



CEFOW Project-specific
Environmental Monitoring
Programme (PEMP)

FINAL

Report to Fortum Energy Ltd

Issued by Aquatera Ltd

P832 – July 2018



www.aquatera.co.uk

This study was completed for:

Fortum Energy Ltd UK
Eco-Innovation Centre
Peterscourt
City Road
Peterborough
PE1 1SA

Contact: Mikko Muoniovaara
Tel: +358405525363
Email: mikko.koivuniemi@fortum.com

This study was completed by:

Aquatera Ltd
Old Academy Business Centre
Stromness
Orkney
KW16 3AW

Contact: Ian Hutchison
Tel: 01856 850 088
Email: ian.hutchison@aquatera.co.uk

Issue record

The version number is indicated on the front cover.

Version	Date	Details
V1	14/06/2018	Issued to client via email
V2	05/07/2018	Second draft issued to client for EMEC review
V3	18/07/2018	Third draft incorporating EMEC and client comments
FINAL	18/07/2018	Final version for issue to client

Members of:



Contents

CONTENTS.....	II
LIST OF FIGURES	III
LIST OF TABLES	III
1 INTRODUCTION	1
1.1 BACKGROUND.....	1
1.2 CONTENTS OF THE PEMP	1
2 CONSTRUCTION METHOD STATEMENT	2
2.1 PROJECT OVERVIEW.....	2
2.2 PROJECT LOCATION	2
2.3 PROJECT SCHEDULE, TIMINGS AND COMMENCEMENT DATES.....	4
2.4 TECHNICAL DESCRIPTION OF COMPONENTS.....	5
2.5 OPERATIONAL PLANS AND METHODOLOGIES.....	5
2.5.1 Construction and installation	5
2.5.2 Operations and maintenance	9
2.5.3 Decommissioning.....	10
3 MITIGATION AND MONITORING PLAN	11
3.1 MITIGATION, MONITORING AND MANAGEMENT MEASURES IN RELATION TO POTENTIAL ENVIRONMENTAL EFFECTS.....	11
4 REFERENCES	17
5 APPENDICES	18
APPENDIX A SUPPLEMENTARY RESEARCH PLAN.....	18
APPENDIX B VESSEL MANAGEMENT PLAN (VMP)	19
B.1 INTRODUCTION.....	19
B.2 VESSEL DETAILS.....	19
B.3 VESSEL ROUTES.....	21
APPENDIX C COMMITMENTS TABLE/REGISTER	23
APPENDIX D RELEVANT MARINE LICENCE CONDITIONS.....	25

List of Figures

Figure 2-1	Proposed CEFOW licence area at Billia Croo wave test site marked in green	3
Figure 2-2	Example multi-cat vessel GM Green Chief	6
Figure 2-3	Example support vessel – GM Green Quest	6
Figure 2-4	Example support vessel – rigid inflatable boat (RIB)	7
Figure 2.5	Sketch of WEC 2 with the new advanced shape	7
Figure 2-6	Indicative mooring view of Penguin device (not to scale)	8
Figure 2-7	Schematic of 3 WEC connections (Wello Oy and Fortum, 2018)	9

List of Tables

Table 2.1	Coordinates of licence boundary	2
Table 2.2	Anticipated installation, operations and decommissioning schedule	4
Table 2.3	Vessels utilised for installation	5
Table 2.4	Planned and unplanned visits to the CEFOW array	10
Table 3.1	Residual impacts and mitigation/monitoring measures	12
Appendix table B.1	Vessel information	21
Appendix table C.2	Commitments register	23

1 INTRODUCTION

1.1 BACKGROUND

Fortum Energy Ltd ('the Developer') is taking part in a European Commission Horizon 2020 project, Clean Energy From Ocean Waves (CEFOW) which aims to deploy an array of three Penguin wave energy converters (WECs), each rated at 1MW capacity, at the European Marine Energy Centre's (EMEC's) Billia Croo test site ('the site'). The Penguin WEC is a floating device that produces energy by converting the movement of the waves to rotational kinetic movement inside the device by using the asymmetric shape of the hull. There is currently one Penguin WEC (WEC 1; see Figure 1.2) deployed at the site which was successfully re-installed in February 2017 and grid connected in March 2017¹. The first of the additional two devices (WEC 2) is expected to be installed in September 2018 with the second (WEC 3) anticipated to be installed in May 2019 to complete the CEFOW array.

The CEFOW array ('the Project') will be situated in the north-west of the Billia Croo site. WEC 2 and WEC 3 will take up station alongside the existing Penguin device at Berth 5 (see Figure 1-1). To allow additional WECs to be installed at Berth 5, the existing export cable will be split using a 4-way subsea electrical smart hub. The CEFOW array is anticipated to be operational up until May 2020, however, to allow some redundancy in the programme the marine licence application will cover the period until 1st March 2021.

This Project-specific Environmental Monitoring Programme (PEMP) has been prepared to support the following necessary licence application:

- Marine Licence under Marine (Scotland) Act 2010, Part 4 Marine Licensing;

This PEMP should be read in parallel with the Environmental Report (Aquatera, 2018) which includes a description of the likely receptors to be affected by the proposed development and, where relevant, additional technical details of the proposal and project components. In addition, an environmental description of the Billia Croo site is provided in EMEC/Aurora Environmental (2009).

1.2 CONTENTS OF THE PEMP

The PEMP details the proposed mitigation, monitoring and management measures for all stages of the project including installation/construction (WEC 2 and WEC 3), operation and maintenance (O&M) and decommissioning of all devices.

Fortum Energy Ltd and Wello are committed to updating and improving this PEMP through consultation and as more data, information and experience is gathered. In addition, they are committed to working closely with stakeholders and other developers to ensure that all mitigation and monitoring activities are conducted in line with best practice and best available knowledge at all times. Fortum Energy Ltd and Wello will also strive to actively engage with other developers and stakeholders to address the key issues and uncertainties associated with wave energy development through targeted research initiatives.

¹ The initial installation period was from the summer of 2012 to the summer of 2014. WEC 1 was installed under Marine Licence number 04064/13/0.



2 CONSTRUCTION METHOD STATEMENT

The Construction Method Statement (CMS) for the CEFOW array has been requested for submission with the Project-specific Environmental Monitoring Programme (PEMP). This chapter provides details of the activities proposed for installation, operation and decommissioning of the CEFOW array. Further details on the Project components are provided in the Project Information Summary (PIS) (Wello, 2018).

2.1 PROJECT OVERVIEW

The following activities are proposed:

- Construction and installation;
 - Installation of drag embedment anchor support system and moorings for WECs 2 and 3;
 - Installation of Penguin WEC 2 and WEC 3;
 - Installation of 4-way subsea electrical hub and its subsequent connection to EMEC's subsea cable;
 - Connection of Penguin WEC umbilical cables to 4-way subsea electrical hub;
- Operation and maintenance of WEC 1², WEC 2 and WEC 3; and
- Decommissioning of electrical hub, three Penguin WECs (WEC1, WEC2 and WEC 3), moorings and anchors.

2.2 PROJECT LOCATION

The Penguin devices (WEC 2 and WEC 3) will be installed at Berth 5 within EMEC's Billia Croo wave test site (see Figure 2-1). This is the deep water Berth located in the northwest of the EMEC test site. The licence boundary required for installation of the devices is provided in Table 2.1. The precise location of the devices and anchors (within the licence boundary provided) will be determined prior to anchor installation and will be confirmed with Marine Scotland upon submission of the formal Table of Deposits (Form FEP5). This flexibility in the installation location is required to ensure that no obstructions exist in proximity of the anchoring locations on the seabed. Coordinates will be provided to MS-LOT upon the completion of installation along with a Table of Deposits.

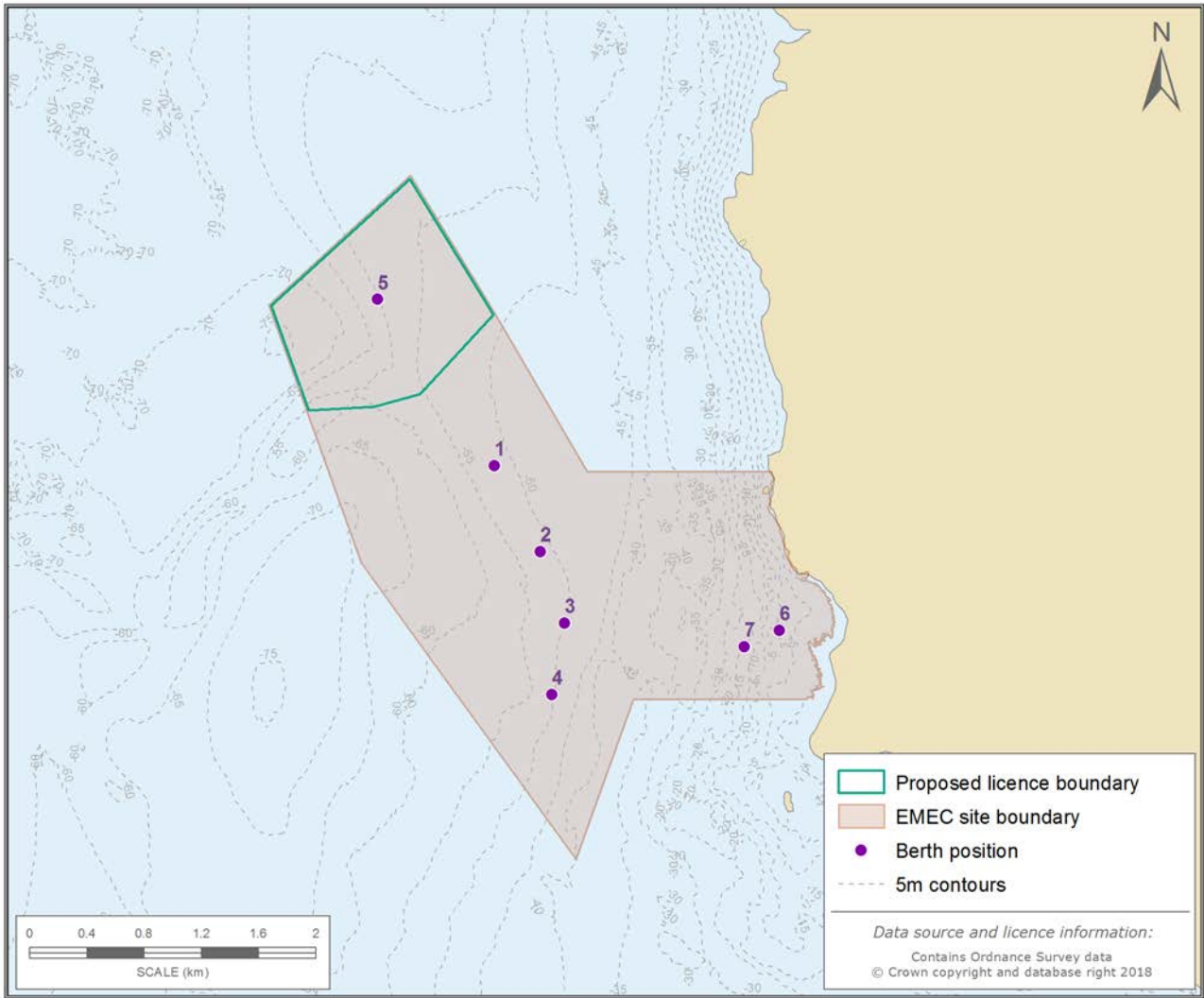
Table 2.1 Coordinates of licence boundary

Point	Latitude	Longitude
NW	58° 59.46'N	003° 25.32'W
N	59° 00.00'N	003° 24.36'W
NE	58° 59.46'N	003° 23.70'W
E	58° 59.16'N	003° 24.24'W
SE	58° 59.10'N	003° 24.60'W
S	58° 59.10'N	003° 25.08'W
SW	58° 59.46'N	003° 25.32'W

² WEC 1 is already installed, under Marine Licence number 04064/13/0.



Figure 2-1 Proposed CEFOW licence area at Billia Croo wave test site marked in green



2.3 PROJECT SCHEDULE, TIMINGS AND COMMENCEMENT DATES

The anticipated installation, operations, maintenance and decommissioning schedule for the Project is shown in Table 2.2. The anticipated date of installation of WEC 2 and its associated mooring system is September 2018 and for WEC 3 is May-July 2019. The operational period is anticipated to last up to May 2020, however, to allow some redundancy in the programme the marine licence application will cover the period until 1st March 2021. Thereafter, all devices will be completely removed from site.

At all times, onsite works will be subject to EMEC's Permit to Work system, which is managed by EMEC to minimise any potential conflicts and maximise any opportunities that may arise.

Table 2.2 Anticipated installation, operations and decommissioning schedule

Activity	2018		2019				2020				2021			
	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Penguin WEC 2														
Installation of drag embedment anchors and mooring lines	■	■												
Deployment of 4-way smart electrical hub	■	■												
Installation of device	■	■												
Operations/Maintenance	■	■	■	■	■	■	■	■	■	■	■			
Removal of device							■	■	■	■	■			
Penguin WEC 3														
Installation of anchors and mooring lines		■	■	■										
Installation of device			■	■	■									
Operations/Maintenance			■	■	■	■	■	■	■	■	■			
Removal of device										■	■			
Penguin WEC 1														
Operations/Maintenance	■	■	■	■	■	■	■	■	■	■	■			
Removal of device							■	■	■	■	■			



2.4 TECHNICAL DESCRIPTION OF COMPONENTS

A technical description of each of the components to be deployed can be found in the Project Information Summary (PIS) (Wello Oy, 2018).

2.5 OPERATIONAL PLANS AND METHODOLOGIES

2.5.1 Construction and installation

WEC 1 is already installed, under Marine Licence number 04064/13/0, and is held in place by six gravity anchors consisting of steel chain or concrete blocks weighing up to fifty tonnes each. WECs 2 and 3 will be held in place by six drag embedment anchors in a similar orientation to WEC 1 (see Figure 2-6). Initially, installation of vessel moorings will take place over a period of two days to aid in the installation of the drag-embedment anchors. A standard multi-cat type vessel will be required for installation of the anchors, which will be installed at predefined locations on the seabed (see Section 2.2). The anchors will be loaded onto the multicat vessel at Copeland's Dock, Stromness. This is the closest harbour facility to the Billia Croo test site.

The six-point catenary mooring system that will be installed for WEC 2 and WEC 3 will consist of various widths (48mm-76mm) of studlink chain that attach to the anchor. Each mooring line will be around 266m in length with the mooring spread of WEC 2 and WEC 3 being 500m (see PIS (Wello, 2018)). Installation of the anchors and moorings for each device is expected to be completed in four days.

The vessel spread required for installation is shown in Table 2.3. Further details of the vessels likely to be used for the deployment are provided in the Vessel Management Plan in the PEMP.

Table 2.3 Vessels utilised for installation

Vessel Type	Task
Multi-cat (x2) (see Figure 2-2)	The vessel will be used to transport and install the anchors and to tow the Penguin devices (WEC 2 and WEC 3) out to the site. The vessel will remain on site whilst the device is installed. A second multi-cat may be used to provide assistance
Workboat (see Figure 2-3)	The workboat is manoeuvrable around the site while the multi-cat is temporarily moored.
Rigid inflatable boat (RIB), or similar (see Figure 2-4)	A RIB will be used to assist with the towing and installation of the device



Figure 2-2 Example multi-cat vessel GM Green Chief



Figure 2-3 Example support vessel – GM Green Quest



Figure 2-4 Example support vessel – rigid inflatable boat (RIB)



Device installation

Technical details of the Penguin device can be found in the Project Information Summary (Wello Oy, 2018). A sketch of the Penguin WEC 2 with a new advanced shape is provided in Figure 2.5.

Figure 2.5 Sketch of WEC 2 with the new advanced shape

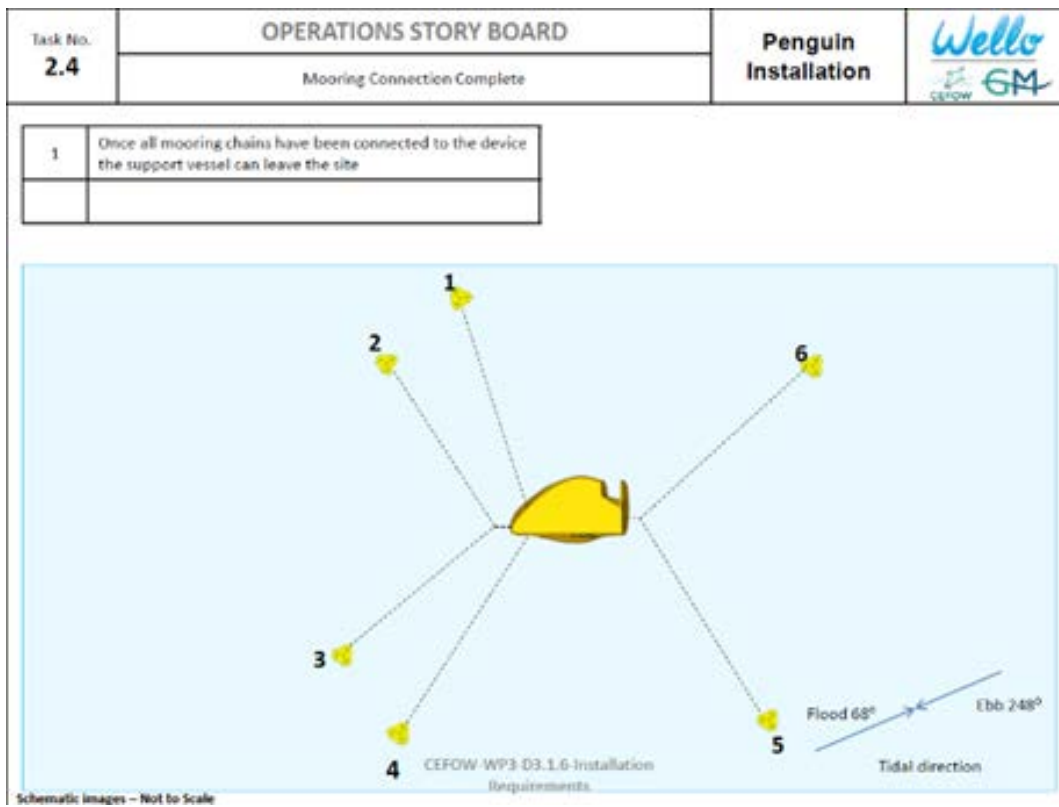


WECs 2 and 3 will be manufactured in Tallin, Estonia and towed by sea to Orkney where it will be berthed at Hatston or Lyness Pier in preparation for deployment at Billia Croo. The device is easily deployed due to its ability to be towed behind a standard multi-cat vessel. When the device arrives on site it will be hooked up to the mooring spread. This will be achieved in the following stages:

- Undertake micro-siting onsite and complete connection to buoys;
- Connect to the midline support buoy; and
- Repeat for all mooring legs.

Figure 2-6 shows an indicative mooring spread of the Penguin device. Installation of each Penguin device is expected to take 1 day.

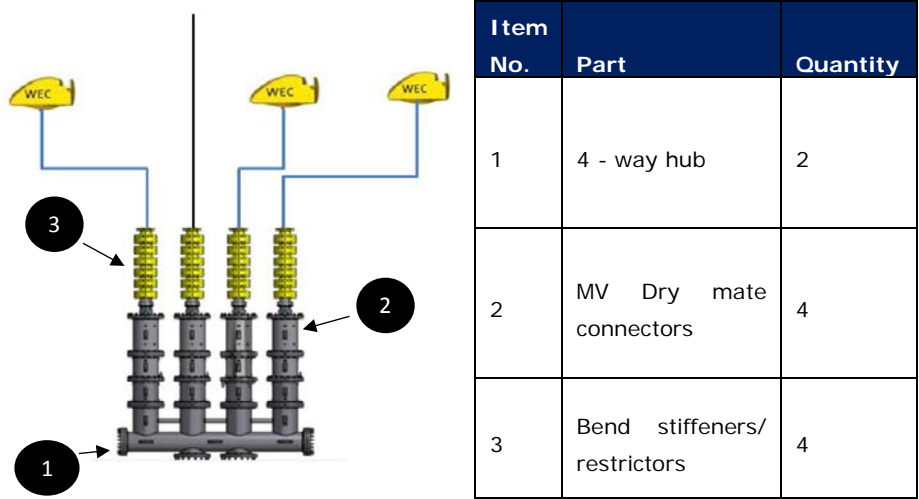
Figure 2-6 Indicative mooring view of Penguin device (not to scale)



Connection of umbilical cable to 4-way subsea electrical hub and then to EMEC’s subsea cable

The EMEC electrical cables run from the sub-station at Billia Croo to each berth location. To allow additional WEC devices to be installed at Berth 5 the export cable will be split using a 4-way subsea electrical smart hub as shown in Figure 2-7.

Figure 2-7 Schematic of 3 WEC connections (Wello Oy and Fortum, 2018)



The hub contains 3 import connections and 1 export connection. The dynamic cable from the WEC devices can be quickly and easily connected to the import connections of the hub via the use of a dry mate connection. Using a 4-way hub then allows multiple WEC devices to be installed exporting power through just the one cable.

The option currently being considered for connecting the 4-way electrical hub with EMEC’s subsea cable termination box is:

- Isolate and apply circuit main earth at the onshore substation;
- Lift the export cable onto the vessel deck and prepare for testing/termination;
- Test cable first, and safe padlock the electrical works;
- Splice the cable and fit the dry-mateable connector to 4-way hub; and
- Deploy cable.

As the cable is double armoured, extra protection is not required. When hoisting and lowering cables, extra care has to be taken to prevent kinks and other damages.

The final task is to carry out a post installation ROV survey. This will include the recording of the precise position of the termination box as laid, debris clearing and demobilisation of all associated equipment. It is anticipated that the installation of the anchors will be completed in four days, the electrical connection in two days, and connecting the Penguin device will be completed within one day. The Penguin device can be installed in conditions of Hs <1.5m.

2.5.2 Operations and maintenance

The device has been designed so that regular maintenance is not required. However, it is anticipated that during testing, maintenance and inspection will be required approximately once a month. This will essentially involve using a RIB or small workboat to transfer personnel onto the device where maintenance and inspection will be conducted within the hull. Maintenance will only be carried out in calm sea conditions (with a wave height less than ~1m Hs to ensure safe access to the device).

Technical monitoring of the device will be undertaken regularly by ROV and diver inspections. In addition, inspections will be done after every severe storm especially during the first years of the Project.

Planned and unplanned onsite maintenance is expected throughout 2018, 2019 and early in 2020 (detailed in Table 2.4). However, WECs may be removed to Hatston or Lyness Pier and subsequently reinstalled where repairs cannot be made at sea.

Table 2.4 Planned and unplanned visits to the CEFOW array

Visit Type	Planned/unplanned	Frequency	Max Hs
On board inspection	Planned	2 times	0.5m
Public relation visits	Planned	2-6 times	0.5m
Inspection of mooring lines and anchors with ROV and divers	Planned	Every two months: Approx. 18 times	1.0m
Removal and re-installation upon significant damage	Unplanned	-	1.0m

Retrieval of the device will follow the reverse of the installation method as presented here. Each Penguin device will be detached from its moorings and subsea-cable and towed back to port. The device will then be redeployed utilising the same method of installation as outlined in Section 2.5.1.

2.5.3 Decommissioning

Decommissioning will involve the retrieval of each Penguin device (WEC 1, WEC 2 and WEC 3) and will be a reverse of the installation procedures outlined in Section 2.5.1. Each Penguin device, its mooring lines and anchors are planned to be removed from site by May 2020, however there may be a requirement to extend the deployment period to March 2021, but no site infrastructure will remain after this period.

When Wello departed the testing Berth at Billia Croo in the summer of 2014 there were a number of items left on the seabed. These include:

- 6x clump weights (exact location within Berth 5 area currently unknown) (24t in air, 14t submerged)
- 3x roll plates:
 - Roll plate 1 (Lower Roll plate) – Deposited on seabed in 2012 – shackles may be damaged (Approx 122t dry / 75t wet)
 - Roll plate 2 (Upper Roll plate) – Deposited on the seabed 2012 – shackles may be damaged Approx 122t dry / 75t wet).
 - Note: Originally Roll plate 1 was suspended approximately 14m below Roll plate 1 with three chains through the slots on Roll Plate 2.
 - When Roll plate 1 was deposited, it was replaced with a bundle of chain, which is now still partially threaded through Roll Plate 2 centre.
 - Roll plate 3 – was deposited 2013 (1X Approx 138t dry / 92t wet).
- Approximately 150m of umbilical cable.

Wello are committed to works to remove these items from the seabed and to clear the EMEC Berth for the next occupant.

Wello will submit a Draft Decommissioning Plan for the CEFOW array, to accompany the Marine Licence application, which will include these items.



3 MITIGATION AND MONITORING PLAN

3.1 MITIGATION, MONITORING AND MANAGEMENT MEASURES IN RELATION TO POTENTIAL ENVIRONMENTAL EFFECTS

The Environmental Report identified a number of potential impacts that are considered relevant to the proposed deployment however as stated in Section 4 of the ER, no likely significant effects were identified. Navigational impacts associated with device deployment will be discussed within the project-specific NRA addendum for the CEFOW project (Orcades Marine, 2018) and are also covered within Section 4 of the ER.

These impacts and proposed mitigation/monitoring measures are outlined and described within the context of the proposals in Table 3.1.



Table 3.1 Residual impacts and mitigation/monitoring measures

Potential residual impact	Receptor	Summary of impact	Proposed mitigation and monitoring measure(s) and reporting
All phases including construction and installation, operation and maintenance and decommissioning			
Disturbance from support vessel activity – vessel noise and presence	Cetaceans Seals Basking sharks Marine birds (seaducks, divers)	Each Penguin device (WEC 2 and 3) and their respective anchors will be installed using one standard multi-cat work vessel, assisted by a second multi-cat, workboat and a RIB. Installation activities will be completed over 7 days therefore no significant effects on any sensitive species are expected from this low level of vessel activity.	<p>Adherence to SMWWC</p> <p>Relevant measures from the Scottish Marine Wildlife Watching Code (SMWWC) will be implemented by Fortum and all marine contractors. These will include:</p> <ul style="list-style-type: none"> • Speed will be reduced to 6 knots when any marine mammals or birds are sighted within or near to transit routes, where consistent with crew and navigational safety and the completion of constrained operations. • A steady speed and course will be maintained where possible if a marine mammal approaches a project vessel. • Care will be taken to avoid splitting up groups and mothers and young. • Minimum approach distances (as stated in the SMWWC) for vessels on approach to marine mammals and birds will be adhered to, although this may be varied according to species and circumstance. Specifics will be agreed with SNH and listed in the CEMD and implemented. • Sudden unpredictable changes in speed, direction and engine noise will be avoided to avoid disturbance to any marine mammals in the vicinity. • Rafts of birds will not be intentionally broken up or flushed. • During the seabird breeding season (April to August inclusive) vessel transit corridors will be at least 50 m from shore in the vicinity of cliff-nesting seabirds to avoid disturbance. <p>Vessel Management Plan</p> <p>A Vessel Management Plan has been developed which will be implemented to help ensure a minimum approach distance is adhered to when passing designated seal haul-outs (refer to draft VMP in Appendix B).</p> <p>Reporting</p> <p>The Vessel Management Plan will be maintained throughout the project. Any changes will be agreed in advance with Marine Scotland.</p>



Potential residual impact	Receptor	Summary of impact	Proposed mitigation and monitoring measure(s) and reporting
Introduction of marine non-native species (MNNS) (via vessels, devices or other equipment)	Benthic species and habitats Benthic fish and shellfish	WECs 2 and 3 will be towed to Hatston or Lyness Pier from Tallin, Estonia. Therefore, there is potential for the introduction of MNNS via vessels used to tow the devices and from the devices themselves. Anti-fouling paint will be applied to the new devices before they are deployed thus limiting the potential for spread of MNNS. Good practice measures as indicated in the adjacent column will reduce the risk and as such no significant impacts are expected as a result of the proposals.	<p>Implement industry good practice measures</p> <p>Good practice measures as detailed in Alien Invasive Species and the Oil and Gas Industry³ 2011 Guidelines for the Control and Management of ships' biofouling to minimise the transfer of invasive aquatic species⁴. Code of Practice on Non-native Species⁵ will be implemented including:</p> <ul style="list-style-type: none"> • Maintain a Biofouling Management Plan, which includes details of: <ul style="list-style-type: none"> ○ Antifouling paints used ○ Biofouling inspections ○ Removal of biofouling ○ Waste management • Removal of any biofouling in the area of its origin before deployment of the Penguin devices (WECs 2 and 3) at EMEC. • Use anti-fouling paints that comply with AFS convention and national legislation suitable for the specific application. The anti-fouling on the device presently (Marine Standard paint) is conforming this legislation and convention. • Undertake maintenance to ensure integrity of paint coverage <p>Reporting:</p> <p>A Biofouling Management Plan will be submitted along with the first Environmental Monitoring Report, four weeks after final device (WEC 3) commissioning.</p>

³ Available at: <http://www.ipieca.org/publication/alien-invasive-species-and-oil-and-gas-industry>

⁴ Available at: <http://www.imo.org/en/OurWork/Environment/Biofouling/Documents/MEPC.1-Circ.792.pdf>

⁵ Available at: www.scotland.gov.uk/Resource/0039/00393567.pdf



Potential residual impact	Receptor	Summary of impact	Proposed mitigation and monitoring measure(s) and reporting
Habitat creation and fish aggregation device (FAD) effects due to introduction of new structures	Benthic species and habitats Fish and shellfish (gadoids and crustaceans)	It is likely that fish will aggregate around the CEFOW array and more specifically around each of the devices. The Penguin WECs have no external moving parts. Therefore, no significant effects are expected and no specific mitigation or monitoring measures are proposed.	No specific mitigation is proposed in relation to this impact during the deployment and operation of the CEFOW array. The Developer will contact ORJIP Ocean Energy to engage the programme's Steering Group and Network to identify other/additional potential opportunities to undertake strategic research around the device. The Developer would welcome any support in these endeavours from Marine Scotland and SNH.
Construction and installation			
Seabed disturbance from installation of drag embedment anchors and 4-way electric hub	Benthic species and habitats Demersal fish and shellfish	During installation of drag embedment anchors and the electrical hub there is potential for disturbance to seabed habitat and to benthic species including demersal fish and shellfish. Additionally, there is potential for direct impacts on these species from smothering impacts associated with a re-suspension of sediment into the water column. This would result in a highly localised and temporary loss of habitat around each anchor point. The habitat in and around Berth 5 is not particularly diverse due to a lack of nutrient upwelling and the influence of tides in the area.	No specific mitigation is proposed in relation to this impact during the deployment and operation of the CEFOW array. An annual research exercise is being carried out by Plymouth and Exeter Universities (see Appendix A) which will utilise a towed underwater camera system to assess the response of seabed biodiversity to single and multiple devices. Results from these surveys will be published and disseminated.
Operation and maintenance			
Displacement of marine mammals, basking sharks and seabirds due to the presence of the array	Marine mammals, basking shark and seabirds	The introduction of new structures into the environment has the potential to displace marine mammals, basking sharks and seabirds from the area which may adversely affect national and international conservation objectives. The presence of three WECs with no external moving parts, together with their anchors and moorings, in an	No specific mitigation is proposed in relation to this impact during the deployment and operation of the CEFOW array. An annual research exercise is being carried out by Plymouth and Exeter Universities (see Appendix A) which will use static underwater camera equipment to assess mobile species distribution and behaviour. Additionally, the Universities will use device-mounted HD cameras to assess seal and seabird utilisation and behaviour.



Potential residual impact	Receptor	Summary of impact	Proposed mitigation and monitoring measure(s) and reporting
		established test site is highly unlikely to adversely affect marine mammals, basking shark and seabirds which will still be able to inhabit and pass through the area.	Results from these surveys will be published and disseminated.
Underwater noise from turbine operation leading to disturbance	Cetaceans Seals Basking sharks	<p>There is no risk of injury or death from underwater noise generated by operating turbines.</p> <p>The Developer does not plan to monitor noise from any of the devices, however, a study by Side and Beharie (2012)⁶ which measured the sound pressure levels produced by the cooling system of the first Penguin device while it was berthed at Lyness Pier, Orkney suggests a sound source level of 140.5 dBrms re 1µPa at 1m. The study concluded that ambient noise levels would be reached within approximately 10m from the device.</p> <p>Therefore, the noise levels produced are well below levels which have potential to cause Temporary or Permanent Threshold Shift (TTS and PTS respectively) in marine mammals.</p> <p>No anticipated significant impacts are expected from the CEFOW array.</p>	No specific mitigation or monitoring is proposed in relation to this impact during the deployment and operation of the Penguin WECs (WECs 1, 2 and 3).
Entanglement in mooring lines or cables leading to injury or death	Cetaceans Basking shark	A study commissioned by Scottish Natural Heritage (SNH) concluded that moorings associated with marine renewable energy devices are unlikely to pose a major threat in terms of entanglement risk to	No specific mitigation or monitoring is proposed in relation to this impact during the deployment and operation of the Penguin WECs (WECs 1, 2 and 3).

⁶ Beharie, R. and Side, J., (2012) "Acoustic Environmental Monitoring – Wello Penguin Cooling System Noise Study." A report commissioned by Aquatera Limited. International Centre for Island Technology, Report No. 2012/01/AQ. Available at: <https://tethys.pnnl.gov/sites/default/files/publications/Wello%20EMEC%20System%20Noise%20Study.pdf> Accessed 19 April 2018.



Potential residual impact	Receptor	Summary of impact	Proposed mitigation and monitoring measure(s) and reporting
		<p>cetaceans and basking sharks due to the size and mass of the moorings. However, there is a greater risk for baleen whales⁷ due to their large size and foraging habits (Benjamins <i>et al.</i> 2014). There are few large baleen whale occurrences at the site with any visitors being transient and unlikely to come into contact with the project infrastructure</p> <p>No anticipated significant impacts are expected from the presence of 18 mooring lines and three device umbilical cables feeding into a 4-way subsea electrical hub.</p>	<p>Reporting</p> <p>Any notable events will be recorded and reported to Marine Scotland no later than 24 hours after observation.</p>
Presence of WEC and associated infrastructure leading to barrier effects	Cetaceans Seals Basking sharks	The presence of three Penguin WECs and associated infrastructure within the Billia Croo test site is not expected to result in any significant barrier effects for marine mammals or basking sharks.	No specific mitigation or monitoring is proposed in relation to this impact.
Changes to hydrodynamics and sediment regime	Hydrodynamic and physical processes	No important impacts of relevance to hydrodynamics or physical processes are expected from developments at Billia Croo.	No specific mitigation or monitoring is proposed in relation to this impact.
Electromagnetic field (EMF) effects	Diadromous fish, gadoids and elasmobranchs	EMF effects are not expected to be a significant issue for three 41mm diameter electrical cables and a 4 way electrical hub at the site.	No specific mitigation or monitoring is proposed in relation to this impact.

⁷ Such as the fin whale *Balaenoptera physalus*, or humpback whale *Megaptera novaeangliae*.



4 REFERENCES

EMEC/Aurora Environmental, 2009. Environment Description for the EMEC Wave Test Site Billia Croo, Orkney [pdf online] Available at: <file:///D:/Downloads/Billia%20Croo%20Environmental%20Description%20REPO96-04-03.pdf> Accessed 12 June 2018.

Aquatera, 2018. CEFOW Penguin Array Environmental Report.

Orcades Marine, 2018. Fortum Project-specific Navigation Risk Assessment Addendum.

Wello Oy, 2018. CEFOW – Penguin Array Project Information Summary.



5 APPENDICES

APPENDIX A SUPPLEMENTARY RESEARCH PLAN

Under the CEFOW project, the universities of Exeter, Plymouth and Uppsala have received grant funding to undertake environmental research campaigns to investigate the responses of seals, seabirds, fish and seabed organisms to the deployment of single and multiple WECs. The proposed investigative research utilises a range of novel and established marine wildlife population census and behavioural observation techniques. In summary, the proposed research includes:

- Device-mounted HD cameras to assess seal and seabird utilisation and behaviour;
- Sonar survey to investigate fish aggregation;
- Annual towed underwater camera survey to assess response of seabed biodiversity to device; and
- Annual static underwater camera survey to assess mobile species distribution and behaviour.

It is also worth noting that the European Commission have accepted the Sea Wave project (Strategic Environmental Assessment of Wave energy technology) for funding under the European Maritime and Fisheries Fund (EMMF). Research under the Sea Wave project will include an acoustic characterisation of WEC devices.

The developer will actively pursue opportunities to undertake and facilitate strategic environmental research around the array and the wider test site during the project and will work closely with Marine Scotland and Scottish Natural Heritage to develop any research plans. Furthermore, the developer would welcome any additional research by other interested parties around the array during its operation at EMEC.



APPENDIX B VESSEL MANAGEMENT PLAN (VMP)

B.1 INTRODUCTION

This VMP details the anticipated type and number of vessels that will be used during the installation, O&M and decommissioning of the CEFOW array at EMEC's Billia Croo site. It also highlights the likely ports and transit routes that will be used during all phases of the deployment.

B.2 VESSEL DETAILS

Deployment of the anchors and devices will be undertaken using a multi-cat vessel (eg Figure B.1 and Figure B.2) assisted by a support vessel such as a second multi-cat, a workboat (eg Figure B.3) and a RIB (eg Figure B.4). Vessel information is provided in Appendix table B.1.

Appendix Figure B.1 Example multi-cat vessel GM Green Chief



Appendix Figure B.2 Example multi-cat vessel GM Green Isle



Appendix Figure B.3 Example work boat vessel GM Green Quest



Appendix Figure B.4 Example support vessel – rigid inflatable boat (RIB)



The selection and contracting of vessels is primarily driven by market conditions, vessel availability and ultimately, cost. Therefore, the actual vessels will be selected near to the time of works. The developer will confirm the project vessel spread with Marine Scotland at the earliest possible opportunity prior to works commencing as required (as per normal maintenance activities).

Appendix table B.1 Vessel information

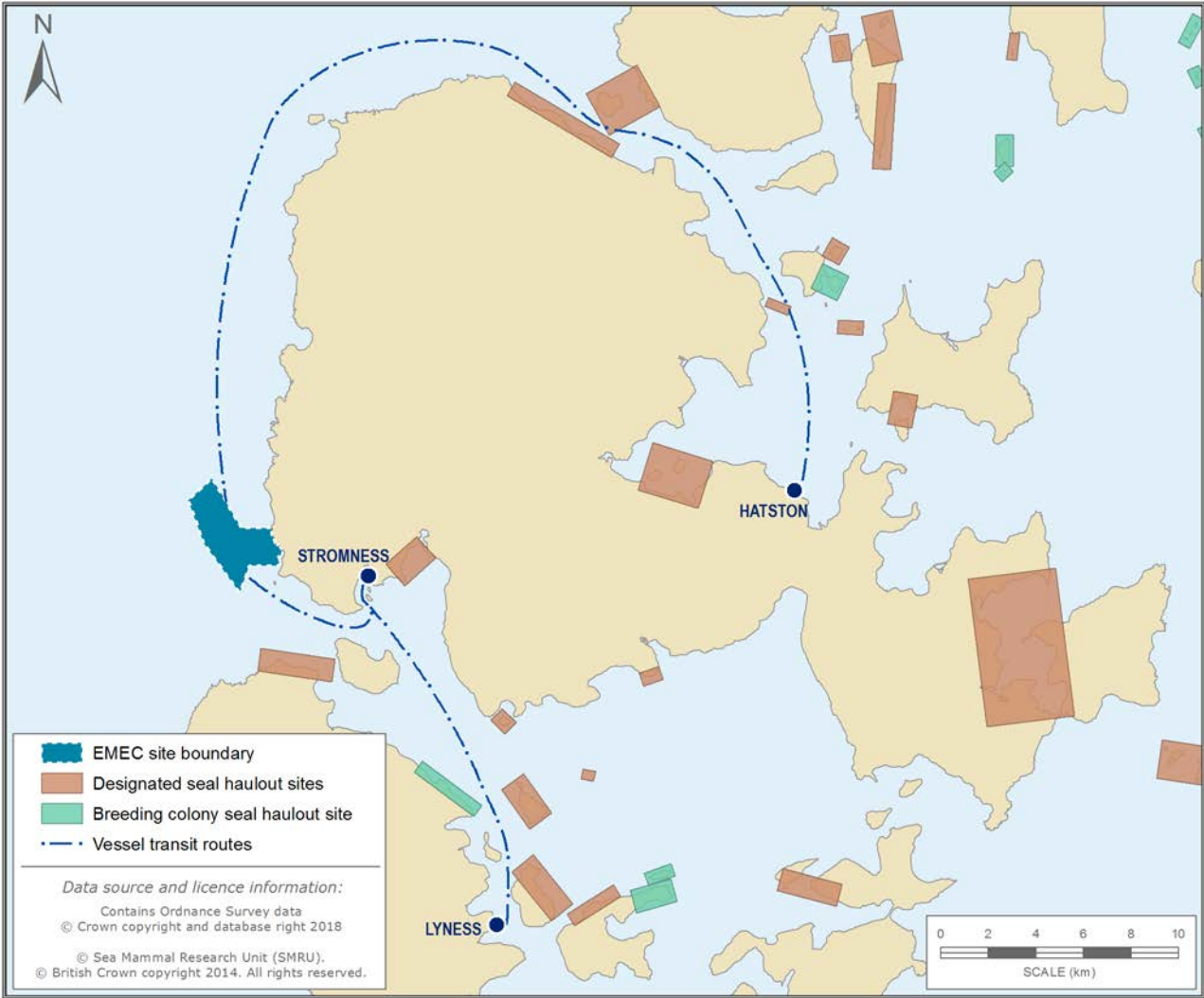
	GM Green Chief	Green Isle	GM Green Quest
Flag state	UK	UK	UK
Port	Stromness	Stromness	Stromness
Year of build	Built 1980, rebuilt 2009	2015	2010
Type	Multi-purpose tug/ workboat	Multi-cat	Wind farm support vessel
Length	26m	27.7m	17.8m
Beam O.A.	7.8m	12.45m	6.4m
Draught	3m	2.85m	1.5m

B.3 VESSEL ROUTES

For deployment and removal of the Penguin WEC devices the route north and west from Hatston or the route across Scapa Flow from Lyness Pier will be used. Multiple removals and re-installation of devices is not planned so these routes will seldom be used. For regular maintenance and inspection purposes ports in Stromness will be used. The transit routes between these ports and the test site are shown in Appendix Figure B.5. Vessels will as far as possible avoid passing within 500m of any identified seal haul-out site when in transit. Seal haul-outs with a 500m buffer and suggested vessel routes in close proximity to the Billia Croo test site are provided in Appendix Figure B.5.



Appendix Figure B.5 Transit routes to site and seal haul-outs with 500m buffer



A designated Marine Operations Manager/Marine Superintendent is responsible for the discharge of relevant licence conditions whilst at sea. The developer is in the progress of appointing one.

APPENDIX C COMMITMENTS TABLE/REGISTER

Appendix table C.2 Commitments register

Ref	Issue	Commitment or action	Responsibility	Timescales	Status
1	Marine Operations	Detailed method statements to be applied throughout and a marine coordinator with significant experience will be employed to oversee the operation. Where practicable vessel crews will have experience of Orkney or similar waters. Vessels to be checked for sound status before hire; cleaned of any bulk or deck contaminants and will follow good maritime practice at all times.	Fortum / Green Marine	Contractor selection, mobilisation & operation	Ongoing
2	Communications	Ensure communication systems are clear and do not interfere with local marine communications systems.	Fortum	Design	Ongoing
3	Environmental Incidents	Oil spill contingency plans will be drafted and adhered to in the event of an incident.	Fortum	Design Installation and operation phases	Ongoing
4	Materials and emissions	Where practicable limit fuel use and minimise engine exhaust emissions.	Fortum	Installation and operation phases	Ongoing
5	Device marking and notice to mariners	The device will be charted in accordance with UKHO requirements and all relevant notices to mariners will be issued by developers as per EMEC SOP063.	Fortum	Design Installation and operation phases	Ongoing
6	Mitigation of potential environmental impacts	The following mitigation measures will be applied prior to, during and following all relevant works: Vessel transit routes will not enter within at least 500m of any seal haul-out sites wherever possible. The Scottish Marine Wildlife Watching Code (SMWWC) will be adhered to wherever possible.	Fortum	All phases	Not started



Ref	Issue	Commitment or action	Responsibility	Timescales	Status
7	Reporting	The following reports/documents will be prepared and submitted for consultation and review: Table of deposits (form FEP5) following installation and device commissioning Environmental Monitoring Report 28 days after final device (WEC 3) commissioning	Fortum		
8	Contingency planning	Develop emergency response plans in accordance with EMEC ERP procedures.	Fortum	Design	Ongoing
9	Local contracting	Where appropriate skills and services are available locally, every effort will be made to work with local companies and to develop ongoing support capacity for tidal energy operations in Orkney	Fortum	Contractor selection	Ongoing

Note: Mitigation measures specific to navigation risks are included in the Project-specific NRA Addendum to the EMEC Billia Croo Test Site NRA (Orcares Marine, 2018).



APPENDIX D RELEVANT MARINE LICENCE CONDITIONS

TBC FOLLOWING DETERMINATION

