West Orkney South Wave Energy Site

Environmental scoping report

80359

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RSK GENERAL NOTES

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TABLE OF CONTENTS

Tables

Figures

1 INTRODUCTION

E.ON Climate and Renewables Developments Ltd (E.ON) is proposing to develop two adjacent wave energy projects off the west coast of Orkney called West Orkney Middle South and West Orkney South. If both of these areas are developed to their full potential, they could provide up to 100 megawatts (MW) of capacity, making a significant contribution to the Scottish Government's renewable energy and emissions reduction targets.

The following scoping report has been produced to provide regulatory authorities, statutory advisers and key stakeholders with an outline of the West Orkney South (WOS) project, the existing environment in which it will be constructed and operated, and the potential environmental impacts arising from these activities. West Orkney Middle South (WOMS) will be the subject of a separate scoping report.

1.1 Background

E.ON participated in The Crown Estate's bidding process for the first round of marine (wave and tidal) development site leasing in Pentland Firth and Orkney Waters Strategic Area.

As a result, in March 2010 E.ON was awarded two lease agreements (i.e. West Orkney South (WOS) and West Orkney Middle South (WOMS)) that allow for delivery of two wave demonstration projects of up to 10MW (Phase 1), each with an option to develop commercial arrays of up to 50MW (Phase 2).

E.ON has contractual obligations with the Crown Estate to meet key milestone dates to undertake development activities to secure the necessary licences and consents, and reach a decision on whether to exercise the commercial option of the lease for the projects.

1.1.1 Company background

E.ON Climate and Renewables has a diverse portfolio of renewable energy projects in the UK, including both onshore and offshore wind farms, dedicated biomass plants and the intent to develop further marine renewable projects. Currently, E.ON has 18 operational onshore and 3 offshore wind farms, and is a partner in what will be the world's largest offshore wind farm, London Array. E.ON has also gained planning consent for a 230MW offshore wind farm, Humber Gateway, off the east coast of Yorkshire and is developing new projects further offshore via The Crown Estate's Round 3 process.

In 2010, E.ON installed its first wave energy device, the next-generation Pelamis wave energy converter (P2) at the European Marine Energy Centre (EMEC) in Orkney. E.ON was the first utility company to test a marine energy device at EMEC, which is the only grid-connected marine test facility in Europe.

1.1.2 Location

WOS and WOMS are located off the west coast of mainland Orkney, as shown in Figure 1.1. Each lease area covers around 30km^2; both are located approximately 3km from the coast at their nearest point. For both phases of development at both sites, cables will be required to carry the electrical power generated to shore; for each phase of development a new substation will be required. Currently the landfall locations for these cables and the proposed substation locations have not been confirmed. However, the preferred location for a WOS substation will be close to the proposed substation for the Scotland (Caithness)-Orkney high voltage direct current (HVDC) cable project (being proposed by Scottish and Southern Energy (SSE)). A consultation document released for this project in October 2011 shows a "preferred landfall option" approximately 2km to the north of the Bay of Skaill, at a location known as South Vestra Fiold (Figure 1.2), with a substation location adjacent to the cliffs at Erens Geo. If this landfall is used for the HVDC cable, then it is likely that landfall for the WOS export cable will be located in the same area and the WOS substation will be in the vicinity.

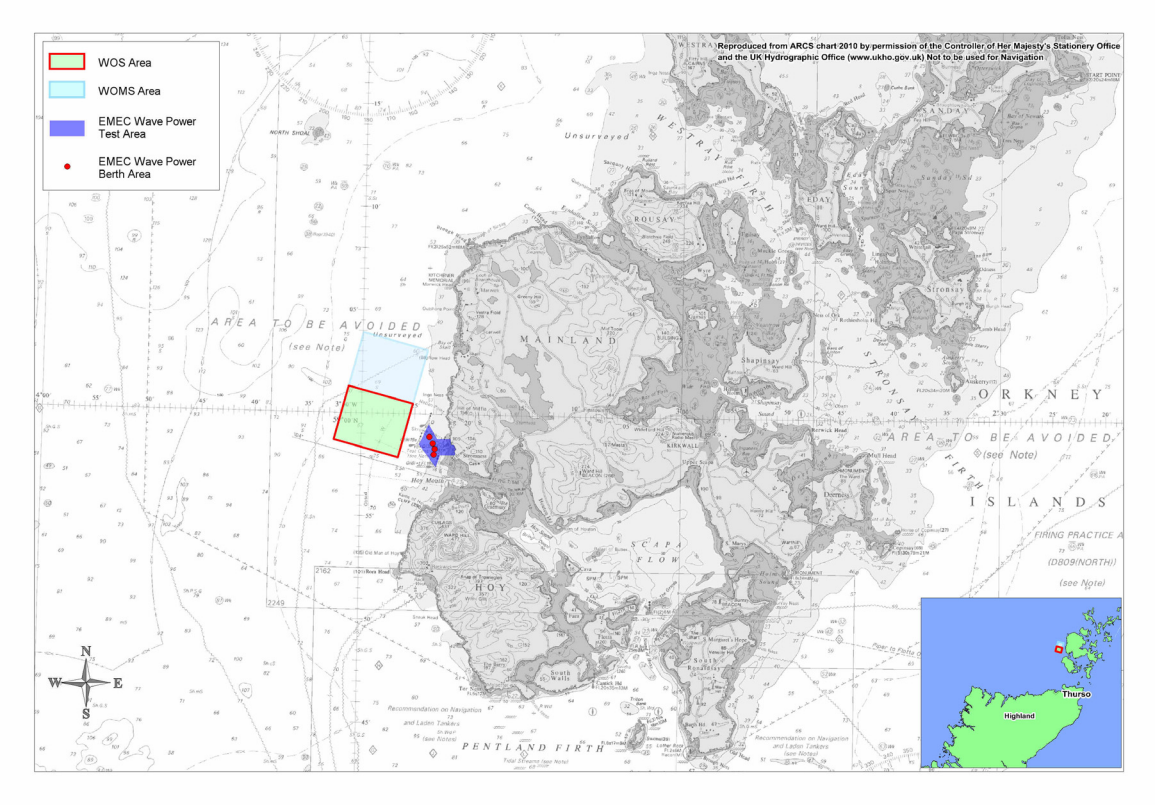


Figure 1.1: Location of West Orkney South wave power site

This scoping report has been written assuming the landfall and substation locations described above will be used, although it should be noted that this could change. If a different site were selected, similar processes to those described in this report would be used to help determine the best cable route from the landfall taking into consideration any environmental issues. Substation locations for Phase 2 of the WOS development have not yet been identified.

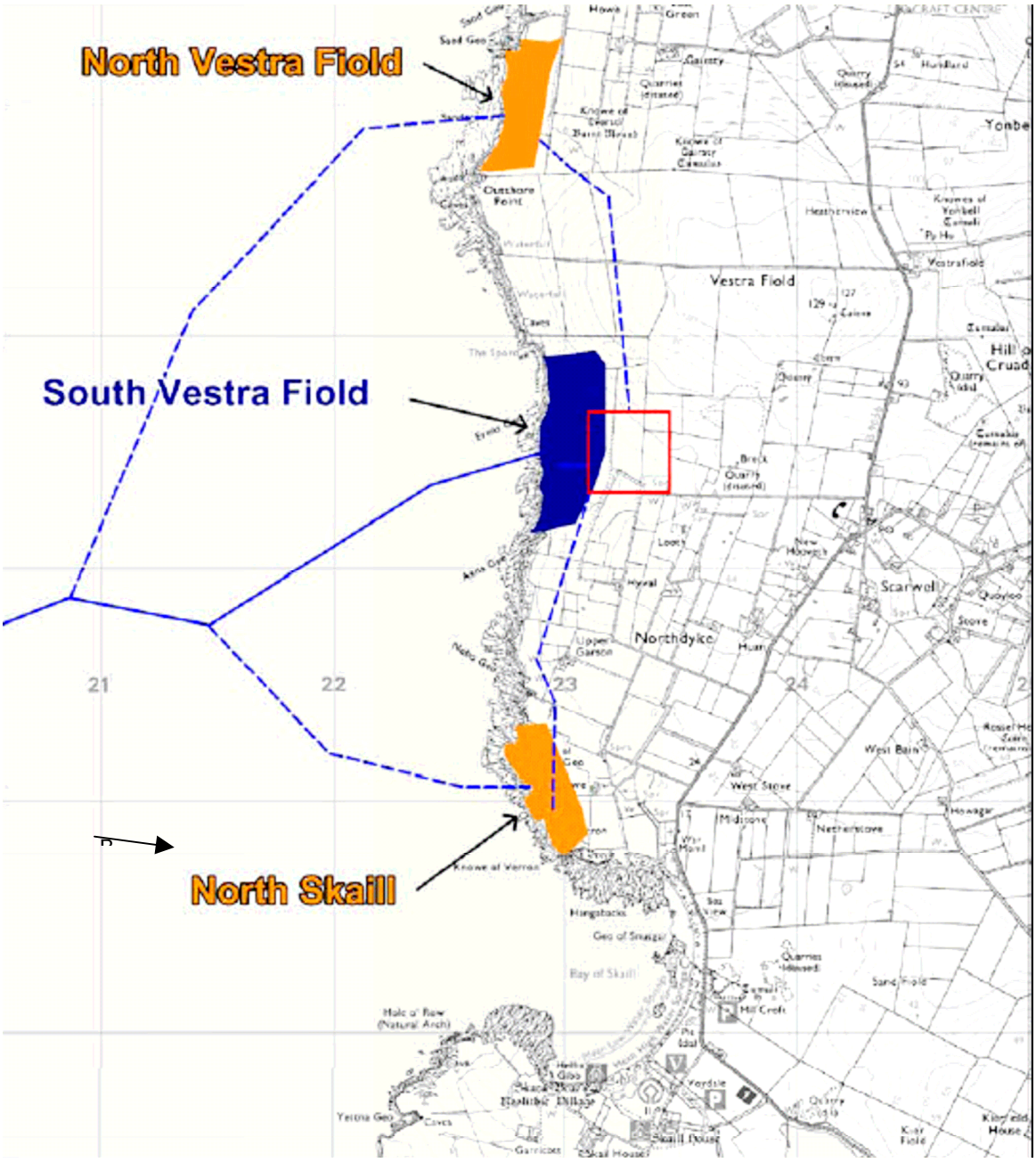


Figure 1.2: Preferred onshore substation location

1.2 Project outline

A description of all of the key elements of the project from moorings, surface structures, export cables, landfall and onshore connection is presented in Section 3.

For both WOS and WOMS, the leases awarded by The Crown Estate allow E.ON to develop a 7-year demonstration project consisting of a single wave energy converter (WEC) or small array of up to 20 WECs with a total capacity not exceeding 10MW. Each lease also contains an option to develop a commercial wave energy array of up to 50MW upon exercising the commercial option of the lease, if the option is taken within

the first 7 years. The commercial lease option for each site is for a period of up to 25 years (subject to obtaining other necessary licences/permits).

1.3 Purpose of scoping report

Scoping forms part of the environmental impact assessment (EIA) process. The purpose of a scoping report is to provide the following information to consultees:

- brief description of the project
- identification of key environmental constraints and sensitivities
- an outline of the strategic background (e.g. legislation, consents and guidance)
- identification of gaps in knowledge and proposals for further studies
- identification of the likely key impacts, both positive and negative, and the associated opportunities for mitigation and enhancement
- identification of the way forward for further stages of the EIA and the consultation process.

The proposed contents of the environmental statement (ES, the product of the EIA process) are also included as Appendix 1 to this scoping report.

The scoping report allows consultees to provide an informed 'scoping opinion', which will in turn influence the scope and content of the ES. A flow diagram of the EIA/scoping process is presented as Figure 1.3.

At this stage issues related to the project that are not considered of environmental concern can be scoped out of the EIA process.

1.4 Scoping report structure

This report includes the following sections:

- **Section 1** Introduction: background information about the proposal; aims and purpose of the scoping report
- **Section 2** Legislation: the regime under which it is proposed the project is consented
- **Section 3** Project Description: outline of the proposed development
- **Section 4** Approach to Assessment: outline of the proposed approach to the EIA and ES
- **Section 5** EIA Topics: outline of the proposed scope of the EIA for each of the topics identified for consideration. Existing information is summarised, potential effects and mitigation are outlined, and any further studies required are indicated;
- **Section 6** Way Forward
- **Section 7** References.

Data gathering	**Project data gathering** Basic description of the construction and operation of the proposed wave power development, including identification of the project components, proposed activities and expected programme ↓	STAKEHOLDER ENGAGEMENT
Scoping	**Environmental data gathering** Collection of information within the zone, cable corridor and substation site ↓ **Identification of environmental sensitivities** Identification of receptors and the key environmental sensitivities, which could potentially be affected by the proposed wave power development; consultation with regulatory authorities to discuss aspects associated with the proposed project activities ↓	
Assessment	**Site survey work** Surveys of the baseline environmental conditions to fill gaps in data, identify and confirm potential constraints identified as part of the desk-based assessment, and assist in the determination of impacts ↓ **EIA** A detailed assessment of the identified potential effects associated with project activities ↓ **Evaluation of significance** Evaluation of significance, including qualitative estimation of magnitude and severity of impacts ↓	
Management	**Mitigation measures** Identification and definition of mitigation measures to be applied to eliminate, minimise or manage the identified potential significant environmental effects ↓	
Compilation of environmental statement	Presentation of the findings of the baseline studies and mitigation measures in a systematic way to determine the significance of the residual effect on the environment; schedule of environmental commitments and monitoring requirements	

Figure 1.3: Flow diagram of EIA process

1.5 Strategic context

Having consulted stakeholders, the Scottish Executive announced in 2003 an aspirational target to generate 40% of its electricity from renewable sources by 2020 (source: *Securing a Renewable Future: Scotland's Renewable Energy*). Having exceeded its interim target in 2011, the Scottish Government raised the 2020 target to 100%. The commitment to renewable energy is driven both by environmental

imperatives and by the potential for new economic development. An increase in renewable electricity generation as a means of reducing carbon emissions forms an important part of Scotland's efforts to tackle climate change. More renewables can also provide greater diversity in their energy mix, which will be vital to ensuring security and continuity of supply as fossil fuels continue to deplete.

> "A thriving renewables sector also has the potential to enhance Scotland's manufacturing capacity, to develop new indigenous industries, particularly in rural areas, and to provide significant export opportunities. Our strategy, therefore, is to encourage the development of renewable energy both as a response to our climate change commitments and as a measure to promote the Scottish economy."

The Pentland Firth and Orkney waters is the first area to be made available for commercial-scale development of wave and tidal energy in Scotland and indeed the whole of the UK. The projects are believed to represent the largest planned development of wave and tidal energy worldwide.

The Crown Estate has entered into agreements for lease for projects with a potential capacity of up to 1600 MW in the Pentland Firth and Orkney waters. This followed a competitive leasing round for demonstration and commercial-scale project sites, and re-tendering of a particular site that received considerable interest from industry. E.ON's WOS and WOMS projects are part of the 1600MW capacity.

1.6 Consultation

Responses to this document are sought from both statutory and non-statutory stakeholders, it has been informed by initial stakeholder engagement. To date this consultation has included:

- meetings with
  - Marine Scotland-Licensing and Operations Team (MS-LOT) and Scottish Natural Heritage (SNH)(Aberdeen, June 2011)
  - Orkney Islands Council (OIC) (Kirkwall, July 2011)
  - Marine and Coastguard Agency (MCA) (Southampton, August 2011)
- attendance at presentations by
  - Orkney Fisheries Association, Orkney Fishermen's Society and Orkney Sustainable Fisheries (Kirkwall, June 2011).

Plans for further consultation on the proposed development are provided in Section 4.5.

2 LEGISLATION AND CONSENTS REQUIRED

The WOS project requires consent for construction and operation, and will need to have a decommissioning plan before its construction is consented. The permissions for the development will be sought from Marine Scotland, OIC and DECC. The sections below describe the background to the legislation that is in place for consenting marine renewable projects in Scottish waters, and how the consenting process will work for the proposed development.

2.1 Introduction

The UK's Marine and Coastal Access Act 2009 devolved powers for marine planning, licensing and nature conservation to Scottish Ministers. The Marine (Scotland) Act 2010 established Marine Scotland as the marine management organisation for Scotland's inshore and offshore waters (up to 200nm) except for designated local areas, such as harbours. The terrestrial limit of Marine Scotland's jurisdiction is generally the high water mark of mean spring tides. Marine Scotland is preparing a national marine plan for Scotland that is expected to be introduced in 2012. It will identify national priorities and set out the strategic objectives for the Scottish marine area and will ensure that international and European Union (EU) commitments are met.

2.2 Offshore planning consents

2.2.1 Consents from Marine Scotland

A key aim of the Marine (Scotland) Act (2010) is to streamline and simplify the consenting process for offshore renewable energy projects. Marine Scotland's Licensing Operations Team (MS-LOT) now acts as a 'front door' single point of contact that handles the consenting/licensing process. It issues consents under section 36 of the Electricity Act 1989, and marine licences under the Marine (Scotland) Act 2010. It also administers the environmental impact assessment process under the EU EIA Directives that are implemented in Scotland by the Environmental Impact Assessment (Scotland) Regulations 1999, the Electricity Works (EIA) (Scotland) Regulations 2000 and the Marine Works (EIA) Regulations 2007 (as amended).

Section 36 consent under the Electricity Act 1989

This consent is required for the construction and operation of a wave power generating station with a capacity of 1MW or more.

Section 21 of the Marine (Scotland) Act 2010

A marine licence is required for the deposit of any substance or object in the sea or on or under the seabed, and for the construction, alteration or improvement works on or over the sea or on or under the seabed.

Environmental impact assessment regulations

MS-LOT screens development projects to determine and advise whether a statutory environmental statement ES is required. For WOS, because the project is of greater than 1MW, an EIA will be required. E.ON therefore did not request a screening opinion

(within which MS-LOT will comment on whether an EIA is required or not), but chose to meet with MS-LOT to discuss the scoping of the full EIA.

Once it has reviewed the scoping report, MS-LOT, together with its advisers, will provide a scoping opinion to E.ON that will include advice as to whether the development is likely to affect a special area of conservation (SAC), special protection area (SPA) or European protected species (EPS). If it is, MS-LOT will advise whether the development requires a Habitats Regulations Appraisal (HRA) or an EPS licence, and whether the application will undergo 'appropriate assessment' under the EU Habitats Directive 92/43/EEC. At this stage, MS-LOT will indicate the level of baseline environmental detail that would be needed to carry out an HRA or an appropriate assessment. It should be noted that MS-LOT will be the competent authority and will undertake the HRA including screening, appropriate assessment and any further stages necessary under the HRA process.

2.2.2 Application

E.ON will submit a single application package to MS-LOT for the above consents. Draft guidance from MS-LOT indicates that the application package should include:

- the relevant forms
- a letter requesting consent under S36 of the Electricity Act 1989
- an ES (if required), a navigational risk assessment (NRA) and a hazard identification and risk analysis (HIRA)
- an independent third-party structural verification (TPV) report and certificate
- any other information or documentation required by MS-LOT (e.g. confirmation that a decommissioning programme has been submitted to the Department of Energy and Climate Change, DECC)
- the appropriate payment.

2.2.3 Consents from other agencies

Developers must obtain a lease from the Crown Estate under the Crown Estate Act (1961) for use of an area of seabed in inshore waters (up to 12nm) or in the renewable Energy Zone (up to 200nm).

Developers must submit a 'decommissioning' programme to the Department of Energy and Climate Change (DECC) under sections 105–114 of the Energy Act 2004.

If the development requires navigational marks or lights, the developer must obtain 'Statutory Sanction' from the Northern Lighthouse Board under the Merchant Shipping Act 1995.

If the development involves discharges of pollutants, water abstraction or certain types of engineering work up to 3nm from the coast (beyond the low-risk activities subject to General Binding Rules for which a licence is not required), the developer may need to apply to the Scottish Environment Protection Agency (SEPA) for a CAR authorisation under section 20 of the Water Environment (Controlled Activities) (Scotland) Regulations 2005 (CAR).

The developer must also have a connection agreement to allow it to connect to the national grid electrical transmission system.

2.3 Planning consent for onshore projects

With regard to the part of the development that is landward of the mean low water spring tides (MLWS) mark, such as transmission cables and substations, the developer must apply to the local planning authority (LPA, in this case Orkney Islands Council) for planning permission under section 90 of the Town and Country Planning (Scotland) Act 1997 or

The Scottish Government recommends that developers apply for deemed planning permission; however, any such deemed permission could only be granted under Section 36 of the Electricity Act 1989, and not under the Marine Scotland Act E.ON will plan to gain consent for the onshore elements of the development by direct application to the OIC.

2.4 Environmental statement approval procedure

2.4.1 Submission

The 'Consenting, EIA and HRA Guidance for Marine Renewable Energy Developments in Scotland' (Scottish Government, 2010) prescribes the contents of an environmental statement (ES). When an ES has been submitted, MS-LOT notifies the developer:

- to supply copies of the ES for statutory consultees
- to place a public notice in specified newspapers to advertise publication of the ES and explain where and how the public may review it or obtain a copy of it, and how they can make representations to MS-LOT.

The developer must make the ES available for public consultation for a statutory period from the date that the advertisements appear.

2.4.2 Consultation

MS-LOT is responsible for circulating copies of the consent application including the ES to the members of the Marine Renewables Facilitators Group (MRFG) for comment. The MRFG comprises representatives of Scottish Natural Heritage, the Maritime and Coastguard Agency, the Northern Lighthouse Board, the Department of Energy and Climate Change, the Scottish Environment Protection Agency and Orkney Islands Council. Relevant members of the MRFG may be called to meet and discuss the consent application.

At least three months before submission of the ES, the developer E.ON will write to MS-LOT to request confirmation that MS-LOT are satisfied with the public engagement process that has taken place.

2.4.3 Habitats Regulations appraisal

MS-LOT (as the competent authority) and its advisors (i.e. the MRFG) must determine whether the proposed development is likely to have an effect on the conservation

objectives of a protected habitat (i.e. an SAC or SPA). If the project is not considered likely to have such an effect, MS-LOT will record that finding. Otherwise, MS-LOT must carry out an 'appropriate assessment' to determine whether the proposed development may adversely affect the habitats and species of the SAC or SPA and the site's conservation objectives. To carry out the appropriate assessment, MS-LOT may require the developer to provide additional information (e.g. more detailed environmental baseline survey information). If the appropriate assessment has any doubt that the development will not have adverse effects on the habitats and species of the SAC or SPA, the application for consents/licences will not proceed to a ministerial decision except where 'there are no alternative solutions and imperative reasons of overriding public interest apply'.

The proximity of the WOS site to coastal special protection areas (as well as more distant Special Areas of Conservation) may mean that an appropriate assessment is required. This is the second step of a Habitats Regulations appraisal, and is likely to be required if the projects do not pass the first step (screening).

2.5 Project determination

MS-LOT will collate comments from the MRFG and from the public. It will liaise with the developer if issues need to be addressed, or if further information or clarification is required.

When consultation on the ES is completed, MS-LOT will advise on the outcome of the application and issue the consents and licences for successful applications. Approval of the ES and issuing of the consents may be subject to the developer meeting specified conditions (e.g. requirements that mitigation measures are implemented and that environmental monitoring is carried out).

The marine licence will be conditional on the developer submitting Form FEP5 to MS-LOT when the construction works are complete.

If consent for the onshore elements of the project is sought from OIC, it will carry out a similar process of consultation with its own advisers.

It is expected that the same process will be carried out for both Phase 1 and Phase 2 of the development. Additional environmental information will be supplied with the application for Phase 2 that has been collected during the operational stage of Phase 1.

2.5.1 Other likely requirements

Other consents and licences may be required to construct and operate a wave power development in UK coastal waters. The requirements for such consents will be determined in consultation with the relevant authorities. These will include consents for survey work on the site, safety zones or for changes to rights of navigation. A second set of permits will also be required for construction and operation of the onshore elements of the project.

3 PROJECT DESCRIPTION

The project description in this scoping report is intended to provide an outline to stakeholders on the nature of the development. The project description in the ES will address in detail those items as recommended by Marine Scotland's 2010 document 'Consenting, EIA and HRA Guidance for Marine Renewable Energy Developments in Scotland - Draft Marine Renewable Licensing Manual, Part 4: Wave and Tidal Annex'. A related section of the ES will review the various options that have been considered in arriving at the final project design; this will include the 'do nothing' scenario.

This outline of the project is split up into eight sections:

- history of the project to date
- a description of the devices to be used and the proposed array layout
- how the devices will be installed
- how the devices will be operated, controlled and maintained
- accidental events
- cables and substation
- how the devices will be decommissioned
- the proposed development schedule.

3.1 The project to date

E.ON awarded a contract to Aquatera in 2008 to provide information for its Round 1 leasing bid for marine renewable projects in the Pentland Firth strategic area. Aquatera considered the potential for different locations within The Crown Estate's area of offer (see Figure 3.1) to provide opportunities for E.ON and potential future partners to develop wave energy projects. The conclusion of the report was made based on the spatial distribution of resources, infrastructure and planning constraints.

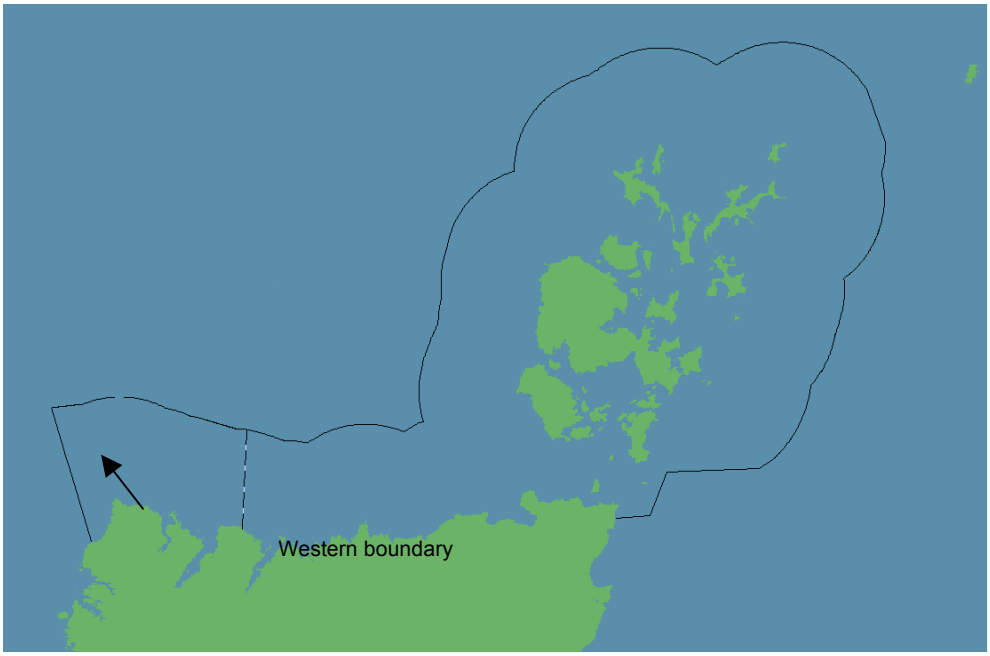


Figure 3.1: The Crown Estate area of offer (from Aquatera, 2009)

The advice provided to E.ON was that the area off the west mainland of Orkney had a good wave regime, and of the locations considered it was closest to base ports and possible grid connections. Aquatera also identified one particular risk for the site: as it is relatively close to the coast, any wave technologies that are developed for deeper waters and deployed to the west of the preferred location for the E.ON project could result in E.ON's project being within a "wave shadow".

Based on the above recommendation, E.ON made an application to the Crown Estate for this area and was awarded two demonstration blocks (see Figure 1.1), which E.ON has named West Orkney Middle South (WOMS) and West Orkney South (WOS). The lease for each site allows E.ON to develop smaller scale demonstration projects within the blocks that can be in place for up to seven years (Phase 1). Beyond this, E.ON has the option to fully develop each site, generating up to 50MW from each (Phase 2) over a further period of up to 25 years, or request an extension to the operational life of the demonstration project for an additional seven years.

The WOS lease area is rectangular with sides of approximately 6km by 5km (coordinates are provided in Table 3.1), and its northern border directly abuts that of the WOMS licence area. WOS covers an area of 30km^2. The closest land to WOS is its north-east corner, which is approximately 3.3 km from Neban Point. The nearest major settlement is Stromness, ~15km away.

Table 3.1: Boundary co-ordinates of West Orkney South licence area

Latitude	Longitude
59.0219°	-3.5225°
59.0083°	-3.4214°
58.9648°	-3.4432°
58.9784°	-3.5442°

E.ON has earmarked the Pelamis P2 technology to develop the WOS site, subject to the successful completion of a one-machine test that is currently being conducted at the European Marine Energy Centre (EMEC) in Orkney. For the Phase 1 development of this site it is planned that an array of up to 13 Pelamis devices will be installed, generating a maximum of 9.75MW (within the 10MW limit) of electrical energy.

The WOS site is very close to EMEC, located off Billia Croo (see Figure 1.1). The parameters being recorded from the P2 deployment will help in the design of the array to be used for Phase 1 at WOS.

Together with ScottishPower Renewables and Brough Head Wave Farm Ltd (a partnership between Aquamarine Power and Scottish and Southern Energy), E.ON has submitted an application to the European New Entrant Reserve (NER 300) fund under the special purpose vehicle 'POWER ltd', which will see the partners work together to develop a combined 28MW project, consisting of 3 modules, one of which is E.ON's 9.75MW P2 demonstration. The other modules under development are adjacent to E.ON projects. A qualifying criterion for receiving NER300 funding is that the 28MW demonstration projects must be operational by 31 December 2015.

3.2 Pelamis wave energy converter, proposed array layout and other required infrastructure

3.2.1 Pelamis – a brief history

The Pelamis wave energy converter has been in development for a number of years. The first design was deployed at EMEC from 2004 to 2005, providing information on a number of design parameters that Pelamis Wave Power Ltd (PWP) has used to assist in its design changes for the P2 generation models. The device, which is currently deployed at Billia Croo, is the first P2 device produced and offers improved future-proofing for performance and operations as well as numerous design advances to facilitate volume manufacturing. A second P2 device, developed for ScottishPower Renewables, will also be installed at EMEC. Under a collaborative agreement, ScottishPower Renewables and E.ON will share the results from monitoring of the devices as they work in relatively close proximity.

3.2.2 *P2 physical characteristics*

Each P2 device is 180m long, weighing approximately 1300 tonnes, and consisting of 5 cylindrical sections of approximately equal length (see Figure 3.2:). P2 is known as an attenuator-type wave device and floats on the surface, effectively riding the waves. The devices have a patented system that keeps them heading into the incident waves. Each device consists of four sections, which can move independently, joints between each section allow lateral and vertical movement (Figure 3.3 and Figure 3.4). Shorter power conversion module (PCM) sections are located between the four larger sections. Each of these houses an independent power generation system consisting of two separate hydraulic circuits. Located at either end of the PCMs are pairs of hydraulic rams, with one pair resisting a sway joint and the other end-pair resisting a heave joint.

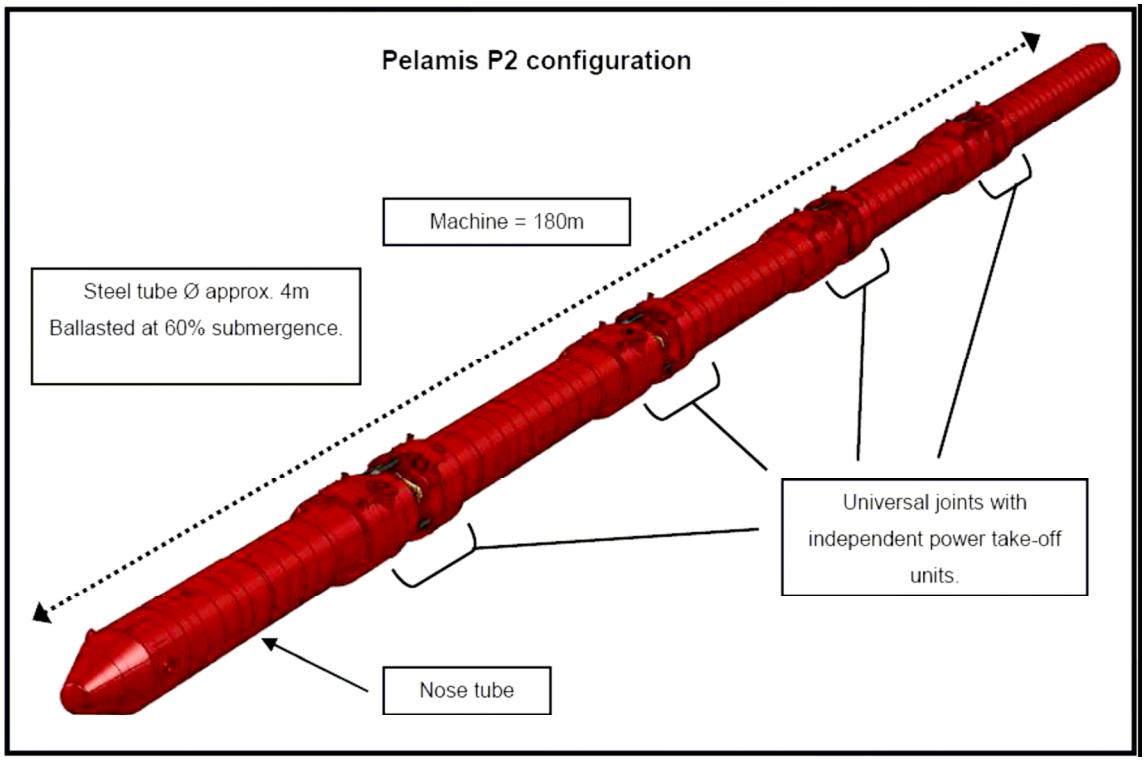


Figure 3.2: Pelamis P2 configuration

As waves pass down the length of the machine, the induced motions of the separate segments relative to one another (Figure 3.3 and Figure 3.4) are resisted by these hydraulic rams. The hydraulic rams drive pressurised fluid into power-smoothing, high-pressure accumulators that then direct the fluid through variable displacement motors and back to low-pressure fluid reservoirs. The variable displacement motor is linked directly to an asynchronous generator producing a three-phase voltage.

The maximum overall generating capacity of a single Pelamis machine is 750kW.

The motor generator sets in each PCM feed the produced electricity onto a high-voltage bus-line that runs the length of the device and feeds into a nose-mounted transformer.

The transformer output is fed down to the seafloor via a flexible umbilical connector, which is subsequently joined to a static high-voltage cable on the seabed taking the generated power to the shore and on to the grid connection.

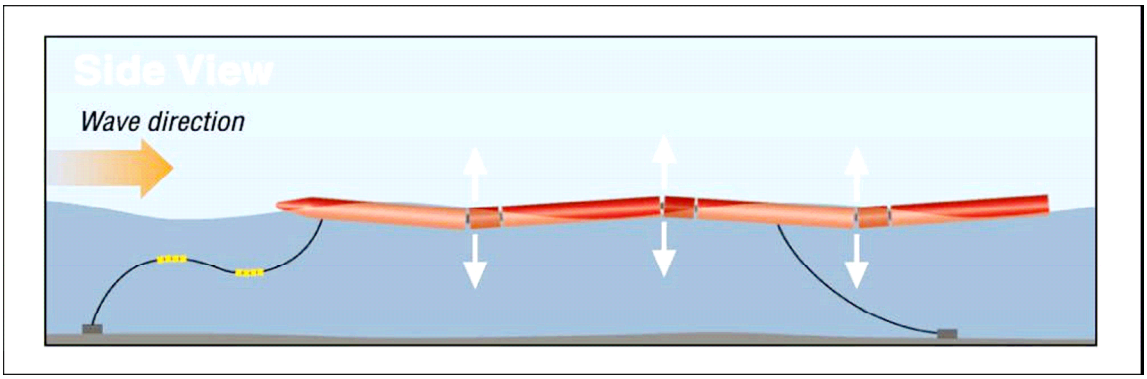


Figure 3.3: Side view of Pelamis device in situ (only four of five sections shown)

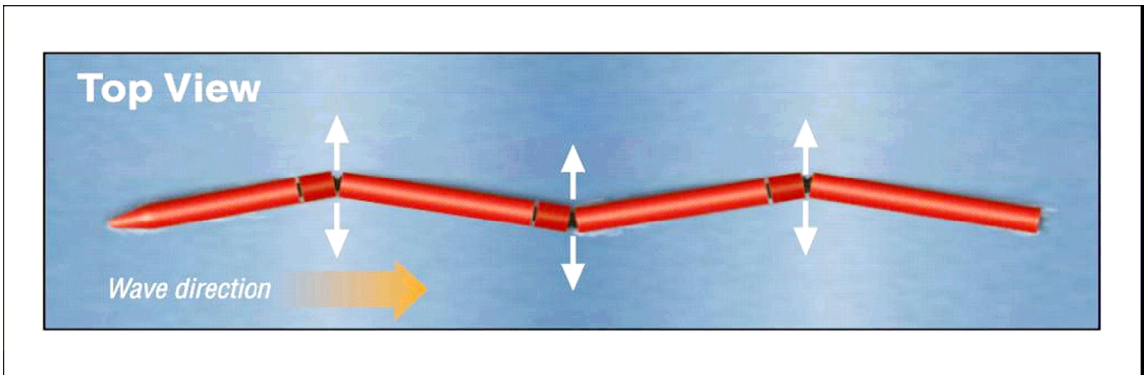


Figure 3.4: Birds-eye view of Pelamis device in situ (only four of five sections shown)

3.2.3 Array design

The first phase of the WOS development will consist of an array of up to 13 Pelamis devices, while the second phase may include up to 66. It is currently proposed that for Phase 1 the devices are arranged as shown in Figure 3.5 (the spacing between columns has arbitrarily been set to 1800m, 10 x length). However, it is possible that this arrangement is modified in advance of the deployment as more information becomes available about performance of the devices as they are moored at EMEC. The detailed design of the array will be completed once a number of parameters have been considered, including any environmental features that the devices, their moorings or cabling systems should avoid.

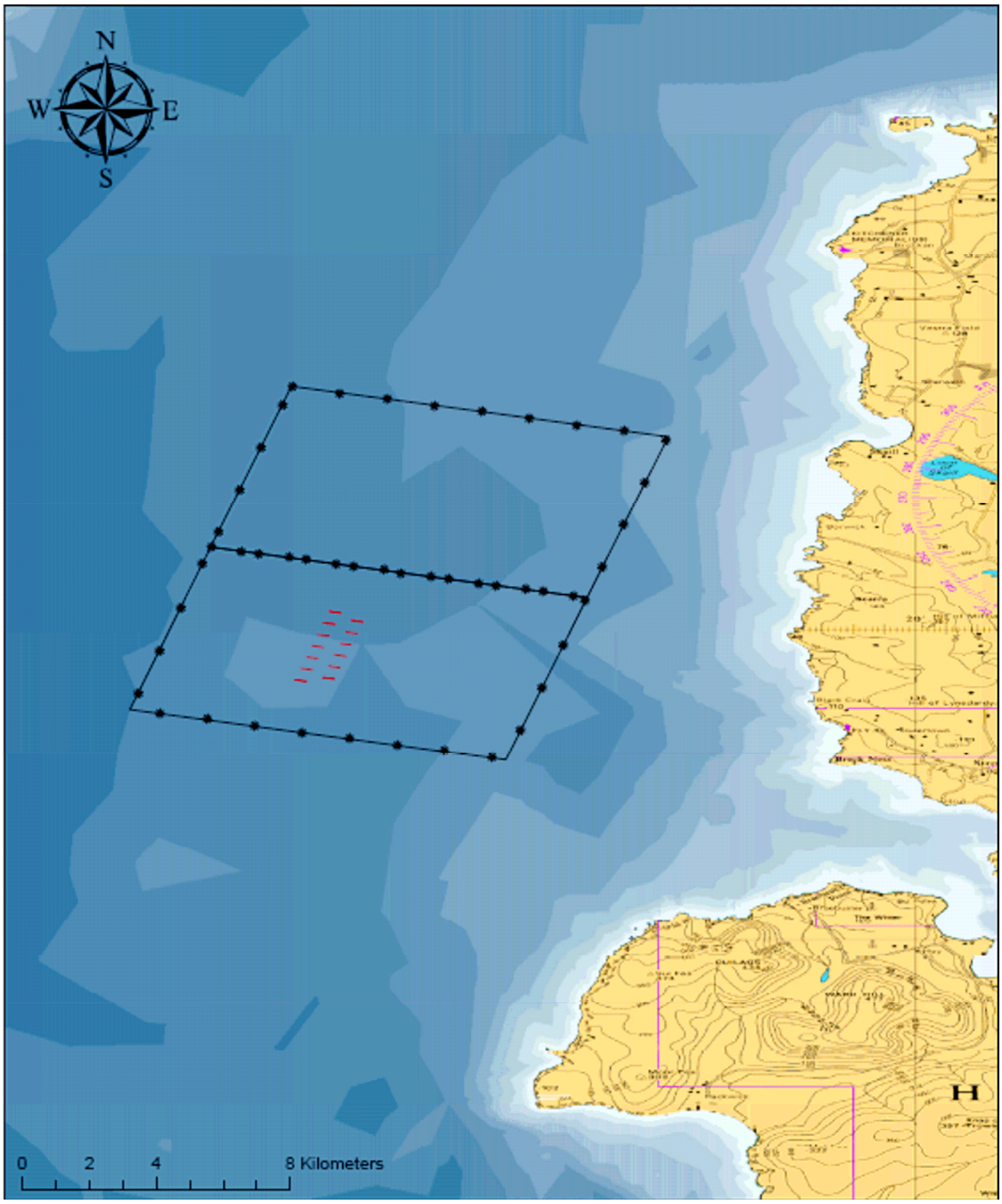


Figure 3.5: Potential array layout for Phase 1 of WOS development

Measurements taken during Phase 1 will help to determine the array layout for Phase 2, monitoring in particular will help to establish whether there are any reduced energy returns from individual devices that are “down-wave” from the leading devices. One potential layout for Phase 2 is presented in Figure 3.6, although this may change as a result of information collected during Phase 1, including information gathered from environmental monitoring.

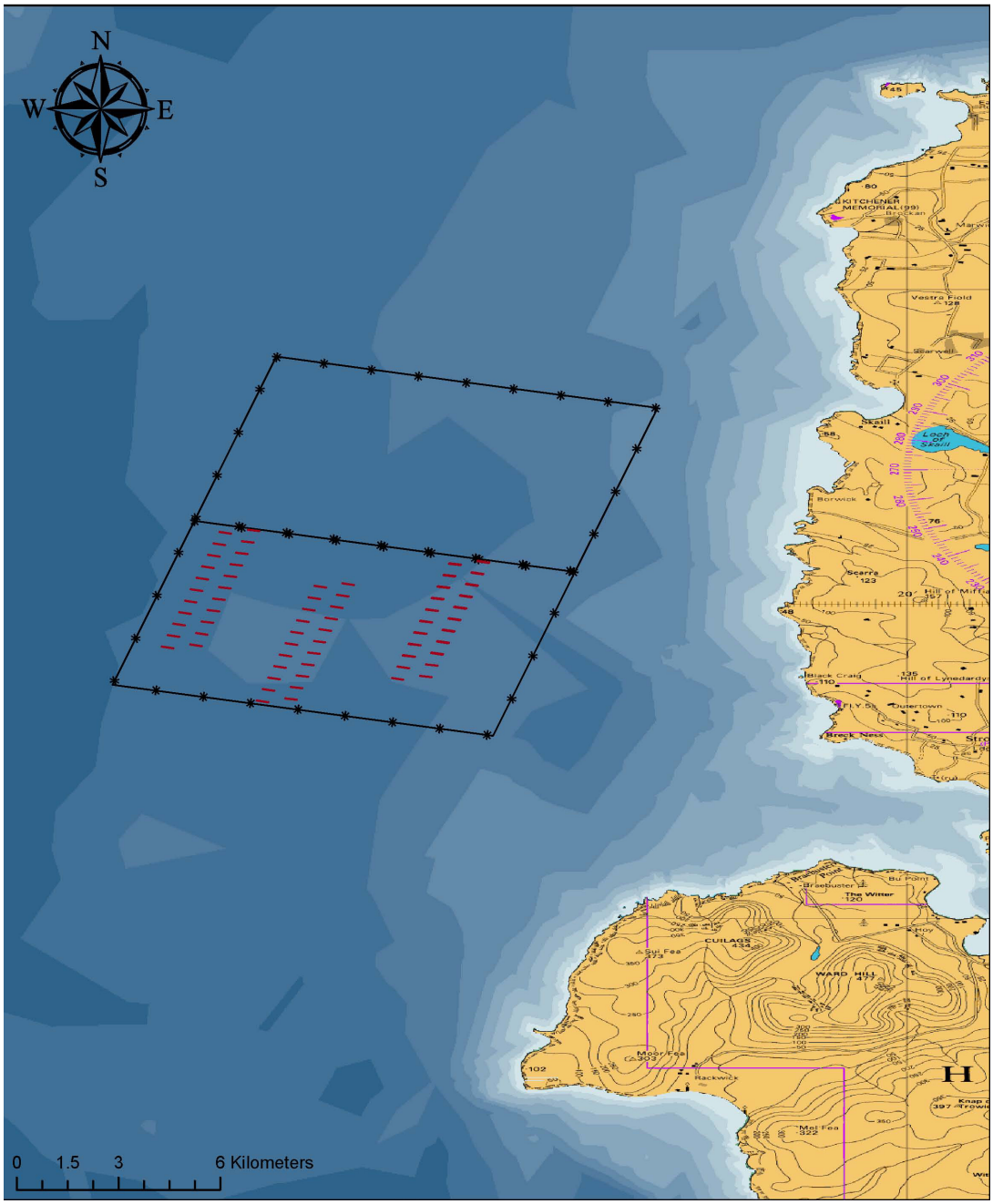


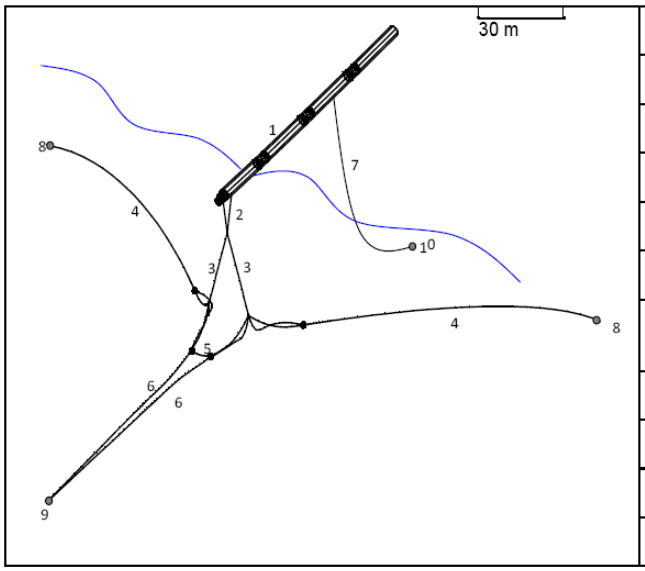
Figure 3.6: Potential array layout for Phase 2 of WOS development

3.2.4 Mooring

Pelamis is held on station by a catenary mooring spread consisting mainly of steel chain and synthetic tethers, with the connection point to the machine being near the nose via a yoke attachment structure, as shown in Figure 3.7. The mooring system allows the machine to weathervane and orientate itself into the predominant swell direction by rotating around the forward central mooring point. The mooring system is designed for water depths greater than 50m. The primary choice for anchors is embedment anchors (the same as used for floating oil rigs), which require sites with sedimentary cover. If site

conditions are not conducive for embedment equipment, PWP may employ alternatives such as gravity, or suction anchors. The EIA will consider impacts that may be created by the following physical characteristics of, and construction and operational activities related to, the moorings:

- characteristics
  - size and material
  - area of coverage and depth of seabed penetration
- installation method
  - foundation construction (materials, mass)
  - seabed preparation including the depths of any excavation required
  - drilling or piling requirements (if any, together with description of such operations)
- operation
  - likely movement of device around moorings (chains, anchors, blocks, piles etc., as well as subsea connections), and the potential for scour induced around moorings
  - maintenance of moorings.



Component	Description
1	Pelamis P2 – 180m
2	Yoke
3	Tether lines
4	Rear lines – studlink chain, 130m long
5	Front connection line
6	Front lines – studlink chain, 140m long
7	Yaw restraint Line
8	Rear embedment anchors – 4T
9	Front embedment anchor – 7.5T
10	1 or 2 x 20T clump weight anchor

Figure 3.7: Pelamis mooring system

To reduce the sea space required for wave farms, the footprint of the mooring system has been designed to occupy as small a space as possible while still fulfilling station-keeping requirements. The plan view of individual mooring system dimensions and excursions is shown in Figure 3.8.

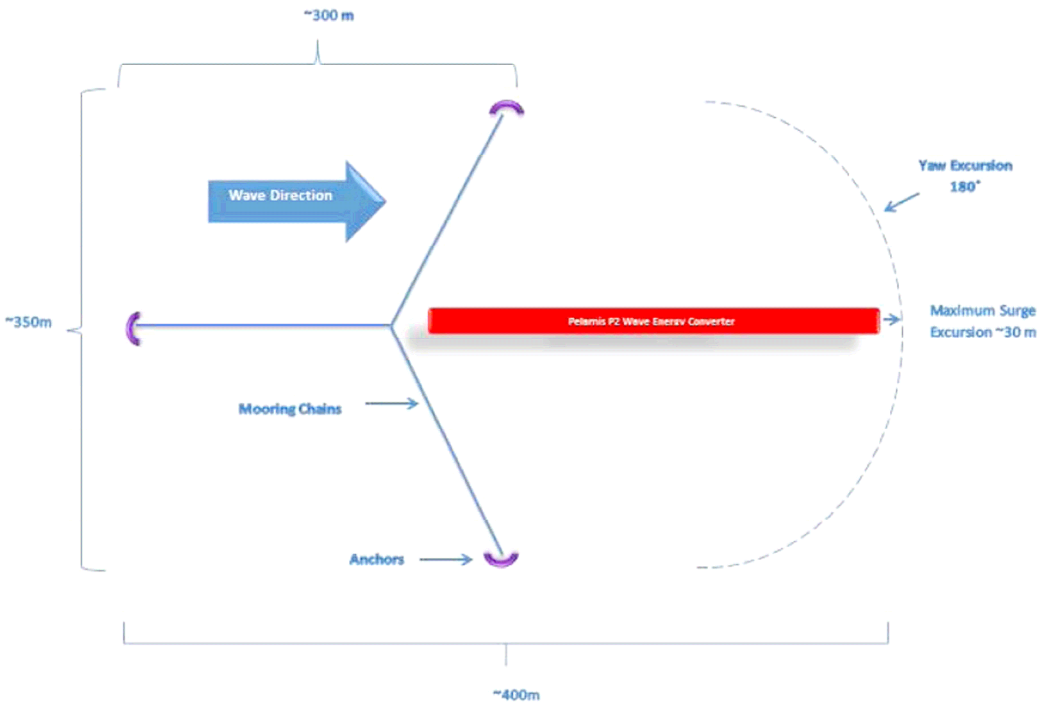


Figure 3.8: Mooring system footprint

3.2.5 Marking

The EIA will provide information on both markings on the devices themselves and any other marker buoys required. Information on position, number, colour, lighting, mass, materials, tether arrangements and tensioning/bend ratios will be included. Recommendations given by the North Lighthouse Board to Marine Scotland in respect of the installation of the P2 device at EMEC state that:

- the devices should be lit with two lights flashing yellow every five seconds, fitted to the yellow nose and tail sections. The range of these lights needs to be two nautical miles
- each light should be a minimum of 1.5m above the calm waterline level, higher if physically sustainable
- a passive radar reflector to increase the conspicuity of the device on marine radar should be fitted to the device at a similar elevation to that of the lighting
- the device should feature yellow stripes down the length of the machine above the calm waterline, with additional yellow banding of the nose, tail and centre sections. The stripes should be 1m wide and 20m long; in the agreed scheme the yellow areas should account for a minimum of 40% of the overall surface area of the device.

3.2.6 *Corrosion protection*

All generating equipment is housed inside the machine in a dry environment. The machine structure is painted with marine grade paint, as used as standard in the oil and gas and shipping industries and cathodic protection is applied to areas of the structural steel components in the submerged zone using sacrificial anodes. PWP follows the offshore oil and gas codes and recommended practices for corrosion protection in the manufacture of its device. The environmental impact assessment will provide more information on the sacrificial anodes and potential for loss into the seawater surrounding the site.

3.2.1 *Export cable*

The cable(s) for Phase 1 will most likely be less than 15cm in diameter, but will be fully armoured for protection and for mass. They will be laid on the seabed surface and may be subsequently buried or ploughed into the seabed. Where any cable has to cross bedrock, additional crushed rock or prefabricated protection systems may be required.

For Phase 2 the cable diameter of the cables used is likely to be similar to that for Phase 1; however, it is likely that more cables will be required.

3.3 Construction and installation

E.ON will contract a suitably qualified and experienced third party (the contractor) to undertake the construction and installation of the wave farm. Currently PWP manages construction, installation, operation and maintenance of devices on behalf of customers but this business model may change in the future as the company moves from the manufacture of single, prototype devices and towards commercial production.

3.3.1 *WEC construction*

The Pelamis WECs are currently manufactured and assembled in PWP's Leith facilities. It is likely that manufacture and assembly of the P2 devices for the demonstration phase of the WOS project will take place at the same facility. Assembly work is carried out by PWP's trained personnel and takes part in three phases:

- population of module skids
- power tube assembly
- assembly of entire machines from power tubes. PWP is currently considering options for machine assembly that include assembly on land and launching using a slip way, sideways launch or strand jack system, or by assembly in water using the nearby docks.

PWP complies with industry-recognised relevant codes and standards for design and manufacture of the Pelamis devices. Where relevant these codes and standards are passed onto its suppliers, and stringent quality control processes ensure compliance.

3.3.2 *Pre-construction surveys*

During the later engineering phases for the WOS development, a number of site surveys will take place to establish the seabed conditions that will dictate, to a degree, the type

of mooring required. These geophysical and geotechnical surveys are likely to consist of the following:

- bathymetry – producing a chart of the depths in the area
- sub-bottom profiling – providing information on shallow sediment conditions
- side-scan sonar – providing information on seabed features (may be obtained with the sub-bottom profiling)
- cone penetration testing
- vibrocore sampling.

The same types of survey will be carried out along the proposed export cable route offshore, and additional surveys will be carried out on the proposed onshore route.

3.3.3 Vessels

Installation of the Pelamis WECs consists of the following operations:

- installing moorings and electrical connectors
- preparing machine at service base for installation
- towing machine from service base to installation site
- installing machine at installation site.

As Pelamis has been installed in Portugal and at EMEC previously, PWP has gained experience in the suitability of different vessels types for carrying out the different tasks. A tug will be required to tow the WEC from port to the site, while a four-point moored barge, DP (dynamic positioning) class anchor handler or large multicat may be capable of carrying out the installation operations at the offshore development site.

Owing to the specialist nature of the mooring and electrical installation operations, the contractor would mobilise a trained and experienced installation crew to manage and carry out this procedure. The contractor's installation manager would control all offshore operations and logistics on site. Control of all marine operations will be in accordance with the requirements of the local port and harbour authorities.

Previous experience gained by PWP indicates that it takes around two to four days to deploy the mechanical structures for the device (anchors and chain) and then a further two days for the tether-line assembly installation. Poor weather conditions will increase these periods, so installation will be planned for summer to reduce the influence of poor weather.

More detailed information on vessel type, number and movements will be provided in the EIA.

3.4 Operational control and maintenance

3.4.1 Control

The Pelamis control system was designed to minimise user intervention, monitor its own health, and act safely and automatically on faults. The control system requires an

onshore base that can provide a connection to the export power cable (the power cable will incorporate fibre-optics that provide the control).

The system has been designed to fulfil the following requirements:

- operations and monitoring (via an onshore graphical user interface, GUI)
- an alarm system that notifies of any unusual events and automatically takes any immediate necessary action
- a data capture system that allows detailed investigation, analysis and archiving of systems
- fully automated operation with minimal monitoring.

Main communications from the GUI to the WECs is via fibre-optic cables embedded in the seabed power cable. Backup communication is made via a radio link from Pelamis machines to the onshore operations unit. This backup link allows the operator to make basic changes to the control system and monitor functionality of the machine, but it is not intended for control during continuous power generation.

The Pelamis WEC will operate in the event of loss of the control software by reverting to local control. The rams adopt a robust, position-based centring control. On loss of mains power, an auxiliary hydraulic generator (located in the nose cone of the WEC) powers the direct current (DC) supply. In the event of complete power failure, a mechanical 'fail-safe' control takes over the piloting of the control valves on the hydraulic rams, implementing a safe position-based centring control. All these modes of operation have been demonstrated successfully.

The radio antennas on the Pelamis machines extend approximately 2.5m and 5m above water level. A non-transmitting GPS antenna is used for monitoring the position of a machine. This system is linked to an audible alarm if the position of the machine exceeds its mooring allowance.

The ES will provide more information on the safety systems that are incorporated within the Pelamis design that help to ensure the device remains moored, and in the event that it does become detached, what measures are in place to ensure that it is recovered quickly with minimum risk to safety and the environment.

3.4.2 Operations and maintenance

Operation and maintenance of onshore grid connections and sub-sea cables would be undertaken by specialist subcontractors employed directly by the project.

The unique nature of the Pelamis wave energy converter (WEC) and its operating environment and economics has necessitated the development of a bespoke strategy for its operation and maintenance (O&M). As with all O&M approaches the goal of this strategy is to maintain the asset integrity and optimise system performance, while optimising O&M costs.

The strategy is based on the use of Pelamis WECs within an array and on the overall performance of the array rather than the individual devices.

PWP's maintenance strategy for Pelamis is to have no manned intervention with a machine at sea. This requires machines to be recovered to harbour, or sheltered water facilities, for all inspection, maintenance and repair work. The availability of a suitable harbour or sheltered water area in the proximity to the wave farm site for the siting of a service base is of key importance; this is currently being considered for a number of projects by the local harbourmasters. Details of proposed locations for maintenance will be provided within the ES based on further investigations. Potential impacts and opportunities associated with each option will be addressed within the ES.

In addition to those activities required for the individual devices, the subsea infrastructure at the site will require inspection and maintenance. This infrastructure is composed of the mooring equipment, and the electrical/communications umbilicals and associated components.

In general, subsea inspection shall be undertaken wherever possible by a remotely operated vehicle (ROV), although specific maintenance tasks may require diver intervention and/or activities using specialist work vessels.

All planned inspection and maintenance will be conducted during summer months to:

- take advantage of statistically longer weather windows
- minimise revenue loss, as summer-time generation capacity is at its lowest.

3.4.3 Materials and energy usage

Various materials will be required in the manufacture and maintenance of the devices and other array equipment, which will include metal, paint, fuel, ballast, lubricants and seals. The ES will provide an estimate of the likely levels of material usage in both construction and installation of the arrays, and during the operational periods of both phases of the development. This inventory will include estimates of air emissions from manufacture and installation of the devices, together with emissions from the likely maintenance regime.

3.5 Cable connections and substation

3.5.1 Connections

The Pelamis WEC is on a flexible mooring system and has an electrical cabling system for connection between devices. Each WEC is 'plugged' into a wet-mate junction box when it is installed at the wave farm site. A downfeeder runs between the fixed cable position on the seabed and the first wet-mate connection box. In an array formation connector cables around 300m long may join one wet-mate box to another so that the devices can be 'daisy-chained' from a single downfeeder. The downfeeder would then be spliced to a static subsea cable for transmission onshore.

There are various options for electrical infrastructure depending on the size of the array, and it is likely to be the case that for Phase 1 the infrastructure will be different from that to be used in Phase 2. The final electrical infrastructure design would depend on the number of machines and would also have been developed considering the costs of capital equipment versus the losses associated with the cabling and voltage.

3.5.2 *Onshore cable and substation*

For Phase 1 of the WOS development it is likely that the export cable will make its landfall at South Vestra Fiold, approximately 2km to the north of the Bay of Skaill. The onshore cable route is likely to be less than 500m in length, assuming the WOS substation location is adjacent to that proposed for the Caithness-Orkney HVDC substation (see Figure 1.2).

It is likely that a joint will be required between the offshore cable and that used for the onshore section, with the aim being to make this joint as close to the top of the shore as possible. Often such joints are made in a small 'pit', which would be beneath ground level and accessed after installation via a manhole cover. Detailed information on the likely location of this pit will be provided in the ES. The position will be governed by several factors, including its potential environmental impact as well as any safety issues. It may be the case that, owing to the close proximity of a substation site to the landfall, such a joint is not required.

E.ON will be responsible for consenting and construction of the substation (Figure 1.2).

The onshore cable will be installed using typical cable installation techniques: a trench will be excavated into which the cable will be laid, all excavated material will be stored in layers as it is extracted, and replaced in the trench to its original depth once the cable is in place. Depending upon ground conditions, some drainage may be installed in advance of cable installation.

At present the potential export cable route and substation for Phase 2 of the development is not known, but during the EIA phase more information will become available on potential locations and this information will be presented in the ES.

3.6 Accidental events

An environmental risk assessment will be undertaken as part of the EIA process for WOS. This will cover all aspects of the design and operation of the array, and will be used to assist in the design of measures to reduce or mitigate the potential effects of accidental events. Potential environmental consequences of each risk identified will be covered, and those that have the highest likelihood of occurrence or highest environmental impacts will become the focus. Issues such as devices becoming detached from moorings or the release of lubricants or hydraulic fluids will be among the risks covered.

An initial risk assessment will help in the determination of the study areas for different environmental features.

3.7 Decommissioning

It is expected that decommissioning would take place at the end of a standard project life of around 25 years. It may be that infrastructure components are changed/renewed within the timeframes of the complete project life, in such instances the obsolete component would be completely removed and taken back to shore for re-use or recycling and a replacement part installed. A schedule for the decommissioning programme will be determined closer to the end of the life of each project.

In the ES for WOS, E.ON will outline its commitments on the decommissioning of the project, ensuring that the design of the project enables all required elements to be removed in line with current guidance from DECC, which itself enacts the UK's obligations under the United Nations Convention on the Law of the Sea (UNCLOS) and the OSPAR Convention.

The decommissioning of the project aims to return the site, as far as is practical and desirable, to the condition it was in before construction of the installation. It will involve the complete removal of all Pelamis machines, electrical connecting cables and connectors, mooring lines, chains, tethers and anchors. All of the above will be returned to shore for re-use or recycling. All working practices will be governed by an environmental action plan and health and safety policy.

The details of the decommissioning programme will be established through consultation with stakeholders and an EIA, and will be in accordance with the guidance provided by DECC on the decommissioning of offshore renewable energy installations under the Energy Act 2004 (most recent guidance was published in January 2011 and includes a note that that the guidance will be flexible to allow it to be adapted in line with any future changes in legislation or policy).

If applicable a monitoring regime for the remains will be established through consultation with the DECC, The Crown Estate and other relevant stakeholders.

3.8 Schedule

The project schedule for the West Orkney South development is presented in Figure 3.9. At present this figure shows only the proposed period for Phase 1 of the development (the demonstration project). Data gathered once that phase has become operational will help determine the design and schedule of Phase 2.

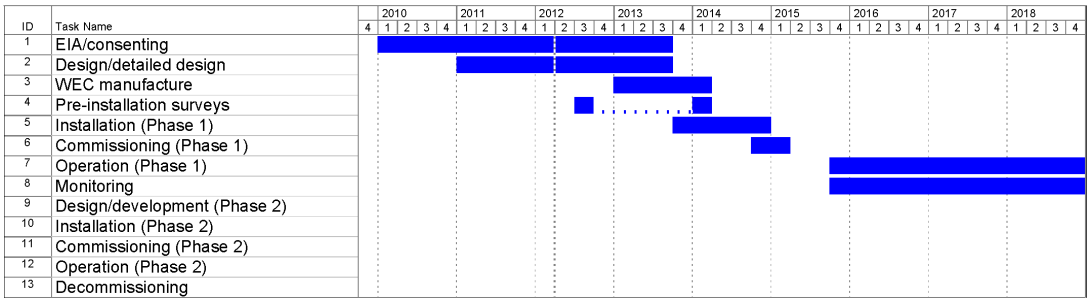


Figure 3.9: Project schedule for the West Orkney South development

4 APPROACH TO THE EIA

4.1 Overview

The assessment of environmental impacts will be conducted in accordance with best practice. The following key stages will form the basis of the assessment process:

- establishing a robust baseline of the existing environment in areas that could be affected by the development
- assessment of the environmental impacts and establishing their significance (primarily the assessment of residual effects once mitigation has been adopted)
- formulation of mitigation measures to ameliorate the potential impacts of the proposed development that cannot be avoided practically through the design process
- consultation with statutory and non-statutory bodies and relevant stakeholders throughout the process.

Following established best practice, it is intended that the design of both Phase 1 and Phase 2 of the project will evolve in an iterative manner with the assessment process, led mainly by the consideration of constraints that exist within and around the site and cable routes (environmental, technical and economic). Once the preferred design is selected, this will form the basis of the impact assessment. The four key stages of assessment are summarised below (Sections 4.2–4.5 inclusive).

4.2 Baseline

For each environmental feature under consideration, the environmental baseline for the site and cable route and their surroundings will be established (see Section 5, which provides a preliminary environmental baseline). This will be achieved largely through consultations with relevant authorities and organisations, a desktop review of available data including that generated from consultations, and detailed interpretation of specialist field surveys where these are required to fill data gaps.

4.3 Assessment of environmental impacts and their significance

The evaluation of the significance of an impact is important. The significance determines the resources that should be applied in avoiding or mitigating an adverse impact or the actual value of a positive impact. Furthermore, the combined significance of the various mitigated impacts determines the overall environmental acceptability of a project. Determining the significance of environmental impacts is one of the most contentious parts of the consenting process, involving value judgements and personal expert interpretations about whether, and to what extent, a proposal is environmentally significant. For some aspects, it is difficult to attach levels of significance to potential impacts, as a large number of factors can influence judgements, including:

- the character of the environment

- the nature, magnitude and duration of the impact
- the resilience/sensitivity of the affected environment
- the confidence in the predicted impacts
- the potential for mitigation along with the level of public concern and knowledge of the issue.

Efforts will be made throughout the assessment to ensure that criteria and standards of significance are documented and the level of certainty of data recorded. To this end, it is proposed that the ES describing the findings of the assessment will present and explain within each relevant section the criteria that have been applied. For all environmental aspects, the significance of residual impacts, i.e. those predicted once mitigation is taken account of, will form the basis of the assessment. An outline of the proposed methods of assessment for each environmental topic is provided in Section 5. This assessment will include cumulative and in-combination effects.

When assessing the impacts of this project in the ES the following key documents will be referred to:

- Scottish Marine Renewables, 'SEA Environmental Report' (2007): Sections C1–21 contain detailed potential impacts of marine renewables, with significance levels assessed and mitigation measures suggested. The report includes specific info on Orkney in Section D, particularly the summary table of potential impacts (Appendix D2.1 Orkney & Shetland).
- Carl Bro, 'EMEC Marine Energy Test Centre (Billia Croo) Environmental Starement' (2002): Discusses potential impacts and mitigation of cable laying, device noise, fisheries, navigation, emergencies/accidents etc. Onshore impacts are also covered.
- PML/SAMS/IECS, 'Offshore and Coastal Renewable Energy: Potential ecological benefits and impacts of large-scale offshore and coastal renewable energy projects' (2009): Includes discussion of scaling up technology from a device to a single array, and from a single array to multiple arrays.

4.4 Development of mitigation measures

Mitigation of impacts may be achieved by locating the site, and routeing the export cable, in such a way as to avoid important features or issues. The evolution of the array and design cable routeing will therefore be reported clearly in the ES, including the rationale behind the preferred choices.

All other measures proposed as mitigation for the development will be reported within the relevant sections of the ES. The mechanism by which these measures will be carried through and implemented on site will also be made clear.

Mitigation measures will include consideration of those suggested and listed by major topic in Marine Scotland (2010, Part 4, Appendix A).

4.5 Consultation

The engagement of relevant stakeholders from an early stage ensures suitable and timely input in the all stages of the EIA, and ultimately the ES. In parallel to the scoping process being undertaken, a process of stakeholder engagement has begun with groups that have been identified within the wider area. This engagement is part of an overall consultation strategy, and provides a mechanism for stakeholders and the developer to share information regarding the proposals. The main purposes of the consultation process is to:

- establish a sufficiently robust environmental baseline of the development and its surroundings
- identify, early in the process, specific concerns and issues relating to the development so that they can be discussed and accounted for appropriately in the design and assessment
- ensure the appropriate involvement of the public and authorities in the assessment and design process.

E.ON is planning to hold a series of meetings with local community groups and open consultation events to provide opportunities for interested parties to inspect its proposals first hand. Consideration will be made for areas where Gaelic is spoken and efforts will be made to communicate with the public in both languages if required.

Additionally, meetings will be held with key offshore and onshore stakeholders to ensure they are fully aware of the project plans, and that they are provided with ample opportunity to provide feedback.

E.ON will meet with the key statutory stakeholders as necessary during the EIA process and beyond, but as a minimum proposes to engage with them following the scoping period and again before the submission of ES and licence application. Similarly, two sets of public exhibitions are proposed, the duration and location of which will be agreed with MS-LOT and OIC, with one event following collation of scoping responses and a second set of events following submission of the ES. Public exhibitions will be advertised in local media, via public notices and by door-to-door leaflet drops in key areas local to the development. E.ON also has a website for the proposed development (http://www.eon-uk.com/generation/OrkneyWaters.aspx), which will be kept up to date throughout the development period.

A list of proposed statutory consultees and stakeholders are presented below.

Marine Scotland Licensing and Operations Team (MS-LOT)
Scottish Executive Environment and Rural Affairs Department
Scottish Natural Heritage
Orkney Island Council (OIC)
Marine Scotland Science
Maritime and Coastguard Agency
Northern Lighthouse Board
NERL Safeguarding
Environmental Concern Orkney
Renewable UK
Highlands and Islands Enterprise – Orkney Region
Orkney Renewable Energy Forum
Harbour Authority (part of OIC)
Royal Yachting Association (RYA) Scotland
Chamber of Shipping
Orkney Dive Boat Operators'

Scottish Environmental Protection Agency (SEPA)
Historic Scotland
The Crown Estate
Department of Energy and Climate Change (DECC)
Health and Safety Executive (HSE)
Ministry of Defence (MOD)
Joint Nature Conservation Committee (JNCC)
Scottish Fishermen's Federation
Orkney Fisheries Association
Orkney Fishermen's Society
Other inshore fisheries groups
National Trust for Scotland
Transport Scotland
Association (ODBOA)
Orkney Sailing Club (OSC)
Stromness Sailing Club (SSC)
National Air Traffic Services
British Telecom (BT)
Marine Conservation Society
Royal Society for the Protection of Birds (RSPB)
Joint Radio Company Ltd (JRC)
Scottish Canoe Association (SCA)
Association of Salmon Fishery Boards
Surfers Against Sewage
EMEC and other developers
Shetland Sea Mammal Group
Aberdeen University Lighthouse Field Station
Whale and Dolphin Conservation Society

Several of the organisations above may be consulted on a joint basis with other developers from the area via the Pentland Firth and Orkney Waters Delivery Group, led by The Crown Estate and the Scottish Government.

5 EIA TOPICS

5.1 Coastal and sedimentary geology processes

5.1.1 Existing situation

Bathymetry

The WOS area lies in water depths of approximately 50–80m. Depths increase relatively rapidly from the inshore area of west mainland Orkney, and depths of over 50m are found within 5km of the shoreline. The Bay of Skaill and its mouth are less than 10m in depth.

Geology

Bedrock types offshore in the WOS development area are sedimentary in origin and include mudstone, conglomerate and sandstone. Coastal rocks mostly consist of Devonian Old Red sandstone. While much of the coastline to the east of WOS is solid rock, the Bay of Skaill represents a relatively rare indented, sedimentary, eroding coastline, and is characterised by a small embayment in the rocks, backed by sand dunes. Due to high-energy waves and currents, bedrock is exposed in much of the nearshore region, up to approximately 1km off the coast. Beyond this, sediments including sandy gravel, gravelly sand and sand overlie the bedrock.

Hydrography

In comparison with other areas around the Orkney Islands, the tidal flow regime in the WOS development area is considered relatively weak. The coastal waters off the Orkney West mainland lie between areas where tidal currents are considerably stronger (around Brough Head to the north and through Hoy Sound to the south).

In the development area the peak tidal current flow during mean spring tides is less than 0.11m/s, while peak flow during mean neap tides is also less than 0.11m/s (ABPMER, 2008).

The annual mean spring tidal range in the area (based on tidal ranges for Stromness) is approximately 3m and the annual mean neap tidal range is 1.3m (UKHO, Chart 2249).

The WOS development area is exposed to the full fetch of the North Atlantic and receives high levels of wave energy in excess of 20kW/m (Figure 5.1) making it favourable for the siting of a wave energy device.

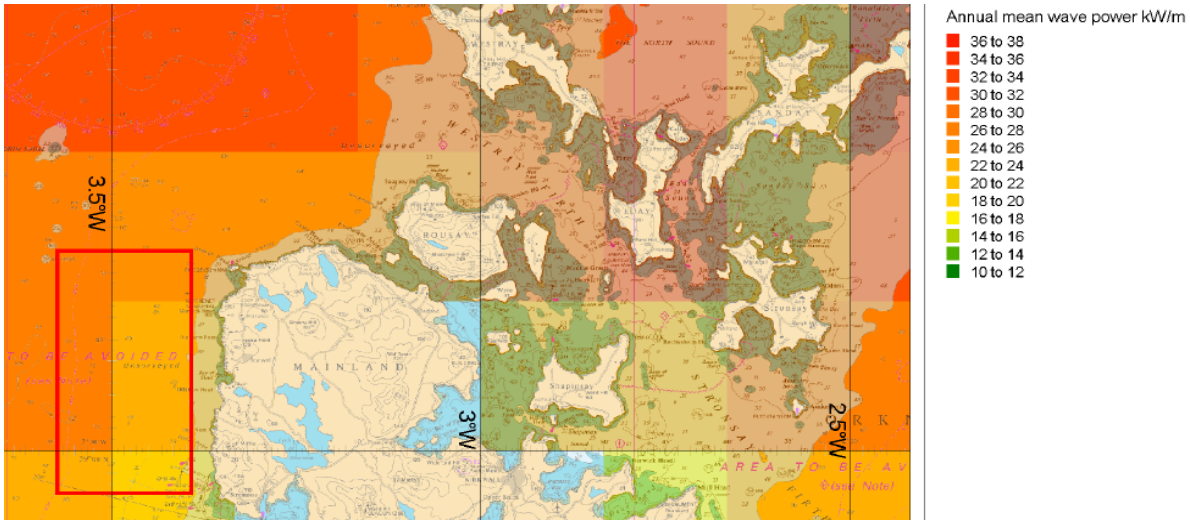


Figure 5.1: Annual mean wave power off west coast of mainland Orkney

Annual mean significant wave height is around 2m (Baxter et al., 2011). The BERR marine renewable resource atlas confirms this, showing annual significant wave heights between 2.01 and 2.25m. The seasonal range in significant wave heights range from 1.01 to 1.50m in summer to around 3m during winter months (ABPMER, 2008).

Climate

The annual mean wind speed at a height of 100m in the vicinity of the WOS development area ranges between 7.1 and 8.5m/s (ABPMER, 2008).

5.1.2 Potential effects and mitigation

Waves

Wave energy devices extract energy from waves and convert it into electrical energy. As waves pass the devices, the incident wave energy landward of the devices may be reduced. The level to which the wave energy is reduced will depend on a number of variables including the height, period and direction of the wave, as well as the angle that the converter intersects the wave. The array of converters may also have some effect on the direction of the waves.

The power of the waves as they reach the shore creates salt spray that is important in maintaining the vegetated sea cliffs, one of the reasons that the Stromness Heaths and Coast is designated as a special area of conservation. Reduction in the energy of the waves could affect the level of spray that hits the cliffs. Reduction in wave energy could also cause a change in shallow subtidal and intertidal ecological communities.

Tides and currents

The coastline adjacent to the development block consists mainly of cliffs, though there are smaller areas where soft sediments are present. In addition to potential changes to the height and direction of waves, the devices also have the potential to affect currents in the area. As the nature of the adjacent coastline is a reflection of the water movement

caused by waves and currents, changes to these features could also affect local currents and possibly sediment deposition patterns in the area. Because of the nature of the substrate within the development zone itself, and the relatively unobtrusive nature of the mooring system that will be installed for each device, any changes to currents are unlikely to result in alteration of the nature of the seabed.

5.1.3 Scope of work for survey and assessment

Waves

A modelling exercise will be undertaken to assess the potential effects on waves and currents that the installation of Phases 1 and 2 of the WOS site could have.

This modelling will be undertaken by experts in the field of hydrodynamics and will focus on the likely changes in wave power as they pass the energy conversion arrays and as they reach the coastline. It is considered unlikely that any changes to the level of spray can be modelled. However, the modellers will be able to provide a qualitative expert opinion, based on the wave modelling, as to levels of any change. The magnitude of any changes will feed into the assessment of impacts on cliff-spray communities.

International wave data sets will be used to inform the model, and locally recorded wave data from the Billia Croo EMEC site will be used to calibrate and validate the model. Other baseline information to be incorporated in the model includes bathymetry data that is available for purchase from several sources. It is not expected that surveys will take place specifically to provide information required by the model during the impact assessment. Where necessary, the wave modelling would also consider the effects from other projects that are planned in the study area.

Currents

Given the nature of the seabed within the development site, changes to currents here are not expected to result in effects on the seabed that are significant. This is therefore considered a minor issue and E.ON will not carry out modelling specifically to investigate any changes here; rather, expert opinion will be provided in the ES.

Should the wave modelling indicate that there are likely to be notable changes that could affect the currents close to the coastline, these changes will be the subject of further hydrodynamic modelling. This would again be carried out by experts using industry-recognised software, and would consider the potential for cable burial issues as the export cable approaches the landfall and the level of protection which it requires as it passes over any harder substrates.

There are no plans for dedicated studies on currents to be carried out as part of the EIA. However, if these are necessary to inform any modelling that needs to take place, their scope will be discussed with Marine Scotland.

Where necessary, the hydrodynamic modelling would also consider the effects from other projects that are planned in the study area.

5.2 Designated sites and conservation interests

5.2.1 Existing situation

There are several areas in the vicinity of WOS that have been designated because of their nature conservation or geological interest (Figure 5.2). Sites that have been designated for other reasons (landscape or archaeological) are presented and discussed in the relevant sections.

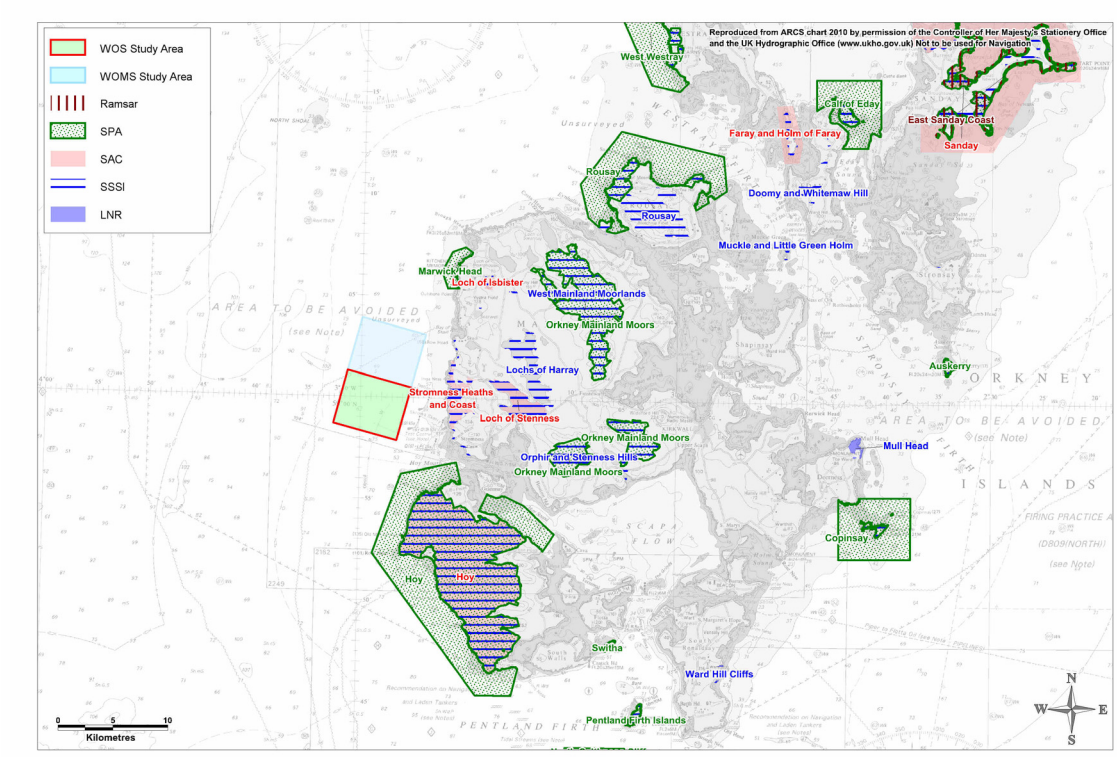


Figure 5.2: Designated conservation areas in vicinity of proposed West Orkney South development area

Key protected areas within the immediate vicinity of the development are summarised below (more comprehensive information will be presented in the ES).

Special areas of conservation (SACs), designated under the EC Directive 92/43/EEC, (Conservation of Natural Habitats and of Wild Fauna and Flora), commonly known as the Habitats Directive:

- Stromness Heaths & Coast: along the majority of the coast directly landward of WOS, the primary reasons for designations are vegetated sea-cliff plant communities and dry heaths. Alkaline fens are included as a secondary interest feature
- Loch of Stenness: approximately 4km to the south of the proposed substation, the largest coastal lagoon (the feature for which it is designated) in the UK

- Loch of Isbister: approximately 3.7km to the north of the proposed substation, the primary feature is the natural eutrophic lake with Magnopotamion-type vegetation, and is the most northerly site for this feature in the UK. Secondary features are transition mires and quaking bogs, and otters
- Faray and Holm of Faray: approximately 37km from WOS, the second largest breeding colony of grey seal in the UK
- Other SACs in the wider region include Hoy (11km from WOS) with vegetated sea cliffs, dystrophic lakes and ponds, heaths, bogs, springs, fens, rocky slopes and terrestrial vegetation; Sanday (53km from WOS) with breeding common seal, reefs, sandbanks and intertidal flats; and Rona (135km from WOS) with grey seal breeding, reefs, sea cliffs and sea caves.

Special protection area (SPAs) designated under the EC Directive 2009/147/EC on the conservation of wild birds, commonly known as the Birds Directive:

- Marwick Head SPA is *circa* 5km to the north of the landfall and *c*.10km to the north-east of WOS and encompasses a breeding colony and the adjacent sea area. It regularly supports 75,000 breeding seabirds, including nationally important populations of guillemot and kittiwake
- Hoy SPA: includes a breeding seabird colony and the adjacent sea area (the north-east part of the site is *c*.2km from the south-west corner of WOS), and breeding red-throated diver. The site regularly supports 120,000 breeding seabirds of several species including arctic and great skua, guillemot, puffin, and kittiwake
- Orkney Mainland Moors SPA: four separate onshore areas, the nearest of which is *c*.5km from the substation location, which have important populations of heathland birds including hen harrier and short-eared owl
- Other more distant SPAs include Rousay, West Westray, Calf of Eday, Copinsay, Auskerry, Pentland Firth Islands, and Sule Skerry and Sule Stack, all of importance for breeding seabirds. Switha is a winter roosting site for Greenland barnacle goose. East Sanday Coast is both an SPA and a Ramsar site (i.e. protected under the 1971 Ramsar Convention on Wetlands of International Importance), based on supporting internationally important numbers of wintering purple sandpiper and turnstone.

Ramsar sites: There is only one Ramsar site within the Orkney Islands, covering the same area as the East Sanday Coast SPA. This is located approximately 50km from WOS and is unlikely to be affected by construction or operation of the project.

Sites of special scientific interest within the vicinity of the onshore cable route (and not included as part of the above SACs/SPAs) include (but are not limited to):

- Bay of Skaill: geological and palaeontological interest
- Cruaday Quarry (2km to the north of the proposed substation location), designated for its palaeontological interest
- Loch of Harray (*c*.2.5km to the south-east of the substation): freshwater biological interest.

Other conservation designations (e.g. local nature reserves, sites of local nature conservation importance, geological conservation review) will be addressed in the ES where relevant.

***Marine protected areas (MPAs)*:** The Scottish Government has international commitments to establish an ecologically coherent network of MPAs by the end of 2012, and is in the process of developing these. MPAs may include 'Nature Conservation MPAs'. No information on potential sites for MPAs areas is currently available, but stakeholder meetings are due to take place in 2011.

5.2.2 Potential effects and mitigation

The proposed development has the potential to impact upon a number of sites that are protected at the European level (Nature 2000 site: SACs and SPAs). Potential effects are summarised below.

Breeding seabirds

The wave devices, or arrays of them, have the potential to alter the behaviour and distribution of seabirds from nearby breeding colonies such as Marwick Head SPA and Hoy SPA. This could be through avoidance by species that are intolerant of the presence of structures or vessels, the aggregation of species that roost on structures (e.g. shag), or through changes in the behaviour and distribution of fish prey species (e.g. aggregation around devices). It is also feasible that accidental events during construction, operation or decommissioning could result in the release of chemicals from devices or vessels that may be harmful to seabirds on the water surface. The significance of any such releases could vary seasonally, depending upon breeding or moulting periods.

Seals

It is possible that seals, especially young pups from the breeding colonies, will be subject to an increased risk of harmful physical interactions as a result of the development. This could feasibly occur through collision, entanglement or entrainment with the devices, mooring cables, and construction and maintenance vessels. The behaviour and distribution of seals may also be altered by noise, vibration or changes in the distribution of prey species (fish).

Maritime vegetation

It is feasible that a reduction in onshore wave energy, as a result of the presence of the array at WOS, could reduce the amount of spray generated on the cliffs. This has the potential to affect the spray-influenced maritime vegetation communities on the cliffs.

Coastal lagoons

Construction activities such as removal, storage or reinstatement of topsoil may cause siltation and/or runoff into local watercourses. In addition, there is the potential for accidental events (e.g. spillage of plant fuel). These pollutants may then be conveyed into nearby sites designated for their freshwater ecology interest (e.g. Loch of Harray), where they may cause damage.

It is considered that, due to their distance from the cable route, the features for which Orkney Mainland Moors are designated will not be impacted by any routine or feasible accidental events of the development. The geological SSSI at the Bay of Skaill will not be impacted negatively, as the cable route will be routed to ensure that hard rock substrates are avoided.

5.2.3 Appropriate assessment

The Habitats Directive (Council Directive 92/43/EEC) has been adopted by the European Community to tackle the continuing deterioration of natural habitats and the threats posed to the wellbeing of certain plant and animal species. This legislation is implement in Scotland by the Offshore Marine Conservation (Natural Habitats, &c.) Regulations 2007 and the Conservation (Natural Habitats and &c.) Regulations 1994 as amended.

The legislation requires the protection of internationally important habitats and species (within Natura sites) from the effects of proposed developments and, to this end, requires that a Habitats Regulations appraisal (HRA) is undertaken, which may include an appropriate assessment (AA). HRA is a process, separate to EIA, required by law, of which the competent authority and developers must be aware, including their associated responsibilities in the process. In the case of marine renewable energy projects in Scotland, the competent authority is MS-LOT.

The HRA process relates specifically to the consideration of effects on Natura[1] sites designated for their importance for European protected habitats and species. The process considers the potential effects of the development on internationally important habitats and/or species for which the sites are or will be designated. The assessment includes consideration of direct and indirect effects on these interests and must consider cumulative effects from other proposed plans or projects.

The AA must ascertain that the proposed project will not adversely affect the integrity of the site. In all other circumstances, including cases where there is doubt about the absence of adverse effects, the proposal may not proceed unless there are no alternative solutions and imperative reasons of over-riding public interest apply.

Although the Habitats Regulations do not specify exactly how HRA should be undertaken, they do specify key responsibility of both the competent authority and developer. The role of the competent authority is to undertake the decision making process and document the AA (if required), while it is the responsibility of the developer to supply the information required to undertake this assessment.

The scope and content of an AA (if required) will depend on the location, size and significance of the proposed project. The assessment must be tailored specifically to

[1] The term Natura sites refers to SACs and SPAs as designated under the Habitats Directive (92/43/EEC) and Wild Birds Directive (2009/147/EC) respectively. Proposed SPAs (pSPAs) and SACs (pSACs) are under consideration for designation and these sites require the same consideration as designated sites.

consider each individual site and project. It should be noted that a development does not have to be located within the boundaries of the designated site to require an AA, as effects may occur even if the development is located some distance from a designated site.

The assessment of potential impacts on Natura sites from the WOS project has already begun; an outline of such effects has been provided in Section 5.2.2. The information contained in this document will help MS-LOT to establish a good understanding of:

- the designated sites that will potentially be affected and the qualifying features for which they have been designated, for example threatened species of birds, seabed habitats and marine mammals
- the underlying trends that should be outlined in baseline data supplied by the developer
- a good understanding of the proposed development and the preferred methods by which this plan will be achieved
- other plans and projects that could affect the integrity of the site.

Once the above have been considered, MS-LOT (the competent authority) and its advisers will be in a position to determine if the proposed development has the potential to affect any Natura sites. This will be communicated to E.ON through the scoping opinion and/or ongoing informal consultation during the EIA process.

If the assessment concludes there is the potential for effect, then an AA is required. This stage of the HRA process requires consideration as to whether the proposed project could adversely affect the integrity of the Natura site(s) in terms of its conservation objectives.

To complete the AA, the competent authority (taking appropriate expert advice) will consider the site's conservation objectives against the potential impacts that the proposed development is likely to cause. If it is ascertained that the proposal will or may adversely affect the habitats and species of the designated site and consequently the conservation objective(s) of the site then action will need to be taken to avoid this.

At the EIA scoping phase, the competent authority will consult with the relevant members of the MRFG to determine what information will be required from the developer, including any suggested methods of data collection and the level of detail that will be required. It is likely that much of the baseline data gathered for EIA will be applicable for HRA, although more information or a higher level of detail is likely to be required to support an AA. There is a requirement to ascertain beyond reasonable scientific doubt that the project will not adversely affect site integrity.

If it is considered there is no potential for likely significant effect on Natura site(s), this will be documented by the competent authority and no further assessment will be required under the requirement of the regulations.

It is noted that Scottish Executive guidance indicates that for a project to proceed it should not adversely affect the interest for which local SSSIs are designated either.

5.2.4 Scope of work for survey and assessment

It is anticipated that in the event that MS-LOT informs E.ON that an AA is required, much of the survey work required has already been outlined in this scoping report. However, there may be further survey work that has not been identified or specified, and if this is the case then discussions will take place with MS-LOT and SNH to determine the full range of surveys required.

The ES will present the survey information collected and will include a signposting appendix to direct the competent authority to the information required to undertake the AA, if necessary.

5.3 Benthic ecology

5.3.1 Existing Situation

The proposed development has elements in both the inter- and subtidal environment. Coastal, intertidal and shallow subtidal habitats on the Orkney Biodiversity Action Plan (BAP) include sand dunes, strandline, coastal vegetated shingle, salt marsh, saline lagoons and seagrass.

Intertidally, two areas are relevant to the ES: the cable landfall location (to the NE of the WOS area, with the preferred location currently being South Vestra Fiold to the north of the Bay of Skaill) and the intertidal area immediately landward (east) of WOS. The intertidal area at South Vestra Fiold appears to consist mainly of exposed rock. Rocky shoreline is also found directly landward (east) of WOS. The supralittoral (spray zone) vegetation communities here form part of the Stromness Heaths and Coasts SAC.

The subtidal environment in the area of the project extends from the lower intertidal to depths in excess of 70m water depth, and encompasses a shallow sandy bay (Bay of Skaill), exposed rocky coast and deeper water offshore. Predicted European Nature Information System (EUNIS) broad habitat types in WOS and areas inshore of it include low-energy infralittoral rock, infralittoral coarse sediment, circalittoral coarse sediment, circalittoral fine sand/muddy sand and deep circalittoral sand (Aquatera, 2009).

There have been no comprehensive surveys of the subtidal environment in the project area, although some information is available from limited survey effort in the WOS area and from surveys of nearby areas. Recent surveys using drop-down photography by Scottish Natural Heritage (Moore and Roberts, 2011) off the west coast of mainland Orkney provide important information on benthic biotopes in and around the West Orkney South area. Within the boundaries of the licensed area offshore, three stations, all approximately 65m deep, were surveyed. Rippled fine sand (SS.Sa.CfiSa) with little surface evidence of biota was found at all three stations. Seabed community types recorded at offshore stations immediately to the north of WOS included both soft sediment (fine and coarse sand, and mixed sediment) and hard substrate (sparse faunal turf on scoured rock). Nearshore in shallower water, high-energy hard substrate communities occurred, including kelp *Laminaria hyperborea*. Another SNH survey recorded benthic biotopes to the NW of Hoy (*c*.10km from WOS) and found a range of habitats including scoured boulders, cobbles and pebbles on medium sand, some of which had limited epifaunal growth including the bryozoan *Flustra foliacea* and keel

worm *Pomatoceros.* These were apparently low diversity communities, and no particular conservation importance was highlighted (Moore, 2009).

5.3.2 Potential effects and mitigation

During construction, there will be a permanent loss of benthos in a very small footprint directly underneath the moorings and any other deposits required (e.g. rock armour or mattressing where required for cable protection). Burial of the export cable and associated landfall construction activities will result in temporary disturbance, displacement and, in some cases, mortality of benthic infauna due to crushing, smothering or increased sediment load, although this will be within a relatively narrow corridor.

During operation, potential impacts to benthos may include scouring around moorings (and e.g. cables and rock armour, if applicable). In the shallow subtidal and intertidal environment landward of the WOS area, it is possible that any wave energy removed from the system by an array of Pelamis devices may alter the natural communities found there. The placement of new material (e.g. rock armour) is likely to result in the development of new epibenthic communities, including both encrusting and mobile species. Any antifoulants used on the device or cables will impact encrusting communities at a highly localised (i.e. device-only) level. Emissions of heat or electromagnetic fields (EMF) may affect benthic organisms. Although there is little existing research, an assessment will be made of these potential impacts in the ES.

Artificial structures (such as wave devices) in the marine environment have the potential to be colonised by non-native species, which in some cases have the potential to become invasive (i.e. ecologically harmful). The potential for the Pelamis devices to become a substrate for alien invasive species will therefore be considered in the ES.

Where possible, impacts to benthos will be mitigated by avoiding any sensitive receptors when routeing the cable route and locating the moorings. The requirements (number, size) for mooring blocks and rock armouring will be minimised as far as possible throughout the design stage. Antifoulants, if required, will be used in accordance with international marine environmental standards.

5.3.3 Scope of work for survey and assessment

The scope of this element has been developed with reference to the informal SNH ‘Guidance on survey and monitoring in relation to marine renewables deployments in Scotland. Volume 5. Benthic Habitats’ (Saunders et al., 2011). Finalised, detailed methodologies for benthic surveys (pre-installation baseline, post-installation operational monitoring, post-decommissioning monitoring) will be submitted to SNH/Marine Scotland at the EIA stage and cover the proposed development area, including foundation systems, cable routes and landfall point. The following provides an outline of these surveys.

For the intertidal landfall area, an ecological walkover survey will be conducted by experienced marine ecologists on the low water of a spring tide. To provide comparable data, the scope of this survey will follow the methodology being used by the International Centre of Island Technology (ICIT, at the Orkney campus of Heriot-Watt

University) in its long-term comprehensive monitoring programme on the distribution and abundance of habitats and species on intertidal areas of the west of Orkney mainland. The scope will be agreed with SNH and MS Science. The intertidal communities on the coastline adjacent to the WOS site will also be surveyed to provide a baseline for assessment of impacts that may result from lower wave energy reaching the coast when the array is in place.

For the subtidal environment, geophysical survey data from the WOS area and the proposed cable route will be reviewed, and a desk-based assessment of any other available data (e.g. ongoing subtidal seabed photographic surveys by ICIT off the west coast, SNH surveys) will be carried out. This will provide an overview of the sediment conditions and possible areas where habitats or species of conservation importance (such as Annex I habitats) could be located. Given the apparent extent of coarser sediments (e.g. gravelly sand) and rock in the WOS area and the cable corridor, photographic techniques (e.g. drop-down, ROV) will be employed to survey possible locations for moorings and along the cable route. However, the scope for any surveys would be agreed with SNH and MS Science. Images resulting from these surveys will be reviewed by experts and classified into standardised biotopes (according to Connor et al., 1997). In the event that surveys reveal sensitive habitats or species (such as biogenic reefs), the survey will be adapted at the time to determine the nature and extent of the feature. Where soft sediment has been identified from geophysical or other data then grab sampling of the benthos will be required and will use standard techniques (e.g. Day grab, 1mm or 0.5mm sieve). It is the intent that the results of the benthic surveys are used to help in the array design and mooring arrangements for both Phase 1 and Phase 2 of the WOS development. The ES will present clear information on the distribution of benthic biotopes, and these will be used by E.ON to inform the layout and design of the final array layout and its export cable route, taking into accounts likely impacts on benthic ecology.

Consideration will be given to the potential for introduction and establishment of alien invasive species in the ES. Mitigation will be proposed, based on best practice guidance (e.g. from the International Maritime Organisation, IMO, and the International Petroleum Industry Environmental Conservation Association, IPIECA).

5.4 Fish and shellfish

5.4.1 Existing situation

The subject zone supports populations of a wide range of fish and shellfish species. These can be broadly split into the following categories:

- elasmobranch fish including tope, spurdog, porbeagle and common skate (see Section 5.6 for basking shark)
- commercially important marine fish include demersal flatfish (e.g. plaice), roundfish (e.g. cod, monkfish) and pelagics (e.g. mackerel). The Orkney area is important as a spawning ground to the Orkney stock of herrings, although this appears to be of a higher intensity to the north and east of the Orkneys (Ellis et al., 2010)

- commercially important shellfish with brown crab and lobster of key importance, also including velvet crab, squid, whelks and scallops
- diadromous fish species: these will include the European eel, which is of particular conservation concern owing to recent declines. Orkney is an important area for recreational sea trout fishing and the fish occur in a number of burns, although apparently they have not been recorded in the burns in the immediate vicinity of the onshore cable route (Orkney Trout Fishing Association, 2011). Salmon are not abundant in Orkney owing to a shortage of large rivers in which to spawn, although Scotland's north coast has several rivers designated as SACs for this species. Salmon and sea trout are of importance from a socio-economic perspective on a local, regional and national level in Scotland. They are also of key ecological importance, as illustrated by the protection of a number of Scottish rivers under the EU Habitats Directive. While there are no significant salmon rivers on Orkney, salmon migration pathways are likely to pass around Orkney en route to Greenland (Malcolm et al., 2010); and
- other fish and shellfish species that may be of little commercial importance locally, but can be highly significant for the local ecology, for example sandeels, which are key prey species for local seabird breeding colonies.

5.4.2 Potential effects and mitigation

Key potential effects on the fish and shellfish populations of the area as a result of the wave power development may include:

- change in the distribution of fish and shellfish species. The presence of an array of floating wave power devices will have the effect of aggregating local populations of certain fish species, and fish and shellfish species may aggregate around the moorings on the seabed. These effects may be augmented by possible exclusion of commercial fishing vessels
- changes to spawning and nursery habitat. For example, the placement of moorings and rock armour could negatively impact herring spawning habitat, or positively impact brown crab with the creation of new habitat
- changes in behaviour of fish and shellfish from noise and vibration, both during construction (from vessels) and operation (from the devices); in addition, the physical presence of the devices has the potential to present a barrier to migratory fish species
- changes in the behaviour and distribution of sensitive species (particularly elasmobranchs) due to the presence of electromagnetic fields (EMFs) from buried inter-array and export cables during the operational phase. For salmon and sea trout this will be assessed on the regional and national scale, including in-combination effects.

5.4.3 Scope of work for survey and assessment

A desk-based assessment of available information (e.g. spawning and nursery maps (Ellis et al., 2010; survey data; SEA 4) will identify areas with data gaps and possible requirements for survey. The recent SNH review (SNH, 2011) will be used to assess

any possible impacts of noise and EMF from the development on diadromous fish species. In addition, the potential effects of EMF on elasmobranch fish species will be assessed using the latest research (e.g. COWRIE documents). The review of migratory routes for several diadromous species provided in Malcolm et al. (2010) will also be used to help in the assessment of impacts.

If any surveys should be required, methodologies will be developed with and approved by MS Science and SNH. Where relevant, this will include consultation and collaboration with local fisheries interests (e.g. regarding shellfish surveys).

Information from desk-based and field surveys will be used to provide a robust baseline, against which to predict impacts, including cumulative impacts in the vicinity.

For salmon and sea trout, information will be obtained from relevant river boards and fishery trusts and associations; this will include reference to life cycles, migrations (both returning fish and smolts), feeding areas and prey species, and relevant conservation legislation. This baseline would then be used to assess scale and magnitudes of potential impacts.

5.5 Birds

5.5.1 Existing situation

Mainland Orkney has high levels of ornithological interest, and is both nationally and internationally important for the following ecological groups:

- onshore birds, including important populations of species of conservation significance such as the hen harrier (one of the largest and most dense populations in the UK), short-eared owl (one of the few UK sites to support significant numbers of this species), breeding red-throated divers (on lakes) and corncrake
- coastal birds: birds along the shoreline and intertidal strandline include ringed plovers, turnstone, purple sandpiper, pipits and twite. The nearest location to the landfall for internationally important wintering populations of wading birds is on the East Sanday Coast SPA and Ramsar site (approximately 35–40 miles away); peregrine falcon are also present on the coastal cliffs of mainland Orkney
- marine birds: mainland Orkney and surrounding islands have significant summer breeding colonies including guillemot, razorbill, puffin, kittiwake, fulmar, great black-backed gull, arctic skua, great skua, and arctic terns. Cliff-top observations of seabirds from the Billia Croo EMEC site have recorded a number of species within ~2km of the WOS. Species most commonly recorded diving from height to feed were gannet, and less frequently arctic tern and kittiwake. The species most commonly recorded diving from the surface to feed was shag, with guillemot, black guillemot, eider, puffin and little auk also recorded (SMRU database CD compiled for EMEC, 2011).

The proposed landfall location is understood to be rocky shore; as such, it is considered unlikely to be of particular importance for breeding or wintering shorebirds. The short

onshore cable corridor /substation location has the potential to be used by ground-nesting species such as skylark.

Existing survey data

A programme of aerial surveys of seabirds commenced in October 2010 and continued through to September 2011 (eight surveys were carried out within this period), and were funded by the Crown Estate Enabling Actions Fund (CEEAF). These surveys covered the whole of the Pentland Firth and Orkney waters Round 1 wave and tidal power area, including WOS and its surroundings. The surveys flew transects that were spaced 2km apart and used high-resolution camera technology to capture digital still images of birds for identification. Where the detail in the images was not sufficient to determine the species, the birds were identified to broad groupings (e.g. auks, gulls). These data were then fully analysed *post hoc*. Photos were taken at 2km intervals on each of the transects.

Georeferenced locations of birds contained within each individual digital still image were used to generate raw counts. Raw counts were divided by the number of images to give the mean number of birds per image (*i*). Population estimates (*N*) were then generated by multiplying the mean number of birds per image by the total number of images required to cover the study area (*A*). Statistical methods were then used to determine how reliable the above estimates might be, based on an estimate of how many photographs would be required in an area to give a reliable population estimate for each species. The calculated 'reliability' or 'precision' used a measure known as the co-efficient of variation (CV). The precision is acceptable if the CV has a value of less than 0.16[2].

The method of estimating the number of samples required to achieve a specific precision is based upon using real data and the relationships between the mean and standard error. Standard error is dependent on sample size: generally, the larger the sample, the smaller the standard error. If mean and variance values from the actual data are assumed to remain approximately constant with the acquisition of increasing samples (generally a fair assumption for over-dispersed data with many zeroes), the effect of increasing sample sizes can be predicted in terms of CV precision values.

Abundance estimates for the each species recorded in the West Orkney South area are shown in Table 5.1. No species population abundances could be estimated within the target level of precision (CV < 0.16) owing to the small numbers of bird sightings made within the area.

[2] This corresponds to a level of precision at which a doubling or halving of the population is detectable (a 'Class 3' level: Bohlin, 1990).

Table 5.1: Counts and population estimates for offshore birds in the West Orkney South area

Survey period	Fulmar		Kittiwake		Un-ID'ed Small Gulls		Razorbills / Guillemots	
	Count	Pop. Est.	Count	Pop. Est.	Count	Pop. Est.	Count	Pop. Est.
Oct/Nov 2010	9	283	2	63	-	-	-	-
Feb/Mar 2011	1	28	-	-	-	-	-	-
Apr/May 2011	15	487	6	195	5	162	-	-
May/Jun 2011	-	-	-	-	-	-	-	-
July 2011	22	670	1	30	-	-	-	-
Aug 2011	12	215	-	-	-	-	1	18

Fulmar was the species most frequently recorded throughout the WOS area during all the surveys, with the exception of May. Auks were recorded in low numbers and only appeared during the August survey. Few kittiwakes were recorded in the survey area, with a peak of six in April.

An example map showing the distribution of species throughout the WOS area for the July 2011 survey period is presented in Figure 5.3.

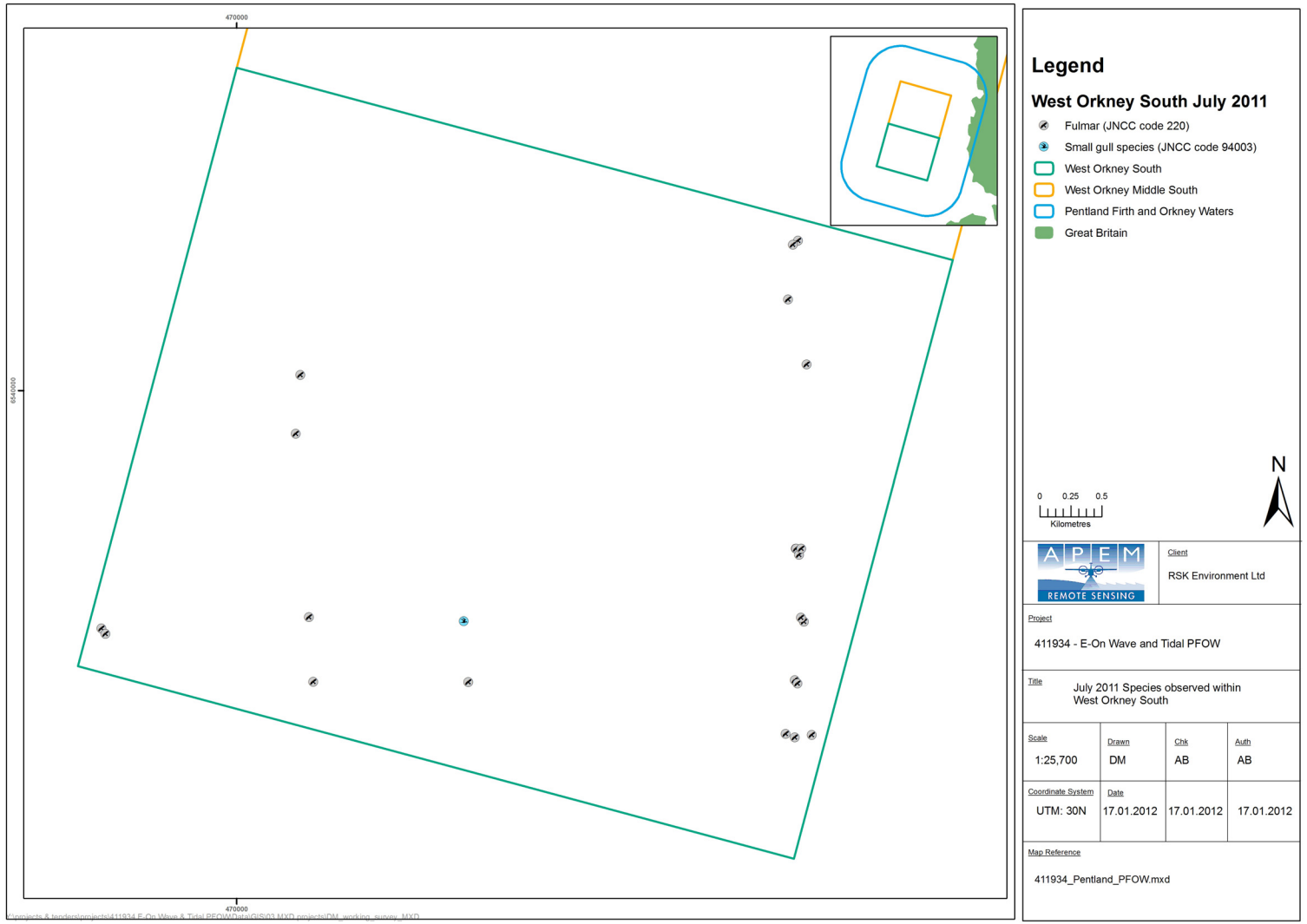


Figure 5.3: Offshore bird species distribution throughout WOS area during July 2011

5.5.2 *Potential effects and mitigation*

During construction there will be an increase in vessel activity in WOS, which has the potential to cause localised, temporary displacement of seabird species known to have a low tolerance of anthropogenic disturbance (e.g. divers). It is also possible that construction work at the landfall and along the cable route will disturb or damage the habitat of ground-nesting birds, which may include species both onshore (e.g. skylark) and at the landfall (e.g. purple sandpiper).

During normal operation, the presence and movement of the wave devices (which may include noise and vibration emissions) may alter the local distribution and abundance of some bird species by deterring sensitive species, or aggregating species known to roost on offshore structures (e.g. for cormorant and shag) – this may be referred to as a 'displacement radius'. Although highly unlikely, it is possible that fluid with the potential to harm seabirds (e.g. hydraulic fluids) could be released as a result of accidental events during both construction (e.g. from vessels) or operation (e.g. from the devices).

Other impacts may include disturbance to birds during maintenance and decommissioning, collision with or entanglement by cables/mooring lines, and cumulative and in-combination impacts with other tidal and wave energy developments in the Pentland Firth and Orkney waters.

It is possible that bird species from SPAs designated for their seabird interest will be impacted by, or interact with, the development. In these cases, a HRA will be required. To identify which SPAs have seabird species (contributing directly to the designation) that may interact with the development, a screening exercise has been carried out. This was based on consultation with SNH, which advised that 'maximum foraging distances' of seabirds (as defined by BirdLife International, 2010) should be used to calculate which Scottish SPAs have breeding seabird interest features whose foraging range could theoretically encompass the WOS site. A rigid screening process started with all Scottish SPAs and then excluded those that do not have seabirds (divers, petrels, shearwaters, fulmar, gannet, cormorants, seaducks, gulls, terns, auks and skuas) as part of the designation. The foraging distance of the furthest-ranging species for each remaining SPA was then cross-referenced to the distance from the SPA to the WOS site, which further excluded a number of SPAs. The remaining SPAs (presented in Table 5.2 and Figure 5.4) are those which have breeding seabird species (as part of their designation) that could theoretically interact with the WOS site while foraging from their breeding area.

Table 5.2: SPAs whose breeding seabird species' foraging range could theoretically encompass WOS site

SPA	Distance to WOS (km)	Breeding seabird species contributing to SPA whose maximum foraging range encompasses the WOS site
Ailsa Craig	421.8	Gannet
Auskerry	47.1	Storm petrel
Buchan Ness to Collieston Coast	191.0	Fulmar, kittiwake, guillemot

SPA	Distance to WOS (km)	Breeding seabird species contributing to SPA whose maximum foraging range encompasses the WOS site
Caithness and Sutherland Peatlands	41.4	Red-throated diver
Calf of Eday	41.0	Fulmar, cormorant, kittiwake, guillemot
Cape Wrath	82.9	Fulmar, kittiwake, puffin, guillemot
Copinsay	40.1	Fulmar, kittiwake, guillemot
East Caithness Cliffs	63.3	Fulmar, kittiwake, puffin, guillemot
Fair Isle	108.4	Fulmar, gannet, kittiwake, puffin, guillemot
Fetlar	214.0	Fulmar
Firth of Forth	303.1	Gannet
Flannan Isles	242.1	Fulmar
Forth Islands	310.2	Fulmar, gannet
Foula	135.2	Fulmar, kittiwake, puffin, guillemot
Fowlsheugh	236.5	Fulmar
Handa	112.2	Fulmar, kittiwake, guillemot
Hermaness, Saxa Vord & Valla Field	230.7	Fulmar, gannet
Hoy	3.1	Red-throated diver, kittiwake, puffin, guillemot
Marwick Head	4.7	Kittiwake, guillemot
Mingulay and Berneray	335.8	Fulmar
North Caithness Cliffs	30.6	Fulmar, kittiwake, puffin, guillemot, razorbill
North Rona and Sula Sgeir	128.3	Fulmar, gannet, kittiwake, puffin, guillemot
Noss	176.5	Fulmar, gannet, kittiwake, puffin, guillemot
Orkney Mainland Moors	11.2	Red-throated diver
Rousay	18.2	Fulmar, kittiwake, guillemot, Arctic skua
Rum	260.1	Manx shearwater
Shiant Isles	198.0	Fulmar, kittiwake, puffin, guillemot
St Kilda	308.1	Manx shearwater, fulmar, gannet
Sule Skerry and Sule Stack	48.0	Storm petrel, Leach's storm petrel, gannet, puffin, guillemot
Sumburgh Head	146.5	Fulmar, kittiwake, guillemot
Troup, Pennan and Lion's Heads	153.8	Fulmar, kittiwake, guillemot
West Westray	30.6	Fulmar, kittiwake, guillemot, razorbill, Arctic skua

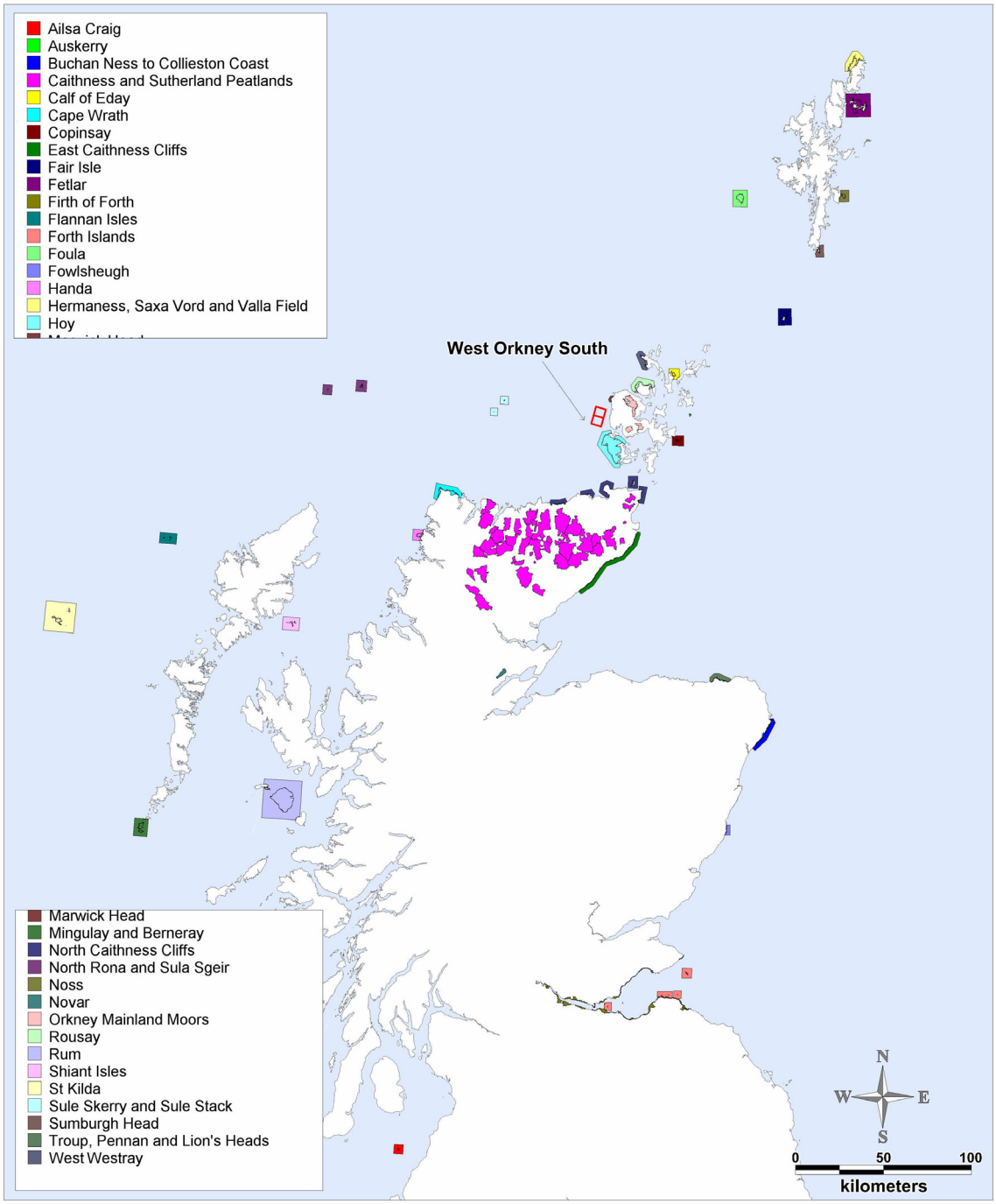


Figure 5.4: SPAs whose breeding seabird species' foraging range could theoretically encompass WOS site

5.5.3 Scope of work for survey and assessment

Offshore

Based on the analysis of images from the WOS area (from the survey over the wider Orkney and Pentland Firth area), the frequency of digital stills taken in the area was

insufficient to provide population estimates with the required level of precision. The low precision of the population estimates is primarily due to the low number of birds encountered within the surveys. Encounter rates may increase (leading to a greater precision) with a greater number of images within the area. Therefore, greater numbers of images would be required to achieve the target level of CV <0.16.

It has been estimated that using a smaller survey grid of 500m over the WOS site (giving 120 images) and including a suitable buffer would maximise the likelihood of achieving the target level of precision. This would not be expected to work for all species groupings, however, owing to the vastly differing numbers of recorded sightings. It is also possible that some species are naturally infrequent in the relatively small survey area. Table 5.3 shows the calculated number of images that would have been required to achieve the required level of precision for different bird groups in each survey period.

Table 5.3: Required sample size for recorded species for each survey month within West Orkney South area (based on CV calculations)

	November 2010	March 2011	April 2011	May 2011	July 2011	August 2011
Fulmar	141		82		107	114
Kittiwake	530		197			
Unidentified small gulls			237			
Guillemot/ razorbill						

NB Where occurrence of a species was extremely low (e.g. guillemot / razorbill), it was not possible to estimate the number of samples needed to achieve the target precision.

Another possibility for estimating populations, which may increase the chance of achieving the target precision, is to utilise statistical modelling, using the environmental conditions to help predict the occurrence and distribution of species within the survey area. It should be noted that temporal and spatial variability would ultimately affect precision calculations. Population estimates made with lower precision are not invalid, but assumptions about change over time should be cautious. However, where species occurrence is low, target precision may not be reached by any aerial photography sampling strategy.

It is understood that The Crown Estate is in the process of negotiating a further year of surveys for the whole Pentland Firth and Orkney Waters area. The level of coverage

provided in these surveys will enable the abundance of the major bird groups to be identified (auks, divers etc.), although exact species may still be very difficult to determine. To provide information on the abundance of the individual species, higher resolution photography will be required and a programme for this level of survey is being discussed between MS-LOT and SNH. These more detailed surveys would be scheduled to take place at the same time as the CEEAF surveys. The data collected in the wider area surveys will help to place the results from the WOS site in context.

However discussions with SNH have concluded that aerial surveys are unlikely to provide the level of precision required. It is therefore proposed that boat-based surveys are performed, for a period of two complete years, using standard transect methodologies and qualified, experienced observers. These surveys will also cover a 'buffer', covering an overall area six times that of the proposed development area. E.ON will endeavour to engage with other developers to coordinate surveys off the west coast of Orkney to maximise efficiency and data comparability.

The above survey work is intended to provide a good understanding of the usage of the site, and will help to identify which species are present on the site that may be from local designated sites. In the event that there are high numbers of such species, and these may be from more than one site, it may be necessary to carry out more specific surveys to determine the flight paths of these birds across or to the site to establish which sites they are from (this may include sites from much further afield if migrating species are recorded in high numbers on the site).

In waters nearer to shore, data will be available from cliff top observations by EMEC near Billia Croo. This will provide important information on seabird usage of nearshore areas, as well as behaviour, such as a 'displacement radius' towards devices that have been deployed, such as the E.ON Pelamis P2 device.

The abundance data, and that from the observation of how birds react to the devices, will be used to assess the potential effects of devices in the offshore environment and in the prediction of impacts of a full commercial array.

Onshore

For the onshore section (cable route and substation location), a breeding bird survey will be performed by a suitably qualified ornithologist in the months of April, May and June. In the first of these surveys, the ornithologist will visit the proposed landfall location and assess its potential for intertidal bird interest. SNH will then be consulted to agree on whether intertidal surveys are necessary and, if so, to agree on an appropriate methodology.

The key findings (e.g. species list, abundance, other points of interest) of all of the bird surveys will be summarised into interim reports (based on biologically relevant periods – e.g. wintering/breeding) and issued to SNH and Marine Scotland for comment. This will help guide the HRA and EIA process and identify any issues early on.

For cumulative and in-combination impacts, E.ON will engage with SNH and Marine Scotland during the EIA process to agree an approach to these sections of the ES.

5.6 Marine mammals (and other megafauna)

5.6.1 Existing situation

The waters around Orkney are of considerable importance for marine mammals, both cetaceans (whales, dolphins and porpoises) and pinnipeds (seals). Local waters support one of the richest cetacean faunas recorded in the UK (17 species). Five species occur regularly: harbour porpoise, minke whale, white-beaked dolphin, Risso's dolphin, and killer whale. Nationally important sites for both common and grey seals are found locally. There are two SACs approximately 40–50 miles to the north-east of the proposed development, both of which have large and/or breeding colonies of seals as primary reasons for designation. Faray and Holm of Faray is the second largest breeding colony of grey seals in the UK, and Sanday is the largest discrete population of common seals in Scotland, whose breeding groups comprise around 4% of the UK population of this species. In addition, the Isle of Rona (approximately 60 miles west of Orkney) hosts the third largest breeding colony of grey seals in the UK. In addition to cetaceans and pinnipeds, basking sharks, otters (intertidal and very shallow nearshore) and turtles (occasional) are recorded around the Orkneys. All of these taxa are either protected or of significant conservation interest.

Cliff-top wildlife observations at the Billia Croo EMEC site have confirmed that grey seal, common seal, harbour porpoise, killer whale, minke whale, Risso's dolphin, white-beaked dolphin and white-sided dolphin all occur in close proximity to the WOS area. Basking shark were also recorded, but infrequently (SMRU database CD compiled for EMEC, 2011).

5.6.2 Potential effects and mitigation

It should be noted that potential impacts to marine megafauna from operation of large-scale arrays of floating wave power devices is an area of ongoing consultation, research and discussion. As such, results of any relevant ongoing or future studies that have yet to be completed will be referred to in the ES where appropriate.

The potential for physical interactions between the devices (and e.g. their cabling) with marine megafauna is not currently quantified. It is possible that air-breathing vertebrates (i.e. cetaceans, seals and turtles; otters are unlikely to occur offshore) will avoid ('displacement radius') or (especially in the case of seals) be attracted to the physical presence of the devices, which may alter their natural behaviour and distribution (the presence of devices that could act as potential 'haul-outs' for seals may affect their behaviour and the behaviour and distribution of their prey (e.g. fish) and predators (killer whales)). It is also documented that marine megafauna can become entangled in the moorings and cables associated with offshore infrastructure, though site-specific risk from the proposed project is yet to be defined. In addition it is possible that megafauna could collide with, or be otherwise harmed by, the devices (especially in poor weather conditions). Otters or their habitat (e.g. holts) may be impacted by construction activities onshore.

Emissions of subsea noise and vibration from the devices (during operation) and vessels (during construction or maintenance) may affect the behaviour of marine mammals (particularly cetaceans). Potential, but unquantified impacts could arise such

as physical damage due to intense noise or long-term exposure (permanent threshold shift, PTS, or temporary threshold shift, TTS) to hearing; disturbance or alarm responses; intermittent/continuous noise leading to local habitat change (exclusion or attraction) or changes in use of haul-outs; and masking of natural calls, echolocation and passive listening. Emissions of EMF from the devices and power export cables may affect the behaviour of basking sharks.

Potential impacts during construction will include increased vessel activity in the offshore area (potentially leading to increased risk of collisions with, and temporary avoidance by, marine megafauna) and use of vehicles, plant and vessels at the cable landfall (which may affect otters). SNH/MS-LOT will be consulted for agreement on suitable mitigation measures to mitigate potential impacts during offshore construction.

It is possible that marine mammals from SACs designated for their marine mammal interest will be impacted by the development. In these cases, a HRA will be required. A list of SACs with marine mammals as a primary feature for site selection or as a qualifying feature of interest are presented in Table 5.4.

Table 5.4: UK SACs with marine mammals as primary feature for site selection or qualifying feature of interest (secondary)

Country	SAC	Common seal	Grey seal	Bottlenose dolphin
S	Ascrib, Islay & Dunvegan	Primary		
S	Dornoch Firth and Morrich More	Primary		
S	Eileanan agus Sgeiran Lios mór	Primary		
S	Faray and Holm of Faray		Primary	
S	Firth of Tay & Eden Estuary	Primary		
S	Isle of May		Primary	
S	Monach Isles		Primary	
S	Moray Firth			Primary
S	Mousa	Primary		
S	North Rona		Primary	
S	Yell Sound Coast	Primary		
S	Sanday	Primary		
S	South-East Islay Skerries	Primary		
S	Treshnish Isles		Primary	
E	The Wash and North Norfolk Coast	Primary		
SE	Berwickshire & North Northumberland Coast		Primary	
E	Humber Estuary		Secondary	
E	Isles of Scilly Complex		Secondary	
E	Lundy		Secondary	
NI	Murlough	Secondary		
NI	Strangford Lough	Secondary		
W	Cardigan Bay/*Bae Ceredigion*		Secondary	Primary
W	Pembrokeshire Marine/Sir Benfro Forol		Primary	
W	Lleyn Peninsula and the Sarnau		Secondary	Secondary

- **Grey seals**: this species is wide ranging, and foraging ranges can span large distances. Tracked individuals frequently travel over 100km between haul-out sites and can feed several hundred kilometres offshore, although most foraging probably occurs within 100km of a haul-out site (SCOS, 2010). For example, tagging of grey seals has shown that individuals from both the North Rona SAC and the Faray and Holm of Faray SAC pass close to or through the WOS site (SMRU, 2011).
- **Common seals**: this species tends to have more limited movements than grey seals, although normal feeding distance from haul-out sites still extends as much as 40–50km (SCOS, 2010). Tagging of common seals has shown that a 'transit corridor' exists for this species to the west of Rousay, which does not overlap with the WOS site (SMRU, 2011). However, tagging data have been more limited in southern Orkney waters.
- **Bottlenose dolphin**: there are relatively few records of bottlenose dolphin around Orkney. The nearest SAC for this species is the Moray Firth, at least 100km from WOS, and it is possible that dolphins from here could pass through the WOS area.

The ES will fully address likely impacts to SACs based on the best available evidence at the time and taking into account the limitations of data such as tagging studies.

5.6.3 Scope of work for survey and assessment

As cetaceans, turtle and otters are all European protected species (EPS), survey methodologies will need to be suitable to inform requirements for an EPS licence for the installation and operation of wave power devices. A desk-based assessment will review the diversity, distribution and abundance of marine megafauna in the project area and surrounding waters, with particular emphasis on identifying any areas, or times of year, of importance. Data sources will include studies by the Sea Mammal Research Unit (SMRU) on Scottish seals, a recent report (2010) by SNH on Orkney common seals, the JNCC cetacean atlas (Reid et al., 2003) and other relevant data or reports as and when they become available, such as the Joint Cetacean Protocol (due in March 2012). Some baseline data will be available from EMEC Billia Croo cliff top observations as well as records of marine megafauna from the aerial bird surveys.

E.ON commissioned experts from the Scottish Association of Marine Science to provide recommendations on the proposed scope of work for baseline survey and assessment, with particular reference to the informal SNH 'Guidance on survey and monitoring in relation to marine renewables deployments in Scotland. Volume 2. Cetaceans and Basking Sharks' (Macleod et al., 2011). The following studies are proposed to gain sufficient data on marine megafauna to inform the EIA with regard to distribution, abundance and behaviour.

Distribution and abundance

Site-specific information on the WOS/WOMS developments will be provided by:

- **local at-sea data collection** in the WOS site (and a suitable buffer zone, where appropriate), comprising
    - boat-based surveys of marine megafauna, undertaken once a month using line transect methodology, for a period of two years. After one year, data would be reviewed in consultation with MS and SNH to optimise surveys where necessary. These surveys will encompass both
        - visual surveys, using experienced marine mammal observers (MMOs). This type of survey has the potential to record distribution, abundance, and behaviour of all species of megafauna (cetaceans, pinnipeds, basking sharks and turtles), as well as also potentially providing a platform for seabird surveys (using different surveyors)
        - towed passive acoustics, which could provide important information on vocalising species such as porpoises
- **passive acoustic monitoring** (e.g. moored C-PODs) in/around the WOS site, which will allow for the collection of longer-term, near-continuous data on presence and relative abundance of vocalising species in the area. If several devices are used, these could provide information on small-scale variability in relative abundance, which may further inform more broad-scale survey data.

To identify the use of intertidal areas by seals as haul-outs (and potential disturbance impacts to them), surveys of the intertidal (see benthos/birds) will record details of any seals observed. Data from this, and other reports, will be used to identify whether the landfall area is of importance as a seal haul-out.

It should be noted that while otters might be recorded in the 'at sea' visual surveys above, they (or signs of them) might also be recorded onshore. Survey for otters in this context is covered in Section 5.11.3.

Complementing the above 'local' methods (i.e. at-sea visual, and towed and moored passive acoustic surveys), a collaborative approach to a larger survey area between E.ON and other developers on the west coast of mainland Orkney may be desirable, given its potential advantages (maximising vessel/weather opportunities, cost efficiency and increased sample size/confidence in generating abundance estimates). E.ON would be prepared to consider contributing to such a wider, industry-led study.

The above proposed surveys/data collection will provide site-specific information for E.ON for the WOS/WOMS site. However, taking into account the SNH guidance, E.ON also notes that, if required, the following items would be useful to investigate on a collaborative basis with other developers/regulatory agencies as part of a wider initiative. Such initiatives might include the following:

- **Broad-scale at-sea visual surveys** of the Orkney (containing the WOS site) and mainland Scotland region. Surveys should ideally be undertaken at least once a month, to provide a snapshot of distribution and abundance. They would enable the local, site-specific observations to be placed in context (such as the relative regional importance of the WOS site to different marine

megafauna species). Although not without challenges and disadvantages, aerial surveys are perhaps the optimal method for this kind of survey in terms of flexibility, coverage, speed, and little or no influence on the behaviour of the species being surveyed. E.ON is contributing to the regional Crown Estate Developers Forum/Enabling Fund aerial seabird surveys that are currently being undertaken, that also record marine megafauna data. The surveys are undertaken several times a year and therefore capture seasonality. It should be noted that land-based (i.e. cliff-top) visual surveys of marine megafauna at sea are unsuitable for the WOS site owing to its distance offshore

- **Beach surveys for strandings and carcasses** of marine megafauna. This could encompass a broad region, including the WOS site and other wave/tidal developments. Surveys could be undertaken monthly or more frequently in areas of particular interest. In addition to providing information on marine megafauna diversity, examinations of stranded/dead animals by appropriately qualified personnel on could also provide important information on injuries (including those potentially caused by wave/tidal devices). Any such scheme should take into account the existing networks and schemes, such as the Scottish Marine Animal Stranding Scheme to avoid duplication of effort and to ensure data comparability.
- **Seal counts at Orkney haul-outs:** E.ON would consider collaborating with other developers and regulatory agencies in undertaking aerial surveys of seal haul-outs in the region. In the context of declining seal populations locally, this would provide important information on changes in abundance over time (and in relation to installation of the devices).
- **Seal telemetry:** E.ON would consider participating with other developers and regulatory agencies in a collaborative telemetry tagging study of seals around Orkney, under the appropriate licensing (Animals (Scientific Procedures) Act 1986). This could provide important information on aspects such as at-sea habitat use and dive profiles, both of which are important in assessing potential impact of wave devices. Tagging has a number of disadvantages, including its relative expense and limited sample size (it is only feasible to tag a very small proportion of any one colony, and animals tagged will behave as individuals and not necessarily in a 'typical' or representative way). Tags typically last a few months, and therefore a few tagging efforts may be required to provide year-round coverage (e.g. of seasonal behaviour). A widespread tagging programme that would be of optimum use to developers and regulators would involve tagging a representative range of seals (i.e. both species, both sexes, and adults/juveniles) from different haul-out sites, and co-ordinating this with the other (e.g. aerial) surveys. If it becomes apparent that seals from particular haul-out sites frequent the WOS area, more detailed monitoring may be appropriate.

A desk-based study of Pelamis device noise in terms of its audibility and nature will be completed. The study is likely to cover the risks of PTS/TTS and will be undertaken by suitably qualified experts. Noise footprints will be modelled for arrays of 1, 13 and 66 Pelamis devices. The desk-based study will also consider other sources of noise (e.g. vessel movements, geophysical surveys) and the potential impacts of disturbance.

Collision risk will also be assessed in the ES and will take note of any information or guidance (currently in development) on marine mammals and potential risks from vessels' thrusters. Findings from these studies will be used to propose mitigation measures in the ES.

The key findings (e.g. species list, abundance, other points of interest) of the marine megafauna surveys will be summarised into interim reports and issued to SNH and Marine Scotland for comment; these will help guide the HRA and EIA process and identify any issues early at an early stage in the process.

5.7 Archaeology and cultural heritage

5.7.1 Existing situation

Orkney enjoys a rich cultural legacy, with internationally important prehistoric remains through to medieval and modern sites of archaeological and cultural interest. Onshore, the majority of western mainland Orkney (including the landfall beach) is part of the Heart of Neolithic Orkney UNESCO World Heritage Site (WHS), which covers 15.9 ha, and is one of five World Heritage Sites in Scotland (Figure 5.5). The WHS is centred on two main areas: Skara Brae, which directly abuts the Bay of Skaill, and Brodgar-Steness ~5km to the SE of the Bay of Skaill. Of particular note within the WHS area in the vicinity of the Bay of Skaill are the scheduled ancient monuments (SAMs) of Skara Brae Neolithic settlement itself, the Verron Broch, and mounds at Cumbla Newgarth. The Category A listed buildings (LBs) of Sandwick Kirk and Skaill House, along with the inventory historic garden and designed landscape (GDL) of Skaill House are also located close to the Bay of Skaill.

In the marine environment, there are no wrecks within ~50nm of the proposed development that are designated under the Protection of Wrecks Act 1973. A number of wrecks of German warships scuttled in Scapa Flow (approximately 30km to the south-west of the proposed development) are protected as scheduled monuments under the Ancient Monuments and Archaeological Areas Act 1979. Also in Scapa Flow, the HMS *Royal Oak* and HMS *Vanguard* are controlled sites under the Protection of Military Remains Act 1986. Off the coast of Marwick Head, the wreck of the HMS *Hampshire*, a cruiser sunk in 1916, is also a controlled site. The National Monuments Record of Scotland (NMRS) records ten documented losses of craft within the vicinity of the Bay of Skaill.

5.7.2 Potential effects and mitigation

The potential impacts are summarised below:

- construction impacts (direct or indirect) on features of archaeological interest
- construction impacts upon previously unrecorded archaeological sites or features
- operational impacts (primarily indirect) on the settings of sites and features of archaeological interest (principally SAMs, gardens and designed landscapes, conservation areas and listed buildings).

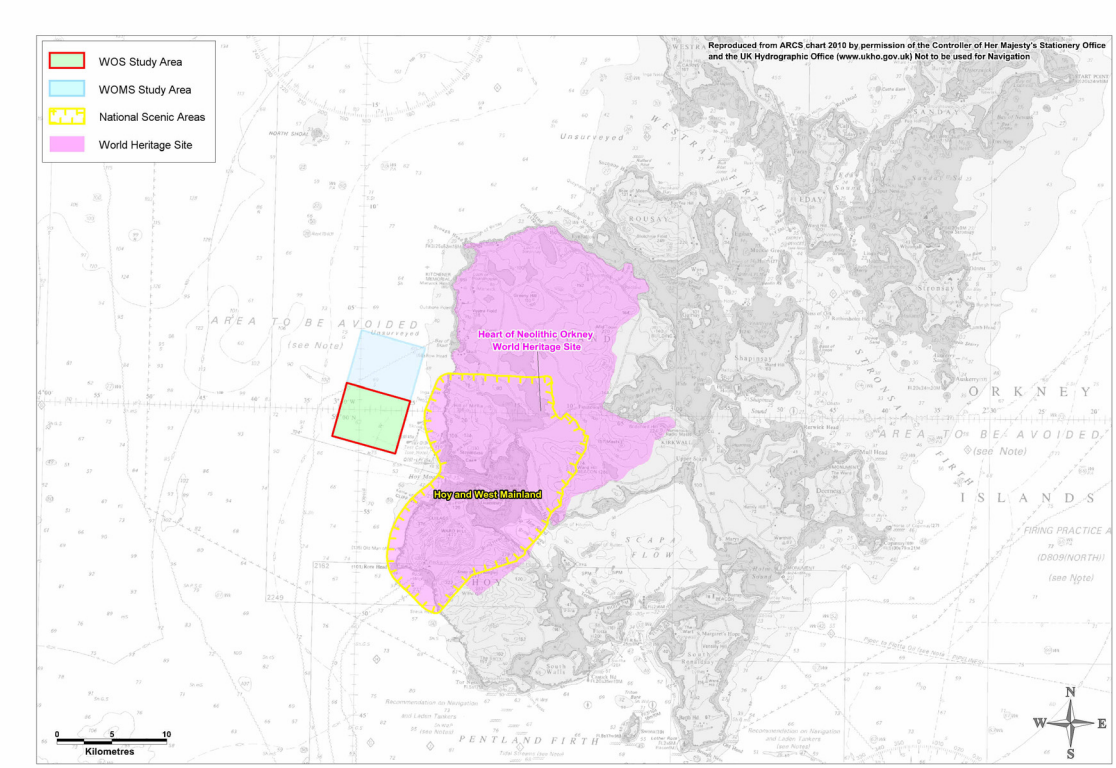


Figure 5.5: World Heritage Site (outer buffer zone) and Hoy and West Mainland National Scenic Area in relation to West Orkney South

Onshore works will consist of laying a buried cable (Phase 1) linking the landfall point and joint with the substation, along with construction of the substation. Phase 2 onshore works may require a second substation, and the construction of either buried or overhead power lines.

Potential effects to onshore archaeological resources could occur during topsoil stripping, benching, cable trenching and the intrusive geotechnical survey that could cause impacts to buried archaeological remains, either previously recorded or unknown. Temporary visual impacts on the setting of designated heritage assets (such as listed buildings and SAMs) could also take place during the construction phase.

During the operational phase of the development, impacts on the setting of designated sites, such as the SAMs, LBs and GDL outlined above, as well as on the Heart of Neolithic Orkney WHS, may occur through the operation of aboveground and above-sea installations, such as the substations (Phase 1 and 2) and overhead cables (if required for Phase 2).

In the offshore environment, potential effects to archaeological resources could occur during installation of mooring and cable structures, as well as any intrusive geotechnical surveying. Receptors could include (amongst others) wrecks, ship-borne artefacts, military aircraft, or unknown prehistoric archaeological remains (including artefacts, evidence of land surfaces, or vessels). In addition, there may also be visual impacts on the setting of land-based heritage receptors such as listed buildings from the wave devices during the operational phase of the development.

Mitigation will mainly consist of avoidance of recorded and designated sites (and others of high archaeological potential) in the routeing of the cable and location of installations, and setting of measures to be implemented during construction phase to limit potential damage to the archaeological resource.

The information obtained from the assessments detailed below is used to define a project-specific mitigation strategy. Typical options for mitigation measures in relation to onshore archaeological and cultural heritage resources are:

- preservation in situ: the preservation in situ of sensitive archaeological remains can be achieved through localised variations to the route or by reducing the working width, laying geotextile matting or bog mats and/or careful reinstatement procedures, e.g. avoidance of sub-soil ripping in archaeologically sensitive areas
- excavation: where preservation in situ is not feasible or desirable an alternative mitigation is pre-construction archaeological excavation. This consists of a detailed programme of archaeological fieldwork to preserve, by record, the archaeological value of the site.

In addition, it is anticipated that during construction a programme of archaeological monitoring of construction activities will be undertaken. Where archaeological features, deposits, artefacts or ecofacts are identified, an appropriate programme of archaeological recording will follow. This could include the detailed archaeological excavation of sites identified. On completion of archaeological fieldwork and construction activities, a programme of post-excavation assessment, analysis, reporting and publication would be designed and implemented. Any treatment and disposal of finds during survey, construction, maintenance or decommissioning will follow Crown Estate and Treasure Trove protocols.

5.7.3 Scope of work for survey and assessment

The assessment will be divided into the following key phases:

- **Consultation**: Orkney Islands Council's archaeologist and Historic Scotland will be consulted to confirm that the scope of work is acceptable for the purposes of the ES. The Council will be asked to comment on recommendations for further assessment, field evaluation and/or mitigation.
- **Desk-based assessment (onshore)**: To consider direct impacts, archaeological desk-based assessments will be undertaken to collate existing data for a 1km study area along the line of the cable routes and substation locations for Phases 1 and 2. Data will be gathered from the following sources to place any findings into an archaeological and historic context:
    - Orkney Islands Council Historic Environment Record (HER)
    - Royal Commission on the Ancient and Historic Monuments of Scotland (RCAHMS) National Monuments Record of Scotland (NMRS)
    - Historic Scotland.

Information will be sought on the presence of scheduled and non-scheduled archaeological sites and monuments, historic buildings, conservation areas, gardens and designed landscapes, and registered battlefields.

Relevant published and unpublished (grey) literature will also be consulted in order to inform the archaeological context of the area. Cartographic records will then be inspected for a reduced study area comprising 50m either side of the cable routes and substation locations. Readily accessible and relevant historic maps and aerial photographs will be viewed. Historical Ordnance Survey mapping will be examined.

To consider indirect impacts, data will be gathered for heritage receptors within the zone of theoretical visibility (ZTV) for the development (as determined by the landscape and visual assessment) of any aboveground or above water installations forming part of the development to allow for the assessment of the impact of the development on the setting of cultural heritage receptors. This will be undertaken in accordance with relevant guidance from Historic Scotland and Orkney Islands Council.

- **Field reconnaissance survey (onshore)**: A walkover survey by an archaeologist from the landfall site to the substation locations for Phases 1 and 2 will be undertaken. This activity will include an assessment of the likely presence of any previously unrecorded archaeological or cultural heritage remains within the area of the proposed cable routes, and a determination of the condition of any recorded archaeological or cultural heritage sites from the baseline sources identified along the proposed lines of the cable route. In conjunction with the landscape and visual assessment, cultural heritage receptors within the ZTV will be identified and visited to assess any potential indirect impacts.
- **Desk-based assessment (offshore)**: A desk-based assessment of the archaeological and cultural heritage resources potentially impacted upon by the offshore aspects of the project. The information gathered from the below data sources will be compiled into a gazetteer and report accompanied by appropriate charts. Data sources assessed will include:
    - any relevant geophysical survey data for the area to be used for the proposed array(s) and cable(s) route. This will reviewed by appropriately qualified archaeologists specialising in marine archaeological assessments for any anomalies potentially relating to seabed marine heritage features
    - UK Hydrographic Office records
    - National Monuments Records (NMR) maintained by Historic Scotland; data obtained for protected and non-protected wreck sites, documented losses, obstructions and fastenings, scheduled monuments, registered battlefields and archaeological events
    - Sites and Monuments Records (SMR) maintained by Orkney Islands Council
    - Historic Environment Records maintained by local authorities, in this case Orkney Islands Council

- Archaeological Data Services website for protected and non-protected wreck sites and other maritime sites (www.ads.ahds.ac.uk)
- Maritime and Coastguard Agency (MCA) website for a list of protected wrecks and designated military remains (www.mca.gov.uk).

- **Impact assessment**: The above studies will be combined to form the impact assessment section of the ES. This will cover:
  - the known archaeological and cultural interest of the study area
  - the potential of encountering archaeological remains
  - the known or potential relative significance of the recorded heritage assets, the likely magnitude of change to those assets and the significance of the effect on those assets
  - the scope of any necessary further archaeological evaluation or mitigation.

The archaeological and cultural heritage assessment will be undertaken in accordance with the Institute for Archaeologists' (IfA) Standard and Guidance for Archaeological Desk-based Assessments and the IFA Code of Conduct. Based on the findings of the desk-based and field assessments and the impact assessment, a series of recommendations will be proposed to mitigate any significant impacts of the proposed development upon the archaeological and cultural heritage resource. Those recommendations will be discussed with Historic Scotland and Orkney Islands Council archaeologists, where appropriate.

5.8 Commercial fisheries and aquaculture

5.8.1 Existing situation

Fisheries are of key importance to Orkney both in terms of economic and social significance. Broad-scale fisheries data are available for the two ICES statistical rectangles (46E6 and 47E6) whose boundary WOS straddles (Figure 5.6).

The MMO/Marine Scotland data by species landings values, averaged for the 10 years of 2001–2010 for ICES rectangles 47E6 and 46E6 (Table 5.5) indicate that the regional area of the development sustains mixed fisheries with a wide range of finfish and shellfish being caught. However, it should be noted the area of the WOS development is small relative to the ICES rectangles and fishing activity is rarely evenly distributed over the area of an ICES rectangle. For the local context, the importance of consultation with local fishermen is recognised for the identification of specific fishing grounds and fishing practices within the WOS area. It should be noted that not all of the below species groups may have been caught in or around the WOS area.

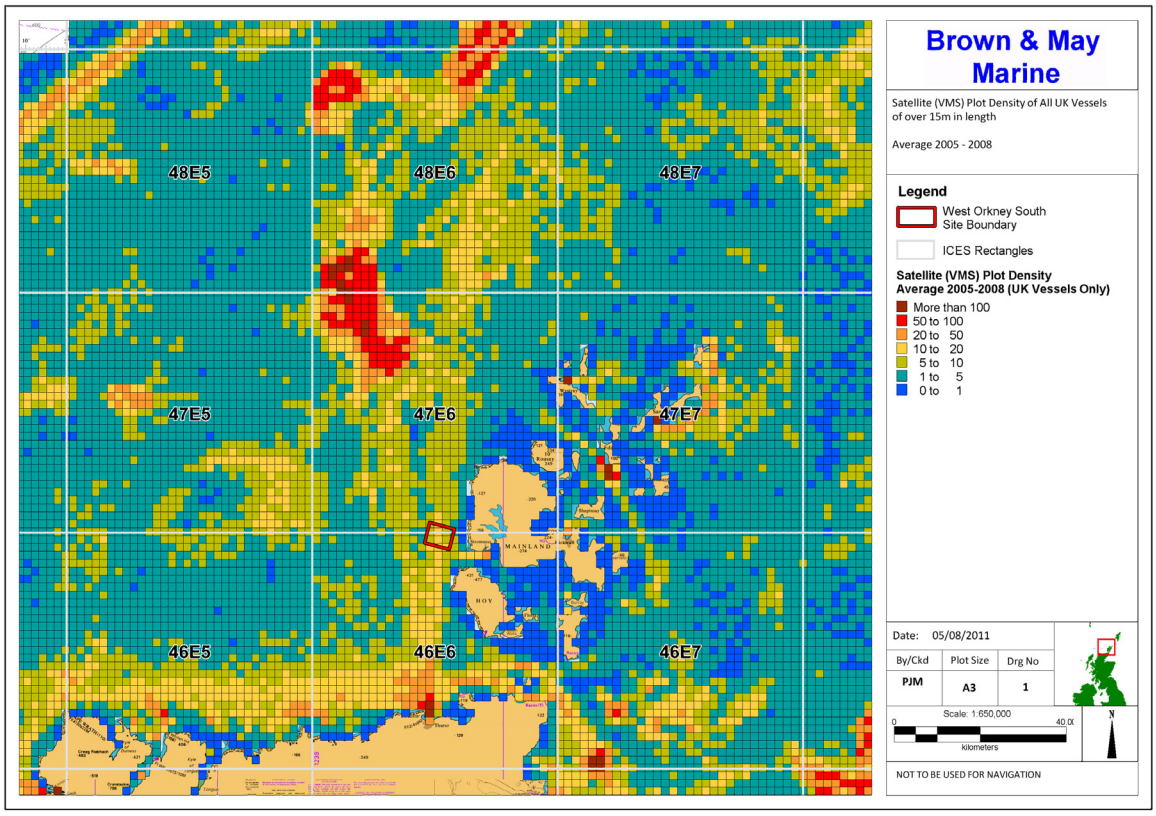


Figure 5.6: Location of West Orkney South site boundary in relation to ICES rectangles, and distribution of VMS plots of UK vessels

Table 5.5: Average landings values (2001–2010) by species from ICES rectangles 47E6 and 46E6

Species	46E6	47E6	Total
Monks or anglers	£1,073,526	£857,609	£1,931,135
Edible (brown) crab	£618,666	£601,655	£1,220,322
Lobsters	£645,494	£314,230	£959,724
Haddock	£395,362	£393,529	£788,891
Velvet crab	£302,966	£389,050	£692,016
Megrim	£291,079	£388,308	£679,387
Nephrops (Norway lobster)	£94,604	£455,639	£550,243
Herring	£39,884	£477,593	£517,477
Cod	£172,143	£255,189	£427,332

Species	46E6	47E6	Total
Scallops	£135,394	£44,959	£180,354
Whiting	£31,556	£83,379	£114,934
Squid	£22,459	£62,852	£85,311
Spurdog	£23,710	£46,813	£70,523
Periwinkles	£51,920	£5837	£57,757
Skates and rays	£12,424	£38,897	£51,321
Whelks	£46,372	£3,141	£49,512
Green crab	£27,739	£19,572	£47,310
Saithe	£25,756	£21,536	£47,292
Plaice	£12,108	£29,994	£42,102
Witch	£2642	£37,560	£40,202
Other species	£64,476	£153,799	£218,275
Total	**£4,090,279**	**£4,681,141**	**£8,771,420**

A wide diversity of fishing methods is used in the broader area (Table 5.6). In particular, these highlight the relative importance of demersal otter trawling (by >15m vessels) and inshore potting by <10m vessels.

Table 5.6: Average landings values (2001–2010) by method from ICES rectangles 47E6 and 46E6

ICES rectangle	Method	U10m	10m-15m	15m and over	Non UK	Total
46E6	Otter trawls – bottom	£14,346	£24,592	£1,658,976	£1018	£1,698,932
	Pots	£988,598	£639,767	£20,768	£6194	£1,655,327
	Otter twin trawls	£0	£1407	£310,976	£0	£312,383
	Hand fishing	£94,136	£8515	£0	£0	£102,651

ICES rectangle	Method	U10m	10m-15m	15m and over	Non UK	Total
	Scottish seines	£0	£0	£99,817	£0	£99,817
	Boat dredges	£11,557	£15,699	£54,506	£4316	£86,077
	Otter trawls – midwater	£0	£0	£41,512	£0	£41,512
	Beam trawls	£0	£0	£35,356	£0	£35,356
	Pair trawls - bottom	£0	£0	£27,812	£0	£27,812
	Miscellaneous gear	£0	£8960	£0	£0	£8960
	Nephrops trawls	£1968	£732	£5888	£0	£8588
	Longlines	£0	£0	£4183	£0	£4183
	Handlines and pole-lines	£3977	£97	£0	£0	£4,074
	Otter trawls (not specified)	£0	£0	£2379	£0	£2379
	Pair trawls – mid-water	£0	£0	£1380	£0	£1380
	Bottom trawls (not specified)	£0	£0	£738	£0	£738
	Gillnets	£10	£89	£0	£0	£98
	Hooks and lines (not specified)	£11	£0	£0	£0	£11
	46E6 Total	**£1,114,601**	**£699,858**	**£2,264,292**	**£11,528**	**£4,090,279**
47E6	Otter trawls – bottom	£1,716	£16,525	£2,262,879	£9,796	£2,290,916
	Pots	£798,171	£271,303	£262,050	£138	£1,331,662
	Otter trawls – mid-water	£0	£0	£430,926	£0	£430,926
	Otter twin trawls	£0	£1,086	£274,961	£0	£276,048
	Nephrops trawls	£0	£0	£121,826	£0	£121,826
	Pair trawls – mid-water	£0	£0	£52,675	£0	£52,675
	Pair trawls – bottom	£0	£0	£42,221	£0	£42,221

ICES rectangle	Method	U10m	10m-15m	15m and over	Non UK	Total
	Boat dredges	£22,307	£1714	£7274	£0	£31,295
	Scottish seines	£0	£0	£29,165	£0	£29,165
	Longlines	£0	£0	£26,495	£0	£26,495
	Hand fishing	£17,345	£3905	£565	£0	£21,815
	With purse lines (purse seines)	£0	£0	£7483	£0	£7483
	Beam trawls	£0	£0	£6560	£0	£6560
	Gillnets	£359	£0	£3,524	£1,962	£5,845
	Handlines and pole-lines	£4419	£0	£0	£0	£4419
	Miscellaneous gear	£0	£1139	£0	£0	£1139
	Bottom trawls (not specified)	£0	£0	£653	£0	£653
	47E6 Total	**£844,317**	**£295,672**	**£3,529,256**	**£11,896**	**£4,681,141**
	Grand Total	**£1,958,918**	**£995,530**	**£5,793,548**	**£23,424**	**£8,771,420**

Figure 5.6 shows the relative density of VMS position plots of UK vessels of over 15 metres in length. This illustrates that fishing activity is not distributed evenly over the area of an ICES rectangle. Figure 5.6 also suggests that a significant proportion of over-15-metre vessel activity is from vessels steaming from Scrabster to fishing grounds to the north-east of Orkney. However, it is recognised that VMS data only applies to vessels over 15 metres in length and that a significant proportion of the fishing activity within and adjacent to the development area will be by smaller vessels not recorded by VMS. Similarly, the limitations of surveillance sightings data, in terms of the frequency of over-flights and daylight hour's restrictions are appreciated, both cases further highlighting the importance of local consultation.

Owin to the exposed nature of the west coast of Orkney, there are no aquaculture facilities either offshore near WOS or inshore near the landfall. The nearest designated shellfish waters are the Bay of Ireland, near Stromness, approximately 10km overland from WOS (SEPA 2011).

5.8.2 *Potential effects and mitigation*

During construction, it is probable that an exclusion zone (applicable to all vessels) will be set up around all operations for safety reasons. This will include both the towing of Pelamis devices to WOS from the construction site at Leith and their installation at the WOS site, and during the cable laying and landfall operations. These exclusions have the potential to impact commercial fisheries by displacing fishermen from usual grounds. In addition, exclusion areas may result in fishermen having to use more time and fuel to steam around to reach their favoured fishing areas.

During operation, it is likely that an exclusion zone will be set up around the WEC devices. It is likely that similar impacts to those for construction will occur (i.e. displacement from traditional areas and increased time and fuel to avoid), although these are likely to be permanent, they will be more limited in extent than during the construction period. It is also possible that any effects of the development on the distribution and behaviour of commercially exploited species (e.g. fish or shellfish aggregation around structures) would in turn affect fisheries. Safety factors will also need to be considered, as there is the potential for gear or vessel interactions with devices, mooring systems, cables, and maintenance vessels. Assessment of cumulative impacts will be important, as many fishers, particularly those using smaller, inshore vessels, are restricted to certain grounds; any displacement will therefore have knock-on effects to other fishermen.

Potential mitigation options would be identified and their feasibility assessed primarily on the basis of:

- the final design of development and the potential impacts as determined during the EIA process
- consultation with fishermen, their representatives, Marine Scotland and other relevant fisheries research centres
- evaluation of mitigation options implemented and proposed for other relevant offshore developments
- published research on potential mitigation options
- the environmental, practical, safety and cost implications of potential options.

5.8.3 *Scope of work for survey and assessment*

The data and information used to establish the commercial fisheries baseline will be acquired from the following sources:

- International Council for the Exploration of the Sea (ICES)
- EU Fisheries Committee publications and data sets (Europa and Eurolex)
- Marine Scotland – Fisheries Statistics Unit and Data Communications Team
- Marine Scotland Science
- SeaFish
- UK Oil and Gas (UKO&G)
- Scottish Fishermen's Federation (SFF)
- local port merchants and agents

- Marine Scotland district fisheries inspectors
- local Harbourmasters.

The importance of consultation with relevant fisheries interests is recognised and given below are the principal representative fisheries organisations with which consultation would be undertaken:

- Scottish Fishermen's Federation
- Fishermen's Association
- Scallop Association
- Scottish Pelagic Fishermen's Association
- Scottish White Fish Producers' Association
- Mallaig & North West Fishermen's Association
- Caithness Static Gear Fishermen's Association
- Orkney Fisheries Association
- Orkney Fishermen's Society
- Orkney Sustainable Fisheries
- Shetland Fishermen's Association
- Western Isles Fishermen's Association
- North Minch Shellfish Association
- Ross, Sutherland, Skye and Lochalsh Fishermen's Association.

It is anticipated that results of the Marine Scotland project 'Scotmap', which logs fishing activity, will be available in time for the production of the ES.

For the baseline section in the ES, the primary objectives will be to identify and evaluate the following:

- the locations of specific local fishing grounds by method, and fishing grounds in the regional and national contexts in respect of the implications of potential cumulative impacts
- the distribution of landings by weight and value, effort by method and vessels base ports
- operating practices by method with particular reference to gear deployment and towing practices
- seasonality of activity
- steaming patterns to traditional fishing grounds
- current and possible future fisheries legislation and conservation measures that may affect fishing pattern during the life of the project
- the value of fishing within the area under consideration in terms of the local, regional and national economies
- the sensitivities and limitations of the data and information sources used.

For the impact assessment, the potential effects upon commercial fisheries to be assessed are as follows:

- temporary or permanent displacement from traditional fishing areas
- the effects on commercially exploited species with reference to the findings of the fish and shellfish ecology assessments
- the potential effects of increases to traditional steaming distances and times
- safety factors with particular reference to fishing gear fastenings and navigational risks
- interference to normal fishing practices
- potential interactions with construction and maintenance vessels
- any other concerns or potential impacts identified in the course of the baseline research and from consultation with the fishing industry and Marine Scotland.

Fish spawning data (Coull et al., 1989; Ellis et al., 2010; other data, for example Marine Scotland Science) of commercial species such as herring will be mapped. Potential impacts will be assessed against spawning type (pelagic or benthic), and seasonality of both spawning and project activity (e.g. mooring block placement/cable burial).

5.9 Marine navigation

A preliminary hazard analysis (PHA) has been carried out for the WOS development, and this is provided as Appendix 2 to this scoping report. The sections below provide a summary of the PHA.

5.9.1 Existing situation

During a 28-day period in 2010 vessels transiting the WOS site were tracked using an automatic identification system (AIS), an average of 11 vessels per day were tracked within 10nm of the site. The most common within 10nm were passenger ships. These were mostly Orkney Ferries' South Isles service between Stromness, Hoy and Graemsay, and NorthLink Ferries' Scrabster/Stromness service. The nearest track was the NorthLink ferry *Hamnavoe* passing 1.5nm south-east of the site boundary.

A total of 21 ships crossed the site boundary over the 28 days, an average of 0.75 per day. This comprised 13 fishing vessels, 4 cargo vessels and 4 'other' ships. The 'other' ships were a fisheries patrol vessel, two sailing vessels and a platform supply ship.

The average length of vessel crossing the site was 45m with the largest vessel recorded being the UK-flagged trawler *Cornelis Vrolijk FZN* at 115m long. Inshore traffic tended to be small vessels. The average speed of the tracks crossing the site was 7.5 knots. The fastest vessel was the platform supply ship *Grampian Talisker* travelling at an average speed of 10.5 knots headed to Aberdeen.

The main destinations of the vessels crossing the site were Aberdeen, Fishing grounds, Shetland, Scalloway and Scrabster.

The WOS site area has below average shipping traffic levels. This is also the case in terms of UK waters as a whole. Within the general area, the highest density of traffic is in Stromness, Hoy Sound, Hoy Mouth and west of Hoy where the NorthLink ferries transit.

Fishing

The AIS data discussed above included a number of fishing vessel tracks. Other sources of data on fishing vessels include information collected on sightings from Marine Scotland Compliance, which monitors the fishing industry in Scottish waters through the deployment of patrol vessels and surveillance aircraft.

Throughout 2006–2010 the sightings per fishing patrol were all very low, with the highest being one vessel per six patrols in the ICES rectangle covering WOS. No fishing vessels were sighted within the WOS site itself.

The main fishing method overall was demersal trawling, accounting for approximately 56%, followed by potter/creeler (36%).

The satellite data only covers larger fishing vessels 15m long and over. The majority of the fishing vessels recorded within the West Orkney South site had speeds greater than 5 knots, indicating they were likely to be steaming on passage rather than fishing on the site.

Yachting

The RYA, supported by the Cruising Association, has identified recreational cruising routes, general sailing and racing areas in the UK. This work was based on extensive consultation and qualitative data collection from RYA and Cruising Association members, through the organisations' specialist and regional committees and through RYA-affiliated clubs. The consultation was also sent to berth holder associations and marinas.

The results of this work were published in 'Sharing the Wind: Recreational Boating in the Offshore Wind Farm Strategic Areas' and updated GIS layers were published in the Coastal Atlas.

Based on the RYA published data, the WOS site is well outside the general racing and sailing areas. There are also no cruising routes passing through the area. There is a cruising route passing to the east of the West Orkney South site. This is a medium-use[3] cruising route transiting off the west mainland of Orkney, including yachts to and from Stromness.

The Clyde Cruising Club produce *Sailing Directions and Anchorages* for various areas of Scotland. The publication covering Orkney Waters, which was compiled with local knowledge, includes information for recreational sailors in the vicinity of the site.

Particular reference is made to EMEC's Billia Croo wave test site and it recommends yachts avoid passing through this area, though passage through the approximate 600m gap between it and the coast is possible. However, it notes that shallow water devices are sometimes deployed on the coastal side of this channel. All devices, both inside and outside this area are marked and lit.

[3] Medium routes are "Popular routes on which some recreational craft will be seen at most times during summer daylight hours"

Incidents

A total of 22 incidents were reported in the area within 10nm of the boundary in the last 10 years, corresponding to an average of 2 per year.

One incident occurred within the site boundary in October 2007. This was a fishing vessel that experienced a complete power black-out after a machinery failure. A call was transmitted to the coastguard and the local lifeboat was launched to tow the vessel to the nearest port.

Royal National Lifeboat Institution (RNLI) lifeboat response data have also been reviewed for 2001–2010: 81 launches to 71 unique incidents were recorded by the RNLI in the area. There were no incidents recorded within the WOS area boundary over the 10 years analysed. The nearest incident took place to the south of the site and involved the same fishing vessel that experienced machinery failure (see previous paragraph).

5.9.2 Potential effects and mitigation

Construction

For all vessels operating in the area there will be risks during installation, removal and, to a lesser extent, maintenance, when there will be additional vessels in and around the site associated with the development, some of which may have restricted manoeuvrability. This will extend beyond the site in the case of cable-laying operations.

These construction activities introduce a collision hazard (vessel-to-vessel) as well as potential obstruction to normal routes beyond the site area. These hazards will be assessed within the full navigational risk assessment (NRA) based on the best available information on the likely areas of operation, number and types of vessels involved, base ports, duration of operations and weather limits.

Operation

During normal operations, the installations will present a potential collision hazard to vessels navigating in the area. The collision risk will be assessed in the NRA using the following inputs:

- device locations and dimensions
- vessel activity
- metocean data.

Further data will be collected on all these inputs during the NRA process.

Any changes in vessel routeing due to the development, e.g., displacement of vessels around the site, will influence the probability of vessels encountering (and colliding) with one another in the area. A comparison will be made between the current and predicted routeing and associated collision risk levels will be modelled.

There is also a potential hazard to vessels in the area should any part of the development fail and become detached/lose station. The object could pose a collision hazard to passing vessels both within and beyond the site boundary. This hazard will be assessed within the NRA taking into account measures for alerting and recovery.

Finally, the subsea cabling could present a snagging hazard to fishing gear and vessel anchors. Once the cabling options are finalised these hazards will be assessed based on the vessel activity in the area and the planned protection measures.

Cumulative effects

As well as assessing West Orkney South on an individual basis, taking into account existing developments such as EMEC Billia Croo, potential cumulative issues associated with nearby sites will be assessed.

Mitigation measures

Appropriate risk control measures will be developed during the NRA to address the risks during all phases of operation to ensure they are reduced to a level as low as reasonably practicable (ALARP).

In addition to preventive mitigation in the form of site selection, there are a large number of measures that can be applied to help control navigation risks, many of which are now standard industry practice such as:

- depiction on charts
- marking and lighting
- circulation of notices to mariners
- fisheries liaison.

Discussions will be held with national and local stakeholders, such as NLB, UKHO and OIC Marine Services, to ensure these and other measures are implemented as effectively as possible for the West Orkney South development, taking into account vessel activity.

5.9.3 Scope of work for survey and assessment

The assessment methodology will be based principally on the following:

- DECC's 'Methodology for Assessing the Marine Navigational Safety Risks of Offshore Wind Farms' (2005
- Maritime and Coastguard Agency (MCA) 'Marine Guidance Notice 371 (MGN 371) Offshore Renewable Energy Installations (OREIs) – Guidance on UK Navigational Practice, Safety and Emergency Response Issues'.

The DECC methodology provides a template for preparing the navigation risk assessment. The methodology is centred on risk controls and the feedback from risk controls into risk assessment. It requires a submission that shows that sufficient risk controls are, or will be, in place for the assessed risk to be judged as broadly acceptable or tolerable with further controls or actions. The DECC assessment methodology includes:

- defining a scope and depth of the submission proportionate to the scale of the development and the magnitude of the risk
- estimating the 'base case' level of risk
- estimating the 'future case' level of risk

- creating a hazard log
- defining risk control and creating a risk control log
- predicting 'base case with project' level of risk
- predicting 'future case with project' level of risk.

The key features of the Marine Safety Navigational Risk Assessment Methodology are risk assessment (supported by appropriate techniques and tools), creating a hazard log, defining the risk controls (in a risk control log) required to achieve a level of risk that is broadly acceptable (or tolerable with controls or actions), and preparing a submission that includes a claim, based on a reasoned argument, for a positive consent decision.

The MCA guidance MGN 371 highlights issues that need to be considered when assessing the impact on navigational safety from offshore renewable energy developments in the UK.

5.10 Terrestrial geology, hydrology and hydrogeology

5.10.1 Existing situation

Where superficial geological deposits are present on mainland Orkney, these comprise blown sand deposits of unknown thickness. Blown sand deposits typically comprise pale brown, fine-grained, uncemented sand. Although geological mapping indicates these units are present across the whole area, this has not been confirmed.

The underlying bedrock geology of western mainland Orkney is composed of units from the Devonian Middle Old Red Sandstone. The Bay of Skaill is a geological SSSI, and the first unit present at the coastline is an important fossiliferous bed known as the Sandwick Fish Bed. This unit is the reason for the SSSI status of the area and reaches a maximum thickness of 61m.

Beyond the Sandwick Fish Bed, Lower Stromness Flags are the bedrock unit outcropping at surface or subcropping beneath superficial units. Both Upper and Lower Stromness Flags comprise grey and black thinly bedded siltstones, shales and sandstones.

There are no major rivers in the vicinity of the proposed onshore cable corridor/substation route. There are a number of small streams, known locally as burns, that discharge to the sea along the west coast of mainland Orkney, which include the Burns of Streather, Eastalet, Selta, Uppadee, Langadee and Brough Burn. A small stream, the Burn of Snusgar, discharges on to the beach at the Bay of Skaill. Surface water bodies within the immediate vicinity of the onshore cable corridor route/preferred substation location include the Loch of Skaill (3km south of the Bay of Skaill), the Mill Dam of Rango (4km south-east), the Loch of Harray (*c*.5km south-east of the substation) and the Loch of Isbister (*c*.3km north-east).

5.10.2 Potential effects and mitigation

Construction works will involve the removal, movement and storage of topsoil and subsoil, and the deployment of vehicles, plant and personnel on the cable route right of way during construction. This has the potential to cause damage to soils (e.g. through

compaction or erosion) and to cause runoff of sediment-laden water to local watercourses. Accidental events during construction or maintenance, such as spillage of fuel or lubricants, also have the potential to impact on soils and surface waters.

Mitigation measures to minimise potential impacts will be identified as part of the ES and may include measures such as the following:

- All surface water run-off from construction works will be controlled to minimise the mobilisation of silts.
- Topsoil will be the last layer to be replaced and will be spread to follow the original profile of the existing land. Care will be taken to prevent the topsoil becoming compacted.
- Where possible, topsoil will be reinstated when in a suitable dry condition in order to prevent compaction problems.
- If the substation site is at risk of flooding then design floor levels can be set to ensure that flood vulnerable equipment (switchgear, control panels etc) are elevated to above a minimum safe level.
- All fuels and lubricants will be stored in accordance with best practice. Accidental spillage of fuels or chemicals will be addressed by the adherence to best practice techniques.

5.10.3 Scope of work for survey and assessment

RSK will undertake an assessment of the physical environment including information on soil and geology, surface water and groundwater abstractions, groundwater source protection zones, flooding issues and an assessment of any other sensitive receptors. The assessment will cover a 500m corridor for the proposed cable route and substation site. This will include the following key tasks:

- desk-based review of published documents: soils maps, geology maps, topographical maps, hydrogeological maps, groundwater vulnerability maps, flood zone maps, Environment Agency and local council information on contaminated land and landfill sites, BGS data on geology and boreholes along the route
- desk-based review of relevant information from a route-specific environmental database search report (Envirocheck report, or similar)
- review and identification of sensitive receptors relating to the physical environment (sites of geological interest, aquifers, water abstraction points, source protection zones, flood risk areas, etc.)
- assessment of impacts relating to aspects identified during the desk-based assessment
- identification of mitigation measures where significant impacts are potentially present
- final assessment of effects (including cumulative) on the physical environment after mitigation measures have been considered
- comment on any residual effects.

The findings of the physical assessment will be reported as part of the physical environment section of the ES. No field survey work is anticipated for this aspect, though information from the phase 1 habitat survey (see 'Terrestrial habitats and ecology' section) will provide some baseline data.

5.11 Terrestrial habitats and ecology

5.11.1 Existing situation

The area in the vicinity of the proposed landfall and onshore cable route supports several terrestrial and coastal habitats. The Orkney Local BAP for 2002–2008 included ten habitats of conservation interest, some of which may be found in or around the onshore cable corridor/landfall: coastal sand dunes, eutrophic standing waters, mesotrophic standing waters, and road verges. Orkney Local BAP priority species include the endemic Orkney vole, which is of conservation interest owing to population declines, changes in land use, and their importance to a number of species of birds of prey. Other local BAP priority species that are found on Orkney include other mammals (e.g. otter) and a number of invertebrate and plant species.

Maritime plant communities form a significant feature of the Stromness Heaths and Coasts SAC, part of which is on the coast directly landward of WOS. A primary reason for designation of this site is the 'Vegetated Sea Cliffs' habitat, characteristic of extremely exposed cliffs. The combination of high, hard acidic rock cliffs and exposure to wind and salt spray results is one of the largest examples of maritime cliff communities in Scotland.

5.11.2 Potential effects and mitigation

Potential impacts from onshore construction activities in relation to terrestrial habitats and ecology are as follows:

- damage to or mortality of protected or notable species within their habitats
- direct or indirect disturbance of protected or notable species within their habitats
- temporary or permanent loss of habitats important for species
- temporary or permanent severance of important habitat for species
- impacts on water quality through pollution
- impacts on overall species composition and diversity as a result of any of the above.

During operation of the offshore development, it is feasible that maritime plant communities on the sea cliffs may be affected by a reduction in wave energy, through a reduction in the sea-spray that is an important factor in influencing the development and extent of this plant community. No activities with the potential to significantly affect terrestrial habitats and ecology are anticipated to take place during the operation of the proposed onshore electrical grid connection, and as such the assessment of effects on terrestrial habitats and ecology during the operational phase of the onshore works has been scoped out of the EIA.

Mitigation measures to minimise potential impacts will be identified as part of the ES and may include measures such as:

- cable routing/substation siting to avoid significant environmental features as far as possible
- all scrub and tree clearance should be kept to a minimum; if clearance is necessary this should ideally be undertaken outside the bird breeding season (breeding season is typically mid-February to early August)
- a reduced working width to be considered where required
- topsoil and subsoil will be stripped and stored separately within the working width and replaced in reverse order to prevent mixing of the soils and degradation of the topsoil seed bank
- re-planting will use native species, preferably of local origin in mixtures that reflect the original species composition whilst aiming to improve species diversity where possible.

5.11.3 Scope of work for survey and assessment

Data will be obtained from a range of statutory and non-statutory organisations for a 500m corridor for the proposed cable route and substation site. This will include contact with the local biological records centre to obtain relevant species records, the local council for information on tree preservation orders (TPO), the county ecologist, local groups (as appropriate), SNH and the Wildlife Trust for details on local wildlife sites.

The ecological assessment will include a background data search (BDS), extended phase 1 habitat survey and animal walkover survey (based on a 30m survey corridor either side of the working width). The purposes of the survey are to:

- map baseline habitats within the site and determine their ecological value
- investigate the presence of protected species and invasive or injurious weeds
- identify any ecological constraints
- identify the need for any further surveys, such as detailed protected species surveys (e.g. otters, in which case SNH guidance on survey methodology and mitigation will be referred to).

This survey will involve identifying and mapping the dominant habitat types following the JNCC/SNH methodology. General details of the habitat type present, plus more specific ‘target notes’ of areas for further attention, will be noted. This will include the location of invasive and injurious weeds or noted potential evidence or suitable habitat for protected species.

Depending on the cable route selected, further detailed surveys may be required to allow a comprehensive EIA to be carried out.

As discussed in Section 5.2 the cliffs adjacent to the WOS site are designated as an SAC because of their flora, which is maintained by the spray from waves that break at the foot of the cliffs. A programme of survey work will be proposed to record the status of the flora before and after construction. Information from the wave modelling work will

be used to assist in the assessment of potential impacts. The scope of the survey will be agreed with SNH.

5.12 Onshore noise and vibration

5.12.1 Existing situation

The onshore part of the development is coastal or rural in nature, with few buildings and extensive agricultural land. As such, levels of anthropogenic noise locally are very low and consist mostly of vehicle noise.

5.12.2 Potential effects and mitigation

Potential temporary effects of construction noise may arise from:

- activities carried out on the surface along the proposed cable route (mainly earth moving and excavation)
- construction activities at the substation site including landscaping
- directional drilling activities (if required)
- heavy goods vehicles servicing the proposed cable corridor and substation, delivering or removing materials (including spoil and fill) and plant.

There are unlikely to be any operational effects relating to operational or maintenance traffic but operational noise effects may arise from the operation of the proposed substation. An assessment would be required to determine whether noise emissions from the permanent substation would be likely to have significant effect on nearby sensitive receptors.

Mitigation measures to minimise potential impacts will be identified as part of the ES and may include measures such as:

- appropriate hours of noisy work (e.g. heavy machinery, demolition and piling) in areas located near residential properties would be proposed and agreed with the local authority
- best practice measures for the control and mitigation of noise impacts will be incorporated into a noise management plan for construction. These may include:
    - site vehicles should not be over revved or left with engines idling in close proximity to residential neighbours
    - all plant and machinery to be properly maintained and silenced in accordance with manufacturer's instructions
    - auxiliary equipment to be shut down when not in use and sited with due consideration to proximity of neighbours.

5.12.3 Scope of work for survey and assessment

During the cable route construction phase, construction noise will potentially affect nearby receptors/locations. The noise will derive from within the working width (i.e. from topsoil stripping, drilling, trenching and reinstatement). Noise levels from construction

activities will be predicted using the sound/power levels and methodology described in BS 5228: 1997 'Noise and vibration control on construction and open sites'. Predicted levels of noise from construction activities will be assessed with regard to the guidance in BS 5228, additional guideline on noise levels set out in BS 8233 and the World Health Organisation (WHO) community noise guidelines.

Operation of the substation will be assessed in accordance with BS 4142 'Method for rating industrial noise affecting mixed residential and industrial areas' and according to the guideline noise levels set out in BS 8233 and the WHO community noise guidelines.

5.13 Onshore traffic and transport

5.13.1 Existing situation

The proposed landfall at South Vestra Fiold is located close to the cliffs and is accessed using a track from the B9056, a single-track lane, which is linked to the main road network in Orkney and connects to the main Stromness road (A967) at Voy; at Hestwall (via the B9055 at Aith); via the B9057 at Kierfiold House; and at Birsay, near the Loch of Board house. Road vehicles to Orkney arrive by ferry from the Scottish mainland from Scrabster (to Stromness) or Aberdeen (to Kirkwall) or from Lerwick (Shetland) into Kirkwall.

If the preferred substation site at South Vestra Fiold is used, it is unlikely that the onshore cable route will cross the B9056. However, access may be restricted on the small lane leading to the site from the B9056.

5.13.2 Potential effects and mitigation

Construction works at the proposed landfall, for the onshore cable route, and at the proposed substation will require a number of vehicles (including specialist plant and large vehicles), to be deployed, some of which will be sourced from outside of the Orkneys. Although deemed unlikely, it is possible that installation of the onshore cable will require a road/track crossing and therefore may result in temporary closures or diversions. In addition, there will be an increase in daily traffic to and from these sites during construction by site personnel. There is therefore the potential for temporary impacts, which may include congestion of minor roads, especially during movement of plant etc. if undertaken during the peak tourist season; increased congestion and traffic for visitors to the Skara Brae tourist attraction; increased journey times due to traffic measures, diversions or congestion; increased traffic disturbance at dwellings near to roads; and increased demand for ferry spaces by construction personnel/contractors (and resultant lack of space for locals and tourist vehicles).

Mitigation measures to minimise potential impacts will be identified as part of the ES and may include measures such as limiting the number of vehicle movements by using traffic-efficient means of transport of site personnel (e.g. minibuses); limiting movement of slow/large plant to outside peak hours; minimising the need for any measures such as diversions or temporary traffic lights; and sourcing vehicles and plant from Orkney.

5.13.3 *Scope of work for survey and assessment*

The traffic and transport assessment will be concentrated on road traffic associated with the construction of the onshore elements of the WOS project, i.e. the assessment excludes the supply of personnel and materials to ports elsewhere serving the offshore construction project.

The traffic and transport assessment will comprise investigation into the likely traffic impact of construction of the onshore cable route and substation, taking into account existing traffic flows, heavy load requirements and local constraints to movements, particularly for any abnormal loads. Construction access routes will be identified and highway improvements, either temporary or permanent legacies, will be put forward where necessary to accommodate increased levels of traffic. The deliverables will include a construction traffic access route study and a traffic and transport section for inclusion within the ES. No traffic monitoring is proposed.

No activities with the potential to significantly impact on traffic are anticipated to take place during the operation of the proposed onshore electrical grid connection, and as such the assessment of effects on traffic during the operational phase has been scoped out of the EIA.

5.14 Other sea and land users

5.14.1 *Existing situation*

In addition to the WOS and WOMS licence blocks (leased to E.ON), there are three other commercial wave power developments on the west coast of mainland Orkney undergoing the consents process (Figure 5.7). The first is Marwick Head (50MW), leased to Scottish Power Renewables (planning to use Pelamis P2 devices) and ~2km offshore of Marwick Head, and ~6km to the north of WOS (~1km from the northern edge of WOMS). The second is Brough Head (200MW), which is leased to Aquamarine Power and Scottish & Southern Energy (SSE) Renewables. This is a coastal site running from Costa Head in the north to Neban Point, which is directly landward of WOS. Thirdly, the Costa Head licence area (200MW) lies ~3km offshore of the north-western coast of mainland Orkney; this is leased to SSE Renewables. Approximately 50km to the south-west of WOS, off the coast of mainland Scotland, is the Farr Point wave energy area. This is under lease (up to 50MW) to Ocean Power Delivery, which plans to use Pelamis P2 devices.

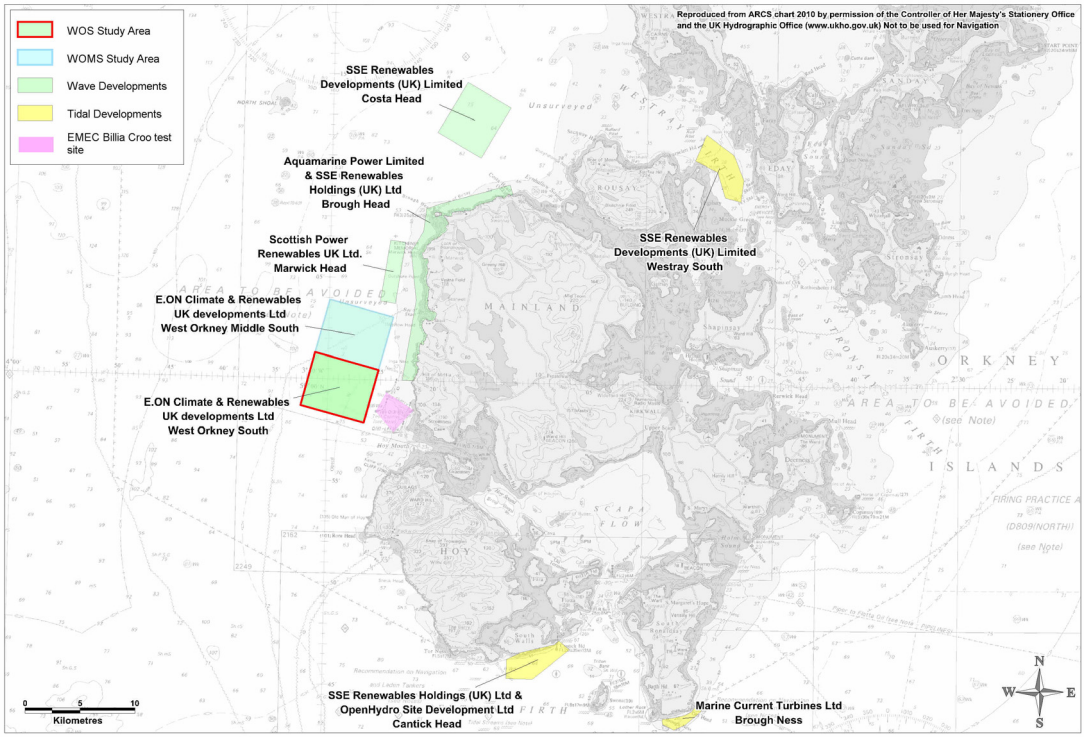


Figure 5.7: Wave and tidal licence areas around Orkney

All tidal energy sites in Orkney and Pentland Firth are at least 20km away from and include Westray South (SSE Renewables, 200MW), Cantick Head (Cantick Head Tidal Development Ltd, 200MW), Brough Ness (SeaGeneration, 100MW), Inner Sound (MayGen, 400MW) and Ness of Duncansby (Scottish Power Renewables, 100MW).

The landward edge of WOS is ~2–3km from waters used by the Billia Croo site of EMEC, which is used for the initial testing and monitoring of wave energy devices. The site has five cabled offshore test berths in up to 70m of water. A shallow water berth situated close to the substation onshore is currently under construction. As a test site, the exact composition of devices at any one time varies. However, a brief summary of some recent, current and planned devices at Billia Croo includes the following:

- E.ON is currently testing a single 750kW Pelamis P2 device. This arrived in July 2010, and is kept at Lyness when not deployed on the wave test site. Scottish Power Renewables will be deploying a second Pelamis P2 device on an adjacent berth.
- Aquamarine Power Ltd operates “Oyster” devices, which use wave energy to pump high-pressure water to an onshore hydro-electric turbine. A small array of three devices is in the process of being consented and constructed. Each Oyster 2 machine will have a generating capacity of 800kW and will measure 26m wide by 16m high.

- Wello Oy will deploy a Penguin device early in 2012. This device captures rotational energy and is approximately 30m in length and 1600 tonnes; it is expected to produce between 0.5–1MW of power.
- Seatricity will deploy devices at a berth in 2012. The technology consists of multiple floats riding the waves and pumping pressurised seawater ashore to drive an onshore turbine.

The Bay of Skaill was the site for landfall of the 'Northern Lights' telecommunications cable from Dunnet Head on the north coast of Scotland in 2008, and the offshore cable route passes through the north-west corner of West Orkney South. There are no military exercise areas near WOS, with the closest being off the east coast of the Orkneys. Similarly, the only oil or gas infrastructure is an oil pipeline from the North Sea to the terminal at Flotta in Scapa Flow.

Waters around the Orkneys are popular for water sports. The Royal Yachting Association classes the area around the west coast of mainland Orkney as medium and light cruising routes (Baxter et al., 2011), and the Bay of Skaill is particularly important for surfing and windsurfing, but also for kite surfing and kayaking (Visit Orkney, 2011). Trout fishing, including fishing for sea trout, is popular in the Orkneys, and catches have risen steadily since around 2005 (Orkney Trout Fishing Association, 2011). There are no designated bathing waters in Orkney. Diving is popular in Scapa Flow and on the west coast in and around Hoy Mouth (between Hoy and Mainland) (Baxter et al., 2011).

The majority of the land on the onshore part of the cable route is used for agriculture (grazing and arable). There are a number of footpaths around Orkney, which include 'core paths' that need consideration with regard to planning developments. One of these is on mainland Orkney and goes from Stromness along the cliff tops to the Bay of Skaill and beyond (Orkney Council, 2011).

The south-western part of mainland Orkney, including WOS, is under a Ministry of Defence (MOD) tactical flying exercise area.

5.14.2 Potential effects and mitigation

Construction works in the nearshore environment, at the landfall and onshore have the potential to temporarily exclude or limit access to some recreational users (e.g. yachts, walkers).

During operation, no activities with the potential to significantly impact on land use and recreation are anticipated to take place, and as such the assessment of recreational impacts during this phase have been scoped out of the EIA. There is a potential for waves of reduced energy of changes period reaching the shore of surfing beaches, which could affect the quality of the waves for surfing. Such potential changes will be considered in the EIA.

5.14.3 Scope of work for survey and assessment

A desk-based review will be performed for this section; it is considered unlikely that any direct survey work will be required, any impacts on the enjoyment of the landscape by visitors will be covered in the landscape and visual impacts section of the ES. There may be survey work involved for that study. The desk-based assessment of the

recreational impacts will include identification of key resources, review of the relevant policies and plans, and key sensitivities (e.g. seasonal). Consultation may be required (e.g. BT cable crossing; surfing interest groups)

5.15 Seascape, landscape and visual impact assessment

5.15.1 Existing situation

Seascape/landscape character

WOS is immediately seaward of the Hoy and West Mainland National Scenic Area. The study area is located in Seascape Unit 31: West Orkney, as identified within the SNH report 'An assessment of the sensitivity and capacity of the Scottish seascape in relation to wind farms'. The key characteristics of this seascape unit are listed as follows:

- high cliffs are the defining characteristic of this seascape, backed by sparsely settled coastal hills
- small bays and low-lying coastal basins interrupt the continuity of high cliffs and these are the focus for settlement
- number of landmark features occur along the coast and include arches, geos, gloups and stacks
- archaeological features are also present in the area.

This report identifies seascape units at a strategic scale, and the seascape, landscape and visual impact assessment (SLVIA) will refine this work to examine specific characteristics of the coast of the study area and their sensitivity in relation to wave power technology. The SLVIA will also take account of the Orkney Landscape Character Assessment (Report No. 100 - Land Use Consultants, published by SNH in 1998) and key landscape character types identified within the study area such as the Cliff Landscape and Inclined Coastal Pastures.

Designations

With regard to landscape designations the Hoy and West Mainland National Scenic Area (NSA) is located within 2km of the wave power site (Figure 5.5). The special qualities of this NSA are identified as:

- a palimpsest of geology, topography, archaeology and land use
- an archaeological landscape of World Heritage Status
- spectacular coastal scenery
- sandstone and flagstone as an essence of Orkney
- a long settled and productive land and sea
- contrast between fertile farmland and unimproved moorland
- landscape of contrasting curves and lines
- land and water in constantly changing combinations under the open sky
- high hills of Hoy
- townscape of Stromness, its setting and link with the sea
- traditional buildings and crofting patterns of Rackwick.

A full assessment of the potential effects of the scheme on this landscape designation and other landscape designations within the study area (including Historic Gardens and Designed Landscapes such as Skaill House) will be undertaken as part of the SLVIA. The effects on the Heart of Neolithic Orkney World Heritage Site will be considered as part of the cultural heritage assessment.

Visual context

Outside of Stromness the coastal edge of Hoy and mainland Orkney within the study area is relatively undeveloped in nature. Views of the scheme from Stromness are not anticipated, however, there are a number of scattered individual properties and farmsteads along the coastal edge that may have views towards the site. Other key land-based and coastal-edge receptors are likely to include recreational walkers using cliff top walks (such as visiting the Old Man of Hoy) and small bays (Bay of Skaill and Warebeth); visiting sites of historic interest; and climbing hills within the study area (such as Hill of Miffia and Cuilags). Key sea-based receptors within the study area include the Scrabster to Stromness Ferry (an important communication route) and recreational boaters/fishermen using the waters off the west coast of Orkney.

5.15.2 Potential effects and mitigation

The key seascape, landscape and visual issues that will be considered as part of the SLVIA are discussed below.

Potential impacts on landscape character

The demonstration phase scheme will introduce a substation into the landscape linked to the wave power devices by an underground cable. Temporary landscape impacts associated with the construction of the underground cable and its restoration period are also anticipated.

The commercial phase scheme is likely to require a larger substation, which may be located outside the study area, and possibly on the North Scottish Coast. Temporary and permanent landscape impacts are anticipated with this and the connection to the wave power devices.

Potential impacts on seascape character

The wave power schemes will introduce temporary and permanent man-made features into the sea. In addition, their construction is likely to introduce increased boat traffic, which could temporarily alter the character of the seascape.

Potential impacts on visual amenity

The schemes will introduce temporary and permanent man-made features into views of the area. This will include the introduction of groups of wave power devices into areas of open water that have the potential to draw the eye and become a point of focus within the view.

Potential mitigation

To minimise potential landscape, seascape and visual effects the following mitigation measures will be considered as part of the SLVIA process, though it is appreciated that some elements may require specific colouration to comply with marine safety codes for navigators:

- colour, finish and any lighting of the wave power devices
- organisation and layout of the wave power devices
- location, design and potential for screening of the substation
- landfall and route of underground cable, avoiding sensitive landscape features as far as possible.

5.15.3 Scope of work for survey and assessment

The SLVIA will be undertaken using standard methodology, in accordance with the *Guidelines for the Landscape and Visual Impact Assessment*, produced by the Landscape Institute and the Institute of Environmental Management and Assessment (2002). The SLVIA will also be undertaken in accordance with the methods outlined in the following best practice guidance:

- An assessment of the sensitivity and capacity of the Scottish seascape in relation to wind farms (SNH, 2005)
- Guidance on landscape/seascape capacity for aquaculture. Natural Heritage Management (SNH, 2008)
- Marine Aquaculture and the Landscape: The siting and designing of marine aquaculture developments in the landscape. Alison Grant for SNH, The Crown Estate and Scottish Quality Salmon (2002)
- Landscape Character Assessment: Guidance for England and Scotland, published by Scottish Natural Heritage and the Countryside Agency (2002)
- Techniques and Criteria for Judging Capacity and Sensitivity. Topic Paper 6, published by Scottish Natural Heritage and the Countryside Agency (2004)
- Visual Representation of Wind Farms, Good Practice Guidance (SNH, 2007)
- Guidance: Cumulative Effect of Wind Farms Version 2 (SNH, 2005).

In line with this guidance, there are six key stages to the SLVIA process:

- analysis and recording of the existing seascape/landscape character and visual context of the study area through desk- and field-based appraisal
- appreciation of the nature, forms and features of the proposed scheme
- assessment of the sensitivity of the existing seascape/landscape and identified visual receptors to change and the magnitude of change likely to result from implementation of the proposed scheme
- evaluation of the significance of the changes identified
- identification of mitigation measures appropriate to the proposed scheme and the receiving seascape/landscape

- assessment of the residual effects on seascape/ landscape character and visual amenity.

Outputs from the SLVIA process will include a zone of theoretical visibility map (ZTV), which will help to inform the extents of the study area. In addition, photomontages from key land-based, sea-based and coastal receptors will demonstrate post construction views of the scheme.

5.16 Cumulative impacts

5.16.1 Existing situation

Alongside the development of WOS, a number of other projects are planned for the same area, including several other renewable energy proposals.

5.16.2 Potential effects and mitigation

Cumulative impacts are those that may result from the combined or incremental effects of past, present or future activities. While a single activity may itself result in an insignificant impact, it may, when combined with other impacts (significant or insignificant) in the same geographical area and occurring at the same time, result in a cumulative impact that is significant.

Consequential, or secondary, impacts are those resulting from additional developments that are not part of the proposal, but which may reasonably be expected to result from the proposed development.

5.16.3 Scope of work for survey and assessment

No direct survey work, but collation of existing environmental information for adjacent developments will be necessary. Assessment will be based on impacts on various environmental components as identified in the WOS ES, in combination with those impacts identified for the same components in ESs for adjacent developments. It is understood that The Crown Estate will fund a cumulative impact assessment for those developments in the Pentland Firth and Orkney waters. The results will be used to inform the cumulative assessment section of the WOS EIA.

For the offshore elements of the project, this will include consideration of the following activities:

- other renewable energy projects
- commercial fisheries activity
- subsea cables and pipelines
- commercial and recreational navigation
- port/harbour development.

Cumulative effects for the onshore elements of the WOS development will also be considered; other types of project that could provide combined effects include:

- windfarms

- roads
- housing.

While there is limited potential for cumulative impacts from onshore elements of Phase 1, they will still be thoroughly investigated. The unknown nature of the landfall and substation location for Phase 2 dictates that the potential for cumulative effects for that stage cannot be estimated at the current stage of the project.

5.17 Environmental management

This section will pull together the environmental mitigation measures that have been included in the ES into one location and outline the environmental management plan (EMP) that will be produced for the construction and operation of the project. This is effectively a list of mitigation measures to which the ES commits the developer.

One issue that has not been raised in the above sections is the introduction of alien species to the Orkneys. The vessels and other equipment that are used to tow and install the devices and cable may well have travelled from other parts of the world, so preventative measures will be used to ensure that non-native species are not introduced to the Orkneys ecosystem.

6 WAY FORWARD

6.1 Environmental impact assessment

This scoping report identifies the proposed way forward for the assessment of the likely environmental effects arising from the proposed wave power development at West Orkney South. Table 6.1 presents a summary of the environmental features that have the greatest potential to suffer impacts, what those impacts might be and the proposed further work that will be carried out to establish the magnitude of the impacts.

Table 6.1: Summary of proposed surveys and assessments to inform the EIA

Topic	Potential issues	Surveys and investigations
Coastal and sedimentary geology and processes	Reduction in wave energy from presence of devices	Hydrodynamic modelling of waves. If results suggest significant change, further work to be performed on currents/sediments.
	Change in currents and sediment processes from the presence of devices and/or mooring blocks	No surveys proposed.
Designated sites and conservation interests (and potential for AA)	Effects on breeding seabirds (physical interactions, accidental events)	Analysis of EMEC cliff-top observations
	Effects on seals (physical interactions)	Analysis of EMEC cliff-top observations
	Effects on maritime vegetation (reduction in wave energy)	Qualitative assessment of wave modelling results. No survey work proposed
	Effects on lagoons and lochs (siltation, pollution)	No survey work proposed
Benthic ecology	Physical effects (mooring block placement; cable burial)	Survey (drop-down or ROV photography) to record biotopes at proposed mooring points and cable route location
		Phase 1 intertidal survey of intertidal landfall
	Reduction in wave energy from presence of device	Continuation of ICIT intertidal community monitoring
Fish and shellfish	Change in distribution/behaviour/ migration (presence of devices/mooring)	Desk-based assessment, including particular reference to both diadromous species and electro-sensitive species. If data gaps require surveys, to be discussed MSS/SNH/fisheries interests

Topic	Potential issues	Surveys and investigations
	Impacts to spawning/nursery habitat (mooring blocks/cable burial) Changes in behaviour/distribution of electro-sensitive species (EMF)	
Birds	Change in behaviour (presence of devices/ construction vessels) Damage from pollutants (Accidental events) Impacts to ground-nesting birds (onshore construction)	Analysis of aerial survey data Analysis of EMEC cliff-top observation data Desk-based assessment Bird surveys as appropriate
Marine mammals (inc. other megafauna)	Change in behaviour (presence of devices/ construction vessels) Physical interactions (devices, mooring or construction vessels)	Desk-based assessment of existing data Analysis of aerial survey data Analysis of EMEC cliff-top observation data Desk-based assessment of sub-sea noise
Archaeology and cultural heritage	Damage to resources (offshore and onshore construction) Visual impacts on setting of resources (mostly operation of devices/substation)	Consultation Desk-based assessment of existing records (including offshore geophysical data) Field reconnaissance survey (onshore) Landscape/visual assessment (see Section 5.15)
Commercial fisheries and aquaculture	Displacement of fishers from traditional grounds and steaming routes (exclusion zone during construction and operation) Changes in distribution/ behaviour of fishery species Navigational safety (presence of device, moorings and cable)	Consultation with fishermen's groups Desk-based assessment. Desk-based assessment. If data gaps require surveys, to be discussed MSS/SNH/fisheries interests Input from navigational risk assessment (Section 5.9)

Topic	Potential issues	Surveys and investigations
Navigation	Navigational safety (presence of device, moorings and cable)	Navigational risk assessment.
Terrestrial geology and hydrology	Damage to soils, surface waters and groundwater (onshore construction)	Desk-based assessment
Terrestrial habitats and ecology	Impacts on habitats and species (construction activities) Alteration of maritime spray-maintained vegetation communities (reduction in onshore wave energy)	Local records searches. Phase 1 habitat survey; specialist surveys as required Qualitative assessment of wave modelling results
Onshore noise and vibration	Noise and vibration, including vehicles movements (cable and substation construction) Noise and vibration (substation operation)	Desk-based assessment Desk-based assessment
Onshore traffic and transport	Increase in vehicle traffic and demand for parking/ferry services (construction)	Desk-based assessment
Other sea and land users	Displacement (e.g. presence of devices, exclusion zone, landfall/onshore construction) of normal activity	Desk-based assessment Input from wave modelling (re: surfing)
Seascape, landscape and visual impact assessment	Temporary (construction activities) or permanent (substation/devices) impacts on visual amenity and sea/landscape character.	Desk-based assessment of publicly available data. Site visit to establish baseline and appraise the cable route and potential substation location(s) and settings in sea/landscape and visual context

A number of industry-led studies will also contribute to an understanding of impacts resulting from the construction, operation and decommissioning of marine renewable

devices. These include studies on benthos, marine mammals, birds and underwater noise, which are being carried out under the umbrella of the 'Hebridean'[4] project.

6.2 Appropriate assessment

There will need to be a screening assessment for marine SACs and SPAs to determine the potential for significant impacts. If an AA is needed, the information necessary for the competent authority to perform an AA will be included in the ES and signposted as necessary to enable easy location within that document.

6.3 Consultation

Consultations with relevant authorities, organisations and stakeholders will be undertaken throughout the assessment and site design process, and this has already started as part of the scoping process. The consultations will serve three main purposes as identified in Section 4.5:

- establish a sufficiently robust environmental baseline of the development and its surroundings
- identify, early in the process, specific concerns and issues relating to the development in order that they can be discussed and accounted for appropriately in the design and assessment
- ensure the appropriate involvement of the public and authorities in the assessment and design process.

6.4 Returning your comments

E.ON seeks a formal scoping opinion for the proposed development to inform any ensuing EIA. All responses should be sent directly to the following address:

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e-mail: joanne.frost@eon-engineering.com

[4] The Hebridean Marine Energy Futures project is an industry led knowledge exchange project – backed by the Scottish Funding Council and supported various industry leading companies including E.ON and Pelamis, among others

Should any queries arise in relation to the contents of this report or the proposed scheme, the same contact details should be used accordingly.

List of consultees receiving report

- Scottish Natural Heritage, Kirkwall
- Scottish Environment Protection Agency, Kirkwall
- Orkney Islands Council, Kirkwall
- Orkney Renewable Energy Forum
- Orkney Archaeological Trust
- European Marine Energy Centre, Stromness
- Orkney Harbours Department, Scapa
- ICIT, Stromness
- RSPB, Stromness
- Orkney Enterprise, Kirkwall
- Visit Scotland, Kirkwall

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UK Coastal Atlas of Recreational Boating; Recreational Cruising Routes, Sailing and Racing Areas around the UK Coast; Second Edition by RYA; Supported by Trinity House.

UKHO. Chart 2249 – Orkney Islands- Western Sheet

Visit Orkney (2011), http://www.visitorkney.com/brochure/get_active.pdf/.

Appendix 1: Proposed table of contents for environmental statement

Proposed contents list for West Orkney South Environmental Statement

Non-Technical Summary
Section 1 - Introduction
Section 2 – Project Description
Section 3 – Consideration of Alternatives
Section 4 - Planning Policy Context
Section 5 - EIA Methodology
Section 6 –Coastal and sedimentary geology processes
Section 7 – Designated sites and conservation interests
Section 8 – Benthic ecology
Section 9 – Fish and shellfish
Section 10 – Birds
Section 11 – Marine mammals (and other megafauna)
Section 12 – Archaeology and cultural heritage
Section 13 – Commercial fisheries and aquaculture
Section 14 – Marine navigation
Section 15 - Terrestrial geology, hydrology and hydrogeology
Section 16 - Terrestrial habitats and ecology
Section 17 - Onshore noise and vibration
Section 18 – Onshore traffic and transport
Section 19 – Other sea and land users
Section 20 - Seascape, landscape and visual impact assessment
Section 21 – Cumulative & Secondary Impacts and Impact Interactions
Section 22 - Environmental Management
Appendices

Appendix 2: Preliminary hazard assessment

Shipping and Navigation - Preliminary Hazard Analysis

West Orkney South Wave Project

(Technical Note)

Prepared by:	Anatec Limited
Presented to:	E.ON Climate & Renewables UK Ltd
Date:	5 August 2011
Revision No.:	00
Ref.:	A2678-EON-PHA-1

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This study has been carried out by Anatec Ltd on behalf of E.ON Climate & Renewables UK 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.

TABLE OF CONTENTS

1. Introduction

1.1 Background

Anatec were commissioned by E.ON Climate & Renewables UK Ltd to carry out a shipping and navigation Preliminary Hazard Analysis (PHA) of the proposed West Orkney South (WOS) Wave project off the west coast of the Orkney mainland, approximately 1.6nm west of Inga Ness.

A chart overview of the area is in Figure 1.1.

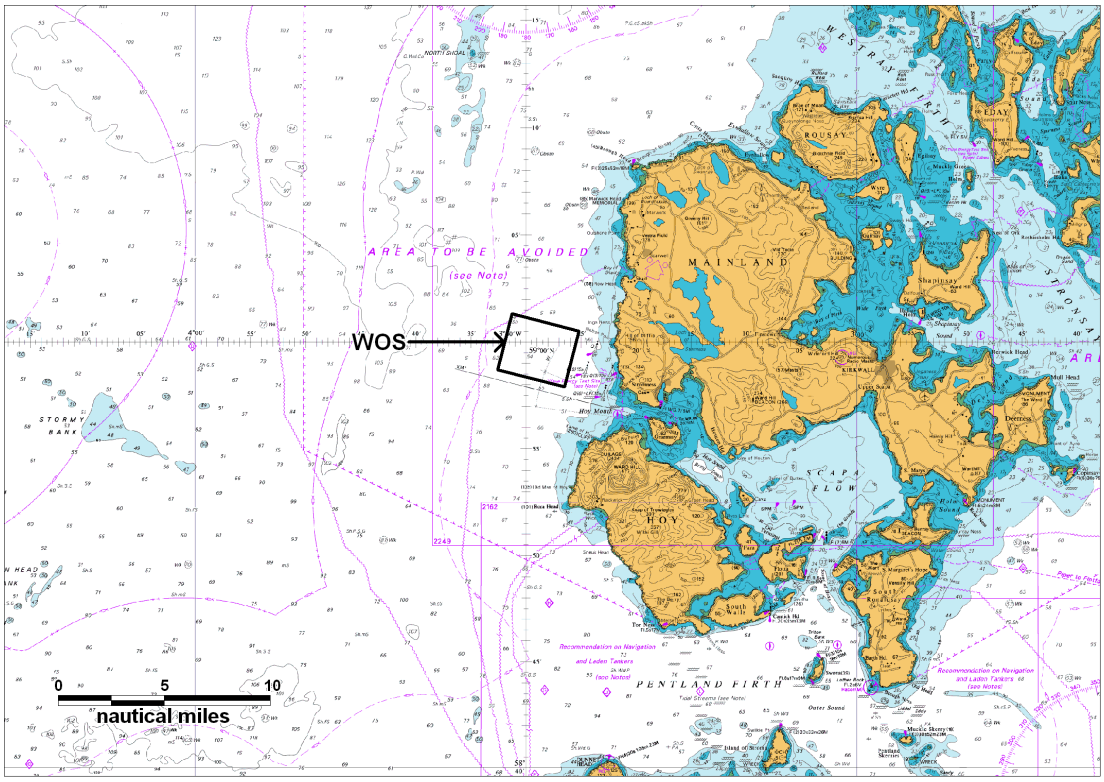

Figure 1.1 General Chart Overview of the West Orkney South Wave Project

1.2 Objectives

The objectives of the work were as follows:

- Review shipping, fishing and recreational vessel activities
- Review historical maritime incidents in the area
- Identify key issues and hazards
- Identify and consult key stakeholders
- Perform a Preliminary Hazard Analysis
- Outline the methodology and scope of work required for the Navigation Risk Assessment

1.3 Abbreviations

The following abbreviations are used in this report.

AHT	-	Anchor Handling Tug
AIS	-	Automatic Identification System
ALARP	-	As Low As Reasonably Practicable
ATBA	-	Area to be Avoided
DfT	-	Department for Transport
EMEC	-	European Marine Energy Centre
GRT	-	Gross Registered Tonnes
GT	-	Gross Tonnes
ICES	-	International Council for the Exploration of the Seas
IALA	-	International Association of Lighthouse Authorities
IMO	-	International Maritime Organisation
km	-	Kilometre
MAIB	-	Marine Accident Investigation Branch
MCA	-	Maritime and Coastguard Agency
MEHRA	-	Marine Environmental High Risk Area
MMO	-	Marine Management Organisation
MW	-	Mega Watts
nm	-	Nautical Mile (1,852 metres)
NRA	-	Navigation Risk Assessment
ODBOA	-	Orkney Dive Boat Operator's Association
OFA	-	Orkney Fisheries Association
OFS	-	Orkney Fishermen's Society
OIC	-	Orkney Islands Council
OREI	-	Offshore Renewable Energy Installations
PHA	-	Preliminary Hazard Analysis
PLN	-	Port Letter Number
RNLI	-	Royal National Lifeboat Institution
RYA	-	Royal Yachting Association
UKHO	-	United Kingdom Hydrographic Office
VMS	-	Vessel Monitoring Service
VTS	-	Vessel Traffic Services
WGS 84	-	World Geodetic System (1984)
WOS	-	West Orkney South

2. Description of Project

2.1 Introduction

This section presents details on the location of the West Orkney South project and the planned wave technology to be used.

2.2 Site Boundary

The coordinates of the area are presented in Table 2.1.

Table 2.1 Coordinates of West Orkney South Site Boundary (WGS 84)

Point	Latitude	Longitude
1	59° 01' 19.24" N	003° 31' 21.01" W
2	59° 00' 30.27" N	003° 25' 17.04" W
3	58° 57' 53.67" N	003° 26' 35.52" W
4	58° 58' 42.63" N	003° 32' 39.13" W

A chart overview of the area is presented in Figure 2.1. The total area is approximately 8.7nm^2 (30km^2).

The charted water depths within the site area vary between 63 and 73 metres (depths are reduced to chart datum which is approximately the level of lowest astronomical tide).

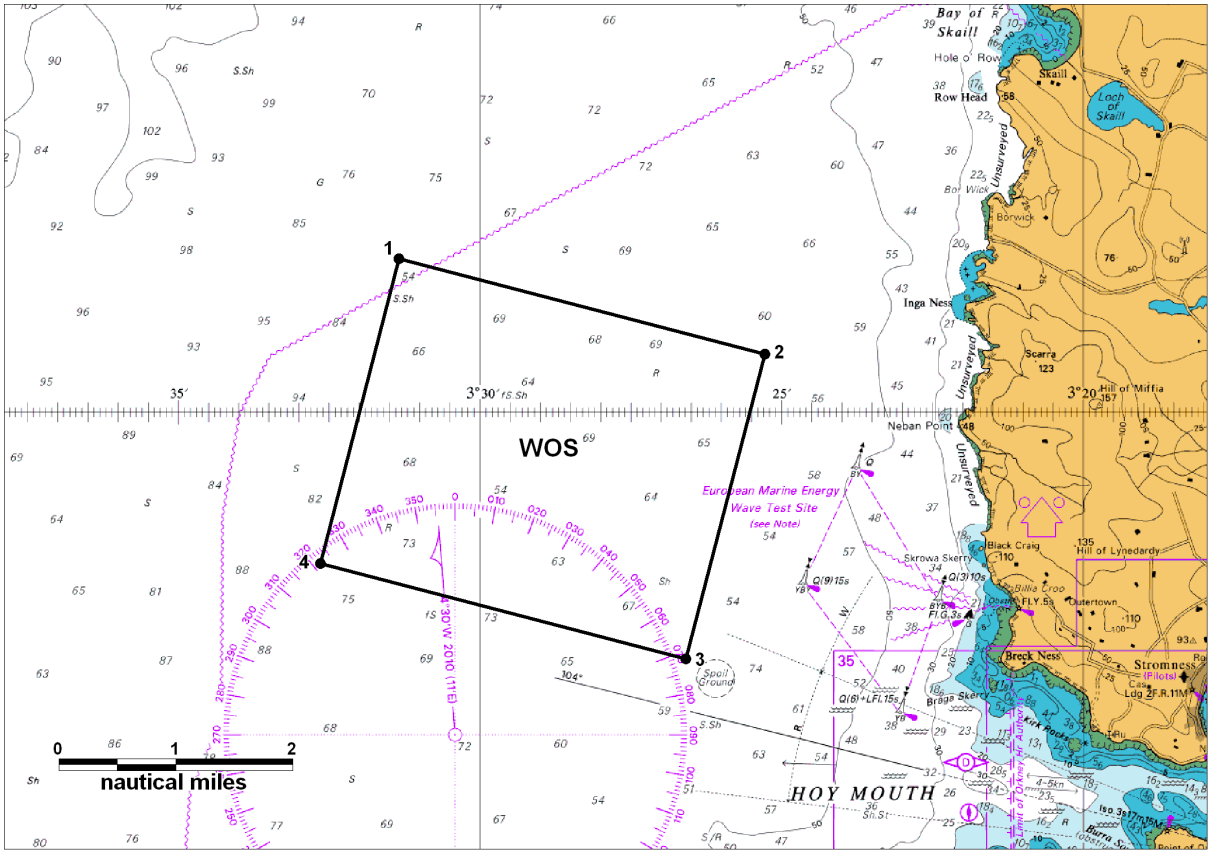

Figure 2.1 Chart Overview of West Orkney South Area

2.3 Technology Details

The West Orkney South site will be developed with Pelamis P2 wave energy converters. The first phase is planned to be 12 devices of 9MW power for up to 7 years and there is an option to develop an array of 50MW for a period of up to 25 years based on the agreement for lease with The Crown Estate.

The P2 is a semi-submerged, articulated structure composed of cylindrical sections linked by hinged joints. The wave induced motion of these joints is resisted by hydraulic rams, which pump high-pressure fluid through hydraulic motors via smoothing accumulators. The hydraulic motors drive electrical generators to produce electricity. Power from all the joints is fed down a single umbilical cable to a junction on the sea bed. Several devices can be connected together and linked to shore through a single seabed cable.

Current production machines are 180m long and 4m in diameter with 4 power conversion modules per machine. Each machine is rated at 750kW.

Some of the key features of the Pelamis P2 devices from a navigational perspective are as follows:

- Catenary mooring system with 3 anchors.

- Machine weathervanes and orientates into predominant swell direction.
- Designed for water depths > 50m.
- Primary anchor choice is embedment (where sedimentary cover allows).
- Machines in a row are electrically interconnected. Interconnectors are installed in the mid-water column with use of cable buoys and small weights.
- Installation can be carried out by a range of vessels but likely to be Anchor Handling Tug (AHT) and multicats.
- Machines are monitored and controlled from an onshore control centre. A potential fault will raise an alarm, including loss of station keeping which is monitored for each machine with GPS tracking.
- There is no manned maintenance at sea. Devices are recovered to harbour or sheltered water facilities for all inspection, maintenance and repair work.

Illustrations of the P2 device and mooring layout are presented below. More details are provided in the Scoping Report.

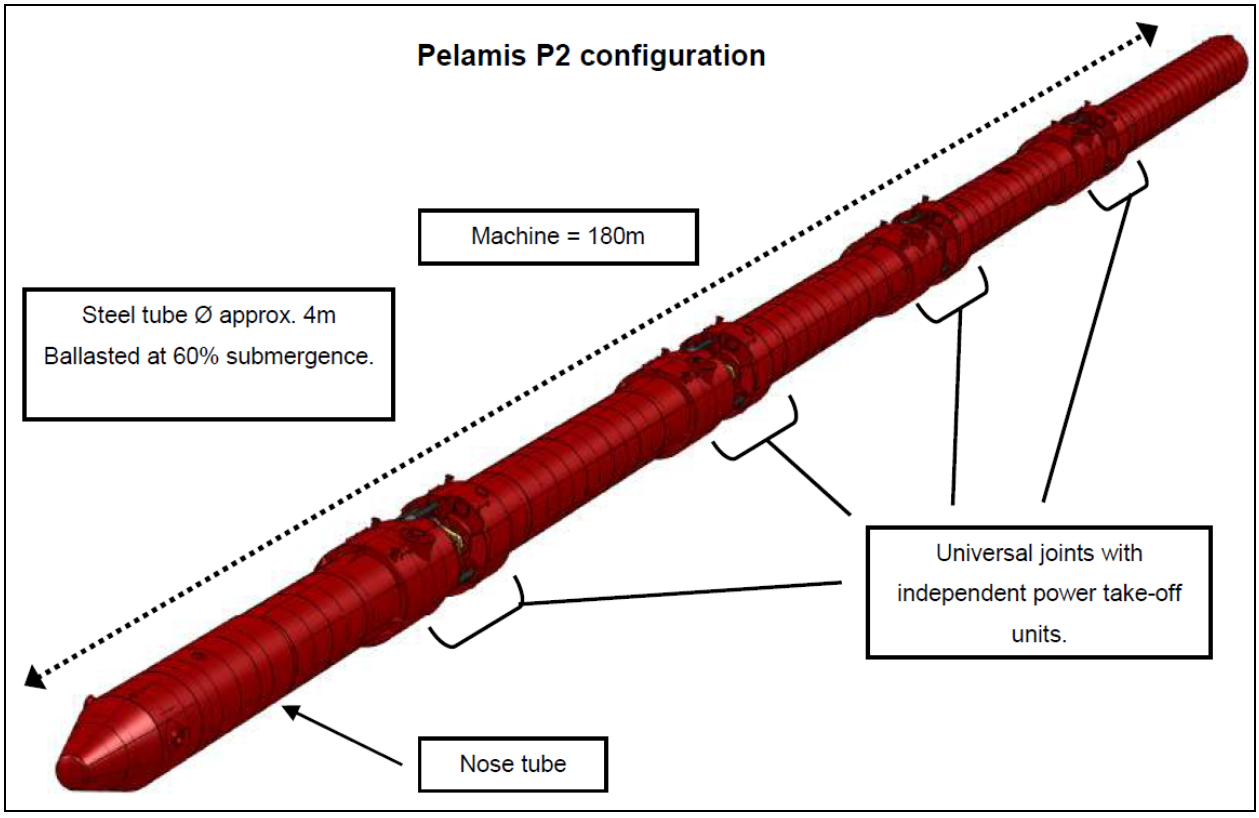

Figure 2.2 Pelamis P2

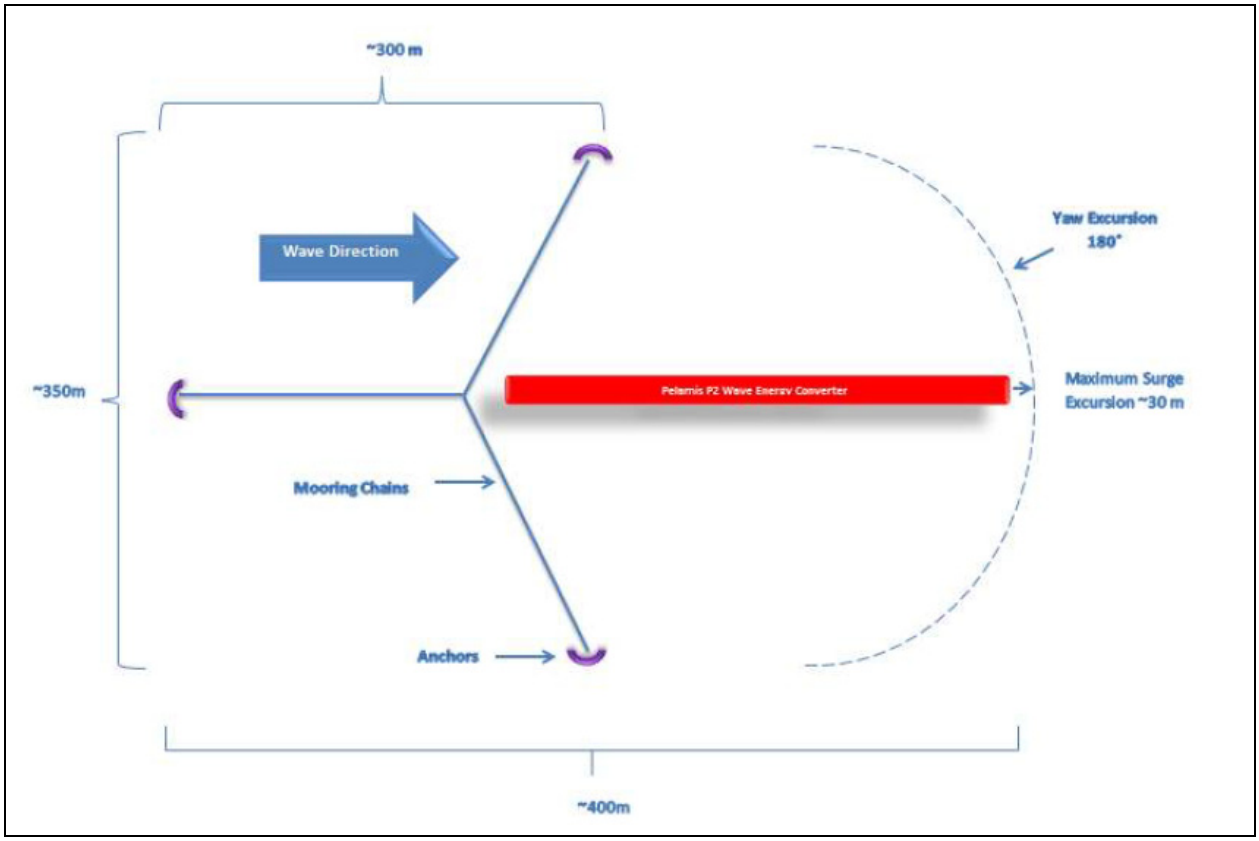

Figure 2.3 Mooring System Footprint

An indicative layout at the West Orkney South site for a full commercial array of 64 devices is presented in Figure 2.4. It should be noted this is a draft layout with the spacing between columns arbitrarily set to 1800m (10 x length).

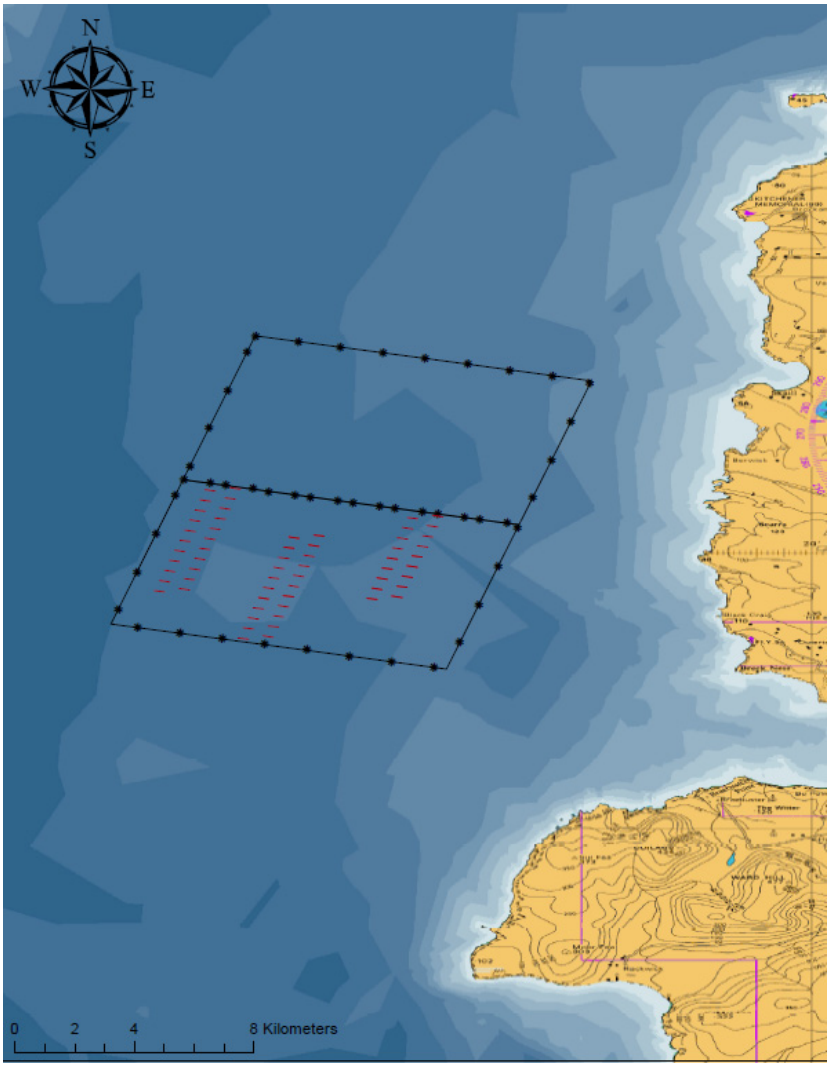

Figure 2.4 Indicative Layout of West Orkney South Area

2.4 Cables

The options for the route along which the subsea cable(s) connecting the project to onshore facilities takes, as well as the cable protection and shore landings, will be further defined following detailed project design work and the results of site and cable route surveying.

The cable will be installed by an external contractor and will require the use of a specialist cable laying vessel.

The cable(s) will most likely be less than 10 cm in diameter, but will be fully armoured for protection and for mass. They will be laid on the surface and may be subsequently buried or ploughed into the seabed. Where any cable has to cross bedrock additional crushed rock or prefabricated protection systems may be required.

More details are provided in the Scoping Report.

3. Navigational Features

The West Orkney South site is located off the west coast of the Orkney mainland.

The waters around Orkney (excluding the Pentland Firth and Scapa Flow) are within an IMO-adopted Area to be Avoided (ATBA), which was established to protect this sensitive coastline following the *Braer* incident. To avoid the risk of pollution and damage to the environment, all vessels over 5,000 GT carrying oil or other hazardous cargoes in bulk, should avoid this area.

Orkney Islands Council (OIC) Marine Services administers 29 Orkney Harbour Areas for which it is the Competent Harbour Authority. The nearest main port is Stromness approximately 4.5nm west of the site. Vessels calling at Stromness report to the Marine Services Vessel Traffic Service (VTS) based at the Harbour Authority Building at Scapa when crossing the Harbour Limit west of Hoy Sound (Reporting Point 'Delta').

The VTS presently have three radar sites for observing traffic:

- Sandy Hill covering Scapa Flow and the Pentland Firth
- Scapa covering the body of Scapa Flow
- Kirkwall covering Kirkwall Harbour and approaches

The VTS is planned to be upgraded and a further three radar sites added by the summer of 2012 aimed at monitoring marine renewable energy sites, including one site near Yesnaby which will cover the west of Orkney.

Pilotage is compulsory within the Competent Harbour Authority areas for passenger vessels over 65m in length, all other vessels over 80m overall length, all vessels under tow where the combined overall length of the towing vessel and the vessel being towed is over 65m, all vessels over 300 GRT carrying persistent oils in bulk. There is a pilot station approximately 2.8nm to the west of the site area.

South east of the site area is the European Marine Energy Centre (EMEC) Billia Croo Wave Test Site, which lies between Neban Point and Breck Ness. This site is used to develop and test a variety of marine wave energy devices. Mariners are advised to avoid passing within the test area marked by cardinal buoys.

To the south of the site area is Hoy Mouth, the entrance to Hoy Sound, which affords entry to Stromness and Scapa Flow from the west. Tidal streams in the vicinity of Hoy Mouth and the western entrance to Hoy Sound are strong in-going east from a line joining Braebuster Point and Breck Ness, and very strong out-going from the narrows of Hoy Sound and Burra Sound through Hoy Mouth.

Tor Ness in Hoy has been identified as a Marine Environmental High Risk Area (MEHRA) by the UK Government, i.e., an area of environmental sensitivity and at high risk of pollution

from ships. The Government expects mariners to take note of MEHRAs and either keep well clear or, where this is not practicable, exercise an even higher degree of care than usual when passing nearby.

Figure 3.1 presents the site area relative to the main navigational features.

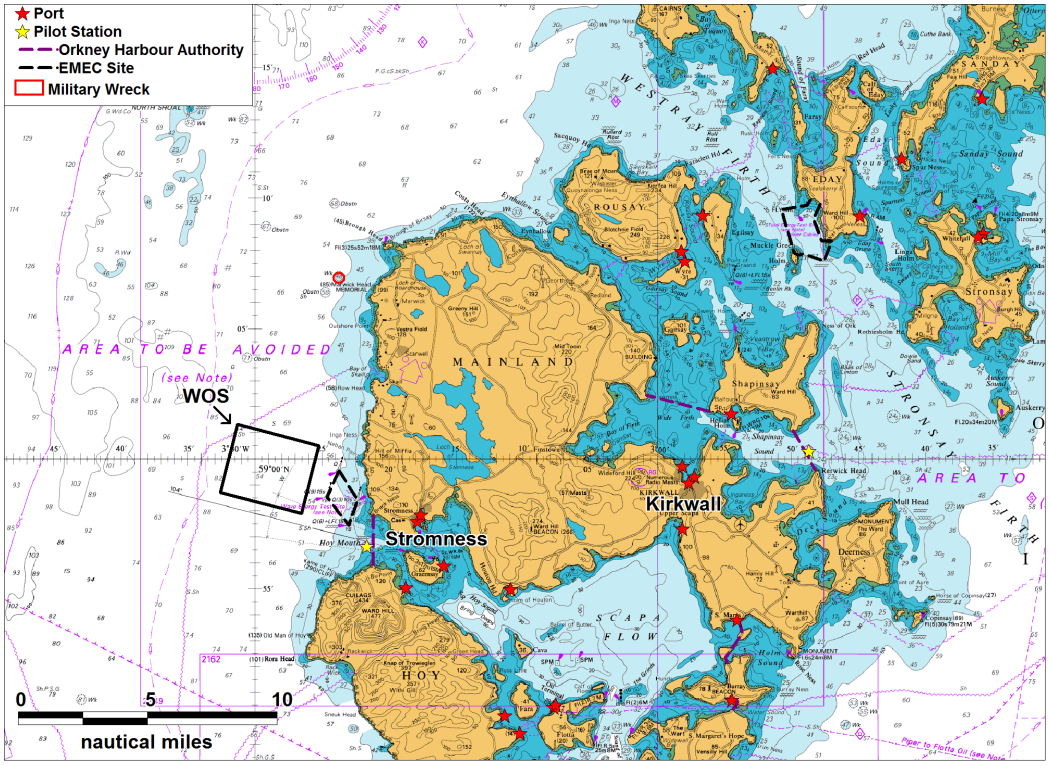

Figure 3.1 Navigational Features in the Area

4. Baseline Vessel Activity Analysis

4.1 Shipping

This section presents AIS data within 10nm of the West Orkney South site for the 28 day period in 2010 (14 days in June and 14 days in November/December). A plot of all the tracks recorded within 10nm of the West Orkney South site, colour-coded by vessel type, is presented in Figure 4.1.

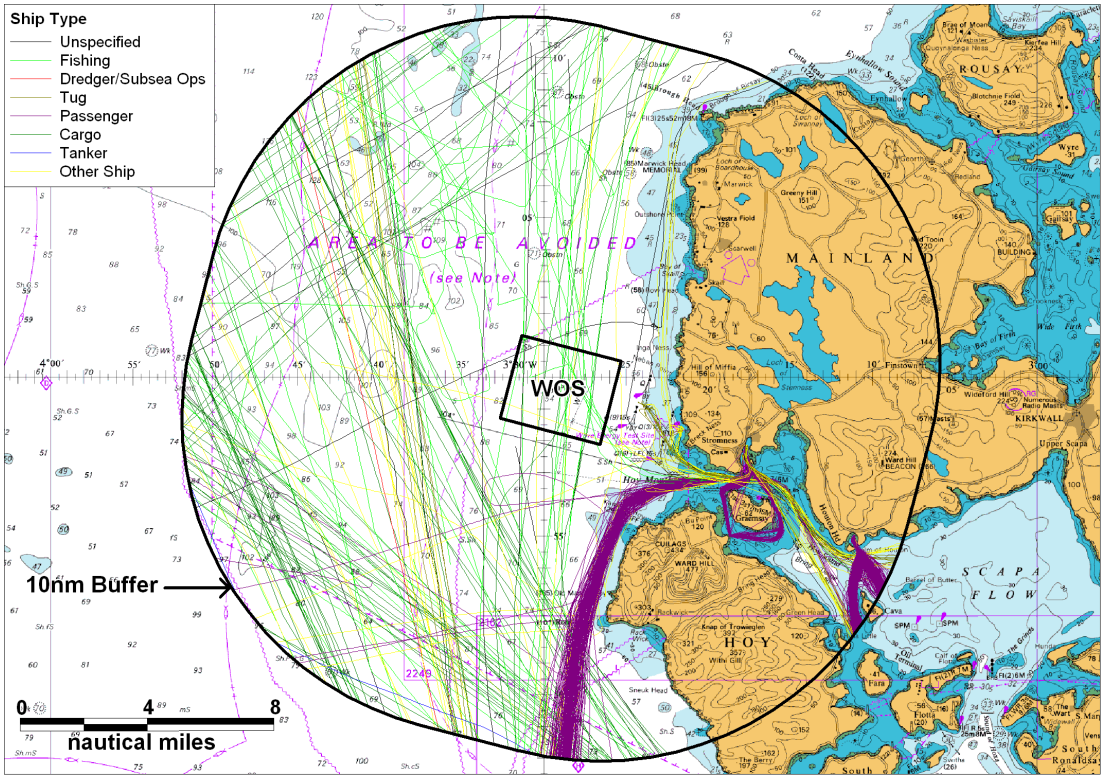

Figure 4.1 AIS Ship Tracks within 10nm of West Orkney South (28 Days from 2010)

An average of 11 vessels per day were tracked within 10nm of the site. The most common type within 10nm was passenger ships. These were mostly Orkney Ferries' South Isles service between Stromness, Hoy and Graemsay, and NorthLink Ferries' Scrabster/Stromness service. The nearest track was the NorthLink ferry *Hamnavoe* passing 1.5nm SE of the site boundary.

A total of 21 ships crossed the site boundary over the 28 days, an average of 0.75 per day. This comprised 13 fishing vessels, 4 cargo vessels and 4 'other' ships. The 'other' ships were a fisheries patrol vessel, two sailing vessels and a platform supply ship.

The AIS tracks colour-coded by ship length is presented in Figure 4.2.

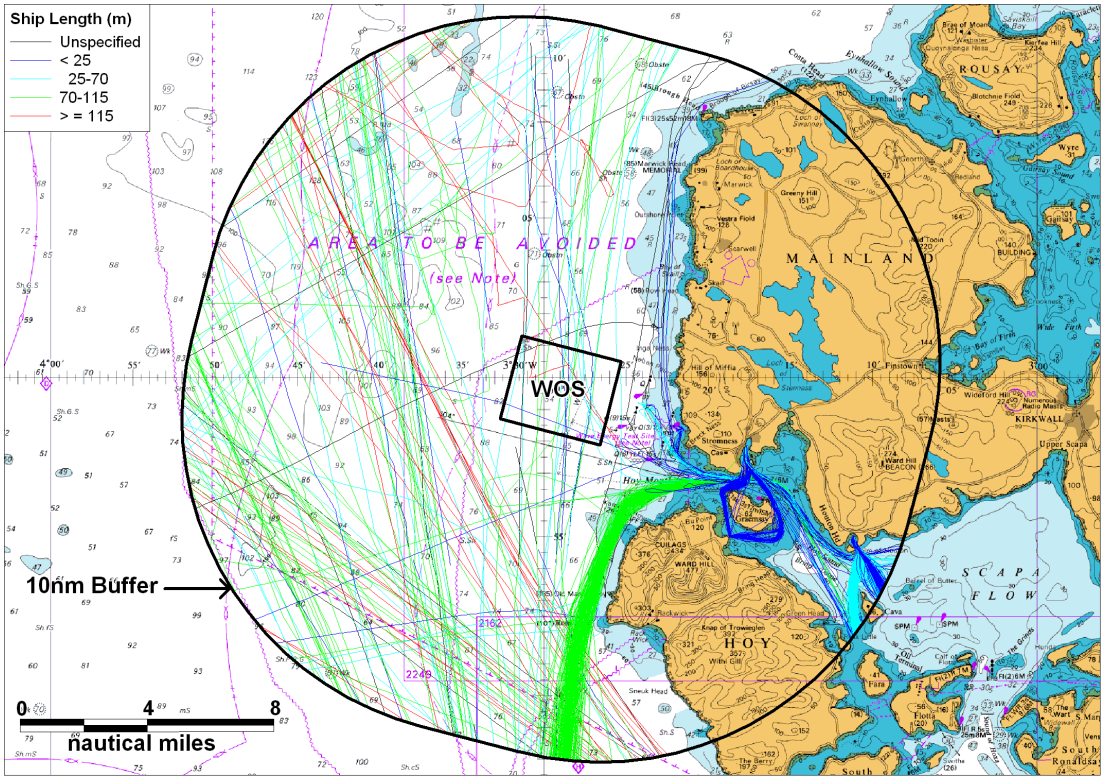

Figure 4.2 Ship Length

The average length of vessel crossing the site was 45m with the largest vessel recorded being the UK-flagged trawler *Cornelis Vrolijk FZN* at 115m long. It can be seen that the inshore traffic tended to be small vessels.

The tracks colour-coded by average speed are presented in Figure 4.3. The average speed of the tracks crossing the site was 7.5 knots. The fastest vessel was the platform supply ship *Grampian Talisker* travelling at an average speed of 10.5 knots headed to Aberdeen.

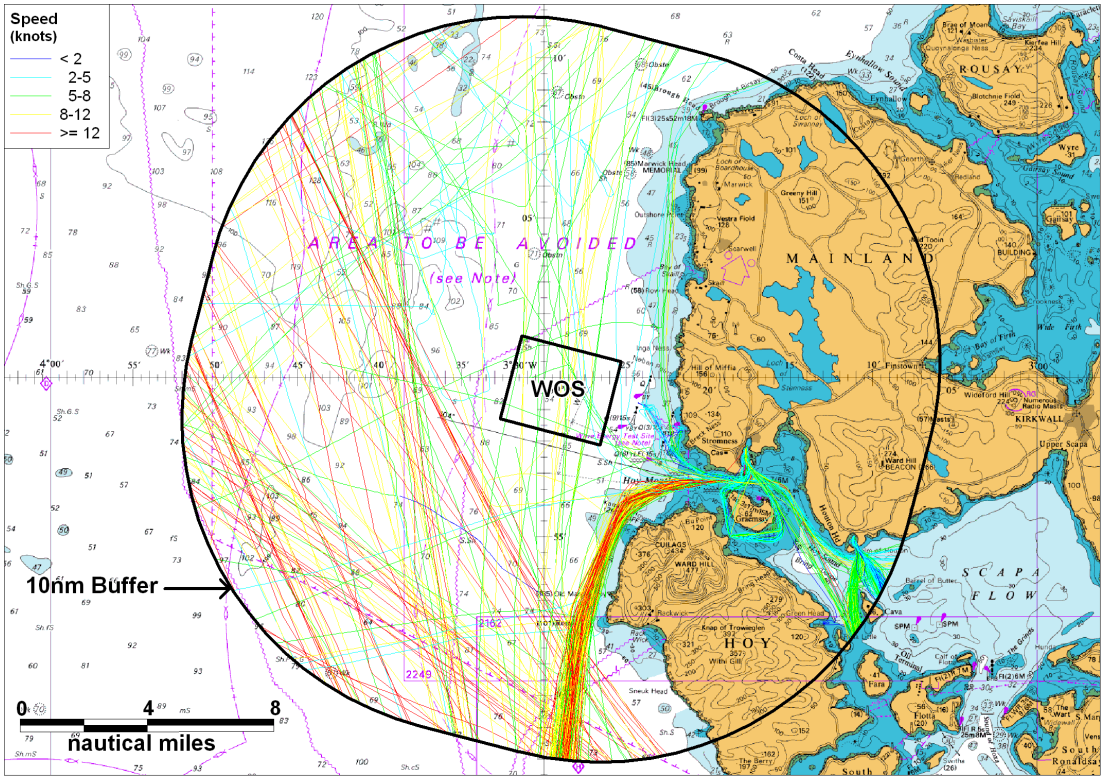

Figure 4.3 Ship Speed

From the AIS data, the main destinations broadcast by vessels crossing the site are presented in Figure 4.4.

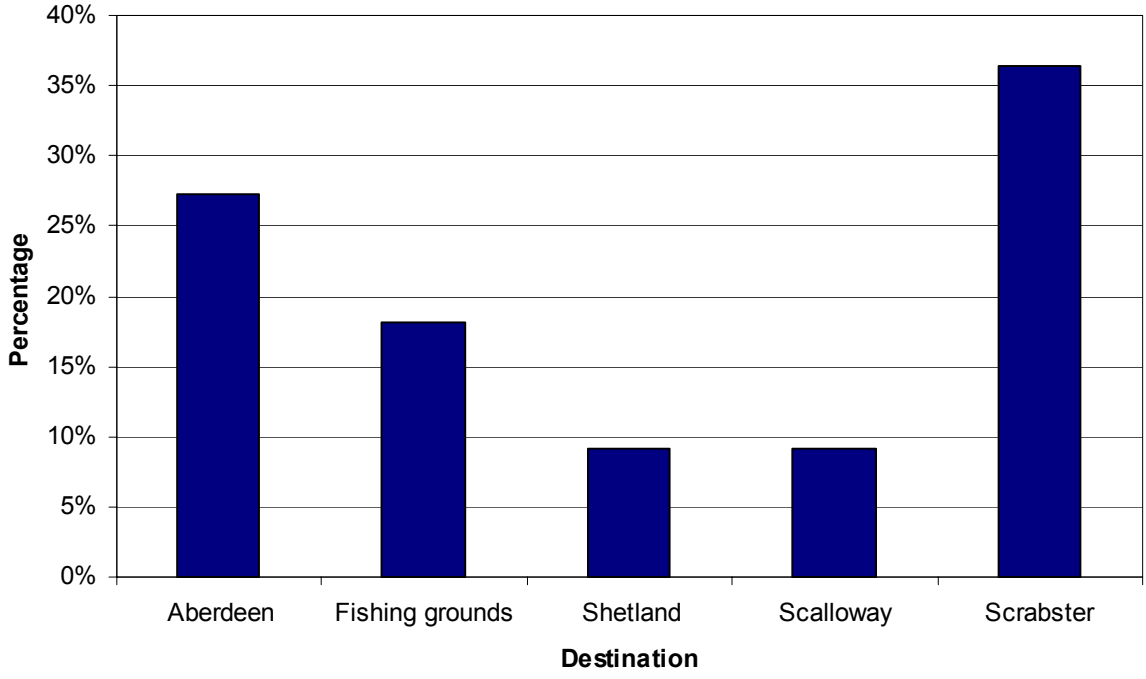

Figure 4.4 Destinations of Vessels crossing the West Orkney South Site

The most common destinations were ports in Scotland such as Aberdeen and Shetland. A significant proportion also had the generic destination of fishing grounds.

A plot of relative ship density within 10nm of the site is presented in Figure 4.5. This illustrates that the site area has below average shipping traffic levels. This is also the case in terms of UK waters as a whole.

The highest density of traffic is in Stromness, Hoy Sound, Hoy Mouth and west of Hoy where the NorthLink ferries transit.

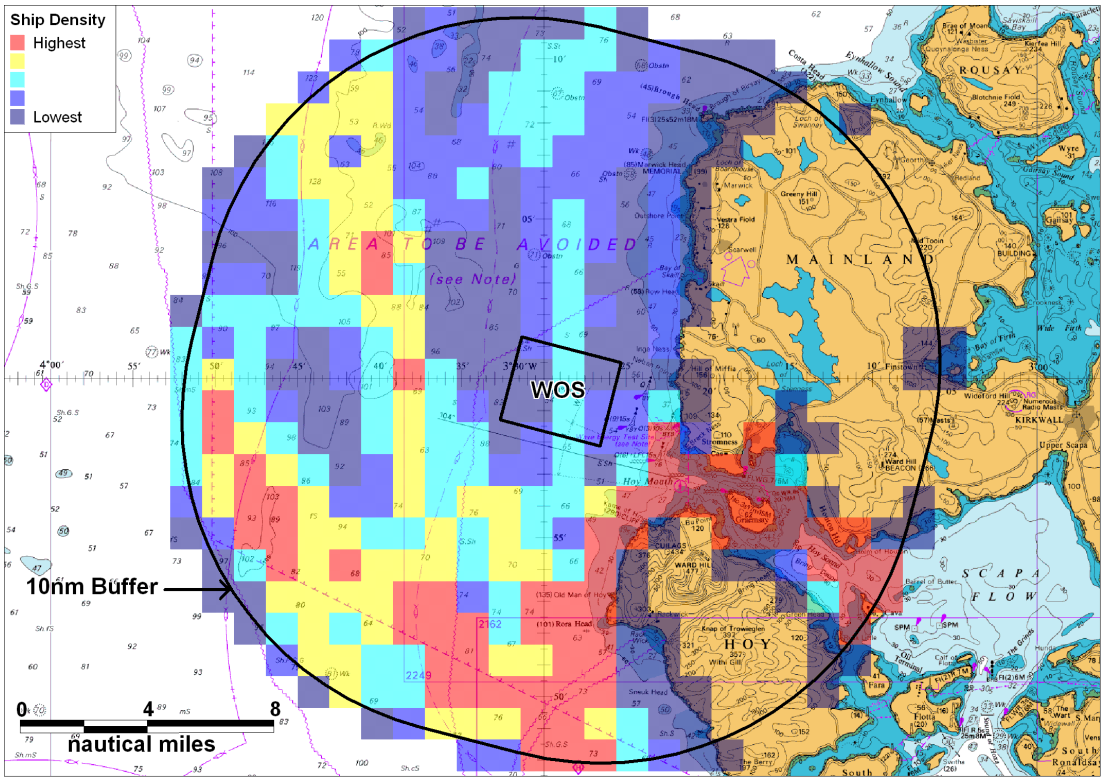

Figure 4.5 Plot of Ship Density within 10nm of the West Orkney South Site

4.2 Fishing Vessel Activity

The AIS data presented above included a number of fishing vessel tracks. This section reviews other sources of fishing vessel activity data in the form of sightings and satellite data.

4.2.1 Sightings Data

Fisheries statistics in the UK are reported by ICES statistical Rectangles and Subsquares. The proposed West Orkney South site is located within ICES Rectangles 47E6 and 46E6, straddling four Subsquares (see Figure 4.7). The average Subsquare area is approximately 232nm^2 (796km^2).

Data on fishing vessel sightings were obtained from Marine Scotland Compliance who monitor the fishing industry in Scottish waters through the deployment of patrol vessels and surveillance aircraft.

Each patrol logs the positions and details of fishing vessels within the Rectangle being patrolled. All vessels are logged, irrespective of size, provided they can be identified by their Port Letter Number (PLN).

The numbers of fishing vessel sightings, surveillance patrols and hence average sightings per patrol within each ICES Subsquare encompassing the proposed site in the five-year period 2006-10 are presented in Table 4.1 and Figure 4.6.

Table 4.1 Average Sightings per Patrol (2006-10)

ICES Subsquare	Sightings	Patrols	Sightings per Patrol
46E6/1	62	453	0.137
46E6/2	52	453	0.115
47E6/3	178	1120	0.159
47E6/4	59	1120	0.053

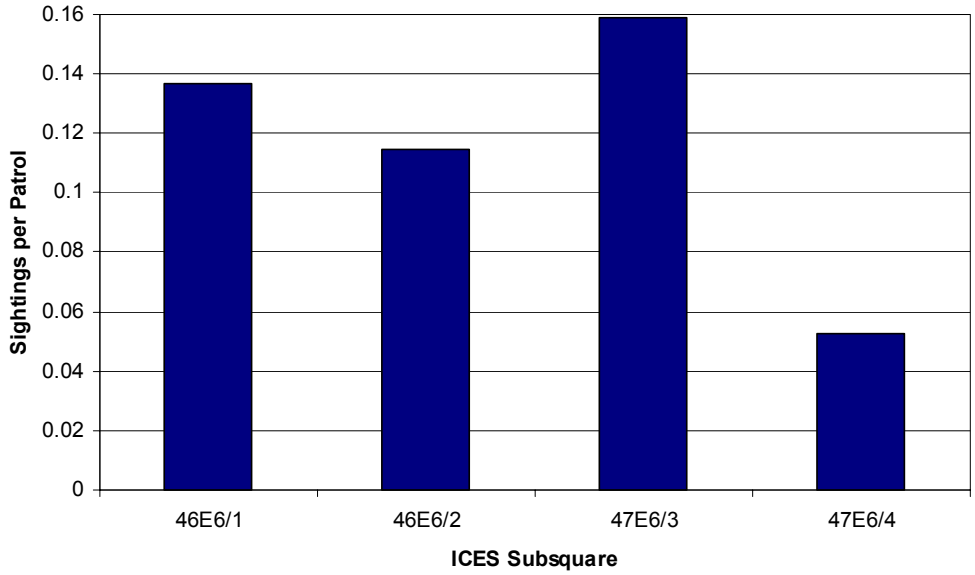

Figure 4.6 Average Fishing Vessel Sightings per Surveillance Patrol (2006 - 2010)

The sightings per patrol were all very low, with the highest being one vessel on average per six patrols.

The sightings data were imported into a GIS for mapping and analysis. Within the proposed West Orkney South site, no fishing vessels were sighted. The fishing vessel sightings colour-coded by nationality are presented in Figure 4.7.

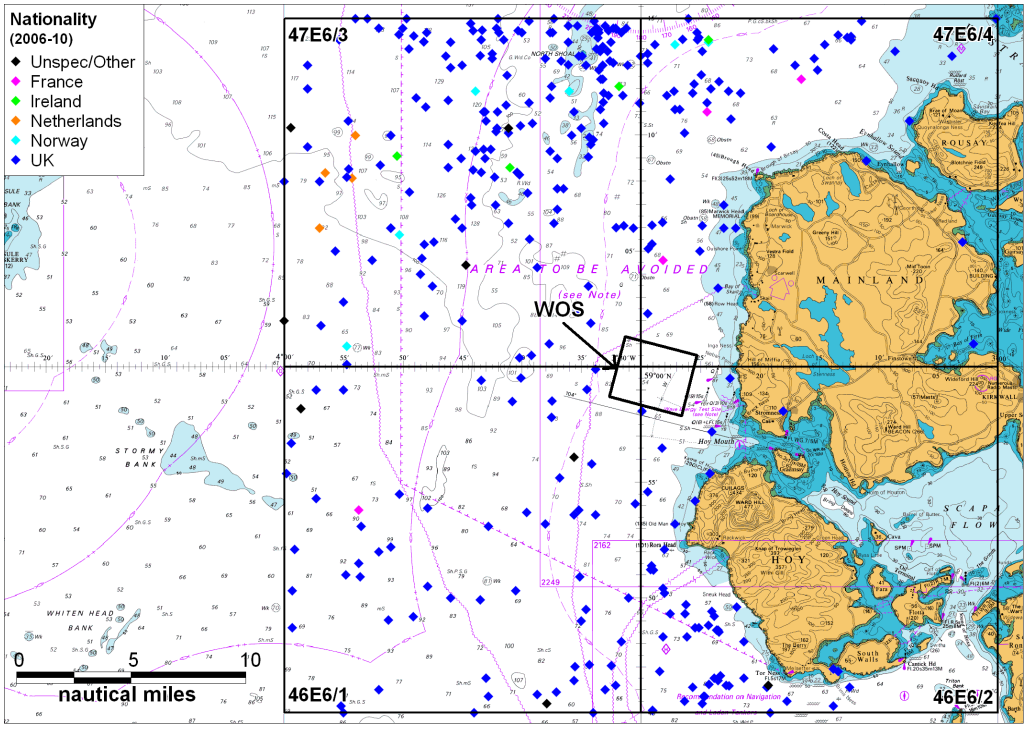

Figure 4.7 Fishing Vessel Sightings by Nationality (2006 – 2010)

It can be seen that the majority of fishing vessels were registered in the UK (93%).

The fishing vessel sightings colour-coded by gear type are presented in Figure 4.8**.**

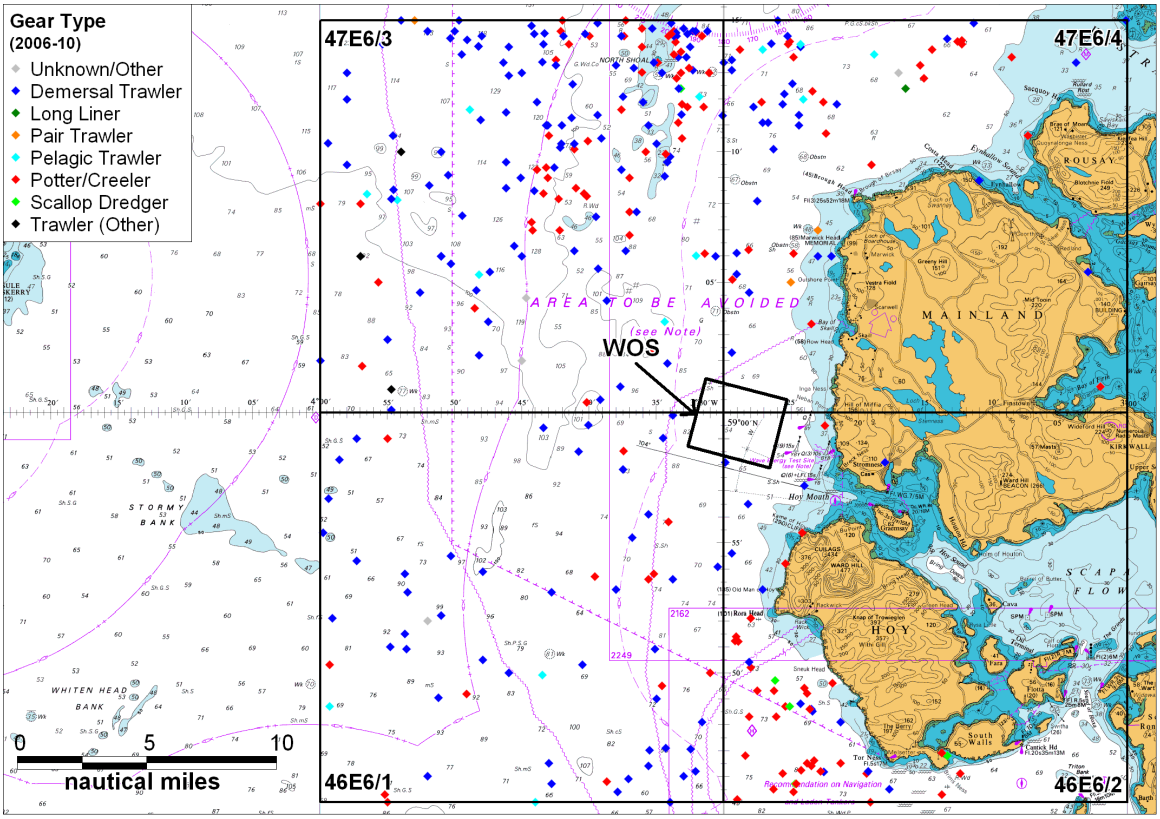

Figure 4.8 Fishing Vessel Gear Types

The main fishing method overall was demersal trawling, accounting for approximately 56%, followed by potter/ creeler (36%).

Activity data (where available) indicated 58% of vessels sighted were steaming (transiting to/from fishing grounds), 39% were engaged in fishing, i.e., gear deployed, and 3% were laid stationary (vessels at anchor or pair vessels whose partner vessel is taking the catch whilst the other stands by).

The length distribution of vessels is presented in Figure 4.9. 59% of sightings were 15m in length or over.

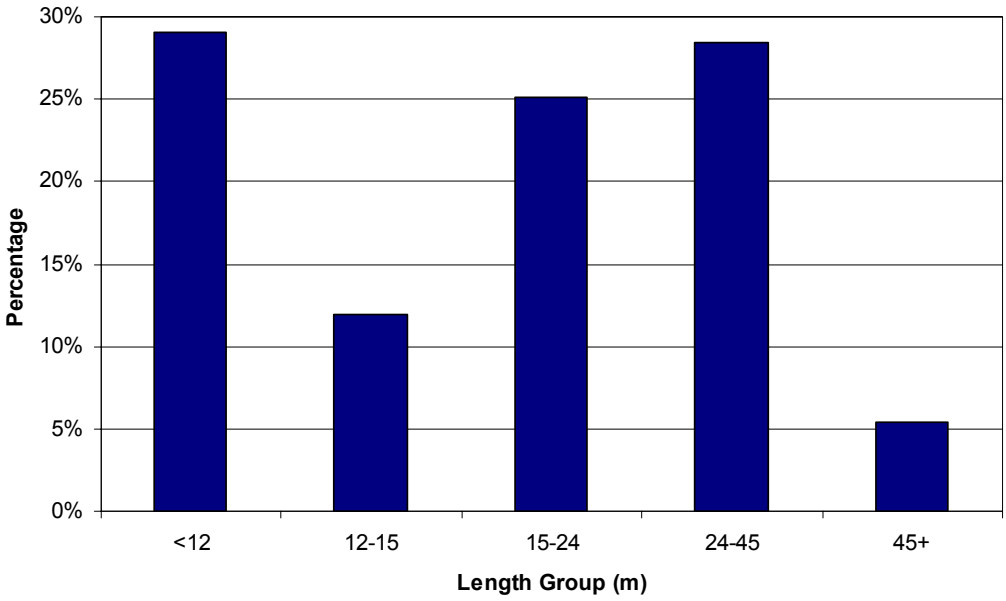

Figure 4.9 Fishing Vessel Sightings by Length Group (2006-10)

4.2.2 Satellite Data Analysis

The Marine Management Organisation (MMO) operate a satellite-based vessel monitoring system. The vessel monitoring system is used, as part of the sea fisheries enforcement programme, to track the positions of fishing vessels of 15m length and over in UK waters. It is also used to track all UK registered fishing vessels globally.

Vessel position reports are typically received every 2 hours. The data covers all EC countries within British Fisheries Limits and certain Third Countries, e.g., Norway and Faeroes. Vessels used exclusively for aquaculture and operating exclusively within baselines are exempt.

The satellite data used for the analysis was provided by Marine Scotland Compliance, who have responsibility for fishing vessel activity in Scottish Waters. Only UK vessel activity was available. Based on the sightings analysis, UK vessels of 15m length and over represent approximately 55% of the vessel activity recorded during patrols.

Plots of vessel positions, colour-coded by vessel speed, are presented in Figure 4.10 to Figure 4.12. The satellite data only covers larger fishing vessels of 15m length and over. It can be seen that the majority of the fishing vessels within the West Orkney South site had speeds greater than 5 knots, indicating they were likely to be steaming on passage.

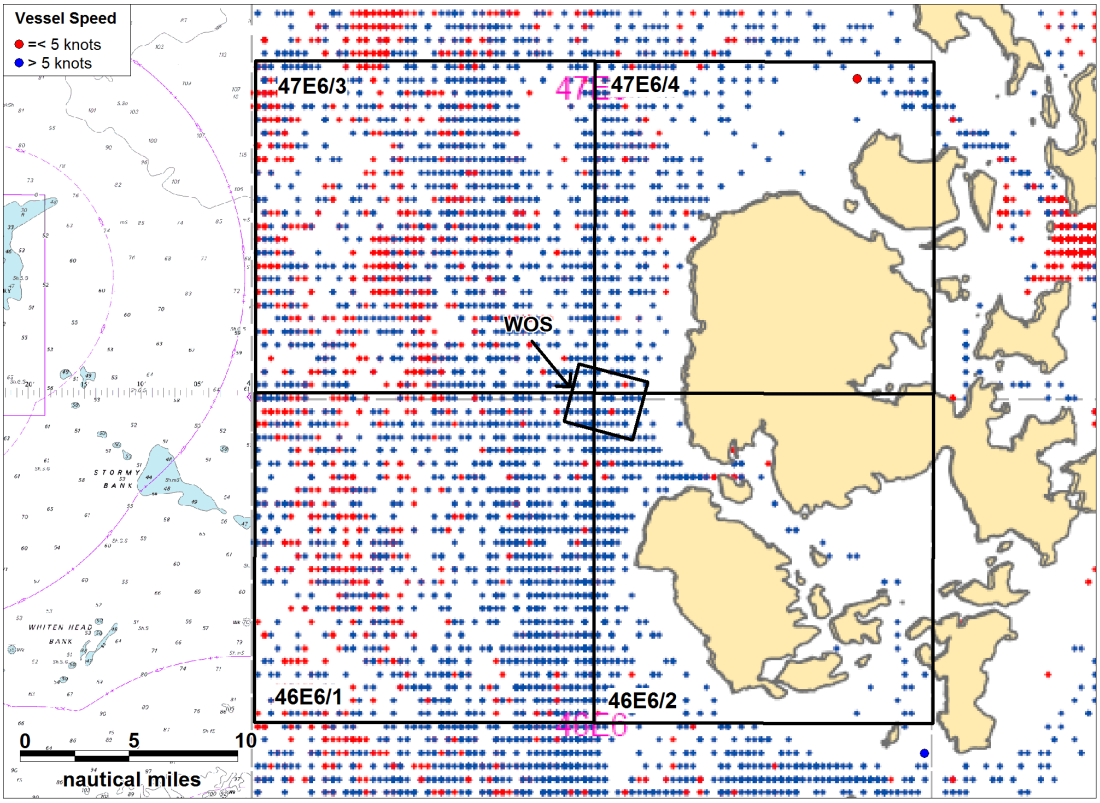

Figure 4.10 Chart of Satellite Fishing Vessel Positions by Vessel Speed (2008)

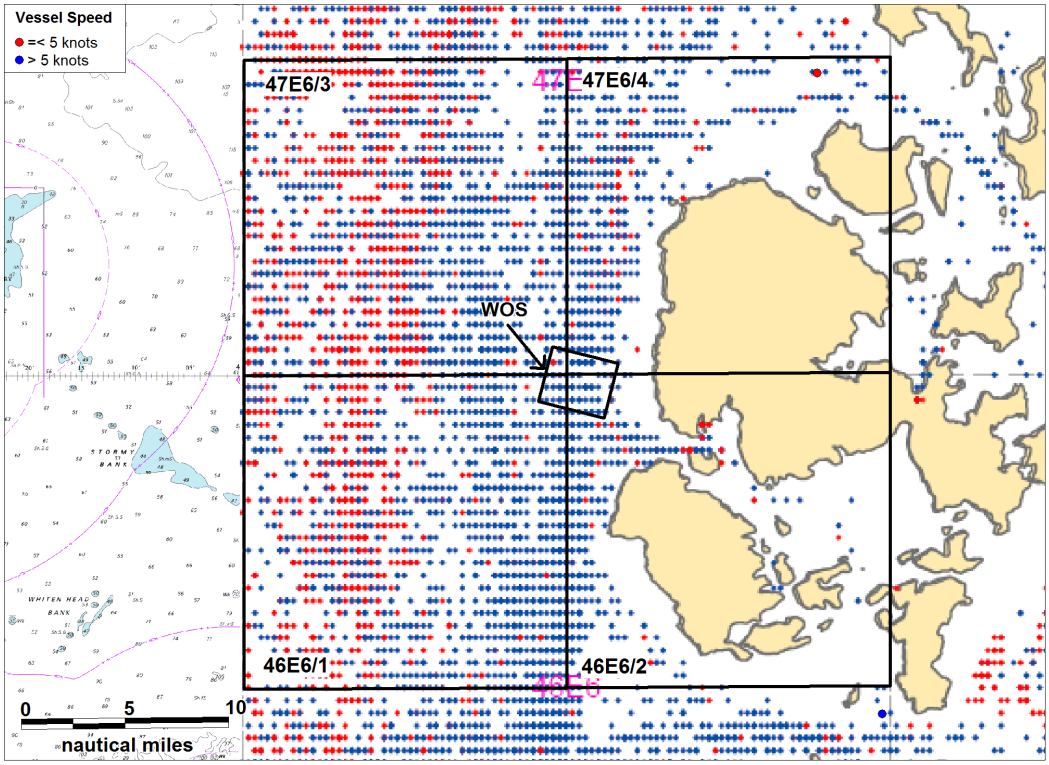

Figure 4.11 Chart of Satellite Fishing Vessel Positions by Vessel Speed (2009)

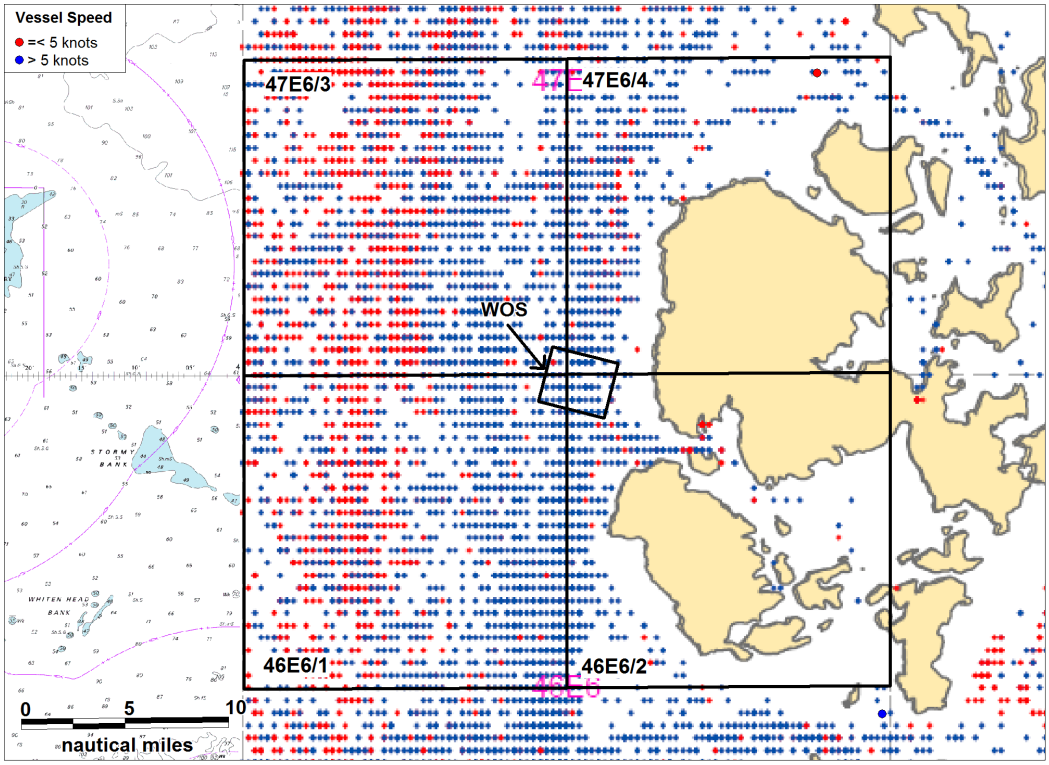

Figure 4.12 Chart of Satellite Fishing Vessel Positions by Vessel Speed (2010)

4.3 Recreational Vessel Activity

This section reviews recreational vessel activity at the West Orkney South site area based on the available desktop information.

4.3.1 RYA Data

The RYA, supported by the Cruising Association, have identified recreational cruising routes, general sailing and racing areas in the UK. This work was based on extensive consultation and qualitative data collection from RYA and Cruising Association members, through the organisations' specialist and regional committees and through the RYA affiliated clubs. The consultation was also sent to berth holder associations and marinas.

The results of this work were published in Sharing The Wind (Ref. i) and updated GIS layers published in the Coastal Atlas (Ref. ii).

A summary plot of the recreational sailing activity and facilities in the North East Scotland Sailing Area is presented in Figure 4.13.

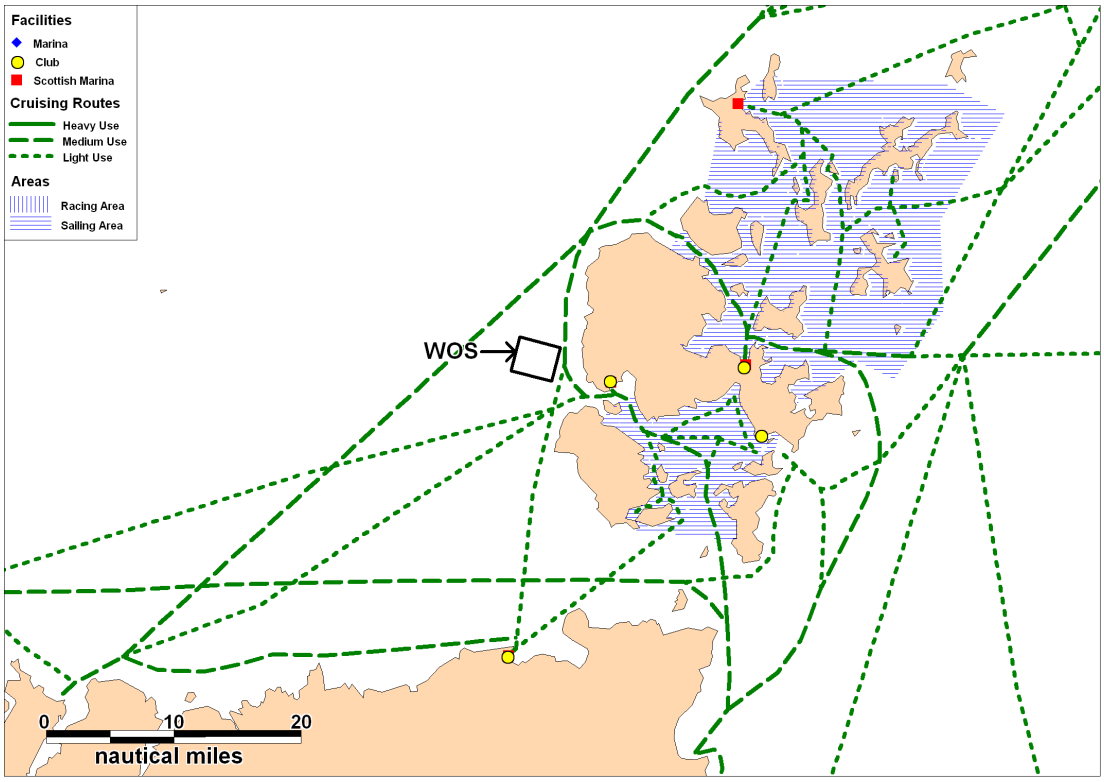

Figure 4.13 Recreational Information for the North East Scotland Strategic Area

Recreational boating, both under sail and power is highly seasonal and highly diurnal. The division of recreational craft routes into Heavy, Medium and Light Use is therefore based on the following classification:

- Heavy Recreational Routes: - Very popular routes on which a minimum of six or more recreational vessels will probably be seen at all times during summer daylight hours. These also include the entrances to harbours, anchorages and places of refuge.
- Medium Recreational Routes: - Popular routes on which some recreational craft will be seen at most times during summer daylight hours.
- Light Recreational Routes: - Routes known to be in common use but which do not qualify for medium or heavy classification.

Based on the RYA published data, the site is well outside the general racing and sailing areas. There are also no cruising routes passing through the area. There is a cruising route passing to the east of the West Orkney South site. This is a medium-use cruising route transiting off the west mainland of Orkney, including yachts to/from Stromness.

In terms of facilities, the nearest club (Stromness Sailing Club) and marina are located in Stromness.

4.3.2 Clyde Cruising Club Sailing Directions

The Clyde Cruising Club produce Sailing Directions for various areas of Scotland. The publication covering Orkney Waters (Ref. iii) which was compiled with local knowledge, includes information for recreational sailors in the vicinity of the site.

Particular reference is made to EMEC's Billia Croo wave test site and it recommends yachts avoid passing through this area, though passage through the approximate 600m gap between it and the coast is possible. However, it notes that shallow water devices are sometimes deployed on the coastal side of this channel. All devices, both inside and outside this area are marked and lit.

Both medium use cruising routes to the west of Brough Head, indicated in Figure 4.13, are used by Clyde Cruising Club. Stromness is used as the most convenient first anchorage for yachts coming to Orkney from the west coast as it avoids tackling the Pentland Firth or the longer passage round the north. Tidal streams in Hoy Sound are very strong (8 knots) and entry should not be attempted in bad weather or with wind against tide or on the ebb tide.

4.3.3 Orkney Marinas Sailing Guides

The Orkney Marinas website has sailing guides for Orkney waters. The publication "Going West from Westray includes information for the sailing community within the vicinity. The routes are described below with Figure 4.14 highlighting some of the key reference points.

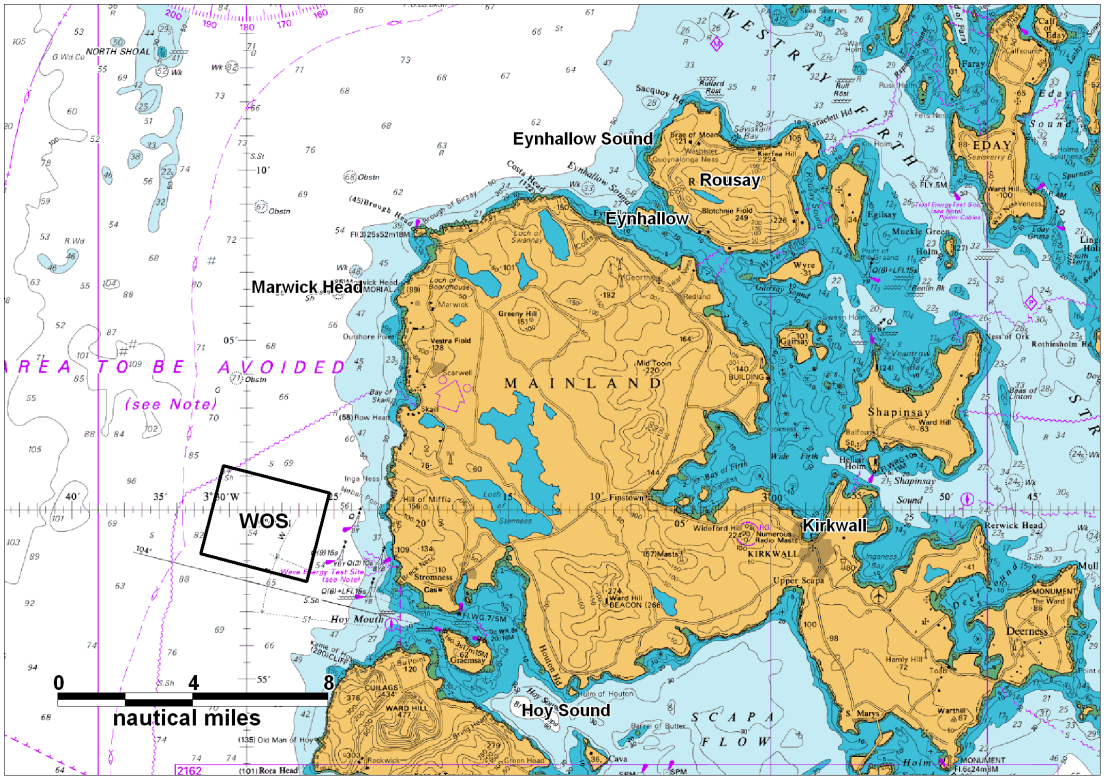

Figure 4.14 West from Westray – Key Features mentioned in Sailing Guide

Westray to Stromness or Cape Wrath / Stromness to Westray

Passage time to Stromness is 4.5 hours at 8 knots. If Pierowall is departed with the first ebb in Papa Sound then the flood tide in Hoy Sound will aid passage into Stromness. Tide is low between Marwick Head and Hoy Sound and turns in Hoy Sound about 40 minutes before Kirkwall. If passage is made from Stromness to Westray two hours before low water it is possible to pick up the flood tide at Marwick Head and carry it to Pierowall.

Kirkwall to Stromness / Stromness to Kirkwall

Kirkwall to Stromness takes about 3.5 hours at 8 knots. Sailing from Stromness to Kirkwall, there is a quite a roost out of Hoy Sound on the ebb during any westerly weather. Eynhallow Sound is best approached on the flood. The deepest water is between Rousay and Eynhallow but the most straightforward channel is between Eynhallow and the Orkney Mainland. The tide in Eynhallow Sound turns approximately the same time as Kirkwall so Hoy Sound is reached at the first flood

5. Review of Historical Maritime Incidents

5.1 Introduction

This section reviews maritime incidents that have occurred in the vicinity of the West Orkney South site in recent years.

The analysis is intended to provide a general indication as to whether the area of the proposed development is currently low or high risk area in terms of maritime incidents. If it was found to be a particular high risk area for incidents, this may indicate that the development could exacerbate the existing maritime safety risks in the area.

Data from the following sources has been analysed:

- Marine Accident Investigation Branch (MAIB)
- Royal National Lifeboat Institution (RNLI)

(It is noted that the same incident may be recorded by two or more of the sources.)

5.2 MAIB

All UK-flagged commercial fishing vessels are required to report accidents to MAIB. Non-UK flagged vessels do not have to report unless they are within a UK port/harbour or within UK 12 mile territorial waters and carrying passengers to or from a UK port (including those in inland waterways). However, the MAIB will record details of significant accidents of which they are notified by bodies such as the Coastguard, or by monitoring news and other information sources for relevant accidents. The Maritime and Coastguard Agency, harbour authorities and inland waterway authorities also have a duty to report accidents to MAIB.

The locations[1] of accidents, injuries and hazardous incidents reported to MAIB within 10nm of the West Orkney South site boundary between January 2001 and December 2010 are presented in Figure 5.1, colour-coded by type.

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

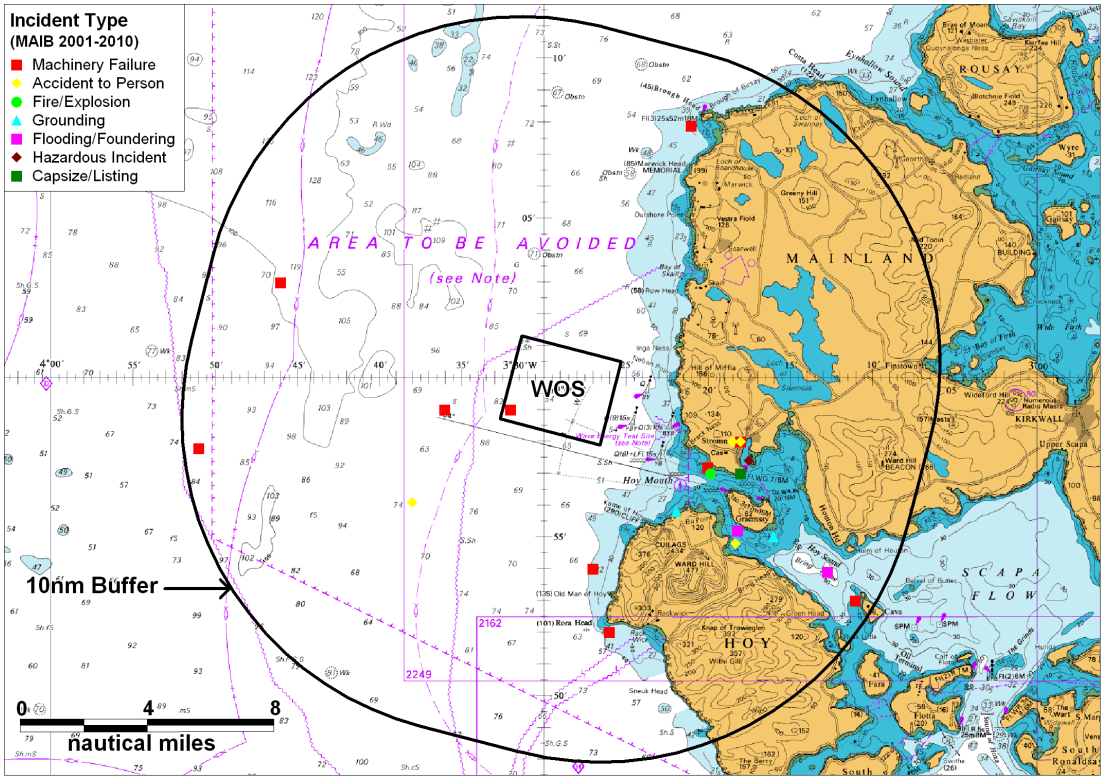

Figure 5.1 MAIB Incident Locations by Type within 10nm of Site Boundary

A total of 22 incidents were reported in the area within 10nm of the boundary, corresponding to an average of two per year.

One incident occurred within the site boundary in October 2007. This was a fishing vessel which experienced a complete power black-out after a machinery failure. A call was transmitted to the Coastguard and the local lifeboat was launched to tow the vessel to the nearest port.

The overall distribution by incident type is presented in Figure 5.2.

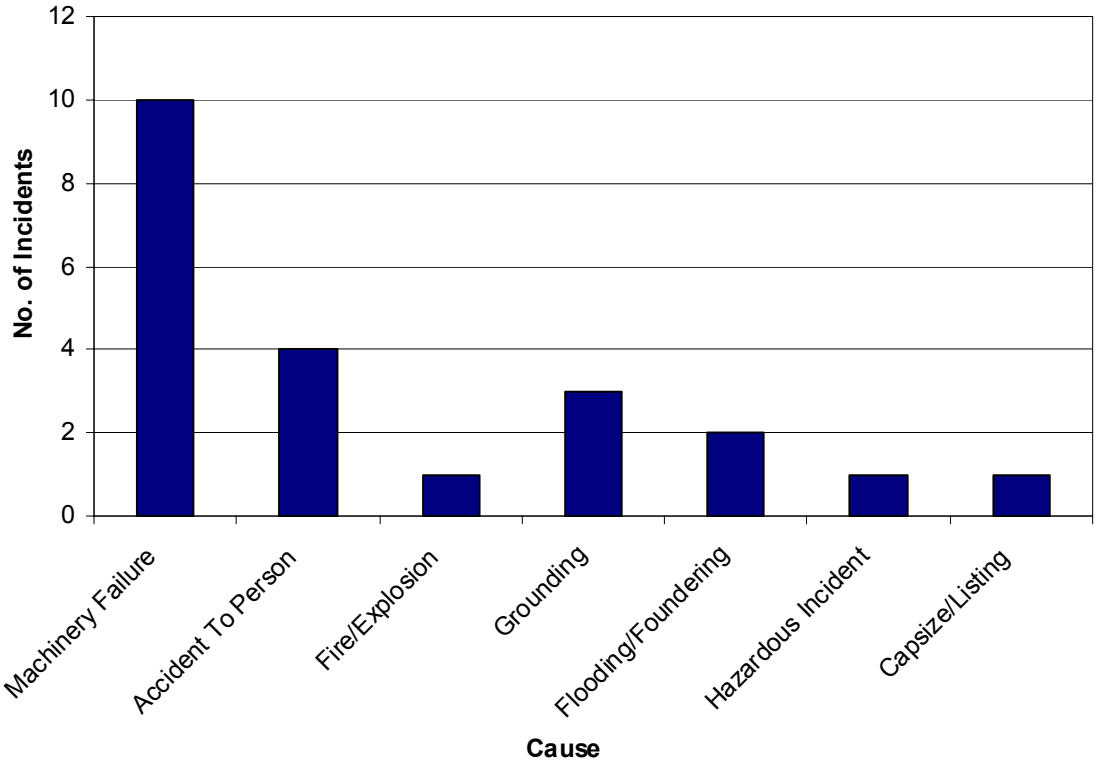

Figure 5.2 MAIB Incidents by Type within 10nm of Site (2001-2010)

5.3 RNLI

Data on RNLI lifeboat responses within 10nm of the West Orkney South site boundary in the ten-year period between 2001 and 2010 have been analysed. A total of 81 launches to 71 unique incidents were recorded by the RNLI (excluding hoaxes and false alarms).

Figure 5.3 presents the geographical location of incidents colour-coded by casualty type.

There were no incidents recorded within the area boundary over the 10 years analysed. The nearest incident took place to the south of the site that involved a fishing vessel that experienced machinery failure. This is the same incident recorded by MAIB within the site. The positions have been logged just over 1nm apart by MAIB and RNLI which is likely to be due to different times of receiving a call.

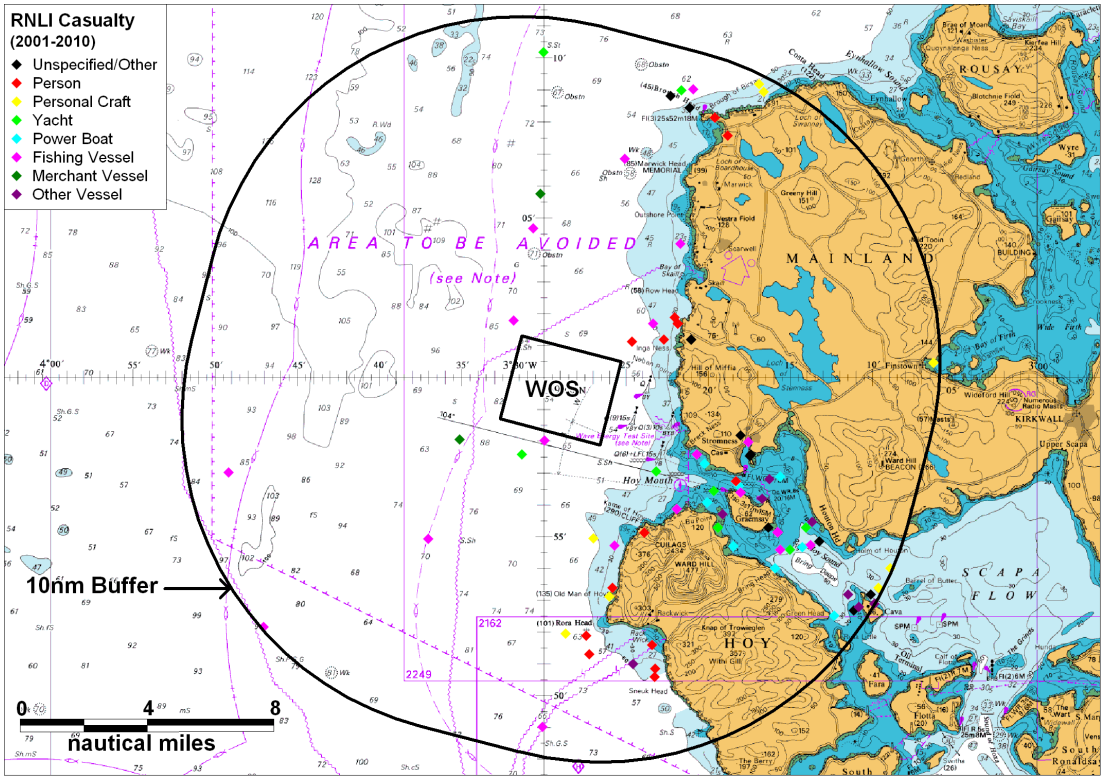

Figure 5.3 RNLI Incidents by Casualty Type within 10nm of Site

The most common vessel types involved were fishing vessels (25%); followed by persons (19%) and yachts (10%).

A chart of the incidents colour-coded by cause is presented in Figure 5.4.

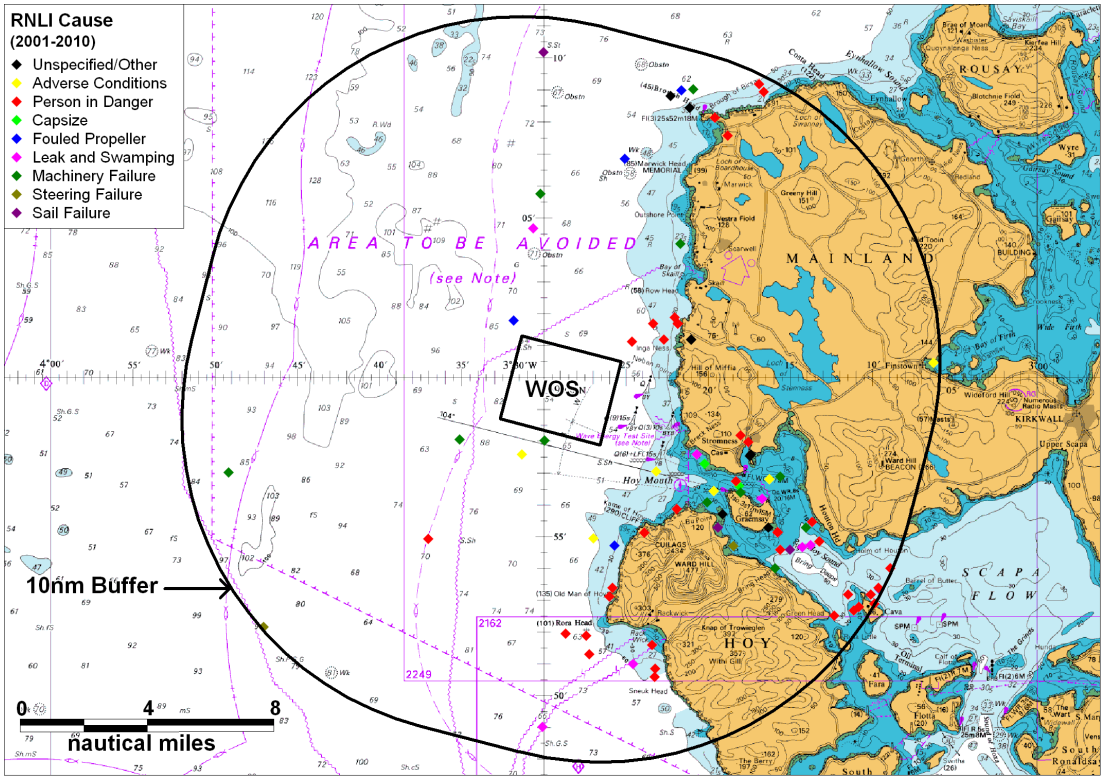

Figure 5.4 RNLI Incidents by Cause within 10nm of Site

The two mains causes were person in danger (46%) and machinery failure (14%).

All the incidents near to the West Orkney South site were responded to by the all-weather lifeboat based at RNLI Stromness.

6. Stakeholder Consultation

Key consultees identified to date include:

- Marine Scotland
- Maritime and Coastguard Agency
- Northern Lighthouse Board (NLB)
- Orkney Fisheries Association (OFA)
- Orkney Fishermen's Society (OFS)
- Orkney Islands Council (OIC) Marine Services
- Orkney Dive Boat Operator's Association (ODBOA)
- Department for Transport (DfT)
- Chamber of Shipping
- RYA (Scotland)
- Cruising Association
- Orkney Sailing Club (OSC)
- Stromness Sailing Club (SSC)
- Orkney Marinas
- EMEC and other developers (see Figure 7.1)

Initial consultation has been carried out with the MCA. Key issues raised included:

- Device layout
- Spacing between columns
- Mooring system
- Marking and lighting (both physical and on charts)
- Emergency response plans, e.g., in the case of loss of station
- Cumulative impacts
- Local stakeholder consultation and circulation of information

7. Preliminary Hazard Analysis

7.1 Introduction

This section provides a preliminary review of the vessel exposure and potential navigational hazards associated with the West Orkney South site based on the existing vessel activity in the area identified from the baseline data collection.

Potential mitigation measures to control the hazards are also discussed.

7.2 Vessel Exposure

From the baseline AIS data collection, a relatively low level of traffic was observed passing through the West Orkney South site, averaging less than one vessel per day. The majority were fishing vessels, with a small number of cargo ships and other vessels.

No tankers were observed within the IMO Area To Be Avoided (ATBA) around Orkney which applies to all vessels over 5,000 gross tonnes carrying oil or other hazardous cargoes in bulk.

The MCA have published guidance to mariners operating in the vicinity of offshore renewable energy installations (OREI) (Ref. iv). The guidance notes that, unlike wind farms, wave energy systems may not be clearly visible to the mariner, and could be semi-submerged.

The MCA guidance suggests three options, in simple terms, for mariners operating in OREI areas:

a. Avoid the area completely
b. Navigate around the edge
c. In the case of a wind farm, navigate, with caution, through the array

The choice will be influenced by a number of factors including the vessel's characteristics (type, tonnage, manoeuvrability, etc.), the weather and sea conditions. The guidance suggests that where there is sufficient sea room it is prudent to avoid the area completely.

The choice will also depend on the navigational features of the area, for example, the sea room and water depth available surrounding the development.

In the case of the West Orkney South site, it should be possible for vessels to navigate around the edge. The minor deviation required, both for the demonstration phase and subsequent build-out to 50 MW, would not significantly affect passage times.

It may also be feasible for some vessels to navigate between columns of devices in an array in appropriate conditions but further information on the layout and moorings is required.

The above discussion applies to transiting fishing vessels, which appear to be in the majority from the data sets analysed. However, further consultation on local fishing vessel activity will be required during the Navigation Risk Assessment (NRA). It is understood there is also creeling for shellfish in this area by local vessels.

A discussion of specific hazards and how they will be addressed within the NRA is presented below for the main operational phases of the West Orkney South development.

7.3 Hazard Review

7.3.1 Normal Operations

During normal operations, the installations will present a potential collision hazard to vessels navigating in the area. The collision risk will be assessed in the NRA using the following inputs:

- Device locations and dimensions
- Vessel activity
- Metocean data

Further data will be collected on all these inputs during the NRA process.

Any changes in vessel routeing due to the development, e.g., displacement of vessels around the site, will influence the probability of vessels encountering (and colliding) with one another in the area. A comparison will be made between the current and predicted routeing and associated collision risk levels will be modelled.

There is also a potential hazard to vessels in the area should any part of the development fail and become detached / lose station. The object could pose a collision hazard to passing vessels both within and beyond the site boundary. This hazard will be assessed within the NRA taking into account measures for alerting and recovery.

Finally, the subsea cabling could present a snagging hazard to fishing gear and vessel anchors. Once the cabling options are finalised these hazards will be assessed based on the vessel activity in the area and the planned protection measures.

7.3.2 Installation, Maintenance and Removal

For all vessels operating in the area there will be risks during installation, removal and to a lesser extent maintenance, when there will be additional vessels in and around the site associated with the development, some of which may have restricted manoeuvrability. This will extend beyond the site in the case of cable-laying operations.

This introduces a collision hazard (vessel-to-vessel) as well as potential obstruction to normal routes beyond the site area.

This will be assessed within the NRA based on the best available information on the likely areas of operation, number and types of vessels involved, base ports, duration of operations and weather limits.

7.3.3 Cumulative Impact

As well as assessing West Orkney South on an individual basis, taking into account existing developments such as EMEC Billia Croo, potential cumulative issues associated with nearby sites will be assessed. An illustration of currently known developments is presented in Figure 7.1.

The most relevant are the adjacent E.ON West Orkney Middle South site, the Scottish Power Renewables Marwick Head site and the Aquamarine / SSE Renewables Brough Head site.

The best available information at the time of performing the NRA will be used. Where there is uncertainty, a maximum development case will be assumed to be conservative.

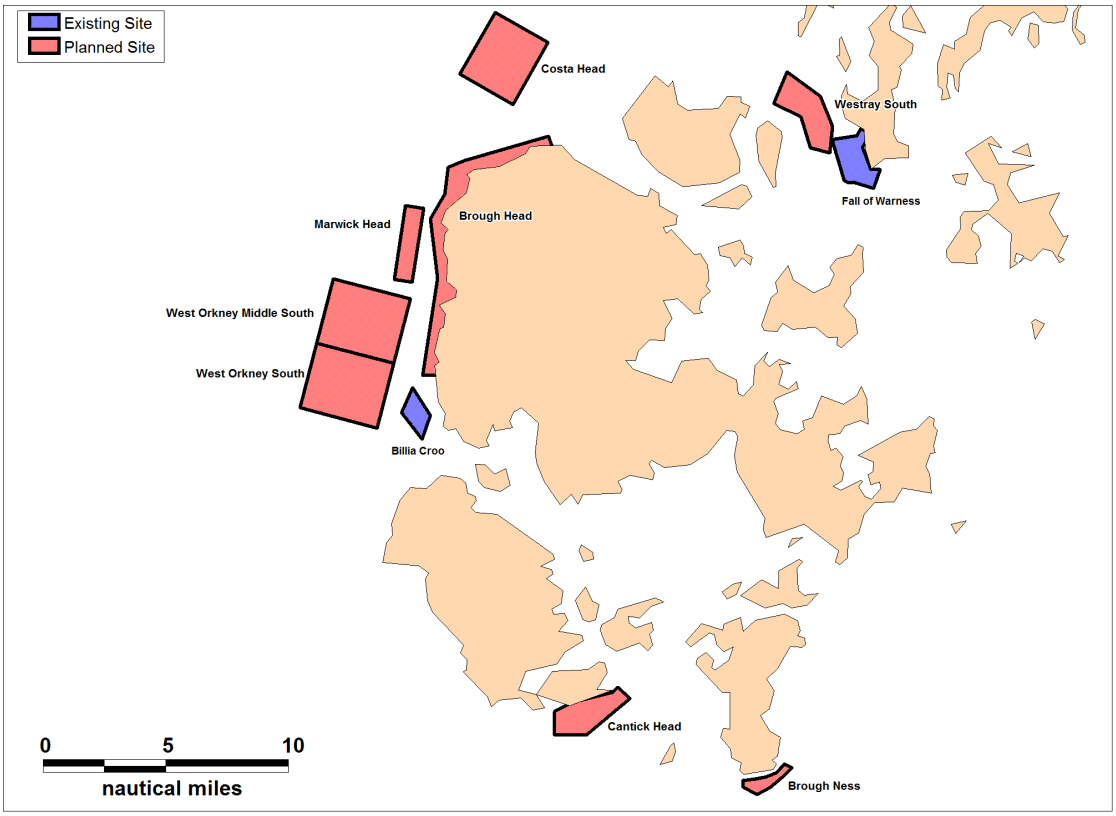

Figure 7.1 Planned Sites to be considered in Cumulative Assessment

7.4 Mitigation Measures

Appropriate risk control measures will be developed during the NRA to address the risks during all phases of operation to ensure they are reduced to a level as low as reasonably practicable (ALARP).

An important measure is to ensure the final array layout is selected to minimise navigational hazards as far as practicable, i.e., taking into account wave resources as well as technical and other constraints. The analysis carried out during this PHA is part of this process, which will continue based on the scoping responses received and throughout the NRA.

In addition to preventive mitigation in the form of site selection, there are a large number of measures that can be applied to help control navigation risks, many of which are now standard industry practice such as:

- Depiction on Charts
- Marking and Lighting
- Circulation of Notices to Mariners
- Fisheries Liaison

Discussions will be held with national and local stakeholders, such as NLB, UKHO and OIC Marine Services, to ensure these and other measures are implemented as effectively as possible for the West Orkney South development, taking into account vessel activity.

Other mitigation measures will be identified during the Hazard Review Workshop, which is discussed further in Section 8.

8. Proposed Methodology – Navigation Risk Assessment

The assessment methodology will principally be based on the following:

- Department for Energy and Climate Change (DECC) Methodology for Assessing the Marine Navigational Safety Risks of Offshore Wind Farms (2005); and

- Maritime and Coastguard Agency (MCA) Marine Guidance Notice 371 (MGN 371) Offshore Renewable Energy Installations (OREIs) – Guidance on UK Navigational Practice, Safety and Emergency Response Issues.

The DECC methodology provides a template for preparing the navigation risk assessment. The methodology is centred on risk controls and the feedback from risk controls into risk assessment. It requires a submission that shows that sufficient risk controls are, or will be, in place for the assessed risk to be judged as broadly acceptable or tolerable with further controls or actions. The DECC assessment methodology includes:

- defining a scope and depth of the submission proportionate to the scale of the development and the magnitude of the risk;
- estimating the 'base case' level of risk;
- estimating the 'future case' level of risk;
- creating a hazard log;
- defining risk control and creating a risk control log;
- predicting 'base case with project' level of risk; and
- predicting 'future case with project' level of risk.

The key features of the Marine Safety Navigational Risk Assessment Methodology are risk assessment (supported by appropriate techniques and tools), creating a hazard log, defining the risk controls (in a Risk Control Log) required to achieve a level of risk that is broadly acceptable (or tolerable with controls or actions), and preparing a submission that includes a Claim, based on a reasoned argument, for a positive consent decision.

The MCA guidance MGN 371 highlights issues that need to be taken into consideration when assessing the impact on navigational safety from offshore renewable energy developments in the UK. Specific annexes that address particular issues include:

- Annex 1: Site position, structures and safety zones;

- Annex 2: Developments, navigation, collision avoidance and communications;

- Annex 3: MCA's windfarm shipping template for assessing windfarm boundary distances from shipping routes;

- Annex 4: Safety and mitigation measures recommended for OREI during construction, operation and decommissioning; and

- Annex 5: Search and Rescue (SAR) matters.

One of the key requirements of MGN 371 is a maritime traffic survey of at least 28 days duration, including seasonal and tidal variations. This will record AIS, radar and visual observations of vessel movements in and around the project site and its vicinity. The method and timetable for survey data collection will be agreed with the MCA in advance to ensure it meets their requirements.

Consultation will be carried out with the organisations listed in Section 6, as well as any other interested parties identified during the Scoping and NRA process. This will be used to inform the final site selection and layout.

Local stakeholders representing all the different maritime interests, including ports, fishing, shipping, recreation and emergency services, will be invited to the Hazard Review Workshop, which is a key part of the NRA and a useful method of identifying additional risk controls.

Other key guidance and reference materials that will be used in the Navigation Risk Assessment are listed below:

- MCA Marine Guidance Notice 372 (2008). Guidance to Mariners Operating in the Vicinity of UK OREIs.

- IALA Recommendation O-139 On The Marking of Man-Made Offshore Structures, 1st Edition December 2008;

- DECC Guidance Notes on Applying for Safety Zones around Offshore Renewable Energy Installations;

- IMO Guidelines for Formal Safety Assessment (FSA);

9. References:

i RYA, Sharing the Wind, 2004.

ii UK Coastal Atlas of Recreational Boating; Recreational Cruising Routes, Sailing and Racing Areas around the UK Coast; Second Edition by RYA; Supported by Trinity House.

iii Clyde Cruising Club Sailing Directions and Anchorages – Part 5; N & NE Scotland and Orkney Islands; Clyde Cruising Club Publications Ltd, 2010.

iv MCA Marine Guidance Notice 372, Guidance to Mariners Operating in the Vicinity of UK OREIs, August 2008