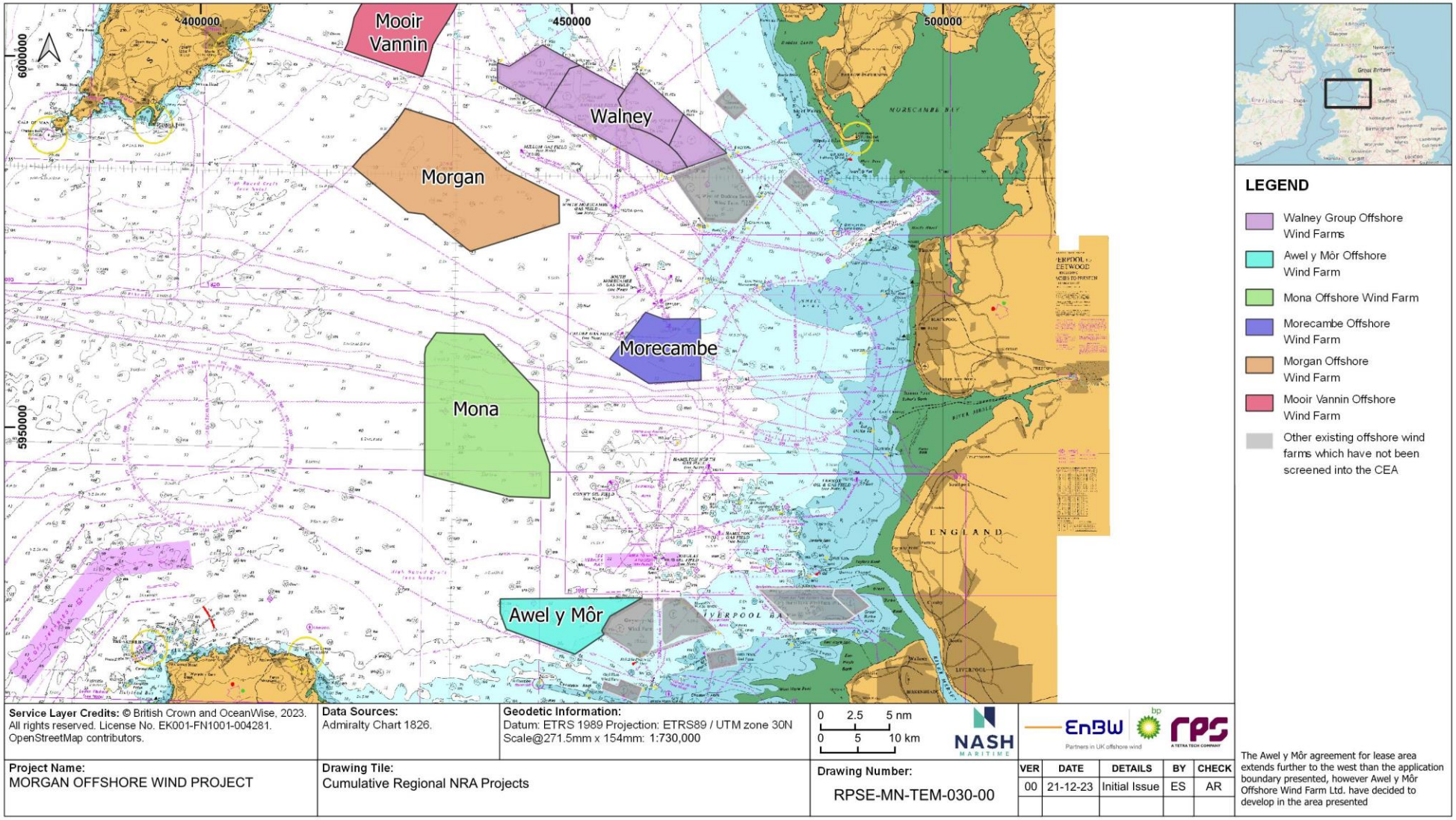

Figure 1.48: Cumulative regional NRA projects.

1.11 Conclusions

1.11.1.1 The NRA has been conducted in compliance with all relevant legislation, policy and guidance (section 1.2).

1.11.1.2 The Morgan Generation Assets would comprise up to 96 wind turbines and four OSPs within the east Irish Sea, including associated inter-array and interconnector cabling.

1.11.1.3 The shipping and navigation study area includes extensive existing activities such as oil and gas, offshore wind and aggregate extraction, but is outside of most port or harbour activities or limits (section 1.5.1 and 1.5.2).

1.11.1.4 The shipping and navigation study area has predominately southwesterly wind and wave conditions (section 1.5.3). Annual adverse weather events can exceed 4.2 m significant wave height and 50 knots wind speed. Reduced visibility might occur up to 24 days/year dependent on location within the shipping and navigation study area.

1.11.1.5 SAR facilities, including RNLI stations and helicopter stations are located immediately adjacent to the shipping and navigation study area throughout the Welsh, English and Isle of Man coastlines (section 1.5.4).

1.11.1.6 Analysis of historical vessel traffic data (section 1.6) identified:

- Cargo and tanker shipping predominately passes into the Port of Liverpool from the northwest or west and is largely clear of the shipping and navigation study area. Smaller general cargo traffic operating between Liverpool, Heysham, Douglas and the east of the Isle of Man pass through the Morgan Array Area
- There is significant passenger vessel activity across the shipping and navigation study area, including ferry services between Liverpool, Heysham, Douglas and the island of Ireland. Cruise ship transits also occur, to a lesser extent, between Douglas and Liverpool
- Recreational vessel traffic is concentrated inshore of the Morgan Array Area, particularly along the UK coast and the Isle of Man. Cruising routes exist between Liverpool and Douglas, Heysham and the Welsh coast, and the Welsh coast and Douglas
- There is static and mobile gear fishing across the shipping and navigation study area, including both local and international based boats
- Service vessels associated with existing offshore wind farms and oil and gas infrastructure account for a large proportion of vessel movements within the shipping and navigation study area but are predominantly outside the Morgan Array Area
- Analysis of adverse weather routeing demonstrates that vessels may deviate from their usual routes frequently throughout the year (section 1.8.3).

1.11.1.7 Analysis of historical incident data identified that the majority of incidents within the shipping and navigation study area occurred inshore, and adjacent to the approaches to the key ports (section 1.6.3). There were few collisions in vicinity of the Morgan Array Area and most incidents were mechanical failures aboard vessels. Analysis of incidents at other offshore wind farms around the UK show that most accidents involve project vessels contacting wind turbines or having incidents in transit between the offshore wind farms and operations and maintenance base.

1.11.1.8 An assessment of the future traffic profile within the shipping and navigation study area (section 1.7) determined that an increase in commercial vessel numbers of 15% by

2035 would be a reasonable assumption. There was little evidence of large changes to recreational or fishing vessel numbers. It is anticipated that oil and gas decommissioning would reduce vessel numbers between the construction and operations and maintenance phases.

1.11.1.9 An assessment of the impacts of the Morgan Generation Assets on recognised sea lanes essential to international navigation determined that access to the TSSs in the shipping and navigation study area would be maintained.

1.11.1.10 An assessment of the impacts of the Morgan Generation Assets on ferry vessel routeing in typical conditions determined that there would be necessary deviation of IoMSPC, Stena and Seatruck routes around the Morgan Array Area:

- The IoMSPC route between Heysham and Douglas would require a 0.5 nm deviation to pass between the Morgan Array Area and Walney offshore wind farm, resulting in an additional 1.6 minutes of transit, which is not considered to make this 3 hour 45 minute route unviable
- The IoMSPC route between Liverpool and Douglas would require a 0.3 nm deviation to increase the passing from the Morgan Array Area, resulting in an additional 0.5 minutes of transit, which is not considered to make this 2 hour 45 minute route unviable
- The Stena Line route between Liverpool and Belfast, east of the Isle of Man, would require between a 0.7 nm and 2.5 nm deviation to pass around the Morgan Array Area, resulting in an additional 2.3 to 7.9 minutes of transit, which is not considered to make this eight hour route unviable. The route to the west of the Isle of Man would not be impacted by the Morgan Array Area
- The Seatruck route between Heysham and Warrenpoint, would require a 0.5 nm deviation to pass south of the Morgan Array Area, resulting in an additional 2 minutes of transit, which is not considered to make this eight hour route unviable.

1.11.1.11 During adverse weather, the assessment determined that Stena and IoMSPC routes may be required to pass to the southwest of the Morgan Array Area to minimise adverse vessel motions:

- The IoMSPC route between Heysham and Douglas would require a 5.7 nm deviation to pass south of the Morgan Array Area, resulting in a further 21.5 minutes of transit in addition to existing delays of between 10 and 23 minutes per crossing
- The Stena Line route between Heysham and Belfast, east of the Isle of Man, would require a 20 nm deviation to pass around the Morgan Array Area, resulting in a further 68.2 minutes of transit, albeit it is more likely these vessels would take the shorter, more common adverse weather route west of the Isle of Man
- The Stena Line route between Liverpool and Belfast, east of the Isle of Man, would require a 16.3 nm deviation to pass around the Morgan Array Area, resulting in a further 61.1 minutes of transit in addition to existing delays of between 40 and 70 minutes per crossing.

1.11.1.12 An assessment of the impacts of the Morgan Generation Assets on cargo/tanker ship routeing determined that the principal shipping routes into Liverpool would be unaffected. Less trafficked routes into Heysham and Douglas would necessitate minor deviations, which are unlikely to make such services unviable.

1.11.1.13 An assessment of the impacts on small craft routeing determined that there is sufficient spacing between turbines to facilitate safe navigation for fishing and recreational craft.

There may be some effect of offsetting these vessels into adjacent routes where vessel choose not to do so.

1.11.1.14 An assessment of the impacts of the Morgan Generation Assets on the likelihood of collision determined that an increase in risk was likely given the concentration of routes to the east and south of the Morgan Array Area. However, through risk modelling and navigation simulations, it was concluded that there was sufficient searoom for Masters to take action in compliance with the COLREGs and good seamanship such that the risk was not significant.

1.11.1.15 The commitment of the Morgan Generation Assets to two lines of orientation is likely to address impacts on SAR access into the Morgan Array Area.

1.11.1.16 The layout of the Morgan Generation Assets, in relation to shipping routes, and accounting for decommissioning activities, would not substantially increase the risk to oil and gas activities.

1.11.1.17 An assessment of the impacts of the Morgan Generation Assets on communications, radar and positioning systems determined that most impacts are negligible. Impacts to radar are inherent when navigating adjacent to offshore wind farms and it is likely that these effects will be experienced in the vicinity of the Morgan Array Area.

1.11.1.18 A risk assessment was undertaken, supported through hazard workshops attended by representatives from ferry operators, regulators, commercial bodies, oil and gas, ports, fishing community, recreational users and the project team. The risk assessment, with applied risk controls concluded that:

- Twenty-five hazards were identified, split across different hazard types, vessel types, areas and phases
- At the Morgan Generation Assets hazard workshop (September 2023) to inform the Environmental Statement, a consensus was reached amongst stakeholders that all hazards were Medium Risk or below. In particular, it was noted that the amendments to the boundaries of the Morgan Array Area substantially reduced risks which were previously unacceptable
- Sixteen of the hazards were assessed as Medium Risk, including the risk of collision, allision, snagging and adverse vessel motions. Several of these hazards were assessed to be greatest in the route between the Morgan Array Area and the Walney offshore wind farm
- The remaining nine were assessed as Low Risk – Broadly Acceptable.

1.11.1.19 A CRNRA was updated from PEIR to assess the impacts of the amended array area boundaries of the Morgan Generation Assets, Mona Offshore Wind Project, and Morecambe Generation Assets on shipping and navigation. The study concluded that all previously High Risk – Unacceptable hazards were now Medium Risk – Tolerable if ALARP.

1.11.1.20 Appropriate risk controls were considered to be embedded in Morgan Generation Asset's design, but additional risk controls were identified as part of the hazard workshops (such as ship routeing and emergency towage vessels). It was agreed with stakeholders that these were disproportionate to the reduction of risk they would achieve. Therefore, the NRA concludes that where risks are scored as Medium, they can be considered to be ALARP and therefore Tolerable without the need for additional risk control measures.

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Appendix A: Hazard Log

ID	Haz. Rank	Project Phase	Area	Hazard Title	Possible causes	Designed in Mitigation	Realistic Most Likely Scenario	People	Property	Environment	Business	Frequency	Realistic Worst Credible Scenario	People	Property	Environment	Business	Frequency	Risk Score	Risk Rating
1	7	C/O/D	Morgan Array Area + 10 nm	Collision - Ferry/Passenger ICW. Cargo/Tanker or Ferry/Passenger	Reduced Searoom Between Offshore Wind Farms; Human Error/Poor Seamanship; Failure to Comply with COLREGs; Fatigue; Radar Interference from wind turbines; Mechanical Failure; Adverse Weather; Avoidance of Small Craft; Reduced Visibility.	Notice to Mariners; Site Marking and Charting; ERCoP; Layout Plan and Lines of Orientation; Boundary Changes.	Multiple major injuries; Moderate damage to vessel; Minor pollution; Widespread adverse publicity; Short term interruption to ferry services.	3	3	2	3	2	Significant loss of life; Constructive Loss; Serious pollution (Tier 2); International adverse publicity. Ferry out of service.	5	5	4	5	2	7.8	Medium Risk - Tolerable (if ALARP)
2	20	C/O/D	Morgan Array Area + 10 nm	Collision - Cargo/Tanker ICW. Cargo/Tanker	Reduced Searoom Between Offshore Wind Farms; Human Error/Poor Seamanship; Failure to Comply with COLREGs; Fatigue; Radar Interference from wind turbines; Mechanical Failure; Adverse Weather; Avoidance of Small Craft; Reduced Visibility.	Notice to Mariners; Site Marking and Charting; ERCoP; Layout Plan and Lines of Orientation; Boundary Changes.	Multiple minor injuries; Moderate damage to vessel; Minor pollution; Widespread adverse publicity; Vessel requires drydock.	2	3	2	3	2	Single fatalities; Constructive Loss; Major pollution incident (Tier 3); National adverse publicity.	4	5	5	4	1	5.1	Low Risk - Broadly Acceptable

ID	Haz. Rank	Project Phase	Area	Hazard Title	Possible causes	Designed in Mitigation	Realistic Most Likely Scenario	People	Property	Environment	Business	Frequency	Realistic Worst Credible Scenario	People	Property	Environment	Business	Frequency	Risk Score	Risk Rating
3	3	C/O/D	Morgan Array Area + 10 nm	Collision - Ferry/Passenger or Cargo/Tanker ICW. Small Craft	Reduced Searoom Between Offshore Wind Farms; Increased Project Vessel Movements; Human Error/Poor Seamanship; Failure to Comply with COLREGs; Fatigue; Radar Interference from wind turbines; Mechanical Failure; Adverse Weather; Avoidance of Small Craft; Reduced Visibility.	Notice to Mariners; Site Marking and Charting; ERCoP; Incident Investigation and Reporting; Layout Plan and Lines of Orientation; Marine Operating Guidelines; Vessel Standards; Training; Compliance of Project Vessels; Vessel Traffic Monitoring; Boundary Changes.	Multiple major injuries; Moderate damage to vessel; Minor pollution; Widespread adverse publicity; Short term interruption to ferry services.	3	3	2	3	3	Multiple fatalities; Loss of small craft; Moderate pollution incident (Tier 2); National adverse publicity.	5	4	3	4	2	8.8	Medium Risk - Tolerable (if ALARP)
4	11	C/O/D	Morgan Array Area + 10 nm	Collision - Small Craft ICW. Small Craft	Reduced Searoom Between Offshore Wind Farms; Increased Project Vessel Movements; Human Error/Poor Seamanship; Fatigue; Radar Interference from wind turbines; Mechanical Failure; Adverse Weather; Avoidance of Small Craft; Reduced Visibility.	Notice to Mariners; Site Marking and Charting; ERCoP; Periodic Exercises; Incident Investigation and Reporting; Layout Plan and Lines of Orientation; Marine Operating Guidelines; Vessel Standards; Training; Compliance of Project Vessels; Vessel Traffic Monitoring; Boundary Changes.	Multiple minor injuries; Moderate damage to small craft; No pollution; Minor adverse publicity.	2	2	1	2	3	Single fatalities; Loss of small craft; Moderate pollution incident (Tier 2); National adverse publicity.	4	4	3	4	2	6.7	Medium Risk - Tolerable (if ALARP)

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ID	Haz. Rank	Project Phase	Area	Hazard Title	Possible causes	Designed in Mitigation	Realistic Most Likely Scenario	People	Property	Environment	Business	Frequency	Realistic Worst Credible Scenario	People	Property	Environment	Business	Frequency	Risk Score	Risk Rating
5	1	C/O/D	Morgan Array Area + 10 nm	Allision - Ferry/Passenger	Presence of wind turbines; Reduced Searoom Between Offshore Wind Farms; Increased Project Vessel Movements; Human Error/Poor Seamanship; AtoNs Failure; Fatigue; Radar Interference from wind turbines; Mechanical Failure; Adverse Weather; Avoidance of Small Craft; Reduced Visibility.	Notice to Mariners; Site Marking and Charting; Safety Zones; ERCoP; Periodic Exercises; Incident Investigation and Reporting; AtoNs; Air Draught Clearance; Layout Plan and Lines of Orientation; Vessel Traffic Monitoring; Boundary Changes.	Multiple major injuries; Moderate damage to vessel; Minor pollution; Widespread adverse publicity; Repairs to wind turbines; Short term interruption to ferry services.	3	3	2	4	3	Multiple fatalities; Serious damage to vessel; Serious pollution (Tier 2); International adverse publicity; Loss of wind turbines; Ferry out of service.	5	5	3	5	2	10.0	Medium Risk - Tolerable (if ALARP)
6	22	C/O/D	Morgan Array Area + 10 nm	Allision - Cargo/Tanker	Presence of wind turbines; Reduced Searoom Between Offshore Wind Farms; Increased Project Vessel Movements; Human Error/Poor Seamanship; AtoNs Failure; Fatigue; Radar Interference from wind turbines; Mechanical Failure; Adverse Weather; Avoidance of Small Craft; Reduced Visibility.	Notice to Mariners; Site Marking and Charting; Safety Zones; ERCoP; Periodic Exercises; Incident Investigation and Reporting; AtoNs; Air Draught Clearance; Layout Plan and Lines of Orientation; Vessel Traffic Monitoring; Boundary Changes.	Multiple minor injuries; Moderate damage to vessel; No pollution; Widespread adverse publicity; Repairs to wind turbines.	2	3	1	3	2	Single fatalities; Drydock required; Serious pollution incident (Tier 2); National adverse publicity; Loss of wind turbines.	4	5	4	5	1	5.0	Low Risk - Broadly Acceptable

ID	Haz. Rank	Project Phase	Area	Hazard Title	Possible causes	Designed in Mitigation	Realistic Most Likely Scenario	People	Property	Environment	Business	Frequency	Realistic Worst Credible Scenario	People	Property	Environment	Business	Frequency	Risk Score	Risk Rating
7	8	C/O/D	Morgan Array Area + 10 nm	Allision - Tug/Service & Small Project Vessels	Presence of wind turbines; Reduced Searoom Between Offshore Wind Farms; Increased Project Vessel Movements; Human Error/Poor Seamanship; AtoNs Failure; Fatigue; Radar Interference from wind turbines; Mechanical Failure; Adverse Weather; Avoidance of Small Craft; Reduced Visibility.	Notice to Mariners; Site Marking and Charting; Safety Zones; ERCoP; Periodic Exercises; Incident Investigation and Reporting; AtoNs; Air Draught Clearance; Layout Plan and Lines of Orientation; Marine Operating Guidelines; Vessel Standards; Training; Compliance of Project Vessels; Boundary Changes.	Multiple minor injuries; Moderate damage to small craft; No pollution; Minor adverse publicity; Repairs to wind turbines.	2	2	1	2	4	Single fatalities; Loss of small craft; Moderate pollution incident (Tier 2); National adverse publicity; Repairs to wind turbines.	4	4	3	4	2	7.6	Medium Risk - Tolerable (if ALARP)
8	2	C/O/D	Morgan Array Area + 10 nm	Allision - Fishing	Presence of wind turbines; Reduced Searoom Between Offshore Wind Farms; Increased Project Vessel Movements; Human Error/Poor Seamanship; AtoNs Failure; Fatigue; Radar Interference from wind turbines; Mechanical Failure; Adverse Weather; Avoidance of Small Craft; Reduced Visibility.	Notice to Mariners; Site Marking and Charting; Safety Zones; Fishing Liaison Plan; ERCoP; Periodic Exercises; Incident Investigation and Reporting; AtoNs; Air Draught Clearance; Layout Plan and Lines of Orientation; Boundary Changes.	Multiple minor injuries; Moderate damage to small craft; No pollution; Minor adverse publicity; Repairs to wind turbines.	2	2	1	2	4	Single fatalities; Loss of small craft; Moderate pollution incident (Tier 2); National adverse publicity; Repairs to wind turbines.	4	4	3	4	3	9.6	Medium Risk - Tolerable (if ALARP)

ID	Haz. Rank	Project Phase	Area	Hazard Title	Possible causes	Designed in Mitigation	Realistic Most Likely Scenario	People	Property	Environment	Business	Frequency	Realistic Worst Credible Scenario	People	Property	Environment	Business	Frequency	Risk Score	Risk Rating
9	11	C/O/D	Morgan Array Area + 10 nm	Allision - Recreational	Presence of wind turbines; Reduced Searoom Between Offshore Wind Farms; Increased Project Vessel Movements; Human Error/Poor Seamanship; AtoNs Failure; Fatigue; Radar Interference from wind turbines; Mechanical Failure; Adverse Weather; Avoidance of Small Craft; Reduced Visibility.	Notice to Mariners; Site Marking and Charting; Safety Zones; ERCoP; Periodic Exercises; Incident Investigation and Reporting; AtoNs; Air Draught Clearance; Layout Plan and Lines of Orientation; Boundary Changes.	Multiple minor injuries; Moderate damage to small craft; No pollution; Minor adverse publicity; Repairs to wind turbines.	2	2	1	2	3	Single fatalities; Loss of small craft; Moderate pollution incident (Tier 2); National adverse publicity; Repairs to wind turbines.	4	4	3	4	2	6.7	Medium Risk - Tolerable (if ALARP)
10	14	C/O/D	Morgan Array Area	Snagging - Fishing	Insufficient Lookout; Inadequate Passage Planning; Human Error/Fatigue; Anchoring in an emergency; Charts not up to date.	Notice to Mariners; Site Marking and Charting; Guard Vessels; Incident Investigation and Reporting; Fishing liaison plan; CBRA.	Minor injuries; Minor damage to gear; No pollution; Cable inspection; Minor adverse publicity.	2	2	1	2	3	Single fatalities Loss of small craft; Minor pollution; Significant cable damage.	4	4	2	4	2	6.6	Medium Risk - Tolerable (if ALARP)
11	25	C/O/D	Morgan Array Area	Snagging - Recreational or Tug/Service	Insufficient Lookout; Inadequate Passage Planning; Human Error/Fatigue; Anchoring in an emergency; Charts not up to date.	Notice to Mariners; Site Marking and Charting; Guard Vessels; Incident Investigation and Reporting; CBRA.	No injuries; Minor damage; No pollution; Cable inspection; Minor adverse publicity.	1	2	1	2	2	Single fatalities Loss of small craft; Minor pollution; Significant cable damage.	4	3	2	4	1	3.6	Negligible Risk - Broadly Acceptable
12	24	C/O/D	Morgan Array Area	Snagging - Cargo/Tanker or Ferry/Passenger	Insufficient Lookout; Inadequate Passage Planning; Human Error/Fatigue; Anchoring in an emergency; Charts not up to date.	Notice to Mariners; Site Marking and Charting; Guard Vessels; Incident Investigation and Reporting; CBRA.	No injuries; No property damage; No pollution; Cable damage requiring repairs.	1	1	1	3	2	No injuries; Loss of the vessel's anchor No pollution; Cable out of service.	1	2	1	5	1	4.1	Negligible Risk - Broadly Acceptable

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ID	Haz. Rank	Project Phase	Area	Hazard Title	Possible causes	Designed in Mitigation	Realistic Most Likely Scenario	People	Property	Environment	Business	Frequency	Realistic Worst Credible Scenario	People	Property	Environment	Business	Frequency	Risk Score	Risk Rating
13	15	C/O/D	Morgan Array Area	Snagging - Project Vessel	Insufficient Lookout; Inadequate Passage Planning; Human Error/Fatigue; Poor Visibility in Area; Mechanical Failure; Charts not up to date.	ERCoP; Periodic Exercises; Incident Investigation and Reporting; Marine Operating Guidelines; Vessel Standards; Training; CBRA; Compliance of Project Vessels.	No injuries; Minor damage; No pollution; Cable inspection; Minor adverse publicity.	1	2	1	2	3	Single fatalities Loss of small craft; Minor pollution; Significant cable damage.	4	3	2	4	2	6.3	Medium Risk - Tolerable (if ALARP)
14	10	O	O&M Route	Collision - Small Project Vessel ICW. Cargo/Tanker or Ferry/Passenger	Increased Project Vessel Movements; Human Error/Poor Seamanship; Failure to Comply with COLREGs; Fatigue; Mechanical Failure; Adverse Weather; Avoidance of Small Craft; Reduced Visibility.	Notice to Mariners; ERCoP; Incident Investigation and Reporting; Marine Operating Guidelines; Vessel Standards; Training; Compliance of Project Vessels; Vessel Traffic Monitoring; Boundary Changes.	Multiple major injuries; Moderate damage to vessel; Minor pollution; Widespread adverse publicity; Short term interruption to ferry services.	3	3	2	3	2	Multiple fatalities; Loss of small craft; Moderate pollution incident (Tier 2); National adverse publicity.	5	4	3	4	2	7.4	Medium Risk - Tolerable (if ALARP)
15	11	O	O&M Route	Collision - Small Project Vessel ICW. Fishing or Recreational or Tug/Service	Increased Project Vessel Movements; Human Error/Poor Seamanship; Fatigue; Mechanical Failure; Adverse Weather; Avoidance of Small Craft; Reduced Visibility.	Notice to Mariners; ERCoP; Periodic Exercises; Incident Investigation and Reporting; Marine Operating Guidelines; Vessel Standards; Training; Compliance of Project Vessels; Vessel Traffic Monitoring; Boundary Changes.	Multiple minor injuries; Moderate damage to small craft; No pollution; Minor adverse publicity.	2	2	1	2	3	Single fatalities; Loss of small craft; Moderate pollution incident (Tier 2); National adverse publicity.	4	4	3	4	2	6.7	Medium Risk - Tolerable (if ALARP)

ID	Haz. Rank	Project Phase	Area	Hazard Title	Possible causes	Designed in Mitigation	Realistic Most Likely Scenario	People	Property	Environment	Business	Frequency	Realistic Worst Credible Scenario	People	Property	Environment	Business	Frequency	Risk Score	Risk Rating
16	17	O	O&M Route	Allision - Small Project Vessel	Increased Project Vessel Movements; Human Error/Poor Seamanship; Fatigue; Mechanical Failure; Adverse Weather; Avoidance of Small Craft; Reduced Visibility.	Notice to Mariners; ERCoP; Periodic Exercises; Incident Investigation and Reporting; Marine Operating Guidelines; Vessel Standards; Training; Compliance of Project Vessels; Boundary Changes.	Multiple minor injuries; Moderate damage to small craft; No pollution; Minor adverse publicity.	2	2	1	2	2	Single fatalities; Loss of small craft; Moderate pollution incident (Tier 2); National adverse publicity.	4	4	3	4	2	5.8	Low Risk - Broadly Acceptable
17	17	O	O&M Route	Grounding - Small Project Vessel	Increased Project Vessel Movements; Human Error/Poor Seamanship; Fatigue; Mechanical Failure; Adverse Weather; Avoidance of Small Craft; Reduced Visibility.	Notice to Mariners; ERCoP; Periodic Exercises; Incident Investigation and Reporting; Marine Operating Guidelines; Vessel Standards; Training; Compliance of Project Vessels.	Multiple minor injuries; Moderate damage to small craft; No pollution; Minor adverse publicity.	2	2	1	2	2	Single fatalities; Loss of small craft; Moderate pollution incident (Tier 2); National adverse publicity.	4	4	3	4	2	5.8	Low Risk - Broadly Acceptable
18	6	C/O/D	Morgan Array Area + 10 nm	Vessel Emergency - Ferry/Passenger or Cargo/Tanker or Large Project Vessel	Human Error/Poor Seamanship; Fatigue; Mechanical Failure; Adverse Weather.	ERCoP; Periodic Exercises; Incident Investigation and Reporting; Boundary Changes.	Multiple minor injuries; Minor damage; No pollution; Minor adverse publicity.	2	2	1	2	3	Multiple fatalities; Major damage; Major pollution (Tier 3); Major adverse publicity.	5	5	5	5	2	7.8	Medium Risk - Tolerable (if ALARP)

MORGAN OFFSHORE WIND PROJECT: GENERATION ASSETS

ID	Haz. Rank	Project Phase	Area	Hazard Title	Possible causes	Designed in Mitigation	Realistic Most Likely Scenario	People	Property	Environment	Business	Frequency	Realistic Worst Credible Scenario	People	Property	Environment	Business	Frequency	Risk Score	Risk Rating
19	9	C/O/D	Morgan Array Area + 10 nm/O&M	Vessel Emergency - Fishing or Recreational or Tug/Service or Small Project Vessel	Human Error/Poor Seamanship; Fatigue; Mechanical Failure; Adverse Weather.	ERCoP; Periodic Exercises; Incident Investigation and Reporting; Boundary Changes.	Multiple minor injuries; Minor damage; No pollution; Minor adverse publicity.	2	2	1	2	3	Multiple fatalities; Serious damage; Serious pollution (Tier 2); Serious adverse publicity.	5	4	4	4	2	7.4	Medium Risk - Tolerable (if ALARP)
20	19	C/D	Morgan Array Area + 10 nm/O&M	Collision - Large Project Vessel ICW. Ferry/Passenger	Reduced Searoom Between Offshore Wind Farms; Human Error/Poor Seamanship; Failure to Comply with COLREGs; Fatigue; Radar Interference from wind turbines; Mechanical Failure; Adverse Weather; Avoidance of Small Craft; Reduced Visibility.	Notice to Mariners; ERCoP; Periodic Exercises; Incident Investigation and Reporting; Marine Operating Guidelines; Vessel Standards; Training; Compliance of Project Vessels; Boundary Changes.	Multiple major injuries; Moderate damage to vessel; Minor pollution; Widespread adverse publicity; Short term interruption to ferry services.	3	3	2	3	2	Significant loss of life; Constructive Loss; Serious pollution (Tier 2); International adverse publicity. Ferry out of service.	5	5	4	5	1	5.3	Low Risk - Broadly Acceptable
21	20	C/D	Morgan Array Area + 10 nm/O&M	Collision - Large Project Vessel ICW. Cargo/Tanker	Reduced Searoom Between Offshore Wind Farms; Human Error/Poor Seamanship; Failure to Comply with COLREGs; Fatigue; Radar Interference from wind turbines; Mechanical Failure; Adverse Weather; Avoidance of Small Craft; Reduced Visibility.	Notice to Mariners; ERCoP; Periodic Exercises; Incident Investigation and Reporting; Marine Operating Guidelines; Vessel Standards; Training; Compliance of Project Vessels; Boundary Changes.	Multiple minor injuries; Moderate damage to vessel; Minor pollution; Widespread adverse publicity; Vessel requires drydock.	2	3	2	3	2	Single fatalities; Constructive Loss; Major pollution incident (Tier 3); National adverse publicity.	4	5	5	4	1	5.1	Low Risk - Broadly Acceptable

ID	Haz. Rank	Project Phase	Area	Hazard Title	Possible causes	Designed in Mitigation	Realistic Most Likely Scenario	People	Property	Environment	Business	Frequency	Realistic Worst Credible Scenario	People	Property	Environment	Business	Frequency	Risk Score	Risk Rating
22	23	C/D	Morgan Array Area + 10 nm/O&M	Collision - Large Project Vessel ICW. Fishing or Recreational or Tug/Service	Reduced Searoom Between Offshore Wind Farms; Human Error/Poor Seamanship; Failure to Comply with COLREGs; Fatigue; Radar Interference from wind turbines; Mechanical Failure; Adverse Weather; Avoidance of Small Craft; Reduced Visibility.	Notice to Mariners; ERCoP; Periodic Exercises; Incident Investigation and Reporting; Marine Operating Guidelines; Vessel Standards; Training; Compliance of Project Vessels; Boundary Changes.	Minor Injuries; Minor damage; No pollution; Minor adverse publicity.	2	2	1	2	2	Multiple fatalities; Loss of small craft; Moderate pollution; Serious adverse publicity.	5	4	3	4	1	4.1	Low Risk - Broadly Acceptable
23	16	C/D	Morgan Array Area + 10 nm/O&M	Allision - Large Project Vessel	Close proximity to wind turbines; Increased Project Vessel Movements; Human Error/Poor Seamanship; Fatigue; Mechanical Failure; Adverse Weather.	ERCoP; Periodic Exercises; Incident Investigation and Reporting; Marine Operating Guidelines; Vessel Standards; Training; Compliance of Project Vessels; Boundary Changes.	Multiple minor injuries; Moderate damage; No pollution; Moderate disruption to activities.	2	3	1	3	3	Single fatalities; Serious damage; Moderate pollution; Major disruption to operations.	4	4	3	5	1	6.2	Medium Risk - Tolerable (if ALARP)
24	4	C/O/D	Morgan Array Area +10 nm	Adverse Vessel Motions - Ferry/Passenger or Cargo/Tanker	Reduced Searoom Between Offshore Wind Farms; Human Error/Poor Seamanship; Adverse Weather; Avoidance of Other Traffic.	Notice to Mariners; Site Marking and Charting; ERCoP; Boundary Changes.	Minor injuries; Minor damage to vessel - some damage to cargo; No pollution; Short term interruption to ferry services.	2	3	1	2	4	Single fatality; Major damage; Minor pollution; National adverse publicity; Ferry out of service.	4	4	2	4	2	8.8	Medium Risk - Tolerable (if ALARP)

ID	Haz. Rank	Project Phase	Area	Hazard Title	Possible causes	Designed in Mitigation	Realistic Most Likely Scenario	People	Property	Environment	Business	Frequency	Realistic Worst Credible Scenario	People	Property	Environment	Business	Frequency	Risk Score	Risk Rating
25	4	C/O/D	Morgan Array Area + 10 nm/O&M	Allision (Oil and Gas) - Ferry/Passenger or Cargo/Tanker or Large Project Vessel	Reduced Searoom Between Offshore Wind Farms; Human Error/Poor Seamanship; Failure to Comply with COLREGs; Fatigue; Radar Interference from wind turbines; Mechanical Failure; Adverse Weather; Avoidance of Small Craft; Reduced Visibility.	Notice to Mariners; Site Marking and Charting; ERCoP; Layout Plan and Lines of Orientation; Boundary Changes.	Multiple major injuries; Moderate damage to vessel; Moderate pollution (Tier 2); Widespread adverse publicity; Short term interruption to ferry services.	3	4	3	4	2	Significant loss of life; Constructive Loss; Serious pollution (Tier 2); International adverse publicity. Ferry out of service.	5	5	5	5	2	8.8	Medium Risk - Tolerable (if ALARP)

Appendix B: Hazard Workshop Summary

B.1 Hazard workshop process

B.1.1.1.1 The hazard workshop preparation consisted of the following:

1. 09 August 2023: Save the date email issued by NASH Maritime to the wider stakeholder group which provided the dates for the hazard workshop, format and location
2. 29 August 2023: Issue of letter to all stakeholders introducing the Morgan Generation Assets, the commitments made post-PEIR and provided further details of the hazard workshop venue and format
3. 18 September 2023: Issue of Morgan Generation Assets update newsletters outlining boundary changes made to the public
4. 21 and 22 September 2023: Issue of pre-read packs to all stakeholders which contained:
   a. Slide pack containing a summary of the Morgan Generation Assets, boundary changes, analysis, methodology and reasoning behind the hazard scoring
   b. Draft hazard logs developed by the project team
5. 29 September 2023: Hazard Workshop.

B.2 Hazard workshop

B.2.1 Introduction

B.2.1.1.1 A hazard workshop for the Morgan Generation Assets was held in person on 29 September 2023 at the Mercure Atlantic Tower Hotel in Liverpool.

B.2.1.1.2 The agenda was as follows:

- 8:30 – 9am Coffee/Tea
- 9 - 9:15am Introduction and Review of CRNRA Findings
- 9:15 - 9:30am Recap of Methodology
- 9:30 - 10:45am Mona Offshore Wind Project Hazard Scoring Session
- 10:45 - 11am Coffee Break.
- 11 – 12am Morgan Generation Assets Hazard Scoring Session.

B.2.2 Attendees

B.2.2.1.1 The details the organisations and representatives that attended the workshop are shown in the Table B.1 below (including attendees from previous day's CRNRA workshop).

Table B.1: Hazard workshop attendees.

Organisation	Category	Role
NASH Maritime	Project Team	Shipping and Navigation Consultants (Mona/Morgan/Morecambe)
HR Wallingford		Consultant Master Mariner Supporting NASH Maritime
Brookes Bell		Consultant Master Mariner Supporting NASH Maritime
bp/EnBW		Developer of Mona Offshore Wind Project and Morgan Generation Assets
Flotation Energy		Developer of Morecambe Generation Assets
Royal Haskoning		EIA Lead for Morecambe Generation Assets
Anglo-North Irish Fish Producers Organization (ANIFPO)	Stakeholder	Impact on Fishing
ENI		Impact on Oil and Gas Operations
Harbour Energy		Impact on Oil and Gas Operations
IoM Government		Impact on Ferry Services and IoM Developments
MCA		Impact on Navigation Safety
Orsted		Impact on Existing and Planned offshore wind farms
Peel Ports		Impact on Navigation Safety and Port Operations
Scottish Whitefish Producers Association (SWFPA)		Impact on Fishing
Seatruck Group		Impact on Navigation Safety and Ferry Services
Spirit Energy		Impact on Oil and Gas Operations
Steam Packet		Impact on Navigation Safety and Ferry Services
Stena Line		Impact on Navigation Safety and Ferry Services
Morgan Fishing Industry Representative (FIR)		Impact on Fishing
UK Chamber of Shipping		Impact on Navigation Safety and Commercial Operators

B.2.3 Workshop process

B.2.3.1.1 At the workshop:

- The project team introduced the material and methodology
- Each hazard was reviewed in turn, with each attendee invited to discuss amongst their tables and score their personalised hazard log. Stakeholders were encouraged to fill out the comments section of each hazard post workshop to provide a higher level of description regarding their scores
- Each hazard score was then reviewed as a group with differences in scoring discussed, before a consensus was sought
- Once each hazard discussion had come to a close, the summary spreadsheet was ‘locked’ to capture the concluding scores of the discussion

- Risk controls were reviewed and appropriate additional risk controls discussed
- Update of hazard risk scores based on the findings of the hazard workshop for inclusion in the NRA.

B.3 Results

B.3.1.1.1 During the hazard workshop, a total of 14 hazards were reviewed as a group for the Morgan Generation Assets, relevant to individual and cumulative assessments. The scores and discussion points raised by stakeholders for each of these hazards are shown in the following pages.

B.3.1.1.2 During the hazard workshop, consensus was not reached on the specific scoring of several hazards, with a range of scores provided between the project teams and amongst stakeholders. However, a consensus was reached that all hazards previously identified as High Risk – Unacceptable were now Medium Risk – Tolerable if ALARP. To derive the final scores for the NRA, the findings of the workshop were therefore considered with the analysis and wider assessment undertaken by the Applicant's project team (see Appendix A).

Hazard ID:	3
Hazard Title:	Collision - Ferry/Passenger or Cargo/Tanker ICW. Small Craft
Area:	Morgan Array Area + 10 nm

Organisation	Realistic Most Likely Scores						Realistic Worst Credible Scores				Baseline Risk Score	Baseline Risk Rating	Notes
	People	Property	Environment	Business	Frequency	People	Property	Environment	Business	Frequency			
Draft Scores	3	3	2	3	3	5	3	3	4	2	8.7	Medium Risk - Tolerable (if ALARP)	
CoS	3	3	2	3	3	5	4	3	4	2	8.8	Medium Risk - Tolerable (if ALARP)	See yesterday scores
ENI	3	3	2	3	3	5	3	3	4	2	8.7	Medium Risk - Tolerable (if ALARP)	
Harbour Energy	3	3	2	3	3	5	3	3	4	3	10.9	Medium Risk - Tolerable (if ALARP)	Change not to drive lowest score of 2
IoM Gov	3	3	2	3	3	5	3	3	4	2	8.7	Medium Risk - Tolerable (if ALARP)	
IoMSPC	3	3	2	3	3	5	3	3	4	2	8.7	Medium Risk - Tolerable (if ALARP)	
MCA	3	3	2	3	3	5	4	3	4	2	8.8	Medium Risk - Tolerable (if ALARP)	
Seatruck	3	3	2	3	3	5	3	3	4	2	8.7	Medium Risk - Tolerable (if ALARP)	Not regularly sailing in this area
Spirit Energy	3	3	2	3	3	5	3	3	4	2	8.7	Medium Risk - Tolerable (if ALARP)	
Stenaline	3	3	2	3	3	5	3	3	4	3	10.9	Medium Risk - Tolerable (if ALARP)	Fishing vessels are likely to be displaced from within the footprint of the windfarms increasing the concentration in the channels. Challenges to identify fishing vessels at night due to backscatter will be increased.
SWPAL	3	3	2	3	3	5	3	3	4	3	10.9	Medium Risk - Tolerable (if ALARP)	Given the seasonality of fisheries a higher number of vessels could be within the array at specific times of the year.
FIR	3	3	2	3	3	5	3	3	4	2	8.7	Medium Risk - Tolerable (if ALARP)	
WCSP	3	3	2	3	3	5	3	3	4	2	8.7	Medium Risk - Tolerable (if ALARP)	
Final Scores	3	3	2	3	3	5	4	3	4	2	8.8	Medium Risk - Tolerable (if ALARP)	

Hazard ID:	8
Hazard Title:	Allision - Fishing
Area:	Morgan Array Area + 10 nm

Organisation	Realistic Most Likely Scores					Realistic Worst Credible Scores					Baseline Risk Score	Baseline Risk Rating	Notes
	People	Property	Environment	Business	Frequency	People	Property	Environment	Business	Frequency			
Draft Scores	2	2	1	2	4	4	4	3	4	2	7.6	Medium Risk - Tolerable (if **ALARP)**	
CoS	2	2	1	2	4	4	5	3	4	3	10.5	Medium Risk - Tolerable (if ALARP)	
ENI	2	2	1	2	4	4	4	3	4	2	7.6	Medium Risk - Tolerable (if ALARP)	Defer to fishing representatives
Harbour Energy	2	2	1	2	4	4	4	3	4	2	7.6	Medium Risk - Tolerable (if ALARP)	
IoM Gov	2	2	1	2	4	4	4	3	4	2	7.6	Medium Risk - Tolerable (if ALARP)	
IoMSPC	2	2	1	2	4	4	4	3	4	2	7.6	Medium Risk - Tolerable (if ALARP)	
MCA	2	2	1	2	4	4	4	3	4	2	7.6	Medium Risk - **Tolerable (if ALARP)**	
Seatruck	2	2	1	2	4	4	4	3	4	3	9.6	Medium Risk - Tolerable (if ALARP)	F/V more likely to be operating inside hence frequency increased to 3 from 2. Recorded fishing allisions in the area.
Spirit Energy	2	2	1	2	4	4	4	3	4	2	7.6	Medium Risk - Tolerable (if ALARP)	
Stenaline	2	2	1	2	4	4	4	3	4	2	7.6	Medium Risk - Tolerable (if ALARP)	
SWPAL	2	2	1	2	4	4	4	3	4	3	9.6	Medium Risk - Tolerable (if ALARP)	Fishing vessels are likely to be displaced from within the footprint of the windfarms increasing the concentration in the channels. Challenges to identify fishing vessels at night due to backscatter will be increased.
FIR	2	2	1	2	4	4	5	3	4	3	10.5	Medium Risk - Tolerable (if ALARP)	Loss of vessel equates to complete loss of business and revenue
WCSP	2	2	1	2	4	4	4	3	4	2	7.6	Medium Risk - Tolerable (if ALARP)	
Final Scores	2	2	1	2	4	4	4	3	4	3	9.6	Medium Risk - Tolerable (if ALARP)	

Hazard ID:	18												
Hazard Title:	Vessel Emergency – Ferry/Passenger or Cargo/Tanker or Large Project Vessel												
Area:	Morgan Array Area + 10 nm												
Organisation	Realistic Most Likely Scores					Realistic Worst Credible Scores					Baseline Risk Score	Baseline Risk Rating	Notes
	People	Property	Environment	Business	Frequency	People	Property	Environment	Business	Frequency			
Draft Scores	2	2	1	2	2	5	5	5	5	2	6.9	Medium Risk - Tolerable (if **ALARP)**	
CoS	2	2	1	2	2	5	5	5	5	2	6.9	Medium Risk - Tolerable (if ALARP)	
ENI	2	2	1	2	3	5	5	5	5	2	7.8	Medium Risk - Tolerable (if ALARP)	
Harbour Energy	2	2	1	2	2	5	5	5	5	2	6.9	Medium Risk - Tolerable (if ALARP)	
IoM Gov	2	2	1	2	3	5	5	5	5	3	10.3	Medium Risk - Tolerable (if ALARP)	
IoMSPC	2	2	1	2	2	5	5	5	5	2	6.9	Medium Risk - Tolerable (if ALARP)	
MCA	2	2	1	2	2	5	5	5	5	2	6.9	Medium Risk - Tolerable (if ALARP)	
Seatruck	2	2	1	2	3	5	5	5	5	2	7.8	Medium Risk - Tolerable (if ALARP)	
Spirit Energy	2	2	1	2	2	5	5	5	5	2	6.9	Medium Risk - Tolerable (if ALARP)	
Stenaline	2	2	1	2	2	5	5	5	5	2	6.9	Medium Risk - Tolerable (if ALARP)	
SWPAL	2	2	1	2	3	5	5	5	5	3	10.3	Medium Risk - Tolerable (if ALARP)	
FIR	2	2	1	2	2	5	5	5	5	2	6.9	Medium Risk - Tolerable (if ALARP)	
WCSP	2	2	1	2	2	5	5	5	5	2	6.9	Medium Risk - Tolerable (if ALARP)	
Final Scores	2	2	1	2	3	5	5	5	5	2	7.8	Medium Risk - Tolerable (if ALARP)	

Hazard ID:	25
Hazard Title:	Allision (Oil and Gas) – Ferry/Passenger or Cargo/Tanker or Large Project Vessel
Area:	Morgan Array Area + 10 nm

Organisation	Realistic Most Likely Scores					Realistic Worst Credible Scores					Baseline Risk Score	Baseline Risk Rating	Notes
	People	Property	Environment	Business	Frequency	People	Property	Environment	Business	Frequency			
Draft Scores	3	3	3	3	2	5	5	4	5	2	7.9	Medium Risk - Tolerable (if ALARP)	
CoS	3	3	3	3	2	5	5	4	5	2	7.9	Medium Risk - Tolerable (if ALARP)	
ENI	3	4	2	4	2	5	5	5	5	2	8.6	Medium Risk - Tolerable (if ALARP)	
Harbour Energy	3	3	3	3	2	5	5	4	5	2	7.9	Medium Risk - Tolerable (if ALARP)	
IoM Gov	5	4	2	4	2	5	4	2	4	2	8.8	Medium Risk - Tolerable (if ALARP)	
IoMSPC	3	4	3	4	3	5	5	4	5	2	10.5	Medium Risk - Tolerable (if ALARP)	
MCA	3	3	3	3	2	5	5	4	5	2	7.9	Medium Risk - Tolerable (if ALARP)	
Seatruck	3	3	3	3	2	5	5	4	5	2	7.9	Medium Risk - Tolerable (if ALARP)	
Spirit Energy	3	4	3	3	3	5	5	4	5	2	10.3	Medium Risk - Tolerable (if ALARP)	
Stenaline	3	5	4	5	2	5	5	4	5	2	9.5	Medium Risk - Tolerable (if ALARP)	Consideration given to the DPPA platform which produce natural gas and has export route for surrounding wells.
SWPAL	3	4	3	4	3	5	5	4	5	2	10.5	Medium Risk - Tolerable (if ALARP)	
FIR	3	3	3	3	2	5	5	4	5	2	7.9	Medium Risk - Tolerable (if ALARP)	
WCSP	3	3	3	3	2	5	5	4	5	2	7.9	Medium Risk - Tolerable (if ALARP)	
Final Scores	3	4	3	4	2	5	5	5	5	2	8.8	Medium Risk - Tolerable (if ALARP)	

Appendix C: MGN654 Checklist

MGN Section	Yes/No	Comments
4. Planning Stage – Prior to Consent		
4.5 Site and Installation Co-ordinates: Developers are responsible for ensuring that formally agreed co-ordinates 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, operations and decommissioning. This should be supplied as authoritative Geographical Information System data, preferably in Environmental Systems Research Institute 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 (ETRS89) datum.		
4.6 Traffic Survey – includes		
All vessel types	✓	Analysis of all vessel types within the shipping and navigation study area is contained within section 1.6.
At least 28 days duration, within either 12 or 24 months prior to submission of the Environmental Impact Assessment Report.	✓	An MGN654 compliant vessel survey (during 2021/2022) has been conducted and is described in section 1.6.1.
Multiple data sources	✓	Section 1.3.5 describes the vessel traffic, incident and secondary data sources used to inform the NRA.
Seasonal variations	✓	Seasonality has been accounted for within the 4x 14 day traffic surveys (section 1.6.1) and is referenced throughout section 1.6.
MCA consultation	✓	Consultation with the MCA has been conducted (see section 1.3.5/1.9.4/Appendix B).
General Lighthouse Authority consultation	✓	Consultation with Trinity House has been conducted (see section 1.3.5/1.9.4/Appendix B).
Chamber of Shipping and shipping company consultation	✓	Consultation with the Chamber of Shipping and ferry companies has been conducted (see section 1.3.5/1.9.4/Appendix B).
Recreational and fishing vessel organisations consultation	✓	Consultation with the RYA and fishing groups has been conducted (see section 1.3.5/1.9.4/Appendix B).
Port and navigation authorities' consultation, as appropriate	✓	Consultation with Peel Ports has been conducted (see section 1.3.5/1.9.4/Appendix B).
4.6.d Assessment of the cumulative and individual effects of (as appropriate):		
i. Proposed OREI site relative to areas used by any type of marine craft.	✓	Vessel traffic analysis within the shipping and navigation study area is described in section 1.6.

MGN Section	Yes/No	Comments
ii. Numbers, types and sizes of vessels presently using such areas	✓	Vessel traffic analysis within the shipping and navigation study area is described in section 1.6. This includes statistical analysis of vessel activity in section 1.6.2.
iii. Non-transit uses of the areas, (e.g. fishing, day cruising of leisure craft, racing, aggregate dredging, personal watercraft etc).	✓	Vessel traffic analysis within the shipping and navigation study area is described in section 1.6.1 and section 1.6.2.
iv. Whether these areas contain transit routes used by coastal, deep-draught or international scheduled vessels on passage.	✓	Vessel traffic analysis within the shipping and navigation study area is described in section 1.6.2, including identification of key shipping routes.
v. Alignment and proximity of the site relative to adjacent shipping routes.	✓	Vessel traffic analysis within the shipping and navigation study area is described in section 1.6.2, including identification of key shipping routes.
vi. Whether the nearby area contains prescribed routeing schemes or precautionary areas.	✓	Navigational features are highlighted in section 1.5.
vii. Proximity of the site to areas used for anchorage (charted or uncharted), safe haven, port approaches and pilot boarding or landing areas.	✓	Navigational features are highlighted in section 1.5. Analysis of anchoring activity is contained within section 1.6.2.
viii. Whether the site lies within the jurisdiction of a port and/or navigation authority.	✓	Navigational features are highlighted in section 1.5.
ix. Proximity of the site to existing fishing grounds, or to routes used by fishing vessels to such grounds.	✓	Analysis of fishing vessel activity is contained within section 1.6.2.
x. Proximity of the site to offshore firing/bombing ranges and areas used for any marine military purposes.	✓	Navigational features are highlighted in section 1.5.
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.	✓	Navigational features are highlighted in section 1.5.
xii. Proximity of the site to existing or proposed OREI developments, in co-operation with other relevant developers, within each round of lease awards.	✓	Navigational features are highlighted in section 1.5. Future proposed OREIs are described in section 1.10.
xiii. Proximity of the site relative to any designated areas for the disposal of dredging spoil or other dumping ground.	✓	Navigational features are highlighted in section 1.5.

MGN Section	Yes/No	Comments
xiv. Proximity of the site to aids to navigation and/or VTS in or adjacent to the area and any impact thereon.	✓	Navigational features are highlighted in section 1.5.
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.	✓	The impact on vessel routeing is assessed within section 1.8.2/1.8.3/1.8.4.
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.	✓	Analysis of historical incident data is contained within section 1.6.3.
xvii. Proximity of the site to areas used for recreation which depend on specific features of the area.	✓	Analysis of recreational traffic is contained within section 1.6.2.
4.7 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.	✓	The impact on vessel routeing is assessed within section 1.8.2/1.8.3/1.8.4 and the impact on allision risk is contained within section 1.8.8.
b. The width of a corridor between sites or OREIs to allow safe passage of shipping.	✓	The cumulative impacts of multiple OREIs is assessed within section 1.10.
4.8. 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.	✓	The export cable corridor is scoped out of the Morgan Generation NRA.
b. Clearances of fixed or floating wind turbine blades above the sea surface are *not less than 22m (*above MHWS for fixed). Floating wind turbines allow for degrees of motion.	✓	The risk of allision with wind turbine blades is assessed in section 1.8.8 and risk controls are described in section 1.4.8.
c. Underwater devices i. changes to charted depth ii. maximum height above seabed iii. Under Keel Clearance.	 ✓ ✓ ✓	The export cable corridor is scoped out of the Morgan Generation NRA.

MGN Section	Yes/No	Comments
d. Whether structure block or hinder the view of other vessels or other navigational features.	✓	Impacts on visual navigation and collision avoidance are considered within section 1.8.7.
4.9 The Effect of Tides, Tidal Streams and Weather: It should be determined whether:		
a. Current maritime traffic flows and operations in the general area are affected by the depth of water in which the proposed installation is situated at various states of the tide i.e. whether the installation could pose problems at high water which do not exist at low water conditions, and vice versa.	✓	The export cable corridor is scoped out of the Morgan Generation NRA.
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.	✓	Analysis of metocean conditions are given in section 1.5.3. Collision and allision (section 1.8.7/1.8.8) assessments consider the impact of metocean conditions.
c. The maximum rate tidal stream runs parallel to the major axis of the proposed site layout, and, if so, its effect.	✓	Analysis of metocean conditions are given in section 1.5.3. Collision and allision (section 1.8.7/1.8.8) assessments consider the impact of metocean conditions.
d. The set is across the major axis of the layout at any time, and, if so, at what rate.	✓	Analysis of metocean conditions are given in section 1.5.3. Collision and allision (section 1.8.7/1.8.8) assessments consider the impact of metocean conditions.
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.	✓	Analysis of metocean conditions are given in section 1.5.3. Collision and allision (section 1.8.7/1.8.8) assessments consider the impact of metocean conditions.
f. The structures themselves could cause changes in the set and rate of the tidal stream.	✓	No effect anticipated.
g. The structures in the tidal stream could be such as to produce siltation, deposition of sediment or scouring, affecting navigable water depths in the windfarm area or adjacent to the area.	✓	Analysis of metocean conditions are given in section 1.5.3.
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.	✓	Adverse weather impacts are assessed within section 1.8.3/1.8.4.
i. The structures could create problems in the area for vessels under sail, such as wind masking, turbulence or sheer.	✓	Analysis of metocean conditions are given in section 1.5.3. Collision and allision (section 1.8.7/1.8.8) assessments consider the impact of metocean conditions.

MGN Section	Yes/No	Comments
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.	✓	Analysis of metocean conditions are given in section 1.5.3. Collision and allision (section 1.8.7/1.8.8) assessments consider the impact of metocean conditions.
4.10 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: for all vessels, or for specified vessel types, operations and/or sizes. in all directions or areas, or in specified directions or areas. in specified tidal, weather or other conditions.	✓	Impacts to vessel routeing are assessed in section 1.8.2/1.8.3/1.8.4.
b. Navigation in and/or near the site should be prohibited or restricted: for specified vessel types, operations and/or sizes. in respect of specific activities, in all areas or directions, or in specified areas or directions, or in specified tidal or weather conditions.	✓	Applied risk controls are outlined in section 1.4.8. Possible additional risk controls are proposed in section 1.9.7.
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).	✓	Impacts to vessel routeing are assessed in section 1.8.2/1.8.3/1.8.4.
d. Guidance on the calculation of safe distance of OREI boundaries from shipping routes has been considered.	✓	Vessel routes are identified in section 1.8.3 and 1.8.4.
4.11 Search and rescue, maritime assistance service, counter pollution and salvage incident response.		
The MCA, through HM Coastguard, is required to provide Search and Rescue and emergency response within the sea area occupied by all offshore renewable energy installations in UK waters. To ensure that such operations can be safely and effectively conducted, certain requirements must be met by developers and operators.		

MGN Section	Yes/No	Comments
a. An ERCOP will be developed for the construction, operations and decommissioning phases of the OREI.	✓	Impacts to SAR are considered within section 1.8.10. Applied risk controls are outlined in section 1.4.8. Possible additional risk controls are proposed in section 1.9.7.
b. The MCA's guidance document *Offshore Renewable Energy Installation: Requirements, Advice and Guidance for Search and Rescue and Emergency Response* for the design, equipment and operation requirements will be followed.	✓	Impacts to SAR are considered within section 1.8.10. Applied risk controls are outlined in section 1.4.8. Possible additional risk controls are proposed in section 1.9.7.
c. A SAR checklist will be completed to record discussions regarding the requirements, recommendations and considerations outlined in the above document (to be agreed with MCA).		Impacts to SAR are considered within section 1.8.10. Applied risk controls are outlined in section 1.4.8. Possible additional risk controls are proposed in section 1.9.7.
4.12 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.	✓	Applied risk controls are outlined in section 1.4.8. Possible additional risk controls are proposed in section 1.9.7.
ii. On a pre-established periodicity during the life of the development.	✓	Applied risk controls are outlined in section 1.4.8. Possible additional risk controls are proposed in section 1.9.7.
ii. Post-construction: Cable route(s)	✓	Applied risk controls are outlined in section 1.4.8. Possible additional risk controls are proposed in section 1.9.7.
iii. Post-decommissioning of all or part of the development: the installed generating assets area and cable route	✓	Applied risk controls are outlined in section 1.4.8. Possible additional risk controls are proposed in section 1.9.7.
4.13 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 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).	✓	Impact on communications, radar and positioning systems are considered within section 1.8.12.

MGN Section	Yes/No	Comments
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; ii. Vessel to shore; iii. VTS radar to vessel iv. Racon to/from vessel	✓	Impact on communications, radar and positioning systems are considered within section 1.8.12.
c. The structures and generators might produce sonar interference affecting fishing, industrial or military systems used in the area.	✓	Impact on communications, radar and positioning systems are considered within section 1.8.12.
d. The site might produce acoustic noise which could mask prescribed sound signals.	✓	Impact on communications, radar and positioning systems are considered within section 1.8.12.
e. Generators and the seabed cabling within the site and onshore might produce electro-magnetic fields affecting compasses and other navigation systems.	✓	Impact on communications, radar and positioning systems are considered within section 1.8.12.
4.14 Risk mitigation measures recommended for OREI during construction, operations and decommissioning. Mitigation and safety measures will be applied to the OREI development appropriate to the level and type of risk determined during the Environmental Impact Assessment (EIA). The specific measures to be employed will be selected in consultation with the Maritime and Coastguard Agency and will be listed in the developer's Environmental Statement. These will be consistent with international standards contained in, for example, the Safety of Life at Sea (SOLAS) Convention - Chapter V, IMO Resolution A.572 (14)[3] and Resolution A.671(16)[4] and could include any or all of the following:		
i. Promulgation of information and warnings through notices to mariners and other appropriate maritime safety information dissemination methods.	✓	Applied risk controls are outlined in section 1.4.8. Possible additional risk controls are proposed in section 1.9.7.
ii. Continuous watch by multi-channel VHF, including Digital Selective Calling.	✓	Applied risk controls are outlined in section 1.4.8. Possible additional risk controls are proposed in section 1.9.7.
iii. Safety zones of appropriate configuration, extent and application to specified vessel.	✓	Applied risk controls are outlined in section 1.4.8. Possible additional risk controls are proposed in section 1.9.7.
iv. Designation of the site as an Area to be Avoided.	✓	Applied risk controls are outlined in section 1.4.8. Possible additional risk controls are proposed in section 1.9.7.
v. Provision of AtoN as determined by the GLA	✓	Applied risk controls are outlined in section 1.4.8. Possible additional risk controls are proposed in section 1.9.7.

MGN Section	Yes/No	Comments
vi. Implementation of routeing measures within or near to the development.	✓	Applied risk controls are outlined in section 1.4.8. Possible additional risk controls are proposed in section 1.9.7.
vii. Monitoring by radar, AIS, CCTV or other agreed means	✓	Applied risk controls are outlined in section 1.4.8. Possible additional risk controls are proposed in section 1.9.7.
viii. Appropriate means for OREI operators to notify, and provide evidence of, the infringement of safety zones.	✓	Applied risk controls are outlined in section 1.4.8. Possible additional risk controls are proposed in section 1.9.7.
ix. Creation of an Emergency Response Cooperation Plan with the MCA's Search and Rescue Branch for the construction phase onwards.	✓	Applied risk controls are outlined in section 1.4.8. Possible additional risk controls are proposed in section 1.9.7.
x. Use of guard vessels, where appropriate	✓	Applied risk controls are outlined in section 1.4.8. Possible additional risk controls are proposed in section 1.9.7.
xi. Update NRAs every two years (e.g. at testing sites).		Applied risk controls are outlined in section 1.4.8. Possible additional risk controls are proposed in section 1.9.7.
xii. Device-specific or array-specific NRAs	✓	Applied risk controls are outlined in section 1.4.8. Possible additional risk controls are proposed in section 1.9.7.
xiii. Design of OREI structures to minimise risk to contacting vessels or craft	✓	Applied risk controls are outlined in section 1.4.8. Possible additional risk controls are proposed in section 1.9.7.
xiv. Any other measures and procedures considered appropriate in consultation with other stakeholders.	✓	Applied risk controls are outlined in section 1.4.8. Possible additional risk controls are proposed in section 1.9.7.

Appendix D: 2023 Vessel Traffic Survey Addendum

D.1 Introduction and Purpose

D.1.1.1.1 NASH Maritime has been commissioned to undertake a NRA for the Morgan Offshore Wind Project, located in the Irish Sea.

D.1.1.1.2 The NRA has been conducted to the standards of the MCA's MGN654 (MCA, 2021). As such, two 14-day vessel traffic surveys were undertaken to collect AIS data, radar and visual observations to inform the assessment. The results of these surveys are reported in section 1.6.1 of the NRA.

D.1.1.1.3 It is noted that MGN654 4.6b states that '*For all OREI developments, subject to the planning process, the survey may be undertaken within 24 months prior to submission. If the EIA Report is not submitted within 24 months an additional 14 day continuation survey data may be required for each subsequent 12-month period*'.

D.1.1.1.4 The vessel traffic survey dates reported in section 1.6.1 of the NRA are:

- 21 November 2021 to 05 December 2021
- 15 June 2022 to 29 July 2022.

D.1.1.1.5 Therefore, the Morgan Offshore Wind Project vessel traffic survey validity would expire in December 2023 and prior to Application. This was recognised in email correspondence with the MCA in May and June 2023.

D.1.1.1.6 To address this, a top-up vessel traffic survey was undertaken in November 2023 for the purposes of extending the validity of the survey data for a further 12-month period beyond the date of Application. Due to programme constraints, this is reported within an appendix to the NRA rather than within the main body of the document.

D.1.1.1.7 The objective of this appendix is twofold. Firstly, to provide a factual record of the top-up marine vessel traffic dataset. Secondly, to compare the results of this survey with the findings of the NRA to confirm whether they are consistent with previous data collection and whether any differences would have a bearing on the conclusions of the NRA. This approach was shared with the MCA in July 2023.

D.2 Marine Vessel Traffic Survey Methodology

D.2.1 Survey Area and Data Extents

D.2.1.1.1 The survey area has been defined with a 10 nm buffer of the Morgan Array Area as shown in Figure D.1. The survey area represents the zone within which vessel traffic data has been analysed in this report. The survey vessel track shows the location of the vessel throughout the survey period.

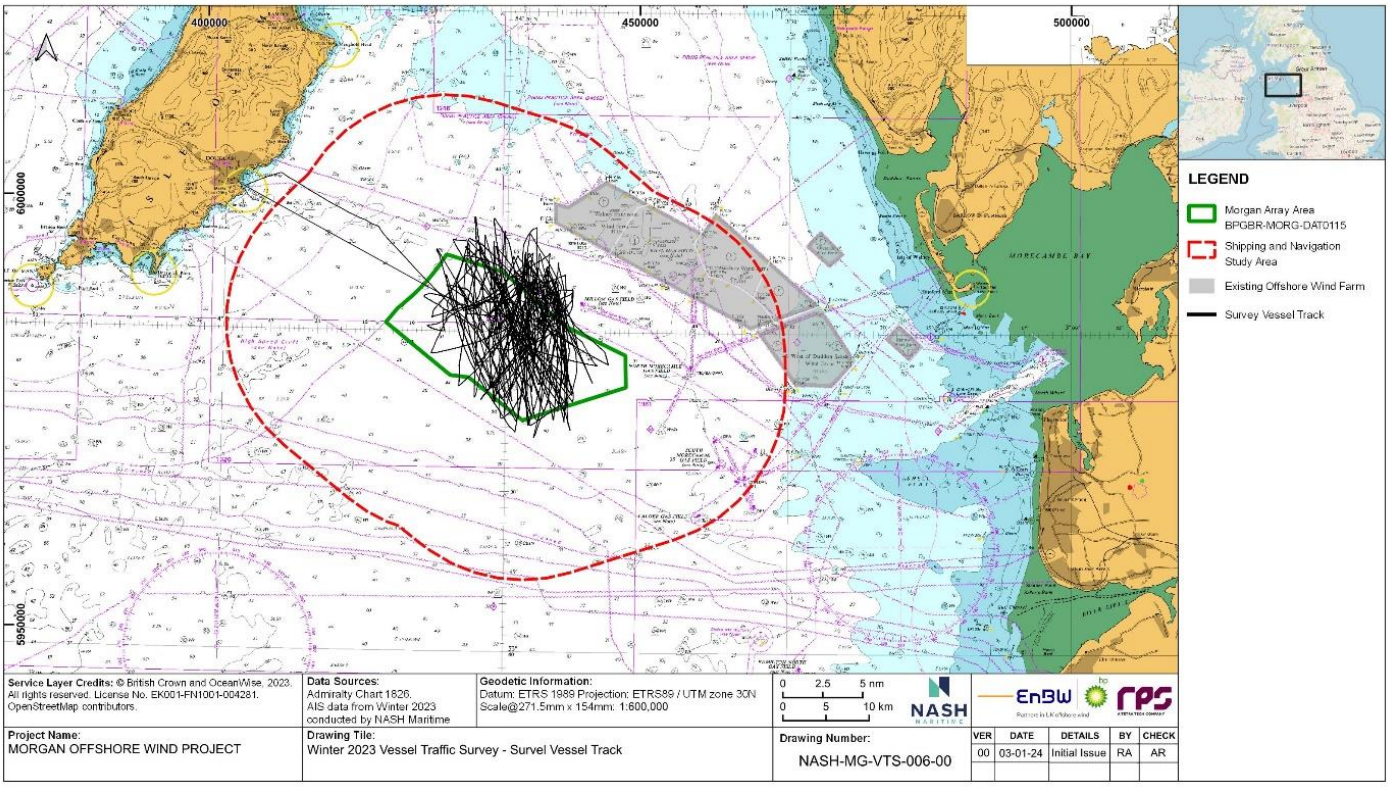

Figure D.1: Survey area and survey vessel track.

D.2.2 Survey Vessel

The vessel-based marine vessel traffic survey was undertaken using the Morning Star survey vessel (see Table D.1).

Table D.1: MORNING STAR specifications.

Feature	Value	Feature	Value
Name	Morning Star	**Tonnage**	146 GT
Callsign	MYXY7	**Main Engine**	Caterpillar C32 500 KW
Date built	1999	**Auxiliary Engine**	Daewoo 230 KW
Hull	Steel	**Speed**	10 kts cruising 12 kts max
Length	23.0 m	**Fuel Oil Capacity**	24,000 litres
Breadth	7.0 m	**Freshwater Capacity**	15,000 litres
Depth	3.8 m		

D.2.3 Survey Period

D.2.3.1.1 The marine survey was undertaken for a duration of 14 days. The survey commenced 15:00 Universal Time Coordinated (UTC) on 11 November 2023 and completed 06:00 UTC on 27 November 2023.

D.2.3.1.2 Daily survey vessel reports were collated describing weather conditions, sea state, vessel status, equipment status and crew actions.

D.2.3.2 Vessel Downtime

D.2.3.2.1 During the surveys, the following downtime was incurred. Morning Star departed Morgan Array Area at 07:00 UTC on 13 November 2023 for shelter due to adverse weather conditions caused by storm Debi. Vessel recommenced survey at 20:36 UTC on 14 November 2023.

D.2.4 Survey Vessel Location

D.2.4.1.1 The location of the survey vessel was monitored using onboard Global Positioning Systems (GPS), and the survey vessel track is presented in Figure D.1**.**

D.2.5 Weather Log

D.2.5.1.1 Weather was recorded by the survey vessel at six hourly intervals during the survey campaign.

D.2.5.1.2 The maximum wind experienced was 40 kts from the west which contributed to a rough sea state (23 November 2023).

D.2.5.1.3 Six of the six-hour intervals across the 14 days were classified as having poor visibility, the majority of days were characterised by good or moderate visibility.

D.2.5.1.4 The most common sea state recorded was Moderate.

D.2.6 Data Competency

D.2.6.1.1 Quality assurance checks on the survey vessel equipment and data collection were undertaken on a continuous basis throughout the survey to ensure competency of equipment, area coverage and data collection fidelity.

D.2.6.1.2 Data outputs following post processing of data are described in section D.3.

D.3 Survey Results

D.3.1 Summary

D.3.1.1.1 Figure D.2 and Table D.2 provides a count of identified vessels during the survey period by vessel type. The most frequently identified vessel type during the survey period was passenger This is largely due to the proximity of multiple ferry routes in operation within the region, primarily between Heysham, Liverpool, Ireland and the Isle of Man.

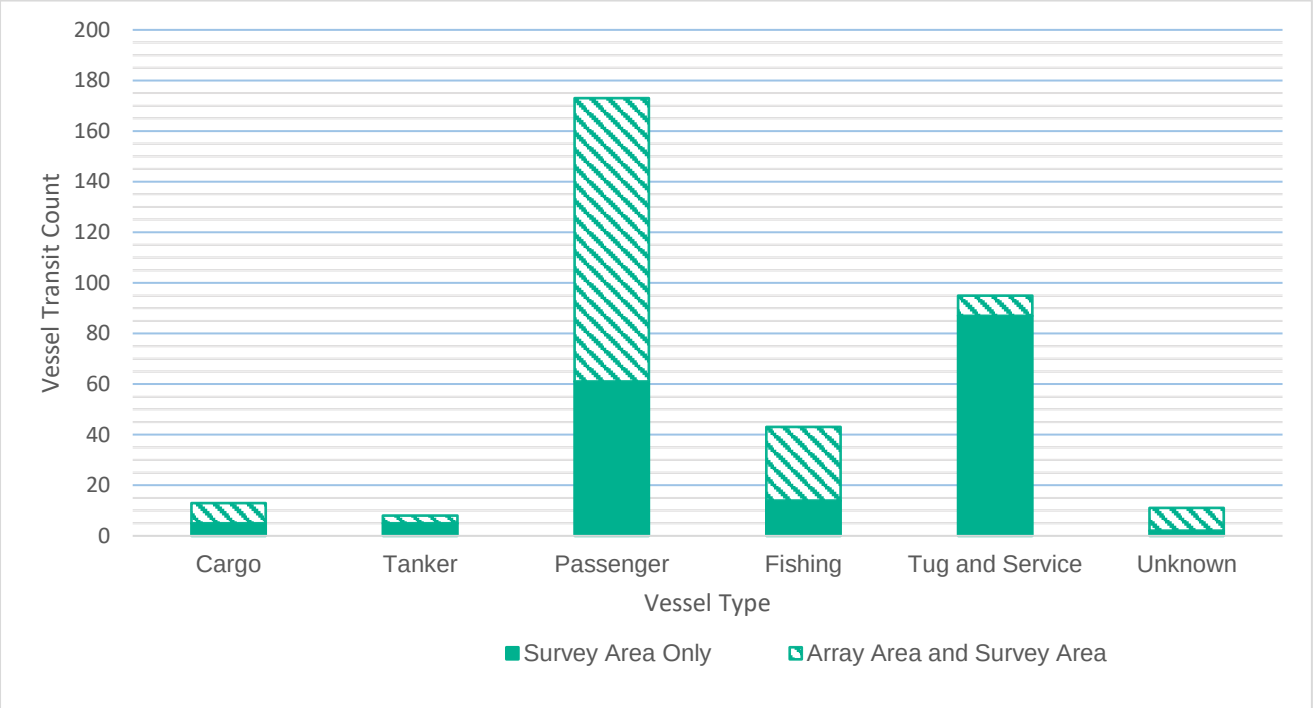

Figure D.2: Top-up survey vessel tracks.

Table D.2: Summary of vessel traffic survey.

Attributes	Top-Up
Vessel	Morning Star (23 m Fishing Vessel)
Dates	15:00:00 11 November 2023 to 06:00:00 27 November 2023
Downtime	07:00:00 13 November 2023 to 20:36:00 14 November 2023
Survey Area	Morgan Array Area + 10nm
Total Vessels Recorded (Morgan Array Area + 10nm)	343 (24.5/day)
Total Vessels Recorded (Morgan Array Area)	169 (12.1/day)
Cargo	**Morgan Array + 10nm**: 13 (0.9/day) **Morgan Array**: 8 (0.6/day)
Fishing	**Morgan Array + 10nm**: 43 (3.1/day) **Morgan Array**: 29 (2.1/day)
Passenger	**Morgan Array + 10nm**: 173 (12.4/day) **Morgan Array**: 112 (8/day)
Recreational	**Morgan Array + 10nm**: 0 (0/day) **Morgan Array**: 0 (0/day)
Tanker	**Morgan Array + 10nm**: 8 (0.6/day) **Morgan Array**: 3 (0.2/day)
Tug and Service	**Morgan Array + 10nm**: 95 (6.8/day) **Morgan Array**: 8 (0.6/day)

D.3.2 Cargo

D.3.2.1.1 There were 15 cargo vessel tracks identified within 13 nm of the Morgan Array Area during the survey as shown in Figure D.3. Of these, 8 tracks crossed the Morgan Array Area. In the 2021 winter survey and 2022 summer survey 29 and 20 cargo vessels were identified respectively and therefore this frequency is consistent with the previous vessel traffic surveys.

D.3.2.1.2 During the survey, the largest cargo vessel was the 294 m container ship MSC TAMPA.

D.3.2.1.3 Half of cargo tracks transiting through the Morgan Array Area are progressing in a northwest-southeast orientation using the Liverpool TSS and passing east of the Isle of Man.

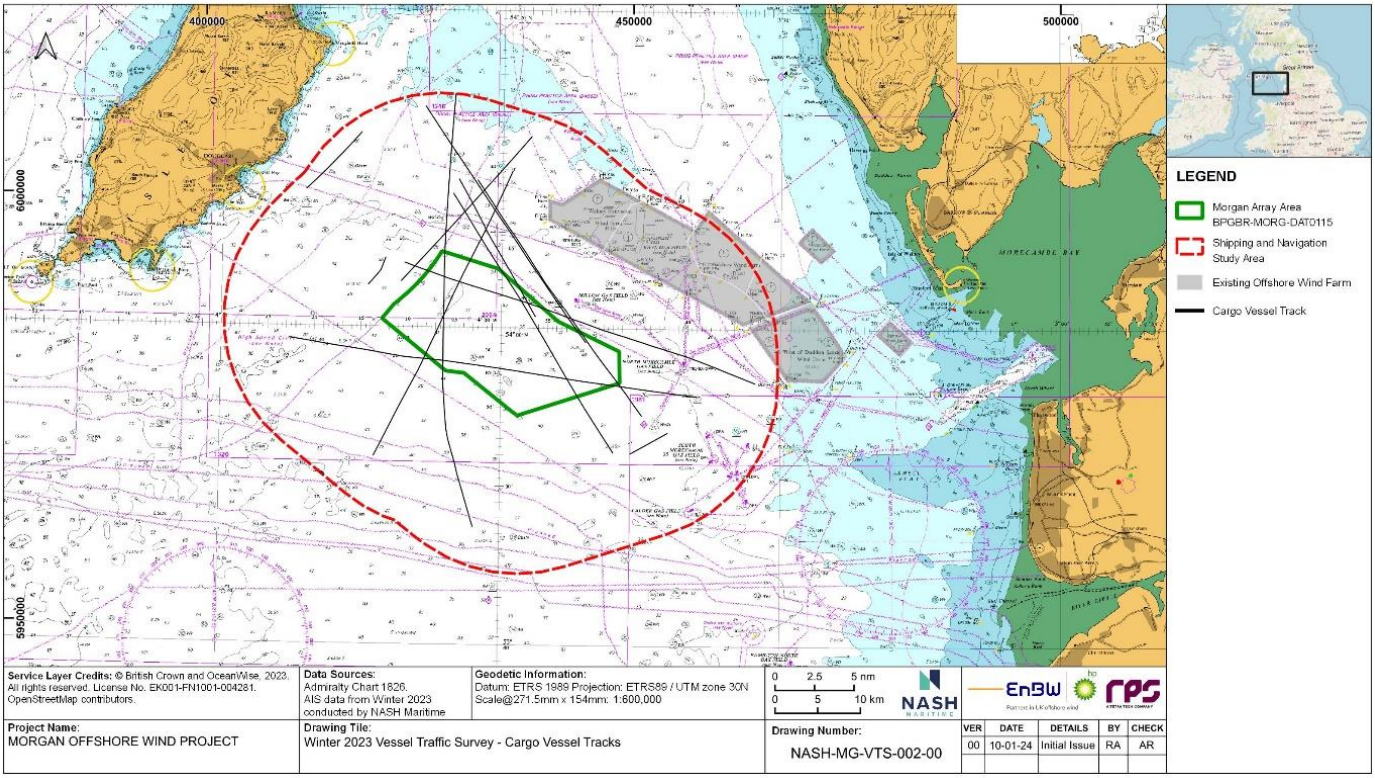

Figure D.3: Cargo survey vessel tracks.

D.3.3 Tanker

D.3.3.1.1 There were eight tanker tracks identified passing through the survey area during the survey period, shown in Figure D.4. Seven of the eight tracks are in an orientation in/out of Liverpool. In total, three of the tanker tracks crossed the Morgan Array Area. This is consistent with the 2021 winter survey that identified 24 vessels in the shipping and navigation study area and four in the Morgan Array Area, as well as the 2022 summer survey that identified 11 tankers in the shipping and navigation study area and four in the Morgan Array Area.

D.3.3.1.2 During the survey, the largest tanker recorded was the STI ALEXIS, a 256 m crude oil tanker. This vessel was identified twice during the survey.

D.3.3.1.3 The majority of tanker vessels transit on a southeast-northwest route using the Liverpool TSS. This is similar to the routes identified in the 2021 winter and 2022 summer surveys.

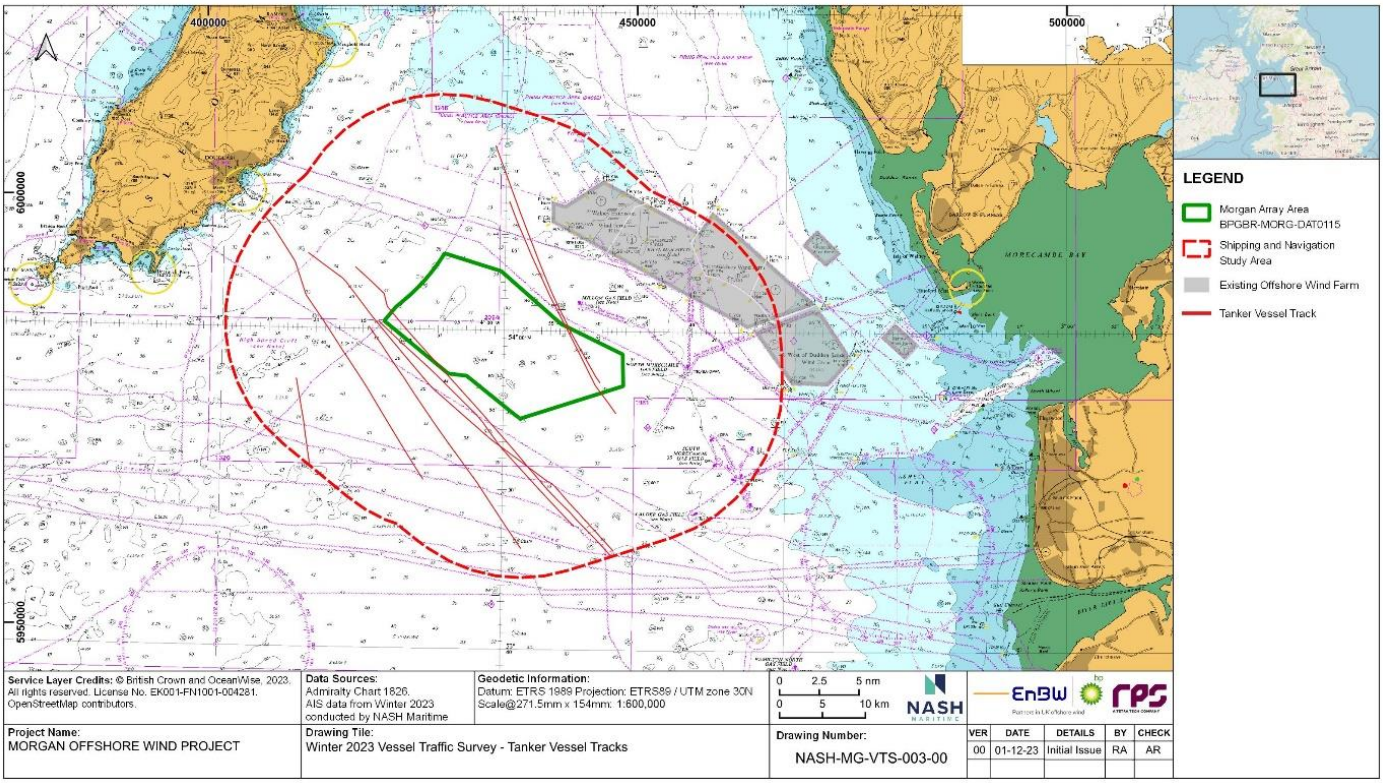

Figure D.4: Tanker vessel tracks.

D.3.4 Passenger

D.3.4.1.1 There were 173 passenger vessel tracks identified during the survey, of which 112 tracks crossed the Morgan Array Area (Figure D.5). 58 of the tracks crossing the Morgan Array Area were vessels operated by Isle of Man Steam Packet Company on passage between Liverpool and Douglas, these were the MANXMAN (55 transits) and ARROW (three transits). Seatruck vessels were also recorded on passage between Heysham and Belfast/Carlingford Lough. Stena Line vessels, Stena Edda and Stena Embla, were also recorded operating between Liverpool, Heysham and Belfast.

D.3.4.1.2 The largest passenger vessels identified during the survey period were the 215 m Stena Line vessels Stena Edda, and Stena Embla. These vessels were also the largest passenger vessels identified during the summer 2022 survey.

D.3.4.1.3 Routes identified are the same ferry routes identified in the previous surveys.

D.3.4.1.4 Comparatively, this survey identified fewer passenger vessels than previously recorded, with 150 passenger vessels being identified in the winter 2021 survey and 206 identified in the summer 2022 survey.

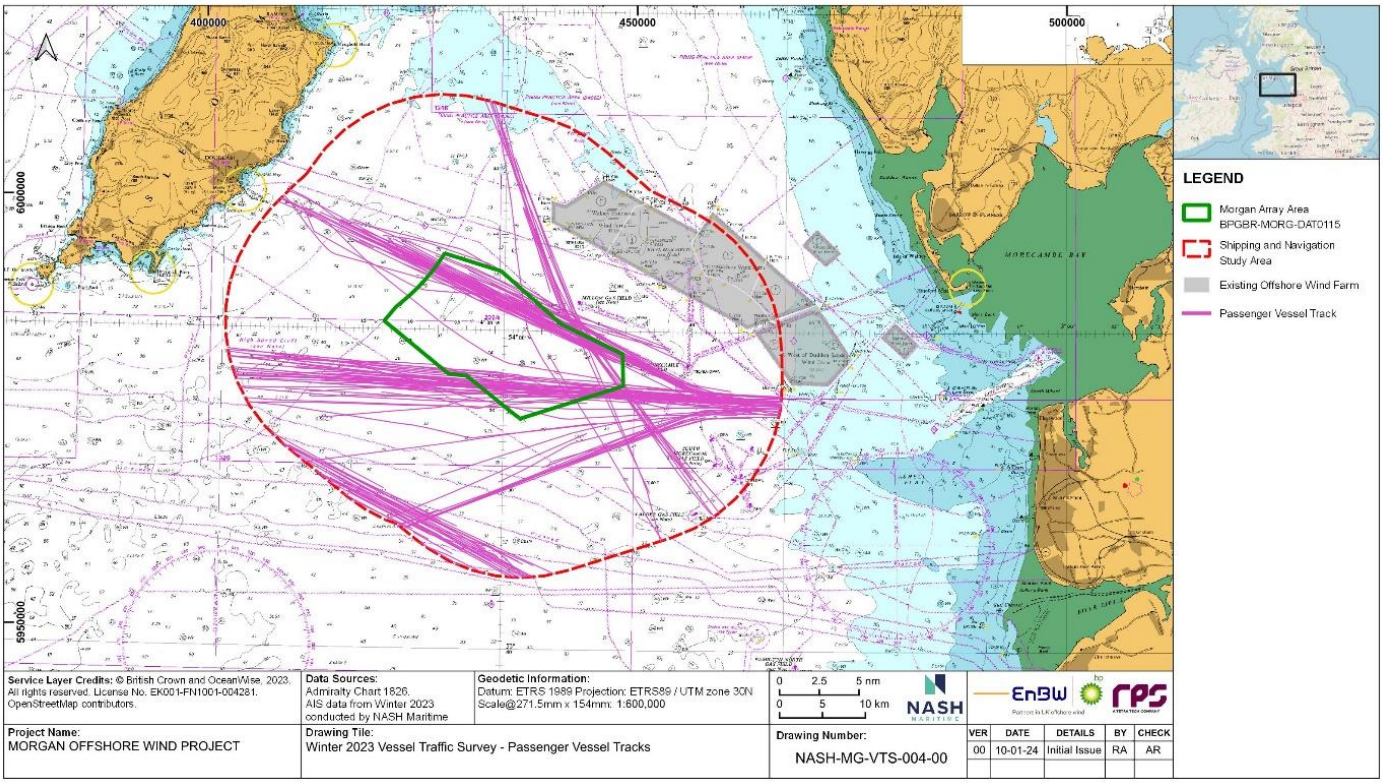

Figure D.5: Passenger vessel tracks.

D.3.5 Fishing

D.3.5.1.1 There were 43 fishing vessel tracks identified during the winter survey period as shown in Figure D.6. The tracks indicate fishing activity in locations corresponding to known areas used for scallop fishing activity. During the survey, vessel tracks recorded were associated to nine unique fishing vessels.

D.3.5.1.2 This activity is consistent with the summer 2022 survey which also recorded 43 fishing vessels but is much lower than the winter 2021 survey which identified 220 vessels.

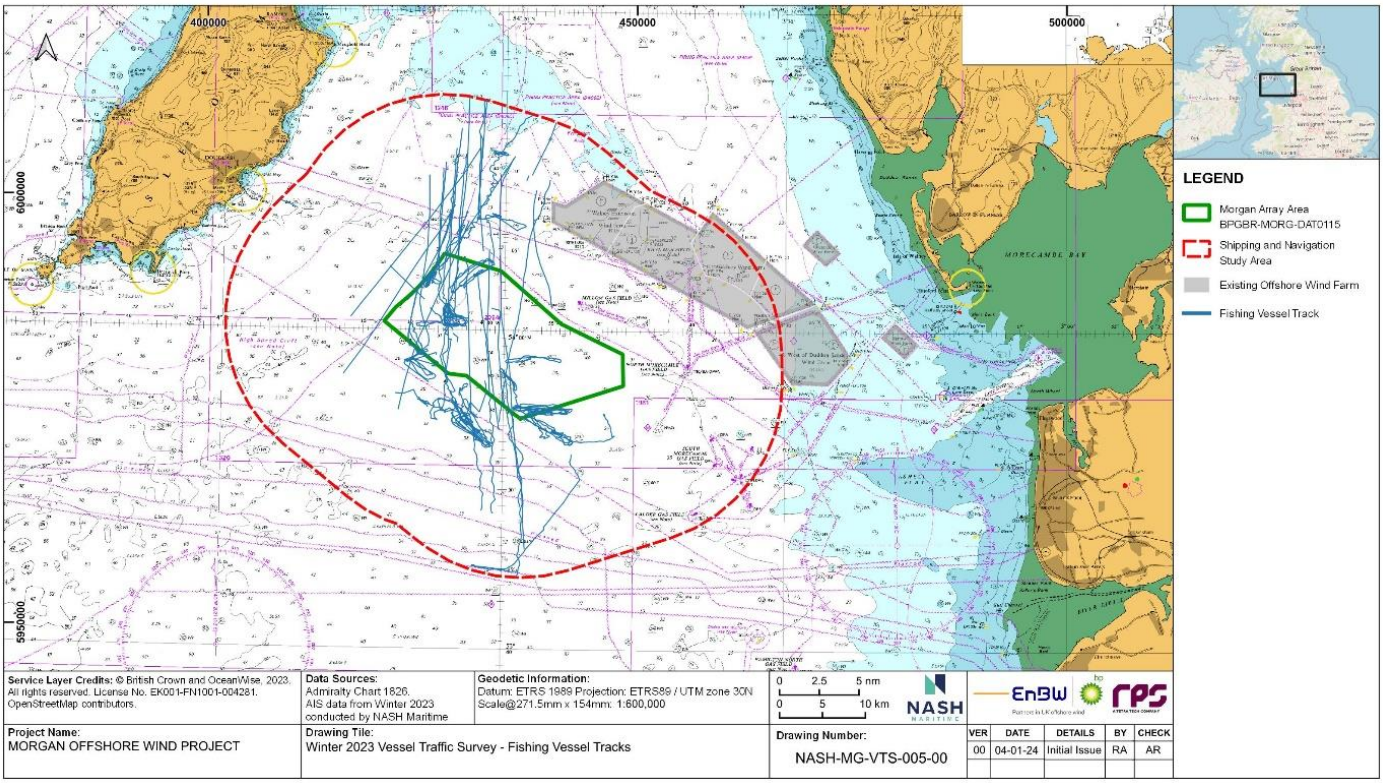

Figure D.6: Fishing vessel tracks.

D.3.6 Recreational

D.3.6.1.1 There was no recreational use of the area during the winter survey period.

D.3.6.1.2 The winter 2021 survey also found no recreational vessels. The summer 2022 survey identified 20 recreational vessels transiting the shipping and navigation study area.

D.3.7 Tug and Service

D.3.7.1.1 Figure D.7 shows regular tug and service activity primarily to the north Morgan Array Area, with a small amount of activity to the southeast. There were 95 tug and service tracks identified during the survey period. A total of 38 tug and service vessel tracks were associated with operations at the Walney Extension offshore windfarm, to the north of the Morgan Array Area, comprising of CTVs, offshore supply vessels, and a wind turbine installation vessel. The majority of activity to the southeast of the Morgan Array Area was the GRAMPIAN FORTRESS, a standby safety vessel operating at the South Morecambe Gas Field.

D.3.7.1.2 The survey identified crew transfer vessels operating between Douglas and the Walney Extension offshore windfarm. These routes were not present in any of the previous vessel traffic surveys or the longer term 2019 and 2022 AIS datasets. These vessel tracks are the operations of the HST PLYMOUTH and HST LLANELLI, neither of which have operated within the Irish Sea since.

D.3.7.1.3 Eight tug and service vessel tracks transited through the Morgan Array Area. Five of these vessels were on a northwest and southeast trajectory from the Irish Sea into the Liverpool Bay TSS.

The winter 2021 and summer 2022 surveys found similar transit numbers with 225 and 124 vessel transits being identified within the survey area. In the winter 2021 survey

28 of these transited the Morgan Array Area and in the summer 2022 there were eight. In the previous surveys the northwest-southeast route is present, along with the activity at the Walney Extension. The activity around the South Morecambe Gas Field is also present, although greater in Winter 2021 than in Summer 2022.

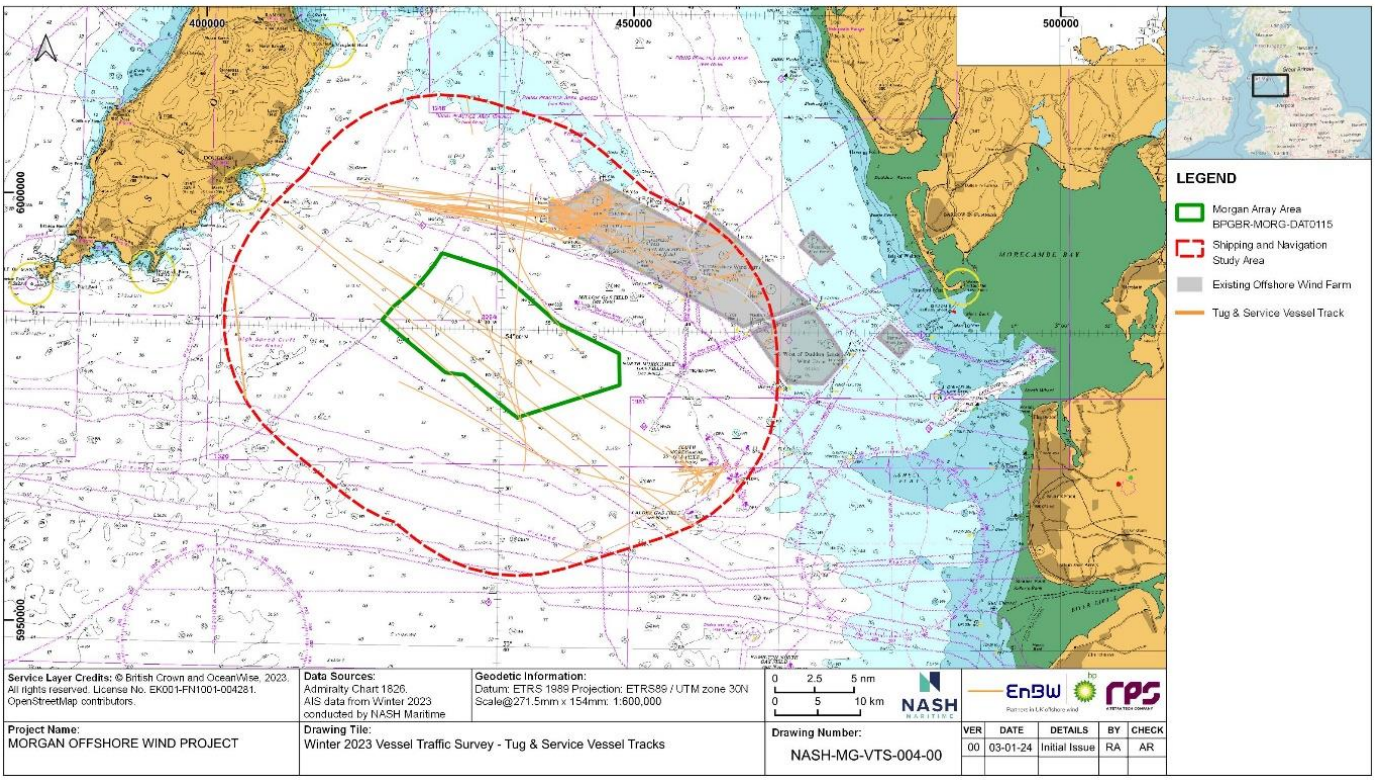

Figure D.7: Tug and service vessel tracks.

D.3.8 Vessel Counts.

D.3.8.1.1 Figure D.8 shows the daily counts of vessel tracks either through the Morgan Array Area or within the 10 nm buffer for the winter survey. There were 343 individual tracks identified during the winter survey period averaging 24.5 per day. 169 of these passed through the Morgan Array Area. The number of vessels transiting the Survey Area is less than the 649 and 426 vessels recorded in the winter 2021 and summer 2022 surveys, respectively. 169 of the recorded 2023 survey tracks passed through the Morgan Array Area. Vessels transiting through the Morgan Array Area was more consistent with the numbers found in the previous surveys, with 150 and 193 being recorded in winter 2021 and summer 2022, respectively.

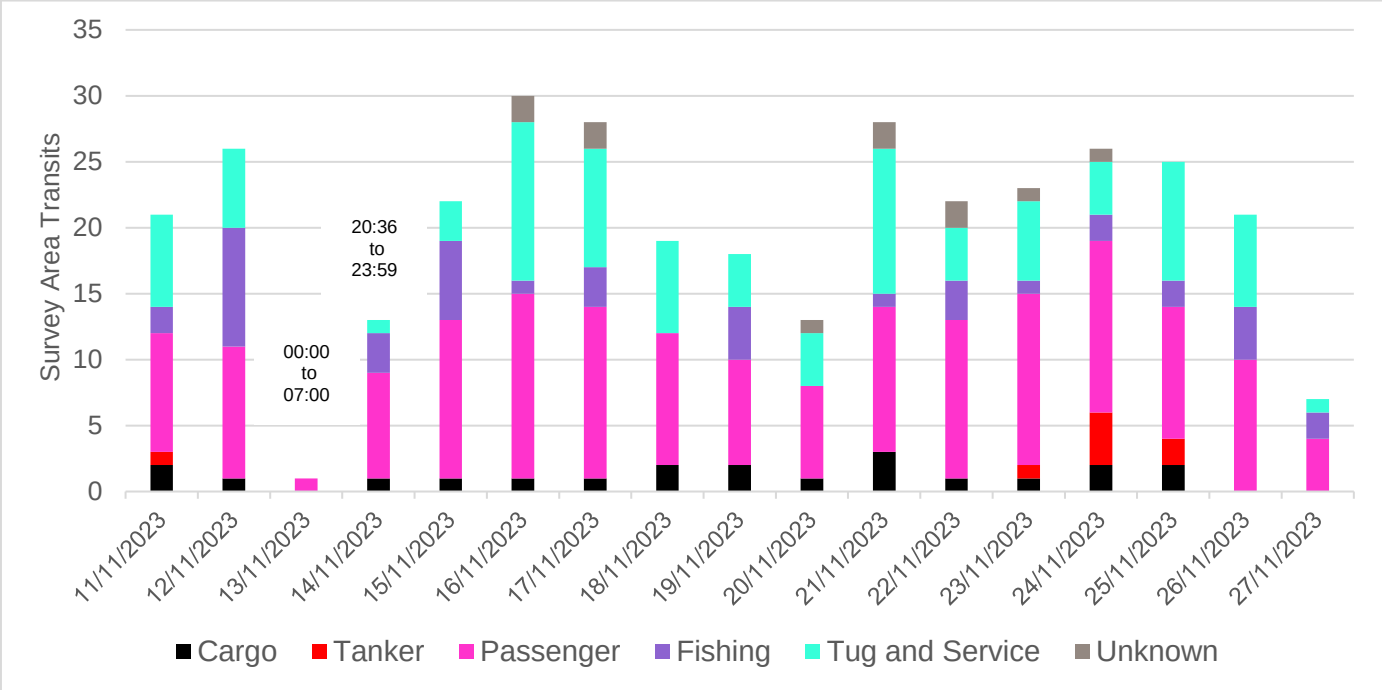

Figure D.8: Vessel counts during the survey.

D.4 Summary

D.4.1.1.1 This appendix describes the findings of a 14 day top-up vessel traffic survey undertaken for the Morgan Generation Assets during November 2023.

D.4.1.1.2 The top up survey found 21 cargo vessel movements. This was judged to be consistent with the previous surveys reported in the NRA and is considered to have no impact on the findings of that NRA.

D.4.1.1.3 The top up survey found eight tanker vessel movements, this is a decline from the counts measured in the previous surveys. As this was a decline rather than an increase, it was judged that the findings of the NRA would not have been adversely affected.

D.4.1.1.4 The top up survey found 165 passenger movements, consistent with those recorded in the previous surveys. The routes operated by Isle of Man Steam Packet Company, Stena Lines, and Seatruck all remained comparable to those identified in the previous surveys reported in the NRA and are considered to have no impact on the findings of that NRA.

D.4.1.1.5 The top up survey found 43 fishing movements with no defined routes identified. This was judged to be consistent with the previous summer 2022 survey reported in the NRA, but substantially smaller than that of the winter 2021 survey. This is considered to have no impact on the findings of that NRA.

D.4.1.1.6 The top up survey found no recreational movements. This was judged to be consistent with the previous winter vessel traffic survey reported in the NRA and is considered to have no impact on the findings of that NRA.

D.4.1.1.7 The top up survey found eight tug and service movements generally transiting on one primary route southeast/northwest through the Morgan Array Area and two areas of high activity in the shipping and navigation study area, Walney Extension and South Morecambe Gas Field. This was judged to be consistent with the previous surveys

reported in the NRA and is considered to have no impact on the findings of that NRA. However, it was noted that there was a new route taken by crew transfer vessels between Walney and Douglas that was not identified in either the previous vessel traffic surveys or longer-term AIS datasets. This behaviour was considered atypical, and the Applicant is not aware of any longer-term aspirations to more routinely use Douglas for operations and maintenance. Furthermore, it was a limited number of transits each day and was not considered to materially affect the assessment of Morgan Generation Assets.

D.4.1.1.8 Therefore, it is concluded that the findings of the top-up survey are consistent with the previous vessel traffic surveys conducted in 2021, 2022 and 2023, as well as the 2019 and 2022 AIS datasets. As such, no impact on the conclusions reached within the NRA have been identified.

D.4.1.1.9 Given this finding the datasets used within the Morgan Offshore Wind Project NRA are concluded to be valid for a further 12 month period as per MGN654 4.6b (MCA, 2021a).

Appendix E: Cumulative Regional Navigation Risk Assessment