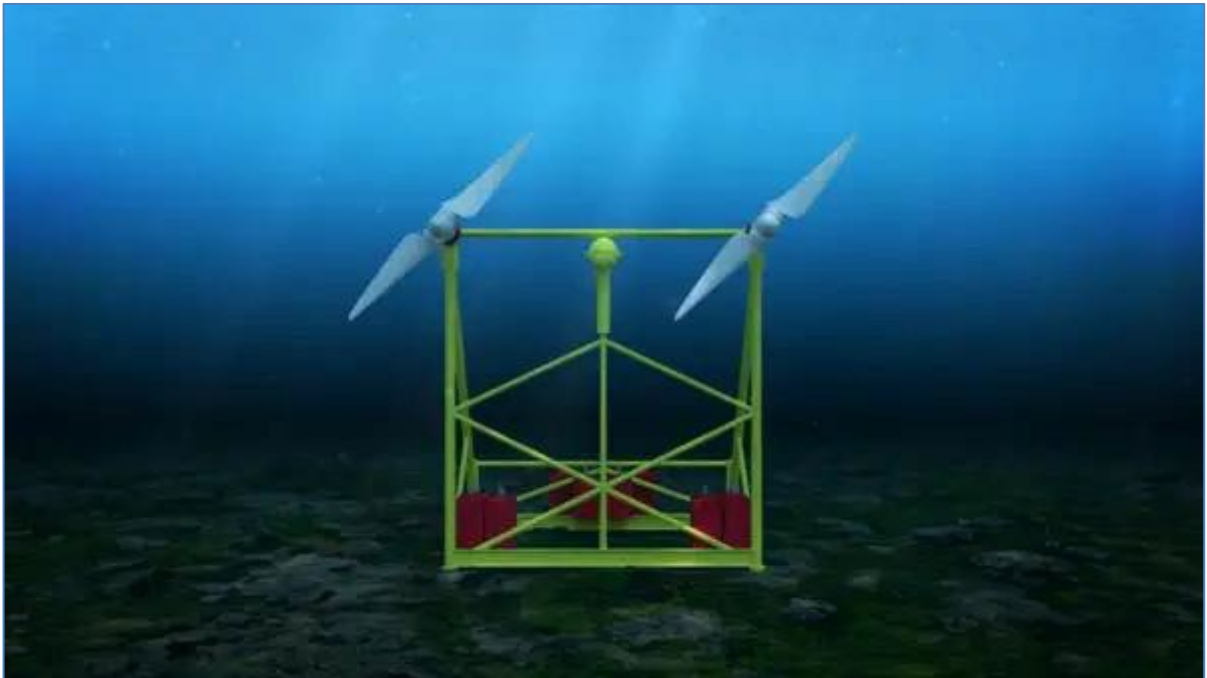


MENTER MÔN

**MORLAIS HYDROWING DEMONSTRATOR NAVIGATION
RISK ASSESSMENT**



Report Number: 24UK2027-HydroWing
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Prepared for: Menter Môn
Town Hall
Bulkley Square
Llangefni
LL77 7LR

Author(s): William Heaps; Ryan Horrocks

QC: Shirley Barnet

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Marine and Risk Consultants Ltd
Marico House
Bramshaw
Lyndhurst
Hampshire
SO43 7JB
United Kingdom

Telephone: + 44 (0) 2380 811133

Email: officeUK@maricogroup.com



EXECUTIVE SUMMARY

Following the consenting of the Morlais Tidal Demonstration Zone (MDZ) in December 2021, Menter Môn has requested Marine and Risk Consultants Ltd (Marico Marine) to undertake a Device Specific Navigation Risk Assessment in response to their marine licence (ORML 1938) conditions. This NRA is for a seabed deployment of a singular “HydroWing” demonstration device. The device is due to be installed in Q4 2026 for a 12-month demonstration deployment. The device will be located within blue zone of the MDZ.

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 previous stakeholder/expert judgement to determine risk levels. It follows the NRA guidelines stipulated by the UK’s Maritime and Coastguard Agency (MCA) in their role as Maritime Regulator under Marine Guidance Note (MGN) 654. This NRA considers only 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, consideration was given to device particulars including size, design and installation requirements, seasonal variations in traffic numbers and weather, and the location of the device.

This installation will be a single sea-bed mounted device with a minimum of 8m water depth above the highest point of the device (blade tip) at any state of the tide.

Energy created by the devices will be transferred from the devices via a temporary export cable that extends towards Abraham’s Bosom to the southeast of the site. The device consists of two rotors, each with a Tocardo T3 turbine with a blade diameter up to 19.6m. The devices will have a maximum height of 26m above the seabed. The devices will be installed on a piled foundation. Because the device is sub-sea and has 8m UKC, the developers do not expect to require marking or buoyage.

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

The assessment concluded that:

- The device footprint is within a 35m x 35m area. The device is due to be installed in the blue zone of the MDZ where there is an 8m UKC requirement. The device has a height of 26m and is to be installed at a depth of 34m, maintaining the required 8m UKC.
- The devices are located in an area of lower 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 are “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 to 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 device is not located in proximity to other offshore developments and is the first instalment of the Morlais Project. The device is expected to be decommissioned before any other devices are installed;
- All hazards were assessed to be ALARP or lower in the baseline risk assessment. Of the 57 hazards assessed within the construction phase, one was scored as ALARP in the baseline assessment. Of the 46 hazards assessed within the operation phase assessment, one was 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, one hazard was assessed to be ALARP in the construction phase residual risk assessment and one within the operational phase risk assessment. All remaining hazards were assessed to be low or lower.

Based on the findings of this assessment, the HydroWing demonstrator deployment 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.

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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 (MDZ) in December 2021, Menter Môn has requested Marine and Risk Consultants Ltd (Marico Marine) to undertake a Device Specific Navigation Risk Assessment (NRA) in response to their marine licence (ORML 1938) conditions. This NRA is for a seabed deployment of a singular “HydroWing” demonstration device. The device is due to be installed in Q4 2026 for a 12-month demonstration deployment. The device will be located within blue zone of the MDZ (**Figure 1**).

This document will assess the operational and deployment/demobilisation phases of the installation, which have been assessed independently. In conjunction with the NRA, and to satisfy the marine licence, Marico Marine have produced a Navigation Monitoring Specification (NMS). For this specific device an Aids to Navigation Plan (AtNP) has not been produced as THLS has confirmed that no AtoNs will be required.

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 previous stakeholder/expert judgement to determine risk levels. It follows the NRA guidelines stipulated by the UK’s Maritime and Coastguard Agency (MCA) in their role as Maritime Regulator under Marine Guidance Note (MGN) 654 (see **Section 1.2**). Please note that this NRA considers only safety of navigation and does not seek to address any possible loss of amenity.

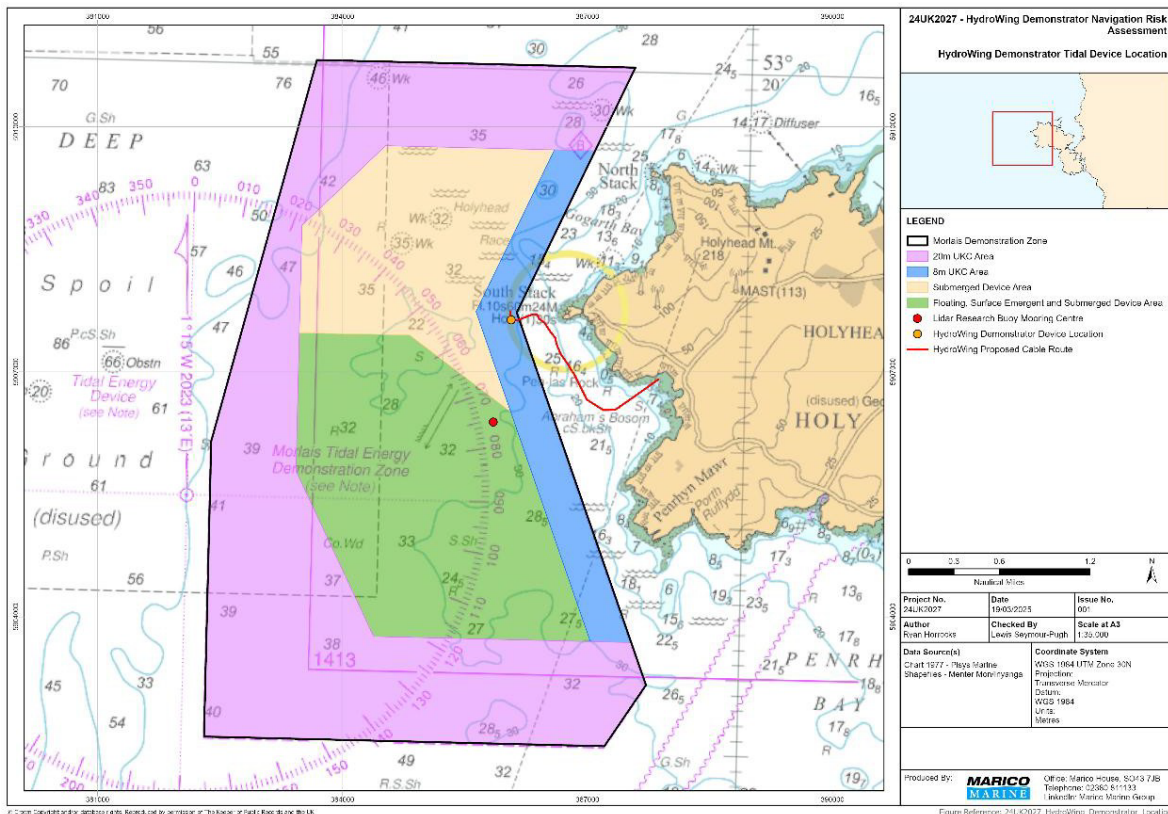


Figure 1: MDZ layout and the location of the HydroWing Demonstrator Device.

1.1 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).

1.2 REFERENCE DOCUMENTS

Table 1: Reference Documents

Document Name	Description
22UK1877_Morlais_Demonstration_Zone Navigation_Risk_Assessment_Issue01	The first MDZ Biennial Sitewide Navigation Risk Assessment completed in 2023
ORML 1938	Menter Môn's 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, 21 st 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.
NRA Parameters	Overview document provided by developer describing timeframes and methodologies.
Device Questionnaire	Summary device specific Information provided by developer (Annex A)
Device Installation Methodology (HYD-MOR25-DIM-001)	Detailed methodologies supplied by developer (Annex B)

2 DESCRIPTION OF THE SITE

2.1 MORLAIS DEMONSTRATION ZONE (MDZ)

The demonstration device is due to be installed within the MDZ, the 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 35km² 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 - HYDROWING DEMONSTRATOR INSTALLATION, 2026

3.1 DEVICE SPECIFIC INFORMATION

This installation will be a single sea-bed mounted device with a minimum of 8m water depth above the highest point of the device (blade tip) at any state of the tide.

Installation is due to commence in Q4 2026 and will consist of the installation of one HydroWing device. 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 temporary subsea export cable and Power connection backpack;
- Preparation and installation - Seabed mounted foundation piled to seabed;
- Installation of Wing, Turbine Control Hub and Turbine.

The device location will be monitored by the developer throughout installation and operation.

The device will be located to the east side of the “Blue” zone within the MDZ; the area where seabed mounted devices with a minimum UKC of 8m have been consented to deploy (see **Figure 3** for position with a micro siting allowance of ±50m and **Table 2** for coordinates).

The principal device dimensions are:

- Device Height: up to 26m
- Device footprint: maximum 35m x 35m
- Charted Depth of seabed = 34m

- UKC = 8m

(See **Figure 2** for General Arrangement).

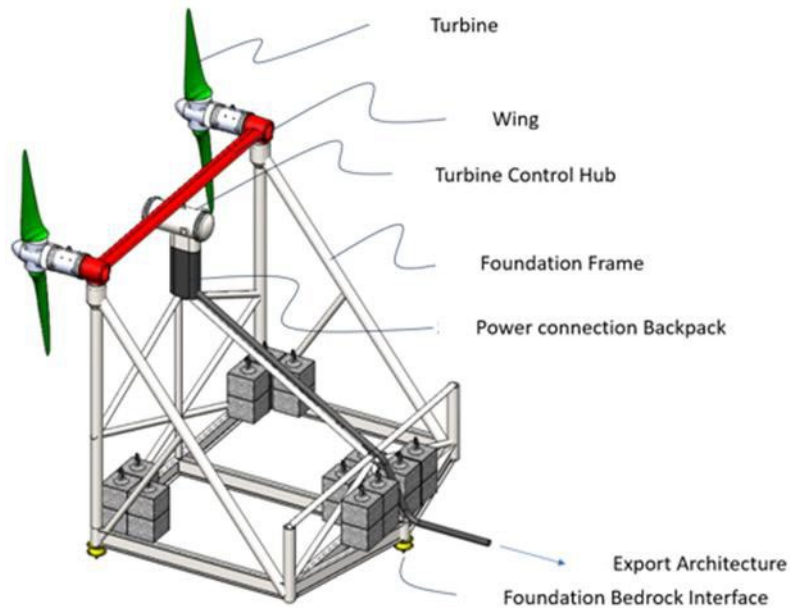


Figure 2: Indicative image of the HydroWing Device.

Energy created by the devices will be transferred from the devices via a temporary export cable that extends towards Abraham’s Bosom to the southeast of the site (the cable corridor with a ± 200 m micro siting allowance is shown on **Figure 3** in red). The device consists of two rotors, each with a Tocardo T3 turbine with a blade diameter of 19.6m. The devices will have a maximum height of 26m above the seabed, resulting in a minimum available depth of water of 8m at LAT. The devices will be installed on a piled foundation. Because the HydroWing device is sub-sea and has 8m UKC, the developers do not expect to require marking or buoyage other than potentially during installation and maintenance operations.

Table 2: Coordinates of Device Deployment - with a micro siting allowance of ± 50 m.

WGS 84 Coordinates		
	Latitude	Longitude
Foundation Centre	53° 18' 20.3N	004° 42' 35.7W

Table 3 Proposed Cable Installation Corridor - with a micro siting allowance of ± 200 m

WGS 84/ UTM Zone 30N	
Easting	Northing
386050.40	5907742.11
386057.44	5907692.64
386064.48	5907685.54
386114.40	5907633.60

WGS 84/ UTM Zone 30N	
Easting	Northing
386145.16	5907630.27
386215.01	5907659.38
386325.18	5907703.03
386367.59	5907705.94
386390.04	5907693.47
386408.75	5907648.15
386480.47	5907593.48
386507.91	5907546.08
386558.63	5907472.91
386607.69	5907413.87
386617.66	5907352.34
386635.54	5907304.12
386670.88	5907220.13
386730.75	5907134.49
386765.67	5907085.43
386795.61	5907030.55
386834.89	5906974.22
386992.05	5906659.91
387194.52	5906531.44
387266.86	5906532.27
387347.52	5906541.42
387374.33	5906559.09
387556.85	5906685.48
387867.96	5906907.10

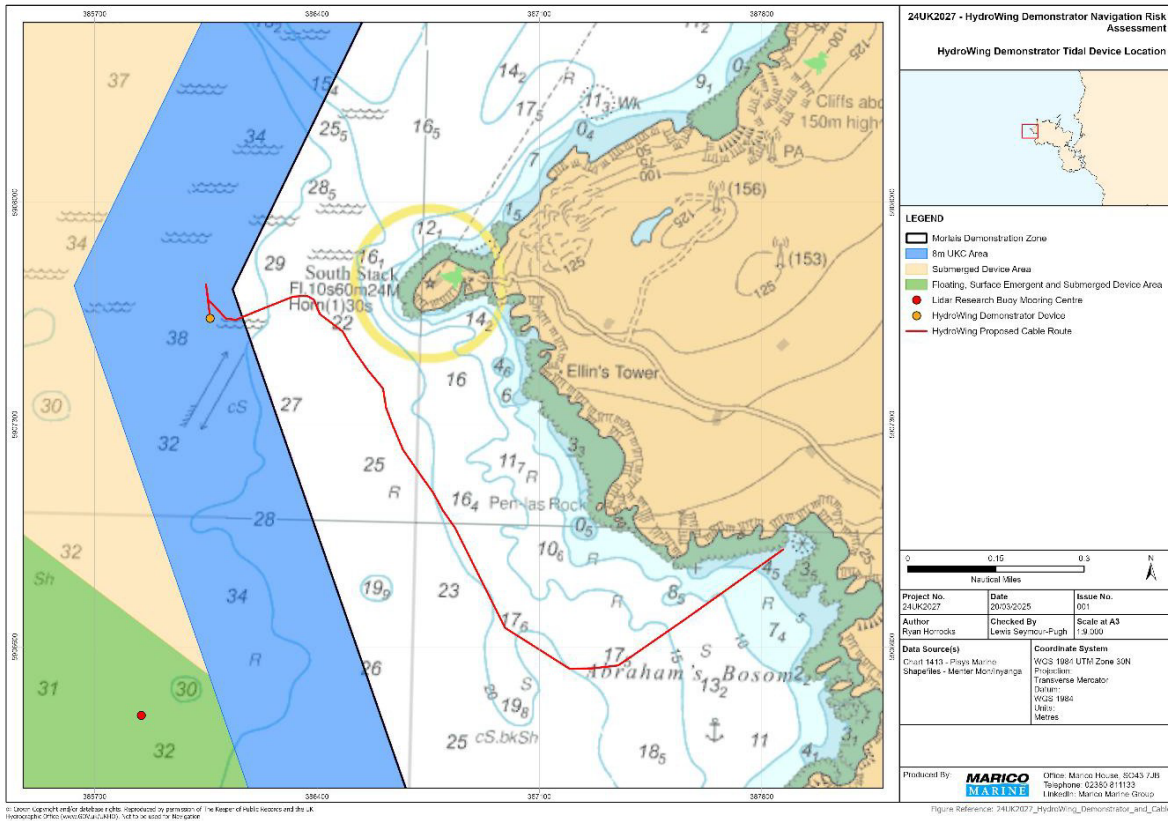


Figure 3: HydroWing, Cable Corridor and LiDAR Buoy Locations.

3.2 DEVICE INSTALLATION, OPERATION AND MAINTENANCE

Both the installation and the removal of the HydroWing demonstration device is likely to take around 6-7 weeks. This will be broken up into the following sections (written as decommission, can be reversed for installation time and activities):

- Foundation: 3 days foundation decommissioning; and
- Cable: 5 days cable laying, 2 days removal of cable protection.

The HydroWing demonstration device is not expected to require any planned maintenance due to its short lifetime in advance of the full HydroWing array. If any unplanned maintenance is required, a vessel will be deployed to recover the components of the device that require repair. This is expected to take ~1 day for recovery, and ~1 day for re-deployment.

Indicative time scales are given in **Table 4**, below.

Table 4: Installation and operation time scales

Stage	2025		2026				2027			
	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Device Manufacturing:	■									
Device Assembly:			■							
Final Integration			■	■						
Installation:					■	■				
Operation and Power Generation:							■			■
Decommissioning										■

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 forecast duration of activities.

Table 5 below summarises operation and maintenance activities, and associated vessel movements.

Table 5: Summary of O&M activities and required vessels

O&M Task	Typical Vessel Requirement	Duration of Task
Turbine inspection	Workboat Diving support vessel	2-3 days per device
Environmental monitoring equipment inspection	Workboat	1 day
Environmental monitoring equipment removal or redeployment	Specialised HydroWing workboat	3-5 days
Turbine repair or replacement		1 day for recovery, 1 day for re-deployment

It should be noted that during the installation and operation phases of the HydroWing demonstration device, a LiDAR Research Buoy will be in the water approximately 0.69nm from the device location.

3.3 DEVICE FOUNDATION METHODOLOGY

For the foundation installation, a standard offshore construction vessel with a strong dynamic positioning capability and a 150t active heave compensated crane capacity will be required. This size of vessel is available from the North Sea. The vessel will be required to lift the ~100t foundation from its transit position on the deck, overboard and lower it to the target position on the seabed.

To confirm positioning, orientation and heading, a Remotely Operated Vehicle (ROV) will be required on the vessel. Once the foundation is installed on the seabed, the vessel will deploy all ballasts on it.

The export cable and jumper cables installation can be carried out using the same vessel as the foundation installation with the intention of saving overall cost by mobilising the cable and equipment at the same time as the foundation.

3.4 WINGS INSTALLATION / RECOVERY

For installation and recovery of the wings, a custom quad hull barge (QHB) is utilised requiring a tug boat for towing and positioning on site. This removes the requirement of a DP2 vessel for lifting the wing and reduces the vessel costs for both installation and O&M. A smaller secondary barge is used to for final assembly of the wing prior to installation and to transition the wing to the QHB.

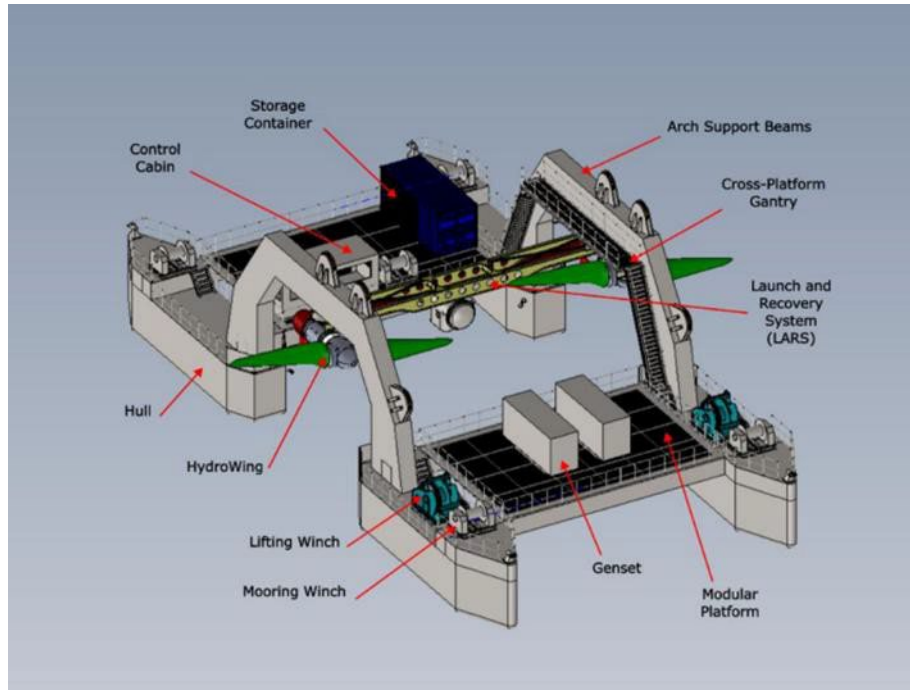


Figure 4 - Quad Hull Barge Diagram

3.5 CABLE INSTALLATION METHODOLOGY

Detailed cable installation methodologies are described in **Annex B** – vessels involved are summarised in **Table 5** above.

4 ASSESSMENT SCOPE AND METHODOLOGY

The scope and objectives for the assessment are as follows:

1. Describe the project;
2. Provide a 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_Issue02 and undertake a device specific NRA that reviews the hazards during the installation, operation and decommissioning phases of the installation. 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_Issue01**

6 VESSEL TRAFFIC STUDY

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 Marine has undertaken the NRA utilising the following data sources:

- 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 E**);
- 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 be seen below in **Table 6**. 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 6: 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

Data Type and Period	Duration of Dataset
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, additional consultation with local stakeholders was undertaken by email. This consultation has been undertaken to support the wide-ranging consultation (completed in October 2023) for both the Phase 1 device deployment (which does not overlap with this installation), and the Biennial site-wide NRA review and to gather comments regarding specific details of the HydroWing install. Device specific information including the location of the device, install depth, height, UKC, moorings and install and decommissioning activities were all provided within the emails. The following stakeholders (all of whom have been previously consulted with) were contacted:

- Stena Line Ferries;
- Stena Line Ports (Holyhead Harbour Master);
- Irish Ferries;
- Royal Yachting Association (RYA);
- National Coastwatch Institution (NCI);
- Commercial Fishing Representative (Anglesey Charter Fishing);
- Kayak Representatives (Sea Kayaking Alliance and Paddle Cymru);
- Holyhead Sailing Club;
- Rhosneigr Sub Aqua Club; and
- Isle of Anglesey County Council.

Consultation emails were sent on 09/06/2025. Two stakeholders (Kayak representatives and RYA) responded with replies based on the information provided (see **Annex E**). Statutory consultation with the MCA and Trinity House has been undertaken through engagement during the production of this NRA report.

Overall, the stakeholders had no concerns over the operation of the device due to the depth at which the device will be installed. Concerns were raised over the installation and decommissioning phases due to the presence of additional vessels in the water and the proximity of the device to the shoreline. It was suggested that emergency egress points should be maintained during install and decommissioning and notice for the construction works should be effectively promulgated. The presence of a guard vessel during construction activities was also recommended.

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_Issue02.

To analyse the traffic that transits within the vicinity of the HydroWing demonstrator device, a gate has been drawn across the MDZ as seen in **Figure 5**. 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.

In total, 190 tracks were recorded intersecting the gate in the summer and 7 in the winter data period. Non-AIS vessels were the most common vessel recorded with 77 tracks in the Summer, accounting for approximately 41% of all transits as shown within **Figure 6**. No passenger or tanker vessels were recorded through this gate within either seasonal survey.

It should be noted that during both survey periods, the LiDAR Research Buoy was present within the area. It was noted in consultation that recreational vessels had been to visit the buoy and therefore there might be more tracks within its vicinity than usual. The LiDAR buoy is due to be present during both the installation and operational phases for the HydroWing Demonstration Device.

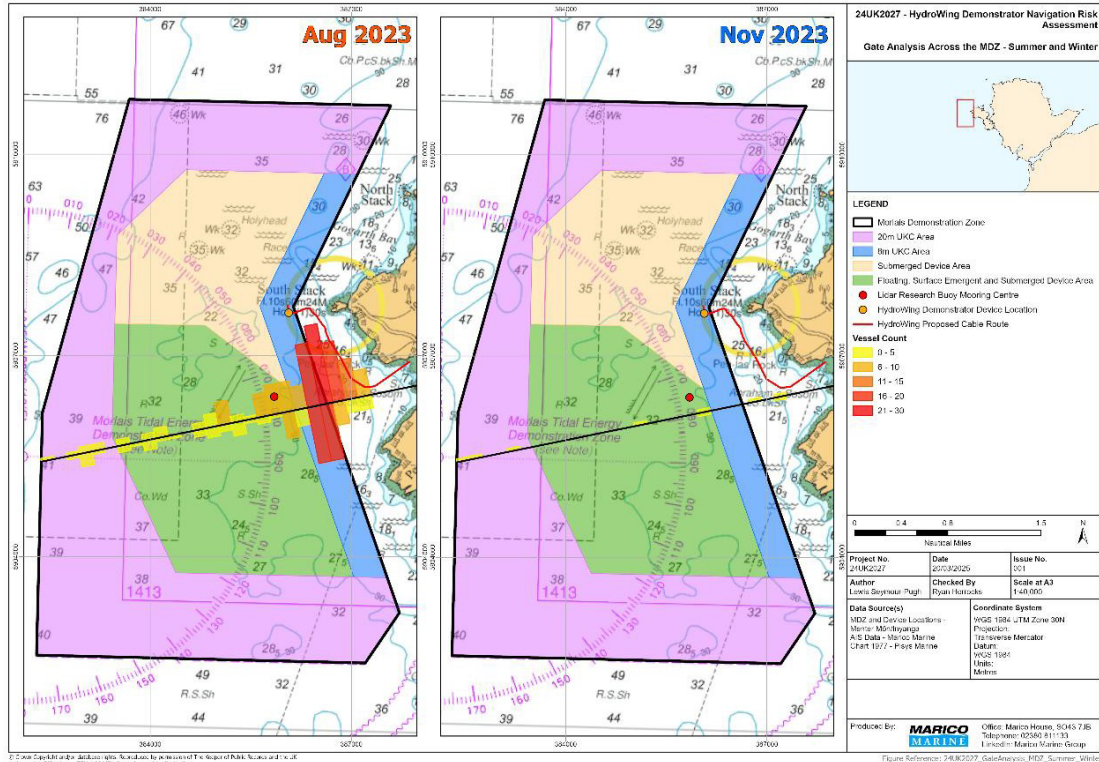


Figure 5: Gate Analysis

Figure 7 demonstrates transits by Length Over-All (LOA) of vessels intersecting the gate. The majority (88%) of summer vessel tracks 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.

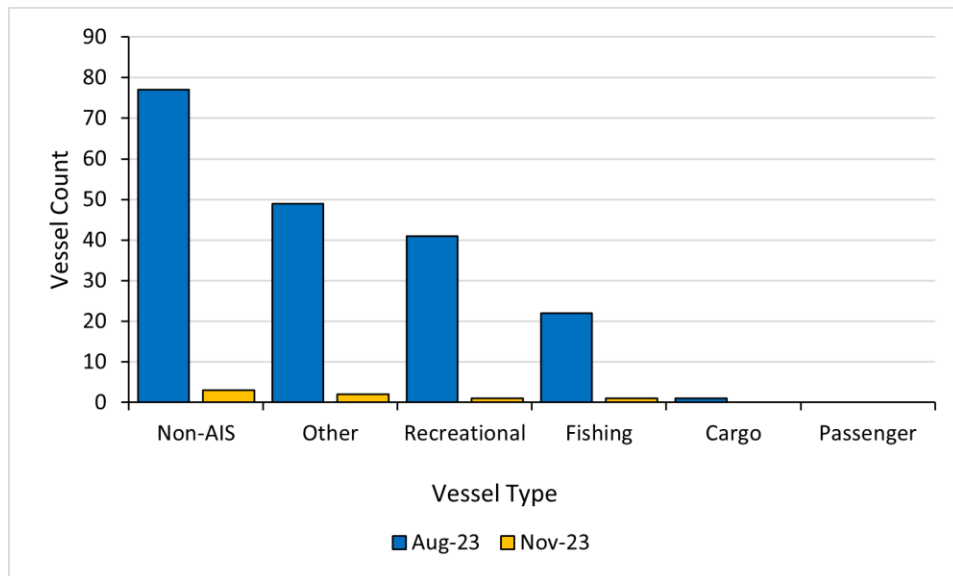


Figure 6: Frequency of transits by vessel type

Transits through the gates were analysed by draught within **Figure 8**. 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.

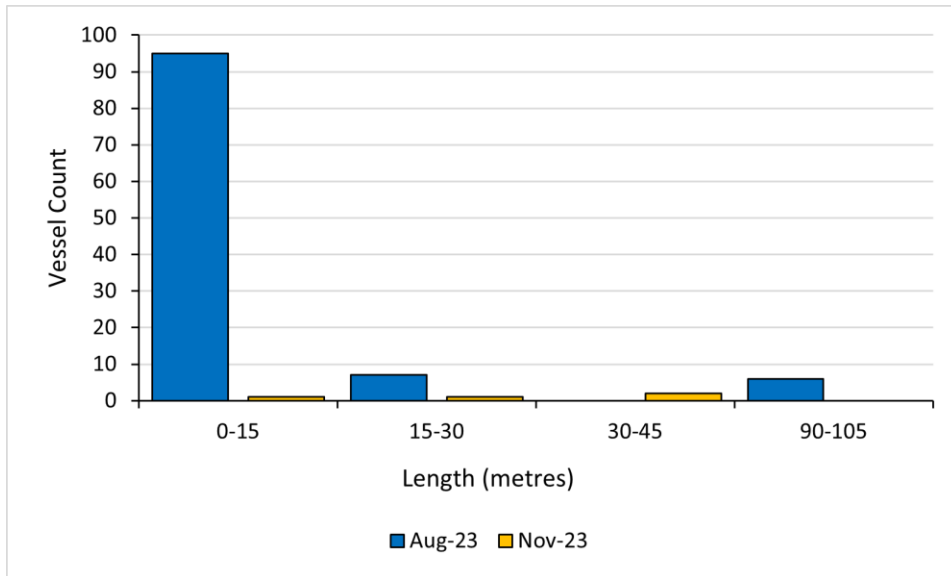


Figure 7: Vessel transits by LOA

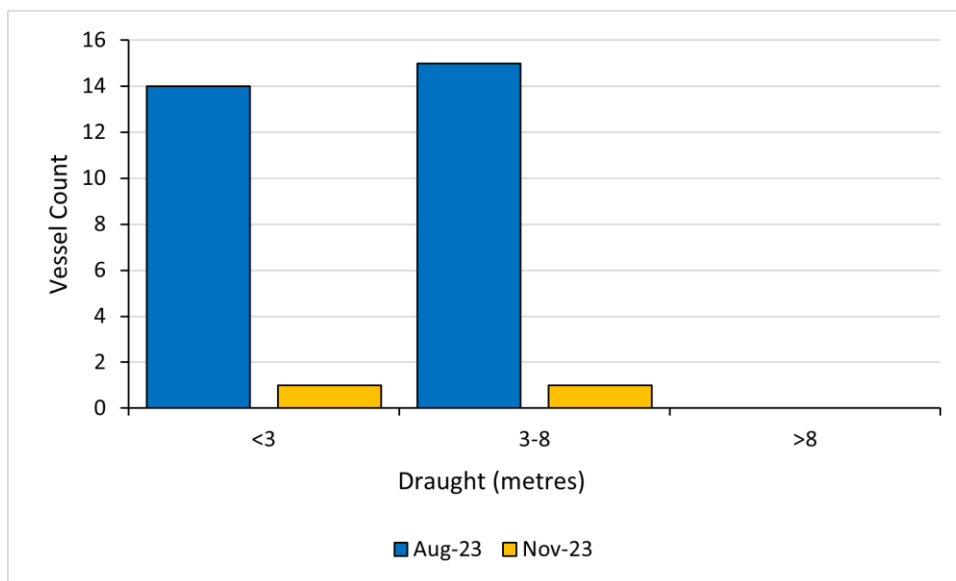


Figure 8: Vessel transits by Draught

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 9** 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.

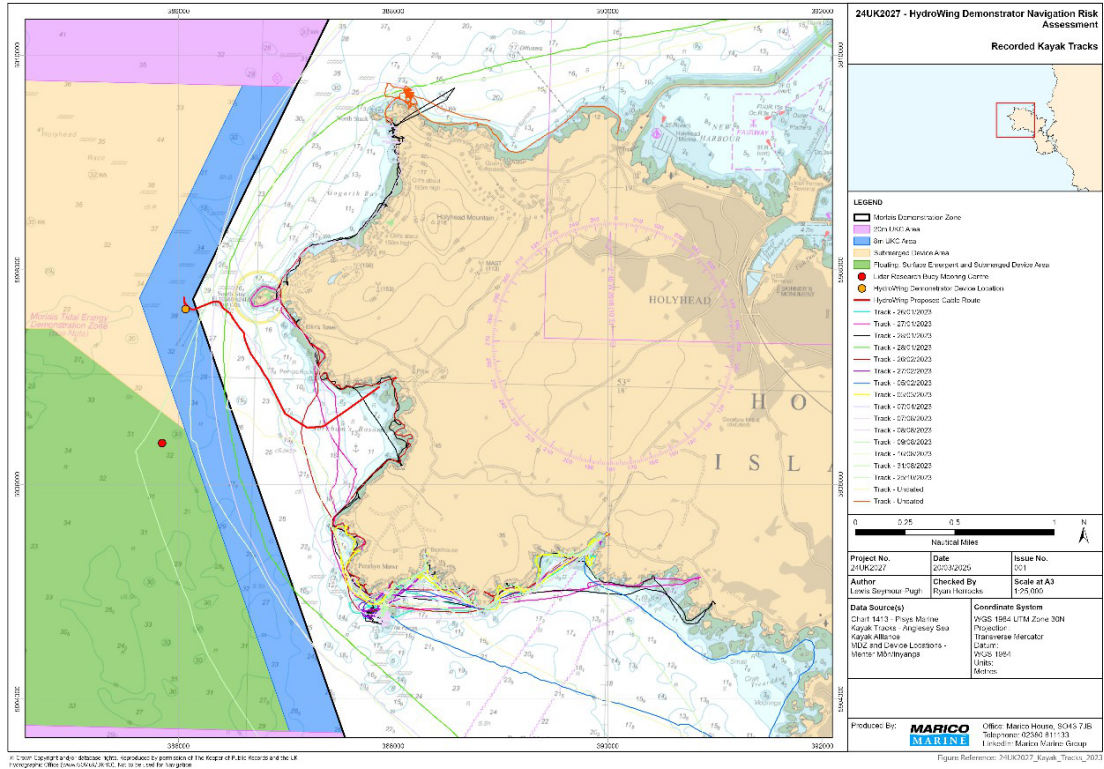


Figure 9: Indicative Kayak GPX Tracks

Table 7 illustrates the visual observations data of recreational vessels across both the summer and winter periods. Marico Marine’s visual observations recorded vessels either within the MDZ or Inshore Passage. NCI visual observations show a count of all vessels transiting in front of observation point at the RSPB South Stack, offering a different observations area. These counts demonstrate numbers of recreational users in the area and kayak counts where possible.

Table 7: Recreational Vessel Transits from Visual Observations – Summer and Winter Surveys

Data Source	Season	Duration	Time Period	Recreation/Sailing Vessel Count	Kayak Count
Marico	Summer	2 weeks	16 th August - 29 th August 2023	208	39
Marico	Winter	2 weeks	30 th October - 12 th November 2023	2	0
NCI	Summer	2 weeks	16 th August - 29 th August 2023	163	N/A
NCI	Winter	2 weeks	30 th October - 12 th November 2023	8	N/A

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_Issue02](#)

9 UNDER KEEL CLEARANCE

Under-Keel Clearance (UKC) is defined as the minimum clearance available between the deepest point on the vessel and the bottom in still water and is calculated using the following formula:

$$\text{UKC} = (\text{Charted Depth of Water} + \text{Height of Tide}) - (\text{Static Draught})$$

The static draught is the “*draught when the vessel is not making way or subject to sea and swell influences*”.

Generally, transits will be planned for any state of tide which, of course, will affect the available depth of water. Two key factors need to be considered when determining the UKC:

- The vertical safety margin between the devices and sea surface; and
- The maximum draught of vessels likely to transit above the device.

9.1 UKC SUMMARY

Vessel transits through the MDZ by draught for both summer and winter periods are given in **Figure 10**. It should be noted that not all vessels were recorded with a draught within the AIS dataset, meaning the number of tracks represented within the figure is less than that observed.

In accordance with the NOREL Under Keel Clearance Policy Paper (UCKP) ¹, ‘*where there is no safe and reasonable deviation for marine traffic using the area, Under Keel Clearance (UKC) over tidal turbines or other man made under water obstructions must allow for the safe transit of vessels at all states of tide.*’

The UKCP states that device height including a vertical safety margin along with vessel draught are two key factors that need to be considered when determining UKC. In open waters a larger UKC allowance is necessary to allow for dynamic movement of the vessel while underway (pitching, rolling, heeling and vertical heave) as a result of swell, sea waves and wind. The available depth of water is, in addition, impacted by the height of tide and, therefore, UKC calculations should consider the worst case - Low Water (LW) tidal conditions considered to be Chart Datum (CD).

¹ MCA MGN 654 Annex 3 - Under Keel Clearance Policy Paper, NOREL, May 2014, Guidance to Developers in Assessing Minimum Water Depth over Tidal Devices.

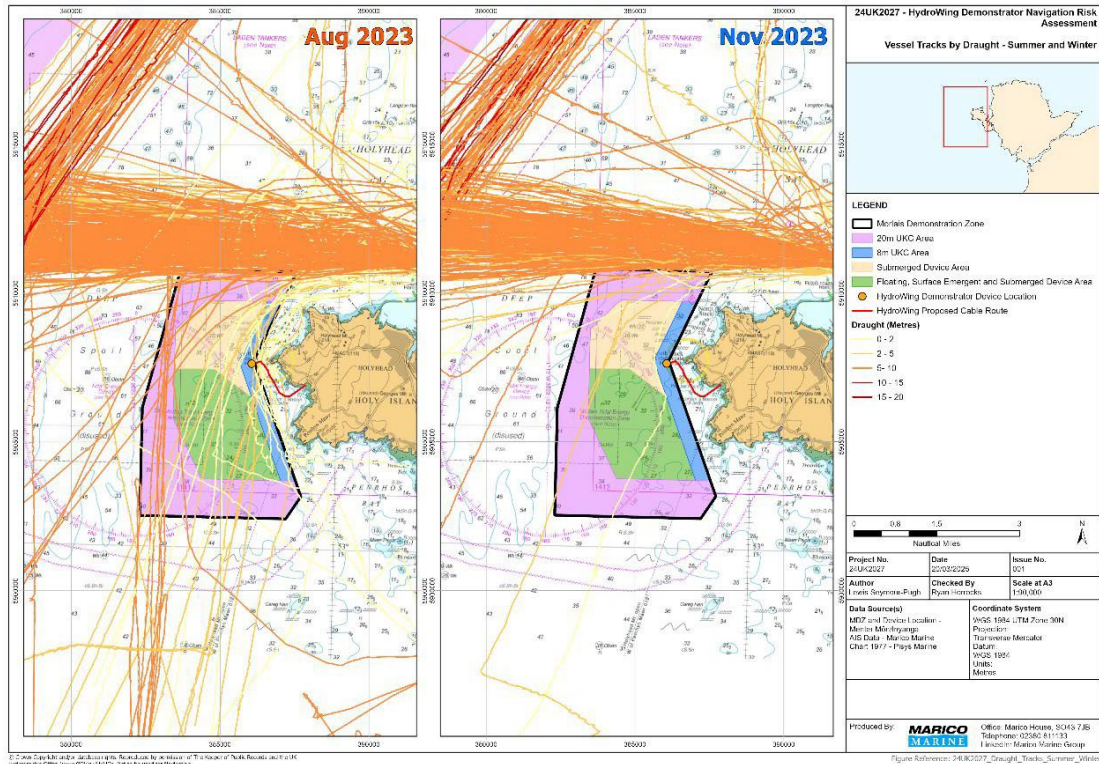


Figure 10: Vessel Track by Draught (AIS only)

The top five maximum draught vessels within the vicinity of the device and the inshore passage are detailed **Table 8**. The corresponding required UKC for each vessel is also shown within **Table 8** where:

- Dynamic factor: 2 x draught to account for vessel motions in accordance with PIANC principles.
- Safety Margin: 30% as stipulated within MCA UKC Policy Paper.

Table 8: Maximum draughts identified within the Vicinity of the HydroWing Demo Device Location

Vessel	Vessel Type	Reported Draught (m)	Required Vessel UKC (m)
SARAH H	Fishing Vessel	3.0	7.80
SASSY LADY FREE	Recreational Vessel	2.0	5.20
TRILOGY	Recreational Vessel	1.9	4.94
HMS PURSUER	Military Vessel	1.8	4.68
MAHALO OF CONWY	Recreational Vessel	1.7	4.42

Given the device is due to be installed within the blue 8m UKC zone, the maximum device design height must not impinge on the minimum UKC requirement. Therefore, with a maximum device height of 26m being installed in a depth of water of 34m (see **Figure 11**), the minimum UKC can be calculated at 8m, which complies with the requirements for blue zone of the MDZ.

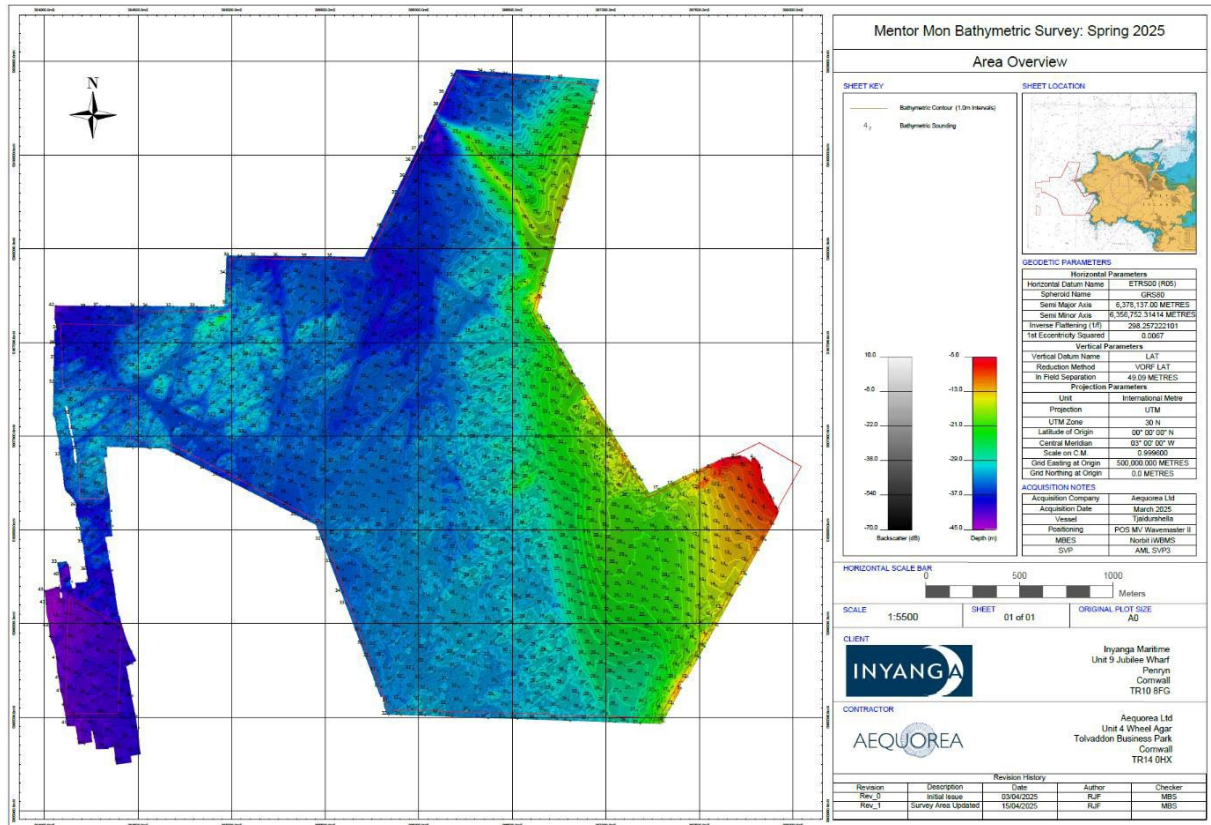


Figure 11: Bathymetric Survey for the Study Area

10 NAVIGATION RISK ASSESSMENT

10.1 METHODOLOGY

Following vessel traffic analysis and stakeholder consultation, a risk assessment was undertaken to assess the navigation risk for the HydroWing device deployment, which includes installation / demobilisation and operational phases. Both installation / demobilisation and operational phases 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 HydroWing device has been deployed and is in operation. The installation / demobilisation phase assesses the risks to navigating vessels during both the installation / demobilisation phases for the device. 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_Issue02.

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 "worst credible". The quantified values of frequency and consequence were then combined using Marico Marine's HAZMAN II software to produce a risk score for each hazard, and then collated into a "Ranked Hazard List". Risk control measures were then suggested that may reduce the risks further (See **Table 16**).

10.2 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 9**.

Table 9: Hazard Categories

Ref	Hazard Category	Hazard Detail	Comments	Number of Assessments (This NRA)	
				Installation / demobilisation Phases	Operational Phase
1	Contact	Sub Surface Device (HydroWing)	One or more vessels makes contact with a sub 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 free of foundations and becomes a hazard to shipping.	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 10**.

Table 10: 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.
4	Fishing Vessel	<3m	Fishing Vessels

Ref	Vessel Type Category	Draught	Including
5	Powered Recreational Vessel	<3m	Yachts, power boats, recreational RIBs, Recreational fishing boats, recreational dive vessels, powered watercrafts
6	Un-Powered Recreational Vessel	<3m	Sailing dinghies, kayaks, canoes, rowing boats, SUPs.
7	Other Vessel	<3m	Tugs and tows, survey vessels, RNLI, construction and maintenance vessels, cable laying vessels, workboats, commercial RIBs, Military.

Hazards were assessed according for both the installation / demobilisation, and operational phases of the deployment. 57 individual hazards were identified for assessment within the installation / demobilisation phases and 46 individual hazards for the operational phase. A full list of hazards is given within **Annex C** for the installation / demobilisation phase assessment, and **Annex D** for the operational phase assessment.

10.3 ASSUMPTIONS

The NRA has been undertaken based upon information provided by the client at the time of commencement of the assessment. The assumptions outlined within **Table 11** are, therefore, applicable.

Table 11: 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 12 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 worst-case displacement of traffic into the areas around the devices.
Devices work as intended and moorings / foundations 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 and foundations are appropriate for this installation.

10.4 EMBEDDED MITIGATION MEASURES

The embedded risk control measures listed within **Table 12** were assumed to be in place when scoring the NRA.

Table 12: 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. ²
5	Marked/lit in accordance with Trinity House requirements	Devices to be marked in accordance with MGN 654 and to comply with IALA standards.

² Marine Accident Investigation Branch (2017) Marine Casualty and Marine Incident Reporting, MGN 564 (M+F)

ID	Embedded Risk Control	Description
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 corridors and devices shall be marked on navigational charts. Detailed and accurate hydrographic surveys are required pre and post construction and following decommissioning. 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. ³
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 ' <i>Offshore Renewable Energy Installation: Requirements, Advice and Guidance for Search and Rescue and Emergency Response</i> ' 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.	The individual developers will have remote systems that allows them to monitor and control function of their devices.
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.

³Maritime 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

11 NAVIGATION RISK ASSESSMENT RESULTS

Risk assessments for the installation / demobilisation and operation phases for the device installation were conducted. The assessments were undertaken utilising the FSA⁴ 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 installation / demobilisation and operation phases is shown in **Table 13**.

Table 13: Baseline Risk Assessment Results Summary – Installation / Demobilisation and Operational Phases

Hazard Category	Category Definition	Installation / Demobilisation 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	1	1
Low Risk	Between 2 to 3.99	42	31
Negligible Risk	Between 0 to 1.99	2	2
N/A	N/A	12	12

The top ten hazards identified for the baseline installation / demobilisation phase assessment for the HydroWing deployment are shown below in **Table 14**. A full list of ranked hazard scores is located within **Annex C**.

The top ten hazards identified for the baseline operational phase for HydroWing deployment, are shown below in **Table 15**. A full list of ranked hazard scores is located within **Annex D**.

Table 14: Top ten hazards - Installation / Demobilisation Phase

Rank	ID	Hazard Title	Baseline Risk Score
1	15	Collision Passenger Vessels ICW Passenger Vessel	4.00
2	16	Collision Passenger Ship ICW Project Vessel	3.71
3	30	Collision Powered Recreational Vessel ICW Powered Recreational Vessel	3.64
4	21	Collision Project Vessel ICW Project Vessel	3.57
5	32	Collision Powered Recreational Vessel ICW Other Vessel	3.49
6	9	Collision Commercial Ship ICW Passenger Vessels	3.45
7	40	Grounding / Forced Ashore Powered Recreational Vessel	3.44
8	34	Collision Un-Powered Recreational Vessel ICW Other Vessel	3.24

⁴ International Maritime Organisation (2018) Revised Guidelines for Formal Safety Assessment (FSA) MSC-mepc.2/Circ.12/Rev.2

Rank	ID	Hazard Title	Baseline Risk Score
9	10	Collision Commercial Ship ICW Project Vessel	3.13
10	2	Contact Passenger Vessels with Mid-Water Device (>8m below CD)	3.11

Table 15: Top ten hazards - Operational Phase

Rank	ID	Hazard Title	Baseline Risk Score
1	13	Collision Passenger Vessels ICW Passenger Vessel	4.00
2	8	Collision Commercial Ship ICW Passenger Vessels	3.45
3	31	Grounding / Forced Ashore Powered Recreational Vessel	3.20
4	2	Contact Passenger Vessels with Mid-Water Device (>8m below CD)	3.11
5	1	Contact Commercial Ship with Mid-Water Device (>8m below CD)	2.88
6	42	Snagging/ Obstruction Fishing Vessel	2.76
7	10	Collision Commercial Ship ICW Powered Recreational Vessel	2.72
8	11	Collision Commercial Ship ICW Un-Powered Recreational Vessel	2.72
9	15	Collision Passenger Vessels ICW Powered Recreational Vessel	2.72
10	16	Collision Passenger Vessels ICW Un-Powered Recreational Vessel	2.72

12 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 16**.

Table 16: Suggested Additional Risk Control Measures

ID	Risk Control	Description	Phase
1	Implementation of a vessel traffic coordination system	<p>While remote monitoring of individual devices is assumed as an embedded risk control factor (Table 12 #10), additional monitoring may be appropriate on a site-wide basis and should be determined in site specific assessments. This will allow a site-wide overview of all deployed devices and give an appropriate means for OREI operators to notify, and provide evidence of, the infringement of safety zones.</p> <p>N.B. For this phase 1 installation, this risk control measure has been considered, but in the absence of other devices deployed during the same time period, the control measure will have negligible impact and need not be implemented until / unless other devices are contemporaneously deployed in the MDZ.</p>	All Phases
2	Appropriate alignment and spacing of devices	<p>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]</p> <p>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.</p> <p>The MCA document 'Offshore Renewable Energy Installation: Requirements, Advice and Guidance for Search and Rescue and Emergency Response' outlines the SAR requirements.</p> <p>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'.</p> <p>N.B. For this installation of a single device, this risk control measure has been considered, but in the absence of other devices deployed during the same time period, the control measure will have no impact and need not be implemented until / unless other devices are contemporaneously deployed in the MDZ.</p>	All Phases
3	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

ID	Risk Control	Description	Phase
4	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
5	Establish no anchoring areas	No anchoring areas to be established around nearshore cable corridor.	All Phases
6	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 referenced to Chart Datum, unless developers are able to demonstrate evidence that any identified risks to any vessel type are satisfactorily mitigated. ⁵	All Phases
7	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
8	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. (N.B. Confirmed not required for this installation)	Construction
9	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

⁵ MGN 654

13 RESIDUAL RISK ASSESSMENT

The risk assessments for the installation / demobilisation 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 installation / demobilisation phases is shown in **Table 17**. In total for the HydroWing deployment, one hazard within the installation / demobilisation phase and one hazard within the operational phase score higher than 4 (low-risk) in the residual assessment.

Table 17: Sitewide Residual Risk Assessment Results Summary – Installation / Demobilisation and Operational Phases

Hazard Category	Category Definition	installation / demobilisation 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	1	1
Low Risk	Between 2 to 3.99	42	31
Negligible Risk	Between 0 to 1.99	2	2
N/A	N/A	12	12

The top ten hazards identified for the residual installation / demobilisation phase assessment for the HydroWing device are shown below in **Table 18**. A full list of ranked hazard scores is located within **Annex C**.

The top ten hazards identified for the residual operational phase for the HydroWing device are shown below in **Table 19**. A full list of ranked hazard scores is located within **Annex D**.

Table 18: Top ten residual hazards – installation / demobilisation Phase

Rank	ID	Hazard Title	Residual Score
1	15	Collision Passenger Vessels ICW Passenger Vessel	4.00
2	15	Collision Passenger Vessels ICW Passenger Vessel	3.57
3	21	Collision Project Vessel ICW Project Vessel	3.45
4	16	Collision Passenger Ship ICW Project Vessel	3.45
5	9	Collision Commercial Ship ICW Passenger Vessels	3.44
6	40	Grounding / Forced Ashore Powered Recreational Vessel	3.13
7	10	Collision Commercial Ship ICW Project Vessel	3.10
8	25	Collision Project Vessel ICW Other Vessel	2.96
9	30	Collision Powered Recreational Vessel ICW Powered Recreational Vessel	2.96
10	18	Collision Passenger Vessels ICW Powered Recreational Vessel	2.96

Table 19: Top ten residual hazards – Operational Phase

Rank	ID	Hazard Title	Residual Score
1	13	Collision Passenger Vessels ICW Passenger Vessel	4.00
2	8	Collision Commercial Ship ICW Passenger Vessels	3.45
3	31	Grounding / Forced Ashore Powered Recreational Vessel	3.20
4	2	Contact Passenger Vessels with Mid-Water Device (>8m below CD)	3.11
5	1	Contact Commercial Ship with Mid-Water Device (>8m below CD)	2.88
6	42	Snagging/ Obstruction Fishing Vessel	2.76
7	10	Collision Commercial Ship ICW Powered Recreational Vessel	2.72
8	11	Collision Commercial Ship ICW Un-Powered Recreational Vessel	2.72
9	15	Collision Passenger Vessels ICW Powered Recreational Vessel	2.72
10	16	Collision Passenger Vessels ICW Un-Powered Recreational Vessel	2.72

The most effective mitigation measures against each primary hazard category for hazards scoring ALARP are shown in **Table 20**.

Table 20: Suggested Risk Control Measures applicable to hazards scoring ALARP within the baseline assessment.

Hazard Category	Suggested Risk Control Measures								
	1 - Coordination System	2 - Appropriate alignment and spacing	3 - Check device surveys	4 - Guard vessel	5 - Establish no anchoring areas	6 - Enhanced cable protection	7 - Implementation of Safety Zones	8 - Temporary navigation aids	9 - Guidance for recreational users
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, 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 very low risk presented by this device to recreational users during the operational phase, due to the sub-surface deployment. However, Marico Marine recommend specific consideration for the following for this device deployment:

- Guidance for recreational users operating around the devices is an effective mitigation measure against groundings and swamping/capsizing. However, this will require efficient promulgation of information.

14 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 device.

There is not expected to be an overlap of deployment periods between this device and any other devices in the MDZ.

The closest other 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.

No cumulative impacts are therefore considered.

15 CONCLUSIONS AND RECOMMENDATIONS

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

The assessment concluded that:

- The HydroWing demonstration device is 20m by 33m blade tip to tip. The device is due to be installed in the blue zone of the MDZ where there is an 8m UKC requirement. The device has a height of 26m and is to be installed at a depth of 34m, maintaining the required 8m UKC.
- The devices are located in an area of lower 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 are "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 to 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 device is not located in proximity to other offshore developments and is the first instalment of the Morlais Project. The device is expected to be decommissioned before any other devices are installed;
- All hazards were assessed to be ALARP or lower in the baseline risk assessment. Of the 57 hazards assessed within the construction phase, one was scored as ALARP in the baseline assessment. Of the 46 hazards assessed within the operation phase assessment, one was 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, one hazard was assessed to be ALARP in the construction phase residual risk assessment and one within the operational phase risk assessment. All remaining hazards were assessed to be low or lower.

Based on the findings of this assessment, the HydroWing demonstrator deployment 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.

Annex A Device Specific Information

Table 2 I: Device Specific Information provided by HydroWing Ltd., updated April 2025

Parameter	Value
Structure	
Overall length	20m
Overall breadth	Width (upright-to-upright) = 19m Width (blade tip-to-tip) = 33m
Operational depth of water above device at LAT	8m minimum
Worst case foundation type	Frame with Gravity base ballast
Volume of oil (litres)	Hydraulic fluids (typically a mixture of base oils, additives, and anti-wear agents) = 15 litre per turbine Lubricants (generally mineral oil-based with additives) = 50 litre per turbine
Max height above Sea Bed	26m (Device will be at least 8m below LAT)
Total max no. of drilled piles / foundation details	12 (4 per foot)
No. marker buoys	0 (not surface piercing so under the assumption that marker buoys are not required)
Cables	
Worst case export cable length (km)	3km
Export cable footprint including protection (m2)	~231km (cable diameter = 77mm)
Duration of cable installation	3
Duration of cable protection installation	2
No. of concurrent cable installations	1
Total Cable Length (km)	3
Total cable footprint (m2)	~231km
Foundation Structure & Mooring Cables	
Mooring system	Micropiles (no moorings or cables)
Total project footprint (m2)	380m ² (19mx20m for foundation)
Footprint of temporary seabed disturbance (m2)	N/A
O&M (time between events)	
Cable Inspection	Regular inspection during 5.5 year O&M schedule
Device inspection	Regular inspection during 5.5 year O&M schedule
No. cable repairs	0 during demonstration device lifetime expected (unless unplanned maintenance required)
Cable repair duration	The duration of this task will depend on extent of repair required.
Area of Cable repairs m2	0 expected

Parameter	Value
Turbine maintenance	The HydroWing demonstration device is not expected to require any planned maintenance due to its short lifetime in advance of the full HydroWing array. If any unplanned maintenance is required, a vessel will be deployed to recover the components of the device that require repair. This is expected to take ~1 day for recovery, and ~1 day for re-deployment.
Rotors	
Type of rotor	Horizontal axis - two bladed
Number of rotors	2
Rotor radius	9.8m
No. blades	4 (2 per rotor)
Mean current speed	1.35
Median water depth	39.8
Swept area (m ²)	604m ² per device
Turbine export power (MW)	0.35
Vessels	
Max vessel installation days	7
No. vessels at any one time	2
No. vessel trips	5
Vessel safety zone (m)	
Vessel route area	Holyhead Port around the north of Holy Island and into birth BL1.
Vessel anchor footprint during device installation (m ²)	
Vessel anchor footprint during hub installation (m ²)	
Vessel anchor footprint during cable installation (m ²)	

Annex B Detailed Device Deployment Methodologies

Annex C Hazard Log – Installation / Demobilisation

ID	Hazard Title	Hazard Detail	Possible Causes	Most Likely Outcome	Worst Credible Outcome	Most Likely Consequence					Worst Credible Consequence					Baseline Risk Score	Suggested Additional Risk Controls	Residual Risk Score
						People	Property	Environment	Business	Frequency	People	Property	Environment	Business	Frequency			
1	Contact Commercial Ship with Mid-Water Device (>8m below CD)	A commercial vessel such as a cargo vessel or tanker contacts the device	Insufficient Lookout; Poor passage planning; Human Error; Equipment or Mechanical Failure; Navigational Aid Failure; Adverse Environmental Conditions; Poor Visibility; Avoidance of other vessel; Devices not visible; Running for shelter / safe haven in poor weather; Device not at stated depth; Lack of knowledge of construction progress / device locations; Partially constructed device not visible.	Light contact; No Injury / Possible very minor injury; Moderate damage to vessel; Negligible effect upon the Environment / No pollution; Temporary suspension of operations or prolonged restrictions to project.	Heavy Contact, person in the water; 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	3	1	3	1	3	4	2	4	1	2.88	Implementation of a vessel traffic coordination system; Check device surveys; Implementation of safety zones; Guard vessel to monitor passing traffic;	2.88
2	Contact Passenger Vessels with Mid-Water Device (>8m below CD)	A ferry / cruise ship contacts the device	Insufficient Lookout; Poor passage planning; Human Error; Equipment or Mechanical Failure; Navigational Aid Failure; Adverse Environmental Conditions; Poor Visibility; Avoidance of other vessel; Devices not visible; Running for shelter / safe haven in poor weather; Device not at stated depth; Lack of knowledge of construction progress / device locations; Partially constructed device not visible.	Light contact; No Injury / Possible very minor injury; Moderate damage to vessel; Negligible effect upon the Environment / No pollution; Temporary suspension of operations or prolonged restrictions to project.	Heavy contact; 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	3	1	3	2	3	4	2	4	1	3.11	Implementation of a vessel traffic coordination system; Check device surveys; Implementation of safety zones; Guard vessel to monitor passing traffic;	2.88
3	Contact Project Vessel with Mid-Water Device (>8m below CD)	A project vessel makes contact with the device	A construction vessel inadvertently makes contact with the device during installation; Insufficient Lookout; Poor passage planning; Human Error; Equipment or Mechanical Failure; Navigational Aid Failure; Adverse Environmental Conditions; Poor Visibility; Avoidance of other vessel; Devices not visible; Partially constructed device not visible.	Light contact; No Injury / Possible very minor injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Short-term loss of revenue.	Heavy Contact, person in the water; 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	3	3	4	2	4	1	2.71	Implementation of a vessel traffic coordination system; Check device surveys;	2.71

ID	Hazard Title	Hazard Detail	Possible Causes	Most Likely Outcome	Worst Credible Outcome	Most Likely Consequence					Worst Credible Consequence					Baseline Risk Score	Suggested Additional Risk Controls	Residual Risk Score
						People	Property	Environment	Business	Frequency	People	Property	Environment	Business	Frequency			
4	Contact Fishing Vessel with Mid-Water Device (>8m below CD)	A fishing vessel contacts the device	N/A	N/A	N/A	1	1	1	1	0	1	1	1	1	0	0.00	NOT SCORED	0.00
5	Contact Powered Recreational Vessel with Mid-Water Device (>8m below CD)	A powered recreational vessel contacts with the device	N/A	N/A	N/A	1	1	1	1	0	1	1	1	1	0	0.00	NOT SCORED	0.00
6	Contact Un-Powered Recreational Vessel with Mid-Water Device (>8m below CD)	An un-powered recreational vessel contacts with the device	N/A	N/A	N/A	1	1	1	1	0	1	1	1	1	0	0.00	NOT SCORED	0.00
7	Contact Other Vessels with Mid-Water Device (>8m below CD)	Maintenance Vessel contacts with the device	N/A	N/A	N/A	1	1	1	1	0	1	1	1	1	0	0.00	NOT SCORED	0.00
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	Implementation of a vessel traffic coordination system; Guard vessel to monitor passing traffic;	2.54

ID	Hazard Title	Hazard Detail	Possible Causes	Most Likely Outcome	Worst Credible Outcome	Most Likely Consequence					Worst Credible Consequence					Baseline Risk Score	Suggested Additional Risk Controls	Residual Risk Score
						People	Property	Environment	Business	Frequency	People	Property	Environment	Business	Frequency			
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	Implementation of a vessel traffic coordination system; Guard vessel to monitor passing traffic;	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	Implementation of a vessel traffic coordination system; Guard vessel to monitor passing traffic; Implementation of safety zones;	3.13
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	Implementation of a vessel traffic coordination system; Guard vessel to monitor passing traffic;	2.27

ID	Hazard Title	Hazard Detail	Possible Causes	Most Likely Outcome	Worst Credible Outcome	Most Likely Consequence					Worst Credible Consequence					Baseline Risk Score	Suggested Additional Risk Controls	Residual Risk Score
						People	Property	Environment	Business	Frequency	People	Property	Environment	Business	Frequency			
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/Awareness; 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	Implementation of a vessel traffic coordination system; Guard vessel to monitor passing traffic; Guidance for recreational users operating around the devices	2.72
13	Collision Commercial Ship ICW Un-Powered Recreational Vessel	A commercial vessel collides with an un-powered recreational vessel due to the presence of the devices	Insufficient Lookout/Awareness; 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	Implementation of a vessel traffic coordination system; Guard vessel to monitor passing traffic; Guidance for recreational users operating around the devices	2.72

ID	Hazard Title	Hazard Detail	Possible Causes	Most Likely Outcome	Worst Credible Outcome	Most Likely Consequence					Worst Credible Consequence					Baseline Risk Score	Suggested Additional Risk Controls	Residual Risk Score
						People	Property	Environment	Business	Frequency	People	Property	Environment	Business	Frequency			
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	Implementation of a vessel traffic coordination system; Guard vessel to monitor passing traffic;	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	Implementation of a vessel traffic coordination system; Guard vessel to monitor passing traffic;	4.00

ID	Hazard Title	Hazard Detail	Possible Causes	Most Likely Outcome	Worst Credible Outcome	Most Likely Consequence					Worst Credible Consequence					Baseline Risk Score	Suggested Additional Risk Controls	Residual Risk Score
						People	Property	Environment	Business	Frequency	People	Property	Environment	Business	Frequency			
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	2	5	4	3	4	1	3.71	Implementation of a vessel traffic coordination system; Guard vessel to monitor passing traffic; Implementation of safety zones;	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	2	4	4	1	2	1	2.43	Implementation of a vessel traffic coordination system; Guard vessel to monitor passing traffic;	2.27
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/Awareness; 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	2	4	3	1	3	1	2.96	Implementation of a vessel traffic coordination system; Guard vessel to monitor passing traffic; Guidance for recreational users operating around the devices	2.96

ID	Hazard Title	Hazard Detail	Possible Causes	Most Likely Outcome	Worst Credible Outcome	Most Likely Consequence					Worst Credible Consequence					Baseline Risk Score	Suggested Additional Risk Controls	Residual Risk Score
						People	Property	Environment	Business	Frequency	People	Property	Environment	Business	Frequency			
19	Collision Passenger Vessels ICW Un-Powered Recreational Vessel	A passenger vessel collides with an un-powered recreational vessel due to the presence of the devices	Insufficient Lookout/Awareness; 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	2	4	3	1	3	1	2.96	Implementation of a vessel traffic coordination system; Guard vessel to monitor passing traffic; Guidance for recreational users operating around the devices	2.96
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	2	4	4	1	2	1	2.43	Implementation of a vessel traffic coordination system; Implementation of safety zones; Guard vessel to monitor passing traffic;	2.43
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	3	4	4	2	4	1	3.57	Implementation of a vessel traffic coordination system;	3.57
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	Implementation of a vessel traffic coordination system; Guard vessel to monitor passing traffic; Implementation of safety zones;	2.43

ID	Hazard Title	Hazard Detail	Possible Causes	Most Likely Outcome	Worst Credible Outcome	Most Likely Consequence					Worst Credible Consequence					Baseline Risk Score	Suggested Additional Risk Controls	Residual Risk Score
						People	Property	Environment	Business	Frequency	People	Property	Environment	Business	Frequency			
23	Collision Project Vessel ICW Powered Recreational Vessel	A project vessel collides with a powered recreational vessel	Insufficient Lookout/Awareness; 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	Implementation of a vessel traffic coordination system; Guard vessel to monitor passing traffic; Implementation of safety zones; Guidance for recreational users operating around the devices	2.44
24	Collision Project Vessel ICW Un-Powered Recreational Vessel	A project vessel collides with an un-powered recreational vessel	Insufficient Lookout/Awareness; 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	3	4	2	1	3	2	2.91	Implementation of a vessel traffic coordination system; Guard vessel to monitor passing traffic; Implementation of safety zones; Guidance for recreational users operating around the devices	2.35
25	Collision Project Vessel ICW Other Vessel	A project vessel collides with an other vessel	Project vessel collides with small other 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.	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; Moderate impact on operations, temporary suspension or prolonged restrictions.	2	2	1	2	3	4	4	1	3	2	3.10	Implementation of a vessel traffic coordination system; Guard vessel to monitor passing traffic; Implementation of safety zones	3.10

ID	Hazard Title	Hazard Detail	Possible Causes	Most Likely Outcome	Worst Credible Outcome	Most Likely Consequence					Worst Credible Consequence					Baseline Risk Score	Suggested Additional Risk Controls	Residual Risk Score
						People	Property	Environment	Business	Frequency	People	Property	Environment	Business	Frequency			
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	2.24	Implementation of a vessel traffic coordination system; Guard vessel to monitor passing traffic;	2.24
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/Awareness; 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	4	3	1	3	1	2.84	Implementation of a vessel traffic coordination system; Guard vessel to monitor passing traffic; Guidance for recreational users operating around the devices	2.84
28	Collision Fishing Vessel ICW Un-Powered Recreational Vessel	A fishing vessel collides with an un-recreational vessel due to the presence of the devices	Narrowing of the inshore route; Increased utilisation of inshore route; Insufficient Lookout/Awareness; 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	Implementation of a vessel traffic coordination system; Guard vessel to monitor passing traffic; Guidance for recreational users operating around the devices	2.64
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	4	3	1	2	1	2.24	Implementation of a vessel traffic coordination system; Implementation of safety zones; Guard vessel to monitor passing traffic;	2.24

ID	Hazard Title	Hazard Detail	Possible Causes	Most Likely Outcome	Worst Credible Outcome	Most Likely Consequence					Worst Credible Consequence					Baseline Risk Score	Suggested Additional Risk Controls	Residual Risk Score
						People	Property	Environment	Business	Frequency	People	Property	Environment	Business	Frequency			
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/Awareness; 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	Implementation of a vessel traffic coordination system; Guard vessel to monitor passing traffic; 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 un-recreational vessel due to the presence of the devices	Narrowing of the inshore route; Increased utilisation of inshore route; Insufficient Lookout/Awareness; 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	Implementation of a vessel traffic coordination system; Guard vessel to monitor passing traffic; Guidance for recreational users operating around the devices	2.12
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/Awareness; 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	Implementation of a vessel traffic coordination system; Guard vessel to monitor passing traffic; Implementation of safety zones; Guidance for recreational users operating around the devices	2.84

ID	Hazard Title	Hazard Detail	Possible Causes	Most Likely Outcome	Worst Credible Outcome	Most Likely Consequence					Worst Credible Consequence					Baseline Risk Score	Suggested Additional Risk Controls	Residual Risk Score
						People	Property	Environment	Business	Frequency	People	Property	Environment	Business	Frequency			
33	Collision Un-Powered Recreational Vessel ICW Un-Powered Recreational Vessel	An un-powered recreational vessel collides with un-powered recreational vessel due to the presence of the devices	Narrowing of the inshore route; Increased utilisation of inshore route; Insufficient Lookout/Awareness; 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.	1	1	1	1	3	4	1	1	3	2	1.74	Implementation of a vessel traffic coordination system; Guard vessel to monitor passing traffic; Guidance for recreational users operating around the devices	1.45
34	Collision Un-Powered 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/Awareness; 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	3	4	2	1	3	2	3.24	Implementation of a vessel traffic coordination system; Guard vessel to monitor passing traffic; Implementation of safety zones; Guidance for recreational users operating around the devices	2.64
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	Implementation of a vessel traffic coordination system; Guard vessel to monitor passing traffic; Implementation of safety zones;	2.24

ID	Hazard Title	Hazard Detail	Possible Causes	Most Likely Outcome	Worst Credible Outcome	Most Likely Consequence					Worst Credible Consequence					Baseline Risk Score	Suggested Additional Risk Controls	Residual Risk Score
						People	Property	Environment	Business	Frequency	People	Property	Environment	Business	Frequency			
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
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 restrictions.	2	2	1	1	2	4	4	2	4	1	2.57	Implementation of a vessel traffic coordination system;	2.57
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	Implementation of a vessel traffic coordination system; Guard vessel to monitor passing traffic;	2.33

ID	Hazard Title	Hazard Detail	Possible Causes	Most Likely Outcome	Worst Credible Outcome	Most Likely Consequence					Worst Credible Consequence					Baseline Risk Score	Suggested Additional Risk Controls	Residual Risk Score
						People	Property	Environment	Business	Frequency	People	Property	Environment	Business	Frequency			
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/Awareness; 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 operations.	3	2	1	2	2	5	3	2	4	1	3.44	Implementation of a vessel traffic coordination system; Guard vessel to monitor passing traffic; Guidance for recreational users operating around the devices	3.44
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/Awareness; 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	2	4	2	1	3	1	2.12	Implementation of a vessel traffic coordination system; Guard vessel to monitor passing traffic; 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 Consequence					Worst Credible Consequence					Baseline Risk Score	Suggested Additional Risk Controls	Residual Risk Score
						People	Property	Environment	Business	Frequency	People	Property	Environment	Business	Frequency			
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	2	4	3	2	2	1	2.33	Implementation of a vessel traffic coordination system; Guard vessel to monitor passing traffic;	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
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.	Human Error; Overloading; 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; Running for shelter / safe haven in poor weather.	Vessel begins to take on water but recovers; Minor injury; Minor damage to vessel; Negligible effect upon the Environment / No pollution; Negligible impact upon operations.	Vessel lost, persons in water; Multiple major injuries or a single fatality; Major damage to vessel; Minor effect upon the Environment / Tier 1 - Tier 2 Pollution Criteria Reached; Temporary closure or prolonged restrictions on project operations.	2	2	1	1	2	4	4	2	4	1	2.57	Implementation of a vessel traffic coordination system; Guard vessel to monitor passing traffic;	2.57

ID	Hazard Title	Hazard Detail	Possible Causes	Most Likely Outcome	Worst Credible Outcome	Most Likely Consequence					Worst Credible Consequence					Baseline Risk Score	Suggested Additional Risk Controls	Residual Risk Score
						People	Property	Environment	Business	Frequency	People	Property	Environment	Business	Frequency			
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
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.	N/A	N/A	N/A	1	1	1	1	0	1	1	1	1	0	0.00	NOT SCORED	0.00
48	Swamping / Capsize Un-Powered Recreational Vessel	An un-powered recreational 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
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
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	2	1	1	1	4	1	1.85	Implementation of a vessel traffic coordination system; Establish no anchoring areas; Enhanced cable protection.	1.74

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						People	Property	Environment	Business	Frequency	People	Property	Environment	Business				Frequency
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	2	1	1	1	4	1	1.85	Implementation of a vessel traffic coordination system; Establish no anchoring areas; Enhanced cable protection.	1.85
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	Implementation of a vessel traffic coordination system; Establish no anchoring areas; Enhanced cable protection.	2.61

ID	Hazard Title	Hazard Detail	Possible Causes	Most Likely Outcome	Worst Credible Outcome	Most Likely Consequence					Worst Credible Consequence					Baseline Risk Score	Suggested Additional Risk Controls	Residual Risk Score
						People	Property	Environment	Business	Frequency	People	Property	Environment	Business	Frequency			
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	3	3	2	1	4	2	2.76	Implementation of a vessel traffic coordination system; 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	2	2	1	1	2	1	0.56	Implementation of a vessel traffic coordination system; Establish no anchoring areas; Enhanced cable protection; Guidance for recreational users operating around the devices	0.56
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.	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	2	2	1	1	2	1	0.56	Implementation of a vessel traffic coordination system; 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				Baseline Risk Score	Suggested Additional Risk Controls	Residual Risk Score	
						People	Property	Environment	Business	Frequency	People	Property	Environment	Business				Frequency
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	Implementation of a vessel traffic coordination system; 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	2	4	4	1	3	1	2.40	Implementation of a vessel traffic coordination system; Check device surveys; Establish no anchoring areas; Implementation of safety zones;	2.40

Annex D Hazard Log – Operational

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 Mid-Water Device (>8m below CD)	A commercial vessel such as a cargo vessel or tanker contacts the device	Insufficient Lookout; Poor passage planning; Human Error; Equipment or Mechanical Failure; Navigational Aid Failure; Adverse Environmental Conditions; Poor Visibility; Avoidance of other vessel; Devices not visible; Running for shelter / safe haven in poor weather; Device not at stated depth.	Light contact; No Injury / Possible very minor injury; Moderate damage to vessel; Negligible effect upon the Environment / No pollution; Temporary suspension of operations or prolonged restrictions to project.	Heavy contact; 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	3	1	3	1	3	4	2	4	1	2.88	Implementation of a vessel traffic coordination system; Check device surveys;	2.88
2	Contact Passenger Vessels with Mid-Water Device (>8m below CD)	A ferry / cruise ship contacts the device	Insufficient Lookout; Poor passage planning; Human Error; Equipment or Mechanical Failure; Navigational Aid Failure; Adverse Environmental Conditions; Poor Visibility; Avoidance of other vessel; Devices not visible; Running for shelter / safe haven in poor weather; Device not at stated depth.	Light contact; No Injury / Possible very minor injury; Moderate damage to vessel; Negligible effect upon the Environment / No pollution; Temporary suspension of operations or prolonged restrictions to project.	Heavy contact; 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	3	1	3	2	3	4	2	4	1	3.11	Implementation of a vessel traffic coordination system; Check device surveys;	2.88
3	Contact Fishing Vessel with Mid-Water Device (>8m below CD)	A fishing vessel contacts the device	N/A	N/A	N/A	1	1	1	1	0	1	1	1	1	0	0.00	NOT SCORED	0.00
4	Contact Powered Recreational Vessel with Mid-Water Device (>8m below CD)	A powered recreational vessel contacts with the device	N/A	N/A	N/A	1	1	1	1	0	1	1	1	1	0	0.00	NOT SCORED	0.00
5	Contact Un-Powered Recreational Vessel with Mid-Water	An un-powered recreational vessel contacts with the device	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			
	Device (>8m below CD)																	
6	Contact Other Vessels with Mid-Water Device (>8m below CD)	Maintenance Vessel contacts with the device	N/A	N/A	N/A	1	1	1	1	0	1	1	1	1	0	0.00	NOT SCORED	0.00
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
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		2.27

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			
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/Awareness; 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	Guidance for recreational users operating around the devices	2.72
11	Collision Commercial Ship ICW Un-Powered Recreational Vessel	A commercial vessel collides with an un-powered recreational vessel due to the presence of the devices	Insufficient Lookout/Awareness; 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	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		2.27

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			
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		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/Awareness; 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	Guidance for recreational users operating around the devices	2.72

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			
16	Collision Passenger Vessels ICW Un-Powered Recreational Vessel	A passenger vessel collides with an un-powered recreational vessel due to the presence of the devices	Insufficient Lookout/Awareness; 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	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		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	1	4	3	1	2	1	2.10		2.10
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/Awareness; 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	1	4	3	1	3	1	2.62	Guidance for recreational users operating around the devices	2.62

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/Awareness; 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	1	4	2	1	3	1	2.44	Guidance for recreational users operating around the devices	2.44
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	1	4	3	1	2	1	2.10		2.10
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/Awareness; 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	Guidance for recreational users operating around the devices	2.72

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			
23	Collision Powered Recreational Vessel ICW Un-Powered Recreational Vessel	An powered recreational 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/Awareness; 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	1	4	2	1	3	1	2.01	Guidance for recreational users operating around the devices	2.01
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/Awareness; 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	1	4	3	1	3	1	2.62	Guidance for recreational users operating around the devices	2.62
25	Collision Un-Powered Recreational Vessel ICW Un-Powered Recreational Vessel	An un-powered recreational 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/Awareness; 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	1	4	1	1	3	1	1.45	Guidance for recreational users operating around the devices	1.45

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			
26	Collision Un-Powered Recreational Vessel ICW Other Vessel	An 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; Taking additional risks whilst racing; Insufficient Lookout/Awareness; 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	1	4	2	1	3	1	2.44	Guidance for recreational users operating around the devices	2.44
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	1	4	3	1	2	1	2.10		2.10
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	1	4	3	2	2	1	2.20		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/Awareness; 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 operations.	3	2	1	2	1	5	3	2	4	1	3.20	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/Awareness; 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;	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	1	4	2	1	3	1	2.01	Guidance for recreational users operating around the devices	2.01

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			
			Running for shelter / safe haven in poor weather.															
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	1	4	3	2	2	1	2.20		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
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

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			
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.	N/A	N/A	N/A	1	1	1	1	0	1	1	1	1	0	0.00	NOT SCORED	0.00
38	Swamping / Capsize Un-Powered Recreational Vessel	An un-powered recreational 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
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	2	1	1	1	4	1	1.85	Implementation of a vessel traffic coordination system; 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					Baseline Risk Score	Suggested Additional Mitigation Measures	Residual Risk Score
						People	Property	Environment	Business	Frequency	People	Property	Environment	Business	Frequency			
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	2	1	1	1	4	1	1.85	Implementation of a vessel traffic coordination system; 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; 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	3	3	2	1	4	2	2.76	Implementation of a vessel traffic coordination system; 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	2	2	1	1	2	1	0.56	Implementation of a vessel traffic coordination system; 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					Baseline Risk Score	Suggested Additional Mitigation Measures	Residual Risk Score
						People	Property	Environment	Business	Frequency	People	Property	Environment	Business	Frequency			
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.	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	2	2	1	1	2	1	0.56	Implementation of a vessel traffic coordination system; Check device surveys; Establish no anchoring areas; Enhanced cable protection; Guidance for recreational users operating around the devices	0.56
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	1	3	2	1	4	1	2.10	Implementation of a vessel traffic coordination system; Check device surveys; Establish no anchoring areas; Enhanced cable protection;	2.10
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	2	4	4	1	3	1	2.40	Implementation of a vessel traffic coordination system; Check device surveys; Establish no anchoring areas.	2.40

Annex E NRA Stakeholder Email Responses

Consultee reply dated 16/06/2025 to initial email send by Marico Marine on 09/06/2025

Thankyou for giving us an opportunity to be consulted over the Hydrowing NRA. This response made here is on behalf of Paddle Cymru and the Anglesey Sea Kayak Alliance.

At the last Navigational Stakeholders Meeting we were advised that Morlais will post a notice on the Kingfisher website at least 14 days before any marine operations. Hence I have opened an account on the website and hopefully correctly set an alert.

The information you have provided does not mention any buoyage associated with the Hydrowing device. Assuming any buoyage presents a very minor hazard we make the following comments:

- 1. During the operational phase of the device, the 8m under keel clearance means we have no significant concerns.*
- 2. During installation & maintenance of the device, the device plus 1 or 2 vessels will present a hazard of at least 33m wide in an area of fast tides and high recreational use.*
- 3. The associated cable laying vessel will also present a hazard, close inshore in an area of fast tides and high recreational use.*
- 4. It is essential that access to Henborth Beach is available throughout as this is used for emergency egress.*
- 5. Hence the most important request is that all members of the public that could possibly be in the vicinity of the above operations are warned of the hazard.*
- 6. It is understood that operations will be announced on the Kingfisher website and it may be possible to promulgate the information through various communication channels.*
- 7. However, there are members of the public who will not be contactable through these channels, for various reasons including they are not members of a group or association (local or otherwise).*
- 8. Hence it is recommended that notice of operations be placed at the following launch points: Trearddur Bay at each end of the beach, Porth Dafarch by the watersports drop off point and Soldiers Point.*
- 9. It is recommended that the notices warn of fast tides outside coastal bays, risk of collision with vessels moored in the fast tides and details of when the hazard is expected to be present.*
- 10. It is recommended a guard boat be present during installation, maintenance & cable laying operations.*

Consultee reply dated 18/06/2025 to initial email send by Marico Marine on 09/06/2025

Thank you for including the RYA on this consultation.

Based on the information provided in the email chain below, we haven't identified any new risks to our interested parties for the proposed work around the installation and decommissioning of the HydroWing Demonstration Device.

I understand from the Morlais Navigational Stakeholder meeting, there will be the appropriate notice to mariners issued for the works.