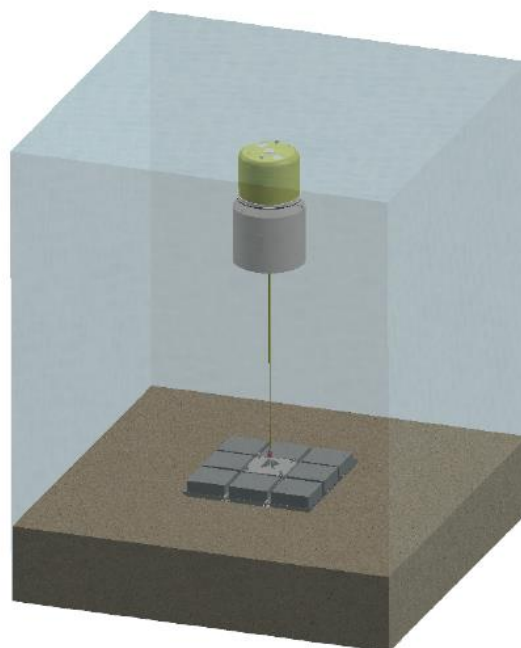


AWS Ocean Energy Ltd | Partial Scale Waveswing Demonstrator

Project Environmental Monitoring Plan

EMEC Scapa Flow Scale Site

December 2020



25m WATER DEPTH



Purpose

This document describes developer-identified mitigation and monitoring measures associated with the proposed deployment and testing of a partial scale Waveswing device (PSWD) at EMEC's small scale test site near St Mary's in Scapa Flow (the Project), including any statutory reporting mechanisms. 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. 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 |
|----------|----------|-------------|---------------|-------------|-------------|
| 1.0 | 15/12/20 | Originate | DL (EMEC) | JM (AWS) | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |



Contents

| | | |
|-----|---|---|
| 1 | Technology | 1 |
| 1.1 | Device Overview | 1 |
| 2 | Environmental Monitoring | 1 |
| 2.1 | Disturbance/displacement..... | 1 |
| 2.2 | Acoustic impact..... | 3 |
| 2.3 | Collision and Entanglement Risk..... | 4 |
| 2.4 | Biofouling and non-native species (NNS) introduction..... | 5 |
| 2.5 | Habitat Creation..... | 6 |
| 2.6 | Seabed Clearance | 6 |
| 2.7 | Discharges to the Marine Environment | 7 |
| 3 | Research Opportunities | 8 |

List of Figures

No table of figures entries found.

List of Tables

| | |
|---|---|
| Table 1. Proposed monitoring and mitigation measures relevant to the impact pathway disturbance/displacement | 1 |
| Table 2. Proposed monitoring and mitigation measures relevant to the impact pathway acoustic impact | 3 |
| Table 3. Proposed monitoring and mitigation measures relevant to the impact pathway collision and entanglement risk | 4 |
| Table 4. Proposed monitoring and mitigation measures relevant to the impact pathway biofouling and introduction of non-native species | 5 |
| Table 5. Proposed monitoring and mitigation measures relevant to the impact pathway habitat creation | 6 |
| Table 6. Proposed monitoring and mitigation measures relevant to the impact pathway seabed clearance..... | 7 |
| Table 7. Proposed monitoring and mitigation measures relevant to the impact pathway discharges to the marine environment | 7 |

1 Technology

1.1 Device Overview

The Archimedes Waveswing is a submerged point absorber that changes volume in response to pressure variations caused by ocean waves. The device is comprised of two large concentric cylinders with the lower being tethered to the seabed and the upper free to move vertically. The lower cylinder is fixed to the seabed by means of a tension tether connected to an anchor that measures 64m². The relative motion between the two parts drives a power take-off unit (PTO). This will be a half-scale device which will contain all the major subsystems, including a fully functioning PTO and control system.

The partial-scale device will measure 4.5m diameter and have an approximate height of 7.5m. The PTO tested will have a continuous rating of 16kW. The device will be designed for full onshore commissioning and extended dry testing ahead of deployment.

2 Environmental Monitoring

The following sections describe the potential key environmental impact(s) considered relevant to the installation, operation, maintenance and decommissioning of the Archimedes Waveswing device at EMEC's Scapa Flow scale 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. NatureScot.

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 short term 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 Scapa Flow 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. 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 Scapa Flow scale test site. Similar vessel movements will occur during decommissioning.

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 1. 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 | <p>Mitigation: Comply with the Scottish Marine Wildlife Watching Code (SMWWC), including the following measures:</p> <ul style="list-style-type: none"> • Steady course and speed throughout operation where possible. • 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 where possible. • Vessel will maintain at least 50m distance from coast during seabird breeding season. <p>Vessels will only be onsite for the minimum period of time required.</p> | Any sightings will be noted as soon as notified by the vessel skipper. |
| Installation of vessel mooring – noise and presence may cause minor disturbance/displacement | Cetaceans, seals, basking sharks | <p>Mitigation: The Scottish Marine Wildlife Watching Code (SMWWC) will be adhered to.</p> | Any sightings will be noted 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 | <p>Mitigation: The Scottish Marine Wildlife Watching Code (SMWWC) will be adhered to.</p> | Any sightings will be noted as soon as notified by the vessel skipper. |
| Installation of vessel mooring – noise and presence may cause | Cetaceans, seals, basking sharks | <p>Mitigation: The Scottish Marine Wildlife Watching Code</p> | Any sightings will be noted as soon as |

| | | | |
|--------------------------------|--|-----------------------------|---------------------------------|
| minor disturbance/displacement | | (SMWWC) will be adhered to. | 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. There is also the potential for activities to cause displacement, avoidance, and reduction in foraging success for diving birds.

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 removal 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 2. 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. | Any sightings will be noted as soon as notified by the vessel skipper. |
| Operational | | | |
| Noise from device generating may cause minor acoustic impact | Cetaceans, Seals, Basking Sharks | The highly localised nature of this output should result in no significant effects. Future projects may allow monitoring of noise outputs from wave energy converters. | |
| 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 sightings will be noted as soon as notified by the vessel skipper. |

| Impact Pathway | Receptor | Proposed Monitoring/ Mitigation Measure | Reporting Mechanism |
|----------------|----------|--|---------------------|
| | | | |

2.3 Collision and Entanglement Risk

It would be very unlikely 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. The lines, while in use will be mostly taught but may be buoyed off for short periods of time during marine operations (estimated to be 1-2 days at a time, on few occasions through the project). It is assumed the mooring lines used within this project will not present a risk to diving seabirds. It is unlikely that Marine mammals and basking sharks would suffer physical trauma and infections from a striking event involving vessels used during installation and decommissioning.

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 3. 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 sightings will be noted 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. |
| Operational | | | |
| Entanglement with device mooring lines | Cetaceans, Seals, Basking Sharks | Monitoring: Potential for sensors, or cameras during future projects. | 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 sightings will be noted as soon as notified by the vessel skipper. |
| Entanglement of large marine organisms in | 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. |

| Impact Pathway | Receptor | Proposed Monitoring/ Mitigation Measure | Reporting Mechanism |
|-------------------------|----------|--|------------------------------|
| temporary boat moorings | | | 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 device to be installed will be antifouled prior to launch and also fitted with an ultrasonic antifoul equipment. Fabrication is underway in Glasgow and it is intended the device will be transported from Glasgow to Orkney under Wet Tow.

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 low 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.

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 4. 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. | |
| Operational | | | |
| Introduction of hard substrate | Benthic species and habitats, and benthic fish and shellfish | Mitigation: The paint used will have anti-fouling properties and the device will be fitted with antifouling equipment. | |
| Decommissioning | | | |
| Introduction of non-native | Benthic species and habitats, and | Mitigation: Local vessel and | |

| Impact Pathway | Receptor | Proposed Monitoring/ Mitigation Measure | Reporting Mechanism |
|-----------------------------------|----------------------------|---|---------------------|
| species (via vessel or equipment) | benthic fish and shellfish | equipment will be used, reducing the potential for introduction of NNS. Compliance with good practice measures. | |

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.

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 5. 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. | |
| 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. Future projects may allow monitoring of this. | |

2.6 Seabed Clearance

During the installation phase, the deployment of vessel moorings and device anchor will cause a temporary loss of benthic habitat. Vessel moorings and device anchors used in this project 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 6. 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 installation to identify the presence of Priority Marine Features. If present, micro-sitting will be carried out. | N/A |
| Installation of anchors causes damage to cultural heritage or archaeological objects within the site. | Cultural heritage and archaeological objects | Mitigation: The Environmental Description of the Scapa Flow site concludes that there no evidence suggesting the existence of any cultural or archaeological objects within the site, however the appropriate consultation with HES will be undertaken if discovered. | The regulator and HES will be consulted if any cultural or archaeological objects are found within or nearby the site. |
| | | | |

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 7. 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 | Local environment | Mitigation: Vessel crews should follow standard procedures to avoid fuel and chemical spills. | Any incidents will be reported to the regulator as soon as possible. |

| Impact Pathway | Receptor | Proposed Monitoring/ Mitigation Measure | Reporting Mechanism |
|--|----------|--|---------------------|
| can damage the local environment temporarily | | | |

3 Research Opportunities

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 this project, baited and un-baited camera surveillance of the seabed and near-device water column will provide the opportunity to further understand spatial patterns of marine life around wave energy converters.