MOCEAN ENERGY | M100P

Project Environmental Monitoring Plan

EMEC Billia Croo Test Site

February 2020

Purpose

Mitigation and monitoring measures have been identified following a review of the project specific environmental impacts, taking into consideration the site environmental description and associated guidance provided by EMEC. This document describes developer-identified mitigation and monitoring measures associated with the proposed project including any statutory reporting mechanisms. For a detailed description of the company, device, and project, please refer to the Project Information Summary.

Document History

Revision	Date	Description	Originated by	Reviewed by	Approved by
1	25/02/21	Submitted	DL (EMEC)	JC (ME)	

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1 Technology

1.1 Device Overview

The M100P consists of two yellow painted steel hulls connected at a hinge through a pair of steel hinge pins. The key dimensions of the machine are given in Table 1. Figure 1 shows a visualisation of the machine on the pier. Figure 2 shows a visualisation of the machine deployed at sea; however, the mooring lines are not shown here. Note that in both figures, the machine will be painted yellow. Figure 3 gives the general arrangement of the machine.

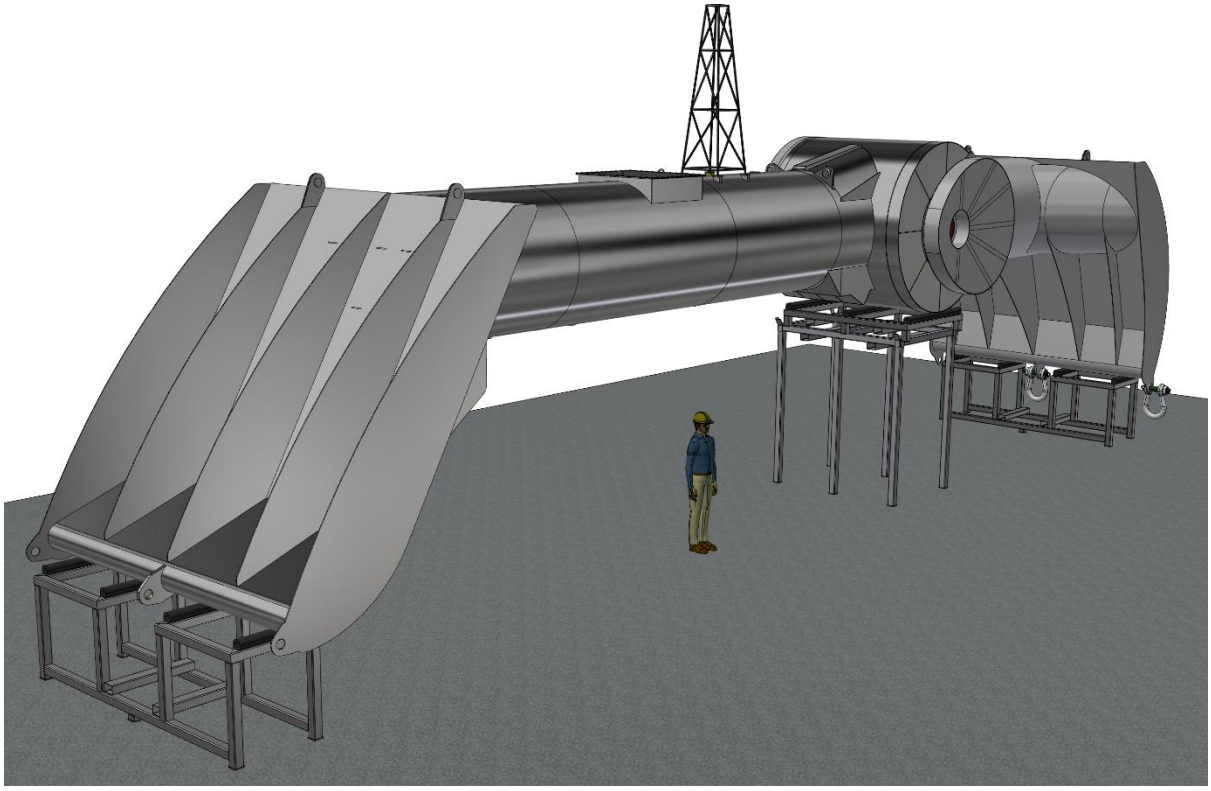

Figure 1. M100P visualisation on pier.

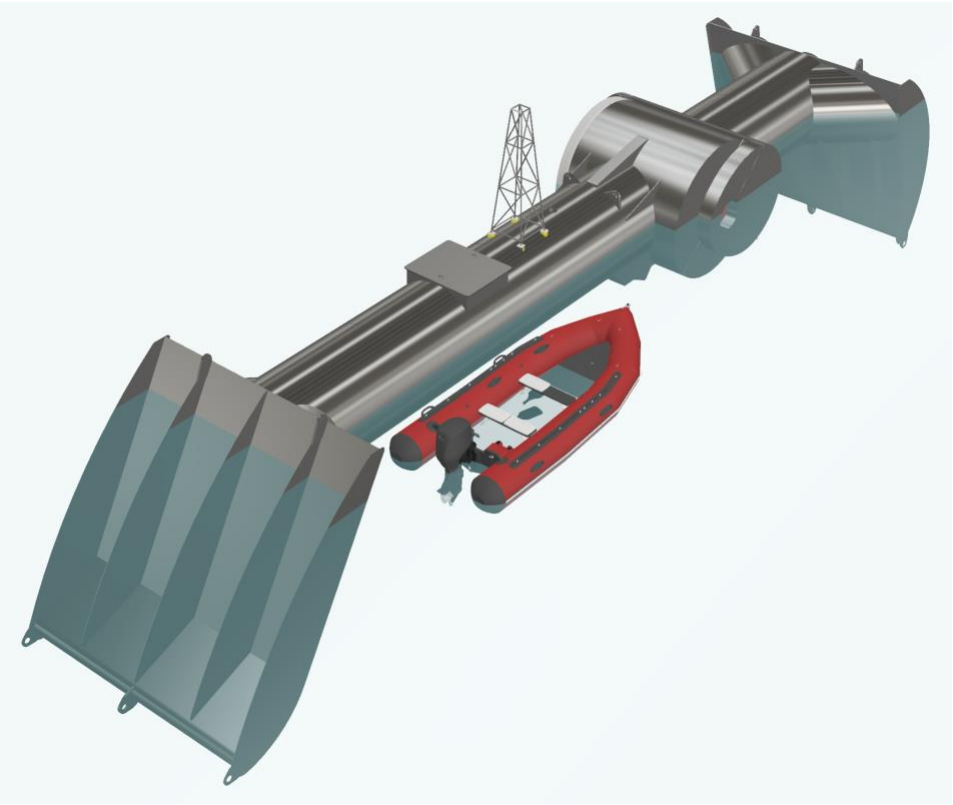

Figure 2. M100P visualisation as deployed at sea.

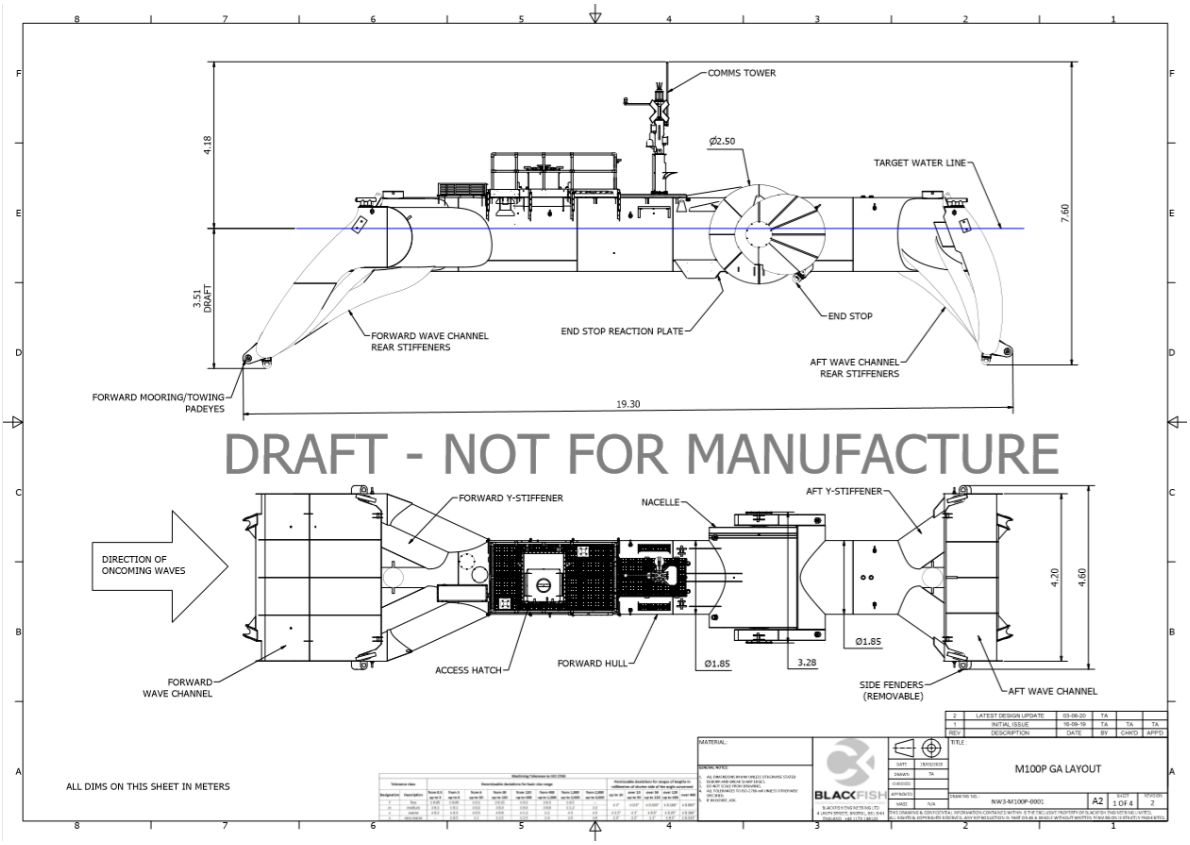

Figure 3. M100P drawing with dimensions.

Table 1. Key dimensions of the M100P.

Dimensions	Units	Value
Length Overall	m	19.2
Beam	m	4.2
Draft	m	3.4
Mass	tonnes	31.5

The rotation of the aft hull with respect to the forward hull drives a gearbox and then a generator. Power from the generator is then conditioned and used onboard the WEC to power local system. Power beyond that needed to power on-board systems is stored in 30 kWh of batteries. Once the batteries are fully charged, excess power is dissipated through an onboard dump resistor. Key onboard systems that use power include: the control, communications, cooling, instrumentation, and navigation lighting.

2 Environmental Monitoring

The following sections describe the potential key environmental impact(s) considered relevant to the installation, operation, maintenance and decommissioning of the M100P device at EMEC's Billia Croo test site. Within the following sections is a summary of the proposed monitoring and mitigation measures relating to each potential impact pathway for the relevant phase of the project. Any key findings from the monitoring will be disseminated to the regulator, Marine Scotland, and appropriate advisors, e.g. Scottish Natural Heritage.

Under the EMFF co-funded SEA Wave project, the Universities of Exeter and Plymouth and EMEC plan to undertake environmental monitoring research activities in order to understand the potential environmental impacts that may be associated with the deployment, operation and decommissioning of wave energy technology. It is hoped that through his project, an acoustic characterisation of the Mocean device can be undertake and the potential for disturbance impacts can be investigated using video surveillance system.

2.1 Disturbance/displacement

Increased anthropogenic activity within the marine environment can potentially cause changes in the behaviour of receptors, particularly sensitive receptors such as cetaceans, seals, basking sharks and marine birds. There is potential to cause spatial displacement of essential activities for certain species due to increased activity in the area. This is likely to be most prevalent during the installation phase when there will be marked increase in vessel traffic accessing the site. In order to determine the significance of such a potential impact, there is a requirement to understand the importance of the habitat and the availability of alternative habitat elsewhere. The frequency of the impact in terms of duration will also be crucial in determining the significance of the impact. As the proposed testing location at the Billia Croo test site is close to the coastline, bird species utilising coastal breeding sites may be affected by the increased vessel traffic in the area. In addition, there is the potential to affect birds foraging success or moulting, if the testing is located within a key foraging area or a moulting site. Vessels are only expected to be onsite for a maximum of a few days in which mooring installation, device installation and vessel mooring removal should be completed. The temporary nature of the increase vessel traffic onsite is not expected to cause any significant impacts to seals, cetaceans, basking sharks and marine birds in the vicinity of the Billia Croo scale test site. Similar disturbance effects due to increased vessel traffic are expected on the decommissioning of the device.

The following table summarises the proposed monitoring and mitigation measures for the relevant project phase relating to each potential impact pathway within disturbance/ displacement.

Table 2. Proposed monitoring and mitigation measures relevant to the impact pathway disturbance/displacement

Impact Pathway	Receptor	Proposed Mitigation/Monitoring Measure	Reporting Mechanism
Installation			
Vessel activity – noise and presence may cause minor disturbance/displacement (including when transiting to and from site)	Cetaceans, seals, basking sharks, seabirds	**Mitigation**: Comply with the Scottish Marine Wildlife Watching Code (SMWWC), including the following measures: • Steady course and speed throughout operation. • Reduction of speed upon sighting of receptor. • Minimum approach distances will be adhered to. • Sudden changes in speed, direction and engine noise will be avoided. • Vessel will maintain at least 50m distance from coast during seabird breeding season. Vessels will only be onsite for the minimum period of time required.	Any non-compliance with the SMWWC will be reported to the regulator as soon as notified by the vessel skipper.
Installation of vessel mooring – noise and presence may cause minor disturbance/displacement	Cetaceans, seals, basking sharks	**Mitigation**: The Scottish Marine Wildlife Watching Code (SMWWC) will be adhered to.	Any non-compliance with the SMWWC will be reported to the regulator as soon as notified by the vessel skipper.
Operational			
Presence of device and mooring may cause very minor disturbance	Cetaceans, seals, basking sharks	No mitigation or monitoring is proposed	N/A
Decommissioning			
Vessel activity – noise and presence may cause minor disturbance/displacement (including when transiting to and from site)	Cetaceans, seals, basking sharks, seabirds	**Mitigation**: The Scottish Marine Wildlife Watching Code (SMWWC) will be adhered to.	Any non-compliance with the SMWWC will be reported to the regulator as soon as notified by the vessel skipper.

Installation of vessel mooring – noise and presence may cause minor disturbance/displacement	Cetaceans, seals, basking sharks	**Mitigation**: The Scottish Marine Wildlife Watching Code (SMWWC) will be adhered to.	Any non-compliance with the SMWWC will be reported to the regulator as soon as notified by the vessel skipper.

2.2 Acoustic impact

Noise disturbance can occur from the presence of vessels, drilling activities, anchoring, and survey activities. The creation of noise must be placed in the context of the existing environment, as other anthropogenic sources of marine noise may already be present within the area and mask the impact of any additional acoustic outputs. It is unlikely acute effects such as non-auditory/auditory tissue damage would be experienced as a consequence of the acoustic outputs from this project but behavioural effects due to disturbance are possible.

Noise disturbance effects may cause mobile species, such as cetaceans, seals and fish to move away from the immediate proximity of the installation site over the short term, but the impact is likely to be highly localised and temporary. Currently there is little known regarding importance of hearing underwater and hearing thresholds for diving birds but there is the potential for it to cause displacement, avoidance, reduction in foraging success or it may have no effect.

It is anticipated that the installation operation will be completed in a short timescale, therefore, it is not expected that any significant effects to marine mammals, fish or marine birds will result from the installation phase. The same is true for maintenance and decommissioning operations.

The following table summarises the proposed monitoring and mitigation measures for the relevant project phase relating to each potential impact pathway within acoustic impact.

Table 3. Proposed monitoring and mitigation measures relevant to the impact pathway acoustic impact

Impact Pathway	Receptor	Proposed Monitoring/ Mitigation Measure	Reporting Mechanism
Installation			
Vessel activity – noise from increased activity will cause minor acoustic impact	Cetaceans, Seals, Basking Sharks	**Mitigation**: The Scottish Marine Wildlife Watching Code (SMWWC) will be adhered to. **Monitoring:** Potentially monitoring noise using static and drifting passive acoustic recorders as part of the SeaWave project	Any non-compliance with the SMWWC will be reported to the regulator as soon as notified by the vessel skipper. A report will be produced if the data collection is conducted
Operational			
Noise from device generating may cause minor acoustic impact	Cetaceans, Seals, Basking Sharks	**Monitoring:** Potentially monitoring noise using static and drifting passive acoustic	A report will be produced if the data collection is conducted

Impact Pathway	Receptor	Proposed Monitoring/ Mitigation Measure	Reporting Mechanism
		recorders as part of the SeaWave project	
Decommissioning			
Vessel activity – noise from increased activity will cause minor acoustic impact	Cetaceans, Seals, Basking Sharks	**Mitigation**: The Scottish Marine Wildlife Watching Code (SMWWC) will be adhered to.	Any non-compliance with the SMWWC will be reported to the regulator as soon as notified by the vessel skipper.

2.3 Collision and Entanglement Risk

It is unknown whether the potential exists for cetaceans, seals and basking shark to become entangled in mooring lines of the size and dimensions required to moor multicat vessels that will be used during this operation. Entangled animals may drown or starve because they are restricted by mooring lines. Winch lines will be used to install the device which in themselves could present an entanglement risk. It is assumed the mooring lines used within this project will not present a risk to diving seabirds. Marine mammals and basking sharks may suffer physical trauma and infections from a striking event involving vessels used during installation and decommissioning. In addition, entangled animals may also be unable to avoid vessels like they normally would, thus increasing the risk of collision.

The following table summarises the proposed monitoring and mitigation measures for the relevant project phase relating to each potential impact pathway within collision and entanglement risk.

Table 4. Proposed monitoring and mitigation measures relevant to the impact pathway collision and entanglement risk

Impact Pathway	Receptor	Proposed Monitoring/ Mitigation Measure	Reporting Mechanism
Installation			
Vessel collision with large marine organisms	Cetaceans, Seals, Basking Sharks	**Mitigation**: The Scottish Marine Wildlife Watching Code (SMWWC) will be adhered to.	Any non-compliance with the SMWWC will be reported to the regulator as soon as notified by the vessel skipper.
Entanglement of large marine organisms in temporary boat moorings	Cetaceans, Seals, Basking Sharks	**Mitigation**: Mooring lines will be kept onsite for as short a period as possible.	Any events will be reported to the regulator as soon as possible on return to shore.
Entanglement with device winching lines	Cetaceans, Seals, Basking Sharks	**Monitoring:** Potential for sensors, or cameras depending on funding available.	Any events will be reported to the regulator as soon as possible on return to shore.
Operational			

Impact Pathway	Receptor	Proposed Monitoring/ Mitigation Measure	Reporting Mechanism
Entanglement with device mooring lines	Cetaceans, Seals, Basking Sharks	**Monitoring:** Potential for sensors, or cameras depending on funding available.	Any events will be reported to the regulator as soon as possible.
Decommissioning			
Vessel collision with large marine organisms	Cetaceans, Seals, Basking Sharks	**Mitigation**: The Scottish Marine Wildlife Watching Code (SMWWC) will be adhered to.	Any non-compliance with the SMWWC will be reported to the regulator as soon as notified by the vessel skipper.
Entanglement of large marine organisms in temporary boat moorings	Cetaceans, Seals, Basking Sharks	**Mitigation**: Mooring lines will be kept onsite for as short a period as possible.	Any events will be reported to the regulator as soon as possible on return to shore.
Entanglement with device winching lines	Cetaceans, Seals, Basking Sharks	**Monitoring:** Potential for sensors, or cameras depending on funding available.	Any events will be reported to the regulator as soon as possible on return to shore.

2.4 Biofouling and non-native species (NNS) introduction

Biofouling is the settlement of biological organisms on man-made structures. Fouling is often a gradual accumulation of organisms which develops over time. Biofouling may consist of microorganism such as bacteria or protozoa or macro-organisms such as barnacles or seaweed. Once installed, the device, moorings, and anchor will be deployed onsite for an extended period of time. This period is expected to provide fouling species an opportunity to settle and grow to maturity.

The spread of non-native organisms can occur through a variety of means including: shipping, transport of fish or shellfish; scientific research and public aquaria. These invasive non-native species can threaten marine diversity. Various guidelines and standards have been referred to in developing the proposed mitigation and monitoring measures (IMO, 2011). It is anticipated that a certain level of biofouling will accumulate, although it is unlikely to pose a risk to introducing non-native species as movements will be limited to UK waters only. However, the introduction of hard substrate into the marine environment may also act as a 'stepping stone' for non-native species. A device may act as locations for non-native species to grow in the area and thus provide a stepping stone for colonization. Detrimental impacts of non-native species on native biota can occur through competition, predation, herbivory, habitat alteration and disease.

The following table summarises the proposed monitoring and mitigation measures for the relevant project phase relating to each potential impact pathway within biofouling and the introduction/transfer of non-native species.

Table 5. Proposed monitoring and mitigation measures relevant to the impact pathway biofouling and introduction of non-native species

Impact Pathway	Receptor	Proposed Monitoring/ Mitigation Measure	Reporting Mechanism
Installation			
Introduction of non-native species (via vessel or equipment)	Benthic species and habitats, and benthic fish and shellfish	**Mitigation**: Local vessel and equipment will be used, reducing the potential for introduction of NNS. Compliance with good practice measures.	Any deviance from the good practice measures will be reported.
Operational			
Accumulation of biofouling on moorings and device may alter local ecosystem	Benthic species and habitats, and benthic fish and shellfish	**Mitigation:** The paint used will have no anti-fouling properties, however the device will be cleaned periodically.	N/A
Decommissioning			
Introduction of non-native species (via vessel or equipment)	Benthic species and habitats, and benthic fish and shellfish	**Mitigation**: Local vessel and equipment will be used, reducing the potential for introduction of NNS. Compliance with good practice measures.	Any deviance from the good practice measures will be reported.

Good practice measures refer to the '2011 guidelines for the control and management of ships biofouling to minimise the transfer of invasive aquatic species' (International Maritime Organisation).

2.5 Habitat Creation

The installation and physical presence of the device and associated anchor will inherently result in direct habitat loss. However, colonisation of the introduced structures may have the potential to function as artificial reefs or fish aggregating devices. The increase in the local reef extent may be limited due to the size of the device therefore diminishing the significance of this impact. This artificial substrate could alter the nature and composition of the species present and may enable non-native species to colonise and potentially spread to other areas.

Cetacean, seal and seabird distribution may be influenced by prey distribution and associated prey habitat. The physical presence of the device may offer enhanced foraging efficiency for some species.

The following table summarises the proposed monitoring and mitigation measures for the relevant project phase relating to each potential impact pathway within habitat creation.

Table 6. Proposed monitoring and mitigation measures relevant to the impact pathway habitat creation

Impact Pathway	Receptor	Proposed Monitoring/ Mitigation Measure	Reporting Mechanism
Operational			
Fish aggregation device (FAD) effect and colonisation of fouling organisms due to introduction of hard structure (Device, moorings and anchor)	Benthic species and habitats, and fish and shellfish	No significant impacts are expected, therefore no specific monitoring measures are proposed.	N/A
Creation of habitat around installed infrastructure	Benthic species and habitats, and fish and shellfish	**Monitoring**: There is a likelihood of reef effects around the installed anchors. There is no proposed monitoring measure however, when the opportunity arises, any video footage of the moorings will be analysed to quantify the level of reefing taking place.	Findings from analysis will be reported to the regulator as and when available.

2.6 Seabed Clearance

During the installation phase, the deployment of vessel moorings and device anchor will cause a temporary loss of benthic habitat. Small amounts of lost habitat may diminish populations of species that are recorded as rare. However, vessel moorings and device anchors tend to have a small footprint and are temporary deposits.

The following table summarises the proposed monitoring and mitigation measures for the relevant project phase relating to each potential impact pathway within seabed clearance.

Table 7. Proposed monitoring and mitigation measures relevant to the impact pathway seabed clearance

Impact Pathway	Receptor	Proposed Monitoring/ Mitigation Measure	Reporting Mechanism
All project phases			
Seabed clearance and habitat loss/disturbance from installation and removal of mooring equipment	Benthic species and habitats, and fish and shellfish	**Mitigation:** Drop-camera will be used during anchor installation and if any sensitive receptors are identified during installation then these areas will be avoided through micro-siting of the anchors and lines/chains on the seabed.	N/A

Impact Pathway	Receptor	Proposed Monitoring/ Mitigation Measure	Reporting Mechanism
Installation of anchors causes damage to cultural heritage or archaeological objects within the site.	Cultural heritage and archaeological objects	**Mitigation:** The appropriate consultation with HES will be undertaken if cultural heritage or archaeological objects are found within Hatston Pier during this operation.	The regulator and HES will be consulted if any cultural or archaeological objects are found within or nearby Hatston pier during the operation.

2.7 Discharges to the Marine Environment

Benthic species may be exposed to materials such as paints, hydraulic fuels and antifouling compounds originating directly from the device. Accidental spillages from installation or maintenance vessels could also occur. Spillages pose a risk to marine mammals, fish, seabirds and benthic communities and can cause direct effects at the time of the spill or can result in chemical accumulation in body tissues leading to lagged effects on health and breeding success.

The following table summarises the proposed monitoring and mitigation measures for the relevant project phase relating to each potential impact pathway for discharges to the marine environment.

Table 8. Proposed monitoring and mitigation measures relevant to the impact pathway discharges to the marine environment

Impact Pathway	Receptor	Proposed Monitoring/ Mitigation Measure	Reporting Mechanism
All project phases			
Leakage of fuel or chemicals from vessels involved with installation, maintenance and decommissioning can enter the food-web at any trophic level	Potentially whole local ecosystem	**Mitigation:** Vessel crews should follow standard procedures to avoid fuel and chemical spills. Suitable spill kits should be onboard all vessels involved in the project.	Any incidents will be reported to the regulator as soon as possible.
Operational			
Corrosion of materials used to construct device and moorings introduce toxins to environment and disrupt ecosystem dynamics	Potentially whole local ecosystem	**Mitigation:** N/A	N/A

3 Cultural Heritage Impacts

3.1 Prehistoric sites

Inferences can be made on the potential for the survival of prehistoric deposits in the area of Billia Croo from coring, bathymetric, side scan sonar (SSS) and sub-bottom profile (SBP) data obtained by various surveys in and close to the test site and observations made during numerous diving operations at various devices and in the general area by SULA Diving.

SSS surveys combined with data from SBP surveys and other studies indicate that there is a transition from exposed bedrock (inshore) to mobile sandy sediments around the 25-20 m contour. Surficial deposits in the area of the EMEC test site are predominantly mobile or featureless sand interspersed with intermittent glacial erratics and patches of coarser sediment interpreted as glacial till deposits since they tend to correlate with areas of deeper sediment deposition and a change in seabed topography. Where present, deposits appear to be 1-10 m thick, overlying bedrock.

In summary, in the offshore lease area, the extension area, and the route to shore at Billia Croo (inshore lease area), the potential for the survival of prehistoric deposits is negligible-low, especially because most of the site is exposed bedrock, or mobile sediments comprising sandy gravels and gravelly sands.

3.2 Shipwrecks, aircraft, and obstructions

No marine cultural heritage statutory designations have been identified in the Billia Croo test site area. There are no UK Hydrographic Office (UKHO) reports showing the existence of any wrecks within the area and none shown on the relevant UKHO charts.

A total of fifteen shipwrecks were identified for this area. No exact wreck positions are known, but the records must be taken as indicative of the potential for wrecks (and artefacts) having been present in the area at some point in time. Considering the nature of the shoreline, the weather and sea conditions experienced along this coast, it is unlikely that the vessels remain intact and in the reported area of foundering, or that any remains survive. The majority of vessels lost in the area were wooden sailing ships stranded in the shallows and many are listed as being broken up and salvaged at the time. Those that came ashore in heavy weather were inevitably broken up by the sea on the rock-strewn coastline. Similarly, later vessels of iron construction were the result of strandings and, given the exposed rocky nature of the coastline and environmental conditions in the area, are not likely to remain intact unless buried in sediment

Multi-beam bathymetry and side scan sonar tend not to be able to distinguish between the wreck and the geology of the seabed. Magnetometry is the only method of determining if a wreck may be present. Given that the area is mostly exposed bedrock and any sediment being shallow and mobile, it is unlikely that much, if anything, survives and nothing has been observed during SULA Diving investigations in the area.