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Marine Characterisation Research Project (MCRP)

MCRP-MARICO-DOC-0006 Morlais_Phase_One_Navigation_Risk_Assessment _Issue03

Menter Môn

Marine Characterisation Research Project (MCRP)
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MENTER MÔN

RISK ASSESSMENT

MORLAIS MAGALLANES PHASE ONE INSTALLATION NAVIGATION

Report Number:	22UK1877
Issue:	03
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MARINE AND RISK CONSULTANTS LTD

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EXECUTIVE SUMMARY

Following the consenting of the Morlais tidal demonstration zone in December 2021, Menter Môn has requested Marine and Risk Consultants Ltd to complete a Device Specific Navigation Risk Assessment in response to their marine licence (ORML 1938) conditions. This Navigation Risk Assessment is the first device specific assessment for the consented demonstration area and will quantify the navigation risk as a result of the deployment of Menter Môn's "Phase One" installation, which consists of four Magallanes devices. The devices are due to be installed in 2027 within green zone of the Morlais Demonstration Zone.

The Navigation Risk Assessment methodology is based on the International Maritime Organisation's Formal Safety Assessment approach to risk management utilising a combination of data analysis and stakeholder/expert judgement to determine risk levels. Please note, the Navigation Risk Assessment considers safety of navigation and does not seek to address any possible loss of amenity.

The Navigation Risk Assessment was informed by stakeholder consultation, baseline marine environmental conditions and vessel traffic data collected by Marico Marine over two two-week periods which included Automatic Identification Systems data, RADAR data, and visual observations data. A variety of secondary sources including the Royal Yachting Association Coastal Atlas, the HR Wallingford Coastal Processes Modelling Report and navigational incident data were also utilised.

During the risk assessments, notable consideration was given to device particulars including size, design and installation requirements, seasonal variations in traffic numbers and weather, and the location of each device.

There is a risk present to recreational users within the area; an additional 2 risk controls have therefore been implemented since the previous Navigation Risk Assessment to reduce the risk for recreational users operating in close proximity to the devices. Based on the effectiveness of the suggested risk controls, Marico Marine recommend specific consideration for the following:

- Recommended within guidance that safety boats are in attendance for Non-Powered Recreational Craft is an effective mitigation measure against loss of life/injury arising from swamping/capsizing and contacts.
- Guidance for recreational users operating around the devices is an effective mitigation measure against groundings and swamping/capsizing. However, will require efficient promulgation of information.
- Continuous Monitoring by Marine Co-ordination Centre is an effective mitigation measure against contacts, groundings, collisions and swamping/capsizing. Monitoring could include CCTV, AIS and RADAR.
- Provision of life saving equipment on fixed structures and floating devices is an effective mitigation measure against swamping/capsizing. These should be designed to avoid snagging hazards themselves and allow for refuge.

This Navigation Risk Assessment assessed the baseline and residual navigation risk profiles for the Phase One installation, to fulfil the requirement set out within Menter Môn's marine licence to undertake device specific installation navigation risk assessments. The assessment has concluded that:

- The devices are 53.6m by 7m. They will be located in the green area of the MDZ and will consist of two rotors with four inter array cables, three electrical hubs and one export cable.
- The devices are located in an area of low-moderate vessel traffic with an average of approximately 14 vessels per day over the summer period passing through the gate as seen in Section 7, the majority of which being "non-AIS" making up approximately 41% of all recorded tracks. A large proportion of those non-AIS vessels are recreational craft. No commercial vessels were recorded within the vicinity of the device locations. Fishing vessels are known pot within the area, but only during the summer months. Kayakers and other non-powered recreational craft do operate in the area. The navigation profile as assessed from AIS, RADAR and visual observations corroborates the views expressed by stakeholders during consultation;
- The devices are located in an area of challenging metocean conditions and a hazardous leeshore. Based on the HR Wallingford report from 2020, devices deployed will have minimal impact over existing sea conditions;
- The devices are not located in proximity to other offshore developments and may be the first instalment of the Morlais Project;
- All hazards were assessed to be ALARP or lower in the baseline risk assessment. Of the 57 hazards assessed within the construction phase, 5 were scored as ALARP in the baseline assessment. Of the 46 hazards assessed within the operation phase assessment, 2 were scored as ALARP in the baseline assessment;
- The specific mitigation and safety measures to be employed should be selected in consultation with the MCA and listed in the developer's safety manual or Safety Management System. 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); and
- With the introduction of the suggested mitigation measures, 2 hazards were assessed to be ALARP in the construction phase residual risk assessment and 2 within the operational phase risk assessment. All remaining hazards were assessed to be low or lower.

Based on the original findings of this assessment, the Phase One installation was assessed to be acceptable in terms of navigational risk assuming compliance with embedded and implementation of suggested additional mitigation measures where appropriate for hazards scoring as ALARP.

Subsequent additional detailed device and cable deployment methodologies and time scales became available in October 2024, and Marico Marine undertook a detailed review of this document (described in section 1.1). This review confirmed the original assessment outcome – the project remains acceptable in terms of navigational risk assuming compliance with embedded and implementation of suggested additional

mitigation measures where appropriate for hazards scoring as ALARP.

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ABBREVIATIONS

Abbreviation	Detail
AIS	Automatic Identification System
ALARP	As Low as Reasonably Practicable
ATBA	Area To Be Avoided
AtoN	Aids to Navigation
AtNP	Aids to Navigation Plan
COLREGS	International Regulations for Preventing Collisions at Sea
ERCoP	Emergency Response Co-operation Plan
ES	Environmental Statement
FSA	Formal Safety Assessment
GIS	Geographic Information System
HSE	Health & Safety Executive
IALA	International Association of Marine Aids to Navigation and Lighthouse Authorities
ICW	In Collision With
IMO	International Maritime Organization
LARS	Local AtoN Reporting System
LOA	Length-Over-All
m	Metre
MAIB	Maritime Accident Investigation Branch
Marico Marine	Marine and Risk Consultants Ltd
MCA	Maritime and Coastguard Agency
MDZ	Morlais Demonstration Zone
MGN	Marine Guidance Note

MMO	Marine Management Organisation
MMSI	Maritime Mobile Service Identity
MSI	Maritime Safety Information
MW	Megawatts
NCI	National Coastwatch Institution
nm	Nautical Mile
NMS	Navigation Monitoring Specification
NRA	Navigation Risk Assessment
NTM	Notice To Mariners
OREI	Offshore Renewable Energy Infrastructure
PA	Precautionary Area

Abbreviation	Detail
PPE	Personal Protective Equipment
RNLI	Royal National Lifeboat Institution
RYA	Royal Yachting Association
SAR	Search and Rescue
SOLAS	Safety Of Life at Sea
TH	Trinity House
UKC	Under Keel Clearance
VHF	Very High Frequency (radio communication)
VMS	Vessel Monitoring System
VTSS	Vessel Traffic Survey Suite

1 INTRODUCTION

Following the consenting of the Morlais tidal demonstration zone in December 2021, Menter Môn has requested Marine and Risk Consultants Ltd (Marico Marine) to complete a Device Specific Navigation Risk Assessment (NRA) in response to their

marine licence (ORML 1938) conditions. This NRA is the first device specific assessment for the consented demonstration area and will quantify the navigation risk as a result of the deployment of Menter Môns "Phase One" installation, which consists of four Magallanes devices. The devices are due to be installed in 2026 within green zone of the Morlais Demonstration Zone (MDZ) (Figure
1).

The document will assess both the construction and operation phases of the Phase One installation, which have been assessed independently. In conjunction with the NRA, and to satisfy the marine licence, Marico Marine have produced an Aids to Navigation Plan (AtNP) for the proposed devices and a Navigation Monitoring Specification (NMS).

The NRA methodology is based on the International Maritime Organization's (IMO) Formal Safety Assessment (FSA) approach to risk management utilising a combination of data analysis and stakeholder/expert judgement to determine risk levels. It follows the navigation risk assessment guidelines stipulated by the UK's Maritime and Coastguard Agency in their role as Maritime Regulator under Marine Guidance Note (MGN) 654 (see next). Please note that this Navigation Risk Assessment considers safety of navigation and does not seek to address any possible loss of amenity.

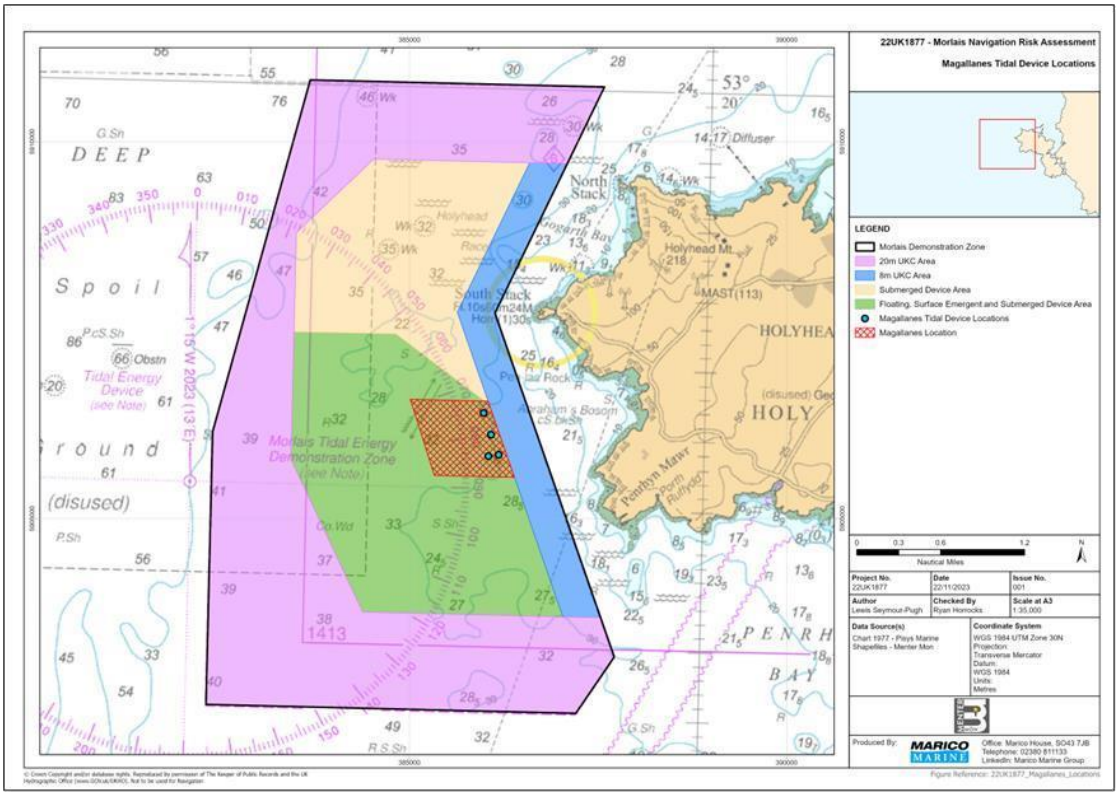

Figure 1: MDZ layout and the location of the Phase One installation devices.

1.1 DOCUMENT REVISION – OCTOBER 2024

Following the initial completion of this assessment (pre-deployment) the device developer has made some changes to the proposed deployment time scales and mooring methodologies.

This assessment has been reviewed to take these changes into account and to confirm that navigation risk remains acceptable.

Specifically, the following sections of this document have been updated since Issue 02 (1 July 2024):

Document Section	Amendment
Exec. Summary	Added reference to October 2024 revision and outcome
1.1	Description of October 2024 amendments
1.3	Additional reference document
3	Date change
3.1	Updates and additional information
3.2	New section with detailed mooring methodologies
3.3	New section with detailed cable installation methodologies
3.4	New section describing support vessels
13.1	New section describing October 2024 cumulative impact
14.1	Minor update clarifying this section is original conclusion
14.2	New section – conclusions of revised assessment, October 2024
Annex A	Table 16 – multiple updates

The overall conclusion at section 14 is unchanged.

1.2 GUIDANCE

The assessment was conducted using the following guidance:

- MGN 654 Guidance on UK Navigational Practice, Safety and Emergency Response Issues (including Methodology for Assessing Marine Navigational Safety & Emergency Response Risks of Offshore Renewable Energy Installations (OREI));

- MGN 372 Amendment 1 Guidance to Mariners Operating in the Vicinity of UK OREIs;
- MGN 489 Pleasure Vessels - UK Regulations;
- MGN 610 (M+F) SOLAS Chapter V: Guidance on the Merchant Shipping (Safety of navigation) regulations 2020;
- MCA - Offshore Renewable Energy Installation: Requirements, Advice and Guidance for Search and Rescue and Emergency Response (Nov 21);
- International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA AISM) G1162 the Marking of Man-Made Offshore Structures;
- Royal Yachting Association (RYA) Position on Offshore Energy Developments;
- International Maritime Organisation (IMO) Formal Safety Assessment. Revised Guidelines for Formal Safety Assessment (FSA) MSC-MEPC.2/Circ.12/Rev.2;
- Regulatory expectations on moorings for floating wind and marine devices – HSE and MCA 2017;
- Cumulative Impact Assessment Guidelines issued by RenewableUK in June 2013; and
- International Regulations for Preventing Collisions at Sea 1972 (as amended) (ColRegs).

1.3 REFERENCE DOCUMENTS

Document Name	Description
22UK1877_Morlais_Demonstration_Zone Navigation_Risk_Assessment_DraftA	The first MDZ Biennial Sitewide Navigation Risk Assessment 2023
ORML 1938	Menter Môns Marine Licence issued by Natural Resources Wales (NRW)
20UK1647_MM_Morlais_NRAAddendum-20 Issue 02	2021 Navigation Risk Assessment Addendum to address sitewide changes and included additional data pertaining to the Morlais Development Zone.
20UK1619_RN_MM_VTS02-02	Interactive Boundary Assessment of the northern and eastern MDZ boundaries in accordance with MGN 543, Annex 3.
06_MOR-HRW-DOC-0001_HR Wallingford Coastal Processes Modelling Report	To assess the impact of the proposed MDZ development on coastal processes, including tidal currents, waves, and sediments.
United Kingdom Hydrographic Office (2022) Admiralty Sailing Directions West Coast of England and Wales Pilot; NP37, 21st Edition	Outlines meteorological and metocean conditions and general guidance in navigation in the area.
Admiralty 1413 – Anglesey – Holyhead Bay	Specific passage guidance for navigation in vicinity of Holy Island.
02_MOR_RHDHV_DOC-0004ES Chapter Description (005)	Morlais Environmental Statement Project Description – Chapter 4, Volume I.
Morlais construction questions Sept 24 v2	Questionnaire completed by developer to provide update timeframes and methodologies.

2 DESCRIPTION OF THE SITE

2.1 MORLAIS DEMONSTRATION ZONE (MDZ)

The Phase One devices are due to be installed within the MDZ, location and layout of which is shown within Figure 1. The MDZ is located to the west of Holy Island, Anglesey, approximately 520m off South Stack. The MDZ occupies a total area of 35km^2

and has been sub-divided into four separate areas; two areas were defined based on visual characteristics, of which one is for all devices including surface emergent devices (green) and one for sub-surface devices (gold). The remaining two areas are based on minimum Under Keel Clearance (UKC) (blue and purple) which will support the installation and commercial demonstration of multiple arrays of tidal energy devices, to a maximum installed capacity of 240 Megawatts (MW).

3 DEVICE SPECIFIC DETAILS, PHASE ONE: MAGALLANES INSTALLATION, 2027

3.1 DEVICE SPECIFIC INFORMATION

Phase One of the Morlais Tidal Demonstration Project is due to commence in June 2027 and will consist of the installation of four Magallanes devices. Device specific information has been provided within Annex A. The information provided has been confirmed as final and is up to date upon the release of this report. Device installation will require the following sequence of events:

- Installation of subsea export cable and hubs;
- Installation of cable protection systems and remedial works;
- Preparation and installation of anchors and moorings at offshore site (for first 4 platforms);
- Installation of first 4 platforms, including attachment of blades, tow to offshore site and attachment to the mooring and subsea cable connections.

An Operations and Management plan will be finalised prior to offshore work commencing.

Monitoring of the devices via a Vessel Traffic Surveillance System (VTSS) will be maintained throughout installation and operation.

The devices will be located to the east side of the “Green” zone within the MDZ; the area where any device specification have been consented to deploy (See Figure 2 for position and Table 2 for coordinates). Each device is 53.6m by 7m (see Annex A, Figure 17 for General Arrangement); energy created by the devices will be transferred from the devices via two dynamic cable hubs, to a central electrical hub which will then be connected to one export cable that extends towards Abraham’s Bosom to the east of the site (the cable route is shown on Figure 2 in black, with the cable corridor shown in brown). The devices consist of two rotors, each with a blade of 21 diameters. The devices will have a draft of 24m with the blades in operation (19.9m when being transported) and will sit approximately 1.97m above sea level (4m with masts included). The devices are due to be installed with 4-point moorings (mooring arrangement is illustrated in Annex A, Figure 16). The Aids to Navigation for the devices have been agreed with Trinity House which have been outlined below. An indicative illustration of the device can be seen in Figure 3.

For device Installation, most works will involve a single multicat vessel with 1 or 2 smaller support vessels. Some works may involve 2 multicat vessels or a multicat and Tug. (See section 3.4 for detail). Estimated installation time scales are given in Table 1 below. Some or all of the vessels will make daily transits from the turbine site to the port of operation (Holyhead). Magallanes have specified a minimum safety zone of 30m around the devices for installation.

Table 1: Installation time scales

Activity	Anticipated duration
Installation of subsea export cable and hubs	Installation of subsea export cable and main hub, including pull-in - 9 days + 5 days weather contingency Installation of 2 off dynamic cable hubs – 1 neap (5 days) + 5 days weather contingency
Installation of cable protection systems and remedial works.	5 days over neap tide period + 3 days weather contingency
Preparation and installation of anchors and moorings at 4 neap tides (5 days operations each neap tide) per platform. 1 offshore site (for first 4 platforms) neap per anchor, including drilling and grouting, curing time	plus connecting and laying mooring line.[1] = Total of 16 neap tides + 3 neaps weather contingency i.e. 80 days on site operations total (non-continuous) over a 4month period (plus contingency)
Installation of first 4 platforms, including attachment 1 neap tide (5 days) per platform for mooring hook-up and of blades, tow to offshore site and attachment to the dynamic cable connection mooring and subsea cable connections = Total of 4 neap tides + 2 neaps weather contingency	i.e. 20 days on site operations total (non-continuous) over a 4month period (plus contingency)
Commissioning of Platforms	28 days + 5 days weather contingency

It should be noted that all schedules might vary since operations are subject to suitable weather and tidal conditions and, therefore, adverse weather may increase the forecasted duration of activities.

For device operation and maintenance, Magallanes have specified that inspections will occur once per month and require maintenance every 10 years. For the cable maintenance, Magallanes have specified that inspections will occur every two years

[1] Times presented are for drilled pile anchors as a worst-case duration.

and will be repaired every 15 years for one month depending on weather.

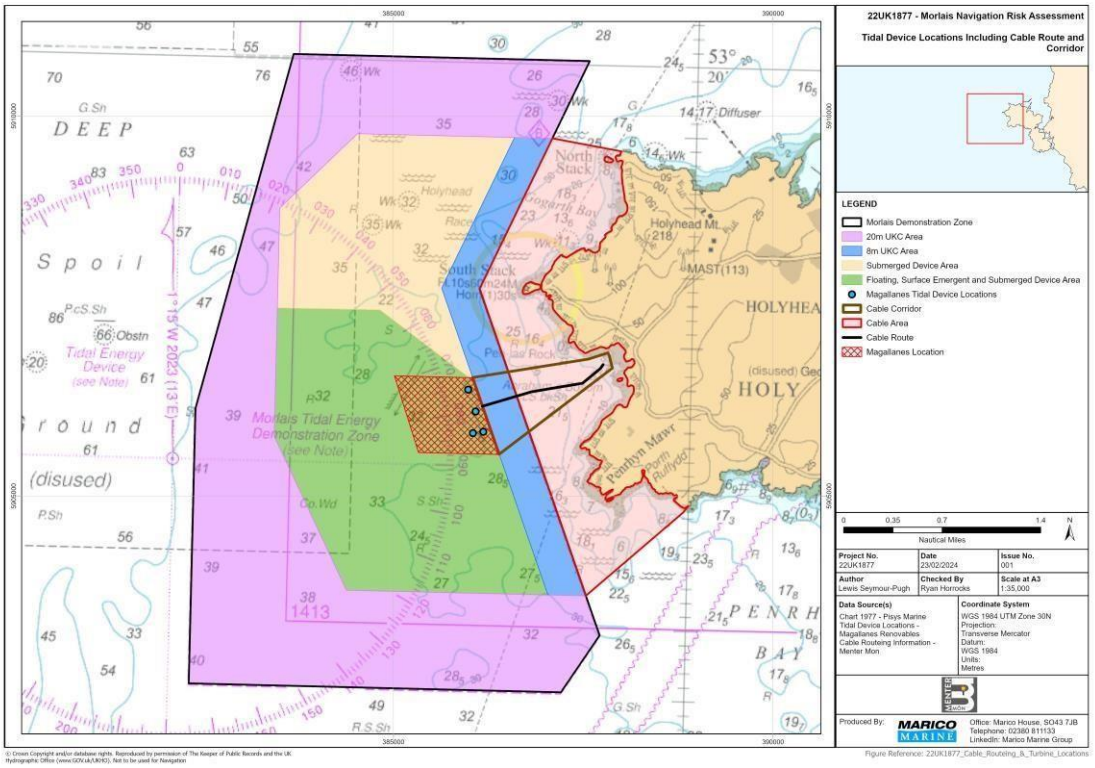

Figure 2: Magallanes Turbine Device Locations.

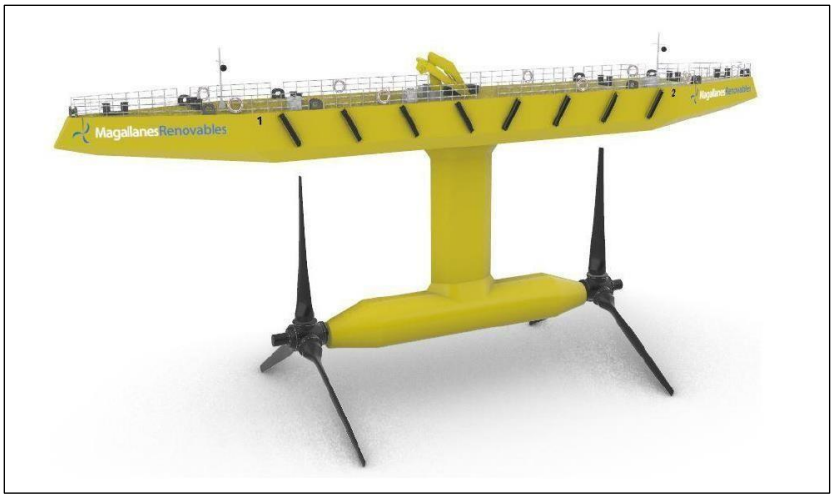

Figure 3 Indicative image of the Magallanes Device

Table 2: Coordinates of Device Deployment.

Deployment locations (WGS 84)										
Device	Latitude		Longitude		Latitude			Longitude		
	D.Degrees		D.Degrees		deg	mins		deg	mins	
Device 1	53.29435	N	4.71067	W	53	17.66	N	4	42.64	W
Device 2	52.29209	N	4.70909	W	52	17.53	N	4	42.55	W
Device 3	53.28941	N	4.70952	W	53	17.36	N	4	42.57	W
Device 4	53.28959	N	4.70747	W	53	17.38	N	4	42.45	W

3.2 DEVICE MOORING METHODOLOGY (UPDATED OCTOBER 2024)

A pre-installation seabed survey will be undertaken initially to gain a better understanding of the seabed conditions to determine if drilled anchors (the preferred solution) is feasible and to size the anchors correctly. The survey will consist of ROV or drop camera footage, grab sampling of the seabed and / or core sampling. This proposed activity may require a separate marine licence or exemption to be obtained from the Licensing Authority prior to undertaking the proposed activity closer to the time. This information will also be useful for assessing, after the decommissioning of the platforms, whether the site has been left in the same condition as it was before the installation.

The installation vessel will use a 4-point mooring spread for the duration of all installation activities on site.

If drilled anchors are used, they will be installed using a submersible drilling rig deployed from a conventional multi-cat type vessel:

- The drill rig will be transported to the deployment site on the deck of a multi-cat;
- Once on site, the vessel will set up on its anchors and the drill rig will be lowered onto the seabed using the vessel crane and levelled using the four independent hydraulic legs;
- Drilling of the anchor to the required depth can then begin;
- If grouted anchors are used, the anchor will be grouted and cured after the drilling is complete;
- A mooring line will then be connected to the anchor and buoyed off for collection later;
- Each anchor will take approximately 1 neap to install and grout then connect and lay its respective mooring line.

Figure 4: Images showing drill rig loadout, deployment to seabed and drilling

If gravity anchors are used (consisting of multiple chain clump weights), these will be deployed from a multicat vessel with sufficient crane capacity to handle the individual clump weights.

Installation operations for the mooring systems and platforms are as described below:

- The multi-cat installation vessel will arrive on site with clumps and lengths of chain prepared on deck.
- Lengths of ground chain will be deployed, connected to each anchor; with the anchors being lowered into their predetermined positions.
- Each chain will be laid on the seabed; and then connected to its recovery system (rope and buoy), ready for connection to the platforms.

Once the mooring systems for the first phase of platforms have been installed and all components and subsystems are fully assembled onto the first platform; that platform will be towed by a multicat or tug vessel to the offshore site. During the towing, the blades will be locked in order to prevent rotation. If necessary, the bottom blade may be removed in a 'bunny ears' configuration to reduce draft. This would then be reattached in a slack period following connection of the platform to its moorings.

The platform will be attached to its 4 anchor points by means of four chain catenary legs, two at the bow and two at the stern.

- The installation multcat will deploy its mooring spread and set up on the moorings;
- The multicat vessel, assisted by a workboat will recover the surface buoy of one chain leg and winch in the ground chain, then connect that leg to the padeye on one end of the platform;
- A second chain will then be connected to the same end of the platform in a similar way;
- The remaining 2 moorings legs will then be connected to the other end of the platform in a similar manner to that described above;
- Finally, the platform will be connected to its cable. The relevant cable tail (from its subsea hub) will be lifted by deck crane from the seabed to the deck of the installation vessel. An umbilical cable (pre-terminated into the platform) will be connected to the connector on the cable tail and the end then laid back onto the seabed.

The other platforms will be connected in a similar manner.

After installation is complete, the installation vessel shall recover its moorings and return to shore.

3.3 CABLE INSTALLATION METHODOLOGY, INCLUDING INSTALLATION OF CABLE HUBS (UPDATED OCTOBER 2024)

A single subsea export cable will be laid from the onshore site to the offshore deployment location as follows:

The export cable will be loaded on to the cable installation vessel - anticipated to be DP capable multicat type vessel. The offshore end of the cable will be pre-terminated with a connector system / hub and 2 cable tails. Two separate 'dynamic cable hubs' will later be connected to these cable tails.[2]

The vessel will sail to the landfall site and set up on anchors or spud legs. A messenger line from the landfall site will be sent out by a small boat. The messenger line will be used to draw out the main pull-in line from the onshore winch. The pull-in line will be attached to the cable end. The cable will then be pulled onshore and through the HDD duct by means of a cable winch and connected to the onshore cable(s) in a transition pit. The vessel will then move to the offshore deployment location paying out the cable onto the seabed as it goes, along the pre-determined cable route. Once at the offshore site, the main connector system / hub and cable tails will be connected to marker buoys and lowered onto the seabed for retrieval later.

Figure 5: Multicat Vessel Equipped for Cable Installation

[2] Note – a variation that consist of a single hub with 6 cable cables is also under consideration, but this multi-hub solution is presented here as a worst case in terms of duration.

In the next Neap following the export cable installation, the 2 ‘dynamic cable hubs’ will be connected to the cable tails from the main hub. Each cable tail in turn will be lifted by deck crane from the seabed to the deck of the installation vessel and connected to a ‘dynamic cable hub’, which will include 3 to 4 cable tails for connection to the platform umbilicals.

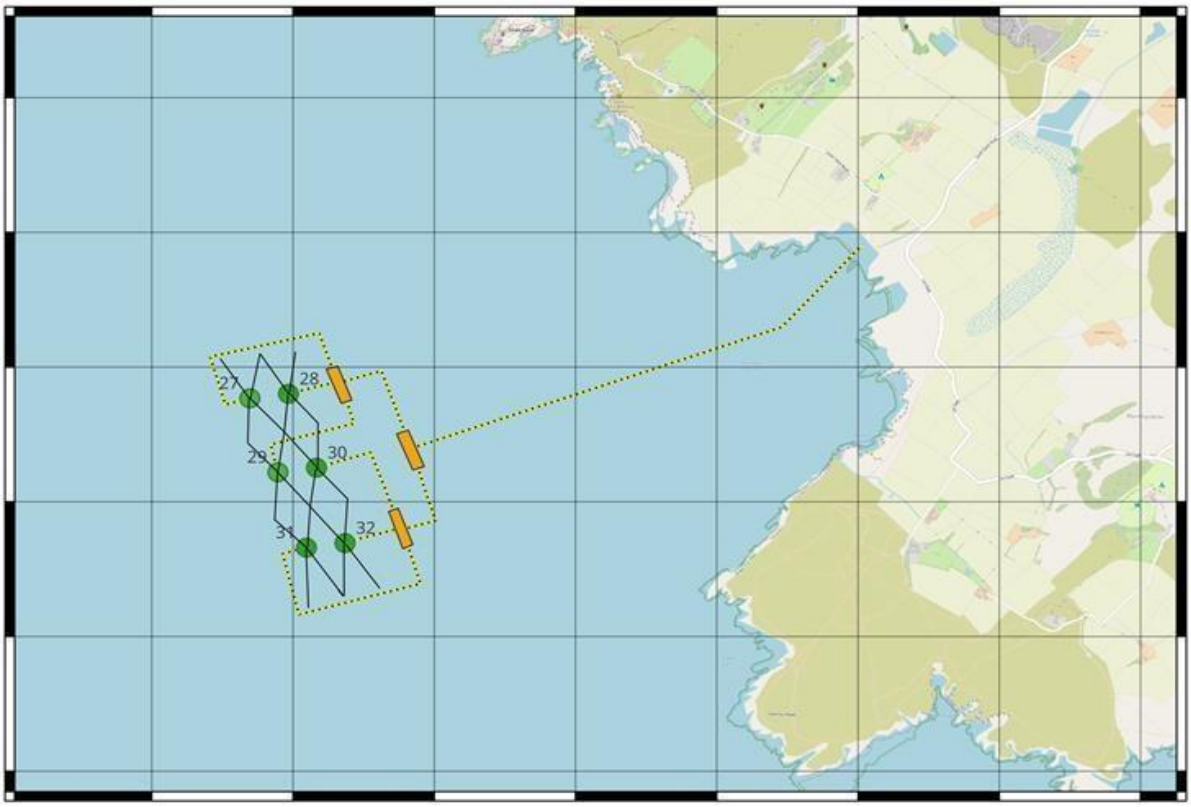

Figure 6: Indicative Cable Connections to Platforms

Cables will be surface laid only, as it is unlikely that much burial can be achieved due to a lack of surface sediment. The export and umbilical cables will be secured / stabilised with the use of rock bags (consisting of graded rock in a mesh ‘bag’) or mattresses (a ‘flexible’ matrix of linked concrete blocks). In the intertidal area, articulated split pipe / cable shells may also be used to further stabilise the cable and add additional protection in this high energy zone.

The rock bags or concrete mattresses will be laid over the cables in pre-determined positions and undertaken using a multicat vessel with a crane or A-frame. The bags / mattresses will be lowered into the sea and positioned manually over the cables using a drop camera and vessel crane or possibly aided by divers or a Remotely Operated Vehicle (ROV).

Figure 7: Examples of Rock Bags and Concrete Mattresses

During the protection work, a post lay survey will also be undertaken by the same vessel and a drop camera or ROV; then any remedial work (re-positioning of cables or any additional bags/mattresses required) can be undertaken immediately.

It may not be possible to completely avoid crossing localised escarpments; in these instances where the cable free hangs / free spans over scarps, issues can be addressed post-lay by either moving the cable a small amount, or by placing rock bags underneath the cable to support it and negate free hanging forces. This is illustrated in Figure 9, this will help prevent cable fatigue or damage due to free spanning.

The post-lay survey, using cameras will be used to identify these free spans and issues with boulders.

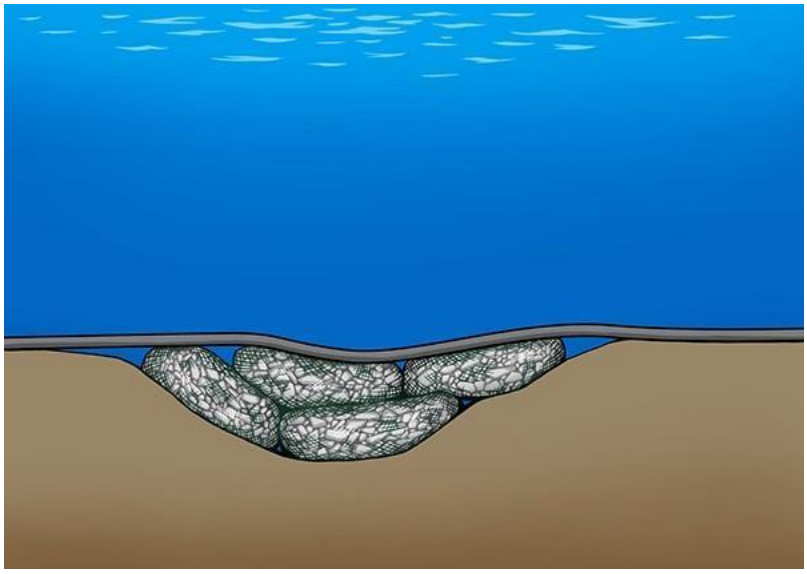

Figure 8: Lay Mitigation Over using Rock Bags to support a Cable over a Depression

3.4 PROJECT INSTALLATION AND SUPPORT VESSELS (UPDATED OCTOBER 2024)

Magallanes Tidal Energy will work closely with local companies experienced in marine operations, with knowledge of the site and available equipment and vessels to develop detailed procedures for the various activities related to the installation of the platforms and systems. It is not known yet the vessels which will be involved for the installation of the platforms, due to the characteristics and dimensions of the device. Typical workboats or multicat workboats such as MV C-Odyssey, MV C-Salvor, MV C-Chariot, or similar, (with lengths of approximately 30m or less and draught up to 4m) rather than large installation or heavy lift vessels will be used. In addition, it may be necessary to utilise support vessels (such as MV Uskmoor or MV Prosperous, or similar) for some tasks during the installation of the platforms.

Most works will involve a single multicat vessel with 1 or 2 smaller support vessels. Some works may involve 2 multicat vessels or a multicat and Tug.

During the installation and subsequent offshore commissioning period, there will also be a daily requirement for a small workboat or RIB (e.g. MV Explorer) for return journeys between the site and Holyhead for transfer of personnel and equipment.

Figure 9: Multi-cat vessels MV C-Odyssey (left) and MV C-Fenna (right)

Figure 10: Typical Support Vessels (MV Uskmoor, MV Prosperous and MV Explorer)

Notices to mariners will be issued prior to undertaking works onsite, specifying the type of works to be carried out and its duration, as well as the vessel(s) involved.

3.5 AIDS TO NAVIGATION SUMMARY

Having understood the IALA guidance and incorporated the direction given at Public Inquiry, the AtN P for Phase One of the Morlais MDZ are detailed below. The following have been signed off by Trinity House:

1. The ends of each device will be painted yellow above the waterline. The extent of the yellow band should be at least 5m wide and high.
2. In addition, there will be a yellow vertical band either side midships, painted behind the identification number of each device.
3. Each device to carry a yellow “X” top mark. This to be at least 1.2m high and wide and to be at least 1 m clear of any other structure on the device, “where it can best be seen.”
4. Each device to have a yellow light flashing every 5 seconds – with a sectored visible range of 5nm from 310°T through West to 190°T and 2nm from 190°T through East to 310°T. The light to be sited at least of 5m above the waterline and not obscured by any part of the device structure. The yellow flashing light to be synchronised with the lights on the other 3 devices such that they flash together.
5. Hazard Warning Signals (fog signals) will be installed on the northern and southwestern most devices sounding a 2 second horn every 30s.

6. The northernmost and southwestern most device to have a Type 3 AIS transponder, enabling it, when interrogated, as a minimum to transit a Message 21 to containing the following information:
    - MMSI, according to ITU category
    - The type of AtoN
    - The name of the AtoN
    - A valid 2D position of the AtoN within the accuracy indicated by the position curacy indicator
    - A position accuracy indicator
    - Type of position fixing device
    - Off position indicator
    - Time stamp
    - Dimensions of the AtoN and reference positions
    - Virtual AtoN flag
    - RAIM flag
7. In addition to that provided by the AIS transponders on the northern and south westernmost devices, all devices to have their own GPS and position transmission capability to warn of “off position.”
8. The NRA has stipulated that each device and its AtoNs will be monitored 24 hours a day and in real time by the project management. The position of each device will be reported in real time by the GPS equipment mentioned in paragraph 8 and the performance / appearance of the AtoNs remotely monitored 24 hours a day by comprehensive CCTV coverage on each device. In the construction phase a guard boat will also be on station 24 hours a day.
9. In the event that an AtoN fails, the project management team will report this using the Trinity House Local AtoN Reporting System (LARS). Work to rectify the fault will be actioned in less than 24 hours, mobilising standby support form Holyhead so as to meet the 99% availability criteria. A Notice to Mariners and Broadcasts should be issued when necessary to do so.
10. A recovery and maintenance plan for the devices has been developed by Magallanes and has been included within the AtNP.

4 SCOPE AND METHODOLOGY

The scope and objectives for the assessment are as follows:

1. Describe the project;
2. Provide an updated description of the existing baseline environment and activities in the project area, including but not limited to:
    a. Local ports and harbours;
    b. Tidal conditions;
    c. Other users of the area such as aggregates, oil and gas, anchorages, military and renewable energy installations;

d. Existing vessel traffic patterns, including frequency and types; and

e. Existing risk profile for navigational incidents.

3. Identify and assess impacts of the development to shipping and navigation, including: a. Traffic routeing;

b. Collision, contact, grounding, breakout, swamping risk etc.;

c. Cable risk, including snagging;

d. Search and Rescue; and

e. Cumulative and In-Combination Effects.

4. Review the document entitled 22UK1877_Morlais_DemonstrationZone_Navigation_Risk Assessment_DraftA and undertake a device specific NRA that reviews the hazards during the construction and operation phases of the development. These hazards are then assessed, and risk controls identified to reduce the risk to an acceptable threshold; and

5. Make recommendations as to the safety of the development and what measures should be implemented to improve it.

5 OVERVIEW OF THE BASELINE MARINE ENVIRONMENT

For an overview of the baseline marine environment, please refer to the previous NRA entitled 22UK1877_Morlais_Demonstration_Zone_Navigation_Risk_Assessment_DraftA

6 VESSEL TRAFFIC ANALYSIS

Analysis of the baseline vessel traffic data seeks to quantitatively determine the extent of navigation in the vicinity of the MDZ and the surrounding area and requires that data and statistics are available to ensure that the risk assessment is as robust and accurate as possible. An assessment of navigation regarding the MDZ was made based on the following available data.

The principal data source used within this assessment is as follows:

- Automatic Identification System (AIS) data to determine:
  - Vessel types in the vicinity of the MDZ and their tracks;
  - Gate analysis to discover the frequency and distribution of vessels transiting the area; and ○ Vessel traffic density.

6.1 DATA SOURCES

Marico has undertaken the NRA utilising the following data sources:

- Automatic Identification System (AIS) data (collected by Marico Marine);
- Radar data (collected by Marico Marine);

- Visual Observations data (collected by Marico Marine and National Coastwatch Institution (NCI))
- GIS shapefiles (including recreational user data and GPX Track kayak positions);
- RYA Coastal Atlas of Recreational Boating;
- MMO Fishing VMS data;
- Maritime Incident Data (Maritime Accident Investigation Branch (MAIB) 1997-2021 and RNLI Callouts 2008 to 2020;
- Stakeholder Consultation (Section 6.2.2 and Annex D);
- Admiralty Sailing Directions – West Coast of England and Wales Pilot, NP37, 21st Edition, 2022; and
- UK Admiralty Charts: 1977, 1413 (All cartography in this report, unless otherwise stated, is to WGS84 UTM Zone 30N standard. All marine charts are in a Mercator projection. Charts are not suitable for navigational purposes).

6.2 DATA COLLECTION

The MCA sets out the requirement for AIS, radar, and visual observations data collection in MGN 654 which advises:

"An up to date, traffic survey of the proposed development area concerned should be undertaken within 12 months prior to submission of the EIA Report. This should include all the vessel and craft types found in the area and total at least 28 days duration but also take account of seasonal variations and peak times in traffic patterns and fishing operations. AIS data alone will not constitute an appropriate traffic survey; radar, manual observations, other data sources (e.g. for fishing and recreation) and stakeholder consultation will ensure those vessels that are not required to carry and operate AIS are included, and it provides an appropriate representation of the base line marine traffic."

"However, to cover seasonal variations, peak times or perceived future traffic trends, the survey period may be extended to a maximum of 24 months. For all OREI developments, subject to the planning process, the survey may be undertaken within 24 months prior to submission. If the EIA Report is not submitted within 24 months an additional 14 day continuation survey data may be required for each subsequent 12-month period. Should there be a break in the continuation surveys, a new full traffic survey may be required and the time period starts from the completion of the initial 28 day survey period."

A desk-based study was undertaken to obtain other relevant data sources mentioned within Section 6.1.

6.2.1 Traffic Survey

To comply with MGN 654, a vessel traffic survey was undertaken by Marico Marine to collect AIS, radar, and visual observations data (using a CCTV Camera). The survey was conducted from South Stack lighthouse to the west of Holy Island. The location offered the best line of sight over the study area as well as an uninterrupted power supply and fog house building on which to deploy the equipment. Permission was provided by Trinity House for this purpose under a formal licence.

Two 2-week summer and winter surveys were undertaken, the data periods of which can been seen below in Table 3. The data periods were of sufficient length to capture 28 days within a 12-month period. A report of survey for both summer and winter periods were produced.

Table 3: Duration of Marico Marine Gathered Datasets.

Data Type and Period	Duration of Dataset
Summer AIS Data	23/08/2023 – 07/09/2023 (Missing two days (30/08 & 31/08) due to technical disruption)
Summer Radar Data	23/08/2023 – 07/09/2023 (Missing two days (30/08 & 31/08) due to technical disruption)
Summer Visual Observations	16/08/2023 – 29/08/2023
Winter AIS Data	27/10/2023 – 9/11/2023
Winter Radar Data	27/10/2023 – 9/11/2023
Winter Visual Observations	30/10/2023 – 12/11/2023

AIS, radar data and visual observations data were collected during a vessel traffic survey to better understand the traffic profile of vessels transiting the site-wide project areas and any potential impacts the development may have upon navigation.

The following were assessed through the analysis of data collected:

- Location of the MDZ relative to areas used by any type of marine craft;
- Numbers, types and sizes of vessels presently using the MDZ including: course, name, IMO Number and nationality where possible;
- Non-transit uses of the areas, e.g. fishing, recreation, racing or military purposes;
- Presence of transit routes used by coastal or deep-draught vessel on passage; and
- Alignment and proximity of the development site relative to adjacent shipping lanes.

6.2.2 Stakeholder Consultation

For this device specific NRA and to reduce consultee fatigue, consultation was undertaken at the same time for both this NRA and the Biennial NRA produced in 2023. The minutes of the consultation meetings have been provided within Annex D.

After the biennial NRA consultation, which concluded in October of 2023, some of the device parameters have been updated. However, the changes were deemed to negligible in terms of navigation risk. Stakeholders were informed of the changes to the device specifications and were given the opportunity to comment on whether the alterations would change the information that consultees previously provided regarding the device specific NRA. Two consultees replied reiterating the point that snagging risks area present on the devices for “paddlers” including SUPs and kayakers. However, upon review of the design specifications and general arrangement, no snagging risks appeared evident regarding the hull of the devices. No further comments or clarifications on the device alterations were communicated. Anonymised responses from the consultees can be found in Annex D.

During consultation, the opportunity was taken to consult as widely as possible to inform this initial device installation. Overall, the consultation process was positive and well supported, and highlighted the following key points with regards to the devices:

- The main concerns for the device specific area highlighted were breakout moorings, people drifting into the devices after capsizing and drifting into the devices after a power loss; and
- Concerns were also raised over the snagging risk of the devices for kayaks.

The following comments were also made regarding the traffic data collected and traffic profile of the wider MDZ area:

- The traffic captured within the survey looks normal and as expected;
- The only noticeable change in traffic observed in recent years was when the Marina was closed in 2018, which saw a reduction in recreational users. A number of consultees also commented that the number of kayaks has increased in summer. Overall, the traffic has not had a noticeable change since the 2021 assessment entitled 20UK1647_MM_Morlais_NRAAddendum-20 Issue 02;
- All ferries that transit to Holyhead may undertake weather routeing more frequently in the winter;
- The traffic data representing summer may be higher than shown within data. The consultees suggested that this could be because of the slightly harsher weather than predicted and a shift in the regatta dates;
- The number of Stand-Up Paddleboards (SUPs) has slightly decreased but the number of experienced kayakers has increased. South Stack is regarded as an area for experienced kayakers;
- Traffic is likely to increase over time with the Holyhead Port expansion (including a DW jetty), plans for bunkering activities, plans to become a port of operation for OREIs and the introduction of a new Marina and holiday park.
- The Minesto project (tidal devices that occupied a site called Holyhead deep approximately 1nm from the MDZ) does not currently appear to have imminent plans to install an array of devices at the Holyhead Deep site.

7 VESSEL TRAFFIC ANALYSIS

For the full, updated vessel traffic analysis, please refer to the previous NRA entitled 22UK1877_Morlais_Demonstration_Zone_Navigation_Risk_Assessment_DraftA.

Analysis of the Phase one array sites was undertaken with a gate being created crossing from the shore through the centre of the array site and across the MDZ as seen in Figure 11. Gate analysis is a tool used by Marico Marine to examine the frequency and direction of traffic through a linear ‘gate’. The gate displays frequency and direction of vessel tracks passing through the transect.

190 transits occurred through the array site gate in the summer and 7 in the winter. Non-AIS vessels were the most common vessel recorded with 77 in the Summer, accounting to 40.5% of all transits as shown within Figure 12. No passenger or tanker vessels were recorded through this gate within either seasonal survey.

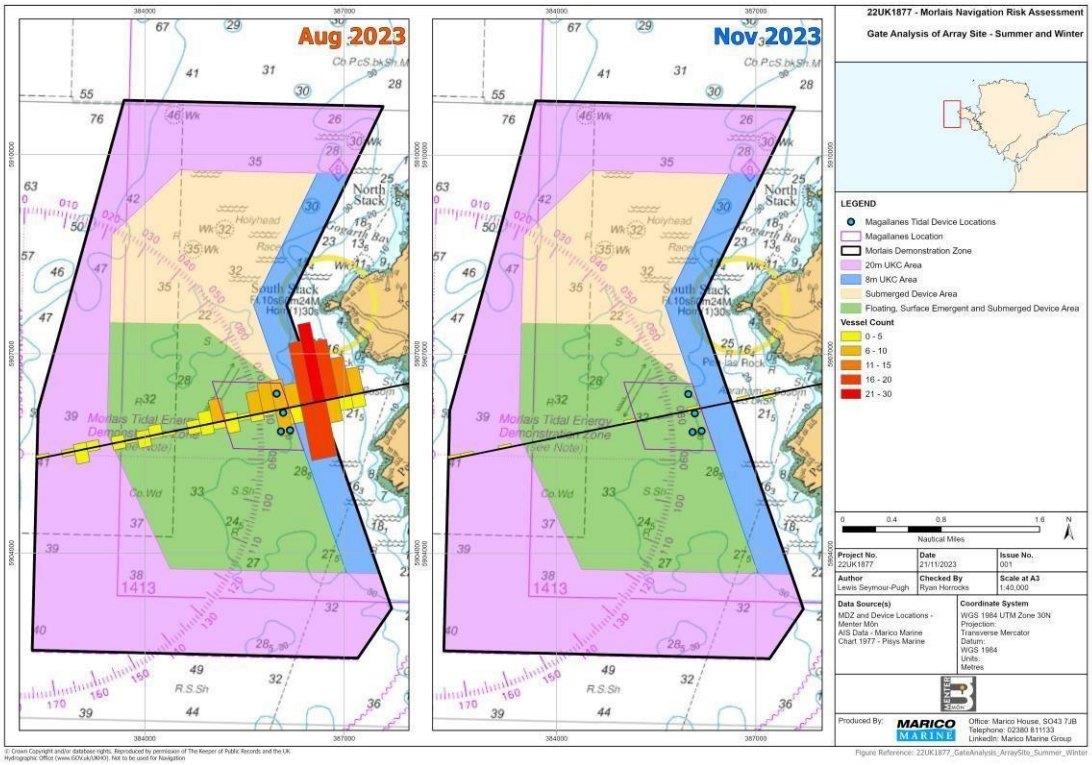

Figure 11: Gate Analysis

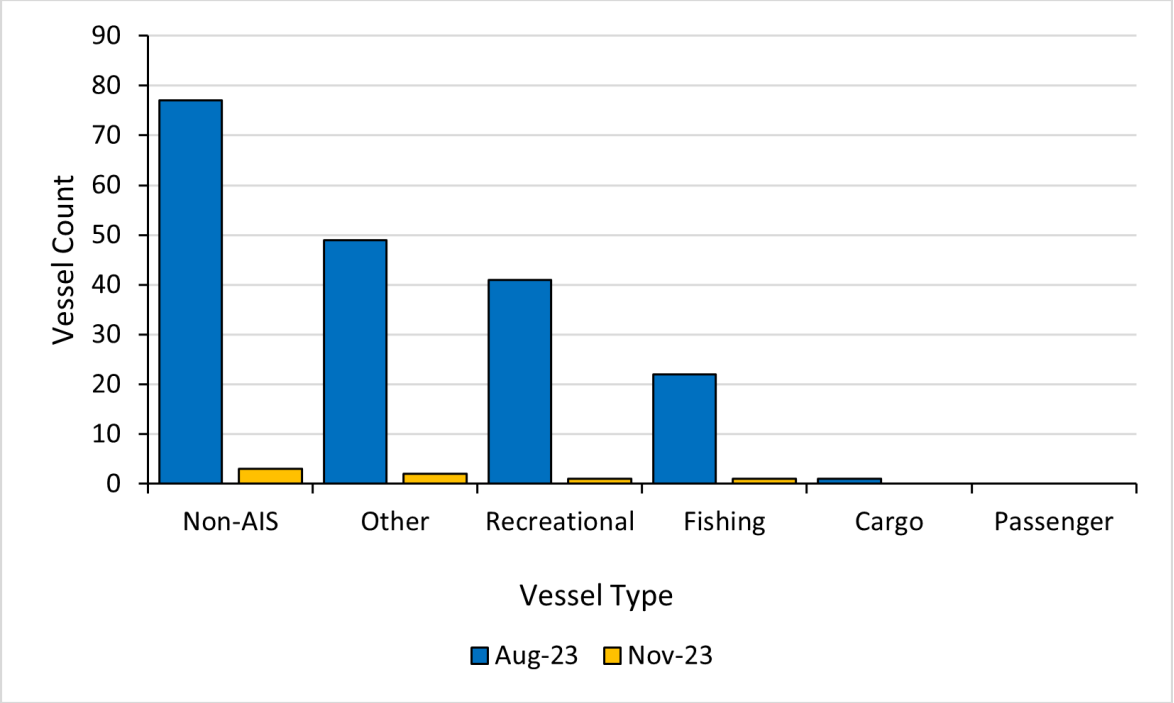

Figure 12: Frequency of transits by vessel type

Figure 13 demonstrates transits by Length of vessels entering the MDZ. The majority (88%) of summer vessels are less than 15m LOA reflecting the predominance of recreational vessels and other small craft within the area. Only 4 vessels transited through the gate within the winter period, with the largest having a 34m length.

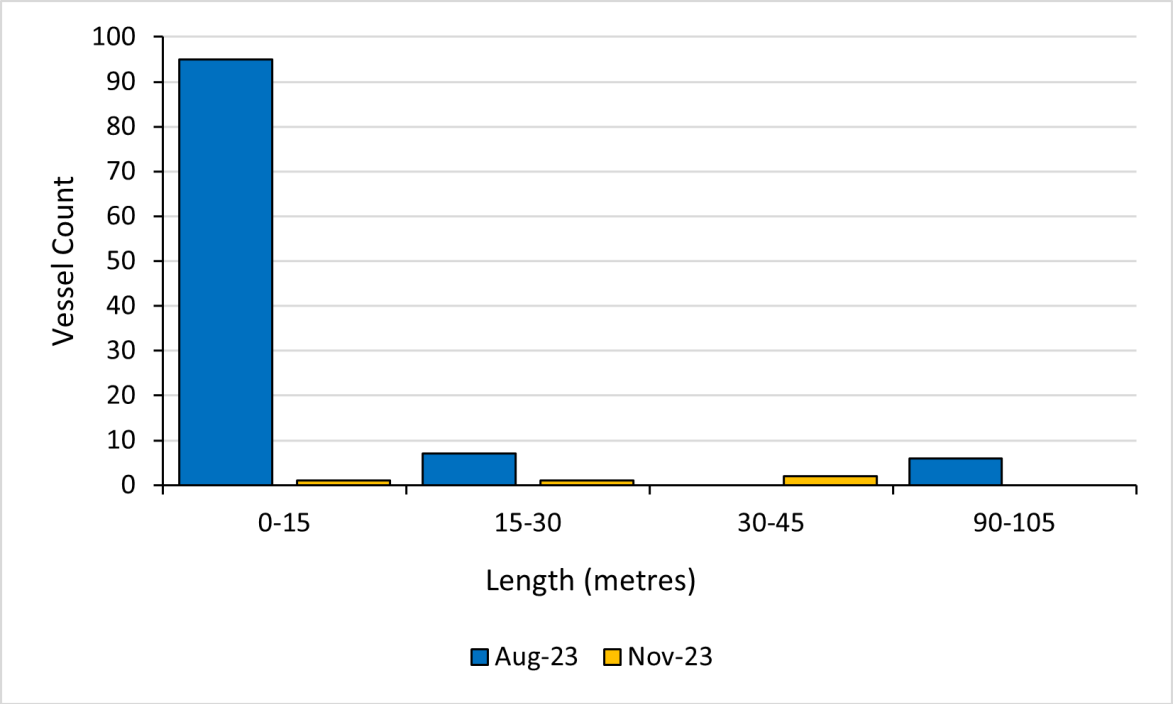

Figure 13: Vessel transits by LOA

Transits through the gates were analysed by draught within Figure 14. 48% of vessels that transited the gate during summer have a draught of less than 3m. 15 vessels with draught between 3m and 8m transited the gate during the two- week summer data period; with no vessels of draught greater than 8m in either period.

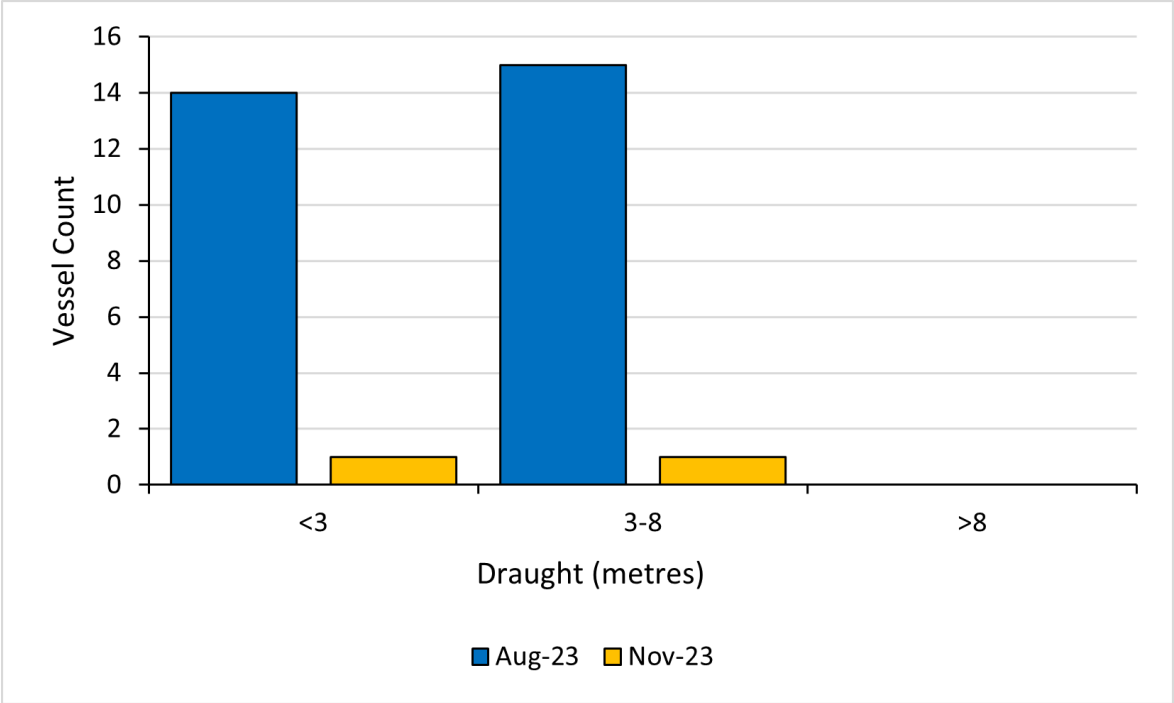

Figure 14: Vessel transits by Draught

It should be noted that activities of small un-powered recreational craft such as kayaks, canoes and small dinghies, similarly to sailing vessels, were reported in consultation to operate primarily inshore of the MDZ. This is further corroborated by Figure 15 which demonstrates indicative kayak transits, these tracks were provided by the Anglesey Sea Kayak Alliance. The majority of these kayak tracks are observed within the inshore passage, close to the shore.

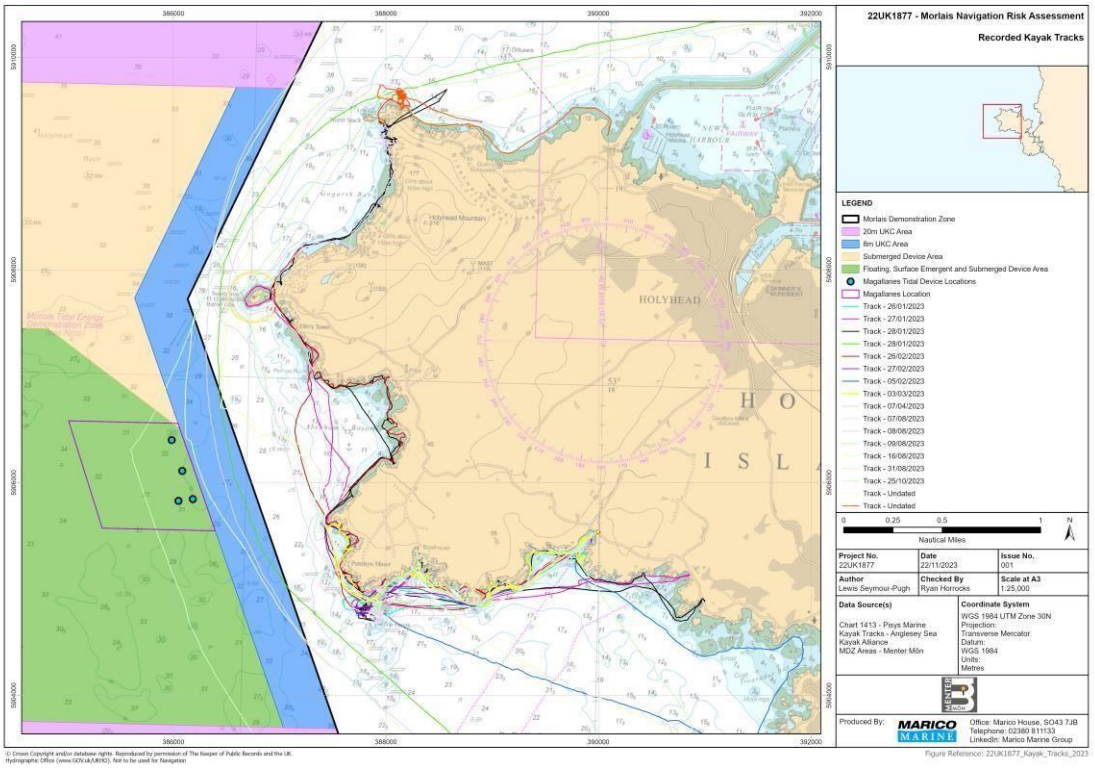

Figure 15: Indicative Kayak GPX Tracks

8 HISTORIC INCIDENTS NEAR PROJECT SITE

For analysis on the historical incidents within the vicinity of the MDZ, please refer to the previous NRA entitled 22UK1877_Morlais_Demonstration_Zone_Navigation_Risk_Assessment_DraftA

9 NAVIGATION RISK ASSESSMENT

9.1 METHODOLOGY

Following vessel traffic analysis and stakeholder consultation, a risk assessment was undertaken to assess the navigation risk for phase one installation, which includes the construction and operational phases. Both operation and construction risk assessments have been assessed independently. The NRA has been commissioned to satisfy conditions outlined within Menter

Môn's Marine Licence. The NRA is limited to identifying and quantifying any additional or increased navigational risk resulting from the project. It subsequently identifies possible mitigation measures where appropriate and makes recommendations.

The operational phase assesses the risk for when the four Magallanes tidal devices have been deployed and are in operation. The construction phase assesses the risks to navigating vessels during both the construction phase, when the devices are first installed, and maintenance periods, which will be every 10 years.

The risk assessments were conducted in accordance with the International Maritime Organisation (IMO) Formal Safety Assessment (FSA) methodology for risk assessments. A detailed description of the methodology used is provided in Annex A. of the previous NRA entitled 22UK1877_Morlais_Demonstration_Zone_Navigation_Risk_Assessment_DraftA.

Hazard identification is the first fundamental step in the risk assessment process and was informed by analysis and feedback from stakeholders. Key navigational hazards were identified and grouped with the identified vessel types operational in the vicinity of the devices (and MDZ) to form the list of potential impacts for both assessments. The hazards were then assessed as a factor of likelihood (frequency) and consequence. This approach considered two scenarios; "most likely" and the "worst credible". The quantified values of frequency and consequence were then combined using Marico Marines HAZMAN ll software to produce a risk score for each hazard and collated into a "Ranked Hazard List". Risk control measures were then suggested that may reduce the hazard to ALARP (See Table 11).

9.2 HAZARD IDENTIFICATION

Hazard Identification was undertaken using the results of the analysis and feedback from local stakeholders.

Hazards are determined to be a factor of hazard category, vessel type/draught and device type/depth.

The primary hazard categories identified for assessment within the NRA are outlined within Table 4.

Table 4: Hazard Categories

Ref	Hazard Category	Hazard Detail	Comments	Phase One NRA	
				Construction Phase	Operation Phase
1	Contact	Surface Device (Magallanes)	One or more vessels makes contact with a surface device.	7	6
2	Collision	All Vessel Types	A vessel collides with another vessel due to the presence of the devices (Including construction vessels not underway).	28	21

3	Grounding / Forced Ashore	All Vessel Types	A vessel unintentionally makes contact with the seabed or is forced ashore onto the cliffs due to the presence of the devices.	7	6
4	Swamping / Capsize	All Vessel Types	A vessel fills with water for any reason including capsize, and when overwhelmed, sinks due to the presence of the devices.	7	6
5	Snagging / Obstruction	All Vessel Types	Gear (e.g. fishing gear or anchor) snags on submerged device, mooring arrangements, export cables or the electrical hub.	7	6
6	Breakout.	All Device Types	Device breaks its moorings and becomes a hazard to shipping or runs aground (including during construction works).	1	1
			Total Hazards Assessed	57	46

In order to focus the assessment of navigation risk within the MDZ, vessel types have been grouped into the vessel categories outlined in Table 5.

Table 5: Vessel Categories

Ref	Vessel Type Category	Draught	Including
1	Commercial Vessel	>3m	Cargo vessels, tankers, dredgers, survey vessels (draught >3m), buoy laying vessels, commercial fishing vessels/ fish carriers.
2	Passenger Vessel	>3m	Ferries, cruise ships
3	Project Vessels	>3m	Cable laying vessels, barges and heavy lift vessels.
3	Fishing Vessel	<3m	Fishing Vessels
4	Powered Recreational Vessel	<3m	Yachts, power boats, recreational RIBs, Recreational fishing boats, recreational dive vessels, powered watercrafts
5	Un-Powered Recreational Vessel	<3m	Sailing dinghies, kayaks, canoes, rowing boats, SUPs.

6	Other Vessel	<3m	Tugs and tows, survey vessels, RNLI, construction and maintenance vessels, cable laying vessels, workboats, commercial RIBs, Military.

Hazards were assessed according to both an operation and construction phase. 57 individual hazards were identified for assessment within the construction phase and 46 individual hazards for the operational phase. A full list of hazard categories is located within Annex B for the construction phase assessment, and Annex C for the operational phase assessment.

9.3 ASSUMPTIONS

The NRA has been undertaken based upon information provided by the client at the time of commencement.

The assumptions outlined within Table 6 are, therefore, applicable to the NRA.

Table 6: NRA Assumptions

Assumption	Description
All information provided is final	This NRA has been scored on the basis that the information provided in Section 3 is final and is not subject to material change upon installation. This includes maintenance schedules and device specific details.
Embedded mitigation measures are in place prior to construction.	Embedded mitigation listed within Table 7 are assumed to be in place and as such are reflected in the scores.
Displaced traffic due to devices.	Hazard assessment informed by traffic analysis assumes the worstcase displacement of traffic into the areas around the devices.
Devices work as intended and moorings are verified.	The necessary checks are in place to ensure that the devices work as intended and that aspects such as cables and hubs are in working order. Checks are also in place to ensure moorings have been 3rd party verified as per "Regulatory expectations on moorings for floating wind and marine devices" and appropriate are for this installation.

9.4 EMBEDDED MITIGATION MEASURES

The embedded risk control measures listed within Table 7 were assumed to be in place when scoring the NRA.

Table 7: Embedded Risk Controls –assumed to be in place for the risk assessment.

ID	Embedded Risk Control	Description
1	Compliance with applicable guidance and regulations.	All construction, operational and maintenance operations are to be fully compliant with legislation, guidance and best practice as well as in accordance with up to date written procedures. Adherence to the MCA Guidance on Offshore Renewable Energy Installation: Requirements, Advice and Guidance for Search and Rescue and Emergency Response. Adherence to Diving Regulations 1997.
2	Promulgation of information to local stakeholders.	Promulgation of information and warnings through local Notices To Mariners (NTM) and other appropriate Maritime Safety Information (MSI) dissemination methods. Rolling and regular updates during construction phases. Planning and coordination between developer and vessel operators.
3	Selection of appropriate construction and maintenance vessels	Suitable vessels are to be utilised and personnel are to be trained and competent persons. Use of appropriate Personal Protective Equipment (PPE) by personnel.
4	Incidents and near misses are reported and investigated by developer and operators.	The developer should undertake their own includes investigation to identify the root cause and implement preventative measure to prevent the recurrence of an incident. Incidents to be reported to the MAIB in accordance with MGN 564: Marine Casualty and Marine Incident Reporting.[3]

5	Marked/lit in accordance with Trinity House requirements	Devices to be marked in accordance with MGN 654 and to comply with IALA standards.

6	Surveyed and charted as required by UKHO	It should be determined at what depth below the seafloor export cables are buried to ensure there are no changes to charted depths. Changes to charted depth arising from tidal turbines and the burial depth of cabling should be surveyed. Cable routes and devices shall be marked on navigational charts. Detailed and accurate hydrographic surveys are required pre and post construction and following decommissioning.

[3] Marine Accident Investigation Branch (2017) Marine Casualty and Marine Incident Reporting, MGN 564 (M+F)

ID	Embedded Risk Control	Description
		Where traffic patterns are altered as a result of installed generating assets - it may be considered necessary that a hydrographic survey of alternate passages be undertaken.[4]
7	Formulation and implementation of an Emergency Response Co-operation Plan (ERCoP)	Creation of an ERCoP with the MCAs Search and Rescue Branch to outline general safety procedures and provide guidance on emergency response procedures in the event of SAR operations. To be in place for the construction phase onwards. The MCA document 'Offshore Renewable Energy Installation: Requirements, Advice and Guidance for Search and Rescue and Emergency Response' outlines the SAR requirements. This will include details of access to a safe havens and places of refuge in the event of an emergency or stress of weather.

8	Passage plans for construction and maintenance craft	Development of routeing plans between site and offshore base.
9	Consideration of weather and sea state during construction planning	Limit hazardous activities during adverse weather conditions.
10	Global Positioning System off station alarm / Supervisory Control and Data Acquisition (SCADA) monitoring system.	-
11	Construction vessels to be marked in accordance with COLREGS	To ensure that construction craft remain visible at all times and to ensure passing craft are aware of construction activities.

[4]Maritime and Coastguard Agency (2021) Safety of Navigation: Offshore Renewable Energy Installations (OREIs) Guidance on UK Navigational Practice, Safety and Emergency Response. MGN 654 (M+F); Maritime and Coastguard Agency (2014) Hydrography Guidelines for Offshore Developers;
Maritime and Coastguard Agency (2014) Offshore Developers: Post-Construction Hydrographic Guidelines

10 NAVIGATION RISK ASSESSMENT RESULTS

Risk assessments for the construction and operation phases for the Phase One installation were conducted. The assessment was undertaken utilising the FSA[5] five step approach. A breakdown of the hazard scores for the baseline assessment of risk (i.e. risk with no additional mitigation measures) for the construction and operation phases is shown in Table 8.

Table 8: Baseline Risk Assessment Results Summary – Construction and Operational Phases

Hazard Category	Category Definition	Construction Phase Results	Operation Phase Results
High Risk	Between 9 and 10	0	0
Significant Risk	Between 7 to 8.99	0	0
ALARP	Between 4 to 6.99	5	2
Low Risk	Between 2 to 3.99	40	33
Negligible Risk	Between 0 to 1.99	4	4
N/A	N/A	8	7

The top ten hazards identified for the baseline construction phase assessment for the Phase One assessment are shown below in Table 9. A full list of ranked hazard scores is located within Annex B.

The top ten hazards identified for the baseline operational phase for the Phase One assessment, are shown below in Table 10. A full list of ranked hazard scores is located within Annex C.

Table 9: Top ten hazards - Construction Phase

Rank	ID	Hazard Title	Baseline Score	Risk
1	21	Collision Project Vessel ICW Project Vessel	4.53	
2	3	Contact Project Vessel with Surface Device	4.38	
3	40	Grounding / Forced Ashore Powered Recreational Vessel	4.18	
4	48	Swamping / Capsize Un-Powered Recreational Vessel	4.13	
5	15	Collision Passenger Vessels ICW Passenger Vessel	4.00	
6	30	Collision Powered Recreational Vessel ICW Powered Recreational Vessel	3.64	
7	5	Contact Powered Recreational Vessel with Surface Device	3.59	
8	6	Contact Un-Powered Recreational Vessel with Surface Device	3.59	
9	47	Swamping / Capsize Powered Recreational Vessel	3.55	
10	32	Collision Powered Recreational Vessel ICW Other Vessel	3.49	

[5] International Maritime Organisation (2018) Revised Guidelines for Formal Safety Assessment (FSA) MSC-mepc.2/Circ.12/Rev.2

Table 10: Top ten hazards - Operational Phase

Rank	ID	Hazard Title	Baseline Score	Risk
1	38	Swamping / Capsize Un-Powered Recreational Vessel	4.13	
2	13	Collision Passenger Vessels ICW Passenger Vessel	4.00	
3	4	Contact Powered Recreational Vessel with Surface Device	3.94	
4	5	Contact Un-Powered Recreational Vessel with Surface Device	3.94	
5	22	Collision Powered Recreational Vessel ICW Powered Recreational Vessel	3.64	
6	24	Collision Powered Recreational Vessel ICW Other Vessel	3.49	
7	3	Contact Fishing Vessel with Surface Device	3.47	
8	8	Collision Commercial Ship ICW Passenger Vessels	3.45	
9	31	Grounding / Forced Ashore Powered Recreational Vessel	3.44	

10	6	Contact Other Vessels with Surface Device	3.35

11 SUGGESTED ADDITIONAL RISK CONTROL MEASURES

While all of the of hazards identified and scored for this risk assessment fell into the ALARP or below categories of risk, further mitigation risk control measures were suggested for the hazards assessed as ALARP or above (>4).

The additional risk control measures that have been identified and are recommended in order to ensure safe and efficient operations are listed in Table 11.

Table 11: Suggested Additional Risk Control Measures

ID	Risk Control	Description	Phase
1	Continuous Monitoring by Marine Coordination Centre	Monitoring by radar, AIS, Closed Circuit Television (CCTV) or other agreed means. Appropriate means for OREI operators to notify, and provide evidence of, the infringement of safety zones or ATBA.	All Phases
2	Restrict Navigation through the Gold and Green MDZ Zones.	For example; via designation of site as an Area To Be Avoided (ATBA) or Precautionary Area (PA). In the UK, all vessels have freedom to transit through OREIs, subject to any applied safety zones, and their own risk assessments and passage plans, which should take account of factors such as vessel size, manoeuvrability, environmental factors and competency of the Master and crew. MGN 372[3] (or subsequent update) provides further guidance on navigation in and around OREIs. An ATBA is an area within defined limits that should be avoided by all ships or certain classes of ship, in which navigation is particularly hazardous or in which it is exceptionally important to avoid casualties. In general, ATBAs should be established only in places where: inadequate survey or insufficient provision of aids to navigation may lead to danger of stranding; where local knowledge is considered essential for safe passage; where there is the possibility that unacceptable damage to the environment could result from a casualty; or where there may be hazards to a vital aid to navigation[4]. PA's are defined as areas within defined limits where ships must navigate with particular caution and within which the direction of flow of traffic may be recommended. [5]	All Phases
3	MDZ designation as No Fishing Zone	To prevent fishing gear snagging on underwater devices and their associated infrastructure.	All Phases
4	Appropriate alignment and spacing of devices	The MCA has statutory obligations to provide Search and Rescue services in and around OREIs in UK waters. Device layout designs must be designed to ensure clear lines of sight and navigation allow safe transit by rescue craft and those vessels that decide to transit through them including during poor visibility, high sea states and at night.[3]	All Phases

3 Maritime and Coastguard Agency (2008) MGN372 Amendment 1 (M+F) Offshore Renewable Energy Installations (OREIs): Guidance to Mariners Operating in the Vicinity of UK OREIs.

4 International Maritime Organisation (1985) General Provisions on Ships' Routeing, adopted Nov. 20, 1985, IMO Resolution A.572(14).

[5] International Maritime Organisation (1985) General Provisions on Ships' Routeing, adopted Nov. 20, 1985, IMO Resolution A.572(14).

ID	Risk Control	Description	Phase
		In order to minimise risks to surface vessels transiting through an OREI, structures (turbines, substations etc) should be aligned and in straight rows or columns. Multiple lines of orientation provide alternative options for passage planning and for vessels to counter the environmental effects on handling i.e. sea state, tides, currents, weather, visibility etc. Developers should plan for at least two lines of orientation unless they can clearly demonstrate that fewer is acceptable. The MCA document 'Offshore Renewable Energy Installation: Requirements, Advice and Guidance for Search and Rescue and Emergency Response' outlines the SAR requirements. It was noted during consultation with recreational stakeholders that 'if surface devices are spaced adequately then sailing could occur between them, although this would not be recommended at night'.	
5	Check device surveys	To ensure devices remain at the stated charted depth. Changes to charted depth arising from tidal turbines should be surveyed and marked on navigational charts.	All Phases
6	Guard vessel to monitor passing traffic	To prevent a vessel contacting a device / partially constructed device during construction / installation. To keep watch and warn vessels that may be in danger, for example, to prevent a collision as a result of third-party avoidance.	Construction
7	Establish no anchoring areas	No anchoring areas to be established around nearshore cable route.	All Phases
8	Enhanced cable protection	If burial is not possible, for example due to underwater features and/or seabed ground conditions export cables should be suitably protected such as by rocks or other such suitable mattress placements to mitigate the risks to the cable and vessels. The MCA would be willing to accept up to 5% reduction in surrounding charted depths	All Phases

		referenced to Chart Datum, unless developers are able to demonstrate evidence that any identified risks to any vessel type are satisfactorily mitigated.[3]	
9	Implementation of Safety Zones	Safety zones of appropriate configuration, extent and application; typically: 500m during construction, extension, maintenance or decommissioning and 50m during operation.	Construction
10	Temporary navigation aids as required by Trinity House	Temporary marking, lighting and buoyage should be utilised during construction phase in accordance with Trinity House requirements.	Construction

ID	Risk Control	Description	Phase
11	Provision of life saving equipment on fixed structures and floating devices.	Provide a refuge for people in the water for example; grab chains and ladders.	All Phases
12	Safety Boats in attendance for Non-Powered Recreational Craft	It should be recommended within guidance that safety boats in the water when kayaks/canoes/SUPs in organised groups are intentionally operating around the devices for recovery and to prevent contact with the devices.	All Phases
13	Guidance for recreational users operating around the devices	Provide guidance to the recreational community to promote safe and best practice when operating around the tidal devices.	All Phases

[3] MGN 654

12 RESIDUAL RISK ASSESSMENT

The risk assessments for the construction and operation were re-assessed following the implementation of the suggested risk control measures. A breakdown of the hazard scores for the residual risk assessment for the construction and operation phases is shown in Table 12. In total for Phase One, 2 hazards within the construction phase and 2 hazards within the operational phase score higher than 4 (low-risk) in the residual assessment.

Table 12: Sitewide Residual Risk Assessment Results Summary – Construction and Operational Phases

Hazard Category	Category Definition	Construction Phase Results	Operation Phase Results
High Risk	Between 9 and 10	0	0
Significant Risk	Between 7 to 8.99	0	0
ALARP	Between 4 to 6.99	2	2
Low Risk	Between 2 to 3.99	43	33
Negligible Risk	Between 0 to 1.99	4	4
N/A	N/A	8	7

The top ten hazards identified for the residual construction phase assessment for the Phase One assessment are shown below in Table 13. A full list of ranked hazard scores is located within Annex B.

The top ten hazards identified for the residual operational phase for the Phase One assessment are shown below in Table 14. A full list of ranked hazard scores is located within Annex C.

Table 13: Top ten residual hazards – Construction Phase

Rank	ID	Hazard Title	Residual Score
1	48	Swamping / Capsize Un-Powered Recreational Vessel	4.13
2	15	Collision Passenger Vessels ICW Passenger Vessel	4.00
3	21	Collision Project Vessel ICW Project Vessel	3.93
4	3	Contact Project Vessel with Surface Device	3.47
5	9	Collision Commercial Ship ICW Passenger Vessels	3.45
6	16	Collision Passenger Ship ICW Project Vessel	3.45
7	40	Grounding / Forced Ashore Powered Recreational Vessel	3.44
8	38	Grounding / Forced Ashore Project Vessels	3.15
9	10	Collision Commercial Ship ICW Project Vessel	3.13

10	27	Collision Fishing Vessel ICW Powered Recreational Vessel	2.99

Table 14: Top ten residual hazards – Operational Phase

Rank	ID	Hazard Title	Residual Score
1	38	Swamping / Capsize Un-Powered Recreational Vessel	4.13
2	13	Collision Passenger Vessels ICW Passenger Vessel	4.00
3	22	Collision Powered Recreational Vessel ICW Powered Recreational Vessel	3.64
4	24	Collision Powered Recreational Vessel ICW Other Vessel	3.49
5	8	Collision Commercial Ship ICW Passenger Vessels	3.45
6	19	Collision Fishing Vessel ICW Powered Recreational Vessel	3.31
7	31	Grounding / Forced Ashore Powered Recreational Vessel	3.20
8	20	Collision Fishing Vessel ICW Un-Powered Recreational Vessel	3.07
9	5	Contact Un-Powered Recreational Vessel with Surface Device	3.02
10	6	Contact Other Vessels with Surface Device	2.95

The most effective mitigation measures against each primary hazard category for hazards scoring ALARP are shown in Table 15.

Table 15: Suggested Risk Control Measures applicable to hazards scoring ALARP within the baseline assessment.

Hazard Category	1 - ContinuousMonitoring	2 – RestrictionofNavigation	3 - DesignationasNoFishing	4 - Appropriatealignmentandspacing	5 - Checkdevicesurveys	6 - Guardvessel	7 - Establishnoanchoringareas	8 - Enhancedcableprotection	9 - ImplementationofSafetyZones	10 - Temporarynavigationaids	11 - Provisionoflifesaving equipment		
Construction Phase													
Contact													

Collision													
Grounding													
Snagging / Obstruction													
Swamping / Capsize													
Breakout													
Operational Phase													
Contact						N/A			N/A	N/A			
Collision						N/A			N/A	N/A			
Grounding						N/A			N/A	N/A			
Snagging / Obstruction						N/A			N/A	N/A			
Swamping / Capsize						N/A			N/A	N/A			
Breakout						N/A			N/A	N/A			

During the risk assessments, notable consideration was given to device particulars including size, design and installation requirements, seasonal variations in traffic numbers and weather, and the location of each device.

There is a risk present to recreational users within the area; an additional 2 risk controls have therefore been implemented since the previous NRA to reduce the risk for recreational users operating in close proximity to the devices. Based on the effectiveness of the suggested risk controls, Marico Marine recommend specific consideration for the following:

- Recommended within guidance that safety boats are in attendance for Non-Powered Recreational Craft is an effective mitigation measure against loss of life/injury arising from swamping/capsizing and contacts.
- Guidance for recreational users operating around the devices is an effective mitigation measure against groundings and swamping/capsizing. However, will require efficient promulgation of information.
- Continuous Monitoring by Marine Co-ordination Centre is an effective mitigation measure against contacts, groundings, collisions and swamping/capsizing. Monitoring could include CCTV, AIS and RADAR.
- Provision of life saving equipment on fixed structures and floating devices is an effective mitigation measure against swamping/capsizing. These should be designed to avoid snagging hazards themselves and allow for refuge.

13 CUMULATIVE IMPACTS

Cumulative impacts refer to the impact upon receptors, proposed developments and activities and any other foreseeable project proposals arising from the presence of the Phase One devices. The closest development across the offshore wind, oil and gas and aggregates industries is the Awel y Mor wind farm extension approximately 48km from the proposed MDZ. It should be noted that based on comments made during consultation, it appears the Minesto devices are no longer operating within the Holyhead Deep site.

13.1 OCTOBER 2024 UPDATE

Based on information provided within the previous NRA reports and on the basis that Phase One was to be the first installation of devices, the cumulative impacts within the vicinity of the proposed development were deemed low risk in issue 02 of this assessment. As such, cumulative impact specific risk controls in addition to those recommended within the project specific risk assessment were not proposed.

It is now likely that a Hydrowing device Demonstration will be deployed from October 2025 - October 2026 (1-year temporary deployment) in the blue restricted area to the northwest of South Stack.

Based on currently available forecasts, this will not overlap with the Magallanes deployment, and consequently there will be no cumulative impact. Even if temporal overlap does occur, the site wide low impact conclusions remain valid and specific risk controls in addition to those recommended within the project specific risk assessment would not be proposed for this site-specific risk assessment.

14 CONCLUSIONS AND RECOMMENDATIONS

This NRA has assessed the baseline and residual navigation risk profiles for the Phase One installation, to fulfil the requirement set out within Menter Môn's marine licence to undertake device specific installation navigation risk assessments.

14.1 JULY 2024 ASSESSMENT

The assessment dated 1 July 2024 (issue 02) in concluded that:

- The devices are 53.6m by 7m. They will be located in the green area of the MDZ and will consist of two rotors with four inter array cables, one electrical hub and one export cable. The installation of the devices will consist of two vessels over 4 days;
- The devices are located in an area of low-moderate vessel traffic with an average of approximately 14 vessels per day over the summer period passing through the gate as seen in Section 7, the majority of which being "non-AIS" making up approximately 41% of all recorded tracks. A large proportion of those non-AIS vessels are recreational craft. No commercial vessels were recorded within the vicinity of the device locations. Fishing vessels are known pot within the area, but only during the summer months. Kayakers and other non-powered recreational craft do operate in the area. The navigation profile as assessed from AIS, RADAR and visual observations corroborates the views expressed by stakeholders during consultation;
- The devices are located in an area of challenging metocean conditions and a hazardous leeshore. Based on the HR Wallingford report from 2020, devices deployed will have minimal impact over existing sea conditions;
- The devices are not located in proximity to offshore developments and are the first instalment of the Morlais Project;
- All hazards were assessed to be ALARP or lower in the baseline risk assessment. Of the 57 hazards assessed within the construction phase, 5 were scored as ALARP in the baseline assessment. Of the 46 hazards assessed within the operation phase assessment, 2 were scored as ALARP in the baseline assessment;
- A number of risk control measures were suggested to further reduce the risk of hazards scoring ALARP. The most effective mitigation measures against each primary hazard category for hazards scoring ALARP are shown in Table 15;
- The specific mitigation and safety measures to be employed should be selected in consultation with the MCA and listed in the developer's safety manual or Safety Management System. 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); and
- With the introduction of the suggested mitigation measures, 2 hazards were assessed to be ALARP in the construction phase residual risk assessment and 2 within the operational phase risk assessment. All remaining hazards were assessed to be low or lower.

Based on the findings of this assessment, the Phase One installation has been assessed to be acceptable in terms of navigational risk assuming compliance with embedded and implementation of suggested additional mitigation measures where appropriate for hazards scoring as ALARP.

14.2 OCTOBER 2024 REVISED ASSESSMENT

Issue 03 of this document dated 29 October 2024 has incorporated revised information received from Menter Môn and the developer, specifically in regard to device installation and mooring methodologies (including the addition of two additional connector hubs into the cable array).

Revision 3 of this document also records and considers changes to deployment dates and timescales.

The revised information has been reviewed and no new hazards have been identified, nor has the frequency at which such hazards might be expected to occur been considered to change (despite slightly compressed time scales in the construction phase of the project).

No significant changes to the operational phase of the devices have been identified and therefore the previous risk assessment outcomes (risk scores), and the suggested mitigation measures remain unchanged.

Based on the findings of this revised assessment, the Phase One installation has been confirmed to remain acceptable in terms of navigational risk assuming compliance with embedded and implementation of suggested additional mitigation measures where appropriate for hazards scoring as ALARP.

Annex A Device Specific Information

Table 16: Device Specific Information provided by Menter Môn, updated* by Marico Marine, October 2024.

Parameter	Value
Structure	
Overall length	53.6m
Overall breadth	7m
Operational draught	24m (with blades, in operation) 19.9m (without blades, during transport)
Worst case foundation type	Floating device (gravity mooring clumps)
Volume of oil (litres)	9,000 litres (both rotors)
Max height above Sea Level	Masts: 4m (deck surface is 1.966m)
no. hubs	Three hubs on the seabed*
no. hub piles	four lines of mooring with gravity clumps
Total max no. of drilled piles	Currently, the foundation is not expected to be done by drilling
No. Surface Piercing Devices	Four devices
No. marker buoys	Devices will have navigation lights and AIS
Cables	
Worst case export cable length (km)	2.8Km (Preliminary. From device to the shore exit of the drilling hole. To the substation it's 500m more)
Cable catenary swept area following installation of floating devices (m2)	600m diameter in Fow. We hope 400m diameter in Morlais. 126.000m2 per device
Cable tail footprint (m2)	The movements of the dynamic cable are within the zone of movement of the anchors mentioned in the previous point
Export cable footprint including protection (m2)	Can we consider an area of 2m around the static cable from the devices to the seabed exit of the drilling hole? 3,420m2
Worst case inter-array cable length (km)	1km (length of the 4 cables from the 4 devices to the underwater hubs)

Inter-array cable footprint including protection (m2)	Can we consider an area of 2m around the static cable of interarray devices? 2000m2
Duration of cable installation	Approx 2 weeks*
Duration of cable protection installation	Approx 1 week*
No. of concurrent cable installations	Bend stiffeners, bend restrictors, splices.
Total Cable Length (km)	3.8Km (preliminary)

Total cable footprint (m2)	5,420m2 (estimation 2 meters each side and total length of cable)
Foundation Structure & Mooring Cables	
Mooring system	4 per device, drilled or gravity tbc*
Total project footprint (m2)	430.000 m2 (preliminary total project, 4 platforms)
Footprint of temporary seabed disturbance (m2)	Multi-cat 4-point mooring anchors*
O&M	
Cable Inspection	2 years
Device inspection	1 month
No. cable repairs	15 years
Cable repair duration	1 month (depending on weather for preparation)
Parameter	Value
Area of Cable repairs m2	200m2 (we need a multicat to do this operation)
Turbine maintenance	10 years (big maintenance in shipyard)
Rotors	
Type of rotor	horizontal axis turbine
Number of rotors	2 Contra-rotative rotors
Min depth	3.154
Rotor radius	21m

No. blades	3 blades
Mean current speed	2m/s
Median water depth	36m
Swept area (m2)	346.36
Turbine export power (MW)	750kW
Vessels	
Max vessel installation days	1 neap: 1 day per platform hookup, 3 days per device cable connection if subsea cable is already installed
No. vessels at any one time	two: (tug boat and multicat)
No. vessel trips	2 per day
Vessel safety zone (m)	yes. The Navigation Risk Assessment estimated a 30m2 in each side, in order to prevent any collision with the mooring lines.
Vessel route area	Holyhead
Vessel anchor footprint during device installation (m2)	Yes, 40.000m2 per device
Vessel anchor footprint during hub installation (m2)	Yes, 65.000m2
Vessel anchor footprint during cable installation (m2)	Yes, 65.000m2 each device

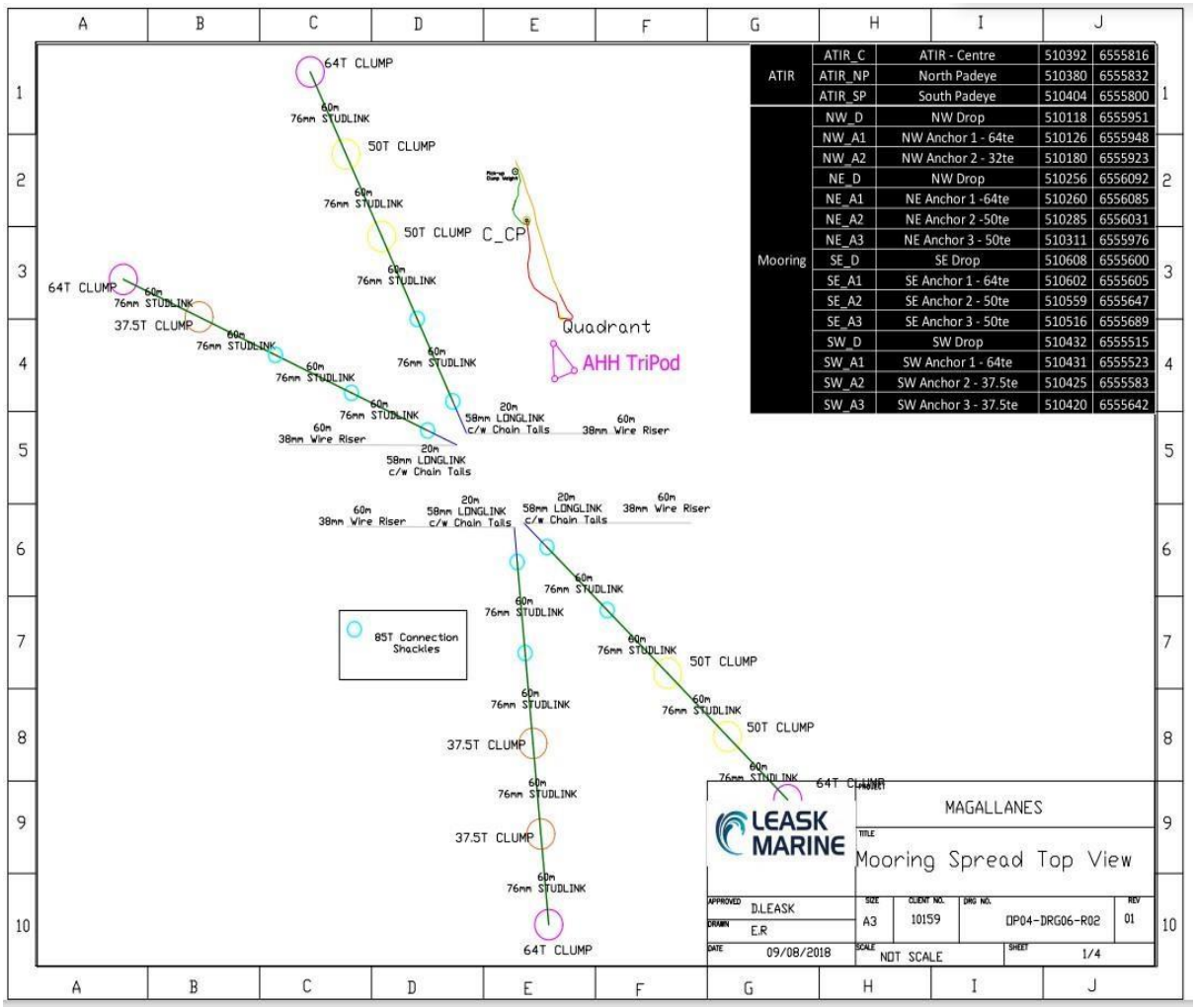

Figure 16: Mooring Arrangement for Magallanes Devices

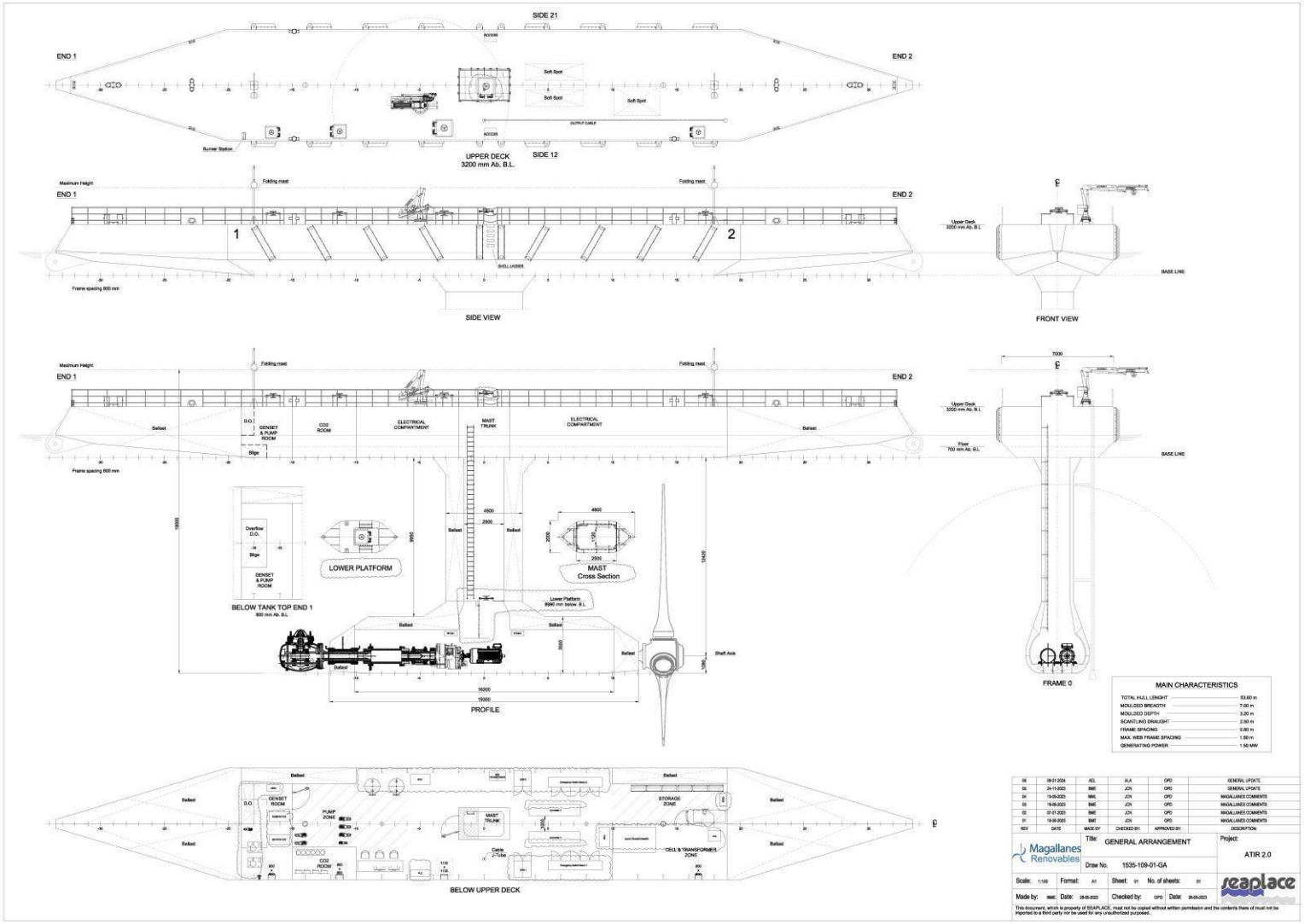

Figure 17: General Arrangement for Magallanes Devices

Annex B Hazard Log – Construction

ID	Hazard Title	Hazard Detail	Possible Causes	Most Likely Outcome	Worst Credible Outcome	Most Likely Consequence					Worst Credible Consequence					Baseline Risk Sore	Suggested Additional Risk Controls	Residual Risk Score
						People	Property	Environment	Business	Frequency	People	Property	Environment	Business	Frequency			
1	Contact Commercial Ship with Surface Device	A commercial vessel such as a cargo vessel or tanker contacts the device	Insufficient Lookout; Human Error; Equipment or Mechanical Failure; Navigational Aid Failure; Adverse Environmental Conditions; Poor Visibility; Avoidance of other vessel; Running for shelter / safe haven in poor weather; Lack of knowledge of construction progress / device locations; Partially constructed device not visible.	No Injury / Possible very minor injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Minor impact upon operations.	Multiple minor or single major injury; Major damage to vessel; Pollution limited to immediate area - Tier 2 Spill Criteria; Temporary closure / prolonged restrictions on operations.	1	2	1	2	1	3	4	3	4	1	2.45	Continuous Monitoring by Marine Coordination Centre; Restrict Navigation through the Gold and Green MDZ Zones; Implementation of Safety Zones; Guard vessel to monitor passing traffic; Temporary navigation aids as required by Trinity House; .	2.45
2	Contact Passenger Vessels with Surface Device	A ferry / cruise ship contacts the device	Insufficient Lookout; Human Error; Equipment or Mechanical Failure; Navigational Aid Failure; Adverse Environmental Conditions; Poor Visibility; Avoidance of other vessel; Running for shelter / safe haven in poor weather; Lack of knowledge of construction progress / device locations; Partially constructed device not visible.	No Injury / Possible very minor injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Minor impact upon operations / short term loss of revenue.	Multiple minor or single major injury; Major damage to vessel; Small operational spill with little effect on the environment - Tier 1 to Tier 2 Spill Criteria; Temporary closure / prolonged restrictions on operations.	1	2	1	2	1	3	4	2	4	1	2.36	Continuous Monitoring by Marine Coordination Centre; Restrict Navigation through the Gold and Green MDZ Zones; Implementation of Safety Zones; Guard vessel to monitor passing traffic; Temporary navigation aids as required by Trinity House; .	2.36
3	Contact Project Vessel with Surface Device	A project vessel contacts with the device	Construction vessel inadvertently contacts surface device during installation; Insufficient Lookout; Human Error; Equipment or Mechanical Failure; Navigational Aid Failure; Adverse Environmental Conditions; Poor Visibility; Avoidance of other vessel; Partially constructed device not visible.	No Injury / Possible very minor injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Minor impact upon operations.	Multiple minor or single major injury; Major damage to vessel; Tier 1 to Tier 2 Spill Criteria, small operational oil spill;; Temporary closure / prolonged restrictions on operations.	1	2	1	2	5	3	4	2	4	2	4.38	Continuous Monitoring by Marine Coordination Centre; Appropriate alignment and spacing of arrays and devices; Temporary navigation aids as required by Trinity House; .	3.47
ID	Hazard Title	Hazard Detail	Possible Causes	Most Likely Outcome	Worst Credible Outcome	Most Likely Consequence					Worst Credible Consequence					Suggested Additional Risk Controls		

						People	Property	Environment	Business	Frequency	People	Property	Environment	Business	Frequency	Baseline Risk Sore		Residual Risk Score
4	Contact Fishing Vessel with Surface Device	A fishing vessel contacts with the device	Insufficient Lookout; Human Error; Insufficient planning and individual risk assessment prior to departure; Equipment or Mechanical Failure; Navigational Aid Failure; Adverse Environmental Conditions; Effect of establishment of devices on tidal streams, eddies, overfalls and waves; Poor Visibility; Avoidance of other vessel; Running for shelter / safe haven in poor weather; Lack of knowledge of construction progress / device locations; Partially constructed device not visible.	Light contact; Minor injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Negligible impact upon operations.	Heavy contact, person in the water; Multiple major injuries or a single fatality; Moderate damage to vessel; Negligible effect upon the Environment / No pollution; Temporary suspension of operations or prolonged restrictions to project.	2	2	1	1	4	4	3	1	3	2.5	3.47	Continuous Monitoring by Marine Coordination Centre; Restrict Navigation through the Gold and Green Morlais Zones; MDZ designation as no fishing zone; Appropriate spacing of devices. Implementation of Safety Zones; Guard vessel to monitor passing traffic; Temporary navigation aids as required by Trinity House; Provision of life saving equipment on fixed structures and floating devices.	2.86
5	Contact Powered Recreational Vessel with Surface Device	A powered recreational vessel contacts with the device	Construction vessel contacts device during installation; Insufficient Lookout; Human Error; Insufficient planning and individual risk assessment prior to departure; Equipment or Mechanical Failure; Navigational Aid Failure; Adverse Environmental Conditions; Effect of establishment of devices on tidal streams, eddies, overfalls and waves; Poor Visibility; Avoidance of other vessel; Running for shelter in poor weather; Lack of knowledge of construction progress / device locations; Partially constructed device not visible.	Light contact; Minor injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Negligible impact upon operations.	Heavy contact, person in the water; Multiple major injuries or a single fatality; Moderate damage to vessel; Negligible effect upon the Environment / No pollution; Minor impact upon operations / short term loss of revenue.	2	2	1	1	4	4	3	1	2	3	3.59	Continuous Monitoring by Marine Coordination Centre; Restrict Navigation through the Gold and Green MDZ Zones; Appropriate alignment and spacing of arrays and devices. Implementation of Safety Zones; Guard vessel to monitor passing traffic; Temporary navigation aids as required by Trinity House; ; Provision of life saving equipment on fixed structures and floating devices. Guidance for recreational users operating around the devices.	2.76

ID	Hazard Title	Hazard Detail	Possible Causes	Most Likely Outcome	Worst Credible Outcome	Most Likely Con equence					Worst Credible Consequence					Baseline Risk Sore	Suggested Additional Risk Controls	Residual Risk Score
						People	Property	Environment	Business	Frequency	People	Property	Environment	Business	Frequency			

6	Contact UnPowered Recreational Vessel with Surface Device	An unpowered recreational vessel contacts with the device	Insufficient Lookout; Human Error; Insufficient planning and individual risk assessment prior to departure; Equipment Failure; Navigational Aid Failure; Adverse Environmental Conditions; Effect of establishment of devices on tidal streams, eddies, overfalls and waves; Set on to device / pinned by tidal stream; Poor Visibility; Avoidance of other vessel; Running for shelter / safe haven in poor weather.	Light contact; Minor injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Negligible impact upon operations.	Heavy contact, person in the water; Multiple major injuries or a single fatality; Moderate damage to vessel; Negligible effect upon the Environment / No pollution; Minor impact upon operations / short term loss of revenue.	2	2	1	1	4	4	3	1	2	3	3.59	Continuous Monitoring by Marine Coordination Centre; Restrict Navigation through the Gold and Green MDZ Zones; Appropriate alignment and spacing of arrays and devices; Guard vessel to monitor passing traffic; Implementation of Safety Zones; Temporary navigation aids as required by Trinity House; ; Provision of life saving equipment on fixed structures and floating devices; Safety Boats in attendance for Non-Powered Recreational Craft; Guidance for recreational users operating around the devices.	2.76
7	Contact Other Vessels with Surface Device	Small vessel (including maintenance Vessel) contacts the device	Construction vessel working on device makes inadvertent contact; Insufficient Lookout; Human Error; Insufficient planning and individual risk assessment prior to departure; Equipment or Mechanical Failure; Navigational Aid Failure; Adverse Environmental Conditions; Effect of establishment of devices on tidal streams, eddies, overfalls and waves; Poor Visibility; Avoidance of other vessel; running for shelter / safe haven in poor weather; Lack of knowledge of construction progress / device locations; Partially constructed device not visible.	Light contact; Minor injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Negligible impact upon operations.	Heavy contact, person in the water; Multiple major injuries or a single fatality; Major damage to vessel; Negligible effect upon the Environment / No pollution; Temporary suspension of operations or prolonged restrictions to project.	2	2	1	1	4	4	4	1	3	2	3.35	Restrict Navigation through the Gold and Green MDZ Zones; Continuous Monitoring by Marine Coordination Centre; Appropriate alignment and spacing of arrays and devices. Implementation of Safety Zones; Guard vessel to monitor passing traffic; Temporary navigation aids as required by Trinity House; ; Provision of life saving equipment on fixed structures and floating devices.	2.95

ID	Hazard Title	Hazard Detail	Possible Causes	Most Likely Outcome	Worst Credible Outcome	Most Likely Con equence					Worst Credible Consequence					Baseline Risk Sore	Suggested Additional Risk Controls	Residual Risk Score
						People	Property	Environment	Business	Frequency	People	Property	Environment	Business	Frequency			

ID	Hazard Title	Hazard Detail	Possible Causes	Most Likely Outcome	Worst Credible Outcome	Most Likely Con equence					Worst Credible Consequence					Baseline Risk Sore	Suggested Additional Risk Controls	Residual Risk Score
						People	Property	Environment	Business	Frequency	People	Property	Environment	Business	Frequency			
8	Collision Commercial Ship ICW Commercial Ship	Two commercial vessels collide due to the presence of the devices.	Increased traffic density to the north and west due to avoidance of the MDZ; Insufficient Lookout; Human Error; Equipment or Mechanical Failure; Adverse Environmental Conditions; Poor Visibility; Avoidance of other vessel / construction activities and associated vessels.	Minor injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Minor impact upon operations/ short term loss of revenue.	Multiple major injuries or a single fatality; Major damage to vessel; Pollution limited to immediate area - Tier 2 Spill Criteria; Temporary suspension of operations or prolonged restrictions to project.	2	2	1	2	1	4	4	3	3	1	2.54	Continuous Monitoring by Marine Coordination Centre; Guard vessel to monitor passing traffic; Temporary navigation aids as required by Trinity House.	2.54
9	Collision Commercial Ship ICW Passenger Vessels	A commercial vessel collides with a passenger vessel due to the presence of the devices	Increased traffic density to the north due to avoidance of the MDZ; Insufficient Lookout; Human Error; Equipment or Mechanical Failure; Adverse Environmental Conditions; Poor Visibility; Avoidance of other vessel / construction activities and associated vessels.	Multiple minor or single major injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Temporary suspension of operations or prolonged restrictions to project.	Multiple fatalities; Major damage to vessel; Pollution limited to immediate area - Tier 2 Spill Criteria; Temporary closure / prolonged restrictions on operations.	3	2	1	3	1	5	4	3	4	1	3.45	Continuous Monitoring by Marine Coordination Centre; Guard vessel to monitor passing traffic; Temporary navigation aids as required by Trinity House;	3.45
10	Collision Commercial Ship ICW Project Vessel	A commercial vessel collides with a project vessel	Insufficient Lookout; Poor passage planning; Human Error; Equipment or Mechanical Failure; Navigational Aid Failure; Adverse Environmental Conditions; Poor Visibility; Avoidance of other vessel.	Multiple minor or single major injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Temporary suspension of operations or prolonged restrictions to project.	Multiple major injuries or single fatality; Major damage to vessel; Pollution limited to immediate area - Tier 2 Spill Criteria; Temporary closure / prolonged restrictions on operations.	3	2	1	3	1	4	4	3	4	1	3.13	Continuous Monitoring by Marine Coordination Centre; Guard vessel to monitor passing traffic; Implementation of safety zones; Temporary navigation aids as required by Trinity House; .	3.13

ID	Hazard Title	Hazard Detail	Possible Causes	Most Likely Outcome	Worst Credible Outcome	Most Likely Con equence					Worst Credible Consequence					Baseline Risk Sore	Suggested Additional Risk Controls	Residual Risk Score
						People	Property	Environment	Business	Frequency	People	Property	Environment	Business	Frequency			
11	Collision Commercial Ship ICW Fishing Vessel	A commercial vessel collides with a fishing vessel due to the presence of the devices	Insufficient Lookout; Human Error; Equipment or Mechanical Failure; Adverse Environmental Conditions; Effect of establishment of devices on tidal streams, eddies, overfalls and waves; Poor Visibility; Avoidance of other vessel / construction activities and associated vessels.	Minor injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Minor impact upon operations/ short term loss of revenue.	Multiple major injuries or a single fatality; Major damage to vessel; Negligible effect upon the Environment / No pollution; Minor impact upon operations/ short term loss of revenue.	2	2	1	2	1	4	4	1	2	1	2.27	Continuous Monitoring by Marine Coordination Centre; Appropriate alignment and spacing of arrays and devices; Guard vessel to monitor passing traffic; Temporary navigation aids as required by Trinity House;	2.27
12	Collision Commercial Ship ICW Powered Recreational Vessel	A commercial vessel collides with a powered recreational vessel due to the presence of the devices	Insufficient Lookout; Human Error; Equipment or Mechanical Failure; Adverse Environmental Conditions; Poor Visibility; Avoidance of other vessel / construction activities and associated vessels.	Multiple minor or single major injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Minor impact upon operations/ short term loss of revenue.	Multiple major injuries or a single fatality; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Temporary suspension of operations or prolonged restrictions to project.	3	2	1	2	1	4	3	1	3	1	2.72	Continuous Monitoring by Marine Coordination Centre; Appropriate alignment and spacing of arrays and devices; Guard vessel to monitor passing traffic; Guidance for recreational users operating around the devices; Temporary navigation aids as required by Trinity House;	2.72

ID	Hazard Title	Hazard Detail	Possible Causes	Most Likely Outcome	Worst Credible Outcome	Most Likely Con equence					Worst Credible Consequence					Baseline Risk Sore	Suggested Additional Risk Controls	Residual Risk Score
						People	Property	Environment	Business	Frequency	People	Property	Environment	Business	Frequency			
13	Collision Commercial Ship ICW UnPowered Recreational Vessel	A commercial vessel collides with an unpowered recreational vessel due to the presence of the devices	Insufficient Lookout; Human Error; Equipment Failure; Adverse Environmental Conditions; Effect of establishment of devices on tidal streams, eddies, overfalls and waves; Poor Visibility; Avoidance of other vessel / construction activities and associated vessels.	Multiple minor or single major injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Minor impact upon operations/ short term loss of revenue.	Multiple major injuries or a single fatality; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Temporary suspension of operations or prolonged restrictions to project.	3	2	1	2	1	4	3	1	3	1	2.72	Continuous Monitoring by Marine Coordination Centre; Appropriate alignment and spacing of arrays and devices; Guard vessel to monitor passing traffic; Temporary navigation aids as required by Trinity House; Safety Boats in attendance for Non-Powered Recreational Craft; Guidance for recreational users operating around the devices.	2.72
14	Collision Commercial Ship ICW Other Vessel	A commercial vessel collides with an other vessel due to the presence of the devices	Insufficient Lookout; Human Error; Equipment or Mechanical Failure; Adverse Environmental Conditions; Effect of establishment of devices on tidal streams, eddies, overfalls and waves; Poor Visibility; Avoidance of other vessel / construction activities and associated vessels.	Minor injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Minor impact upon operations/ short term loss of revenue.	Multiple major injuries or a single fatality; Major damage to vessel; Negligible effect upon the Environment / No pollution; Minor impact upon operations/ short term loss of revenue.	2	2	1	2	1	4	4	1	2	1	2.27	Continuous Monitoring by Marine Coordination Centre; Appropriate alignment and spacing of arrays and devices; Guard vessel to monitor passing traffic; Temporary navigation aids as required by Trinity House;	2.27

15	Collision Passenger Vessels ICW Passenger Vessel	A passenger vessel collides with a passenger vessel due to the presence of the devices	Increased traffic density to the north due to avoidance of the MDZ; Insufficient Lookout; Human Error; Equipment or Mechanical Failure; Adverse Environmental Conditions; Poor Visibility; Avoidance of other vessel / construction activities and associated vessels.	Multiple minor or single major injury; Moderate damage to vessel; Minor effect upon the Environment / Tier 1 - Tier 2 Pollution Criteria Reached; Major impact upon operations / temporary closure or prolonged restrictions on project operations.	Multiple fatalities; Major damage to vessel; Pollution limited to immediate area - Tier 2 Spill Criteria; Temporary closure / prolonged restrictions on operations.	3	3	2	4	1	5	4	3	4	1	4.00	Continuous Monitoring by Marine Coordination Centre; Guard vessel to monitor passing traffic; Temporary navigation aids as required by Trinity House;	4.00
16	Collision Passenger Ship ICW Project Vessel	A passenger vessel collides with a project vessel	A ferry collides with a construction vessel carrying out construction activities in the north of the MDZ; Insufficient Lookout; Poor passage planning; Human Error; Equipment or Mechanical Failure; Navigational Aid Failure; Adverse Environmental Conditions; Poor Visibility; Avoidance of other vessel.	Multiple minor or single major injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Temporary suspension of operations or prolonged restrictions to project.	Multiple major injuries or single fatality; Major damage to vessel; Pollution limited to immediate area - Tier 2 Spill Criteria; Temporary closure / prolonged restrictions on operations.	3	2	1	3	1	5	4	3	4	1	3.45	Continuous Monitoring by Marine Coordination Centre; Guard vessel to monitor passing traffic; Implementation of safety zones; Temporary navigation aids as required by Trinity House; .	3.45
17	Collision Passenger Vessels ICW Fishing Vessel	A passenger vessel collides with a fishing vessel due to the presence of the devices	Insufficient Lookout; Human Error; Equipment or Mechanical Failure; Adverse Environmental Conditions; Effect of establishment of devices on tidal streams, eddies, overfalls and waves; Poor Visibility; Avoidance of other vessel / construction activities and associated vessels.	Minor injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Minor impact upon operations/ short term loss of revenue.	Multiple major injuries or a single fatality; Major damage to vessel; Negligible effect upon the Environment / No pollution; Minor impact upon operations/ short term loss of revenue.	2	2	1	2	1	4	4	1	2	1	2.27	Continuous Monitoring by Marine Coordination Centre; Appropriate alignment and spacing of arrays and devices; Guard vessel to monitor passing traffic; Temporary navigation aids as required by Trinity House;	2.27

ID	Hazard Title	Hazard Detail	Possible Causes	Most Likely Outcome	Worst Credible Outcome	Most Likely Con equence	Worst Credible Consequence	

						People	Property	Environment	Business	Frequency	People	Property	Environment	Business	Frequency	Baseline Risk Sore	Suggested Additional Risk Controls	Residual Risk Score
18	Collision Passenger Vessels ICW Powered Recreational Vessel	A passenger vessel collides with a powered recreational vessel due to the presence of the devices	Insufficient Lookout; Human Error; Equipment or Mechanical Failure; Adverse Environmental Conditions; Effect of establishment of devices on tidal streams, eddies, overfalls and waves; Poor Visibility; Avoidance of other vessel / construction activities and associated vessels.	Multiple minor or single major injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Minor impact upon operations/ short term loss of revenue.	Multiple major injuries or a single fatality; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Temporary suspension of operations or prolonged restrictions to project.	3	2	1	2	1	4	3	1	3	1	2.72	Continuous Monitoring by Marine Coordination Centre; Appropriate alignment and spacing of arrays and devices; Guard vessel to monitor passing traffic; Temporary navigation aids as required by Trinity House; Guidance for recreational users operating around the devices.	2.72
19	Collision Passenger Vessels ICW Un-Powered Recreational Vessel	A passenger vessel collides with an unpowered recreational vessel due to the presence of the devices	Insufficient Lookout; Human Error; Equipment Failure; Adverse Environmental Conditions; Effect of establishment of devices on tidal streams, eddies, overfalls and waves; Poor Visibility; Avoidance of other vessel / construction activities and associated vessels.	Multiple minor or single major injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Minor impact upon operations/ short term loss of revenue.	Multiple major injuries or a single fatality; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Temporary suspension of operations or prolonged restrictions to project.	3	2	1	2	1	4	3	1	3	1	2.72	Continuous Monitoring by Marine Coordination Centre; Appropriate alignment and spacing of arrays and devices; Guard vessel to monitor passing traffic; Temporary navigation aids as required by Trinity House; Safety Boats in attendance for Non-Powered Recreational Craft; Guidance for recreational users operating around the devices.	2.72
20	Collision Passenger Vessels ICW Other Vessels	A passenger vessel collides with an other vessel due to the presence of the devices	Insufficient Lookout; Human Error; Equipment or Mechanical Failure; Adverse Environmental Conditions; Effect of establishment of devices on tidal streams, eddies, overfalls and waves; Poor Visibility; Avoidance of other vessel / construction activities and associated vessels.	Minor injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Minor impact upon operations/ short term loss of revenue.	Multiple major injuries or a single fatality; Major damage to vessel; Negligible effect upon the Environment / No pollution; Minor impact upon operations/ short term loss of revenue.	2	2	1	2	1	4	4	1	2	1	2.27	Continuous Monitoring by Marine Coordination Centre; Appropriate alignment and spacing of arrays and devices; Implementation of safety zones; Guard vessel to monitor passing traffic; Temporary navigation aids as required by Trinity House;	2.27
21	Collision Project Vessel ICW Project Vessel	A project vessel collides with a project vessel	A project vessel collides with another project vessel while undertaking construction activities; Insufficient Lookout; Poor passage planning; Human Error; Equipment or Mechanical Failure; Navigational Aid Failure; Adverse Environmental Conditions; Poor Visibility; Avoidance of other vessel.	Multiple minor or single major injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Temporary suspension of operations or short term loss of revenue.	Multiple major injuries or single fatality; Major damage to vessel; Tier 1 - Tier 2 Spill Criteria; Temporary closure / prolonged restrictions on operations.	3	2	1	2	4	4	4	2	4	2	4.53	Continuous Monitoring by Marine Coordination Centre; Temporary navigation aids as required by Trinity House.	3.93

ID	Hazard Title	Hazard Detail	Possible Causes	Most Likely Outcome	Worst Credible Outcome	Most Likely Con equence	Worst Credible Consequence	

						People	Property	Environment	Business	Frequency	People	Property	Environment	Business	Frequency	Baseline Risk Sore	Suggested Additional Risk Controls	Residual Risk Score
22	Collision Project Vessel ICW Fishing Vessel	A project vessel collides with a fishing vessel	Insufficient Lookout; Poor passage planning; Human Error; Equipment or Mechanical Failure; Navigational Aid Failure; Adverse Environmental Conditions; Poor Visibility; Avoidance of other vessel.	Minor injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Minor impact upon operations/ short term loss of revenue.	Multiple major injuries or a single fatality; Major damage to vessel; Negligible effect upon the Environment / No pollution; Minor impact upon operations/ short term loss of revenue.	2	2	1	2	3	4	4	1	2	2	3.00	Continuous Monitoring by Marine Coordination Centre; Restrict navigation through the gold and green MDZ zones; MDZ designation as a no fishing zone; Appropriate alignment and spacing of devices; Guard vessel to monitor passing traffic; Implementation of safety zones; Temporary navigation aids as required by Trinity House; ;	2.43
23	Collision Project Vessel ICW Powered Recreational Vessel	A project vessel collides with a powered recreational vessel	Insufficient Lookout; Poor passage planning; Insufficient planning and individual risk assessment prior to departure; Human Error; Equipment or Mechanical Failure; Navigational Aid Failure; Adverse Environmental Conditions; Effect of establishment of devices on tidal streams, eddies, overfalls and waves; Set on to construction activities as a result of tidal stream; Poor Visibility; Avoidance of other vessel.	Minor injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Minor impact upon operations/ short term loss of revenue.	Multiple major injuries or a single fatality; Moderate damage to vessel; Negligible effect upon the Environment / No pollution; Moderate impact, temporary suspension of operations or prolonged restrictions on operations.	2	2	1	2	3	4	3	1	3	2	3.02	Continuous Monitoring by Marine Coordination Centre; Restrict navigation through the gold and green MDZ zones; Appropriate alignment and spacing of devices; Guard vessel to monitor passing traffic; Implementation of safety zones; Temporary navigation aids as required by Trinity House; ; Guidance for recreational users operating around the devices.	2.76
24	Collision Project Vessel ICW Un-Powered Recreational Vessel	A project vessel collides with an un-powered recreational vessel	Insufficient Lookout; Poor passage planning; Insufficient planning and individual risk assessment prior to departure; Human Error; Equipment Failure; Navigational Aid Failure; Adverse Environmental Conditions; Effect of establishment of devices on tidal streams, eddies, overfalls and waves; Set on to construction activities / pinned as a result of tidal stream; Poor Visibility; Avoidance of other vessel.	Minor injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Minor impact upon operations/ short term loss of revenue.	Multiple major injuries or a single fatality; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Moderate impact, temporary suspension of operations or prolonged restrictions on operations.	2	2	1	2	2	4	2	1	3	2	2.66	Continuous Monitoring by Marine Coordination Centre; Restrict navigation through the gold and green MDZ zones; Appropriate alignment and spacing of devices; Guard vessel to monitor passing traffic; Implementation of safety zones; Temporary navigation aids as required by Trinity House; ; Safety Boats in attendance for Non-Powered Recreational Craft; Guidance for recreational users operating around the devices.	2.50

25	Collision Project Vessel ICW Other Vessel	A project vessel collides with an other vessel	Project vessel collides with small workboat / construction vessel while undertaking construction activities; Insufficient Lookout; Poor passage planning;	Minor injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution;	Multiple major injuries or a single fatality; Major damage to vessel; Negligible effect upon the Environment / No	2	2	1	2	3	4	4	1	3	2	3.10	Continuous Monitoring by Marine Coordination Centre; Restrict navigation through the gold and green MDZ zones; Appropriate alignment and spacing of devices;	2.52

ID	Hazard Title	Hazard Detail	Possible Causes	Most Likely Outcome	Worst Credible Outcome	Most Likely Consequence					Worst Credible Consequence					Baseline Risk Sore	Suggested Additional Risk Controls	Residual Risk Score
						People	Property	Environment	Business	Frequency	People	Property	Environment	Business	Frequency			
			Human Error; Equipment or Mechanical Failure; Navigational Aid Failure; Adverse Environmental Conditions; Poor Visibility; Avoidance of other vessel.	Minor impact upon operations/ short term loss of revenue.	pollution; Moderate impact on operations, temporary suspension or prolonged restrictions.												Guard vessel to monitor passing traffic; Implementation of safety zones; Temporary navigation aids as required by Trinity House; ;	
26	Collision Fishing Vessel ICW Fishing Vessel	A fishing vessel collides with a fishing vessel due to the presence of the devices	Narrowing of the inshore route; Increased utilisation of inshore route; Insufficient Lookout; Human Error; Equipment or Mechanical Failure; Adverse Environmental Conditions; Effect of establishment of devices on tidal streams, eddies, overfalls and waves; Poor Visibility; Avoidance of other vessel / construction activities and associated vessels.	Minor injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Negligible impact upon operations.	Multiple major injuries or a single fatality; Moderate damage to vessel; Negligible effect upon the Environment / No pollution; Minor impact upon operations / short term loss of revenue.	2	2	1	1	2	4	3	1	2	1.5	2.38	Continuous Monitoring by Marine Coordination Centre; Appropriate alignment and spacing of arrays and devices; Guard vessel to monitor passing traffic; Temporary navigation aids as required by Trinity House;	2.10
27	Collision Fishing Vessel ICW Powered Recreational Vessel	A fishing vessel collides with a recreational vessel due to the presence of the devices	Narrowing of the inshore route; Increased utilisation of inshore route; Insufficient Lookout; Human Error; Equipment or Mechanical Failure; Adverse Environmental Conditions; Effect of establishment of devices on tidal streams, eddies, overfalls and waves; Poor Visibility; Avoidance of other vessel / construction activities and associated vessels.	Multiple minor or single major injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Negligible impact upon operations.	Multiple major injuries or a single fatality; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Temporary suspension of operations or prolonged restrictions to project.	3	2	1	1	2.5	4	3	1	3	2	3.31	Continuous Monitoring by Marine Coordination Centre; Appropriate alignment and spacing of arrays and devices; Guard vessel to monitor passing traffic; Temporary navigation aids as required by Trinity House; Guidance for recreational users operating around the devices.	2.99

ID	Hazard Title	Hazard Detail	Possible Causes	Most Likely Outcome	Worst Credible Outcome	Most Likely Consequence					Worst Credible Consequence					Baseline Risk Sore	Suggested Additional Risk Controls	Residual Risk Score
						People	Property	Environment	Business	Frequency	People	Property	Environment	Business	Frequency			
28	Collision Fishing Vessel ICW Un-Powered Recreational Vessel	A fishing vessel collides with an unrecreational vessel due to the presence of the devices	Narrowing of the inshore route; Increased utilisation of inshore route; Insufficient Lookout; Human Error; Equipment or Mechanical Failure; Adverse Environmental Conditions; Effect of establishment of devices on tidal streams, eddies, overfalls and waves; Poor Visibility; Avoidance of other vessel / construction activities and associated vessels.	Multiple minor or single major injury; Negligible damage to vessel; Negligible effect upon the Environment / No pollution; Negligible impact upon operations.	Multiple major injuries or a single fatality; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Temporary suspension of operations or prolonged restrictions to project.	3	1	1	1	2.5	4	2	1	3	2	3.07	Continuous Monitoring by Marine Coordination Centre; Appropriate alignment and spacing of arrays and devices; Guard vessel to monitor passing traffic; Temporary navigation aids as required by Trinity House; Safety Boats in attendance for Non-Powered Recreational Craft; Guidance for recreational users operating around the devices.	2.78
29	Collision Fishing Vessel ICW Other Vessels	A fishing vessel collides with an other vessel due to the presence of the devices	Narrowing of the inshore route; Increased utilisation of inshore route; Insufficient Lookout; Human Error; Equipment or Mechanical Failure; Adverse Environmental Conditions; Effect of establishment of devices on tidal streams, eddies, overfalls and waves; Poor Visibility; Avoidance of other vessel / construction activities and associated vessels.	Minor injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Negligible impact upon operations.	Multiple major injuries or a single fatality; Moderate damage to vessel; Negligible effect upon the Environment / No pollution; Minor impact upon operations / short term loss of revenue.	2	2	1	1	2.5	4	3	1	2	2	2.64	Continuous Monitoring by Marine Coordination Centre; Appropriate alignment and spacing of arrays and devices; Implementation of safety zones; Guard vessel to monitor passing traffic; Temporary navigation aids as required by Trinity House;	2.38
30	Collision Powered Recreational Vessel ICW Powered Recreational Vessel	A recreational vessel collides with a recreational vessel due to the presence of the devices	Narrowing of the inshore route during construction activities; Increased utilisation of inshore route; Insufficient Lookout; Human Error; Equipment or Mechanical Failure; Adverse Environmental Conditions; Effect of establishment of devices on tidal streams, eddies, overfalls and waves; Poor Visibility; Avoidance of other vessel / construction activities and associated vessels.	Multiple minor or single major injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Minor impact upon operations / short term loss of revenue.	Multiple major injuries or a single fatality; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Temporary suspension of operations or prolonged restrictions to project.	3	2	1	2	3	4	3	1	3	2	3.64	Continuous Monitoring by Marine Coordination Centre; Appropriate alignment and spacing of arrays and devices; Guard vessel to monitor passing traffic; Temporary navigation aids as required by Trinity House; Guidance for recreational users operating around the devices.	2.96

31	Collision Powered Recreational Vessel ICW Un-Powered Recreational Vessel	A powered recreational vessel collides with an unrecreational vessel due to the presence of the devices	Narrowing of the inshore route; Increased utilisation of inshore route; Insufficient Lookout; Human Error; Equipment or Mechanical Failure; Adverse Environmental Conditions; Effect of establishment of devices on tidal streams, eddies, overfalls and waves; Poor Visibility; Avoidance of other vessel / construction activities and associated vessels.	Multiple minor or single major injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Minor impact upon operations / short term loss of revenue.	Multiple major injuries or a single fatality; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Temporary suspension of operations or prolonged restrictions to project.	2	1	1	1	3	4	2	1	3	2	2.61	Continuous Monitoring by Marine Coordination Centre; Appropriate alignment and spacing of arrays and devices; Guard vessel to monitor passing traffic; Temporary navigation aids as required by Trinity House; Safety Boats in attendance for Non-Powered Recreational Craft; Guidance for recreational users operating around the devices.	2.12

ID	Hazard Title	Hazard Detail	Possible Causes	Most Likely Outcome	Worst Credible Outcome	Most Likely Con equence					Worst Credible Consequence					Baseline Risk Sore	Suggested Additional Risk Controls	Residual Risk Score
						People	Property	Environment	Business	Frequency	People	Property	Environment	Business	Frequency			
32	Collision Powered Recreational Vessel ICW Other Vessel	A recreational vessel collides with an other vessel due to the presence of the devices	Narrowing of the inshore route; Increased utilisation of inshore route; Insufficient Lookout; Human Error; Equipment or Mechanical Failure; Adverse Environmental Conditions; Effect of establishment of devices on tidal streams, eddies, overfalls and waves; Poor Visibility; Avoidance of other vessel / construction activities and associated vessels.	Multiple minor or single major injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Negligible impact upon operations.	Multiple major injuries or a single fatality; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Temporary suspension of operations or prolonged restrictions to project.	3	2	1	1	3	4	3	1	3	2	3.49	Continuous Monitoring by Marine Coordination Centre; Appropriate alignment and spacing of arrays and devices; Guard vessel to monitor passing traffic; Implementation of safety zones; Temporary navigation aids as required by Trinity House; Guidance for recreational users operating around the devices.	2.84
33	Collision UnPowered Recreational Vessel ICW Un-Powered Recreational Vessel	An un-powered recreational vessel collides with unpowered recreational vessel due to the presence of the devices	Narrowing of the inshore route; Increased utilisation of inshore route; Insufficient Lookout; Human Error; Equipment Failure; Adverse Environmental Conditions; Effect of establishment of devices on tidal streams, eddies, overfalls and waves; Poor Visibility; Avoidance of other vessel / construction activities and associated vessels.	Multiple minor or single major injury; Negligible damage to vessel; Negligible effect upon the Environment / No pollution; Minor impact upon operations / short term loss of revenue.	Multiple major injuries or a single fatality; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Temporary suspension of operations or prolonged restrictions to project.	1	1	1	1	3	4	1	1	3	2	1.74	Continuous Monitoring by Marine Coordination Centre; Appropriate alignment and spacing of arrays and devices; Guard vessel to monitor passing traffic; Temporary navigation aids as required by Trinity House; Safety Boats in attendance for Non-Powered Recreational Craft; Guidance for recreational users operating around the devices.	1.63

34	Collision UnPowered Recreational Vessel ICW Other Vessel	A un-powered recreational vessel collides with an other vessel due to the presence of the devices	Narrowing of the inshore route; Increased utilisation of inshore route; Insufficient Lookout; Human Error; Equipment or Mechanical Failure; Adverse Environmental Conditions; Effect of establishment of devices on tidal streams, eddies, overfalls and waves; Poor Visibility; Avoidance of other vessel / construction activities and associated vessels.	Multiple minor or single major injury; Negligible damage to vessel; Negligible effect upon the Environment / No pollution; Negligible impact upon operations.	Multiple major injuries or a single fatality; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Temporary suspension of operations or prolonged restrictions to project.	3	1	1	1	2	4	2	1	3	1	2.64	Continuous Monitoring by Marine Coordination Centre; Appropriate alignment and spacing of arrays and devices; Guard vessel to monitor passing traffic; Implementation of safety zones; Temporary navigation aids as required by Trinity House; Safety Boats in attendance for Non-Powered Recreational Craft; Guidance for recreational users operating around the devices.	2.44

ID	Hazard Title	Hazard Detail	Possible Causes	Most Likely Outcome	Worst Credible Outcome	Most Likely Con equence					Worst Credible Consequence					Baseline Risk Sore	Suggested Additional Risk Controls	Residual Risk Score
						People	Property	Environment	Business	Frequency	People	Property	Environment	Business	Frequency			
35	Collision Other Vessels ICW Other Vessels	An other vessel collides with an other vessel due to the presence of the devices.	Narrowing of the inshore route; Increased utilisation of inshore route; Insufficient Lookout; Human Error; Equipment or Mechanical Failure; Adverse Environmental Conditions; Effect of establishment of devices on tidal streams, eddies, overfalls and waves; Poor Visibility; Avoidance of other vessel / construction activities and associated vessels.	Minor injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Negligible impact upon operations.	Multiple major injuries or a single fatality; Moderate damage to vessel; Negligible effect upon the Environment / No pollution; Minor impact upon operations / short term loss of revenue.	2	2	1	1	3	4	3	1	2	2	2.76	Continuous Monitoring by Marine Coordination Centre; Appropriate alignment and spacing of arrays and devices; Guard vessel to monitor passing traffic; Implementation of safety zones; Temporary navigation aids as required by Trinity House;	2.24
36	Grounding / Forced Ashore Commercial Ship	A commercial vessel grounds due to the presence of the devices and their moorings.	N/A	N/A	N/A	1	1	1	1	0	1	1	1	1	0	0.00	NOT SCORED	0.00

37	Grounding / Forced Ashore Passenger Vessels	A passenger vessel grounds due to the presence of the devices and their moorings.	N/A	N/A	N/A	1	1	1	1	0	1	1	1	1	0	0.00	NOT SCORED	0.00

ID	Hazard Title	Hazard Detail	Possible Causes	Most Likely Outcome	Worst Credible Outcome	Most Likely Con equence					Worst Credible Consequence					Baseline Risk Sore	Suggested Additional Risk Controls	Residual Risk Score
						People	Property	Environment	Business	Frequency	People	Property	Environment	Business	Frequency			
38	Grounding / Forced Ashore Project Vessels	A project vessel runs aground	While undertaking construction activities in vicinity of inshore route; Insufficient Lookout; Human Error; Equipment or Mechanical Failure; Adverse Environmental Conditions; Poor Visibility; Avoidance of other vessel / construction activities and associated vessels.	Grounding with little damage; Minor injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Negligible impact upon operations.	Forced ashore onto rocks / cliffs; Multiple major injuries or a single fatality; Major damage to vessel; Minor effect upon the Environment / Tier 1 - Tier 2 Pollution Criteria Reached; Major impact upon operations, temporary closure or prolonged restrictio ns.	2	2	1	1	3	4	4	2	4	2	3.15	Continuous Monitoring by Marine Coordination Centre; Temporary navigation aids as required by Trinity House.	3.15
39	Grounding / Forced Ashore Fishing Vessel	A fishing vessel grounds / contacts seabed, rocks or cliff due to the presence of the devices and their moorings.	Narrowing of the inshore route; Increased utilisation of inshore route; Insufficient Lookout; Human Error; Insufficient planning and individual risk assessment prior to departure; Equipment or Mechanical Failure; Adverse Environmental Conditions; Effect of establishment of devices on tidal streams, eddies, overfalls and waves; Poor Visibility; Avoidance of other vessel / construction activities and associated vessels; Avoidance of safety zones. Running for shelter / safe haven in poor weather.	Grounding with little damage; Minor injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Negligible impact upon operations.	Forced ashore onto rocks / cliffs; Multiple major injuries or a single fatality; Moderate damage to vessel; Minor effect upon the Environment / Tier 1 - Tier 2 Pollution Criteria Reached; Minor impact upon operations / short term loss of revenue.	2	2	1	1	2	4	3	2	2	1	2.33	Continuous Monitoring by Marine Coordination Centre; Appropriate alignment and spacing of arrays and devices; Guard vessel to monitor passing traffic; Temporary navigation aids as required by Trinity House; ;	2.20

40	Grounding / Forced Ashore Powered Recreational Vessel	A recreational vessel grounds / contacts seabed, rocks or cliff due to the presence of the devices and their moorings.	Narrowing of the inshore route; Increased utilisation of inshore route; Insufficient Lookout; Human Error; Insufficient planning and individual risk assessment prior to departure; Equipment or Mechanical Failure; Adverse Environmental Conditions; Effect of establishment of devices on tidal streams, eddies, overfalls and waves; Poor Visibility; Avoidance of other vessel / construction activities and associated vessels; Avoidance of safety zones; Running for shelter / safe haven in poor weather.	Grounding with little damage; Multiple major injuries or a single fatality; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Minor impact upon operations / short term loss of revenue.	Forced ashore onto rocks / cliffs; Multiple fatalities; Moderate damage to vessel; Minor effect upon the Environment / Tier 1 - Tier 2 Pollution Criteria Reached; Major impact upon operations / temporary closure or prolonged restrictions on project operati ons.	3	2	1	2	3	5	3	2	4	2	4.18	Continuous Monitoring by Marine Coordination Centre; Appropriate alignment and spacing of arrays and devices; Guard vessel to monitor passing traffic; Temporary navigation aids as required by Trinity House; ; Guidance for recreational users operating around the devices.	3.44

ID	Hazard Title	Hazard Detail	Possible Causes	Most Likely Outcome	Worst Credible Outcome	Most Likely Con equence					Worst Credible Consequence					Baseline Risk Sore	Suggested Additional Risk Controls	Residual Risk Score
						People	Property	Environment	Business	Frequency	People	Property	Environment	Business	Frequency			
41	Grounding / Forced Ashore Un-Powered Recreational Vessel	An un-powered recreational vessel grounds / contacts seabed, rocks or cliff due to the presence of the devices and their moorings.	Narrowing of the inshore route; Increased utilisation of inshore route; Insufficient Lookout; Human Error; Insufficient planning and individual risk assessment prior to departure; Equipment Failure; Adverse Environmental Conditions; Effect of establishment of devices on tidal streams, eddies, overfalls and waves; Poor Visibility; Avoidance of other vessel / construction activities and associated vessels; Avoidance of safety zones; Running for shelter / safe haven in poor weather.	Grounding with little damage; Single minor injury; Negligible damage to vessel; Negligible effect upon the Environment / No pollution; Negligible impact upon operations.	Forced ashore onto rocks / cliffs; Multiple fatalities; Moderate damage to vessel; Minor effect upon the Environment / Tier 1 - Tier 2 Pollution Criteria Reached; Moderate impact upon operations / temporary suspension or prolonged restrictions.	2	1	1	1	3	4	2	1	3	2	2.61	Continuous Monitoring by Marine Coordination Centre; Appropriate alignment and spacing of arrays and devices; Guard vessel to monitor passing traffic; Temporary navigation aids as required by Trinity House; ; Safety Boats in attendance for Non-Powered Recreational Craft; Guidance for recreational users operating around the devices.	2.61

42	Grounding / Forced Ashore Other Vessel	An other vessel / contacts seabed, rocks or cliff grounds due to the presence of the devices and their moorings.	Narrowing of the inshore route; Increased utilisation of inshore route; Insufficient Lookout; Human Error; Insufficient planning and individual risk assessment prior to departure; Equipment or Mechanical Failure; Adverse Environmental Conditions; Effect of establishment of devices on tidal streams, eddies, overfalls and waves; Poor Visibility; Avoidance of other vessel / construction activities and associated vessels; Avoidance of safety zones; Running for shelter / safe haven in poor weather.	Grounding with little damage; Minor injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Negligible impact upon operations.	Forced ashore onto rocks / cliffs; Multiple major injuries or a single fatality; Moderate damage to vessel; Minor effect upon the Environment / Tier 1 - Tier 2 Pollution Criteria Reached; Minor impact upon operations / short term loss of revenue.	2	2	1	1	3	4	3	2	2	2	2.88	Continuous Monitoring by Marine Coordination Centre; Appropriate alignment and spacing of arrays and devices; Guard vessel to monitor passing traffic; Temporary navigation aids as required by Trinity House; ;	2.33
43	Swamping / Capsize Commercial Ship	A commercial vessel swamps / capsizes due to the presence of the devices and their moorings.	N/A	N/A	N/A	1	1	1	1	0	1	1	1	1	0	0.00	NOT SCORED	0.00

ID	Hazard Title	Hazard Detail	Possible Causes	Most Likely Outcome	Worst Credible Outcome	Most Likely Consequence	Worst Credible Consequence	Suggested Additional Risk Controls

						People	Property	Environment	Business	Frequency	People	Property	Environment	Business	Frequency	Baseline Risk Sore		Residual Risk Score
44	Swamping / Capsize Passenger Vessels	A passenger vessel swamps / capsizes due to the presence of the devices and their moorings.	N/A	N/A	N/A	1	1	1	1	0	1	1	1	1	0	0.00	NOT SCORED	0.00
45	Swamping / Capsize Project Vessels	A project vessel swamps / capsizes due to the presence of the devices and their moorings.	N/A	N/A	N/A	1	1	1	1	0	1	1	1	1	0	0.00	NOT SCORED	0.00
46	Swamping / Capsize Fishing Vessel	A fishing vessel overwhelmed by sea and swamps / capsizes due to the presence of the devices and their moorings.	N/A	N/A	N/A	1	1	1	1	0	1	1	1	1	0	0.00	NOT SCORED	0.00

ID	Hazard Title	Hazard Detail	Possible Causes	Most Likely Outcome	Worst Credible Outcome	Most Likely Con equence					Worst Credible Consequence					Baseline Risk Sore	Suggested Additional Risk Controls	Residual Risk Score
						People	Property	Environment	Business	Frequency	People	Property	Environment	Business	Frequency			

ID	Hazard Title	Hazard Detail	Possible Causes	Most Likely Outcome	Worst Credible Outcome	Most Likely Con equence					Worst Credible Consequence					Baseline Risk Sore	Suggested Additional Risk Controls	Residual Risk Score
						People	Property	Environment	Business	Frequency	People	Property	Environment	Business	Frequency			
47	Swamping / Capsize Powered Recreational Vessel	A powered recreational vessel overwhelmed by sea and swamps / capsizes due to the presence of the devices and their moorings.	Narrowing of the inshore route; Human Error; Insufficient planning and individual risk assessment prior to departure; Equipment or Mechanical Failure; Adverse Environmental Conditions; Effect of establishment of devices on tidal streams, eddies, overfalls and waves; Avoidance of other vessel / construction activities and associated vessels; Avoidance of safety zones; Running for shelter / safe haven in poor weather.	Vessel filled with water but does not sink;	Vessel lost, persons in water;	2	2	1	2	3	5	3	2	4	2	3.55	Continuous monitoring by marine coordination centre; Appropriate alignment and spacing of arrays and devices; Guard vessel to monitor passing traffic; Provision of life saving equipment on fixed structures and floating devices; Guidance for recreational users operating around the devices.	2.93
48	Swamping / Capsize UnPowered Recreational Vessel	An un-powered recreational vessel overwhelmed by sea and swamps / capsizes due to the presence of the devices and their moorings.	Narrowing of the inshore route; Human Error; Insufficient planning and individual risk assessment prior to departure; Equipment Failure; Adverse Environmental Conditions; Effect of establishment of devices on tidal streams, eddies, overfalls and waves; Avoidance of other vessel / construction activities and associated vessels; Avoidance of safety zones; Running for shelter / safe haven in poor weather.	Vessel filled with water but does not sink;	Vessel lost, persons in water;	2	1	1	1	5	4	2	1	3	3	4.13	Continuous monitoring by marine coordination centre; Appropriate alignment and spacing of arrays and devices; Guard vessel to monitor passing traffic; Provision of life saving equipment on fixed structures and floating devices; Safety Boats in attendance for Non-Powered Recreational Craft; Guidance for recreational users operating around the devices.	4.13
49	Swamping / Capsize Other Vessel	An other vessel overwhelmed by sea and swamps / capsizes due to the presence of the devices and their moorings.	N/A	N/A	N/A	1	1	1	1	0	1	1	1	1	0	0.00	NOT SCORED	0.00

ID	Hazard Title	Hazard Detail	Possible Causes	Most Likely Outcome	Worst Credible Outcome	Most Likely Con equence					Worst Credible Consequence					Baseline Risk Sore	Suggested Additional Risk Controls	Residual Risk Score
						People	Property	Environment	Business	Frequency	People	Property	Environment	Business	Frequency			
50	Snagging/ Obstruction Commercial Ship	A commercial vessel's anchor interacts with a cable or the device and its moorings.	Emergency anchoring; Anchoring in an inappropriate position; Equipment or Mechanical Failure; Insufficient cable protection; Adverse Environmental Conditions; Poor Visibility; Running for shelter / safe haven in poor weather. Navigation aid failure.	Anchor snags mooring lines or power cables but cleared on weighing anchor; No Injury / Possible very minor injury; Negligible damage to vessel; Negligible effect upon the Environment / No pollution; Minor impact upon operations / short term loss of revenue.	Anchor snags mooring lines or power cables but cannot be cleared on weighing anchor seriously damaging moorings, devices or power cables; No Injury / Possible very minor injury; Negligible damage to vessel; Negligible effect upon the Environment / No pollution; Temporary closure or prolonged restrictions on project operations.	1	1	1	2	1	1	1	1	4	1	1.74	Continuous Monitoring by Marine Coordination Centre; Restrict navigation through gold and green MDZ zones; Establish no anchoring areas; Enhanced cable protection.	1.74
51	Snagging/ Obstruction Passenger Vessels	A ferry's anchor interacts with a device, its moorings or a cable.	Emergency anchoring; Anchoring in an inappropriate position; Equipment or Mechanical Failure; Insufficient cable protection; Adverse Environmental Conditions; Poor Visibility; Running for shelter / safe haven in poor weather. Navigation aid failure.	Anchor snags mooring lines or power cables but cleared on weighing; No Injury / Possible very minor injury; Negligible damage to vessel; Negligible effect upon the Environment / No pollution; Minor impact upon operations / short term loss of revenue.	Anchor snags mooring lines or power cables but cannot be cleared on weighing seriously damaging moorings, devices or power cables; No Injury / Possible very minor injury; Negligible damage to vessel; Negligible effect upon the Environment / No pollution; Temporary closure or prolonged restrictions on project operations.	1	1	1	2	1	1	1	1	4	1	1.74	Continuous Monitoring by Marine Coordination Centre; Restrict navigation through gold and green MDZ zones; Establish no anchoring areas; Enhanced cable protection.	1.74

52	Snagging / Obstruction Project Vessels	A project vessels anchor interacts with a device, its moorings or a cable.	Construction vessel snags cable while undertaking installation activities; Emergency anchoring; Anchoring in an inappropriate position; Equipment or Mechanical Failure; Insufficient cable protection; Adverse Environmental Conditions; Poor Visibility; Running for shelter / safe haven in poor weather. Navigation aid failure.	Anchor snags mooring lines or power cables but cleared; No Injury / Possible very minor injury; Negligible damage to vessel; Negligible effect upon the Environment / No pollution; Minor impact upon operations / short term loss of revenue.	Anchor snags mooring lines or power cables but cannot be cleared seriously damaging moorings or power cables; Multiple minor injuries or a single major; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Temporary closure or prolonged restrictions on project operations.	1	1	1	2	3	3	2	1	4	2	2.61	Continuous Monitoring by Marine Coordination Centre; Establish no anchoring areas; Enhanced cable protection.	2.61
53	Snagging/ Obstruction Fishing Vessel	A fishing vessel's gear/ anchor interacts with a cable or the device and its moorings.	Fishing gear snags moorings, device or power cable; Emergency anchoring; Anchoring in an inappropriate position; Equipment or Mechanical Failure; Insufficient cable protection; Adverse Environmental Conditions; Poor Visibility; Running for shelter / safe haven in poor weather. Navigation aid failure.	Fishing gear or anchor snags mooring lines or power cables but cleared; Minor injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Negligible impact upon operations.	Fishing gear or anchor snags mooring lines or power cables but cannot be cleared seriously damaging moorings, devices or power cables; Multiple major injuries or a single fatality; Major damage to vessel; Negligible effect upon the Environment / No pollution; Temporary closure or prolonged restrictions on project operations.	2	2	1	1	4	3	2	1	4	2	3.16	Continuous Monitoring by Marine Coordination Centre; Restrict navigation through gold and green MDZ zones; MDZ designation as no fishing zone; Establish no anchoring areas; Enhanced cable protection.	2.76
54	Snagging/ Obstruction Powered Recreational Vessel	A recreational vessel's gear/ anchor interacts with a cable or the device and its moorings.	Emergency anchoring; Anchoring in an inappropriate position; Equipment or Mechanical Failure; Insufficient cable protection; Adverse Environmental Conditions; Poor Visibility; Running for shelter / safe haven in poor weather. Navigation aid failure.	Anchor snags mooring lines or power cables but cleared; No Injury / Possible very minor injury; Negligible damage to vessel; Negligible effect upon the Environment / No pollution; Negligible impact upon operations.	Anchor snags mooring lines or power cables but cannot be cleared seriously damaging moorings, devices or power cables; Minor injury; Negligible damage to vessel; Negligible effect upon the Environment / No pollution; Minor impact upon operations / short term loss of revenue.	1	1	1	1	1	2	1	1	2	1	0.56	Continuous Monitoring by Marine Coordination Centre; Restrict navigation through gold and green MDZ zones; Establish no anchoring areas; Enhanced cable protection; Guidance for recreational users operating around the devices.	0.56

ID	Hazard Title	Hazard Detail	Possible Causes	Most Likely Outcome	Worst Credible Outcome	Most Likely Consequence					Worst Credible Consequence					Suggested Additional Risk Controls

						People	Property	Environment	Business	Frequency	People	Property	Environment	Business	Frequency	Baseline Risk Sore		Residual Risk Score
55	Snagging/ Obstruction Un-Powered Recreational Vessel	An un-powered recreational vessel's gear/ anchor interacts with a cable, the device, marker buoy or its moorings.	N/A	N/A	N/A	1	1	1	1	0	1	1	1	1	0	0.00	NOT SCORED	0.00
56	Snagging/ Obstruction Other Vessel	An other vessel's gear/anchor interacts with a cable or the device and its moorings.	Construction vessel inadvertently snags mooring lines or power cables during works; Emergency anchoring; Anchoring in an inappropriate position; Equipment or Mechanical Failure; Insufficient cable protection; Adverse Environmental Conditions; Poor Visibility; Running for shelter / safe haven in poor weather. Navigation aid failure.	Anchor snags mooring lines or power cables but cleared; No Injury / Possible very minor injury; Negligible damage to vessel; Negligible effect upon the Environment / No pollution; Negligible impact upon operations.	Anchor snags mooring lines or power cables but cannot be cleared seriously damaging moorings, devices or power cables; Minor injury; Negligible damage to vessel; Negligible effect upon the Environment / No pollution; Minor impact upon operations / short term loss of revenue.	2	2	1	1	2	3	2	1	4	1	2.24	Continuous Monitoring by Marine Coordination Centre; Restrict navigation through gold and green MDZ zones; Establish no anchoring areas; Enhanced cable protection.	2.24
57	Breakout of device / device not at stated depth	The device's moorings fail, device becomes a hazard to navigation.	Equipment / mooring failure; Adverse Environmental Conditions; Breaks adrift during deployment operations; Device or its mooring lines hit / snagged by vessel.	Mooring failure, device remains in position and at stated depth; Minor injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Negligible impact upon operations.	Mooring failure, device breaks free or no longer at stated depth / required UKC and becomes contact hazard. Multiple major injuries or a single fatality; Major damage to vessel; Negligible effect upon the Environment / No pollution; Temporary suspension of operations or prolonged restrictions to project.	2	2	1	1	3	4	4	1	3	2	2.95	Restrict Navigation through gold and green MDZ zones; Continuous Monitoring by Marine Coordination Centre; Check device surveys; Establish no anchoring areas; Implementation of safety zones; Temporary navigation aids as required by Trinity House.	2.95

Annex C Hazard Log – Operational

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ID	Hazard Title	Hazard Detail	Possible Causes	Most Likely Outcome	Worst Credible Outcome	Most Likely Consequence					Worst Credible Consequence					Baseline Risk Score	Suggested Additional Mitigation Measures	Residual Risk Score
						People	Property	Environment	Business	Frequency	People	Property	Environment	Business	Frequency			
1	Contact Commercial Ship with Surface Device	A commercial vessel such as a cargo vessel or tanker contacts the device	Insufficient Lookout; Human Error; Equipment or Mechanical Failure; Navigational Aid Failure; Adverse Environmental Conditions; Poor Visibility; Avoidance of other vessel; Running for shelter / safe haven in poor weather;	No Injury / Possible very minor injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Minor impact upon operations.	Multiple minor or single major injury; Major damage to vessel; Pollution limited to immediate area - Tier 2 Spill Criteria; Temporary closure / prolonged restrictions on operations.	1	2	1	2	1	3	4	3	4	1	2.45	Continuous Monitoring by Marine Coordination Centre; Restrict Navigation through the Gold and Green MDZ Zones;	2.45
2	Contact Passenger Vessels with Surface Device	A ferry / cruise ship contacts the device	Insufficient Lookout; Human Error; Equipment or Mechanical Failure; Navigational Aid Failure; Adverse Environmental Conditions; Poor Visibility; Avoidance of other vessel; Running for shelter / safe haven in poor weather	No Injury / Possible very minor injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Minor impact upon operations / short term loss of revenue.	Multiple minor or single major injury; Major damage to vessel; Small operational spill with little effect on the environment - Tier 1 to Tier 2 Spill Criteria; Temporary closure / prolonged restrictions on operations.	1	2	1	2	1	3	4	2	4	1	2.36	Continuous Monitoring by Marine Coordination Centre; Restrict Navigation through the Gold and Green MDZ Zones;	2.36

3	Contact Fishing Vessel with Surface Device	A fishing vessel contacts with the device	Insufficient Lookout; Human Error; Insufficient planning and individual risk assessment prior to departure; Equipment or Mechanical Failure; Navigational Aid Failure; Adverse Environmental Conditions; Effect of establishment of devices on tidal streams, eddies, overfalls and waves; Poor Visibility; Avoidance of other vessel; Running for shelter / safe haven in poor weather;	Light contact; Minor injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Negligible impact upon operations.	Heavy contact, person in the water; Multiple major injuries or a single fatality; Moderate damage to vessel; Negligible effect upon the Environment / No pollution; Temporary suspension of operations or prolonged restrictions to project.	2	2	1	1	4	4	3	1	3	2.5	3.47	Continuous Monitoring by Marine Coordination Centre; Restrict Navigation through the Gold and Green MDZ Zones; MDZ designation as No Fishing Zone; Appropriate alignment and spacing of arrays and devices; Provision of life saving equipment on fixed structures and floating devices.	2.86

ID	Hazard Title	Hazard Detail	Possible Causes	Most Likely Outcome	Worst Credible Outcome	Most Likely Consequence					Worst Credible Consequence					Baseline Risk Score	Suggested Additional Mitigation Measures	Residual Risk Score
						People	Property	Environment	Business	Frequency	People	Property	Environment	Business	Frequency			
4	Contact Powered Recreational Vessel with Surface Device	A powered recreational vessel contacts with the device	Insufficient Lookout; Human Error; Insufficient planning and individual risk assessment prior to departure; Equipment or Mechanical Failure; Navigational Aid Failure; Adverse Environmental Conditions; Effect of establishment of devices on tidal streams, eddies, overfalls and waves; Poor Visibility; Avoidance of other vessel; Running for shelter / safe haven in poor weather	Light contact; Minor injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Negligible impact upon operations.	Heavy contact, person in the water; Multiple major injuries or a single fatality; Moderate damage to vessel; Negligible effect upon the Environment / No pollution; Minor impact upon operations / short term loss of revenue.	2	2	1	1	4.5	4	3	1	2	3	3.94	Continuous Monitoring by Marine Coordination Centre; Restrict Navigation through the Gold and Green MDZ Zones; Appropriate alignment and spacing of arrays and devices; Provision of life saving equipment on fixed structures and floating devices. Guidance for recreational users operating around the devices.	2.76

5	Contact UnPowered Recreational Vessel with Surface Device	A non-powered recreational vessel contacts with the device	Insufficient Lookout; Human Error; Insufficient planning and individual risk assessment prior to departure; Equipment Failure; Navigational Aid Failure; Adverse Environmental Conditions; Effect of establishment of devices on tidal streams, eddies, overfalls and waves; Set on to device / pinned by tidal stream; Poor Visibility; Avoidance of other vessel; Running for shelter / safe haven in poor weather.	Light contact; Minor injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Minor impact upon operations / short term loss of revenue.	Heavy contact, person in the water; Multiple major injuries or a single fatality; Moderate damage to vessel; Negligible effect upon the Environment / No pollution; Moderate impact upon operations / short term loss of revenue.	2	2	1	2	4	4	3	1	3	3	3.94	Continuous Monitoring by Marine Coordination Centre; Restrict Navigation through the Gold and Green MDZ Zones; Appropriate alignment and spacing of arrays and devices; Provision of life saving equipment on fixed structures and floating devices. Safety Boats in attendance for Non-Powered Recreational Craft; Guidance for recreational users operating around the devices.	3.02

ID	Hazard Title	Hazard Detail	Possible Causes	Most Likely Outcome	Worst Credible Outcome	Most Likely Consequence					Worst Credible Consequence					Baseline Risk Score	Suggested Additional Mitigation Measures	Residual Risk Score
						People	Property	Environment	Business	Frequency	People	Property	Environment	Business	Frequency			
6	Contact Other Vessels with Surface Device	Small vessel (including maintenance Vessel) contacts with the device	Maintenence vessel working on device makes inadvertent contact; Insufficient Lookout; Human Error; Insufficient planning and individual risk assessment prior to departure; Equipment or Mechanical Failure; Navigational Aid Failure; Adverse Environmental Conditions; Effect of establishment of devices on tidal streams, eddies, overfalls and waves; Poor Visibility; Avoidance of other vessel; Running for shelter / safe haven in poor weather	Light contact; Minor injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Negligible impact upon operations.	Heavy contact, person in the water; Multiple major injuries or a single fatality; Major damage to vessel; Negligible effect upon the Environment / No pollution; Temporary suspension of operations or prolonged restrictions to project.	2	2	1	1	4	4	4	1	3	2	3.35	Continuous Monitoring by Marine Coordination Centre; Restrict Navigation through the Gold and Green MDZ Zones; Appropriate alignment and spacing of arrays and devices; Provision of life saving equipment on fixed structures and floating devices.	2.95

7	Collision Commercial Ship ICW Commercial Ship	Two commercial vessels collide due to the presence of the devices.	Increased traffic density to the north due to avoidance of the MDZ; Insufficient Lookout; Human Error; Equipment or Mechanical Failure; Adverse Environmental Conditions; Poor Visibility; Avoidance of other vessel.	Minor injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Minor impact upon operations/ short term loss of revenue.	Multiple major injuries or a single fatality; Major damage to vessel; Pollution limited to immediate area - Tier 2 Spill Criteria; Temporary suspension of operations or prolonged restrictions to project.	2	2	1	2	1	4	4	3	3	1	2.54		2.54
8	Collision Commercial Ship ICW Passenger Vessels	A commercial vessel collides with a passenger vessel due to the presence of the devices	Increased traffic density to the north due to avoidance of the MDZ; Insufficient Lookout; Human Error; Equipment or Mechanical Failure; Adverse Environmental Conditions; Poor Visibility; Avoidance of other vessel.	Multiple minor or single major injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Temporary suspension of operations or prolonged restrictions to project.	Multiple fatalities; Major damage to vessel; Pollution limited to immediate area - Tier 2 Spill Criteria; Temporary closure / prolonged restrictions on operations.	3	2	1	3	1	5	4	3	4	1	3.45		3.45

ID	Hazard Title	Hazard Detail	Possible Causes	Most Likely Outcome	Worst Credible Outcome	Most Likely Consequence					Worst Credible Consequence					Baseline Risk Score	Suggested Additional Mitigation Measures	Residual Risk Score
						People	Property	Environment	Business	Frequency	People	Property	Environment	Business	Frequency			
9	Collision Commercial Ship ICW Fishing Vessel	A commercial vessel collides with a fishing vessel due to the presence of the devices	Insufficient Lookout; Human Error; Equipment or Mechanical Failure; Adverse Environmental Conditions; Effect of establishment of devices on tidal streams, eddies, overfalls and waves; Poor Visibility; Avoidance of other vessel.	Minor injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Minor impact upon operations/ short term loss of revenue.	Multiple major injuries or a single fatality; Major damage to vessel; Negligible effect upon the Environment / No pollution; Minor impact upon operations/ short term loss of revenue.	2	2	1	2	1	4	4	1	2	1	2.27	Appropriate alignment and spacing of arrays and devices;	2.27

10	Collision Commercial Ship ICW Powered Recreational Vessel	A commercial vessel collides with a powered recreational vessel due to the presence of the devices	Insufficient Lookout; Human Error; Equipment or Mechanical Failure; Adverse Environmental Conditions; Effect of establishment of devices on tidal streams, eddies, overfalls and waves; Poor Visibility; Avoidance of other vessel.	Multiple minor or single major injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Minor impact upon operations/ short term loss of revenue.	Multiple major injuries or a single fatality; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Temporary suspension of operations or prolonged restrictions to project.	3	2	1	2	1	4	3	1	3	1	2.72	Appropriate alignment and spacing of arrays and devices; Safety Boats in attendance for Non-Powered Recreational Craft; Guidance for recreational users operating around the devices.	2.72

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						People	Property	Environment	Business	Frequency	People	Property	Environment	Business	Frequency			
11	Collision Commercial Ship ICW Un-Powered Recreational Vessel	A commercial vessel collides with an unpowered recreational vessel due to the presence of the devices	Insufficient Lookout; Human Error; Equipment Failure; Adverse Environmental Conditions; Effect of establishment of devices on tidal streams, eddies, overfalls and waves; Poor Visibility; Avoidance of other vessel.	Multiple minor or single major injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Minor impact upon operations/ short term loss of revenue.	Multiple major injuries or a single fatality; Moderate damage to vessel; Negligible effect upon the Environment / No pollution; Temporary suspension of operations or prolonged restrictions to project.	3	2	1	2	1	4	3	1	3	1	2.72	Appropriate alignment and spacing of arrays and devices; Safety Boats in attendance for Non-Powered Recreational Craft; Guidance for recreational users operating around the devices.	2.72

12	Collision Commercial Ship ICW Other Vessel	A commercial vessel collides with an other vessel due to the presence of the devices	Insufficient Lookout; Human Error; Equipment or Mechanical Failure; Adverse Environmental Conditions; Effect of establishment of devices on tidal streams, eddies, overfalls and waves; Poor Visibility; Avoidance of other vessel.	Minor injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Minor impact upon operations/ short term loss of revenue.	Multiple major injuries or a single fatality; Major damage to vessel; Negligible effect upon the Environment / No pollution; Minor impact upon operations/ short term loss of revenue.	2	2	1	2	1	4	4	1	2	1	2.27	Appropriate alignment and spacing of arrays and devices;	2.27

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						People	Property	Environment	Business	Frequency	People	Property	Environment	Business	Frequency			
13	Collision Passenger Vessels ICW Passenger Vessel	A passenger vessel collides with a passenger vessel due to the presence of the devices	Increased traffic density to the north due to avoidance of the MDZ; Insufficient Lookout; Human Error; Equipment or Mechanical Failure; Adverse Environmental Conditions; Poor Visibility; Avoidance of other vessel.	Multiple minor or single major injury; Moderate damage to vessel; Minor effect upon the Environment / Tier 1 - Tier 2 Pollution Criteria Reached; Major impact upon operations / temporary closure or prolonged restrictions on project operations.	Multiple fatalities; Major damage to vessel; Pollution limited to immediate area - Tier 2 Spill Criteria; Temporary closure / prolonged restrictions on operations.	3	3	2	4	1	5	4	3	4	1	4.00		4.00

14	Collision Passenger Vessels ICW Fishing Vessel	A passenger vessel collides with a fishing vessel due to the presence of the devices	Insufficient Lookout; Human Error; Equipment or Mechanical Failure; Adverse Environmental Conditions; Effect of establishment of devices on tidal streams, eddies, overfalls and waves; Poor Visibility; Avoidance of other vessel.	Minor injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Minor impact upon operations/ short term loss of revenue.	Multiple major injuries or a single fatality; Major damage to vessel; Negligible effect upon the Environment / No pollution; Minor impact upon operations/ short term loss of revenue.	2	2	1	2	1	4	4	1	2	1	2.27	Appropriate alignment and spacing of arrays and devices;	2.27
15	Collision Passenger Vessels ICW Powered Recreational Vessel	A passenger vessel collides with a powered recreational vessel due to the presence of the devices	Insufficient Lookout; Human Error; Equipment or Mechanical Failure; Adverse Environmental Conditions; Effect of establishment of devices on tidal streams, eddies, overfalls and waves; Poor Visibility; Avoidance of other vessel.	Multiple minor or single major injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Minor impact upon operations/ short term loss of revenue.	Multiple major injuries or a single fatality; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Temporary suspension of operations or prolonged restrictions to project.	3	2	1	2	1	4	3	1	3	1	2.72	Appropriate alignment and spacing of arrays and devices; Guidance for recreational users operating around the devices.	2.72

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						People	Property	Environment	Business	Frequency	People	Property	Environment	Business	Frequency			
16	Collision Passenger Vessels ICW Un-Powered Recreational Vessel	A passenger vessel collides with an unpowered recreational vessel due to the presence of the devices	Insufficient Lookout; Human Error; Equipment Failure; Adverse Environmental Conditions; Effect of establishment of devices on tidal streams, eddies, overfalls and waves; Poor Visibility; Avoidance of other vessel.	Multiple minor or single major injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Minor impact upon operations/ short term loss of revenue.	Multiple major injuries or a single fatality; Moderate damage to vessel; Negligible effect upon the Environment / No pollution; Temporary suspension of operations or prolonged restrictions to project.	3	2	1	2	1	4	3	1	3	1	2.72	Appropriate alignment and spacing of arrays and devices; Safety Boats in attendance for Non-Powered Recreational Craft; Guidance for recreational users operating around the devices.	2.72

17	Collision Passenger Vessels ICW Other Vessels	A passenger vessel collides with an other vessel due to the presence of the devices	Insufficient Lookout; Human Error; Equipment or Mechanical Failure; Adverse Environmental Conditions; Effect of establishment of devices on tidal streams, eddies, overfalls and waves; Poor Visibility; Avoidance of other vessel.	Minor injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Minor impact upon operations/ short term loss of revenue.	Multiple major injuries or a single fatality; Major damage to vessel; Negligible effect upon the Environment / No pollution; Minor impact upon operations/ short term loss of revenue.	2	2	1	2	1	4	4	1	2	1	2.27	Appropriate alignment and spacing of arrays and devices;	2.27
18	Collision Fishing Vessel ICW Fishing Vessel	A fishing vessel collides with a fishing vessel due to the presence of the devices	Narrowing of the inshore route; Increased utilisation of inshore route; Taking additional risks whilst racing; Insufficient Lookout; Human Error; Equipment or Mechanical Failure; Adverse Environmental Conditions; Effect of establishment of devices on tidal streams, eddies, overfalls and waves; Poor Visibility; Avoidance of other vessel.	Minor injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Negligible impact upon operations.	Multiple major injuries or a single fatality; Moderate damage to vessel; Negligible effect upon the Environment / No pollution; Minor impact upon operations / short term loss of revenue.	2	2	1	1	2	4	3	1	2	1.5	2.38	Appropriate alignment and spacing of arrays and devices;	2.38
19	Collision Fishing Vessel ICW Powered Recreational Vessel	A fishing vessel collides with a powered recreational vessel due to the presence of the devices.	Narrowing of the inshore route; Increased utilisation of inshore route; Taking additional risks whilst racing; Insufficient Lookout; Human Error; Equipment or Mechanical Failure; Adverse Environmental Conditions; Effect of establishment of devices on tidal streams, eddies, overfalls and waves; Poor Visibility; Avoidance of other vessel.	Multiple minor or single major injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Negligible impact upon operations.	Multiple major injuries or a single fatality; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Temporary suspension of operations or prolonged restrictions to project.	3	2	1	1	2.5	4	3	1	3	2	3.31	Appropriate alignment and spacing of arrays and devices; Safety Boats in attendance for Non-Powered Recreational Craft; Guidance for recreational users operating around the devices.	3.31

ID	Hazard Title	Hazard Detail	Possible Causes	Most Likely Outcome	Worst Credible Outcome	Most Likely Consequence					Worst Credible Consequence					Baseline Risk Score	Suggested Additional Mitigation Measures	Residual Risk Score
						People	Property	Environment	Business	Frequency	People	Property	Environment	Business	Frequency			

ID	Hazard Title	Hazard Detail	Possible Causes	Most Likely Outcome	Worst Credible Outcome	Most Likely Consequence					Worst Credible Consequence					Baseline Risk Score	Suggested Additional Mitigation Measures	Residual Risk Score
						People	Property	Environment	Business	Frequency	People	Property	Environment	Business	Frequency			
20	Collision Fishing Vessel ICW Un-Powered Recreational Vessel	A fishing vessel collides with an un-powered recreational vessel due to the presence of the devices.	Narrowing of the inshore route; Increased utilisation of inshore route; Taking additional risks whilst racing; Insufficient Lookout; Human Error; Equipment Failure; Adverse Environmental Conditions; Effect of establishment of devices on tidal streams, eddies, overfalls and waves; Poor Visibility; Avoidance of other vessel.	Multiple minor or single major injury; Negligible damage to vessel; Negligible effect upon the Environment / No pollution; Negligible impact upon operations.	Multiple major injuries or a single fatality; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Temporary suspension of operations or prolonged restrictions to project.	3	1	1	1	2.5	4	2	1	3	2	3.07	Appropriate alignment and spacing of arrays and devices; Safety Boats in attendance for Non-Powered Recreational Craft; Guidance for recreational users operating around the devices.	3.07
21	Collision Fishing Vessel ICW Other Vessels	A fishing vessel collides with an other vessel due to the presence of the devices	Narrowing of the inshore route; Increased utilisation of inshore route; Taking additional risks whilst racing; Insufficient Lookout; Human Error; Equipment or Mechanical Failure; Adverse Environmental Conditions; Effect of establishment of devices on tidal streams, eddies, overfalls and waves; Poor Visibility; Avoidance of other vessel.	Minor injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Negligible impact upon operations.	Multiple major injuries or a single fatality; Moderate damage to vessel; Negligible effect upon the Environment / No pollution; Minor impact upon operations / short term loss of revenue.	2	2	1	1	2.5	4	3	1	2	2	2.64	Appropriate alignment and spacing of arrays and devices;	2.64
22	Collision Powered Recreational Vessel ICW Powered Recreational Vessel	A powered recreational vessel collides with a powered recreational vessel due to the presence of the devices	Narrowing of the inshore route; Increased utilisation of inshore route; Taking additional risks whilst racing; Insufficient Lookout; Human Error; Equipment or Mechanical Failure; Adverse Environmental Conditions; Effect of establishment of devices on tidal streams, eddies, overfalls and waves; Poor Visibility; Avoidance of other vessel.	Multiple minor or single major injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Minor impact upon operations / short term loss of revenue.	Multiple major injuries or a single fatality; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Temporary suspension of operations or prolonged restrictions to project.	3	2	1	2	3	4	3	1	3	2	3.64	Appropriate alignment and spacing of arrays and devices; Guidance for recreational users operating around the devices.	3.64

23	Collision Powered Recreational Vessel ICW Un-Powered Recreational Vessel	An powered recreational vessel collides with an unpowered recreational vessel due to the presence of the devices	Narrowing of the inshore route; Increased utilisation of inshore route; Taking additional risks whilst racing; Insufficient Lookout; Human Error; Equipment and Mechanical Failure; Adverse Environmental Conditions; Effect of establishment of devices on tidal streams, eddies, overfalls and waves; Poor Visibility; Avoidance of other vessel.	Single minor injury; Negligible damage to vessel; Negligible effect upon the Environment / No pollution; Negligible impact upon operations / short term loss of revenue.	Multiple major injuries or a single fatality; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Temporary suspension of operations or prolonged restrictions to project.	2	1	1	1	3	4	2	1	3	2	2.61	Appropriate alignment and spacing of arrays and devices; Safety Boats in attendance for Non-Powered Recreational Craft; Guidance for recreational users operating around the devices.	2.61
24	Collision Powered Recreational Vessel ICW Other Vessel	A recreational vessel collides with an other vessel due to the presence of the devices	Narrowing of the inshore route; Increased utilisation of inshore route; Taking additional risks whilst racing; Insufficient Lookout; Human Error; Equipment or Mechanical Failure; Adverse Environmental Conditions; Effect of establishment of devices on tidal streams, eddies, overfalls and waves; Poor Visibility; Avoidance of other vessel.	Multiple minor or single major injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Negligible impact upon operations.	Multiple major injuries or a single fatality; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Temporary suspension of operations or prolonged restrictions to project.	3	2	1	1	3	4	3	1	3	2	3.49	Appropriate alignment and spacing of arrays and devices; Guidance for recreational users operating around the devices.	3.49
25	Collision UnPowered Recreational Vessel ICW Un-Powered Recreational Vessel	An un-powered recreational vessel collides with an unpowered recreational vessel due to the presence of the devices	Narrowing of the inshore route; Increased utilisation of inshore route; Taking additional risks whilst racing; Insufficient Lookout; Human Error Equipment Failure; Adverse Environmental Conditions; Effect of establishment of devices on tidal streams, eddies, overfalls and waves; Poor Visibility; Avoidance of other vessel.	Single minor injury; Negligible damage to vessel; Negligible effect upon the Environment / No pollution; Negligible impact upon operations.	Multiple major injuries or a single fatality; Negligible damage to vessel; Negligible effect upon the Environment / No pollution; Temporary suspension of operations or prolonged restrictions to project.	1	1	1	1	3	4	1	1	3	2	1.74	Appropriate alignment and spacing of arrays and devices; Safety Boats in attendance for Non-Powered Recreational Craft; Guidance for recreational users operating around the devices.	1.63

ID	Hazard Title	Hazard Detail	Possible Causes	Most Likely Outcome	Worst Credible Outcome	Most Likely Consequence					Worst Credible Consequence					Baseline Risk Score	Suggested Additional Mitigation Measures	Residual Risk Score
						People	Property	Environment	Business	Frequency	People	Property	Environment	Business	Frequency			

26	Collision UnPowered Recreational Vessel ICW Other Vessel	An unrecreational vessel collides with an other vessel due to the presence of the devices	Narrowing of the inshore route; Increased utilisation of inshore route; Taking additional risks whilst racing; Insufficient Lookout; Human Error; Equipment or Mechanical Failure; Adverse Environmental Conditions; Effect of establishment of devices on tidal streams, eddies, overfalls and waves; Poor Visibility; Avoidance of other vessel.	Multiple minor or single major injury; Negligible damage to vessel; Negligible effect upon the Environment / No pollution; Negligible impact upon operations.	Multiple major injuries or a single fatality; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Temporary suspension of operations or prolonged restrictions to project.	3	1	1	1	2	4	2	1	3	1	2.64	Appropriate alignment and spacing of arrays and devices; Safety Boats in attendance for Non-Powered Recreational Craft; Guidance for recreational users operating around the devices.	2.64
27	Collision Other Vessels ICW Other Vessels	An other vessel collides with an other vessel due to the presence of the devices.	Narrowing of the inshore route; Increased utilisation of inshore route; Taking additional risks whilst racing; Insufficient Lookout; Human Error; Equipment or Mechanical Failure; Adverse Environmental Conditions; Effect of establishment of devices on tidal streams, eddies, overfalls and waves; Poor Visibility; Avoidance of other vessel.	Minor injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Negligible impact upon operations.	Multiple major injuries or a single fatality; Moderate damage to vessel; Negligible effect upon the Environment / No pollution; Minor impact upon operations / short term loss of revenue.	2	2	1	1	3	4	3	1	2	2	2.76	Appropriate alignment and spacing of arrays and devices;	2.76

ID	Hazard Title	Hazard Detail	Possible Causes	Most Likely Outcome	Worst Credible Outcome	Most Likely Consequence					Worst Credible Consequence					Baseline Risk Score	Suggested Additional Mitigation Measures	Residual Risk Score
						People	Property	Environment	Business	Frequency	People	Property	Environment	Business	Frequency			

ID	Hazard Title	Hazard Detail	Possible Causes	Most Likely Outcome	Worst Credible Outcome	Most Likely Consequence					Worst Credible Consequence					Baseline Risk Score	Suggested Additional Mitigation Measures	Residual Risk Score
						People	Property	Environment	Business	Frequency	People	Property	Environment	Business	Frequency			
28	Grounding / Forced Ashore Commercial Ship	A commercial vessel grounds due to the presence of the devices and their moorings.	N/A	N/A	N/A	1	1	1	1	0	1	1	1	1	0	0.00	NOT SCORED	0.00
29	Grounding / Forced Ashore Passenger Vessels	A passenger vessel grounds due to the presence of the devices and their moorings.	N/A	N/A	N/A	1	1	1	1	0	1	1	1	1	0	0.00	NOT SCORED	0.00

ID	Hazard Title	Hazard Detail	Possible Causes	Most Likely Outcome	Worst Credible Outcome	Most Likely Consequence					Worst Credible Consequence					Baseline Risk Score	Suggested Additional Mitigation Measures	Residual Risk Score
						People	Property	Environment	Business	Frequency	People	Property	Environment	Business	Frequency			
30	Grounding / Forced Ashore Fishing Vessel	A fishing vessel grounds / contacts seabed, rocks or cliff due to the presence of the devices and their moorings.	Narrowing of the inshore route; Increased utilisation of inshore route; Insufficient Lookout; Human Error; Insufficient planning and individual risk assessment prior to departure; Equipment or Mechanical Failure; Adverse Environmental Conditions; Effect of establishment of devices on tidal streams, eddies, overfalls and waves; Poor Visibility; Avoidance of other vessel; Running for shelter / safe haven in poor weather.	Grounding with little damage; Minor injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Negligible impact upon operations.	Forced ashore onto rocks / cliffs; Multiple major injuries or a single fatality; Moderate damage to vessel; Minor effect upon the Environment / Tier 1 - Tier 2 Pollution Criteria Reached; Minor impact upon operations / short term loss of revenue.	2	2	1	1	2	4	3	2	2	1	2.33	Appropriate alignment and spacing of arrays and devices;	2.20
31	Grounding / Forced Ashore Powered Recreational Vessel	A recreational vessel grounds / contacts seabed, rocks or cliff due to the presence of the devices and their moorings.	Narrowing of the inshore route; Increased utilisation of inshore route; Insufficient Lookout; Human Error; Insufficient planning and individual risk assessment prior to departure; Equipment or Mechanical Failure; Adverse Environmental Conditions; Effect of establishment of devices on tidal streams, eddies, overfalls and waves; Poor Visibility; Avoidance of other vessel; Running for shelter / safe haven in poor weather.	Grounding with little damage; Multiple major injuries or a single fatality; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Minor impact upon operations / short term loss of revenue.	Forced ashore onto rocks / cliffs; Multiple fatalities; Moderate damage to vessel; Minor effect upon the Environment / Tier 1 - Tier 2 Pollution Criteria Reached; Major impact upon operations / temporary closure or prolonged restrictions on project operati ons.	3	2	1	2	2	5	3	2	4	1	3.44	Appropriate alignment and spacing of arrays and devices; Guidance for recreational users operating around the devices.	3.20

32	Grounding / Forced Ashore Un-Powered Recreational Vessel	An un-powered recreational vessel grounds / contacts seabed, rocks or cliff due to the presence of the devices and their moorings.	Narrowing of the inshore route; Increased utilisation of inshore route; Insufficient Lookout; Human Error; Insufficient planning and individual risk assessment prior to departure; Equipment Failure; Adverse Environmental Conditions; Effect of establishment of devices on tidal streams, eddies, overfalls and waves; Poor Visibility; Avoidance of other vessel; Running for shelter / safe haven in poor weather.	Grounding with little damage; Single minor injury; Negligible damage to vessel; Negligible effect upon the Environment / No pollution; Negligible impact upon operations / short term loss of revenue.	Forced ashore onto rocks / cliffs; Multiple fatalities; Minor damage to vessel; Minor effect upon the Environment / Tier 1 - Tier 2 Pollution Criteria Reached; Moderate impact upon operations / temporary suspension / prolonged restrictions.	2	1	1	1	2	4	2	1	3	1	2.12	Appropriate alignment and spacing of arrays and devices; Safety Boats in attendance for Non-Powered Recreational Craft; Guidance for recreational users operating around the devices.	2.01
33	Grounding / Forced Ashore Other Vessel	An other vessel / contacts seabed, rocks or cliff grounds due to the presence of the devices and their moorings.	Narrowing of the inshore route; Increased utilisation of inshore route; Insufficient Lookout; Human Error; Insufficient planning and individual risk assessment prior to departure; Equipment or Mechanical Failure; Adverse Environmental Conditions; Effect of establishment of devices on tidal streams, eddies, overfalls and waves; Poor Visibility; Avoidance of other vessel; Running for shelter / safe haven in poor weather.	Grounding with little damage; Minor injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Negligible impact upon operations.	Forced ashore onto rocks / cliffs; Multiple major injuries or a single fatality; Moderate damage to vessel; Minor effect upon the Environment / Tier 1 - Tier 2 Pollution Criteria Reached; Minor impact upon operations / short term loss of revenue.	2	2	1	1	2	4	3	2	2	1	2.33	Appropriate alignment and spacing of arrays and devices;	2.20
34	Swamping / Capsize Commercial Ship	A commercial vessel swamps / capsizes due to the presence of the devices and their moorings.	N/A	N/A	N/A	1	1	1	1	0	1	1	1	1	0	0.00	NOT SCORED	0.00

ID	Hazard Title	Hazard Detail	Possible Causes	Most Likely Outcome	Worst Credible Outcome	Most Likely Consequence	Worst Credible Consequence	Suggested Additional Mitigation Measures

						People	Property	Environment	Business	Frequency	People	Property	Environment	Business	Frequency	Baseline Risk Score		Residual Risk Score
35	Swamping / Capsize Passenger Vessels	A passenger vessel swamps / capsizes due to the presence of the devices and their moorings.	N/A	N/A	N/A	1	1	1	1	0	1	1	1	1	0	0.00	NOT SCORED	0.00
36	Swamping / Capsize Fishing Vessel	A fishing vessel overwhelmed by sea and swamps / capsizes.	N/A	N/A	N/A	1	1	1	1	0	1	1	1	1	0	0.00	NOT SCORED	0.00
37	Swamping / Capsize Powered Recreational Vessel	A powered recreational vessel overwhelmed by sea and swamps / capsizes.	Human Error; Insufficient planning and individual risk assessment prior to departure; Taking additional risks during racing; Equipment or Mechanical Failure; Adverse Environmental Conditions; Effect of establishment of devices on tidal streams, eddies, overfalls and waves; Running for shelter / safe haven in poor weather.	Vessel filled with water but does not sink; Minor injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Minor impact upon operations/ short term loss of revenue.	Vessel lost, persons in water; Multiple fatalities; Moderate damage to vessel; Minor effect upon the Environment / No pollution; Temporary closure or prolonged restrictions.	2	2	1	2	2	5	3	2	4	1	2.93	Continuous monitoring by marine coordination centre; Appropriate alignment and spacing of arrays and devices; Provision of life saving equipment on fixed structures and floating devices; Guidance for recreational users operating around the devices.	2.93

ID	Hazard Title	Hazard Detail	Possible Causes	Most Likely Outcome	Worst Credible Outcome	Most Likely Consequence	Worst Credible Consequence	Suggested Additional Mitigation Measures

						People	Property	Environment	Business	Frequency	People	Property	Environment	Business	Frequency	Baseline Risk Score		Residual Risk Score
38	Swamping / Capsize UnPowered Recreational Vessel	An un-powered recreational vessel overwhelmed by sea and swamps / capsizes due to the presence of the devices and their moorings.	Human Error; Insufficient planning and individual risk assessment prior to departure; Taking additional risks during racing; Equipment Failure; Adverse Environmental Conditions; Effect of establishment of devices on tidal streams, eddies, overfalls and waves; Running for shelter / safe haven in poor weather.	Vessel filled with water but does not sink; Single minor injury; Negligible damage to vessel; Negligible effect upon the Environment / No pollution; Negligible impact upon operations / short term loss of revenue.	Vessel lost, persons in water; Multiple major injuries or a single fatality; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Temporary suspension of operations or prolonged restrictions to project.	2	1	1	1	5	4	2	1	3	3	4.13	Continuous monitoring by marine coordination centre; Provision of life saving equipment on fixed structures and floating devices. Safety Boats in attendance for Non-Powered Recreational Craft; Guidance for recreational users operating around the devices.	4.13
39	Swamping / Capsize Other Vessel	An other vessel overwhelmed by sea and swamps / capsizes due to the presence of the devices and their moorings.	N/A	N/A	N/A	1	1	1	1	0	1	1	1	1	0	0.00	NOT SCORED	0.00
40	Snagging/ Obstruction Commercial Ship	A commercial vessel's anchor interacts with a cable, the device, its moorings or marker buoy moorings.	Emergency anchoring; Anchoring in an inappropriate position; Equipment or Mechanical Failure; Insufficient cable protection; Adverse Environmental Conditions; Running for shelter / safe haven in poor weather. Poor Visibility; Navigation aid failure.	Anchor snags mooring lines or power cables but cleared on weighing; No Injury / Possible very minor injury; Negligible damage to vessel; Negligible effect upon the Environment / No pollution; Minor impact upon operations / short term loss of revenue.	Anchor snags mooring lines or power cables but cannot be cleared on weighing anchor seriously damaging moorings, devices or power cables; No Injury / Possible very minor injury; Negligible damage to vessel; Negligible effect upon the Environment / No pollution; Temporary closure or prolonged restrictions on project operations.	1	1	1	2	1	1	1	1	4	1	1.74	Continuous Monitoring by Marine Coordination Centre; Restrict navigation through gold and green MDZ zones; Appropriate alignment and spacing of arrays and devices; Check Device Surveys; Establish no anchoring areas; Enhanced cable protection;	1.74

ID	Hazard Title	Hazard Detail	Possible Causes	Most Likely Outcome	Worst Credible Outcome	Most Likely Consequence	Worst Credible Consequence	Suggested Additional Mitigation Measures

						People	Property	Environment	Business	Frequency	People	Property	Environment	Business	Frequency	Baseline Risk Score		Residual Risk Score
41	Snagging/ Obstruction Passenger Vessels	A ferry's anchor interacts with a cable, the device, marker buoy or its moorings.	Emergency anchoring; Anchoring in an inappropriate position; Equipment or Mechanical Failure; Adverse Environmental Conditions; Poor Visibility; Navigation aid failure.	Anchor snags mooring lines or power cables but cleared on weighing; No Injury / Possible very minor injury; Negligible damage to vessel; Negligible effect upon the Environment / No pollution; Minor impact upon operations / short term loss of revenue.	Anchor snags mooring lines or power cables but cannot be cleared on weighing seriously damaging moorings, devices or power cables; No Injury / Possible very minor injury; Negligible damage to vessel; Negligible effect upon the Environment / No pollution; Temporary closure or prolonged restrictions on project operations.	1	1	1	2	1	1	1	1	4	1	1.74	Continuous Monitoring by Marine Coordination Centre; Restrict navigation through gold and green MDZ zones; Appropriate alignment and spacing of arrays and devices; Check Device Surveys; Establish no anchoring areas; Enhanced cable protection;	1.74
42	Snagging/ Obstruction Fishing Vessel	A fishing vessel's gear/ anchor interacts with a cable, the device, marker buoy or its moorings.	Fishing gear snags moorings, device or power cable; Emergency anchoring; Anchoring in an inappropriate position; Equipment or Mechanical Failure; Adverse Environmental Conditions; Poor Visibility; Navigation aid failure.	Fishing gear or anchor snags mooring lines or power cables but cleared; Minor injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Negligible impact upon operations.	Fishing gear or anchor snags mooring lines or power cables but cannot be cleared seriously damaging moorings, devices or power cables; Multiple major injuries or a single fatality; Major damage to vessel; Negligible effect upon the Environment / No pollution; Temporary closure or prolonged restrictions on project operations.	2	2	1	1	4	3	2	1	4	2	3.16	Continuous Monitoring by Marine Coordination Centre; Restrict navigation through gold and green MDZ zones; MDZ designation as no fishing zone; Appropriate alignment and spacing of arrays and devices; Check Device Surveys; Establish no anchoring areas; Enhanced cable protection;	2.76
43	Snagging/ Obstruction Powered Recreational Vessel	A powered recreational vessel's gear/ anchor interacts with a cable, the device, marker buoy or its moorings.	Emergency anchoring; Anchoring in an inappropriate position; Equipment or Mechanical Failure; Adverse Environmental Conditions; Poor Visibility; Navigation aid failure.	Anchor snags mooring lines or power cables but cleared; No Injury / Possible very minor injury; Negligible damage to vessel; Negligible effect upon the Environment / No pollution; Negligible impact upon operations.	Anchor snags mooring lines or power cables but cannot be cleared seriously damaging moorings, devices or power cables; Minor injury; Negligible damage to vessel; Negligible effect upon the Environment / No pollution; Minor impact upon operations / short term loss of revenue.	1	1	1	1	1	2	1	1	2	1	0.56	Continuous Monitoring by Marine Coordination Centre; Restrict navigation through gold and green MDZ zones; Appropriate alignment and spacing of arrays and devices; Check Device Surveys; Establish no anchoring areas; Enhanced cable protection; Guidance for recreational users operating around the devices.	0.56

ID	Hazard Title	Hazard Detail	Possible Causes	Most Likely Outcome	Worst Credible Outcome	Most Likely Consequence	Worst Credible Consequence	Suggested Additional Mitigation Measures

							People	Property	Environment	Business	Frequency	People	Property	Environment	Business	Frequency	Baseline Risk Score		Residual Risk Score
44	Snagging/ Obstruction Un-Powered Recreational Vessel	An un-powered recreational vessel's gear/ anchor interacts with a cable, the device, marker buoy or its moorings.	N/A	N/A	N/A		1	1	1	1	0	1	1	1	1	0	0.00	NOT SCORED	0.00
45	Snagging/ Obstruction Other Vessel	An other vessel's gear/anchor interacts with a cable, the device, marker buoy or its moorings.	Emergency anchoring; Anchoring in an inappropriate position; Equipment or Mechanical Failure; Adverse Environmental Conditions; Poor Visibility; Navigation aid failure.	Anchor snags mooring lines or power cables but cleared; No Injury / Possible very minor injury; Negligible damage to vessel; Negligible effect upon the Environment / No pollution; Negligible impact upon operations.	Anchor snags mooring lines or power cables but cannot be cleared seriously damaging moorings, devices or power cables; Minor injury; Negligible damage to vessel; Negligible effect upon the Environment / No pollution; Minor impact upon operations / short term loss of revenue.		2	2	1	1	2	3	2	1	4	1	2.24	Continuous Monitoring by Marine Coordination Centre; Restrict navigation through gold and green MDZ zones; Appropriate alignment and spacing of arrays and devices; Check Device Surveys; Establish no anchoring areas; Enhanced cable protection;	2.24
46	Breakout of device / device not at stated depth	The device's moorings fail, device becomes a hazard to navigation.	Equipment / mooring failure; Adverse Environmental Conditions; Contact by vessel.	Mooring failure, device remains in position and at stated depth; Minor injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Negligible impact upon operations.	Mooring failure, device breaks free or no longer at stated depth / required UKC and becomes contact hazard; Multiple major injuries or a single fatality; Major damage to vessel; Negligible effect upon the Environment / No pollution; Temporary suspension of operations or prolonged restrictions to project.		2	2	1	1	3	4	4	1	3	2	2.95	Restrict Navigation through gold and green MDZ zones; Continuous Monitoring by Marine Coordination Centre; Check device surveys; Establish no anchoring areas.	2.40

Annex D NRA Stakeholder Minutes and Email Responses

Minutes of Meeting held on 02-October-2023 – MCA

Client:	Menter Môn	
Project:	22UK1877	
Venue:	MS Teams	
Date of Meeting:	02-October-2023 at 11.00	
Present:	MCA	Nick Salter (NS)
		Vinu John (VJ)
	Marico Marine	Ryan Horrocks (RH)
		William Heaps (WH)

Item	Action item / Notes for the record	Action
1	WH and RH introduced themselves and the project.	
1.1	• Both NS and VJ are aware of the project • VJ mentioned that he is leading on Tidal and Wave energy projects for the MCA.	
2	WH showed the MCA the development and results of the VTS AIS and Radar Analysis.	

2.1	• WH ran through the slides and the MCA made the following comments: • VJ asked if the devices are the same as those being installed at Fall of Warness, Orkney by Magallanes. WH responded with, yes. All vessel tracks; • No comment Non-AIS (only Radar) tracks; • No comment Recreational tracks; and • No comment Passenger tracks; • No comment • The MCA said they were content with the traffic conditions and will await the combined analysis of summer and winter before they comment. • Marico Marine's winter survey is due to take place in October. NS suggested that the MCA would consider this more of an Autum survey. • WH stated that the guidance does not state "summer" and "winter" and that the survey in October should cover variation between seasons. • VJ asked about fishing data and specifically if any had been captured and how Marico were going to capture the seasonal variation. • RH suggested that fishing vessels operate all year round in the area of interest (based on results from the previous NRA, more fishing occurs during the summer. In the winter, vessels tend to transit through the site rather than fish). • NS asked if any other AIS data had been collected.	RH to send Fishing Tracks
	• RH mentioned that AIS data had been collected in March, to which NS stated he believed that was more of a spring survey. • WH asked if the MCA could provide scope on what the MCA expect to see from the Winter survey. • NS suggested that a winter survey should cover different weather conditions and capture for bad weather routeing.	
3	WH asked if NS had any other views/changes in vessel traffic.	
3.1	• VJ said that ferries are more likely to undertake weather routeing in the winter and suggested that this be captured within the NRA. • No changes to the area for vessel traffic. • VJ asked if any additional data had been collected other than AIS and Radar. • WH said that visuals had been conducted over the two-week summer period.	
4	WH showed the hazard list from the previous NRA.	
4.1	• The MCA had no comment.	

5	WH showed the vessel types identified within the previous NRA.	
5.1	• The MCA had no comment.	
6	WH showed the mitigations suggested from the previous NRA.	
6.1	• VJ mentioned mitigation 3 – "Restrict Navigation through the Gold and Green MDZ Zones" and questioned what it meant. • WH said that he assumes it would be advice and notices however, this is something to clarify within the NRA. • NS believed that this was raised within the NRA process previously. • NS mentioned that the layout plan would need agreement from the NRA. • NS questioned mitigation 4 "MDZ designation as No Fishing Zone". • WH suggested that this would be clarified within the next NRA. • NS mentioned that 3rd party verification of mooring arrangements for tidal devices would be needed, and consideration would need to be given to the MCA guidance entitled "Regulatory expectations on moorings for floating wind and marine devices" 2017. • VJ questioned if safety zones would be implemented just through installation or through the entirety of the project. • NS stated that the MCA will review the NRA and provide a list of conditions which are subject to review for specific devices.	WH to check
7	WH asked about cumulative impacts	
7.1	• VJ mentioned Minetso to the west of Morlais and suggested it should be considered. • VJ also suggested that research should be undertaken to consider future plans.	
8	WH asked if there were any further comments.	
8.1	• VJ questioned if the NRA was for the sitewide of Morlais. • WH said that the NRA will consider the 4 devices mentioned, a device specific NRA will be undertaken for each installation and assumed that each device installation would need a separate license.	
	• NS stated that the MCA could review the application and may add a few more conditions.	

Minutes of Meeting held on 02-October-2023 – UK Chamber of Shipping

Client:	Menter Môn
Project:	22UK1877
Venue:	MS Teams
Date of Meeting:	02-October-2023 at 15.00

Present:	UK CoS	Robert Merrylees (RM)
	Marico Marine	Ryan Horrocks (RH)
		William Heaps (WH)

Item	Action item / Notes for the record	Action
1	WH and RH introduced themselves and the project. WH then asked RM about the UK CoSs activity within the area of interest.	
1.1	• RM was involved in the project in 2017-2018. • The UK Chamber of Shipping is the primary trade organisation for the UK's shipping industry. • RM said that the CoS was primarily interested in the development from a navigation risk perspective for commercial operators. • RM asked about the continual monitoring of the project and agreed with the requirement that an NRA is to be undertaken every two years.	
2	WH showed RM the development and results of the VTS AIS and Radar Analysis.	
2.1	• WH ran through the slides and RM made the following comments: All vessel tracks; • No comment Non-AIS (only Radar) tracks; • No comment Recreational tracks; and • No comment Passenger tracks; • Cruise traffic reduced during covid. This year (2023) is a representable year for cruise traffic. • Zonal approach was agreed with passenger ferries including the weather routeing during the original NRA process. • RM asked if the area would be an exclusion zone. • WH suggested that this would not be possible in the UK and installations should be individually marked.	
3	WH asked if RM had any other views/changes to the area.	
3.1	• RM mentioned there were projects in the Irish sea with ongoing consultation (Morgan, Mona, Morecambe.) and would be Isle of Man waters. • RM asked what is agreed for the lighting/marking of the devices.	
	• RH mentioned that Marico are producing an Aids to Navigation plan with input from Trinity House and for device specific marking, a decision will be made closer to the installation date. • RM suggested that a standardise approach would be useful towards the marking of the devices.	

	• RM stated that the zonal approach mitigated concerns from the ferry users in the original NRA process. • RM asked whether there would be multiple cables along the inshore passageway and if so, would there be any coordination. This was through concerns over CBRAs and Nagging risks etc. • WH believed there were 9 cables accounted for through the consenting process connecting up to 200 devices as per the marine licence. • Irish getting going with MARA for offshore renewables and may want to be involved in the consultation.	WH to check

Minutes of Meeting held on 02-November-2023 – Anglesey Charter Fishing

Client:	Menter Môn	
Project:	22UK1877	
Venue:	MS Teams	
Date of Meeting:	02-November-2023 at 08.00	
Present:	Anglesey Charter Fishing	Aaron Smith (AS)
	Marico Marine	Ryan Horrocks (RH)
		William Heaps (WH)

Item	Action item / Notes for the record	Action
1	WH and RH introduced themselves and the project. WH then asked AS about their activity within the area of interest.	
1.1	• AS stated that there are 3 commercial fishermen including himself that actively fish within the MDZ. AS mentioned that there is another fisherman who occasionally fishers around the area. • AS suggested that he was acting as a representative of the commercial fishermen in the area. • As said that he is based at the Holyhead Fish Docks and works over the full western side of the island. • AS mentioned that fishermen work in and around the MDZ from midsummer until now (November) and suggested that the work within the MDZ is all pot fishing. AS suggested that they fish all year round. • AS also mentioned that he is the only fisherman to take charters out for anglers. • AS said that there are also 2 additional angling vessels, separate to the 4 mentioned previously which operate in the same season. • AS mentioned that he had undertaken surveys for the project. • AS mentioned that he has fished the area for a long time. AS said that there are no lobsters until July/August and fishers will fish until the weather is too harsh.	
2	WH showed AS the development and results of the VTS AIS and Radar Analysis.	

2.1	• WH ran through the slides and MB made the following comments: All vessel tracks; • No comment Non-AIS (only Radar) tracks; • AS mentioned that Radar will struggle to pick up smaller vessels. • RH stated that visual observations were also undertaken. Recreational tracks; and • No comment Passenger tracks; • Prince Madog may be the vessel that "zigzags" over the wrecks.	

	• AS mentioned that the traffic data looks exactly as expected. • AS said that not much angling takes part in the area due to strong tides. • AS mentioned that Holyhead is one of the main stop-off ports on in the Irish sea and it is the only deep-water port in the area. • WH mentioned he was aware that there was no marina at the moment due to storm damage. • AS mentioned that when the marina was in place, it had 40-50 vessels during its peak. • AS suggested that once the marina has been built, recreational traffic would likely pick up again.	
3	WH asked if AS had any other views/changes in vessel traffic.	
3.1	• AS could not recall any changes to the area or vessel traffic in recent years. • AS mentioned that the only change observed was when the Marina was shut down. • AS said that vessels have been interested in the LiDAR research buoy currently within the MDZ. • AS said that he is a member of the RNLI and could not recall any incidents within the site. • AS mentioned that some incidents occurred around North Stack, most of which break downs. AS also mentioned that getting to North Stack at the wrong time can catch out inexperienced mariners. • Most incidents are involving people lacking experience.	
4	WH showed the hazard list from the previous NRA.	
4.1	• AS suggested that devices could get caught on lobster buoys, however, they are usually only out for an hour per day on the surface. • AS mentioned that the area experiences extreme winds and tides. • AS was surprised that the area had been chosen considering the conditions. • WH suggested that tidal conditions are the attraction for the development	

5	WH showed the vessel types identified within the previous NRA.	
5.1	• AS mentioned that he once encountered a "Human Hamster Ball". • AS suggested that recreational dive vessels should also be included.	
6	WH showed the mitigations suggested from the previous NRA.	
6.1	• AS suggested that for a quarter of the year, the area can become busy with fishing/recreational vessels. • AS suggested that wind farms north of the site have used guard vessels.	
7	WH asked about cumulative impacts	
7.1	• AS suggested that the Minesto project located in Holyhead Deep has moved to the Faroe Islands and no longer operate in the area. • AS mentioned that their offices in Holyhead appear vacant. • AS also mentioned that Holyhead marina was the only development in the area that he was aware of.	
8	WH asked if there were any further comments.	
8.1	• AS stated that the fishermen's main concern is potential loss fishing grounds. AS mentioned that the fishers could not afford to lose the area	
	as a potential fishing ground. AS said that they work all year round and move offshore in August. • AS suggested that during the summer months, fishers could have 700-800 pots in the area at any one time. AS mentioned that 300 of those could be his. • AS said that 50 pots can be on a line that is ¾ mile long.	

Minutes of Meeting held on 04-October-2023 – Various Consultees

Client:	Menter Môn	
Project:	22UK1877	
Venue:	MS Teams	
Date of Meeting:	04-October-2023 at 17.00	
Present:	Irish Ferries	Andreas Cabans (AC)
	NCI	Trevor Sturrock (TS)
		Caro Wilson (CW)
	RNLI	Andrew Hodgson (AH)
		Megan Dixon (MD)
		Delme Mullings (DM)
		Paul Moffat (PM)
	Holyhead Port	John Goddard (JG)

	Marico Marine	Ryan Horrocks (RH) William Heaps (WH)

Item	Action item / Notes for the record	Action
1	WH and RH introduced themselves and the project.	
1.1	• Andreas Cabans – Master on Irish Ferries Vessel, Ulysses. • Trevor Sturrock - Station Manager for NCI Rhoscolyn. • Caro Wilson - Assistant Station Manager for NCI Rhoscolyn. • Andrew Hodgson – RNLI Crewmember. • Megan Dixon - RNLI Crewmember. • Delme Mullings - RNLI Crewmember. • Paul Moffat – RNLI Operations Manager. • John Goddard – Holyhead Harbour Master. Magallanes device information stated within meeting (all measurements are subject to change): • Approx. height of devices is 3.4m (2.09m above sea level); • Approx. draught is 29.6 with blades (approx. 23m diameter); • Approx. length of devices is 55m; and • 4-point gravity mooring is planned.	
2	WH showed the room the development and results of the VTS AIS and Radar Analysis.	
2.1	• CW asked if the 4 devices being installed would be just below the surface. • WH explained that the device will be on the surface in the green zone. • PM asked what the height of the Magallanes devices would be, if they are to be aligned, and how many of those devices would they be able to fit in the area. • PM also asked if there are taller devices going through the regulator. And if they exceeded 3.4m.	

	• PM asked what the max height of a device could be. • AC asked if there were more than those devices (Magallanes) in the water. • WH explained that any major changes to the device specification will need to be updated within the document. All vessel tracks; • No comment Non-AIS (only Radar) tracks; • No comment Recreational tracks; and • MD suggested that the area may be busier as the Regatta was cancelled through August and took place at a later date. • RH mentioned that the plot should look denser as most of the NonAIS tracks were also recreational tracks. Tracks also don't include kayakers and smaller craft that are identified by Radar. Passenger tracks; • AC mentioned that Stena Line and Irish ferries may cross the zone for weather routeing. More often in winter months. • AH said that traffic numbers might be higher due to a post-covid surge. However, it won't be particularly busy. • WH asked if kayaker traffic had increased. • DM, TH both agreed that kayak traffic had increased since the covid pandemic. • TH suggested that South Stack tends to be a bit safer for kayaks. • CW said that there were more smaller craft which included SUPs and Kayaks but was surprised that there wasn't more recorded during the NCI watch from the RSPB Café. • TH agreed with CW and expected the area to be busier. • CW said that their watch site missed the very narrow area over the cliffs that may contain more kayaks. • TH suggested they missed an area of approximately 100m. • JG asked if a winter survey was due to be completed. • AC asked if the devices are equipped with Aids to Navigation for example AIS, Racon etc. • WH said that Marico Marine are developing an Aids to Navigation plan for the area which is subject to TH approval. • AC also asked if there were any exclusion zones for vessels. • WH suggested that as far as he was aware, permanent exclusion zone cannot be established under current legislation. However, recommendations to avoid an area can be made. • DM suggested that from his experience, there are more jet skis in the area. These can be more dangerous as they have no knowledge of the area and can come from afar to transit the area. Some jet skiers come in groups, launch on local beaches and don't respect by laws. They may not be aware of local regulations. • CW added that they see a lot of groups of jet skis. Some have no consideration for other water users and NCI tend to see more in the summer.	

3	WH asked if anyone had any other views/changes in vessel traffic.	
3.1	• JG said that more windfarms are moving south and will need mobilization ports within the area. • JG also mentioned that the port has plans to expand and increase activities. • JG mentioned they had concerns over ferry routeing with the new development. • AC suggested that if weather was heavier, Irish Ferries would travel further south to head into Holyhead port. • JG expressed concerns for passenger ferry safety and asked if the zones had been agreed. • AC suggested that on the chart, the zones looked fine. But still expressed a concern. • JG explained that the area can't be completely free to navigation due to the nature of the devices being installed and asked if there were plans from Trintiy House regarding aids to navigation. • JG suggested that area would effectively be a "no-go area". • JG also asked who would be liable if a ferry was to use the weather route and collide with a device. • JG asked how their input would enter the assessment. • WH explained that comments made in this session will be considered as a part of the assessment and that the meeting minutes will be included within the report. • JG asked if the re-routeing of a ferry being accounted for. • AH explained that if the RNLI were searching in the area, they could miss targets. • JG asked if the previous NRA was available for viewing. • JG asked if the risk assessment will be for all the devices that go in. • JG asked if consultation would occur every time devices enter the water and if they would be considered as a group or as individual turbines. • WH explained that as devices enter the water, the cumulative impacts would be assessed. • PM explained that the RNLI get an alert when they deploy which does not give them much time to respond. • JG asked if there would be a blade breaching the surface of the water. • WH explained that there will not be a blade breaching the water. • AC had concerns over a breakout mooring and the recovering of the devices. They asked if the devices would have AIS so they were visible. • WH said that the control room should monitor the health and activity of devices	RH to provide link to previous NRA
4	WH showed the hazard list from the previous NRA.	
4.1	• No comments from group	
5	WH showed the vessel types identified within the previous NRA.	

5.1	• DM asked if the environmental impacts had been assessed. • WH explained that Marico Marine are only involved with regards to navigation, but environmental risks are fully considered as part of the project.	
	• JG asked if rogue vessels were considered, mainly because of their inexperience. JG explained that they currently have a rogue vessel in port limits that was trying to travel from Ireland to Africa. • DM suggested that the RNLI have not only recovered inexperienced users but also experienced users this year.	
6	WH showed the mitigations suggested from the previous NRA.	
6.1	• JG suggested that guard vessels as a mitigation is not realistic. They may be used for the installation but didn't think they'd be used for any other part of the project. • JG suggested that the submerged devices (Gold area) would be the biggest risk. • AH asked if there were only tidal devices being installed in the area. • WH explained that only tidal devices are to be installed. • DM suggested that the devices will have an effect on South Stack as it is a popular area. • PM questioned the validity of assessment as consultancies conducting assessments are not based locally. • WH explained that the consultation process is designed to include the views and concerns from local, experienced users. • PM also asked when the devices are to be installed and at what point do they decide what goes in the water. • PM asked if there is an action plan in place if an incident was to occur. • PM explained that they won't send out a team in harsh weather. • RH explained that the assessment will be undertaken in line with MCA guidance. • CW expressed concerns over developing in an area with a high traffic density. • WH explained that the site has been identified as a productive site for tidal energy and the area has been previously risk assessed and will continue to be risk assessed. • CW agreed that the site is good for tidal energy but had concerns over the visual impact. • DM asked if the substation had been built. • WH explained that they had started to build the substation. • AC asked if different turbines are due to be installed and what is the selection process of the different devices.	
7	WH asked about cumulative impacts	
7.1	• No comments from group	
8	WH asked if there were any further comments.	

8.1	• No comments from group	

Minutes of Meeting held on 04-October-2023 – Various Consultees

Client:	Menter Môn
Project:	22UK1877
Venue:	MS Teams
Date of Meeting:	04-October-2023 at 19.00

Present:	Sea Kayaking Alliance	Jenny Wong (JW)
	Canoe Wales	Alistair Dickson (AD)
		Alistair Pattullo (AP)
	Holyhead Sailing Club	Mark Rosenthal (MR)
	Snowdonia Canoe Club	Jim Potter (JP)
	Rhosneigr Scuba	Andy Easter (AE)
	Marico Marine	Ryan Horrocks (RH)
		William Heaps (WH)

Item	Action item / Notes for the record	Action
1	WH and RH introduced themselves and the project.	
1.1	• Jenny Wong – representative for the Anglesey Sea Kayak Alliance. • Alistair Dickson – CEO of Canoe Wales. • Alistair Pattullo – representative for Canoe Wales. • Mark Rosenthal – representative for Holyhead Sailing Club. • Jim Potter - representative for Snowdonia Canoe Club. • Andy Easter - representative for Rhosneigr Scuba. Magallanes device information stated within meeting (all measurements are subject to change): • Approx. height of devices is 3.4m (2.09m above sea level); • Approx. draught is 29.6 with blades (approx. 23m diameter); • Approx. length of devices is 55m; and • 4-point gravity mooring is planned.	
2	WH showed the attendees the development and results of the VTS AIS and Radar Analysis.	
2.1	• JW assumed the NRA would consider the whole MDZ site. • WH explained that the NRA will cover the site-wide and also consider device specific information.	

	• JW suggested that the first NRA was vague when considering the site and questioned if there was a new plan for the site. • WH explained that the site layout has the same areas as the first NRA produced and will also show the locations of the 4 devices to be installed in 2026. • AP clarified by asking if the NRA would consider the sitewide with the devices. • JW suggested that the risk assessment should be focused.	

	• MR asked if the assessment is being considered for location specific or sitewide. • WH explained that the NRA will cover the sitewide and the location of the 4 devices to the best of our knowledge. • MR asked if sailing clubs have been considered as part of the consultation.	

	• AD suggested that they could pass information on through their contacts with regards to sailing clubs. • MR questioned the "gold areas" safety with regards to the depth of the devices. • AP questioned how the devices are due to moored. • MR questioned the efficiency of the mooring and believed that they could be ineffective due to a varied wave pattern. • JW suggested that Orkney is more sheltered therefore moorings within the devices installed there would be more effective when compared to the same devices at South Stack. • WH explained that the mooring arrangement discussion was out of our scope. • WH explained that Marico would assess the risk of a breakout mooring. • In response to JW, RH explained the indicative diameter of the turbine blade on the proposed devices was 23m. • MR assumed that the devices would be inline the flow rate. • JW suggested that a device specific NRA could not be undertaken as there no final design details because details are subject to change. • AE questioned if the moorings would be taught or moving. • WH explained that devices are likely to move slightly. • MR suggested that tide rise and fall should be considered as devices will move in the water. • In response to JW, RH stated the dates of the summer survey were 23-29 August and 1-7 September 2023. • MR was surprised at the volume of traffic as a lot of vessels don't use AIS. • AE suggested that the devices could become an attraction to many users. • MR suggested that it would be helpful if Marico Marines figures were on a larger scale so they could view more of the surrounding area. • MR suggested that clubs from Liverpool and South tend to transit around the surrounding area. • AD suggested that the devices are being installed in what looks to be the busiest area. • WH explained that currently, there is the Marinus Buoy which is located in the area of interest and many users went to inspect it. • MR suggested that vessel patterns should be considered for racing vessels catching the "eddy" for safety. • AE had concerns for people under the water who could drift into the devices. • AD suggested that mitigations should be for the developer, not the user. WH explained that mitigations are on both the user and developer. • AP added that risk should be ALARP and measures must be put in place that are reasonably practical. • MR questioned how the power will get ashore. •	MR to supply contacts for Sailing clubs that use the area

	• WH explained that the site has inter-array cables and a corridor route.	

- JW asked what vessels are picked up on the radar installed at South Stack.
- RH explained that Jet skis and ribs can be detected depending on location and weather conditions, but mainly it is small yachts and sailing vessels. The radar could not pick up kayaks, however they could be captured within the visual observations.
- AE explained that weather has been bad this year and for the survey period and question if any more data had been collected.
- WH explained that we have a winter survey to undertake and have kayak data and NCI visual observations to support NRA.
- JW mentioned she collected the kayak data and that kayakers have varied risk levels depending on the type of kayak they are using.
- MR added that you will also have users of varied experience on kayaks.
- JW added that there is a different risk for a stand up paddleboarder (SUP) compared to a touring group of sea kayakers.
- AP suggested that August weather was worse than expected and that traffic recorded could be lower than expected.
- JW suggested that weather wouldn't make much difference to a kayaker

	going out. • JW added upon review that "This looks like a misunderstanding. If I made a point here it would have been that experienced sea kayakers do seek out 'conditions' so there can be people out in severe weather. However, this wasn't intended to downplay the point that August this year was particularly poor and overall numbers of people out around the Stacks would have been much lower than in good weather." • AD said that across Wales, recreational activities have decreased and experienced paddlers are more likely to visit Anglesey as it is considered within the industry to be a highly experienced area. • AP said that kayak races involve surfing waves. • JW added that this leads to a high probability of capsizing and kayaks could drift into the zone. They suggested that this could be individuals or groups of 15. JW suggested that kayaks could spend up to 2 hours at a time in the area. • JW suggested that incidents that could occur within the MDZ may originate other areas where kayakers have drifted into the zone. • JW suggested that consideration must be given to the areas around the site as well as the site itself. • They explained that SUPs get into the most trouble at sea as they are likely the most inexperienced. • AD mentioned that nice weather may bring recreational users out. • MR said that no training is required for most recreational vessels and recommended that training is provided to ensure that users are safe on the water. • AD added that the RYA are reluctant to run training but do offer it. • JW said that sea kayakers are trained at South Stack and that generally sea kayakers are lower risk as they are experienced. • JP said that Canoe Wales consider the area to be an advanced area and it is a risk for inexperienced SUPs. • AP added that some SUPs don't read the tides and people may be attracted to the devices installed. •	JW shared information surrounding swimmers passing south stack on the 2nd Sept 2023.

	• JW said that the devices could produce wake for kayakers to ride. • MR explained that Anglesey Council displays signs at the bay detailing weather conditions for recreational users. • WH asked the group what they thought was the falling frequency of SUPs/capsizing for kayakers. • JP added they were not aware. • AP suggested that there have been 3 incidents in the last 10 years that he could recall where kayakers have capsized and drifted, all of which were luckily recovered. • JW said that there was an incident at South Stack where a race group were evacuated, the RNLI were not called for this particular incident. • AP suggested that it is not infrequent for this to happen. • AP believed that the devices have three snagging risks which could damage kayakers and vessels. • JW suggested that consideration must be given to third party risks such as business risks. • AP suggested that hazards will also be present from support vessels during device installation. • AD asked how frequent the maintenance for the devices is. • MR asked where the cable is and was concerned of a snagging risk. • AP suggested that a tether off the device with the cable on it could reduce the risk of snagging. • MR suggested that the ferries don't run in severe weather. • AE questioned if the devices will have beacons. • WH mentioned that Marico Marine are developing an Aids to Navigation plan that is subject to approval by Trinity House. • AP suggested that marker points on each end of the device would be helpful to identify devices on approach. • AE asked if the devices have a battery backup.	
3	WH showed the hazard list from the previous NRA.	

3.1	• MR and AD agreed that most yachts sail and do not use their motor. • JW suggested that Jet skis should be listed under powered recreational vessels. • AE suggested a no-diving area be implemented. • MR thought that the exclusion zone was removed during the first NRA. • AE suggested that there have been cases of divers becoming lost. • JW suggested that consideration must be given to people who have lost power. • MR suggested that if the exclusion zone was implemented it could be similar to that of a wind farm. • AP suggested that this is the first time an area of high recreational use has had access to tidal devices and wanted to ensure they were safe. • JP suggested that area can't be inherently safe as the devices will be present and people can hit them. • AP suggested that the devices are pushed further out to sea as they pose a danger.	

	• AD suggested that the traffic numbers are more than an argument for mitigation. • AP suggested that the original plan was that devices were 500m offshore, this was since increased as ALARP was reached. AP questioned how this can be safe if ALARP is not reached within the NRA. • JW believed the risk was too high for kayakers in the area to mitigate. • JW added upon review "My point was it is difficult to mitigate risks as most kayakers in distress would be drifting at the mercy of tide/wind/waves." • AE suggested that reviews of the NRA should be better informed with data. • AP suggested that the only risk present in the area currently is the (Marinus) buoy. • AD suggested that the process should try and pre-empt the risks. • WH explained that this is one of the reasons we undertake consultation. • MR suggested that the risks for the full site are incomprehensible to user.	
4	WH showed the vessel types identified within the previous NRA.	
4.1	• No comments from group	
5	WH showed the mitigations suggested from the previous NRA.	
5.1	• No comments from group	
6	WH asked about cumulative impacts	
6.1	• No comments from group	
7	WH asked if there were any further comments.	

7.1	• JW questioned the MCAs MGN 654 and asked if there were plans to undertake tidal stream modelling and believed that this could determine if the devices have an effect on waves/tides in the area. • JW suggested that aspects of the original NRA were omitted that she believes should be considered. • AD questioned the reason for consultation and suggested that the process is not very structured. • MR suggested that a document containing relevant information could be provided before consultation. • In response to AP, WH suggested that the previous NRA is within the public domain. The NRA being produced may also be within the public domain when complete. • AD suggested that it makes more sense to see a draft of the document before consultation so that details can be discussed. • WH explained that consultation is a necessary step to complete the NRA and is important in the process. • JW suggested that an NRA workshop should be undertaken after the NRA has been completed. • AP believed that IMO guidance suggests a workshop should be undertaken. • AD questioned the relevance of the meeting and suggested an NRA workshop after data has been gathered. • AD did not believe that this meeting identified any further risks and was reluctant to get involved after this meeting. • JW believed that the buoy can't be called a buoy due to its size.	
	• MR suggested that the weather this week has had low pressure, high winds, spring tides and should give details on the movement of the buoy. • In response to AP, WH suggested the NRA would be complete by the end of 2023. • AP questioned whether a kayaker would be considered in the NRA if they fell in the water. • JW explained that 3 swimmers swam around the stacks this year which is • likely to increase. AP suggested they had an issue within the methodology used and questioned the validity of the risk methodology being used as he believed it was not compliant with the IMO or HSE.	AP shared his thoughts on Methodology

Minutes of Meeting held on 16-October-2023 – Anglesey County Council

Client:	Menter Môn
Project:	22UK1877
Venue:	MS Teams
Date of Meeting:	16-October-2023 at 11.00

Present:	Anglesey County Council	Andy Godber (AG)
	Marico Marine	Ryan Horrocks (RH)
		William Heaps (WH)

Item	Action item / Notes for the record	Action
1	WH and RH introduced themselves and the project. WH then asked AG about their activity within the area of interest.	
1.1	• Andy Godber – Visitor Economy and Coastal Areas Manager. • AG stated his role involves managing beach wardening, statutory harbours, navigation risk, biodiversity. • AG has been with the council for 6 months. • AG was interested in how the devices were going to be marked and raised concerns over devices just below or on the water. • AG asked if the cables for the 4 devices being installed would be on the seabed. • AG quested how they are due to be moored. • WH explained that the cable will be on the seabed and that a 4-point mooring will be used for the devices.	
2	WH showed AG the development and results of the VTS AIS and Radar Analysis.	
2.1	• WH ran through the slides and AG made the following comments: • AG asked if devices would be on the seabed. • WH explained that there will be various devices at different depths over the course of the project and proceeded to explain how the zoning of the MDZ worked. • AG suggested that devices could have an impact over all phases of the project from construction to operation. All vessel tracks; • No comment Non-AIS (only Radar) tracks; • No comment Recreational tracks; and • No comment Passenger tracks; • No comment	

	• AG suggested that he expected more activity coming out of Trearddur Bay. • WH explained that the image shown was AIS and Radar, which were unlikely to pick up all the activity in the Trearddur Bay area as most vessels are non-AIS. • AG asked if the radar would be able to detect Jet Skis. • Based on the images shown, AG suggested that most activity appears to be within the inshore passage of the MDZ, slightly east of the devices.	
3	WH asked if AG had any other views/changes in vessel traffic.	
3.1	• AG suggested there appears to be less vessels on the water that use slipways and suggested that this could be down to the weather or the economic downturn. • AG suggested that there is certainty less vessels than previous years. • AG said that jet skis come from all over to (Liverpool/Manchester etc) to ride around the island but in recent years have been unable due to the price of filling up their cars. • AG said that there has not been much change to other vessel types but suggested that SUPs have taken a gradual but significant reduction which he believed was because the interest had faded. • AG mentioned that over the last 2 years, there has been minimal change to activity, however, labelled the area as a "Hot Bed" for Kayaks. Suggesting that the area is popular for the more experienced kayakers.	AG to provide Figures.
4	WH showed the hazard list from the previous NRA.	
4.1	• AG suggested that the council have many incident reports, mainly around Trearddur Bay.	AG to provide Incident reports.
5	WH showed the vessel types identified within the previous NRA.	
5.1	• AG had no comment.	
6	WH showed the mitigations suggested from the previous NRA.	
6.1	• WH explained that an Aids to Navigation plan was being created by Marico Marine for the area. • AG asked if the devices were being treated as isolated hazards or marked as a group. • AG questioned if an impact assessment had been undertaken to assess how the lights on devices would affect bird populations.	
7	WH asked about cumulative impacts	

7.1	• AG mentioned the Penrhos holiday park development and suggested that it may bring more leisure users to the area. • AG mentioned that from a tourism perspective, they are focusing on quiet enjoyment which includes appropriate usage of the sea, this includes encouraging kayaks and SUPs. • AG mentioned that South Stack will still remain an area for experienced kayakers and the development is likely not to affect Trearddur Bay.	
8	WH asked if there were any further comments.	
8.1	• AG had no comment.	

Minutes of Meeting held on 16-October-2023 – Trinity House

Client:	Menter Môn	
Project:	22UK1877	
Venue:	MS Teams	
Date of Meeting:	16-October-2023 at 14.00	
Present:	Menter Môn	Helen Roberts (HR)
	Trinity House	Trevor Harris (TH)
		Stephen Vanstone (SV)
	Marico Marine	Ryan Horrocks (RH)
		Paul Brown (PB)
		William Heaps (WH)

Item	Action item / Notes for the record	Action
1	PB introduced himself and proceeded to talk through Draft A / V1 of the Aids to Navigation plan.	
1.1	• TH mentioned that IALA Recommendation O-139 has been superseded by IALA Guideline G1162. PB stated that he would update the AtNP. • SV mentioned that within the Aids to Navigation Plan, they would only want to see the final version as agreed with Trinity House.	PB
2	PB explained the structure of the Aids to Navigation Plan using excerpts from paragraph 2.4.2.& 2.51 of G1162.	

2.1	"Unlit individual structures can be made more conspicuous with retro-reflective areas." • TH that this would require a lot of retro-reflective material and there might be a problem with keeping the material on the devices. • TH recommended that the yellow colouring at each of the devices would suffice. • SV suggested that a reflective strip could be added around the ID number – this was incorporated into the plan. "Use of flashing yellow lights with a nominal range of 2 nautical miles" • SV mentioned that Trinity House do not require the lights to synchronize however, it would not be an issue with Trinity House if they were to commit to the synchronization of the lights on the four devices. PB stated that synchronisation would be preferable. • SV agreed that the devices should be treated as corner markers themselves. "Sectoring the Lights" • PB mentioned that this could be a simple as a 0-180° or they can align with the shore. • SV suggested the sectoring could be along 345° and align with the devices. • TH suggested that sectoring of the lights will also be dependent on the mooring method and device specifics.	

	• An agreement was made between SV, PB and TH for 345° to be the dividing line between the range sectoring of the lights and this would be included the Aids to Navigation plan. "Racons" • TH mentioned that RACONs would not be considered necessary by Trinity House for the four devices. "AIS" • TH questioned how the devices will be monitored. • PB explained that CCTV and 3G monitoring will be utilized for the devices and suggested that AIS should be used for safety of navigation, not monitoring. • TH suggested that AIS would merge if it were installed on all 4 devices and suggested that if AIS is to be used for the safety of navigation, then AIS should be installed on the most northern and south western devices. • WH suggested that this would appeal to local stakeholders and could be encouraging from a PR perspective. • PB suggested that AIS should therefore be installed on most northern and southwestern devices which received no objections from Trinity House.	
3	PB explained Aids to Navigation Plan Paragraph 2.5.2	

3.1	"To improve the effectiveness of the lighting and taking into account background lighting, synchronisation can be used." • SV mentioned that this had been discussed briefly previously within "Use of flashing yellow lights with a nominal range of 2 nautical miles". However, had no objections to the synchronization of the lights. • WH suggested that this would satisfy the views of local stakeholders. "Individual wave and tidal energy devices within a site that extend above the surface are painted yellow above the waterline." • PB added that devices could be grey in the middle and yellow at each end. • TH suggested that if devices are white in the middle, they may be harder to see depending on the weather and suggested that a vertical yellow stripe be added down the centre of the devices. • HR asked if the device was white rather than grey would that negate the need for a yellow stripe. • TH explained that it would not make a difference to the visibility of the devices and suggested that a yellow stripe would be necessary to satisfy Trinity House. • TH stated that the devices being totally yellow would be unnecessary. • PB stated that a midships yellow stripe behind the ID number and surrounded by a reflective strip will be added to the AtNP. "If marked, the individual devices should have flashing yellow lights. The flash character of such lights must be sufficiently different from those displayed on the boundary lights with a nominal range of not less than 2 Nautical miles." • SV mentioned that this had previously been discussed within "Use of flashing yellow lights with a nominal range of 2 nautical miles". • SV questioned what the expected flash character of the lights was. • PB stated that 3s flash character had been suggested. • SV suggested that Trinity House would be satisfied with a flash character of 5s where all 4 devices have a synchronized flash. • PB stated that 5s vs 3s will be incorporated into the plan.	
	"Based on risk assessment, a single wave or tidal energy extraction structure, standing alone, may be marked as follows: ○ Isolated Mark ○ Special Mark" • PB recommended that a 1.2m cross yellow special mark be displayed at least 1m above the structure. • TH suggested that this would be adequate. "Specific guidance to small craft needs early consideration". • TH suggested that an individual NRA should be undertaken to satisfy the marine license but also consider small craft and site-specific risk.	
4	Additional comments/concerns	

4.1	• TH questioned whether the introduction of AIS is likely to be done through a classification society as Menter Môn might find it hard to obtain a license. TH mentioned that they have had similar issues with floating wind. • TH mentioned that Menter Môn will also need to obtain insurance. • TH mentioned that the Aids to Navigation plan will need to consider any responses to a casualties/maintenance of lights which also achieves 99% availability.	
5	Summary	
5.1	The following Aids to Navigation have been agreed with Trinity House and will be added to the Morlais Aids to Navigation Plan: • Reflective strip to be added around the ID number. • Vertical yellow strip down the center of the devices. • 345 sectoring lights. • No Racon. • AIS to be installed on the most northern and southwestern devices. • 5s flash character yellow lights that are synchronized between devices with a 2nm range. • 1.2m cross yellow special mark be displayed at least 1m above the structure • GPS confirmed by HR to be on the device for monitoring purposes. • Will need to provide details regarding responses to casualties for lights.	
	Morlais NRA Consultation	
1	WH introduced himself and asked Trinity House if they were aware of anything that might have changed within the last 2 years within the area of interest.	
	• WH mentioned that the license has already been issued and a 2 yearly review condition had been written into the marine license. • TH suggested that there were no changes with regards to Aids to Navigation or general traffic that they could recall. • SV quested if the NRA was for the sitewide or site-specific for devices. • WH explained that this is the first 2 yearly NRA and will consider the 4 devices mentioned. • SV clarified that as per the marine license, a new NRA should be completed every time new devices enter the water. • TH mentioned that there are no planned updates/changes to aids to navigation in the area of interest.	

Minutes of Meeting held on 25-September-2023 – Stena Line Ferries

Client: Menter Môn

Project: 22UK1877

Venue: MS Teams

Date of Meeting: 25-September-2023 at 13.00

Present:	Stena Line Ferries	Michael Proctor (MP) Neil Whittaker (NW)
	Marico Marine	Ryan Horrocks (RH) William Heaps (WH)

Item	Action item / Notes for the record	Action
1	WH and RH introduced themselves and the project. WH then asked Stena Line Ferries (SLF) about their activity within the area of interest.	
1.1	• NW stated that they travel from Dublin to Holyhead using the Adventure and Estrid. (Each vessel makes one round trip from Dublin).	
2	WH showed SLF the development and results of the VTS AIS and Radar Analysis.	
2.1	• WH ran through the slides and MB made the following comments: All vessel tracks; • No comment Non-AIS (only Radar) tracks; • No comment Recreational tracks; and • No comment Passenger tracks; • MP explained that the "gold area" as defined within the study area is used as part of their weather routeing plan for when dealing with strong gales. MP explained that this is rare but does happen. • RH mentioned that the gold area is for fully submerged devices. • MP mentioned that cruise liners can pass through the (MDZ) area once a day in season and typically come from the south towards Holyhead/Liverpool; and • MP mentioned that there might be a concern from the port with vessels travelling up from the south of the development.	SLF to share route. RH to check
3	WH asked if MP had any other views/changes in vessel traffic.	
3.1	• MP mentioned that the port has plans to bunker commercial vessels from Holyhead Port. • MP said that the port will only get busier as they have become a free port. The port has bought the DW layby berth and plan to increase cruise ship movements. This should bring business to the area and may allow the	
	port to expand operations, which could include becoming a mobilisation port for recent developments.	

4	WH showed the hazard list from the previous NRA.	
4.1	• MP had concerns over break out moorings and if devices were to break out, they could drift into the path of the ferries. • MP asked what the plan for recovery is and what will be the mobilization port? • If mobilization is from Holyhead MP had concerns over disruption to SLF schedule. MP stated that in previous endeavors, ports have worked around SLF schedule, so they are not disrupted.	RH to check
5	WH showed the vessel types identified within the previous NRA.	
5.1	• SLF had no comment.	
6	WH showed the mitigations suggested from the previous NRA.	
6.1	• MP made a comment regarding the "Restrict Navigation through the Gold and Green MDZ Zones" mitigation. MP mentioned that this is not ideal weather routeing plan as they pass through the gold area and if there are submerged devices in the area.	
7	WH asked about cumulative impacts	
7.1	• MD had no comment and no additional information.	
8	WH asked if there were any further comments.	
8.1	• SLF had no comment • Reply on email - Regarding the Gold area, as the submerged devices can be at any depth, all merchant and fishing vessels will need to regard the area as a no-go area. This as I mentioned will result in some operational restrictions for ourselves when weather routing and will also effect other traffic routing to and from the port of Holyhead when approaching from or departing to the South.	

Minutes of Meeting held on 25-September-2023 – Trearddur Bay Sailing Club

Client:	Menter Môn	
Project:	22UK1877	
Venue:	MS Teams	
Date of Meeting:	25-September-2023 at 11.00	
Present:	Trearddur Bay Sailing Club	Michael Davis (MD)
	Marico Marine	Ryan Horrocks (RH)
		William Heaps (WH)

Item	Action item / Notes for the record	Action
1	WH and RH introduced themselves and the project. WH then asked MD about the TBSCs activity within the area of interest.	

1.1	• MD explained that he is a long-standing member of the TBSC and mentioned that he was representing on behalf of the club. He explained that the club was established in 1919 is mainly built up of holiday residents, however many are now Anglesey residents; • The main activity for the club happens over a 4-week period (or 5 weekends) running over July/August. The club tends to run about 20 races through this period; • The majority of their activity is within the Trearddur Bay area and can extend to Rhoscolyn Therefore 95% of their activity will not be affected by the development. They do have one event per year where vessels pass the stacks to Holyhead which involves 20-25 boats, however this only lasts for one day; • MD suggested that there are no concerns as long as the inshore passage remains navigable; • The club members do have powerboats in the water from Easter to September which might use the inshore passage; • Therefore, MD explained that they should not be affected by the development; • WH then asked if they could make a longer passage; and • MD replied stating that passages tend to be shorter, with only a couple of longer passages that he could recall in the last 10 years and they tend to be in coastal passages straight lines from point A to B. Some vessels travel to and from Bardsey and travel around the stacks to the Skerries or around Anglesey.	
2	WH showed MD the development and results of the VTS AIS and Radar Analysis.	
2.1	• MD asked where the ("Marinus") research buoy is located in relation to the site; • RH explained what dates the survey had been undertaken from to which MD replied that the busiest times within the area of interest for recreational traffic are July and August. A drop in traffic volume tends to occur after the August Bank Holiday weekend; and • WH ran through the slides and MB made the following comments:	RH to send location

	All vessel tracks; • No comment Non-AIS (only Radar) tracks; • No comment Recreational tracks; and • No comment Passenger tracks; • No comment – MD mentioned that they can see cruise ships coming to/from Holyhead.	
3	WH asked if MD had any other views/changes in vessel traffic.	
3.1	• MD stated that kayaking is growing consistently, however, they are very weather dependant. The weather in June was very good and therefore more kayakers were seen; and • MD stated that there is no capacity for additional safe moorings or extra public slipways on the West coast of Anglesey making it unlikely for traffic increases apart from kayaks.	
4	WH showed the hazard list from the previous NRA.	
4.1	• MD had no comment	
5	WH showed the vessel types identified within the previous NRA.	
5.1	• MD had no comment	
6	WH showed the mitigations suggested from the previous NRA.	
6.1	• MD had concerns over the 500m safety distance for installation and how it would impact the inshore passage; and • MD brought attention to the MDZ being a “no fishing zone” mitigation. MD stated that the area is heavily potted and questioned if pots would count as part of this.	
7	WH asked about cumulative impacts	
7.1	• MD had no comment and no additional information.	
8	WH asked if there were any further comments.	
8.1	• MD had no comment	

Consultee reply dated 27/02/2024 to initial email send by Marico Marine on 23/02/2024 Hi, thankyou for your email.

I understand that the deck of the Magallanes devices will be 0.12m closer to the sea at 1.97m above sea level - so not a lot of change.

In response to your request I would just like to reiterate that I perceive the snagging risk to paddlers (kayakers, Stand Up Paddle boarders etc. whether in or on their vessel or in the water following a capsize) to arise from the bow facing the tide flow of each Magallanes device and the 4 tethers anchoring the device to the sea bed. In addition, if waves are high enough to wash the decks, there is also the added hazard from snagging on the deck furniture if a paddler is washed onto the deck.

The above issues have already been identified to Marico, at the NRA consultation meeting on 04-10-23 and in my subsequent email to yourself dated 09-12-23. I have assumed a smooth vessel hull and deck parallel to sea level in all tide flows. Please advise if there are any additional snagging risks below the level of the deck and if the separation between deck and sea level is significantly affected by turbine loading at high tide flows. Regards,

Consultee reply dated 29/02/2024 to initial email send by Marico Marine on 23/02/2024 Thanks for this information and opportunity to make a few comments.

At first glance it appears that the change in dimensions of the Magallanes device is small. However, it is the profile of the vessel, particularly the presence of any protuberances or fixtures which might present a snagging hazard and how it behaves in swell i.e. whether waves break over the deck which is of most relevance to evaluation of the risk it poses to kayakers and swimmers (i.e. people who have become separated from their boat). We did ask some time ago whether it would be possible to view drawings if the profile of the vessel so we are better able to provide useful comments.

Could you please advise what the device-specific NRA will include.

I am a little surprised that the locations at which the devices are to be deployed are final when I see from the NRW marine portal that the detailed surveys of the berth are only just starting. Or are these surveys just intended to be the baseline surveys around the established locations?

Best wishes,