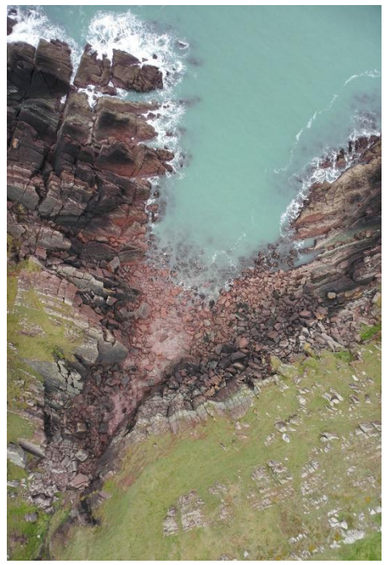
mWave Marine Energy Device and Onshore Infrastructure

ENVIRONMENTAL STATEMENT



NON TECHNICAL SUMMARY

June 2019

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Glossary

Term	Definition
Cumulative impact	Impacts that result from changes caused by other past, present or reasonably foreseeable actions together with the mWave project, that have not already been considered as part of the baseline.
Acoustic Doppler Current Profiler	An Acoustic Doppler Current Profiler (ADCP) is a hydroacoustic current meter similar to sonar, used to measure waves and water current velocities over a range of depth.
Effect	Term used to express the consequence of an impact. The significance of an effect is determined by correlating the magnitude of the impact with the importance, or sensitivity, of the receptor or resource in accordance with defined significance criteria.
EIA Directive	European Union Directive 85/337/EEC, as amended by Directives 97/11/EC, 2003/35/EC and 2009/31/EC and then codified by Directive 2011/92/EU of 13 December 2011 (as amended in 2014 by Directive 2014/52/EU.
Environmental Impact Assessment (EIA)	A statutory process by which certain planned projects must be assessed before a formal decision to proceed can be made. It involves the collection and consideration of environmental information, which fulfils the assessment requirements of the EIA Directive and EIA Regulations, including the publication of an Environmental Statement.
Impact	Change that is caused by an action; for example, land clearing (action) during construction which results in habitat loss (impact).
META Project	The META project, located in Pembrokeshire, consists of eight test sites where a range of marine energy testing activities will be permitted over a 15 year period. The licensing and consenting of the mWave project was originally intended to be undertaken within the consenting and licensing of the META project. mWave will be deployed within META Site 8 geographic area.
MHWS	The height of mean high water springs is the average throughout the year (when the average maximum declination of the moon is 23.5°) of two successive high waters during those periods of 24 hours when the range of the tide is at its greatest.
MLWS	The height of the mean low water springs is the average height obtained by the two successive low waters during the same period as mean high water springs.
Receptor	A component of the natural or man-made environment that is affected by an impact, including people.
Special Area of Conservation (SAC)	A site designation specified in the Habitats Directive (Council Directive 92/43/EEC). Each site is designated for one or more of the habitats and species listed in the Directive. The Directive requires that a management plan be prepared and implemented for each SAC to ensure the favourable conservation status of the habitats or species for which it was designated. In combination with SPAs, these sites contribute to the 'Natura 2000' or 'European' Sites network.
Special Protection Area (SPA)	A site of European Community importance designated under the Birds Directive (Directive 2009/147/EC), classified for rare and vulnerable birds (as listed on Annex I of the Directive), and for regularly occurring migratory species. SPAs contribute to the Natura 2000 Sites network.
Site of Special Scientific Interest (SSSI)	Conservation designation denoting a protected area. In England and Wales these sites are identified and protected under the Wildlife and Countryside Act 1981 (as amended).
Subsea Umbilical Termination Unit	Underwater connection box approx 1.5m^2. mWave umbilical and ADCP will connect into unit.
Transboundary	Crossing into other European Economic Association (EEA) States.

Acronyms

Acronym	Description
ADCP	Acoustic Doppler Current Profiler
bcd	Below chart datum
CIA	Cumulative Impact Assessment
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EMMP	Environmental Mitigation and Monitoring Plan
ES	Environmental Statement
MCA	Maritime and Coastguard Agency
MCAA	Marine and Coastal Access Act
META	Marine Energy Test Areas
MEW	Marine Energy Wales
MHPA	Milford Haven Port Authority
MHWS	Mean High Water Springs
ML	Marine Licence
MLW	Mean Low Water
MLWS	Mean Low Water Springs
MOD	Ministry of Defence
NRWa	Natural Resources Wales Advisory
NRW-PS	Natural Resources Wales Permitting Services
PCNPA	Pembroke Coast National Park Authority
SAC	Special Area of Conservation
SPA	Special Protection Area
SSSI	Site of Special Scientific Interest
SUTU	Subsea Umbilical Termination Unit
TCE	The Crown Estate

1. INTRODUCTION

1.1 Introduction

1.1.1.1 An Environmental Statement has been prepared by Bombora Wave Power Ltd (Bombora) to support the consent/permission for the mWave demonstrator marine energy project and associated offshore and onshore works. The Environmental Statement accompanies the applications for a Marine Licence (ML) from Natural Resources Wales Permitting Services (NRW-PS) and Town and County Planning Permission from Pembrokeshire Coast National Park Authority (PCNPA). This Non Technical Summary introduces and provides background to the project and summarises the findings of the Environmental Statement in non technical language.

1.2 The applicant and the journey so far

1.2.1.1 The proposed mWave marine energy device is being developed by Bombora (the applicant). Bombora is a privately-owned award-winning ocean energy company, which was founded in 2012 in Perth Western Australia. After the successful testing of their small and medium scale prototype, and with an office based in Pembroke Dock, Pembrokeshire, Bombora look to test their first full scale device in the coastal waters off West Wales.

1.2.1.2 Originally, Bombora intended that the licensing and consenting of the mWave project would be undertaken within the consenting and licensing of the META project, with mWave being deployed within META Site 8 (East Pickard Bay) once consents for the META project as whole were in place and conditions discharged. However, due to the nature of the META project, which will facilitate testing of a variety of device types and sizes, the timescales of Bombora's project and after detailed consultation with NRW-PS and MEW it was agreed that the most appropriate route would be for Bombora to submit separate applications for consent for the mWave project outside of the framework of the META project consenting in anticipation of a shorter determination period for the mWave project.

1.2.2 The Project and its location

1.2.2.1 The offshore element of the mWave project comprises a full scale Wave Energy Converter (WEC), mWave, and any agreed navigational markers, a Subsea Umbilical Termination Unit (SUTU) which connects mWave to an Acoustic Doppler Current Profiler (ADCP) for monitoring currents and the marine communication cable up to Mean High Water Springs (MHWS). The onshore works comprise the communication cable from Mean Low Water Spring (MLWS) to termination box and anchor point close to the coast, and then onwards to the control station. The project requires consent/permissions for 18 months to allow installation/decommissioning of the various elements and offshore testing for around 6-12 months.

1.2.2.2 The mWave device is to be located in the inshore waters of Pembrokeshire, south of the Angle Peninsula, with the communication cable making landfall at East Pickard Bay. The site is some 2.5km south-east of Sheep Island, the southern extent of the Milford Haven Waterway, and some 1.3km west of Freshwater West beach. The proposed deployment site off the Angle peninsula is exposed to a good wave resource benefiting from a significant fetch from the prevailing wind direction which is ideal for testing mWave (Figure 1.1). As can be seen in Figure 1 there are a number of sites in the area which are important for offshore and onshore ecology and as such an Environmental Statement has been prepared in support of the project.

1.2.2.3 In addition to the Environmental Statement assessments have been prepared under the Water Framework Directive and the Habitats Directive. Finally, an archaeological desk-based assessment has also been undertaken and will be provided in support of the onshore planning application.

1.2.2.4 The following section of this document presents an overview of the project and summarises the findings of the various reports.

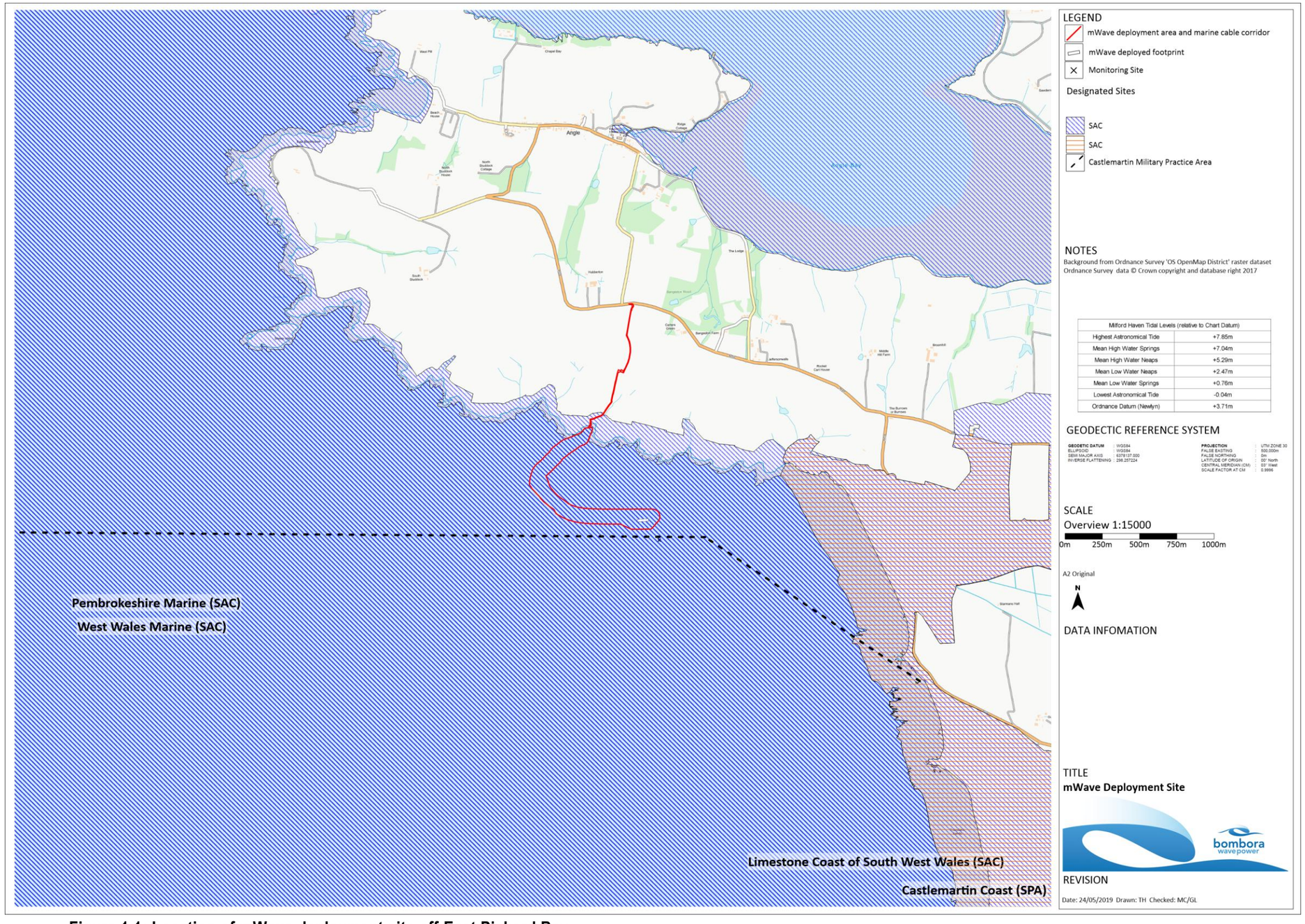

Figure 1.1: Location of mWave deployment site off East Pickard Bay

2. PROJECT OVERVIEW

2.1 Existing Site and Surrounding Area

2.1.1.1 The marine element of the project will be located in the inshore waters of Pembrokeshire, south of the Angle Peninsula off East Pickard Bay as shown on Figure 1.1. The marine cable will make landfall at a rocky gully called East Pickard Bay before running in land to the control station. The control station site is situated on agricultural land which was formerly the south eastern extent of RAF Angle Airfield. It is approximately 500m from the B4320, 275m from the coastal footpath and 1.5km from the western extent of Freshwater West Beach. The nearest residential property is approximately 470m to the northeast. There is an existing gated access off the B4320 to a farm track which initially runs down between two fenced field boundaries to the site. The topography and existing vegetation provides some screening from all directions.

2.2 Offshore element of Project

2.2.1 Overview of mWave and marine communication cable

2.2.1.1 The mWave is a full scale WEC prototype that sits on the seabed with four membrane covered air filled cells. The gravity base foundation means that there will be no requirement for moorings. As a wave passes overhead the device uses the change in water pressure to displace air in the membrane covered cells, the membranes inflate and deflate to move air within the device (Figure 2.1). At any instant, those cells with a higher pressure supply air to a high-pressure duct which then flows through the enclosed turbine and returns to low pressure cells. The turbine is totally enclosed so that no water gets into the enclosed pressurised air system Through the air being pushed through the turbine by change in water pressure, electricity can be generated by the turbine. Note, during offshore testing of mWave electricity will not be exported.

2.2.1.2 The mWave device has been designed with gravity foundations, so that installation will be relatively simple with no need for piles or anchoring points. The foundation of mWave comprises a keyed skirt that presses into the sand (Figure 2.2). The device is placed on the seabed and the penetration of the skirt into the sand up to 1m keeps the device in place throughout its deployment. The device contains ballast trays in the areas not occupied by cells and chain will be placed in the trays to add further weight to the device. Bathymetric survey of the seabed (Titan 2018) has confirmed that the area is relatively flat featureless sand. As such there will be no need to do any ground preparation before mWave us brought to site thereby reducing the effects on the surrounding area.

2.2.1.3 The physical size of the mWave structure is approximately 75m long, 7m high and 15m wide at the base and approximately 17m wide across the widest point. The offshore location of mWave means that there will be between 4.2m - 10.5m water above the device at all times. Surface navigational markers, if required by navigational statutory stakeholders (MHPA, Trinity House, Maritime and Coast Guard (MCA)), will be used to identify the position of the mWave device on the seabed. A communication cable will be laid on the seabed from mWave to shore to allow support for the device (backup power and compressed air for the air cells) and data to be collected during testing.

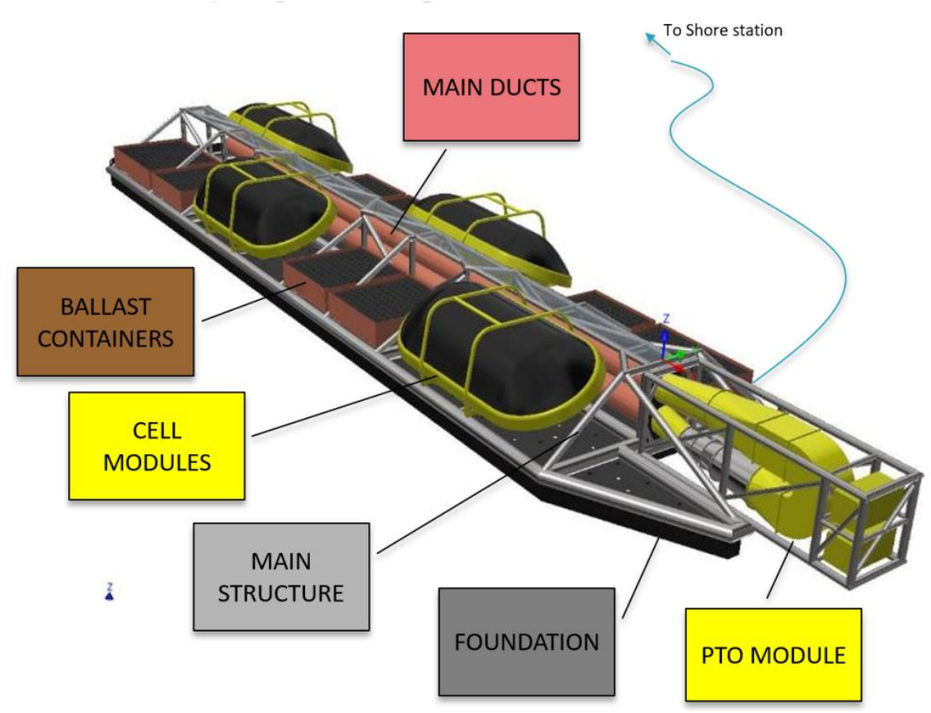

Figure 2.1 Key components of mWave

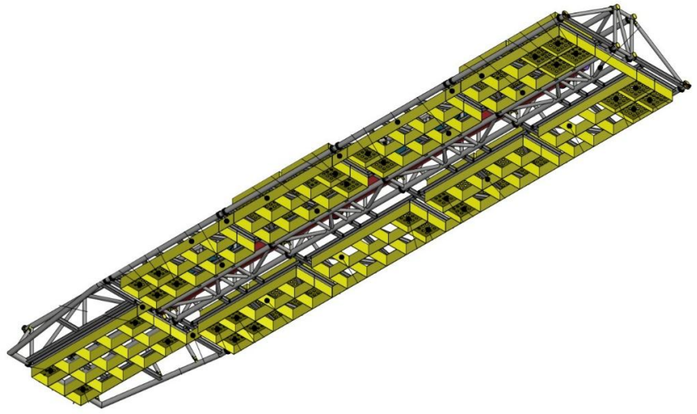

Figure 2.2 mWave gravity foundation

2.2.2 Overview of installation

2.2.2.1 Installation of mWave is relatively simple. Six moorings will be pre-installed on site a day or so in advance. Using the buoyancy of the air-filled cells, mWave will be floated on the surface and towed by two vessels, from the Pembroke Dock to the deployment site, where a guard boat will also be present. Sufficient air will then be released from the cells for the device to be slowly lowered to the seabed on a winch. One end will be lowered and touch the seabed before the other end is lowered. Once on the seabed, additional weight in the form of chain will be placed within trays on the device to keep it on the seabed. In this way no separate mooring or anchoring is required for the device.

2.2.2.2 The cable laying vessel will start off at East Pickard Bay. A winch cable will be attached from the onshore winch point to the cable and the cable will be floated ashore. Once secured the floats will be cut so that the cable rests on the seabed and the cable laying vessel will move offshore to lay the remainder of the cable. Overall only a limited number of vessels are required to install mWave and the cable, three for mWave and one for the cable, both activities taking about 3 days. The ballast chain for mWave will take 14 vessel trips over 5 days.

2.2.3 Overview of Operation and Maintenance

2.2.3.1 mWave will be tested over a 6-12month period and day to day operation does not require offshore intervention. During testing, offshore O&M activities will be undertaken approximately once per month. This will comprise routine inspection and scheduled maintenance, where elements of mWave may be lifted out and replaced, whilst the main structure remains in place. The major O&M activity will require three vessels on site for two days. In total it is predicted that there will be 76 vessel trips during a 12 month period. There will be no O&M requirements for the cable. Data monitored from the device will be transmitted onshore via the communication cable.

2.2.3.2 Whilst a sandy site is required for the gravity foundations, depressions in the sand may occur around the edges of mWave from the action of tidal currents, in particular during storm events. A video camera will be positioned on the device and it will monitor the seabed level at the device. If monitoring indicates that protection is needed around mWave, rock will be brought to site contained in bags and placed around the device. It is estimated that it would take up to 10 vessel trips over a five day period to put in this rock protection.

2.2.4 Overview of Decommissioning

2.2.4.1 Removal of the offshore mWave device and marine cable will be undertaken after the short term deployment of up to 18 months. The removal of the marine element will be the reverse of the installation.

2.3 Onshore element of Project

2.3.1.1 From the point at which the cable comes onshore, there will be approximately 50m of cable in the intertidal section and approximately 350m to the control station. At East Pickard Bay the cable will be taken up the vertical western side of the gully to the cliff top. The cable will be within a plastic conduit that is fixed to the rock surface using clamps. A termination box and an anchor point (to take the strain of any cable movement from the tides) will be located at the top of the cliff. The cable would then be laid on the ground along field boundaries to the control station. The control station, which will be located on agricultural land, comprises three shipping containers, each 20-23ft by 8ft by 8ft, a 1m Wifi antenna (15cm^2), a chemical toilet and bunded fuel tank. Parking for three cars will be provided (Figure 2.3).

Figure 2.3 Control Station location and layout

2.3.2 Overview of installation

2.3.2.1 As discussed above the cable will be attached to the onshore winch system and brought onshore. The end of the cable then be pulled out of the gully (through a plastic conduit) to the termination box and anchor point, using two hand propelled winches and two temporary anchor points. The work in this area will be undertaken using handheld tools only. A roll of cable will then be brought to site on a trailer using a 4WD vehicle. The vehicle will position itself within agricultural fields as close to the gully as possible. One end of the cable will then be pulled off the drum down to the termination box. Once secured, the 4WD vehicle will works its way back up the agricultural fields to the control station allowing the cable to be laid along the required field boundaries. The cable will also need to cross the Wales Coast Path, which will be achieved close to an existing gate on the path (in consultation with PCNPA).

2.3.2.2 The amount of noise likely to be generated from the installation works onshore was looked at in terms of the nearest residential property and users of the Wales Coast Path. The results showed that the levels at the nearest property will be well below the required day time threshold, and at the coastal path levels will be at or just below the threshold during the short-term work at the gully or the anchor points.

2.3.2.3 At the control station site, limited ground preparation works using a wheeled digger and delivery of 2 lorries of stone, will be required prior to installation of the control station. Delivery and installation of control station units will require three trips by a lorry with HIAB which would occur over 2-3 days, depending on availability. The chemical toilet and bunded fuel store will also be delivered to site. It is anticipated that it will take approximately 9 days in total to prepare and lay the cable, with the actual cable pull only being a few days. Preparation and installation of the control station will take place over roughly a 2 week period.

2.3.2.4 It is proposed that vehicles for the installation will use the A477 and A4075 to Pembroke and then the B4319, Clay Lane and the B4320 to site. Delivery lorries will not use the A4319 and Main Street through the centre of Pembroke. Local access for the installation of the temporary control station and onshore cabling will be via the existing farm track across private land which is accessed through an existing farm gate off the B4320.

2.3.3 Overview of Operation and Maintenance

2.3.3.1 A generator and a compressor will be located at the control station. They will be used approximately 3hrs in every 6hr period, with timing linked to the tidal height. The generator and compressor will be secured in soundproof enclosures, where needed. The mWave is designed to work with minimum human intervention so site visits will be kept to a minimum. Staff visits will be typically up to two vehicles once per week during the daytime, although initially visits will be more frequent. A lorry will be required to deliver fuel for the operation of the generator and compressor approximately at fortnightly intervals. All staff and delivery vehicles will use the farm track and will park by the control station, away from the main road. There will be no external lighting at the control station and there is no maintenance required for the cable.

2.3.4 Overview of Decommissioning

2.3.4.1 After offshore testing has been completed, the control station and cable will be removed, with removal being similar to installation. An HGV with mounted crane would be used to remove the control station units. The cable from the termination box to the control station would be pulled landward and taken off site by road. The cable from the termination box out to sea would be pulled offshore by a cable vessel and taken off site.

2.3.5 Embedded Mitigation

2.3.5.1 As part of the project design process, a number of designed-in measures have been used to reduce the potential effects. Key ones are shown below, with a full list provided in Chapter 2 Project Description.

Table 2.1 Examples of embedded mitigation included in project design

Measures adopted as part of the mWave project	Justification
Deployment site located on flat sand substrate and cable route along area of low diversity.	Minimises potential impact on special sensitive habitats.
Flat sandy seabed. No requirement for seabed preparation in advance of deployment.	Minimises disturbance during installation, potential for increased suspended sediments and noise.
Gravity foundation, simple installation, requires no moorings.	Minimises potential for collision, disturbance from noise and suspended sediments.
Cable laid on surface and not trenched offshore and onshore.	Minimises disturbance during installation and potential for suspended sediments and disturbance to ecology onshore.
Deployment of mWave on seabed with limited vessel activity during installation and operation.	Minimises potential for collision and pollution incidents.
No external moving parts which may cause impact to marine life (only the membranes at the top of the device inflating and deflating to move air within the device)	Minimises potential for collision and impact on marine ecology.
Due to design using air to generate energy, noise levels are anticipated to be lower than conventional WEC.	WEC design will minimise potential for noise. In addition, gravity foundation with no need for mooring lines reduces noise.
Site selection process for onshore control station and cable route.	Onshore cable route and control station site selected to minimise potential impact on ecological features including protected species.
EMP - Environmental Management Plan. The Environmental Management Plan (EMP) will cover both the offshore and onshore elements of the project.	The marine section of EMP will include planning for accidental spills, including measures to reduce the risk of an incident. In addition to this it will include an INNS assessment using NRW-PS Biosecurity Risk Assessment. The onshore element will present the procedures agreed with PCNPA with regard to works in proximity to the coastal path.
EMMP - Environmental Monitoring and Mitigation Plan. The EMMP will cover both the offshore and onshore elements of the project.	Linked closely to the EMP, this document will provide details of any requirements identified within this chapter to minimise potential effects on ecology prior to installation, as well as any recommended monitoring.

3. ENVIRONMENTAL ASSESSMENT

3.1.1.1 The following sections provide a summary of the key findings of the effects of the project on the environment. The effects of the project in combination with other possible projects in the area has also been considered, along with possible wider effects (transboundary) other EEA (European Economic Area) States.

3.2 Coastal Processes

3.2.1.1 mWave will be located on sandy substrate at a water depth of around 11m below low water, in this way there will always be 4.2m water above the device. An assessment of the effect of the mWave project on the waves and currents, for installation and operation has been undertaken.

3.2.1.2 The assessment found that due to the simple installation method, with no need to prepare the seabed, and with mWave and the cable being placed on the seabed, there will be very little sand disturbed. Any that is disturbed should settle. Only minor changes may be seen in the seabed sand transport as a result of the project due to the open bay location and relatively quickly. As the site is on open coast away from potential pollution inputs, the sand in the area is clean as such there is no risk of contaminants.

3.2.1.3 In terms of changes to sand movement or currents, the device footprint is small and due to its alignment there will be little change, with any change being in the immediate vicinity. The device will result in a local reduction in water depth. Due to this, during major storms some waves may start to break over the area of the device, but as soon as they pass over they will return to background levels.

3.2.1.4 In conclusion, due to the limited size of device and the temporary nature of deployment the impacts of the mWave project activities on its own or in combination would be minor and not significant in EIA terms.

3.3 Underwater Noise

3.3.1.1 The amount of noise generated underwater from offshore installation activities and mWave operation was calculated. The information was then used to assess the effects on marine life. The results of the noise assessment provided distances within which marine species such as fish and marine mammals may be injured or disturbed if they stayed in the same place for 24 hours. The noise assessment looked at the noisiest activity on site.

3.3.1.2 As there is no levelling work or piling, the noisiest activity was the cable laying vessel. The results showed that for a range of marine mammal species they could be injured from the effects of noise within 0m-50m of the cable laying vessel (if they stayed for 24hours) or disturbed (could hear works) within a 2-7km area. Fish could be injured in 1 - 3m of work and disturbed in 7m - 21m. All works on site would not occur for 24 hours continuously and the overall duration of installation is short (a few days).

3.3.1.3 The mWave project will be the first deployment of the full scale device and as such operational noise data is not available. A worst case assessment was undertaken using data from other marine energy devices. Note, as mWave uses air circulating around the device and operating the turbines and does not have moorings a lot of the noise which is recorded from other marine devices won't be present.

3.3.1.4 The results of the assessment showed that marine mammals would have the potential to be injured within a 3m-76m area from the device if they stayed for 24 hours, or they could be disturbed (hear the device) within a 0.5km to 7km area. In terms of fish the 24 hour injury area would be 0m-4m with disturbance in a 6m-78m area. Monitoring will be undertaken during operation to collect underwater noise data for mWave.

3.4 Benthic Subtidal and Intertidal Ecology

3.4.1.1 Installation activities associated with the mWave project have the potential to result in a range of potential impacts on marine life which lives on the seabed (benthic ecology). These impacts include, among other things, the effects from disturbed sediments during installation on habitats, as well as the potential introduction of alien species from boats moving back and forth. Due to the limited extent of the mWave project, the short duration of activity and the limited number of vessels required, the predicted effects on benthic species, including those associated with designated sites, was of negligible or minor adverse significance (not significant in EIA terms). Decommissioning activities are predicted to have the same effect as installation.

3.4.1.2 The operation and maintenance of the mWave project may affect the marine ecology through the presence of mWave and associated cable on the seabed resulting in temporary habitat loss (up to 18 months) or through operation and maintenance activities possibly facilitating the introduction or spread of alien non native marine species. These impacts are predicted to result in effects on benthic receptors and designated features of nature conservation sites of negligible or minor adverse significance (not significant in EIA terms).

3.4.1.3 Cumulative impacts upon benthic subtidal and intertidal ecology from the mWave project have been considered together with other possible projects in the area. In conclusion, due to the limited size of device and the temporary nature of deployment the impacts of the mWave project activities on its own or in combination would be minor and not significant in EIA terms. A screening of transboundary impacts (effects across other EEA states) has been carried out which has identified that there is no potential for significant transboundary effects with regard to benthic subtidal and intertidal ecology from the project.

3.5 Fish and Shellfish

3.5.1.1 Fish and shellfish ecology refer to the communities of animals which live within the marine environment and the relationships that they have with each other and with the physical environment. The fish and shellfish ecology of the mWave project site was characterised using site-specific surveys (underwater video), available published data and a thorough literature review.

3.5.1.2 The fish species in the area were found to be predominately demersal species (living close to the seabed), including flatfish and elasmobranchs, with migratory fish species, such as Atlantic salmon, lamprey and shad which move to the Waterway which is some 3.5km to the north west. Shellfish species primarily consist of the mussel beds, edible crab and lobsters. In addition, underwater video survey determined the presence of spotted catsharks, flatfish and spider crabs in the waters off East Pickard Bay.

3.5.1.3 A number of potential impacts on fish and shellfish communities/species associated with the installation, operation and maintenance, and decommissioning of the mWave project, were identified. These included 'temporary changes to fish and shellfish habitat', 'temporary increases in suspended sediments', 'accidental pollution', 'colonisation of hard structures' and 'medium term habitat loss''.

3.5.1.4 Due to the fact that the installation of mWave does not require any site levelling or piling, with the device just placed on the seabed using minimal numbers of vessels, the temporary impacts for the installation and decommissioning were deemed to be of negligible to minor adverse significance (not significant in EIA terms). For operation, as there are no moving parts which may impact on fish, and the size of mWave is small in comparison to the available habitat, all impacts were deemed to be of negligible to minor adverse significance (not significant in EIA terms). Notwithstanding this, measures will be put in place during offshore works to further reduce the chance of an incident resulting in accidental pollution or the potential for spread of alien non native species.

3.5.1.5 The combined impact of mWave with other projects which may happen at the same time as mWave was assessed and the effects were of negligible to minor adverse significance (not significant in EIA terms) within the fish and shellfish study area. No transboundary effects with regard to fish and shellfish from the mWave project on the interests of other EEA States were predicted. Overall the measures which are embedded in the project design (Table 2.1) has minimised the effects of the project on the surrounding environment. As such no further mitigation has been proposed for fish and shellfish as the significance of effect is deemed to be not significant (in EIA terms).

3.6 Marine Mammals

3.6.1.1 A baseline data review was undertaken to identify which marine mammal species may be in the waters off Pembrokeshire. According to sightings data, harbour porpoise, bottlenose dolphin, short-beaked common dolphin, Risso's dolphin, minke whale and grey seal are expected to occur intermittently, in low numbers. Grey seals are considered most likely to occur around the northern headland of the Milford Haven Waterway or within the Waterway.

3.6.1.2 A number of potential impacts associated with the installation, operation and maintenance, and decommissioning phases of the mWave project on marine mammals, were assessed. These included increased underwater noise and increased collision risk due to more vessels in the area, increased underwater noise during operation, changes in fish and shellfish communities which would provide a food source; accidental pollution from vessels and entanglement risk.

3.6.1.3 It was concluded that whilst there would be some increase in underwater noise and potential for collision risk, and therefore accidental pollution as a result of increased vessel numbers, the effect would be limited and not significant due to the scale of works. Notwithstanding this, measures will be put in place during offshore works to further reduce the chance of an incident resulting in accidental pollution or the potential for spread of alien non native species.

3.6.1.4 During operation, as identified in the Underwater Noise chapter based on a worst case assessment, there would be a localised effect for injury, if the marine mammals stayed in the area for 24 hours, and there would be a wider area of disturbance (the device being heard). Neither were identified as more than minor significance. Other effects such as impacts on food sources through habitat or species disturbance, were insignificant due to the small scale of the project and its temporary nature. In terms of collision, through the design of mWave, there are no moving parts or mooring ropes to hold the device in place, which may affect marine mammals.

3.6.1.5 The potential for cumulative effects arising from the proposed project, in association with other projects was assessed. In conclusion, due to the limited size of device and the temporary nature of deployment the impacts of the mWave project activities on its own or in combination would be minor and not significant in EIA terms. A screening of transboundary impacts (effects across other EEA states) has been carried out which has identified that there is no potential for significant transboundary effects with regard to marine mammals from the project.

3.7 Marine ornithology

3.7.1.1 Installation, decommissioning, operation and maintenance activities associated with the mWave project have the potential to result in a range of potential impacts on marine birds. These include the disturbance/ displacement of coastal birds, accidental pollution impacts to marine and coastal birds, and increased collision risk with the fixed underwater structure to marine birds which may dive into the water to feed. As such these effects were considered in the marine ornithology chapter.

3.7.1.2 The marine ornithology chapter identifies a range of seabird species as marine ornithology receptors including Atlantic puffin, guillemot, razorbill, gannet, kittiwake, shag, cormorant, brent goose, diving ducks (scaup, red-breasted merganser, common scoter) and divers (red-throated diver and great northern diver). Atlantic puffin, razorbill, guillemot, and kittiwake are notified interest features of the Skomer, Skokholm and the seas off Pembrokeshire/ Sgomer, Sgogwm a Moroedd Penfro Special Protection Area (SPA).

3.7.1.3 Potential for displacement and disturbance to occur to coastal birds, or increased risk of collision as a result of an increase in vessel traffic, during installation and operation was assessed. Due to the short times scale of any works on site, and the limited number of vessels required the significance of the disturbance effects was assessed as negligible to minor (adverse).

3.7.1.4 In terms of increased risk of collision to sea birds who may dive into the water to catch fish, as for marine mammals and fish, the design of mWave means that there are no moving external parts. As such the risk of collision was considered to be negligible.

3.7.1.5 Accidental pollution may affect sensitive birds, either by resting on the surface the sea or diving to forage. Any offshore works will be undertaken in good sea conditions with a limited number of vessels as such the risk of accidental pollution is minimal. Notwithstanding this, measures will be put in place during offshore works to further reduce the chance of an incident resulting in accidental pollution.

3.7.1.6 Cumulative impacts upon marine ornithology from the mWave project have been considered together with the impacts predicted to arise from other projects in the area. Overall, the cumulative impacts on marine ornithological interest and designated features of nature conservation sites will be of negligible to minor adverse significance (not significant in EIA terms). Finally, a screening of transboundary impacts (effects across other EEA states) has been carried out which has identified that there is no potential for significant transboundary effects with regard to marine ornithology from the project.

3.8 Commercial Fisheries

3.8.1.1 Commercial fishing is the activity of catching fish and shellfish for the purpose of making commercial profit. The commercial fisheries that have the potential to be impacted by the mWave project were characterised through review of publicly available datasets and through consultation undertaken by the META project with local fishermen and stakeholder groups within the Pembrokeshire area.

3.8.1.2 Commercially important species found within the area included shellfish (lobster, brown crab and whelks) and bottom-dwelling fish species (bass, haddock and elasmobranchs). These species were found to support a variety of fisheries, including nets, trawling and hand-gathering in the wider area with potting being along the rocky coastal areas.

3.8.1.3 A number of potential impacts on the commercial fisheries, associated with the construction, operation and maintenance, and decommissioning of the mWave project, were identified. These included the vessel interference to traditional fishing grounds, loss of traditional fishing grounds and damage to fishing equipment. Mitigation measures are proposed to minimise the effects of the offshore works including issuing a notice to mariners which will advise fishermen of the area of work. The impact assessment concluded that due to the limited area and duration of works, and with the proposed mitigation measures in place, these impacts result in effects of either negligible **-** minor (adverse) significance

3.8.1.4 Cumulative impacts of the mWave project were also considered along with other projects in the area. Once again due to the limited extent of the mWave project they were predicted to result in effects of negligible - minor (adverse) significance (not significant in EIA terms). No transboundary effects with regard to commercial fisheries from the mWave Project on the interests of other EEA States were predicted.

3.9 Shipping and Navigation

3.9.1.1 Information on Shipping and Navigation within the study area was collected through a detailed desktop review of existing studies and datasets, including Automated Identification System data which provides tracks of larger vessels. The data showed that in general the main route taken by shipping to and from the Waterway is about 2km to the west of the mWave deployment site. Vessels such as tankers, passenger ferries etc take a route around the Angle Peninsula headland down towards Linney Head in the south east by passing the waters off East Pickard Bay. As such, vessels which tend to be present in waters off East Pickard Bay are smaller eg small potting vessels or recreational craft with keels of around 2m.

3.9.1.2 A number of potential impacts associated with the installation, operation and maintenance, and decommissioning phases of the mWave project on shipping and navigation receptors have been assessed including: installation activities leading to potential for interaction with leisure users; increased allision risk with the device to vessels not under command (including unattended small craft, capsized craft) and in an emergency situation (e.g. machinery related problems and drifting); reduction of under keel clearance for vessels as a result of the device on the seabed; increased risk of gear/anchor snagging with the device on the seabed, and potential for interaction between leisure users and the device.

3.9.1.3 In terms of the potential for vessel interaction with activities associated with mWave, either from vessels under power on in an emergency, due to distance from the main shipping route the risk is identified as negligible or minor and not insignificant.

3.9.1.4 An assessment was made of the impacts on vessels of the reduction in depth directly above the mWave device. The main vessels in the area are smaller fishing vessels or recreational vessels with keels around 2m. Due to the location of mWave there will always be a between 4.2m and 10.5m of water above the device allowing vessels to pass freely over the top. In addition to this there will be ample space inshore as well as offshore of the device for vessels to move freely.

3.9.1.5 In terms of an increased risk of gear/anchor snagging from the presence of the device, the area affected would be small and designed-in measures advising people as to the device's location would help mitigate such events. Mitigation measures adopted include: Notices to Mariners; navigational marker (if required); a notice board at the main Freshwater West beach (with permission from PCNPA); 200m advisory clearance distances around project vessels undertaking installation, decommissioning and operational activities; the use of a guard boat on site during installation works and major O&M; and compliance with International Maritime Organisation Conventions. With the implementation of the mitigation above, all impacts were concluded as negligible to minor and not significant in EIA terms.

3.9.1.6 Finally, an assessment was made as to the risk to kayakers who may investigate the area. As mWave will sit on the seabed there will be no interaction between kayakers and the device. During installation and O&M procedures, with the mitigation measures identified above, the risk to kayakers is insignificant.

3.9.1.7 Due to the position of mWave away from main shipping routes, the cumulative impact of the mWave project is predicted to result in effects of negligible - minor (adverse) significance (not significant in EIA terms). No transboundary effects with regard to shipping from the mWave Project on the interests of other EEA States were predicted.

3.10 Marine Archaeology

3.10.1.1 Maritime archaeology is the study of physical remains of human activity, surviving beneath and at the edges of the water, and in the intertidal zone (e.g. submerged landscapes, wrecks and quays). The baseline assessment identifies all heritage assets that could be affected by the proposed development, along with provision of a description of the value of those assets including the contribution made by their setting.

3.10.1.2 The marine archaeology chapter identifies the likely effects of the proposed development on heritage assets within the mWave site as well as for an appropriate area around it. There are no statutorily designated assets, such as designated wrecks, within the mWave project site and there are no designated heritage assets within the vicinity of the offshore works. There is one scheduled monument, West Pickard Camp located on West Pickard Bay headland approximately 100m to the west of the cable landfall at East Pickard Bay. This would not be affected by the project.

3.10.1.3 The offshore area encompassing mWave and the marine cable route have a medium potential for archaeological deposits dating to the early Prehistoric, post-Medieval and Modern periods. There is high potential for deposits dated to the post-Medieval period, specifically associated with a wreck, believed to be the Highland Home which is about 1.5km from mWave deployment site. The offshore area encompassing mWave and the marine cable have negligible potential for archaeological deposits dating to the Roman and Medieval periods. Where these archaeological deposits survive, they would be of local to regional significance. There is a landing craft gun which is mapped approximately 1.5km from mWave and is a Protected Place under the Protection of Military Remains Act 1986.

3.10.1.4 A number of potential impacts on maritime archaeology, associated with the installation, operation and maintenance, and decommissioning of the mWave project, were identified. These impacts included disturbance of sediments, buried prehistoric deposits, or archaeological resource (including shipwrecks), as well as increased sediment deposition on the seabed. Assessment of all these impacts results in effects of either negligible or minor adverse significance.

3.10.1.5 A survey of the seabed has been undertaken of the mWave deployment site and its immediate vicinity (Titan, 2018). The survey concluded that there were no sonar contacts or magnetic anomalies which appear to have any archaeological significance and no substantial wrecks or debris were identified.

3.10.1.6 The possibility of direct effects from installation and decommissioning activities on the archaeological resource, such as installation of temporary moorings (note no site clearance or levelling work is required), were considered to be localised and of minor adverse significance (not significant in EIA terms). Due to the design of mWave and the fact that the marine cable will be laid on the seabed surface, temporary increases in suspended sediment concentrations and associated deposition were deemed to be of negligible to minor adverse significance (not significant in EIA terms).

3.10.1.7 Cumulative impacts were assessed, and no significant cumulative effects were identified. No transboundary effects with regard to maritime archaeology from the mWave Project on the interests of other EEA States were predicted.

3.11 Seascape Landscape Assessment

3.11.1.1 A Seascape Landscape Assessment (SLA) has been undertaken to determine the effects of the onshore and offshore elements of the mWave project within a 5km study area. The assessment looked at both the physical effects on the seascape, landscape and visual amenity within the defined study area, during the installation, operational and decommissioning phases of the mWave project.

3.11.1.2 The mWave deployment site lies off the south coast of Angle peninsula with the communication cable making landfall at East Pickard Bay and lies within Seascape Character Area (SCA) 34 – Freshwater West. The onshore control station is located approximately 0.4km from the coastal edge and lies within the boundary of the Pembrokeshire Coast National Park and within Landscape Character Area (LCA) 7 – Angle Peninsula. The southern facing coastline within the 5km study area is characterised by the wild and exposed, jagged sandstone cliffs that extend from West Angle Bay to the extensive sandy beach at Freshwater West and which overlooks the open waters of the Celtic Sea. The northern facing coastline is enclosed by the deep waters of Milford Haven and is influenced by the oil refineries of Rhoscrowther and South Hook LNG terminal.

3.11.1.3 The terrestrial areas of the study area are dominated by farmland, used for a mix of arable and pasture and typically enclosed by hedgerows. A number of woodland blocks are evident, most notably to the south east of Angle. Adjacent to the beach of Freshwater West lay the sand dunes of Kilpaison Burrows and Brownslade Burrows. Transport routes within the study area are limited, with the B4320 that runs in an east – west direction along the ridgeline of the Angle Peninsula the key route. The small village of Angle is the main settlement within the study area, although there are several farmhouses, predominantly adjacent to the B4320. Although there are no major settlements, the Rhoscrowther Oil Refinery and the South Hook LNG terminal are prominent industrial features within the landscape.

3.11.1.4 The Wales Coast Path, which provides a continuous walking route around the whole coast of Wales, passes through the study area and is located approximately 0.27km from the proposed onshore control station.

Effects on Seascape and Landscape Character

3.11.1.5 Due to the type and size of the development proposed, effects on seascape and landscape character during the installation, deployment and decommissioning phase will be restricted to a very small proportion of the total study area and to locations within and immediately surrounding the site. From coastal locations, the movement of vessels to deploy the mWave device and onshore activity associated with installation of the cable and onshore control station will be evident. This activity may result in a small, but temporary change in landscape character, although any effects are not predicted to be significant.

3.11.1.6 Effects during the operation and maintenance phase of the project are not predicted to be significant from any of the seascape or landscape character areas that are located within the study area.

3.11.1.7 Any effects on seascape character will be restricted to within SCA 34 – Freshwater West. Within this character area the movement of vessels undertaking maintenance work will be visible, although the movement of vessels is already a common feature within this part of the sea. The introduction of the cable to the onshore control station may also result in a very minor change in character to the foreshore, although any effects will be limited to a small proportion of the seascape character area as a whole.

3.11.1.8 Effects on landscape character will be restricted to within LCA 7 – Angle Peninsula, where the introduction of the onshore control station will result in an increased awareness of manmade features within the landscape. However, any effects will be limited to a very small area and will be temporary in duration. From the majority of the landscape character area there will be no perceptible change in landscape character following the introduction of the mWave project.

Effects on Visual Amenity

3.11.1.9 The Seascape and Landscape Visual Impact Assessment (SLVIA) assessed the effects on visual amenity of the mWave project from three locations within the 5km study area, which are listed below:

- Viewpoint 1 – Hill Fort, South West of the Site
- Viewpoint 2 – Wales Coast Path
- Viewpoint 3 – War Memorial, B4319

3.11.1.10 Effects on visual amenity during the installation and deployment, and decommissioning phase would be restricted to locations within close proximity of the site, including the Wales Coast Path. At close proximity, the movement of vessels within the water will be visible, although the movement of vessels is an existing common feature within this part of the sea. Work to the site entrance, which is located on the B4320 may also be visible, as will the installation of the onshore control station and the laying of the marine cable. Any effects will however by short in duration and restricted to a very small proportion of the total study area.

3.11.1.11 Locations within the study area where the onshore control station will be visible are likely to be significantly restricted by local landform and vegetation such as hedgerows and trees. Therefore, from the majority of the study area it is predicted that the onshore control station will not be visible.

3.11.1.12 From the three viewpoints assessed, the onshore control station will be the most visible component of the mWave project and most notable from Viewpoint 2 – Wales Coast Path. This viewpoint is located approximately 0.27km south of the site and from the footpath the containers will be a recognisable new feature, although it will be seen against existing vegetation and occupy only a small proportion of the view. The marine cable may also be visible from this location, as will the O&M vessels. Effects will be temporary in duration and not change the overall quality of the view.

3.11.1.13 From the other two viewpoints, the onshore control station will form a minor component of the view that may be missed by users of the coastal path or people visiting the war memorial, as the combination of distance; landform and screening by vegetation will help reduce visual effects.

3.11.1.14 Effects on visual amenity are not predicted to be significant from all three viewpoints.

Cumulative Effects

3.11.1.15 The Cumulative Impact Assessment (CIA) takes into account the impact associated with the mWave project together with other projects and plans. Overall it was concluded that whilst other activity may be taking place offshore which could add more vessel movements, they will potentially not be offshore at the same time and, if they were, the movement of vessels is not an uncharacteristic feature of the seascape or of existing views, therefore cumulative effects are not considered to be significant.

3.12 Other users

3.12.1.1 Freshwater West beach which is located approximately 1.3km to the east of mWave is an extensive sandy beach approximately 1km long, bounded by headland to the north northwest, a low lying rocky platform (also approximately 1km long), to the south-southeast, and backed with sand dunes. Frainslake Sands, a smaller sandy beach, is situated just beyond the rocky platform and lies within the Castlemartin Range. The Freshwater West beach has a main car park with toilet facilities opposite the beach, plus a smaller car park within the sand dunes to the north. The car parks get very busy in the summer with parking spilling over onto the narrow B4320 which is used to access the area. There is small seasonal cafe (Cafe Mor) which provides an excellent diverse range of locally sourced food.

3.12.1.2 Due to Freshwater West beach's south west facing aspect it is regarded as one of the best surfing locations in Wales. The beach is popular with watersports enthusiasts and is host to the annual Welsh National Surfing Championships, and a surf school. The beach is used by experienced surfers due to the strong currents, although learner surfers associated with the surf school may also be present. The beach is also used for body boarding, kite boarding, sea angling, swimming and dog walking activities. RNLI Lifeguards monitor the beach during the summer months.

3.12.1.3 Due to mWave's distance offshore the potential effect on recreational users is minimised. The installation and O&M works will be undertaken during good sea conditions which will not be favourable to kite surfers or wind surfers. Mitigation measures as identified in the shipping and navigation assessment, will ensure that any risks are minimised.

3.12.1.4 A number of other users in addition to recreational usage, were identified and assessed in the wider area including subsea pipelines, cables, dredging sites etc. No significant impacts were identified.

3.12.1.5 The location of the control station and cable route are approximately 2km from the beach. The control station will have no impact on recreational users. The cable will have to cross the Wales Coast Path and as such there will be potential disruption to users of the path. The cable will be buried at the crossing point. A temporary diversion of the path will be discussed and agreed with PCNPA Access Officer which will only be implemented when needed in order to minimise disruption during the short term installation of the cable.

3.12.1.1 Cumulative impacts were assessed, and with the available recreational resource in the wider area, no significant cumulative effects were identified. No transboundary effects with regard to maritime archaeology from the mWave Project on the interests of other EEA States were predicted.

3.13 Geology, hydrology and land quality

3.13.1.1 The potential impact of the project on geological features hydrology and land quality has been considered. The control station will be positioned within agricultural land at the south eastern extent of the old WWII RAF Angle Airfield, to the south of the B4320. Although the site is currently used for agriculture, it could be classified as a brown field site as a result of its previous use. Whilst there are remnants of its previous use as an airfield in some fields, the control station site is rough grassland and shows little evidence of its former use. Notwithstanding this, the consideration of the potential for contamination from the former land use has been incorporated into the project to ensure that there will be minimal risk from contamination.

3.13.1.2 With respect to water features in the area, there is a small stream which forms from two springs approximately 100m to the south east (>5m downhill) of the control station site. The stream then follows the valley down into the narrow gully of East Pickard Bay and onto the intertidal area. Due to the cable installation method, surface laying at some distance from water features and minimal works prior to installation of the control station, no impacts are predicted on water features.

3.13.1.1 In terms of geology in the area East Pickard Bay is a significant site for scientific study, not least because it includes relatively easily accessible and clean exposures of two of the thickest tuff units (originally layers of volcanic ash) within the lower part (Milford Haven sub-Group) of the 'Old Red Sandstone' (ORS). The sedimentary sequence in which the tuffs occur is also of related interest. As identified previously the cable will make landfall at East Pickard Bay and will brought out of the gully in a conduit attached to the rock face. Site survey by a qualified geologist has confirmed that the cable route passes well clear of (50m away from) the key locations for scientific study and there will be no impact on geological features of interest.

3.14 Terrestrial Ecology

3.14.1.1 The assessment of the potential impact on terrestrial ecology was informed by site specific surveys including Phase I mapping, searches for protected species such as otter and badger, botanical survey, breeding bird survey. In addition to this data was collated for a 1km study area.

3.14.1.2 The impacts of the installation, operation and maintenance as well as decommissioning of the mWave project will have limited implications to valued ecological features relating to terrestrial ecology. In addition, the proposals are not considered to represent a threat to the conservation status of features associated with a number of designated sites including Pembrokeshire Marine SAC, Limestone Coast of South Wales SAC, Pembrokeshire Bat Sites SAC, Castlemartin Coast SPA, Angle Peninsula Coast SSSI, Milford Haven SSSI or Broomhill Burrows SSSI.

3.14.1.3 The most significant impacts were considered to be associated with loss of maritime cliff and coastal grassland habitat beneath the footprint of the communication cable as it passes through the Angle Peninsula Coast SSSI. Approximately 30m^2 of habitat could be temporarily lost. However, in the context of the locally available resource, this is considered to represent a temporary and fully reversible minor impact at a local level. Furthermore, it is not considered a threat to the conservation status or objectives relating to these communities.

3.14.1.4 In terms of species interest, no significant impacts were identified. The limited impact to flowering plants and secondary impacts to related groups such as invertebrates mirror the assessment of the coastal grassland community (to which they are directly linked). Impact to these groups was considered to represent a temporary and fully reversible minor impact at a local level and at a National level (due to the location of the coastal grassland within a SSSI) was considered insignificant.