Project Erebus

Navigation Risk Assessment

MarineSpace Ltd

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ABBREVIATIONS

Abbreviation	Detail
AIS	Automatic Identification System
ALARP	As Low as Reasonably Practicable
ARPA	Automatic Radar Plotting Aid
ATBA	Area To Be Avoided
AtoN	Aid to Navigation
BEIS	The Department for Business, Energy and Industrial Strategy
CCTV	Closed Circuit Television
CGOC	Coastguard Operations Centre
CHA	Competent Harbour Authority
CTV	Crew Transfer Vessel
ES	Environmental Statement
FLOW	Floating Offshore Wind
FSA	Formal Safety Assessment
GPS	Global Positioning System
HMCG	Her Majesty's Coatguard
HVAC	High Voltage Alternating Current
HW	High Water
ICW	In Collision With
IALA	International Association of Marine Aids to Navigation and Lighthouse Authorities
IMO	International Maritime Organisation
ITT	Invitation to Tender
kt	Knot (unit of speed equal to nautical mile per hour, approximately 1.15 mph)
LOA	Length Overall
LW	Low Water
m	Metre
MAIB	Marine Accident Investigation Branch
MCA	Maritime and Coastguard Agency
MCAA	Marine and Coastal Access Act
MGN	Marine Guidance Note
MHPA	Milford Haven Port Authority
MHWN	Mean High Water Neaps
MHWS	Mean High Water Springs
MLWN	Mean Low Water Neaps

MLWS	Mean Low Water Springs
MMO	Marine Management Organisation
MSMS	Marine Safety Management System
NAABSA	Not Always Afloat But Safe Aground
nm	Nautical Mile
NPS	National Policy Statement
NSIP	Nationally Significant Infrastructure Project
NRA	Navigation Risk Assessment
NRW	Natural Resources Wales
O&M	Operations and Maintenance
OREI	Offshore Renewable Energy Installation
PDE	Project Design Envelope
PEC	Pilotage Exemption Certificate
PINS	Planning Inspectorate
PMSC	Port Marine Safety Code
PWC	Personal Water Craft
RIB	Rigid Inflatable Boat
RML	Realistic Most Likely
RNLI	Royal National Lifeboat Institution
RWC	Realistic Worst Credible
RYA	Royal Yachting Association
SAC	Special Areas of Conservation
SAR	Search and Rescue
SBE	Simply Blue Energy
SCADA	Supervisory Control and Data Acquisition
SHA	Statutory Harbour Authority
SMS	Safety Management System
SPA	Special Protection Area
STCW	Standards of Training Certification and Watchkeeping
THLS	Trinity House Lighthouse Service
TOS	Traffic Organisation Service
TSS	Traffic Separation Scheme
VHF	Very High Frequency (radio communication)
VTS	Vessel Traffic Service
WFSV	Wind Farm Service Vessels
WNMP	Welsh National Marine Plan
WTG	Wind Turbine Generator

1. INTRODUCTION

1.1 PROJECT BACKGROUND

This Navigation Risk Assessment (NRA) has been prepared by NASH Maritime Ltd on behalf of MarineSpace Ltd as part of the Environmental Statement for Project Erebus (hereafter 'the Project'). The Project comprises construction, operation and decommissioning of a Floating Offshore Wind (FLOW) development in the Celtic Sea.

The Project is a demonstration scale FLOW development and the Applicant, Blue Gem Wind, is a joint venture between Simply Blue Energy (SBE) and TOTALEnergies, set up to create a new low carbon offshore energy sector in the region; that contributes to climate change targets, supply chain diversification and energy security.

1.2 PURPOSE AND SCOPE OF THE NAVIGATION RISK ASSESSMENT

The Project is seeking a Section 36 consent, with deemed planning permission, under the Electricity Act 1989 from Welsh Ministers, administered by Planning and Environment Decision Wales (PEDW) and a Marine Licence under the Marine and Coastal Access Act (MCAA) 2009 from Natural Resources Wales (NRW).

The Project has the potential to impact upon the safety and navigation of vessels transiting through or within the vicinity of the FLOW development. The NRA is an important requirement for the consent process for FLOW developments, and identifies the potential effects and impacts of the Project on shipping and navigation.

This NRA follows the requirements of the Maritime and Coastguard Agency (MCA) Marine Guidance Note (MGN) 654 and accompanying methodology within Annex 1. The scope and objectives of this assessment are as follows:

- Provide a description of the baseline environment;
- Describe the baseline vessel traffic and risk profile;
- Determine the likely future traffic profile;
- Identify and assess potential impacts of the Project on shipping and navigation;
- Identify and assess potential cumulative and in-combination effects;
- Undertake an NRA that identifies and assesses hazards during construction, operation and decommissioning phases of the development.
- Identification of risk controls in relation to the project hazards to reduce the risk to As Low As Reasonably Practicable (ALARP); and
- Provide recommendations in relation to the safety of the development and co-existence of users with regards to shipping and navigation.

1.3 ASSUMPTIONS

1.3.1 Project Design Envelope

For purposes of the assessment the project is defined within **Section 3** based on the Project Design Envelope (PDE). The PDE sets out a series of design options for the Project and typically contains both a realistic minimum and maximum extent/value for key project components. The final design values/parameters are expected to lie between these minimum and maximum values. The PDE is therefore used to robustly establish the extent to which the project could impact on the environment by ensuring that the worst-case scenario is assessed.

This NRA will assess a conservative scenario on a precautionary basis noting that the final design and construction is not finalised.

This provides the degree of flexibility needed when progressing to the detailed design stage and when needing to take account of any changes in technologies available to the Project post-consent, e.g. size/capacity of Wind Turbine Generator (WTG), or amount of cable protection needed.

This approach is also designed to prevent any assessments presented in the ES being deemed invalid due to being based on different project parameters to those finalised during detailed design.

Where appropriate the realistic worst case scenario for specific receptors and impacts has been defined.

Particular aspects, relevant to Shipping and Navigation, and for which flexibility is particularly important include:

- WTG capacity and parameters: due to the potential evolution of technology prior to offshore construction of the Project;
- Number and dimensions of the semi-submersible floating platform proposed: direct correlation with size and capacity of WTG selected;
- Numbers and configuration of subsea mooring lines: linked to dimensions of the semi-submersible floating platform;
- Type of foundation options, i.e. drag embedment anchors; suction piling; driven piles: linked to dimensions of the semi-submersible floating platform and site-specific ground conditions;
- Amount and exact location of cable protection along the export cable: linked to site-specific ground conditions; and
- Exact construction timing and methodologies: to be fully developed once project design is finalised and installation contractors are appointed.

An offshore consent boundary has been developed within which all offshore project components will be located.

Whilst the exact layout of the semi-submersible floating platform and WTGs within the offshore consent boundary is not known beyond potential indicative options, this assessment considers the worst-case spatial extent such that these structures are positioned along the maximum extent of the array area. The worst-case design characteristics for the semi-submersible floating platform/WTGs will also be assessed.

1.3.2 Risk Control Mitigations

A number of the designed in (embedded) risk control mitigations (**see Section 9.2**) will require further definition and development once the project design has been further developed, i.e. post consent. The NRA has been progressed on the basis of these risk controls being developed and agreed to an acceptable standard and them being effective in their implementation.

1.3.3 Risk Assessment Requirements across Statutory Boundaries

The assessment considers the key project components of the array area and the export cable holistically within one assessment. The array area and the majority of the export cable are within waters where the MCA hold statutory responsibility for safety of navigation. However, the export cable route passes through, and makes landfall within, the port limits of Milford Haven Port Authority (MHPA) who hold statutory responsibility for safety of navigation within this area. As part of this NRA process, an early review was undertaken, including liaison with MHPA on 10-Jul-2020, on the potential requirement to fully integrate with the existing MHPA risk assessment and methodology under the Port Marine Safety Code (PMSC) within MHPA port limits. It was decided that the whole export cable route would be assessed within one combined NRA in accordance with MGN 654 to demonstrate good practice rather than through separate assessments under MGN 654 and the PMSC.

2. POLICY, GUIDANCE AND ASSESSMENT METHODOLOGY

This section provides an overview of the key guidance and policy documentation relevant to this assessment.

2.1 GUIDANCE DOCUMENTS

A summary of the primary guidance relevant to shipping and navigation is provided in **Table 1.**

Table 1 Summary of guidance relevant to shipping and navigation.

Guidance	Key Provisions
MGN 654 (M+F) Safety of Navigation: Offshore Renewable Energy Installations (OREIs) – Guidance on UK Navigational Practice, Safety and Emergency Response.	Highlights issues that need to be taken into consideration when assessing the impact on navigational safety and emergency responses caused by offshore renewable energy installation. MGN 654 provides guidance on traffic surveys, consultation, structure layout, collision avoidance, impacts on communications, radar and positioning systems and hydrography.
MCA Offshore Renewable Energy Installations: Requirements, Guidance and Operational Considerations for Search and Rescue and Emergency Response	Accompanying Annex 5 to MGN654 providing a description of MCA policy and guidance, methodology for assessment, advice and specific requirements for assessing marine navigational safety and emergency response for OREI projects.
MCA Methodology for Assessing the Marine Navigational Safety & Emergency Response Risks of Offshore Renewable Energy Installations	This document is incorporated into MGN 654 as Annex 1 and should be read in conjunction. Its purpose is to be used as guidance for developers in preparing their navigation risk and emergency response assessment and includes a suggested template for preparing Navigational Risk Assessments for offshore wind farms.
MGN 372 Guidance to Mariners Operating in the Vicinity of UK OREIS	Guidance outlining the issues to be considered when planning and undertaking voyages near OREIs off the UK coast.
MCA Offshore Renewable Energy Installations: Impact on Shipping	Guidance describing how wind farms and wave and tidal energy devices can endanger navigation, emergency response operations, marine radar and Global Positioning System (GPS) communications.
International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA AISM) 0-139 the Marking of Man-Made Offshore Structures	Provides guidance to national authorities on the marking of offshore structures, including floating wind farms.
International Maritime Organisation (IMO) Formal Safety Assessment MSC-MEPC.2/Circ.12/Rev.2	Outlines the process for undertaking marine navigation risk assessments.
Royal Yachting Association (RYA) Position on Offshore Energy Developments	Outlines potential the recreational boating impacts and surrounding offshore renewable energy developments. Provides considerations for assessment and risk controls.

2.1.1 MCA MGN 654

The primary guidance relevant to this assessment is MGN 654 (M+F) and the accompanying Annex 1, which highlights issues that need to be taken into consideration when assessing the impact on navigational safety and emergency responses caused by offshore renewable energy installation.

This NRA therefore draws on guidance given in MGN 654 which outlines the considerations and criteria for evaluating navigational safety around OREI's through traffic surveys and highlights issues that should be considered within the NRA. MGN 654 replaced MGN 543 in May 2021 during the period of this assessment and should also be considered in conjunction with:

- MCA MGN 372 Offshore Renewable Energy Installations (OREIs) – Guidance to Mariners Operating in the Vicinity of UK OREIs
- MCA Methodology for Assessing the Marine Navigational Safety Risks & Emergency Response of Offshore Renewable Energy Installations (OREI)

Table 2 shows where the requirements and key components of MGN 654 have been addressed within this assessment and Appendix A of this NRA provides the detailed MGN 654 checklist.

Table 2 MGN 654 Annex 6 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	Comments
A risk claim is included that is supported by a reasoned argument and evidence	✓	The risk assessment conducted in **Section 9** is supported by: • Data analysis (**Section 5**) • Consultation (**Section 7**) • Review and discussion of impacts (**Section 8**) Therefore, a risk claim is made in **Section 10**.
Description of the marine environment	✓	A description of the baseline marine environment is provided in **section 4**.
Search and Rescue overview and assessment	✓	Existing search and rescue provision is described in **section 4.4.3.1**. An assessment of impacts of the Project to search and rescue is provided in **section 8.6**.
Description of the OREI development and how it changes the marine environment	✓	A description of the OREI development is provided in **section 3**. Potential impacts are described in **section 7.7**.

The following content is included:	Compliant Yes/No	Comments
Analysis of the marine traffic, including base case and future traffic densities and types.	✓	A detailed analysis of the baseline vessel traffic is provided in **section 5**. **Section 6** presents the future baseline traffic profile.
Status of the hazard log • Hazard Identification • Risk Assessment • Influences on level of risk • Tolerability of risk • Risk matrix	✓	The navigational risk assessment is provided in **Section 9**, including hazard identification (**Section 9.1)**, methodology (**Section 9.3**) risk assessment (**Section 9.4**) and risk controls (**Section 9.2** and **9.5**). The hazard log is provided in Appendix C.
Navigation Risk Assessment • Appropriate risk assessment • MCA acceptance for assessment techniques and tools • Demonstration of results • Limitations	✓	The navigational risk assessment is provided in **Section 9**. Data and methodology for the NRA were confirmed in consultation with statutory stakeholders, including MCA. Results are presented in **Section 9.4.** Assumptions and limitations underpinning the basis of this assessment are described in **Sections 1.3, 3 and 9.** Limitations specific to the input data and how they are mitigated are described in **Section 5.**
Risk control log	✓	A risk control log is provided in **Sections 9.2**. and 9.5

2.2 NATIONAL POLICY STATEMENT

National Policy Statements (NPS's) set out UK Government policy on different types of national infrastructure developments, i.e. Nationally Significant Infrastructure Projects (NSIPs). Whilst Project Erebus is not a NSIP, this NRA has been undertaken in accordance with the instructions and guidance provided within the NPS for Renewable Energy Infrastructure (EN-3). **Table 3** provides a summary of the guidance provided by NPS EN-3 that is relevant to shipping and navigation.

Table 3 NPS EN-3 guidance relevant to shipping and navigation.

Paragraph	Key Provisions
2.6.153	Applicants should establish stakeholder engagement with interested parties in the navigation sector early in the development phase of the proposed offshore wind farm and this should continue throughout the life of the development including during the construction, operation, and decommissioning phases. Such engagement should be taken to ensure that solutions are sought that allow offshore wind farms and navigation uses of the sea to successfully co-exist

Paragraph	Key Provisions
2.6.154	Assessment should be underpinned by consultation with the Marine Management Organisation (MMO), Maritime and Coastguard Agency (MCA), the relevant General Lighthouse Authority, 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.
2.6.155	Information on internationally recognised sea lanes is publicly available and this should be considered by applicants prior to undertaking assessments. The assessment should include reference to any relevant, publicly available data available on the Maritime Database
2.6.156	Applicants should 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.
2.6.157	The navigation risk assessment will for example necessitate: a survey of vessels 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; and cumulative and in-combination risks associated with the development and other developments (including other wind farms) in the same area of sea
2.6.158	Where there is a possibility that safety zones will be sought around offshore infrastructure, potential effects should be included in the assessment on navigation and shipping.
2.6.159	Where the precise extents of potential safety zones are unknown, a realistic worst-case scenario should be assessed. Applicants should consult the MCA and refer to the Government guidance on safety zones.
2.6.160	The potential effect on recreational craft, such as yachts, should be considered in any assessment.

2.2.1 Welsh National Marine Plan

NPS EN-3 indicates that the decision-maker should take account of the Welsh Government's policies and plans in the area as relevant. As such, the Welsh National Marine Plan (WNMP), published by the Welsh Government in November 2019, has been considered within this assessment.

Table 4 provides a summary of the key guidance from the WNMP relevant to shipping and navigation.

Table 4 Welsh National Marine Plan guidance relevant to shipping and navigation

Paragraph	Key Provisions
410	Aims to safeguard established shipping routes and support sustainable development in the shipping and ports sector.
414	Identifies Milford Haven as the largest liquid bulk port in the UK and highlights the presence of significant energy related traffic at Milford Haven.
415	Outlines the key shipping activity in the area and the key provisions, including anchorages and pilot boarding places, that play a role in the movement and safe navigation of maritime traffic. Recognizes the IMO routes operating as Traffic

Paragraph	Key Provisions
	Separation Scheme areas off Pembrokeshire and identifies the busier traffic areas occurring around areas of access to ports and around headlands.
421	Ports and shipping are sensitive to economic trends and the activities of other sectors; such dynamics are variable and therefore difficult to forecast. However, the WNMP states that current trends indicate opportunities to host value added processes such as manufacturing, e.g. supporting and servicing offshore renewable energy, particularly for ports in close proximity to developments.
434	Policy **SAF_01 a** applies to all proposals from all sectors (including new Ports and Shipping sector proposals) with the potential to impact upon existing ports, harbours and marinas, including navigation routes within port, harbour and marina boundaries.
435	Policy **SAF_01 b** applies to all proposals from all sectors (including new Ports and Shipping sector proposals) with the potential to impact upon established commercial navigation routes, pilot boarding areas and commercial anchorages outside of existing port, harbour and marina boundaries.
436	These safeguarding policies seek to minimise negative impacts on shipping activity, ensure freedom of navigation and navigational safety which are provided under international law, and protect the efficiency and resilience of continuing port operations, including their economic interests. They do this by ensuring that developments or other activities which may restrict ports and shipping in terms of continuing current operations and responding to future development opportunities are considered and addressed in decision making. They also recognise the significant potential for coexistence of compatible activities with ports and shipping. Displacement of shipping should be avoided where possible.
437	Public authorities should only issue consent if they are satisfied that the proposal will not adversely impact on navigational safety or have an unacceptable impact on shipping activities and freedom of navigation and are in compliance with national and international maritime law.

2.3 FORMAL SAFETY ASSESSMENT PROCESS AND METHODOLOGY

The International Maritime Organisation (IMO) Formal Safety Assessment (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.

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); and

- Step 5: Recommendations for decision making.

2.4 IALA RISK MANAGEMENT TOOL - METHODOLOGY - QUANTITATIVE RISK MODELLING

Collision and contact risk modelling has been conducted using quantitative methods. The model IWRAP MKII has been used which is a quantitative collision, contact and grounding model, developed by International Association of Lighthouse Authorities (IALA) as a component of the IALA Risk Management Tool recognised by the IMO. The model is a probability model with the underlying risk frequency analysis based on a mathematical model first introduced in 1974 by Fuji & MacDuff, and since modified by Pedersen and Friis-Hansen. The method is probabilistic and based on statistical analysis of vessel routes.

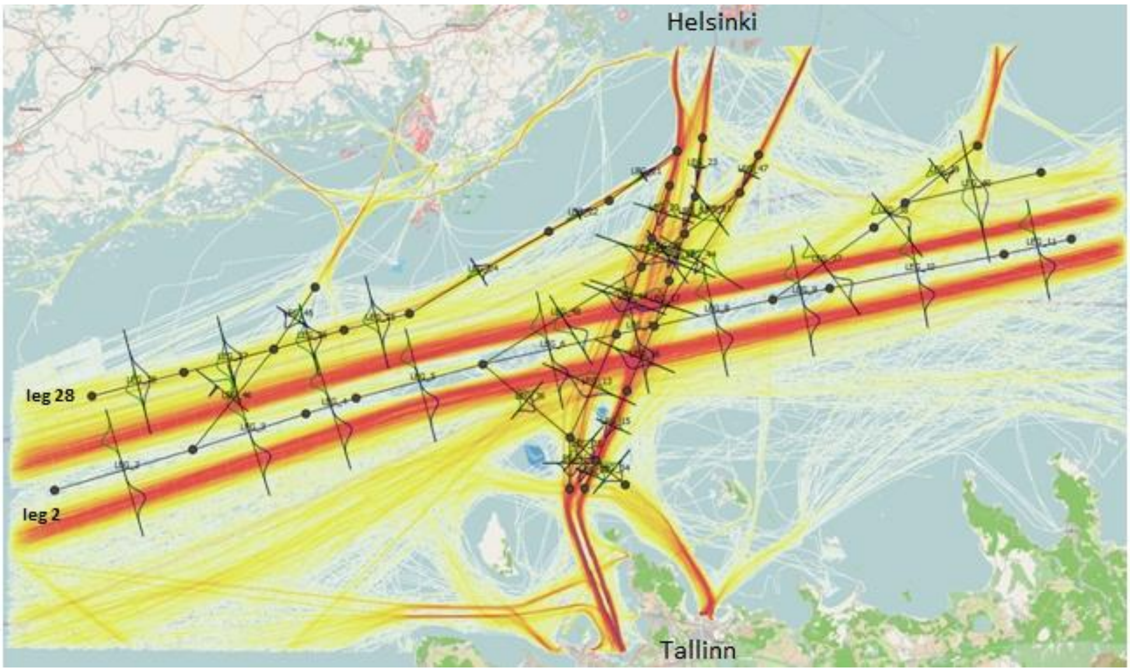


Figure 1 IWRAP MKII model example, Gulf of Finland (Source: IALA)

The study area is modelled using several vessel routes called legs which connect one waypoint to another. Several legs may be connected to the same waypoint, e.g., at a crossing or at a merging location. For each leg, a statistical distribution is assigned describing how far from the leg centre vessels are travelling. The general principle is to calculate how many collisions, allisions or groundings will occur if all the vessels sail straight ahead without taking any evasive manoeuvres or actions to avoid the occurrence. This gives the number of theoretical geometrical collisions, allisions and groundings. Vessels do not generally navigate in this manner, and in general, around 1 or 2 in 10,000 encounters are not avoided as they should be - this is called the causation factor. The causation factor models the probability that the vessel does not react in time when on a collision course with another vessel, or alternatively an allision or grounding course. IALA has, together with a group of experts, defined a set of globally applicable causation factor values. The total number of collisions, allisions or groundings is the number of geometrical candidates multiplied by the causation factor. The method has been extensively tested and found to estimate the number of collisions and allisions close to the observed numbers all around the world. Within this study two IWRAP models are developed, a base case without the Project in place and another future case with the Project in place. By comparing the calculated risk scores in each scenario, a change in risk can be determined.

3. PROJECT DESCRIPTION

The project information provided within this section has been drawn from Environmental Statement (ES) Chapter 4: Proposed Development Description and the PDE. This section provides a summary of key aspects of the project information that has informed the NRA.

3.1 OVERVIEW

The Project will comprise 6 to 10 floating WTG with a maximum generating capacity of up to 100 MW, with associated semi-submersible floating platforms, mooring infrastructure and array cables. Each WTG is housed on a semi-submersible floating platform with a mooring system comprising a maximum of 5 catenary mooring lines, up to 870 m in length, and secured to the seabed. Up to 10 dynamic inter array cable are proposed, with a lazy wave configuration from the semi-submersible floating platform to the seabed.

An offshore export cable approximately 49 km in length, will transport electricity from the array area to the landfall at West Angle Bay (see **Figure 2** and **Figure 16**). The preference is for horizontal directional drilling (HDD) to be utilised at landfall. However, open cut trenching may be required if conditions do not allow for HDD. If HDD is undertaken, there will be a HDD exit point in the shallow sub-tidal area (around KP0.6) that will require some form of permanent rock protection.

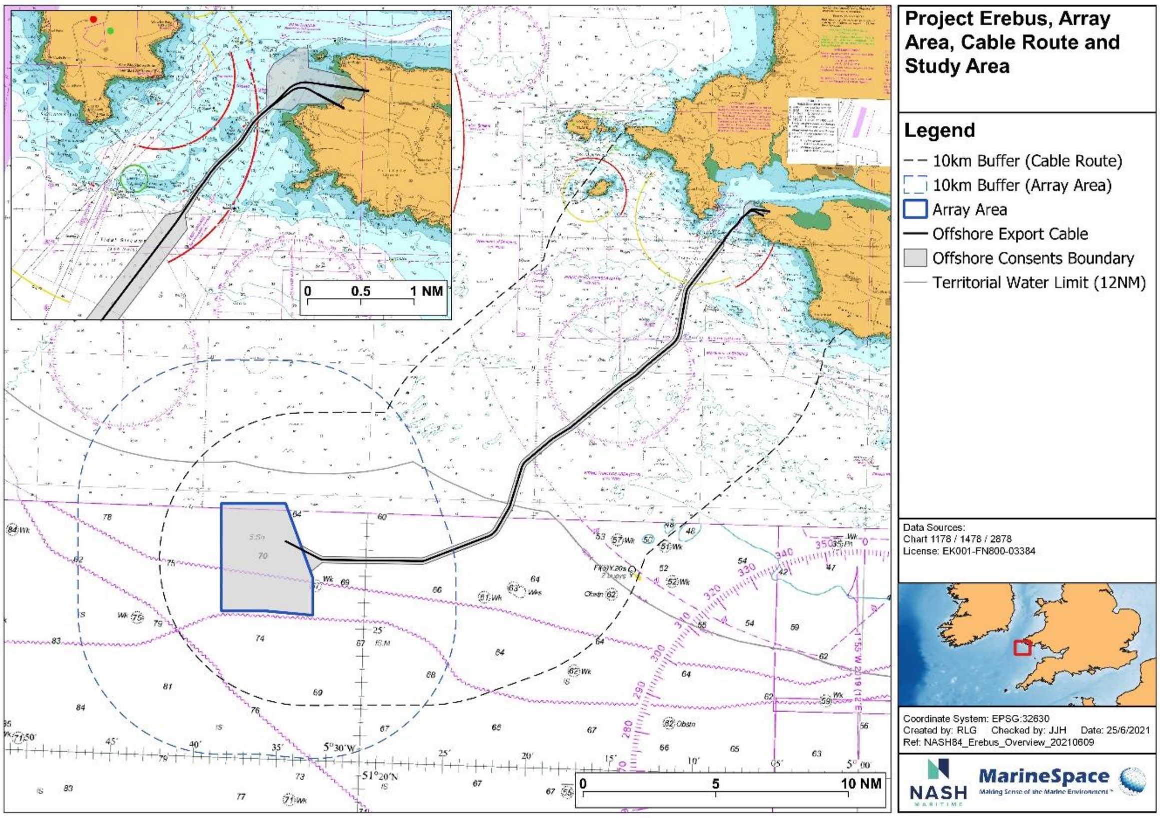


Figure 2 Overview of project boundaries and study area.

3.2 SITE DESCRIPTION

The FLOW array area is located approximately 44 km southwest of the Pembrokeshire coastline in the Celtic Sea. The Project location is provided in **Figure 2**. The Celtic Sea is an area of the Atlantic Ocean, off the south coast of Ireland, the southwest coast of England and Wales, with the East Irish Sea to the north. The array area is located outside of the 12 nm limit, but all elements of the Project, array area, offshore export cable corridor and landfall fall within Welsh waters. Water depths at the array area are between 65 m and 85 m below the lowest astronomical tide (LAT), with the site boundary measuring approximately 43.5 km^2.

The offshore export cable will be up to 49 km long, connecting the offshore array area to the coast and will be buried where ground conditions permit. However, there may be a need for cable protection where burial is not achievable. The offshore export cable corridor will pass through the Skomer, Skokholm and Seas off Pembrokeshire Special Protection Area (SPA), the West Wales Marine Special Areas of Conservation (SAC) and Pembrokeshire Marine SAC.

The offshore export cable landfall will be at West Angle Bay and will cross through the Arfordir Penrhyn Angle Site of Special Scientific Interest (SSSI). The offshore export cable will cross the East Channel into the Port of Milford Haven and the Castlemartin Firing Range.

The study area for the assessment is shown in **Figure 2Figure 2**.

3.3 LAYOUT

There are seven indicative layouts proposed for the array area, these are shown in **Figure 3**. The final layout of the Project will be determined post-consent. This NRA is undertaken on a precautionary basis and assumes the maximum spatial extent of the offshore consent boundary will be filled with project infrastructure.

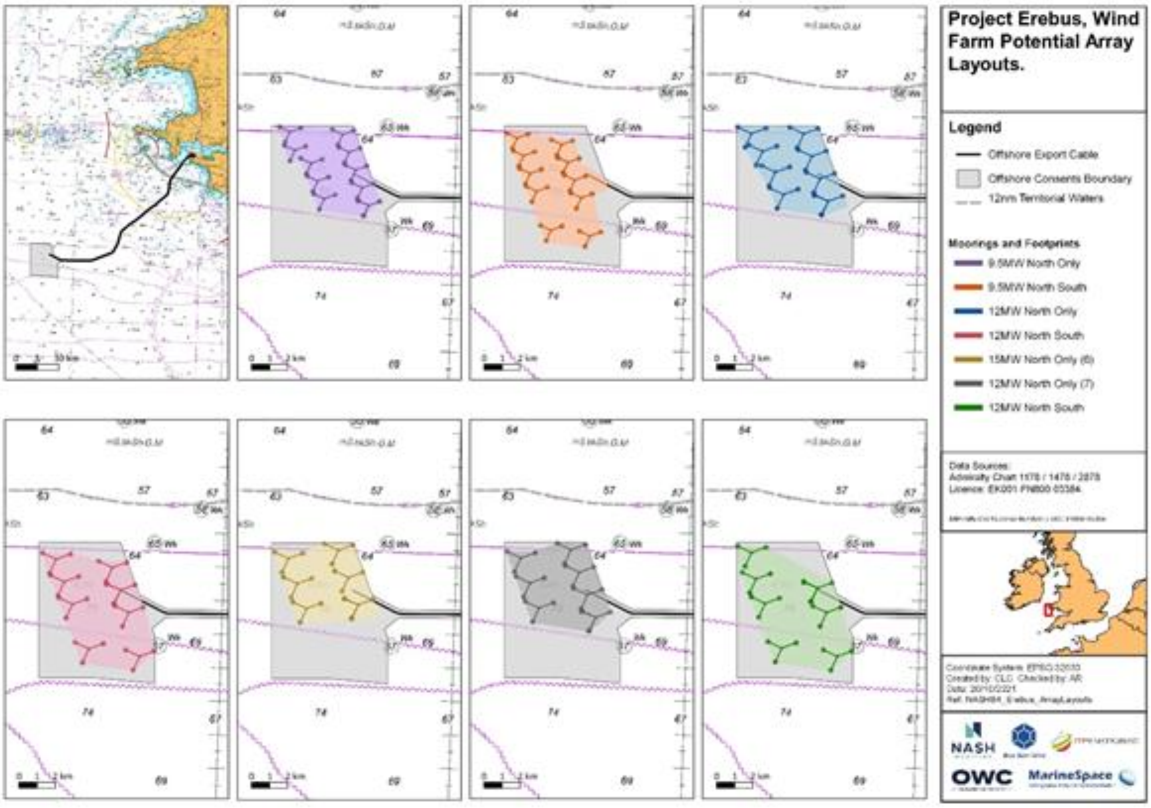


Figure 3 Wind Farm Indicative Array Layouts

3.4 WIND TURBINE GENERATORS

The Project will involve installation of between 6 and 10 WTGs. The WTGs proposed to be used will be between 9.5 MW and 18 MW rated capacity and will be mounted on the semi-submersible floating platforms. They will follow the traditional offshore WTG design with three blades and a horizontal rotor axis.

Each WTG will have its own control system to carry out functions like yaw control and ramp down in high wind speeds. All the WTGs will also be connected to a central Supervisory Control and Data Acquisition (SCADA) system for the control of the wind farm remotely. The SCADA system will communicate with the wind farm via fibre optic cables, microwave, or satellite links. Individual WTGs can also be controlled manually from within the WTG nacelle or tower base in order to control the WTG for commissioning or maintenance.

All WTGs will be designed with a minimum clearance of 22m between the lowest point of the rotor blade above water level and allow for anticipated range of motion (pitch, roll, yaw, heave, surge and sway), as appropriate. The maximum design characteristics for turbine size are shown in **Figure 4.**

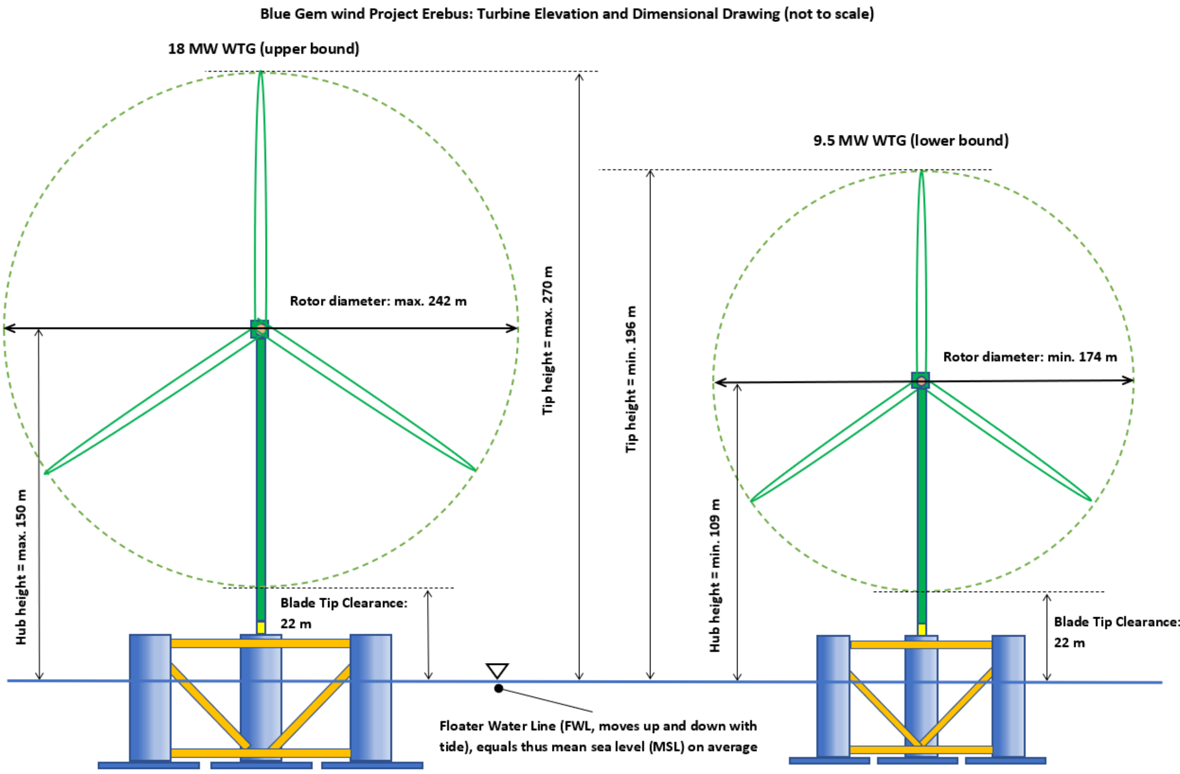


Figure 4 Maximum and minimum WTG design parameters

3.5 PLATFORMS

The Project will involve between 6 and 10 floating semi-submersible platforms secured to the seabed using an asymmetric mooring system designed to achieve high stability levels. The semi-submersible platform will provide buoyancy to support the WTG and counteract the large wind-induced overturning momentum.

The semi-submersible platform comprises three columns inter-connected with a truss structure composed of main beams, connecting columns and bracings. Secondary structures include a boat landing on one of the columns, deck space and railings (for personnel access) and associated equipment (onboard davit crane, array cable hang-off etc.). An example semi-submersible floating platform, WindFloat™ is shown in **Figure 5**.

Two platform designs are considered based on the WTG size and will have a triangular area footprint of either 104m x 82m or 94m x 74m, an operating freeboard of 14.5m and an operating draft of 17.4m.

Figure 5 Indicative semi-submersible floating platform WindFloat (Source: Principle Power).

3.6 MOORING SYSTEM

The semi-submersible floating platform will be attached to the seabed using a series of anchored mooring lines. The mooring system is designed to address station keeping issues and enables simple installation and connection-disconnection procedures that be performed by widely available anchor handling vessels.

There will be between three to five mooring lines in a triangular or spread fashion from each semi-submersible floating platforms to provide a mooring system with low pre-tension requirements. The mooring line will range in length from a minimum of 530m to a maximum length of 870 m. The total number of mooring lines will be between 20 and 35. In line with the predominant wind direction (south - southwest), there will always be at least two mooring lines upwind, and one downwind.

The mooring lines will connect to the underside of the semi-submersible floating platform compensating heave plates at 17.4m below the water surface and a catenary mooring system will be used, comprising anchors and mooring lines made of ground chains, steel, synthetic ropes and other connectors using offshore grade materials (see Error! Reference source not found.)

Clump weights, usually iron and occasionally concrete, will be used to load the line, therefore, managing the in water catenary angle. This will result in 80-95% of the mooring line being on the seabed and reducing the overall length of the mooring lines. A maximum of 25 clump weights will be attached to each mooring line, each weighing up to 20 tons.

Subject to verification, drag embedment anchors are the most likely and preferred option for securing the mooring lines to the seabed. However, to enable a flexible approach that encompasses all worst-case scenarios, suction piling with gravity anchors, driven piles and drilled piles have also been included within the PDE.

The maximum lateral excursion of the platform from the nominal central position is anticipated to be between 40 and 50m.

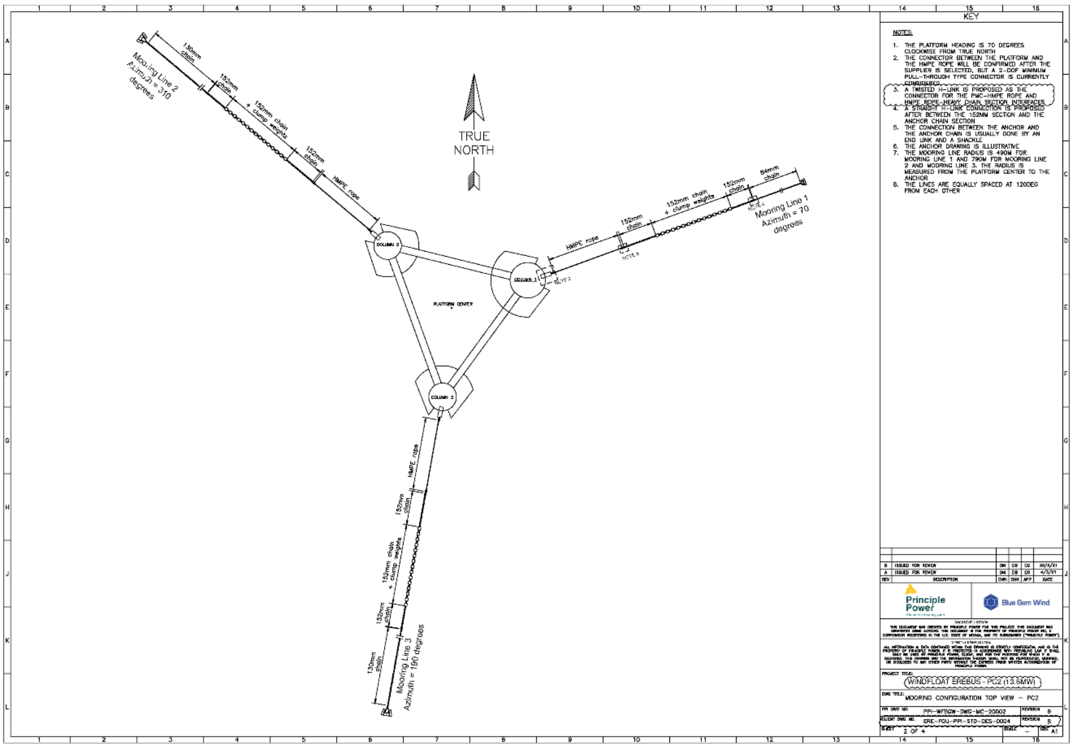
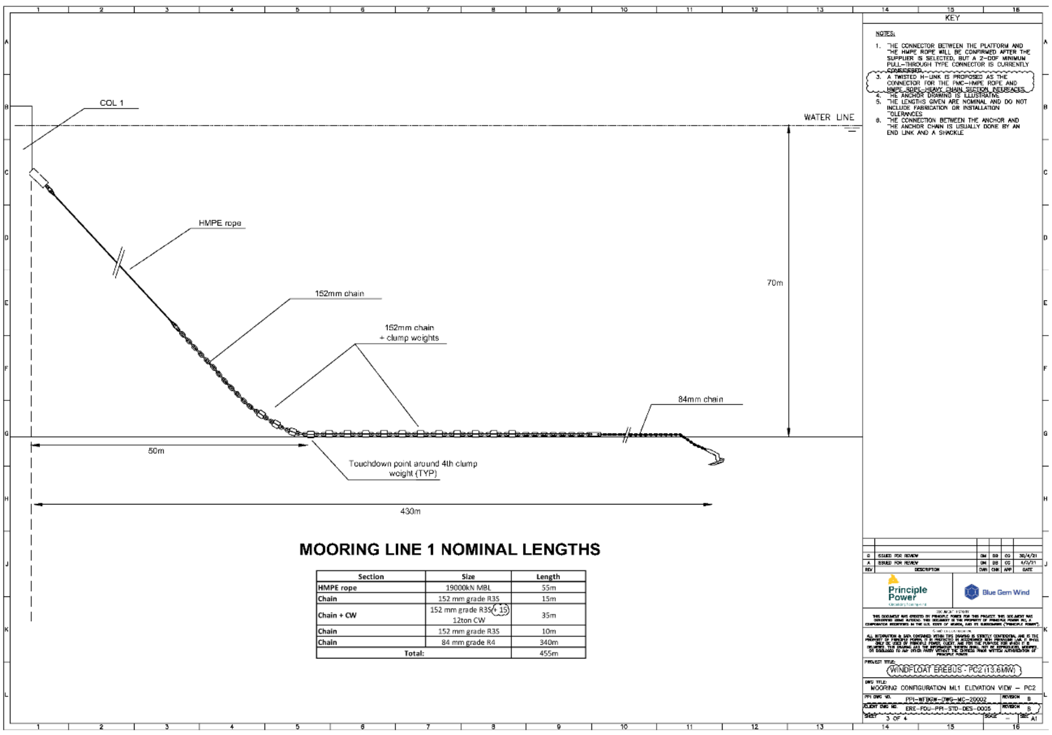
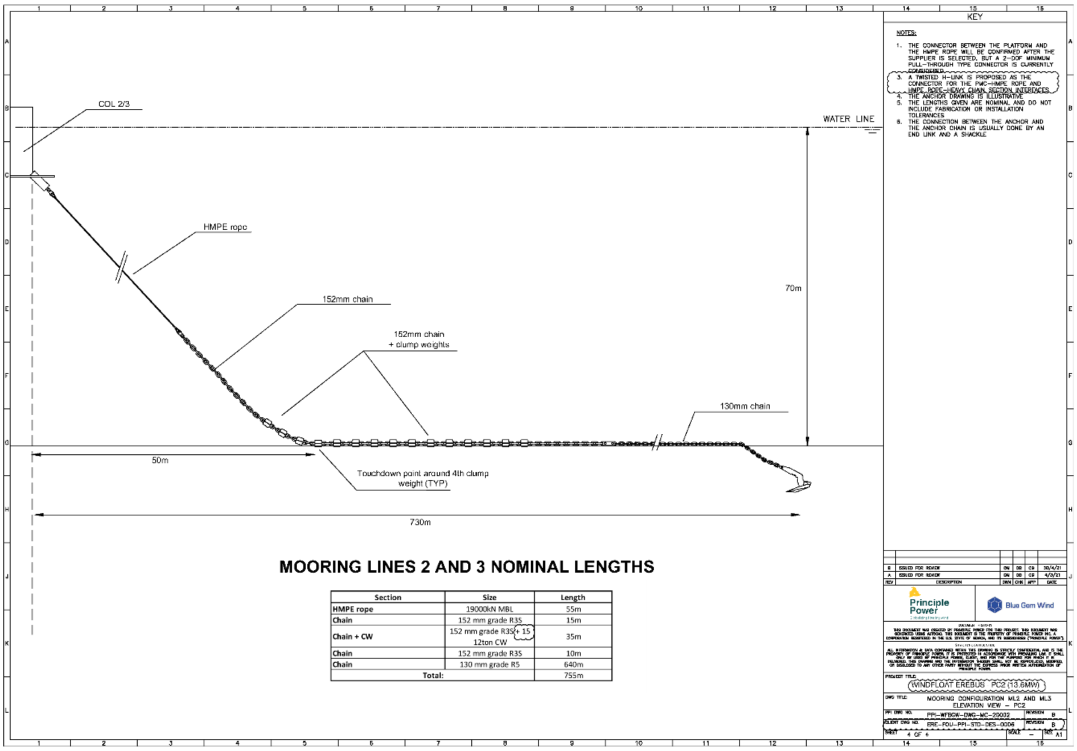


Figure 6 Mooring configuration - top view.



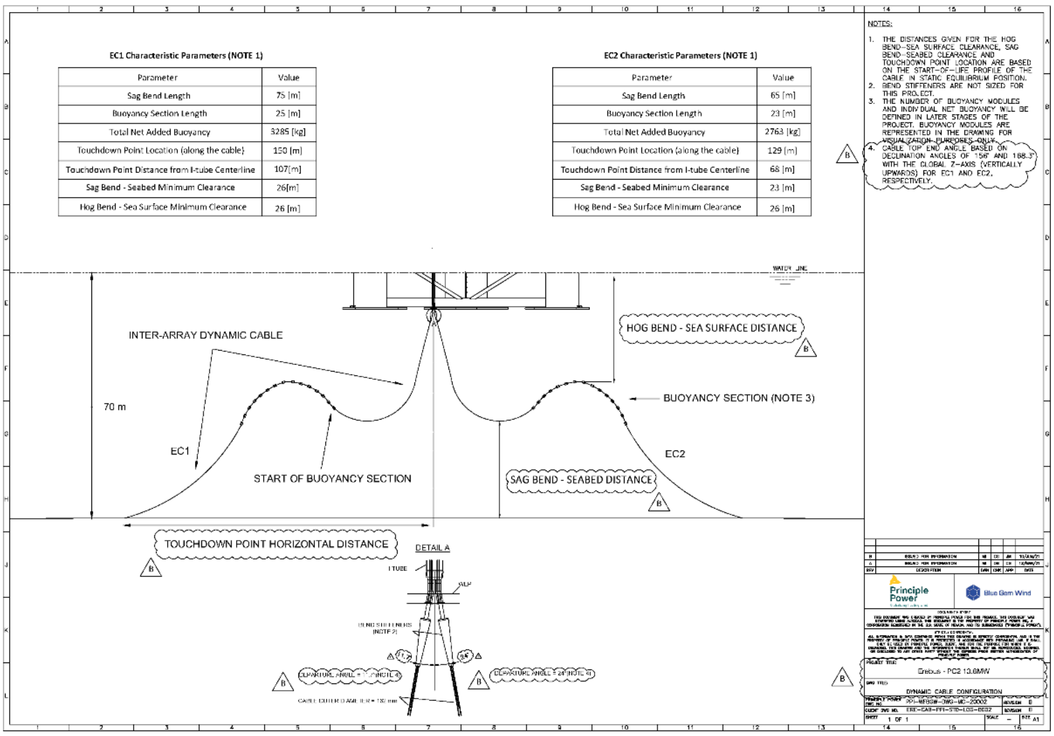
Section	Size	Length
HMPE rope	19000kN MBL	55m
Chain	152 mm grade R3S	15m
Chain + CW	152 mm grade R3S + 15 12ton CW	35m
Chain	152 mm grade R3S	10m
Chain	84 mm grade R4	340m
Total:		455m

Figure 7 Mooring Line 1 - elevation view.



Section	Size	Length
HMPE rope	19000kN MBL	55m
Chain	152 mm grade R3S	15m
Chain + CW	152 mm grade R3S + 15 12ton CW	35m
Chain	152 mm grade R3S	10m
Chain	130 mm grade R5	640m
Total:		755m

Figure 8 Mooring Lines 2 and 3 - elevation view.



EC1 Characteristic Parameters (NOTE 1)

Parameter	Value
Sag Bend Length	75 [m]
Buoyancy Section Length	25 [m]
Total Net Added Buoyancy	3285 [kg]
Touchdown Point Location (along the cable)	150 [m]
Touchdown Point Distance from I-tube Centerline	107[m]
Sag Bend - Seabed Minimum Clearance	26[m]
Hog Bend - Sea Surface Minimum Clearance	26 [m]

EC2 Characteristic Parameters (NOTE 1)

Parameter	Value
Sag Bend Length	65 [m]
Buoyancy Section Length	23 [m]
Total Net Added Buoyancy	2763 [kg]
Touchdown Point Location (along the cable)	129 [m]
Touchdown Point Distance from I-tube Centerline	68 [m]
Sag Bend - Seabed Minimum Clearance	23 [m]
Hog Bend - Sea Surface Minimum Clearance	26 [m]

Figure 9 Dynamic inter-array cable configuration.

Cables carrying the electrical current produced by the WTGs will link the WTGs to one another, from where the electricity generated can be transferred to shore. The WTG units will be connected through a series of array cables either through a two-way split radial array or the preferred option of a looped circuit (see **Figure 9**).

The array cables will consist of a three-core dynamic High Voltage Alternating Current (HVAC) subsea cable rated up to 72.5 kV and will have a Lazy Wave formation to allow for dynamic movement without the cable stretching or snapping. The array cables will touchdown on the seabed up to 140 m from the hull of the semi-submersible floating platform and will be designed not to conflict with the mooring arrangement.

3.7 CABLE ROUTE

The offshore array will be connected to the landfall point via a marine export cable along which electricity will be transported to the grid at the onshore substation. The offshore export cable will be up to 49 km long. Consent is being sought for an export cable corridor that varies in width between 50 m and 450 m, providing the flexibility for potential re-routing and micrositing of the final export cable once further site investigations have been carried out in the post-consent phase. The actual footprint width of export cable installation works will be approximately 10m. In some areas, sandwave levelling is predicted to be required prior to cable installation. The footprint of seabed disturbance in these areas will be 50 m.

The export cable will be buried for a majority of the cable route, however, where the target burial depth cannot be achieved due to seabed conditions, the cable is proposed to be protected via placement of rock bags or concrete mattresses. Where protection is placed, under keel clearance will not be compromised by >5%, in accordance with MGN 654. Trench depth will range between 0 and 3m. Details for some of the cable protection techniques that may be deployed are detailed below:

- Rock placement involves the laying of rocks on top of the cable to provide protection which is effective on crossings and other areas requiring protection; and
- Concrete mattresses, which are prefabricated flexible concrete coverings that are laid on top of the cable, are an alternative to rock placement. The placement of mattresses is slow and as such is only used for short spans. Grout or sand bags may be used as an alternative to concrete mattressing; this method is generally applied on smaller scale applications than concrete mattressing.

Landfall for the marine export cable is West Angle Bay. To maintain the necessary flexibility of the Project, two potential installation options have been developed for landfall: HDD (north or south alignment) or open-cut trenching (north alignment only) as a contingency option. The precautionary assumption is that nearshore/sub tidal area punchout will at between 3m and 5m LAT with localised protection (KP0.6).

This cable route and landfall at West Angle Bay requires no interaction with existing port infrastructure, although offshore sections of the cable route will require crossing of the planned Greenlink Interconnector.

3.8 NAVIGATIONAL MARKERS, LIGHTING AND CHARTING

Appropriate navigational markers, lighting and signage will be installed at the offshore site to mitigate potential risks and provide warning to marine operations, other sea users and the aviation industry as far as possible. Examples of typical aids to navigation are shown in Chapter 4: Proposed Development Description.

As the layout has not yet been determined, it is recognised that a detailed 'Aids to Navigation Management Plan' will be developed with associated navigation markers and lighting which will require approval by the MCA and Trinity House post consent and prior to construction. Consideration will be required to temporary aids to navigation, including buoyage, during construction. Commitments stated in this section are therefore limited to those known and the principles provided.

The semi-submersible floating platforms will be painted yellow and be marked by marine lanterns with flashing yellow lights. Fog signals may also be installed at the offshore site which will take into account the prevailing visibility, topography and vessel traffic conditions, with a range of at least 2 nm. A unique alphanumeric identifier will be allocated to each platform, and Automatic Identification System (AIS) likely to also be fitted on selected platforms (e.g. on the periphery).

It is proposed to name individual floating platforms as part of the community engagement strategy and in partnership with the community. This will be designed in a manner so as not to detract from navigational markings, colours, lights and the formal alphanumeric identification panels.

Consideration will be given to use of virtual aids to navigation (AtoN) including AIS transponders as well as buoyage (in construction). The site will be marked on the UK hydrographic charts and through Kingfisher Information Service - Offshore Renewable & Cable Awareness (KIS-ORCA) to manage fisheries awareness.

All navigational aids will be in accordance with relevant guidance including MGN 654, and IALA guidance (Recommendation O-139 on The Marking of Man Made Offshore Structures, Edition 2, December 2013). It is recognised that O-139 is scheduled for an update and thus the superseding guidance will require consideration.

The WTG units will be marked in accordance with relevant aviation requirement, such as the Civil Aviation Authority (CAA) Guidelines on Wind Turbines CAP 764, and in consultation with other key organisation such as the MCA.

3.9 CONSTRUCTION METHODOLOGY

3.9.1 Structures

In contrast to fixed foundation offshore wind projects, where most installation works happen on-site (offshore), for FLOW projects a considerable amount of the offshore installation activity can take place onshore or in the relatively sheltered environment of a port/harbour. This not only substantially reduces the extent of marine operations associated with the project construction but also the requirement for specialist construction vessels during installation operations.

Generally, the WTGs will be installed using the following process activities and it is assumed that the overall offshore construction duration will be 8 months with a nominally continuous series of activities through these process activities with no delay (for example due to off peak weather season) between installation of the mooring system and mooring hook-up with the WTG:

- Mooring system pre-lay
- Array cable pre-lay
- Installation of export cable and cable protection where required
- Installation of WTG onto semi-submersible floating platforms in port / quayside
- Offshore tow and mooring hook-up
- Commissioning activities

3.10 O&M

The operation and maintenance (O&M) of the project is expected to be for the 25 year lifespan of the Project. **Table 5** provides a summary of the anticipated O&M activities over the Project lifespan.

The primary traffic volume arises from daily Crew Transfer Vessel (CTV) vessel visits as shown in **Table 5** although it is anticipated that normal operations will likely reduce to 1 CTV per 12-24 hour period.

Major maintenance activities during the operational phase are considered including return of the platform to port and replacement of mooring lines.

Table 5 Summary of typical repairs and project operating modes [HOLD].

Parameter	Minimum	Maximum
Vessel visits per day (24 hr period)	-	2 x 12 hr per day CTV (transit 1.5 – 2 hrs)
Minor maintenance (in line with WTG manufacturer maintenance recommendations	1	7
Major maintenance (asset return to port)	1	3
Mooring line replacement	0	2
Estimated cable repair during lifespan (offshore)	0	5

3.11 DECOMMISSIONING

The Project will be decommissioned at the end of its operational life. The initial operational life is 25 years, however, this may be extended to longer should re-powering of the site happen.

In the event of repowering, a further consent process would be required to allow for operation beyond the initial 25 years assumed for this consent process.

The decommissioning process will largely be the reverse of that undertaken during the construction. It is expected that the WTG, platforms and mooring will be completely removed and returned to port for disassembly, re-use or disposal. Cable decommissioning will also be decided toward the end of the project lifetime. The preferred option is for the cable to be left in situ as far as is possible from a technical and environmental perspective.

4. OVERVIEW OF THE BASELINE ENVIRONMENT

4.1 ADMIRALTY CHARTS

The Project area is well charted and covered by the following navigational charts:

- 1178: Approaches to the Bristol Channel (1: 200 000)
- 1478: Saint Govan's Head to Saint David's Head (1: 75 000)
- 2878: Approaches to Milford Haven (1: 25000)

4.2 LOCAL PORTS AND HARBOURS

The Milford Haven Waterway is located 25km to the northeast of the array area (**Figure 10**). The waterway is the largest estuary in Wales and one of the deepest natural harbours in the world. Its sheltered, tidal waters have led to the waterway being extensively developed and it is the largest port in Wales and a significant UK energy port in addition to handling liquid bulk, break bulk, dry bulk and project cargoes.

Major energy marine terminals within the Milford Haven Waterway include Valero Refinery, Valero Pembrokeshire Oil Terminal, Puma Energy, South Hook LNG and Dragon LNG with trade and processed materials being transported domestically and internationally. The gas-fired Pembroke combined-cycle gas turbine (CCGT) Power Station is located on the southern shore of Milford Haven Waterway.

The Milford Haven Waterway and Docks are home to a commercial fishing fleet comprising UK and non-UK vessels, and Pembroke Dock facilitates a twice-daily ferry service to Ireland, as well as general and infrastructure project cargo facilities. Pembroke Port is also undergoing significant redevelopment working to accommodate increased marine renewable energy activity in this region.

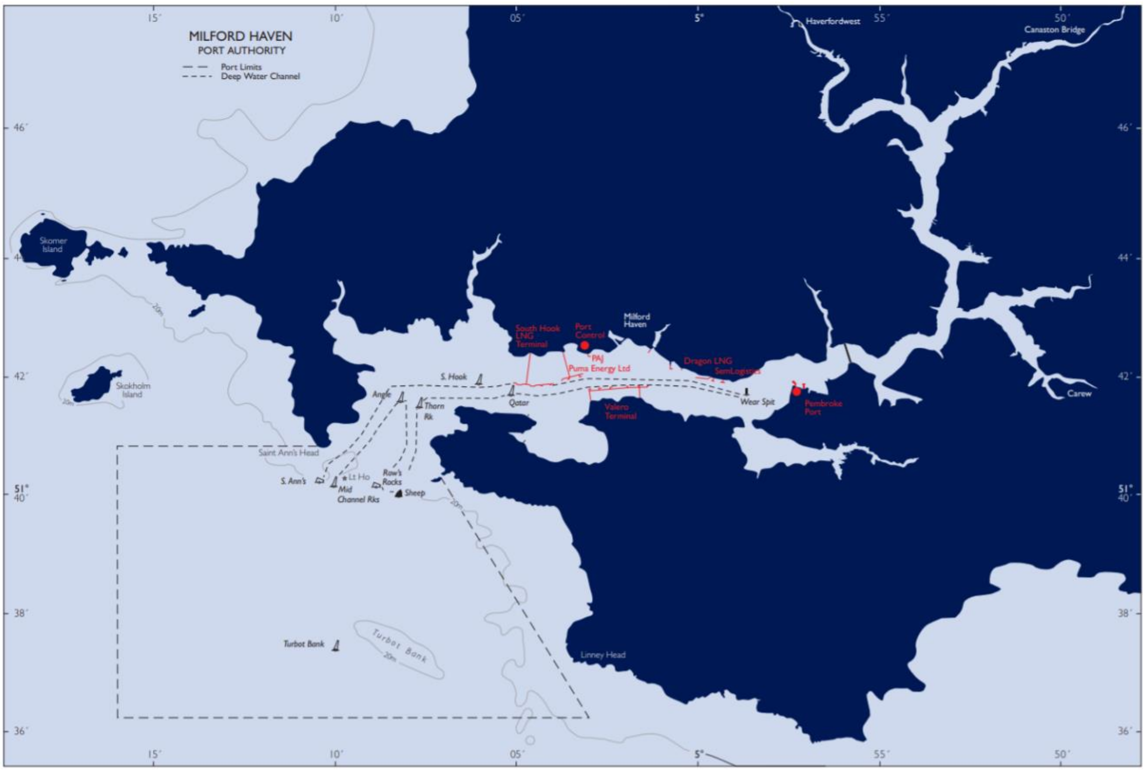


Figure 10 Port limits (Source: MHPA).

4.3 METOCEAN CONDITIONS

4.3.1 Wind and Wave Climate

Further details on metocean conditions can be found in Chapter 6: Marine and Coastal Processes and key features are provided in this section for reference.

Waves in the area are driven by the wind regime, with the largest waves being a result of winds from the longest fetch direction from the southwest, across the Atlantic Ocean. Exposure to largest waves is more pronounced on coasts and submarine shoals facing the longest fetch. The region is one of the windiest in the UK, with mean hourly coastal wind speeds exceeding approximately 3.5 m/s for 75% of the time, and exceeding 19 m/s for approximately 0.1% of the time. The dominant south-westerly winds blow for approximately 20% of the time, whereas winds from the east blow for about 9% of the time as shown in **Figure 121**.

Both the array area and the wider Study Area generally lie in a zone where the mean significant wave height is in the range of 1.5 to 2 m, with generally decreasing wave energy to the northeast, towards the adjacent coastlines. **Figure 12** shows the annual mean significant wave height. **Figure 13** shows the wave roses for three locations within the vicinity of the array area showing that the dominant wave direction is from the southwest.

The Milford Haven waterway is comparatively sheltered and particularly from prevailing south-westerly conditions.

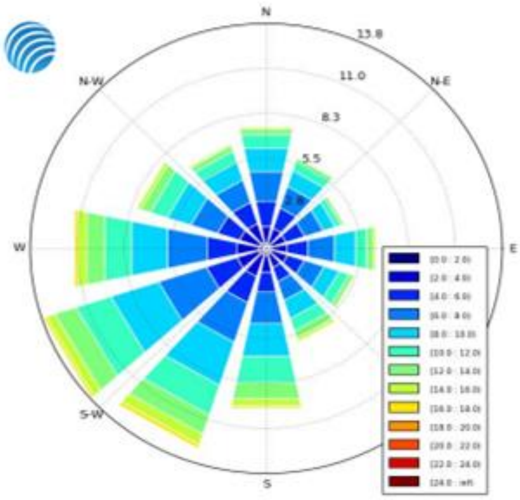


Figure 11 Wind rose of long-term wind directions & speeds at 10m height

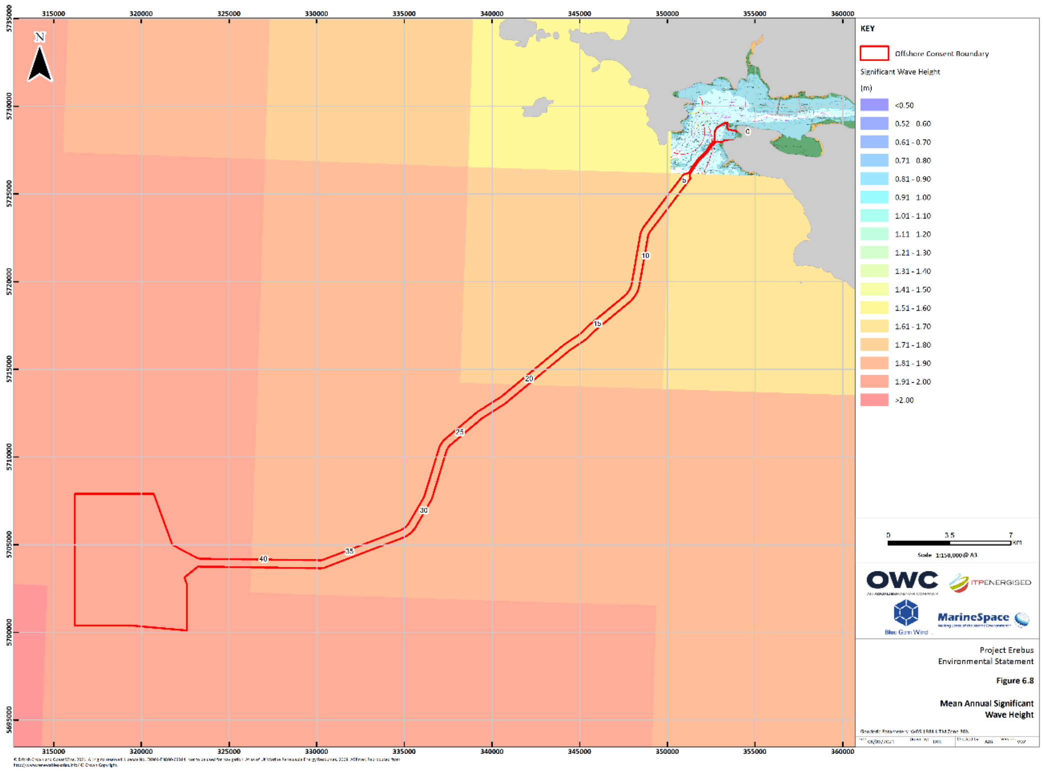
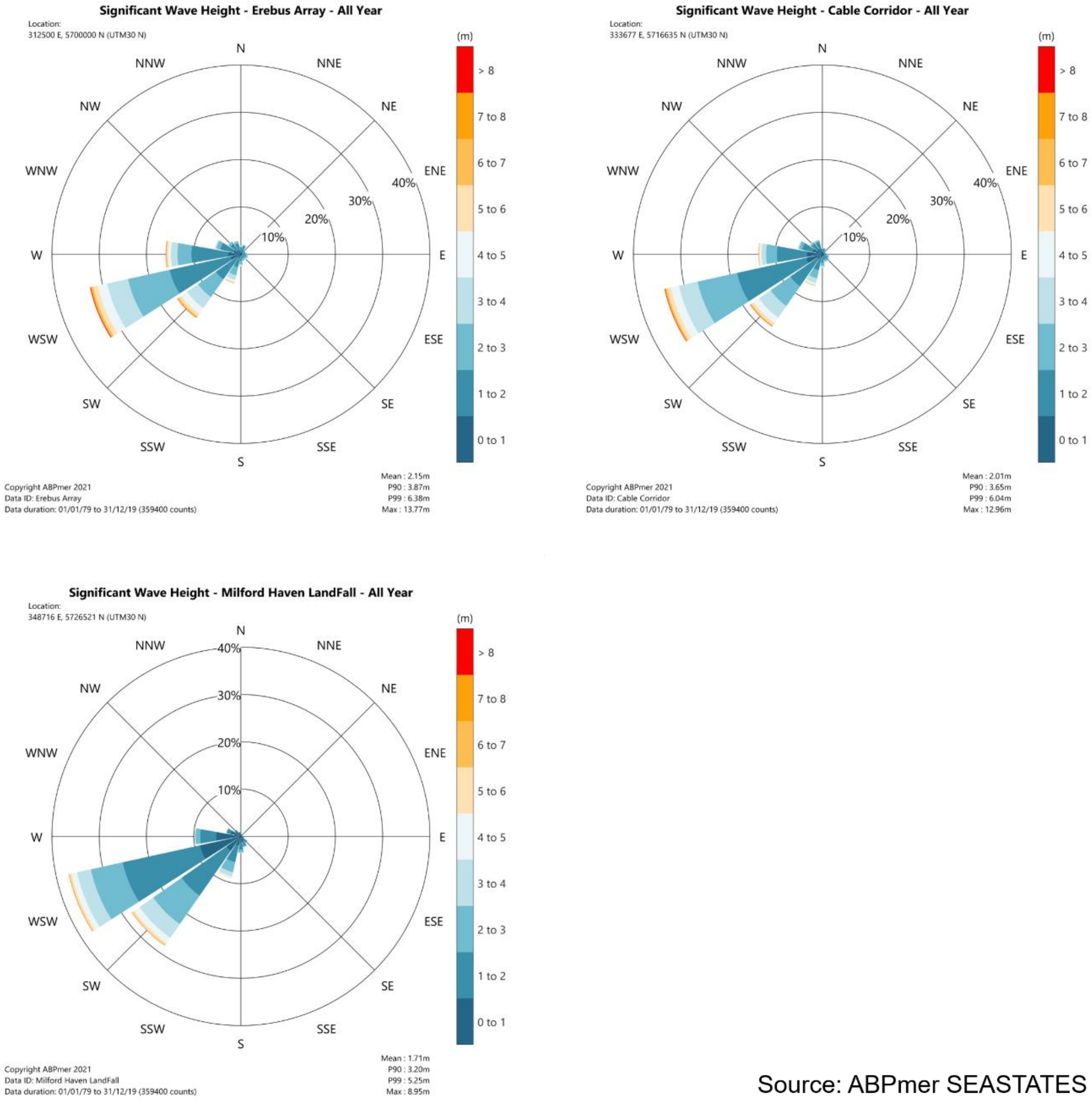


Figure 12 Annual mean significant wave height



Source: ABPmer SEASTATES

Figure 13 All year wave roses for three locations in the study area

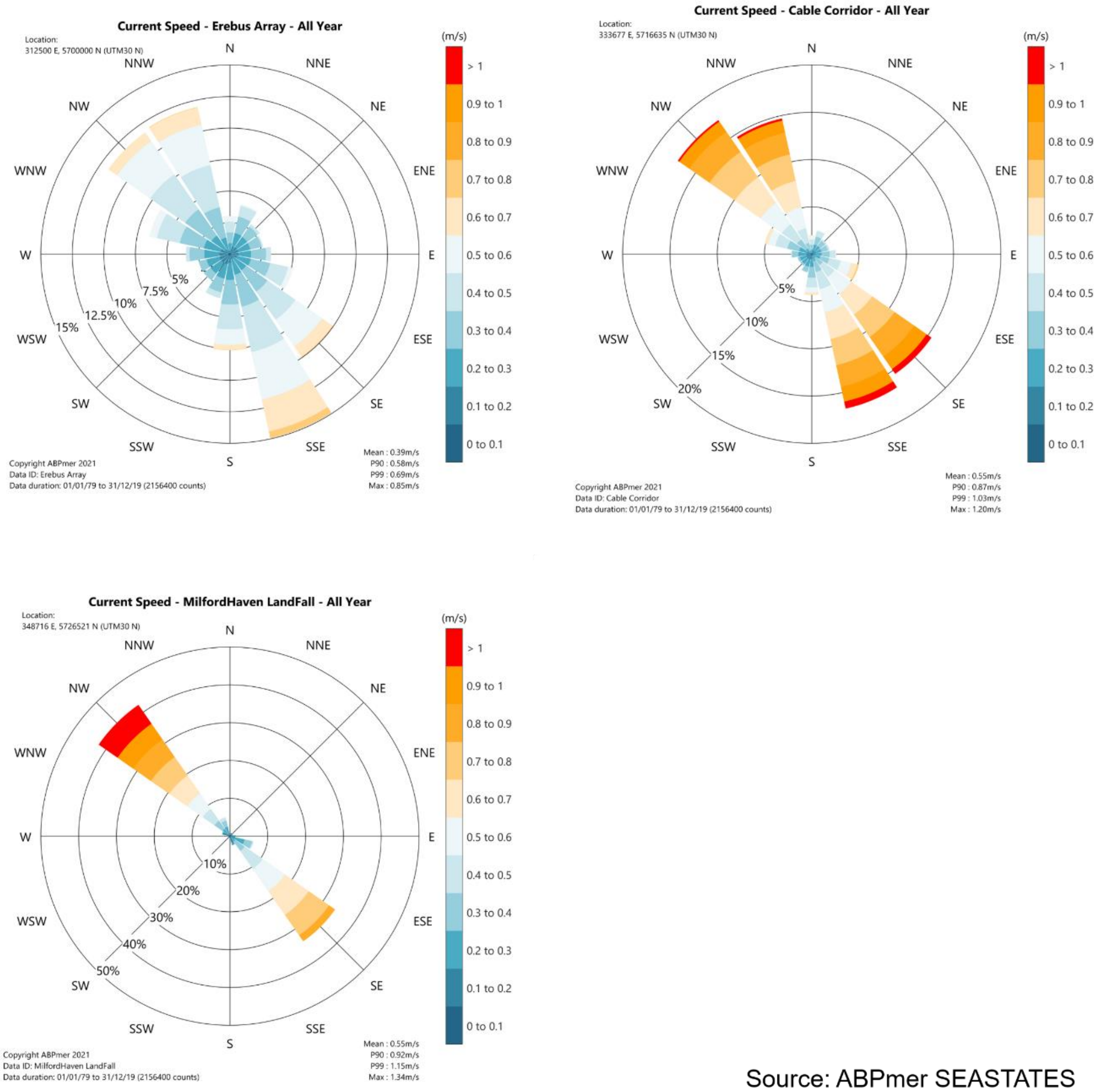
4.3.2 Tide and Current

Figure 14 shows the tidal current roses for the study area at nominal array area, cable route and landfall locations. The tidal stream across Milford Haven entrance runs approximately perpendicular to the line of approach. The tidal diamond “B” from Admiralty Chart 1478-0 is presented in **Table 6** providing context of tidal current rates and directions in spring and neap tidal cycle conditions.

There are no tidal limitations at the array area or on the cable route and Milford Haven is a deep water port with 24 hour tidal access to most vessels.

Table 6 Details for tidal diamond "B" on Admiralty Chart 1478-0.

Hours		Directions of Streams	Rates at spring tide (kn)	Rates at neap tide (kn)
Before high water	6	143	1.6	0.8
	5	137	2.2	1.0
	4	127	2.1	1.0
	3	115	1.5	0.7
	2	084	0.7	0.3
	1	355	0.9	0.4
High Water		323	1.7	0.8
After high water	1	318	2.1	1.0
	2	314	2.0	0.9
	3	306	1.5	0.7
	4	278	0.6	0.3
	5	189	0.6	0.3
	6	146	1.3	0.6



Source: ABPmer SEASTATES

Figure 14 All-year tidal current roses across the study area.

4.4 EXISTING VESSEL AND SAFETY OF NAVIGATION MANAGEMENT

Key relevant features relating to management of vessels and safety of navigation are described in this section.

4.4.1 Responsible Authorities – MCA and MHPA

The array area and majority of cable route is in an area of general navigation in UK waters with the MCA as the responsible authority for safe navigation. The site is close to the approaches to Milford Haven waterway and circa 11 km of the export cable routes to the landfall at West Angle Bay through and within the port limits of the Port of Milford Haven Statutory Harbour Authority (SHA) and Competent Harbour Authority (CHA) areas managed by MHPA. MHPA actively manage and assess marine and navigation risk within these limits through a Marine Safety Management System (MSMS) and in accordance with the PMSC which sets out sets out a national standard for port marine safety for harbour authorities and other marine facilities, berths and terminals in the UK. MHPA are responsible for pilotage and conservancy on the waterway and also provides a Vessel Traffic Service (VTS) actively monitoring the whole waterway.

4.4.2 IMO Routeing/Reporting Measures and Recommended Channels

Off Smalls Traffic Separation Scheme (TSS) is located approximately 22km to the north west of the array area (**Figure 15**). There is an Area To Be Avoided (ATBA) located approximately 22km directly north of the array area between The Smalls and Grassholm (**Figure 15**). Vessels laden with oil, gas or noxious liquid substances, and all vessels >500GT should avoid this area to avoid the risk of pollution by stranding.

There are two Recommended Channels coming into Milford Haven. The West Channel is used by the largest tankers, whilst the East Channel is available to all vessels suitable to size. Vessels able to use the East Channel are requested to do so when larger tankers and entering or leaving via the West Channel.

4.4.3 Aids to Navigation

There are no AtoNs situated within the array area. A west cardinal marker demarks the western extent of Turbot Bank, 1km east of the cable route. Turbot Bank is shown in **Figure 16**. The West Channel and East Channel coming into Milford Haven are marked with buoys. Row's Rocks, Rat and East Chapel buoys demarking the East Channel lie within the proposed cable route (see chart 2878).

4.4.3.1 Pilotage

The Port of Milford Haven are the CHA and provide Pilotage Directions as devolved from the Pilotage Act 1987. Pilotage is compulsory within the Haven for all ships, or tug and tow combinations, of 50 metres or more in length overall except:

- General Lighthouse Authority tenders
- Ships which are moving from one berth to another within a dock
- HM ships and certain vessels owned or controlled by HM Government
- Vessels that have a holder of a Pilotage Exemption Certificate on board

Pilotage Exemption Certificates (PEC) may be granted to the master or chief officer of vessels that regularly trade to Milford Haven and can demonstrate a competence equivalent to that of a pilot. Commercial traffic in the area will also variously be subject to other existing port control measures, such as passage planning requirements.

4.4.3.2 VTS

The VTS for the Port of Milford Haven is located at Hubberston Point, Milford Haven. It operates s 24-hour, 7 days a week service for all marine traffic within the VTS area. The VTS operates under the call sign 'Milford Haven Port Control'. Milford Haven Port Control is a Traffic Organisation Service (TOS) defined by the IMO as 'a service to prevent the development of dangerous maritime traffic situations and to provide for the safe and efficient movement of vessel traffic within the VTS area'. All shipping movements are coordinated by Milford Haven Port Control and the system is mandatory for all vessels over 20 metres in length that are operating within the VTS area. The VTS area comprises the Port Limits (see **Figure 10** and **Figure 16**) and the level of high water on the shores of Milford Haven and the approaches thereto within the Port Limits, including all bays, creeks, pools, inlets and rivers as far as the tide flows.

4.5 SEARCH AND RESCUE

The local coastguard base for the region is the Milford Haven Coastguard Operations Centre (CGOC). The CGOC is co-located with the MHPA offices and the VTS centre.

Her Majesty's Coastguard's (HMCG) Aviation Branch provides aviation-based search and rescue via the UK Search and Rescue (SAR) Helicopter (UKSARH) programme. HMCG's helicopter assets are located at St Athan, Wales and Newquay, Cornwall airbases.

Royal National Lifeboat Institution (RNLI) lifeboats are stationed at Angle Lifeboat Station, situated on the southern shore of Milford Haven Waterway, approximately 3km east of cable landfall at West Angle Bay (see **Figure 16**). The Angle lifeboats include a Tamar class all weather lifeboat and two inshore D class lifeboats. The Tamar class lifeboat is 16.3 Length Overall (LOA) with a range of 250 nm and is capable of 25 knots.

4.6 OTHER OFFSHORE ACTIVITIES

4.6.1 Oil and Gas

No oil and gas sites were identified near the study area.

4.6.2 Subsea Cables

There are several subsea cables within and near the array area (see **Figure 15**). A subsea cable passes east to west through the southern portion of the array area. There are currently no subsea cables intersecting the proposed cable route, however, the proposed Greenlink Interconnector will intersect the export cable near landfall (see **Figure 90**) which is considered within the cumulative effects assessment (see **Section 8.11**).

4.6.3 Aggregates

There are no aggregate production sites within the vicinity of the array area or cable route. The nearest aggregate production sites are located approximately 35 nm east of the array area in the Bristol Channel.

4.6.4 Dredging Areas and Spoil Grounds

There are two spoil grounds charted within the vicinity of the array site and cable route (see **Figure 15**). The closest spoil ground is charted 9km north of the array area. The site is named Milford Haven Three (LU169) and has a dredge volume of 100,000 to 500,000 tonnes per year. This is primarily used for finer sediments.

A second spoil ground, known as Milford Haven Two (LU168), is located 25km east of the array area and 4km south of the cable route and is used less frequently than LU169 due to its specification for larger grain size sediments.

Dredging within port limits is managed by MHPA, whilst the licensing of dredged areas and disposal sites are regulated through licensing and consents by NRW.

Maintenance dredging activity within Milford Haven Port is undertaken approximately on a 2-3 year frequency and for a 6 - 8 week duration. Dredging sites within Milford Haven are shown in **Figure 17**.

4.6.5 Other Offshore Renewable Projects

Whilst no existing offshore renewable projects have been identified within the area, there are several future inshore and offshore renewable projects currently in the planning process, these are identified in **Figure 90** and are considered within the cumulative effects assessment (see **Section 8.11**).

4.6.6 Anchorages and Offshore Waiting Areas

No formal anchorages exist within or near the array area. Vessels anchoring in Milford Haven are required to obtain advice on location from Milford Haven Port Control. Deep-draught vessels (>12m) are advised not to anchor within 5 miles of Middle Channel Rocks Lighthouse. Dale Roads is the only anchorage for ships between 7 and 12m draught. Mariners are advised not to anchor within the vicinity of submarine cables.

Vessels are known to wait and loiter within the wider approaches to the waterway for a range of operational reasons and prior to embarking a pilot and entering port. The waiting locations can be determined from vessel traffic data analysis.

4.6.7 Practice and Exercise Areas

Castlemartin Firing Range (Firing Practice Area) is located approximately 17km to the northeast of the array area (see **Figure 15**). Approximately 20km of the cable route lies within the Firing Practice Area. Whilst this range is active, it is actively managed and protected by a range safety vessel. No restrictions are placed on the right to transit the firing practice area at any time and it is operated using a clear range procedure.

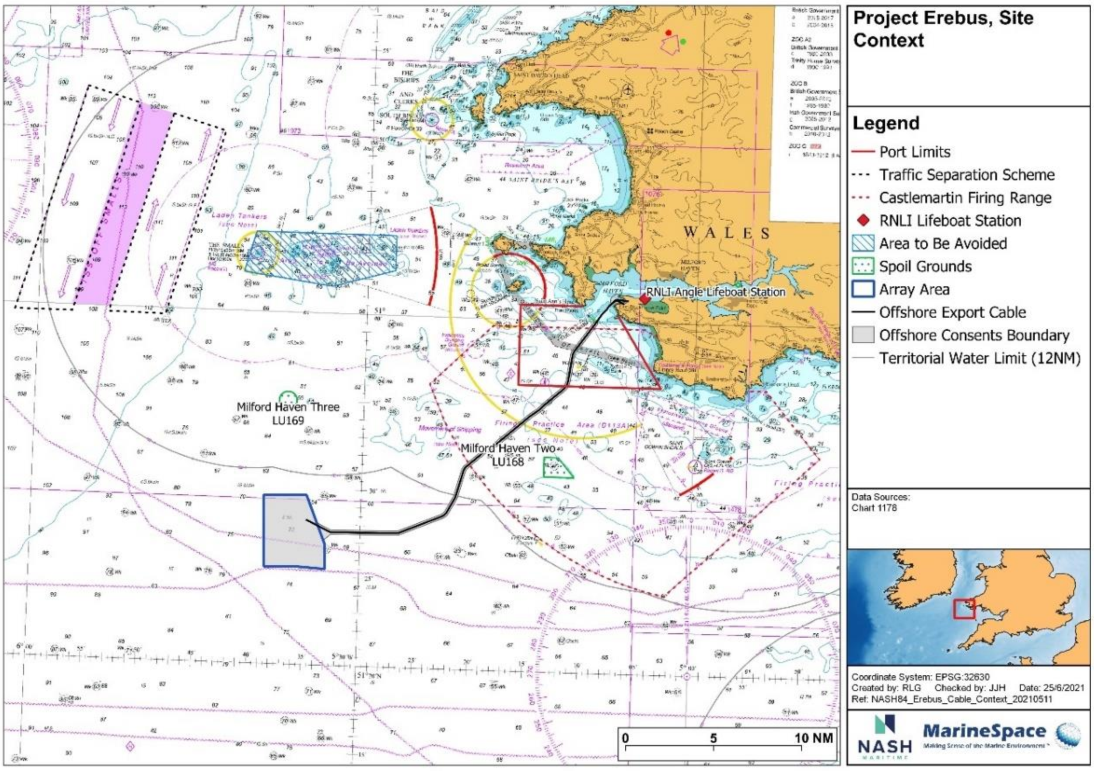


Figure 15 Offshore activities: Overview.

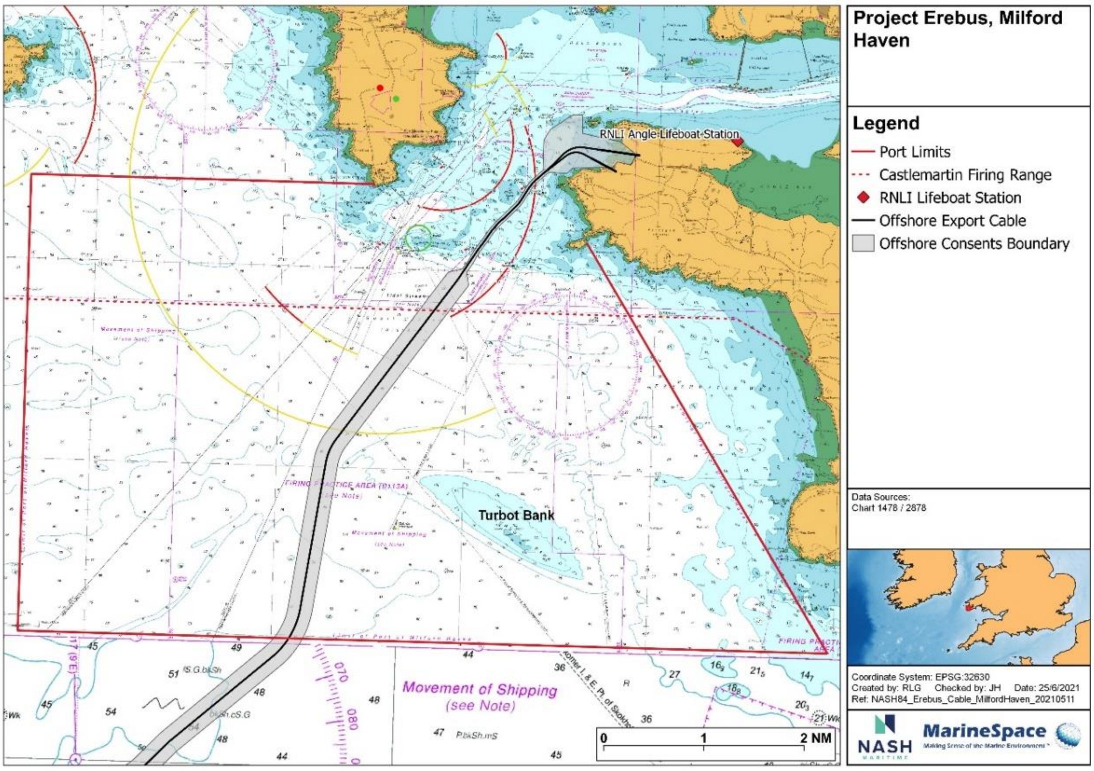


Figure 16 Offshore activities: Nearshore Cable route and landfall.

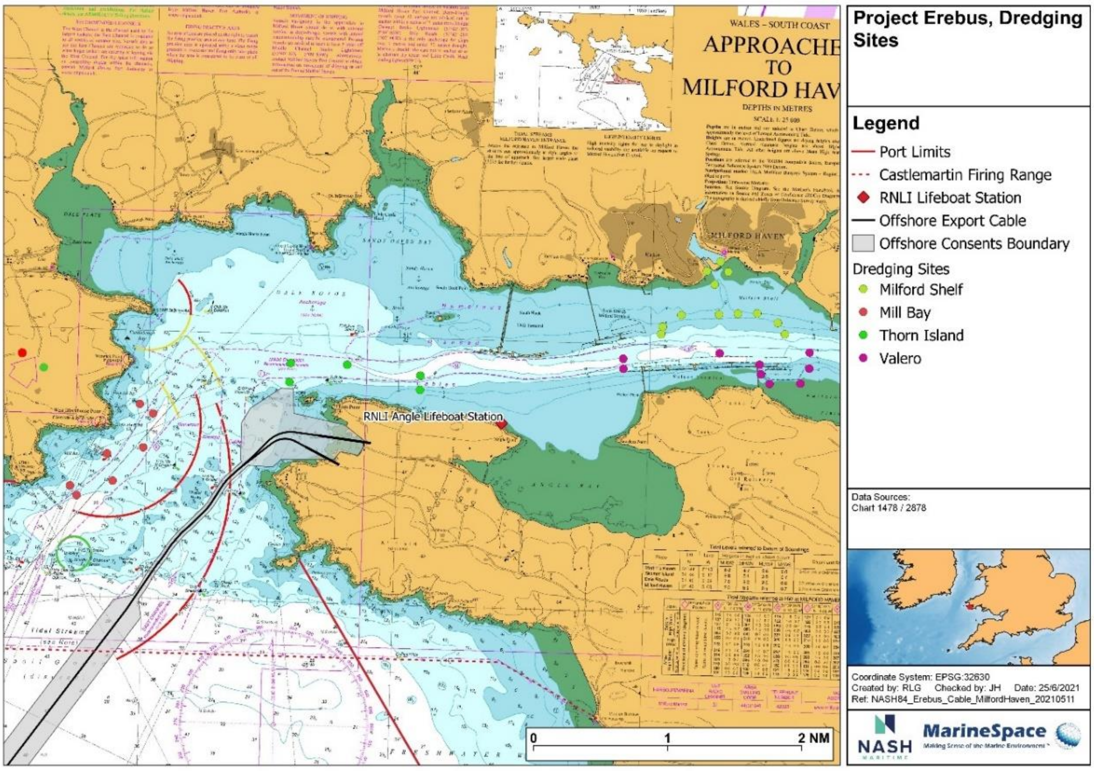


Figure 17 Offshore activities: Dredging areas within MHPA port limits.

5. BASELINE VESSEL TRAFFIC ACTIVITY

5.1 INTRODUCTION AND DATA STRATEGY

Analysis of the baseline vessel traffic profile was undertaken using a composite of datasets sourced from 2019 and 2020 covering both the array area and cable route with suitable buffer distances. A strategy for the collection of appropriate datasets was established by NASH Maritime at their commencement of work (post Scoping) and in consultation with key stakeholders (including MCA on 08-Jun-2020 and MHPA on 10-Jul-2020) to ensure that the data used within the NRA are representative of the vessel traffic within the area.

Due to the COVID-19 pandemic, the data strategy sought to ensure that the datasets represent, as far as reasonably possible, a typical baseline vessel traffic profile. Vessel traffic datasets from 2019 (pre-ceding the COVID-19 pandemic) and 2020 were therefore obtained and integrated together with benchmarking undertaken. This exercise allowed any impacts of the COVID-19 pandemic on vessel traffic during the vessel traffic survey to be considered.

This section describes the key datasets, sources and benchmarking used to integrate the datasets which were taken forward to the NRA. The marine traffic analysis of this data is presented in **Section 5.3.**

5.2 DATA SOURCES

5.2.1 Vessel Traffic Data – Overview of Primary Sources

Marine vessel traffic data was been collected in accordance with requirements of MGN 654 together with other guidance and policy documents detailed in **Section 2**. Vessel traffic data sources include:

- AIS, radar and visual data collected during a two 14-day marine vessel traffic surveys;
- Longterm AIS data; and
- Other traffic data sources including VMS fishing effort and MHPA vessel / port call data.

Two 14-day marine vessel traffic surveys were conducted during representative summer and winter periods during 2020, totalling a 28-day traffic survey recording all marine craft using radar, AIS and visual means. Longterm AIS datasets were used to supplement the vessel-based survey data and provide coverage of the export cable route. A summary of the data sources used within the NRA is provided in **Table 7**.

Table 7 Summary of vessel traffic data sources.

Data type	Data	Coverage	Notes
Marine Vessel Traffic Survey	14-day summer survey (2020)	Array area + 10km buffer	AIS, radar and visual data collected over 28 days. Winter and summer surveys to capture seasonality.
	14-day winter survey (2020)	Array Area + 10km buffer	
Longterm AIS	6 months AIS data (2019)	Array area and cable route + 10km buffer	AIS data.
	MMO data (2015)	Array area and cable route + 10km buffer and wider project area	1 year AIS data used in scoping.
	MMO data (2017)	Array area and cable route + 10km buffer and wider project area	1 year AIS data.
Other Traffic Data Sources	VMS fishing effort density (2017)	Array area and cable route + 10km buffer and wider project area	Provides wider context for fishing activity within the area.
	MHPA vessel/port call information (2015-2020)	Within MHPA port limits	Provide information on vessels calling at Milford Haven.
	RYA Coastal Atlas	Array area and cable route + 10km buffer	Provides information on key recreational routes and activity.
Incident Data	Marine Accident Investigation Board (MAIB) incident data between 2010 and 2020	Array area and cable route + 10km buffer	Incident data providing location and incident details.
	RNLI incident data between 2009 and 2019	Array area and cable route + 10km buffer	Incident data providing location and incident details.
	MHPA incident data between 2015 and 2020	Within MHPA port limits and approaches	Incident data providing incident and near miss trends by key user groups.

5.2.2 Marine Vessel Traffic Survey

Marine vessel traffic survey was undertaken in accordance with MGN 654 together with guidance documents detailed in in **section 2**. Visual, AIS and radar vessel traffic data were collected within the array area and a 10km. In accordance with MGN 654, the data was collected over 28 days in total and, in order to ensure the overall survey incorporated seasonal variations in traffic patterns and consider peak and off-peak periods, the survey was split into two survey campaign periods - each of 14 days over a summer and winter season. The summer survey data was collected between 06-Aug-20 and 23-Aug-20 and the winter survey between 22-Nov-20 and 08-Dec-20.

Both survey campaigns were interrupted by adverse weather events which prevented the safe undertaking of survey duties by the survey vessel and therefore each survey was temporarily paused before recommencing and collecting the balance of the data. Weather was recorded by the survey vessel at 6 hourly intervals. **Table 8** provides a summary of the vessel traffic surveys.

Vessel traffic surveys were conducted from a dedicated survey vessel stationed nominally within the north-eastern extent of the array area and 10km buffer (see **Figure 19**). Full specifications for the survey vessel *Rover Alpha* (see **Figure 18)** including vessel operating limits and configurations for the survey were provided by the survey contractor and refined for the survey.

Figure 18 Survey vessel 'Rover Alpha (Source: Kinnaird Marine).

Dedicated survey logging and processing equipment was installed on the Rover Alpha to integrate with onboard systems and was then tested and maintained by NASH Maritime engineers throughout the survey period. The equipment included primary and secondary survey computers configured with NASH Maritime hardware and software packages for data capture, logging, back-up and transfer. Interface junctions were installed to provide integration and data connection from AIS and radar equipment to computers.

Digital cameras were deployed to provide photographic evidence of radar targets when within visual range. Survey procedures and protocols were defined covering the data capture, logging, back-up and transfer of the AIS, radar and visual data and records.

The *Rover Alpha* was equipped with Automatic Radar Plotting Aid (ARPA) radar, AIS receiver, satellite broadband and 3G and 4G mobile phone coverage for data transfer. Data downloads and competency checks were undertaken daily during each survey campaign with daily or more frequent communication between the vessel based and shore based survey team.

Table 8 Vessel traffic survey summary

	Date	Time (UTC)	Comment
Summer Survey	06-Aug-20	0215	Rover Alpha arrived in survey area and commenced survey duties.
	19-Aug-20	1600	Rover Alpha ceased survey duties and departed survey area due to deteriorating weather and forecast conditions.
	23-Aug-20	1000	Rover Alpha arrived at survey area and re-commenced survey duties.
		2200	Rover Alpha completed survey and departed survey area.
Winter Survey	22-Nov-20	0530	Rover Alpha arrived in survey area and commenced survey duties.
	03-Dec-20	1800	Rover Alpha ceased survey duties due to deteriorating weather and forecast conditions.
	05-Dec-20	2200	Rover Alpha arrived at survey area and re- commenced survey duties.
	08-Dec-20	1045	Rover Alpha completed survey duties and departed survey area.

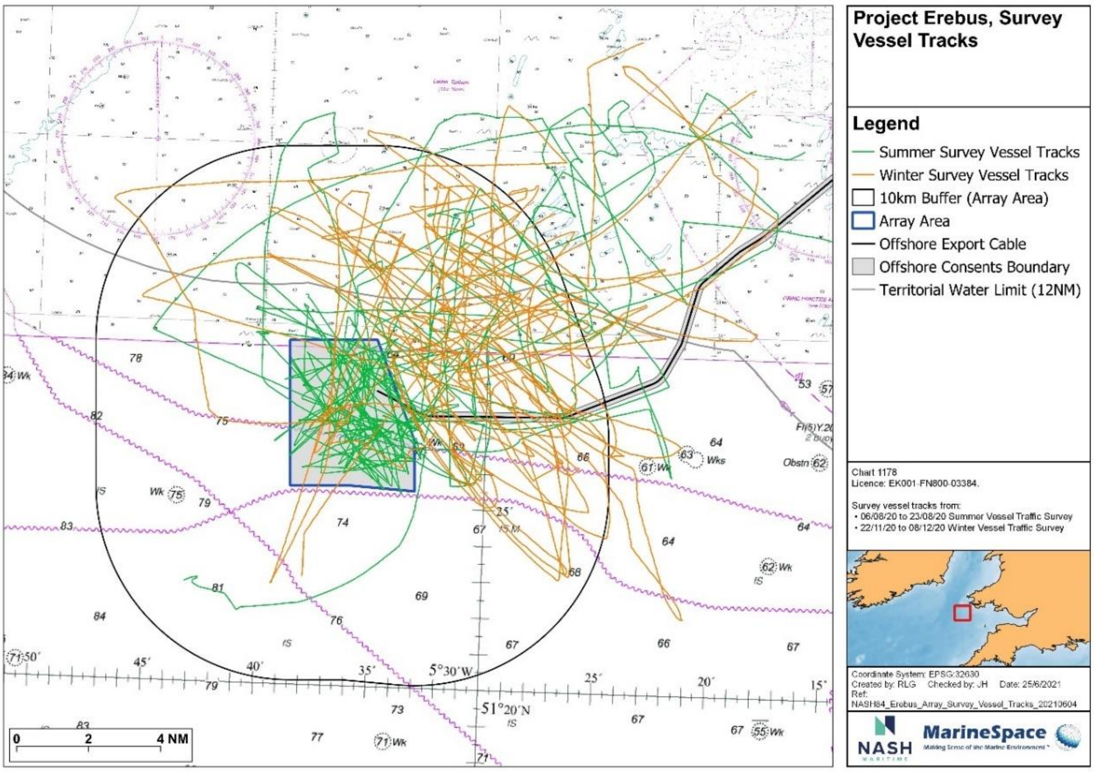


Figure 19 Survey vessel tracks during the winter and summer surveys.

5.2.2.1 Radio Survey Report

A baseline VHF radio reception survey was undertaken by the *Rover Alpha*, in accordance with MCA requirements, in order to provide a baseline and ascertain what level of mitigation may be required and to allow a comparison once construction has completed and/or the project is operational. The *Rover Alpha* has a comparable aerial height to that used by Project vessels so was deemed suitable. The Coastguard Operations Centre was contacted prior to the survey to confirm an appropriate time.

5.2.3 Longterm AIS Data

The longterm AIS datasets summarised in **Table 7** have been used to supplement the 28-day vessel traffic survey data. These datasets cover the array and cable route, plus 10km buffers. The purpose of these datasets is to:

- Analyse baseline vessel traffic along the cable route not covered in the vessel traffic survey.
- Provide a longer term dataset in order to supplement and benchmark the vessel traffic survey data (2020) against pre-COVID-19 pandemic levels.
- Identify any seasonal trends beyond those identified in the vessel traffic survey summer and winter periods.

5.2.4 Benchmarking

The marine vessel traffic survey was undertaken during two survey periods in 2020, during periods when vessel traffic may have been impacted by the COVID-19 pandemic. In order to mitigate any impact that the COVID-19 pandemic and associated restrictions may have had on marine vessel traffic in the area, vessel traffic data collected during the 2020 winter and summer surveys has been compared to AIS data for comparative periods in 2019. This approach was agreed with MCA during early consultation meetings (see **section 7**).

The 6-month duration of AIS data for 2019 for the offshore array area and cable route with a 10km buffer ensured a longer duration dataset was obtained and also allowed the vessel traffic survey data collected in 2020 to be benchmarked, enabling any potential influences from the COVID-19 pandemic on vessel traffic to be identified. Data was obtained for a 6-month period between 01-Jul-19 and 31-Dec-19 (i.e. prior to the COVID-19 pandemic) to cover a continuous period, including the same summer and winter dates of the marine vessel traffic survey from a pre-COVID-19 period.

Figure 20 and **Figure 21** show that the number of unique vessels identified by AIS within the array area and 10km buffer during the vessel traffic survey in 2020 is broadly comparable to the previous year, indicating that vessel traffic was not significantly impacted during the vessel traffic survey. Vessel traffic was elevated during the winter months, in both 2019 and 2020, demonstrating seasonal variation.

Vessel tracks identified through radar, but not AIS, contribute to a small proportion of the total vessels observed indicating that vessel traffic within the survey array area is well represented by AIS. Throughout the marine traffic analysis, radar tracks are only presented where no AIS tracks were identified for the same track.

A maximum three radar-only vessels were identified on any single day during the vessel traffic surveys. Radar-only vessels, that were able to be identified, largely comprised fishing and recreational vessel types.

Vessels categorised as radar tracks include vessels that are not carrying AIS or vessels that are carrying AIS but who's transmissions were intermittent or had poor range.

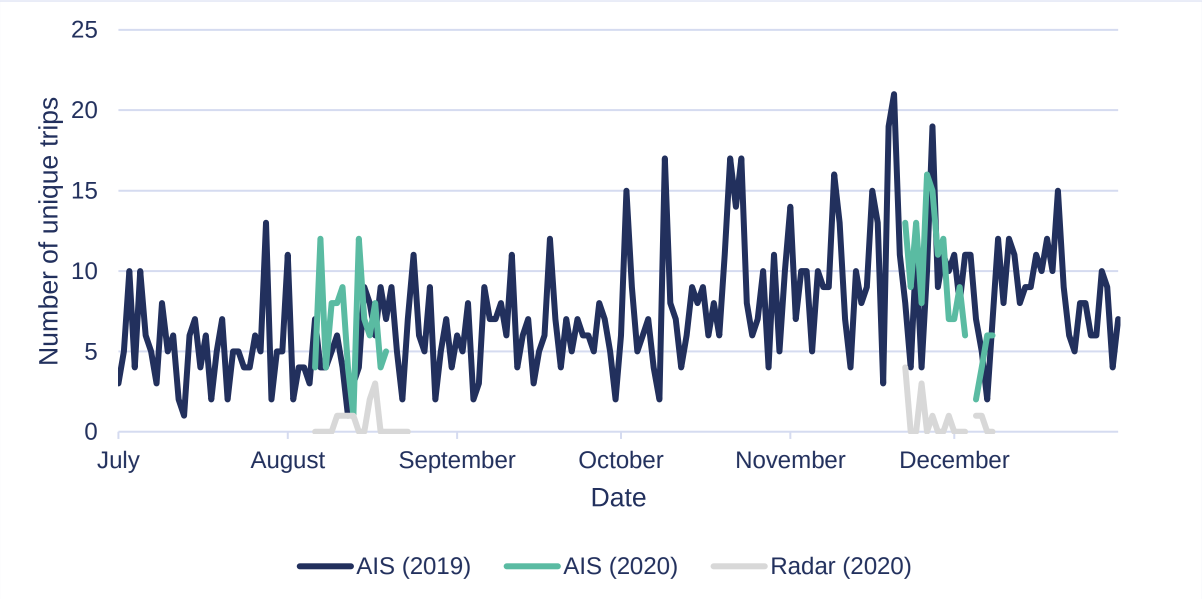


Figure 20 Unique vessel transits per day through the array area + 10km buffer.

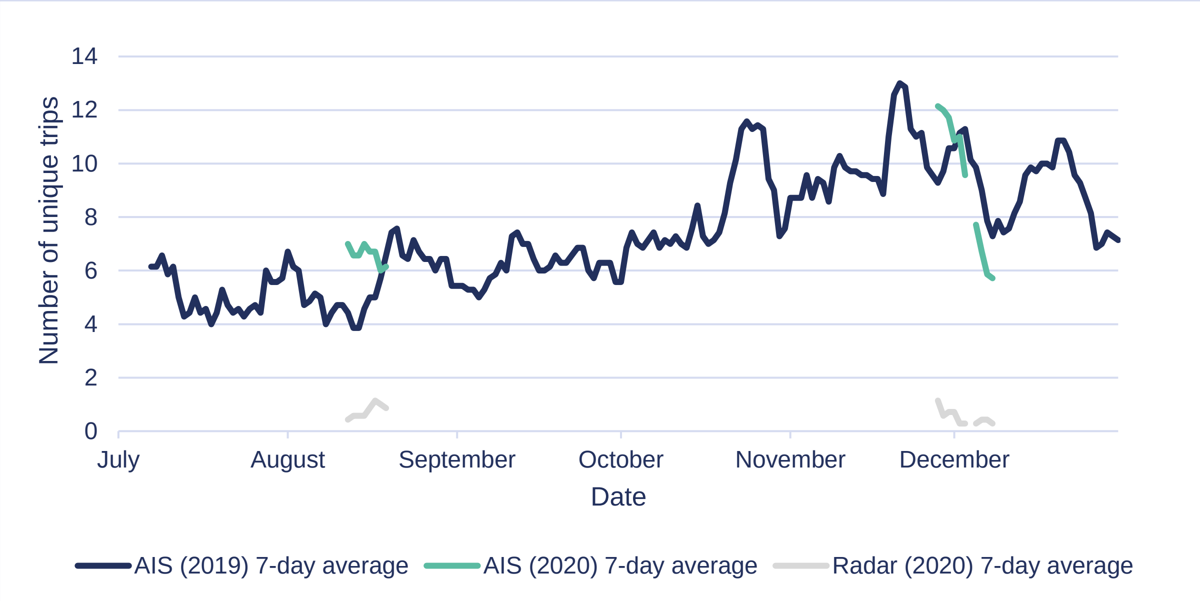


Figure 21 Unique vessel transits per day through array area + 10km buffer (7-day rolling average).

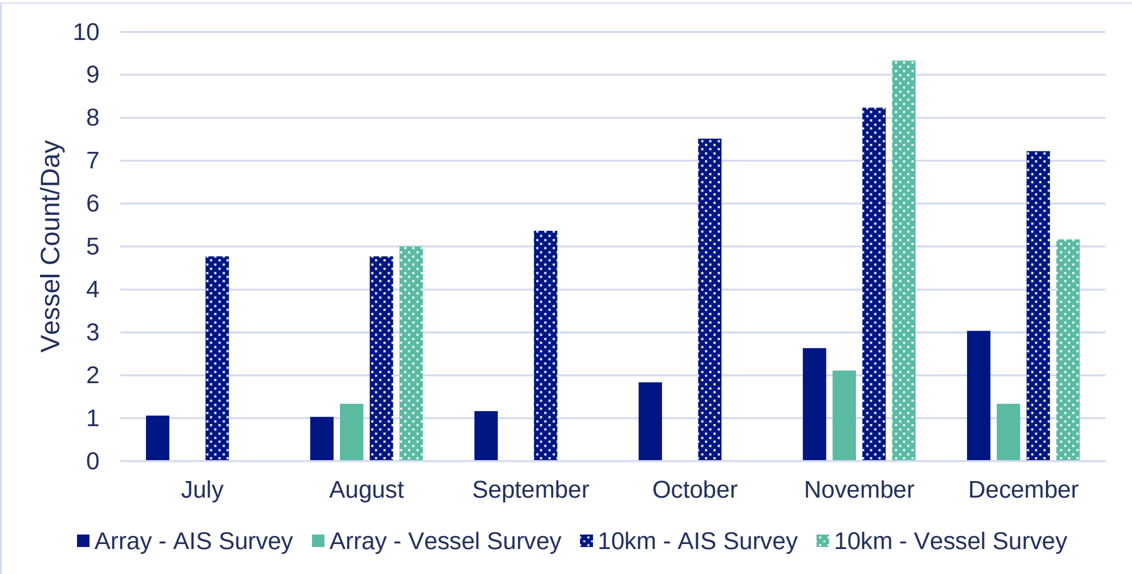


Figure 22 Transits per month within array area plus 10km buffer.

5.2.5 Dataset Integration

Vessel traffic data presented within this report is presented with a focus on the array area or cable route, plus 10km buffer. These two study areas are shown in **Figure 2**.

5.2.5.1 Array Area

Both the long term AIS dataset and the vessel traffic survey provide coverage of the array area and a 10km buffer and, following the benchmarking, have been integrated together to provide a longer duration datasets to support the study. Radar data has been integrated into the analysis where the vessel track is not also identified using AIS. This is referred to as 'radar only'.

The following datasets are presented for the array area plus 10km buffer:

1. AIS data between 01-July-2019 and 31-December-2019
2. Summer survey data between 06-August-2020 and 23-August-2020
    a. AIS data
    b. Radar only
3. Winter survey data between 22-November-2020 and 08-December-2020
    a. AIS data
    b. Radar only

5.2.5.2 Cable Route

The vessel traffic survey was conducted within the array area and so did not cover the full cable route. The procured longer term AIS data between 01-July-2019 and 31-December-2019 has therefore been used in analysis of the cable route and 10km buffer.

5.2.5.3 Nearshore Cable Route Data Limitations

Radar and visual surveys were not undertaken nearshore along the cable route and near landfall. This was partly due to the potential impacts of COVID-19 government guidelines on reducing recreational and fishing vessel activities in this area and the recognition that these vessel types could therefore be under-represented in any radar and/or visual survey undertaken after March 2020 (and would also likely be under-represented in any historic AIS dataset that could be purchased after this date during the pandemic).

In any event, it is recognised that these vessel categories typically under-represent in AIS and radar data due to the relatively low proportion of recreational vessels that transmit AIS and/or present a strong radar signature (through use of radar reflectors or otherwise to improve signature). Precautionary estimates can assume that only 20-30% of this vessel category in nearshore areas may transmit AIS and/or use a radar reflector.

It was recognised during early consultation that, in normal circumstances, recreational vessel activity was likely to be potentially significant nearshore within Milford Haven and, notwithstanding impacts by the COVID-19 pandemic, this user category could potentially therefore be under represented within the AIS and radar traffic data and subsequent analysis presented in this report.

Emphasis has therefore been placed on reviewing complementing datasets, user guides and stakeholder consultation to ensure that these user groups were identified and their use of the area qualitatively understood, with confidence, for the purposes of the assessment. Because the waterway is actively managed by MHPA this information has been readily available and it is therefore considered that the assessment based on appropriate and adequate understanding of recreational activity. Consultation with the MCA confirmed that the data sources used within this assessment are considered to be appropriate to ensure a robust evidence base, see **section 7**.

5.2.6 Other Traffic Data Sources

In addition to the vessel traffic data described in **sections 5.2.2** and **5.2.3**, the following data sources have been referenced:

- VMS fishing effort density
- MHPA vessel/port call information
- RYA Coastal Atlas – underlying datasets

The 2017 MMO VMS fishing data provides broader context for fishing effort in the area by giving the total time of fishing activity by density, this is shown in **Figure 34**.

MHPA vessel and port call data was provided by MHPA, and provides information on the vessel types and counts that enter Milford Haven, this is shown in **Section 5.3.5**.

The RYA Coastal Atlas has been considered within the assessment of recreational vessels. Although the RYA Coastal Atlas has not been presented directly within this report it originates from the same underlying MMO AIS data and there are some observed limitations in the data coverage extending offshore towards the array area. Therefore, the MMO data, together with the longterm AIS data, ,vessel traffic survey datasets and stakeholder consultation collectively provide a comprehensive basis for assessing impacts on recreational vessels within the area.

5.2.7 Incident Data

Incident data was obtained for the area from the following sources:

- Marine Accident Investigation Board (MAIB) incident data between 2010 and 2020
- RNLI incident data between 2009 and 2019
- MHPA incident data between 2015 and 2020

5.3 MARINE TRAFFIC ANALYSIS

5.3.1 Overview

The array area is shown in relation to the general shipping routes within the Irish Sea in **Figure 23** using annualized vessel traffic density derived from the MMO 2017 AIS data and the following observations are made:

- The key offshore traffic routes determined by the Off Smalls TSS are clearly identified more than 10km to the west of the array site.
- The ferry route between Milford Haven and Ireland interests the plot from a north-west to south-easterly direction.
- The route through the Bristol Channel is visible in the bottom right of the plot.

Therefore, the array area is clear of the major Irish and Bristol Channel shipping routes. This corroborates with the shipping routes identified in the WNMP shown in **Figure 24**.

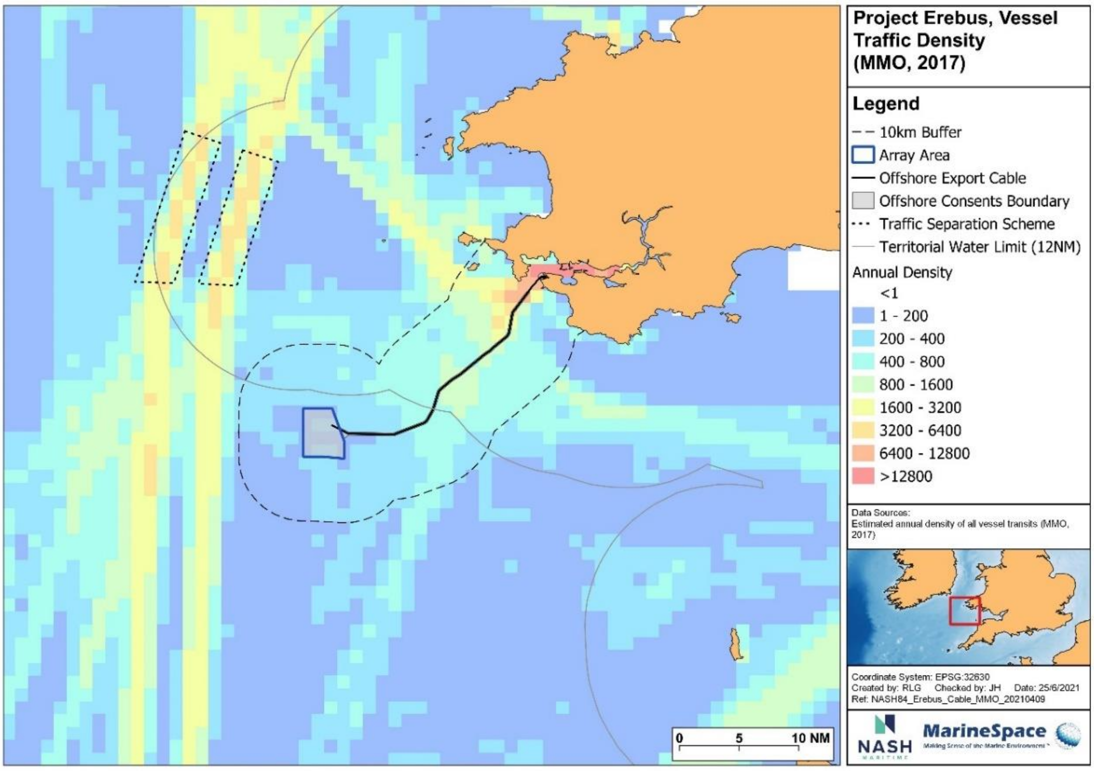


Figure 23 Estimated annualised density of vessel transits (MMO, 2017).

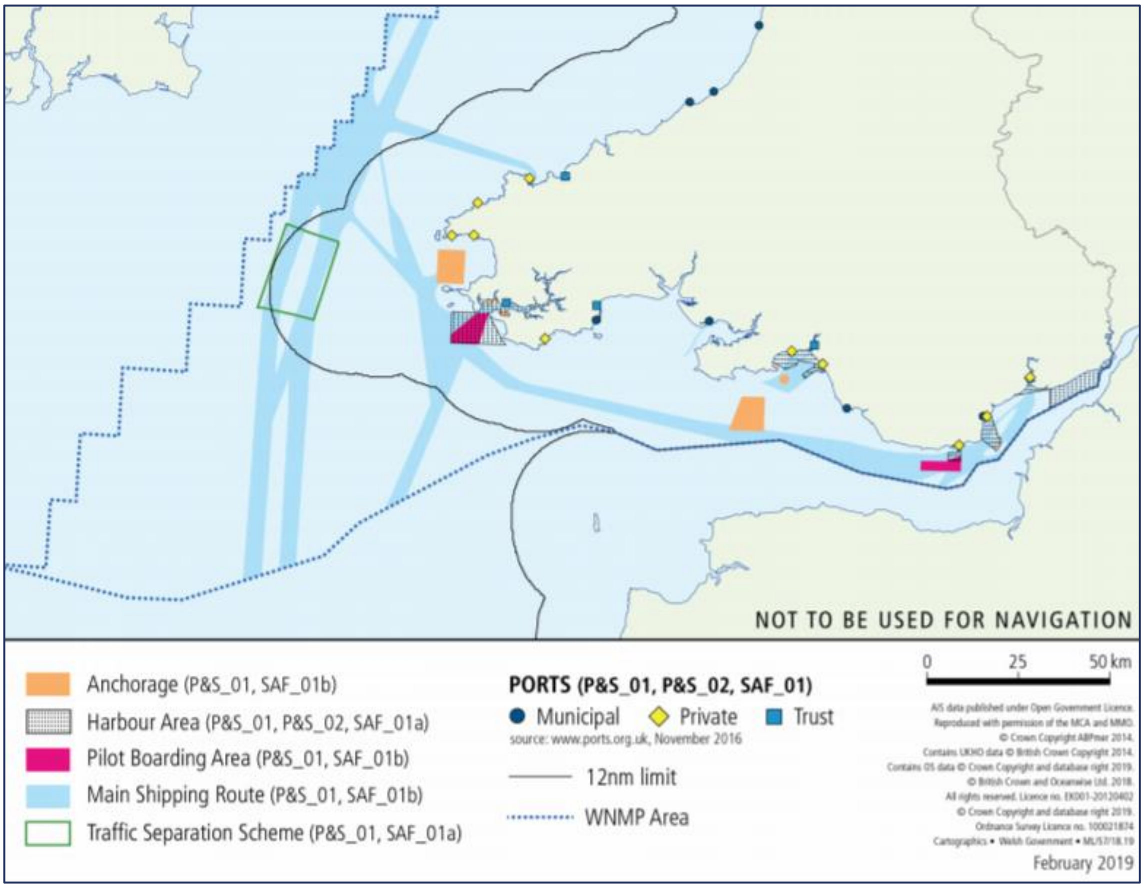


Figure 24 Key shipping routes within the area (Source: Welsh National Marine Plan).

The tracks of all vessels recorded during the traffic survey (2020) and long term dataset (2019) are shown in **Figure 25** and **Figure 26**, respectively. It can be seen that there are relatively few transits within the array area as compared to across the cable route, particularly closer to shore. Furthermore, there is no clear evidence of frequently used shipping routes.

To better understand the magnitude of vessel transits, the vessel tracks have been converted into a density plot, based on the number of transits through each grid cell. **Figure 27** shows all traffic within the study area, with the greatest shipping density clearly within the approaches to Milford Haven. Passenger, tanker and cargo vessels over 50m LOA primarily approach Milford Haven from the west, passing south of Stockholm Island and from the southwest from Lands End, well to the east of the array area. Larger vessels (>50m LOA) utilise the West Channel (see **Figure 28**). Activity from smaller vessels (<50m LOA) is concentrated inshore and around the entrance to Milford Haven (**Figure 29**). In particular, the activities of tugs and pilot boats are limited to only a few nautical miles from the entrance to the estuary, whilst small range boats and passenger boats account for areas of greater density along the coast.

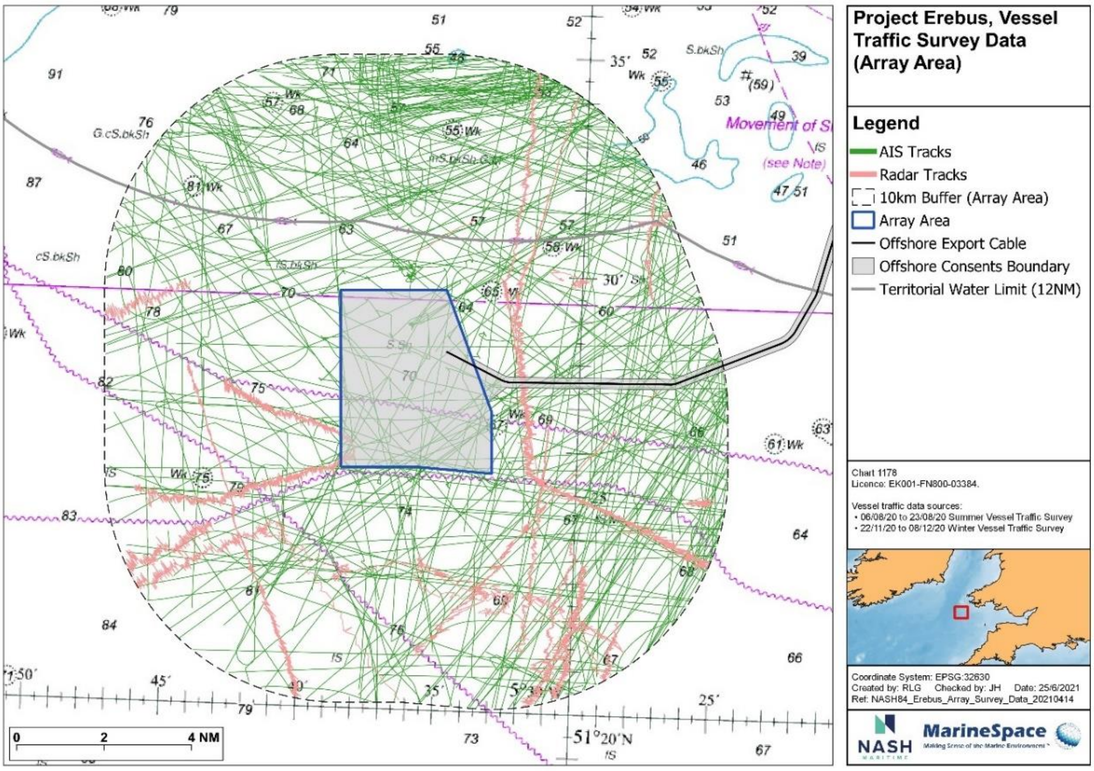


Figure 25 AIS and radar tracks identified during the combined vessel traffic surveys.

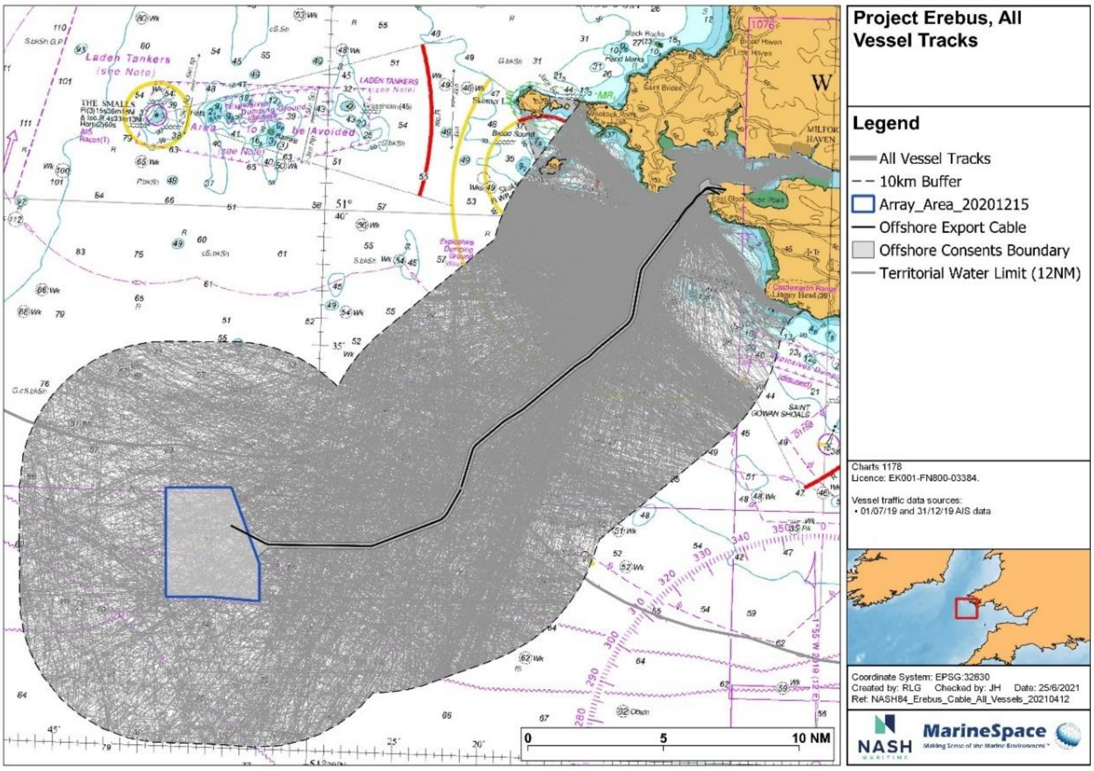


Figure 26 Longterm AIS data (All Vessel Tracks).

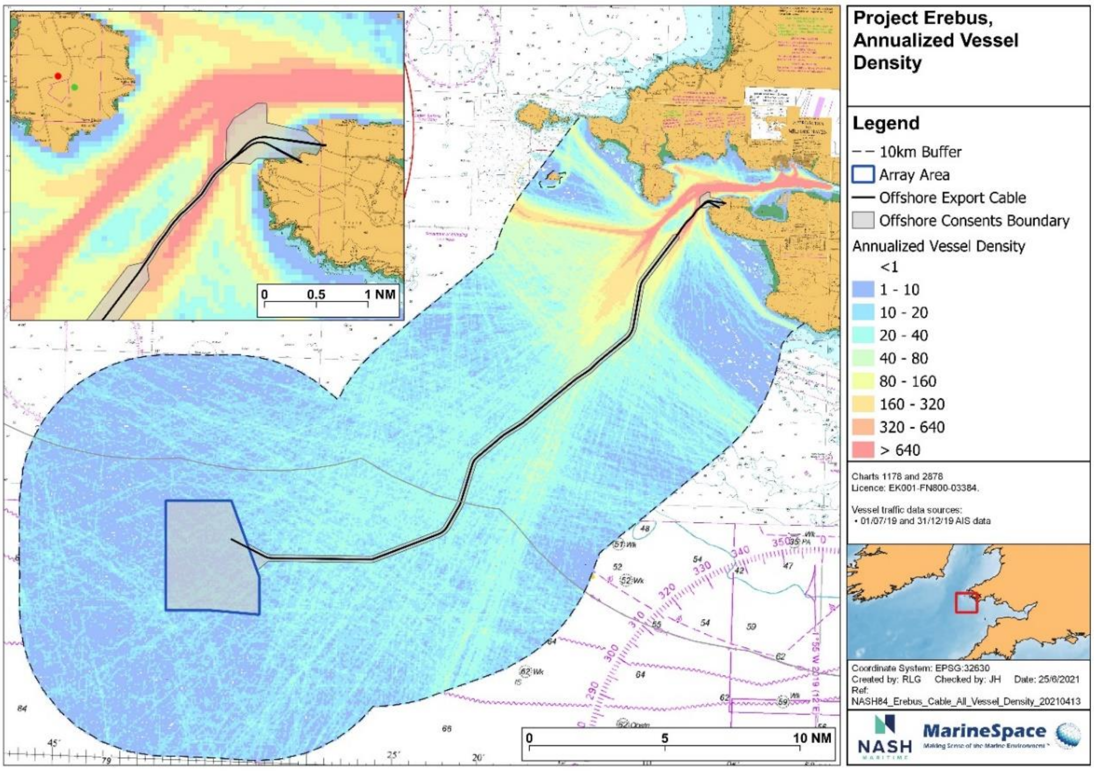


Figure 27 Annualised vessel density for the cable route plus 10km buffer.

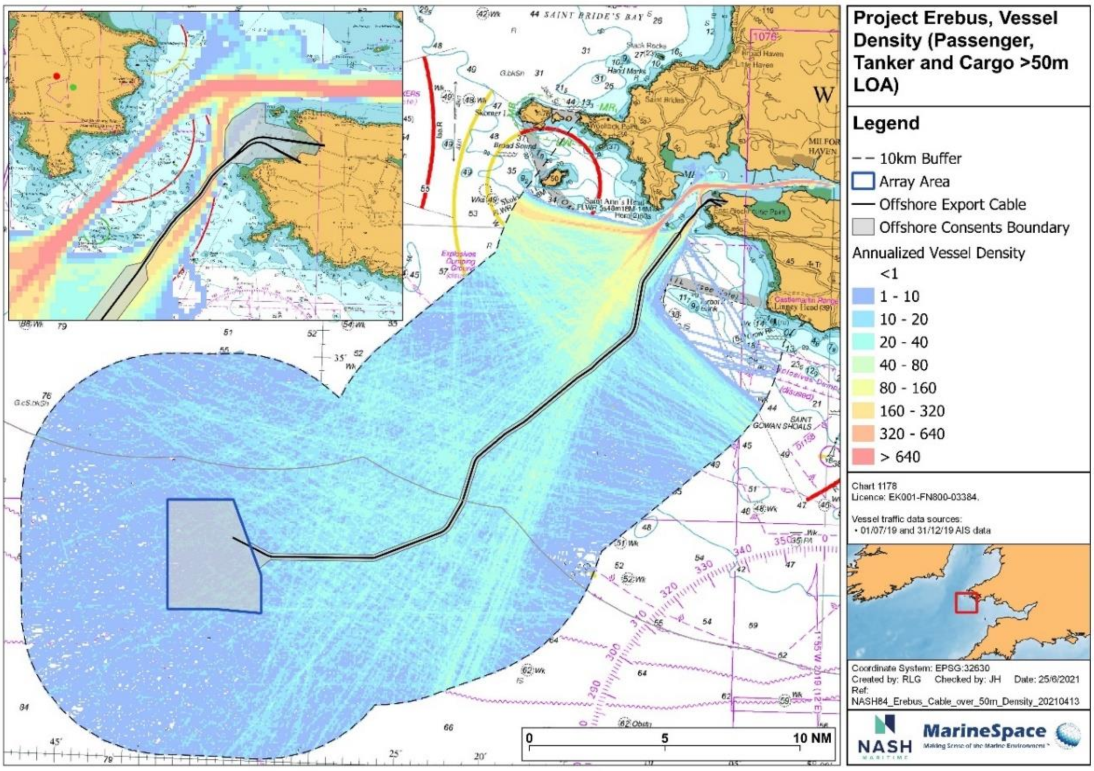


Figure 28 Annualised density for passenger, tanker and cargo vessels >50m LOA.

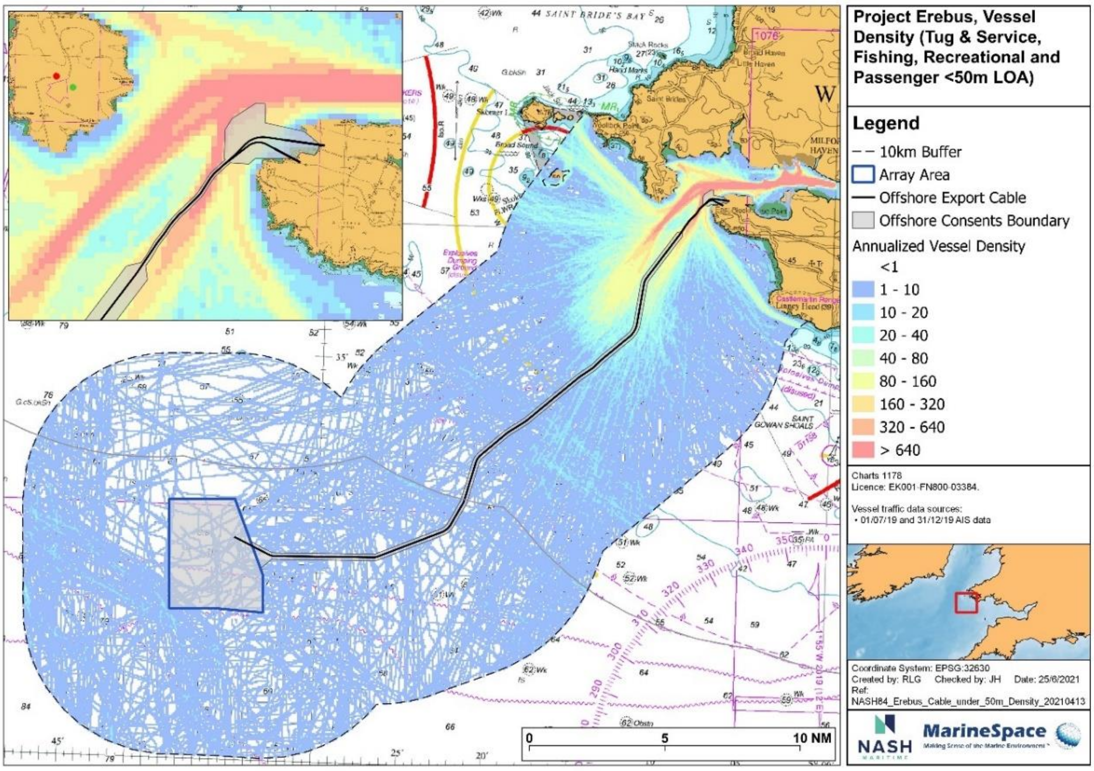


Figure 29 Annualised density for tug & service, fishing, recreational and passenger vessels <50m LOA.

5.3.2 Vessel Traffic by Vessel Type

5.3.2.1 Cargo

The tracks of cargo vessels within the array area and cable route are presented within **Figure 30** and **Figure 31**, respectively. Milford Haven does not handle significant dry cargo trade and only two transits a month were recorded during the data period, typically general cargo vessels between 90m and 150m. Offshore, several routes into the Bristol Channel are evident to Avonmouth, Cardiff, Newport, Swansea and Portbury amongst others, passing more than 5nm from the entrance to the estuary.

In the vicinity of the array area, there are relatively few cargo vessel transits but are associated with regular trade. For example, immediately due east, the 140m container vessel *Kristin Schepers* makes regular transits between Bilbao and Liverpool and is one of the few vessels choosing to pass inshore of the Smalls. The route for vessels bound for Bristol Channel from Cork Harbour pass more than 2nm to the north. The route between the south coast of Ireland (including ports such as Limerick) and the Bristol Channel passes 1nm to the south. In general, most of these vessels are small general cargo vessels. Whilst most larger vessels bound between the Off Smalls TSS and the Bristol Channel pass to the north, some container and bulk carrier vessels up to 300m in size were recorded taking a wider and more southerly route that passed through the array area.

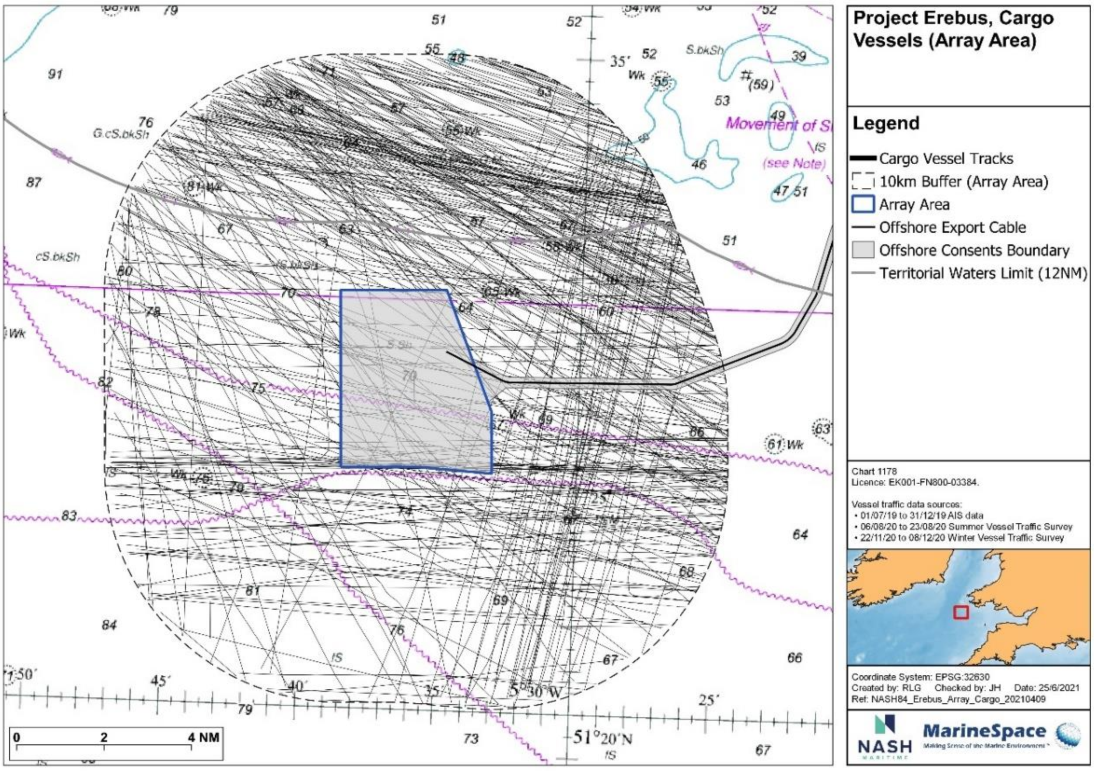


Figure 30 Cargo vessel tracks within the array area plus 10km buffer.

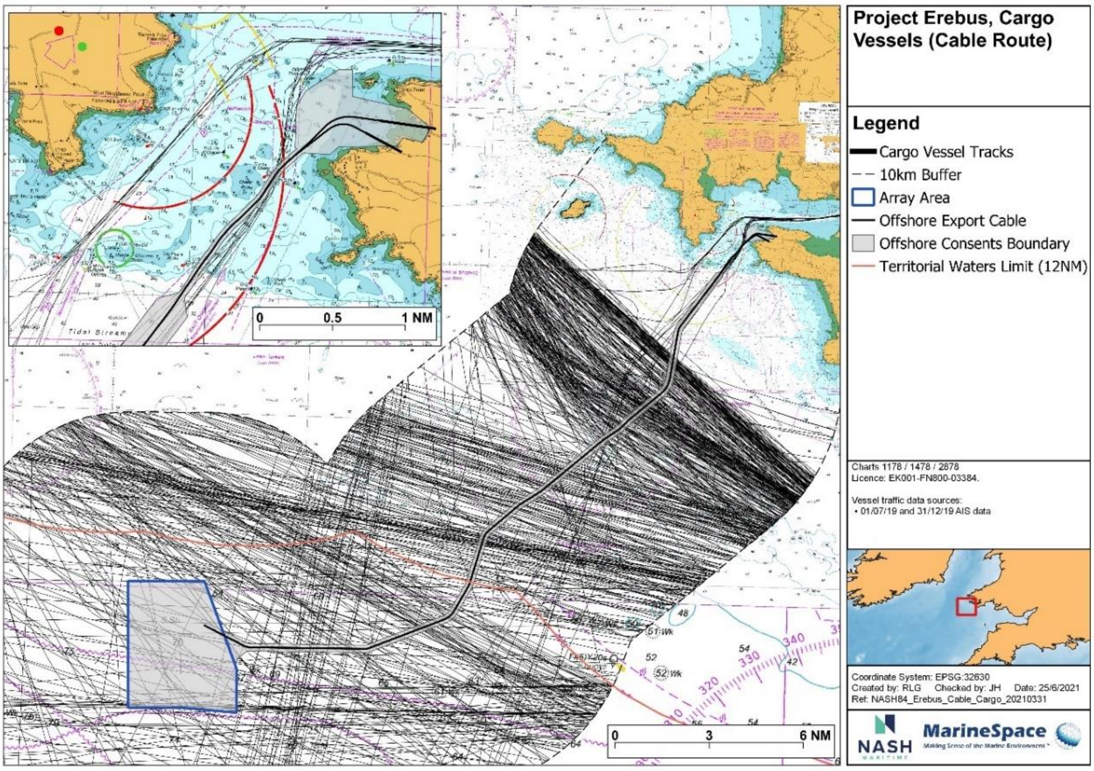


Figure 31 Cargo vessel tracks along the cable route plus 10km buffer.

5.3.2.2 Fishing

The tracks of fishing vessels within the array area and cable route are presented in **Figure 32** and **Figure 33**, respectively. There is considerable fishing activity near to the array area, with 30 different vessels recorded during the long term AIS dataset. Most of these are small vessels between 40m and 10m in size from local ports. However, much larger trawlers were recorded including the 140m *Annelies Ilena* and *Willem Van Der Zwan* operating out of the Dutch port of Ijmuiden.

Figure 33 shows that a number of fishing vessels operate out of Milford Haven itself, however few of these vessels were recorded fishing within the array area itself. Several fishing charter vessels were identified operating out of Milford Haven, these vessels were identified as fishing vessels via AIS. During consultation, it was identified that some charter vessels drift as part of their fishing activities.

Figure 34 shows the intensity of fishing activity as recorded by the MMO using the Vessel Monitoring System (VMS), required on fishing vessels over 15m LOA. For those vessels recorded, there is little activity within the array area with most activity concentrated to the north of the array area.

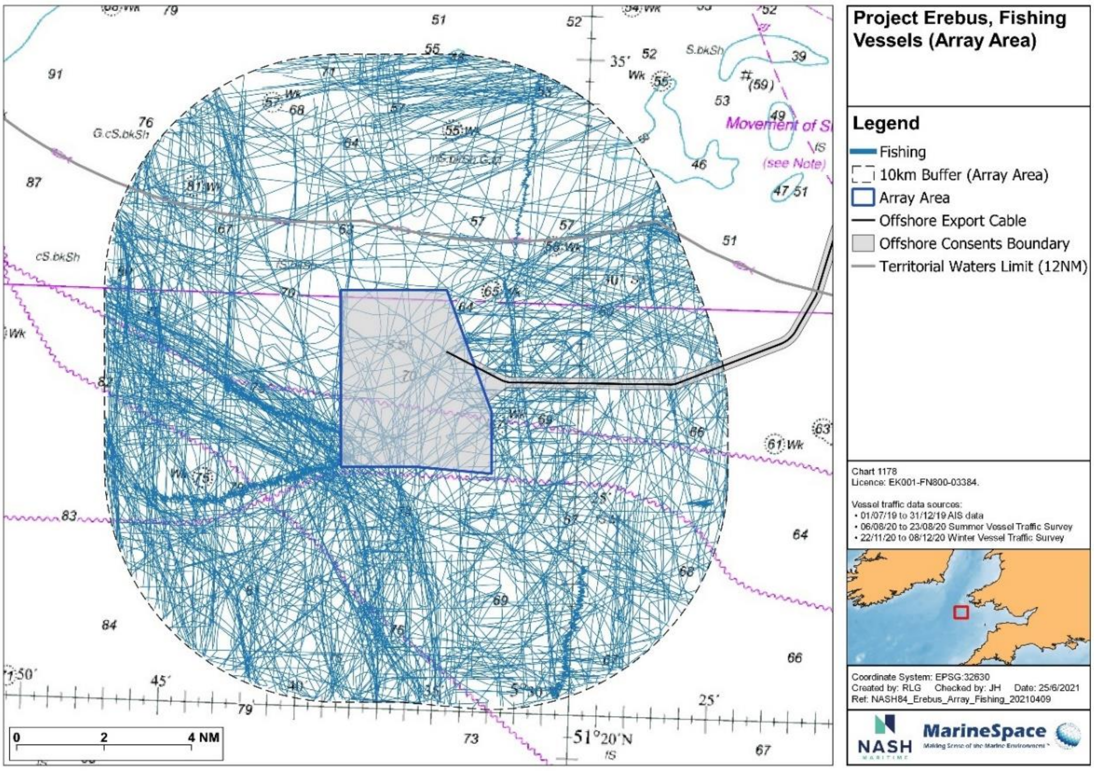


Figure 32 Fishing vessel tracks within the array area plus 10km buffer.

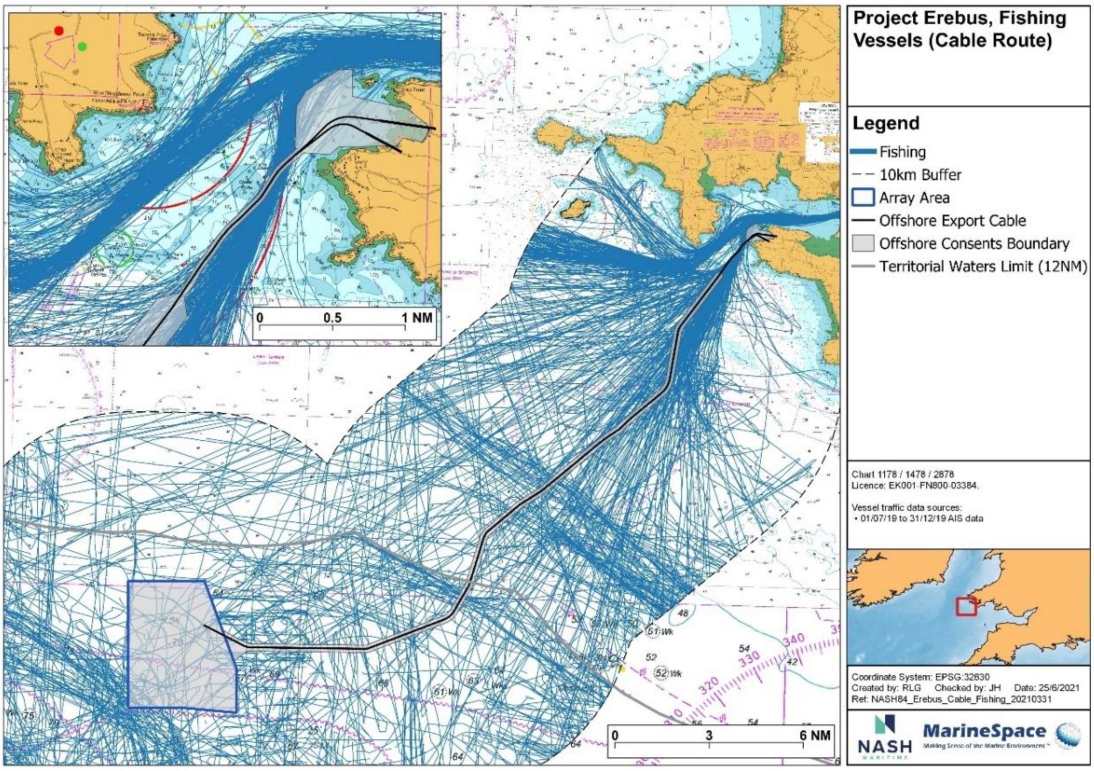


Figure 33 Fishing vessel tracks along the cable route plus 10km buffer.

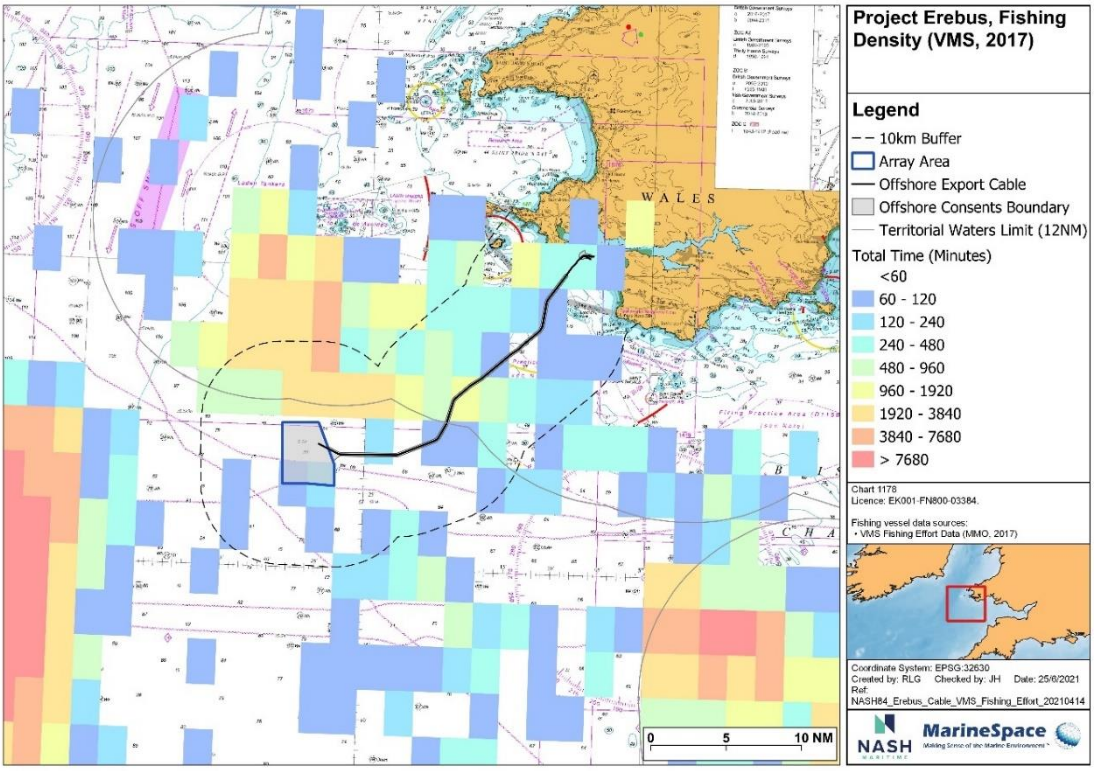


Figure 34 VMS data showing total time (minutes) of fishing vessels in 2017.

5.3.2.3 Passenger

The tracks of passenger vessels within the array area and cable route are presented in **Figure 35** and **Figure 36**, respectively. Only two passenger vessels transited through the array area footprint, namely the cruise ships *Seabourn Ovation* at 210m and the *Marco Polo* at 176m, both on passage from Ireland to the Bristol Channel. Similarly, those vessels transiting adjacent to the array area are also cruise ships of a similar size.

Whilst few passenger vessels transited through the array area (see **Figure 35**), several frequently used passenger routes were identified to be operating from Milford Haven (see **Figure 37**).The ro-ro ferry *MS Isle of Inishmore* is owned by Irish Ferries and operates on the Rosslare-Pembroke service. The *MS Isle of Inishmore* does not transit near the array area but crosses the cable route as it utilizes both the West and East channels into Milford Haven (see **Figure 37**). Additionally, several passenger boats provide trips to Skomer and Stokholm Islands, passing over the cable route and within the vicinity of landfall at West Angle Bay (see **Figure 37**). On occasions, cruise ships enter Milford Haven, including the 198m *Europa* and the luxury cruise ferry 194m *W.B.Yeats*, both having originated from Ireland.

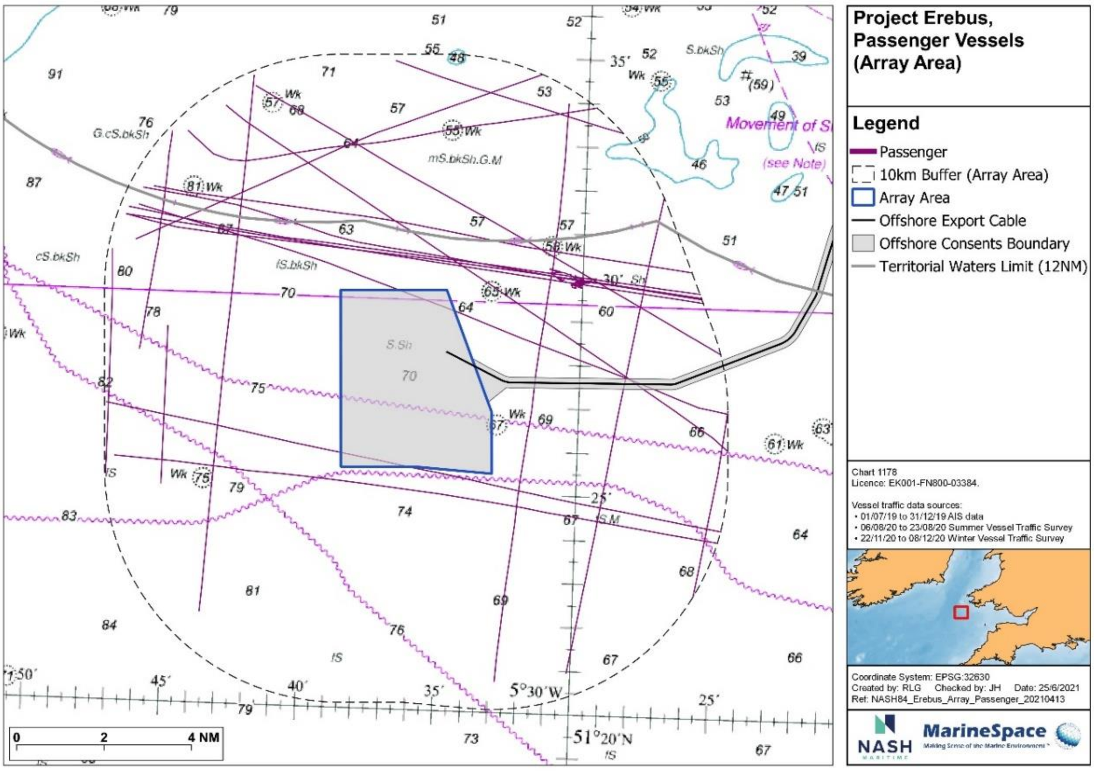


Figure 35 Passenger vessel tracks within the array area plus 10km buffer.

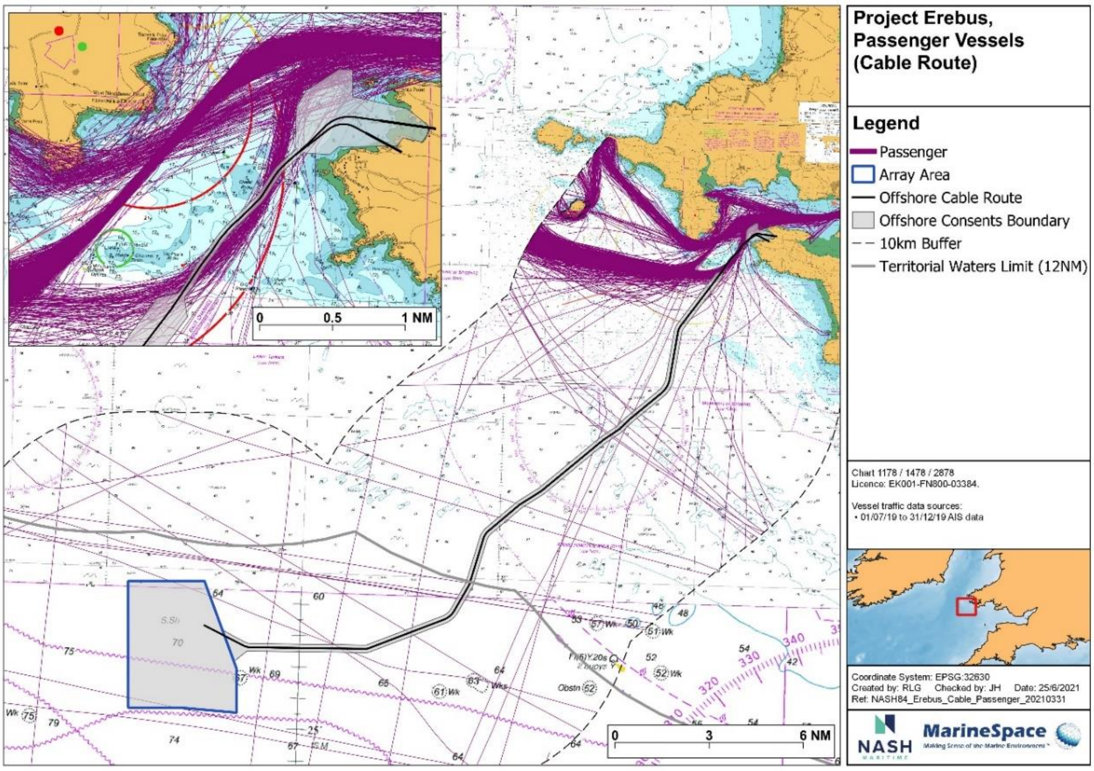


Figure 36 Passenger vessel tracks along the cable route plus 10km buffer.

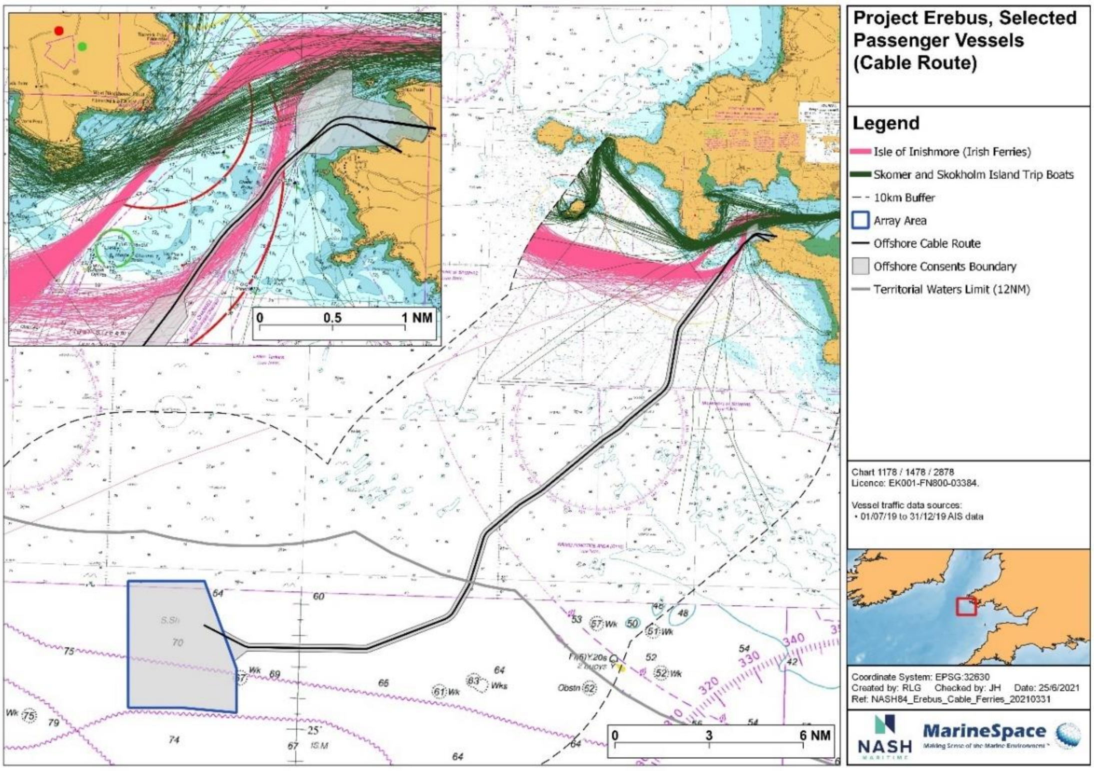


Figure 37 Selected passenger vessels along the cable route plus 10km buffer.

5.3.2.4 Recreational

The tracks of recreational vessels within the array area and cable route are presented in **Figure 38** and **Figure 39**, respectively. Recreational vessels may range from powered craft to unpowered recreational craft including wind powered craft (e.g. yachts, dinghies, wind surfers, kites and wing powered craft) to rowing and other paddle propelled craft. Very few recreational craft were recorded transiting near to the array area. Mostly these are sailing vessels on passage, likely from the Irish Sea round Lands End.

Figure 39 shows significant recreational vessel activity inshore and largely corroborate with the RYA Cruising Routes. Vessels from Pembroke and Milford Marina exit the estuary and are shown to spread along the coast to the east or west, or transit directly offshore to the south-east towards Cornwall. There is also some recreational activity recorded with AIS within West Angle Bay, where vessels may anchor (see **Figure 40**) which lies within an RYA General Boating Area.

An extract from the Milford Haven recreational guide is shown in **Figure 41**, describing the rules and regulations around marine leisure usage within the estuary and various areas for a range of designated activities.

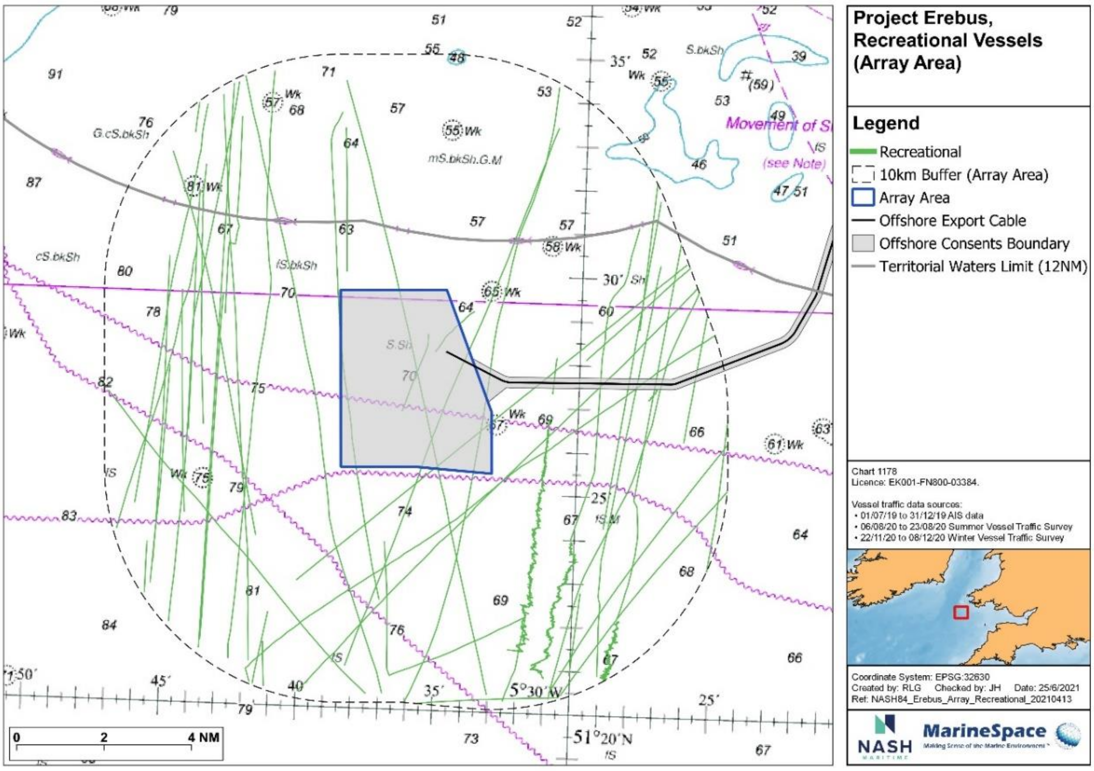


Figure 38 Recreational vessel tracks within the array area plus 10km buffer.

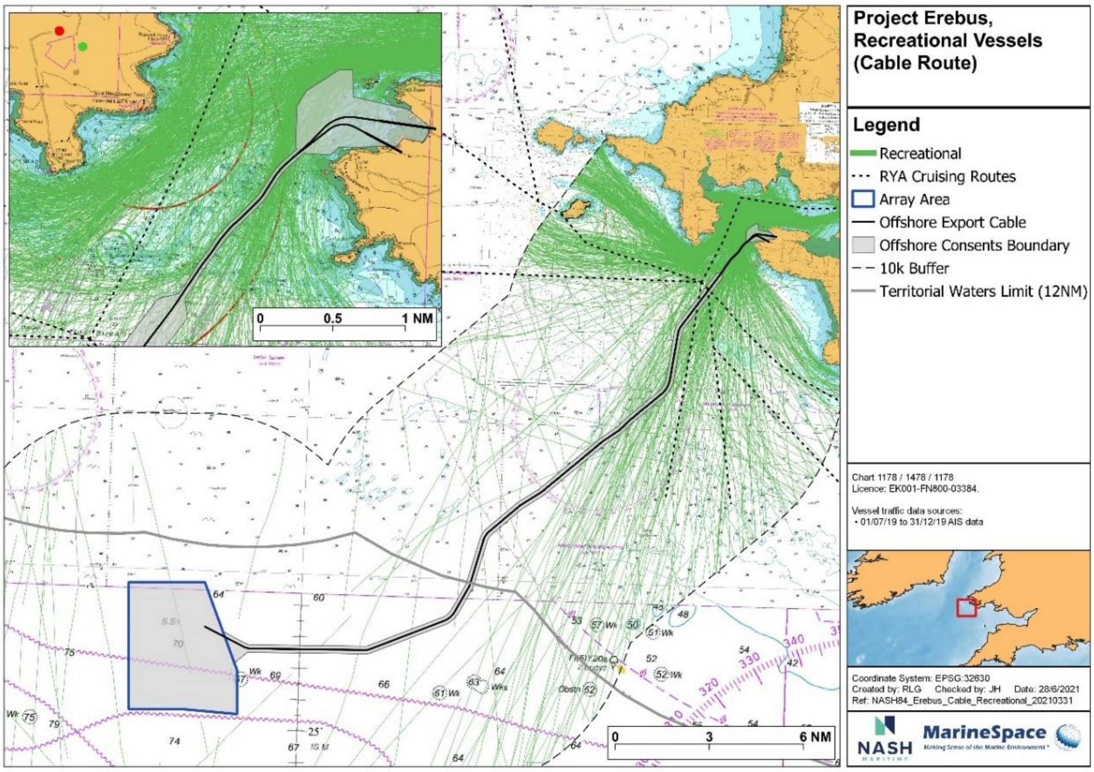


Figure 39 Recreational vessels along the cable route plus 10km buffer.

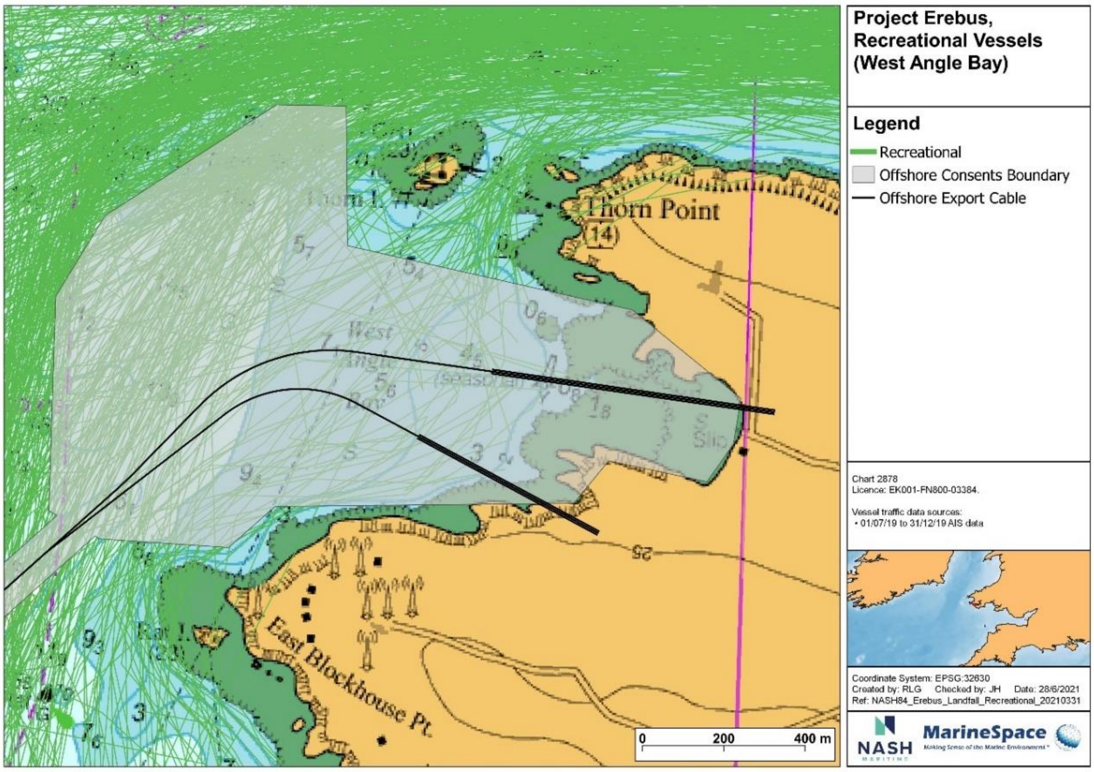


Figure 40 Recreational vessels at West Angle Bay (cable landfall).

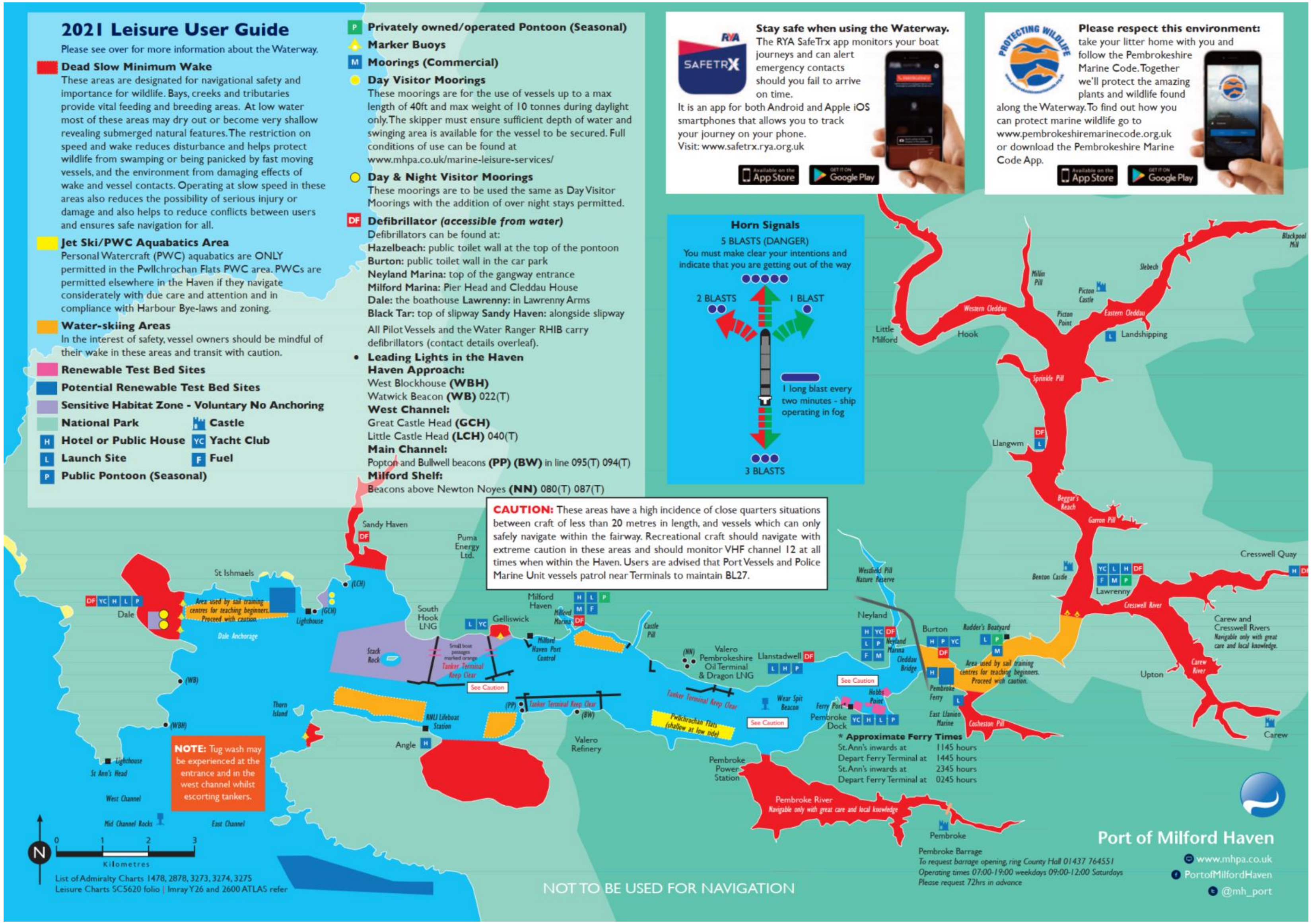


Figure 41 Milford Haven Leisure User Guide (Source: MHPA).

5.3.2.5 Tankers

The tracks of tanker vessels within the array area and cable route are presented in **Figure 42** and **Figure 43**, respectively. Milford Haven is a major liquid cargo port and there is significant tanker vessel activity both within the array area and along the cable route. Within the array area, tankers ranging in size from 90m through to 345m are recorded. These include LNG tankers from Qatar, crude oil tankers, oil/chemical tankers and LPG tankers. Whilst vessels transiting through the array have originated from the Middle East and America, a significant number are waiting offshore before entering Milford Haven. A discussion and analysis of this behaviour is provided in **Section 5.3.6**.

Given the proximity of the cable route to the East Channel, a significant number of these tankers transit over the cable corridor (**Figure 43**).

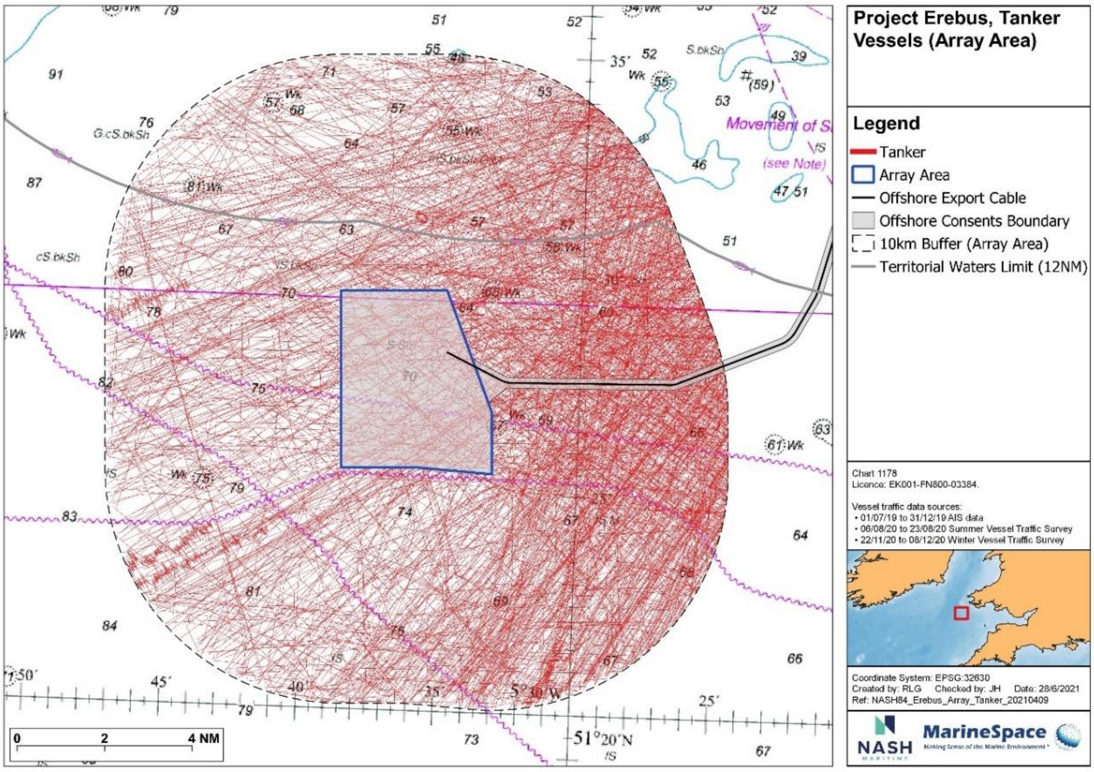


Figure 42 Tanker vessel tracks within the array area plus 10km buffer.

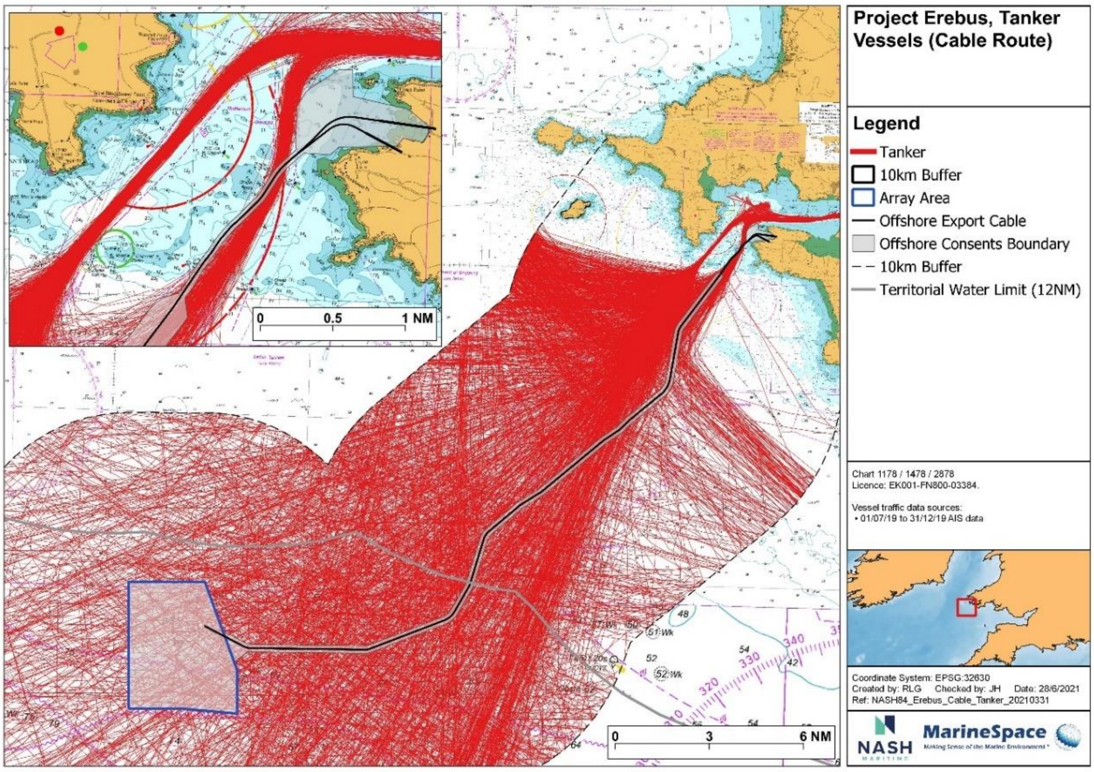


Figure 43 Tanker vessels along the cable route plus 10km buffer.

5.3.2.6 Tug and Service

The tracks of tug and service vessels within the array area and cable route are presented in **Figure 44** and **Figure 45**, respectively. Tug and service vessel tracks are concentrated inshore and include pilot boats and escort towage who can transit six nautical miles from the estuary to approaching and departing vessels. Vessel tracks for tugs and pilot vessels are shown in **Figure 46** and **Figure 47**, respectively. **Figure 48** shows the range boats and Castlemartin Firing Range. The range boats frequently cross the cable route and area near landfall.

Within the array area, there are few transits of vessels of these types, including cable layers, SAR and research and survey vessels.

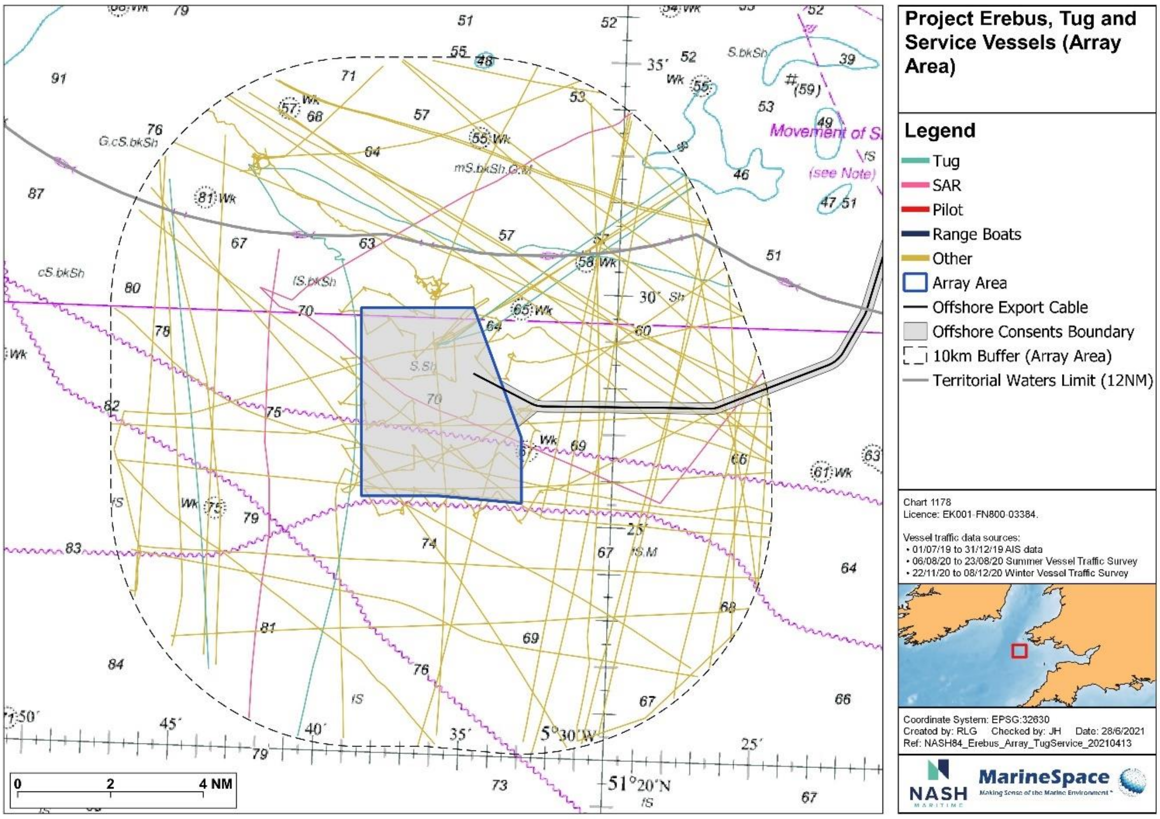


Figure 44 Tug and service vessels within the array area plus 10km buffer.

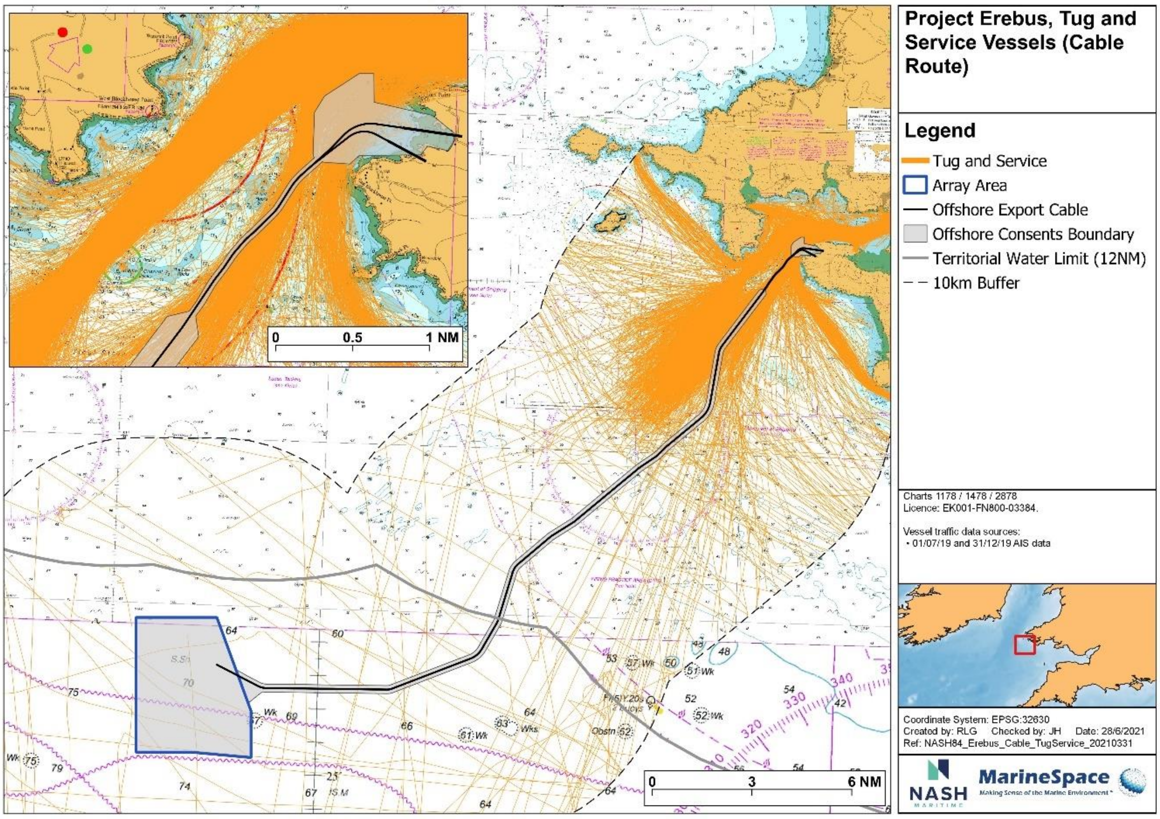


Figure 45 Tug and service vessels along the cable route plus 10km buffer.

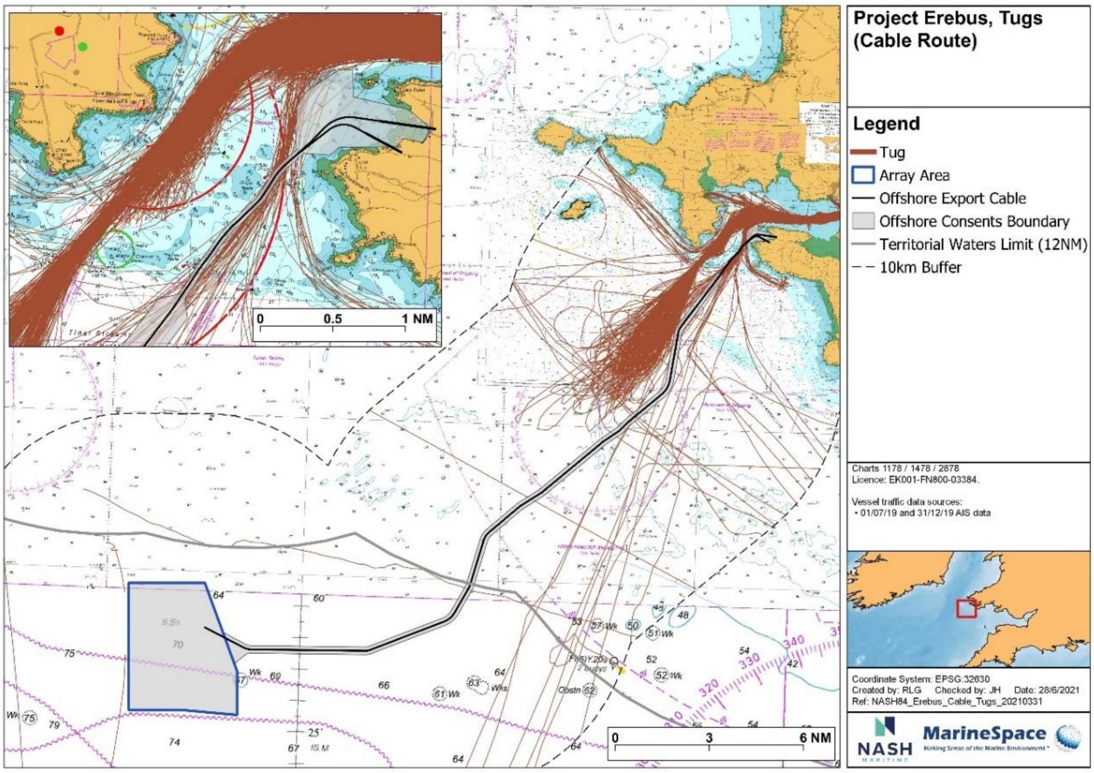


Figure 46 Tug vessels along the cable route plus 10km buffer.

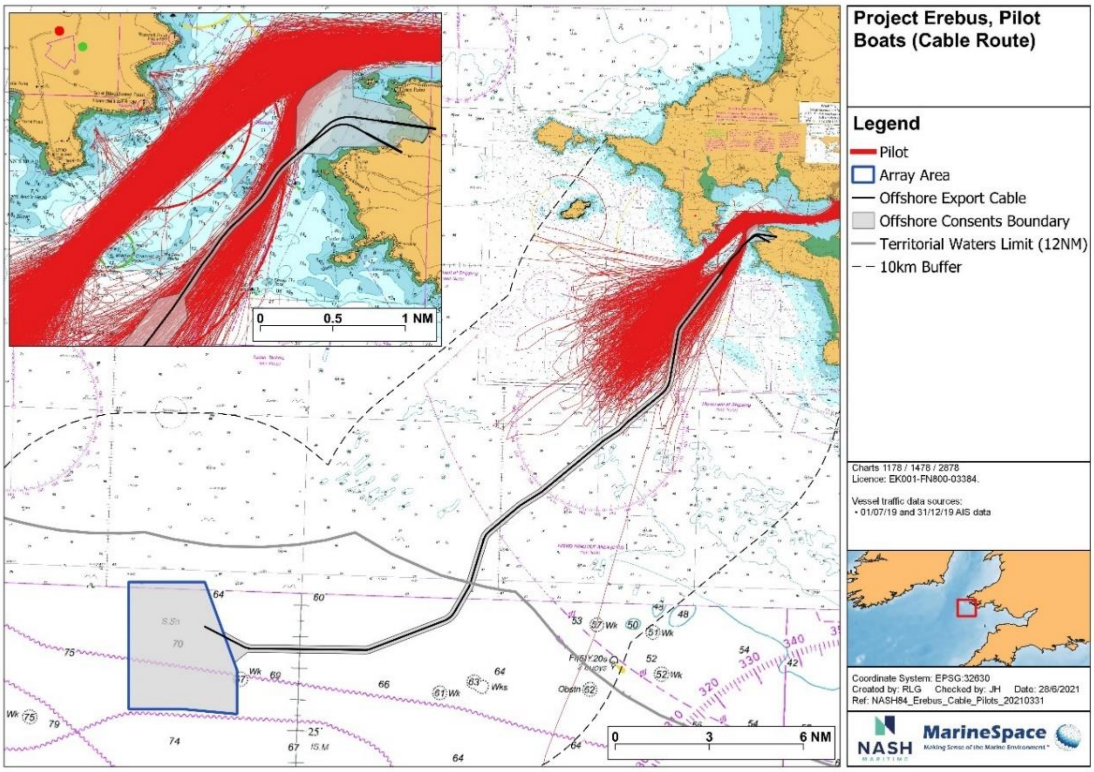


Figure 47 Pilot vessels along the cable route plus 10km buffer.

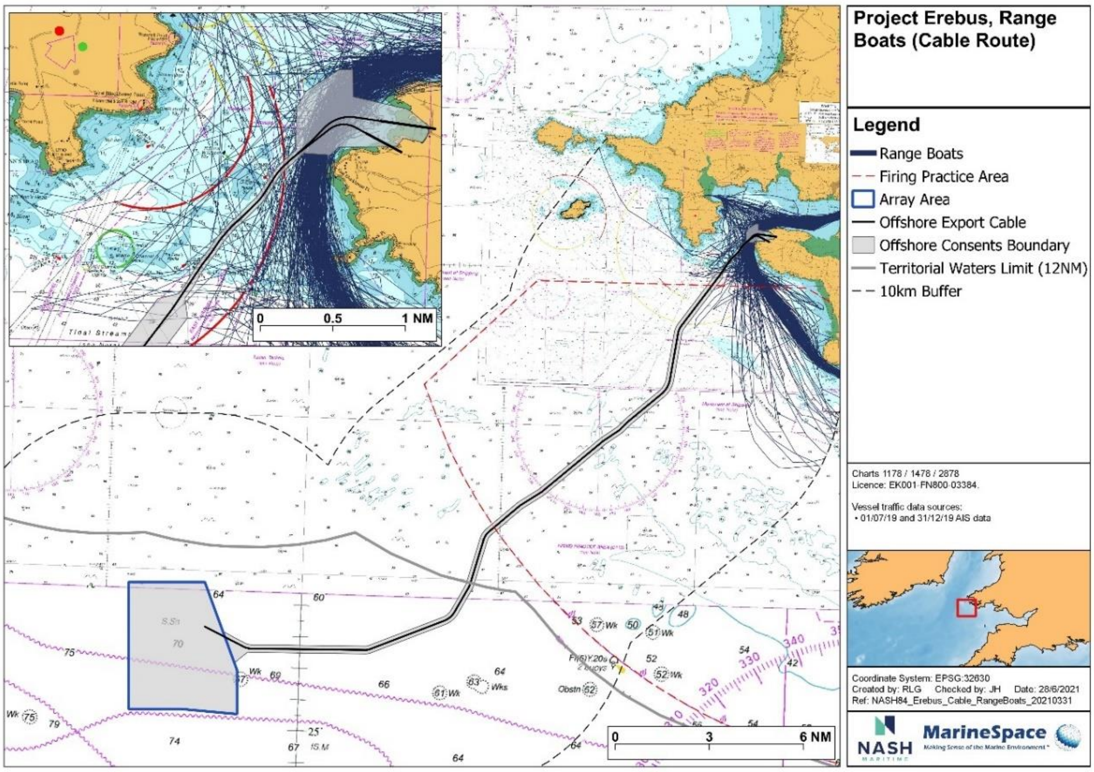


Figure 48 Range boats along the cable route plus 10km buffer.

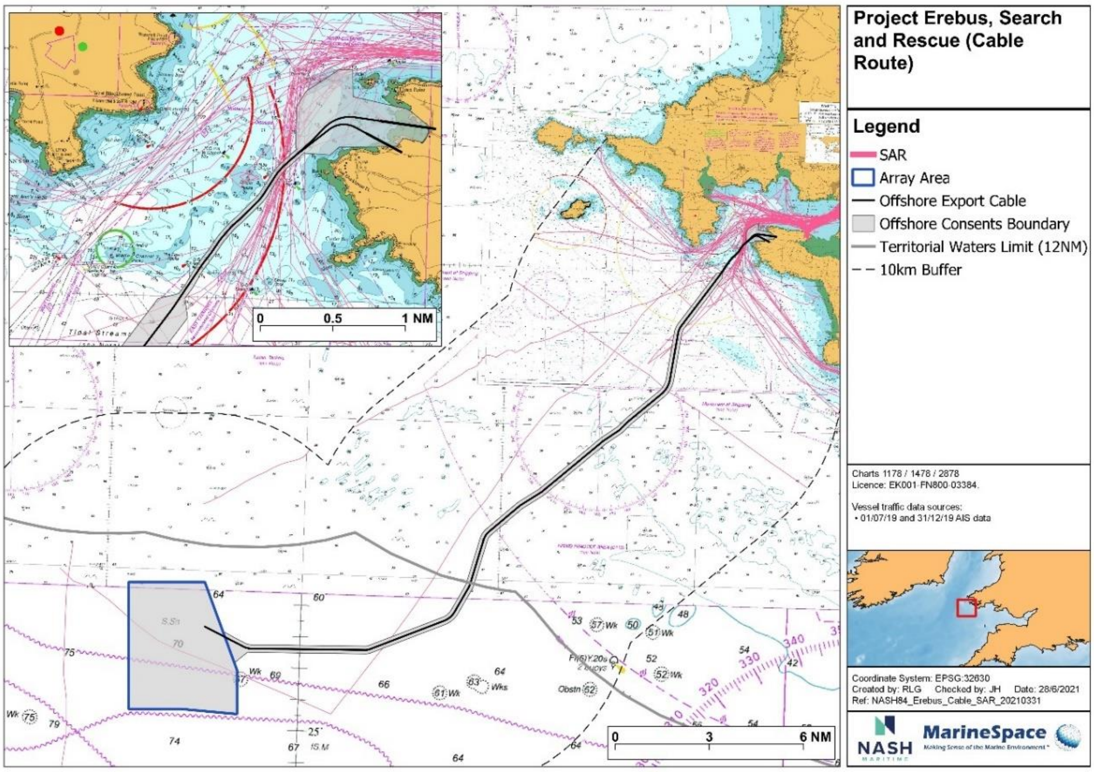


Figure 49 Search and Rescue vessels along the cable route plus 10km buffer.

5.3.3 Vessel Traffic By Size

5.3.3.1 By Vessel Length

Figure 50 shows all vessel tracks within the array area by vessel length. Vessels of all length navigate within the array area due to the propensity for fishing and tankers of various sizes to operate here.

Figure 51 shows all vessel tracks along the cable route by vessel length. Smaller vessels navigate further inshore and utilise both the East and West Channels coming into Milford Haven. In contrast, vessels over 200m LOA follow a more defined route approaching Milford Haven from the southwest and primarily use the West Channel. **Figure 51** demonstrates that larger vessels require a longer approach from the southwest to manoeuvre on entry to Milford Haven with consultation with MHPA Pilots confirming that larger vessels require substantial sea room to manoeuvre within a 5-10m range of the port limits to embark a pilot, line up for approach and be on the leading light transit by approximately 3nm.

Vessels over 200m LOA are also seen concentrated to the east of the array area, indicating vessels waiting to enter Milford Haven.

5.3.3.2 By Vessel Draught

Figure 52 shows all vessel tracks within the array area by vessel draught. Vessels of all draughts navigate within the array area, with few vessels with a draught of over 15m.

Figure 53 shows all vessel tracks along the cable route by vessel draught. **Figure 53** shows that vessels with shallower draughts navigate further inshore and utilise both the East and West Channels coming into Milford Haven. In contrast, vessels with draughts over 10m only (stated at 14.5m during consultation with MHPA Pilots) use the West Channel.

5.3.3.3 By Gross Tonnage

Figure 54 shows all vessel tracks within the array area by gross tonnage. Vessels of all gross tonnage navigate within the array area. Vessels over 75,000 GRT are concentrated to the east of the array area, indicating vessels waiting to enter Milford Haven.

Figure 52 shows all vessel tracks along the cable route by vessel draught. **Figure 53** shows that vessels with shallower draughts navigate further inshore and utilise both the East and West Channels coming into Milford Haven. In contrast, vessels with draughts over 10m only use the West Channel.

Figure 54 suggests that a majority of vessels over 75,000 GRT navigating through the array area are doing so on approaching Milford Haven, whilst smaller vessels may be navigating on various other routes.

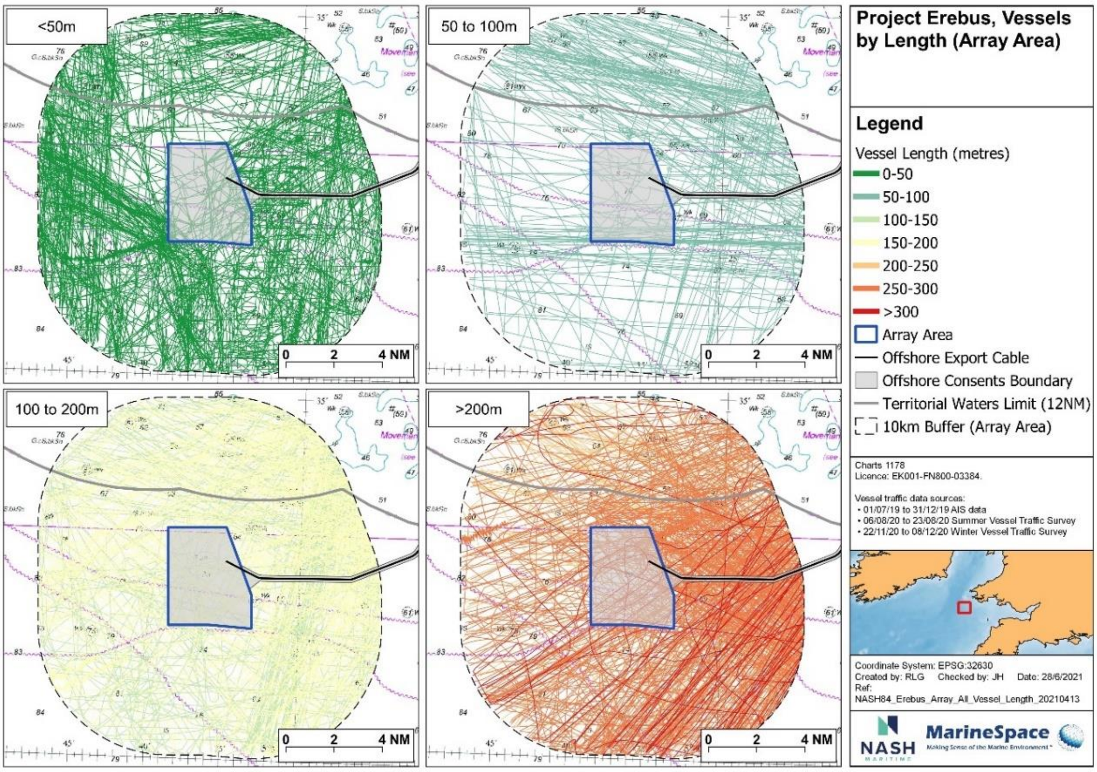


Figure 50 Vessel tracks by length within the array area plus 10km buffer.

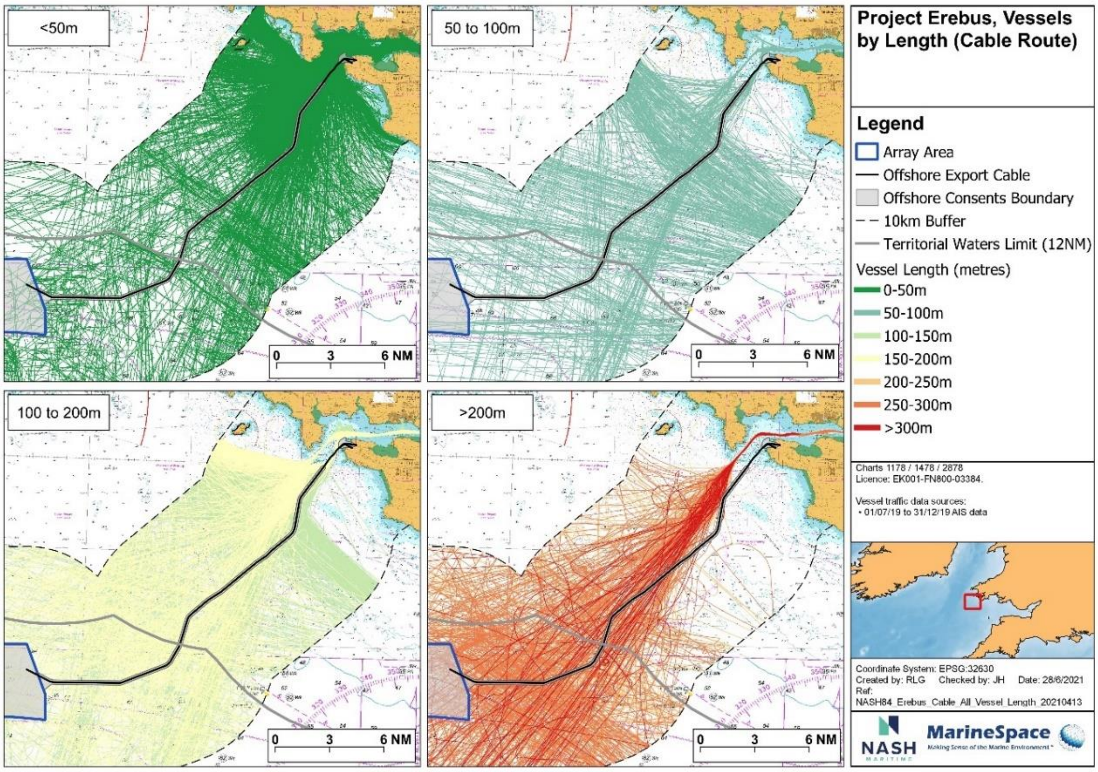


Figure 51 Vessel tracks by length within the cable route plus 10km buffer.

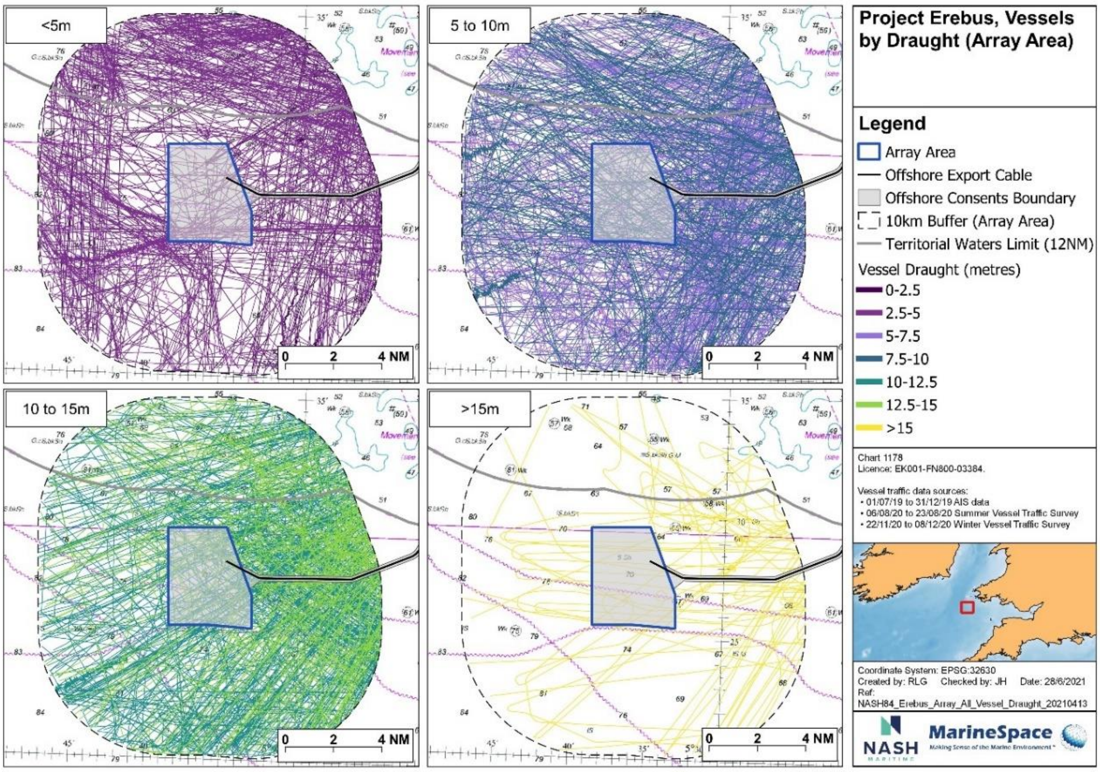


Figure 52 Vessel tracks by draught within the array area plus 10km buffer.

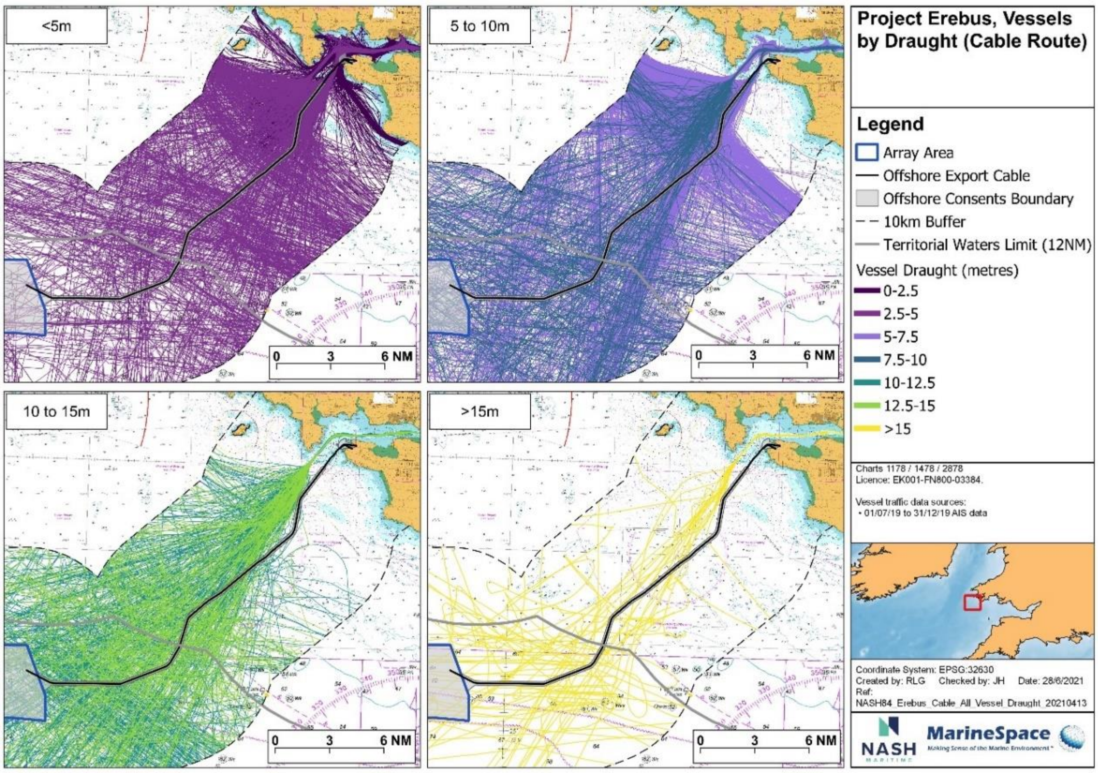


Figure 53 Vessel tracks by draught within the cable route plus 10km buffer.

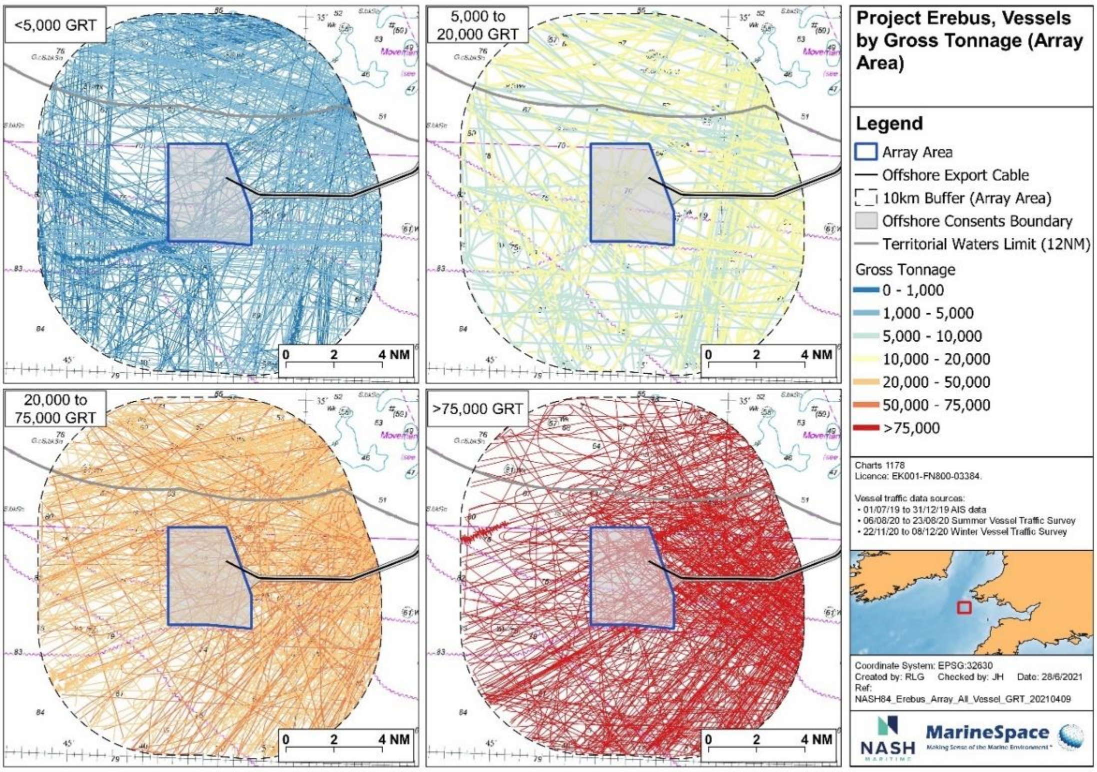


Figure 54 Vessel tracks by gross tonnage within the array area plus 10km buffer.

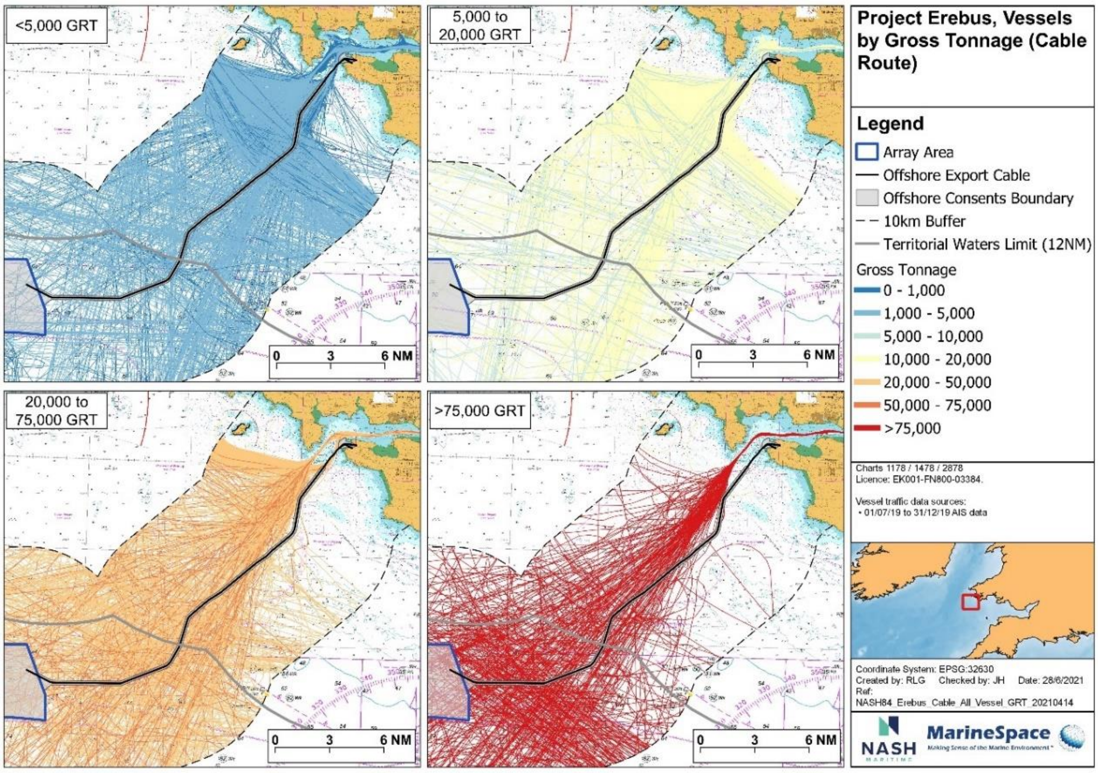


Figure 55 Vessel tracks by gross tonnage within the cable route plus 10km buffer.

5.3.4 Transit Counts and Seasonality for Array and Cable Route

Figure 56 and **Figure 57** compares the number of transits within the array area and cable areas with their respective buffers. Within the array area, more than five times as many vessels transit within 10km of the array area as transited within the array. This indicates that most routes are adjacent to the array rather than intersecting it. Furthermore, there is indication that there is generally more activity in October-December than July-September.

For the cable route, the ratio is smaller with approximately two to three times as many transits within the 10km buffer than within the cable corridor itself. However, the seasonal trend is reversed with July having the greatest number of transits, likely due to seasonal recreational activity.

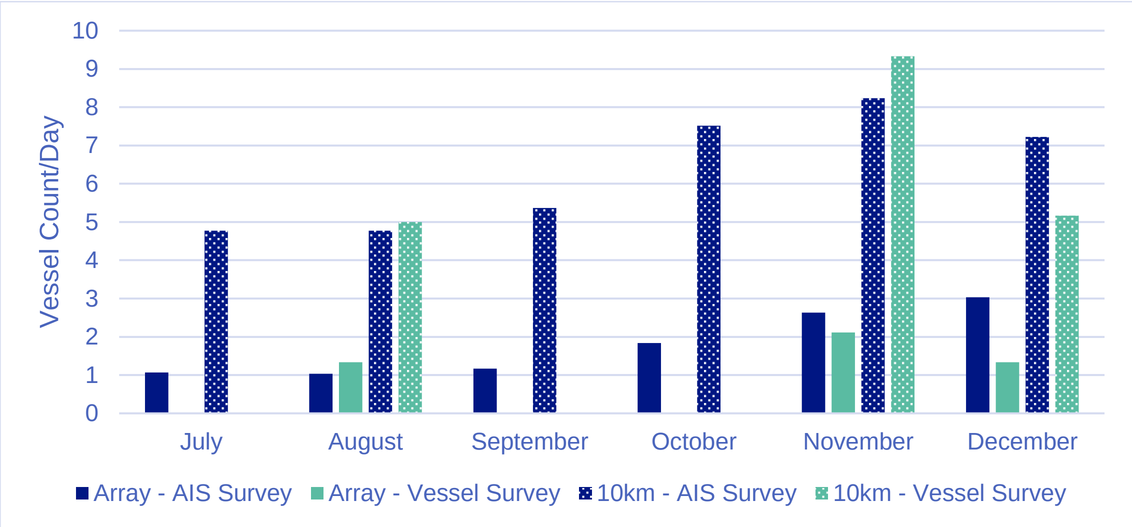


Figure 56 Transits by month within array area plus 10km buffer.

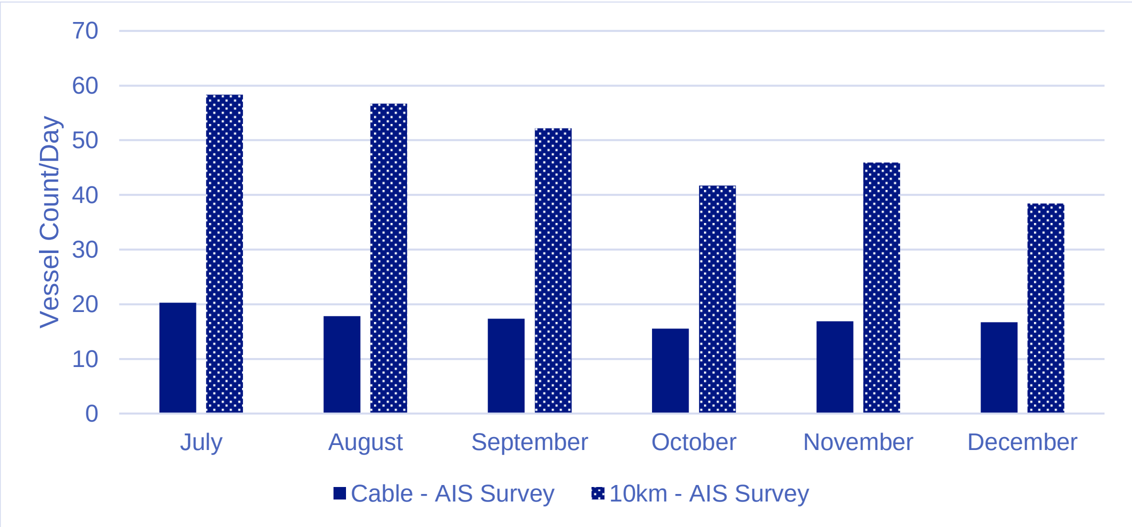
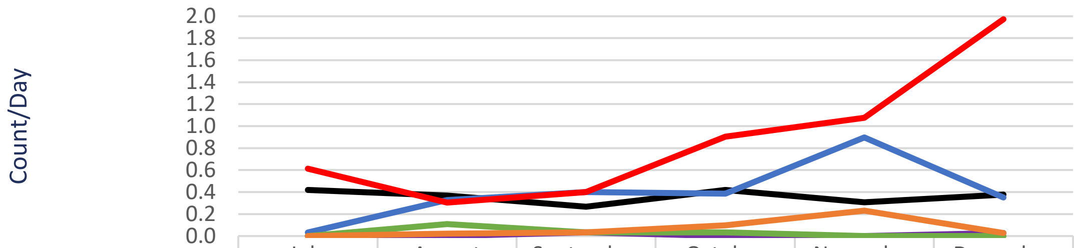


Figure 57 Transits by month within cable route plus 10km buffer.

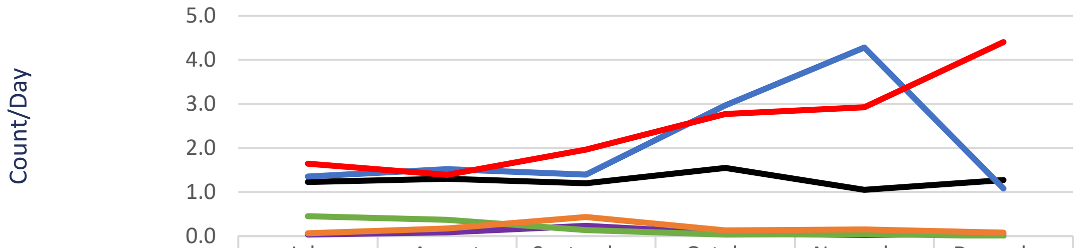
Figure 58 through **Figure 61** show the breakdown of vessel types for the aforementioned areas. Near to the array area, an increase in tanker activity is driving the seasonal trend, whilst near to the cable route, the reduction in recreational activity is causing a summer peak season.

Fishing also has a greater activity during November that the other months surveyed. Other vessel types appear relatively static in their trends.



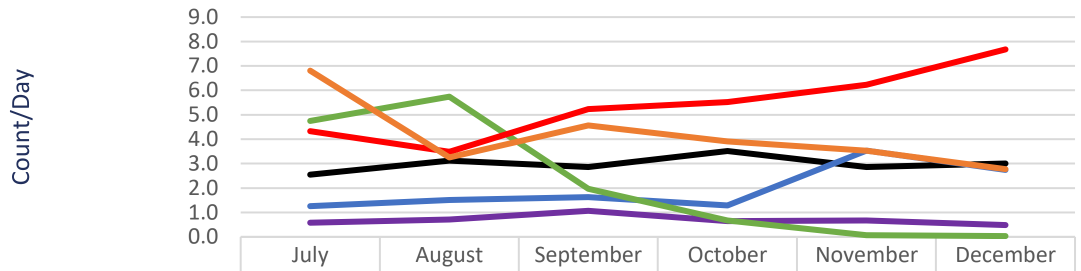
	July	August	September	October	November	December
Cargo	0.4	0.4	0.3	0.4	0.3	0.4
Fishing	0.0	0.3	0.4	0.4	0.9	0.4
Passenger	0.0	0.0	0.0	0.0	0.0	0.0
Recreational	0.0	0.1	0.0	0.0	0.0	0.0
Tanker	0.6	0.3	0.4	0.9	1.1	2.0
Tug and Service	0.0	0.0	0.0	0.1	0.2	0.0

Figure 58 Transits by type within array area.



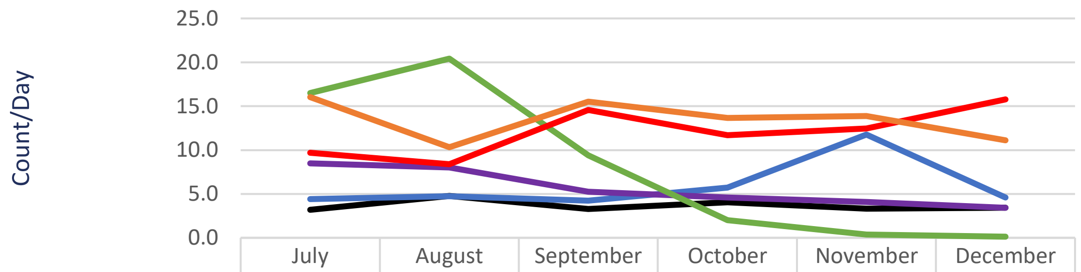
	July	August	September	October	November	December
Cargo	1.2	1.3	1.2	1.5	1.1	1.3
Fishing	1.4	1.5	1.4	3.0	4.3	1.1
Passenger	0.0	0.1	0.2	0.1	0.0	0.1
Recreational	0.5	0.4	0.1	0.0	0.1	0.0
Tanker	1.6	1.4	2.0	2.8	2.9	4.4
Tug and Service	0.1	0.2	0.4	0.1	0.2	0.1

Figure 59 Transits by type within array area plus 10km buffer.



	July	August	September	October	November	December
Cargo	2.5	3.1	2.9	3.5	2.9	3.0
Fishing	1.3	1.5	1.6	1.3	3.5	2.7
Passenger	0.6	0.7	1.1	0.6	0.7	0.5
Recreational	4.7	5.7	2.0	0.7	0.1	0.0
Tanker	4.3	3.5	5.2	5.5	6.2	7.7
Tug and Service	6.8	3.3	4.6	3.9	3.5	2.8

Figure 60 Transits by type within cable route.



	July	August	September	October	November	December
Cargo	3.2	4.8	3.3	4.0	3.3	3.4
Fishing	4.4	4.7	4.2	5.7	11.8	4.6
Passenger	8.5	8.0	5.2	4.6	4.1	3.4
Recreational	16.5	20.4	9.4	2.0	0.4	0.1
Tanker	9.7	8.4	14.6	11.7	12.5	15.8
Tug and Service	16.0	10.3	15.5	13.7	13.9	11.1

Figure 61 Transits by type within cable route plus 10km buffer.

Figure 62 through **Figure 65** show the same analysis but with vessel size. The majority of vessels recorded near to the array area and cable route are smaller vessels including recreational and fishing vessels. However, within the array area itself, the vessel size distribution is much more equal between the smallest and largest vessels.

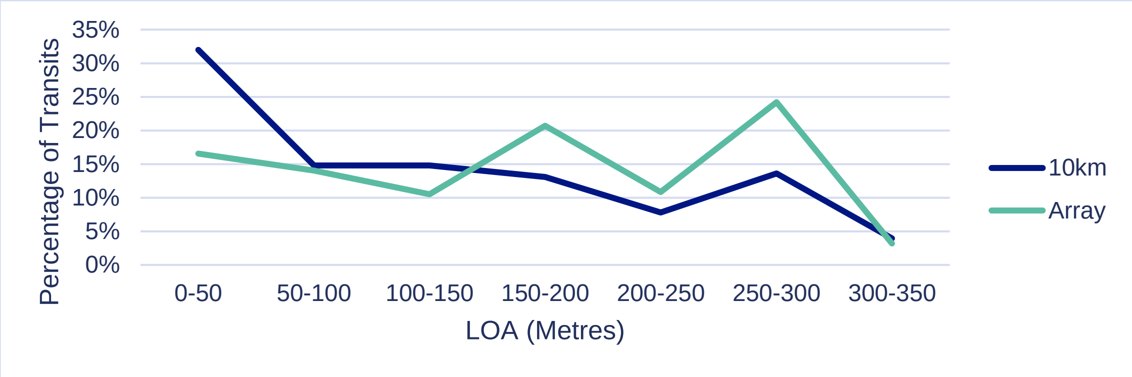


Figure 62 Transits by length within the array area plus 10km buffer.

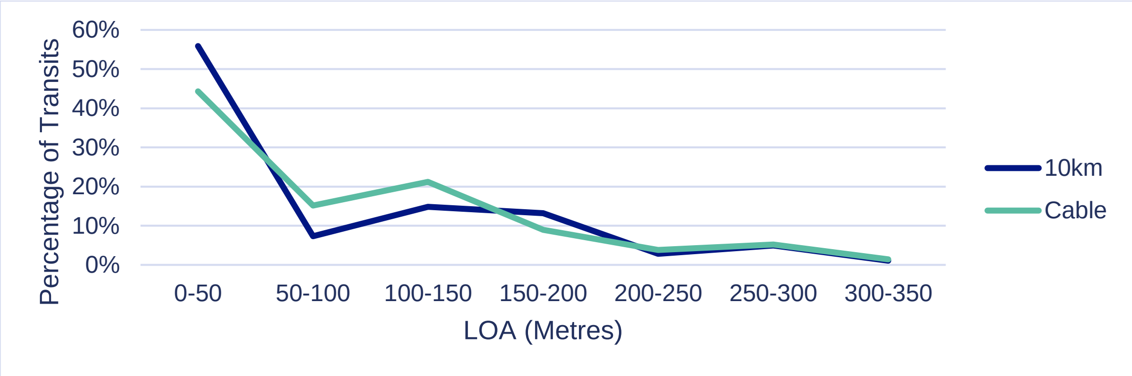


Figure 63 Transits by length within the cable route plus 10km buffer.

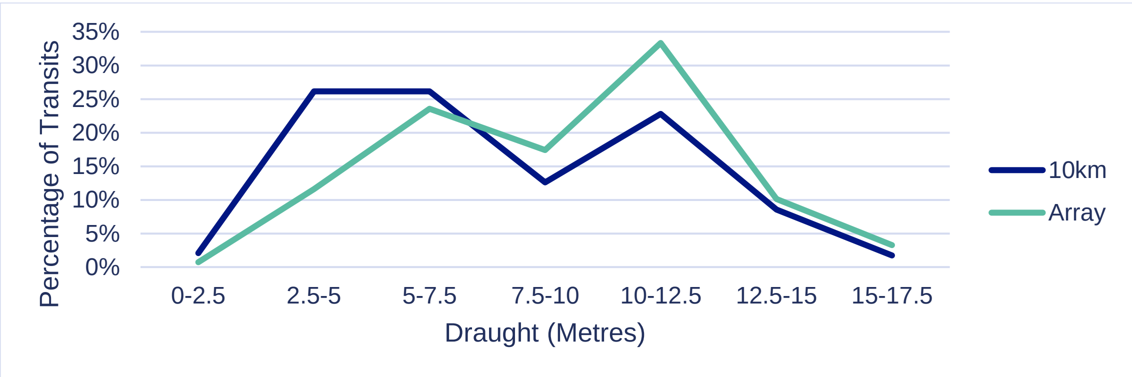


Figure 64 Transits by draught within array and 10km buffer.

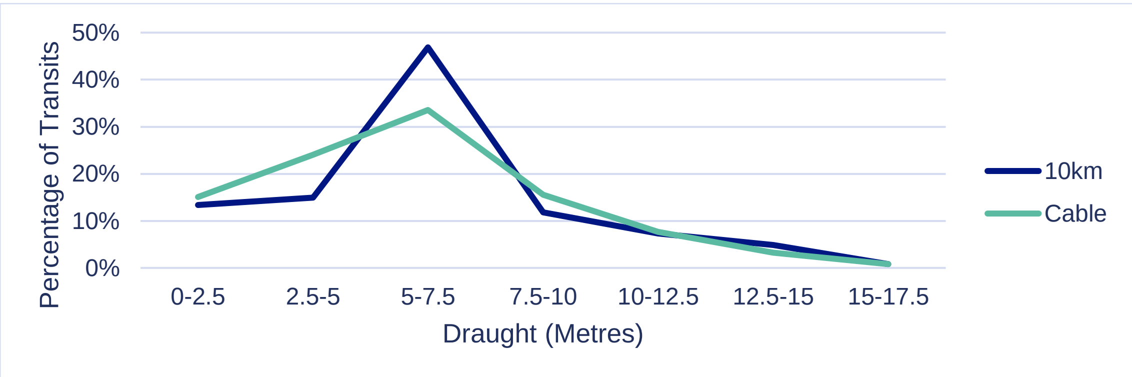


Figure 65 Transits by draught within cable route plus 10km buffer.

5.3.5 Transits within Milford Haven Port Authority

To better understand the frequency and types of vessels entering Milford Haven, a transit gate was constructed and is shown in **Figure 66Figure 66.** Each bar indicates the distribution, direction and frequency of vessel transits. The greatest number of transits are through the West Channel, whilst fishing and passenger vessels are shown to cut to the south of the Angle north cardinal mark. These transits are concentrated in the centre of both channels. A minority of vessels transit outside of the main channels, particularly near to the East and West Blockhouse Points.

Figure 67 Figure 67 shows the frequency of vessel movements across the gate using the longterm AIS data. Whilst most vessel types are relatively constant across the months, the significant reduction in recreational transits between July and December from 300 to 3, results in a seasonal difference. Passenger vessel movements also decline from 196 in July to 96 in December as the seasonal trade reduces.

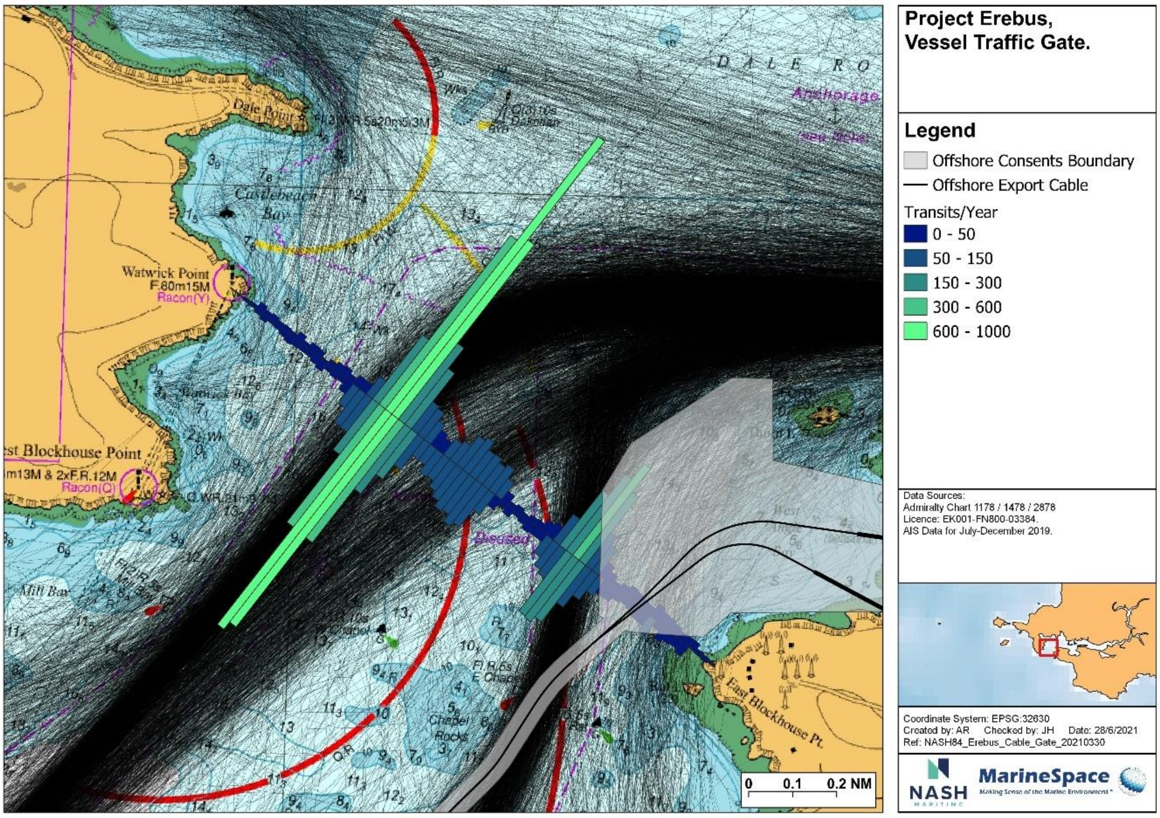


Figure 66 Transit gate.

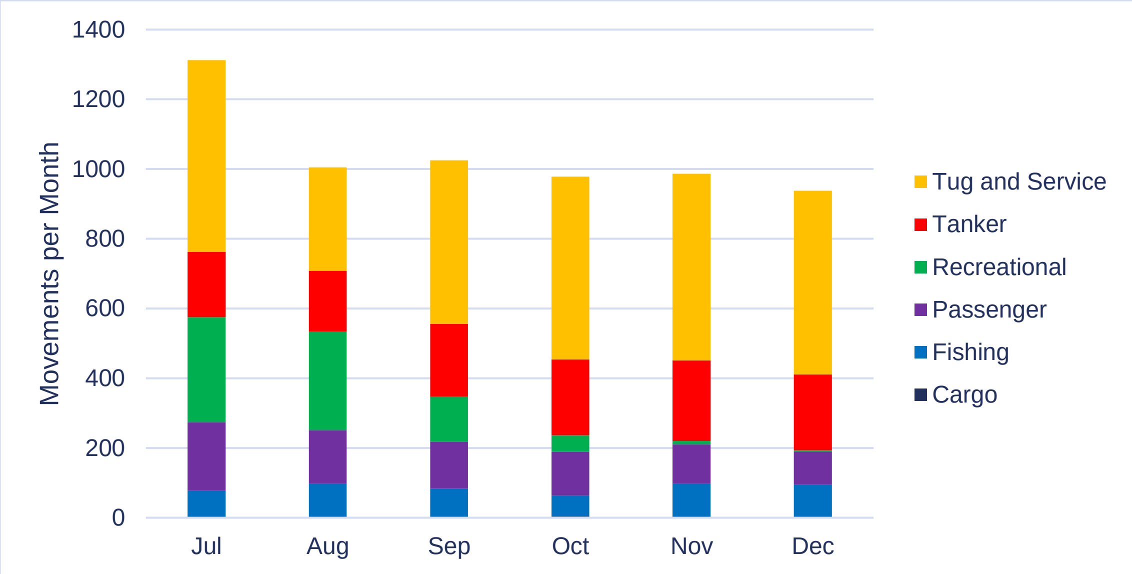


Figure 67 Vessel movements into Milford Haven per month.

To supplement the AIS data, Milford Haven port call data arrivals and inward movements between 2015 and 2020 are presented in **Table 9** and **Figure 83**.

Table 9 MHPA vessel arrivals and inward movements between 2015 and 2020.

Vessel Type	2015 Total	2016 Total	2017 Total	2018 Total	2019 Total	2020 Total
Cargo	43	49	37	22	14	23
Fishing	256	213	236	221	269	354
Passenger	711	715	718	692	684	687
Recreational	13	19	10	7	17	4
Tanker	1336	1289	1261	1265	1243	1092
Tug and Service	193	245	156	123	108	114
Grand Total	**2552**	**2530**	**2418**	**2330**	**2335**	**2274**

5.3.6 Anchoring and Waiting Vessels

The analysis conducted in the above sections has concentrated on vessel transits, however, it was noted during consultation that, for operational reasons, a relevant portion of tankers spend significant time either at anchor or waiting to enter the estuary. Vessels over 50m LOA with speeds of less than 1kt within Milford Haven are shown in **Figure 68.** These indicate significant anchorage activity in the Dale Roads, which is a charted anchorage.

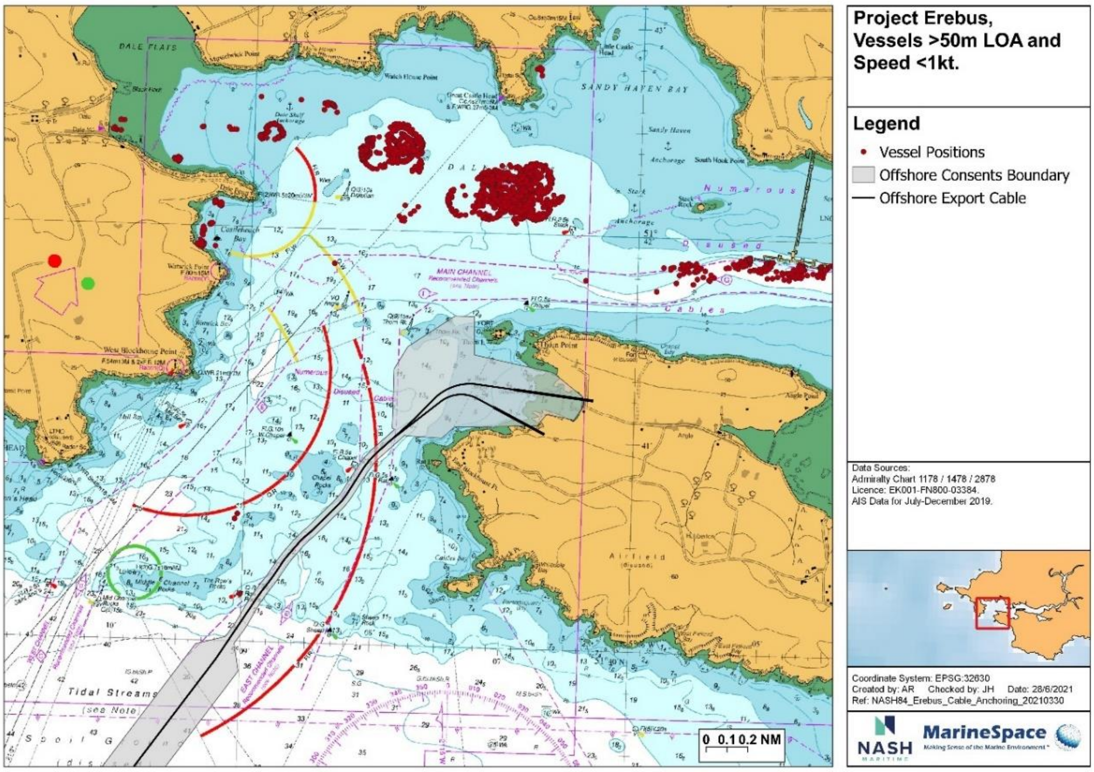


Figure 68 Anchored vessels.

Tankers waiting to enter Milford Haven are shown in **Figure 69** and **Figure 70**. These have been extracted by analysing their behaviour and extracting tankers with an average speed of less than 8 knots. These plots show that whilst some tankers do wait in the waters around the array area, the majority of waiting activity is located to the east of the array.

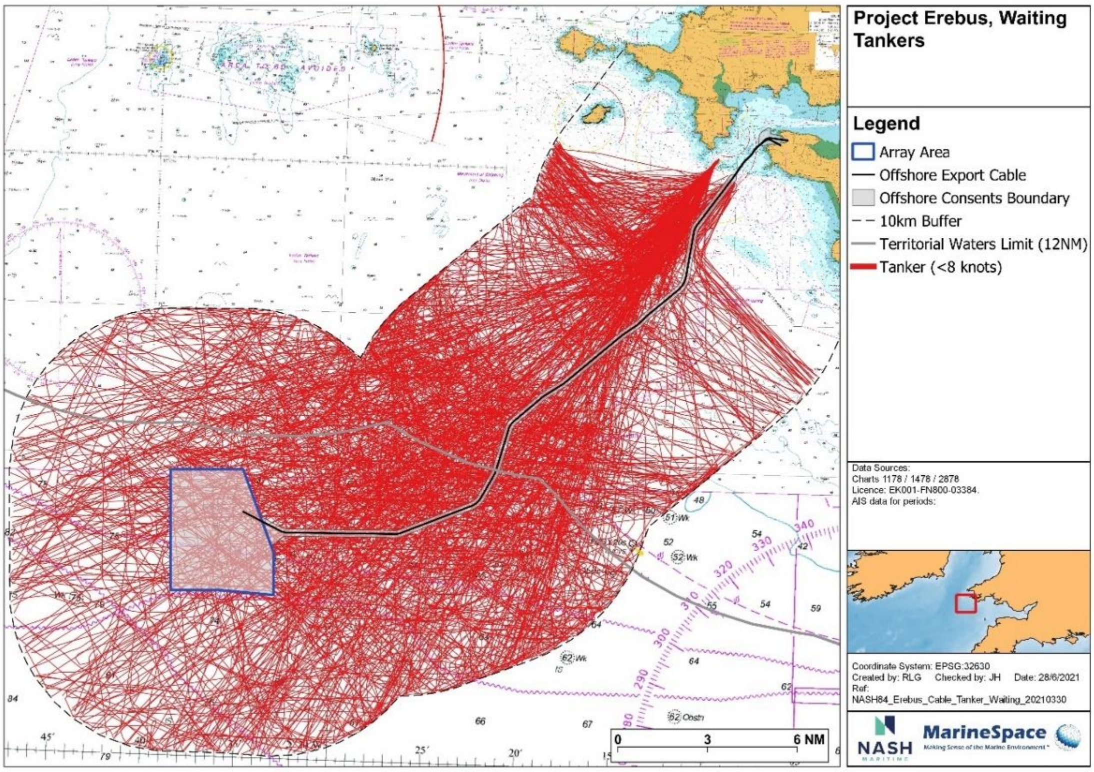


Figure 69 Tankers waiting to enter Milford Haven (travelling <8 knots).

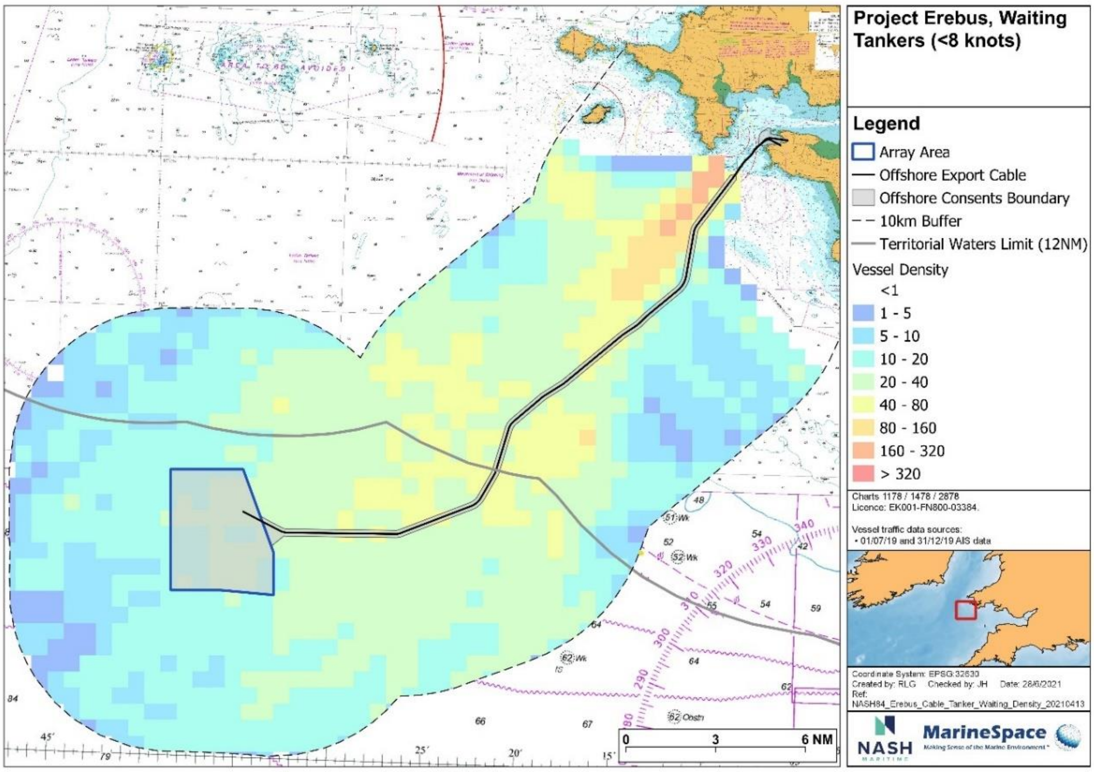


Figure 70 Vessels waiting to enter Milford Haven.

5.4 MARITIME INCIDENTS

Analysis of historical incidents near to the array area can provide additional information on the background frequency and types of accidents which could occur or be exacerbated by the development. Analysis of MAIB, RNLI and MHPA incident data has been conducted for this purpose.

Figure 71 and **Figure 72** show the location of MAIB or RNLI reported incidents within the array area and cable routes respectively. Eight incidents were recorded within 10km of the array, five of which were mechanical incidents with small craft. One near miss was recorded between two fishing vessels. None of the incidents involved large commercial vessels. Almost 275 incidents were recorded within 10km of the cable corridor and are analysed further below.

Figure 73 through **Figure 76** provide a more complete breakdown of the types of accidents recorded within the study areas. There were no recorded collisions, contacts or groundings in the area around the array. 27 collisions were recorded within 10km of the cable route, typically involving small fishing and recreational craft or pilot vessels or tugs. 29 groundings were recorded, 23 of which involved recreational craft. One major incident which occurred in the cable route was the grounding of the *Sea Empress* in 1996. The vessel was inbound into Milford Haven when she ran aground on Mid Channel Rocks and spilt 72,000 tonnes of crude oil.

In addition, a review was conducted of wind farm accidents at other projects reported to the MAIB, recorded by the RNLI or reported within the media. In total 69 incidents were identified between 2010 and 2020, namely:

- 6 collisions (75% involve Wind Farm Service Vessels (WFSVs))
- 29 contacts (27 of which were WFSVs, 2 of which are fishing vessels)
- 21 groundings (100% are WFSVs)
- 13 near misses.

Therefore, most incidents involved with OWFs involve project vessels in contact with turbines during construction or whilst on passage between the array and the O&M port.

Incident data was received from MHPA for 2015 to 2020. The recording formats and summary nature of the content prevents detailed analysis of the incident location and details although qualitative review was undertaken to inform the risk assessment. Review of the trends (**Figure 77**) implies that commercial near miss reporting has increased whilst leisure near miss reporting and incidents (commercial and leisure) have not exhibited any notable trends. It is possible this may reflect recent drives within the industry to promote more near miss and incident reporting.

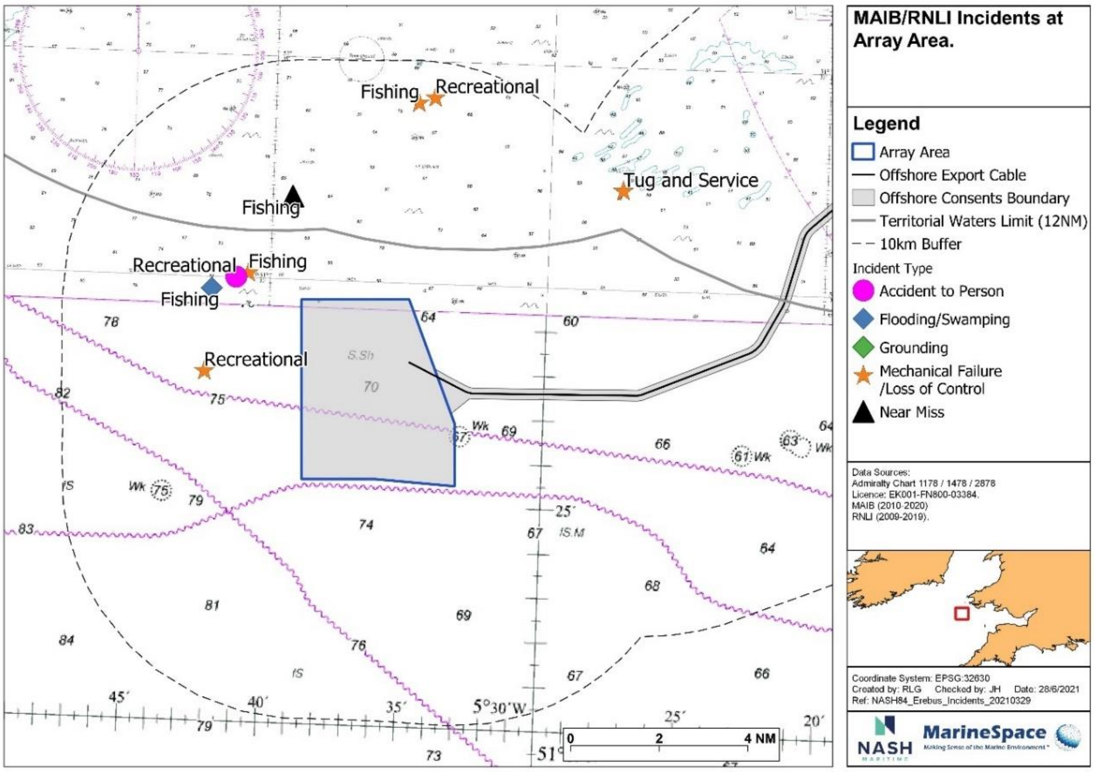


Figure 71 Incidents within array area plus 10km buffer.

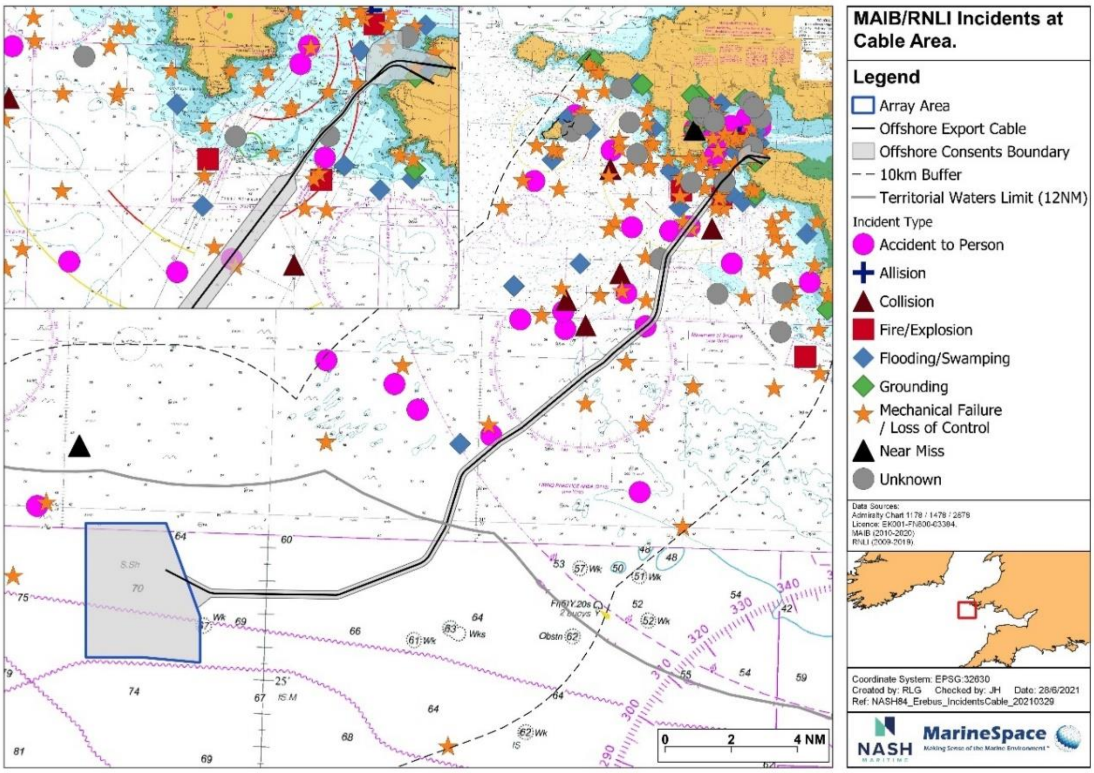
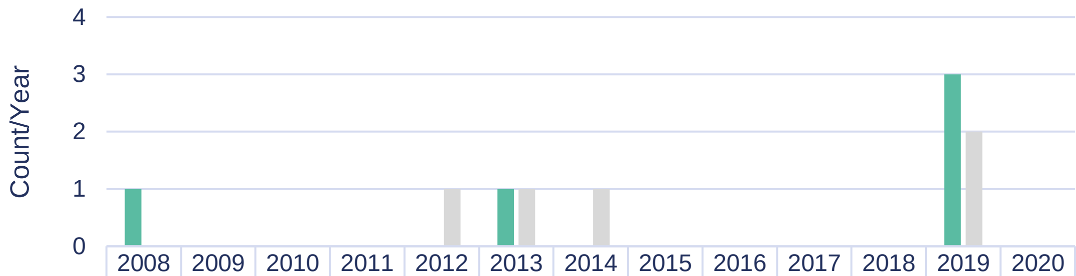
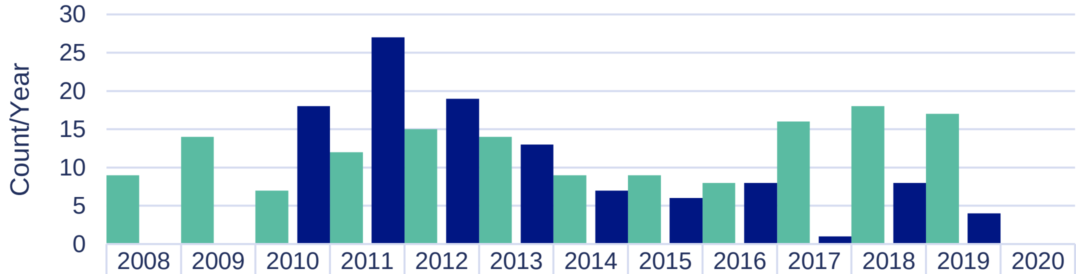


Figure 72 Incidents within cable route plus 10km buffer.



	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
RNLI	1	0	0	0	0	1	0	0	0	0	0	3	0
MAIB	0	0	0	0	1	1	1	0	0	0	0	2	0

Figure 73 Incidents within 10km of array area.



	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
RNLI	9	14	7	12	15	14	9	9	8	16	18	17	0
MAIB	0	0	18	27	19	13	7	6	8	1	8	4	0

Figure 74 Incidents within 10km of cable route.

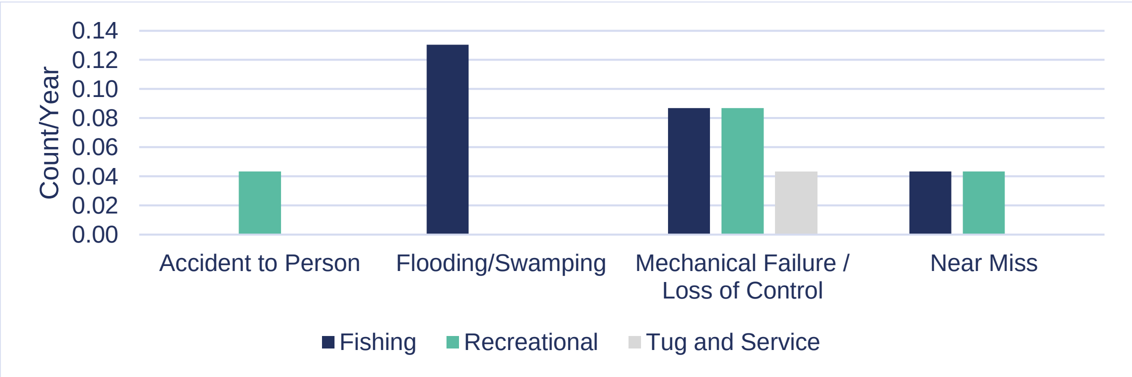


Figure 75 Incidents within 10km of array area by type.

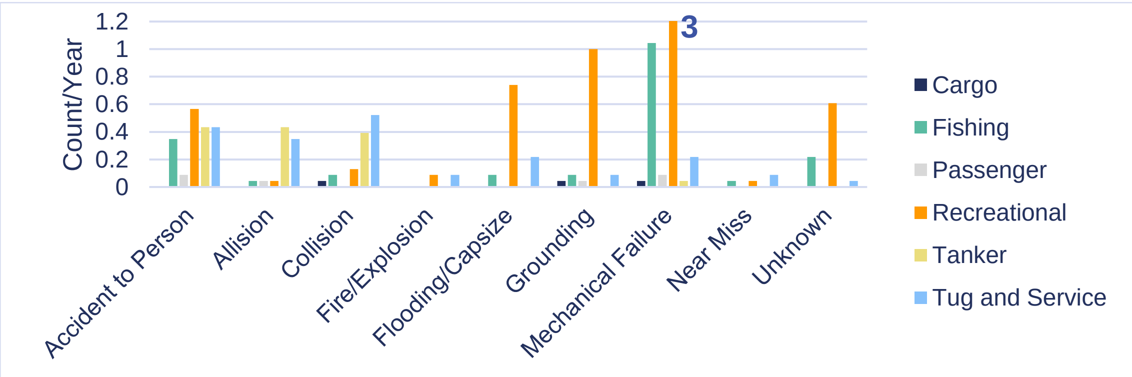


Figure 76 Incidents within 10km of cable route by type.

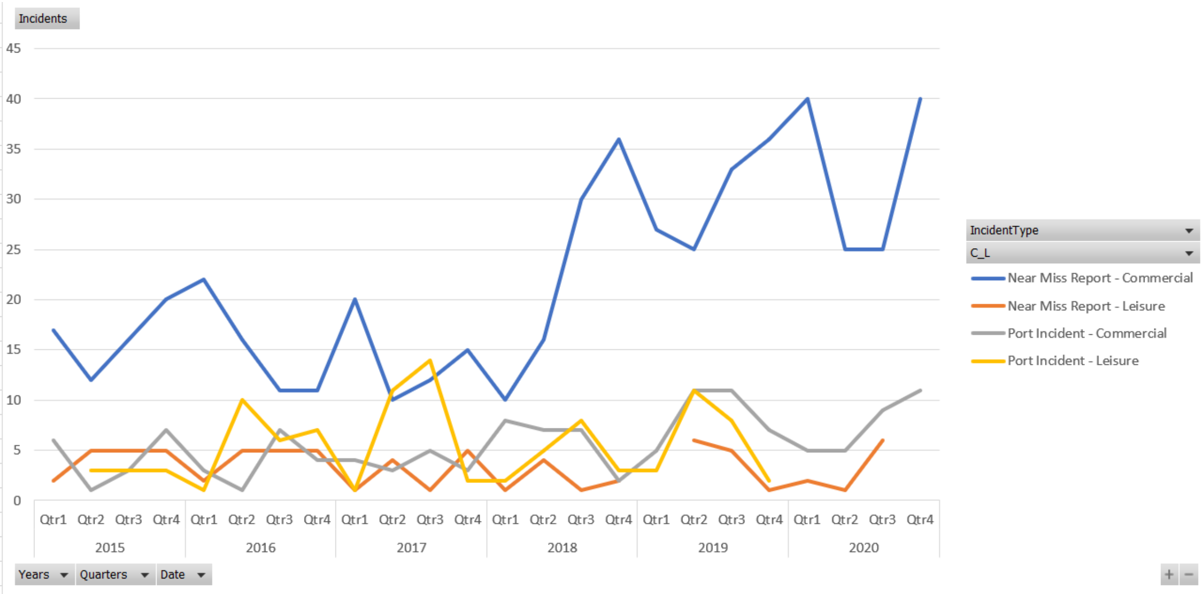


Figure 77 MHPA provided incident trends 2015 to 2020 (Source: MHPA)

6. FUTURE BASELINE TRAFFIC PROFILE

The project has a designed lifecycle of 25 years, during which time it is possible that the frequency and types of vessel movements would change. This section describes the predicted future baseline utilised in the NRA.

6.1 National Trends

Figure 78 shows Department for Transport (DfT) data on UK port trade since 1980. Between 1980 and 2007 there is a general increase from 400 million tonnes to 550 million tonnes, however, following the financial crisis of 2007-2008, trade reduced to 500 million tonnes and has remained relatively steady since. Whilst there may be national macroeconomic factors which might change the number of movements in the study area, this is not considered to be significant.

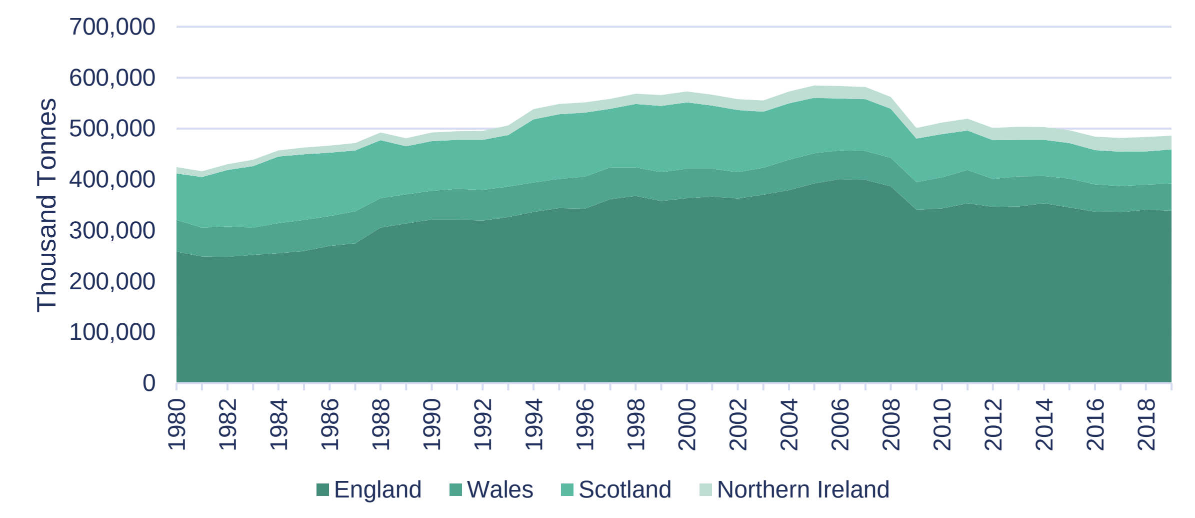


Figure 78 UK Port Trade (1980 to 2019).

The RYA Water Sports Participation Survey conducted in 2019[1] found that the proportion of adults participating in boating activities has fluctuated between 6% and 8% between 2002 and 2018. 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. Therefore, it is unlikely that there will be a significant change in the number of recreational users due to macro trends.

It is anticipated that fishing activity is unlikely to change over the next 5 years, with both UK and non-UK vessels continuing to be active in the region. In the event that there is a reduction in non-UK fishing activity due to restrictions, it is anticipated that this will be balanced by an increase in UK fleet capacity. It is therefore envisaged that fishing activity levels will remain constant for the next 15 to 20 years.

[1] www.rya.org.uk/SiteCollectionDocuments/sportsdevelopment/2018-watersports-study-exec-summary-final.pdf.

6.2 Milford Haven Vessel Trends

Milford Haven is a major port, with 35 million tonnes of cargo and 1,949 shipping movements in 2019.[2] **Figure 79** through **Figure 82** show a selection of statistics recorded by DfT for vessel movements in Milford Haven. Whilst there was a 13% increase in cargo traded last year, the volume is significantly decreased from its peak in 2011. The number of passenger vessel movements maintains a steady level year on year in the last decade, however numbers of tankers fluctuate significantly following changes in the market. This includes 103 LNG vessels in 2019, the second busiest year for the port.

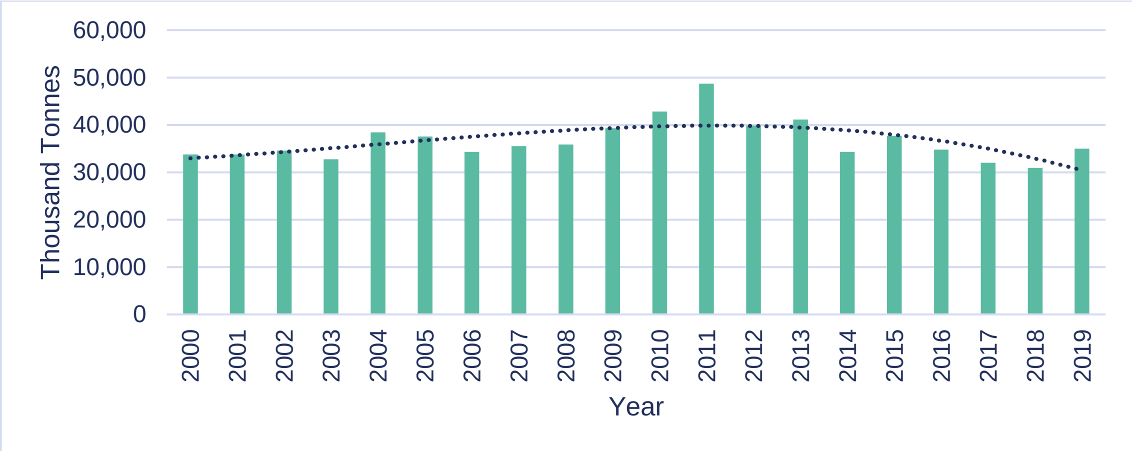


Figure 79 Major and minor port freight traffic by year for Milford Haven Port (DFT).

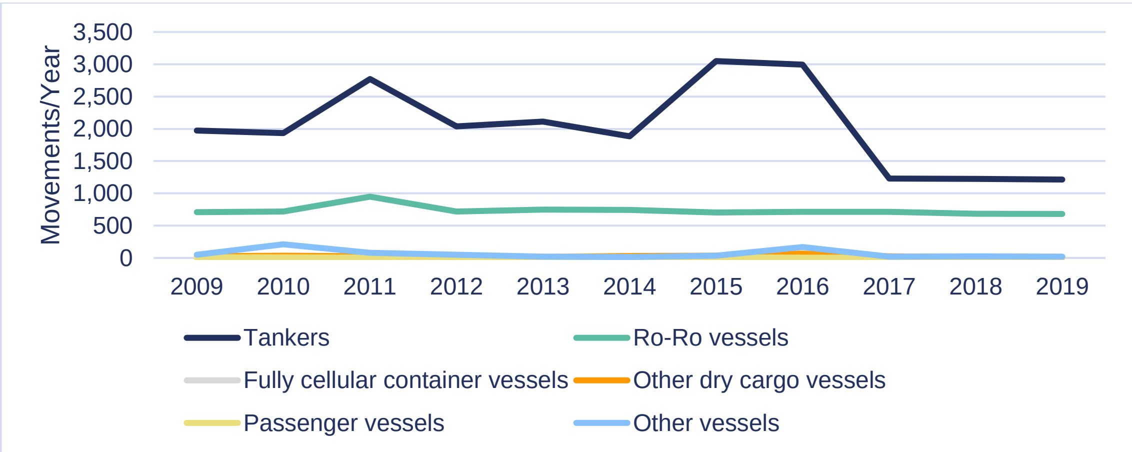


Figure 80 Milford Haven Ship Arrivals by Type (DFT PORT0601) – note change in reporting standard for 2017 onwards.[3]

[2] https://www.mhpa.co.uk/uploads/2020-06-03-06-1-pomh-ar19.pdf

[3] In particular, the pre-2017 system included intra-port movements between Milford Haven terminals whilst the post-2017 system did not. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1002364/port-freight-notes-and-definitions.pdf.

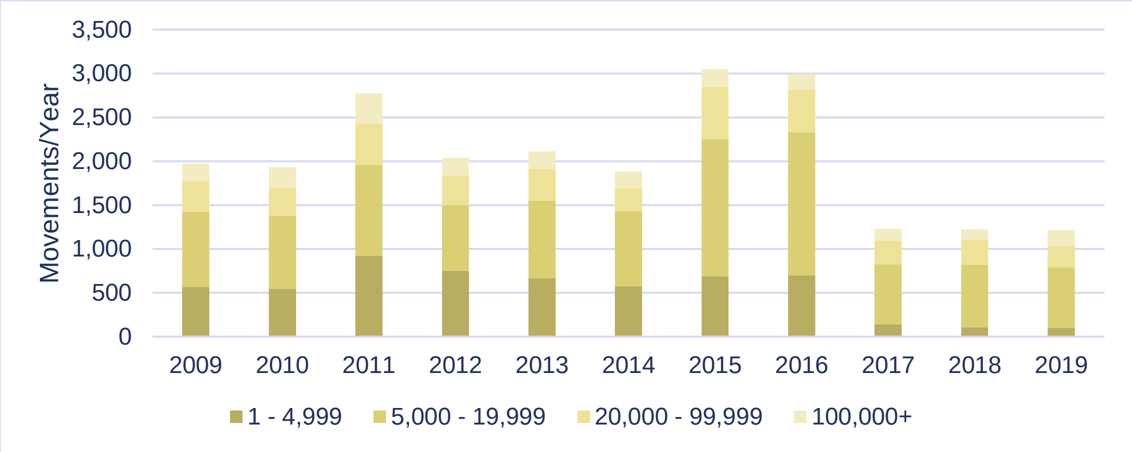


Figure 81 Milford Haven Ship Tanker Arrivals by Size (DFT PORT0601) – note change in reporting standard for 2017 onwards.

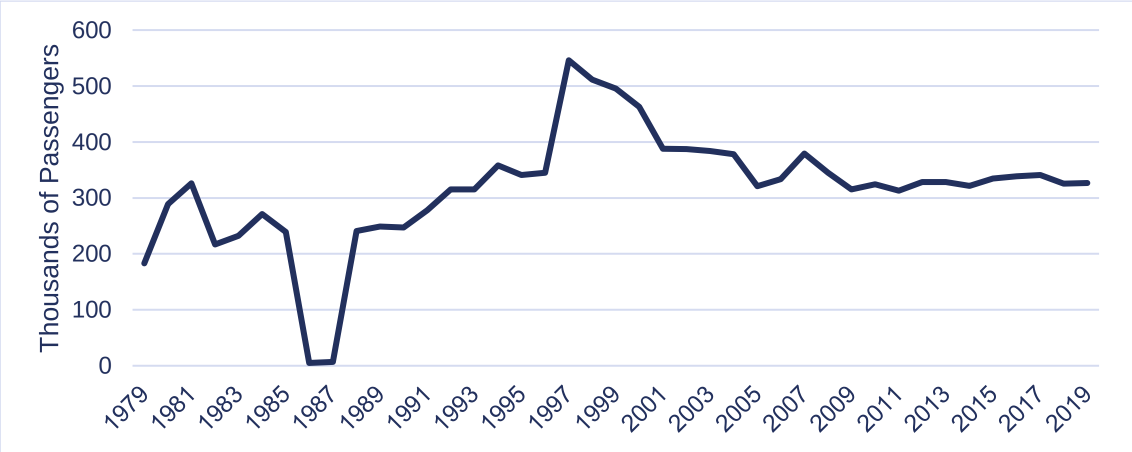


Figure 82 All passenger voyages at Milford Haven (DFT SPAS0101).

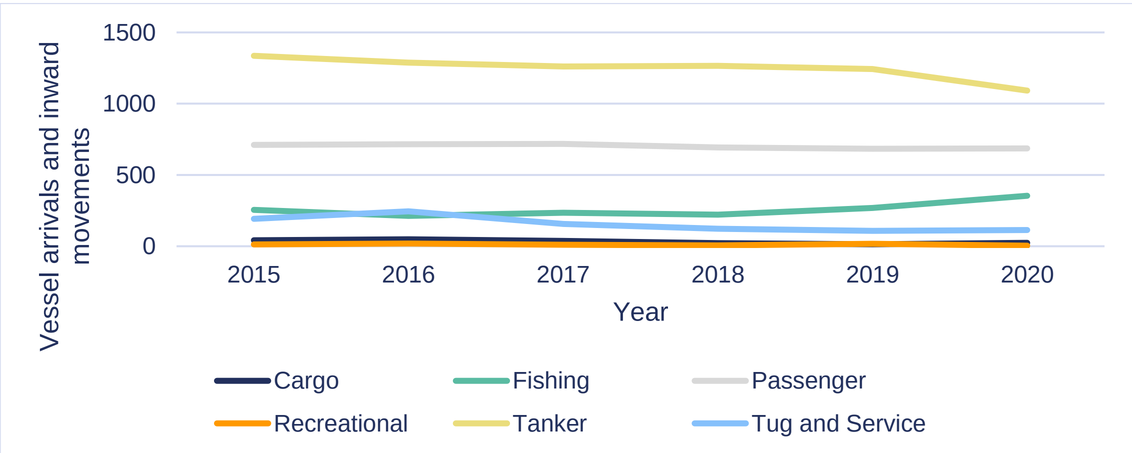


Figure 83 MHPA vessel arrivals and inward movements between 2015 and 2020.

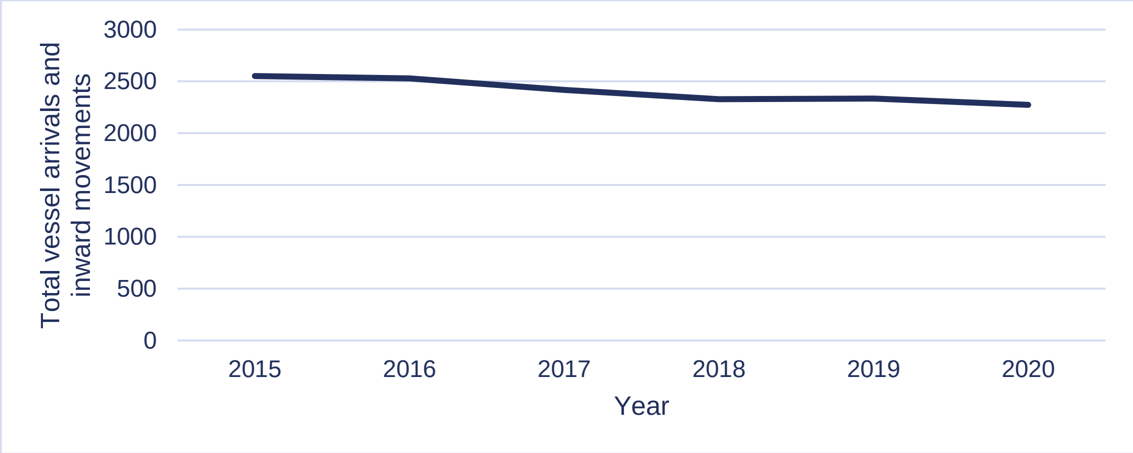


Figure 84 MHPA total vessel arrivals and inward movements between 2015 and 2020.

6.3 Increases in Traffic associated with Project Erebus operations

In **Section 5.3.4**, there were shown to be on average 1,000 movements per month into Milford Haven between the heads. In addition, a number of fishing and recreational vessels may not carry AIS and the total is likely to be higher.

The proposed project vessels during the operation phase assume a maximum of 2 vessels per 12 hour period (in any 24 hour period) resulting in approximately 60 transits per month representing a 6% increase in movements. Therefore, the increase in vessel movements associated with the project are not significant.

7. STAKEHOLDER CONSULTATION

Consultation was undertaken with key stakeholders throughout the NRA process in order to discuss and agree: the data strategy; the approach to the assessment; to better understand the baseline marine usage and vessel traffic; to identify possible impacts that could result from the proposed development and how (and with what evidence base) they may be appropriately assessed and mitigated.

An overview of the consultation process is provided in **Figure 85** and this section provides an overview of which consultees were consulted during this process, when they were consulted and through what means. A summary of key themes and issues is provided at **Section 7.7** and **Table 12**.

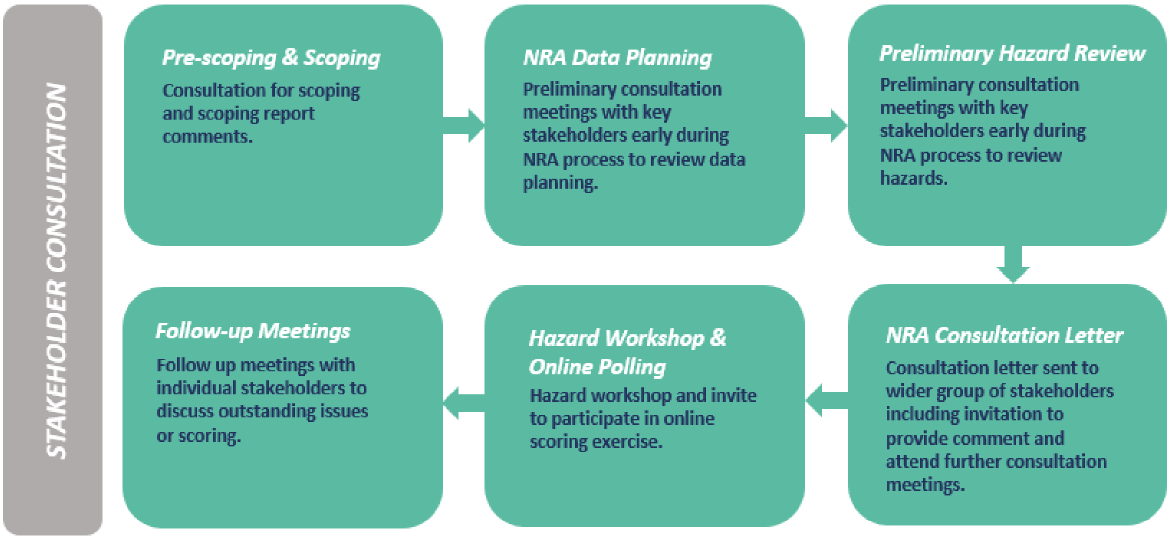


Figure 85 Overview of stakeholder consultation process for the NRA

The following key stakeholder groups were consulted throughout the consultation process from **Figure 85** and summarised in **Table 10**:

- Maritime and Coastguard Agency (MCA);
- Trinity House (THLS);
- Chamber of Shipping;
- Milford Haven Port Authority (MHPA);
- Local and Regional fishing groups;
- Royal Yachting Association (RYA); and
- Recreational and commercial stakeholders.

•

Table 10 Overview of consultation process.

User Group	Consultee	NRA Data Planning (June 2020)	Prelim Hazard Review (January 2021)	NRA Consultation Letter (March 2021)	NRA Consultation Response Received? (March-April 2021)	Attended NRA Consultation Workshop (April 2021)	Post Hazard Workshop Discussions (April-May 2021)
Statutory Regulator	MCA	✓	✓	✓	✓		
	THLS	✓	✓	✓	✓		
Statutory Harbour Authority	MHPA (including pilot representative)	✓	✓	✓		✓	
Industry	Chamber of Shipping		✓	✓		✓	
Government	MOD			✓		✓	
Recreational (Representatives)	RYA (National)			✓	✓		
	Milford Harbor User Association			✓		✓	
	MHPA Water Ranger			✓		✓	
Recreational (Clubs and Groups)	Various consultees. See Appendix B for full list.			✓			
Harbours & Marinas	Various consultees. See Appendix B for full list.			✓			
Fishing	Various consultees. See Appendix B for full list.			✓	✓	✓	
Commercial	Various consultees. See Appendix B for full list.			✓	✓		
Regular Runners	Various consultees. See Appendix B for full list.			✓			

7.1 SCOPING

An EIA Scoping Report was produced by MarineSpace (lead offshore EIA Consultants) and submitted to NRW and Welsh Government in October 2019. Further consultation with statutory bodies and key stakeholders upon the contents of the Scoping Report was then undertaken by NRW. Shipping and Navigation consultation bodies who responded included the below with key points being incorporated within NRW's formal EIA Scoping Opinion (received January 2021):

- MCA
- THLS
- RYA

7.2 DATA STRATEGY / PLANNING

Following appointment as the Shipping and Navigation (S&N) consultant, the NASH Maritime project team held a meeting with the MCA on 08-Jun-2020 in order to provide an overview of the project status (following receipt of the Scoping Opinion) and primarily to input to the project data strategy underpinning the shipping and navigation assessment, specifically the proposed vessel traffic survey and additional datasets as described in Section 5.

NASH Maritime also attended a project consultation meeting with MHPA on 10-Jul-2020 to review potential navigation implications of the project – specifically proposed cable routing within MHPA port limits and potential mitigations for consideration including the option for a separate MHPA specific NRA (dovetailing with the existing MHPA MSMS under PMSC requirements) for cable routing, design, installation and major maintenance/repair activities. This was not progressed and therefore cable impacts within the port limits are incorporated within this overall assessment. Discussions also included review of potential MHPA datasets and co-ordination regarding the vessel traffic survey.

7.3 PRELIMINARY HAZARD REVIEW

In Jan-2021, following completion of the two vessel traffic surveys, a preliminary hazard review was commenced and a number of key consultees were approached to:

- Review key points from the Scoping Report and Scoping Opinion
- Provide a project update (overview of project description)
- Overview of the proposed S&N assessment including NRA methodology, impact assessment and schedule

- Provide overview of S&N project data and evidence sources (including sharing preliminary outputs from the recently completed marine vessel traffic survey) and discussion on activity of your user group where relevant
- Review additional local data sources where appropriate (inc. any additional relevant sources via MHPA)
- Identification of S&N users and stakeholders for consultation
- Discussion on any known potential impacts for inclusion within the NRA

7.4 NRA CONSULTATION LETTER

In Mar-2021, consultation letters were sent to a wide group of potential interested parties, including statutory and non-statutory stakeholders, identified regular operating vessels (regular runners), recreational users, the fishing community and other relevant organisations. The list was developed in conjunction with the lead offshore EIA consultants through analysis of data, desktop review of the area and users together with liaison with other consultees.

Letters to each consultee included project information, explanation of the NRA process and an invitation to provide comment and views on:

- Whether the proposed development of the array area and/or cable route is likely to impact the routing of any specific vessels or the organisation during construction, operation or decommissioning phases.
- Whether the proposed development of the array area and/or cable route is likely to pose any concerns to safety of navigation or specific hazards during construction, operation or decommissioning phases. This request was accompanied with a request that the consultee provide commentary on the potential likelihood and consequence of these hazards to people, property, business and the environment.
- Potential suitable risk controls or means to mitigate impacts on routing or safety of navigation.

Finally, all consultees were invited to attend and participate in Hazard Workshops to be held in Apr-2021. **Appendix B** provides a summary of all parties that were contacted and responses.

7.5 HAZARD WORKSHOPS AND ONLINE POLLING

The Hazard Workshop is a key tool in the NRA process and, following the NRA consultation letters, a group Hazard Workshop was held online on the 22-Apr-2021. Due to government restrictions associated with the COVID-19 pandemic, the Hazard Workshop was held remotely using Microsoft Teams (and telephone dial in) to enable videoconference and screen sharing. A workshop pack containing pre-read material was issued in advance of the workshop and meeting minutes from this workshop were issued (see **Appendix B**). Attendees at the Hazard Workshop included:

- MHPA
- MHPA Pilots
- North Devon Fisheries Association
- Chamber of Shipping
- S&P Trawlers
- MoD
- Celtic Charter
- Milford Harbour User Association
- Water Ranger
- MarineSpace Ltd
- Blue Gem Wind
- NASH Maritime Ltd

During the Hazard Workshop, the following topics were presented and discussed:

1. Project information
2. Vessel traffic analysis
3. Identified Hazards
4. Risk Controls
5. Hazard Scoring

Prior to the Hazard Workshop, and within the pre-workshop pack material, NASH Maritime had prepared, distributed and scored a provisional hazard list as a basis for hazard identification and provisional scoring (with a basis behind each hazard). Workshop participants were invited to input into the scoring and comment on relevant hazards throughout the workshop and, in order to further promote stakeholder input and provide time for consultees to consider their inputs, an online polling system was co-ordinated by NASH Maritime. The online polling remained open to participants for a few weeks following the Hazard Workshop to allow consultees to reflect, review and input to relevant hazards with scores and comments in a considered manner. These were collated and inputted into the NRA to update the preliminary scoring.

7.6 POST HAZARD WORKSHOPS AND ISSUE SPECIFIC MEETINGS

Additional meetings were convened after the Hazard Workshop in Apr/May-2021 to address specific issues raised during the Hazard Workshop and discuss online polling scores. These post Hazard Workshop breakout sessions were specifically held in order to address the following topics detailed further in **Table 11**:

- Hazard scoring for hazards related to fishing vessels (S&P Trawlers)
- Additional hazards providing breakdown/sub categorisation by phase, area and to review draft scores collectively (MHPA)
- Safety zones (MCA and The Department for Business, Energy and Industrial Strategy (BEIS))

Table 11 Post Hazard Workshop Issue Specific Meetings

Meeting	Attendees	Agenda
Post Hazard Workshop scoring for fishing	S&P Trawlers	1. Talk through the scoring methodology 2. Run through the draft hazard scores for hazards relating to fishing 3. Provide opportunity for S&P Trawlers (representing a few local fishermen) to input adjusted scores for relevant hazards
MHPA Post Hazard Workshop Meeting	MHPA MHPA Pilot Representative	1. Review minutes from the Hazard Workshop 2. Review queries and clarifications from Hazard Workshop (including dredging and management of PEC) 3. Review queries on additional collision hazards (further categorisation by area and project phase) 4. Review hazard risk scores for collisions, tankers, commercial and recreational vessels
MHPA Draft NRA Scoring Review	MHPA	1. Review outputs from previous workshop (see above) 2. Modify/amend embedded risk controls 3. Review and confirm scores for additional collision hazards (further categorisation by area and project phase) 4. Review and reconcile MHPA/NASH Maritime scored hazards and agree adopted scores
Safety Zones	MCA, BEIS	1. Review preliminary NRA risk score and results 2. Review proposed safety zones (embedded risk control) for all phases including considerations for potential operational phase safety zone, industry considerations for FOWF and any guidance updates planned.

7.7 SUMMARY OF KEY POTENTIAL ISSUES FROM CONSULTEES

Table 12 provides a summary of key potential issues raised by consultees throughout the consultation process.

Table 12 Summary of issues raised by consultees.

Consultee	Engagement	Key Issues Raised
MCA	08-Jun-2020: NRA Data Planning 20-Jan-2021: Preliminary Consultation Meeting 11-Jun-2021: Safety Zone Meeting	**Comments received during NRA Data Planning Meeting held on 08-Jun-2020** • NASH Maritime sought confirmation from the MCA on whether the proposed survey methodology and data types were considered appropriate, particularly in light of impacts from the COVID-19 pandemic. • MCA agreed that the overall approach was appropriate and the additional information sources would be beneficial. **Comments received during Preliminary Consultation Meeting held on 20-Jan-2021** • Request to see reference to mooring guidance developed between HSE and MCA and third-party verification of mooring arrangements as per Risk Control 17: Inspection / Monitoring Regime. • Safety zones were discussed and MCA noted that the case for any safety zone would require sufficient justification. **Comments received during the Safety Zone Meeting on 11-Jun-20** • Discussion held on whether a safety zone of 50m (or greater) during the operational phase is necessary. • MCA explained that the justification for a safety zone should be based on the following key points and should be clear in how it reduces risk in context with/beyond other risk controls: ○ Necessity ○ Rationale ○ Appropriateness • MCA noted that how the applicant proposes to monitor the safety zone and non-conformities is important and there should be a clear and credible plan on how this will be achieved. • MCA stated that smart/remote and autonomous methods for monitoring would be considered where proposed.

Consultee	Engagement	Key Issues Raised
BEIS	11-Jun-2021: Safety Zone Meeting	**Comments received during the Safety Zone Meeting on 11-Jun-20** • Discussion held on whether a safety zone of 50m (or greater) during the operational phase is necessary. • BEIS noted that loss or sea-space a right to navigation for mariners' would be an important consideration and particularly cumulatively as a policy consideration with the emergence of more floating OWF project UK wide and if Safety Zones become more prevalent.
THLS	20-Jan-2021: Preliminary Consultation Meeting	**Comments received during the Preliminary Consultation Meeting on 20-Jan-2021** • When reviewing preliminary risk control mitigation THLS raised point around the inspection and monitoring in the event of incidents in the vicinity of the array area. • THLS raised concern over the impacts of cable laying on the East Channel buoy and potential changes to Aids to Navigation due to the proposed cable route. Specifically, if any buoys would be displacement due to the cable route.
MHPA	25-Jan-2021: Preliminary Consultation Meeting 22-Apr-2021: Hazard Workshop 20-May-2021: Post Hazard Workshop Meeting - MHPA	**Comments received during the Preliminary Consultation Meeting held on 25-Jan-2021** • Clarifications were provided to MHPA on the platform and turbine design, mooring system and construction phase. • Vessel traffic plots were presented and data discussed, impacts of COVID-19 were discussed. • MHPA noted need for consideration of Greenlink Interconnector within the assessment. • MHPA noted that there is not significant levels of recreational traffic in West Angle Bay in terms of non-AIS vessels. • MHPA noted that consultation with the Water Ranger would be beneficial. **Comments received during the Hazard Workshop held on 22-Apr-2021** • Requested that collision risk between large and small vessels be considered by area, in order to capture area-specific risks. • There may be a pinch point within the vicinity of Turbot Bank, and that this will be considered as an operational matter.

Consultee	Engagement	Key Issues Raised
		Comments received during Post Hazard Workshop Meeting held on 20-May-2021 • MHPA proposed Pilotage Exemption Certificate (PEC) for Project construction vessels within the MHPA area. MHPA would define spatial extent and requirements for limited area PEC for construction and decommissioning phases. • It was confirmed that the Erebus OWF risk assessment undertaken by NASH Maritime does not seek to replicate the MHPA risk assessment although it has been revied by the Erebus team. • Concern was raised around the higher density of traffic within port limits and around the East and West Channels compared to the array area and this should be reflected in area-specific hazards and risk scores. It was agreed that risk scores will be broken out by phase for relevant hazards. • It was noted that it would be useful for MHPA to have input into the schedule and timing of planned works to minimize impact to vessels using the East Channel and resulting use of West Channel can be managed.
CoS	20-Jan-2021: Preliminary Consultation Meeting 22-Apr-2021: Hazard Workshop	**Comments received during Preliminary Consultation Meeting held on 20-Jan-2021** • Confirmed it would be useful to benchmark 2020 data to previous years to identify impacts of the COVID-19 pandemic. • Inclusion of commercial operators and regular runners that transit through array area, even if not entering MHPA. **Comments received during the Hazard Workshop held on 22-Apr-2021** • Clarification was provided that 2020 data will be benchmarked against previous years. • Confirmation that long term MAIB incident data is being used in addition to reference to RNLI and MHPA data.
NRW	Scoping Opinion	**Comments relating to shipping and navigation assessment included in the Scoping Opinion** The following impacts must be scoped into the ES: • The impact of visual intrusion and noise on commercial and recreational craft. • The risk to drifting recreational craft in adverse weather or tidal conditions. • The effect on small craft navigational and communications equipment. • The likely squeeze of small craft into the routes of larger commercial vessels.

Consultee	Engagement	Key Issues Raised
		• A Burial Protection Index study to be included where cable burial is proposed and if applicable, an anchor penetration study should be considered • An assessment of the impact of, and emergency response to, a turbine breaking free of its moorings, along with appropriate risk mitigation measures (e.g. AIS / GPS monitoring of offshore structures). The scoping opinion also outlined requirements surrounding: • Hydrographic survey requirements • THLS AtoNs • MCA consultation • MGN checklist • Third-Party verification of the mooring arrangement
North Devon Fisheries Association (John Balls)	22-Apr-2021: Hazard Workshop	**Comments received during Hazard Workshop held on 22-Apr-2021** • Whilst Erebus project is a comparatively small array site, NDFA raised concern around safety for fisherman fishing in the area, particularly given the increase in infrastructure within the area and other proposed projects. • The mooring systems and subsea cables makes the array area “high risk” and it is unlikely that fisherman would fish within the area to avoid potential risk to gear, and they are also unlikely to pot within the array area. The array area is effectively a ‘no go’ area to fishing. • Confirmation of buoyage would be useful and all information needs to be clearly communicated to the fishing community.
S&P Trawlers	22-Apr-2021: Hazard Workshop	**Comments received during the Hazard Workshop held on 22-Apr-2021** The current array area is in the preferred position from a commercial fishing point of view. There is comparatively little fishing activity within the array area and the location of the array is preferred compared to previous options. Primary concern surrounds the cable as it runs through the central fishing grounds, and area which is heavily towed. Primary concerns related to the cable route include: • Cable burial and seabed movement: concern surrounding movement of the seabed, particularly during winter storms, when the cable could become uncovered. In the event of cable exposure, there is the potential for fishing gear snagging.

Consultee	Engagement	Key Issues Raised
		• Liability relating to snagging events at any point in the lifecycle of the windfarm. There is concern that in the event that a fishing vessel becomes snagged on the cable, that the fishing vessel/persons/company involved could be liable for damage to the windfarm or cable. Reassurance is sought from the fishing community that the cable will be sufficiently buried or protected to prevent potential snagging and clarification is provided around future liability. SW suggested that a larger exclusion zone be considered (around WTG's) for prudency to discourage and prevent fishing vessels snagging on the mooring system or drifting into the array. Suggested potential 0.5 – 1mile exclusion zone around the array considered reasonable considering the length of fishing gear used, fishing vessels and personal experience.
MOD	22-Apr-2021: Hazard Workshop	**Comments provided during the Hazard Workshop on 22-Apr-2021** • Large MOD templates can occupy the entire range area, occurring twice a year. These usually take place in January, seeking periods when there is less shipping to minimise impacts. Templates are planned a minimum of 12 months in advance and can be shared. • Cable landfall location/design will not affect the range. • Primary concern surrounds recreational vessels being diverted into the range during cable laying, particularly as recreational vessels often don't carry radios • A key concern from the MOD is ordnance accidently being set off during cable laying.
Broadside Dale	Email correspondence received 08-Apr-2021.	**Comments received via email on 08-Apr-2021** A description of the charter vessel operation was provided: • Operate two 10m LOA vessels fore recreational fishing, sightseeing and diving activities from Dale, located at the mouth of the Milford Haven waterway. • Vessels primarily operate in the Celtic Deep, approximately 25 to 35 WSW of St Ann's Head.

Consultee	Engagement	Key Issues Raised
		Outlined concerns surrounding the Project, primarily surrounding impact on marine life and business operation. In particular: • Noise disruption to cetaceans, sharks and BFT reducing catches and sightings • Increased traffic between the proposed site and Milford Haven causing hazards and delays. • Project structures, 'no go zones' and service vessels increasing hazards and transit times heading back to Milford Haven. • Vessels converging into routes on the West side to avoid the proposed site increasing collision risks. • Obstructions to the charter vessel drifting activities. Specific concerns surrounding impacts on drifting activities: • Drifting activities relies on an unbroken scent trail. Therefore, any interruption caused by needing to avoid project structures or vessels would interrupt the chart vessel operation. • It was felt that any increased activity to the west of the array area would impact charter vessel operation. • Concern over drifting into the array area or increased transit times when having to navigate around the array area. • Noted that there were approximately 8 other charter vessels operating in a similar manner, with some visiting and private vessels. Concern was raised over the cumulative impacts of the Project and Project Valorous.
Celtic Charter	Email correspondence received 13-Apr-2021. 22-Apr-2021: Hazard Workshop.	**Comments received via email on 13-Apr-2021** A description was given of how the charter vessels operate in the area: • 8 to 10 charted boats operate in the Celtic Deeps, although not necessarily beyond the 100m contour. • Occasional private boats frequent the area. • Season starts in late May and continues through to late October. • The charter vessels target shark, which requires drifting with wind and tide. The distance of drift varies from day to day.

Consultee	Engagement	Key Issues Raised
		Potential impacts to charter vessel activity from the Project were described: • Exclusion zones, or the presence of Project structures, during the lifetime of the Project could impact charter vessel operation. This impact would be worst to the west of the array area when also considering the Off Smalls TSS. • Raised concern over increased traffic around the northwest corner of the array area. • Raised concern over cable laying during the construction phase impacting navigation of recreational and commercial traffic. • Raised concern over cumulative impact of Project Valorous and cable laying during construction. • Impact of increased service vessel traffic associated with the Project on navigation of smaller vessels in the area. **Comments from Hazard Workshop held on 22-Apr-2021** • The charter vessels often undertake drifts near the proposes array area and would therefore be required to cease drift early if drifting towards the array area. Vessels drift would have fishing gear deployed during the drift. • Noted that there are other fishing charter vessels that operate within the area. • Reiterated concern over cumulative impact of multiple projects coming forward in the area.
Milford Haven User Association	22-Apr-2021: Hazard Workshop.	**Comments from the Hazard Workshop held on 22-Apr-2021** It was confirmed that the current array area location has minimal impact on recreational vessels as there are no major routes through this area. The impact of cable laying within the range / port limits on recreational vessels. A primary route for recreational vessels is southeast out of Milford Haven. Cable laying within this area could therefore extend the route for leisure vessels which could make some trips unviable. Liaison between the cable lay vessel and the Castlemartin firing range to provide agreement on suitable inshore route for leisure vessels, would mitigate this by reducing displacement of leisure vessels. This may also impact tourist and fishing vessels. A southeasterly (inshore) departure route for recreational vessels agreed between MHPA, the range, cable contractor and other groups would be reviewed.

Consultee	Engagement	Key Issues Raised
		Noted that AIS aids to navigation on the WTGs could leave vessels unequipped with AIS receiving ability (or radar) at risk of contact in restricted visibility conditions.
Milford Haven Water Ranger	Telephone conversation on 13-Apr-2021.	Indicated that there were no major concerns regarding the Project and that the key consideration would surround fishing activity.
Irish Ferries	Telephone call following letter and email correspondence.	Telephone call elicited no major concerns.
RYA (National)	Letter received via email correspondence on 07-Apr-2021.	**Comments from letter dated 07-Apr-2021** The RYA reiterated their support of well-planned and designed energy projects that consider recreational use and safety and signposted to their position statement for offshore wind energy. The RYA presented comments which covered: 1. Accuracy of surveys of recreational traffic that rely solely on AIS data given that some recreational vessels do not carry AIS transponders. 2. Emphasis of visual surveys for inshore areas to identify recreational traffic. 3. Stated 20-30% use of AIS by larger recreational craft within offshore areas and use of radar reflectors. 4. Identified that cable landfall is located within an RYA General Boating Area and likely high recreational traffic. 5. The RYA Coastal Atlas indicates that the entrance to Milford Haven is of moderate to high use area for craft fitted with AIS, and moderate use offshore. 6. RYA AIS intensity data shows low recreational use within or immediately east of the array area. Low intensity recreational cruising route between Milford Haven and Land's End. 7. The RYA will be concerned that construction and operation of the wind farm and cable route does not increase collision, allision or grounding risk to recreational craft; and that risk has been properly assessed, given how recreational craft are likely to be equipped in this area. Proposals should keep disruption of recreational activity to a minimum and not exclude users from areas previously used for recreation.
South Hook LNG	Email correspondence received via MHPA on 09-Apr-2021.	**Comments received via MHPA email dated 09-Apr-2021.** The Terminal would be looking for re-assurances on: • During construction, operation or decommissioning phases there will be no adverse impact on LNGC vessels for SHLNG

Consultee	Engagement	Key Issues Raised
		• Location of the Windfarm & cable route will not significantly limit approach to Port of Milford Haven / SHLNG • Ongoing maintenance of the new facility - there will be a robust plan in place that will limit risk of any unplanned disruption to shipping routes.

8. Potential Impacts

Table 13 summarises the key potential impacts raised by review of the EIA Scoping Report, NRW Scoping Opinion, guidance documents (**Section 2**), review of the baseline (**Section 5**) and stakeholder consultees (**Section 7**). Each of these issues are discussed in the preceding sections.

Table 13 Key Impacts of Project.

ID	Impact	MGN 654 Ref	Issue raised by:
1	Vessel Routeing	4.6, 4.7, 4.10	
2	Contact (Allision)	4.7, 4.10	NDFA S&P Trawlers Broadside Dale Celtic Charter
3	Collision	4.6, 4.7, 4.10	Broadside Dale Celtic Charter MHPA
4	Operations at MHPA	4.10	MHPA MHPA Water Ranger Irish Ferries MOD Milford Harbour User Association
5	Cable Route	4.8	S&P Trawlers MOD Celtic Charter Milford Harbour User Association South Hook LNG Chamber of Shipping
6	Search and Rescue	4.11, Annex 5	MCA
7	Visual Navigation and Collision Avoidance	4.8	
8	Communications, Radar and Positioning Systems	4.13, Annex 2	
9	Under Keel Clearance and Snagging	4.8, Annex 3	MHPA THLS S&P Trawlers Broadside Dale Celtic Charter NDFA
10	Breakout	6.5	NDFA MCA THLS
11	Cumulative Effects	4.6	MHPA Broadside Dale Celtic Charter NDFA

8.1 Impact On Vessel Traffic Routeing

Based on the vessel traffic survey, **Figure 86** marks the key routes in relation to the array area which has been reviewed in context of supporting information from the WNMP as shown in Error! Reference source not found.. The most significant are more than 10nm to the west with m ore approximately 9,000 vessels a year utilising the Off Smalls TSS. Secondly, the route inshore of the Smalls is used by the Rosslare ferry and Milford Haven traffic into St Brides Bay, with approximately 2,500 movements per year. All of these routes are considered sufficiently well clear of the array area.

Four routes are identified through the study area from the Bristol Channel, one passing inshore of the Smalls, two joining the Off Smalls TSS (passing either side of the special yellow marks) and one through to Cork. All of these routes are more than 2nm from the array area and collectively account for 1,200 movements per year.

Finally, three routes pass through the study area in a south-west north-east direction. The main route from Land's End to Milford Haven is more than 7nm clear to the east. Secondly, a minor route is identified between Land's End and inshore of the Smalls with <200 transits a year, passing 1.5nm from the eastern boundary of the array area. This route consists of mostly 80-200m cargo and tanker vessels between ports such as Liverpool, Rotterdam and Bilbao, or using the St Brides Bay anchorage. Thirdly, for vessels approaching Milford Haven from the Atlantic, a route of approximately 400 transits a year passes through the array area. These vessels originate from US Ports (Houston), Russian (Sabetta) or Ras Laffan (Qatar), including the largest LNG Tankers. This route is significantly dispersed with not all vessels transiting through the array area. Given the distance of travel for these vessels, it is not anticipated that the additional deviation around the array would have a significant impact on their operations.

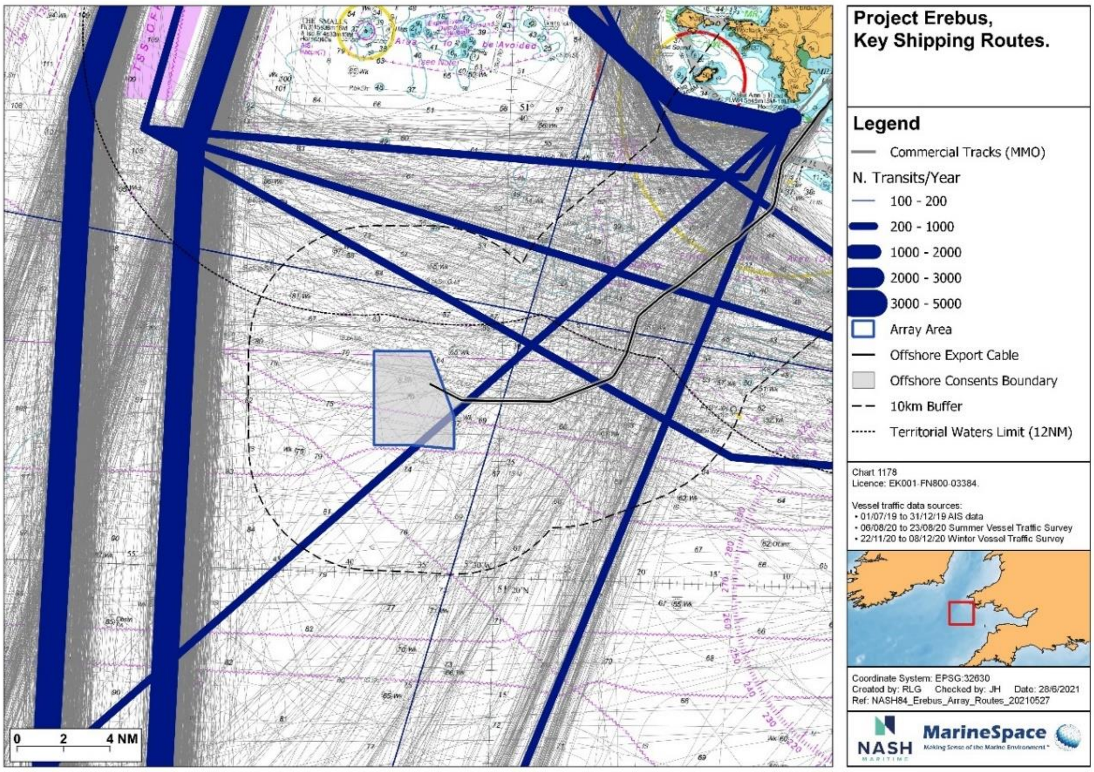


Figure 86 Key shipping routes in study area.

8.2 Risk of Contact

As with many OWFs, those vessels most likely to come into contact with a turbine are the construction and maintenance vessels given their operational requirements. Hard contacts are known to occur relatively frequently on other projects (**Section 5.4**) and therefore the likelihood of this has been scored higher than other hazards. In particular, during construction and decommissioning, with potentially semi-constructed turbines, a hard contact resulting in some damage is a realistic possibility. Given the size of these vessels, such an event may result in significant damage to the vessels, turbine and result in delays of the project.

Section 5.3.2 demonstrates that the array area is not within any major offshore routes for commercial vessels. The major shipping route is located more than 10nm to the west between the Off Smalls TSS and Land's End. Furthermore, routes into the Bristol Channel typically pass to the north and routes into Milford Haven pass to the north or east of the array area. Therefore, the risk of a powered commercial ship contact into the array is not considered likely, but if it were to occur could have significant damage to the turbines and the ship, resulting in major damage and pollution. Given the proximity of these shipping routes, and the addition of the loitering vessels for Milford Haven (**Section 5.3.2.5**), a drift contact is more likely which has a lower potential consequence.

The array area is located a significant distance from shore with few recreational routes identified either in the data analysis (**Section 5.3.2.4**) or consultation (**Section 7**). Therefore, it is unlikely that a recreational vessel would contact a turbine. Were it to do so, a glancing blow with minor damage is the most credible outcome.

During consultation, the risk of contact was mostly identified by fishermen. In **Section 5.3.2.2** it can be seen that there is evidence of fishing activity around the array area but limited within it. Compared to conventional OWFs with fixed monopiles where fishermen routinely fish within the array area, the presence of subsurface infrastructure made it more likely that fishermen would avoid the array area due to the potential risk to safety and damage or loss of gear. Several consultees described the array area as becoming a no-go area for fishing. Therefore, there will be a natural tendency to offset their activities from the array area and the risk of potentially contacting a turbine is reduced. Were a contact to occur, through for example mechanical breakdown or error, the most likely outcome would be a glancing contact with minor damage. However, it is possible but unlikely that the fishing vessel could capsize with the potential for loss of life.

To provide some quantitative metrics of allision probability, modelling in IWRAP has been conducted for the array area using an example layout. **Figure 86** shows the results of the analysis with deviated routes for commercial vessels. Prior to the project, the risk of contact with a turbine is zero as there are no other structures near the array area. With the project, the calculated risk of contact for commercial vessels is once in 712 years. The turbines to the south-east are shown to be most at risk, given the proximity to the routes passing south-west to north-east (into Milford Haven).

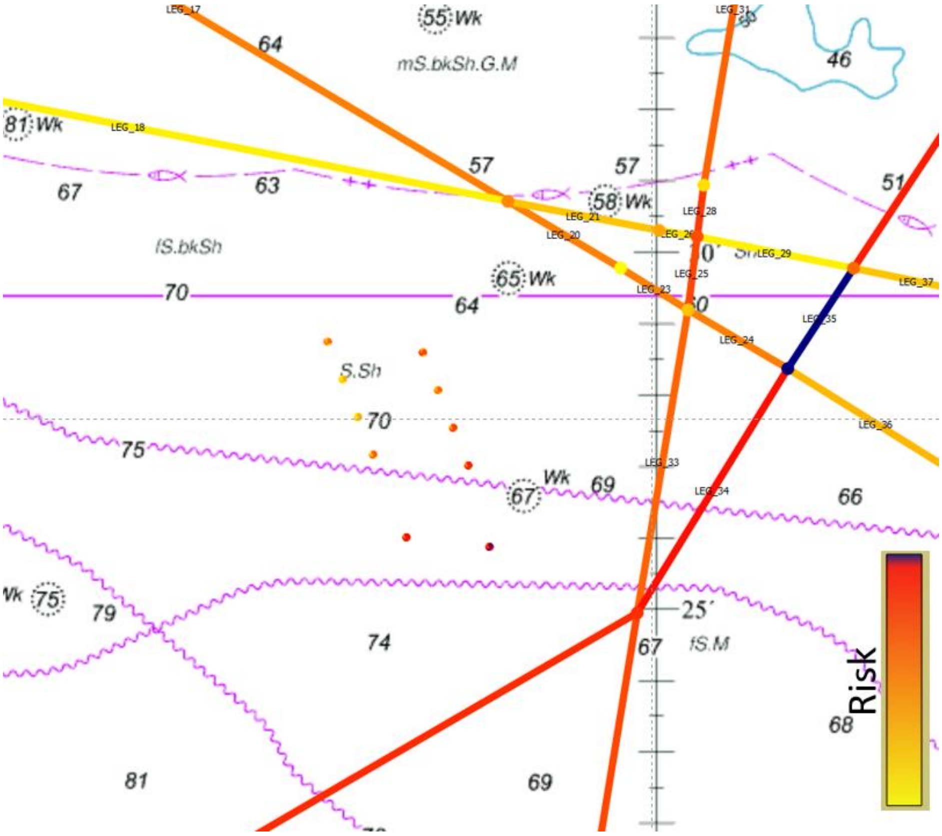


Figure 87 Risk Modelling Results

8.3 Increased Collision Risk

An OWF can increase the risk of collision in two ways. Firstly, the construction of an OWF in an otherwise navigable area can constrain shipping routes and result in pinch points or areas of high density. As shown in **Section 8.1**, the array is well clear of all the major routes in the study area. Whilst some offsetting of shipping, including loitering vessels, is inevitable, there is significant sea room to support this and therefore the increased risk of collision is believed to be negligible.

Secondly, the risk of collision can be heightened through additional vessel movements. Particularly during construction/decommissioning or during O&M where there will be more vessel movements between the array and Milford Haven. These vessels are typically high-speed catamarans, and there have been incidents on other projects of collisions or near misses with other users (**Section 5.4**). These vessels will be required to comply with the principals of good seamanship, COLREGs and regulations of MHPA in order to safely transit into MHPA's waters. However, given the relatively low number of additional movements this will entail, the increased risk is not considered to be significant.

To provide some quantitative metrics of collision probability, modelling in IWRAP has been conducted for the array area. Figure 86 shows the results of the analysis with deviated routes for commercial vessels. Prior to the project, the risk of collision is calculated as less than once in 10,000 years. The increase is shown to be negligible and remains less than once in 10,000 years. Whilst there is some impact on the vessel routes, the density of traffic is low in the study area and therefore the impact on collision risk is not shown to be significant.

8.4 Impact on Operations at Milford Haven

8.4.1 Cable Laying

One of the most significant impacts raised by stakeholders was the impact on vessel movements in the approaches to Milford Haven during cable laying. The cable route is approximately 47km long and a cable laying vessel can achieve more than 1km lay per day (see **Figure 88**). Therefore, it is anticipated that for between 1-2 weeks the cable laying vessel will be effecting movements into Milford Haven, particularly within the East Channel.

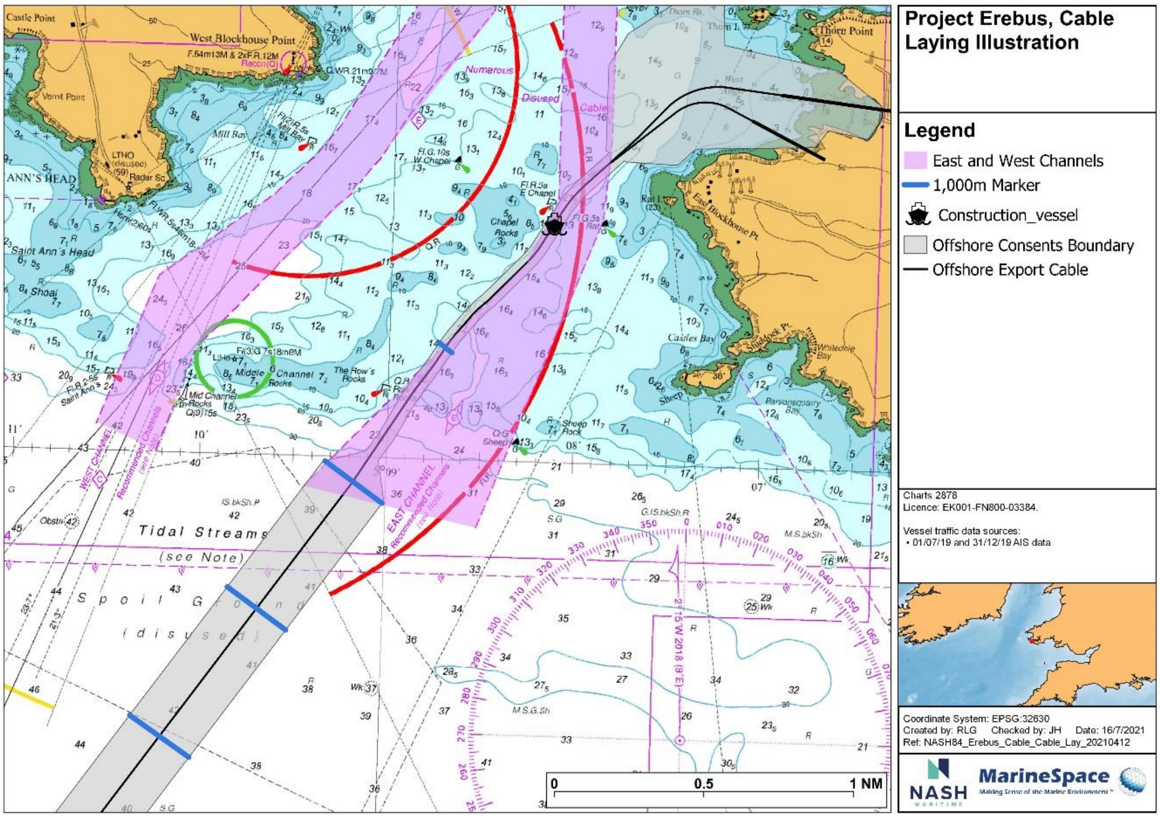


Figure 88 Cable Laying with 1km sections.

For the safety of the cable laying vessel, cable and other users, an advisory safe passing distance of up to 1,000m is proposed during these activities. This would result in several users to be impacted:

- Temporary suspension of use of east channel would cause operational impacts to large vessel movements into Milford Haven through displacement of vessels into the west channel and potential co-existence conflicts.
- In combination with the shallows at the Turbot Bank to the south-east of the East Channel, vessels would be greatly offset during the latter stages of cable laying.
- Recreational cruising to the south may not be feasible for small durations during cable laying.
- Offsetting recreational users further inshore to avoid the cable layer would cause disrupting to the firing range.

Many of these impacts are significant for a temporary period but can be mitigated by continual liaison between the cable laying vessel and MHPA. In particular, the development of a suitable temporary inshore passage and operational co-ordination protocol when the ranges are active was proposed to be developed to reduce displacement of recreational vessels which would otherwise need to navigate round.

8.4.2 Loitering Vessels

During analysis of baseline vessel traffic data and consultation with MHPA, it was noted that large commercial vessels calling at Milford Haven would routinely loiter approximately 10nm offshore, including within the vicinity of the array area. Whilst the construction of the wind farm would necessarily offset these vessels, there is sufficient unobstructed and quiet sea room to the east for this not to have a significant impact.

8.5 Risk of Export Cable to Navigating Vessels

Subsea cables are both at risk of anchor or fishing gear strikes and can pose a hazard to navigating vessels. The final export cable route and burial/protection method will be reviewed following the completion of a cable burial risk assessment. The cable is intended to be fully buried, or where this is not possible, protected using rock armouring.

The vessel traffic data shows limited fishing activity near to cable landfall where cable burial might not be achieved and. Therefore, the risk of snagging is reduced. Offshore, with more significant depths of water and the fishing activity is far greater, the risk of snagging is mitigated. Were a fishing vessel to snag the cable, the most likely outcome is loss of gear and potentially minor damage to the cable. A worst credible outcome however is the loss of the fishing vessel as it capsizes.

For recreational vessels, the risks of the cable are limited to the landfall location, where vessels anchor in West Angle Bay. Given adequate protection, it is unlikely that a yacht's anchor would either snag or damage the cable. Furthermore, the MCA and RYA recommend that any protection should not reduce the under-keel clearance for navigating vessels by more than 5%. Any protection should account for this to prevent an additional risk of grounding.

There is no evidence of commercial vessels anchoring in the vicinity of the cable route (**Section 5.3.5**). The presence of the cable in the East Channel could influence a pilot or master's decision to deploy an anchor in an emergency, such as following engine failure. These events are rare, and it is likely that the prevention of a grounding would be overriding requirement. Therefore, this scenario is not considered likely.

To better understand the potential interactions between the cable and navigating vessels, a Burial Protection Index (BPI) study has been conducted. The methodology was developed in the 1990s (Mole et al. 1997; Allan, 1999) and consists of three levels:

- BPI = 1: Protection from fishing gear and small recreational anchors.
- BPI = 2: Protection from vessels with anchors up to 2 tonnes.
- BPI = 3: Protection from the largest vessels, including in major anchorages.

The cable route consists of two principal sections, inshore at Angle Bay, which is charted as having a sandy and rocky bottom. As only small vessels fish or anchor here, only a BPI of 1 is required. Given this BPI requirement and bottom type, a burial depth of >0.5m is warranted. Once the cable enters the East Channel and into the Irish Sea, the types of vessels passing over the cable increase in size, therefore, a BPI of 3 is required. The remainder of the cable route consists of Rock, Gravel and Fine Sand and Broken Shells. Given this BPI requirement and bottom type, a burial depth of >1.5m is warranted.

The BPI is a high-level tool for determining appropriate cable burial depths. It has recently been superseded by the Cable Burial Risk Assessment Methodology (Carbon Trust, 2015) which is more detailed and practical. The Applicant intends to undertake a full CBRA prior to making final decisions on cable burial/protection which will be informed by results of this further work conducted using this methodology.

The 5% UKC commitment is provided within the embedded risk controls and is appropriate for the vast majority of the cable route.

8.5.1 Nearshore Export Cable / Landfall

For the very nearshore/landfall portion and between 3m and 5m LAT there may be localised protection that reduces the depth and beyond the 5% UKC rule threshold. As this depth/location lies within the line between Thorn Pt and East Blockhouse Pt (**Figure 89**) this is considered very localised and any grounding hazard will likely only relate to small/recreational fishing and recreational user type categories within the bay rather than on transit.

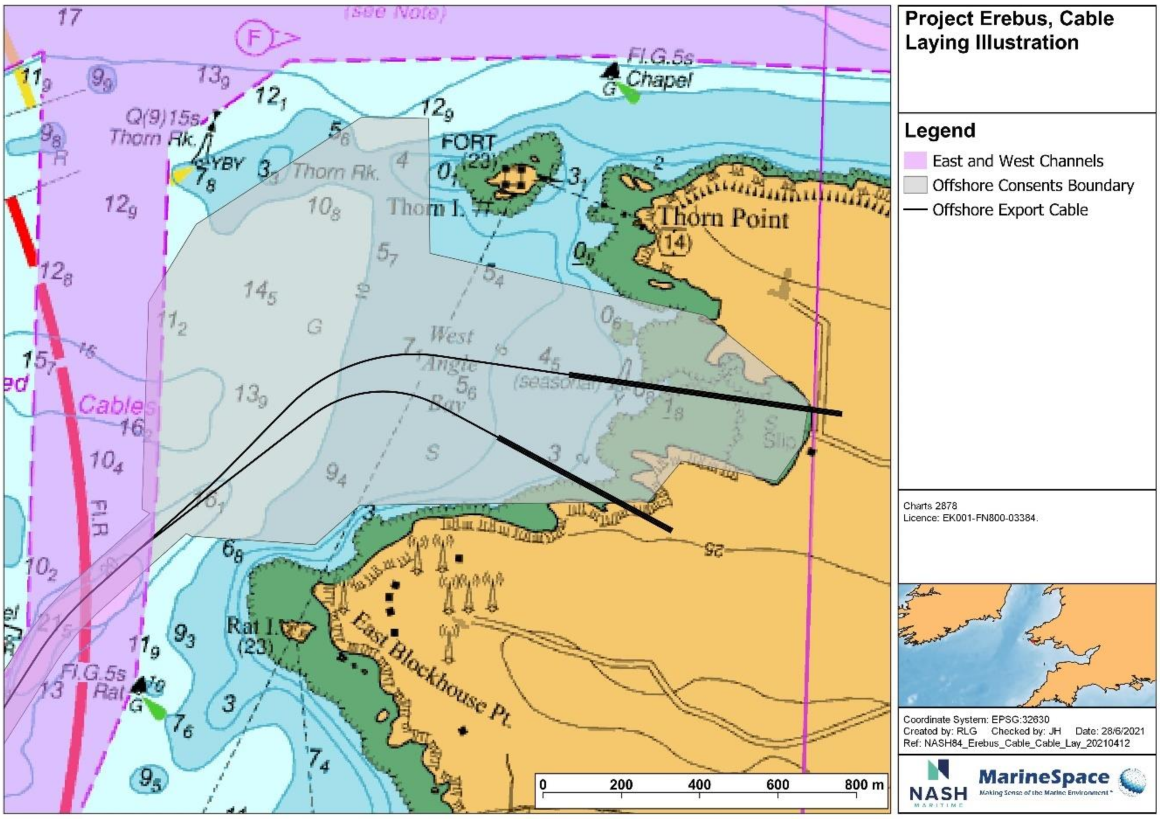


Figure 89 Cable landfall within West Angle Bay.

8.6 Impact to Search and Rescue

In the unlikely event of an incident, SAR assets are required to access the array area 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.

Although the wind farm layout is under development the project is seeking to maintain a minimum of two lines of orientation and the relative spacing between platforms is sufficiently large that the potential excursion of up to 50m of platforms around their nominal central location is not considered significant to surface or aviation SAR.

The final project layout should be reviewed by the MCA in order to ensure that access of SAR assets is not compromised. Given the small size of the array area, the impact on SAR response is not considered to be significant.

8.7 Visual Navigation and Collision Avoidance

MGN 654 notes that an OWF could block or hinder the view of other vessels or any navigational feature such as the coastline or aids to navigation. Given the relatively low traffic density near the array, the small diameter of the turbines and the distance to other navigation aids or hazards, this is not considered to be a significant impact.

8.8 Impact on Communications, Radar and Positioning Systems

MGN 654 notes that an OWF may have adverse impacts on the equipment used for navigation, collision avoidance or communications. A significant body of work has been conducted to examine these impacts on detail, and reference is made to the following studies:

- 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 Maritime and Coastguard Agency.
- BWEA (2007). Investigation of Technical and Operational Effects on Marine Radar Close to Kentish Flats Offshore Wind Farm.

Table 14 provides a summary of these potential impacts, for which there are not anticipated to be any significant effects.

Table 14 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 turbines. The QinetiQ study found no noticeable effect on VHF communications both ship-shore and ship-ship within or adjacent to the wind farm.
AIS	AIS enhances the identification between vessels for collision avoidance. AIS signal could be blocked or interfered with by the presence of turbines. The QinetiQ study found no noticeable effect on AIS reception.
GNSS	GNSS (such as GPS) is used for satellite positioning systems and navigation. Satellite reception could be impacted by the presence of turbines. The QinetiQ study found no noticeable effect on GPS reception.
Marine Radar	Marine radar is used for both collision avoidance and vessel navigation. Wind turbines, like other structure, can result in spurious returns such as echoes, reflections and blanketing. These effects were studied in both the QinetiQ and BWEA studies. Based on this, the MCA developed a shipping route template that placed the extent of these effects at 1.5nm, increasing as the vessels transit closer to the turbines. As shown in Sections 5.2.6 and 8.1, near the array area the density of traffic is low and there are few other navigational hazards, and therefore this impact is not considered to be significant.
Shore Radar	Similar to marine radars, shore radars could be impacted by the wind turbines. However, MHPA do not routinely monitor this area and it is outside their port limits, therefore this impact is not considered significant.
Noise	The sound generated by the turbines could mask navigational sound signals from vessels or aids to navigation. Whilst turbines make an audible sound whilst rotating, the low density of shipping and distance to other navigational marks makes this potential impact negligible.
Compass	Compasses are used for vessel navigation. These are potentially impacted by electromagnetic interference from the turbines or cable. The degree of this impact is related to the depth of water, cable design and alignment with the earth's magnetic field. Whilst this has impact has not been directly observed in studies, it is possible that small vessel compasses could be impacted near to cable landfall.

8.9 Impact on Under Keel Clearance of Mooring System and Potential Snagging

The location and of the mooring lines (mounted to the underside of the heave plates at 17.4m below surface and with a steep gradient catenary) and the array cable (within the footprint of the subsea mooring system) mean that minimal risk is posed to surface navigation of vessels of most size and any interaction potential with large draught vessels (greater than circa 15m in draft) is considered unlikely as vessels of this size will likely transit significantly clear of the platform.

Stakeholder concern was raised regarding fishing vessels with deployed gear and the potential snagging with consequence of risk to life, damage to gear and the mooring system. As per the risk of contact (8.2) most fishing vessels (with deployed gear) were considered likely to self-exclude with an appropriate buffer distance to safeguard risk to vessel, safety of life and damage/loss of fishing gear in consideration of their vessel, prevailing conditions and other factors. However, and in the absence of formal exclusion measures, it was recognised that some fishing vessels may elect to fish in close proximity to the turbines (and subsea equipment) for competitive advantage or end up in close proximity with gear deployed through error or having not appreciated the potential excursion of the platform (of up to 50m) from its nominal and charted position.

Given the low density of vessel traffic and the general preference of all vessel masters on avoidance of wind turbines, it is unlikely that a surface navigation vessel will contact and snag the subsea mooring and cable arrangements. It is more likely that a fishing vessel with gear deployed will contact and snag the subsea mooring and cable arrangements with a potentially high consequence outcome including capsize, loss of life and damage to gear, vessel or platform.

During major maintenance, the inter-array cables may be left in the water column whilst the WTG is removed for maintenance. In this scenario, a 500m safety zone should be applied in order to mitigate the risk of potential snagging.

8.10 Risk of FLOW Turbine Breakout

Were the moorings to partially or completely fail, and the turbine become significantly displaced from position or break free, it could become a navigational hazard to other vessels. The mooring systems are designed to resist extreme conditions such as 50 year return period event (i.e. significant wave height of 12.5m and wind speed of 40.4m/s (1-hr averaged)) therefore, the likelihood of breakout is low.

Were the turbines to breakout, they will still be marked and visible to other navigating vessels and a response plan will be included within the ErCOP with additional measures such as failure warning measures and tracking devices as well as response and recovery procedures. These measures will assist other navigating vessels to identify and avoid the hazard. The risk of collision is therefore very low.

8.11 Cumulative Effects

Consideration has been given to the potential cumulative impacts of the project with potential future projects in the Celtic Sea. Error! Reference source not found. **Table 15** identifies projects that, together with one another, have the potential to impact shipping and navigation greater than each in isolation. The cumulative effects as a result of the Project have been reviewed and assessed within this section. It is noted that Bombora Wave Energy (mWave) is located near cable landfall, however no cumulative impacts during construction, operations and maintenance phases are anticipated to arise in relation to shipping and navigation.

The potential cumulative impacts of the Pembrokeshire Demonstration Zone (PDZ) have not been considered at the time of writing due to the lack of detail with which to assess the effects of the proposed project. An EIA Scoping Report was produced and issued to NRW in 2018 for a proposed wave/floating wind project however based on discussions with Celtic Sea Power (the 3rd party agents for the PDZ) and recent public presentations by members of Celtic Sea Power, it is understood the PDZ will be repurposed as an offshore electrical hub. In the absence of an updated EIA Scoping Report and insufficient project information to allow the effects to be reasonably understood and a cumulative assessment undertaken, it has been omitted from this assessment.

For those reasons identified above, including the absence of EIA Scoping Reports, the potential cumulative impacts of the recently announced Llyr 1, Llyr 2 and Whitecross FLOW projects are also omitted from this cumulative assessment.

Table 15 Projects scoped into the cumulative impact assessment.

Project	Location	Distance from Array (km)	Distance from Export Cable	Footprint of project area (km)	Construction Timings
META	Milford Haven Waterway	37.2	1.5	1.52	As a test site deployment and recovery will be dictated by client bookings. There is no programme, and activity will be managed by NtM and stakeholder updates.
Greenlink Interconnector	Landfall at Freshwater West	17.8	0.0	0.16	2024
Project Valorous	Offshore, Pembrokeshire	3.3	9.7	150	2026-2028

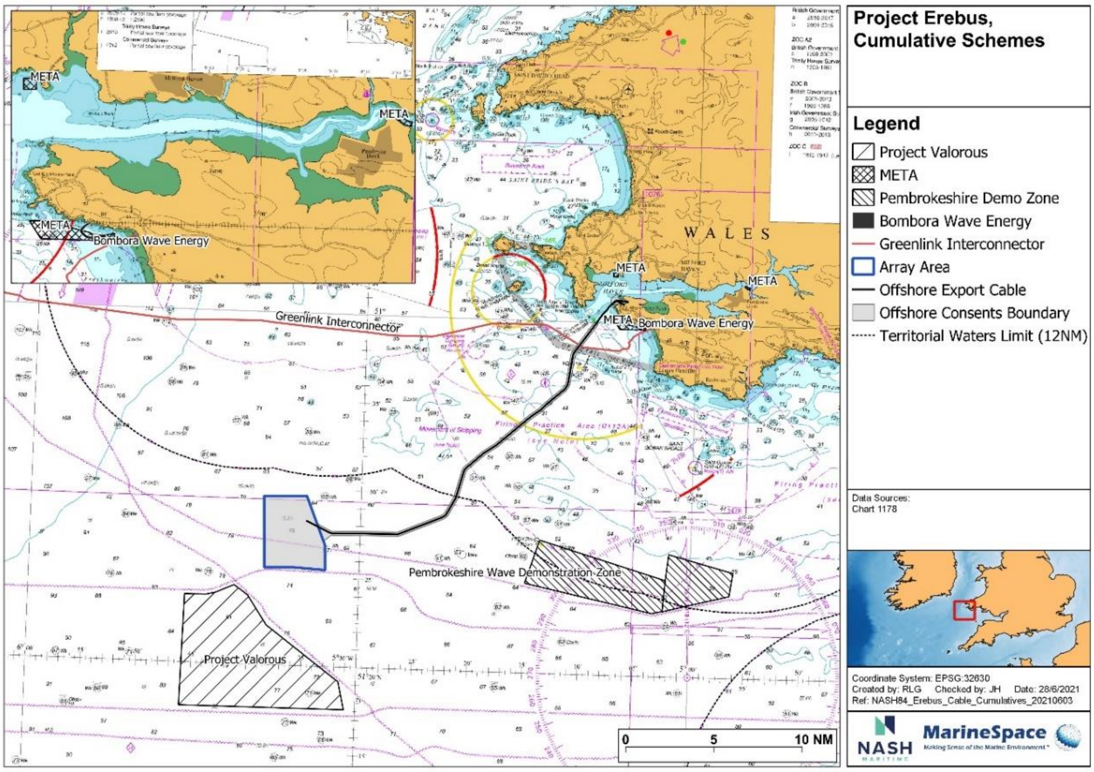


Figure 90 Cumulative schemes.

The two developments which could cause cumulative impacts on shipping and navigation receptors are Project Valorous and META. These impacts are considered in turn:

8.11.1 Vessel Routeing

As described in **Section 8.1**, only one route intersects the Erebus array area, namely a dispersed route between the Atlantic and Milford Haven. **Figure 91** shows the possible impacts on vessel routeing that these developments could have.

- A minor route between Land's End and inshore of the Smalls would have a small deviation further west, away from the Erebus array area. Given the low numbers of vessels on this route and the minor deviation, this impact is not considered significant.
- A route between the Off Smalls TSS and the Bristol Channel passing to the south of the special yellow marks would likely need to pass further north, adjoining the existing route between the same two locations. This may increase the disruption to activities of the Firing Practice Area. Given these vessels are currently travelling further to pass to the south of the mark, the distance travelled by these vessels would be reduced.

8.11.2 Risk of Contact

The additional infrastructure in the study area will necessarily increase the risk of contact between vessels and turbines.

As a result of the impact of the other developments, commercial vessels will likely be routed further from Erebus (**Figure 91**), thereby reducing the risk of contact with this project.

However, with the construction and maintenance activities at Project Valorous, the WFSVs would likely transit past Erebus to their O&M base. Whilst it is not anticipated they would transit through Erebus, a navigational error or mechanical failure in close proximity to the turbines could result in additional contacts. Furthermore, Erebus O&M vessels will transit into and out of Milford Haven, passed devices at META and therefore have a potential for allision. However, the META sites are clear of the main navigational channels and the risks are not likely to be significant.

8.11.3 Risk of Collision

Cumulatively, the two offshore projects reduce the available sea room for loitering vessels waiting for entry into Milford Haven. This could bring them closer together and increase the risk of collision. However, the vessel traffic analysis demonstrated that there are relatively few concurrent waiting vessels, and the risk of two meeting is low.

During construction and maintenance, there will be an increase in activity of project related vessels operating between the array areas and Milford Haven. These vessels could collide with each other and other vessels, particularly in the approaches to Milford Haven. This increased pressure on MHPA may warrant additional risk controls to safely manage this additional traffic.

A two nautical mile separation between Erebus and Project Valorous could result in increased vessel collisions as vessels are funnelled. However, the vessel traffic analysis has not identified this as a major route and therefore the likelihood of two vessels meeting here is not significant.

Collectively, the two projects in relatively close proximity reduce the visual and electronic (radar/AIS) identification of other vessels. However, as the major routes pass around the development sites, it is unlikely that vessels could emerge undetected and pose an additional risk of collision. Furthermore, the research presented in **Section 8.8** demonstrates that these effects have not been shown to be significant.

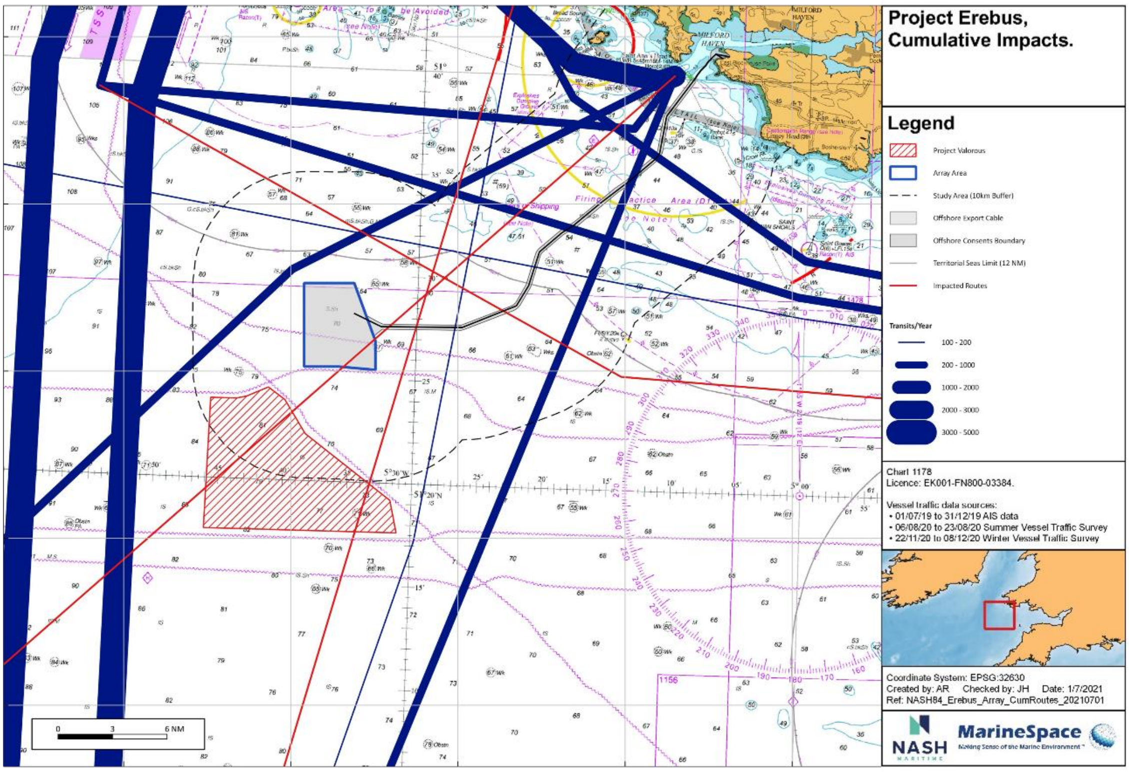


Figure 91 Cumulative Impacts on Vessel Routeing with Future Projects.

8.11.4 Presence of Project structures disrupting MHPA tanker waiting area

Cumulatively, the two offshore projects reduce the available sea room for loitering vessels waiting for entry into Milford Haven. This could bring them closer together and increase the risk of collision. However, the vessel traffic analysis demonstrated that there are relatively few concurrent waiting vessels and the risk of two meeting is low.

The cumulative effects are not considered to be significantly worse than the Project in isolation.

9. NAVIGATION RISK ASSESSMENT

This assessment is based on the IMO Formal Safety Assessment process (FSA) as approved in 2002 and most recently amended in 2018 by MSC-MEPC.2/Circ.12/Rev.2 and as described in **Section 2.3**.

The methodology has been applied in a manner which is commensurate with the nature and significance of the projects with a basis of proportionality to the scale of the project and the magnitude of risks and navigational impacts. The project is considered, on a precautionary basis, of medium scale and complexity together with respect to navigational risks and impacts.

9.1 HAZARD IDENTIFICATION

The first step in the navigation risk assessment process is hazard identification. Key contributions to risk and hazard identification in the project were the preliminary hazard review and the Hazard Workshop, which collectively involved structured group reviews with project team and relevant stakeholders, aiming to identify the causes and effects of accidents and relevant hazards. Hazard identification was therefore undertaken by NASH Maritime navigation risk specialists in conjunction with stakeholder consultation input at various stages through the project and as detailed in **Section 7**.

Potential hazards were organized under four categories:

1. Vessel type
    a. Commercial vessels
    b. Tankers
    c. Fishing vessels
    d. Recreational vessels
    e. OWF Construction vessels
    f. OWF Service vessels
2. Hazard type
    a. Collision
    b. Contact / Allision with WTG (in place)
    c. Contact / Allision with WTG adrift (due to WTG breakout)
    d. Snagging with WTG moorings, inter array cables or export cables
    e. Grounding (export cable route only)
3. Phase
    a. Construction (C)
    b. Operation (O)
    c. Decommissioning (D)

4. Area
    a. Array area (Area 1)
    b. Export cable route (Area 2)

A variety of vessel types are operational within the area and the Port of Milford Haven and these have been assessed within the marine traffic analysis. However, for the purpose of the risk assessment, vessel types have been further categorized into the following groups for hazards relating to collision. The grouping of vessels with similar characteristics reduces the number of distinct hazards whilst still capturing the cumulative risk of each vessel type. Particularly for collision hazards, increasing the number of vessel type categories results in many more distinct hazards, which increases the uncertainty of assessment. Additionally, increasing the number of collision hazards ultimately results in lower risk scores because it is less likely that any specific pair of vessel types are involved in a collision. As such, vessel types have been categorized into further groups for collision hazards:

5. Large vessels
    a. Commercial vessels
    b. Construction vessels
6. Small vessels
    a. Fishing vessels
    b. Recreational vessels
    c. Windfarm service vessels

In total, 26 hazards were identified.

9.2 DESIGNED IN RISK CONTROL MITIGATION

Table 16 lists the key risk control mitigation measures to reduce the likelihood or consequence of incidents associated with the project. These are considered as embedded risk controls designed into the project and thus included as assumptions in the baseline risk assessment.

The risk controls are derived from a combination of regulation, guidance, good practice and, through evolution during the risk assessment process and consultation with relevant stakeholders, a number of risk controls have been optimised or enhanced to more specifically suit the project and hazards.

Table 16 Embedded risk control mitigation measures.

ID	Title	Detail and Basis
1	Promulgation of Information	Promulgation of Information and warnings through Notices to Mariners or other appropriate Marine Safety Information (MSI) dissemination methods. Rolling and regular updates during construction phases. Planning and co-ordination between developer and vessel operators
2	Continuous watch	Continuous watch by multi-channel VHF, including Digital Selective Calling (DSC)

ID	Title	Detail and Basis
3	Vessel Traffic Monitoring (and data collection to MGN654 standard)	Continuous monitoring by radar, AIS, closed circuit television (CCTV) or other agreed means (to minimum of MGN654 standard) during construction and immediate period (3 months) post construction whilst traffic habituates to MCA approval. Consider use of guard vessel to achieve this function (see RC ID 9).
4	Safety Zones	Application and use of safety zones of up to 500 m from platform edge (at sea level) during construction/major maintenance and decommissioning phases. Safety zones shall be of appropriate configuration, extent and application to specified vessels of identified primary risk of sub-sea equipment to Fishing and snagging hazard
5	Advisory safe distances	A advisory safe passing distance of up to 1,000m around work areas (cable landfall proximity) during construction and decommissioning phases, and up to 1,000 m advisory safe distances around cable installation/removal or maintenance vessels [where feasible and in agreement with MHPA where within MHPA port limits]. These are advisory and are not enforceable; however vessels will also be displaying Restricted in Ability to Manoeuvre lights and shapes under COLREGs (IMO, 1972 as amended).
6	Permanent Aids to Navigation Aids to Navigation Management Plan	Suitable Aids to Navigation (AtoN) lighting and marking the OWF site shall be undertaken complying with International Association of Lighthouse Authorities (IALA) Recommendations O-139 (IALA, 2013 and due to be updated prior to construction), to be finalised and approved in consultation with MCA and THLS through an Aids to Navigation Management Plan. Fog horns to alert vessels to the position of structures when visibility is poor. Note planned update to O-139 to include painting reference from waterline (not HAT). WTG informal naming/associated markings shall not interfere with formal AtoN's. AIS transponders to be placed on periphery corner WTG's
7	Buoyed construction area (Temporary Aids to Navigation)	Buoys deployed around construction work in array area in line with THLS requirements and may include a combination of cardinal and/or safe water marks. To be finalised and approved in consultation with MCA and THLS through an Aids to Navigation Management Plan.
8	Emergency Response Cooperation Plan (ERCoP)	Emergency Response Co-Operation Plan with agreement of MCA. Including: 1. WTG partial/complete breakout response and recovery plan 2. Interface with MHPA and UK National Contingency Plan re: marine pollution. Measures will be adopted to ensure that the potential for release of pollutants from construction and operation and maintenance activities is minimised, which will include planning for accidental spills and responding to all potential contaminant releases.
9	Provision of Guard Vessel	Provision of guard vessel in vicinity of array area to monitor 3rd party vessel traffic and intervene with warnings as necessary. Presence during construction phase and consider immediate period (3 months) post construction whilst traffic habituates with MCA approval prior to release.

ID	Title	Detail and Basis
10	Cable Burial Risk Assessment and periodic validation surveys	CBRA to be undertaken pre-construction, including consideration of under keel clearance. All subsea cables will be either fully buried (where ground conditions permit and burial tool performance allows), partially buried (buried but not to target depth) with rock protection, or surface laid with rock protection. (Note that that the sections of the array cables that leave the semi-submersible floating platforms/WTGs will remain within the water column throughout the operational phase of the project). Selected methods will be based on the risk assessment and the protection will be periodically monitored and maintained as practicable. No more than 5% reduction in water depth (referenced to Chart Datum) will occur at any point on the cable route without prior written approval from the Licensing Authority.
11	Compliance with International, UK and Flag State Regulations inc IMO conventions	Compliance from all vessels associated with the proposed project with international maritime regulations as adopted by the relevant flag state (e.g. International Convention for the Prevention of Collision at Sea (COLREGS) (IMO, 1972) and International Convention for the Safety of Life at Sea (SOLAS (IMO, 1974)
12	Vessel health and safety requirements	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 (HSE) 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; and • All marine operations will be governed by operational limits, tidal conditions, weather conditions and vessel traffic information. • Walk to work solutions will be utilised.
13	Under keel clearance Requirements within array area	Minimum UKC to be maintained around turbines to ensure they do not impact on vessels transiting within the array.
14	Fishing Liaison Plan	Provision of detailed project information to fishermen, such as site and export cable route location for upload into fish plotters

ID	Title	Detail and Basis
15	Project Vessel Marine Operations Plan, Traffic Co-ordination Plan and Promulgation of Information	Contractor/Vessel operators to develop Marine Operations Plan (MOP) and, for all activities inside MHPA port limits (and recommended within 5nm of MHPA port limits), this shall include comprehensive passage plan in pre-approved format for review and authorisation by MHPA. Pre-deployment meeting shall be held with MHPA, MHPA Pilots and Contractor/Vessel Operator to review MOP, co-ordinate operations, identify and reduce operational disturbance and mitigate risks to navigational safety. Project 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 and any MHPA lines of communication) to enable vessels and operators to effectively and safely navigate around the array area and activities during the offshore cable corridor construction.
16	Air Draught Clearance	Wind turbine blades will have at least 22 m clearance above water level and allow for anticipated range of motion (pitch, roll, yaw, heave, surge and sway), as appropriate.
17	Charting of Array Area	Charting of array area structures (WTG and subsea mooring/array cable equipment inc. anchor spread patterns) clearly on appropriately scaled nautical charts and electronic charts in line with UKHO standard and using wind farm symbology. Consideration to scaling to ensure sub-sea equipment in vicinity of individual WTG's is visible.
18	Charting of Export Cable	Charting of export cables and landfall infrastructure clearly on appropriately scaled nautical charts and electronic charts in line with UKHO standard in line with UKHO standard and using standard symobology.
19	Layout Plan and Lines of Orientation	WTG layout plan to be agreed with MCA and THLS prior to construction and maintain two lines of orientation unless justified and agreed with the MCA.
20	Marine traffic control / Co-ordination	Project vessels during construction and co-ordination during O&M to ensure project vessels to not present unacceptable risks to each other or third parties (see also RC ID 15).
21	Sub-Sea equipment Verification, Inspection and Monitoring regime	Third party verification of mooring (sub-sea) equipment shall be undertaken in line with MCA/HSE developed guidance. Independent and regular audit of all subsea equipment shall be undertaken at appropriate manufacturer recommended intervals during operational phase.
22	WTG Position Monitoring Tracking	Location monitoring device (GPS based) providing warning on breach of WTG's position near/beyond excursion limits and position tracking in event of partial/full breakout. Device should be integrated with AIS transponders (see also AtoN)
23	Electromagnetic interference minimisation	A Cable Specification and Installation Plan will be prepared as part of the Code of Construction Practice. This 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.
24	Personal Protective Equipment (PPE)	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 (QHSE) documentation. This will include the use of Personal Locator Beacons (PLB's).
25	QHSE documentation	Marine QHSE documentation will ensure safe operation on a daily basis, including work vessel operations.

ID	Title	Detail and Basis
26	Hydrographic Survey	Hydrographic surveys will be undertaken pre-consent, post consent and decommissioning in accordance with the MCA's 'Hydrography Guidelines for Offshore Developers'
27	MHPA Waterway management in E Channel works	During period when cable construction activity is within MHPA limits and approaches (within circa 5nm), Applicant will liaise with MHPA and ensure MHPA integrated risk based approach is considered for works within MHPA waters. Consideration will be given to introduction of specific routes/measures and protocols for construction works and specific vessels (e.g. regular 'larger' vessels [Irish Ferries], Recreational and Fishing community together with the Castlemartin ranges) using East Channel during defined periods when cable associated works are present in channel. Consideration will be given to navigation lines (and port approaches), relationship of vessel usage of West/East channel and limit state conditions (restricted visibility. limiting metocean conditions). See also RC ID 15
28	Tow out passage plan risk assessment method statement	A platform and WTG tow-out passage plan risk assessment and method statement (RAMS) should be undertaken by the Contractor covering the period between quayside departure and completion of the mooring connection being made. This should consider aspects including: • Risks to project vessels • Risks to 3rd party vessels (and consequential collision, contact or grounding risks) through reduced maneuverability • Breakout of the device under tow

9.3 HAZARD SCORING

9.3.1 Scoring Methodology

Following identification, hazards and their associated scenarios are ranked. Hazards are ranked through assignment of consequence and frequency scores, based on available data, and supported by professional judgement and in consideration of the designed in risk control mitigation (**Section 9.2**) being in place and effective.

The basis for consequence and frequency scores are as defined in **Table 17** and **Table 18** , respectively. Each hazard is scored on frequency of occurrence and severity of consequence for two scenarios, the 'most likely' and 'worst probable'. Severity of consequence with each hazard under both scenarios is considered in terms of damage to:

- People;
- Property;
- Environment; and
- Business.

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 project risk matrix (**Table 19**) and tolerability with regards to significance and acceptability with or without further action that may include regular review, additional risk controls or cessation of the proposed activity (**Table 20** and **Table 21**).

Table 17 Severity of consequence categories and criteria.

Rank	Description	Definition			
		People	Property	Environment	Business
1	Negligible	No Perceptible Impact	No Perceptible Impact or less than £10,0000	No Perceptible Impact	No Perceptible Impact
2	Minor	Slight injury(s)	£10,000-£100,000	Tier 1 Local assistance required	Local negative publicity, short term loss of revenue to port/OWF £10,000-£100,000
3	Moderate	Multiple minor or single serious injury	£100,000-£1million	Tier 2 Limited external assistance required	Widespread negative publicity, temporary suspension of activities at port/OWF £100,000 Local publicity -£1million
4	Serious	Multiple serious injury or single fatality	£1million-£10million	Tier 2 Regional assistance required	National negative publicity, prolonged closure or restrictions to port/OWF £1million National publicity -£10million
5	Major	More than one fatality	>£10million	Tier 3 National assistance required	International negative publicity, serious disruption to operations to port/OWF >£10million International publicity

Table 18 Frequency of occurrence criteria.

Rank	Description	Definition
1	Negligible	<1 occurrence per 10,000 years
2	Extremely unlikely	1 per 100 – 10,000 years
3	Remote	1 per 10 – 100 years
4	Reasonably probable	1 per 1 – 10 years
5	Frequent	Yearly

Table 19 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
			Negligible	Extremely unlikely	Remote	Reasonably probable	Frequent
			Frequency of Occurrence				

Table 20 Tolerability and risk ratings.

Hazard Risk Score	Hazard Risk Rating	Tolerability
1-3.99	Negligible Risk	Broadly Acceptable
4-8.99	Low Risk	Broadly Acceptable
9-14.99	Medium Risk	Tolerable (if ALARP)
15-19.99	Significant Risk	Unacceptable
20-25	High Risk	Unacceptable

Table 21 Tolerability description

Hazard Risk Rating	Tolerability	Description
Negligible Risk	Broadly Acceptable	Generally regarded as not significant and adequately mitigated. Additional risk reduction should be implemented if reasonably practicable and proportionate
Low Risk		
Medium Risk	Tolerable (if ALARP)	Generally regarded as within a zone where the risk may be tolerable in consideration of the project. Requirement to properly assess risks, regularly review and implement risk controls to maintain risks to within ALARP where possible.
Significant Risk	Unacceptable	Generally regarded as significant and unacceptable for project to proceed without further review.
High Risk	Unacceptable	

9.3.2 Preliminary Scoring

Based on the hazard identification conducted in **Section 9.1**, the preliminary stakeholder consultation (**Section 7.1**), vessel traffic analysis (**Section 5**) and review of potential impacts (**Section 7.7**), a draft hazard log was created with preliminary scores inputted by the NASH

Maritime project team in an internal hazard scoring workshop. Each hazard was scored for the most likely and worst credible likelihood and consequences based on the methodology described in in **Section 2**.

9.3.3 Scoring Maturation

Preliminary scores were shared in the Hazard Workshop pre-pack together with the basis of scoring and were reviewed collectively in a group manner during the workshop with some amendments made during the workshop. The identified hazards were also shared with online polling methods to attendees inviting participants to reflect on the scores and propose their own scoring.

Notably, as per **Section 7.6**, and following the workshop, additional sessions where scores were further reviewed and updated were held with fishing representatives and MHPA to review scores. Minor amendments were made following the fishing representative scorings.

Two meetings were held with MHPA at which additional hazards were provided to reflect further delineation for collision hazards by phase and area. Scores were then populated independently by MHPA and NASH Maritime before reconvening at the second meeting where scores were reconciled and final scores agreed together with modification to some of the designed in risk control measures.

9.4 RESULTS

Table 22 shows a summary of the risk assessment results, with full hazard logs contained in **Appendix C**. Of the 26 hazards, 20 assessed as Low Risk / Broadly Acceptable whilst six are found to be medium risk / ALARP. Of these six, three relate to construction or O&M vessels making hard contact with the turbines or snagging on the moorings or export cable. Given the proximity to the turbines at which these vessels work, contacts are likely and occur frequently on other projects (see Section 5.4 and 8.1). One hazard relates to the potential for collision between large vessels within the cable route area and particularly relating to concern during the period when the cable layer is within proximity to the port limits. This hazard was notably introduced through additional concern raised by MHPA post Hazard Workshop and the sensitivity to large vessel operations in the approaches and potential consequences. The hazard has been managed through targeted enhancement of some of the designed in risk controls – particularly around RC ID 15 and the development of Project Vessel Marine Operations Plan, Traffic Co-ordination Plan and Promulgation of Information.

The remaining two hazards assessed to be ALARP are contacts or snagging between fishing vessels and turbines, moorings or export cable. There is a significant activity of fishing adjacent to the array (Section 5.3.2.2) and there is a possibility of human error or mechanical failure resulting in a vessel or gear coming into contact with the project infrastructure. However, it is likely that fishermen will give the project a wide berth to reduce the risk of loss of gear.

Of those hazards assessed to be low risk, the highest ranking collision involves small vessels, such as fishing vessels, recreational craft and WFSVs. This could occur throughout the project lifecycle with WFSVs transiting between the array area and the O&M base. Other collisions are judged to be less significant, particularly given the sparsity of vessel routes adjacent to the array area (Section 5.3.2 and 8.1).

Whilst the risks of breakout of the turbines have been identified as a hazard, the design standards to 1 in 50 year storms, and the low likelihood that a drifting turbine would be collided with, gives a low risk score (Section 8.10). Similarly, the risk of grounding is limited to small craft in Angle Bay, where the cable makes landfall. With cable burial, it is unlikely that such groundings would occur (Section 8.9).

Table 22 Risk Assessment Results.

ID	Rank	Hazard title	Phase	Area	Risk
24	1	Collision of Large Vessels with Large Vessels	C/D	2	10.5
8	2	Contact / Allision with WTG (in place) of OWF Construction Vessels	C/D	1	10.2
9	3	Contact / Allision with WTG (in place) of OWF Service Vessels	O	1	9.5
20	4	Snagging with WTG moorings, inter array cables or export cable of OWF Construction Vessels	C/D	1, 2	9.3
18	5	Snagging with WTG moorings, inter array cables or export cable of Fishing Vessels	C/O/D	1, 2	9.2
6	6	Contact / Allision with WTG (in place) of Fishing Vessels	C/O/D	1	9.0
26	7	Collision of Small Vessels with Small Vessels	C/O/D	2	8.5
25	8	Collision of Large Vessels with Small Vessels	C/O/D	2	8.4
21	9	Snagging with WTG moorings, inter array cables or export cable of OWF Service Vessels	O	1, 2	8.3
5	10	Contact / Allision with WTG (in place) of Tankers	C/O/D	1	7.8
4	11	Contact / Allision with WTG (in place) of Commercial vessels	C/O/D	1	7.4
1	12	Collision of Large Vessels with Large Vessels	C/O/D	1	7.3
2	13	Collision of Large Vessels with Small Vessels	C/O/D	1	7.2
14	14	Contact / Allision with WTG adrift (due to WTG breakout) of OWF Construction Vessels	C/D	1, 2	6.5
12	15	Contact / Allision with WTG adrift (due to WTG breakout) of Fishing Vessels	C/O/D	1, 2	6.3
23	16	Grounding (export cable route only) of Recreational Vessels	C/O/D	2	6.1
19	16	Snagging with WTG moorings, inter array cables or export cable of Recreational Vessels	C/O/D	1, 2	6.1
15	18	Contact / Allision with WTG adrift (due to WTG breakout) of OWF Service Vessels	O	1, 2	6.1
7	19	Contact / Allision with WTG (in place) of Recreational Vessels	C/O/D	1	6.0
13	19	Contact / Allision with WTG adrift (due to WTG breakout) of Recreational Vessels	C/O/D	1, 2	6.0
17	19	Snagging with WTG moorings, inter array cables or export cable of Tankers	C/O/D	1, 2	6.0
3	22	Collision of Small Vessels with Small Vessels	C/O/D	1	5.9

ID	Rank	Hazard title	Phase	Area	Risk
16	23	Snagging with WTG moorings, inter array cables or export cable of Commercial vessels	C/O/D	1, 2	5.7
22	24	Grounding (export cable route only) of Fishing Vessels	C/O/D	2	5.3
11	25	Contact / Allision with WTG adrift (due to WTG breakout) of Tankers	C/O/D	1, 2	4.5
10	26	Contact / Allision with WTG adrift (due to WTG breakout) of Commercial vessels	C/O/D	1, 2	4.3

9.5 ADDITIONAL RISK CONTROL MITIGATION

In addition to those embedded risk controls included within the project (**Table 16** and **Section 9.2**), several additional risk control measures were identified in **Table 23** which could further reduce impact or risk of the project. These risk controls are primarily identified with respect to their risk reduction for impacts or hazards scoring ‘medium risk – tolerable if ALARP’ where they may further reduce risk.

These risk controls, and their effectiveness in reduction of risk likelihood or consequence have not been scored and the risks are not being taken forwards but are recommended for further consideration and review.

Table 23 Additional risk control mitigation measure options.

ID	Title	Detail and Basis
1	Safety Zones during Operational Phase	Enhance Embedded RC ID 4 and provide safety zones of 50m or greater in operational phase.
2	Extended duration of Guard vessel	Enhance Embedded RC ID 9 and extend duration of guard vessel deployment for minimum of 6 months in agreement with MCA (from 3 months as per Embedded RC ID 9) post construction to provide longer period (and extend seasonal variance) of additional warning to 3rd party vessel traffic. Consider in parallel with Additional RC ID 3
3	Extended duration of vessel traffic monitoring (and data collection to MGN654 standard)	Enhance Embedded RC ID 3 and extend duration of monitoring (and data collection) for minimum of 6 months (from 3 months as per RC ID 3) in agreement with MCA to: 1. provide longer duration of monitoring of vessel traffic with project in place 2. collect evidence base (with MGN654 compliant dataset) to determine whether vessel traffic profile and risk profile has habituated to acceptable levels. Consider in parallel with Additional RC ID 2.

9.5.1 Safety Zone

Table 23 identifies the potential option for adopting safety zones during the operational phase of the project and further narrative is provided on this option in this section.

9.5.1.1 Background

Safety zones are typically applied for post consent and based on the NRA and consultation with the MCA, General Lighthouse Authority (Trinity House), BEIS and other relevant stakeholders. It is therefore preferable to consider, where possible, the intended approach to safety zones within the NRA and during the consent stage given their nature in the overall risk profile and ensuring that the consent decision maker is presented with as realistic a scenario as possible.

Safety zones effectively extinguish the right to navigation (other than essential transits by emergency craft etc.) within a defined radius from the WTG tower (or outer edge of the platform at sea level). This serves to preserve safety of life for those working on the WTG, safety of life for those on the navigating vessels and protection of the WTG (and associated infrastructure) and vessel assets including fishing gear.

Standard safety zones of up to 500m during the construction phase, major maintenance activities in the operation phase and decommissioning phase are considered industry standard practice (and are an embedded risk control on Erebus as per **Table 16**). However safety zones during the operation phase of UK offshore wind farms (outwith of major operation and maintenance activities) are significantly less common and, in any event, a standard operational phase safety zone would be 50m (although the regulations allow for up to 500m).

A safety zone, where adopted, is required to be monitored and policed to detect (and report) potential infringements and threats to life, asset or the environment. This is typically undertaken by a guard vessel during construction, major operation and maintenance and decommissioning phases. During an operation phase, this could be undertaken through AIS, radar and visual monitoring and also using remotely managed hardware/software solutions.

9.5.1.2 Project Erebus Considerations

In the case of Erebus, careful consideration was given to the potential implementation of a safety zone during the operation phase of the project in recognition of the nascent nature of floating technology and the scored hazards and risk profile 'medium risk – tolerable if ALARP' for fishing vessels contacting the platforms and/or snagging the platform subsea mooring or cable equipment.

Discussion was held on these issues initially with key user groups during the HAZID workshops, during breakout sessions and finally with the MCA and BEIS at a meeting on 11-Jun-2021. Further detail on the HAZID workshops and breakout sessions is provided in **section 7**, all meetings held are detailed in **Table 11.**

Once the project is operational it is considered that the prudent mariner on most through transiting commercial, fishing and recreational vessels will likely elect to transit clear of the floating platforms by a minimum of 500m which would provide a suitable buffer to absorb the potential excursion of the platform and also the portion of the catenary mooring/lazy wave cable within the upper portion of the water column (noting in any case the connection is 17.4m below the water level on the heave plate undersides). Most fishing vessels (engaged in fishing) may be assumed to self-exclude with an appropriate (1 nm) buffer distance to safeguard risk to vessel, safety of life and damage/loss of fishing gear in consideration of their vessel, prevailing conditions and other factors. However, it was recognised that some fishing vessels may elect to fish in close proximity to the turbines (and subsea equipment) for competitive advantage or end up in close proximity with gear deployed in this area through error.

Additional risk controls providing alternative means of mitigating the identified hazards were considered but are not being proposed as possible additional risk control mitigations, including:

- Areas to Be Avoided (ATBA)
- Fishing free zones
- Voluntary and advisory zones

The contribution of other risk controls in combination, as per **Table 16**, should also be considered collectively in their overall contribution to risk reduction and, in particular, the charting of the seabed footprint (RC ID 17), use of aids to navigation and markings with AIS transponders (RC ID 6) together with industry specific and broader maritime information and promulgation of information (RC ID 14 & 15).

It is recommended that future review is made post consent, including further consultation with MCA, BEIS and key users to review the assessed risk and whether other risk controls effectively reduce risk or whether a safety zone in the operation phase should be further considered and innovative means of monitoring it for enforcement.

It is not considered that safety zones of 50m in the operational phase would have a material impact on loss of sea room and the ability of vessels to transit through the array area.

9.5.2 Extended Deployment of Guard Boat and Enhanced Traffic Monitoring

Table 23 identifies the potential option for extending the deployment of a guard vessel in the vicinity of the array area combined with extended vessel traffic monitoring for a minimum of 6 months. The embedded risk control scenario assumes that these will remain in pace for circa 3 months on completion of construction to provide immediate crossover and transition support whilst third party traffic (and the risk profile) habituates and normalises.

This risk control would be applicable primarily to the scored hazards and risk profile ‘medium risk – tolerable if ALARP’ associated with fishing vessels contacting the platforms and/or snagging the platform subsea mooring or cable equipment during the operation phase of the project. The extension of the guard vessel for greater than 3 months would enable a greater period of seasonal variance in fishing vessels to be considered and the collection of vessel traffic data (from the guard vessel and in accordance with MGN654) would provide the project an evidence base to undertake a quantitative review of navigation risk, to the requirements of the MCA should this be required

Whilst the Applicant has elected not to proceed with this risk control, it is recommended that future review is made post consent, potentially during the initial 3 month post construction period to enable consideration of up to date traffic data and any learnings from the project being in place.

Extended traffic monitoring could be undertaken through AIS, radar and visual monitoring using remotely managed hardware/software solutions from WTG platform or buoy mounted solutions within the array area rather than from a guard boat platform.

10. CONCLUSIONS

10.1 SUMMARY

An NRA has been undertaken of the proposed Project Erebus and in accordance with relevant policy, guidance and assessment methodology.

This has included:

- Description of the baseline environment;
- Description of the existing and future baseline vessel traffic and risk profiles;
- Identification and assessment of potential impacts of the Project on shipping and navigation;
- Identify and assess potential cumulative and in-combination effects;
- An NRA that identifies and assesses hazards and impacts during construction, operation and decommissioning phases of the development.
- Stakeholder consultation including a hazard identification and scoring workshop involving a representative cross-section of relevant stakeholders.
- Identification of risk controls in relation to the project hazards and impacts to reduce the risk to As Low As Reasonably Practicable (ALARP); and
- Provision of recommendations in relation to the safety of the development and co-existence of users with regards to shipping and navigation.

The potential hazards and impacts to vessel activity have been assessed based on the above and the results. Of the 26 hazards, 20 were assessed as Low Risk / Broadly Acceptable whilst six were found to be within the medium risk rating category and are considered tolerable (if ALARP). These are described below:

- The highest scoring hazard relates to the potential collision of large vessels within the approaches to Milford Haven Waterway during the construction period although the enhancement of the designed in risk controls has mitigated this to within a tolerable level.
- 3 of the 6 highest scoring hazards relate to the project specific vessels in all phases (contact with the turbines or snagging on the moorings or export cable) and should be effectively managed by the construction and O&M contractor to maintain within a tolerable level.

- 2 of the 6 highest scoring hazards relate to the potential for fishing vessels to contact or snag with the platform or mooring system in all project phases.

The results of this NRA therefore indicate that the navigational safety of this project, with the identified risk controls in place, is not unacceptably high and is therefore considered generally acceptable and tolerable with the proposed designed in mitigation.

Risks should be regularly reviewed in relation to the implementation risk controls to maintain risks to within ALARP where possible.

10.2 DEVELOPMENT OF RISK CONTROLS

Further work will be undertaken by the Applicant to develop the detail, and plan for the implementation, of some of the designed in risk control measures which require further definition once the design has been progressed and/or consent has been obtained. This work will include consultation with statutory and non-statutory stakeholders. Risk controls for development include those identified in **Table 24**.

Table 24 Development of Risk Controls

ID	Title	Action
1	Promulgation of Information	Development of planning and co-ordination and dissemination methods pre construction phase.
3	Vessel Traffic Monitoring (and data collection to MGN654 standard)	Develop specification and methodology for the vessel traffic monitoring and basis of review with MCA pending decision to extend beyond 3 months post construction completion. Note relationship with guard vessel to achieve this function (see RC ID 9).
4	Safety Zones	Develop proposed Safety Zone applications of appropriate configuration, extent and application to specified vessels of identified primary risk of sub-sea equipment to Fishing and snagging hazard. Note the designed in risk control relates to the Construction, Major Maintenance and Decommissioning phases only. The use of Safety Zones in the Operational Phase are ‘additional risk controls’ and not being progressed at this time.
6	Permanent Aids to Navigation Aids to Navigation Management Plan	Develop a Aids to Navigation Management Plan once detailed layout and construction methodology is known. To be finalised and approved in consultation with MCA and THLS.
7	Buoyed construction area (Temporary Aids to Navigation)	To be finalised and approved in consultation with MCA and THLS through an Aids to Navigation Management Plan (see also RC ID 6).

ID	Title	Action
8	Emergency Response Cooperation Plan (ERCoP)	Develop Emergency Response Co-Operation Plan with agreement of MCA. Including: 1. WTG partial/complete breakout response and recovery plan 2. Interface with MHPA and UK National Contingency Plan
9	Provision of Guard Vessel	Develop specification and functional requirements for guard vessel. Note relationship with vessel traffic monitoring pre and post construction (see RC ID 3).
10	Cable Burial Risk Assessment and periodic validation surveys	Develop Cable Burial Risk Assessment on completion of cable route design Develop regime for periodic monitoring and maintenance.
14	Fishing Liaison Plan	Develop Fishing Liaison Plan
15	Project Vessel Marine Operations Plan, Traffic Co-ordination Plan and Promulgation of Information	Develop and define Marine Operations Plan (MOP), marine traffic coordination plans and basis of liaison with MHPA for all activities within 5nm of MHPA port limits.
17	Charting of Array Area	Develop proposed charting of array area structures (WTG and subsea mooring/array cable equipment inc. anchor spread patterns).
18	Charting of Export Cable	Develop proposed charting of export cables and landfall infrastructure
19	Layout Plan and Lines of Orientation	WTG layout plan to be agreed with MCA and THLS
20	Marine traffic control / Co-ordination	Define marine traffic control and co-ordination (see also RC ID 15).
21	Sub-Sea equipment Verification, Inspection and Monitoring regime	Develop third party verification of mooring (sub-sea) equipment in line with MCA/HSE developed guidance for MCA review together with strategy for independent and regular audit of all subsea equipment.
22	WTG Position Monitoring Tracking	Develop location monitoring device (GPS based) providing warning on breach of WTG's position near/beyond excursion limits and position tracking in event of partial/full breakout. Device should be integrated with AIS transponders (see also AtoN)
26	Hydrographic Survey	Undertake hydrographic surveys pre-consent, post consent and decommissioning in accordance with the MCA's 'Hydrography Guidelines for Offshore Developers'
27	MHPA Waterway management in E Channel works	Develop waterway management strategy with MHPA and relevant users. See also RC ID 15 and 20.
28	Tow out passage plan risk assessment method statement	Develop platform and WTG tow-out passage plan risk assessment and method statement (RAMS).

REFERENCES

Allan, PG. (1999), Selecting Appropriate Cable Burial Depths – A Methodology, Submarine Communications, Cannes

BWEA (2007). Investigation of Technical and Operational Effects on Marine Radar Close to Kentish Flats Offshore Wind Farm.

Mole, P., Featherstone, J. and Winter, S. (1997) Cable Protection – Solutions Through New Installation and Burial Approaches. SubOptic '97. San Francisco.

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 Maritime and Coastguard Agency.

Appendix A
MGN 654 Checklist

MGN 654 (M+F) Safety of Navigation: Offshore Renewable Energy Installations – Guidance on UK Navigational Practice, Safety and Emergency Response

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, operation and decommissioning. This should be supplied as authoritative Geographical Information System (GIS) data, preferably in Environmental Systems Research Institute (ESRI) format. Metadata should facilitate the identification of the data creator, its date and purpose, and the geodetic datum used. For mariners' use, appropriate data should also be provided with latitude and longitude coordinates in WGS84 (ETRS89) datum.		
4.6 Traffic Survey – includes:		
All vessel types	✓	
At least 28 days duration, within either 12 or 24 months prior to submission of the Environmental Impact Assessment Report	✓	
Multiple data sources	✓	
Seasonal variations	✓	
MCA consultation	✓	
General Lighthouse Authority consultation	✓	
Chamber of Shipping and shipping company consultation	✓	
Recreational and fishing vessel organisations consultation	✓	
Port and navigation authorities consultation, as appropriate	✓	

MGN Section	Yes/No	Comments
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.	✓	
ii. Numbers, types and sizes of vessels presently using such areas	✓	
iii. Non-transit uses of the areas, e.g. fishing, day cruising of leisure craft, racing, aggregate dredging, personal watercraft etc.	✓	
iv. Whether these areas contain transit routes used by coastal, deep-draught or international scheduled vessels on passage.	✓	
v. Alignment and proximity of the site relative to adjacent shipping routes	✓	
vi. Whether the nearby area contains prescribed routeing schemes or precautionary areas	✓	
vii. Proximity of the site to areas used for anchorage (charted or uncharted), safe haven, port approaches and pilot boarding or landing areas.	✓	
viii. Whether the site lies within the jurisdiction of a port and/or navigation authority.	✓	
ix. Proximity of the site to existing fishing grounds, or to routes used by fishing vessels to such grounds.	✓	

MGN Section	Yes/No	Comments
x. Proximity of the site to offshore firing/bombing ranges and areas used for any marine military purposes.	✓	
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	✓	
xii. Proximity of the site to existing or proposed OREI developments, in co-operation with other relevant developers, within each round of lease awards.	✓	
xiii. Proximity of the site relative to any designated areas for the disposal of dredging spoil or other dumping ground	✓	
xiv. Proximity of the site to aids to navigation and/or Vessel Traffic Services (VTS) in or adjacent to the area and any impact thereon.	✓	
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.	✓	
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.	✓	

MGN Section	Yes/No	Comments
xvii. Proximity of the site to areas used for recreation which depend on specific features of the area		
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.	✓	
b. The width of a corridor between sites or OREIs to allow safe passage of shipping.	✓	
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.	✓	
b. Clearances of fixed or floating wind turbine blades above the sea surface are *not less than 22 metres (*above MHWS for fixed). Floating turbines allow for degrees of motion.	✓	
c. Underwater devices i. changes to charted depth ii. maximum height above seabed iii. Under Keel Clearance	✓ ✓ ✓	
d. Whether structure block or hinder the view of other vessels or other navigational features.	✓	
4.9 The Effect of Tides, Tidal Streams and Weather: It should be determined whether:		

MGN Section	Yes/No	Comments
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.	✓	
b. The set and rate of the tidal stream, at any state of the tide, has a significant affect on vessels in the area of the OREI site.	✓	
c. The maximum rate tidal stream runs parallel to the major axis of the proposed site layout, and, if so, its effect.	✓	
d. The set is across the major axis of the layout at any time, and, if so, at what rate.	✓	
e. In general, whether engine failure or other circumstance could cause vessels to be set into danger by the tidal stream, including unpowered vessels and and small, low speed craft.	✓	
f. The structures themselves could cause changes in the set and rate of the tidal stream.	✓	
g. The structures in the tidal stream could be such as to produce siltation, deposition of sediment or scouring, affecting navigable water depths in the wind farm area or adjacent to the area	✓	
h. The site, in normal, bad weather, or restricted visibility conditions, could present difficulties or dangers	✓	

MGN Section	Yes/No	Comments
to craft, including sailing vessels, which might pass in close proximity to it.		
i. The structures could create problems in the area for vessels under sail, such as wind masking, turbulence or sheer.	✓	
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.	✓	
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:		
i. for all vessels, or ii. for specified vessel types, operations and/or sizes. iii. in all directions or areas, or iv. in specified directions or areas. v. in specified tidal, weather or other conditions	✓ ✓ ✓ ✓ ✓	
b. Navigation in and/or near the site should be prohibited or restricted:		
i. for specified vessels types, operations and/or sizes. ii. in respect of specific activities, iii. in all areas or directions, or	✓ ✓ ✓	

MGN Section	Yes/No	Comments
iv. in specified areas or directions, or v. in specified tidal or weather conditions,	✓	
c. Where it is not feasible for vessels to access or navigate through the site it could cause navigational, safety or routeing problems for vessels operating in the area e.g. by preventing vessels from responding to calls for assistance from persons in distress	✓	
d. Guidance on the calculation of safe distance of OREI boundaries from shipping routes has been considered	✓	
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.		
a. An ERCoP will be developed for the construction, operation and decommissioning phases of the OREI.	✓	
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.	✓	
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)	✓	

MGN Section	Yes/No	Comments
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	✓	
ii. On a pre-established periodicity during the life of the development	✓	
ii. Post-construction: Cable route(s)	✓	
iii. Post-decommissioning of all or part of the development: the installed generating assets area and cable route	✓	
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.	✓	
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:	✓	

MGN Section	Yes/No	Comments
i. Vessel to vessel;		
ii. Vessel to shore;	✓	
iii. VTS radar to vessel	✓	
iv. Racon to/from vessel	✓	
c. The structures and generators might produce sonar interference affecting fishing, industrial or military systems used in the area.	✓	
d. The site might produce acoustic noise which could mask prescribed sound signals.	✓	
e. Generators and the seabed cabling within the site and onshore might produce electro-magnetic fields affecting compasses and other navigation systems.	✓	
4.14 Risk mitigation measures recommended for OREI during construction, operation and decommissioning.		
Mitigation and safety measures will be applied to the OREI development appropriate to the level and type of risk determined during the 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 (ES). 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:	✓	

MGN Section	Yes/No	Comments
i. Promulgation of information and warnings through notices to mariners and other appropriate maritime safety information (MSI) dissemination methods.	✓	
ii. Continuous watch by multi-channel VHF, including Digital Selective Calling (DSC).	✓	
iii. Safety zones of appropriate configuration, extent and application to specified vessels[1]	✓	
iv. Designation of the site as an area to be avoided (ATBA).	✓	
v. Provision of AtoN as determined by the GLA		
vi. Implementation of routeing measures within or near to the development.	✓	
vii. Monitoring by radar, AIS, CCTV or other agreed means	✓	
viii. Appropriate means for OREI operators to notify, and provide evidence of, the infringement of safety zones.	✓	
ix. Creation of an Emergency Response Cooperation Plan with the MCA's Search and Rescue Branch for the construction phase onwards.	✓	
x. Use of guard vessels, where appropriate	✓	
xi. Update NRAs every two years e.g. at testing sites.	✓	

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

MGN Section	Yes/No	Comments
xii. Device-specific or array-specific NRAs	✓	
xiii. Design of OREI structures to minimise risk to contacting vessels or craft	✓	
xiv. Any other measures and procedures considered appropriate in consultation with other stakeholders.	✓	

Appendix B
Stakeholder Consultation

User Group	Consultee	NRA Data Planning	Prelim Hazard Review	NRA Consultation Letter	NRA Consultation Response Received?	Attended NRA Consultation Workshop	Post Hazard Workshop Discussions
Statutory Regulator	MCA	✓	✓	✓	✓		
	THLS	✓	✓	✓	✓		
Statutory Harbour Authority	MHPA	✓	✓	✓	✓	✓	✓
	MHPA Pilot Representative			✓	✓	✓	✓
Industry	Chamber of Shipping		✓	✓	✓	✓	
Government	MOD			✓	✓	✓	
Recreational (Representatives)	RYA (National)			✓	✓		
	Milford Harbor User Association			✓	✓	✓	
	MHPA Water Ranger			✓	✓	✓	
Harbours & Marinas	Milford Dock and Marina			✓			
	Neyland Yacht Haven			✓			
	Pembroke Dock			✓			
	Puma Energy			✓			
	South Hook LNG			✓	✓		
	Dragon LNG			✓			
	Valero			✓			
Recreational	RYA (National)			✓	✓		
	RYA (Cymru)			✓			
	Tenby Sailing Club			✓			
	Milford Harbour User Association			✓			
	Pembrokeshire Cruising			✓			
	Canoe Wales			✓			
	MHPA Water Ranger			✓			
	Cruising Association			✓			
Commercial	Dredging and Aggregate Representatives			✓	✓		
	Rosslare Ferry			✓	✓		
Regular Runners	Gaslog			✓			
	Berg Maritime			✓			
SAR	RNLI (Angle Lifeboat Station)			✓			
	South and West Wales Fishing			✓			
	Welsh Fisherman's Association			✓			
	Welsh Marine Fisheries Advisory			✓			
	Fishing Communities Development			✓			
	Milford Haven, Welsh Government Local Fisheries Officer			✓			
	Severn and Devon IFCA			✓			
	South West Fish Producers Organisation (SWFPO)			✓			
	S&P Trawlers			✓	✓	✓	✓
	North Devon Fisheries Association			✓	✓	✓	
	Waterdance Fishing			✓			
	Cornish Fish Producers Organisation (CFPO)			✓			
	Interfish Ltd			✓			

Fishing	Stichting voor Visserjontwikkeling (SDVO)			✓			
	Danish Fishermen's Association (DFA)			✓			
	Comité National des Pêches (CNPMEM)			✓			
	Comité National des Pêches (CNPMEM)			✓			
	Deutscher Fischerei Verband (DFV)			✓			
	VisNed (Netherlands Fishermen's Federations)			✓			
	Nederlande Vissersbond			✓			
	Norwegian Fishermen's Association (NFA)			✓			
	Southern Norway Trawler Association			✓			
	Swedish Fishermen's Association			✓			
	Norrards (Fishing Agents - Belgium)			✓			
	Anglo-Spanish			✓			
	National Federations of Fishermans's Organisations			✓			
	Local / Inshore Fishermen			✓	✓		
Recreational Groups and Charter	Dale Yacht Club			✓			
	Celtic Deep Tours			✓			
	Pembrokeshire Outdoor Charter Group			✓			
	Activity Pembrokeshire			✓			
	Awesome Fishing			✓			
	Haven Boat Charters			✓			
	Fishing and Foraging Wales			✓			
	Haven Diving Services			✓			
	Cleddau King Boat Charters			✓			
	Broadside Boat Charters			✓	✓		
	West Wales Dive Company			✓			
	Neyland Yacht Club			✓			
	Pembrokeshire Haven Yacht Club			✓			
	Pembrokeshire Yacht Club			✓			
	Fishguard Bay Yacht Club			✓			
	Newport Boat Club			✓			
	Saundersfoot Sailing Club			✓			
	Welsh Federation of Sea Anglers			✓			
	Celtic Charter			✓	✓	✓	
	Dale Sailing			✓			

Notes of Meeting – Hazard Workshop

Project Erebus Floating Offshore Wind Farm

Client:	MarineSpace
Project:	EIA for Project Erebus Floating Offshore Wind farm Shipping and Navigation Assessment
Venue:	Microsoft Teams Meeting
Date of Meeting:	22-Apr-2021 (1000 - 1330)

Present (note some attendees joined/left during workshop):

Milford Haven Port Authority (MHPA)	David Lockwood (DL) Mike Ryan (MR)
MHPA (Pilots)	Matt Jennings (MJ)
North Devon Fisheries Association	John Balls (JB)
Chamber of Shipping (CoS)	Robert Merrylees (RM)
S&P Trawlers	Scott Wharton (SW)
MOD	Steven Phillips Harries (SPH)
Celtic Charter	Nick O'Sullivan (NO)
Milford Harbour User Association	John Hancock (JH)
Water Ranger	Brian McFarlane (BM)
MarineSpace	Rhianna Roberts (RR) Lara Lawrie (LL) Phil Durrant (PD) Jonny Lewis (JL)
Blue Gem Wind	Sean Evans (SE)
NASH Maritime Ltd	Jamie Holmes (JJH) Ed Rogers (ER) Raffi Gracie (RG)

Apologies / Did not attend:

Milford Haven Port Authority (MHPA)	Stephen Balmain
Maritime and Coastguard Agency (MCA)	Nick Salter
Trinity House	Captain Trevor Harris
Broadside Dale	Andy Truelove
Inshore Fishing	Nick Howells
Inshore Fishing	Chris Hughes

Inshore Fishing	Timothy Bowman-Davies
Irish Ferries	Chris Peake
Blue Gem Wind	Ben Huskinson

1.	**Introductions**
1.1	JJH shared a presentation on screen, outlining workshop housekeeping and the materials/resources available, including: • Letter and project information (issued in prior to 26-Mar-2021) • Slide Pack (as issued to all attendees on 19-Apr-2021) • Polling function on hazard scoring • Minutes to be issued after the meeting The project developer and EIA team were introduced, and attendance list was completed. *[Post meeting note: Instructions and links for completing the polls for hazard scoring were shared with relevant attendees after the meeting on 23-Apr-2021.]*
2.	**Objectives and Terms of Reference**
2.1	JJH reiterated the requests (Questions) which the workshop was to address - as set out in the consultation letter sent to all stakeholders. The three questions were: 1. *"Whether the proposed development of the array area and/or cable route is likely to impact the routing of any specific vessels or your organisation during construction, operation or decommissioning phases?* 2. *Whether the proposed development of the array area and/or cable route is likely to pose any concerns to safety of navigation or specific hazards during construction, operation or decommissioning phases. Where hazards are identified it would be helpful if you can provide commentary on the potential likelihood and consequence of these hazards to people, property, business and the environment?* 3. *Potential suitable risk controls or means to mitigate impacts on routing or safety of navigation?"*
3.	**Project Information**
3.1	JJH and the project team presented and explained relevant project information including items below and as presented in slides 10 to 19 of the meeting pack: • Project overview • Array Area and Potential layouts • Export Cable Route and Landfall • Wind Turbine Generator and floating platform • Mooring system • Lazy Wave array cable • Construction/installation at array area • Installation of the export cable • Operation and maintenance Discussion points raised during the above include: <u>Station keeping and platform stability</u> • The maximum excursion of the WTG platform vs. the nominal position is up to 40-50m, with a maximum of 50m based on 20% contingency. • JB raised concern over movement of the WTG in heavy swell and highlighted that the most significant concern for fishing is the size of the mooring footprint.

	- SE clarified that the mooring system is for positional station keeping around the co-ordinates of it's central location whilst the semi-submersible platform provides sea keeping stability. - SE to provide further clarification on station keeping. *[Post meeting note (SE): The mooring system is designed to resist extreme conditions such as 50 year return period event (i.e. significant wave height of 12.5m, wind speed of 56 knots (1hr based) and current velocity of 2.2 knots).* *The associated maximum offset (excursion) of the floater with regard to its nominal position is 40m under such extreme event.]* Inter-array cable - DL queried the clearance between the bottom of the semi-submersible floating platform and the buoyant section of the lazy wave inter-array cable (the latter having a nominal depth below the sea surface of 26m, but a worst case level of 14m below the sea surface, which would be approximately level with the underside of the semi-submersible floating platform, and risk of the mooring system, lazy wave inter-array cable and/or platform becoming entangled. - SE/JJH confirmed that the lazy wave array cable will be designed to de-conflict with the platform so there is no risk of snagging although the project agreed to provide clarification on this aspect of the design. *[Post meeting note (SE): The IAC configuration (lazy wave) is designed to avoid any clash with the surrounding elements, i.e. adjacent mooring lines, adjacent IAC and the Hull structure, and without the hog bend of the lazy wave reaching the surface and without the sag bend of the lazy wave contacting the sea bed.* *The current minimum clearances are achieved in extreme conditions:* - *19m with the mooring lines;* - *5m between the sag bend of the lazy wave and the sea bed in the most unfavorable loading conditions (i.e. with Marine Growth);* - *14m between the hog bend of the lazy wave and the surface (without Marine Growth).* *Clash analysis between IAC has not been performed at this stage as the WTG layout and the associated IAC routing is yet to be finalized but it will be designed to achieve comfortable clearance margin in extreme condition.* *As a general statement, this is a clear design requirement to avoid any contact of the IAC with any surrounding elements of the FOWT with comfortable clearance margin. During the engineering phase of the project dedicated clash analysis will be performed to demonstrate compliance with this requirement.]* Mooring system - JB queried why choice of foundation for the mooring system had not been confirmed yet with options being considered including drag embedment anchors, suction piles, drilled piles and driven piles. ○ JL explained that further survey work is being undertaken this spring in order to obtain the information needed to make a decision. - SW commented that drag embedment anchors are preferred because piling has a bigger impact on fish.

	◦ JL confirmed that impacts to fish and marine mammals will be assessed and considered in the overall application. Cable laying • JJH presented schematic of cable laying near West Angle Bay and the East Channel, highlighting the likely lay rate (between 1,000 and 2,000m per day) and 500m safety zone around the cable lay vessel. • John Hancock (JH) commented that the phase mostly likely to impact recreational users is during the laying of the cable through the East Channel. JH also queried length of time it would to lay the cable in this area. ◦ JJH approximated 1-2 weeks as a rough estimate allowing for above rates and transitions – precautionary basis of <4 weeks. Lifespan • JB requested confirmation on windfarm life cycle. ◦ JL: 25 year lifecycle and 2-3 years decommissioning
4.	**Vessel Traffic Data**
4.1	JJH introduced the data sources and vessel traffic analysis, providing an overview of: • Data sources • Overview and context through vessel traffic density plots *[Post meeting note: All stakeholders invited to review the vessel traffic plots relevant to them, and provide confirmation that the data and represented use of the area is considered appropriate.]* Impacts of COVID-19 • The summer and winter vessel traffic surveys were undertaken during the COVID-19 pandemic, a period where vessel traffic may have been adversely impacted. • RM queried whether vessel traffic survey data from 2020 had been benchmarked against previous years. ◦ JJH confirmed that NASH Maritime have undertaken a benchmarking exercise with datasets including 2019 and 2020 datasets (and MHPA port call data) to ensure the data used in the assessment is representative considering any impact of the COVID-19 pandemic on vessel traffic levels. This analysis will be presented within the NRA. Incident data • RM/ER/JJH confirmed that long term MAIB incident data is being used (in addition to reference to RNLI and MHPA data). • ER provided information on the incident data: ◦ Some incidents require further analysis and classification of the description to ensure standardised and correct interpretation. For example some incidents such as collisions may be logged twice (one for each vessel involved) or may have incorrect location or hazard cause/effect description. ◦ However initial review of the available data showed little evidence of incidents occurring around the array area. In general the number of incidents increase towards MHPA entrance and the coast – which is as expected. • ER invited comment from attendees on representativeness of incident data and sources in the area. No comments were made.

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<tr><td>5.</td><td>Navigation Risk Assessment Methodology</td></tr>
<tr><td>5.1</td><td>ER provided overview of industry guidance and risk assessment methodology as per slides 24 and 25 of the pre-pack.

ER explained the matrices and highlighted as reference for later in the session
ER provided worked examples of realistic most likely and realistic worst credible hazard scores
ER invited comment from attendees on proposed methodology. No comments were made.
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<tr><td>6</td><td>Hazard Identification</td></tr>
<tr><td>6.1</td><td>JJH provided context to the hazard types and scores discussed within the workshop.

An initial hazard identification and scoring workshop had been undertaken by the NASH Maritime project team based on:

traffic and incident data analysis,
early consultation with some of the workshop attendees,
written comments from consultees,
expertise and judgement of the project team.

These draft hazard scores were presented to the meeting.
JJH described how hazards have been identified and categorized into 23 individual hazards.

<u>Categorization of large and small vessels</u>

Discussion held on the basis of ‘large’ and ‘small’ vessel categories adopted for <u>collision</u> risk hazards.
RM queried small commercial and large cruise ships included within one category ‘large vessels’.

JJH explained these vessels are scored separately but analyzed as subgroups (as per direct hazards) to ensure the hazard is fully considered
ER noted that the level of traffic within the array area is very low resulting in low collision likelihood and that differences in consequences were addressed using the ‘realistic worst credible’ score which will consider worst case scenario (e.g. consider largest vessels)
RM accepted this rationale and was interested to see how this is presented in NRA. JJH and ER noted that ‘Large’ and ‘Small’ vessels will be defined within the NRA

DL highlighted the area-specific nature of any potential hazard and queried whether large and small vessels will be considered differently depending on area. For example, the array area, turbot bank or cable laying within port limits. Raised concern because there will be different considerations and level of risk between offshore deep-water collisions and collisions within the West Channel or Pilot Station.

JJH: noted the comment and the area specific nature across the project area (array area vs cable route vs cable route within port limits) and also balancing the multiple phases of the project lifecycle. For example collision risk potential along the cable route (and therefore MHPA limits) may change during cable installation works.

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	○ JJH also acknowledged the existing MHPA risk assessment encompassing MHPA port limits and approaches and the importance of balancing consistency between the assessments (the Erebus NRA does not seek to 'replace' or replicate the MHPA risk assessment for example). ○ NASH Maritime agreed to discuss how NRA is integrated with existing risk assessment within port limits. *[Post meeting note: Meeting set up with MHPA to review relevant hazards and any risk assessment queries – which may include identifying additional hazards.]* JJH presented and explained the table of risk controls (embedded within the risk assessment) and invited attendees to review after the meeting, prior to completing the hazard scoring polls.
7	**Hazard Workshop** This section presents the key hazard workshop discussion points grouped by user type for ease of reference. This portion of the workshop included: • An overview of the navigation characteristics and vessel traffic disposition in the area (by user type) based on data analysis and an invite for attendees to validate and provide commentary on this. • Discussion on key navigation impacts, hazards and risk controls • Review of preliminary hazard risk scoring (developed by NASH Maritime) prior to online polling forms to be issued following workshop.
7.1	JJH shared screen showing example hazard score poll (generated via Microsoft Forms) to be shared with attendees (based on relevant hazards) post workshop. • MR requested clarification as to who consequence is measured against. ○ JH: consequence is considered with respect to People, Property, Environment and Business and signposted to the scoring matrix (slide 26 of pre-pack).
7.2	**<u>Fishing (charter vessels)</u>** Using plots showing the vessel tracks of selected fishing charter vessels, discussion was held to help understand how the fishing charter vessels use the area, and how they might be impacted. • NO provided narrative on how and where they fish, and the activities that are undertaken. ○ The fishing charter vessels often drift when fishing, during which their trajectory is dictated by the wind and tide. ○ Vessels usually work the 100m contour west and southwest of St Ann's Head. ○ Drifts usually start to the west and drift towards the array area, often finishing the drift at the cable crossing southwest of the array area. ○ Often undertake drifts near the proposed array area and would therefore have to cease drift early, pull in gear and relocate if drifting toward the array. ○ NO noted existing restrictions associated with the TSS to the west. ○ NO noted that other fishing charters (notably Andy Truelove) participate in similar activities and share similar views. ○ NO noted concern that whilst Erebus itself was not a large project site, he had concern on cumulative impact of multiple projects of larger size.

Fishing (commercial)

Array area, cable burial and fishing

Discussion held around fishing and potential hazards, specifically relating to the cable route and cable burial.

- SW reiterated that the current array area is in the preferred position from a commercial fishing point of view. There is comparatively little fishing activity within the array area and the location of the array is preferred compared to previous options. Primary concern surrounds the cable as it runs through the central fishing grounds, and area which is heavily towed.
- Primary concerns summarised by SW relate to the cable route include:
  - Cable burial and seabed movement: concern surrounding movement of the seabed, particularly during winter storms, when the cable could become uncovered. In the event of cable exposure, there is the potential for fishing gear snagging.
  - Liability relating to snagging events at any point in the lifecycle of the windfarm. There is concern that in the event that a fishing vessel becomes snagged on the cable, that the fishing vessel/persons/company involved could be liable for damage to the windfarm or cable.
- Reassurance is sought from the fishing community that the cable will be sufficiently buried or protected to prevent potential snagging and clarification is provided around future liability.
- RM seconded concerns around seabed movement and adequate cable burial and/or protection.

[Post meeting note (SE): The final export cable route will be subject to a detailed cable burial risk assessment prior to installation, with full consideration of the depth of lowering required to minimise potential for interaction (taking account of burial protection requirements supported by anchor/trawl/dredge/otter board penetration considerations). The cable is anticipated to be either: fully buried (where ground conditions permit and burial tool performance allows); partially buried (buried, but not to target depth) with rock protection; or surface laid with rock protection. The Project team are aware of, and have acquired site specific data on, mobile bedforms that occur within the proposed cable corridor e.g. sandwaves. Preliminary cable routing assessment work has sought to identify routing options that run in the troughs of and parallel to the orientation of sandwaves in the direction of the bedform migration such that any future sandwave migration would add to cable over cover.

Notwithstanding the above, the Project acknowledges that snagging risk cannot be ruled out entirely over the lifetime of the project. However, the following risk controls are embedded within the Project to reduce snagging risk to an acceptable level (see slide 30 of the pre-pack):

- *Risk Control 1: Promulgation of Information*
- *Risk Control 3: Safety Zones*
- *Risk Control 10: Cable Burial Risk Assessment and periodic validation surveys*
- *Risk Control 14: Fisheries Liaison Plan*
- *Risk Control 18: Charting of Export Cable*
- *Risk Control 21: Sub-Sea equipment Verification, Inspection, and Monitoring regime*

Were any such incidents to theoretically occur, the Project envisages that prevailing best practice at the time of occurrence would be followed, including issue of NtMs with information of any cable exposures and chart updates where appropriate. There would also be with a

	presumption that fishers would act in a manner that maximises the chance of safe outcomes and minimises potential for damage to assets.] *[Post meeting note (MarineSpace): The ML is likely to include a condition to undertake periodic surveys of the export cable throughout the lifetime of the development to monitor its condition with regard to burial and potential exposures. The ML will require remedial action including notification to navigation stakeholders within a specified time period should exposed sections of the cable be identified.]* *Cumulative impacts on fishing* • JB noted that, whilst Erebus project is a comparatively small array site, he raised concern around safety for fisherman fishing in the area, particularly given the increase in infrastructure within the area and other proposed projects. *Navigation within or in vicinity of array area* JJH requested input on how fishing vessels might navigate within, in vicinity or around the array area on the basis of the project information that has been provided and invited comments on risk to safety of navigation. • JB: because the site includes floating technology, there will be no fishing within the array area. The mooring systems and subsea cables make's the array area "high risk" and it is unlikely that fisherman would fish within the area to avoid potential risk to gear, and they are also unlikely to pot within the array area. The array area is effectively a 'no go' area to fishing. • JJH described the proposed buoyage during construction (to be removed on completion) and charting of the array area, mooring footprints, anchor spread and queried whether this is helpful to fishermen. ○ JB: noted typical 50m radius around fixed foundations as an excluded area (meeting postscript – assumed as Safety Zone as per Electricity Act) confirmed buoyage would be useful and all information needs to be clearly communicated to the fishing community. ○ JJH also noted that a guard vessel would be in place through duration of construction period and period afterwards (whilst traffic habituates) to provide onsite risk reduction. • SW reiterated that the current array site is the preferred option. • SW suggested that a larger exclusion zone be considered for prudency to prevent fishing vessels snagging on the mooring system or drifting into the array. ○ Suggested 0.5 – 1mile exclusion zone around the array which he considered reasonable considering the length of fishing gear used, fishing vessels and personal experience. ○ JJH noted these points and clarified understanding that project was not currently proposing a Safety Zone or other formal means of exclusion or extinguished rights of navigation around the array area other than for construction or major maintenance activities. • JB and SW requested meeting with MarineSpace and any relevant information to be passed on to NASH as appropriate. ○ JL happy to liaise. • JL confirmed that for the commercial fisheries chapter (note that this is assessed separately from the shipping and navigation in terms of commercial impacts), a 1nm buffer around the array area is considered as area lost for fishing.

	• Online hazard polling would be shared for review/input from attendees (issued on 23-Apr)
7.3	**<u>Recreational</u>** It was confirmed that the current array area location has minimal impact on recreational vessels as there are no major routes through this area. JH highlighted the impact of cable laying within the range / port limits on recreational vessels. A primary route for recreational vessels is southeast out of Milford Haven. Cable laying within this area could therefore extend the route for leisure vessels which JH considered could make some trips unviable. Liaison between the cable lay vessel and the Castlemartin firing range (see also 7.5 of these minutes) to provide agreement on suitable inshore route for leisure vessels, would mitigate this by reducing displacement of leisure vessels. This may also impact tourist and fishing vessels. SPH and DL agreed this operational co-ordination would be considered feasible. JJH noted these concerns in relation to recreational vessels, concluding that with active operational management, activities could be undertaken safely. Impacts are minor and primarily relate to displacement of recreational vessels during the relatively short duration of cable lay within the nearshore area (assume <4 weeks). Concluded points: ○ A southeasterly (inshore) departure route for recreational vessels agreed between MHPA, the range, cable contractor and other groups would be reviewed. ○ Noted that AIS aids to navigation on the WTGs could leave vessels unequipped with AIS receiving ability (or radar) at risk of contact in restricted visibility conditions. ○ Attending recreational users intended to review and complete hazard scoring poll (issued on 23-Apr).
7.4	**<u>Commercial/Tankers</u>** DL requested an additional and separate session with MHPA pilot and additional representatives from MHPA – which would be beneficial to review commercial vessels. DL to propose date and time. Main comments from MHPA include: • Discussion of large and small vessel by area, in order to capture area-specific risks *[Post meeting note: JJH contacted DL and MHPA to share online hazard polling, provide clarification on large/small vessel grouping and seek follow up session]*; and • MHPA intended to review and complete hazard scoring poll (issued on 23-Apr). <u>Turbot Bank</u> • DL noted that there may be a pinch point within the vicinity of Turbot Bank, and that this will be considered as an operational matter. ○ JL: Turbot Bank has been considered within the cable route, in terms of nature conservation and navigation.
7.5	**<u>MOD / Castlemartin Range area</u>** SPH noted that large MOD templates can occupy the entire range area, occurring twice a year. These usually take place in January, seeking periods when there is less shipping to minimise impacts. Templates are planned a minimum of 12 months in advance and can be shared. Cable landfall location/design will not affect the range.

Cable lay

- Primary concern surrounds recreational vessels being diverted into the range during cable laying, particularly as recreational vessels often don't carry radios (see also 7.3 of these minutes).
- SPH raised concern over the 500m safety zone for the cable lay vessel when operating within and near the range. Concern is around vessels entering the range as they avoid the cable lay vessel, their preference is therefore for vessels to pass to the west of the cable lay vessel, avoiding the range. See also Recreational section.
- The size of sea area used will vary and depends on the template being used on the range.
    - JL: There is a nominal safety zone of 500m around the cable laying vessels, although there could be flexibility around this. For example, this could be reduced within the range area or port limits (with MHPA review/agreement) in order to reduce the number of vessels diverted into the range.
    - JJH noted that a variable safety zone was reviewed with MHPA in previous meeting and whilst MHPA would review on a case by case basis, they considered that reduced/variable safety zones were more appropriate on survey activities appropriate to the hazard and project vessels ability to manoeuvre, whilst cable lay activities were considered higher risk and more restricted - so a reduction would be less preferable.
    - JL/SPH agree that a variable safety zone should be considered where safe to do so, and would be decided with the future contractor (and with MHPA if within or adjacent to MHPA port limits).
    - Noted that a guard vessel would be in place through duration of construction period.

UXO

- SPH queried how legacy ordnance would be avoided when laying the cable and during trenching. A key concern from the MOD is ordnance accidently being set off during cable laying.
    - JL responded that managing ordnance is a high priority for the project, the appropriate surveys are being undertaken to identify UXO and that data will be analysed by UXO specialists and the appropriate risk certificates will be obtained.

SPH queried whether pilot boarding stations will be moved during construction.

- DL/JJH confirmed that the pilot boarding station is not intended to be moved. Also noted that cable route had been optimized to reduce impact on approaching vessels (including to deconflict with leading lights)

Meeting Actions

No.	Action	Status
1	Blue Gem Wind Ltd to provide further details to JB on station keeping (ref 3.1)	Closed – post meeting note included above
2	Blue Gem Wind Ltd to provide further details to attendees on any potential interaction of lazy wave array cable, mooring system and semi-submersible floating platform (ref 3.1)	Closed – post meeting note included above
3	All attendees to provide any further commentary on vessel traffic plots relevant to their user group, and representativeness of baseline use of the project area (ref 4.1)	
4	Blue Gem Wind to provide further details on project liability to fishing vessels and cable burial depth (ref 7.2)	Closed – post meeting note included above
5	NASH Maritime and MHPA to hold follow up session of vessel categorization, issues specific to MHPA and commercial vessels and the risk assessment (ref: various)	Information issued by NASH Maritime on 23-Apr-21 and await meeting date
6	MarineSpace to provide any additional relevant outputs from consultation with fishing community	
7	NASH Maritime to issue polling for hazards to groups below for response prior to end of Wed-28-Apr: 1. Recreation 2. MHPA 3. Fishing	Issued by NASH Maritime on 23-Apr-21

Notes of Meeting – Draft NRA Scoring Review Meeting - MHPA

Project Erebus Floating Offshore Wind Farm

Client:	MarineSpace
Project:	EIA for Project Erebus Floating Offshore Wind farm Shipping and Navigation Assessment
Venue:	Microsoft Teams Meeting
Date of Meeting:	08-June-2021 (1300 - 1400)

Present:

Milford Haven Port Authority (MHPA)	David Lockwood (DL)
MarineSpace	Phil Durrant (PD)
NASH Maritime Ltd	Jamie Holmes (JH) Ed Rogers (ER) Andrew Rawson (AR) Raffi Gracie (RG)
Apologies:	Mike Ryan Matt Jennings Stephen Balmain

1.	**Introduction**
1.1	Brief introductions with attendees and apologies. JH thanked MHPA for their time and input into the assessment including the consultation and scoring process, noting the difficulties with undertaking workshops remotely.
2.	**Agenda and Recap**
2.1	JH shared agenda and material sent prior to the meeting, including: • Sheet showing collated scores for selected hazards. NASH scored hazards (from group hazard workshop on 22-Apr-2021 and updated following workshop held on 18-May-2021) and the subsequent scores for these hazards by MHPA from the online polling post 18-May-2021. • 22-Apr-2021 Workshop pre-issue pack (slide 26/60 with scoring criteria as key reference) Objective of this meeting: To review the scores provided by MHPA after the Hazard Workshop and seek common agreement where possible in particular for: • HAZ ID 24: Collision of large vessels with large vessels along the cable route in construction phase (MHPA: 19.3 | NASH 7.5) • HAZ ID 25: Collision of large vessels with small vessels along the cable route in all phases (MHPA: 12.4 | NASH 8.1)

	• HAZ ID 1: Collision of large vessels with large vessels in the array area in all phases (MHPA: 9.1 | NASH 6.6) JH noted that whilst scores between NASH and MHPA are broadly similar across many hazards, these are the hazards with significant difference in number and at least risk rating category difference - hence proposed focus for the meeting. JH refreshed all on the methodology matrices and scoring criteria (slide 26/60) for scoring risks so that consequence and frequency scores could be discussed for both the realistic most likely (RML) and realistic worst credible (RWC) scenarios. Embedded risk controls table were reviewed as a group so that relevant risk controls understood and contextualised. DL agreed that focusing on these hazards would be suitable given that HAZ ID 24 and 25 cover areas of most concern to MHPA (JH noted that 24 &25 were added post HAZID workshop following MHPA comments on these issues). DL reiterated concern around Turbot Bank and the East Channel with knock on impacts to west channel. For an example, DL noted that in the first week of June 2019, 122 vessels >20m LOA transited through the harbour entrance. DL noted that these vessels comprise all commercial vessels including tankers, with many being made up of the ferry. DL also noted that many of these vessels are restricted to using the West Channel. This does not include any fishing or recreational vessels under 20m LOA.
3.	**Risk Controls**
3.1	DL described the recent issues with project survey vessels and communication with MHPA. There had been a lack of communication between the survey vessel and MHPA, leading to deficient passage plan information and safety measures being provided in advance together with incomplete knowledge of General Directions. This resulted in increased disturbance to MHPA and pilots, due to multiple short-notice rearrangements to the schedule that had a knock on effect to the pilot roster. DL raised concern that these deficiencies impacted wider safety of navigation and disturbance to MHPA operations. PD provided apologies on behalf of the Project and assured that this feedback had already been raised with the Project to prevent this happening in the future. DL and JH discussed the proposed risk control by MHPA of limited PEC to project vessels to relieve pressure on pilot rosters albeit this will still require MHPA confidence in project vessel passage plans, schedules and MHPA/local area requirements and awareness prior to PEC status being granted and activities commencing. All agreed that this was beneficial feedback with learning opportunities. JH suggested that learnings from this incident could be used to enhance embedded Risk Control 15: Project Vessel Traffic Co-ordination Plan and Promulgation of Information. *"Project marine traffic coordination to define project vessel passage plans 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 to effectively and safely navigate around the array area and offshore cable corridor."* **Risk Control 15: Project Vessel Traffic Co-ordination Plan and Promulgation of Information** DL suggested a pre-deployment and planning meeting with representatives from vessel, MHPA and pilots would help resolve and prevent major issues beforehand. JH suggested proposing risk control wording: Meeting postscript: *"Contractor/Vessel operators to develop Marine Operations Plan and, for all activities inside MHPA port limits (and recommended within 5nm of MHPA port limits), this shall include comprehensive passage plan in*

pre-approved format for review and authorisation by MHPA. Pre-deployment meeting shall be held with MHPA, MHPA Pilots and Contractor/Vessel Operator to review MOP, co-ordinate operations, identify and reduce operational disturbance and mitigate risks to navigational safety.

Project 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 and any MHPA lines of communication) to enable vessels and operators to effectively and safely navigate around the array area and activities during the offshore cable corridor construction."'

4. Hazard Scoring Review

4.1 JH shared the hazard scoring sheet showing both MHPA scores and draft NASH scores. The consequence and frequency scores for the realistic most likely and the worst credible scenarios were discussed for HAZ ID 24, 25 and 1,

DL confirmed that HAZ ID 24 and 25 are of the most concern to MHPA, as shown by the higher scores.

Hazard ID 24 Collision of large vessels with large vessels along the cable route in construction phase (MHPA: 19.3 | NASH 7.5)

MHPA	24	Collision of Large Vessels with Large Vessels	Collision	Large Vessels with Large Vessels	2	C/D	No injuries Minor Damage No Pollution Minor Business	3	4	5	5	4	Multiple fatalities Major property damage Major pollution Serious business	5	5	5	5	4	19.3	Significant Risk - Unacceptable
NASH	24	Collision of Large Vessels with Large Vessels	Collision	Large Vessels with Large Vessels	2	C/D	No injuries Minor Damage No Pollution Minor Business	1	2	1	2	3	Multiple fatalities Major property damage Major pollution Serious business	5	5	5	4	2	7.5	Low Risk - Broadly Acceptable

JH explained that the scores provided by MHPA result in a risk rating category of 'significant risk – unacceptable' such that the Project couldn't proceed on this basis.

Hazard scores were discussed and adjusted in light of enhance RC ID 15 and alignment on basis of frequency and likelihood. DL confirmed the amended scores and acceptable.

Realistic Most Likely

- Discussion to contextualise this being a glancing blow collision scenario
- DL noted that even though short duration of construction and decommissioning phase it's is a high concern area and so wouldn't go below 3 for frequency.
- DL proposed amending people to 2, property to 2 and environment to 2 because standard response is to send out response team (and environmental sensitivity of the area), business to 2
- JH noted that NASH environment (1) should be upgraded to 2 on the same basis
- DL noted env sensitive area.

Realistic Worst Credible

- Noted alignment in consequence scores and primary difference being in likelihood/frequency
- JH and ER explained that conventionally they would anticipate the RWC being a less frequent, higher consequence event relative to the more frequent lower consequence RML event. Discussion held on this point
- DL proposed reducing frequency to 3 and noting comfortable in resulting overall medium risk category.

All agreed on revised scores.

Hazard 25: Collision of large vessels with small vessels along the cable route in all phases (MHPA: 12.4 | NASH 8.1)

MHPA	25	Collision of Large Vessels with Small Vessels	Collision	Large Vessels with Small Vessels	2	C/O/D	Minor Injuries Minor Damage No Pollution Minor Business	3	2	2	3	4	Multiple fatalities Moderate property damage Moderate Pollution Serious business	5	4	4	4	3	12.4	Medium Risk - Tolerable (If ALARP)
NASH	25	Collision of Large Vessels with Small Vessels	Collision	Large Vessels with Small Vessels	2	C/O/D	Minor Injuries Minor Damage No Pollution Minor Business	2	2	1	2	4	Multiple fatalities Moderate property damage Moderate Pollution Serious business	5	3	3	4	2	8.1	Low Risk - Broadly Acceptable

Realistic Most Likely

- DL noted primary concern is on construction phase
- JH noted MHPA scores have e higher consequence scores under RML and same frequency
- DL proposed to reduce people and business to 2.
- JH proposed to increase NASH environment score to 2.

Realistic Worst Credible

- DL reduced property and environment from 4 to 3.
- DL reduced frequency from 3 to 2

All agreed on revised scores and low risk rating category.

Hazard ID 1: Collision of large vessels with large vessels in the array area in all phases (MHPA: 9.1 | NASH 6.6)

MHPA	1	Collision of Large Vessels with Large Vessels	Collision	Large Vessels with Large Vessels	1	C/O/D	No injuries Minor Damage No Pollution Minor Business	3	3	4	3	2	Multiple fatalities Major property damage Major pollution Serious business	3	3	4	3	3	9.1	Medium Risk - Tolerable (If ALARP)
NASH	1	Collision of Large Vessels with Large Vessels	Collision	Large Vessels with Large Vessels	1	C/O/D	No injuries Minor Damage No Pollution Minor Business	1	2	1	2	2	Multiple fatalities Major property damage Major pollution Serious business	5	5	5	4	2	6.6	Low Risk - Broadly Acceptable

Discussion on RWC consequence which was reduced from 3 to 2 and resulting scores of 'low risk' was agreed as appropriate.

Overview provides of scores for general review and context.

5	A.O.B
5.1	JH confirmed that NRA will be updated and DL is comfortable to see these within the draft report in due course.

Meeting Actions

No.	Action	Status
1	NASH to look at wording on Risk Control 15 to share with attendees	See above
2	MHPA to review/amend Risk Control 15	Open - MHPA

Notes of Meeting – Post HAZID Workshop Meeting - MHPA

Project Erebus Floating Offshore Wind Farm

Client:	MarineSpace
Project:	EIA for Project Erebus Floating Offshore Wind farm Shipping and Navigation Assessment
Venue:	Microsoft Teams Meeting
Date of Meeting:	18-Apr-2021 (1400 - 1530)

Present:

Milford Haven Port Authority (MHPA)	David Lockwood (DL) Mike Ryan (MR) Stephen Balmain (SB)
MHPA (Pilots)	Matt Jennings (MJ)
NASH Maritime Ltd	Jamie Holmes (JH) Andrew Rawson (AR) Raffi Gracie (RG)

1.	**Introductions**
1.1	All attendees were introduced, and JH thanked MHPA for helpful and active participation in assisting NASH Maritime progressing the shipping & navigation studies through attendance at meetings and provision of supporting data and information.
2.	**Agenda**
2.1	JH shared presentation and outlined agenda for this follow-up workshop: • Review minutes from Hazard Workshop held on 22-Apr-2021 (finalised minutes R02-00 had been issued on 17-May-2021). • Review post hazard workshop queries and clarifications from SB on dredging and MHPA considerations on management of PEC • Review hazard workshop follow up email (23-Apr-2021), including hazard risk scores for: ○ Collisions (inc. query raised by DL during Hazard workshop) ○ Tankers ○ Commercial ○ Recreational
3.	**Review Minutes from Hazard Workshop**
3.1	JH talked through the meeting actions presented in the final minutes from the Hazard Workshop.

	NASH will reissue polling links with updated hazards following this workshop and it was requested that MHPA input into the polls, if possible, prior to 26-May-2021. MR noted that small face-to-face meetings could be facilitated (likely no more than 8 people) if necessary and preferable. JH and MR agreed that this could be beneficial and proposed to review if required if any key issues arose from this workshop and scoring differential on the follow up polls. Noted that this would require review in context with Covid restrictions and also with MHPA and BGW risk assessment/policies in place.
4.	**Dredging and PEC Queries**
4.1	***Dredging*** JH noted SB query on potential impact on MHPA and use of licenced sites for dredging activity. JH presented plot showing licenced areas and summarised a follow up discussion held with Antony Bates Partnership (MHPA dredging advisors) to review potential impacts to dredging activities within the area. • LU169 is the most used area for fine sediments • LU168 used less (larger grain size) • Maintenance dredging undertaken on a 2-3 year frequency for a 6-8 week duration • Potential impact considered low albeit any overlap of any Erebus construction activity with a dredging campaign should be considered and protocols established (through communication) to minimise impact to dredger transits and cycle times. • SB happy that dredging activities have been adequately considered. ***Pilotage Exemption Certificate (PEC)*** JH noted that MHPA are proposing a limited area PEC for the Erebus construction vessels within MHPA area. MHPA to define spatial extent and requirements for limited area PEC for construction and decommissioning phases of the project.
5.	**Post Workshop Activities**
5.1	***Hazard Risk Scores*** JH and DL discussed hazard categories and balance between ensuring hazards are identified and appropriately broken out by specific risks, areas, phases and vessels/activities. JH clarified that the Erebus OWF risk assessment is a standalone risk assessment covering the array area and cable route under MGN543 guidance (updated to MGN654 in May-2021). It is recognised, as per discussions in Jul/Aug-2020 that MHPA have an extensive and mature risk assessment covering their port limits and the Erebus OWF risk assessment doesn't seek to replicate the MHPA risk assessment although this has been reviewed by the Erebus team. DL noted higher density traffic within port limits and round the East and West Channels (i.e. in proximity to the cable route) compared to the array area and that combining some of these areas/phases could reduce opportunity to delineate between individual hazards within the risk assessment. JH noted this and that NASH had proposed (ref JH email 23-Apr-2021) to break out specific hazards where MHPA feel this may be required (principally collision) and to ensure that the project risks are captured – see item 5.2 of these minutes. MR noted timing and flexibility around use of East Channel. It would be useful for MHPA to have input into schedule and timing of planned works to minimise impact to vessels using the East Channel and so they can manage the resulting use of the West channel by the full mix of

	vessels (e.g. schedule sensitive ferries with large O&G vessels). All agreed that coordination and understanding of limitations around use of East Channel during works is important so that MHPA can manage changes during construction. JH confirmed that co-ordination of this nature is proposed through the embedded risk controls.
5.2	***Collisions*** DL noted that the port is primarily concerned with risk within the port limits and approaches, given the density and mix of traffic and the inability of some larger vessels to take avoiding action from slow moving cable lay vessels operating within busy port areas during construction. MHPA must also consider operational hazards, such as those impacting schedule critical ferry routes. JH noted that consultation had been sought with Irish Ferries (and others) on this point. JH recapped that currently 3 hazards had been established covering collision between large/small vessels across the cable route and array area during all phases. JH and DL discussed NASH proposed options for breaking out area specific collision hazards so that risks along the cable route within the port limits are appropriately defined and scored separately. • JH suggests splitting hazards by phase and by area • Risks during the construction phase within vicinity of port limits should be reflected Discussion held on areas and approaches by large vessels. DL summarised that: • > 10nm - offshore / waiting (JH confirmed this with respect to AIS data analysis showing waiting of vessels (at <8kts to east of the array site); • 5-10nm – maneuvering area; and • <5nm - inshore approaches area. MJ provided an overview of the manoeuvrability of larger vessels approaching the port and supplementary commentary to port guidelines. • Large vessels (and those with a draught >14.5m) use West Channel • Vessels around 40 000 DWT need circa 1nm to abort when entering the West Channel, and need to be on leading lights no closer than 3nm. • Vessels <20 000 DWT can use the East Channel as long as not low water springs. • Pilot boarding station is circa 4nm away to allow time for pilot transfer prior/post manoeuvring onto the leading light/transits. • MJ suggested that risk mitigation is considered up to the 5 mile port limits (JH confirmed this is the case). JH shared the draft scores from the original internal HAZID and scoring workshop (HAZ ID 1, 2 & 3) and asked for comment: • DL reiterated concern of area-specific risks relating to the high vessel traffic within port areas not being split out within in the current hazards. Primary concern around manoeuvring areas in vicinity of the cable route. • JH confirmed that area-specific risks may not necessarily increase within the port area because mitigation measures are in place. JH presented mitigation measures table and specified relevant risk controls. *ACTION: NASH to update risk register and hazard scoring breaking out collision risks by phase.* *MEETING POST SCRIPT: See slide 10 and 11*

	• *Slide 10: HAZ ID 1, 2 & 3 amended for collision of all vessel types in the array area only during all project phases* • *Slide 11: Additional HAZ ID 24, 25 & 26 for collision of all vessel types in cable route (and hence port limits and approaches) during construction/decom for large vessels (HAZ ID 24) and also operation phase for all vessels.*
5.3	***Tankers (Contact/Snagging)*** AR confirmed tankers split from other large commercial given specific nature of activity at MHPA. JH presented risk scores for tanker hazards (HAZ ID 5, 11 & 17) and asked for comment. SB confirmed that the scores look fine. Tankers would navigate away from the array area and so the most likely hazard would be associated with breakout and a drifting WTG.
5.4	***Commercial (Contact/Snagging)*** JH presented risk scores for commercial vessels (HAZ ID 4, 10, 16) and asked for comment. No further comments.
5.5	***Recreational (Various)*** JH presented risk scores and highlighted that some recreational hazards fall within MHPA although recreational users have also been consulted directly. DL confirmed that all scores look reasonable.
6	**AOB**
6.1	No other comments from attendees and MHPA agreed to review minutes and scores by NASH Maritime and then respond with online polling/direct comments if further discussion. JH thanks all again for participation and explained that the NRA technical chapter is being progressed over the next 3-4wks to a draft report. *MEETING POST SCRIPT*: NASH Maritime have confirmed with the project team that the NRA will be shared, pre-application (circa Jul-Aug) with MHPA for comment.

Meeting Actions

No.	Action	Status
1	NASH to break out collision risks and score	NASH held internal scoring workshop 19-May-2021 to update and score collision risks.
2	NASH to send out polling links	NASH issued polling links via email on 20-May-2021.
3	MHPA to complete hazard polls	To be completed by 26-May-2021

Appendix C
Hazard L

Hazard ID	Hazard Rank	Hazard title	Hazard type	Vessel Type (Receptor)	Area	Phase (C/O/D)	Realistic Most Likely Consequences	Realistic Most Likely Scores					Realistic Worst Credible Consequences	Realistic Worst Credible Scores					Overall Risk Score	Overall Risk Rating
								People	Property	Environment	Business	Frequency		People	Property	Environment	Business	Frequency		
1	12	Collision of Large Vessels with Large Vessels	Collision	Large Vessels with Large Vessels	1	C/O/D	No injuries Minor Damage No Pollution Minor Business	3	3	4	3	2	Multiple fatalities Major property damage Major pollution Serious business	3	3	4	3	2	7.3	Low Risk - Broadly Acceptable
2	13	Collision of Large Vessels with Small Vessels	Collision	Large Vessels with Small Vessels	1	C/O/D	Minor Injuries Minor Damage No Pollution Minor Business	2	2	1	2	3	Multiple fatalities Moderate property damage Moderate Pollution Serious business	5	3	3	4	2	7.2	Low Risk - Broadly Acceptable
3	22	Collision of Small Vessels with Small Vessels	Collision	Small Vessels with Small Vessels	1	C/O/D	Minor Injuries Negligible damage No Pollution Negligble publicity	2	1	1	1	3	Multiple major injuries Moderate damage Moderate pollution Minor business	4	3	3	2	2	5.9	Low Risk - Broadly Acceptable
4	11	Contact / Allision with WTG (in place) of Commercial vessels	Contact / Allision with WTG (in place)	Commercial vessels	1	C/O/D	Negligible injuries Minor damage No pollution Moderate publicity	1	2	1	3	3	Multiple serious injuries Serious damage Moderate pollution Serious business	4	4	3	4	2	7.4	Low Risk - Broadly Acceptable
5	10	Contact / Allision with WTG (in place) of Tankers	Contact / Allision with WTG (in place)	Tankers	1	C/O/D	Negligible injuries Minor damage Minor pollution Moderate publicity	1	2	2	3	3	Multiple serious injuries Serious damage Serious pollution Serious business	4	4	4	4	2	7.8	Low Risk - Broadly Acceptable
6	6	Contact / Allision with WTG (in place) of Fishing Vessels	Contact / Allision with WTG (in place)	Fishing Vessels	1	C/O/D	Slight injuries Minor damage No pollution Minor business	2	2	1	2	4	Multiple serious/1 fatality Moderate damage Minor pollution Moderate business	4	3	2	3	3	9.0	Medium Risk - Tolerable (if ALARP)
7	19	Contact / Allision with WTG (in place) of Recreational Vessels	Contact / Allision with WTG (in place)	Recreational Vessels	1	C/O/D	Slight injuries Minor damage No pollution Neg. business	2	2	1	1	3	Multiple serious/1 fatality Moderate damage Minor pollution Minor business	4	3	2	2	2	6.0	Low Risk - Broadly Acceptable
8	2	Contact / Allision with WTG (in place) of OWF Construction Vessels	Contact / Allision with WTG (in place)	OWF Construction Vessels	1	C/D	Neg. injuries Minor damage No pollution Minor business	1	2	1	2	5	Serious injury Serious damage Moderate pollution Serious business	4	4	3	4	3	10.2	Medium Risk - Tolerable (if ALARP)

9	3	Contact / Allision with WTG (in place) of OWF Service Vessels	Contact / Allision with WTG (in place)	OWF Service Vessels	1	O	Slight injuries Neg damage No pollution Neg business	2	1	1	1	5	Serious injury Moderate damage Minor pollution Serious business	4	3	2	4	3	9.5	Medium Risk - Tolerable (if ALARP)
10	26	Contact / Allision with WTG adrift (due to WTG breakout) of Commercial vessels	Contact / Allision with WTG adrift (due to WTG breakout)	Commercial vessels	1, 2	C/O/D	Negligible injuries Minor damage No pollution Moderate publicity	1	2	1	3	2	Multiple serious injuries Serious damage Moderate pollution Serious business	4	4	3	4	1	4.3	Low Risk - Broadly Acceptable
11	25	Contact / Allision with WTG adrift (due to WTG breakout) of Tankers	Contact / Allision with WTG adrift (due to WTG breakout)	Tankers	1, 2	C/O/D	Negligible injuries Minor damage Minor pollution Moderate publicity	1	2	2	3	2	Multiple serious injuries Serious damage Serious pollution Serious business	4	4	4	4	1	4.5	Low Risk - Broadly Acceptable
12	15	Contact / Allision with WTG adrift (due to WTG breakout) of Fishing Vessels	Contact / Allision with WTG adrift (due to WTG breakout)	Fishing Vessels	1, 2	C/O/D	Slight injuries Minor damage No pollution Minor business	2	2	1	2	3	Multiple serious/1 fatality Moderate damage Minor pollution Moderate business	4	3	2	3	2	6.3	Low Risk - Broadly Acceptable
13	19	Contact / Allision with WTG adrift (due to WTG breakout) of Recreational Vessels	Contact / Allision with WTG adrift (due to WTG breakout)	Recreational Vessels	1, 2	C/O/D	Slight injuries Minor damage No pollution Neg. business	2	2	1	1	3	Multiple serious/1 fatality Moderate damage Minor pollution Minor business	4	3	2	2	2	6.0	Low Risk - Broadly Acceptable
14	14	Contact / Allision with WTG adrift (due to WTG breakout) of OWF Construction Vessels	Contact / Allision with WTG adrift (due to WTG breakout)	OWF Construction Vessels	1, 2	C/D	Neg. injuries Minor damage No pollution Minor business	1	2	1	2	3	Serious injury Serious damage Moderate pollution Serious business	4	4	3	4	2	6.5	Low Risk - Broadly Acceptable
15	18	Contact / Allision with WTG adrift (due to WTG breakout) of OWF Service Vessels	Contact / Allision with WTG adrift (due to WTG breakout)	OWF Service Vessels	1, 2	O	Slight injuries Neg damage No pollution Neg business	2	1	1	1	3	Serious injury Moderate damage Minor pollution Serious business	4	3	2	4	2	6.1	Low Risk - Broadly Acceptable
16	23	Snagging with WTG moorings, inter array cables or export cable of Commercial vessels	Snagging with WTG moorings, inter array cables or export cable	Commercial vessels	1, 2	C/O/D	Negligible injuries Neg damage No pollution Minor Business	1	1	1	2	3	Minor injuries Minor damage Minor pollution Serious business	2	2	2	4	2	5.7	Low Risk - Broadly Acceptable
17	19	Snagging with WTG moorings, inter array cables or export cable of Tankers	Snagging with WTG moorings, inter array cables or export cable	Tankers	1, 2	C/O/D	Negligible injuries Neg damage No pollution Minor Business	1	1	2	2	3	Minor injuries Minor damage Minor pollution Serious business	2	2	3	4	2	6.0	Low Risk - Broadly Acceptable

18	5	Snagging with WTG moorings, inter array cables or export cable of Fishing Vessels	Snagging with WTG moorings, inter array cables or export cable	Fishing Vessels	1, 2	C/O/D	Slight injuries Minor damage No pollution Minor business	2	2	1	2	4	Multiple serious/1 fatality Moderate damage Minor pollution Serious business	4	3	2	4	3	9.2	Medium Risk - Tolerable (if ALARP)
19	16	Snagging with WTG moorings, inter array cables or export cable of Recreational Vessels	Snagging with WTG moorings, inter array cables or export cable	Recreational Vessels	1, 2	C/O/D	Slight injuries Minor damage No pollution Neg. business	2	2	1	1	3	Multiple serious/1 fatality Moderate damage Minor pollution Moderate business	4	3	2	3	2	6.1	Low Risk - Broadly Acceptable
20	4	Snagging with WTG moorings, inter array cables or export cable of OWF Construction Vessels	Snagging with WTG moorings, inter array cables or export cable	OWF Construction Vessels	1, 2	C/D	Neg. injuries Minor damage No pollution Minor business	1	2	1	2	5	Minor injury Minor damage Minor pollution Serious business	2	2	2	4	3	9.3	Medium Risk - Tolerable (if ALARP)
21	9	Snagging with WTG moorings, inter array cables or export cable of OWF Service Vessels	Snagging with WTG moorings, inter array cables or export cable	OWF Service Vessels	1, 2	O	Slight injuries Neg damage No pollution Neg business	2	1	1	1	4	Moderate injury Minor damage Minor pollution Serious business	3	2	2	4	3	8.3	Low Risk - Broadly Acceptable
22	24	Grounding (export cable route only) of Fishing Vessels	Grounding (export cable route only)	Fishing Vessels	2	C/O/D	Minor injuries Neg Damage No Pollution Neg Business	2	1	1	1	3	Moderate injury Moderate damage Minor pollution Moderate business	3	3	2	3	2	5.3	Low Risk - Broadly Acceptable
23	16	Grounding (export cable route only) of Recreational Vessels	Grounding (export cable route only)	Recreational Vessels	2	C/O/D	Minor injuries Neg Damage No Pollution Neg Business	2	1	1	1	4	Moderate injury Moderate damage Minor pollution Moderate business	3	3	2	3	2	6.1	Low Risk - Broadly Acceptable
24	1	Collision of Large Vessels with Large Vessels	Collision	Large Vessels with Large Vessels	2	C/D	No injuries Minor Damage No Pollution Minor Business	2	2	2	2	3	Multiple fatalities Major property damage Major pollution Serious business	5	5	5	5	3	10.5	Medium Risk - Tolerable (if ALARP)
25	8	Collision of Large Vessels with Small Vessels	Collision	Large Vessels with Small Vessels	2	C/O/D	Minor Injuries Minor Damage No Pollution Minor Business	2	2	2	2	4	Multiple fatalities Moderate property damage Moderate Pollution Serious business	5	3	3	4	2	8.4	Low Risk - Broadly Acceptable
26	7	Collision of Small Vessels with Small Vessels	Collision	Small Vessels with Small Vessels	2	C/O/D	Minor Injuries Negligible damage No Pollution Negligble publicity	2	1	1	1	4	Multiple major injuries Moderate damage Moderate pollution Minor business	4	3	3	2	3	8.5	Low Risk - Broadly Acceptable

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