Scotrenewables Tidal Power Ltd

SR250 Deployment

Fall of Warness

Environmental Statement

Volume II – Appendices

October 2010

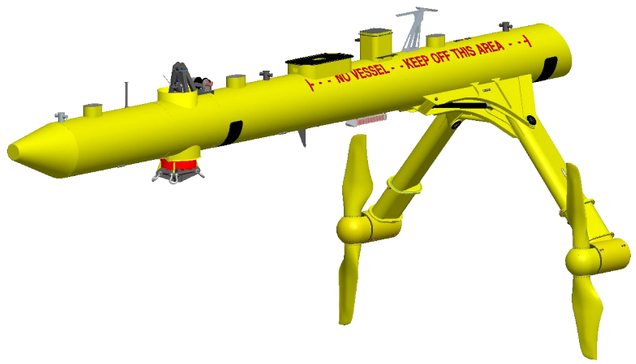
Scotrenewables® Tidal Power Ltd

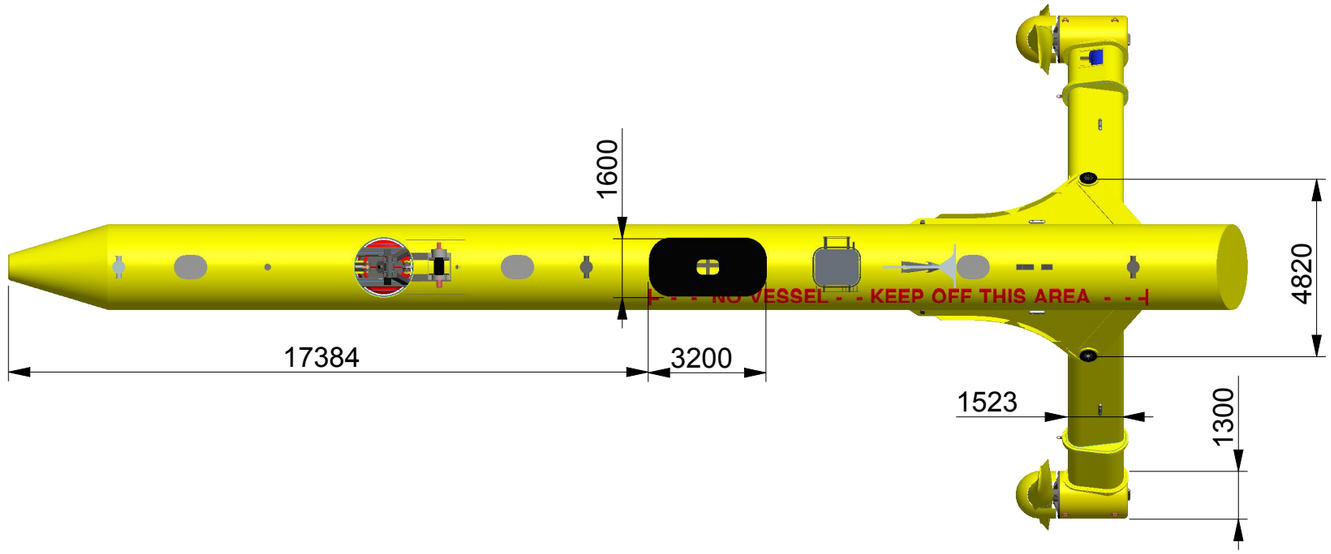
Contents

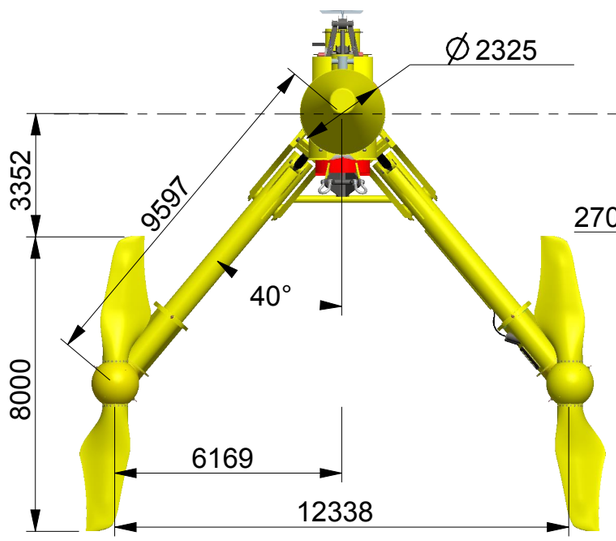
Appendix 1

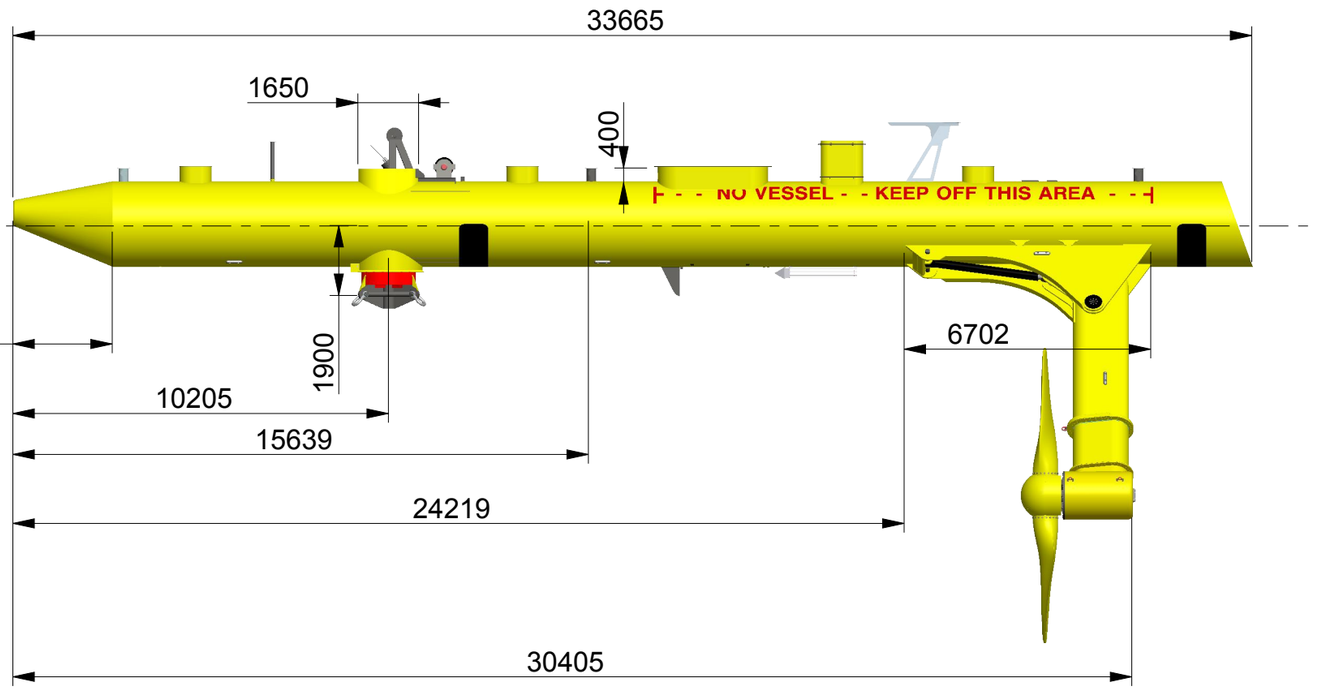
Dimensional Drawing of Full Scale SR250

Scotrenewables®
Tidal Power Ltd









REV	DATE	REVISION INFO	DRAWN BY	CHK
0	16-Sep-10		BS	

PRODUCED IN ProE DO NOT CHANGE MANUALLY

NOT TO SCALE UNLESS OTHERWISE STATED

SHEET SIZE
A3

Scotrenewables®
Marine Power

PROJECT TITLE
SR250kW

DRAWING TITLE
SR250kw Overview

CAD Model
SRTT-250_POST_PROD_MAY_2010

DOCUMENT CODE
250-01-02-009-A

COMPONENT	ASSEMBLY
	SR250
MATERIAL	MASS (kg)
	89074,296

DESCRIPTION

Appendix 2

Scoping Feedback

Scotrenewables®
Tidal Power Ltd

Scottish Natural Heritage
All of nature for all of Scotland

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24 May 2010

Your ref: Projects\0030-Scotrenewables\Consents\Scoping
Our ref: CNS/REN/Tidal/EMEC Orkney – Eday tidal test site/Scotrenewables/case ref. 61207

Dear Matthew,

'SCOPING' REQUEST (FOR SUPPORTING DOCUMENT OF A LICENCE APPLICATION): SCOTRENEWABLES TIDAL TURBINE (SRTT) SCOTRENEWABLES (MARINE POWER) LIMITED

Thank you for consulting Scottish Natural Heritage (SNH) on the scoping report for a proposal by Scotrenewables to deploy a tidal energy device at the EMEC tidal test site. On the 17th November 2009 we provided comments on the scoping report for the proposal to install a 1 MW tidal energy device at the EMEC site. However, following updates to the device design and location, Scotrenewables wish to re-scope the revised project.

Originally Scotrenewables were proposing to install a floating 1 MW tidal stream energy device, known as the Scotrenewables Tidal Turbine (SRTT), at berth no. 5 at the EMEC Tidal Test site at the Falls of Warness, Eday, Orkney, during 2010. However, due to the high energy environment at this location and concerns regarding the operation of the device, it is now proposed to deploy in a more sheltered location within the test site and scale down the device.

SNH position statement

In principle SNH supports the development of marine renewable energy devices where sensitively designed and sited (SNH Policy Statement 04/01)[1]. As the proposal falls below the threshold for a Section 36 application, SNH is providing advice to EMEC's Environmental Impact Assessment (EIA) procedure.

[1] Marine Renewable Energy and the Natural Heritage: An Overview and Policy Statement. Policy Statement No. 04/0

SNH considers that the key issues to be addressed in detail are:

- **Sanday Special Area of Conservation (SAC) and Faray and Holm of Faray SAC.**
- **European Protected Species (EPS), namely cetaceans.**
- **Protected species, namely harbour/common seals.**
- **Cumulative impacts on protected species caused by collision risk.**

Background

The revised full-scale prototype has a reduced power rating of 250kW. The hull comprises a 29m long steel tube with a 2.2m diameter. The rotors are each suspended from separate retractable rotor legs attached to the buoyancy tube, which raise and lower the rotors from transport to operation modes. The rotors will be 8m in diameter and the maximum rotor rotation speed will be 24RPM.

The device is moored to the seabed using a four-riser mooring system with a disconnectable turret which will remain a minimum of 10m below LAT when the SRTT is off site. The turret is approximately 3.0m high and 1.5m in diameter, and allows the device to passively yaw around the mooring system to capture the tidal flow in any direction. The device mooring lines will be in a "X" configuration with a half angle of 30 degrees, taking up an area approximately 218m by 126m. Mooring lines will comprise of synthetic lines and ground chains and will be anchored to the seabed using gravity anchors. Each of the 4 (one at each corner) gravity anchors consists of 2 reinforced concrete blocks measuring 2.9mx2.9mx1.3m bridled together.

Installation works will include:

- Installation of an armoured seabed cable (50mm diameter) located north east of the existing cable ends in the Fall of Warness. The cable will be laid by a multicat type vessel, and the works are expected to take less than a day. The total length of the seabed cable will be less than 2km. It is proposed to undertake the cable installation works during the third quarter of 2010. Recent correspondence with Scotrenewables indicated that the digging of the cable trench would be carried out by EMEC and occur during July 2010.

- Installation of the mooring system. This will involve the installation of the gravity anchors in the third quarter of 2010, and the installation of the four-riser mooring system in early 2011.

- After several towing trials, the single device will be installed onsite at EMEC for numerous short-term test periods. The duration of test periods will gradually increase to the point where a continuous three-month grid connected deployment is achieved during 2011.

During the operational phase, Scotrenewables will monitor the device and carry out any necessary maintenance using contractors. All maintenance activities will take place away from the site.

Scoping issues

We consider that the key issues to be addressed in detail are:

- **Sanday Special Area of Conservation (SAC) and Faray and Holm of Faray SAC.**

- **European Protected Species (EPS), namely cetaceans.**
- **Protected species, namely harbour/common seals.**
- **Cumulative impacts on protected species caused by collision risk.**

Additional issues which are of lesser importance but should nevertheless be taken into account in this non-statutory EIA process are noted in the main text below.

These issues should be considered throughout the various stages of the proposed developments lifetime including construction, operation, maintenance, and decommissioning.

EMEC has produced, with input from SNH, sensitivity tables and summary reports detailing natural heritage interests at the tidal test site. We recommend that these are used to guide operations such as installation and decommissioning, to avoid potential impacts.

Service Level Statement

SNH has produced a Service Level Statement (SLS) for renewable energy consultations. This provides information regarding the level of input that can be expected from SNH at various stages of the EIA process. Annex A of the SLS details a list of references which should be considered as part of the EIA process. Though this development is not subject to the statutory EIA process, these may be of value nonetheless. A copy of the SLS can be found on the renewable energy section of our website - http://www.snh.gov.uk/docs/A404002.pdf

General

We offer the following advice on the scoping document to inform a more detailed environmental statement for submission with appropriate licence applications.

1.0 Natural Heritage Interests to be considered in an EIA

Listed below are the key natural heritage interests we recommend need consideration in relation to this development.

1.1 European Sites

There are two Special Areas of Conservation (SACs) that need to be considered in relation to this development:

1.1.1 Sanday SAC

The JNCC statement (2005) supporting the designation of Sanday as an SAC for common seals states "Sanday SAC is situated in the north-east of the Orkney archipelago and supports the largest group of **common seal *Phoca vitulina*** at any discrete site in Scotland. The breeding groups, found on intertidal haul-out sites that are unevenly distributed around the Sanday coast, represent over 4% of the UK population. Nearshore kelp beds that surround Sanday are important foraging areas for the seals"[2].

The colony is part of a single metapopulation inhabiting the Northern Isles of Orkney (advice from the Sea Mammal Research Unit (SMRU) to SCOS (Special Committee on Seals). The Orkney harbour seal population has declined by 67% since the late 1990s and has been falling at an average rate of >13% p.a. since 2001 (SCOS[3]).

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[2] Joint Nature Conservancy Council Special Area of Conservation Site Details. www.jncc.gov.uk

[3] Scientific Advice on Matters Related to the Management of Seal Populations: 2009. SCOS report.

Sanday SAC is also designated for intertidal mudflats and sandflats, reefs, and subtidal sandbanks.

Further site information, such as Conservation Objectives and Site Citation, can be found on the SNH SiteLink website.

Further details regarding proposals affecting Natura sites such as this please see SNH's essential quick guide, which can be downloaded at http://www.snh.gov.uk/docs/C204761.pdf

1.1.2 Faray and Holm of Faray SAC

These two uninhabited islands in the northern part of Orkney support a well-established **grey seal *Halichoerus grypus*** breeding colony. The seals tend to be found in areas where there is easy access from the shore, and freshwater pools on the islands appear to be particularly important. The islands support the second-largest breeding colony in the UK, contributing around 9% of annual UK pup production.

2.0 Legislative Requirements

The legislative requirements for European sites are as detailed in Appendix A. Note that these apply outwith the site boundaries where a plan or proposal has the potential to affect the qualifying species from within the site(s) concerned, as is the case in this instance with regards to common and grey seals, and seabirds. The legislation refers to three steps: the outcome of each deciding whether or not the next needs to be implemented. These three steps – set out below as questions, are:

(i) Is the proposal directly connected with or necessary to the management of the site?
(ii) Is the proposal, alone or in combination with other developments, likely to have a significant effect on the site?
(iii) Can it be ascertained in light of the conservation objectives that the proposal will not adversely affect the integrity of the site?

In our opinion, the deployment of the SRTT and cable installation is not directly connected with or necessary to the management of any of the SACs or SPAs listed above. Hence further consideration is required.

3.0 SNH Advice in relation to qualifying interest(s)

3.1 Sanday SAC

Common Seals

Common seals from Sanday and the Northern Isles of Orkney metapopulation are likely to utilise the Falls of Warness, and there is an unquantified potential for animals to collide with the turbine blades, **Our advice is that this proposal is likely to have a significant effect on the qualifying interest(s) of the site (common seal) due to the potential loss of individuals through collision with the operational turbines.** As a consequence our advice is that step (iii) will need to be addressed and that the Competent Authority(ies) will be required to carry out an appropriate assessment of the implications of the proposal for the site's qualifying interest(s) before issuing consents or licences for this device.

This assessment will need to consider all aspects of the proposal with potential to affect the conservation objectives of the site and, through this, ascertain that the integrity of the site will not be affected.

In our opinion, based on available information, the key requirement will be to demonstrate that collisions between seals and the operational turbines, should these occur, will not affect the population viability of this species (Conservation Objective 1). The Potential Biological Removal (PBR) for common seal numbers in the Northern Isles metapopulation (SMRU 2008[4]) has been calculated from 2007 counts as 23 individuals. This figure relates to all non-natural forms of mortality affecting the common seal population, not just those that may arise as a consequence of this development. It is likely that this value will be revised downwards following re-calculation of the PBR from 2008/09 counts. SNH, in consultation with the Sea Mammal Research Unit (SMRU), considers it possible that this device, alone or in combination with other human activity within the Northern Isles of Orkney metapopulation area, has the potential to remove more than 23 individuals from the metapopulation. The metapopulation's sensitivity to additional mortality, combined with the lack of empirical knowledge of device-seal interactions, especially collision risk, means that the appropriate assessment is unlikely to clearly conclude that there will be no adverse effect on Sanday's common seals. The EIA should consider whether adaptive management e.g. shut-down in response to collisions, could be adopted to ensure mortality does not reach a level that would have an adverse effect on population viability.

The appropriate assessment should be based on an appraisal of the following:

a) Likely collision risk of common seals with the SRTT device, in combination with any proposed mitigation such as shut down contingent on detection of collisions above an agreed threshold.
b) Estimates from SMRU of the Potential Biological Removal (PBR) of common seals from this metapopulation[4].
c) Consideration of outcomes of EMEC monitoring projects (if available by that time).
d) Consideration of advice from an appropriate organisation, such as SMRU Ltd, on options for monitoring and mitigating collision risk between the operational turbines and seals.
e) Cumulative effects on this metapopulation of common seals from this development and others either at the test centre or elsewhere in the North Isles area.

Once this information has been provided, we will be in a position to give further consideration to this proposal.

Qualifying habitats (intertidal mudflats and sandbanks, reefs and subtidal sandbanks)
The qualifying habitats of Sanday SAC are either intertidal or subtidal and as such a tidal turbine 13km distance from the location of these habitats is very unlikely to have an impact on these designated interests. SNH considers therefore that it is unlikely that the proposal will have a significant effect on any qualifying interests either directly or indirectly and in SNH's view an appropriate assessment is therefore not required for designated habitat interests.

3.2 Faray and Holm of Faray SAC

On the basis of the information submitted to date, **our advice is that this proposal is likely to have a significant effect on the qualifying interest(s) of the site due to the potential loss of individuals from the SAC through collision with the operational turbine**. As a consequence our advice is that step (iii) will need to be addressed and that the Competent Authority(ies) will be required to carry out an appropriate assessment of the implications of the proposal for the site's qualifying interest(s) before issuing consents or licences for this device.

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[4] Surveys of harbour (common) seals around Scotland, August 2007. A report for Scottish Natural Heritage, SMRU, October 2008.

This assessment will need to consider all aspects of the proposal with potential to affect the conservation objectives of the site and, through this, ascertain that the integrity of the site will not be affected. In this instance, however, based on available information, SNH would advise that an AA is likely to ascertain that the proposal will not adversely affect the integrity of this SAC. Grey seal populations in Orkney are stable and increasing slightly. PBR of grey seals from the Northern Isles of Orkney has been calculated by SMRU (SMRU 2008) as 885. SNH consider it is unlikely that this tidal turbine, alone or in combination with other tidal devices already in situ at the Falls of Warness, is likely to cause more than 885 individuals to be removed from the Grey seal population.

The Appropriate Assessment should be based on an appraisal of the following:

a) Likely collision risk of grey seals with the SRTT device, in combination with any proposed mitigation such as shut down contingent on detection of collisions above an agreed threshold.
b) Estimates from SMRU of the Potential Biological Removal (PBR) of grey seals from this metapopulation.
c) Consideration of outcomes of EMEC monitoring projects (if available by that time).
d) Consideration of advice from an appropriate organisation, such as SMRU Ltd, on options for monitoring and mitigating collision risk between the operational turbines and seals
e) Cumulative effects on this metapopulation of grey seals from this development and others either at the test centre or elsewhere in the North Isles area.

Once this information has been provided, we will be in a position to give further consideration to this proposal.

4.0 European Protected Species

4.1 Cetaceans

EMEC's monitoring work at the Falls of Warness indicates that the area is utilised by a number of cetacean species including harbour porpoise, minke, killer whales and white-beaked dolphins. In particular harbour porpoise have been recorded in the Falls of Warness between July and November in the location of the proposed turbine, and there is evidence that minke whales use the same area for feeding between July and September.

All species of cetacean are protected under the Conservation (Natural Habitats &c.) Regulations 1994 (as amended) [the Habitats Regulations] as European Protected Species (EPS) and the Nature Conservation (Scotland) Act 2004. The Habitats Regulations list a number of offences in relation to EPS; a list of the offences is given in the Appendix B to this letter.

Where it is proposed to carry out works that could impact upon EPS, consideration should be given to whether the proposals could constitute an offence under the Habitats Regulations. If this is the case, then it may be possible to undertake the works under license from the appropriate licensing authority, which, in this case is the Scottish Government.

The installation and operation of the SRTT device could potentially result in actions that are listed as offences under the Habitats Regulations in respect of cetaceans, such as collision risk with rotors (operational) or avoidance due to noise produced by the operational turbine.

It may therefore be necessary to apply for a license in this respect. Any licence application should consider what impacts might occur (with reference to the offences listed in the Appendix B to this letter), what their magnitude and duration might be and how they could be mitigated.

4.2 Otters

Most of the coastline of Orkney is considered likely to have otters present. Land-based works may have the potential to affect otters. We advise that the developer establishes the use and distribution of otters in the locality of any potential on-shore infrastructure or cabling works out to 10m water depth off shore. Information on survey methodologies and mitigation for otters is available in the SNH publication "Otters and Development" at http://www.snh.org.uk/publications/on-line/wildlife/otters/default.asp.

5.0 National Interests

5.1 Muckle and Little Green Holm SSSI

Muckle and Little Green Holm Site of Special Scientific Interest (SSSI) is notified for its nationally important breeding colony of grey seals. Grey seals have been regularly recorded in the area immediately off the east coast of Muckle and Little Green Holm and in lower numbers throughout the Falls of Warness, though there is some evidence that grey seals may feed in the centre section of the Falls. Consideration should be given to the potential impact of the device installation, operation and decomissioning on grey seals utilising the Falls, particularly young seals which are especially vulnerable when first leaving pupping beaches, including details of any mitigation proposed to minimise impacts.

5.2 Birds

The Falls of Warness are utilised by species of diving birds as a feeding area. In particular Muckle and Little Green Holm SSSI hosts a colony of breeding cormorants. Consideration should be given to the potential impact of the device installation and operation on diving birds utilising the Falls including details of any mitigation proposed to minimise impacts.

5.3 Basking Sharks

Basking sharks (*Cetorhinus maximus*) are likely to use the area for passage and/or feeding. Basking sharks have full protection from intentional capture or disturbance in British waters (up to 12 miles offshore) under a 1998 listing on Schedule 5 of the Wildlife and Countryside Act (1981). They are also listed under CITES Appendix III in UK waters. Consideration should be given to any potential adverse impacts on this species together with details of proposed mitigation.

5.4 Seals

Both harbour and grey seals are protected under Annex II and Annex V of the Habitats Directive 1992. As mentioned above, the Orkney harbour seal population has undergone a severe decline since the late 1990's. If any construction/installation works, such as cable trench digging, are carried out during the sensitive pupping and moulting periods for harbour seals (late May to August inclusive), we advise that such work could have potentially serious adverse impact on the harbour seal population.

We highlight the sharp fall there has been in the UK population of harbour seals – particularly in Shetland, Orkney and Firth of Tay. The SACs in these areas are in unfavourable condition (as assessed through site condition monitoring) and, overall, the conservation status for harbour seals at a UK level has been assessed as 'unfavourable-inadequate'. The seals are currently vulnerable to any impacts which could lead to their

further population decline or prevent their recovery, and options for addressing these will need to be considered within the EIA.

6.0 General

6.1 Noise disturbance

Sea mammals, in particular cetaceans, are sensitive to noise disturbance. The potential for noise and /or vibration generated by installation and operation of the device to cause disturbance to species of sea mammal utilising the Falls should be considered in more detail, particularly in light of the protection afforded to cetaceans referred to above.

A detailed assessment should be made to identify, quantify and mitigate impacts arising from noise during installation and operation. **Cumulative/in-combination impacts** arising from noise should be assessed for both the proposed installation and other installations and operations in the vicinity.

When considering the potential impacts of noise on cetaceans and other marine mammals we recommend the applicant refer to the following references:

1. Marine Mammals and Noise, Richardson et al 1995 Academic Press
2. Marine Mammal Noise Exposure Criteria: Initial Scientific recommendations, Southall et al 2007, Aquatic Mammals Vol 33, Issue 4

6.2 Collision risk

The design of the SRTT device is such that it has the potential to interact with marine wildlife. In particular SNH consider that there is a potential risk of collision with cetaceans, common and grey seals, diving birds and large fish such as basking sharks. The potential collision risk to marine wildlife should be considered in detail, particularly in reference to cetaceans and seals.

6.3 Monitoring

We advise that the design of this device makes it possible for significant interaction with marine natural heritage. Therefore we strongly advise that monitoring the environmental impacts of the device should be fully considered in any supporting environmental information. Such information will, moreover, be crucial for determining the acceptability or otherwise of tidal turbine arrays that Scotrenewables (or others wishing to utilise this technology) may wish to deploy elsewhere. We advise that monitoring of the following may be particularly appropriate:

- potential interaction of the device with marine mammals including cetaceans and common and grey seals.
- potential interaction of the device with large fish such as basking sharks, skates and rays.
- interaction with diving birds
- down stream effects

We do not consider it sufficient to rely on EMEC monitoring projects to deliver monitoring of the SRTT device as these lie out with the control of Scotrenewables and there is no guarantee that these will address the specific monitoring requirements for this device. More

importantly, EMEC monitoring data may not adequately cover the zone of likely impact for the proposal, and future EMEC monitoring is subject to additional Scottish Government funding.

We advise that Scotrenewables should commit to ensuring appropriate monitoring is undertaken. A detailed and thorough monitoring strategy should be submitted as part of the EIA to ensure likely impacts of the device on marine wildlife are fully assessed. This strategy should explicitly state what Scotrenewables will undertake which is not contingent upon others.

The monitoring area should cover the modelled zone of likely impact of the development (including installation, operation and decommissioning). Although JNCC guidance currently recommends a minimum of 1km radius as the impact zone, we recommend that noise modelling is carried out in order to determine what impact zone is appropriate for this development. The survey plan should be designed so that EMEC baseline data can be compared with data during and after construction.

We are currently producing detailed guidance for the survey and monitoring of marine birds and mammals, which will hopefully be completed in July 2010.

6.4 Anti-foulants, lubricants and anti-corrosives

We welcome Scotrenewables commitment to providing an emergency contingency plan for the accidental release of potential pollutants.

Details should be provided on the makes and types of chemicals used in the operation of the device and their potential environmental impact. This should include any supporting documentation available confirming their suitability for use in a marine environment. Where practicable, SNH advocates the use of ultra-smooth surfaces and regular out-of-sea maintenance for marine renewable devices in preference to the use of anti-fouling paints.

6.5 Installation

Details should be supplied on any site preparation required for installation of the device. The developer should supply information regarding existing benthos in the specific location for device and mooring system deployment, any potential seabed impacts during the installation and operation (i.e. scouring caused by the ground chains), and any viable mitigation.

6.6 Decommissioning

Full details should be provided of the decommissioning process, including potential disturbance to the seabed resulting from decommissioning of the mooring system and the device itself.

We would be happy to meet with the developer, EMEC and/or any other relevant parties to discuss the proposal, should this be deemed useful.

Please contact Chris Eastham in the SNH Ayr office on (chris.eastham@snh.gov.uk / 01292 261 392) should you require any further information or advice in relation to the above proposal.

Yours sincerely

John Uttley
Area Manager
Northern Isles

cc - Fiona Thompson
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Appendix A

Legislative Requirements for European Sites
In Scotland, European Sites are defined as candidate Special Areas of Conservation (cSACs), designated Special Areas of Conservation (SACs) and classified Special Protection Areas (SPAs).

The Conservation (Natural Habitats, &c.) Regulations 1994 as amended, (the "Habitats Regulations") apply to European Sites. The requirements are summarised in Circular 6/1995 as amended June 2000 and include, at paragraph 12,

> "The Regulations (*48*) require that, where an authority concludes that a development proposal unconnected with the nature conservation management of a Natura 2000 site is likely to have a significant effect on that site, it must undertake an appropriate assessment of the implications for the conservation interests for which the area has been designated."

The need for appropriate assessment extends to plans or projects outwith the boundary of the site in order to determine their implications for the interest protected within the site.

Under regulation 48 of the Habitats Regulations, this means that the competent authority has a duty to:

- determine whether the proposal is directly connected with or necessary to site management for conservation; and, if not,
- determine whether the proposal is likely to have a significant effect on the site either individually or in combination with other plans or projects; and, if so, then
- make an appropriate assessment of the implications (of the proposal) for the site in view of that site's conservation objectives.

Scottish Natural Heritage recommends that the first bullet should only be accepted where it is a part of a fully assessed, and agreed, management programme.

If significant effects are unknown or likely, the competent authority can only agree to the proposal under regulation 48 after having ascertained that it will not adversely affect the integrity of the site. If this is not the case, and there are no alternative solutions, either:

(i) for sites where no priority habitat[5] is affected

The proposal can only be allowed to proceed if there are imperative reasons of overriding public interest, which in this case can include those of a social or economic nature. If you propose to approve the plan on the grounds of imperative reasons of overriding public interest then regulation 49 states that you must inform Scottish Ministers and you must not issue approval for a period of 21 days after receipt by Scottish Ministers unless notified otherwise.

If proposals are allowed to proceed in accordance with regulation 49 then it should be noted that regulation 53 requires that Scottish Ministers shall secure that any necessary compensatory measures are taken to ensure that the overall coherence of Natura 2000 is protected.

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[5] Priority habitats (within the meaning of the Habitats Directive and the Habitats Regulations) which occur as qualifying interests in SACs in Scotland are listed here. Priority habitats are not qualifying interests of SPAs and there are no European sites designated for any priority species in Scotland.

Or (ii) for sites where a priority habitat[6] is affected

The proposal can only be allowed to proceed if there are imperative reasons of overriding public interest. As the site is identified for a priority habitat, reasons of overriding public interest can relate only to human health, public safety, beneficial consequences of primary importance for the environment or other reasons subject to the opinion of the European Commission (via the Government). If you propose to approve the plan on the grounds of imperative reasons of overriding public interest then regulation 49 states that you must inform Scottish Ministers and you must not issue approval for a period of 21 days after receipt by Scottish Ministers unless notified otherwise.

If proposals are allowed to proceed in accordance with regulation 49 then it should be noted that regulation 53 requires that Scottish Ministers shall secure that any necessary compensatory measures are taken to ensure that the overall coherence of Natura 2000 is protected.

[6] Priority habitats (within the meaning of the Habitats Directive and the Habitats Regulations) which occur as qualifying interests in SACs in Scotland are listed here. Priority habitats are not qualifying interests of SPAs and there are no European sites designated for any priority species in Scotland.

Appendix B

Legal position relating to European Protected Species (EPS)

Regulations 39 and 43 of The Conservation (Natural Habitats &c.) Regulations 1994 (as amended) (Habitats Regulations) provide full protection for certain animal and plant species. The species identified above are referred to as European protected species and are listed on Schedules 2 (animals) and 4 (plants) of the Habitats Regulations.

This means it is illegal to:

- Deliberately or recklessly capture, injure or kill a European protected species of wild animal or to deliberately or recklessly (i) harass an animal or group of animals; (ii) disturb an animal while it's occupying a structure or place used for shelter or protection; (iii) disturb an animal while it's rearing or otherwise caring for its young; (iv) obstruct access to a breeding site or resting place, or otherwise deny the animal use of the breeding site or resting place; (v) disturb an animal in a manner that is, or in circumstances which are, likely to significantly affect the local distribution or abundance of the species to which it belongs; (vi) disturb an animal in a manner that is, or in circumstances which are, likely to impair its ability to survive, breed or reproduce, or rear or otherwise care for its young; (vii) disturb an animal while it is migrating or hibernating
- Deliberately or recklessly take or destroy its egg
- Deliberately or recklessly disturb any cetacean
- Damage or destroy the breeding sites or resting places of such animals
- Deliberately or recklessly pick, collect, cut, uproot or destroy European protected species of wild plant

Where it is proposed to carry out works which will affect European protected species or their shelter/breeding places, whether or not they are present in these refuges, a licence is required from the licensing authority (in this case likely to be Scottish Government). It is strongly advised that you refer to the Scottish Government information on the current interim licensing arrangements, which can be found in the document *European Protected Species, Development Sites and the Planning System: Interim Guidance for Local Authorities on Licensing Arrangements*, (October 2001) before applying for a licence. Copies of this are available at http://www.scotland.gov.uk/library3/environment/epsg-00.asp or by writing to the Landscapes and Habitats Division, Scottish Government Rural Directorate, Room GH 93, Victoria Quay, Edinburgh EH6 6QQ or by telephoning 0131 244 7140.

As highlighted in the Interim Guidance, three tests must be satisfied before the licensing authority can issue a licence under Regulation 44(2) of the Conservation (Natural Habitats &c.) Regulations 1994 (as amended) to permit otherwise prohibited acts. An application for a licence will fail unless all of the three tests are satisfied. The three tests involve the following considerations:

- Test 1 - The licence application must demonstrably relate to one of the purposes specified in Regulation 44(2) (as amended). For development proposals, the relevant purpose is likely to be Regulation 44(2)(e) for which Scottish Government is currently the licensing authority. This regulation states that licences may be granted by Scottish Government only for the purpose of *"preserving public health or public safety or other imperative reasons of overriding public interest including those of a social or economic nature and beneficial consequences of primary importance for the environment."*

- Test 2 - Regulation 44(3)(a) states that a licence may not be granted unless Scottish Government is satisfied *"that there is no satisfactory alternative".*

- Test 3 - Regulation 44(3)(b) states that a licence cannot be issued unless Scottish Government is satisfied that the action proposed *"will not be detrimental to the maintenance of the population of the species concerned at a favourable conservation status in their natural range*" (Scottish Government will, however, seek the expert advice of Scottish Natural Heritage on this matter).

Consideration of European protected species must be included as part of the planning application process, not as an issue to be dealt with at a later stage. Any planning consent given without due consideration to these species is likely to breach European Directives with the possibility of consequential delays or the project being halted by the EC, as has happened previously.

Northern Lighthouse Board

Your Ref: SRTT Scoping 270410
Our Ref: AJ/OPS/Nav/OREI/10/W+T SRTT

84 George Street
Edinburgh EH2 3DA
Switchboard: 0131 473 3100
Fax: 0131 220 2093
Website: www.nlb.org.uk
Email: enquiries@nlb.org.uk

Gina Penwarden (Environmental Consultant)
Scotrenewables (Marine Power) Ltd
Hillside Office
Hillside Road
Stromness
Orkney
KW16 3HS

26 May 2010

Dear Gina

Scotrenewables Tidal Turbine Scoping Document – 27 April 2010

We are in receipt of an e-mail dated 27 April 2010 from Mr Matthew Finn at EMEC regarding the intention of **Scotrenewables (Marine Power) Ltd** to install a tidal turbine device in the Falls of Warness for the purposes of testing and assessment.

We would advise that the following should be considered as our initial response to the Scoping Document and that any formal recommendations for lighting and marking will be given through the Coast Protection Act 1949 – Section 34 consultation process.

We note that the location for the intended testing is to the east of any existing test berth facility at the Falls of Warness area and that the device shall be a modified version of the previously detailed full scale prototype.

We would further advise that having taken into account the modifications to the device, the recommendations made in our response dated 22 October 2009 (a copy of which is enclosed) would continue to be our requirements for the safe marking and lighting of the device with the exception of the required number of flashing yellow lights.

The full scale device should be predominantly yellow in colour and lit by a single Yellow light, flashing once every five seconds (Fl Y 5s) with a nominal range of 2 nautical miles and mounted 1.5 metres above the waterline at the turret connection end of the device. Additionally, a radar reflector of such design as to increase the conspicuity of the device on marine radar should be fitted to the device at a similar elevation.

The Navigational Risk Assessment should include procedures to be taken and navigational warnings broadcast should any part of the structure become detached from the main unit during this phase.

We would ask that the Hydrographic Office be informed of the device location in order that the Admiralty Chart is updated to give information of the installation.

The projected installation of the device would indicate that during the 3rd quarter of 2010 the mooring anchors shall be installed and that 2011 will see a return to the site for the installation of the mooring lines, cable connection and device deployment.

The monitoring of the unit and its moorings through GPS position information alongside those already in place at EMEC should ensure that any unpredicted occurrence will be safely and efficiently dealt with.

The decommissioning of this test device shall also require notification of timescale, manner and vessels to be used communicated to the mariner in order that re-routing and avoidance can be predicted.

Regards

Peter Douglas
Navigation Manager

Cc Mathew Finn

Enc

marinescotland

The Scottish Government

EUROPEAN MARINE ENERGY CENTRE (EMEC) LTD
OLD ACADEMY
BACK ROAD
STROMNESS
ORKNEY
KW16 3AW

14 June 2010

Dear Matthew

FOOD AND ENVIRONMENT PROTECTION ACT 1985, PART II DEPOSITS IN THE SEA (AS AMENDED) (FEPA)

SCOTTISH RENEWABLES TIDAL TURBINE 250kW FULL SCALE PROTOTYPE (SRTT): EMEC, ORKNEY

Thank you very much for the opportunity to comment on the environmental assessment scoping report for the proposed works described above. Marine Scotland, Licensing Operations Team (MS-LOT) is the licensing authority for the above Act which extends seaward of the mean high water spring mark. The proposal is for the deployment of a full scale tidal turbine, which will not exceed 250kW max capacity, at the end of 2010 at EMEC. Marine Scotland fully understands and supports SRTT's decision to down scale the prototype from a 1MW to 250kW device. MS-LOT provided a scoping response to the 1MW proposal on the 1 December 2009. The device is no longer being deployed at berth 5 at EMEC but at a new shallower and more sheltered location (within the EMEC site). SRTT are aiming to install the new cable required for the new site and the gravity anchors for the mooring system during the third quarter of 2010 and the four-riser mooring system will then be installed onsite early in 2011. The SRTT full scale device is now due to be constructed towards the middle of 2010 and it will then undergo towing trials prior to installation. The device will then undergo short–term testing within the EMEC site until a safe connection and disconnection procedure can be established.

The scoping opinion states that 'the vast majority of monitoring will be conducted remotely'. This is true for the device monitoring but not the environmental monitoring. During the operational phase environmental monitoring (e.g. collision risk and disturbance) will be covered under the existing EMEC monitoring programme and should be referenced within the Environmental Statement. The scoping report provided the maximum rotating speed for the 250kW device to be 24rpm whereas the max rotating speed of the 1MW device was only 19rpm. Due to the design and speed of the SRTT device there may be a significant risk for marine mammals, large fish and diving birds to collide with the device. Mitigation and/or monitoring will need to be assessed in full within the supporting Environmental information with the application.

MS-LOT will seek advice from SNH regarding the monitoring requirements of the device to allow us to fully assess all possible interactions; SRTT may be required to undertake more surveys than outlined within EMEC's existing protocols.

Marine Scotland supports the participation in active sonar development and noise monitoring studies should be undertaken to identify the noise emitted by the turbine and its significance in relation to background noise in the area. This work may take advantage of background noise measurements made previously or to be made under existing or planned projects. Due to the high level of activity at the Falls of Warness site during 2010 and 2011 Marine Scotland requires the developers to assess the cumulative and in-combination effects associated with construction, installation and operation. Detailed assessments should be done to provide the regulator with definitive installation timelines as soon as possible.

Potential for disturbance to EPS species during operation should be covered by the EMEC wildlife observation programme. The SRTT device differs from other tidal devices within EMEC as it has mooring chains. Marine Scotland recommends that all monitoring requirements are undertaken to understand the interactions between the mooring chains and the device whilst at the EMEC site.

Marine Scotland would like to add that any extra survey requirements at this time can then be used as supporting information for future environmental impact assessments for commercial scale arrays. Marine Scotland would also be interested in any findings from the deployment of SRTT's 1/5th scale device in Burra Sound, particularly the forces placed on mooring lines from tidal effects.

Thank you for consulting with us on this matter.

Yours sincerely

Fiona Thompson
Marine Scotland

Marine Scotland

I have no issues with this document. So long as all the issues identified are fully covered in the NRA that accompanies the application, which should also include the verification certificate (covering both mooring system and device)

Val Ferguson
Ports and Harbours Branch

OIC Marine Services

David and I had a meeting with Gina from Scotrenewables and had a few of points for them to consider which I repeat here:

a) The new position is on the track for ferries deviating to avoid weather.
b) When the SRTT is deployed what is the catenary going to be like of the mooring that has the most tension – ie what will be the footprint that ferries and other craft will have to avoid
c) Considerations about marking – both when the device is connected to the turret and when not.

Best Regards
David

Capt David Thomson | Head of Marine Services (Operations)

Marine Coastguard Agency

We have now had an opportunity to review the scoping report and would comment as follows:
Given the low freeboard of the device when floating on the surface the marking and lighting and radar reflecting issues will be of particular importance.
The chart marking and note may need to be revised to reflect the increasing number of devices in the area.
It is not clear how long the device will be on site, which may have an influence on the above.

Regards
Paul
Capt Paul Townsend
Navigation Manager

RSPB

Thank you for the opportunity to comment on the Scotrenewables tidal device planned for the Fall of Warness. RSPB Scotland have no wish to object to the deployment of this device but would strongly urge EMEC and the developer to carry out as much underwater monitoring of wildlife interactions with the device as possible. Our knowledge of such interactions is still extremely limited and any information that can be gathered would be extremely useful.

Best wishes,

Eric

E.R.Meek, RSPB Orkney Area Manager

From: orkneyfisheries [mailto:orkneyfisheries@btconnect.com]
Sent: 14 June 2010 11:56
To: Christina Bristow
Subject: Re: Scotrenewables scoping feedback

Christina

With regard to your query re Scotrenewables, I apologise for the delay in reponding but there have been a number of unforeseen circumstance which prevented an earlier reply.

However we had our AGM on Saturday when the various renewable projects were on the agenda. The meeting was attended by a number of fishermen who regularly use the area and provided an ideal opportunity for comment. With particular regard to the Scotrenewable project, the area they have chosen is in an area extensively used seasonally by our divers and represents a steady and valuable part of their income. a sketch of the diving and creeling areas was provided some time ago and you will see that this confirms this ues. Readings provided by the divers show an area bounded by 59 09 03 N 2 48 27 E to 59 09 40 N 2 48 50 out to 81 W as the area used when tides and vision allow. The period used would normally run between mid- June to mid- October.

Placing the unit on this site would also create dangerous circumstances for divers trying to work the area. We would therefore suggest the site be moved ½ to 1 mile further south, preferably out to the 40m contour, where in our view a better, more regular tidal movement would occur based on our experience of the area.

Our other main concern is the extensive moorings shown in the diagrams without dimensions. This would be another hazard for divers and creel which emphasises the need to move the site further offshore outside the hard ground. Buoyage would also require to be sufficiently well marked to be visible at all times to the small vessels likely to use this area both for fishing and passage. There have been problems in other areas with buoys being pulled under in strong tides.

At the meeting considerable disappointement was expressed that the site chosen was outwith the areas which were agreed after extensive consultation between EMEC and OFA.

Regards

Alan

Email forwarded by Mike Grainger (Orkney RYA representation) to Anatec in response to NRA consultation

From: Emma Stewart [mailto:emma.stewart@rya.org.uk]
Sent: 13 September 2010 11:51
To: mikegrainger@btinternet.com
Cc: John Beattie; Pauline McGrow; Caroline Price; graham.kate.russell@btopenworld.com
Subject: Fall of Warness

Dear Mike,

Thanks for drawing this to our attention. Graham Russell and I have talked about this. We have had a look through the scoping report this morning, dated March 2010, and we know that the developers are aware of the key issues regarding recreational boating and are trying to address them accordingly. From your message it appears that there are two further issues to be clarified.

1) Procedures in place to deal with vessels swept onto the site by adverse conditions
2) Marking and lighting of the site and devices.

In the first case we suspect that the developer can put in place plans to address this eventuality. Even though this is not a particularly busy channel we appreciate that one vessel put at risk is one too many. We are sure the developer feels the same and are happy to discuss options and possible mitigation measures.

With regards to the second point we share your concern about the visibility of the device, particularly in rough seas and feel that the NLB recommendations while fine for larger vessels are inadequate for recreational craft in this particular location. The RYA is certainly happy to discuss this further with the developer. We value the opportunity of learning from experiences from test sites such as this to develop guidance for future wave and tidal developments. We consider this to be a very specific site and therefore believe lighting and marking may need to differ from the usual NLB guidance.

Kind Regards

Graham Russell
RYA Scotland

Emma Stewart
Planning and Environmental Officer

Our ref: PCS107191
Your ref: None

If telephoning ask for:
Susan Haslam

7 May 2010

Matthew Finn
The European Marine Energy Centre (EMEC) Limited

By email only to: Matthew.Finn@emec.org.uk

Dear Mr Finn

FEPA Scoping consultation
Scotrenewables (Marine Power) Ltd SRTT 250kW Full Scale Prototype
EMEC Fall of Warness Tidal Test Facility, Eday, Orkney

Thank you for consulting SEPA further on the revised scoping document for the above development proposal. We have only one further comment to make on the proposal above those we provided in our response dated 10 December 2009.

Table 5.1 of the scoping report states that mooring chain movement will have an impact on sediment distribution and seabed species. It is not clear from Figure 3.3 – Mooring Configuration and Figure 4.1 – Location of New Test Site and Cable Route how much seabed will be affected by seabed scour resulting from chain movement. It would be useful if the Environmental Statement included information on the approximate area of seabed that will be impacted during the operation of the device, and how this has been minimized.

Should you wish to discuss this consultation please do not hesitate to contact me on 01349 860359 or planning.dingwall@sepa.org.uk. Please note that all electronic scoping consultations should be sent to planning.dingwall@sepa.org.uk.

Yours sincerely

Susan Haslam
Senior Planning Officer
Planning Service

Appendix 3

Device Specific Navigation Risk Assessment

Scotrenewables®
Tidal Power Ltd

SR250 Tidal Device
Navigation Risk Assessment

Fall of Warness

Prepared by:	Anatec Ltd.
On behalf of:	Scotrenewables Tidal Power Ltd
Date:	15 September 2010
Revision No.:	02
Ref.:	A2445-SR-NRA-2

Anatec	**Aberdeen Office**	**Cambs Office**
Address:	36 Upperkirkgate, Aberdeen AB10 1BA, Scotland, UK	16 Ward Way, Witchford, Ely, Cambs, CB6 2JR, UK
Tel:	01224 633711	01353 661200
Fax:	0709 2367306	0709 2367306
Email:	aberdeen@anatec.com	cambs@anatec.com

This study has been carried out by Anatec Ltd on behalf of Scotrenewables Tidal Power Ltd. The assessment represents Anatec's best judgment based on the information available at the time of preparation. Any use which a third party makes of this report is the responsibility of such third party. Anatec accepts no responsibility for damages suffered as a result of decisions made or actions taken in reliance on information contained in this report.

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1. Introduction

1.1 Background

Anatec have been commissioned by Scotrenewables Tidal Power Limited (Scotrenewables) to perform a device-specific Navigation Risk Assessment (NRA) for the proposed deployment of the SR250 tidal device at the EMEC test facility in the Fall of Warness (FoW) off the coast of the island of Eday in the Orkney Islands.

Anatec carried out the 'Generic' NRA for the Fall of Warness in 2010 (Ref. i). This device-specific study is an addendum to that report which reviews the location and site-specific issues relating to the SR250 deployment.

For more background information on the baseline data sources as well as a comprehensive review of the vessel activity within the FoW lease areas, please refer to the Generic FoW NRA.

1.2 Objectives

The main aims of this study were as follows:

- Perform a location-specific assessment referencing the baseline data used in the FoW generic NRA to the SR250 location, including:
    - Shipping activity
    - Fishing activity
    - Recreational Vessel activity
    - Eday Watchkeeper Vessel Logs
    - Historical Incidents
    - Search and Rescue resources
- Present metocean data for the SR250 location.
- Summarise consultation carried out on the planned deployment with navigational stakeholders.
- Review the navigational risks associated with the planned SR250 deployment.

1.3 Abbreviations

The following abbreviations are used in this report:

AIS	-	Automatic Identification System
ATBA	-	Area To Be Avoided
EMEC	-	European Marine Energy Centre
FoW	-	Fall of Warness

GRT	-	Gross Registered Tonnage
H_{max}	-	Maximum Wave Height (m)
H_s	-	Significant Wave Height (m)
IALA	-	International Association of Lighthouse Authorities
IMO	-	International Maritime Organisation
kW	-	Kilo-Watts
LAN	-	Local Area Network
LAT	-	Lowest Astronomical Tide
m	-	Metre
MCA	-	Maritime and Coastguard Agency
MGN	-	Marine Guidance Note
NLB	-	Northern Lighthouse Board
nm	-	Nautical Mile (1nm ≡ 1,852metres)
NRA	-	Navigation Risk Assessment
OFA	-	Orkney Fisheries Association
OIC	-	Orkney Islands Council
OREI	-	Offshore Renewable Energy Installation
RNLI	-	Royal National Lifeboat Institution
RPM	-	Revolutions Per Minute
RYA	-	Royal Yachting Association
SAR	-	Search and Rescue
SCADA	-	Supervisory Control And Data Acquisition
SFF	-	Scottish Fishermen's Federation
SFPA	-	Scottish Fisheries Protection Agency
T_p	-	Average Peak Wave Period (seconds)
T_z	-	Mean Zero-crossing Period (seconds)
WGS84	-	World Geodetic System 1984

2. Site Details

2.1 Location Overview

A single SR250 device is planned to be deployed within the Fall of Warness lease area, to the southwest of the Isle of Eday. It will be installed at a new cable berth, as shown in Figure 2.1, which also shows the five existing test berths (1-5) and two planned for installation in 2010 (6-7).

The device location coordinates are 59 08.681' North, 002 48.392' West (WGS84). The water depth at the location is 35 metres (LAT).

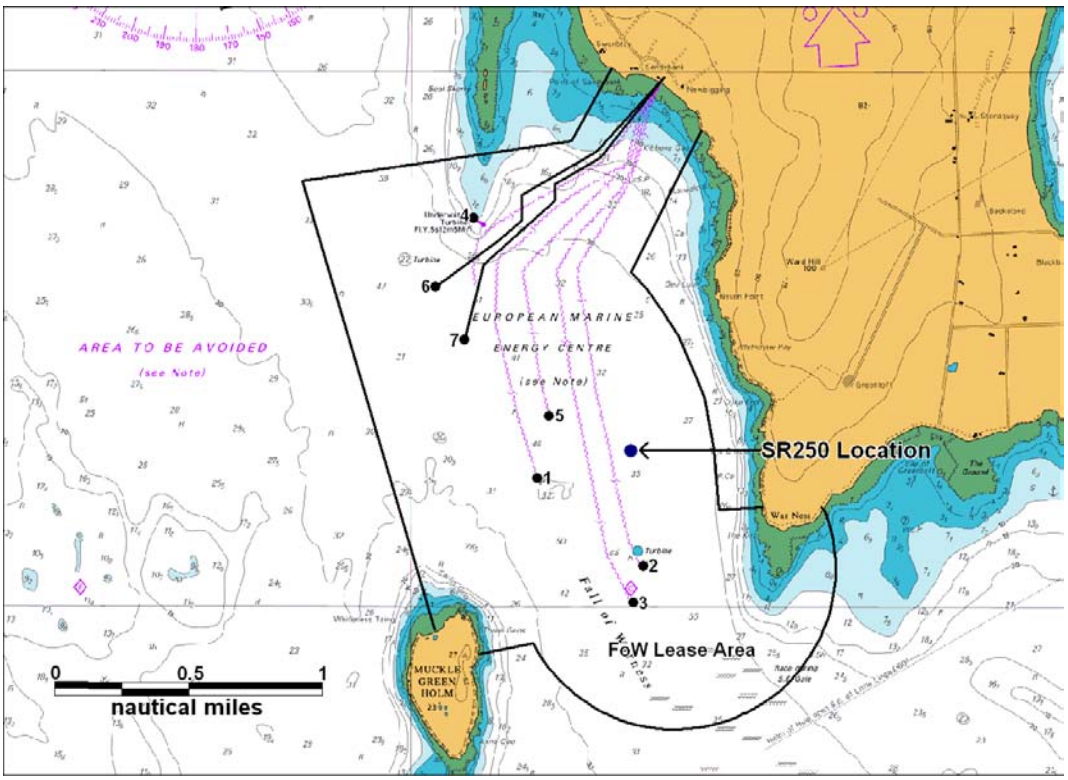


Figure 2.1 Chart of SR250 Location relative to other FoW Cable Berths

The site is approximately 0.5nm to the South of the location where it was originally proposed to deploy the SR250.

2.2 Device Details

The SR250 is a surface floating tidal stream energy converter. The design has undergone extensive scale model testing and hydrodynamic modelling for several years, including 1/5th scale model tow-testing and an open-sea test programme at Burra Sound in Orkney. The design progression toward full-scale is being closely assisted by DNV, who will continue to provide independent certification as the project develops. The maximum rated capacity of the device will not exceed 250 kW.

Details are summarised below and further information can be found in the Scoping Report (Ref. ii) and Basis of Design (Ref. iii).

The hull comprises a 32m long steel tube with a 2.2m diameter. The rotors are each suspended from separate retractable rotor legs attached to the buoyancy tube, which raise and lower the rotors from transport to operation modes.

The rotors will be 8m in diameter and the maximum rotation speed will be 24rpm. The material of construction will be cathodically protected carbon steel, unless specific design requirements suggest other material are more suitable. The system will have a total displacement of approximately 80 tonnes.

The SR250 is depicted below showing deployment and survival configuration (Figure 2.2), and operational mode (Figure 2.3).

All control systems are remotely accessible such that the device can be shutdown in the survivability mode upon demand.

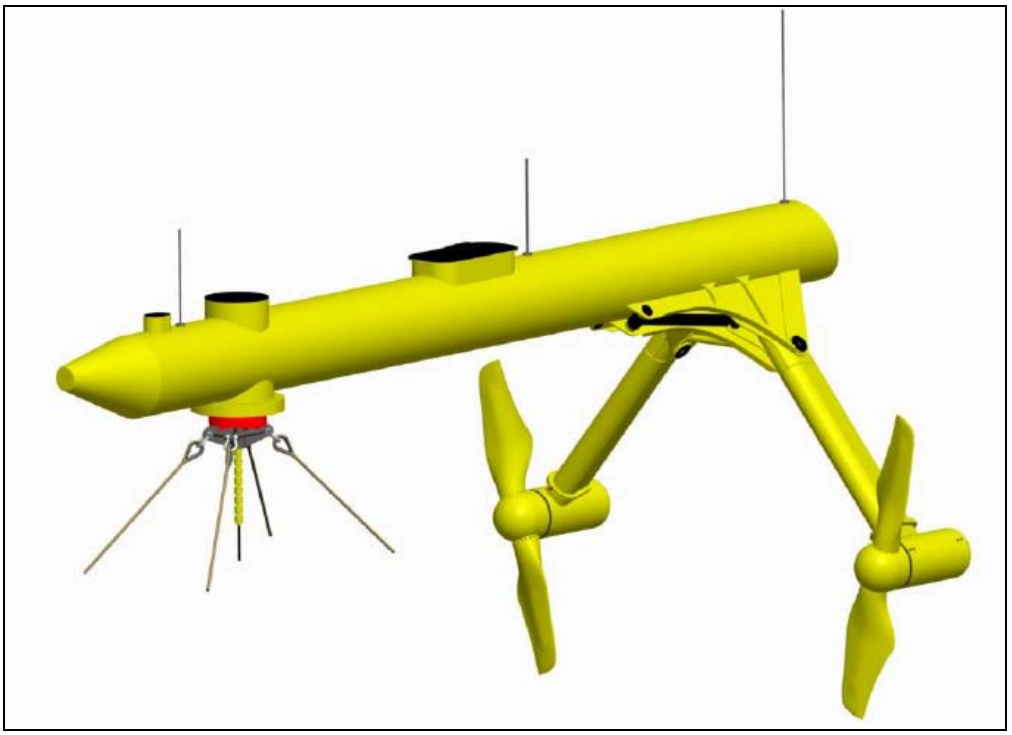


Figure 2.2 SR250 in Operational Mode

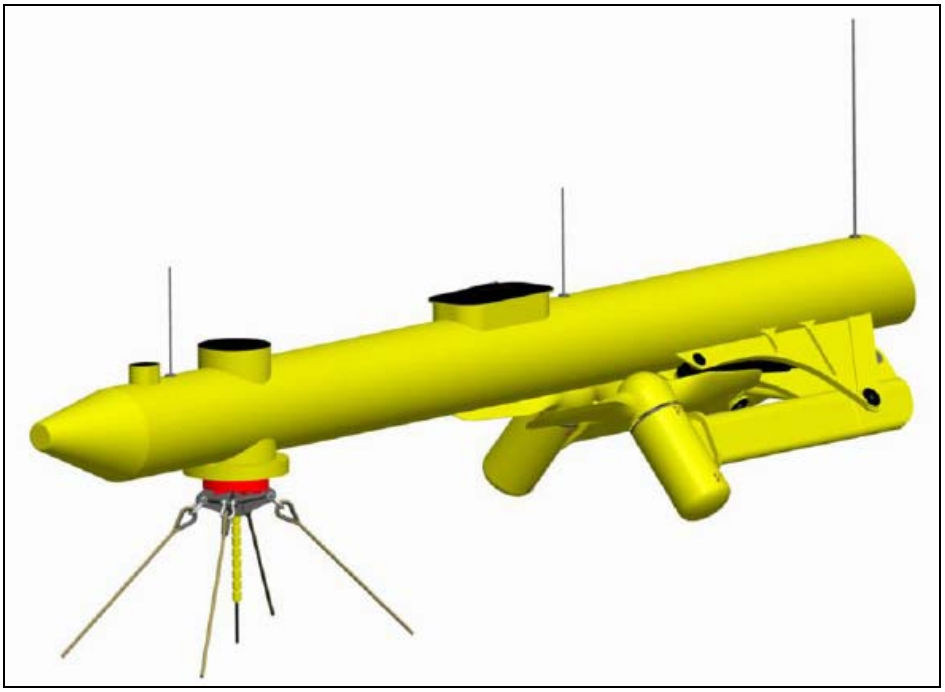


Figure 2.3 SR250 in Transport / Survivability Mode

2.3 Mooring System

The device will be anchored to the seabed using a four-riser catenary spread compliant mooring system with a centrally located, disconnectable turret. The mooring is illustrated in Figure 2.4.

The turret is approximately 3.0m high and 1.5m in diameter, and allows the device to passively yaw around the mooring system to capture the tidal flow in any direction. The turret will remain a minimum of 10m below LAT when the SR250 is off site. The turret contains quick-release mechanical and electrical connections which allow remote connection and disconnection of the SR250 in a quick single action without the requirement for vessels alongside or personnel on board the device.

The device mooring lines will be in an "X" configuration with a half angle of 30 degrees, taking up an area of approximately 220m by 130m (0.03km^2).

Mooring lines will comprise of synthetic lines and ground chains and will be anchored to the seabed using gravity anchors. Each of the four (one at each corner) gravity anchors consists of two reinforced concrete blocks measuring 2.9m x 2.9m x 1.3m bridled together.

The provisional anchor positions are listed in Table 2.1. The mooring are all within the FoW Lease Area, as illustrated in Figure 2.5. The normal excursion of the device from its neutral (centre) position will be up to 13m.

Table 2.1 Anchor Positions (WGS84)

Anchor	Latitude	Longitude
NW	59° 08.615' N	002° 48.510' W
NE	59° 08.649' N	002° 48.392' W
SE	59° 08.547' N	002° 48.274' W
SW	59° 08.513' N	002° 48.392' W
Centre	59° 08.581' N	002° 48.392' W

The mooring design will be covered by an Independent Structural Verification Report.

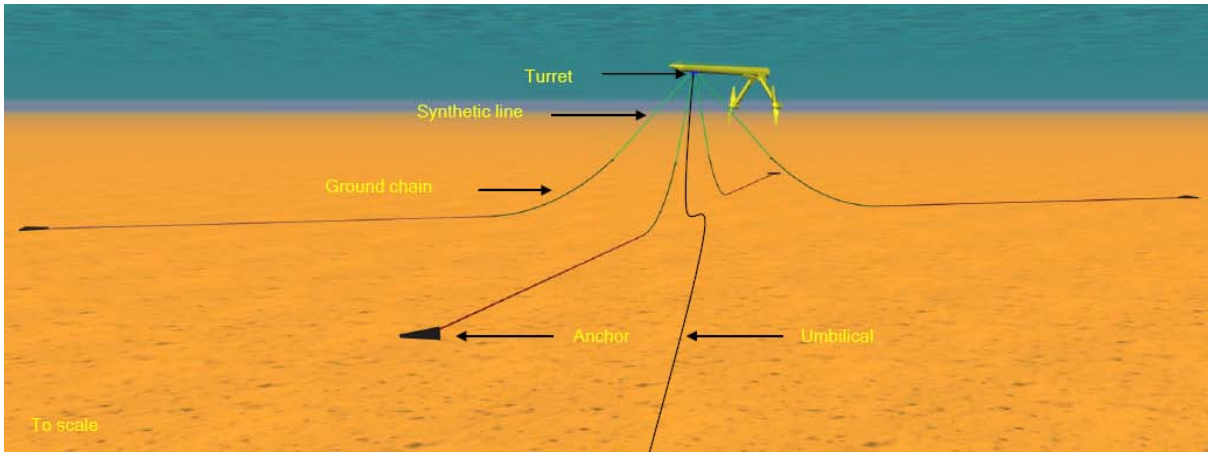


Figure 2.4 SR250 Mooring Configuration

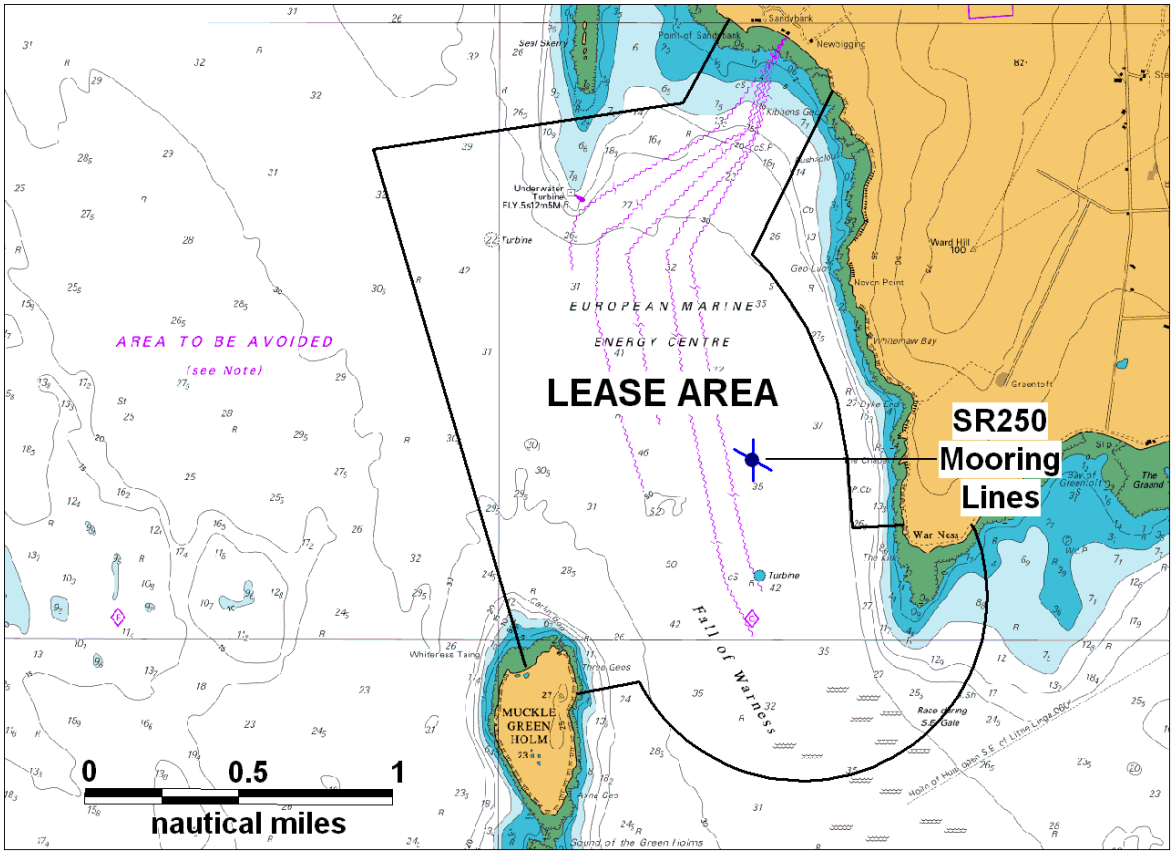


Figure 2.5 SR250 Mooring Line Configuration within FoW Lease Area

2.4 Cable

Scotrenewables plan to install a separate armoured seabed cable located North East of the existing cable ends in the Falls of Warness (see Figure 2.6). EMEC will provide a cable duct from the shore facility to the mean spring low water level. The cable will be laid by a multicat type vessel, and the works are expected to take less than a day. Unlike the other EMEC cables which have a 5MW rated capacity, the new cable will only have to have a 250kW capacity, so will be considerably smaller at approx. 50mm diameter. The cable will be extended from the original proposed site for the SR250 to the new location. The total length of the seabed cable will be approximately 3km.

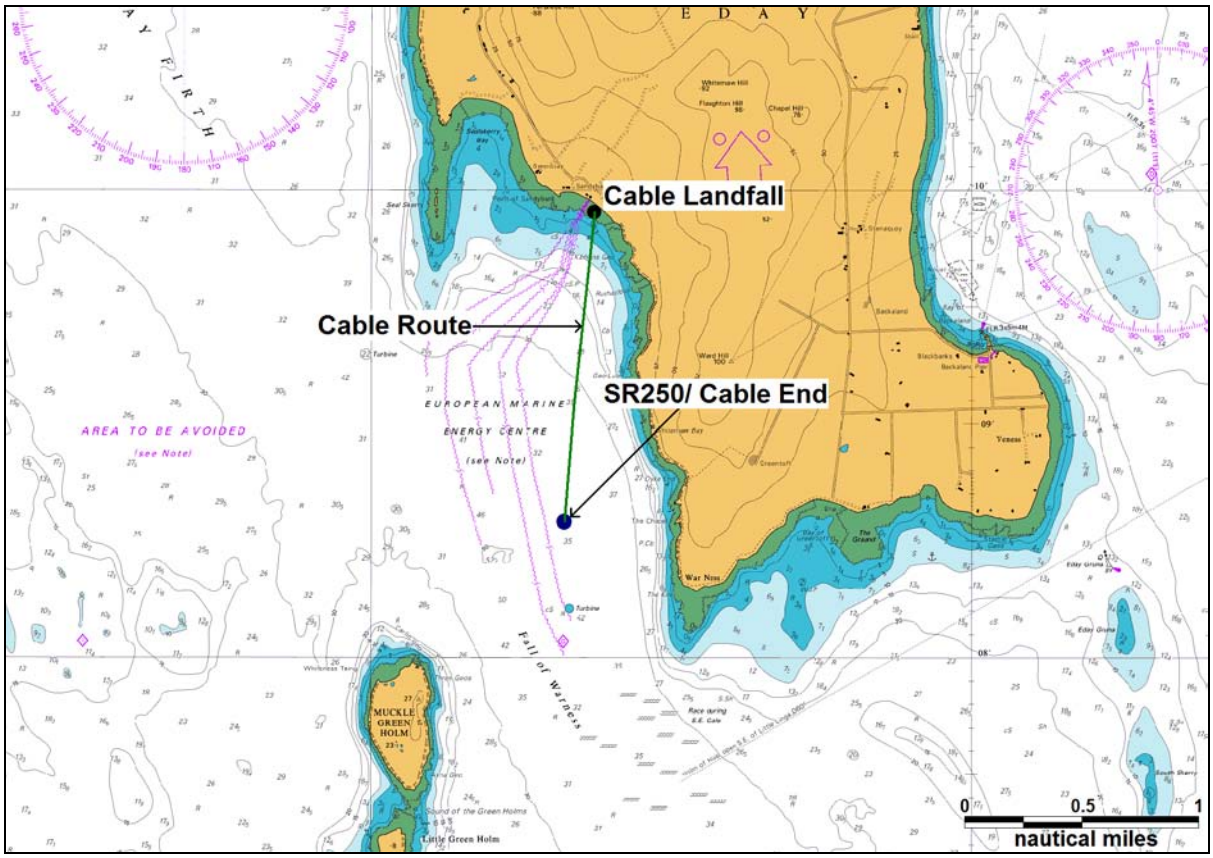


Figure 2.6 Approximate Cable Route from Shore to Test Site

The cable will have additional protection (cast iron sheath) through the surf zone out to 5m depth. After this the cable will be laid on the seabed (neither trenched nor buried).

2.5 Installation Works

The installation works will include:

- Installation of the seabed cable during early 2011.
- Installation of the mooring system. This will involve the installation of the gravity anchors and the four-riser mooring system in early 2011.
- After several towing trials, the device will be connected to the mooring system at EMEC. Initially, the electrical energy will be dissipated to an onboard resistive load bank avoiding the extra complexities of a grid connection. Once satisfied that an efficient and safe connection and disconnection procedure has been achieved for the mooring system, the SR250 will be connected to the grid. The duration of test periods will gradually increase to the point where a continuous three-month grid connected deployment is achieved during 2012 (see Figure 2.7).

During the operational phase, Scotrenewables will monitor the device and carry out any necessary maintenance using contractors. All maintenance activities will take place away from the site.

Due to the floating nature of the device and its low mass, all installation and maintenance operations are designed to be carried out using a modest sized readily available multi-cat type workboat (<26m).

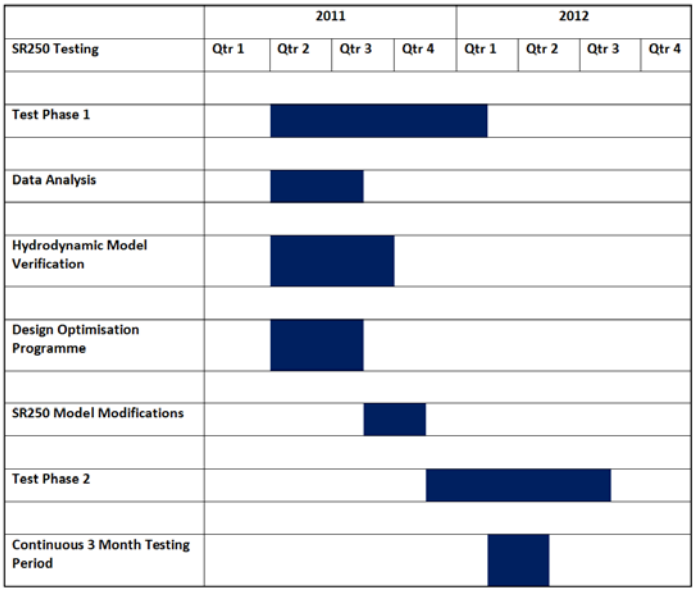


Figure 2.7 SR250 Provisional Testing Phase Timetable

3. Metocean Data

Metocean data (wave, wind, tide and visibility data) for the Fall of Warness is presented in the Generic NRA.

Detailed data for the precise SR250 location was obtained from a wave-current interaction study at the Fall of Warness completed by DHI for EMEC, which has been validated against onsite recorded wave and current data. The data is from 2005 and was provided at 20 minute intervals. It is understood 2005 was a worse than average year in terms of weather.

Summary plots of this data are presented in Figure 3.1 and Figure 3.2. In terms of wave heights, the average significant wave height in 2005 was in the range 0.5-1m, within only a 0.3% exceedence of 3m. The average maximum wave height was between 1-2m with approximately 1% exceedence of 5m.

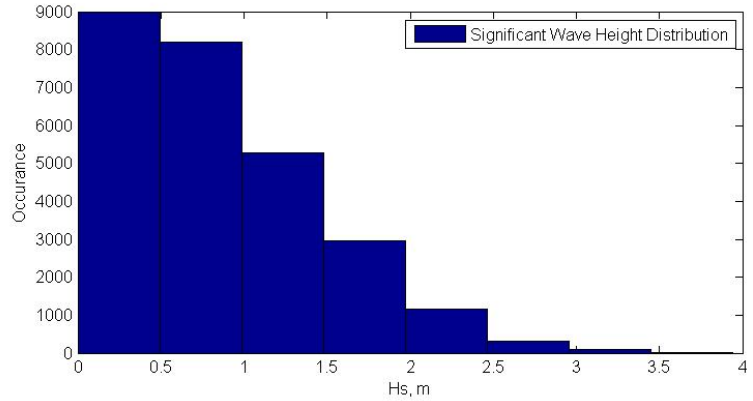
The average peak wave period in 2005 was just over 6 seconds, corresponding to a wave length of approximately 60m. The peak wave direction was NW.

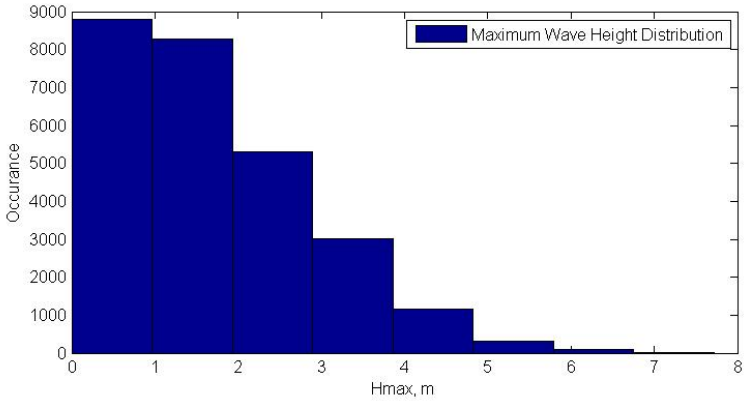
Predominantly current directions are NW and SE although the speeds at the SR250 location are much lower than further west within the channel, typically between 0-2 knots.

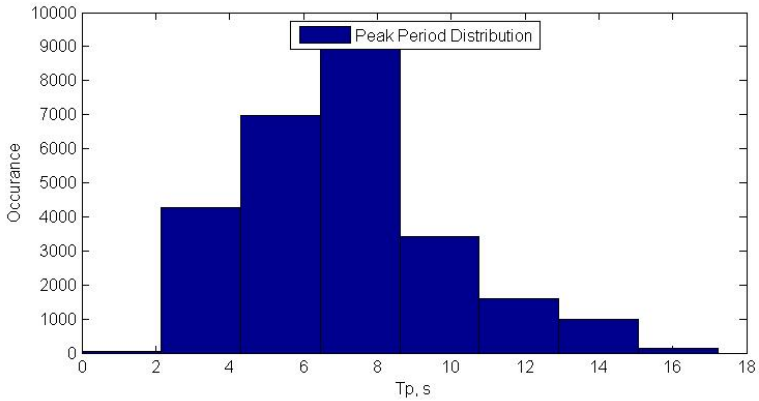
Modelling work carried out by EMEC indicates the following 10 and 100 year return events for the device location.

Table 3.1 Return Events – SR250 Location (Estimated)

Parameter	Return Period (years)	
	10	**100**
Significant Wave Height, H_s (m)	4.2	5.1
Maximum Wave Height, H_{max} (m)	8.0	9.8
Peak Wave Period, T_p (s)	9.7	11.6
Zero Crossing period, T_z (s)	6.0	6.7







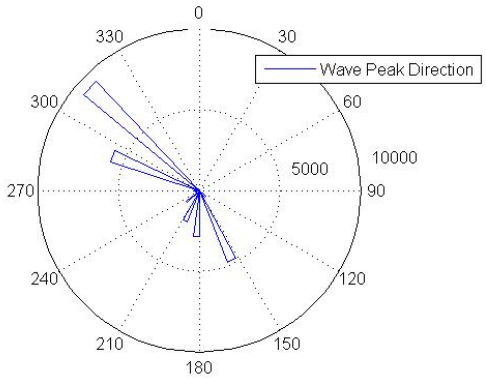


Figure 3.1 Wave Data for SR250 Site (2005)

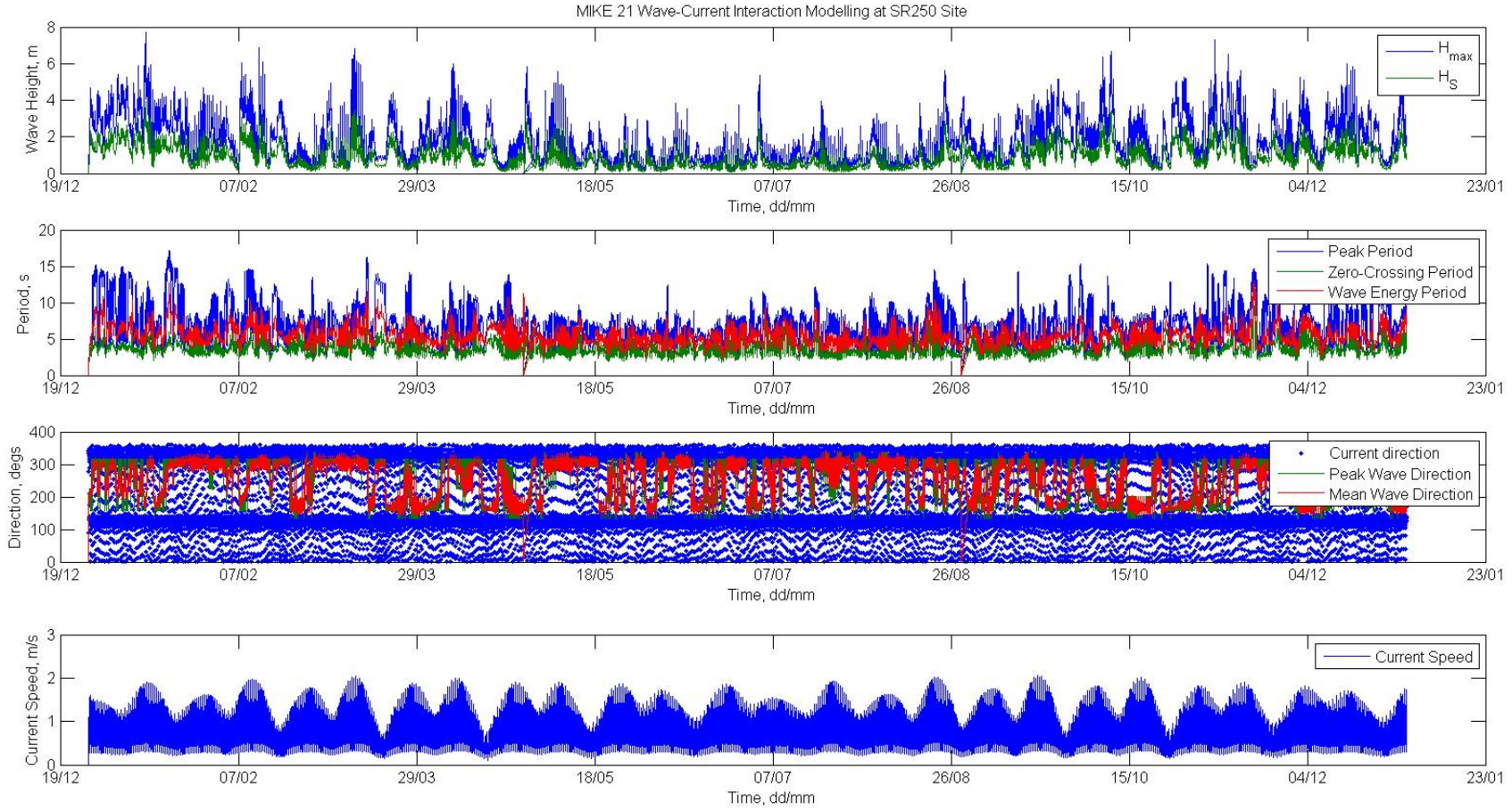


Figure 3.2 Wave and Current Data for SR250 Site (2005)

4. Consultation

Widespread consultation on the Fall of Warness development was carried out during the original and revised Generic Navigation Risk Assessments.

Further consultation has been carried out on the proposed SR250 deployment during the scoping stage as well as during preparation of this NRA. The main comments received from stakeholders are presented in Table 4.1.

Table 4.1 Consultation Comments relating to SR250

Stakeholder	Comments
Cruising Association	The device is close to the direct line through the Fall of Warness, but should not be a problem provided that any surface or near surface obstructions are very clearly marked at all states of the tide. A potential problem is that a low powered vessel may be set north into the Fall by the tide when trying to clear the south end of Eday so could find themselves off their planned passage. Quite a few visiting yachts misjudge the local tidal streams.
MCA	Raised the following issues during scoping: • Given the low freeboard of the device when floating on the surface the marking and lighting and radar reflecting issues will be of particular importance. • The chart marking and note may need to be revised to reflect the increasing number of devices in the area. • It is not clear how long the device will be on site, which may have an influence on the above. Further information was provided during preparation of the NRA and the MCA had no further comments at this stage.
NLB	Recommend that the device should be predominantly yellow in colour, lit by a yellow light flashing once every five seconds (fl Y 5s) with a nominal range of 2 nautical miles and mounted 1.5 metres above the waterline at the turret connection end of the device. Additionally, a radar reflector of such design as to increase the conspicuity of the device on marine radar should be fitted at a similar elevation. Additionally, recommend the turret be marked by a high visibility (mooring type) buoy of approximately 1 metre diameter. This could either be attached to the turret or moored sufficiently close to mark the area without interfering with the turret. This will indicate an underwater obstruction when the device is not on location. Formal recommendations for lighting and marking will be given through the Coast Protection Act 1949 Section 34 consultation process.

Stakeholder	Comments
OIC Marine Services	Clarification was provided on the following issues raised at the original scoping stage: • Markings- concerns over fitting of radar reflectors and height of navigation lights when tidal stream is running • Mobilisation Areas • Mooring System (footprint area / catenary spread) • Inter-Island Ferry – possible interference with track used by ferries deviating to avoid bad weather • Height to which Mooring System reverts when device is removed
RYA	Emphasised that routes used by recreational sailors depend upon the tide and the weather and have to be adjusted during the voyage. For example, if travelling from Pierowall to Kirkwall there are two routes which can be taken, to the east of Eday through Calf Sound or to the west of Eday. If the passage begins at the start of the flood, a vessel would pass on the west side of Shapinsay and avoid the Fall of Warness. If the passage is started towards the middle of the flood then a vessel go through the Fall of Warness, down the east of Shapinsay and take the ebb through the String. If travelling north you would be doing this on the ebb. In this case a tidal race forms to the south and west of Green Holm and the smoother passage is through the Fall of Warness. By keeping close to the Eday shore, the turbulent water in the Westray Firth is avoided. Two key issues were raised regarding the proposed deployment: 1) Procedures to deal with vessels swept onto the site by adverse conditions. 2) Marking and lighting of the site and device. Further discussions are planned to discuss these issues. In general, the RYA value the opportunity of learning from experiences from test sites such as this to develop guidance for future wave and tidal developments.
UKHO	Cable and device will be depicted on Admiralty Charts as they are planned to be in situ for over six months. More details on depiction to be provided once finalised details are available, including dates, markings and exact cable coordinates. (At other FoW sites, device has been depicted based on worst case clearance, i.e., assuming the surface obstruction is in place.)

It is noted that consultation was conducted with fisheries stakeholders for an initial site planned by SR250. Due to issues raised by fishermen, the location was revised to the one considered in this report. It is understood fisheries stakeholders are satisfied with the new location based on the consultation conducted by EMEC and Scotrenewables.

5. Baseline Data – SR250 Location

5.1 Introduction

This section presents analysis of the baseline information collated for the Fall of Warness Generic NRA (Ref. i) relative to the planned SR250 device location.

The following data sets are reviewed:

- AIS Tracking Data
- Fishing Vessel Surveillance Data
- RYA / CA Data
- Eday Watchkeeper Vessel Logs
- Historical Maritime Incidents (MAIB and RNLI)
- Search and Rescue Resources

5.2 AIS Analysis

Twelve weeks of AIS survey data has been analysed for the location; six weeks from summer 2009 (June-July) and six weeks from winter 2010 (February-April). Vessels identified to be working at the Fall of Warness site (*Valkyrie*, *Sarah Grey* and *Uskmoor*) have been excluded.

During the 6 weeks in summer, 13 tracks passed within 0.5 nautical miles of the planned SR250 location. The closest vessel, *Pathway*, was identified to pass at a distance of 0.35nm WSW of the SR250 location. This is a 2,623 DWT fishing vessel.

During the winter survey, 13 tracks were identified passing within 0.5nm of the proposed SR250 location. The closest vessel, *Earl Thorfinn*, passed to the SSW of the location at a distance of 210m. This 231 DWT inter-island ferry transits between Kirkwall and the Northern Isles.

Overall during the 12 weeks, 26 tracks passed within 0.5nm of the site, an average of just over two per week. Nineteen were transiting between the Westray and Stronsay Firths via Fall of Warness, passing WSW of the site at distances ranging from 0.3-0.6nm. These were mainly passenger cruise ships (summer only), pelagic fishing vessels and fisheries patrol vessels.

Seven inter-island ferries passed to the SSW of the site at minimum passing distances ranging from 0.1-0.5nm, all during the winter period.

More details on the vessels that passed within 0.5nm of the SR250 location on more than one occasion during the 12 weeks are presented in Table 5.1.

Table 5.1 Details of Vessels passing within 0.5nm of SR250 Location

Name	Type	Destination	Length (m)	Draught (m)	Transits (12 Weeks)
Earl Thorfinn	Inter-Island Ferry	North Isles - Kirkwall	45	3	3
Earl Sigurd	Inter-Island Ferry	Westray	45	3.2	3
Minna	Fisheries Patrol	'Patrol'	47.7	4	3
Maersk Fetcher	Offshore Tug/Supply	Aberdeen – West of Shetland	82.5	5.0 - 5.7	2
Saga Rose	Passenger	Killybegs - Liverpool	188.9	8.3	2
Astor	Passenger	Hafnarfjordur	176	6.2	2
National Geographic Explorer	Passenger	Kirkwall	108.6	5	2

Detailed plots of the tracks relative to the SR250 site during summer and winter, colour-coded by vessel type, length and draught, are presented in Figure 5.1 to Figure 5.6.

OIC Marine Services expressed concern during consultation that ferries may pass close to the location when weather routeing. During the winter survey, seven ferries were tracked passing within 0.5nm of the site to the south. These ferries were mostly passing north of Muckle Green Holm.

Longer term data was reviewed to investigate the ferry tracks taken in different conditions. A plot of the ferry tracks based on six months of AIS, covering different times of year, is presented in Figure 5.7. This showed a total of 10 ferry tracks passing within 0.5nm of the site to the south, indicating that the weather route north of Muckle Green Holm is used relatively infrequently and mainly in winter. The closest ferry to the site over the six months was *Earl Thorfinn* passing 210m SSW.

There were also five ferry tracks passing within 0.5nm to the west of the site when heading between Kirkwall and Westray. The closest passed 510m from the proposed location. It is not considered these ferries would pass significantly closer to the SR250 location as their route is west of Muckle Green Holm.

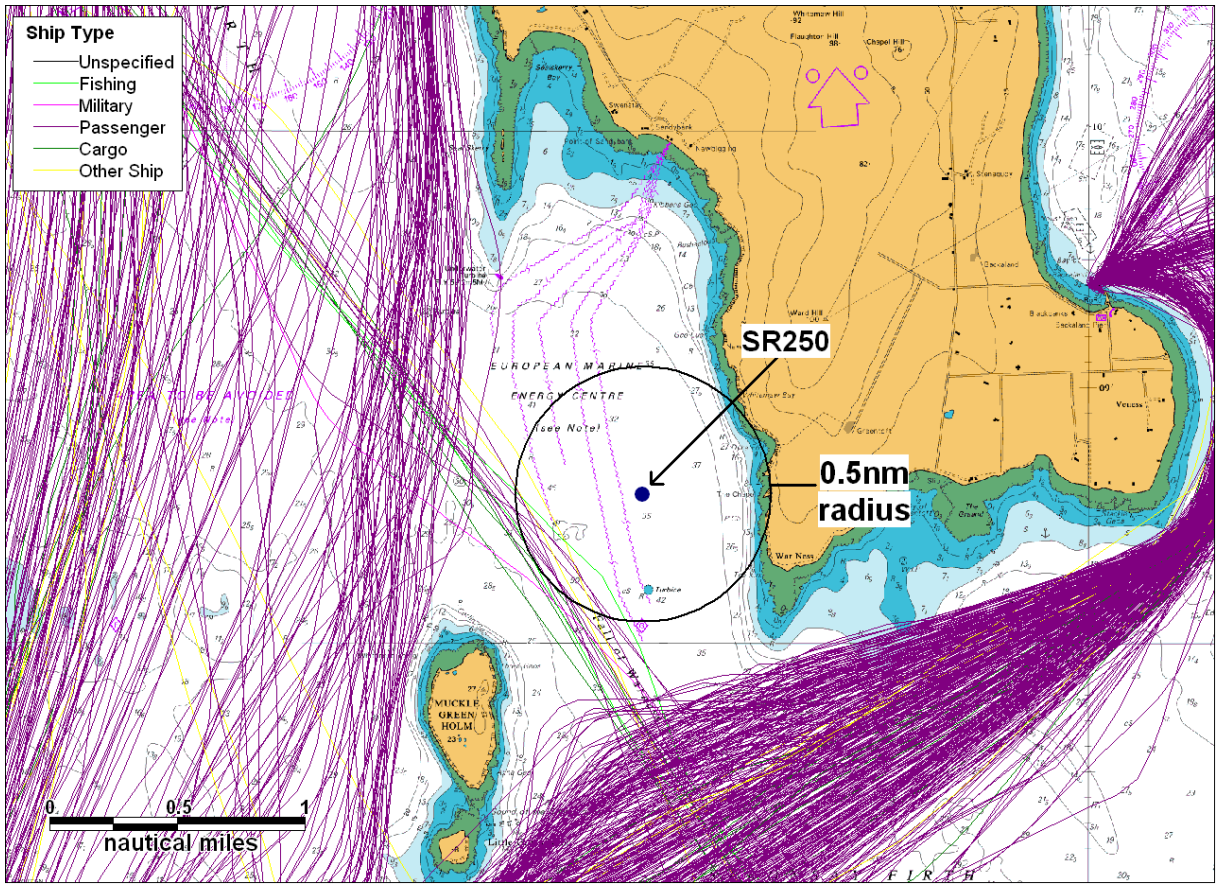


Figure 5.1 Detailed Plot of Summer 2009 AIS Tracks

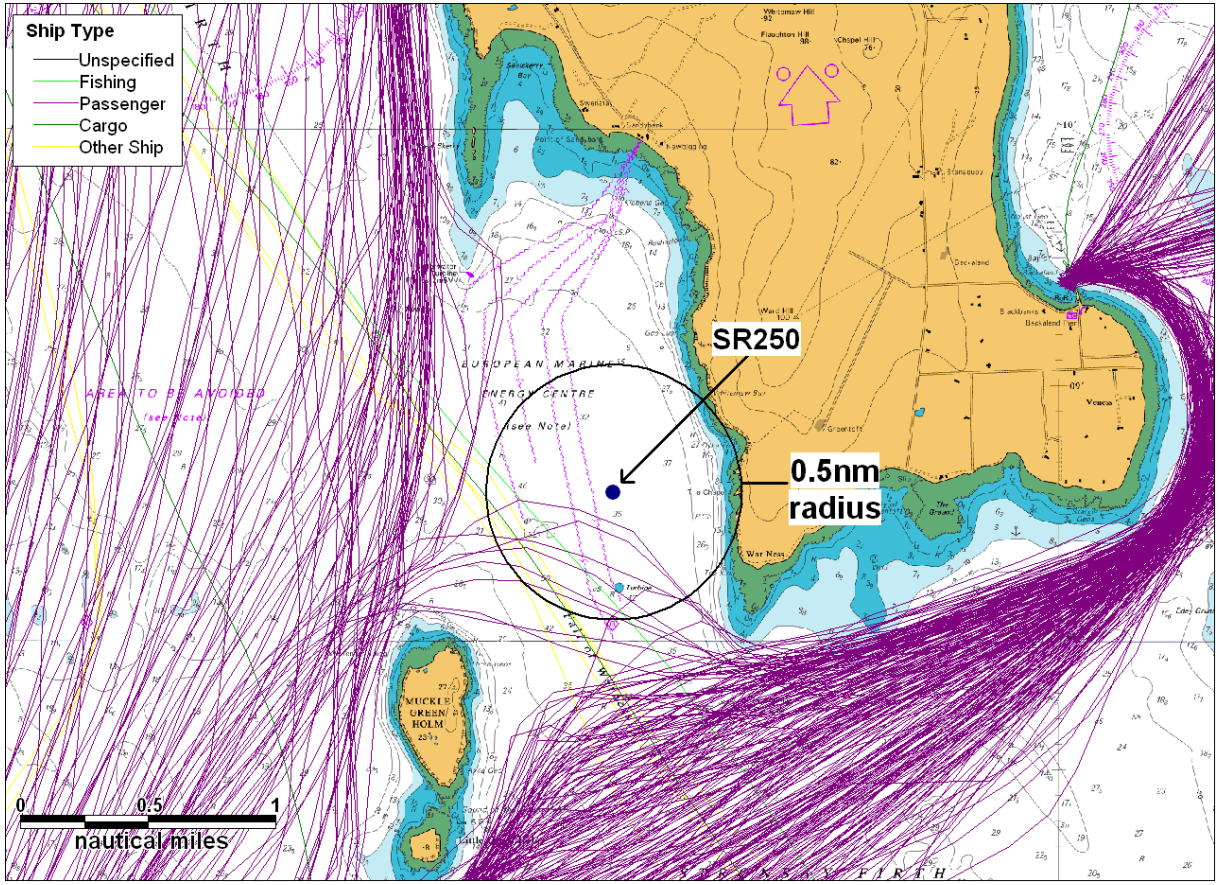


Figure 5.2 Detailed Plot of Winter 2010 AIS Tracks

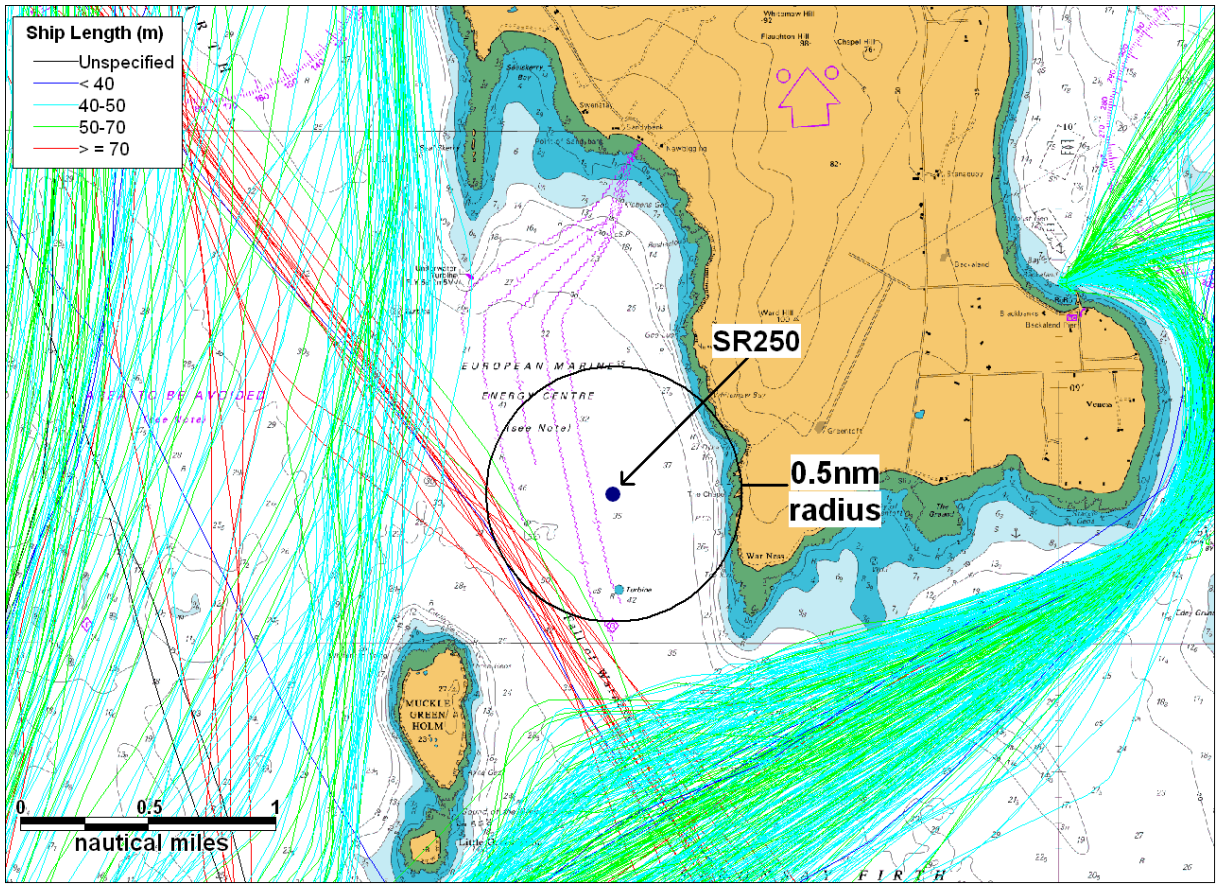


Figure 5.3 Detailed Plot of Summer 2009 AIS Tracks by Length

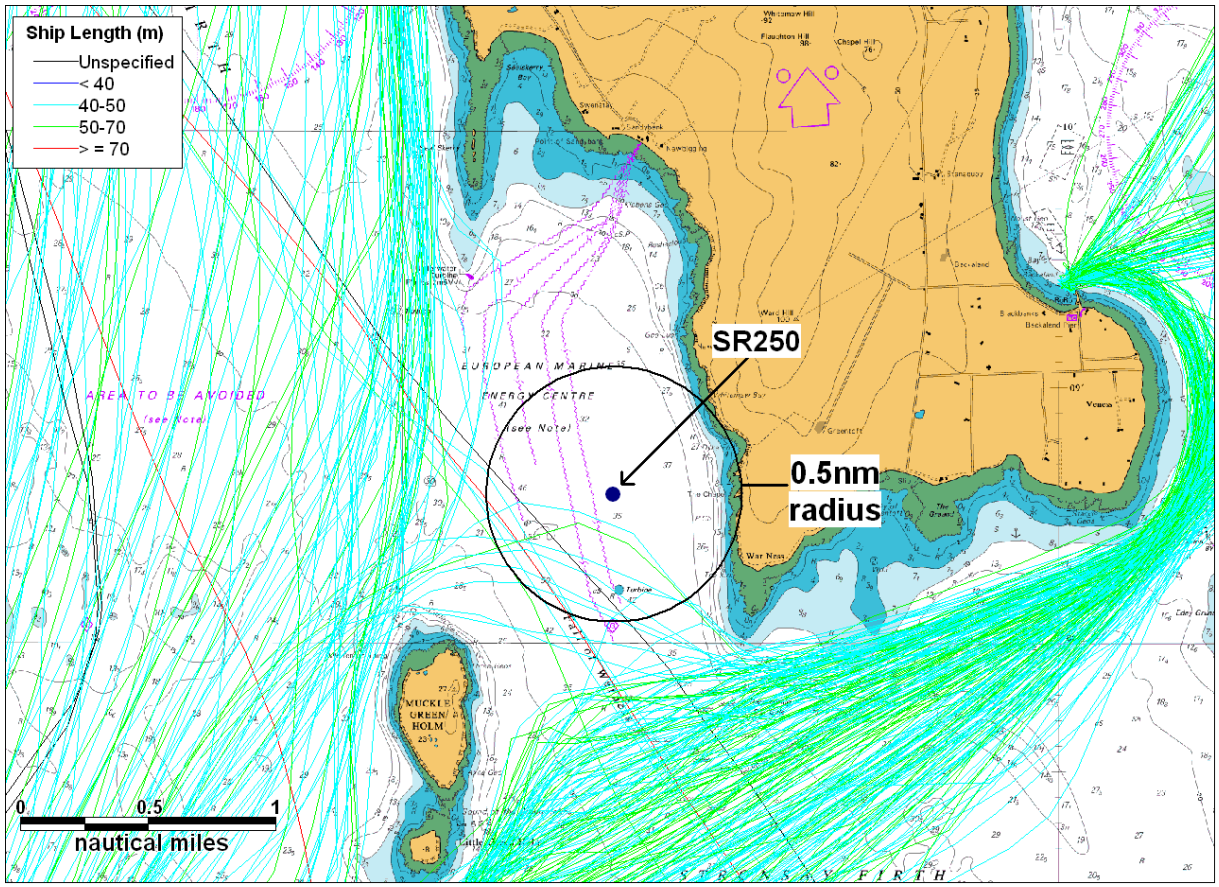


Figure 5.4 Detailed Plot of Winter 2010 AIS Tracks by Length

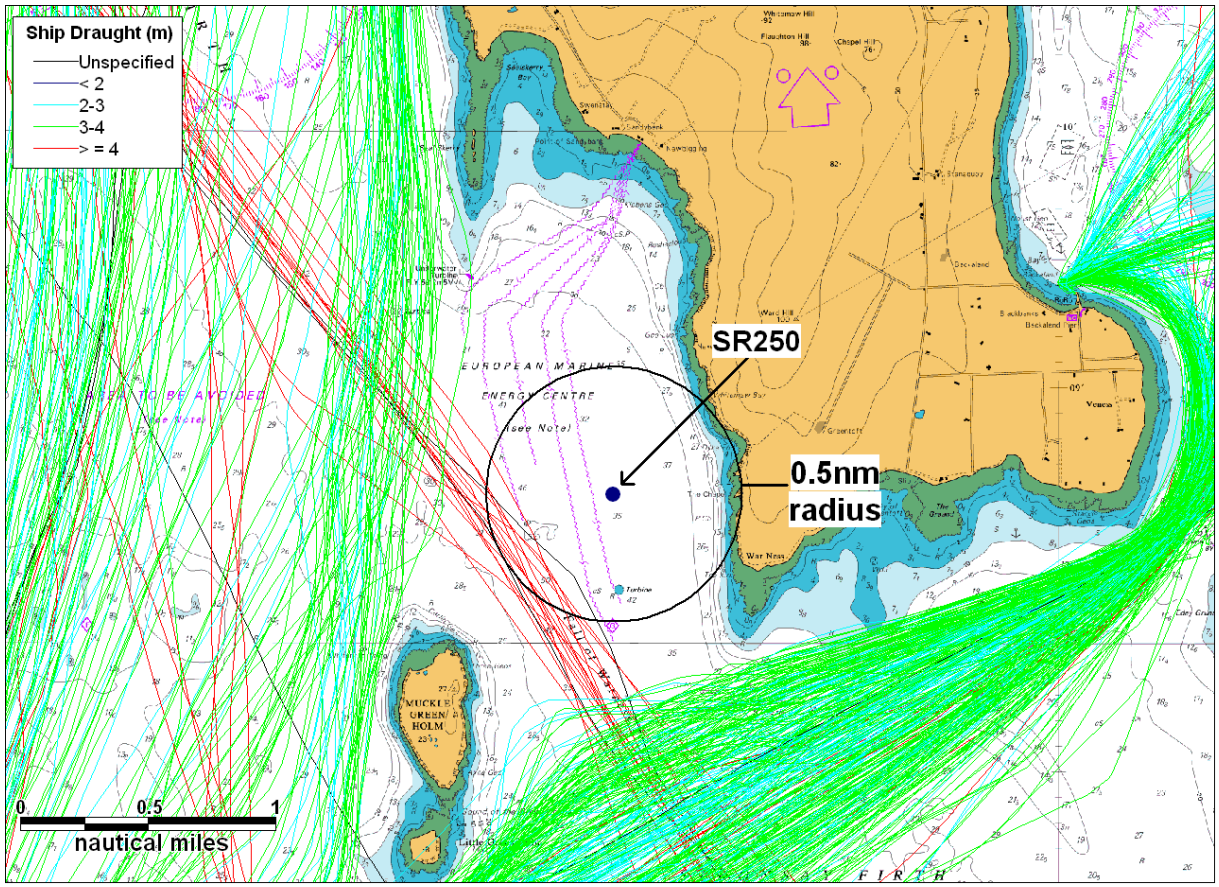


Figure 5.5 Detailed Plot of Summer 2009 AIS Tracks by Draught

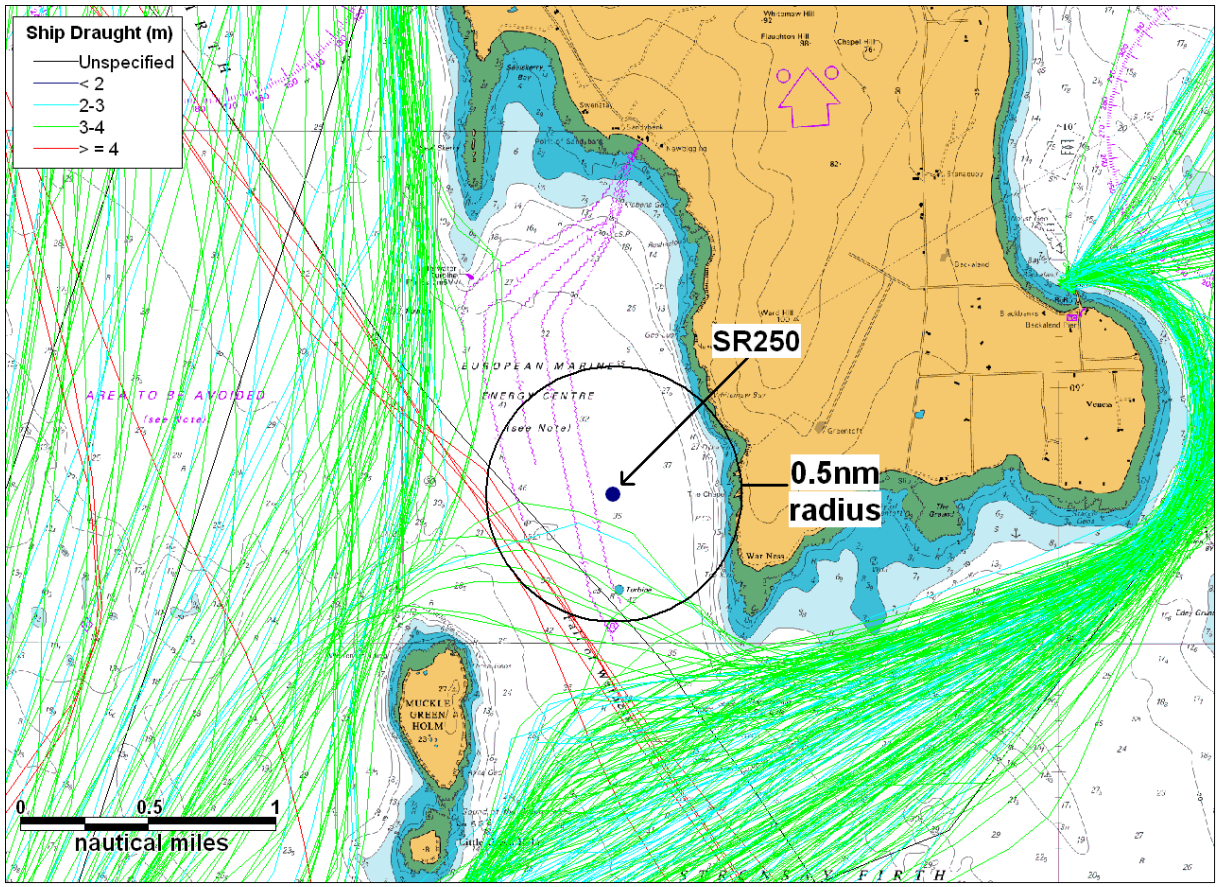


Figure 5.6 Detailed Plot of Winter 2010 AIS Tracks by Draught

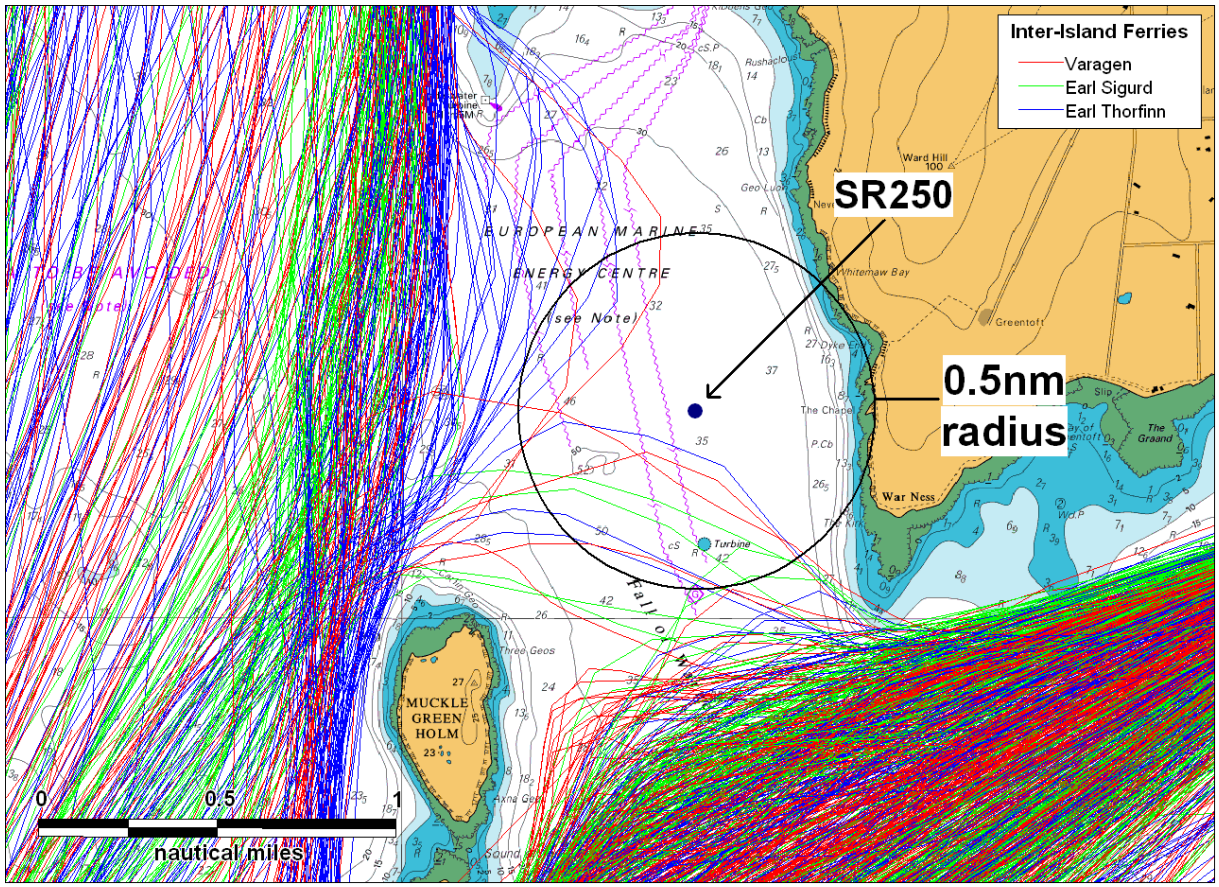


Figure 5.7 Inter-Island Ferry Tracks passing SR250 Location (6 Months)

5.3 Fishing Vessel Activity Analysis

A plot of the fishing vessel sighting locations colour-coded by gear type is presented in Figure 5.8. This is based on a total of 341 patrols of the area by spotter aircraft and fisheries patrol vessels over the five-year period 2005-09.

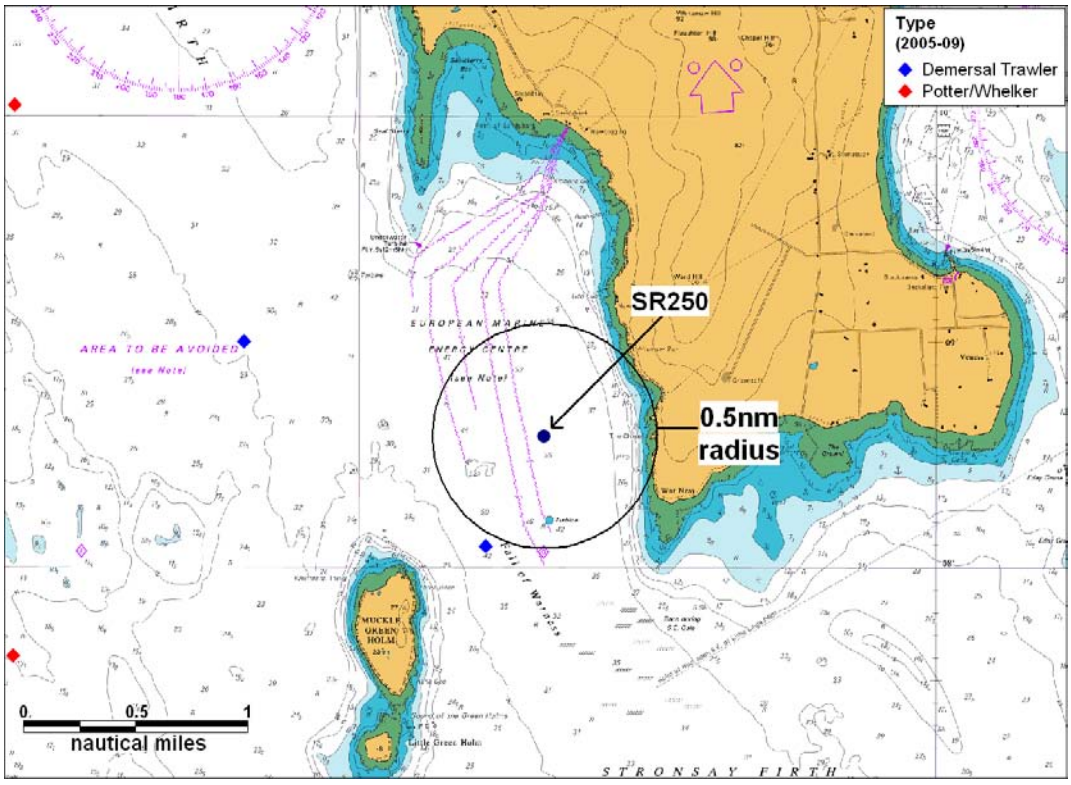


Figure 5.8 Sightings by Gear Type relative to SR250 Location (2005-09)

The nearest vessel sighting occurred at a distance of 0.6nm southwest of the SR250 location. This UK registered vessel was a demersal stern trawler and was laid stationary.

The fishing vessel satellite positions recorded in 2006, colour-coded by nationality (where available), are presented in Figure 5.9.

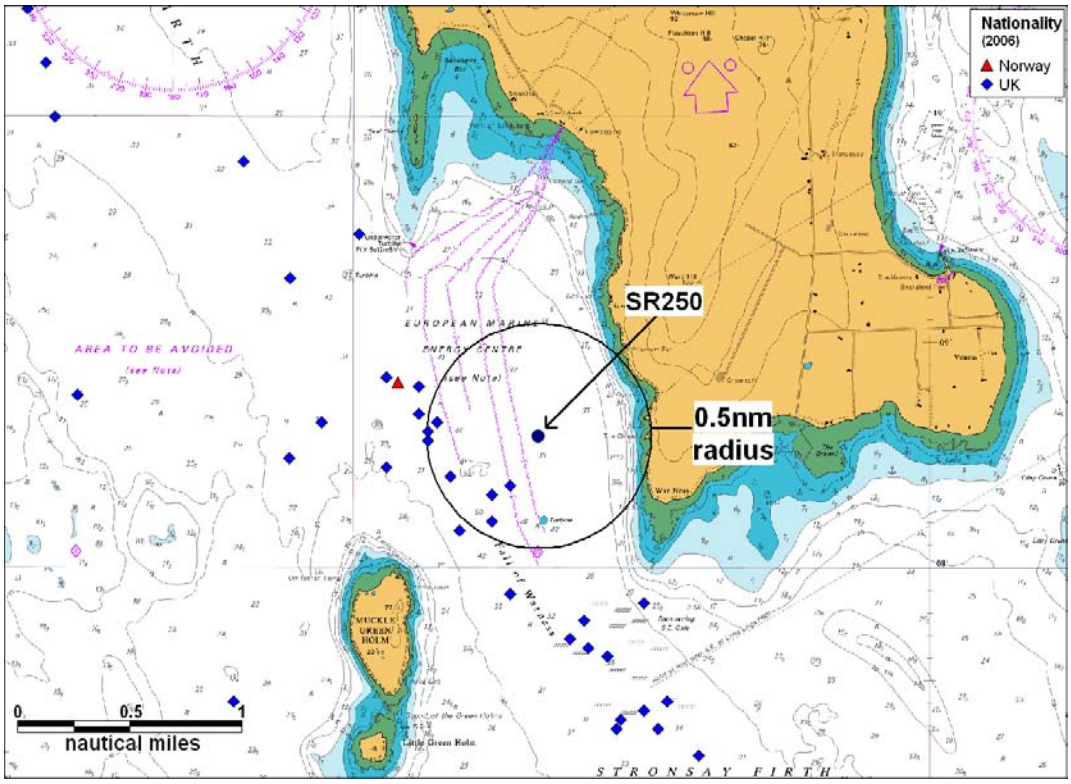


Figure 5.9 Satellite Positions by Nationality relative to SR250 Location (2006)

It can be seen that the majority of vessels were registered in the UK. These vessels are likely to be larger pelagic trawlers transiting the Fall of Warness heading between the Westray Firth and Stronsay Firth, similar to the vessels identified in the AIS survey analysis.

The latest available satellite data for UK vessels only from 2008 is presented in Figure 5.10. However, it should be noted that the vessels operating near the location were identified to be working as guard vessels at the EMEC site in 2008. Excluding this FoW activity, the fishing vessels recorded by satellite were mainly transiting NW-SE between the Westray Firth and Stronsay Firth via the Fall of Warness, similar to the pattern above.

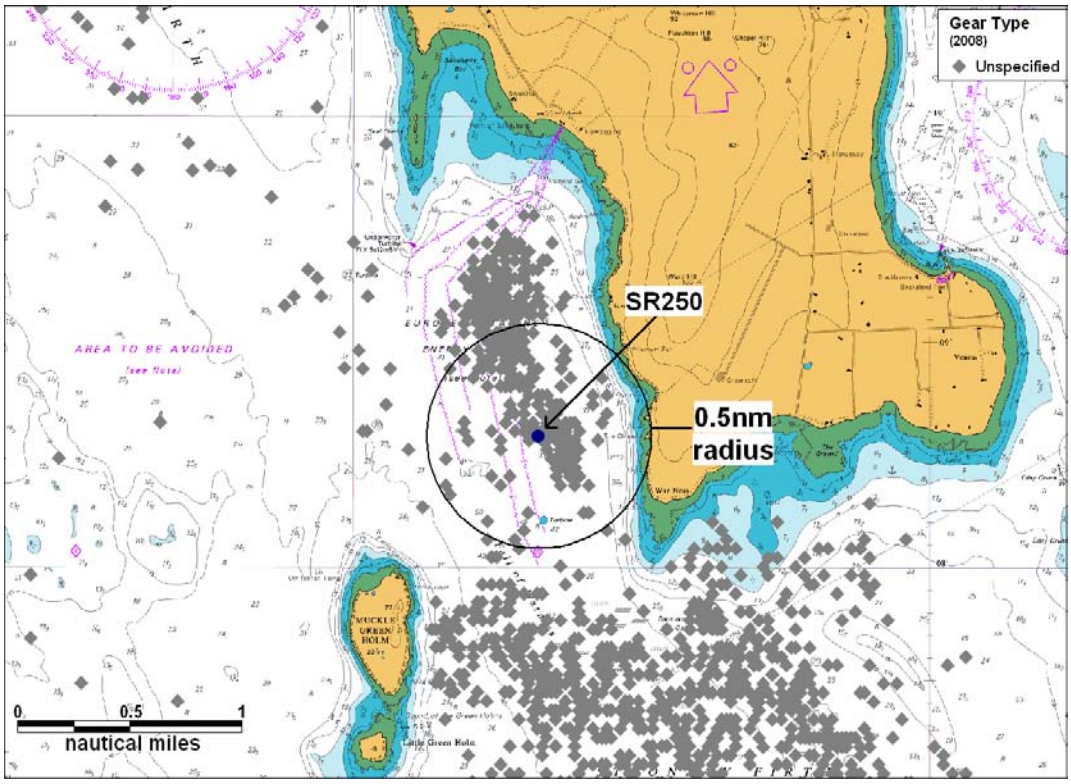


Figure 5.10 UK Satellite Positions by Gear Type relative to SR250 Location (2008)

5.4 Recreational Vessel Activity Analysis

A plot of the recreational sailing activity and facilities in the vicinity of SR250 location are presented in Figure 5.11. This is based on data from the RYA Coastal Atlas.

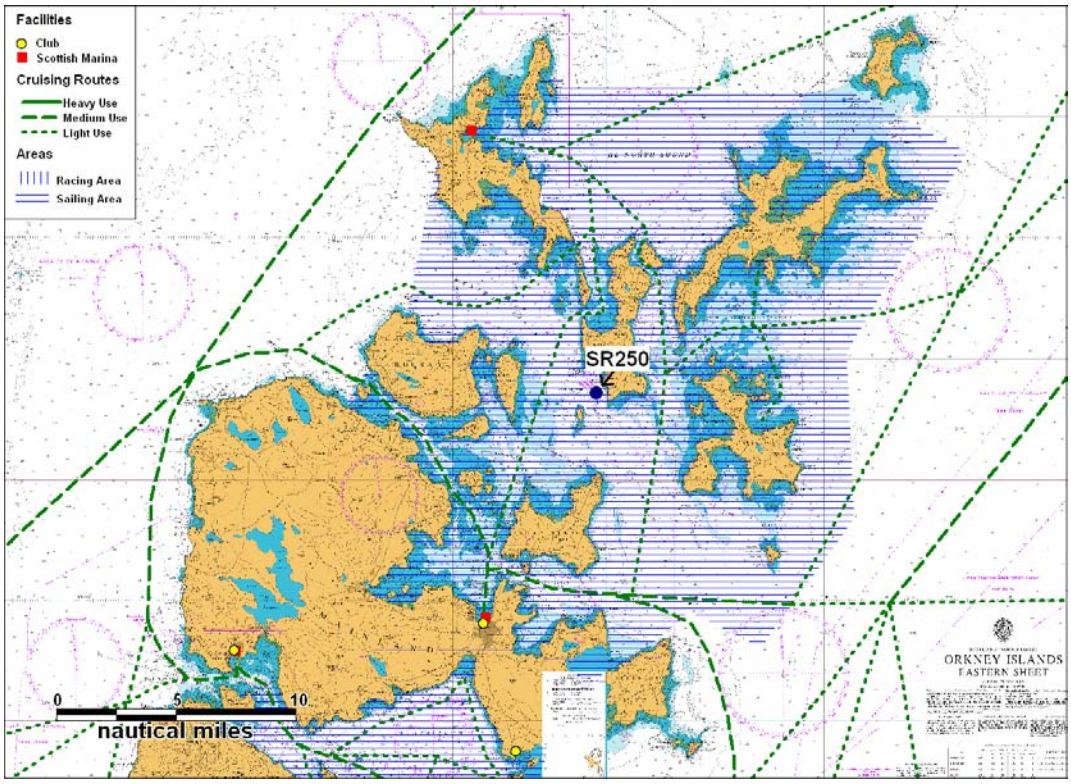


Figure 5.11 Recreational Information for SR250 Location

The closest route, at a distance of 2.2nm from the SR250 location, is a light-use cruising route passing west of Muckle Green Holm transiting between Kirkwall and Westray via the Sound of Faray.

5.5 Watchkeeper Logs

The watchkeeping logs collected from Eday (20 hours per week between 2006 and June 2010) do not provide as precise sighting locations as the AIS or fisheries surveillance data.

However, based on the grid and indicative routes used to log vessels, there is no fishing activity at the proposed site and the transiting routes used by local fishing vessels, e.g., creelers working at Sealskerry Bay, tend to pass inshore of the location, i.e., closer to the Eday shore.

A limited number of recreational craft were logged transiting the FoW area over the four and a half years.

5.6 Historical Incidents

The locations[1] of accidents, injuries and hazardous incidents reported to MAIB in the vicinity of SR250 location between January 1994 and 8th March 2010 are presented in Figure 5.12, colour-coded by type.

[1] MAIB aim for 97% accuracy in reporting the locations of incidents.

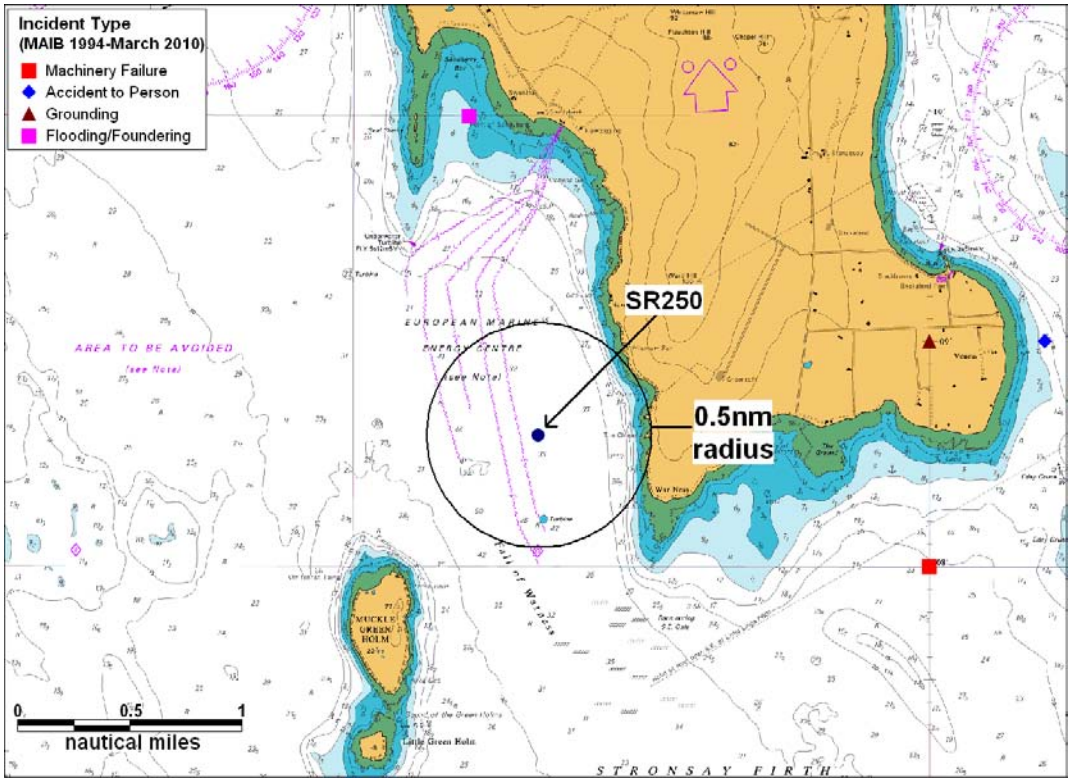


Figure 5.12 MAIB Incidents by Type near to SR250 Location (1994-March 2010)

The closest incident to the location occurred at a distance of 2.7nm north from the location. This involved a fishing vessel of 9.9m length which suffered flooding due to a broken sea discharge water pipe in August 2000.

Figure 5.13 presents the geographical location of incidents, recorded by RNLI, colour-coded by casualty type.

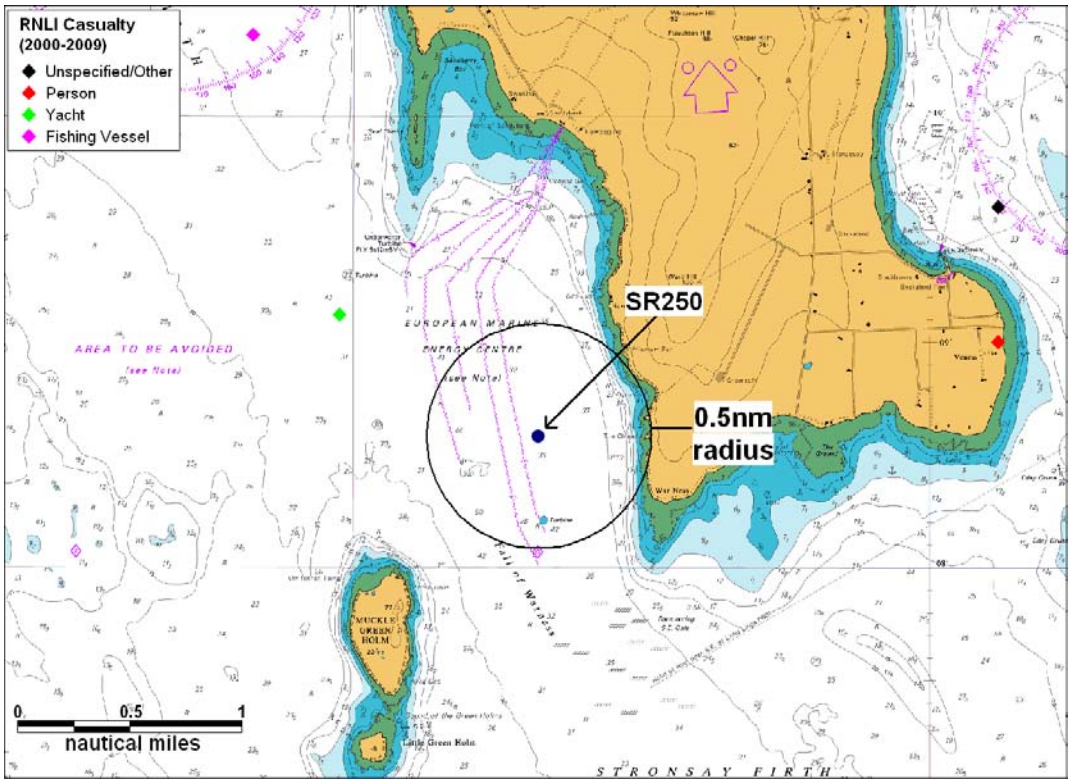


Figure 5.13 RNLI Incidents by Casualty Type near to SR250 Location (2000-09)

The closest incident occurred at a distance of 1.9nm northwest of SR250 location. On 18th June 2004 a yacht (with auxiliary engine) experienced adverse conditions. The Kirkwall all-weather lifeboat (ALB) responded although it did not require to give assistance.

5.7 Search and Rescue (SAR) Resources

The closest SAR helicopter base is located at Sumburgh in Shetland, operated by the RAF, approximately 64nm to the NE of the SR250 location. The day-time response to the site will be in the order of 50 minutes. At night time this will increase by 30 minutes to approximately 1 hour 20 minutes due to the additional response time at the base. It is noted that these calculation are based on still air and will vary depending on the prevailing conditions.

The RNLI stations in the vicinity of the SR250 location are presented in Figure 5.14.

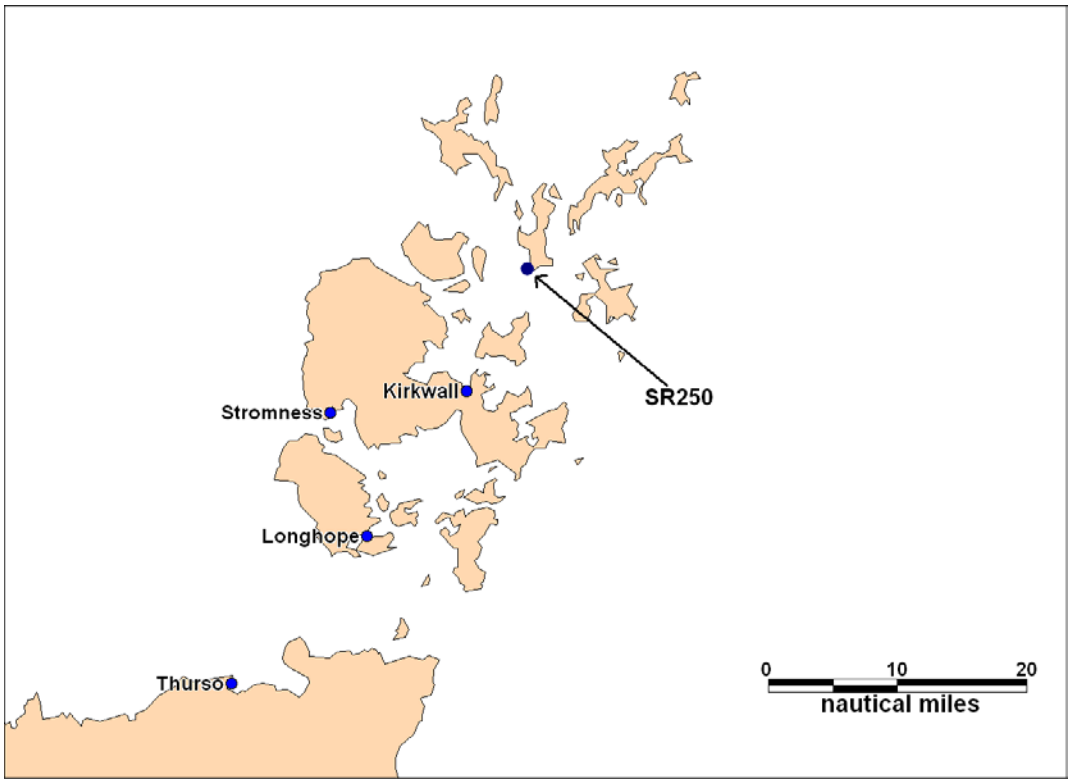


Figure 5.14 RNLI Stations closest to the SR250 location

The nearest RNLI station is located at Kirkwall, at a distance of 10.4nm southwest of the SR250 location. Response times vary but an average declared by RNLI is 14 minutes for all-weather lifeboats. This is the time from callout, i.e., first intimation from Coastguard to the lifeboat station to launch. The time for an all-weather lifeboat to reach the SR250 location would therefore be approximately 42 minutes from Kirkwall (total time from callout to being on scene).

6. Risk Review

6.1 Introduction

This section reviews the navigational hazards and planned mitigation measures associated with the SR250 deployment at the Fall of Warness site.

6.2 Mitigation Measures

A general review of the risks and existing mitigation measures associated with the lease area is presented in the Generic FoW NRA, which highlights the fact the site was chosen by EMEC in part because it has low vessel activity, it is within an IMO Area To Be Avoided, has been established since 2006, it is marked on charts and is well known to local fishermen and recreational sailors.

For the SR250 device, specific mitigation will include:

- Marking and lighting to NLB requirements based on IALA Recommendation 0-131 on the marking of offshore wave and tidal energy devices (see Table 4.1)
- Depiction on UKHO Admiralty Charts
- EMEC procedures (e.g., Maritime Safety Information to ensure information is circulated to local mariners)
- Emergency Response based on mooring line failure / loss of station alarming via SCADA and GPS Monitoring
- Turret under keel clearance (minimum of 10m below LAT) when device is not on location

The following sections review the potential risks to shipping, fishing vessels and recreational vessels from the SR250 deployment at Fall of Warness in more detail.

6.3 Shipping Risks

The nearest ship identified from the 12 weeks of AIS track analysis was an inter-island ferry which passed at 210m SSW of the site. Using a combined six months of AIS data it was confirmed this was the closest passing ferry, although several other ferries passed within 0.5nm. Based on the survey data, the ferries naturally tend to avoid the location, even when weather routeing.

When the device is not on location, the turret will be a minimum of 10m under water at LAT. Based on the Under Keel Clearance discussion presented in the Generic FoW NRA (Ref. i), and taking into account the wave height return periods presented Section 3 of this report, the turret should pose a minimal collision risk to the inter-island ferries (*Earl Thorfinn*, *Earl Sigurd* and *Varagen* with draughts ranging from 2.9 to 3.2 metres) in the event they passed directly over it.

Other commercial shipping, including passenger cruise ships in the summer, tend to pass 0.3-0.6nm to the WSW of the SR250 location. Therefore, the risk of a powered passing ship collision with the device is considered to be very low. The deeper draught cruise ships could potentially interact with the submerged turret at 10m below LAT but as they tend to keep towards the centre of the channel between Muckle Green Holm and Eday, clear of the SR250 location, this risk is considered to be very low.

In the event of a vessel transiting via the Fall of Warness to the WSW losing power and drifting, the drift direction is most likely to be NW-SE rather than towards the device. Any vessel drifting in the direction of the device is likely to be more at risk of grounding on the Eday shore.

6.4 Fishing Vessel Risks

As with commercial shipping described above, transiting fishing vessels heading NW / SE via the Fall of Warness naturally tend to avoid the location. This includes the larger pelagic trawlers, some of which have draughts that could interact with the submerged turret.

Creeling activity off the coast of Eday tends to be close inshore within the 15 metre contour, with occasional deployment out to 30 metres. The FoW Lease Area was shaped by EMEC to avoid infringing the 30m bathymetry contour which consultation had indicated was the main fishing area. The water depths at the SR250 site and within the mooring spread are greater than 30 metres.

In addition to creelers, small diving boats have been observed on occasion diving for scallops off the Eday shore. Scotrenewables have modified the SR250 location based on local consultation to avoid interfering with the scallop grounds.

Fishing vessels could also be exposed when transiting to and from fishing grounds. Watchkeeping logs indicated the main transiting routes are clear of the proposed site. Given this, the fact these are all local vessels, and the device will be marked and lit appropriately, the risk of collision should be low.

When the device is not on location the submerged turret should pose a minimal collision risk to these shallow draught local fishing vessels (draughts up to about 3m, similar to the inter-island ferries).

The marker buoy will assist fishing vessels in identifying the turret position when the device is not on location to avoid any potential risk of gear interaction.

6.5 Recreational Vessel Risks

From the consultation and baseline activity review carried out during the Generic FoW NRA, it was identified the Fall of Warness area is not popular with recreational users due to the strong tides. The RYA Coastal Atlas indicates no cruising routes through the area.

However, local consultation identified the area is used on occasion in certain tidal and weather conditions, which was confirmed by the Eday Vessel Logs. Two key issues were raised regarding the proposed deployment:

1. Procedures to deal with vessels swept onto the site by adverse conditions.
2. Marking and lighting of the site and device.

Further discussions are planned with the RYA to discuss these issues.

Based on marking and lighting the device appropriately, and the low frequency of recreational vessel passages through the area, the risk of collision should be assessed to be low.

When the device is not on location, the draughts of recreational vessels in the area (up to about 3m) mean the risk of collision with the submerged turret is minimal.

6.6 Cable Interaction

The armoured subsea cable from shore to the device is planned to be of relatively short length (approximately 3km). The cable route will be depicted on charts to ensure mariners are aware of its position.

Based on the local activity in the area, it is not expected to pose a significant hazard to fishing vessels or other mariners.

6.7 Maintenance and Decommissioning

No on-site maintenance is planned during the test period. Should any maintenance be required, the device will be removed from the mooring system and towed to a suitable harbour facility using a multi-cat vessel.

Scotrenewables have discussed the availability of suitable sites with OIC Marine Services. The most likely are Loth (Sanday) and Eday Pier, at times not to interference with ferry traffic. The device may also be berthed at Hatston Pier (Kirkwall).

Therefore, the only time the multi-cat and the SR250 will be in close contact will be in sheltered waters/harbour for maintenance. On-site, as all the SR250 systems including connection to the turret are controlled remotely, the multi-cat can be moored a safe distance away.

The multi-cat has permanently attached fenders all round, and heavy duty fenders underwater on the strake (to protect against the edge of the hull impacting on a section of the SR250). In addition, semi-submerged ‘Yokohama’s’ type fenders (c 3.5mx1.5m) will be used between the multi-cat and the SR250.

The device is fully compliant so any potential impact will result in the SR250 being moved away from the point of impact lessening the force, rather than absorbing the full force of any impact.

The front section of the SR250 is a separate compartment from the rest of the device. In the event of this being damaged and water ingress occurring it will not compromise the rest of the structure.

All materials will be completely removed from the tidal test site during decommissioning. The device has been designed so as to make removal and installation as simple as possible. Therefore, the SR250 will be disconnected and towed from the site using a multicat (or similar vessel). The mooring system including gravity anchors will then be completely removed from the berth. A decommissioning plan will be submitted to DECC under the Energy Act.

6.8 Mooring Line Failure / Loss of Position / Loss of Station

The mooring system allows excursions of the device up to a maximum of 13 metres from its neutral position under steady and unsteady forces. In the event of a single line failure, the maximum excursion is approximately 25m.

If the two lines taking the load failed the SR250 would be pulled downstream until the two aft lines took the load which is the excursion plus the full length of the mooring system, roughly 230m from the neutral position of the mooring system. This would also mean breaking the power umbilical or ripping the junction box and cable off the seabed. This is not a design case, but an accidental failure case.

In the event of three line failures the device will still be anchored within a 300m buffer zone around the centre of the site.

Scotrenewables would be alerted initially about a line failure and EMEC may also request to receive this notification. The tension present in turret's load cells will be monitored by the SCADA system. If one or more of the mooring cables is broken, that load cells should show a near zero value. The GPS onboard will also be able to raise an alarm if the device goes outside its normal operating area due to a line failure. Cameras onboard the device and onshore will also be available as a secondary check on position.

EMEC operates a 24/7 emergency response Duty Manager system. Whilst emergencies involving devices are the full responsibility of the developer and any contractor they employ, the EMEC emergency response system ensures that developers are aware of any incident and take appropriate action.

In addition, the SR250 communication will ensure the Scotrenewables 24/7 emergency response system will alert the Duty Manager.

The communications system will consist of:

- Radio Frequency Link: Will control emergency shutdown system, main start-up procedure (essentially an ignition switch);
- Wireless LAN: Will be used for control and data communication/video monitoring, when the umbilical is not connected (towing to site, tow testing) and as a backup to the ethernet communication link;
- Long Distance Ethernet: Will be used for control and data communication/video monitoring, when the umbilical is connected; and
- GSM Mobile Communication: This independent alarm system uses mobile phone communications from a standalone transmitter/receiver based on the device.

When the umbilical is connected to the device the data will pass down the umbilical and connect to onshore Scotrenewables communications equipment where the data may be stored or communicated over the EMEC internet connection located in the data rack in the EMEC facility.

The SCADA system has the facility to set up user configurable alarms that can be transmitted by email, automated phone call or text message to a dedicated duty holder's mobile. All parameters of the system can be monitored through the SCADA system and limits or ranges can be setup and alarms can be generated if the parameter goes outside this limit or range. For example, operational parameters can be setup (temperature, oil levels and pressures, etc) that if the values go out with normal ranges it raises an alarm at the SCADA monitor. Also additional parameters like bilge alarms or fire detection alarms can be setup that display alarms on the SCADA system and additionally sends an alarm to the Duty Manager's mobile.

There will be a separate alarm system that will be independent of the SCADA / communication system which will send a text messages or call multiple mobile numbers on detection of water ingress or smoke/fire.

A stationing verification system will allow the device to be monitored with control system alerts to the dedicated Duty Manager. Through the use of a GPS, this function will observe the movement of the device and provide an alert if the system strays from the predefined operational area.

There is a battery bank and also a diesel generator on board for back-up power for emergency systems in the event of loss of grid. The device should always be either on its moorings and connected to the grid or attached to a vessel via a tow rope. If it breaks free from either moorings or vessel the device should have approximately 10 – 12 hours of back-up power available for emergency systems.

In the event of even a single mooring line failure the device would automatically go into emergency state, and the rotors would retract. Any unusual event would lead to the system going into emergency mode as a precaution.

In terms of buoyancy, the device would be expected to float in either mode as long as there was no breach in the hull. The hull has four water tight compartments providing single compartmental failure, so a single hull breach would only result in one compartment flooding – the device will have sufficient excess buoyancy to stay afloat.

If a blade were to break off, the blade cavities are flooded and the density of the composite structure will be slightly heavier than water so the blades would sink.

The emergency response would include informing the Coastguard and OIC Marine Services so that vessels in the area can be alerted to the potential hazard. Scotrenewables staff and support vessel would be immediately deployed to recover the device.

7. Conclusions and Recommendations

7.1 Conclusions

This study has revised the navigation risk assessment for the SR250 device at the EMEC Fall of Warness tidal power site.

The baseline analysis has included referencing the data used in the FoW Generic NRA to the SR250 location, such as AIS vessel tracking information, as well as presenting metocean information for the precise device location.

Consultation carried out on the SR250 with navigational stakeholders identified relatively few issues associated with the final location. The site has been modified from that initially planned to take into account concerns of fishing stakeholders. The remaining issues should be manageable through the planned risk control measures, such as appropriate marking and lighting, which are outlined in Section 6.2.

Any vessels operating near the site will be made aware of it through the planned mitigation measures. For example, EMEC's Maritime Safety Information procedure will ensure the appropriate authorities, e.g., OIC Marine Services (Harbours and Ferries) and Shetland Coastguard, are informed of the device, its moorings and associated work activities such that the information is promulgated via appropriate channels to mariners.

Commercial ships including the inter-island ferries tend to keep well to the south or west of the location and therefore should not be at risk of collision with the floating device.

When not on the location, the under keel clearance of the turret (minimum 10m at LAT) is considered to pose minimal risk of collision based on the draughts of local vessels operating in the area and the wave conditions. Deeper draught vessels, such as passenger cruise ships and pelagic trawlers, tend to naturally avoid the location as they keep towards the centre of the channel

The risk of mooring line failure and potential device loss of station are safeguarded by the independent structural verification report and adhering to industry standards. In the event of a problem there are various systems in place to ensure the alarm is raised, at which time emergency response procedures would be implemented, which would include navigation warnings to vessels and recovering the device to a safe location.

7.2 Recommendations

In addition to adhering to industry best-practice and carrying out the planned mitigation measures outlined in Section 6.2 the following recommendations are made:

- Information on the device position, mooring lines and cable should be provided to Kingfisher Information Services, who produce paper and electronic awareness charts for fishermen.

- Targeted information should also be sent to local fishing and recreational sailing organisations ahead of the planned deployment.

- Scotrenewables should liaise with the RNLI Kirkwall and the MCA about the development and provide any further information requested to assist SAR response. Once the device is on station, the lifeboat at Kirkwall should be invited to visit the site to view the device setup. Further talks should also be held with the RYA regarding emergency response procedures in the event of a small vessel getting into difficulty in the area.

- Marking and lighting of the device is critical to ensure any mariners operating in the area are aware of its presence. RYA have requested further discussions on this issue, which should be carried out involving NLB. Once the marking is in place it should be checked regularly by appropriate means (e.g., SCADA or on camera) to ensure it remains effective at all times.

8. References

i Anatec Ltd, Navigation Risk Assessment of the Fall of Warness Tidal Test Facility, Report No. A2343-EMEC-NRA-1 (2010), Prepared for EMEC.

ii Scotrenewables, SRTT Full Scale Prototype Environmental Scoping Information, March 2010.

iii Scotrenewables, SRTT-250 Basis of Design, 22nd April 2010.

Appendix 4

Materials Specification Sheets

Scotrenewables®
Tidal Power Ltd

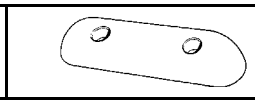
MG Duff International Ltd.
1 Timberlaine Estate. Gravel Lane.
Quarry Lane. Chichester. West
Sussex
PO19 8PP
Tel: 00 44 [0] 1243 533336
Fax: 00 44 [0] 1243 533422
Email: sales@mgduff.co.uk

ISO 9001 : 2000
REGISTERED FIRM
Certificate No: A10145

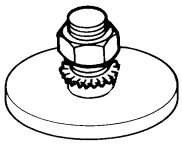
MGDUFF

ALUMINIUM ALLOY ANODES

Specification Code		AL-CHEM 1
Composition (weight %)		
Iron	Fe	0.12 max.
Silicon	Si	0.05 - 0.15
Copper	Cu	0.003 max.
Zinc*	Zn	3.0 – 6.0
Indium	In	0.015 – 0.030 max.
Mercury	Hg	0.001 max.
Titanium	Ti	0.025 max.
Others each		0.02 max. (<0.1 total)
Aluminium*	Al	Remainder
Capacity- Amp.hr/kg		Typically 2760

Anode Number		Overall Dimensions mm			Anode Body Dimensions mm			Net Weight (kg)	Gross Weight (kg)
		Length	Width	Height	Length	Width	Height		
AD72B		**457**	**102**	**64**	**9” (229mm) Hole Centres for use with M16 studs**			**4.6**	**5.1**

FIXING TYPE M16 C FOR STEEL HULLS



Registered Number: 2621868 Place of Registration: England Registered Office Address: 1 Timberlaine Estate. Gravel Lane. Quarry Lane. Chichester. West Sussex. PO19 8PP

International

Intersleek®900

Fluoropolymer foul release coating

Product Description

Intersleek®900 is a fluoropolymer foul release coating designed for all vessel types. Intersleek®900 is suitable for use at Maintenance & Repair or Newbuilding.

Features	Benefits
Ultra smooth, glossy surface with excellent foul release properties	Control of fuel efficiency and subsequent emissions (up to 9% saving*).
Biocides are not used to control fouling	Freedom from biocide restrictions Control of treatment and disposal costs for wash water/blasting abrasive at subsequent drydockings
Can be applied over existing antifouling systems in good condition (via Intersleek® Linkcoat)	Control of conversion costs to the Intersleek®900 system
Excellent long term fouling resistance	Flexibility in drydocking schedule
Flexible with good resistance to mechanical damage	Hull roughness control
Excellent colour retention	Vessel appearance
Good hold-up with reduced overspray	Remove the need for double application, reduces yard rework and clean-up

* Depending on in service conditions

Product Information

Colour	FXA970 White, FXA971 Grey, FXA972 Blue, FXA977 Red, FXA979 Black
Surface preparation	Intersleek®900 must be applied over Intersleek®737 or Intersleek®731
Volume solids	74% ±2% (ISO 3233:1998)
Typical film thickness	150 microns
Hard dry	20 hours @ 25ºC
Minimum application temperature	0ºC
Method of application	Airless Spray, Brush, Roller

For each of our products the relevant Product Data Sheet, Material Safety Data Sheet and package labelling comprise an integral information system about the product in question. Copies of our Product Data Sheets and Material Safety Data Sheets are available on request or from our website.

In Service Performance

'Ikuna' achieved a 10% increase in speed with no increase in fuel consumption, effectively meaning one free trip for every ten trips undertaken

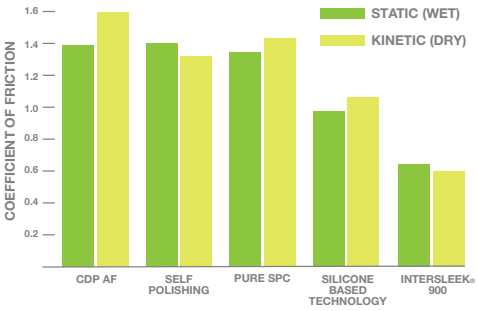
Queen Mary II achieved operational speed using less power compared to previous SPC system

Corona Ace after 31 months in service. Excellent condition, 8% fuel saving reported

AkzoNobel

Intersleek®900

Drag Reduction



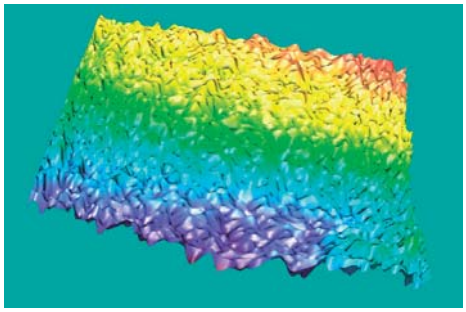
Measured coefficient of friction

*Reference: ASTM D1894-06 'Static and Kinetic Coefficient of Friction'

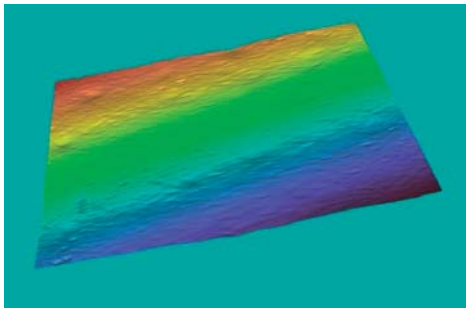
Intersleek®900 gives a significant reduction in coefficient of friction when compared to silicone based technology and more conventional Self Polishing Copolymer (SPC), Self Polishing Antifouling and Controlled Depletion Polymer (CDP) antifoulings. This relates to the amount of drag experienced by the vessel; lower coefficient of friction results in reduced energy requirements to propel the vessel.

Smoother Surface

Intersleek®900 - shows superior smoothness compared to Self Polishing Copolymer (SPC). Average Hull Roughness (AHR) is reduced.



Typical condition of SPC after 2 years in-service. AHR 160-180 microns



Typical condition of Intersleek®900. AHR around 70 microns

Improved Slime Resistance

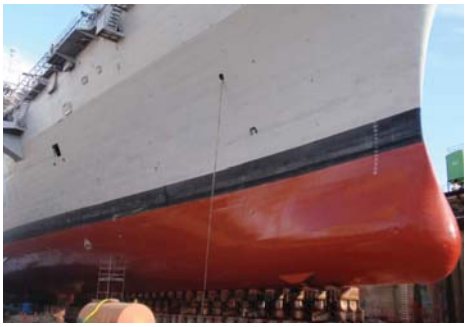
Test patches of Intersleek®900 show significantly improved resistance to slime build-up compared to silicone foul release technology over long service intervals.

Intersleek 900 test patch on LNG after 30 months

Intersleek 900 test patch on VLCC after 59 months

In Service Performance

Mercator Lines report 9% fuel savings with subsequent greenhouse gas emission reductions



Principe de Asturias reported a speed increase of 3 knots after Intersleek®900 application

Seismic research vessel after 44 months in the Gulf of Mexico showing excellent antifouling performance

Research vessel after 31 months in service off West Africa and 5 weeks static in Walvis Bay, before washing

To find out more visit: www.international-marine.com

International Paint Ltd, Stoneygate Lane, Felling, Gateshead NE10 0JY. Tel: +44 (0)191 469 6111 Fax: +44 (0)191 495 2003

August 2010

Appendix 5

Shore Birds

Scotrenewables®
Tidal Power Ltd

Appendix 5: Shore Birds

Bird species know to use the coastline between the east end of the Bay of Greentoft and the west end of Sealskerry Bay for shelter, nesting and feeding sites (EMEC 2009).

Location	Common Name	Species Name	Additional Information
Cauldale	Ringed Plover	*(Charadrius*	Nest regularly from May to July
	Meadow Pipit	*(Anthus pratensis)*	Nest regularly from May to July
	Rock Pipit	*(Anthus spinoletta)*	Nest regularly from May to July
	Shelduck	*(Tadorna tadorna)*	To rear young
	Eider	*(Somateria*	To rear young
Sandybank	Lapwing	*(Vanellus vanellus)*	Fairly important
	Fulmar	*(Fulmarus glacialis)*	Nest in cliffs in the winter
	Black Guillemot	*(Cepphus grille)*	
Seal Skerry	Sanderling	*(Calidris alba)*	Significant winter flock feeding area
	Dunlin	*(Calidris alpina)*	
	Shag	*(Phalacrocorax*	
	Grey Heron	*(Ardea cinerea)*	
	Mallards	*(Anas*	
	Rarer Shoveler	*(Anus clypeata)*	
	Teal	*(Anas crecca)*	Region's smallest breeding duck
	Wigeon	*(Anas Penelope)*	
	Ringed Plover		
	Turnstone	*(Arenaria interpres)*	
	Purple Sandpiper	*(Calidris maritime)*	
	Redshank	*(Tringa tetanus)*	
	Kittiwake	*(Rissa tridactyla)*	
	Gannet	*(Morus bassanus)*	A few present
Neven Point	Fulmar		Present over winter
	Eider		Present over winter
	Black Guillemot		Very important
WarNess	Shag		Very important over winter
	Cormorant	*(Phalacrocorax carbo)*	Very important over winter
	Eider		Fairly important
	Oystercatcher	*(Haematopus ostralegus)*	Fairly important
	Puffin	*(Fratercula arctica)*	Fairly important
	Rock Dove		Fairly important
	Turnstone		Fairly important
	Purple Sandpiper		Fairly important
	Redshank		Fairly important
	Great Blackback Gull	*(Larus marinus)*	Fairly important
	Kittiwake		Fairly important
	Arctic Tern	*(Sterna paradisaea)*	Present through May and July
	Sandwich Tern	*(Sterna sandvicensis)*	May and July possibly
	Ringed Plover		Nest here regularly
	Rock Pipit		Nest here regularly
The chapel area	Fulmar		Fairly important
	Black Guillemot		Very important
Greentoft	Ringed Plover		Fairly important over summer
	Shelduck		
	Eider		

	Rock Pipit		Nest under the banks
	Meadow Pipit		Nest under the banks
	Turnstone		Numerous within flocks
	Dunlin		Numerous within flocks
	Purple Sandpiper		Numerous within flocks
	Curlew	*(Numenius arquata)*	
	Bar-tailed Godwit	*(Limosa lapponica)*	
	Oystercatcher		
	Redshank		
	Grey plover		
	Sanderling		
Muckle Green Holm	Black Guillemot		Important
	Puffin		Present between April and August
	Shag		Important (March-August)
	Cormorant		Important when breeding (April-June)
	Storm Petrel		Reported sightings
Little Green Holm	Cormorant		Important when breeding (April-June)
	Arctic Tern		Colony (May-July)
	Black Guillemot		Very important breeding area

Appendix 6

Sanday SAC – Information to Inform Appropriate Assessment

Scotrenewables®
Tidal Power Ltd

Appendix 6: Sanday SAC – information to inform Appropriate Assessment

As detailed in the scoping response from SNH (Appendix 2) the following information is required to inform the Appropriate Assessment:

1. Likely collision risk of common seals with the SR250 device, in combination with any mitigation such as shut down contingent on detection of collisions above an agreed threshold.

   It is not possible, with any degree of accuracy, to predict the likely risk of collision of common seals with the SR250. Limited experience at 5th scale has shown that seals have shown interest in operations but never directly approached the site. Scotrenewables plan to use a number of methods to monitor seal behaviour and also to detect when a suspected marine mammal collision has occurred with the device. These methods include the use of shore based observations, underwater camera, hydrophones and strain gauges. Full details of the proposed mitigation can be found in the Environmental Statement Section 7.1.

   Scotrenewables made the decision not to establish the environmental monitoring strategy until as late in the process as possible in order to take advantage of the latest techniques, information and guidelines available. This process has now begun. More detail on the proposed environmental monitoring strategy can be found in the Environmental Statement in Section 9.3.

2. Estimate from SMR of the Potential Biological Removal (PBR) of common seals from this metapopulation.
   The Potential Biological Removal (PBR) for grey seal numbers in the Northern Isles metapopulation (SMRU 2008) was calculated from 2007 counts as 23. This figure has been revised and now the PBR stands at 13 for the whole of the North Isles of Orkney. This was based on the last complete count (2008) and this is to cover all unnatual deaths of adult harbour seals (Ruth DeSilva, SNH pers comm.).

3. Consideration of the outcomes of EMEC monitoring projects

   The latest 3rd year report has been withdrawn. However a 5 year summary report has been commissioned and should be available soon.

4. Consideration of advice from an appropriate assessment organisations, such as SMRU ltd., on options for monitoring and mitigating collision risk between the operating turbine and seals.

   SMRU will be consulted as part of the environmental monitoring strategy development process which will be undertaken in consultation with SNH and EMEC. This process is already underway.

5. Cumulative effects on the metapopulation of common seals from this development and others whether at the test site or elsewhere in the North Isles area.

   It is very difficult to make any kind of assessment of what the cumulative effect might be of multiple operators on common (harbour) seal populations in the Fall of Warness when it is not know yet what the impact of the individual devices will be, particularly where many aspects of other developments remain commercially sensitive. Potentially, the combined activities could result in seals being displaced from habitual haul out sites and pupping beaches in the Fall of Warness. In addition, potentially fatal strikes when considering all operating devices could have a catastrophic impact on the common seal metapopulation.

Appendix 7

Faray and Holm of Faray SAC – Information to Inform Appropriate Assessment

Scotrenewables®
Tidal Power Ltd

Appendix 7: Faray and Holm of Faray SAC – information to inform Appropriate Assessment

As detailed in the scoping response from SNH (Appendix 2) the following information is required to inform the Appropriate Assessment:

1. Likely collision risk of grey seals with the SR250 device, in combination with any mitigation such as shut down contingent on detection of collisions above an agreed threshold.

   It is not possible, with any degree of accuracy, to predict the likely risk of collision of grey seals with the SR250. Limited experience at 5th scale has shown that seals have shown interest in operations but never directly approached the site. Scotrenewables plan to use a number of methods to monitor seal behaviour and also to detect when a suspected marine mammal collision has occurred with the device. These methods include the use of shore based observations, underwater camera, hydrophones and strain gauges. Full details of the proposed mitigation can be found in the Environmental Statement Section 7.1.

   Scotrenewables made the decision not to establish the environmental monitoring strategy until as late in the process as possible in order to take advantage of the latest techniques, information and guidelines available. This process has now begun. More detail on the proposed environmental monitoring strategy can be found in the Environmental Statement in Section 9.3.

2. Estimate from SMRU of the Potential Biological Removal (PBR) of grey seals from this metapopulation.

   The Potential Biological Removal (PBR) for grey seal numbers in the Northern Isles metapopulation (SMRU 2008) was calculated from 2007 counts as 885 individuals, a much healthier figure than that for the common seal.

3. Consideration of the outcomes of EMEC monitoring projects

   The latest 3rd year report has been withdrawn. However a 5 year summary report has been commissioned and should be available soon.

4. Consideration of advice from an appropriate assessment organisations, such as SMRU Ltd., on options for monitoring and mitigating collision risk between the operating turbine and seals.

SMRU will be consulted as part of the environmental monitoring strategy development process which will be undertaken in consultation with SNH and EMEC. This process is already underway.

5. Cumulative effects on the metapopulation of grey seals from this development and others whether at the test site or elsewhere in the North Isles area.

   It is very difficult to make any kind of assessment of what the cumulative effect might be of multiple operators on grey seal populations in the Fall of Warness when it is not know yet what the impact of the individual devices will be, particularly where many aspects of other developments remain commercially sensitive. It is considered that as PBR for harbour seals is

Appendix 8

Seabed Survey Report

Scotrenewables®
Tidal Power Ltd

aquatera.co.uk
environmental services and products

Seabed survey report: cable route and potential mooring locations at Fall of Warness test site

Report to:

Scotrenewables Tidal Power Ltd

Issued by:

Aquatera Ltd

P353 – September 2010

Aquatera Ltd
Stromness Business Centre
Stromness, Orkney, Scotland
KW16 3AW

This study was completed for:

Scotrenewables Ltd.
Hillside Office
Stromness
Orkney
KW16 3HS

Contact: Gina Penwarden
Tel: 01856 851641
Fax: 01856 851642
Email: gina@scotrenewables.com

This study was completed by:

Aquatera Ltd
Stromness Business Centre
Stromness
Orkney
KW16 3AW

Contact: David Runciman
Tel: 01856 850 088
Fax: 01856 850 089
Email: dave.runciman@aquatera.co.uk

Revision record

Revision Number	Issue Date	Revision Details
1.0	-	Internal draft
1.1	-	Internal review
1.2	20/08/10	Draft for issue
1.3	16/09/10	Final report for issue

Contents

1 Introduction

Diver and ROV (Remotely Operated Vehicle) surveys of the Fall of Warness area were undertaken on behalf of Scotrenewables Ltd. to collect video footage of the seabed both along the potential cable route and in the vicinity of the proposed installation site for their prototype tidal energy device and associated mooring system. The output from these surveys gives an indication of the seabed habitats and topography present in the area prior to the commencement of development activities at the site.

This report provides an overall assessment of the video footage collected. The video obtained was reviewed for the presence of any key environmental sensitivities within the survey area and the findings summarised. A series of representative images captured from the video footage, showing the typical features of the surveyed areas, is presented in Section 4 of this report.

2 Survey Methodology

2.1 Near-shore cable route survey (July 2010)

The video survey of the near-shore section of the potential cable route (in water depths ranging from approximately 3 to 15 m) was carried out on behalf of Scotrenewables by Sula Diving Ltd. An operational log summarising the survey activities has been provided separately by Sula. The dive survey was conducted by a diver swimming along pre-laid transect lines (tagged at 5 m intervals) between points specified by Scotrenewables (see Section 3). Video footage was collected using a waterproof hand-held camera.

2.2 Offshore cable route and mooring site seabed survey (August 2010)

The ROV survey operations were carried out on Friday 6th and Saturday 7th August 2010. The timing of the survey was selected to correspond with the neap phase of the tidal cycle when tidal currents would be expected to be at a minimum at the site and maximum ROV deployment time could be achieved. A *Seaeye Falcon* observation-class ROV was deployed from the survey vessel *MV Loadsman*. Accurate ROV position-fixing was achieved using a calibrated Ultra Short BaseLine (USBL) sonar system and the data overlaid on the video footage collected as UTM (Universal Transverse Mercator) coordinates.

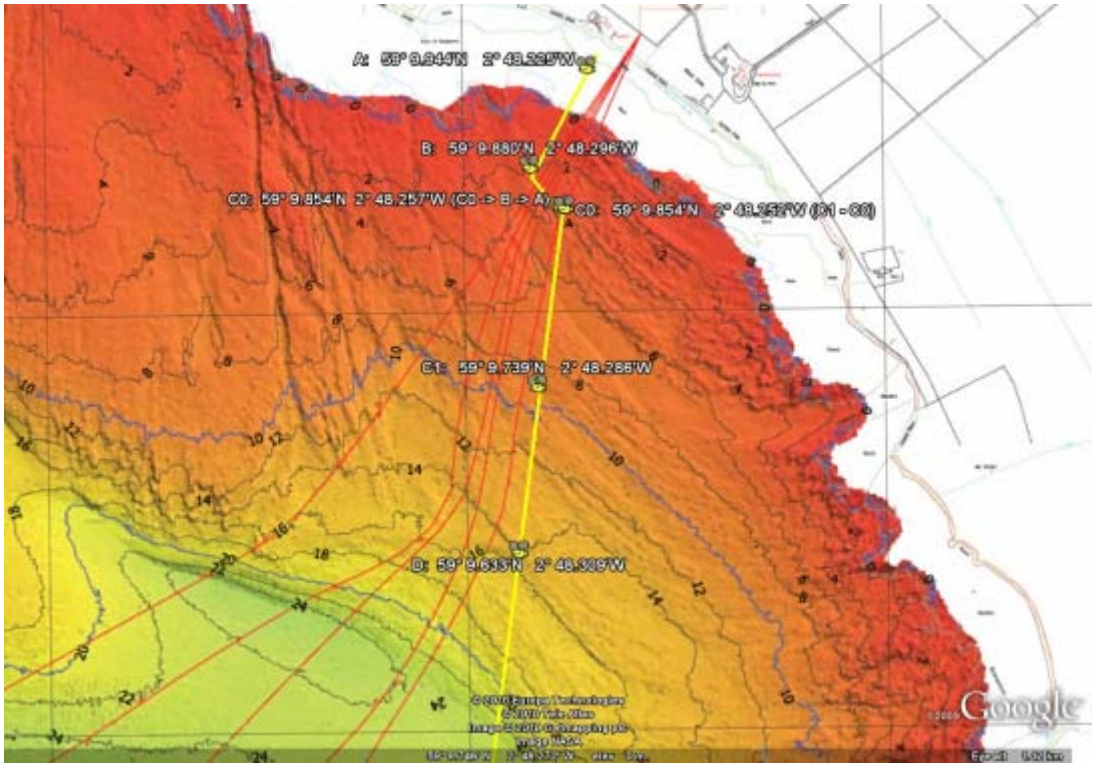
The vessel crew included the skipper, an umbilical man for the ROV, the ROV pilot and a USBL operator. A marine scientist was present in a survey coordinator role to observe the live footage and to guide the ROV pilot to any notable physical/ecological features. In summary:

- Skipper — Keith Bichan (RovingEye Enterprises Ltd.)
- ROV Pilot — David Stevenson (RovingEye Enterprises Ltd.)
- Umbilical man — Colin Ross
- Navigation/position fixing — Tris Thorne (Triscom Ltd.)
- Marine Scientist — David Runciman (Aquatera Ltd.)

The survey protocol used was consistent with the guidelines issued by EMEC (ROV Seabed Survey Guideline REP167-02-02 20100210). The ROV was flown over the seabed at a suitable height to provide a general overview of the seabed characteristics. The transit of the ROV was paused to obtain steady shots of any interesting seabed features, habitats or species encountered along the survey transects. Details of the ROV transects collected during the survey are provided in Section 3. Detailed information relating to the survey operations has been provided separately by Triscom

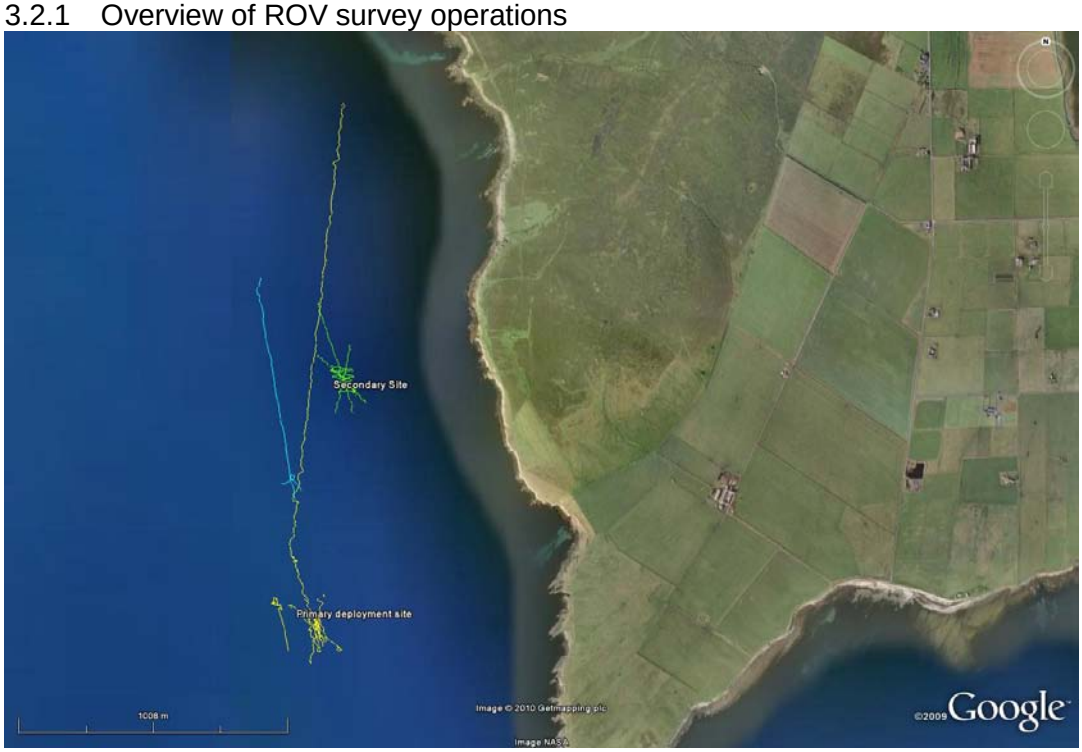
3 Survey Areas

3.1 Near-shore cable route survey – diver survey



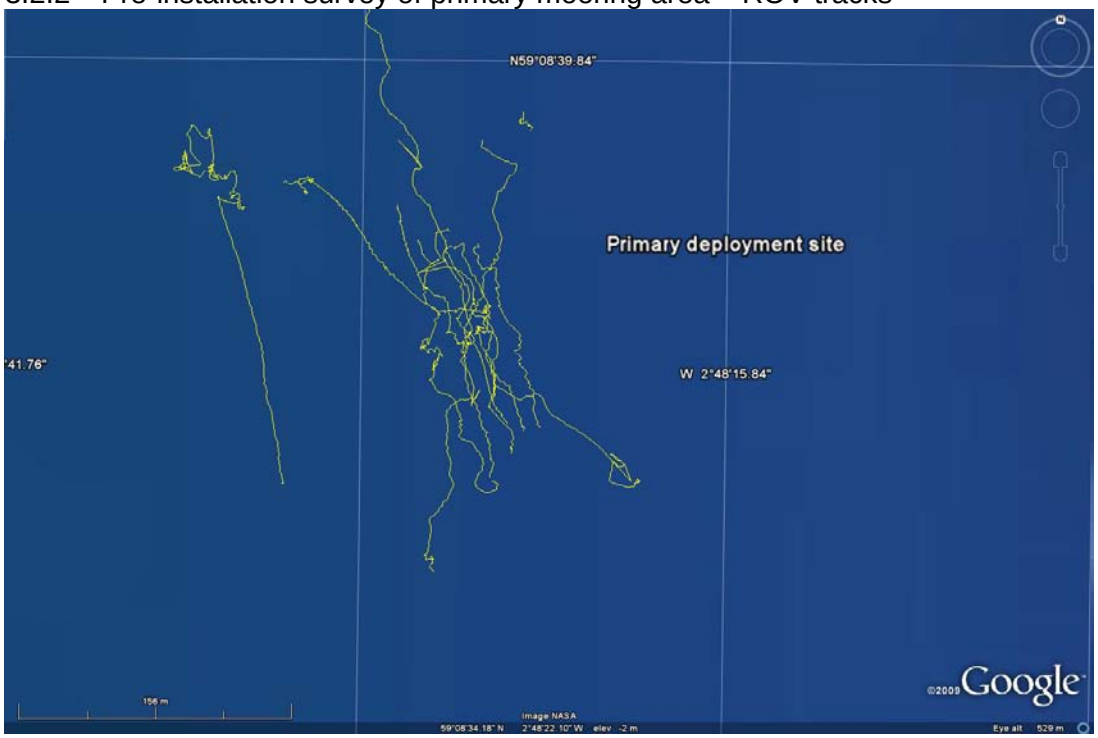
3.2 Offshore cable route and mooring site surveys

3.2.1 Overview of ROV survey operations

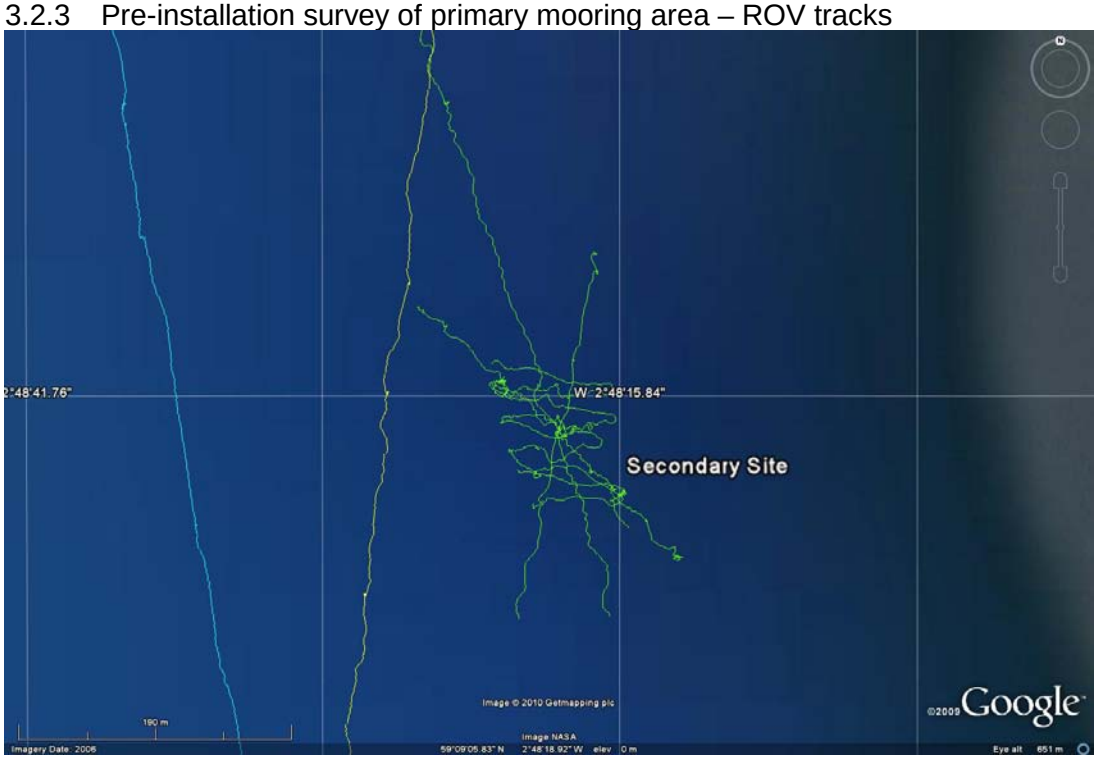


Yellow – primary mooring site and associated cable route
Green – secondary mooring site and associated cable route
Blue – 'wet-storage' cable survey

3.2.2 Pre-installation survey of primary mooring area – ROV tracks



3.2.3 Pre-installation survey of primary mooring area – ROV tracks



4 Survey observations

4.1 Near-shore cable route survey

Brief environmental descriptions and representative stills captured from the video footage collected are provided for the three legs of the dive survey of the near-shore cable route:

4.1.1 Dive 1: Cable route from C0 to B to A

This dive covered the cable route from point C0, located approximately 150 m from the shore in a water depth of less than 5 m, to point A located near the shoreline (see Section 3). The seabed is composed of medium/coarse shelly sand with areas of pebbles and cobbles and occasional boulders. The hard substrates present tended to be covered by large seaweeds (predominantly kelp, *Laminaria hyperborea)*, algae and small encrusting bryozoans and sponges. Observed fauna included juvenile fish, urchins, various species of crab and small molluscs. Worm casts were observed in sandy areas.

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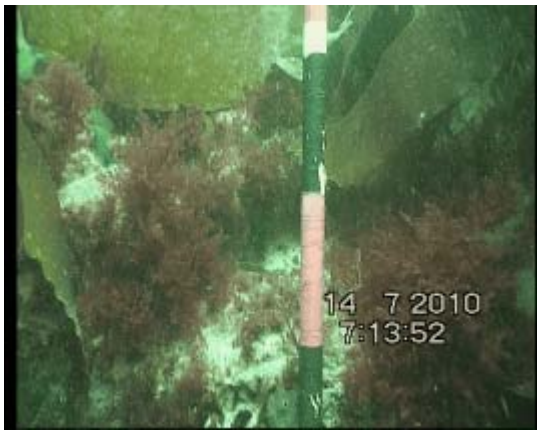
</td><td> 
</td></tr>
<tr><td>Coarse sandy seabed with area of seaweed growth, predominantly kelp species Laminaria hyperborea and Laminaria digitata and bootlace weed Chorda Filum.</td><td>Seabed in densely vegetated areas dominated by coarse sand/shell debris, pebbles and cobbles. Red Plocamium cartilagineum seaweed commonly encountered.</td></tr>
<tr><td> 
</td><td> 
</td></tr>
<tr><td>Image of kelp canopy. Transect line can be seen on right of image.</td><td>Encrusting calcareous algae, ascidians/sponges observed on exposed rock surfaces.</td></tr>
</table>

Ulva lactuca, sea lettuce relatively common in densely vegetated areas.

Oblique view of dense kelp outcrop.

Sandy area with worm casts and small crab possibly *Carcinus maenas* (green crab).

Rocky outcrop near shore with fuciod seaweed growth, *Fucus ceranoides* and/or *Fucus serratus.*

Example of epiphytic growth on kelp stipe.

4.1.2 Dive 2: Cable route from C0 to C1

This dive covered the cable route from point C0, along a 200 m transect to point C1 (see Section 3). The seabed habitat is again composed of patches of medium/coarse shelly sands with areas of pebbles, cobbles and boulders however it is generally rockier than the area found closer to shore. The hard substrates present tended to be covered by large seaweeds (predominantly kelp *Laminaria hyperborea)*, algae and small encrusting bryozoans and sponges. Observed fauna included saithe, sea scorpion, urchins, starfish, various species of crab and mollusc. Worm casts were observed in sandy areas.

<table>
<tr><td> 
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<tr><td>Mixed sand/pebble seabed and urchin (Echinus esculentus).</td><td>Saithe (Pollachius virens) observed swimming above the kelp canopy</td></tr>
<tr><td> 
</td><td> 
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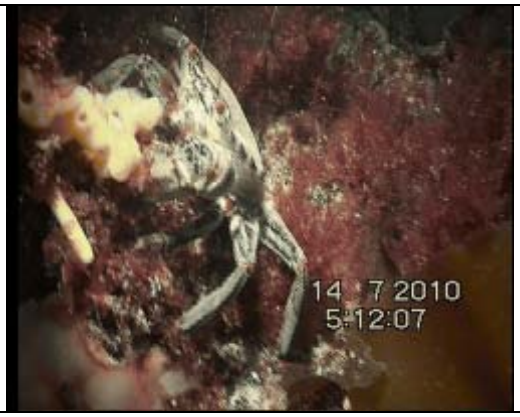
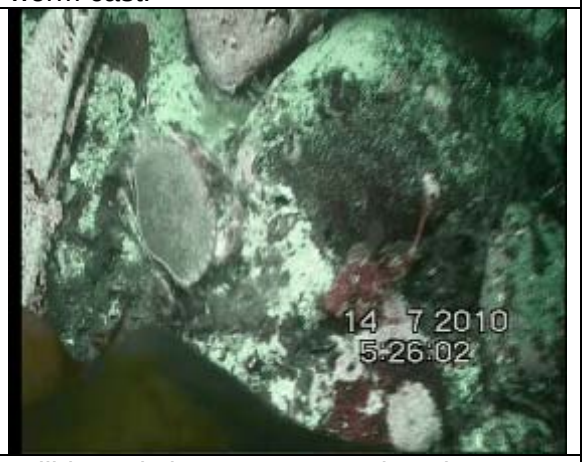
<tr><td>Scallop (Pecten maximus) in sandy seabed area.</td><td>Kelp holdfasts on rocky seabed.</td></tr>
<tr><td> 
</td><td> 
</td></tr>
<tr><td>Velvet crab (Necora puber).</td><td>Spider crab (Hyas araneus) in dense seaweed.</td></tr>
</table>

Unidentified sponge on kelp stipe.

Small hermit crab on sandy seabed with worm cast.

Common Starfish (*Asterias rubens*)



Edible crab (*Cancer pagurus*) and sea scorpion (*Taurulus bubalis*).

Sea scorpion (*T. bubalis*)

4.1.3 Dive 3: Cable route from C1 to D

This dive covered the cable route from point C1, along a 200 m transect away from the shoreline to point D in an approximate water depth of 15 m (Section 3). The seabed habitat was similar to that recorded between C0 and C1 however the frequency and density of kelp growth was noted to decrease as water depth increased. Tidal strength also appeared to increase as distance from the shore increased. Observed fauna included dogfish, sea scorpion, urchins and starfish.

<table>
<tr><td> 
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<tr><td>Scallop (Pecten maximus) in sandy seabed area.</td><td>Large starfish, possibly Luidia ciliaris.</td></tr>
<tr><td> 
</td><td> 
</td></tr>
<tr><td>Dogfish (Scyliorhinus caniculus) in kelp forest.</td><td>Sea scorpion (Taurulus bubalis)</td></tr>
<tr><td> 
</td><td> 
</td></tr>
<tr><td>Light bulb ascidian colony (Clavelina lepadiformis) on Kelp stipe.</td><td>Kelp plants showing increased tidal currents.</td></tr>
</table>

4.2 Cable route and primary deployment site

4.2.1 Cable route

The ROV was flown over the proposed cable route from the end of the near-shore diver survey to the centre of the primary deployment site covering a distance of approximately 2.5km with water depths increasing from approximately 15m to 36m along the route (Section 3). Initially the seabed habitat was similar to that recorded during the diver survey however the extensive vegetation growth initially observed rapidly decreased as water depth increased with kelp disappearing from the seabed as water depths approached 20-25m. The seabed was relatively heterogeneous and composed of areas dominated by medium/coarse shelly sands, patches of pebbles/cobbles and exposed bed rock/boulders. The hard, rocky seabed types tended to dominate in the area around the proposed deployment site. The flora and fauna observed in the shallower areas of the transect were typical of those recorded in the dive survey. As water depth increased beyond 20-25m the most common seabed fauna observed were urchins, starfish, anemones, bryozoans and sponges. At a depth of around 25m there are some fragments of dead maerl visible. The extent of this character seems to be widespread but there is no evidence of live maerl in the surveyed area. These fragments may therefore be swept in from adjacent areas by the strong tides.

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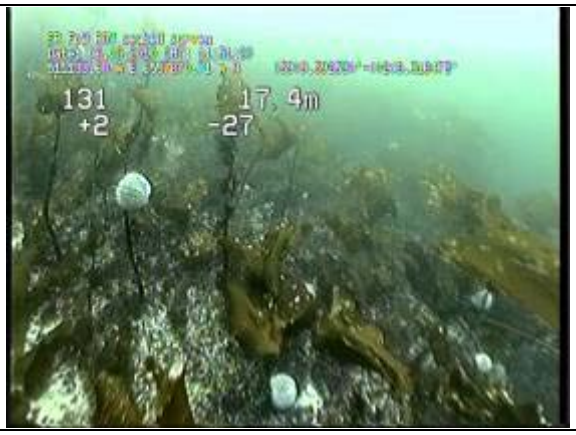
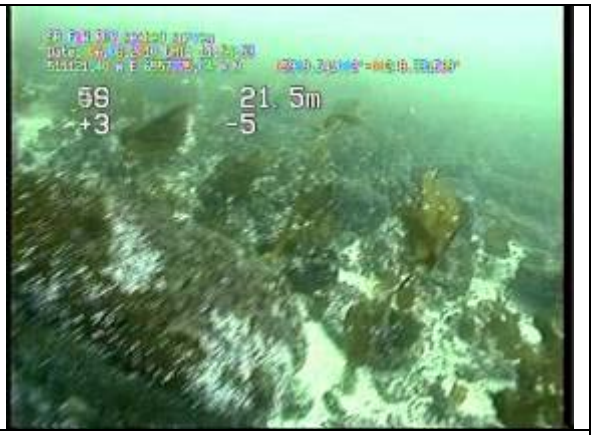
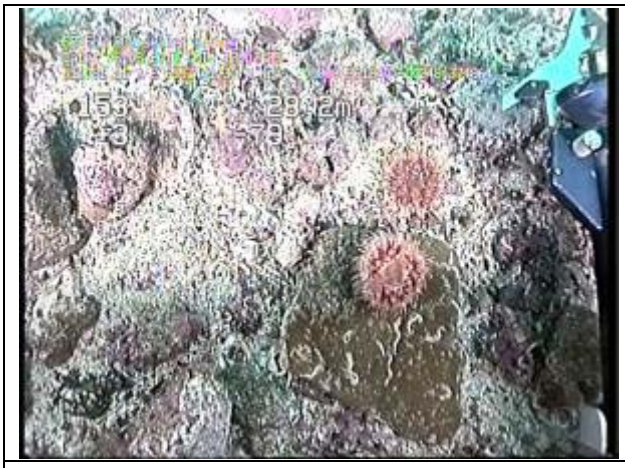
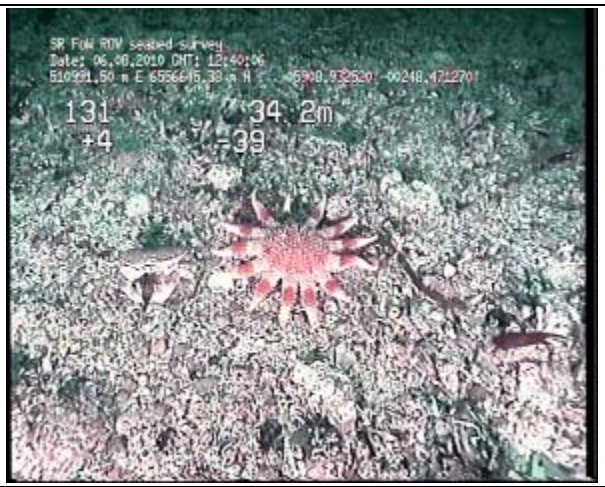
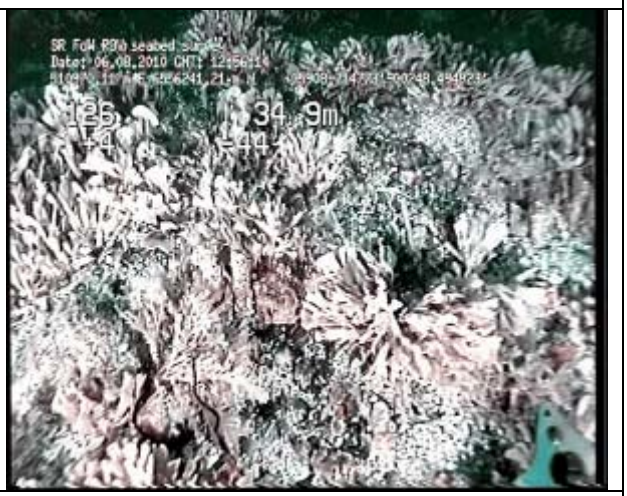
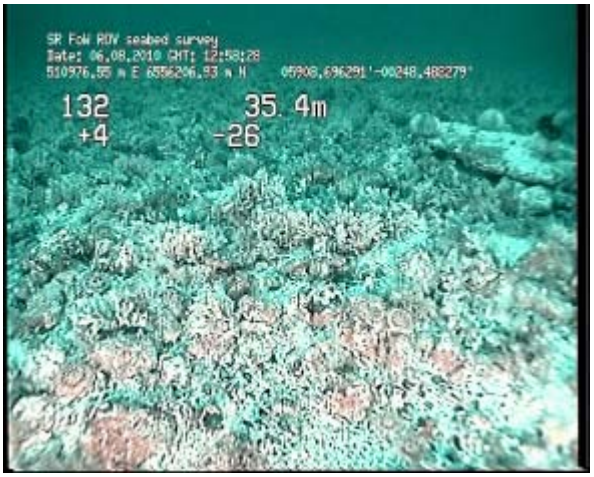
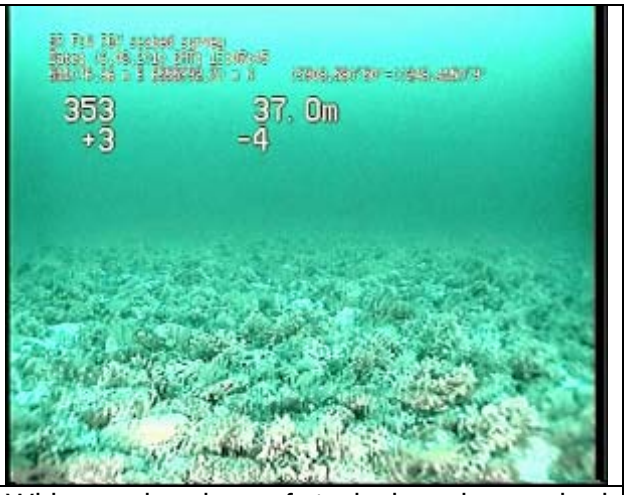
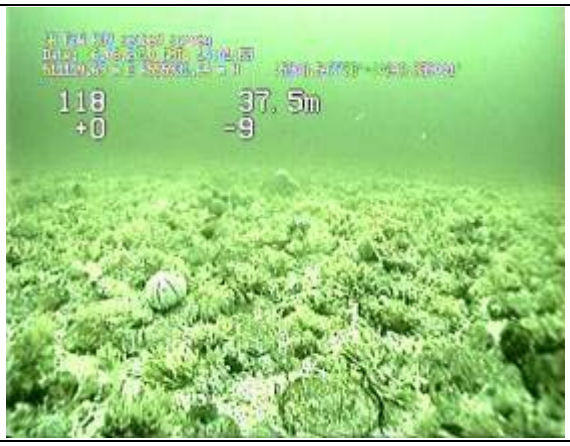
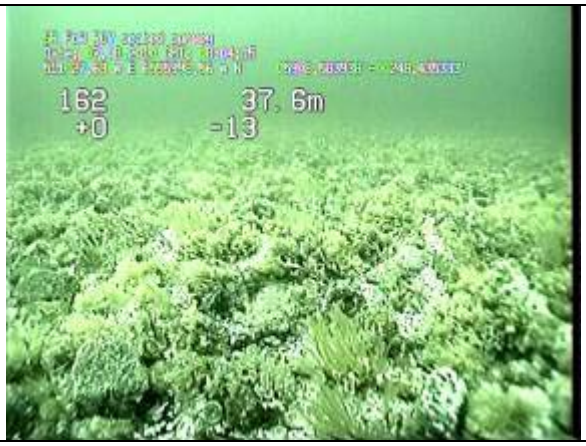
<tr><td> 
</td><td> 
</td></tr>
<tr><td>Sparse kelp growth and numerous urchins (Echinus esculentus)</td><td>Rocky seabed, showing reduced seaweed cover (21.5m depth).</td></tr>
<tr><td>  </td><td> 
</td></tr>
<tr><td>Close-up of coarse sandy seabed area with occasional pebbles and maerl debris.</td><td>Wide angle view of typical rocky seabed encountered in water depths of greater than 25m.</td></tr>
</table>

	
Seabed close-up image showing typical hard-substrate epifauna including sea anemone (*Sagartia elegans*) and keel worm (*Pomtoceros lamarcki*).	Boulder with encrusting sponge (possibly *Myxilla fimbriata*), unidentified bryozoan and urchin.
	
Mixed seabed area with scallop (*Pecten maximus)*, sunstar (*Crossaster papposus*), and urchin	Sandy seabed close-up showing worm tubes.
	
Mixed seabed area with sunstar (*Crossaster papposus*), and edible crab (*Cancer pagurus*).	Seabed close-up showing numerous bryozoan (*Flustra foliacea*) colonies.

	
Wide angle view of typical rocky seabed encountered in proposed deployment area showing rocky seabed covered by dense faunal 'turf' composed of bryozoans, sponges, hydroids and anemones.	Wide angle view of typical rocky seabed encountered in proposed deployment area (2).

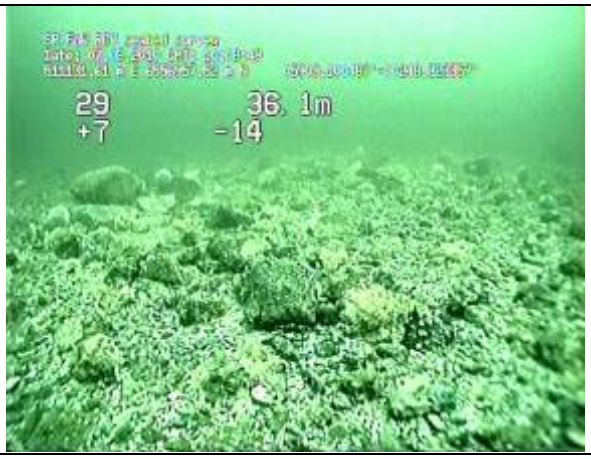
4.2.2 Primary deployment site

A total of eight video transects were run at the primary deployment site, two diagonal transects covering the proposed anchor locations and a series of parallel transects covering the central area (refer to Section 3). The seabed was predominantly hard and rocky and composed of pebbles and cobbles and occasional boulders with patches of coarse/medium sand. A relatively dense turf of seabed fauna was observed throughout the area with the most dominant species present being bryozoans, anemones, hydroids and sponges. Occasional urchins and starfish were also observed.

	
Wide angle view of typical rocky seabed encountered in proposed deployment area.	Typical rocky seabed habitat showing anemones, bryozoan (*Flustra foliacea)* and hydroid (*Nemertesia antennina*) colonies*.*
	
Typical rocky seabed habitat with anemones, bryozoan (*Flustra foliacea)* and hydroid (*Nemertesia antennina*) colonies*.*	Seabed close-up showing epibenthic turf with anemones, bryozoan (*Flustra foliacea)* and hydroid (*Nemertesia antennina*) colonies and sea urchin.

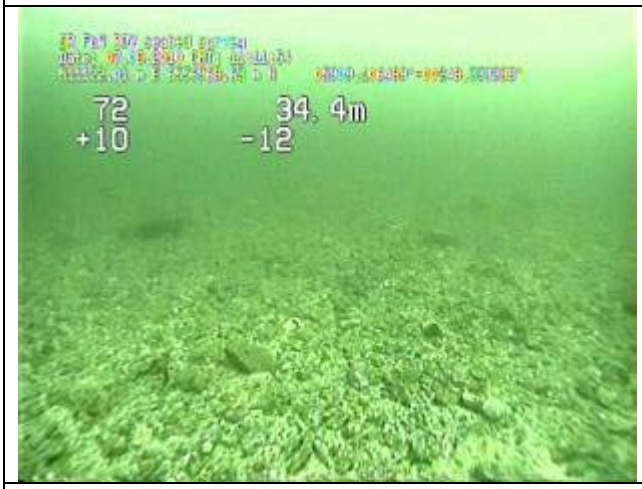
4.3 Secondary deployment site and cable route

A total of four video transects were run at the secondary deployment site; two diagonal transects covering the proposed anchor locations, a continuous 'snake' transect covering the central area and a cable route transect (Section 3). The seabed was broadly similar to that observed at the primary deployment site being predominantly hard and rocky and composed of pebbles, cobbles and occasional boulders with patches of coarse/medium sand. Again, a relatively dense turf of seabed fauna was observed throughout the area with the most dominant species present being bryozoans, anemones, hydroids and sponges. Occasional urchins and starfish were also observed.



Wide angle view of typical rocky seabed encountered in cable route area.

Boulder with sea urchins and encrusting sponges.



Wide angle view of typical rocky seabed encountered in proposed deployment area.

5 Conclusion

The recorded footage allowed a basic assessment of the baseline environmental conditions and sensitivities of the areas proposed for development. The following key observations were made:

- The primary deployment site is located in a water depth of approximately 35m within a tidal-swept inter-island trough. The seabed is mainly hard and rocky with pebbles, cobbles and boulders interspersed with patches of coarse shelly sand. The faunal community recorded in the vicinity is typical of such habitats in Orkney waters and is dominated by sponges, anemones, bryozoans, encrusting invertebrates and associated species such as urchins and starfish.

- The secondary deployment site is located slightly closer to the shore in a similar water depth. The seabed habitat recorded in this area was broadly similar to that recorded in the primary deployment site.

- The potential cable route bisects a range of different habitat types ranging from near-shore macrophyte dominated communities to the hard, rocky seabed habitats encountered in the tidal swept deployment areas. The near-shore/shallow water (<20 m) environment is dominated by kelp forests that support a relatively diverse community of fauna, including many species of crustacea, molluscs and fish. The seabed communities observed further offshore in deeper water (>20 m) are more typical of the offshore deployment sites and dominated by encrusting invertebrates. Some fragments of maerl were found in this zone at around 25 m water depth, but they appeared to be dead and may have been swept in by tides from elsewhere.

Overall, the footage collected during the survey operations indicates the presence of a range of habitats and communities typical of the Fall of Warness area and other such sites around Orkney. No particularly sensitive species or communities were recorded in the vicinity of the planned deployment areas or cable route. The fragments of maerl that were encountered are not numerous enough to constitute a maerl bed and may have been swept in from adjacent areas.

Appendix 9

Supplementary study conducted to ascertain the attenuation of sound from the operations on site during the installation of the SR250

Scotrenewables®
Tidal Power Ltd

Study conducted to ascertain the attenuation of sound from the operations on site during the installation of the SR250
J S Side July 23rd 2010

This section describes the findings of a supplementary study conducted to ascertain the attenuation of sound from the operations on site during the installation of the SR250. Concerns have been raised, particularly in the summer months during pupping, over the influence of transmitted noise on seal haul-outs on Seal Skerry, and throughout the year on nearby seal activity. The species of concern is the harbour seal (*Phoca vitulina*) and the haul-outs on Seal Skerry are some 2.5km from the site for the installation of the SR250 (59° 8.530'N 2° 48.429'W), with possible haul-outs also on the adjacent shore some 1km distant.

The swimming activity of pups is believed to be limited to water depths less than 5m and accordingly for this work the focus has been on a zone extending 1.2km from the installation site and the potential interference of installation noise on harbour seal behaviour within this zone.

General Statement of Methodology

In general the description of sound transmission loss from a sound source underwater (and in air), and the corresponding zone of effect for a vulnerable target species requires:

1. The determination of the sound pressure level of the sound source (usually for continuous sounds in rms dB re 1μPa at 1m in water, and rms dB(A) re 20 μPa at 1m in air).
2. The determination of background levels in the area occupied by the target species.
3. The setting of appropriate thresholds of concern for the target species.
4. A model of underwater sound attenuation, which describes transmission loss appropriately for the area under consideration.
5. The determination of the zone within which such thresholds are exceeded or the distance required before background noise levels are likely to mask any signal from the sound source.

Each of these is presented in turn, with a final discussion on why the approach adopted here is likely to be conservative and result in an overestimation of zones of influence.

There are many measures of sound pressure levels, but the rms (root mean squared) which provides an averaged value for continuous sounds (in dB re 1μPa) is used here. For impulsive sounds measures of impulse or peak-to-peak values are preferred as the impact on sensitive marine organisms is from the short duration, high intensity variation in the signal rather than from exposure to a continuous sound source. These measures which better characterise short lived high energy pulses would be applied, for example, to pile driving, use of explosives, and seismic sound sources such as air guns. In air dB(A) re 20μPa is more routinely used as it is a measure adjusted for the frequency-specific threshold of human hearing.

Sound Pressure Levels of the Sound Source

The workboat to be used for the installation of the SRTT has three 800hp engines (with 1700mm diameter propellers) and is 26m in length. The vessel complies with the MCA Code of Practice for the Safety of Small Workboats & Pilot Boats which requires that a surface noise level of 65dB (A) should not be exceeded.

Typical but larger twin engine work boats have recorded underwater noise levels of 159dB (re 1µPa at 1m) which can be derived by considering the contribution of each engine. Table 1 shows a simple method for doing this:

Difference between two source pressure levels (dB)	Value to be added to the higher SPL (dB)
0-1	3
2-3	2
4-9	1
>10	0

Table 1 Approximate values for determining the combined noise level from two noise sources (after Norton, 1989).

Thus for a combined noise level of 159dB, from two identical engines, each would have a sound pressure level of 156dB. The addition of one further engine would result in a combined sound pressure level from all three of 161dB. This illustrates the rather counter-intuitive effect of the dB scale being logarithmic.

As the workboat being used is rather smaller than the workboat for which these data exist the use of 161dB is considered to be conservative. Generally the dominant frequencies for workboats are in the 400-650Hz range.

Attenuation of Surface Noise Levels in Air

Background noise levels in air are likely to be highly dependent on sea state and wind conditions, and no measurements exist for background levels under differing environmental conditions on Seal Skerry, or along the Eday coast. Figure 1 plots the 65dB(A) limit for surface noise and extrapolates this over distance from the source, using wind speed only as an approximate measure of background levels. It also shows for comparison the corresponding attenuation of noise from a jack-up barge and pneumatic jack hammer. As a general rule of thumb the attenuation, of surface noise from the workboat will result in levels comparable to a library, or quiet study area, within 50m of its operation. It is likely that ambient noise levels from wind (shown on Figure 1) and arising from the corresponding sea-state will be considerably greater than this. Thus we can conclude that transmission losses in air are such that no interference with wildlife on Seal Skerry, or from haul-outs on the adjacent coast, will result from airborne noise. Even on those rare occasions where the sea surface is like a

mirror, it is unlikely that noise from the workboat will be detectable against background levels on the Eday coast.

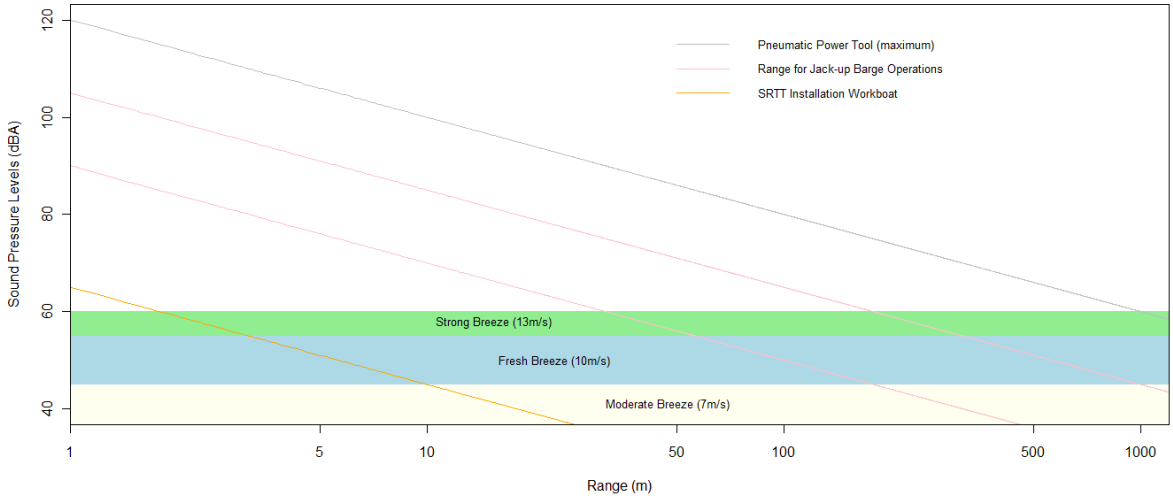


Figure 1 Showing noise transmission losses in air from the workboat (orange) and for comparison the operation of a jack-up barge and pneumatic jack hammer tool.

Attenuation of Underwater Noise

Background Noise Levels

A measure of the ambient noise environment is particularly useful in assessing the influence of noise from point source maritime activities. In shallow coastal regions background noise levels can vary from 90-155dB re 1µPa (Nedwell *et al*., 2003). In recent studies in the Moray Firth background noise levels ranged from 104-121dB re 1µPa (Bailey *et al*., in press) and in a Strangford Lough study from 115-125dB re 1µPa (Nedwell and Brooker, 2008). Maritime traffic can have a significant influence on these levels and thus in the vicinity of construction vessel traffic for the Beatrice Wind Farm in the Moray Firth Bailey *et al.* record background noise levels increasing to 138dB re 1µPa. These are rms broadband measures, and the only comparison possible in the Fall of Warness is from drifter buoys in the main channel and not in the vicinity of Seal Skerry or coastal waters. A comparison of the power spectrum levels of background noise for both the Moray Firth and Strangford Lough indicates comparatively elevated background noise levels for the main channel in the Fall of Warness (Wilson and Carter, 2008).

It is unlikely that such elevated background noise levels are found in the shallower waters in adjacent to the coast and thus a background noise level range of 115-125dB re 1µPa has been selected as the threshold for this present work. Again we feel this is conservative but more appropriate than the field data for the centre channel.

It is highly likely that from time to time ferry and other maritime traffic increase background levels further. Textbook values for maritime traffic range from 120-170dB re 1µPa at 1m and

plots of ferry movements within this area suggest often a close proximity of passing ferry traffic to Seal Skerry and the Eday coast.

Thresholds of Concern for Target Species

In addition to the level of background noise there are a number of thresholds that have gained acceptance in the scientific literature when considering the effects of underwater noise on vulnerable species:

1. Auditory injury or permanent threshold shift in hearing (PTS)
2. Temporary threshold shift in hearing (TTS)
3. Behavioural disturbance thresholds (BHT) – sometimes ranked as minor or major.
4. Hearing Threshold (sometimes "ht") or auditory threshold for the species concerned

Generally the latter, auditory thresholds, are used to analyse measured data to determine *perceived* noise levels for the species concerned. This mirrors the approach employed with human perception of noise levels. This is discussed briefly in the final section of this report.

Cited levels for PTS and TTS in pinnipeds exceed any that are forecast from the source sound pressure levels suggested above, and thus have not been used. Put simply, auditory impairment in the harbour seal could not occur even immediately adjacent to workboat operations. It is worth making comparison at this stage with pile driving activities. For example Bailey *et al.* (in press) conclude that for pinnipeds PTS onset would occur within a 20m zone of the pile driving operation for the Beatrice Wind Farm in the Moray Firth and TTS onset within a 40m zone.

Historically the behavioural disturbance threshold proposed by the US National Marine Fisheries Service (NMFS) for the lower limit of auditory damage (180dB re 1µPa) has been used.

More recent work (Harris *et al.*, 2001) has suggested Minor Disturbance and Major Disturbance thresholds of 160 and 200 dB re 1µPa (peak to peak, not rms). Again it is important to remember that these threshold values are for high-energy, short bursts from pile driving, underwater explosives and seismic sound sources, and are thus not directly comparable. In the graphical outputs of this study the US NMFS threshold of (180dB re 1µPa) has been used, and does provide the basis for the determination of safety zones in California and Sakalin (see, for a review of international safety standards in this respect, Compton *et al.*, 2007). Additionally the Minor Disturbance Threshold suggested by Harris *et al.*, of 160dB re 1µPa (peak to peak) is shown on the graphs purely for reference.

Model of Sound Attenuation

In an unbounded medium sound waves will spread spherically and the intensity will decrease with distance from the source. In such purely geometrical cases sound attenuation is described by a simple spherical spreading relationship for transmission loss:

$$TL = 20\log_{10}\frac{P}{P(r)}$$

Here *P* is the source sound pressure (at 1m) and *P(r)* is the sound pressure at distance *r*. The transmission loss at any distance can thus be calculated and it can be readily shown that:

$$TL = 20\log_{10} r$$

which is referred to as the spherical spreading (SS) law (*r* is the distance from source). If the geometry approximates to a channel (with horizontal extent much greater than depth then a cylindrical spreading (CS) relationship for wave propagation geometry is suggested:

$$TL = 10\log_{10} r$$

In addition to these geometrical considerations there are many other factors influencing the propagation of underwater sound waves. Generally sound waves from a source close to the seabed or surface will travel along multiple sound paths before reaching a single point at distance. Multi-path propagation is common where a source is located relatively close to a boundary (sea surface or seabed) and when the depth is small in relation to the horizontal propagation distance. In this case while some sound waves may follow a path directly from the source to the receiver others will be reflected from the surface and seabed many times resulting in constructive and destructive interference, with the received sound pressure level being reduced as a consequence of reflection losses.

In these circumstances the smoothness of sea surface, and physical nature of the seabed and its topography, are critical to the received sound pressure levels at any point. Because of constructive and destructive interference it is possible for the resulting sound field to contain an alternating series of sound pressure maxima and minima. This reflective phenomenon is sometimes referred to as the Lloyd mirror effect. Importantly it should be remembered that sound can also be transmitted through bedrock at the seabed, adding a further consideration to this complex mix.

Frequently the literature suggests an intermediate form (IS) of the above transmission loss equations to take into account these effects,

$$TL = 15\log_{10} r$$

Thus in the literature we find a variety of formulations for shallow water transmission loss, many of this general form, but with additional terms where models are fitted to data.

Importantly in many shallow water studies, where multi-path propagation occurs, the level of attenuation observed has required the use of values greater than 20 (greater than that used to describe spherical spreading). These appear frequently where piling operations are involved in shallow coastal waters, and where peak to peak or impulse metrics are analysed, rather than rms dB, see for example Malme *et al.* (1986) and Nedwell *et al.* (2003).

It will be readily appreciated from the brief discussion above that there can be no off-the-shelf modelling approach that can be applied with empirically supported data from the literature. Indeed a case by case approach must be adopted and model selection in the absence of measured data is one of judgement. In order to further elaborate these considerations, in the approach adopted here a number of models have been used to show each one's effect on transmission losses during sound propagation.

Figure 2 shows the attenuation of sound pressure levels from the 3 principal forms of transmission loss equation described above for a 170dB (re 1µPa at 1m) sound source. Added to this are the NMFS 180dB limit for auditory damage which is the safety zone threshold now applied in Californian state legislation and in Sakalin; and the 160 dB (peak to peak) minor disturbance zone suggested by Harris et al. (2001). It should be noted that the range from the sound source is shown on a logarithmic scale.

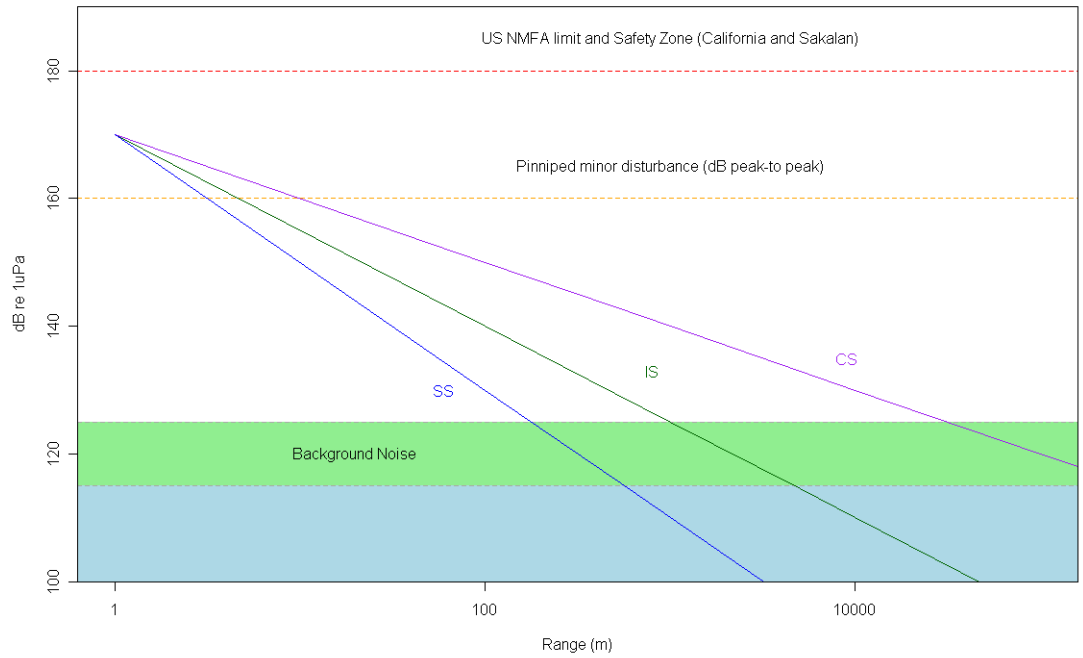


Figure 2 Showing 3 forms of the transmission loss model (SS - Spherical Spreading; CS – Cylindrical Spreading; IS – the intermediate form) and attenuation to background levels with distance.

Cylindrical spreading is rarely observed in practice owing to multi-path propagation, and indeed in a number of shallow water studies transmission losses are much greater than those suggested by spherical spreading models. The only practical case where a model has been developed from field data comparable to the Fall of Warness site, is for pin pile drilling in

Strangford Lough. Although we are in this study concerned with transmission into much shallower water and from a workboat rather than pin-pile drilling from a barge, this is the favoured model as it has been developed from empirical data for a similar tidal channel. The fit to data value ranges at each sampling location is shown in Figure 3. The elevated maximum level at the most distant sampling site is most likely a contribution from noise in the tidal channel.

These measurements were recorded over depths of about 40m and thus are not quite comparable with the case investigated here where we are concerned with propagation into shallow water. In this study we would expect greater attenuation in shallower water conditions.

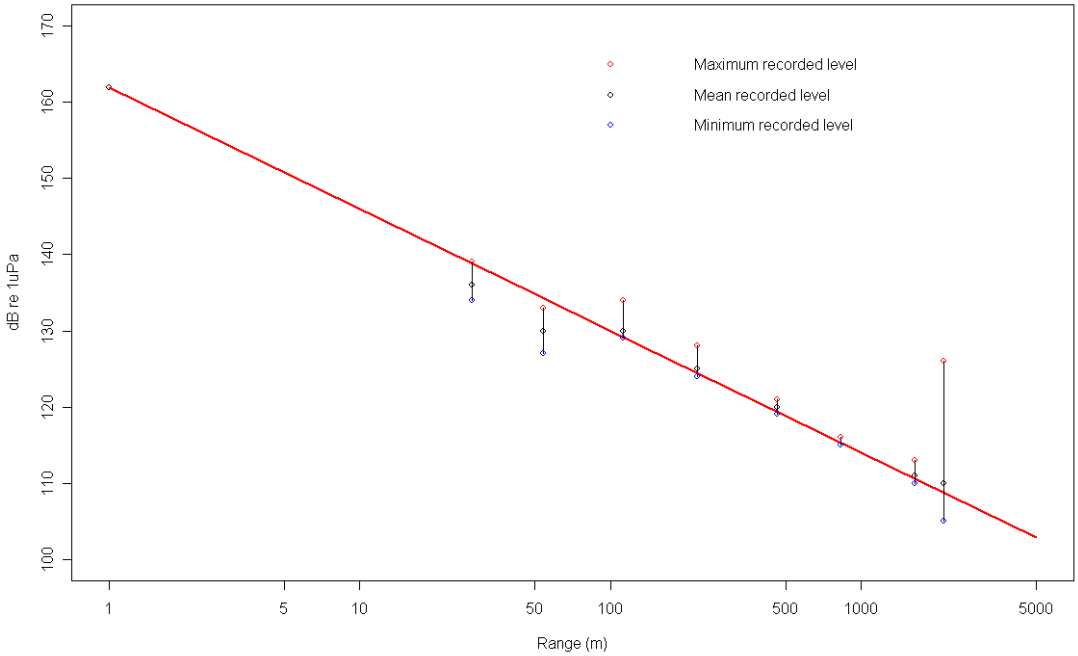


Figure 3 Showing fit of field data ranges to empirically derived model of sound attenuation from pile drilling for the SeaGen tidal turbine in Strangford Lough. (Source: from Nedwell and Brooker, 2008).

The model uses $16\log_{10} r$ as a fit to measure data. This is used below for a preferred case of a sound source of 161dB at 1m. For use in the worst case approach, we adopt the intermediate form (IS in Figure 2) to apply to the 161dB at 1m source sound pressure level.

Model Prediction of Underwater Sound Attenuation from Workboat Operations

Figure 4 shows the resulting attenuation of sound pressure levels with range for both the preferred model and the worst case model assumptions. Contrary to convention the range

scale used here is linear in order to offer greater clarity.

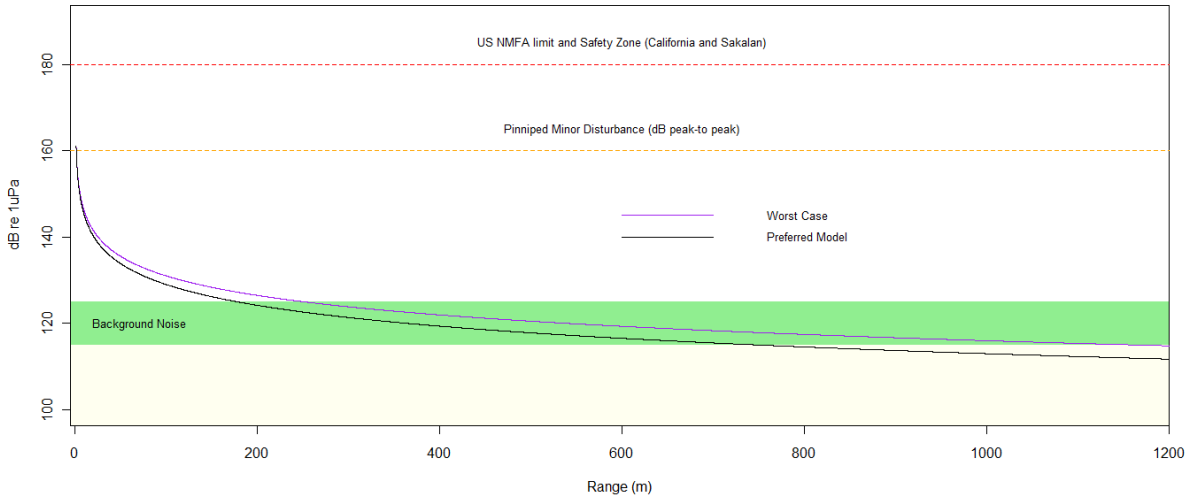


Figure 4 Sound Attenuation using the preferred and worst case modelling approaches

In both cases we anticipate that background noise levels will be reached within 250m of the site and thus at some distance seaward of the shallow waters surrounding the Eday coast and Seal Skerry haul-outs. In the preferred model this is within 200m of the workboat operations. Although the minor disturbance threshold is for peak-to-peak measurements of short duration sounds (e.g. pile driving, seismic airguns) and therefore not directly comparable it nonetheless provides confidence that altered disturbance will be limited at most to within a few metres of the workboat. Indeed the physical presence of the workboat may exert a stronger influence on seal behaviour.

Discussion of other factors suggesting this approach is conservative

There are a number of other factors, which we consider here. Firstly we note above that in shallow water studies where empirical data has been fitted to models values in excess of $20\log_{10}r$ are not uncommon. Thus the attenuation of sound is likely to be greater than that shown for Strangford Lough (the preferred model which uses $16\log_{10}r$) or the worst case (the intermediate model which uses $15\ \log_{10}r$).

Secondly the discussion so far has ignored the frequency of underwater noise sources and we have noted above that the dominant frequencies for workboat operations are likely to be in the 400-650Hz range. It is important to remember that many marine species are insensitive to, or rather have high thresholds of perception to, underwater sound and pinnipeds in particular are insensitive to sound at high and low frequencies. The audiogram in Figure 7 shows the sensitivity of the harbour seal to underwater sound.

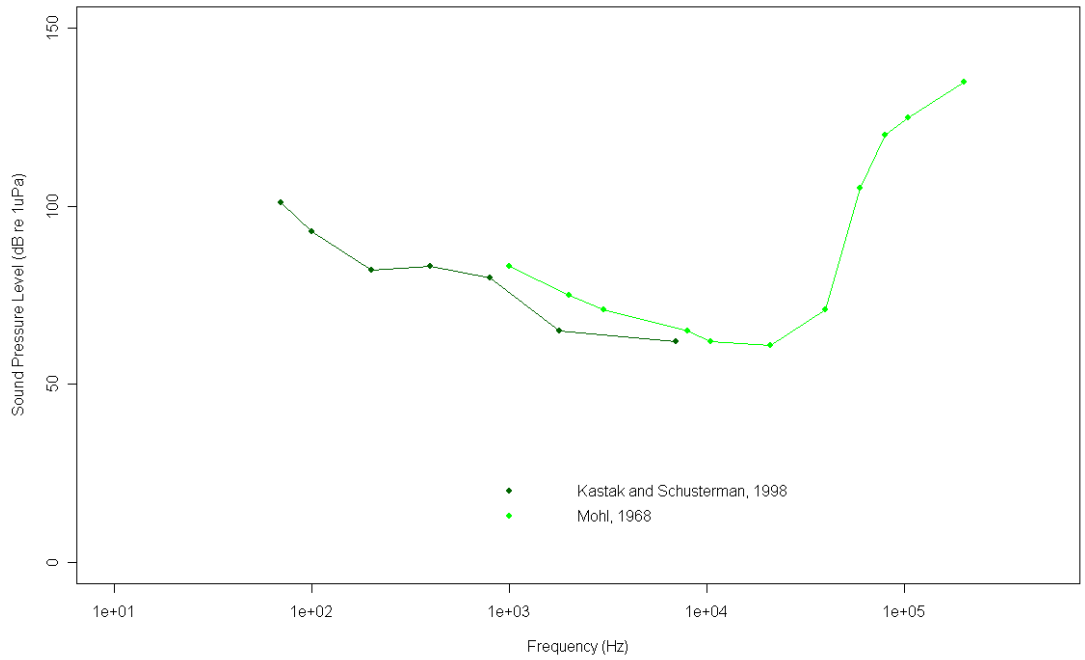


Figure 5 Hearing threshold for the harbour seal (Phoca vitulina) after Kastak and Schusterman (1998) and Mohl (1968).

Summary

This work, conducted in support of the Environmental Impact Assessment, concludes:

- that there is little risk of any auditory impairment of harbour seals even in the immediate vicinity of the workboat operations.
- that the zone of mild disturbance will be limited to at most a few metres, and thus the physical presence of the workboat may have a more significant influence on seal behaviour than any noise generated during installation of the SRTT.
- the attenuation of noise from the workboat is such that levels of background noise are likely to be reached within 200m (preferred approach) to 250m (worst case) of the site and at some distance seaward of the shallow waters surrounding the Eday coast and Seal Skerry haul-outs.

There are a number of other considerations that suggest the approach adopted in this study may be overly conservative. These include the insensitivity of harbour seals to low frequency noise and reference to other shallow water studies where attenuation has been significantly greater than that suggested by the approaches adopted here.

Nonetheless this work has been conducted in the absence of measured background noise levels close to Seal Skerry, and is based principally on the general approach to modelling

sound attenuation appearing in the scientific literature and in comparable situations. In particular the work conducted by Nedwell and Brooker (2008) and their measurements for the pile drilling for the SeaGen tidal turbine in Strangford Lough have been extensively relied on. There is no off-the-shelf model that can be used in these circumstances.

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Appendix 10

Scotrenewables Statement of Policy on Health and Safety at Work

Scotrenewables®
Tidal Power Ltd

STATEMENT OF POLICY ON HEALTH AND SAFETY AT WORK

INTRODUCTION

It is the policy of the Company that its operations are executed at all times in such a way as to ensure, so far as is reasonably practicable the health, safety and welfare of all its employees and all persons likely to be affected by its operations. This will include where appropriate Clients, Principal Contractors, Contractors and the Public.

POLICY
The Company's policy and commitments therefore are to:

Provide: a safe place of work and a healthy working environment, including a good standard of occupational hygiene.

Establish and ensure: procedures that are designed to protect employees and all others are followed to ensure safe working practices and efficient working conditions.

Compliance with: all UK, EC and Local Authority Regulations & Legislation, pertaining to the occupational health and safety of personnel.

Promotion of: health and safety measures as an essential part of management's duties, ensuring the implementation of such measures receive the highest priority.

Promotion of: environmental measures as an essential part of managements and employees duties ensuring such measures receive the highest the priority.

Encourage: employees' involvement to improve health, safety & environmental standards and require them to act responsibly to prevent injury to themselves or others. Individual responsibility for safety cannot be delegated.

Development of: the conviction that accident prevention is an essential part of good working practices. This can benefit the efficiency of the company's operations and the welfare of its employees.

Name: **Barry Johnston**

Signed:
Signed on behalf of the company

Date: