

EVOPD ¼-SCALE TIDAL ENERGY CONVERTER: DECOMMISSIONING PROGRAMME – SANDA SOUND, KINTYRE, SCOTLAND

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1 INTRODUCTION

Evopod E35 is a prototype $\frac{1}{4}$ scale tidal energy converter, and will be commissioned and tested in the sea from the 3rd quarter of 2014 at a nearshore site in Sanda Sound, Argyll & Bute. In accordance with the requirements of the Energy Act 2004, we have assembled this decommissioning plan, to outline our methods and procedures for the proper decommissioning of this marine renewable prototype test project. Evopod E35 and its associated infrastructural elements, licenses and leases are all wholly owned or registered in the name of Oceanflow Development Ltd., a Scottish registered wholly owned subsidiary of Newcastle-upon-Tyne based tidal technology development company Ocean Flow Energy Ltd.

1.1 EXECUTIVE SUMMARY

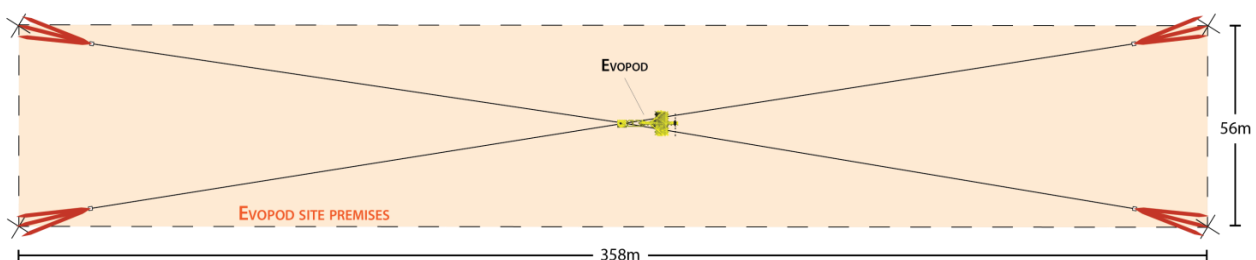
This document details the full procedure for decommissioning of an Evopod E35 floating tethered tidal energy conversion system, in accordance with the Energy Act 2004, Part 2, Chapter 3. This report contains (i) a complete description of the device and its mooring, including a breakdown of the materials incorporated within the structure, (ii) the methods proposed for removal of the device and the mooring, (iii) the potential and anticipated environmental impacts of the decommissioning process, (iv) the estimated costs of decommissioning and post-decommissioning procedures, plus the financial assurances offered to cover these costs, (v) plans for post-decommissioning monitoring.

2 BACKGROUND

Evopod E35 is a 4.5m diameter horizontal axis tidal turbine, mounted on a semi-submerged floating platform, tethered to the seabed with a 4-point spread mooring attached to gravity anchors. The rated power output of the device is 35kW, and it displaces 12 tonnes. The device is owned and will be operated by Oceanflow Development.

2.1 PROJECT LAYOUT & SPECIFICATION

A plan view of the device (Evopod E35) and mooring is shown below. The power cable connection to shore is not shown in this diagram.



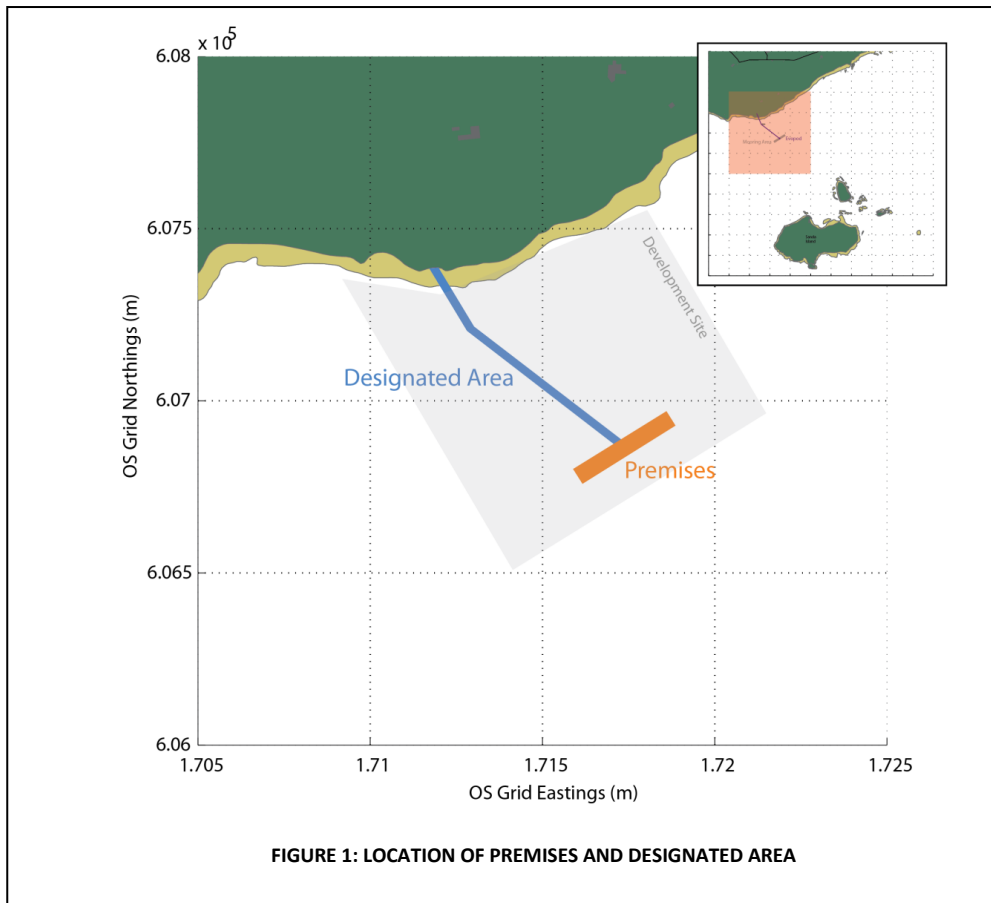
The four gravity anchors are made up of 16 tonnes of heavy gauge steel chain each, for a total of 64 tonnes. The mooring spread consists of 11.5 tonnes of steel chain and mooring jewellery.

Electrical power is generated on board Evopod by a Rotor squirrel-cage induction generator, rated to 35kW. The output of this generator is regulated to a constant 400V and is conveyed via an umbilical cable to a seabed mounted gravity base housing a transformer where the output is stepped-up to 3kV for transmission to shore.

The power transmission cable is 1000m in length, and is rated for transmission at 3kV. The cable is held in place on the seabed using steel cable protectors and heavy chain.

2.2 SITE & CO-ORDINATES

2.2.1 The Sanda Sound test site leased from The Crown Estate consists of the “Premises” where the E35 device and its mooring system will be deployed and the “Designated Area” where the seabed power cable is laid for exporting E35’s electrical output back to the shore. The Premises and Designated Area are located within the boundary of the “Development Site” which is allocated by The Crown Estate exclusively to Oceanflow for the testing of its tidal turbines.



Name	Latitude	Longitude
Premises Coordinate A	55°18.211' N	5°35.7086' W
Premises Coordinate B	55°18.236' N	5°35.7392' W
Premises Coordinate C	55°18.125' N	5°36.0167' W
Premises Coordinate D	55°18.1' N	5°35.9861' W
Designated Area Coordinate A	55°18.438' N	5°36.403' W
Designated Area Coordinate B	55°18.431' N	5°36.422' W
Designated Area Coordinate C	55°18.345' N	5°36.292' W
Designated Area Coordinate D	55°18.338' N	5°36.311' W
Designated Area Coordinate E	55°18.174' N	5°35.856' W
Designated Area Coordinate F	55°18.163' N	5°35.869' W

2.3 SITE ENVIRONMENT

2.3.1 SANDA SOUND

Sanda Sound is located at the South-Eastern end of the Mull of Kintyre, between the mainland and Sanda Island. Our installation site is approximately 800m offshore SSE from Pennyseorach Farm (see Figure 3) at central coordinates 55°18.168'N, 5°35.863'W. The nearest port is Campbeltown, on the East Coast of Kintyre.

2.3.2 WAVE, TIDAL STREAM & WEATHER CONDITIONS

This site was chosen for its moderately strong tidal currents and for its exposure to waves in order to robustly test the performance and survivability of the device. The chart indicates up to 5 knots in the deeper channel of Sanda Sound, 1-2km south of our site. However, our measurements indicate the maximum spring tide current in the vicinity of our install site is 4 knots. Any work at the site is always preferentially scheduled for a neap tide, where the currents will generally reach a daily peak of 2 knots. The compass bearing of the tidal stream current is generally the same at our site as is indicated by the arrows on the chart in Figure 5.

Sanda Sound is subject to ocean swells originating in both the Irish Sea and the Atlantic Ocean, and is also exposed to strong prevailing Westerly winds, as is the whole Kintyre peninsula. The mooring site is however somewhat protected from these swells by the Kintyre peninsula and Sanda Island.

2.3.3 SEABED

Our own benthic survey work has revealed the seabed at our installation site to be primarily bare rock, with pebbles, stones, rocks, and occasionally large rocks/boulders. The seabed is general flat with a very shallow gradient (approximately 1/50 across the area of the mooring) – see Figure 2. Any vessel attempting to anchor itself in the Sound must have suitably heavy clump weight anchors on board, as conventional drag-in anchors will not hold.

2.3.4 FISHING AND SHIPPING ACTIVITY

A navigational risk assessment (NRA) was carried out by Oceanflow, utilising two data sources to ascertain both vessel transit and fishing activity in the sound: (i) vantage point survey, (ii) historical AIS. The results of the NRA (report ref: ODL-P10-003-E4008) were that traffic in the Sound was very low both in summer and winter, especially through the inshore region in which Evopod will be located. Fishing activity was extremely low, with only a single vessel identified using the Sound to deploy lobster pots. The owner of the vessel was consulted via the Campbeltown Marina Harbourmaster.

2.3.5 CONNECTIVITY WITH CONSERVATION AREAS

The location of Sanda Sound places it in the peripheral vicinity of two European protected sites, Rathlin Island SPA and Ailsa Craig SPA. We carried out a program of environmental monitoring in the Sound, and submitted data and reports to Marine Scotland as part of the Marine Licensing process (add report ref). The recommendation of SNH regarding the Special Areas of Conservation (under the Habitats Directive) and Special Protection Areas (under the Birds Directive) was as follows:

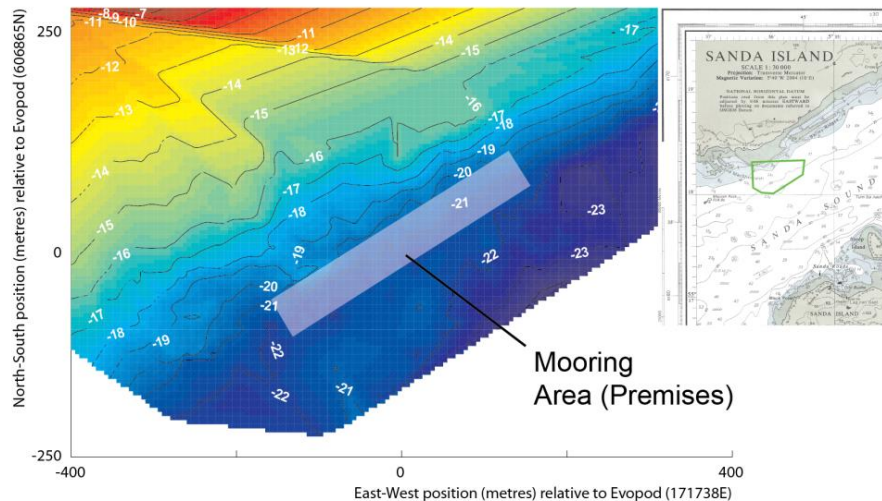


FIGURE 2: SEABED BATHYMETRY AROUND INSTALLATION SITE

“In our view, it is unlikely that the proposal will have a significant effect on any of the qualifying features of Rathlin Island SPA, Alisa Craig SPA, South-east Islay Skerries SAC or Treshnish Isles SAC. An appropriate assessment is therefore not required.”

There were further recommendations regarding how to proceed regarding the project, which have been integrated into Oceanflow’s Environmental Monitoring Programme (report ref ODL-P10-003-E4003).

3 ITEMS SUBJECT TO DECOMMISSIONING

The items subject to decommissioning are detailed in the following subsections.

3.1 EVOPOD E35

3.1.1 SPECIFICATION

Technology:	Semi-submerged floating tethered tidal energy converter
Turbine type:	Single, 4-bladed horizontal axis turbine
Turbine Diameter:	4.5 metre
Device displacement:	12 tonnes
Generator type:	Squirrel-cage induction
Generator rating:	35kW, 400V

3.1.2 DESIGN

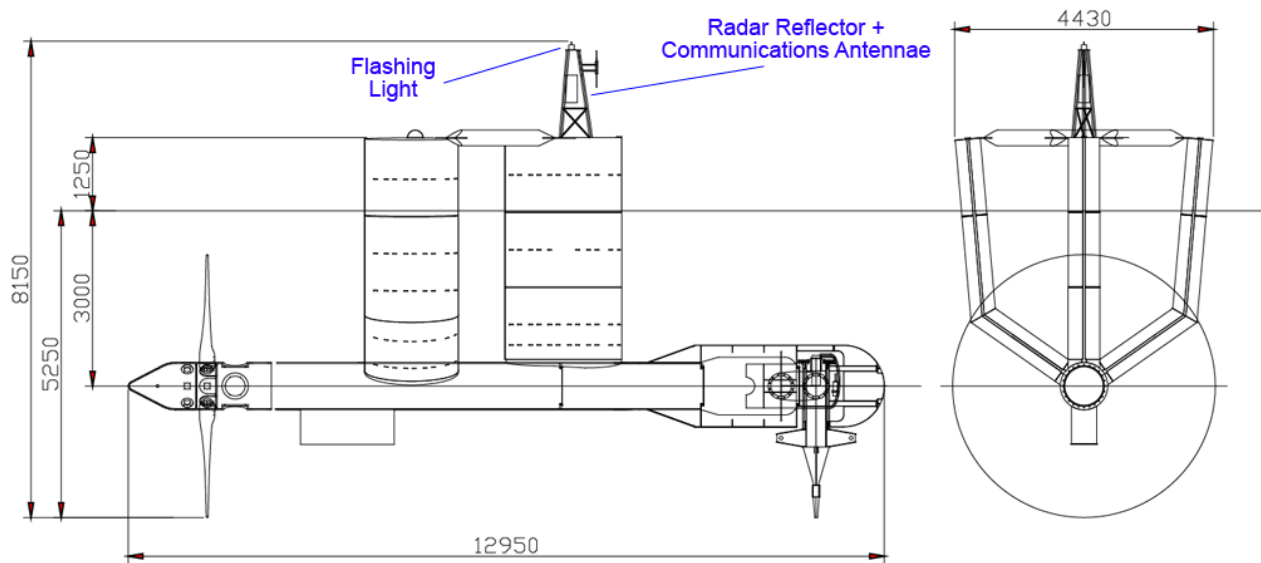


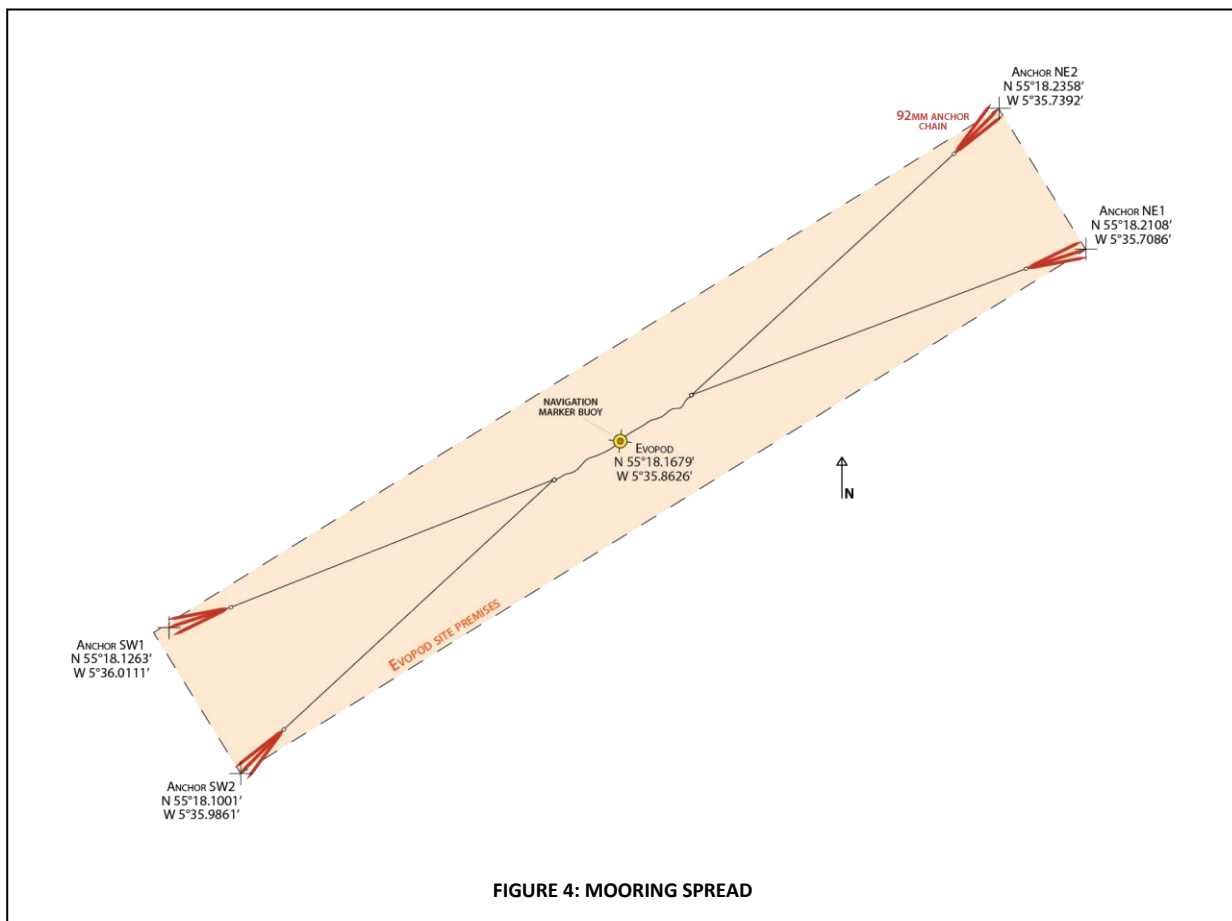
FIGURE 3: E35-01 GENERAL ARRANGEMENT

3.2 MOORING

3.2.1 SPECIFICATION

Technology:	Four-point catenary spread mooring
Line type:	Stud link chain
Anchor type:	Steel clump weight (92mm stud link chain)
Line mass:	4 x 3.0 t (12.0 t)
Anchor mass:	4 x 16.3 t (65.2 t)

3.2.2 LAYOUT



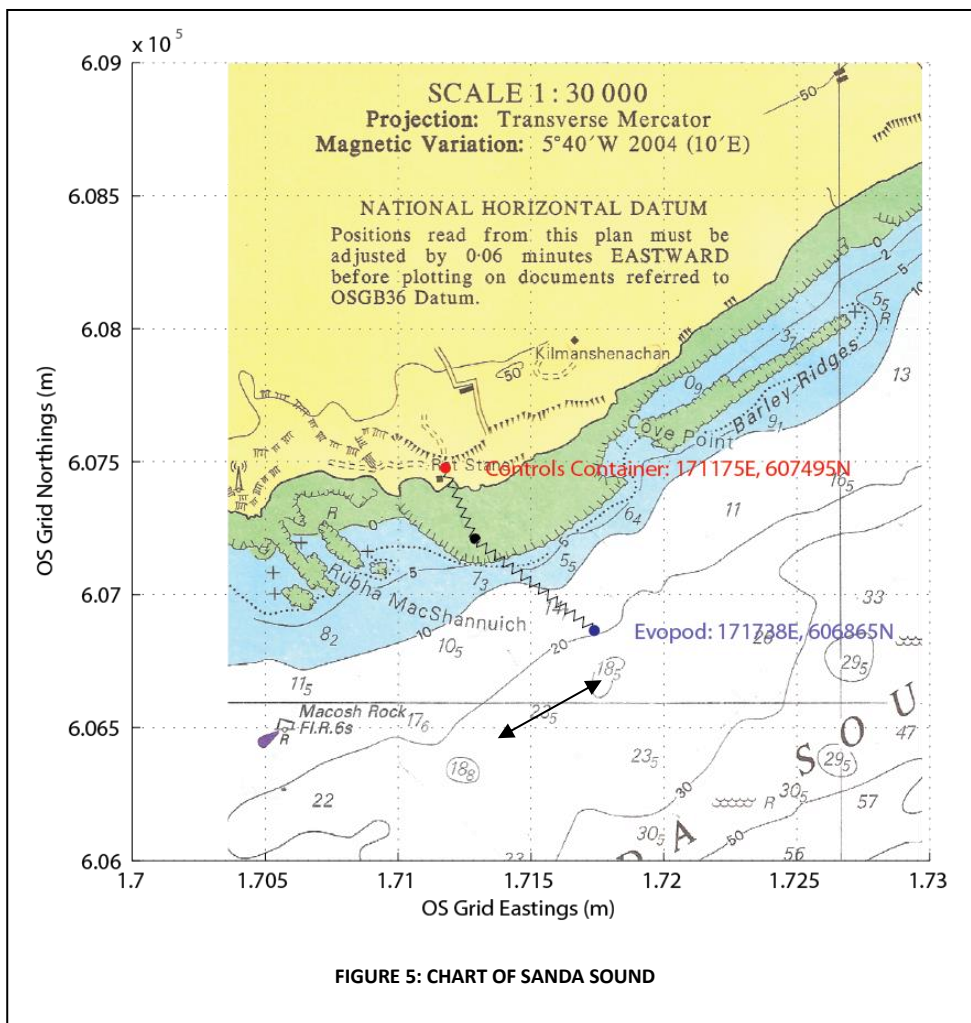
3.3 SEABED CABLE

3.3.1 SPECIFICATION

Outer Material: Polyurethane
 Density: 3 kg/m
 Overall Diameter: 40mm
 Overall Length: 900m
 Length on seabed: 760m

3.3.2 CABLE ROUTE

Name	Latitude	Longitude
Evopod	55°18.168' N	5°35.863' W
Cable Landing MHWS	55°18.434' N	5°36.413' W
Controls Container	55°18.491' N	5°36.424' W



4 DECOMMISSIONING METHODS

4.1 SUMMARY

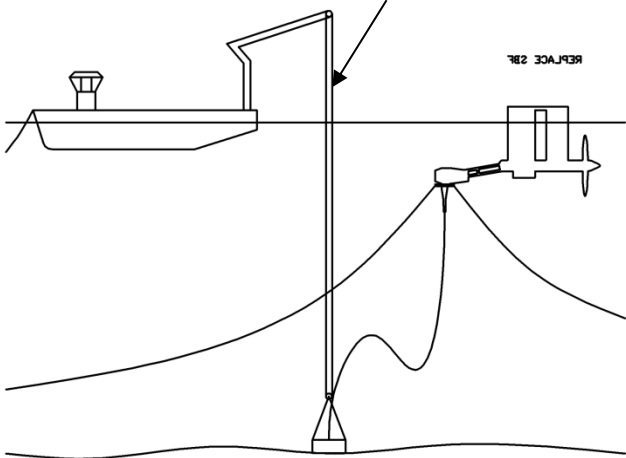
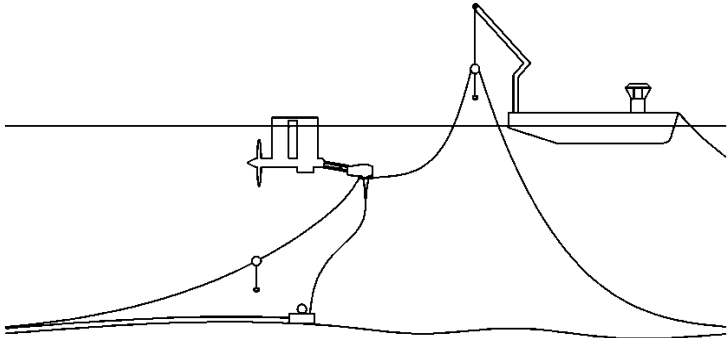
Due to the nature of this project, and its requirement of only superficial material deposits on the seabed, the process for decommissioning will be almost purely a reversal of the installation procedure. The turbine itself floats at the surface, and will simply be disconnected and towed away, while the mooring, anchors and cable, which purely consists of chain of various sizes will be recovered in much the same way as they were laid – using the winches and cranes of a workboat. The decommissioning process can be split into three separate phases: (i) Disconnection and removal of Evopod, (ii) uplift and removal of moorings and anchors, (iii) uplift and removal of seabed cable.

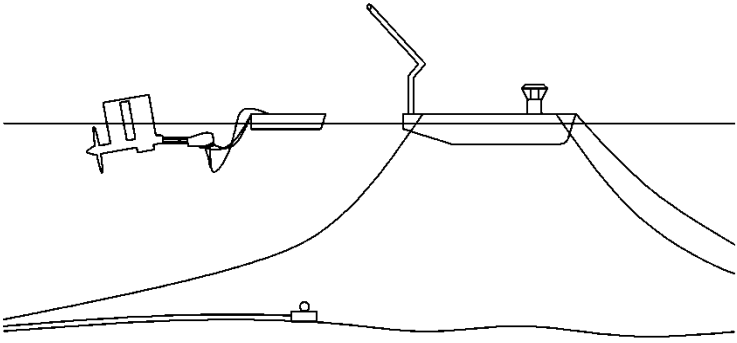
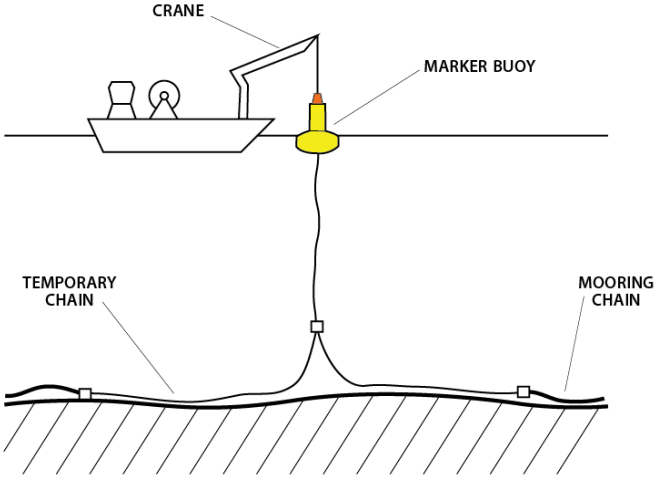
Prior to removal of E35-01, Statutory Sanction will be sought from The Commissioner of Northern Lights to remove the requirement to display a Special Mark on the turbine and to discontinue the deployment of an alternative Special Mark buoy at the Sanda Sound tidal test location. If sanction is given to permanently remove the Special Mark then HM Hydrographic Office will be advised so that a Notice to Mariners can be issued and the appropriate charts updated. If the Commissioners require that the Special Mark remains on station for a set time from the planned removal of E35-01 then E35-01 will be replaced by a Special Mark buoy with an appropriate anchor and mooring system which will be recovered at some future date when permission for its removal is granted by The Commissioners for Northern Lights.

4.2 DISCONNECTION AND REMOVAL OF EVOPOD

<p>Assembly of E35 recovery vessels at Sanda Sound</p>	<p>The recovery of E35 is to take place in up to Beaufort force 3 / sea state 2, but can take place at any time throughout the lunar month.</p> <p>The recovery vessel (RV), E35 tow vessel and a standby safety RIB are to rendezvous at the E35 deployment site at 1 hour before low water slack. E35 is to be shut down and the shaft brake applied. E35 is to be locked-out from the grid at the Controls Container.</p>
<p>Release of the umbilical from the SCF</p>	<p>The RV is to deploy its 5t clump weight anchor between the two westerly E35 anchors. The RV is then to pay out its mooring line until it lies just upstream (flood tide) of the SCF.</p> <p>At slack water the pick-up buoy is to be released from the SCF using the acoustic release mechanism. The pick-up buoy is to be retrieved by the RIB and brought to the RV.</p> <p>The RV is to use a winch to haul up the SCF with the subsea cable and umbilical attached until the SCF approaches the surface. A lifting line from the RV's crane is to be attached to the SCF and the SCF is to be recovered onto the deck of the RV.</p>

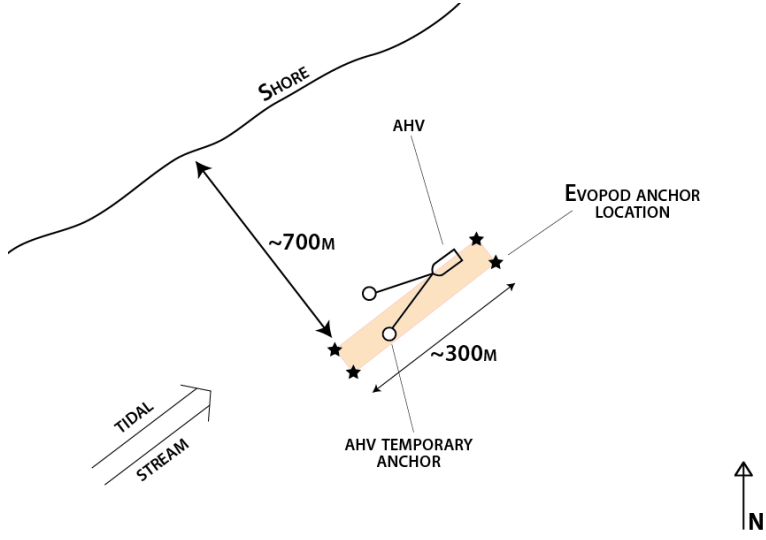
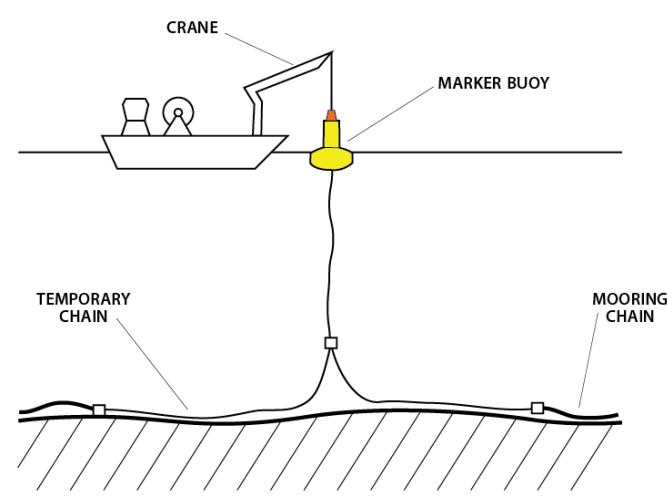
Pick-up buoy and line

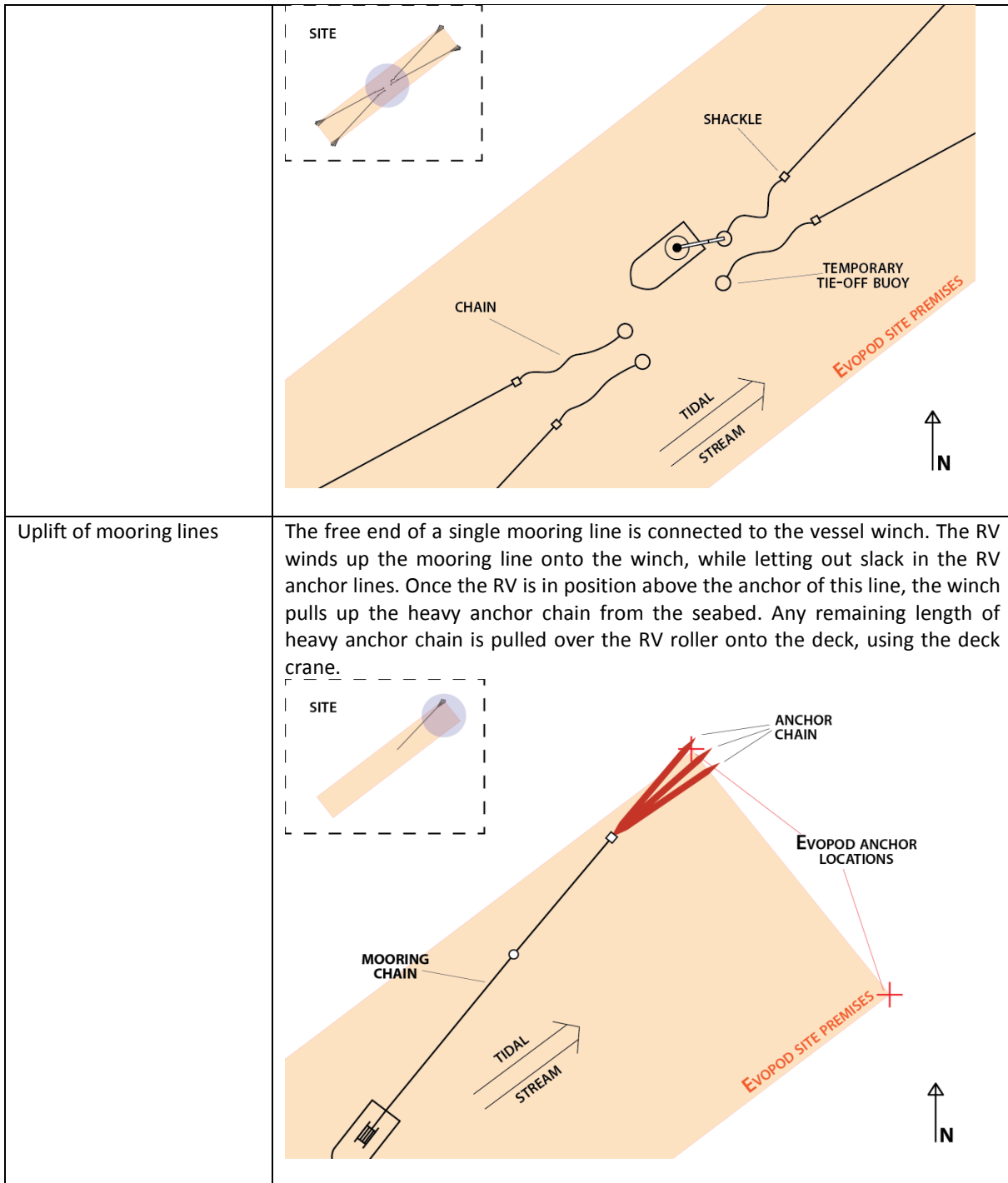
	 <p>The umbilical flange connection is to be unbolted from the SCF and the umbilical cable's dry mateable plugs are to be decoupled from the subsea cable's dry mateable sockets and a blanking flange fitted to the socket.</p> <p>The SCF with the umbilical now disconnected is to be lowered to the seabed.</p> <p>The umbilical free end is to be retained on the RV.</p>
<p>Release of E35 from mooring</p>	 <p>The RV is to position itself downstream of E35 and recover and un-shackle in turn the catenary anchor lines, buoing off the anchor lines before lowering to the seabed.</p> <p>The process is repeated until all four anchor lines are retrieved, disconnected from E35 and E35 made fast to the RV.</p> <p>A tow line is attached to E35 short connector chains and made fast to the RV. The tow line is allowed to pay out so that E35 drifts away from the RV on the tide. The tow line is then passed to the tow vessel and E35 is now free to be towed back to Campbeltown accompanied by the RIB safety vessel to keep other vessels clear of the tow.</p>

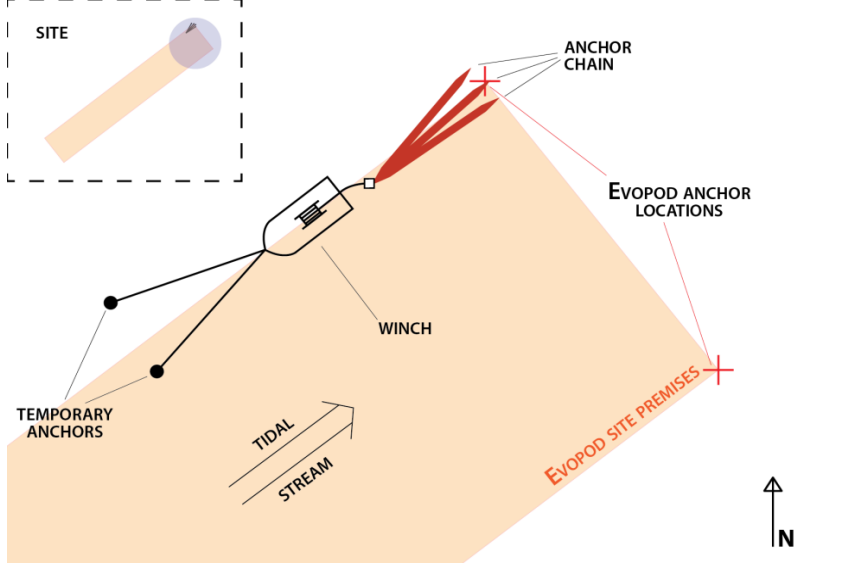
	 <p>The four mooring lines held by the RV are brought together and connected to a swivel. The temporary navigation buoy is shackled to the swivel and the complete assembly is released into the sea.</p> <p>The BDV is to recover its 5t clump weight anchor and return to Campbeltown.</p>
<p>Navigation Buoy</p>	 <p>CRANE</p> <p>MARKER BUOY</p> <p>TEMPORARY CHAIN</p> <p>MOORING CHAIN</p>
<p>Recover E35 to shore</p>	<p>The tow vessel is to bring E35 alongside at Campbeltown harbour.</p> <p>A shore crane rated at 20t at 5m outreach from the quayside is prepared for lifting E35 out of the water. Strops are to be lowered and shackled onto the padeyes on top of E35's struts and MWB.</p> <p>E35 is lifted out of the water and place it on its cradle on the quayside.</p> <p>E35 can now be stored or decommissioned / broken up at. Campbeltown or transported by road or sea to another deployment site.</p>

4.3 UPLIFT AND REMOVAL OF MOORINGS AND ANCHORS

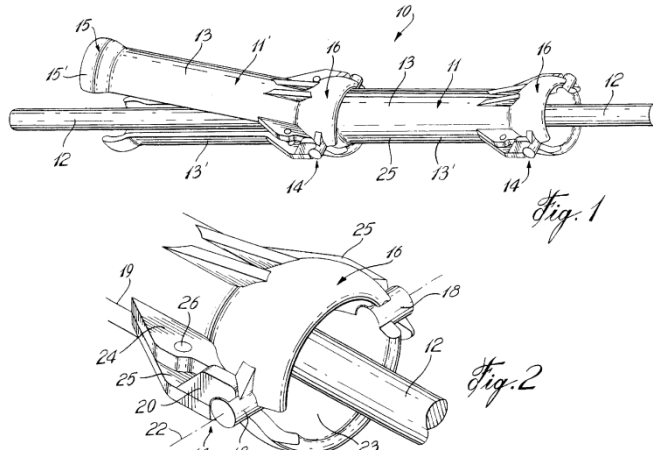
<p>Assembly of E35 mooring recovery vessels at Sanda</p>	<p>The recovery of E35 moorings can take place in up to Beaufort force 6 and in</p>
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<p>Sound</p>	<p>up to sea state 3, but can take place at any time throughout the lunar month.</p> <p>The recovery vessel (RV) and a standby safety RIB are to rendezvous at the E35 deployment site at 1 hour before low water slack. The RV will drop sufficient temporary anchors, or tie off to the existing mooring to carry out the operation.</p> 
<p>Navigation Buoy Recovery</p>	<p>The RV recovers the navigation buoy using the deck crane.</p> 
<p>Mooring lines separated</p>	<p>The four mooring lines are detached from the navigation buoy and tied off separately to temporary buoys.</p>



	 <p>The diagram illustrates the mooring recovery process. A vessel is positioned near a mooring structure. A winch is used to pull in mooring lines. Temporary anchors are used to secure the lines. The mooring lines are then transported to the shore. The diagram also shows the location of the mooring structure relative to the tidal stream and the Evopod site premises. A north arrow is provided for orientation.</p>
<p>Recover mooring to shore</p>	<p>The uplifted mooring lines and anchors are transported to Campbeltown and offloaded at the harbour for sale as scrap or re-use on another project.</p>

4.4 UPLIFT AND REMOVAL OF SEABED CABLE

<p>Assembly of E35 recovery vessels at Sanda Sound</p>	<p>The recovery of E35 seabed cable can take place in up to Beaufort force 4, sea state 2,, and can take place at any time throughout the lunar month.</p> <p>The recovery vessel (RV) and a standby safety RIB are to rendezvous at the E35 deployment site at 1 hour before low water slack. The RV will drop sufficient temporary anchors, or tie off to the existing mooring to carry out the operation.</p> <p>The seabed cable is completely isolated from the grid connection at the shore end of the cable before decommissioning commences.</p>
<p>Removal of cable anchor chain</p>	<p>The seaward end of the seabed cable is lifted onto the deck of the RV. The cable end weight and electrical connection is removed, then the cable anchor chain is connected to the RV main winch. The RV moves towards shore along the path of the cable, removing and winding up the cable anchor chain as it goes.</p>
<p>Seabed cable retrieval</p>	<p>The landward end of the cable is disconnected from its connection to the Control Container. The seaward end of the cable is lifted to the deck once again using the deck winch. A kelly's grip is used to couple the cable to the main winch. The main winch then pulls in the cable, through the inshore cable protectors and onto the barrel of its deck winch.</p>
<p>Inshore Cable protectors retrieval</p>	<p>Cable protectors are fitted to the inshore section of the cable. The inshore length of cable protectors cannot be retrieved by the RV as the water depth is too shallow for the RV. The inshore cable protectors are therefore recovered by passing a line from the RV main winch to shore. The line is shackled onto the shoreward end of the inshore cable protectors and routed around a shore pulley. The main winch pulls on the line, and the cable protectors are pulled along the seabed and onto the beach, where they are collected and uplifted.</p> 

4.5 WASTE MANAGEMENT

There will be no waste generated or left on site during decommissioning. All equipment will be removed from the project site and either reused or recycled. A list of deposits recovered from the seabed will be submitted to Marine Scotland. The table below outlines the destination of each component after decommissioning.

Component	Post-Decommissioning Destination
Evopod E35 hull & internal components	Refurbished for scientific purposes / sold as scrap metal
Seabed power cable	Sold as scrap metal
Mooring and anchor chains	Sold as scrap metal

5 ENVIRONMENTAL IMPACTS

The environmental impact of the project will be recorded and assessed during operation, as part of Oceanflow's Environmental Monitoring Programme. To assess the impact of decommissioning, a seabed survey will be planned, and the decommissioning operations will be monitored to record any interactions with vulnerable wildlife.

5.1 SEABED SURVEY

Within 3 months of completion of decommissioning, an ROV will be sent down to inspect the site of the project, to photographically document the state of the seabed. The ROV will also be sent along the path of the power export seabed cable, as far inshore as is safe for the survey vessel. This photographic documentation will serve as a record to assess the effect on the seabed of the decommissioning of Evopod, its spread mooring and power export cable.

The video camera on board the ROV shall be of HD resolution if possible. If an ROV of this specification is not available, then in place of an ROV, a drop-down camera will be used. If neither ROV nor drop-down cameras are available at the time of inspection, divers will be called in to perform the survey work. The seabed survey will be carried out at a similar time of year to the baseline seabed survey.

5.2 MARINE MAMMAL WATCH

During decommissioning of Evopod and its moorings, Oceanflow will accommodate a marine mammal observer, if considered appropriate by Marine Scotland.

6 CONSULTATIONS WITH INTERESTED PARTIES

The following table details the consultations with interested parties that took place regarding the Evopod E35 deployment in Sanda Sound project. In addition to this, our project plans were made publicly available through the following: (i) The Argyll & Bute planning application process, (ii) A public information day, held in Campbeltown on 14/07/2012, (iii) A public notice in the Campbeltown Courier newspaper on 9/9/2011 and (iv) A local notice in the Southend Post Office, South Kintyre.

Interested Party	Form of Consultation
Scottish Fishermans Federation	Via Marine Scotland
Scottish Fisheries Protection Agency	Via Marine Scotland
Chamber of Shipping	Direct Correspondence
Royal Yacht Association (Scotland)	Via Marine Scotland and by Direct Correspondence
Joint Nature Conservation Committee	Via Marine Scotland
Scottish Environment Protection Agency	Via Marine Scotland
Historic Scotland	Direct Correspondence
Maritime and Coastguard Agency	Via Marine Scotland
Northern Lighthouse Board	Via Marine Scotland
Scottish Natural Heritage	Via Marine Scotland
Campbeltown Harbour	Direct Correspondence

In addition, following submission of the draft Decommissioning Plan to DECC on the 21st December 2012, DECC consulted with key stakeholders as detailed below.

Interested Party	Form of Consultation
Marine Scotland	Draft Decommissioning Plan to Marine Scotland - Licencing Operations Team (MS-LOT)
UK Hydrographic Office	Draft Decommissioning Plan to UKHO
The Crown Estate	Draft Decommissioning Plan to The Crown Estate

Consultee	Feedback	Oceanflow Response
MS-LOT	<p>The caseworker for this project has reviewed the Sanda Sound Draft decommissioning plan and MS-LOT have the following comments to make.</p> <ul style="list-style-type: none"> • 5.2 Marine Mammal Observation. Marine Scotland would consider that it is appropriate to have a MMO in place during decommissioning. • A Marine Licence to remove the deposits from the seabed may be required. 	<p>A Marine Mammal Observer (MMO) will be in place during decommissioning (see 5.2)</p> <p>Accepted.</p>
UKHO	Nil return from UKHO	Accepted
The Crown Estate	I have reviewed the decommissioning plan, and whilst I do not profess to be a master mariner, the approach appears well considered, practicable and thorough enough to give confidence that it is achievable within the approximate budget Oceanflow have provided for.	Accepted

7 DECOMMISSIONING COSTS

Section withheld – commercial confidentiality.

8 FINANCIAL SECURITY

DECC has laid down its guiding principles regarding decommissioning of offshore renewable installations and its overall approach for ensuring that the field developer has made provision for decommissioning liabilities in their Industry Guidance Notes “Decommissioning of Offshore Renewable Energy Installations under the Energy Act 2004”.

Ocean Flow Energy Limited has provide financial securities to BEIS for the decommissioning of site with a commitment to complete the decommission before the end of 2017.

9 DECOMMISSIONING SCHEDULE

The decommissioning work and seabed survey will be executed and completed before the end of 2017.

10 PROJECT MANAGEMENT

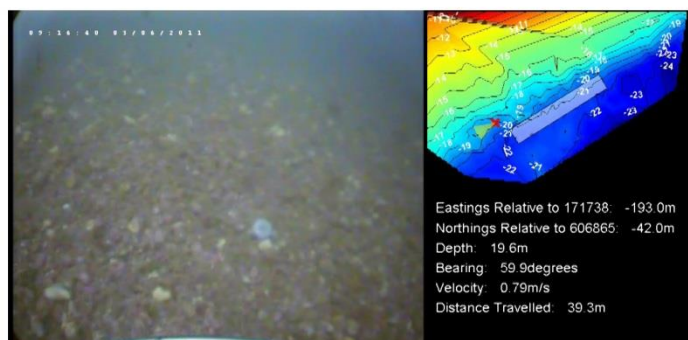
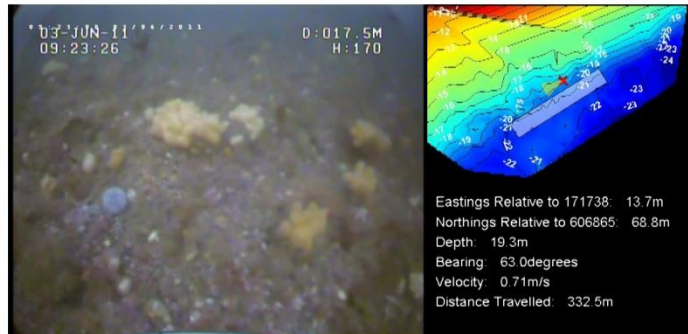
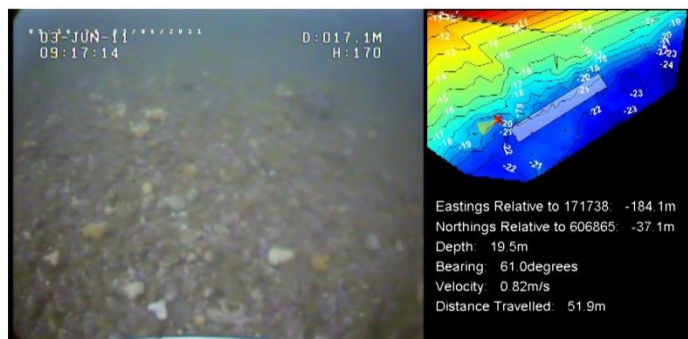
Project management of the Decommissioning process will be carried out by Ocean Flow Energy as the company has the necessary technical experience and knowledge of the Sanda Sound environment and adjacent port facilities to manage the task.

11 SEABED CLEARANCE

Once decommissioning is complete, a survey will be undertaken to confirm that the seabed has been cleared of all deposited material. This will be combined with the environmental survey described in section 5.1. Due to the small scale of the project and that a record is being maintained of all items deposited on the seabed for correlation with the decommissioned and recovered items, we will not extend the search area out to the 500m radius used in the oil and gas industry, rather we will investigate the restricted areas of the seabed where materials were deposited.

In the event that materials are located on the seabed they will be recovered and taken ashore.

The seabed survey will be carried out by a third-party ROV operator, and the obtained footage will be analysed by a contracted specialist.



12 RESTORATION OF SITE HABITAT

The total footprint of all the deposited elements (anchors, mooring chains and power export cable) is 165m². However, most of this is spread out over the site premises, which measures just less than 20000m². Therefore, the coverage of this (still quite small area) is less than 1%. The seabed biotope in Sanda Sound is rocky, with topical gravel and small stones – there is very little to no sediment. This means that there is very little risk of unnatural sediment

build-up due to our mooring system. The only effect likely to be seen is a degree of scouring of the seabed by the mooring lines, and the covering of 165m² of the seabed, which will be uncovered again during the decommissioning process. It is unclear at this point how it would be possible to restore this small area of seabed to its pre-installation state. There will likely be some disturbance of seabed fauna in and around our deposited materials. However, the area disturbed, as mentioned, is small, and there is no obvious reason why this area will not be re-colonised naturally by seabed fauna soon after the decommissioning operation takes place. Oceanflow suggests that the results of a post-decommissioning site survey be used to inform decisions on possible restoration of site habitat.

13 POST-DECOMMISSIONING MONITORING, MAINTENANCE AND MANAGEMENT

No remains are to be left in place at the site therefore no subsequent monitoring is required.

ANNEXURE 1: DECC CONSULTEE'S RESPONSES

From: [REDACTED]@scotland.gsi.gov.uk [mailto:[REDACTED]@scotland.gsi.gov.uk]

Sent: 06 February 2013 12:12

To: [REDACTED] (Energy Development)

Subject: Draft Decommissioning Programme - Oceanflow Development, Tidal (Evopod), Sanda Sound

[REDACTED],

Sorry for the tight to deadline reply on this.

The caseworker for this project has reviewed the Sanda Sound Draft decommissioning plan and MS-LOT have the following comments to make.

- 5.2 Marine Mammal Observation. Marine Scotland would consider that it is appropriate to have a MMO in place during decommissioning.
- A Marine Licence to remove the deposits from the seabed may be required.

Many thanks

[REDACTED]

From: [REDACTED] [mailto:[REDACTED]@UKHO.gov.uk]

Sent: 07 February 2013 11:55

To: [REDACTED] (Energy Development)

Subject: RE: Draft Decommissioning Programme - Oceanflow Development, Tidal (Evopod), Sanda Sound

Nil return from UKHO

[REDACTED]
United Kingdom Hydrographic Office

[REDACTED]
www.ukho.gov.uk

From: [REDACTED] [mailto:[REDACTED]@thecrownestate.co.uk]

Sent: 21 March 2013 17:30

To: [REDACTED] (Energy Development)

Subject: RE: Draft Decommissioning Programme - Oceanflow Development, Tidal (Evopod), Sanda Sound

[REDACTED]

Sorry it has taken so long to respond on this – it got lost in the handover from [REDACTED].

I have reviewed the decommissioning plan, and whilst I do not profess to be a master mariner, the approach appears well considered, practicable and thorough enough to give confidence that it is achievable within the approximate budget Oceanflow have provided for.

Does this give you what you need to close this action out?

Please let me know if not and I'll revisit accordingly.

Best regards,

[REDACTED]
