

Wave Dragon Pre-Commercial Wave Energy Device

Environmental Statement Volume 1: Non-Technical Summary

A Development proposed by

 Wave Dragon

Environmental Statement prepared by

 **PMSS**
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A Report for




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**Wave Dragon Pre-Commercial
 Wave Energy Device**

**Environmental Statement
 Volume I, Non-Technical Summary**

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Preface

This Environmental Statement has been prepared by Project Management Support Services Ltd (PMSS), on behalf of Wave Dragon Wales Limited, in support of the applications for statutory offshore consents for a Pre-Commercial Demonstrator device known as the Wave Dragon Demonstrator off the Pembrokeshire coast. Associated onshore works on the Marloes Peninsula are considered in the EIA but formal applications for onshore works are not being made at this time.

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A downloadable version of the Non Technical Summary is also available from the Wave Dragon Website, www.wavedragon.co.uk

The Environmental Statement can be viewed during the statutory consultation period at the following locations :

- Haverfordwest Library
- Milford Haven Library
- Pembrokeshire Coast National Park Authority offices
- Wave Dragon Wales Ltd offices

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The Environmental Statement has been prepared for the following applications :

Application	Lead Authority
Section 36 of the Electricity Act 1989	The Department of Trade and Industry (DTI)
Food and Environment Protection Act 1985 Part II	The Department for Environment, Food and Rural Affairs (Defra)
Section 34 of the Coast Protection Act 1949	The Department for Environment, Food and Rural Affairs (Defra)

In addition, the following application will be made in due course :

Application	Lead Authority
Section 57 Town and Country Planning Act 1990	Pembrokeshire Coastal National Park Authority

1. Introduction

1.1 Introduction

Wave Dragon Wales Ltd (referred to herein as WDWL) is proposing the construction, installation, operation and decommissioning of a pre-commercial demonstration wave energy converter device off the Pembrokeshire Coast. The proposed development is called the Wave Dragon Pre-Commercial Demonstrator.

The demonstration project is being partly funded by the Welsh Assembly Government under the Objective 1 initiative. The device is intended to be tested for up to 5 years, whereupon it will be removed from the site and the site decommissioned.

The Wave Dragon device proposal is for a full scale floating slack moored wave energy converter. The Wave Dragon Company has been working toward commercialisation of the device for 3 years, and has deployed a prototype in Denmark since 2003 where reliable power production has already been demonstrated.

1.2 Project Objectives

The first objective of the project is to prove the feasibility of installing and grid connecting the device at commercial scale, with the intention of undertaking tests and verifying performance for a period of up to 5 years. After the 5 year period and once proven, the intention would be to commercialise the development of multiple devices to be deployed further offshore as part of a Wave Farm or array. This second stage would be subject to a separate consent process.

The second objective of the project is to generate clean electricity from a renewable source of energy, i.e. wave power.

2. The Need for Renewable Energy Generation

The UK Government has stated a target of generating 10% of electricity demand from renewable sources by 2010. This target has recently been extended by the Government to 15% by 2015 with an aspiration of 20% by 2020.

In addition the UK has a commitment of reducing greenhouse gas emissions by 20% relative to 1990 levels by 2010 and 60% by 2050. The generation of electricity from renewable energy sources (such as wave energy) produces no emissions, and by offsetting the combustion of fossil fuels helps to reduce emissions of environmentally harmful gases.

The development focuses on the generation of energy from a renewable source. The electricity generated by the proposed Wave Dragon Pre-Commercial Demonstrator will contribute to

Government targets, and will offset the annual release of approximately 1042 tonnes of carbon dioxide, the main greenhouse gas.

The Welsh Assembly Government has a duty under Section 121 of the Government of Wales Act 1998 to promote sustainable development in the exercise of its functions, that is, in everything it does. In effect, the incorporation of legislation on sustainable development required it to prepare a Scheme setting out how it would fulfil this duty, and to regularly review performance.

In addition, the Welsh Assembly Government is committed to consider the implementation of an ecosystem-based approach to managing activities in the marine environment. This is underpinned by six key principles :

- sustainable development
- integrated management
- conservation of biodiversity
- robust science
- the precautionary principle, and
- stakeholder involvement

In 2005, the Welsh Assembly Government issued an Energy Route Map consultation document, setting out its intentions to meet the contrasting challenges of fuelling an internationally competitive economy while maintaining the highest environmental standards and mitigating global warming effects. The Energy Route Map stated that Welsh energy policy currently has five important strands (priority actions), one of which is to secure 4TWhr per annum of renewable electricity production by 2010 and 7TWhr by 2020. As part of this, one objective is the development of marine (wave and tidal) energy systems with a key targets of major demonstration projects being located within Wales with the first such project being operational by 2008.

The Wave Dragon Pre-Commercial Demonstrator is intended to be the first such project in Welsh waters.

3. Offshore Wave Power

The majority of wave energy potential in UK waters is located on the west coast of the British Isles, with the areas of highest potential density being off Cornwall, Pembrokeshire, and the Outer Hebrides. In the waters around Wales, almost the entire commercially exploitable wave energy resource lies off the Pembrokeshire coast.

Resource studies have indicated that in theory, the efficient exploitation of the wave energy resource could make UK self sufficient in electricity.

The wave energy industry is in its early stages. At present there are 30 to 40 known wave energy converter devices in early development, less than half a dozen of which have reached the prototype stage. The Wave Dragon Pre-Commercial Demonstrator will move the technology beyond the prototype stage.

4. Wave Dragon Pre-Commercial Demonstrator Project

The site for the proposed Wave Dragon Pre-Commercial Demonstrator is approximately 1.7km (0.9 nautical miles) off the Pembrokeshire Coast at Long Point (the closest point on land), see Figure 1.



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Figure 1 Project Location

The Wave Dragon Pre-Commercial Demonstrator is a floating slack moored wave energy converter with a rated capacity of 7MW. It is moored (like a ship) in relatively deep water, i.e. more than 25 m to take advantage of the ocean waves before they lose energy as they reach the coastal area. This is in contrast to many known wave energy converters that are either built into the shoreline or fixed on the seabed in shallow water.



Figure 2 Artists impression of the Wave Dragon device

The Wave Dragon device allows ocean waves to overtop a ramp, which elevates water to a reservoir above sea level. This creates an artificial 'head' of water, which is subsequently released through a number of turbines and in this way transformed into electricity. Water is returned to the sea through draft tubes in the base of the unit, which house the turbines.

Water is elevated to the reservoir where it is stored temporarily before falling into the turbine chambers thus converting mechanical wave energy to electrical output directly. The only moving parts of the device are the turbines themselves.

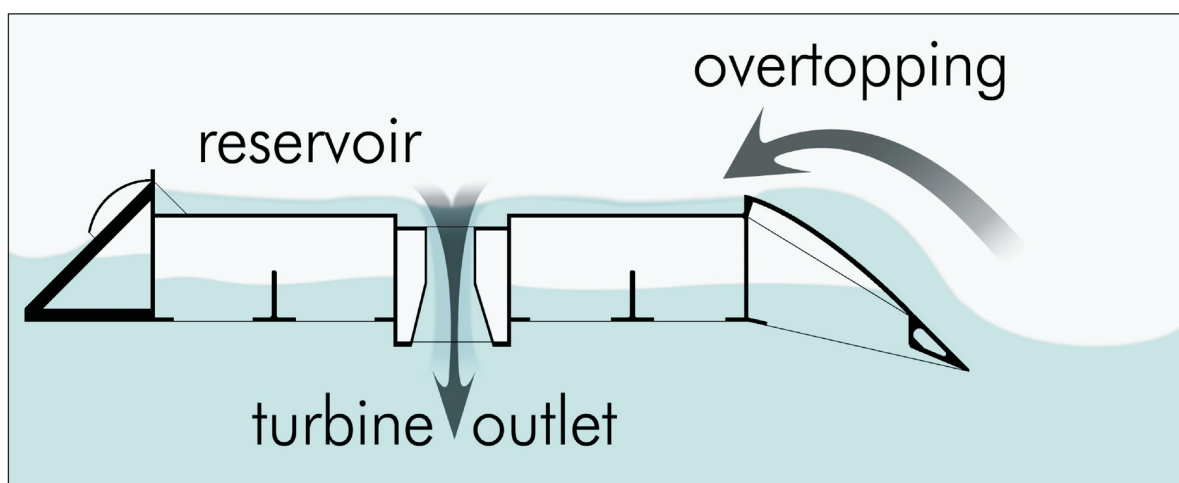


Figure 3 Energy Conversion Schematic

The unit comprises a central platform, with a curved ramp and a large water reservoir equipped with an array of hydro turbines, and two lateral curved wave reflecting wings which concentrate the power of incoming waves. The turbines used in the device are low head axial turbines derived from a conventional Kaplan hydro-electric turbine.

The Wave Dragon device is designed to remain within a defined movement area, and to extract the energy of waves passing over it. Whilst the device itself will move with changing wave direction and tidal currents, it will be fixed to a forward buoy that will remain essentially stationary (in plan view).

The device is fixed to the seabed using a mooring system, as shown in Figure 4

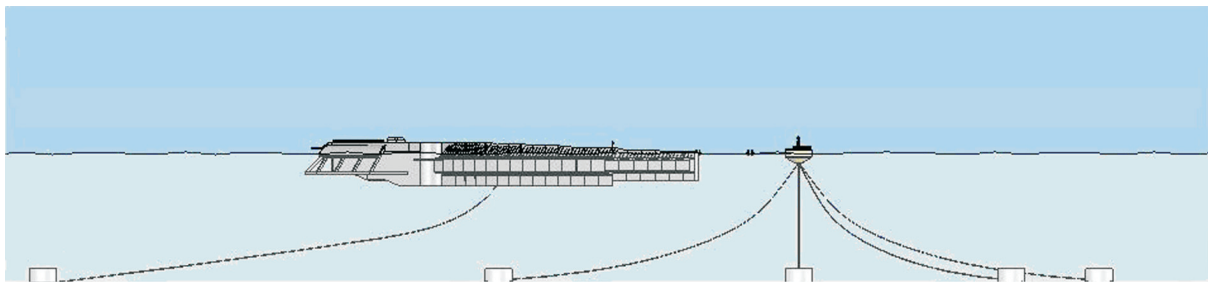


Figure 4 Wave Dragon Mooring System

It is likely that the mooring system for the Wave Dragon device will feature between six and eight concrete gravity mooring blocks and a series of catenary mooring lines (steel chain) fixed to a buoy. In addition there will be one rear mooring block to stop the device from rotating too far in tidal currents.

5. Statutory Consents

The consenting regime for small-scale marine renewable energy generation demonstration devices in English and Welsh territorial waters and the whole of the UK Renewable Energy Zone (REZ) (except that part beyond Scottish territorial waters) is subject to guidance from the Department of Trade and Industry (DTI).

The consents being applied for the project are as follows :

- Consent from Secretary of State for Trade and Industry under Section 36 of the Electricity Act 1989
- Licence from the Department for Environment, Food and Rural Affairs (DEFRA) on behalf of Welsh Assembly Government under Section 5 of the Food and Environment Protection Act 1985;
- Licence from Secretary of State for Environment, Food and Rural Affairs under Section 34 of the Coast Protection Act 1949;

The application area is shown in Figure 2 below:

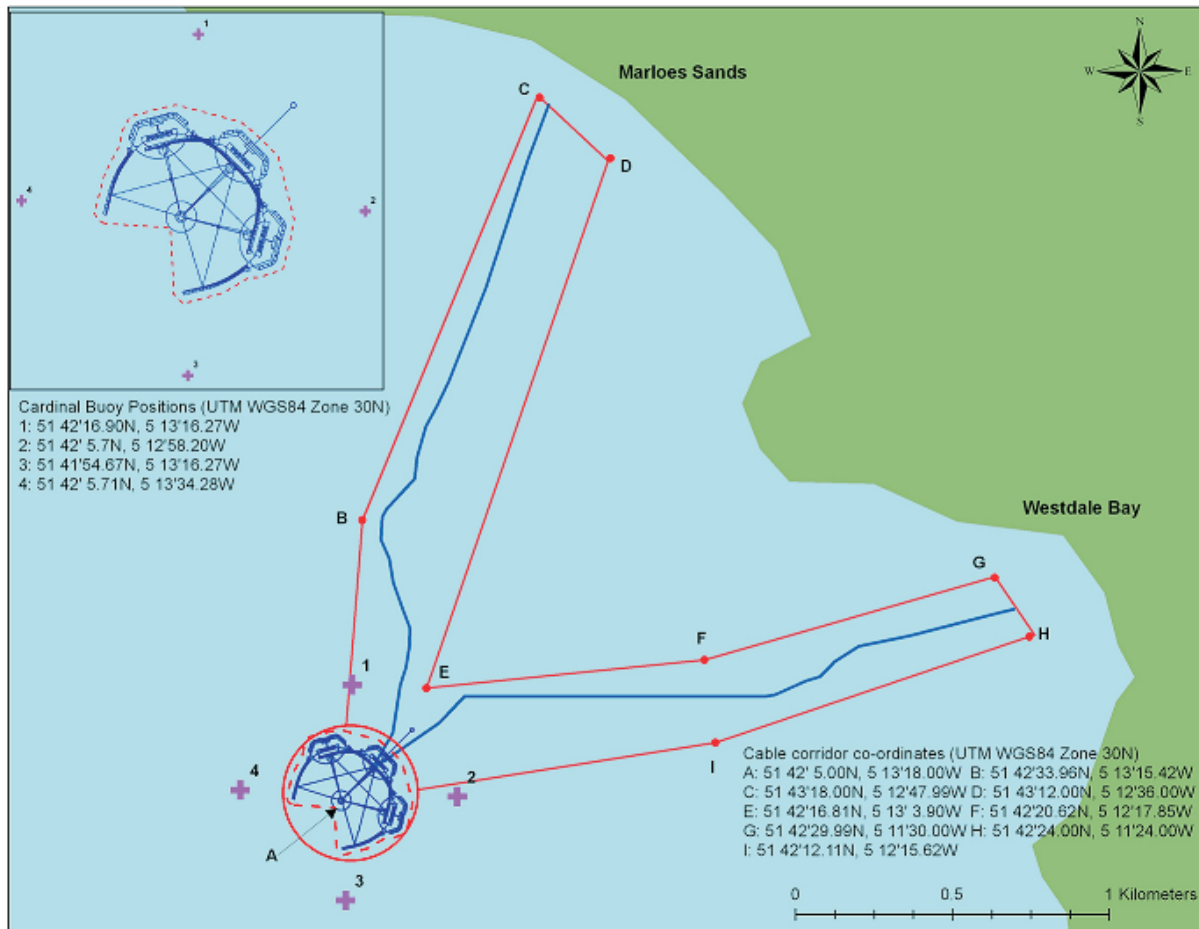


Figure 2: Application Area and details of works (cable alignments are tentative only)

6. Consultation

Communication and consultation is a key element of the EIA process, designed to allow stakeholders and the public to be fully informed and engaged in the evolution of the development proposal. This process also ensures that any concerns relating to the project or ideas on how the development should progress are considered.

A variety of stakeholders may need to be involved in any consultation process both to meet statutory requirements and to represent the full range of views on an issue. Identification and engagement of a balanced and wide range of stakeholders can be the most challenging aspect of project consultation. When consulting such a broad range of interested parties, including the public, a number of different mechanisms can be used and each should be designed specifically to meet the needs of the target audience in an appropriate and effective way to provide valuable feedback.

The consultees can be broadly categorised into the following groups:

- a) Regulatory Authorities;
- b) Statutory Consultees / Publicly Funded Organisations;
- c) Non-Governmental Organisations; and
- d) Clubs and Societies.

WDWL have been keen to keep all stakeholders and consultees as informed as possible from the start of the process. Initially, a Project Briefing was held in March 2006 at Marloes Village Hall together with an exhibition showing details of the project. This was followed by numerous meetings with stakeholders, and information sent to consultees. Information has also been made available to the public on the project website www.wavedragon.co.uk and through numerous articles on the project in local and national newspapers.

7. Environmental Impact Assessment

The Environmental Impact Assessment (EIA) process seeks to identify those impacts associated with a development through all phases of its evolution. This is based on knowledge of the existing environment, the definition of the project proposed and the response of the environment to any potential changes. Where possible, mitigation is built into the project's design to reduce impacts 'at source', and where this is not possible a range of mitigation measures may be applied to reduce any residual impacts which arise.

This Environmental Statement (ES) sets out the assessment of the likely significant environmental effects of the project and the measures proposed to mitigate them. The Environmental Statement is intended to assist decision makers and the public in understanding the implications of the project, including its benefits. In addition to the ES itself, the consultation responses submitted to the consenting authorities, by the Statutory Consultees, are an important part of the overall environmental information to be considered by them in ensuring that the full environmental effects are taken into account. The consideration of these responses is an integral part of the EIA process.

The EIA has considered the impact of the proposed Wave Dragon device on the following broad areas:

- Physical Environment
- Biological Environment
- Human Environment

7.1 Physical Environment

The Physical Environment assessment has considered potential environmental impacts through effects on the following major environmental aspects:

- water quality;
- coastal processes (sediment fluxes, waves and tidal currents);
- onshore physical environment.

It should be noted that applications for onshore consent (planning permission) are not yet being sought, therefore, the assessments relating to landfall and onshore impacts should be viewed as preliminary. Upon clarification of defined onshore works proposals, due consideration for any changes to the assessment of impacts will be made.

7.1.1 Water and Sediment Quality

A combination of desk based analysis and sediment sampling were undertaken to assess the quality of the coastal waters and seabed sediments in the area for deployment.

The area was found to contain only small quantities of mobile sediment in the offshore environment and deployment area. Being a high energy site, it was concluded that most waterborne pollutants will be readily dispersed. Tests revealed that these sediments did not contain significant quantities of contaminants. Therefore, no impact through elevated suspended sediments or contaminant suspension on existing water or sediment quality is anticipated.

During the offshore installation phase, with suitable management plans in place, there would be a low risk of accidental discharges of oils or lubricants that could adversely affect sediment or water quality. However, this is considered to be insignificant compared to other sediment generating activities occurring within the area, most notably navigational channel maintenance dredging and associated spoil dispersal for the nearby shipping channels of Milford Haven.

7.1.2 Coastal and Seabed Processes

A desk based and modelling study was undertaken in order to describe the seabed processes, impacts and effects of the Wave Dragon device deployment.

Water depths at the deployment site are approximately 26 to 28m below CD (Chart Datum) and the seabed is primarily bed rock with pocket and gully deposits of coarse pebbles and cobbles, apart from the potential cable landfalls which will pass under the sand and gravel beaches.

The site is exposed to high energy waves from the Atlantic making it a dynamic environment. The adjacent coastline comprises rocky headlands, hard cliffs and pocket beaches and the nearshore areas are designated for nature or geology conservation and are considered important as a recreational resource.

The impacts and effects of the deployment of the Wave Dragon device were assessed in relation to waves, currents and sediment distribution. The device, anchor blocks and cable were assessed close to the device and also further away up to the shoreline.

The study concluded that the proposed scheme is likely to have a moderate impact on the waves close to the device and some localised impact on the currents and beach processes in the immediate vicinity of the development. However, it concluded that there is unlikely to be any noticeable impacts further away from the device towards the shore.

7.1.3 Onshore Physical Environment

The coastline adjacent to the deployment location consists of a number of small beaches and cliffs with some rocky outcrops. The land use around the coastline and particularly the areas identified as options for the proposed onshore works is primarily improved grassland and arable agriculture. The majority of the solid geology beneath the proposed onshore works at Marloes comprises Silurian sedimentary and volcanic rocks. At the Dale landfall site the solid geology beneath the proposed onshore route comprises Devonian Red Marl.

An assessment of the potential impacts of the proposed development on the onshore physical environment was undertaken and it concluded that the geology and hydrology of the area could be sensitive to construction.

At the time of writing, the placement and design of any onshore structures or infrastructure is yet to be defined and therefore this sensitivity will be taken into account in finalising the locations chosen. The construction programme itself is likely to cause temporary disruption to farming activities around the onshore options. However, the study concluded that where best practice and environmental management controls are implemented during the construction phase, the scheme will have no adverse effects on the onshore physical environment.

7.2 Biological Environment

WDWL undertook an assessment of the potential impacts of the Wave Dragon device upon marine, inter-tidal and land based ecology and including fish, marine mammals and birds.

7.2.1 Impact on Designated Sites

The Wave Dragon device will be deployed within an area designated as a conservation site known as the Pembrokeshire Marine Special Area of Conservation (SAC).

At this stage there is insufficient information to confirm whether or not the deployment of device will impact on the nature conservation status of the site. Further studies on the marine life in the deployment area and cable route options will be undertaken during the summer of 2007 in order to establish the presence / absence of any species or habitats of conservation interest and define ways in which this impact can be minimised. An assessment will need to be undertaken by the competent authority, in this instance DEFRA, and WDWL will work with CCW in submitting relevant information to DEFRA in order to carry out this work prior to any consent being granted.

7.2.2 Marine Ecology

A study was carried out looking at the existing environment at the deployment site and assessing the impacts of the deployment, operation and decommissioning of the Wave Dragon Pre-Commercial Demonstrator on marine ecology.

Installation activities (other than work on the cable route) would affect seabed habitat only. The study concluded that the impact would be low and that the areas would recover rapidly after decommissioning.

The effect of installing nine mooring blocks may increase the overall diversity of the local seabed communities by providing an increased area for colonisation.

The main potential impacts of cable installation are the ploughing action of cable burial, pinning of the cable over areas of bedrock and potential damage caused by anchors and anchor lines. However it is not envisaged that these activities will have a significant impact.

There may, however, be significant impacts due to installation of the cable across bedrock on certain reef species such as Pink Sea Fan which are included in the designation of the area as a conservation site. This will need to be assessed in greater detail following surveys scheduled for early summer 2007, and the results submitted as an additional report.

During operation, the mooring chains and structures do have the potential to affect sensitive and designated species attached to and protruding from bedrock reef habitat, should the device be sited in such an area. The blocks are being situated on sediment, therefore the impacts are mitigated through avoidance of the most sensitive areas. Micro-siting of the device and mooring structures will be undertaken as a way of minimising these impacts, following more detailed surveys.

The decommissioning of the device was identified as having some potential to impact on the marine communities, however the impact of this was considered to be low.

7.2.3 Fish

A desk based review and consultations were undertaken to determine the fish species present in the area and to assess any likely impacts to these species arising from the deployment of the device.

The area was found to be rich in species such as dab and several species of shark were identified as using the area. The area was also noted for migratory species such as salmon and several internationally protected species such as river lamprey and basking shark. Crustaceans such as crab, lobster and crayfish were noted as being present in the area and of commercial importance.

The effect of the changes upon commercially important local species such as crabs, lobsters and crawfish, and local fish populations will be negligible in the context of the extent of local fisheries.

Fish are unlikely to pass over the ramp structure into the reservoir. Larger fish will, however, be prevented from passing through turbines by grills around the turbines and hence it is envisaged that they will flow back out of the reservoir unharmed. The turbines turn at a relatively slow speed so any fish small enough to pass through the grills should pass through the turbines unharmed.

The attenuation of underwater noise is likely to occur over a relatively short distance and installation occurs over a short timescale therefore there is unlikely to be any impact due to noise to the fish populations of the area.

7.2.4 Electromagnetic Fields

Electricity cables can produce an electromagnetic field around them, which can be detected by sensitive fish species. The Wave Dragon device power export cable would be no more than 2.3km in length and would therefore represent a very small feature within the existing marine environment. The expected magnetic field from the cable is considered to be relatively low and given both the small scale of the project and the low magnitude of the anticipated magnetic field it is not anticipated that there is any likelihood of a significant impact for magnetically sensitive fish species.

7.2.5 Marine Mammals

A desk based literature review and local consultations were undertaken in order to assess the potential for impacts on marine mammals, including cetaceans, seals, otters and marine turtles throughout the lifecycle of the Wave Dragon pre-commercial demonstrator project.

The immediate area of the proposed Wave Dragon installation site is not understood to be of high importance for marine mammals in a local context, though Pembrokeshire coastal waters are recognised as being of relatively high importance regionally and nationally.

Impact to marine mammals mainly relates to noise issues both during installation and operation. Noise disturbance of marine mammals may occur up to several hundred metres from the noisiest construction activities for short periods of time within the construction period but this is not considered to be significant. There is the potential for greater effects on cetaceans in the area during installation but appropriate measures will be used to minimise noise during the construction process.

7.2.6 Onshore and Inter-tidal Ecology

A combination of a walk-over survey and a desk study were used to provide information to support the impact assessment for the ecology in the inter-tidal zone and of onshore habitats and species in relation to potential cable landfall locations at Marloes Sands and Westdale Bay and in the vicinity of candidate onshore cable routes.

The Pembrokeshire coastline has a diverse range of shoreline habitats from exposed bedrock on headlands to sheltered sandy coves and sheltered mud in the estuaries. Hard substrate areas, for example on bedrock or boulders outcropping from sand, typically support communities of algae.

The potential cable routes (to either Dale or Marloes Sands) will pass through the Dale and Marloes Site of Special Scientific Interest (SSSI), which is a conservation site designated for its maritime grassland, heath, cliff crevice and ledge vegetation and coastal scrub.

The project design aims to minimise disturbance and impacts to rocky reef or inter-tidal areas by avoiding these areas at the cable landfall therefore the impact is therefore likely to be very small. Minor changes in beach profiles arising from the changes in the coastal processes during the operation of the Wave Dragon device were found to be possible and may cause some habitat loss caused by moving sands. However this impact would be temporary in nature and beach profiles are known to change significantly through natural processes.

Certain important species, specifically Scaly Cricket, were identified by the studies in one of the landfall areas on Marloes Sands. These will be investigated further and the finalised design will take this into account. Scaly Cricket habitat will be avoided by moving temporary works away from sensitive areas.

At this stage, no further detailed assessment of protected species and habitats can be made with any authority as the final onshore cable route has yet to be chosen. Once the onshore cable route is finalised the impacts relating to these can be ascertained.

7.2.7 Birds

A desk based study, drawing on current knowledge and data was undertaken to assess the potential for impacts to birds arising from the deployment and operations of the Wave Dragon Pre-Commercial Demonstrator device. Consultations were also undertaken with key representatives on bird populations in the area.

The development has the potential to interact with bird species directly, due to disturbance or exclusion from available foraging habitat, or collision with the structure; or indirectly by causing changes to habitat characteristics, in particular by introducing noise and movement. Lighting required as aids to navigation was also assessed.

The deployment area is proximate to three conservation areas specific to birds and ten bird species were identified as being of importance, including the Manx Shearwater, and Red-billed Chough.

However, for the ten key species assessed within the impact assessment, the impact was considered to be low. Both the deployment and operation phases indicated negligible negative effects and for species like Storm Petrel, Lesser Black-backed Gull and Kittiwake the device would have no negative effects. Given the high intensity of ships in the area creating artificial lighting at night in the nearshore environment, the addition of navigation lighting from the Wave Dragon scheme will present a negligible addition.

7.3 Human Environment

WDWL undertook assessments of the potential impacts of the Wave Dragon device upon landscape and seascape, archaeology, socio-economics, noise, commercial fisheries and navigation.

7.3.1 Landscape and Seascape

A seascape, landscape and visual impact assessment (SLVIA) was undertaken for the proposed Wave Dragon Pre-Commercial Demonstrator. The potential impacts of the development on the seascape / landscape resource and visual amenity were assessed using a desk study and preliminary site survey, baseline seascape, landscape and visual assessment (including field survey).

The land within the study area all forms part of the Pembrokeshire National Park, in addition the coastline is also designated as heritage coast. Two Landscapes of Historic Interest are located within the study area, Skomer Island and the Milford Haven Waterway. Within the 7km radius study area and the main users of the area, key viewpoints and key features were identified.

The presence of the offshore islands, together with the landform of the Dale Peninsula provides both enclosure and visual interest. It was noted that the absence of any landform in a south westerly direction allows long distance views across open sea. There are several Public Rights of Way routed throughout the mainland study area.

Nine viewpoints were identified, all of which were considered to be of high sensitivity. The study concluded that the device could be viewed from the setting units identified to the north and south i.e. to the north of Skomer Island, Milford Haven and Pickard. However, any views to the proposed device would be restricted to coastal locations within these areas and any potential effects will be reduced due to the distance and the low height (above sea level) of the proposed device. Sea users may be able to see the device at closer quarters, however this is solely dependent upon the route through the sea area that the users choose.

Figure 5 shows a photomontage representing a typical view of the device from the shore.

As the proposed development is a Pre-Commercial Demonstrator, it will only be a temporary feature, expected to remain in place for a period of up to five years. All readily visual components will be removed on decommissioning and any effects to landscape and visual amenity, including seascape, will be reversed.

7.3.2 Archaeology and Cultural Heritage

Geophysical and desk based studies were undertaken in order to provide a statement of the known and potential archaeological remains within the offshore and onshore study area to assess the likely impacts, and the significance of effects of the proposal. A geophysical survey was undertaken of the offshore survey area and cable route to shore, covering both the cable route options to Marloes Sands and Dale including a 2km area of search buffer zone.

The marine survey area was found to contain seven wrecks and sites of archaeological interest; in addition there are 110 reported losses within the area for which there are no known seabed remains. There is the potential for archaeological remains within the deployment area and it is anticipated that the final position of the mooring blocks will need to be informed by a seabed inspection prior to installation. This should eliminate any significant impact on any known or as yet unknown wreck structures within the proposed area for deployment.

The onshore cable route corridor was found to contain 28 sites and monuments. Further studies will be required in order to assess the likely impacts to the onshore archaeology and cultural heritage through the onshore construction phase of the development once onshore infrastructure has been further defined.

7.3.3 Socio-Economics

WDWL has undertaken an assessment of the social and economic environment in the Pembrokeshire and West Wales region and assessed the likely impacts arising from the deployment of the Wave Dragon Pre-Commercial demonstration device.

Employment in the area was found to be dominated by the service and public sector with tourism featuring as the dominant factor in the Pembrokeshire economy. It was noted that the region attracts large numbers of visitors for the outdoor and marine activities present in the region. The Pembrokeshire Coastal Path and marine leisure activities such as sailing, diving, kayaking and coastering were all found to make major contributions to the areas economy.

The study was unable to qualify any effects on the levels of tourism caused by the device, however surveys aimed specifically at tourists for other renewable energy projects suggest that rather than having a negative impact on tourism, renewable energy projects could actually be a positive influence in that tourists may be keen to visit the developments themselves. There is the possibility of the Wave Dragon device becoming a tourist attraction with charter trips including a detour to the site.

The development and operation of the Wave Dragon device will involve some sourcing of labour, materials and services from the local and regional economy. The resulting capital expenditure and direct and indirect job creation is likely to be complemented by additional reputation benefits for the region. It is envisaged that the proposed Wave Dragon Demonstrator device would provide employment for the equivalent of 70 people in the construction and deployment stage, and the equivalent employment of 18 people through indirect and induced benefits.

It can be concluded that the Wave Dragon project will make a moderately positive contribution to the region.

7.3.4 Noise

An assessment of the potential for underwater noise attenuation during the construction and operation of the Wave Dragon Pre-commercial Demonstrator device was undertaken. The underwater noise from the Wave Dragon generator system has been estimated from measurements of a single Kaplan turbine in a controlled laboratory environment, and compared to on-site measurements.

The main activities causing underwater noise impact during the deployment and operational phases of the Wave Dragon device are from increased vessel traffic in the region. Ships supporting the installation of the Wave Dragon device will generate underwater noise as a result of propulsion systems, bow thrusters, rotating machinery, generators, dynamic positioning systems (if used) and ship echosounders. These sources are likely to dominate the

underwater noise environment to a range of a few kilometres for the periods that vessels are present at the site.

The underwater noise from the Wave Dragon generator system has been estimated from measurements of a single turbine. This study suggested that the underwater noise from the generator system may cause a behavioural response in species of marine mammal over a range of a few metres, however this is not considered significant. Other noise mechanisms associated with wave interaction with the body of the device and hydraulic noise have been assessed as having a low likelihood of causing a significant disturbance to marine species.

The study concluded that it is unlikely that the underwater noise, produced during any of activities identified during the construction and operational phases of the Wave Dragon scheme, will kill or cause direct physical injury to fish or marine mammal species. Disturbance to some sensitive species may occur in very close proximity to the deployment location, however, this is considered to be insignificant.

7.3.5 Commercial Fisheries

An assessment of the potential impacts to the commercial fishing industry was undertaken as part of the socio-economic assessment. Information regarding commercial fishing activity and its value, areas of use and landing data were gathered from official records and consultation meetings.

Consultations were held with Officers of the Marine Fisheries Agency (MFA), Sea Fisheries Inspectorate (SFI) in Milford Haven, the South Wales Sea Fisheries Committee, local fishermen's group South & West Wales Fishing Communities Ltd and individual fishermen in the region. This information was used to assist and supplement the official statistics.

From this assessment and visual records, it is estimated that the maximum number of fishing vessels active on site at any one time is three, however these are not always the same vessels.

The main impacts identified relate to the loss of access to grounds, restricted access through navigational controls, disruption to the industry through the cable laying and stabilisation, loss of habitat (and potentially resource) and increased risk through the potential for accidents and collisions. There is some potential for enhanced fisheries through a mussel seeding scheme, attached to the device, however this is subject to the correct permissions being granted.

In using a Fisheries Liaison Officer and using informative measures such as continual liaison and Notice to Mariners, all potential impacts can be mitigated and reduced. It is considered that the impact of the deployment and operation of the Wave Dragon Demonstrator will be minimal, provided good liaison and clear early notification is given to the fishing industry.

7.3.6 Navigation

A detailed Navigation Risk Assessment has been carried out for the proposed Wave Dragon Pre-Commercial Demonstrator Project in order to understand the effects and risks to navigation from the deployment of the device. This has been based on a maritime traffic survey of the area, supplemented by research of other available data sources as well as consultation with navigational stakeholders.

The nearest port is Milford Haven, approximately 7 miles east of the proposed site. Is the busiest Welsh port and handled 37.5 million tonnes of traffic in 2005. This traffic was dominated by tankers (58%), whereas fishing and recreation made up 5% and 2% respectively.

The Wave Dragon location is away from the main shipping lanes in the area, which are associated with Milford Haven. The risk of a commercial ship drifting off course and colliding with the structure was assessed to be very low.

Similarly, studies performed by the developer have indicated that there is large redundancy in the mooring system and hence there is negligible risk of mooring failure of the device causing it to come adrift. Even if this were to occur, contingency plans will be in place to alert shore-based personnel and respond to the emergency.

Based on the best-estimate of fishing activity identified from the assessment, the frequency of fishing vessel collisions was estimated to be 1 in 100 years. To aid the identification of the device and minimise the likelihood of any collisions, the device will be appropriately lit and marked and awareness of the location of the device will be raised amongst local stakeholders.

The Wave Dragon device and mooring system are unlikely to have a significant impact on the local marine recreation and amenity. The device is large and will be marked and lit to the required standards, and will be marked on Admiralty Charts. It will also move slowly throughout its movement envelope.

The generic risks of collision and cable snag are considered low, and risks of stranded personnel will be included within the Emergency Response Plan to be drafted prior to construction.

7.3.7 Other Relevant Projects / Marine Uses

A review of other relevant marine activities in areas surrounding the deployment location was undertaken as part of a desk based review.

Six types of marine activity or industries were identified as being relevant to this project including:

- Offshore Oil and Gas
- Marine Aggregate Extraction
- Subsea Cables and Pipelines
- Marine Waste Disposal and Dumping
- Military and Civil Aviation
- Abandoned Munitions

The study identified that the deployment of the Wave Dragon device would not cause any significant impacts in relation to these.

7.4 Summary

The development of the Wave Dragon Pre-Commercial Demonstrator will play an important role in helping the UK to achieve its aspirations for a marine energy industry to contribute to the energy mix and ultimately meet green energy targets. These targets have been set in order to help tackle climate change and secure energy supplies for the future. This deployment signifies the first of its kind in UK waters and will be a milestone in the delivery of significant wave energy projects in Wales.

WDWL has undertaken a rigorous site selection and project design process in order to minimise the effects that the works will have on the physical, biological and human environment. In particular, careful attention has been given to specific site selection and the project design within the conservation areas with further micro-siting and marine studies to be undertaken during the summer. Extensive consultation has been undertaken with residents, stakeholders and statutory consultees, and the advice of specialists has informed the impact assessment and proposals for measures to minimise any impacts.

It should be noted that, subsequent to the submission of the Environmental Statement and supporting documents, WDWL intend to provide addendum information relating to marine ecology surveys, which will be submitted for consideration once the survey data has been assessed.

In the course of the assessment no significant impacts have been identified with the exception of potential significant impacts some marine seabed habitat from cable installation (which cannot currently be corroborated until video and diver survey work has taken place). It is anticipated that through a strategy of avoidance of such habitat and micro-siting of components on the seabed, the overall impact of the proposed scheme will be reduced to an acceptable level.