

# South West of England Regional Development Agency

## Wave Hub Non-Technical Summary

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**Halcrow**



**South West of England**  
Regional Development Agency

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# Contents Amendment Record

This report has been issued and amended as follows:

Issue	Revision	Description	Date	Signed
1	0	Non-Technical Summary	1/6/06	SC



# 1 Introduction

The South West of England Regional Development Agency (SWRDA) is proposing the Wave Hub project to provide the electrical infrastructure necessary to support and encourage developers of wave energy converter devices (WECs) to generate electricity from wave energy. It will allow developers the opportunity to test groups (arrays) of devices over several years to prove the technologies will operate effectively in realistic offshore marine conditions and that they will produce the expected amounts of power.

Wave Hub will support the UK government's energy policy by contributing towards the UK's drive to meet the challenges and achieve the goals of the new energy policy including a 60% reduction in carbon emissions by 2050. In addition, Wave Hub will support the South West region's commitment to encouraging technologies for renewable energy generation that will contribute to the region's renewable energy target of 11% - 15% of electricity production by 2010.

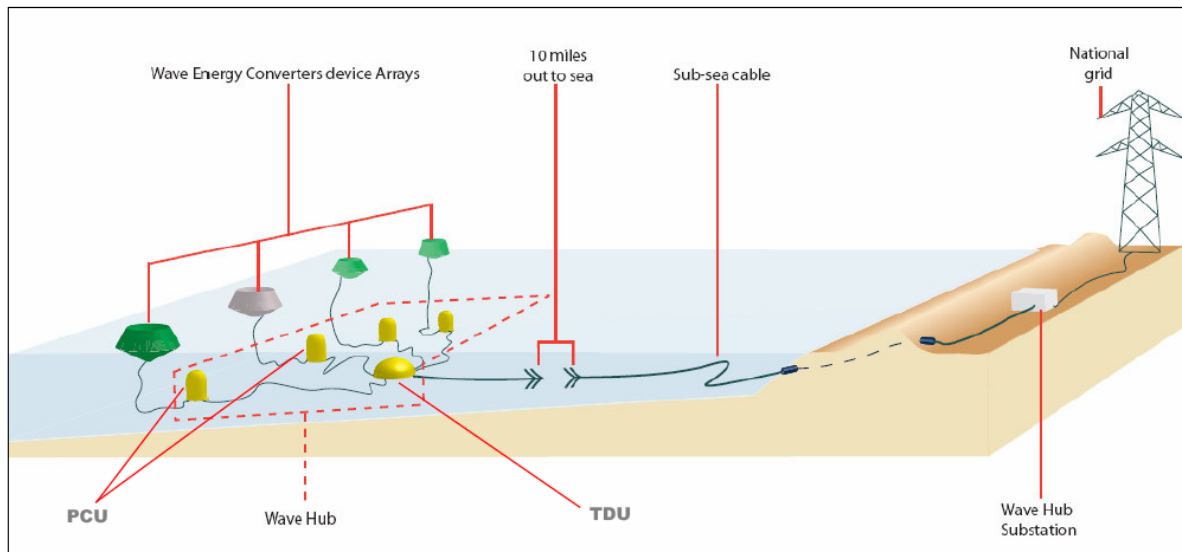
The proposed consent for Wave Hub involves an application to the Department of Trade & Industry (DTI) made under the Electricity Act 1989 incorporating deemed planning permission under the Town & Country Planning Act 1990), together with an application to the Department of the Environment, Food and Rural Affairs (DEFRA) under the Coast Protection Act 1949 and a licence under the Food & Environment Protection Act 1985.

An application of this type must be accompanied by an environmental statement: that is, a detailed technical report which documents the potential impacts of the project on various aspects of the natural and human environment. If the consents are granted, we expect the Wave Hub to be installed in the spring/early summer of 2008 and for the first WECs to be installed from that time.

This document is the Non-Technical Summary of the Wave Hub Environmental Statement.

## 2 Project description

Wave Hub's infrastructure comprises an onshore substation connected to offshore electrical equipment on the seabed via a 25 kilometres long sub-sea cable. The offshore electrical equipment includes a termination and distribution unit (TDU; i.e. a 4-way cable splitter), four interconnecting cables, and four power converter units (PCUs; i.e. transformer units) into which can be plugged the WECs (see Figure 1).



*Figure 1 Conceptual illustration of Wave Hub*

The offshore electrical equipment and the WECs (including their mooring systems) will be situated in a deployment area approximately 10 nautical miles off St Ives, in approximately 50m of water (see Figure 2). The deployment area occupies an area of 4 kilometres by 2 kilometres and will be marked by various aids to navigation. Wave Hub's onshore substation will be situated adjacent to the existing substation facilities at Hayle, located behind the Hayle Towans sand dunes. The sub-sea cable will connect the offshore deployment area to the onshore substation. Offshore, 17 kilometres of sub-sea cable will be laid on the surface of the seabed as there is insufficient sediment to allow it to be buried. Inshore, 8 kilometres of the cable will be buried in the seabed where it passes through St Ives Bay and across the beach at Hayle. On land, the cable will be installed in a duct drilled through the Hayle Towans at the top of the beach and connected to the new substation.

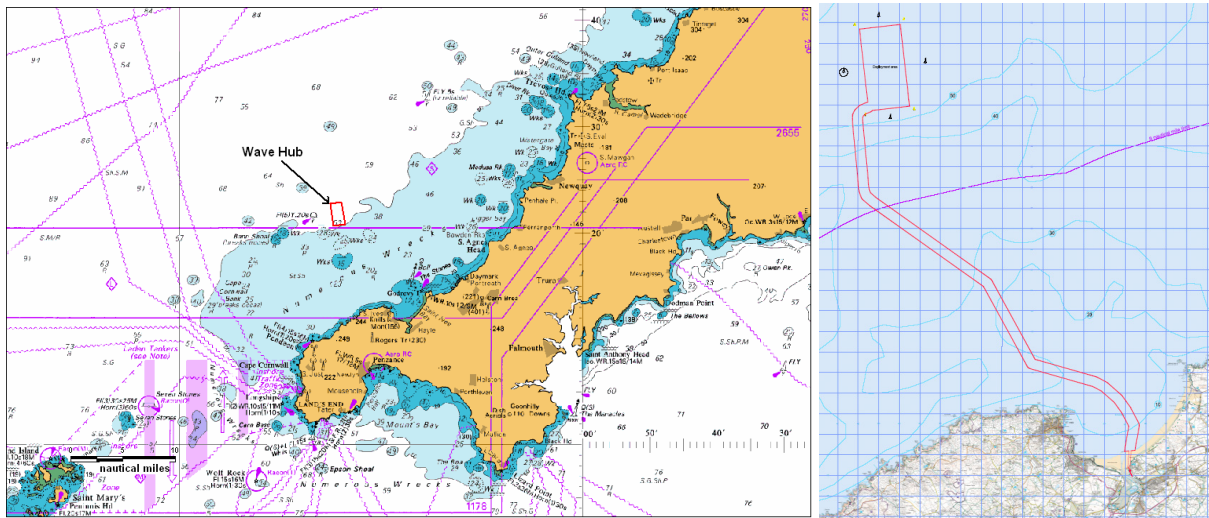


Figure 2 Wave Hub development location

The WEC devices will be floating on or slightly below the water surface, connected to the Wave Hub's PCUs by cable, and anchored to the seabed via mooring lines. WEC units may take a number of forms, with varying electrical power outputs, numbers in an array, and spacing. Figure 3 presents three examples of WECs. Safety zones up to 500m around the WECs may be established to prohibit certain activities, such as navigation by commercial shipping, to ensure that the devices operate safely.

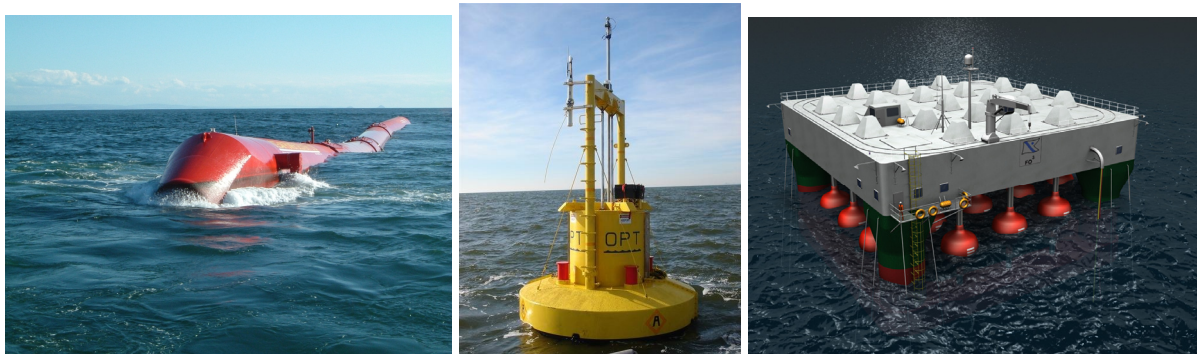



Figure 3 Examples of WECs – Pelamis, PowerBuoy and FO<sup>3</sup> devices



An example layout of Wave Hub's offshore deployment area is shown on Figure 4. This figure shows a likely layout for the electrical equipment, individual and arrays of WECs, and navigation aids.

Wave Hub will be able to generate up to 20 megawatts of electricity (each of the four PCUs can handle up to 5 megawatts). This is the equivalent amount of energy to power approximately 7,500 average UK homes. In local terms, this translates to around 3% of Cornwall's domestic energy requirement.

### **3 Alternative options**

In selecting the location for Wave Hub, a number of alternative options were examined in detail. For example, different options for the location of the onshore substation and the landfall point for the sub-sea cable were considered. In addition, alternative locations for the offshore deployment area were considered, as well as the route for the sub-sea cable.

In considering alternative options for the above aspects of Wave Hub a variety of physical, technical, environmental and economic factors were taken into account. The preferred option for Wave Hub represents the optimal balance of these factors.

### **4 EIA process**

EIA is established by law and is a process that considers the likely environmental effects of certain projects in order to assist decision-making on consent applications. The EIA process for Wave Hub considered the construction, operation and decommissioning of the project and, where appropriate, assessed the potential environmental impacts against likely and worst case scenarios for some aspects of the project, such as the use of different types and arrangements of WECs within the site. Various actions led to the preparation of the Wave Hub Environmental Statement, including:

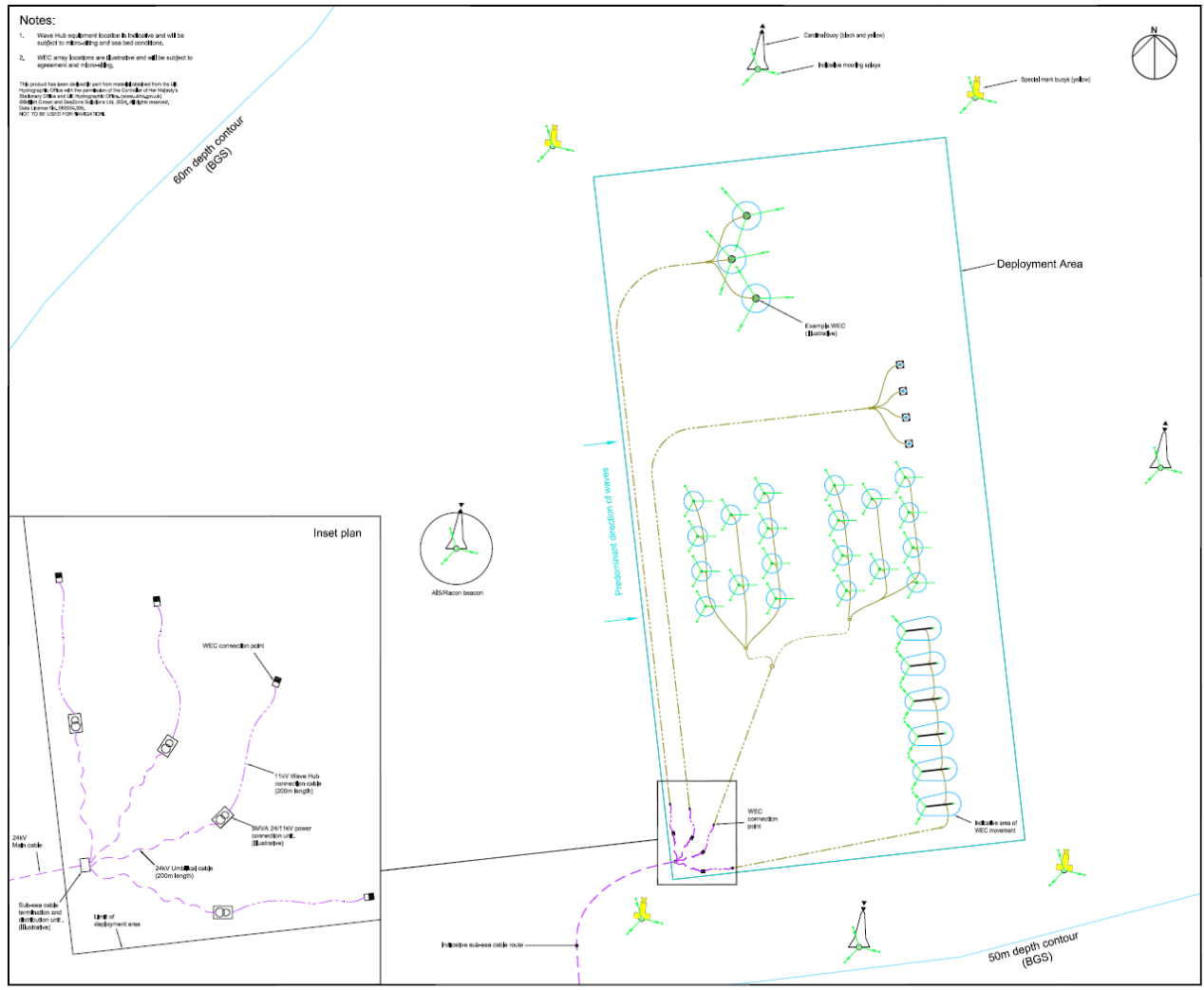



Figure 4 Example of possible layout at Wave Hub's deployment area



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- an Environmental Scoping Study to determine the context and extent of the information to be covered by the Environmental Statement;
  - surveys to understand the present wave climate, water quality, sediment quality, soil quality, terrestrial ecology, offshore birds, intertidal birds, intertidal ecology, subtidal ecology, cetaceans, fish resources and marine archaeology;
  - specialist investigations including computer modelling of coastal processes, commercial fisheries study, risk assessment for shipping, landscape and visual impact assessment, and archaeological assessment;
  - establishment of series of likely case and worst case scenarios for WEC layouts and navigation aids requirements to inform the impact assessments;
  - use of a stepped procedure to identify, predict and assess the environmental impacts, to devise impact mitigation measures where necessary, and to consider uncertainty about the impact assessment; and
  - consultation with stakeholders and interested parties to understand their opinions and share information and to gain their input into impact identification, surveys and specialist investigations.

## 5 Planning and policy framework

Wave Hub does not conflict with any of the relevant plans or policies at the local and regional level. In a number of cases, Wave Hub is in accordance with plans and policies. Of particular importance, the proposed development makes a significant contribution towards policies relating to sustainable development and regional targets for the generation of energy from renewable sources. In particular, Wave Hub presents an opportunity to contribute towards the UK's drive to meet the challenges and achieve the goals of the new energy policy including a 60% reduction in carbon emissions by 2050, which is likely to need renewable energy sources by then to be contributing at least 30% to 40% of electricity generation.



## 6 Coastal processes

The present conditions were derived from the latest available data on water levels, offshore wave conditions (including a desktop review of available data, Met Office wave model data), tidal streams and currents, and sediment regimes. The potential effects of Wave Hub on coastal processes were examined using computer modelling of wave climate, tidal currents and sediment movements for a likely case scenario (see Figure 4) and a worst case scenario for WEC layouts. Modelling predicted:

- Up to 3% and 5% reductions to wave heights at the coast between Gwithian and Newquay during a 1 in 1 year storm event for the likely case and worst case scenarios for WEC layouts respectively;
- Up to 5% and 11% reductions to small and big surfing wave heights between Portreath and Chapel Porth for the likely case and worst case scenarios for WEC layouts respectively (see Figure 5);
- Changes of up to -0.8 metres per second and +0.6 metres per second changes to surface currents during the flood and ebb tidal flows within a box 15 kilometres by 15 kilometres around the Wave Hub, and no changes to tidal currents at the coast.
- Up to -0.2 metres and +0.2 metres seabed height change for the example case and worst case scenarios which will be largely indiscernible against background sediment transport conditions and beach levels along the northern Cornish coast.

The modelling results were used to inform impact assessments on other aspects of the environment. For example, changes to the wave climate informed the assessment of impacts on recreation associated with surfing conditions.

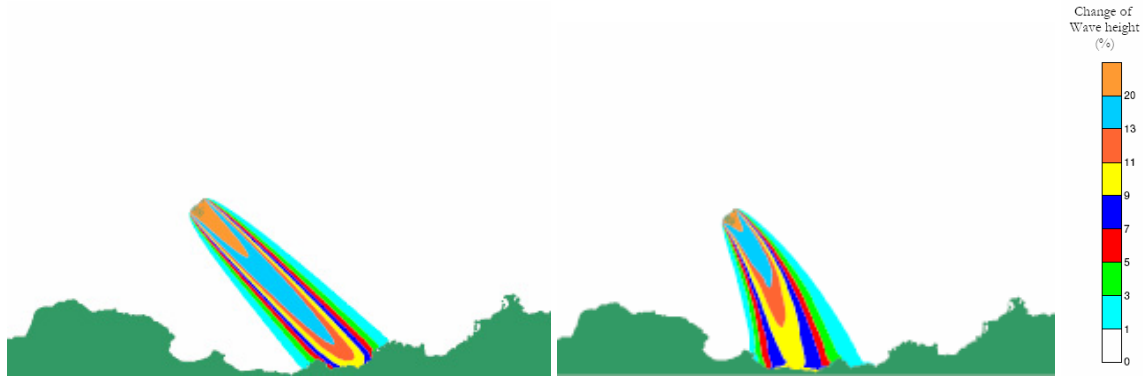


Figure 5 Changes under the worse case WEC layout scenario to wave heights during small wave surfing conditions (left) and during big wave surfing conditions (right)

## 7 Water, sediment and soil quality

The present conditions were determined through survey for water quality (suspended solids concentrations), sediment quality (chemical contaminant concentrations) and soil quality (chemical contaminant concentrations). Impacts were assessed by comparing concentrations to environmental quality criteria.

There should be no impact on water quality due to pollution under normal conditions, but there is non-quantifiable risk of pollution due to damage, negligence and/or accidents so precautionary measures are proposed in the form of a contingency plan. The magnitude of seabed sediment disturbance was found to have little potential to significantly increase suspended solids concentrations and affect turbidity, or to release chemical contaminants into the water. Onshore works are not expected to increase the potential for contaminants in the soil to affect water quality.



## 8 Terrestrial ecology

A walkover survey and an extended habitat survey were undertaken to establish the ecological importance of the area for reptiles, birds, plants, invertebrates and general habitat value. There were no features of national, regional, county or district value. Dune habitats around the site and reptile populations within the site have been evaluated as being of local value, whilst other ecological features have been evaluated as being of importance within the immediate site area only.

Impact assessment for terrestrial ecology was undertaken in accordance with draft assessment guidelines published by the Institute of Ecology and Environmental Management (IEEM). The construction of the substation was found to have the potential to cause adverse impacts on the terrestrial ecology due to habitat loss and disturbance. However, measures including clearance, fencing and translocation should minimise the impacts.

## 9 Ornithology

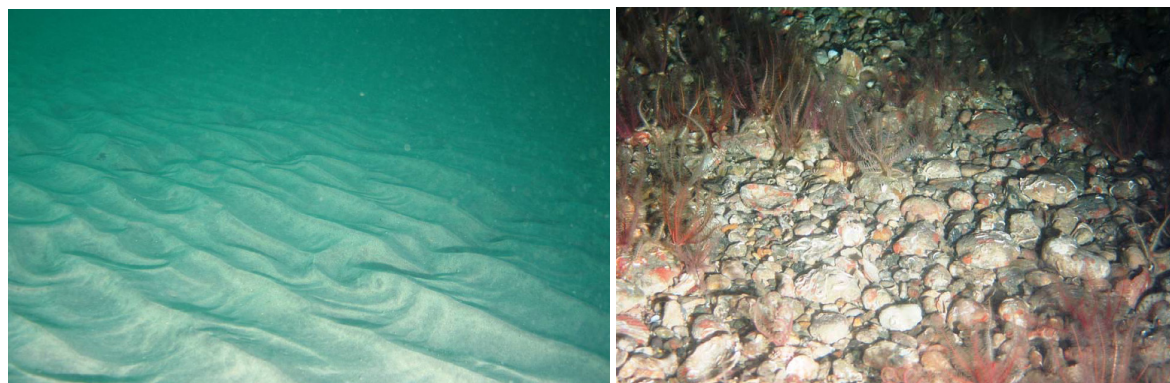
The present conditions were established by a series of intertidal and offshore bird surveys which revealed that the beach is not an important area for birds whilst 13 species of seabirds were observed in the offshore area including fulmar, gannet, guillemot, kittiwake, puffin and storm petrel. The Wave Hub's location falls outside of areas designated at an international or national level of importance for seabirds and there is no evidence to suggest that the Wave Hub's deployment area provides particularly important feeding areas for seabirds or that significant seabird concentrations occur there. However, data from the survey and *The Atlas of Seabird Distribution in North-west European Waters* indicates that the open sea is used by birds from nationally and internationally important seabird colonies on the Isles of Scilly, Lundy and off south Wales and would, therefore, be considered of national importance for seabirds.

Impact assessment for ornithology was undertaken in accordance with draft assessment guidelines published by IEEM. Potential impact on offshore seabirds could occur through disturbance through increased shipping activity. However, as the offshore construction, operation and decommissioning activities take only a few weeks and low numbers of vessels required, no significant impact is predicted. With the Wave Hub in place, potential impacts on offshore seabirds could occur due to loss of feeding area due to the presence of WECs, increased food availability as a result of the sanctuary created by navigation restrictions, risk of collision / entanglement with WECs, cabling and anchoring,

and disturbance / disorientation of birds due to lighting at night. However, due to the relatively small-scale of Wave Hub in the context of the surrounding open sea area, no significant impact on offshore bird populations was predicted.

## 10 Marine ecology


Baseline surveys for intertidal and subtidal ecology were undertaken to determine the biological communities present. The intertidal survey found that the majority of the intertidal area comprises barren or amphipods dominated mobile sand shores, while the subtidal surveys found very diverse communities associated with the sand, pebble and rocky seabed (see Figure 6). In addition to the above, the importance of the Wave Hub's deployment area was established for marine mammals (e.g. dolphins, porpoises) and elasmobranchs (e.g. species sensitive to electromagnetism such as sharks and rays) through desk-based studies and marine mammal surveys. This work revealed that the offshore area is most important for basking sharks and bottlenose dolphins.



*Figure 6 Examples of subtidal sandy seabed habitat inshore (left) and pebbly/rocky seabed offshore (right)*

Disturbance to seabed ecology will occur due to the placement of infrastructure on the seabed. However, the works will be of low impact with a relatively small area of seabed being affected. In the longer term, effects on subtidal ecology will be negligible.

The main potential impacts on marine mammal and elasmobranch species relates to underwater noise caused by piling (that may be needed to install the mooring anchors on the seabed for the WEC



devices and navigation aids), noise caused by the operational WECs, and electromagnetic fields emitted from the sub-sea cable. It was found that:

- Species should move away underwater noise sources but no effect on population levels was predicted given that any noise disturbance will be short-term; lasting for the duration of the piling;
- The operational noise from the WECs is not known since this is new technology, but the noise was predicted to be unlikely to have a significant effect on marine mammals; nevertheless, some monitoring was recommended given the uncertainty of this prediction; and
- The zone of influence of any electric field is relatively localised to the route of the sub-sea cable along the seabed, so pelagic species such as basking sharks should be unaffected while benthic species such as rays may be attracted to the cable but no effect on population levels is expected since damage to individuals should not occur. In addition, no significant impact is predicted as a consequence of magnetic fields generated by the cables given that the leakage of magnetic field is insignificant in the context of the background geomagnetic field generated by the Earth.

## 11 Fish resources and commercial fishing

The existing fish resource conditions were established through four multi-gear fishing surveys undertaken to identify the seasonal importance of the area for fish. This information was supplemented with a commercial fisheries study which collated information from various sources (e.g. fish landing statistics) and involved extensive consultation with local fishermen. The studies concluded that the sea area in and around the Wave Hub's infrastructure is of most importance for potting (e.g. crab and lobster) with a range of species targeted by trawling in the wider area. A key component of the commercial fishery is the summer spider crab fishery. The local fishing industry is based out of Hayle, St Ives, Portreath and, to a certain extent, Newlyn.

The main effect of the Wave Hub on fishing activity will be:

- Potential interference with fishing activity (e.g. navigation of fishing vessels) due to vessels working on and servicing Wave Hub, which will be mitigated through navigation measures and Notices to Mariners;

- Potential interference with fishing activity (e.g. snagging of fishing gear) due to the sub-sea cable, which will be mitigated by fishing methods, information concerning the cable's position on the seabed, and cable laying methods to avoid, reduce and (if necessary) remedy cable spans; and
- Exclusion of fishing activity from the deployment area and/or safety zones around the WECs potentially displacing established fishing grounds and adding pressure to neighbouring fishing grounds – particularly for potting – which was found to be a potential moderate adverse impact on a small number of fishermen. No mitigation measures were available since the exclusion of vessels will be a matter of law, but prevention of fishing was expected to benefit fish resources within the area in which fishing is excluded and this has the potential to benefit fish resources outside the safety zones.

## 12 Navigation

A vessel traffic survey and a navigation risk assessment were undertaken to identify the importance of the Wave Hub's offshore area for commercial, recreational and fishing activities. The assessment involved surveys and consultation with a number of relevant stakeholders. By far the greatest use of the area is by commercial cargo vessels (see Figure 7 (left)) and six shipping routes were identified as passing in the vicinity of the study area, with one passing to the north of the deployment area and another passing to the south of the deployment area.

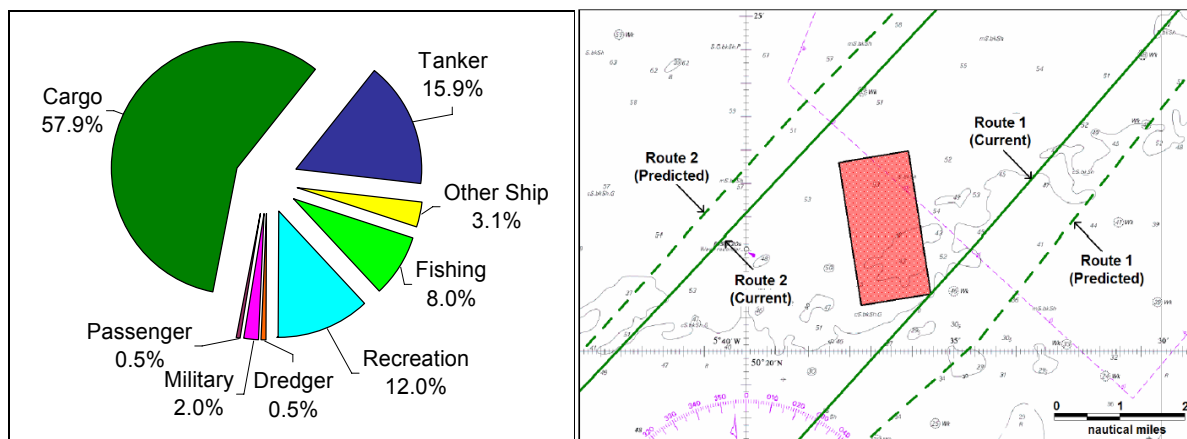



Figure 7 Wave Hub vessel traffic survey results (left) and shipping lanes around Wave Hub (right)





The navigation risk assessment involved detailed computer modelling of the risk of collisions between vessels and the risk of collisions with WEC devices as a consequence of the presence of Wave Hub. Given the proximity of two shipping routes, it was found that vessels on these routes will have to slightly divert their course to avoid Wave Hub's deployment area (see Figure 7 (right)). As a result of this increased separation of vessels on these routes, the risk of vessel-to-vessel collision is predicted to decrease compared with the existing situation. The risk assessment concluded that there will be a very low level of risk of collision with WEC devices and no significant impact is predicted. A range of mitigation measures will be put in place such as marking of the deployment area including lighting, the designation of safety zones, and potentially the designation of a recommendatory routing measure (an area to be avoided) which will be marked on nautical charts.

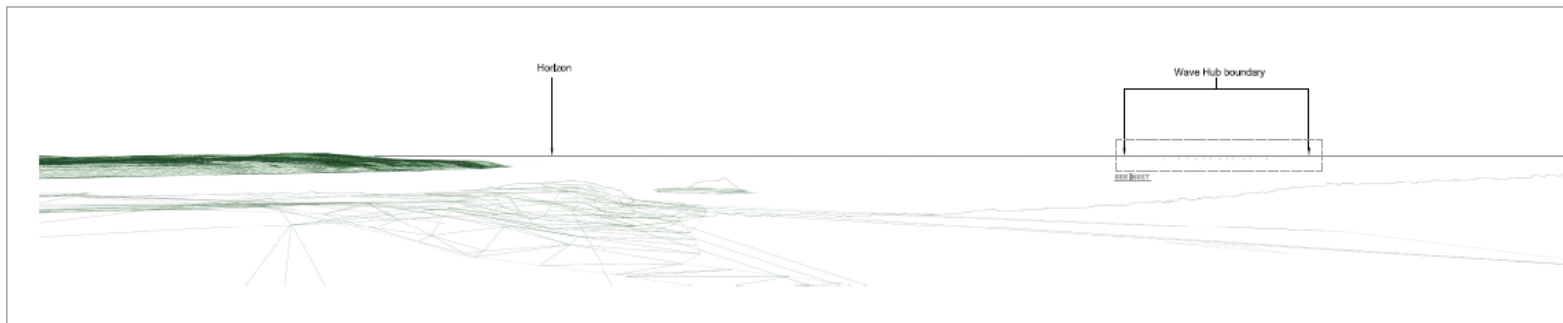
## 13 Landscape and views

A landscape and visual impact assessment was undertaken by drawing upon best practice guidance as outlined in the Landscape Institute / Institute for Environmental Management & Assessment's *Guidelines for Landscape and Visual Impact Assessment* (second edition).

The investigations determined that the onshore site of the Wave Hub's substation is not of high landscape value. Wave Hub's subsea cable and electrical infrastructure will be on the seabed and will not be visible. However, the WECs and navigation aids will be visible from high points along the coast including sections that the assessment determined to be of high landscape value.

The assessment found that the visual impact of the WECs, even under the worst case scenario, will be relatively low and an impact of minor adverse significance was predicted (see Figure 8). At night time, the site will be visible due to the lighting that is needed to mark Wave Hub and an impact of minor to moderate adverse significance is predicted.





Viewpoint No.	Description	NGR SW	Approximate Elevation	Distance To Centre of Wave Hub Site	Reasons For Selection of Viewpoint	
7	Looking north from Navax Point at Treg Point towards Godrevy Point with St. Ives Bay in distance	59164 E 43432 N	78mAOD	21.4km	<ul style="list-style-type: none"> <li>- AONB</li> <li>- Public footpath near SW Coast Path</li> <li>- National Trust land</li> </ul>	<p>INSET (MAGNIFIED BY 3 TIMES)</p>

Figure 8 View from Navax Point based on worst case scenario for WEC layout

An Archaeological Assessment was undertaken according to the Institute of Field Archaeologists' Standards and Guidance for Archaeological Desk-based Assessments and Evaluations, Planning Policy Guidance Note 16 (PPG16): Archaeology and Planning and The Joint Nautical Archaeology Policy Committee's Code of Practices for Seabed Developers.

The assessment included desk-based research of existing sources of information and geophysical survey of the seabed to assess the nature of the potential archaeological resource of the area around onshore and offshore areas of Wave Hub. It was found that the site of the proposed substation is adjacent to the proposed Cornish Mining World Heritage Site. There are no Scheduled Monuments or Listed Buildings present and there are no protected wreck sites with the area, although there are a number of known wrecks in the wider area. The geophysical survey identified a number of features on the seabed of possible archaeological interest, including a wreck location which is marked elsewhere on Admiralty Charts [Note The cable route was designed to avoid known wreck locations, and this design philosophy will be applied to the new wreck revealed along the cable route.]

Given that it is not possible to identify the nature of the potential (or unknown) archaeological resource on the basis of surveys alone, there is a level of uncertainty involved in the impact prediction and, therefore, there is the potential for an impact of high significance to arise where the Wave Hub project has the potential to disturb ground and seabed materials, for example, during onshore excavation works, cable laying or the installation of mooring anchors. To address uncertainty, a number of mitigation measures are proposed including a programme of archaeological recording and a Written Scheme of Investigation to be developed and approved. This approach will mean that all practicable measures have been put in place to minimise potential adverse impacts as far as possible and, with mitigation, an overall impact of minor adverse significance is predicted.



## 15 Road traffic and access


The local road traffic and access network includes the A30, from which Hayle can be accessed from the east or west and is the main road link in Cornwall to the M5, the nearest motorway, at Exeter. The South West Coast Path is a National Trail which runs to the west of the onshore site area. The path also follows the coast north along the dunes and east towards Gwithian. There is a short length of public footpath near Mexico Towans and Beachside Leisure Park, and there is wider public access along the beach and the local road network. A Sustrans cycle route runs to the south of the onshore area being routed along Hayle River and inland along Kings Memorial Road.

It is proposed that the onshore site compound for Wave Hub will be located at the end of North Quay Road and the site will be accessed by the Kings Memorial Road. Construction works will involve the transport of materials to the proposed substation site and the removal of excavated waste. As a result, there will be a short-term increase in traffic on the local road network, although this is predicted to be of minor adverse significance. There is also the potential for some disruption to users of the South West Coast Path and the Sustrans cycle route as there may be a requirement to temporarily divert these routes during construction in the vicinity of the works for health and safety reasons.

## 16 Tourism and recreation

Cornwall is one of Britain's most popular tourism destinations, and forms an important part of the Cornish economy. Hayle and the surrounding beaches are an important attraction for local visitors and tourists. Surfing is a popular and important recreational activity along the Cornish coast. There are a number of surfing sites within St Ives Bay including in front of the caravan site at Hayle Towans and at Gwithian, Godrevy and around St Ives. Further away, surfing takes place at Portreath, Porthtowan, St Agnes, Droskyn, Chapel Porth, Perranporth, Crantock and around Newquay. A number of recreational activities take place within St Ives Bay and further offshore including sea angling and sailing.

Cable-laying across the beach and in the near-shore water area, and the installation of the offshore infrastructure, has the potential to cause disruption to recreation, particularly as the works are likely to take place in late spring or early summer. It will be necessary to cordon off an area of the beach



during the works and signs will inform the public of the works. If necessary, alternative access points to the beach will need to be provided in order that access is not restricted. As a result, no significant impacts are predicted other than part of the beach at Hayle being unavailable for a short period of time when the cable is to be installed. With the WECs operating, the main potential impact is the effect on surf conditions due to the devices utilising wave energy and thereby reducing wave heights at the coast. The computer modelling undertaken to examine effects on wave climate predicted up to 5% and 11% magnitude reductions in typical small and big surfing wave heights for the example case and worst case scenarios for WEC layouts respectively. Surfing sites between Portreath and Penhale could be affected but under most conditions it is unlikely that the impact will be noticed by surfers given its magnitude and the other factors that influence the quality of a surfable wave.

## 17 Noise and air quality

No information was available on the present day background noise levels at the onshore site in Hayle. However, typical background noise is likely to be associated with low level noise from human activity, cars and beach users. Offshore sources of noise are expected to be dominated by the sea and wind.

Noise sources for onshore works for Wave Hub will be associated with typical construction equipment such as excavators, lorries and drilling equipment. The nearest residential areas are Riviere Towans Chalet Camp, Riviere Towans, isolated houses on Hayle Towans overlooking the site of the proposed substation. Users of the beach and walkers on the South West Coast Path will also be affected. Local residents will be informed of the construction works prior to their commencement and it is recommended that the works contractor and the Environmental Health Officer for Penwith District Council will agree details of the construction works prior to commencement. Particular attention will be paid to scheduling noisy works within normal working daytime hours (e.g. between 08:00 to 18:00) to avoid significant disturbance. In addition, there could be localised increases in dust generation as a result of the onshore works. However, the effect on air quality will be intermittent and highly localised so it is concluded that no significant impact will arise.



## 18 Socio-economics

An economic impact assessment was undertaken to assess the overall economic impact of Wave Hub. Hayle is one of the most deprived parts of Penwith District and Cornwall. Levels of unemployment are high compared to other parts of Cornwall with many of the jobs being seasonal. The Hayle Area Forum (regeneration group) is driving a strategy known as 'Revitalise! Hayle Coast and Country'. The top priorities of the local vision are a revitalised harbour, more and better quality shops, restaurants and cafes, improved town buildings and town centre, and better focal points for the town.

The economic impact assessment determined the magnitude of the direct economic impacts of the Wave Hub and WEC manufacture and deployment. During the construction and development phase, total employment is predicted to peak at over 140 jobs. Of these about 30 would be based within Cornwall. During its operational phase, Wave Hub itself will consist of 1.5 full-time staff. It is estimated that the project will spend over £420,000 per annum for ongoing Wave Hub operations and maintenance. In addition to the above, WEC developers will manufacture, deploy, operate and maintain WECs to be connected to Wave Hub. Many of these activities will increase gross value added and create jobs in Cornwall and the South West. It was concluded that Wave Hub represents an overall impact of moderate beneficial significance to the socio-economic environment.

## 19 Monitoring

The Environmental Statement concludes that there are unlikely to be any significant impacts on offshore seabirds. However, given that the project is the first of its kind in the UK, it recommends that post-construction monitoring of offshore seabirds is undertaken in order that the findings of the EIA process can be verified.

It is also proposed that monitoring of underwater noise and marine mammals is undertaken during construction if piling is required for the installation of the mooring anchors for the WECs. In addition, given that there is no information on noise generated by operational WECs, monitoring of operational noise is proposed.



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