

OYSTER NO. 1

Monitoring

**R05
(X01)**

June 2009

Revisions

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R05	June 2009, All stakeholder feedback incorporated
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Table of Contents

1	<i>Introduction</i>	4
2	<i>Executive Summary</i>	4
3	<i>Monitoring Programme</i>	5
3.1	Marine Mammal Observation	5
3.2	Underwater Noise Monitoring	11
3.3	Seabed Impact Assessment.....	16
	<i>Appendix A</i>	19
	<i>Appendix B</i>	20

1 Introduction

Under the conditions of the FEPA, CPA and/or EPS licences granted for the installation and testing of Oyster 1 at EMEC, Aquamarine is required to produce a monitoring programme. This document outlines Aquamarine Power's monitoring plans for Oyster 1.

2 Executive Summary

Aquamarine Power Ltd (APL) has developed the Oyster 1 wave energy device for capturing wave energy and converting it into electrical power. The offshore element of the device consists of a seabed mounted power conversion unit (PCU), which comprises an Oscillator flap mounted on a Sub-frame Support Structure. The oscillating action of waves on the flap drive hydraulic rams and the flow is used to drive a generator.

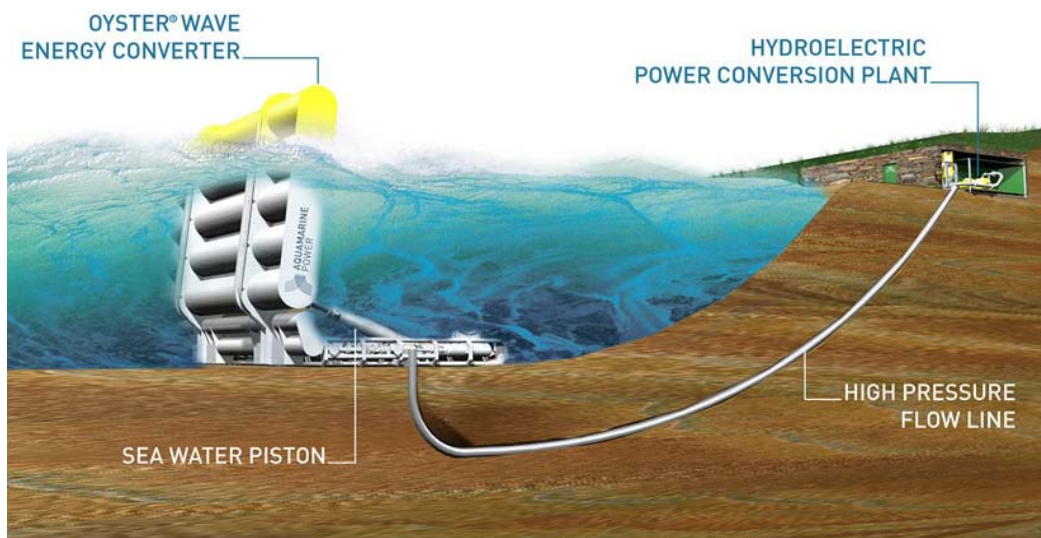


Figure 1: Oyster 1 Wave Energy device

The installation of a full scale Demonstrator Unit, Oyster 1, is scheduled for the summer of 2009 at the European Marine Energy Centre (EMEC) wave device test area in Orkney.

3 Monitoring Programme

As required under the conditions of the FEPA, CPA and/or EPS licences, supported by the Environmental Statement and Addendum, the Oyster 1 monitoring programme shall comprise:

- Marine mammal observations
- Underwater noise monitoring
- Seabed impact assessment

Each of these elements of the monitoring programme are described in detail in the following sections.

3.1 Marine Mammal Observation

MMO Procedure

To ensure that impacts from installation activities, including potential for the generation of underwater noise are minimised, EMEC (in consultation with SNH) has developed a marine mammal observation (MMO) procedure. In accordance with the CPA and EPS licence conditions, the EMEC MMO procedure will be employed at all stages of site preparation and installation, from barge jack up through to installation of the PCU.

Requirements of the EMEC MMO procedure

Look and Listen - Begin at least 30 minutes before commencement of the phase for which the dedicated Marine Mammal Observer (MMO) or a nominated member of the ships company is required (e.g. drilling/piling). Carefully make a visual check from a suitable high observation platform to see if there are any marine mammals within 500 metres (measured from the centre of the works area).

Delay - If marine mammals are seen within 500 metres of the centre of the works area, the start of the operational phase (e.g. drilling or piling) should be delayed until they have moved away, allowing adequate time after the last sighting for the animals to move away (at least 20 minutes).

Soft Start/Operation Phase - If no marine mammals are sighted, the power should be built up slowly from a low energy start-up to give adequate time for any marine mammals that may be present but not visible to leave the vicinity. This build up of power should occur in uniform stages to provide a constant increase in output.

During the operational phase, observations should continue at regular intervals across the phase of works. Only periods when the observer is actually concentrating on looking for marine mammals should be included.

Implementation of EMEC MMO Procedure for Oyster 1 Installation Activities

Operations during the installation of the Oyster 1 device and its foundation are 24hrs. To ensure impacts of the installation activities on marine mammals (including cetaceans, seals and basking sharks) are minimised, MMO observations will be undertaken as per the EMEC procedure prior to the commencement of noisy activities. Aquamarine has identified the following key installation activities highlighted in yellow as being potentially noisy/disturbing.

PCF INSTALLATION

Tow Deep Diver from Stromness, position & jack up
 Divers clearing kelp

Tow PCF from Stromness, Install PCF, level and anchor down

SW PILE
 Reposition Deep Diver for SE pile

Drill socket
 Install pile & grout socket (including curing time)

NW PILE
 Reposition Deep Diver for NE pile

Drill Socket
 Install pile and grout socket (including curing time)

NE PILE
 Reposition Deep Diver for NW pile

Drill socket
 Install pile & grout socket (including curing time)

SE PILE
 Reposition Deep Diver for SW pile

Drill socket
 Install pile & grout socket
 Seal and grout NW & SW pile cans
 Seal and grout NE & SE pile cans

Remove anchors & install sandwich plates (4)
 Post installation diver survey

PCU DELIVERY
 Tow PCU to Orkneys
 Delay contingency

PCU INSTALLATION

Sheerleg transit to site
Reposition Deep Diver & Position Sheerleg

Connect and lower PCU

Bolt PCU to frame/make good
Final Survey

Tow Deep Diver to Stromness
Demobilise at site
Tow from site

Should these noisy activities be interrupted for any reason for a period of more than 30 minutes, then the MMO procedure would be implemented prior to restart to ensure that there are no marine mammals present in the area.

The initial activity involving the positioning and jack up of the barge on the Bilia Croo site is expected to take place on Tuesday 2nd June 2009. (Nb, actual date of operation was Sunday 7th June 2009).

Whilst this is not expected to generate significant underwater noise, due to the hydraulic, slow and controlled manner in which the jackup legs are lowered, it has been included as a key MMO activity in recognition of it being the first activity at the location.

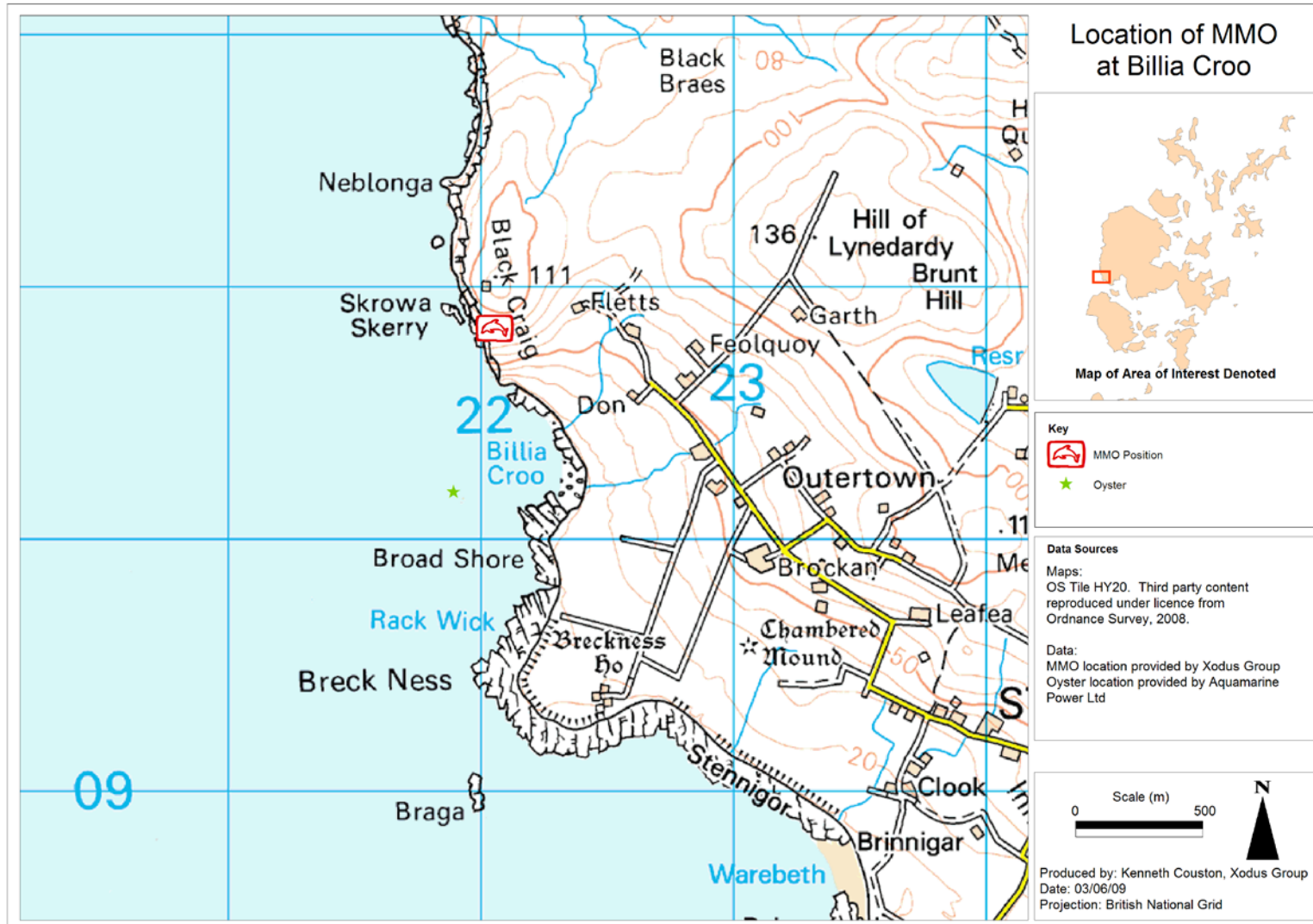
Subsequent noisy activities include the lowering of the Pile Connector Frame (PCF), drilling of each of the four piles, and finally the lowering and connection of the PCU.

In addition to implementation of the MMO procedure for these key activities, sightings of marine mammals made throughout the installation activities will also be recorded (as per the EMEC procedure).

Observation Points

MMO observations will take place from the land or sea, depending on logistics and Health & Safety (H&S). As discussed with SNH, the initial activity will not allow for the MMO to be aboard the multicat vessel, as it is being used as a workboat for this activity and is unable to take the MMO and observation staff on board for H&S reasons; any additional vessels in the area would also present a possible H&S hazard.

In light of this, the MMO will observe from a suitable land-based MMO location with a clear view of the activities. The observation location is shown in the map below. The final chosen location incorporated advice from SNH on getting the highest possible vantage point.



The MMO will have communications with the construction vessel via a representative of the installation contractor (IC) who is overseeing the operations from the landbased vantage point and has full communication with the vessel.

There is the added advantage that the the IC representative will also be able to advise the MMO as to the activities being carried out. The IC representative will attend the Toolbox Talk (described below) and their role is one of observation; they will also be on the multicat vessel for the later key MMO activities and so there is advantage in them becoming familiar with the role of the MMO from the start.

Following the initial activity, subsequent key activities will be monitored by the MMO from the multicat support vessel with adequate coverage of the sea area around the jackup barge. It is felt that sea based observations provide optimum vantage, due to their proximity and greater ability to view the seaward side of the operations. For health and safety reasons it is preferred that there is not additional personnel on the construction barge itself. The multicat support vessel will be in communication with the barge at all times and be able to advise of any actions that need to be taken to minimise impacts on marine mammals, e.g. in the event operation commencement should be delayed.

MMO Responsibility

It is proposed that a trained MMO be used to undertake MMO operations during initial installation operations and during this period he will train up specified personnel on the support vessel to take over responsibility for the MMO observations. It is not deemed feasible for H&S reasons to have a dedicated MMO observer onboard the support vessel at all times. Handover of the MMO observations will not take place until the trained MMO is confident the personnel are appropriately trained and can adequately carry out the observations.

The personnel specified to take over the responsibility of MMO observations will not be directly involved in the installation related activities and therefore have the capability to be dedicated MMOs.

Toolbox Talk / Training

Aquamarine and their environmental monitoring contractor will undertake an informal training session / tool box talk for relevant marine staff, detailing the marine mammal sensitivities in the area and present the requirements of the EMEC MMO procedure. The objectives of the toolbox talk are to:

- ensure that all relevant personnel are aware of MMO requirements and how they will be implemented for this project;

- raise awareness of the potential presence of marine mammals and of their status as European Protected Species;
- allow for understanding between the MMO and the marine staff of the work each is carrying out and to highlight Health & Safety issues or concerns.

This toolbox talk is being scheduled for the morning of Friday 29th May, prior to the anticipated mobilisation.

Working with EMEC

Aquamarine is aware that EMEC is carrying out regular monitoring of wildlife observations and surface interactions at the wave site, from a land-based vantage point at Black Craig. Aquamarine will seek to work with EMEC to optimise the collection of data on marine mammal observations and learning achieved from this in terms of information provided by the data and continuous improvement of methodologies for data gathering. The results of this work will be used to inform any future EIAs for commercial scale developments.

MMO Programme Update - 8th June 2009

Aquamarine can provide the following update on the MMO Programme, as reported to SNH by email.

The MMO carried out some initial monitoring from the land-based view point on the night of anticipated start of operations on Tues 2nd June last week. He observed for close to 2 hrs; this was approximately 40 minutes before the Jack-up barge arrived on site, for the duration of the positioning and for the time taken to place the legs on the seabed. He spoke to the IC representative who reported that the divers were in the water and the jacking-up would commence shortly; however, the light was poor and the divers could not see sufficiently well to identify a level piece of seabed for the jackup legs and so the operation was cancelled and the jackup returned to Stromness. No marine mammals were observed within the 500 m zone during the observations.

Due to the delayed start in operations, Aquamarine and the environmental monitoring contractor have been able to carry out full training of the vessel staff offshore last week. The environmental monitoring contractor's MMO went out on the boat to the site and trained members of the vessel staff; two of which will actually be on the jackup barge and one of whom is an IC representative. The latter gives an added bonus, in that there will be three people with the MMO training and capable of undertaking MMO duties. They sailed round the site were guided through the MMO procedure; including the different periods they would be observing at and what to do in certain eventualities. They then observed for a period to put their training into practice. The vessel staff were comfortable with what was required and Aquamarine is confident that they will perform the monitoring well. This means that all future MMO monitoring

can be done offshore to optimise both the view of the operations and ease of communications with the drilling staff.

Finally, Aquamarine can report that the jackup barge was successfully positioned and legs lowered on Sunday 7th June (as reported to SNH). MMO observation began at 11.10am with jackup barge activity following, commencing at 11.42am. No marine mammals were observed within the 500 m zone during the observations.

3.2 Underwater Noise Monitoring

In accordance with SNH's expectations cited within the ES Addendum and reference in the EPS licence to mitigation measures detailed in the ES Addendum, Aquamarine will carry out underwater acoustic monitoring, including frequency and noise levels generated from operation of the device. In combination with the data gathered from the MMO, this will inform the assessment of underwater noise impacts on fish and marine mammals.

As detailed in the ES Addendum, there is no 'turbine' type equipment associated with the offshore Oyster 1 PCU. As stated in the ES, Aquamarine considers that *'noise from the operation of the device is expected to be in the range of local ambient sea noise. Ambient noise levels are high due to strong wind and wave regime and rugged nature of the exposed coastline (boulder beach)'*.

Noise from the installation and decommissioning of the PCU is expected to be in the same range as noise produced during the installation of offshore wind farms. Noise from activities such as vessel movement and hydraulic drilling is generally of low frequency in the range of 0 to 3,000 Hz.

EMEC is currently seeking funding to develop a methodology for the monitoring of noise emanating from offshore devices during their operation. However, in the absence of this methodology, Aquamarine has devised the following underwater noise monitoring programme for Oyster 1.

The underwater noise monitoring programme comprises measurements of underwater noise prior to installation to provide the baseline acoustic 'signature' of the site, followed by measurement during the operation of the device. For each measurement, the following data will be collected.

- Geographical position (Latitude/Longitude)
- Water depth
- Sea conditions

- Swell height and direction
- Hydrophone depth
- Weather conditions: wind speed/direction, cloud cover, rain rate (if raining)
- Any other boats/shipping in area
- Any other potential noise sources visible in area

It is anticipated that radiated noise will originate in the following areas:

- Water splashing
- Hinge noise
- Pump noise

Other possible sources include:

- Mooring noise (from nearby boat engines, mooring chains for anchored boats and navigation marks)
- Sediment transport noise due to enhanced current patterns
- Pipe resonance effects

These noises will cover the frequency range from below 10 Hz to over 100 kHz.

Such noises have the potential to impact the marine environment and may also help to locate deficiencies in the Oyster 1 mechanics leading to an improved design with lower radiated noise levels.

Baseline measurement

A baseline measurement will be undertaken by ICIT (Herriot Watt University) prior to the installation of Oyster 1 to establish an understanding of the sources of underwater noise and where possible to ascribe noise levels to contributions in the environs of the Oyster 1 site.

The methodology will make use of two hydrophones: one fixed in position and the other drifting. The stationary hydrophone will be moored at the Oyster 1 site and a second roving hydrophone deployed from the drifting surface vessel (MV 'Welcome Home') to allow coverage in different locations nearby.

Stationary Recordings at the Deployment Area

Stationary recordings will use the DolphinEAR acoustic measuring technology, for which the specification is provided below.

DolphinEAR Specification

- Frequency Range (Overall): 7 Hz - 22,000 Hz *
- Hydrophone Transducer Type: MPC (Piezo)
- Configuration: OmniDirectional
- Hydrophone Packaging: Rugged epoxy case, approx. 60mm Dia x 8 mm Thick
- Cable Type: High Quality, Low Noise, Neoprene/PVC jacketed for long life
- Cable Length: standard is 8, 16, 24, 32 metres; optional is up to 100 metres.
- Preamp: Supplied with Line/Earphone Output
- Audio Output: MONO. Adjustable Level ~ approx. 50 mW
- Output Connector: 3.5mm (1/8") stereo jack
- Earphones: Samarium Cobalt in-ear type ('walkman-style')
- Power: Approx 7 mA at 9V
- Battery: Standard 9V (PP3) transistor radio battery

The stationary hydrophone (DolphinEar) will be deployed from a moored, floating recording buoy at the Oyster 1 site. The equipment buoy will contain the recording computer and the hydrophone will be suspended underneath. The equipment buoy will be attached to a surface marker buoy, which will be moored by a clump weight to the seabed. The intention is to have the hydrophone in mid-water; at approximately 5-7m depth depending on tides. Recording will take place over periods of 30 minutes with the recording process initiated by remote control. During recording the vessel will move away from the equipment and vessel systems will be turned off, to avoid potential interference.

Drift Recordings in the Vicinity of the Deployment Area

For the drift recordings, the Reson TC4042 technology will be used and a specification is provided below.

Reson TC4042 Specification

- Receiving Sensitivity, typical: -173dB re 1V/uPa (2.2 mV/Pa)
- Useable frequency range: 5Hz to 85kHz
- Linear frequency range: 15Hz to 45kHz +1/-5dB
- Horizontal directivity: ± 2 dB at 40kHz
- Vertical directivity: ± 3 dB at 40kHz over 270 deg.
- Max. operating depth: 1000m
- Survival depth: 1200m
- Operating temperature range: -2° to +55°C
- Storage temperature range: -30° to +70°C
- Preamplifier gain: +20dB
- Max. voltage output: 3Vrms (at 12V supply) 7Vrms (at 24V supply)
- Current consumption: ≤ 9 mA (at 12V supply) ≤ 22 mA (at 24V supply)
- Output impedance: 100ohms + 100 μ F
- High pass filter: 15Hz (-3dB)
- Low-pass filter: 150KHz (-3dB)
- Hydrophone weight: 450gr.
- Housing material: Alu Bronze AlCu10Ni5Fe4

Encapsulating polymer: Special formulated NBR

The Reson hydrophone will be suspended from a small surface buoy and its cable will run on floats drifting alongside the vessel. Runs will last approximately 30mins. The intention will be to conduct a number of recording runs at distances of a few hundred metres from the Oyster 1 site, at depths of 5 and 10m.

Vessel operations and hence measurements will be limited to sea states of less than 1.5m (Hs). The equipment will be calibrated by the manufacturer at time of purchase by feeding a known voltage signal through the processing electronics. Wet calibration will also be considered, using a source at a known distance from the equipment. 10 measurements will be recorded, including a test.

Baseline monitoring was successfully completed between 17.55 and 20.57 on 21st May 2009, and between 08.35 and 11.07 on 22nd May 2009, prior to the commencement of installation works. The depths of recordings were 5 and 10m. The results of these recordings are currently being analysed.

Operational measurements

Following the installation of Oyster 1 and start up of operations, further noise monitoring will take place.

Given the lack of industry defined methodology, the methodology will be to some degree experimental, allowing for continuous improvement of the method and procedures. Aquamarine will seek to share this information with EMEC and participate in forthcoming projects related to the development of noise measurement systems for wave sites. Given that Oyster 1 is deployed in the near shore environment, noise monitoring is particularly challenging due to the hostility of the environment and the significant ambient noise expected (to be confirmed through the analysis of the baseline monitoring).

The methodology anticipated to be most effective for operational measurements involves the deployment of two fixed hydrophones, supplemented by repeat boat surveys if appropriate. The boat borne equipment will be as used for the baseline monitoring and as described above. The fixed equipment includes one hydrophone fixed to the PCU along the line of the hinge, at approximately 13m water depth (MSL; the Oyster 1 device sits on the seabed at approximately 15m MSL) and one fixed to an ADCP (approx. 1m from the seabed and 14m water depth MSL) located approximately 12m away from the PCU on the seabed.

Data will be transferred to shore via cables inside the umbilical, which resides inside the low pressure pipeline. It is intended to have a dedicated PC located onshore to receive the data and reports will be produced from monthly datasets by a yet to be identified competent organisation (see below). This analysis will need to be developed and as with the measuring equipment will be refined and improved over time.

Locating the equipment at these locations will allow in particular for the effective measurement of noise emanating from the hinge and pump which is located underneath the device.

It is anticipated that ICIT (Herriot Watt University) will deploy and service the equipment, as well as analyse the data. The equipment will be calibrated as for the baseline monitoring. Vessel borne equipment (DolphinEAR; as described above) will have the capacity to record in all sea states in which the vessel is able to operate.

The equipment will be serviced regularly by divers to remove marine growth and entangled debris.

3.3 Seabed Impact Assessment

Seabed Monitoring Requirement

The FEPA licence requires monitoring of the seabed to be undertaken pre- and post-installation and post-decommissioning. This monitoring relates solely to the deposits licensed under the FEPA licence. For clarity this does not include the drill cuttings generated during pile installation. The seabed surveys will be undertaken using divers or ROV. Where an ROV is used, Aquamarine will follow the EMEC ROV Seabed Survey Guidelines (included in Appendix A); where divers are used, procedures are approved by EMEC as part of Aquamarine operations on the site.

The survey will include inspection of the following:

- location at which the Oyster 1 will be installed;
- area of seabed around the where the pipelines emerge
 - HP1 - 58°58'18.7511 N, 3°21'34.3840 W
 - HP2 - 58°58'18.4863 N, 3°21'34.0012 W
 - LP1 - 58°58'18.4814 N, 3°21'34.0280 W;
- area of seabed around the hookup between the pipeline and PCU.

A diagram of the offshore layout is provided in Appendix B.

Diver video survey methodology

Survey of the Oyster 1 location

1. Moor the vessel close to the position of the Oyster 1 centre location (58 58 304 N, 30 21 592 W).
2. Divers enter water and establish position over the Oyster 1 centre co-ordinates.

3. Delineate the Oyster 1 site using a rigid rectangular frame, measuring 8.645m x 8.375m.
4. Record the depth at each corner of the frame using a divers depth gauge. Record the time of each depth reading so that the depth can be related to lowest astronomical tide (LAT) at each corner.
5. Record the slope and direction at each corner. Using a spirit level and measuring stick, measure the depth difference on a radius of 0.563m (to represent the size of the piles which will be located at each corner) at 45° increments around each corner point.
6. Conduct a visual inspection, collect video footage and digital photographs of the seabed at the location; in particular the specific Oyster 1 footprint (delineated by the frame) and where the piles will be drilled (corners of the frame) to fix it to the seabed.
7. Remove the frame from the seabed and return all equipment to the vessel.

Survey of the pipeline emergence and hookup area

1. Moor the vessel close to the position of the Oyster 1 centre location (58 58 304 N, 30 21 592 W), pipeline emergence points and hence intervening hookup area.
2. Divers enter water and establish position over pipeline emergence points and hookup area in turn.
3. Conduct a visual inspection, collect video footage and digital photographs of the seabed at the location; in particular the pipeline emergence points for the low pressure and two high pressure pipelines.
4. Divers return with all equipment to the vessel.

Pre-installation survey

Several diver video surveys were carried out prior to the installation of Oyster 1. As detailed in the ES Addendum, an initial seabed video survey of the Oyster 1 offshore site was carried out for Aquamarine by a local marine contractor Orkney in 2007. The survey was carried out in approximately 12 m water depth, wholly within the infralittoral zone of the exposed western coast of the Orkney Mainland.

The survey revealed that the infralittoral zone is typical of such zones seen around Orkney and is typical of exposed Scottish Atlantic coasts and there are no species of conservation importance.

As the location of Oyster 1 was refined, in May 2008, further video surveys of the seabed were carried out. A risk assessment and procedure documents

(including a review of diving methods) were submitted to EMEC for approval prior to the start of the work.

In February 2009, a final pre-installation video survey was undertaken, including the pipeline emergence points and hookup area.

Reporting

On completion, each survey is to be summarised in a report containing information on each run:

- Coordinates of seabed video location
- Still photographs of key features and any debris or anomalies identified
- Record of length of survey and plot extremes i.e. minimum / maximum coordinates
- Survey Reference Number
- Name of Diving Company carrying out the work.
- Vessel name / I.D.
- Diver video equipment name / I.D. including camera lens details
- Record of weather conditions, sea state etc.

The report of each survey will be submitted to Marine Scotland and EMEC following completion of each survey. On final completion of decommissioning, Aquamarine will produce a decommissioning report which requires a biological interpretation of the three ROV surveys. This will be undertaken by an appropriately qualified marine biologist to provide a brief overview of the seabed ecology and appraisal of any change to the seabed conditions in so far as can be assessed by seabed video.

Aquamarine propose to combine the pre-installation surveys into one report for Marine Scotland and, based on a review of this report, agree the proposed format for the post-installation and post-decommissioning reports.

Proposed Survey Timing

It is proposed the surveys are undertaken at the following times:

- Pre-installation – 2007; May 2008; also February 2009 to include pipeline emergence points and hookup area.
- Post-installation – August / September 2009
- Post-decommissioning - December 2014

Appendix A

EMEC ROV Seabed Survey Guidelines

Developers are required to undertake pre-installation, pre-decommissioning and post-decommissioning ROV of the seabed where their device is to be installed. This is to fulfil both regulatory and contractual requirements. To provide a standard approach to this EMEC has formulated the ROV methodology described below.

On completion, each survey is to be summarised in a report containing information on each run:

- Coordinate file showing ROV track
- Still photographs of key features and any debris or anomalies identified
- Record of length of survey and plot extremes i.e. minimum / maximum coordinates
- Survey Reference Number
- Pilot name / I.D.
- Vessel name / I.D.
- ROV name / I.D. including camera lens details
- Record of weather conditions, sea state etc.

On final completion of decommissioning, developers will also produce a decommissioning report, which requires a biological interpretation of the three ROV surveys. This will be undertaken by an appropriately qualified marine biologist to provide a brief overview of the seabed ecology and appraisal of any change to the seabed conditions in so far as can be assessed by ROV.

ROV Survey Methodology

Equipment required: A suitable work boat mobilised with DGPS, an ROV complete with camera, video recording system and video overlay capability, plus an acoustic positioning package.

Survey of the mooring centre location:

1. Moor the vessel close to the position of the 1st mooring centre location.
2. Deploy the ROV to the mooring centre co-ordinates.
3. Once at the mooring centre, conduct a visual inspection of the seabed, flying the ROV 50m to the North, South, East and West from the central location.*
4. Recover the ROV.
5. Reposition the vessel on the next mooring centre location (if required) and repeat the above for all remaining mooring locations.

Survey of the cable ends (not required for pre-decommissioning survey):

1. Moor the vessel close to the position of the 1st cable end.
2. Deploy the ROV to the cable end co-ordinates.
3. Once at the cable end, confirm its co-ordinates and conduct a visual inspection of the cable flying the ROV 50m along its length.*
4. Recover the ROV.

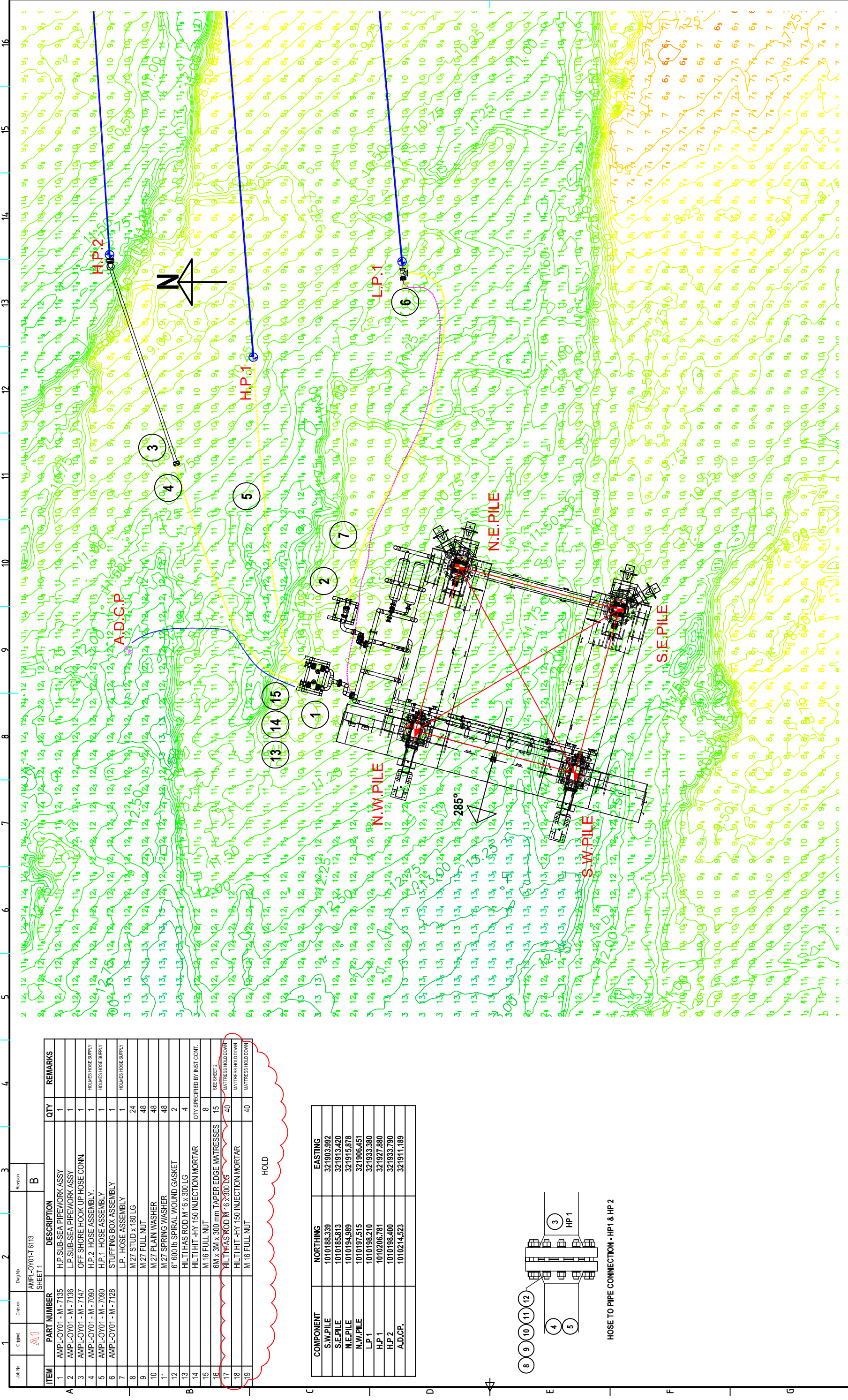
*Video footage is to be recorded of each run, with the ROV flying at a suitable height to give as clear a view as possible of the seabed/cable. To give the widest possible view, the camera is to be panned from left to right along the full length of the run. Any debris or anomalies identified along the run are to be fully investigated and recorded, including the taking of a positional fix. Each run is to be identified on the video



through either header text overlaid on the screen, or by noting the times in a video log. The video overlay shall display: position, depth & orientation of ROV and date.

Appendix B

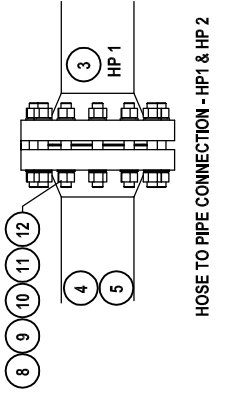
Offshore layout of Oyster 1 device based on latest coordinate information (June 2009)



ITEM	PART NUMBER	DESCRIPTION	QTY	REMARKS
1	AMPL-OY01-M-7135	H.P. SUB-SEA PIPEWORK ASSY	1	
2	AMPL-OY01-M-7136	L.P. SUB-SEA PIPEWORK ASSY	1	
3	AMPL-OY01-M-7147	OFF SHORE HOOK UP HOSE CONN.	1	HOLMES HOSE SUPPLY
4	AMPL-OY01-M-7090	H.P.2 HOSE ASSEMBLY	1	HOLMES HOSE SUPPLY
5	AMPL-OY01-M-7090	H.P.1 HOSE ASSEMBLY	1	HOLMES HOSE SUPPLY
6	AMPL-OY01-M-7128	STUFFING BOX ASSEMBLY	1	HOLMES HOSE SUPPLY
7		L.P. HOSE ASSEMBLY	1	
8	M 27 STUD X 180 LG		24	
9	M 27 FULL NUT		48	
10	M 27 PLAIN WASHER		48	
11	M 27 SPRING WASHER		48	
12	6" 600 lb SPIRAL WOUND GASKET		2	
13	HLTI HAS ROD M 18 x 300 LG		4	
14	HLTI HIT -HY 150 INJECTION MORTAR		QTY SPECIFIED BY INST CONT.	
15	M 16 FULL NUT		8	SEE SHEET 2
16	6M x 3M x 300 mm TAPER EDGE MATRESSES		15	MATRESS HOLD DOWN
17	HLTI HAS ROD M 18 x 300 LG		40	MATRESS HOLD DOWN
18	HLTI HIT -HY 150 INJECTION MORTAR		40	MATRESS HOLD DOWN
19	M 16 FULL NUT		40	MATRESS HOLD DOWN

HOLD

COMPONENT	NORTHING	EASTING
S.W.PILE	1010188.339	321903.992
S.E.PILE	1010185.813	321913.420
N.E.PILE	1010194.989	321915.878
N.W.PILE	1010197.515	321906.451
LP 1	1010198.210	321933.380
HP 1	1010206.781	321927.880
HP 2	1010198.400	321933.790
A.D.C.P.	1010214.523	321911.189



HOSE TO PIPE CONNECTION - HP 1 & HP 2

Client
OYSTER 1

THE SUB-SEA PIPEWORK LAYOUT

Drawn: Geo.J. Dickson
Date: 01-05-09

Checked: D. Naylor
Date: 01-05-09

Approved: D. Naylor
Date: 01-05-09

Job No: Original
Scale: @A1
Sheet: A1

AMPL-OY01-T-6113
SHEET 1

Aquamarine Power Ltd.
10 Saint Andrew Square
Edinburgh EH2 2AF
Website: www.aquamarinepower.com

ADAMARINE POWER

Aquamarine Power Ltd
NAME: Geo.J. Dickson
DATE: 01-05-09

DESCRIPTION: ISSUED FOR INFORMATION

REVISIONS:
REV. A
REV. B

THE DRAWING MAY NOT BE REPRODUCED OR COMMUNICATED TO A THIRD PARTY WITHOUT THE WRITTEN PERMISSION OF AQUAMARINE POWER LTD.
ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE STATED.
CENTRES OF CIRCLES TO BE TO 0.25
ALL BORED HOLES MATCHED TO BE 0.50
NON-TOLERANCED DIMENSIONS TO MILLIMETRES
DIMENSIONS TO CENTRE UNLESS OTHERWISE STATED
DIMENSIONS TO FACE UNLESS OTHERWISE STATED

DO NOT SCALE DRAWING

PROJECTION:

AMPL-OY01-T-6113
SHEET 1

AMPL-OY01-T-6113
SHEET 1