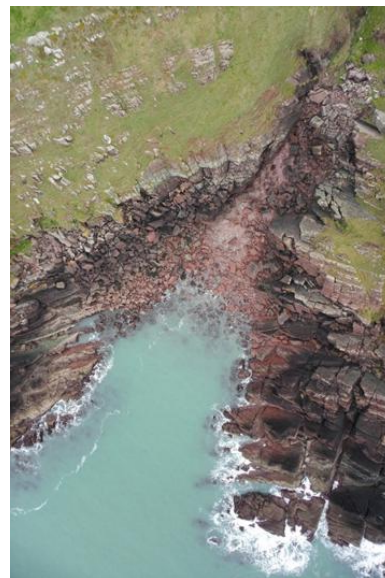




mWave Marine Energy Device and Onshore Infrastructure

ENVIRONMENTAL STATEMENT



June 2019

CHAPTER 17: Terrestrial Ecology

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Glossary

Term	Definition
Benthic ecology	Benthic ecology encompasses the study of the organisms living in and on the sea floor, the interactions between them and impacts on the surrounding environment.
Bryophyte	An informal group of non-vascular plants including mosses and liverworts.
Constancy	In terms of NVC, it is the frequency that a species occurs from one sample to the next.
European site	Special Area of Conservation (SAC) or candidate SAC, a Special Protection Area (SPA) or potential SPA, a site listed as a Site of Community importance (SCI) or a Ramsar site.
Foliose	Leaf like. A foliose lichen forms flat leaf-like lobes.
Fruticose	Tufted or pendant-like.
Heritage Coast	Heritage Coast status is agreed between the relevant statutory agency (Natural Resources Wales) and the local authority (Pembrokeshire Coast National Parks Authority) in recognition of the natural beauty, wildlife and heritage resources of an area as well as accessibility of the public to enjoy them. Heritage Coasts are protected through development control in the planning system.
Intertidal	An area of a seashore that is covered at high tide and uncovered at low tide.
Sites of Special Scientific Interest	SSSIs form one of the main building blocks of site-based nature and geological conservation legislation. Sites are notified where they support some of the best representative samples of habitat or species assemblages, geology or geo-morphology, within a given geographical area.
Special Areas of Conservation	SACs are European protected sites designated under the Habitats Directive (Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora). Article 3 requires the establishment of a European network of important high-quality conservation sites contributing to the conservation of 189 habitat types and 788 species identified in Annexes I and II of the Directive (as amended).
Special Protection Areas	SPAs are strictly protected sites classified in accordance with Article 4 of the EC Birds Directive, which came into force in April 1979. They are classified for rare and vulnerable birds (as listed on Annex I of the Directive), and for regularly occurring migratory species.
Therophyte	Annual plants that complete their life cycles in a short time-scale and survive harsh conditions as seeds.
Vascular plant	Land plants with specialised tissues (xylem) for conducting water and minerals.

Acronyms

Acronym	Description
BAP	Biodiversity Action Plan
CCW	Countryside Council for Wales
INNS	Invasive Non-Native Species
JNCC	Joint Nature Conservation Committee
MCZ	Marine Conservation Zone
MHWS	Mean High Water Spring
MLWS	Mean Low Water Spring
NVC	National Vegetation Classification
OSPAR	Oslo-Paris Commission

Acronym	Description
SSSI	Sites of Special Scientific Interest
SAC	Special Areas of Conservation
SPA	Special Protection Areas
ZoL	Zone of Impact

Units

Unit	Description
%	Percent
ha	Hectare
km	Kilometre
l	Litres
m	Metres
m ²	Metre squared

17. TERRESTRIAL ECOLOGY

17.1 Introduction

17.1.1.1 This chapter of the Environmental Statement presents the results of the Environmental Impact Assessment (EIA) for the potential impacts of the mWave project on terrestrial ecology. Specifically, this chapter considers the potential impact of the mWave project during its installation, operation and maintenance, and decommissioning phases.

17.2 Purpose of this chapter

17.2.1.1 The primary purpose of the Environmental Statement is to support the planning application, which will be submitted to Pembrokeshire Coast National Park Authority (PCNPA), for the onshore elements of the mWave Project comprising a control station and communication cable down to Mean Low Water (MLW). A Marine Licence application has also been submitted to Natural Resources Wales for the marine element of the project, comprising a full scale Wave Energy Converter (WEC), Acoustic Doppler Current Profiler (ADCP) and marine communication cable up to Mean High Water Springs (MHWS) (Chapter 1: Introduction). As the proposed project has the potential to affect Natura 2000 sites, a Habitats Regulation Assessment has been undertaken and a No Significant Effect Report (NSER) has been prepared for the project. The assessments contained within this chapter has been used to inform the NSER.

17.2.1.2 In particular, this Environmental Statement chapter:

- Presents the existing environmental baseline established from desk studies, field surveys and consultation;

- Presents the potential environmental effects on terrestrial ecology arising from the mWave project, based on the information gathered and the analysis and assessments undertaken;
- Identifies any assumptions and limitations encountered in compiling the environmental information; and
- Highlights any necessary monitoring and/or mitigation measures which could prevent, minimise, reduce or offset the possible environmental effects identified in the EIA process.

17.2.1.3 The assessment of effects of the communication cable on marine ecology is provided in Chapter 7: Benthic Subtidal and Intertidal Ecology.

17.3 Study area

17.3.1.1 The mWave terrestrial ecology study area is defined as habitat in the immediate vicinity (within 100m) of the proposed communication cable route from the point where it emerges from the intertidal zone to its termination at the control station as well as an access track to the control station from the B4320. Notwithstanding this, a buffer of 2km is used for consideration of national and locally designated sites as well as protected or otherwise notable species. A buffer of 10km for sites of international significance such as Natura 2000 sites.

17.4 Legislation and planning policy guidance

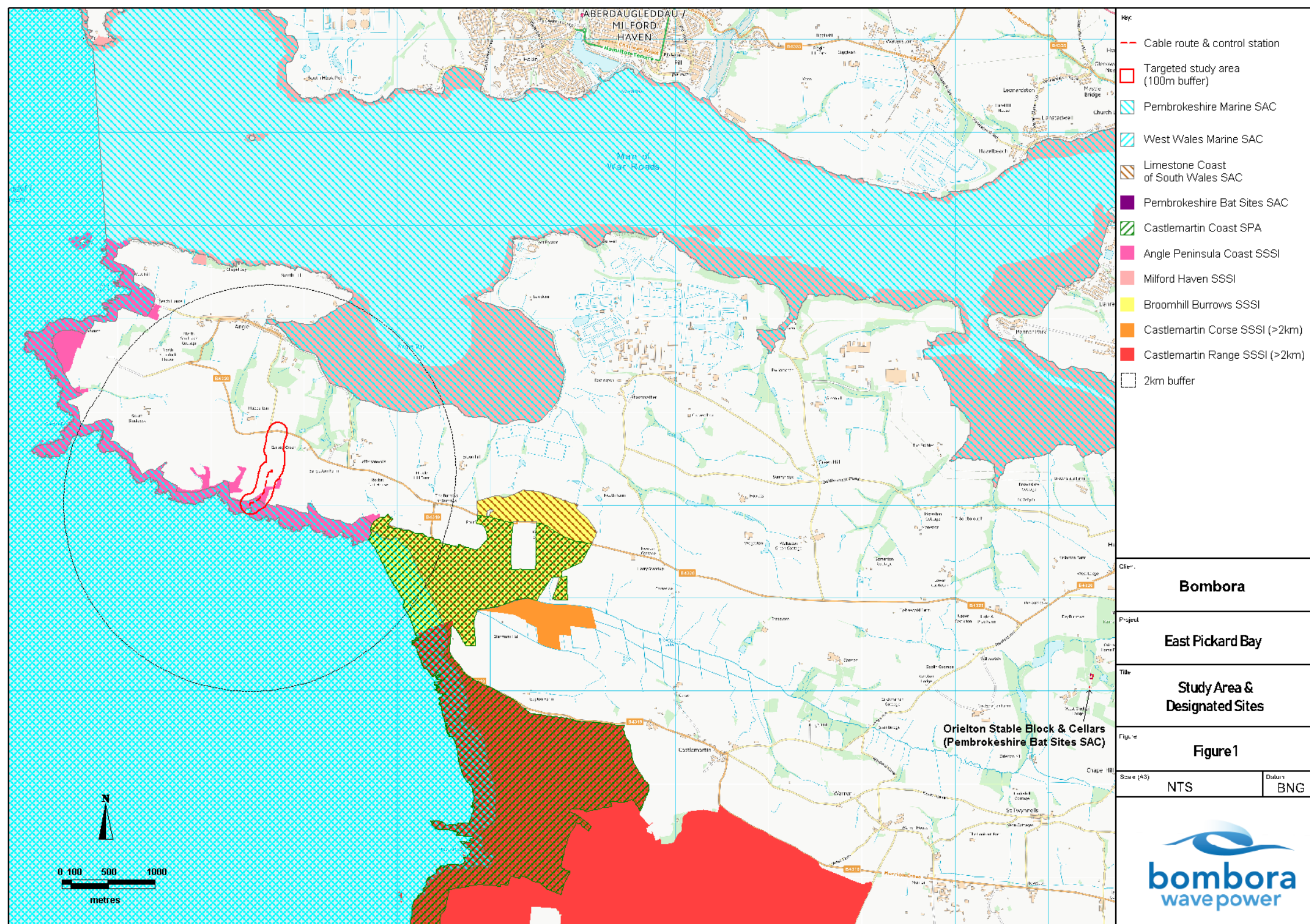
17.4.1.1 Legislation, planning policy and other guidance considered relevant to the assessment of potentially significant ecological effects of the Project during installation, operation, maintenance and decommissioning have been considered and are summarised in the tables below:

Table 17.1: Summary of legislation relevant to terrestrial ecology.

Legislation	Relevance	How and where considered in the Environmental Statement
The Conservation of Habitats and Species Regulations 2017	The Conservation of Habitats and Species Regulations 2017, commonly known as the 'Habitats Regulations' transpose the requirements of the Habitats Directive and the Birds Directive into UK law. The Habitats Directive relates to Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora. The Birds Directive (Council Directive 2009/147/EC (which codifies Directive 79/409/EEC) for rare, vulnerable and regularly occurring migratory bird species and internationally important wetlands. The Habitats Regulations allow for the designation of both Special Protection Areas (SPAs) for birds and Special Areas of Conservation (SACs) for the protection of other species and habitats. These protected areas are collectively known as the Natura 2000 network of sites. Species listed under the Habitats Regulations are known as European Protected Species (EPS). EPS including great crested newts (<i>Triturus cristatus</i>), otter (<i>Lutra lutra</i>) and all species of bat are fully protected under United Kingdom law making it an offence to kill, injure or disturb EPS and to destroy any place used for rest or shelter.	The applicant has investigated the potential for species protected under the Habitat Regulations using existing records, consultation and specific surveys. Scheme design has been influenced by baseline surveys and where feasible, potential impacts have been avoided or minimised.
The Wildlife and Countryside Act 1981 (as amended)	The Wildlife and Countryside Act 1981 (as amended) (WCA) is the principal legislation relating to wildlife protection in the United Kingdom. The Act provides for the designation of Sites of Special Scientific Interest (SSSI), which are selected as the best national examples of habitat types, sites with notable species and sites of geological importance. Schedules 1-4 of the Act deal with the protection of wild birds. Schedule 5 of the Act details with the protection of other animal species. Full protection is given under Section 9 of the Act to certain animals listed on Schedule 5, including all species of bats. Partial protection under Section 9 is given to certain other species, including all common species of reptile. Schedule 8 of the Wildlife and Countryside Act details protection for plants and fungi. It is an offence to knowingly cause the spread, into the wild, of plants listed on Schedule 9 of the Act. Special penalties are available for offences related to birds listed on Schedule 1 of the Act and there are additional offences of disturbing these birds at their nests, or their dependent young, as well as the strict protection afforded to birds, their nests and eggs.	Scheme design has been influenced by baseline surveys and where feasible, potential impacts have been avoided or minimised (see Chapter 3 Needs and Alternatives).
The Countryside and Rights of Way Act 2000	The Countryside and Rights of Way Act 2000 (CRoW Act) primarily deals with the rights of members of the public to access the countryside. The CRoW Act updated and strengthened the legal protection for designated sites (such as SSSIs) as well as certain species. In particular, the CRoW Act strengthened legislation by introducing the offence of 'reckless disturbance'. Section 74 of CRoW Act placed a statutory duty on government departments to have regard to biodiversity conservation and requires the preparation and maintenance of lists of priority species and habitats. Some of the provisions set out in CRoW Act have been incorporated into amendments to the WCA or have been superceded by the Natural Environment and Rural Communities Act 2006 (NERC 2006), which in Wales has been again superceded by the Environment (Wales) Act 2016.	The potential impact of the project on features of biodiversity interest have been considered during design stages and where feasible, avoided or minimised.
Natural Environment and Rural Communities Act 2006	NERC 2006 placed a duty upon public bodies to conserve biodiversity, stating that: <i>Every public authority must, in exercising its functions, have regard, so far as is consistent with the proper exercise of those functions, to the purpose of conserving biodiversity.</i> Section 40(3) expanded this further to explain that "conserving biodiversity includes, in relation to a living organism or type of habitat, restoring or enhancing a population or habitat". Section 42 related to a definitive list of species and habitats of principal importance in Wales. The list was intended to inform decision-makers such as local planning authorities, involved in operations or decisions that affect Welsh biodiversity.	The potential impact of the project on features of biodiversity interest have been considered during design stages and where feasible, avoided or minimised.
Environment (Wales) Act 2016	Section 6 of the Environment (Wales) Act 2016 created a legal duty for Welsh Ministers along with public authorities to 'seek to maintain and enhance biodiversity' so far as it is consistent with the proper exercise of those functions. The duty replaces the section 40 duty in the Natural Environment and Rural Communities Act 2006 (NERC Act 2006), in relation to Wales, and applies to those authorities that fell within the previous duty. Public authorities will be required to report on the actions they are taking to improve biodiversity and promote ecosystem resilience. Section 7 of the Act replaces the duty in section 42 of the NERC Act 2006. The Welsh Ministers will publish, review and revise lists of living organisms and types of habitat in Wales, which they consider are of key significance to sustain and improve biodiversity in relation to Wales.	In particular, the presence of habitats and species listed under Section 7 of the Act have been considered.
The Protection of Badgers Act 1992	The Protection of Badgers Act 1992 makes it an offence to: - Wilfully (or attempt to) take, injure or kill a badger; - Cruelly ill-treat a badger; - Interfere with a badger sett (including damaging any part of a sett, obstruction to any sett entrance, disturbance of a badger whilst it is occupying a sett, or causing a dog to enter a sett); - Selling or possession of live badgers; - Marking or ringing badgers without a licence.	Field surveys aimed at identifying setts were undertaken in order to influence scheme design (and in particular the route of the communication cable and location of the control station) to avoid impacts from the outset.

Table 17.2: Summary of planning policies relevant to terrestrial ecology.

Policy	Key provisions	How and where considered in the Environmental Statement
Planning Policy Wales (PPW) Edition 9 (November 2016)	Chapter 5 of PPW Edition 9 'Conserving and Improving Natural Heritage and the Coast' provides guidance to Local Planning Authorities (LPA) in relation to safeguarding biodiversity, protected sites, protected species and their habitats. PPW requires LPAs to fully consider the effect of planning decisions on natural heritage and sets out the following objectives for the conservation and improvement of natural heritage: • Promote the conservation of landscape and biodiversity, in particular the conservation of native wildlife and habitats; • Ensure that action in Wales contributes to meeting international obligations and responsibilities for the natural environment; • Ensure that statutory designated sites are properly protected and managed; • Safeguard protected species; and Promote the functions and benefits of soils, and in particular their function as a carbon store. PPW states that a key role of the planning system is to ensure that society's land requirements are met in ways which do not impose unnecessary constraints on development whilst ensuring that all reasonable steps are taken to safeguard or enhance the environment. In addition, there is recognition that conservation and development can often be fully integrated and that with careful planning and design, not only can the potential for conflict be minimised but new opportunities for sustainable development can be created.	Investigation into the ecological value of the site has been undertaken in order to influence scheme design and fulfil the aims of PPW9.
Technical Advice Note 5 (TAN5) Nature Conservation and Planning (September 2009)	Chapter 2 of TAN5 sets out what are described as the 'Key Principles of Positive Planning for Nature Conservation' and states that: <i>When considering policies and proposals in local development plans and when deciding planning applications that may affect nature conservation, local planning authorities should:</i> • Pay particular attention to the principles of sustainable development, including respect for environmental limits, applying the precautionary principle, using scientific knowledge to aid decision making and taking account of the full range of costs and benefits in a long term perspective; • Contribute to the protection and improvement of the environment, so as to improve the quality of life and protect local and global ecosystems, seeking to avoid irreversible harmful effects on the natural environment; • Promote the conservation and enhancement of statutorily designated areas and undeveloped coast; • Ensure that appropriate weight is attached to designated sites of international, national and local importance; • Protect wildlife and natural features in the wider environment, with appropriate weight attached to priority habitats and species in Biodiversity Action Plans; • Ensure that all material considerations are taken into account and decisions are informed by adequate information about the potential effects of development on nature conservation; • Ensure that the range and population of protected species is sustained; and • Adopt a step-wise approach to avoid harm to nature conservation, minimise unavoidable harm by mitigation measures, offset residual harm by compensation measures and look for new opportunities to enhance nature conservation; where there may be significant harmful effects local planning authorities will need to be satisfied that any reasonable alternative sites that would result in less.	Investigation by the ES into the ecological value of the site aims to provide the local planning authority with the information required to consider potential impacts of this renewable energy project.
Pembrokeshire Coast National Park Local Development Plan	All Local Planning Authorities (LPAs) in Wales produce Local Development Plans (LDPs) that follow guidance set out in PPW. Any development proposal submitted to a LPA is subsequently tested against the policies set out within the LDP. The relevant LDP for East Pickard Bay is the Pembrokeshire National Park Authority LDP. Policies most relevant to terrestrial ecology are as follows:	
Policy 1 - National Park Purposes and Duty (Strategy Policy)	Development within the National Park must be compatible with: a) the conservation or enhancement of the natural beauty, wildlife and cultural heritage of the Park, and b) the public understanding and enjoyment of those qualities. In determining proposals, due regard will be paid to the need to foster the economic and social well-being of the local communities within the Park provided this is compatible with the statutory National Park purposes embodied in the foregoing considerations.	Scheme design aims to minimise potential visual as well as ecological impacts (Chapter 2 Project Description Section 2.6.2 and Chapter 14 Seascape Landscape Assessment).
Policy 10 - Local Sites of Nature Conservation or Geological Interest	Development that would be liable to significantly harm the nature conservation value of a Local Nature Reserve or other site of local nature conservation interest, or the main features of interest within a Regionally Important Geodiversity Site, will only be permitted if the importance of the development outweighs the local value of the site and mitigation, minimisation or off setting has been investigated.	The ES sets out how potential impacts have been identified and avoided or minimised (see also Chapter 16: Geology, Hydrology and Land Quality).
Policy 11 - Protection of Biodiversity	Development that would disturb or otherwise harm protected species or their habitats or the integrity of other habitats, sites or features of importance to wildlife and individual species including Local Biodiversity Action Plan species and habitats will only be permitted where the effects will be acceptably minimised or mitigated through careful design, work scheduling or other measures.	The ES sets out how potential impacts have been identified and avoided or minimised.
Policy 17 - Shore Based Facilities	Development of shore based facilities including those linked to proposals below mean low water, will be permitted within the developed areas of the coast where compatible with adjacent uses. Marina developments are not considered appropriate on the sensitive coast of the National Park.	The ES sets out how the minimal shore-based facilities are compatible with adjacent users.
Policy 33 – Renewable Energy (Strategy Policy)	Small scale renewable energy schemes will be considered favourably, subject to there being no over-riding environmental and amenity considerations. Medium scale schemes also offer some potential and will be permitted subject to the same considerations. Large scale renewable energy schemes will only be permitted where they do not compromise the special qualities of the National Park. Where there are other renewable energy schemes already in operation in the area, cumulative impacts will be an important consideration. Onshore connections to off shore renewable energy generators will also be permitted subject to there being no over-riding environmental and amenity considerations. Developers requiring an undeveloped coastal location for onshore connections to offshore renewable energy installations will need to clearly justify this need in relation to Policy 8i) with the least obtrusive approach to design being taken.	The ES aims to set out why there are no over-riding environmental or amenity considerations to this small scale renewable energy trial (Chapter 3: Needs and Alternatives).



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Figure 17.1: The focus of the terrestrial ecology study area.

17.5 Consultation

- 17.5.1.1 As set out in Chapter 1: Introduction, Bombora originally intended that the licensing and consenting of the mWave project would be undertaken within the consenting and licensing of the Marine Energy Wales META project, with mWave being deployed at the eastern end of META Site 8. A scoping opinion on the META scoping report, which included four locations for the onshore control station, was received from PCNPA in January 2019. This response provided guidance with respect to all four potential onshore site options, each with their own distinct characteristics.
- 17.5.1.2 Table 17.3 below summarises the issues raised relevant to terrestrial ecology. Table 17.3 also indicates either how these issues have been addressed within this Environmental Statement or how the Applicant has had regard to them.

Table 17.3: Summary of key consultation issues raised during consultation activities undertaken for the mWave project relevant to terrestrial ecology.

Date	Consultee and type of response	Issues raised	Response to issue raised and/or where considered in this chapter
10 January 2019	NRW advisory – discretionary advice service.	Regulation 37 package for the Pembrokeshire Marine Special Area of Conservation (SAC) should be used to provide further clarification on the ecology and designations of the SAC as well as the Conservation Objectives for the habitat features.	The Regulation 37 package has been used to inform the terrestrial ecology characterisation presented in section 17.7 and will also be used in the NSER for the project.
		For the terrestrial section the cable lay itself would be unlikely to have any impacts upon the biological features of the SSSI. However, given the potential for increased activity and construction in the area adjacent to the cable lay we suggest a phase 1 survey is undertaken as a precaution.	A phase 1 habitat survey, including an assessment for the potential of protected species, was undertaken for the onshore cable route corridor, the onshore control station site and access track. Surveys were undertaken in March and April 2019. The information is presented in section 17.7 and Appendix 17.1.
		In addition, we suggest that ornithological interest features are also considered on the cable route and checks are carried out prior to works to ensure that no nests are present along the route. This is a known area for Chough feeding and nesting so this is of paramount importance.	The presence of chough was recorded during site visits. Information on chough nesting sites has been collated and the information has been used to inform the assessment of potential effect (Section 17.10 as well as Appendix 17.2).
18 January 2019	Pembrokeshire Coast National Park Authority (PCNPA) Scoping Response	The PCNPA ecologist raised concerns in respect of the lack of marine and terrestrial surveys to support the proposal.	Terrestrial and marine surveys have since been undertaken to identify potential ecological constraints.
		Additional concern was raised that terrestrial elements may fall within the	Terrestrial elements of the project at East Pickard Bay avoid the Geological

Date	Consultee and type of response	Issues raised	Response to issue raised and/or where considered in this chapter
		Freshwater West (north) Geological Conservation Review Site, Pembrokeshire Marine SAC, Castlemartin Coast SPA or Broomhill Burrows SSSI. In particular, no surveys have been submitted to inform the location and potential impacts or subsequent mitigation of the proposals.	Conservation Review Site, Castlemartin Coast SPA and Broomhill Burrows SSSI (see Chapter 16 Geology, Hydrology and Land Quality).

17.6 Methodology to inform the baseline

17.6.1 Phase1 habitat survey

- 17.6.1.1 An extended phase 1 habitat survey of the terrestrial elements of the Project was undertaken during site visits on the 19 March 2019 and 18 April 2019. JNCC (2010) habitat survey techniques were used, with habitats and other features of ecological interest being mapped and described using target notes. Particular note was taken of protected and/or notable species (as well as the potential for them to occur) during site visits following the Institute of Environmental Assessment Guidelines (IEA, 1995).

- 17.6.1.2 Appendix 17.1 presents the phase 1 habitat map and target notes.

17.6.2 Breeding bird survey

- 17.6.2.1 Early arrival to site on the 18 April 2019 enabled a breeding bird survey to be undertaken. The visit was undertaken during suitable weather conditions, between the hours of 6.15am and 8am. The surveyor noted the singing or calling of birds, repeated territorial calls, territorial aggression, displaying, adults carrying food or nesting material, juvenile birds and family groups on a field map. The mapping of birds, heard or seen, utilised Common Bird Census (CBC) codes of the British Trust for Ornithology (BTO) (Marchant, 1983). The survey began at the northern end of the site (B4320) and finished at the coastline. The single survey visit was undertaken relatively early in the bird breeding season (March-August). Appendix 17.2 presents the breeding bird survey map.

17.6.3 Badger / Otter survey

- 17.6.3.1 The site was systematically surveyed for all signs of badger activity with a particular focus on linear features (i.e. hedgerows, banks, ditches, streams and fence lines). Open areas of each field were also traversed and any point features (e.g. trees, structures) were inspected. All signs of badger activity (e.g. setts, latrines, clearly defined runs etc.) were recorded and any badger runs were followed until they either petered out or reached the boundary of the study area.

17.6.3.2 Otters are wide-ranging animals known to occur around the Pembrokeshire coastline. A search for field sign in the form of footprints, spraints (including tar spots), feeding remains and slides (entry points into watercourses) as well as laying-up areas and holts was undertaken. The focus of the survey was the stream and gully forming East Pickard Bay as this provided the most accessible route for otters from the coastline to cover associated with inland scrub.

17.6.4 Botanical survey

17.6.4.1 The initial phase 1 habitat survey of the study area identified higher value habitat associated with the clifftop grasslands. In order to supplement notes taken during phase 1 habitat survey and categorise this grassland in terms of plant communities of the National Vegetation Classification (Rodwell, 2000), recording of five 2m x 2m quadrats was undertaken. Post-collection statistical analysis of quadrat data was undertaken using the Modular Analysis of Vegetation Information System (MAVIS) of the Centre for Ecology and Hydrology (CEH, 2014). Appendix 17.3 presents the location and results of quadrat surveys.

17.6.5 Overwinter chough survey

17.6.5.1 Four overwintering chough surveys were undertake between October 2018 and January 2019. The surveys were initially focused on the coastal grassland and dune areas behind Freshwater West beach and, subsequently, along the cliff tops of the Angle Peninsula (Appendix 17.4).

17.6.6 Desktop study

17.6.6.1 Information on terrestrial ecology was collected through a West Wales Biodiversity Information Centre (WWBIC) data search as well as review of existing datasets. These sources of information are summarised at Table 17.4 below.

Table 17.4: Summary of key desktop reports.

Title	Source	Year	Author
Terrestrial ecology			
West Wales Biodiversity Information Centre (WWBIC) data search (2km buffer) of SM86600133 (09/04/2019) for protected or notable species and protected sites.	WWBIC	2019	WWBIC
Designated site GIS resource (for SSSI, SAC, SPA, NNR, LNR and National Parks).	http://lle.gov.wales/	2019	NRW
Countryside Council for Wales (CCW) Terrestrial Phase 1 habitat mapping survey of Wales (1979 to 1997).	http://lle.gov.wales/	2019	NRW
All Pembrokeshire 2018 Chough Breeding Records	John Hudson, NRW	2018	Bob Haycock

Title	Source	Year	Author
Section 7 list of Species and Habitats of Principal Importance for Conservation of Biological Diversity in Wales	https://www.biodiversitywales.org.uk/Environment-Wales-Act	2019	Welsh Government
The Mosses and Liverworts of Pembrokeshire	Literature	2010	S.D.S. Bosanquet

17.7 Baseline environment

17.7.1.1 This section characterises the existing environment within the terrestrial ecology study area as illustrated in Figure 17.1 and outlined in section 17.3.

17.7.2 Designated sites

17.7.2.1 Designated sites in proximity to the terrestrial ecology study are described in Table 17.5 below. A buffer of 10km has been used for Internationally designated sites and 2km for sites of National or Local interest.

Table 17.5: Designated sites and relevant qualifying interest features for the mWave project terrestrial ecology chapter.

Designated Site	Distance to study area (km)	Relevant Qualifying Interest Feature
Special Areas of Conservation		
Pembrokeshire Marine/ Sir Benfro Forol SAC	0	The third largest UK marine SAC, covering an area of 138,069 ha and supporting eight Annex I habitats and seven Annex II species. Annex 1 habitats forming the primary reason for site selection include: • Estuaries; • Large shallow inlets and bays; and • Reefs. Annex 1 habitats forming qualifying features include: Sandbanks which are slightly covered by seawater all the time; Mudflats and sandflats not covered by seawater at low tide; Coastal lagoons (Priority feature); Atlantic salt meadows (<i>Glaucopuccinellietalia maritima</i>); and Submerged or partially submerged sea caves. Annex II species forming the primary reason for site selection include: • Grey seal (<i>Halichoerus grypus</i>); and • Shore dock (<i>Rumex rupestris</i>). Annex II species forming qualifying features include: Sea lamprey (<i>Petromyzon marinus</i>); River lamprey (<i>Lampetra fluviatilis</i>); Allis shad (<i>Alosa alosa</i>); Twaite shad (<i>Alosa fallax</i>); and Otter (<i>Lutra lutra</i>).
Limestone Coast of South West Wales / Arfordir Calchfaen de Orllewin Cymru SAC	1.1	The site is comprised of carboniferous limestone sea-cliffs in exposed and sheltered elevations. The SAC stretches from Castlemartin in Pembrokeshire to the Bishopston Valley on Gower. Annex I habitats forming the primary reason for site selection include: • Vegetated sea cliffs of the Atlantic and Baltic coasts; and • Fixed coastal dunes with herbaceous vegetation (grey dunes);

Designated Site	Distance to study area (km)	Relevant Qualifying Interest Feature
		Annex I habitats forming qualifying features include: European dry heaths; Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometalia) (*important orchid sites); Caves not open to the public; and Submerged or partially submerged sea caves. Annex II species forming the primary reason for site selection include: - Greater horseshoe bat (<i>Rhinolophus ferrumequinum</i>); and - Early gentian (<i>Gentianella anglica</i>). Annex II species forming qualifying features include: Petalwort (<i>Petalophyllum ralfsii</i>).
Pembrokeshire Bat Sites and Bosherton Lakes / Safleoedd Ystlum Sir Benfro a Llynnoedd Bosherton SAC	8.95	The site is focussed on habitats and species associated with eight sites centred around the National Trust owned Stackpole Estate. In particular, the site encompasses the shallow marl lake system of Bosherton Lakes (created by damming and drowning three valleys in the Carboniferous Limestone during the late 18th and mid-19th Century) as well as important bat roosts. Annex I habitats forming the primary reason for site selection include: - Hard oligo-mesotrophic waters with benthic vegetation of Chara spp. Annex II species forming the primary reason for site selection include: - Greater horseshoe bat (<i>Rhinolophus ferrumequinum</i>). Annex II species forming qualifying features include: Lesser horseshoe bat (<i>Rhinolophus hipposideros</i>); and Otter (<i>Lutra lutra</i>).
Special Protection Areas		
Castlemartin Coast	1.1	Carboniferous limestone rocky coastline of geological and biological interest. The site supports exposed cliff communities, species-rich maritime grasslands, maritime heath and scrub. In particular the coastline is known for its breeding and over-wintering population of Chough (<i>Pyrrhocorax pyrrhocorax</i>), an Annex I species of European importance.
Sites of Special Scientific Interest		
Angle Peninsula Coast / Arfordir Penrhyn Angle SSSI	0	The site is of special interest for its quaternary and non-marine Devonian geology, particularly exposure of intertidal rock, sand, and gravel habitats with rockpools, caves, tide-swept and under-boulder communities. In addition to a range of seaweeds and sponges, terrestrial habitats support a range of uncommon plants. The cliffs and maritime grasslands are noted for supporting a population of roosting and feeding chough as well as Greater and Lesser horseshoe bats.
Milford Haven Waterway SSSI	0.7	The Milford Haven Waterway is an exceptional example of a ria (a valley or valleys flooded by post-glacial sea level rise), noted for its geology, ancient woodland, marine biology, saltmarsh, swamp, saline lagoons, rare and scarce plants and invertebrates, nationally important numbers of migratory waterfowl as well as Greater and Lesser horseshoe bats and Otter.
Broomhill Burrows SSSI	1.2	One of Pembrokeshire's largest dune systems supporting an extensive area of slack and fixed dune grassland habitat as well as a diverse assemblage of plants, lichens and invertebrates.
Heritage Coast		
South Pembrokeshire Heritage Coast	0	Coastline of the Angle Peninsula is encompassed within the South Pembrokeshire Heritage Coast.

17.7.3 Habitats

Rocky shore and maritime cliff

17.7.3.1 The shoreline at East Pickard Bay is characterised by sandstone exposures locally overlain by eroded blocks, boulders and cobbles. Lichens are one of the first colonists on rocks in the splash and spray zone above the high tide line. At East Pickard Bay, the first of these is *Verrucaria maura* which forms a black band along the base of the lowest rock surfaces. Above this, orange lichens of the genus *Caloplaca* dominate, followed by greys and oranges of *Orchrolechia parella*, *Xanthoria* spp and *Ramalina* spp. In particular, outcropping rocks of the clifftops support abundant cover of sea ivory (*Ramalina siliquosa*). (Please refer to Appendix 17.1 TN25 and 27).

17.7.3.2 In terms of vascular plants, cracks and rock crevices towards the cliff tops support tufts of golden samphire (*Inula crithmoides*), common scurvygrass (*Cochlearia officinalis*), sea mayweed (*Tripleurospermum maritimum*), sea thrift (*Armeria maritima*), and red fescue (*Festuca rubra*). This community was considered to best fit the MC1b *Crithmum maritimum-Spergularia rupicola maritime rock-crevice community Inula crithmoides sub-community* of the NVC (Rodwell, 2000). (Please refer to Appendix 17.1 TN27).

17.7.3.3 The Section 7 *Maritime cliff and slopes* habitat of the Environment (Wales) Act 2016 encompasses this community.

Coastal grassland

17.7.3.4 The coastal grasslands associated with East Pickard Bay are typically dominated by red fescue, Yorkshire-fog (*Holcus lanatus*) and Cock's-foot (*Dactylis glomerata*). Locally, spring squill (*Scilla verna*) forms a significant component of the sward. Other grassland herbs included sea thrift, English stonecrop (*Sedum anglicum*), kidney vetch (*Anthyllis vulneraria*), common bird's-foot-trefoil (*Lotus corniculatus*) and sea campion (*Silene uniflora*) as well as annuals such as sea mouse-ear (*Cerastium diffusum*). Stag's-horn plantain (*Plantago coronopus*) dominated vegetation was also noted from the thin and exposed soils at the cliff edge.

17.7.3.5 The coastal grassland can generally be assigned to the MC9 *Festuca rubra-Holcus lanatus maritime grassland* community of the NVC (Rodwell, 2000). (Please refer to Appendix 17.1 TN20, 22, 23 and 24).

17.7.3.6 The Section 7 *Maritime cliff and slopes* habitat of the Environment (Wales) Act 2016 encompasses this community.

Species-rich semi-improved neutral grassland

17.7.3.7 The first agriculturally enclosed field at the south-western end of the study area supported species-rich semi-improved neutral grassland. Grazed by sheep and cattle, the field supported a short turf with red fescue, Yorkshire-fog, common bent (*Agrostis capillaris*), sweet vernal-grass (*Anthoxanthum odoratum*), field woodrush (*Luzula campestris*), ribwort plantain (*Plantago lanceolata*), common knapweed (*Centaurea nigra*), common bird's-foot-trefoil and the semi-parasitic herb, yellow rattle (*Rhinanthus minor*). (Please refer to Appendix 17.1 TN19).

17.7.3.8 The Section 7 Lowland meadow habitat of the Environment (Wales) Act 2016 encompasses this community.

Marshy grassland

17.7.3.9 A small area of rank marshy grassland dominated by purple moor-grass (*Molinia caerulea*) was noted from the gully above East Pickard Bay. The grassland was fringed by low bramble scrub and tall herbs including hemp agrimony (*Eupatorium cannabinum*) and red campion (*Silene dioica*) with occasional primrose (*Primula vulgaris*). (Please refer to Appendix 17.1 TN17).

17.7.3.10 A poorly-draining hollow in a depression between two banks to the north of the study area supported creeping bent and common spike-rush (*Eleocharis palustris*) with soft-rush (*Juncus effusus*), common fleabane (*Pulicaria dysenterica*), hemp-agrimony and creeping cinquefoil (*Potentilla reptans*). (Please refer to Appendix 17.1 TN10).

17.7.3.11 Purple moor-grass and rush pastures are a Section 7 habitat of the Environment (Wales) Act 2016.

Improved grassland

17.7.3.12 The bulk of the study area comprised sheep and cattle-grazed improved grassland habitat. The communities were typically rank in character and dominated by a mix of perennial ryegrass (*Lolium perenne*), Yorkshire-fog, timothy (*Phleum pratense*), creeping bent (*Agrostis stolonifera*), white clover (*Trifolium repens*) and creeping buttercup (*Ranunculus repens*). Plants of curled dock (*Rumex crispus*), creeping thistle (*Cirsium arvense*) and nettle (*Urtica dioica*) were also present. False oat-grass (*Arrhenatherum elatius*) was also noted from neglected areas subject to less grazing pressure. (Please refer to Appendix 17.1 TN2, 9 and 13).

Hedgerows, scrub and tree cover

17.7.3.13 Scrub associated with the steep rocky slopes and grassland of the coastal fringe was dominated by patches of common gorse (*Ulex europaeus*) and bramble (*Rubus fruticosus* agg.) interspersed by occasional stands of bracken (*Pteridium aquilinum*). (Please refer to Appendix 17.1 TN18 and 26).

17.7.3.14 Inland, blackthorn (*Prunus spinosa*) interspersed with bramble was more typical and was a particular feature of the gully inland of East Pickard Bay. (Please refer to Appendix 17.1 TN15).

17.7.3.15 The northern part of the study area supported hedgerows as well as scrub-covered banks associated with the former airfield. Earth and rubble banks were typical vegetated by bramble and tall herbs with patches of blackthorn and occasionally, young trees of Ash (*Fraxinus excelsior*) and Sycamore (*Acer pseudoplatanus*). (Please refer to Appendix 17.1 TN3 and 8).

17.7.3.16 Hedgerows within the northern part of the study area were species-poor and generally dominated by hawthorn and blackthorn with a species-poor ground flora dominated by cleavers (*Galium aparine*), ivy (*Hedera helix*) and nettle. (Please refer to Appendix 17.1 TN1, 4 and 5).

17.7.3.17 Hedgerows are a Section 7 habitat of the Environment (Wales) Act 2016.

Watercourses

17.7.3.18 A small watercourse discharges into East Pickard Bay. Where the watercourse flows in more open topography, Hemlock water-dropwort (*Oenanthe crocata*) dominated the narrow channel. However, where it cascaded over rocky substrate on steeper slopes, long-beaked water feather-moss (*Platyhypnidium riparioides*) was a conspicuous component of the channel. Wet ground and rock surfaces near the watercourse (including small flushes seeping into it) were found to support fern-leaved hook-moss (*Crataneuron filicinum*) and endive peltia (*Pellia endiviifolia*). Seaside Grimmia (*Schistidium maritimum*) was also noted. (Please refer to Appendix 17.1 TN22 and 23).

17.7.4 Protected, rare or notable species

Data search

17.7.4.1 The West Wales Biodiversity Information Centre (WWBIC) data search identified 2316 records comprising 867 different species of algae, lichen, bryophyte, flowering plant, invertebrate, bird and mammal, from habitats within 2km of the site (centred on National Grid Reference SM86600133).

17.7.4.2 Of particular note were records of species with International or UK legal protection as well as Section 7 species of the Environment (Wales) Act 2016. A total of 244 of the records comprising 71 different species fell within this category. They included:

- **Amphibian** – Common toad (*Bufo bufo*) and common frog (*Rana temporaria*);
- **Birds** – 32 species including chough (*Pyrrhocorax pyrrhocorax*);
- **Flowering plant** – Bluebell (*Hyacinthoides non-scripta*);
- **Beetle** – Black oil-beetle (*Meloe proscarabaeus*);
- **Butterflies** – Small pearl-bordered fritillary (*Boloria selene*), small heath (*Coenonympha pamphilus*), grayling (*Hipparchia semele*) and wall (*Lasiommata megera*);

- **Bee** – Shrill carder-bee (*Bombus sylvarum*);
- **Moths** – 15 species of moth;
- **Lichen** – *Parmotrema perlatum*;
- **Reptiles** – Slow-worm (*Anguis fragilis*), grass snake (*Natrix helvetica*), adder (*Vipera berus*) and common lizard (*Zootoca vivipara*); and
- **Mammals** – Hedgehog (*Erinaceus europaeus*), otter (*Lutra lutra*), badger (*Meles meles*), stoat (*Mustela erminea*), polecat (*Mustela putorius*), Daubenton's bat (*Myotis daubentonii*), common pipistrelle (*Pipistrellus pipistrellus*), soprano pipistrelle (*Pipistrellus pygmaeus*), greater horseshoe bat (*Rhinolophus ferrumequinum*) and lesser horseshoe bat (*Rhinolophus hipposideros*).

Lichens and lower plants

- 17.7.4.3 The most conspicuous of the lichens noted during site visits was the fruticose lichen known as sea ivory (*Ramalina siliquosa*). Outcropping rocks within grassland of the clifftops were adorned with the fronds of this lichen giving them a shaggy grey appearance (Appendix 17.1 TN 25). Whilst the foliose lichen, *Parmotrema perlatum* can grow on rock substrates it was not noted during site visits.
- 17.7.4.4 Pembrokeshire is a relatively well-recorded county although inconspicuous groups such as bryophytes can remain overlooked in even heavily visited locations. Bosanquet (2010) noted that the extensive exposures of Old Red Sandstone on the southern side of the Angle Peninsula made it an important stretch of the Pembrokeshire coastline for bryophytes. In particular, base rich outcrops above Gravel Bay were noted for broad scalewort (*Porella obtusata*), *Grimmia lisae*, bird's-foot wing-moss (*Pterogonium gracile*) and Stirton's yoke-moss (*Zygodon stirtonii*).
- 17.7.4.5 The most conspicuous bryophytes noted during visits were associated with the watercourse and flushed rocky habitat of the East Pickard Bay gully. The most notable of those recorded being *Schistidium maritimum*.

Flowering plants

- 17.7.4.6 Shore dock (*Rumex rupestris*) is listed as a feature of the Pembrokeshire Marine SAC. The closest known plants to East Pickard Bay grow at Marloes Sands some distance (10km+) from the study area (J Woodman 2019, pers.comm.). Shoreline habitat at the base of the East Pickard Bay gully was searched for this species but no plants were found.
- 17.7.4.7 It is illegal under the Wildlife and Countryside Act 1981 (as amended) for landowners to collect Bluebell (bulbs or seeds) and offer for sale. Bluebell are a relatively common and widespread species although not a feature of the study area.
- 17.7.4.8 None of the flowering plants species recorded during site visits were protected or considered particularly rare. Species including yellow rattle noted from semi-improved neutral grassland (Appendix 17.1 TN19) and others including golden samphire, spring squill, sea campion and sea mouse-ear associated with maritime cliffs and grassland (Appendix 17.1 TN20, 24 and 27) are limited in their distribution by specific habitat preferences.

Invertebrates

- 17.7.4.9 The presence of extensive tracts of unimproved habitat including coastal grasslands as well as nearby sites such as Broomhill Dunes and Castlemartin Common favour the presence of a diverse invertebrate assemblage. Existing records confirm the presence of a range of Section 7 species locally.
- 17.7.4.10 Relatively few invertebrates were recorded during the site visit. The most notable observation was that of a black oil beetle within the gully at East Pickard Bay. Black oil beetles are Section 7 species of the Environment (Wales) Act 2016. Additional observations included a green tiger beetle (*Cicindela campestris*) on bare ground associated with the Pembrokeshire coastal footpath and speckled wood butterfly (*Pararge aegeria*) was noted near scrub at the northern end of the site.

Amphibians

- 17.7.4.11 Open water with the potential to support breeding amphibians was not identified within the immediate study area although Ordnance Survey mapping indicates waterbodies at Carter's Green to the north-east. Widely occurring species such as palmate newt (*Lissotriton helveticus*), common frog and common toad would be expected from the wider landscape but would be considered unlikely within the study area in any significant number.

Reptiles

- 17.7.4.12 A single adult common lizard was observed from coastal grassland habitat during a site visit in April 2019. In addition, existing records indicate the presence of slow-worm, grass snake and adder in close proximity to the study area.
- 17.7.4.13 Habitat associated with the study area, particularly the coastal fringe as well as watercourses, banks and hedgerows inland, are all considered suitable for reptiles. With the exception of tightly grazed grassland, one or more species of reptile would be expected from most areas of the study area.

Birds

- 17.7.4.14 The Pembrokeshire Coast National Park, which encompasses the Angle Peninsula Coastline (SSSI) as well as Castlemartin Coast (SPA), are recognised for their importance as both feeding and breeding areas for cough. Within the National Park, cough distribution, numbers of breeding pairs as well as productivity have been subject to annual surveillance since 1992. In 2017 a total of 79 occupied territories were recorded of which 51 successfully reared young (Hodges & Haycock, 2018).
- 17.7.4.15 An all Pembrokeshire survey of breeding sites returned a negative result for East Pickard Bay in 2018 (Haycock, 2018) and the site visit in mid-April 2019 failed to identify any potential nesting activity. However, coastal grassland habitat associated with the study area provides optimal foraging habitat for cough and a site visit on the 25 March 2019 observed a flock of 16 feeding within clifftop grassland.

17.7.4.16 Overwintering surveys were undertaken between October 2018 and January 2019. Initial focus was on the Freshwater West area with the latter two surveys including the proposed onshore works area at East Pickard Bay (Appendix 17.4). The survey identified a low number of chough in the dunes behind Freshwater West, or calling from the fields behind. No chough were recorded during the surveys at East Pickard Bay during the December and January. Notwithstanding this, during the Phase 1 survey on the 19 March 2019 a flock of 16 chough were recorded feeding in the coastal grassland around East Pickard Bay. These birds appeared largely unperturbed by occasional coastal path walkers as well as several surveyors and occasional drone flights going on at the time.

17.7.4.17 The WWBIC data search identified 32 protected or Section 7 bird species within 2km of the study area. A breeding bird survey on the 18th April 2019 recorded 24 species in the immediate study area including evidence of 3 Section 7 species (song thrush *Turdus philomelos*, linnet *Linaria cannabina* and skylark *Alauda arvensis*) as well as RSPB red and amber listed birds of conservation concern (Eaton et al, 2015). The species recorded during the survey are set out below in Table 17.6:

Table 17.6: Bird species recorded during 18 April 2019 site visit.

Common name	Scientific name	Notes	Conservation Status
Blue tit	<i>Cyanistes caeruleus</i>	Present	BoCC: Green
Wren	<i>Troglodytes troglodytes</i>	Territorial singing	BoCC: Green
Pied wagtail	<i>Motacilla alba</i>	Flyover	BoCC: Green
Dunnock	<i>Prunella modularis</i>	Territorial singing	BoCC: Amber
Grasshopper warbler	<i>Locustella naevia</i>	Territorial singing	BoCC: Red
Magpie	<i>Pica pica</i>	Foraging	BoCC: Green
Blackcap	<i>Sylvia atricapilla</i>	Territorial singing	BoCC: Green
Blackbird	<i>Turdus merula</i>	Territorial singing	BoCC: Green
Song thrush	<i>Turdus philomelos</i>	Territorial singing	Section 7 / BoCC: Red
Robin	<i>Erithacus rubecula</i>	Territorial singing	BoCC: Green
Skylark	<i>Alauda arvensis</i>	Territorial singing	Section 7 / BoCC: Red
Linnet	<i>Carduelis cannabina</i>	Breeding	Section 7 / BoCC: Red
Goldfinch	<i>Carduelis carduelis</i>	Flyover	BoCC: Green
Chaffinch	<i>Fringilla coelebs</i>	Territorial singing	BoCC: Green
Raven	<i>Corvus corax</i>	Flyover	BoCC: Green
Sparrowhawk	<i>Accipiter nisus</i>	Hunting	BoCC: Green
Chiffchaff	<i>Phylloscopus collybita</i>	Territorial singing	BoCC: Green
Carrion crow	<i>Corvus corone</i>	Flyover	BoCC: Green
Herring gull	<i>Larus argentatus</i>	Flyover	BoCC: Red
Lesser black-backed gull	<i>Larus fuscus</i>	Flyover	BoCC: Amber
Rock pipit	<i>Anthus petrosus</i>	Present	BoCC: Green
Meadow pipit	<i>Anthus pratensis</i>	Territorial singing	BoCC: Green

Common name	Scientific name	Notes	Conservation Status
Jackdaw	<i>Corvus monedula</i>	Present	BoCC: Green
Wood pigeon	<i>Columba palumbus</i>	Present	BoCC: Green

Bats

17.7.4.18 WWBIC returned 10 existing records of bats within 2km of the study area (although none within 1km). These included Daubenton's bat, common pipistrelle, soprano pipistrelle, greater horseshoe bat and lesser horseshoe bat.

17.7.4.19 No specific bat activity surveys were undertaken given the limited nature of the terrestrial elements of the project however, the East Pickard Bay gully was assessed for rock features such as caves with potential to support horseshoe bats. No features with the potential to support roosting bats were found.

Badger

17.7.4.20 Existing WWBIC records of badger within 2km of the study area were sparse (single record of a road casualty) whilst field signs indicated relatively high levels of badger activity in parts of the site.

17.7.4.21 In particular, trails and latrines were noted from the eastern end of the former airfield and a sett was found in blackthorn scrub marking the landward end of the East Pickard Bay gully. At the time of the survey at least three active sett entrances were present as well as bedding material at entrances (Appendix 17.1 TN14). A thorough search of the area was impeded due to the impenetrability of the scrub habitat. The sett was considered likely to represent the edge of a main sett or a subsidiary or annex to an unidentified main sett.

Otter

17.7.4.22 WWBIC returned two records for otter including a 2015 observation of an individual walking the length of Freshwater West Beach.

17.7.4.23 Otter occupy a home range within which they feed, rest and breed. The size of this range depends on habitat quality and particularly food supply. Radio-tracking of otters has taken place in various UK locations (Green et al (1994) and Durbin (1998)) although data is based on a limited numbers of animals. Kruuk (2006) suggests male home ranges average 32km (but may be as long as 80km) and female ranges average 20km.

17.7.4.24 The Otter Survey of Wales Project (Strachan, 2015) provides a valuable insight into the status of this protected mammal. It is believed that hunting, poor water quality and the introduction of persistent organochlorine pesticides (as well as endocrine disrupting chemical such as polychlorinated biphenyls (Chanin, 2003)) from the late 1950s led to a drastic decline in the otter population to such an extent that by the mid 1970s UK otters only survived in Scotland, parts of Wales and south-west England. In order to investigate the otter population in Wales, the country was divided into 15 hydrometric areas with over a thousand separate survey sites. The Angle Peninsula falls within the Cleddau hydrometric survey area. From a low point in 1977-78 where only 41% of survey sites were positive for otter, it is now believed that the Cleddau region is one of a number of regions now nearing carrying capacity (97% positive returns from 67 survey sites in 2009-10).

17.7.4.25 In terms of the availability of habitat for otters at East Pickard Bay, the coastline and watercourses feeding into it provides opportunities for hunting. Additionally, temporary shelter is provided beneath rocks of the upper shoreline and more substantial cover is likely to be available in scrub and woodland habitat inland. However, no field sign suggesting the presence of otters was found during site visits.

Other

17.7.4.26 WWBIC returned records for common and widely distributed mammals including hedgehogs (*Erinaceus europaeus*).

17.8 Impact Assessment Methodology

General approach

17.8.1.1 The assessment methodology follows guidance by the Chartered Institute of Ecology and Environmental Management (CIEEM, 2018). CIEEM describe Ecological Impact Assessment or EclA as a process of identifying, quantifying and evaluating potential effects of development-related or other proposed actions on habitats, species and ecosystems.

17.8.1.2 In practice, ecological issues are usually raised after undertaking a Preliminary Ecological Assessment (PEA) of a site although additional methods including research and consultation should play a role. This process, known as scoping, helps determine which ecological issues should be addressed, sets out the methods and resources required, as well as establishing the spatial and temporal limits for surveys and assessments. The main output of the process is the identification of 'Important Ecological Features', which in this Environmental Statement are known as Valuable Ecological Receptors (VERs).

17.8.1.3 VERs are features considered sufficiently valuable for any significant effects upon them to be material in the decision-making process. The emphasis is not only placed on formal designation but also considers biodiversity value, secondary or supporting values as well as multi-functional features. The ranking of VERs has been determined based on available contextual information. Individual plant or animal groups have been assessed using available information detailing rarity, status and distribution. Habitats have been evaluated against existing selection criteria, for instance, those used in the designation of SSSIs (the "Ratcliffe Criteria", 1977). Table 17.7 provides examples and geographical context:

Table 17.1: Geographic Frame of Reference for Ecological Receptors.

Importance of VER	Criteria to define value
International (Very high)	- A feature of importance in the context of international biodiversity beyond the United Kingdom, such as a European Site (e.g. Special Protection Area (SPA)). - Habitats and species protected under international law (i.e. Annex I habitats within an SAC boundary).
National (High)	- A feature of importance in the context of the United Kingdom's (Wales) biodiversity resource, such as a nationally designated site (SSSI, NNR, MNR¹) or a discrete area, which the country conservation agency has determined meets the published selection criteria for national designation (e.g. SSSI selection guidelines) irrespective of whether or not it has yet been notified. - Species protected under national law. - Annex I habitats not within an SAC boundary. - Nationally important populations of a species (particularly within the context of habitats/species that may be rare or threatened within the UK^a) that occur within the study area such as: UK BAP priority species and habitats that continue to be regarded as conservation priorities in the subsequent UK Post-2010 Biodiversity Framework; priority habitats and species under Section 7 of the Environment (Wales) Act 2016.
Regional (Medium)	- A feature of importance in the context of a county's biodiversity resource. - Regionally important populations of a species (particularly within the context of habitats/species that may be rare or threatened within the UK) that occur within the study area such as: UK BAP priority species and habitats that continue to be regarded as conservation priorities in the subsequent UK Post-2010 Biodiversity Framework; priority habitats and species under Section 7 of the Environment (Wales) Act 2016. - Habitats or species that provide important prey items for other species of conservation or commercial value.
Local / Site (Low)	Habitats and species which are not protected under conservation legislation but which form a key component of the within the terrestrial ecology study area.

^a Measured against criteria such as OSPAR threatened/declining species and IUCN Red List of threatened species.

¹ SSSI (Site of Special Scientific Interest), NNR (National Nature Reserve), MNR (Marine Nature Reserve)

- 17.8.1.4 The assessment has therefore focussed on VERs that are present within the 'Zone of Influence' of the project. The Zone of Influence (ZoL) is the area over which the project could have an influence on ecological features. The ZoL is likely to vary for different features. However, in general terms the ZoL for this development proposal is considered to comprise the land within 100m of the cable route, control station and access track. Notwithstanding this, a wider ZoL has been considered for species associated with internationally designated sites.
- 17.8.1.5 The baseline conditions for VERs are described from the survey results and additional research. The impacts are characterised from knowledge of the development proposals after considering a range of relevant impact parameters including:
- Whether change is positive or negative;
 - Extent of the predicted impact;
 - Magnitude of the change;
 - Duration of the impact before it recovers or is replaced;
 - Reversibility of the impact naturally or through implementation of mitigation measures; as well as
 - Timing and frequency of the impact.
- 17.8.1.6 Consideration is also given to confidence in the assessment with likelihood expressed in terms: certain (95% or more probability); probable (50-94%); unlikely (5-49%); and extremely unlikely (less than 5%).
- 17.8.1.7 The following principles, in order of importance, underpin the process:
- **Avoidance.** Seek options that avoid harm to ecological features.
 - **Mitigation.** Avoid or minimise adverse effects through mitigation measures, either through careful project design or the subsequent application of guaranteed measures (e.g. condition or planning obligation).
 - **Compensation.** Significant residual adverse ecological effects that remain despite the application of mitigation measures, should be offset by appropriate compensatory measures.
- 17.8.1.8 Enhancement measures above and beyond those required for mitigation purposes are sometimes associated with development projects. Enhancement measures can provide significant biodiversity gain although such gains may not directly relate to impacts on specific VERs.

- 17.8.1.9 The CIEEM guidelines define a significant effect as one that either supports or undermines biodiversity conservation objectives (for VERs or for biodiversity in general). The impact characterisation process enables an assessor to establish how a feature will be changed as a result of the project and determine (and justify) whether that change should be considered significant. For designated sites, an assessment can be defined against specific conservation objectives for that site. For habitats and species, conservation status can be used.

- 17.8.1.10 For instance, habitat associated with a site may support a species population of County importance, but, if development is unlikely to result in any noticeable effect on its conservation status at the county scale – this is not significant. Notwithstanding this, the population could also be considered important at a 'local' scale, and its conservation status at this scale may be affected – in which case an outcome of significant at the local scale would be presented.

17.8.2 Project description

- 17.8.2.1 A full account of the project description is provided by Chapter 2 of the Environmental Statement. This summary is provided to give context to potential impacts on VERs:
- 17.8.2.2 The mWave is a full-scale wave energy prototype device which is to be deployed for up to 18 months off East Pickard Bay. Testing of mWave will not be grid-connected, although a temporary communications cable and onshore control station will be required.
- 17.8.2.3 The mWave is a submerged pressure-differential absorber with flexible membranes as the working interface. As such the mWave device will sit on the seabed, and it will comprise multiple seafloor-mounted, air-filled cells covered by flexible rubber membranes. As a wave passes overhead the device uses the change in water pressure to displace air in the membrane covered cells, namely, the flexible rubber membranes secured to the cell inflate and deflate to move air within the device. This high-pressure air flows through the enclosed turbine and returns to low pressure cells, via a low-pressure manifold and non-return inlet valves. The turbine is 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.
- 17.8.2.4 The mWave device is approximately 75m long, 7m high and 15m wide at the base. It has been designed with gravity foundations and a 1m deep keyed skirt that presses into the seabed negating the need for piles or anchoring points. The device will be fabricated then transported from Pembroke Dock using two multicat installation vessels.

- 17.8.2.5 A marine cable linked to an onshore control station is required to support the offshore testing of the mWave device. Approximately 1.4km of cable be required from the device to MLWS, approximately 50m of cable will be required in the intertidal area (between MLWS and MHWS) and a further 350m of cable will be required from MHWS to the control station. The cable and onshore control station will be in situ for up to 18 months. The control station will sit in an area approximately 28m by 20m and will comprise three standard (20-23ft) shipping containers as well as parking for three cars. The area will not be illuminated. The cable and control station will be removed following testing of the mWave device.
- 17.8.2.6 In order to minimise installation impacts of the temporary cable, it will be laid on the surface of the ground. Rock bags will be positioned at strategic points along the subsea cable route to keep the cable in place, whilst an onshore anchoring system (to take the strain of the cable as it is affected by tidal movement) and a small termination box (approximately 100cm x 60cm x 60cm) will be positioned onshore at an appropriate location near the coast.
- 17.8.2.7 The communication cable will emerge from the intertidal at the western side of East Pickard Bay before passing up the cliff face and then east through coastal grassland to the Pembrokeshire Coastal Footpath (Wales Coast Path).
- 17.8.2.8 During installation, the cable will be pulled onshore from the offshore cable laying vessel. Two winch points will be positioned in agricultural land at approximately 55m AOD. The two hand operated mobile winches and a temporary anchoring system would be used to manually pull the cable onshore at East Pickard Bay to the top of the cliffs.
- 17.8.2.9 The cable will fed up through a plastic conduit that is fixed to the rock surface with clamps. Each clamp will be attached to the rock by two bolts with one clamp being required approximately every 5m. The attachment of the clamps to the rock will be undertaken using hand held tools only (Chapter 2, Section 2.5.3).
- 17.8.2.10 A wire cable link between the marine cable on the offshore vessel and the cable pull location will be established. The cable will then be winched onshore and taken up the west side of the gully to the termination box.
- 17.8.2.11 In order to lay the cable between the termination box and the control station, a roll of cable will 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 work its way back up the agricultural fields to the control station allowing the cable to be laid along the required field boundaries. It is proposed that the termination box is positioned/hidden beside existing rocks or covered with turf.

- 17.8.2.12 It is anticipated that it will take up to six days to install the clamps/conduit and anchor points using up to four personnel with battery-operated hand-held tools. Once an appropriate weather window is identified it will take approximately three days to pull the cable onshore across the intertidal area to the termination box on the cliff top. The cable from the control station will be installed during this period as well.

17.8.3 Scoping of Valued Ecological Receptors

- 17.8.3.1 Based on the EIA baseline characterisation described in section 17.7, the habitats and species present within the terrestrial ecology study area have been grouped and presented in Table 17.8. These VERs have been used to assess impacts associated with the installation, operation and maintenance and decommissioning of the mWave project on terrestrial ecology within study area.

Table 17.2: Terrestrial ecology VER scoping.

Terrestrial ecology VER area	Feature relevant to the terrestrial ecology study area	Importance of VER	Significance within study area
Designated sites			
Pembrokeshire Marine SAC (edge of study area)	- Annex II species (primary): Shore dock - Annex II species (secondary): Otter	International (Very high)	Shore dock is absent from study area with nearest known population approximately 10km away. Otter are widespread in Pembrokeshire and likely to occasionally use habitat associated with the study area although no signs of activity were discovered during site visits in March and April 2019. Otter will be considered further in this assessment.
Limestone Coast of South Wales SAC (within 1.1km of study area)	- Annex I habitat (primary): Vegetated sea cliffs of the Atlantic and Baltic coasts. - Annex I habitat (secondary): European dry heaths - Annex II species (primary): Greater horseshoe bat - Annex II species (secondary): Lesser horseshoe bat & otter	International (Very high)	No direct impact pathway has been identified. However, the study area supports both vegetated sea cliffs (an Annex I habitat outside of a SAC) and is likely to support foraging horseshoe bats as well as otter. As mobile species, bats and otter will be considered further in this assessment.
Pembrokeshire Bat Sites SAC (within 8.95km)	- Annex II species (primary): Greater horseshoe bat - Annex II species (secondary): Lesser horseshoe bat & otter	International (Very high)	No direct impact pathway has been identified. However, the study area is likely to support foraging horseshoe bats as well as otter. Bats and otter will be considered further in this assessment.
Castlemartin Coast SPA (within 1.1km)	Annex I species: Chough	International (Very high)	No direct impact pathway has been identified. However, coastal grassland associated with the study area provides a foraging resource known to be used by the local Chough population. Chough will be considered further in this assessment.
Angle Peninsula Coast SSSI (within study area)	Habitat supporting chough, greater horseshoe bat and lesser horseshoe bat	National (High)	The cable route passes through the SSSI. Habitat associated with the SSSI is known to be used by chough and horseshoe bats. Vegetation of coastal cliff and grasslands as well as chough and bats will be considered further in this assessment.
Milford Haven SSSI (within 0.7km)	Habitat supporting chough, greater horseshoe bat and lesser horseshoe bat	National (High)	No direct impact pathway has been identified. Habitat associated with the SSSI is known to be used by chough and horseshoe bats which are being considered further elsewhere. Milford Haven SSSI will not be considered further in this assessment.
Broomhill Burrows SSSI (within 1.2km)	Sand dune habitat supporting a diverse assemblage of flowering plants and invertebrates	National (High)	No direct impact pathway has been identified to Broomhill Burrows. The potential interruption of sand supply to the dune system by a device some 75m long by 15m wide for a 12-month period given its distance from the shoreline is not considered likely.
Habitats			
Rocky shore and maritime cliff	- Annex I habitat outside of a SAC boundary - Habitat encompassed within a SSSI	National (High)	The cable route passes through a rocky shore and maritime cliff community. The habitat will be considered further in this assessment.
Coastal grassland	- Annex I habitat outside of a SAC boundary - Habitat encompassed within a SSSI	National (High)	The cable route passes through coastal grassland habitat. The habitat will be considered further in this assessment.
Species-rich semi-improved neutral grassland	Section 7 habitat of the Environment (Wales) Act 2016.	National (High)	The cable route avoids the species-rich semi-improved neutral grassland identified during site visits in March and April 2019. The habitat will not be considered further in this assessment.
Marshy grassland	Section 7 habitat of the Environment (Wales) Act 2016.	Regional (Medium)	The cable route avoids a small area of rank purple moor-grass dominated marshy grassland identified during site visits in March and April 2019. The habitat will not be considered further in this assessment.
Improved grassland	Ubiquitous grassland community of widespread distribution and limited conservation value.	Local / Site (Low)	The cable route follows the edge of one grassland and impacts a limited area within a second grassland. Given the low conservation status of improved grassland habitat and the limited project impact (physical, temporal and reversible), this habitat is not considered further.
Hedgerows, scrub and tree cover	Hedgerows are a Section 7 habitat of the Environment (Wales) Act 2016.	Regional (Medium)	Hedgerows are a feature to the north of the site and avoided by the project. In addition, the cable route avoids any significant areas of scrub or tree cover apart from some low bramble. This habitat will not be considered further.

Water courses	Section 7 habitat of the Environment (Wales) Act 2016.	Regional (Medium)	Cable route has potential to disturb habitat associated with the watercourse during installation. The habitat will be considered further in this assessment.
Species			
Lichens and bryophytes	No protected or otherwise notable species are known to occur.	Regional (Medium)	Anchor points for the cable pull have the potential to impact rocks supporting lichens. However, the freestanding rocks supporting growth of <i>Ramalina siliquosa</i> which punctuate coastal grasslands above the cliff tops tend to be weathered and unsuitable as anchor points. Species of the low cliffs such as <i>Verrucaria maura</i> are ubiquitous. This group will not be considered further in this assessment.
Flowering plants	No protected species are known to occur.	Regional (Medium)	Given that no specific protected species were identified, flowering plants will only be assessed in terms of habitat in which they occur.
Invertebrates	Black oil beetle (a Section 7 species of the Environment (Wales) Act 2016) is present.	National (High)	Invertebrates and in particular, black oil beetle, will be considered. Invertebrates will be considered further in this assessment.
Amphibians	No specific amphibian interest identified.	Local / Site (Low)	No waterbodies with potential to support breeding amphibians have been identified in proximity to the study area. Given the lack of impact pathways, amphibians will not be considered further in this assessment.
Reptiles	- Field observation and existing records identify the presence of reptiles. - Section 7 species of the Environment (Wales) Act 2016.	National (High)	Reptiles will be considered further in this assessment.
Birds	Chough, an Annex I species is present.	International (Very high)	Birds and in particular, chough, will be considered further in this assessment.
Bats	Horseshoe bats are known to occur.	National (High)	Bats will be considered further in this assessment.
Badger	Badgers are present.	Regional (Medium)	Although badger activity including the presence of setts has been identified, the cable route and control station avoid sensitive locations. Badgers will not be considered further in this assessment.
Otter	Otters are likely to occasionally use habitat within the study area.	National (High)	Otters will be considered further in this assessment.
Other	Common and widespread species may occur.	Local / Site (Low)	No other significant groups with potential to be adversely impacted by proposals have been identified.

17.8.4 Future baseline scenario

- 17.8.4.1 The Town and Country Planning (Environmental Impact Assessment) Regulations 2017 expanded the scope of EIA to include an assessment of the impact of a project on climate as well as vulnerability of the project to climate change.
- 17.8.4.2 It is envisaged that a technology such as mWave could have a positive impact on climate change if it proves successful. However, the vulnerability of the project to climate change is not considered significant given the short timescale of the project.

17.8.5 Data limitations

- 17.8.5.1 Existing data sources as well as targeted site-specific surveys have been used to assess the terrestrial ecology baseline. Notwithstanding this and based on project design as well as the minimal potential impacts predicted for some species groups such as bats, the decision was made not to undertake certain site-specific surveys. Assessment in these cases relies on existing records as well as pre-existing knowledge of distribution, population status, habitat preferences and behaviour.

Table 17.9: Impacts scoped out of the assessment for terrestrial ecology.

Potential impact	Justification
Operational phase	
Light spill	The control station will not be lit at night.

17.8.6 Designated sites

- 17.8.6.1 Where Natura 2000 sites (i.e. SACs & SPAs) are considered, this chapter summarises the assessments made on the interest features of the sites as described within Table 17.8 of this chapter (with the assessment on the site itself deferred to the NSER).
- 17.8.6.2 With respect to nationally and locally designated sites, where these sites fall within the boundaries of an internationally designated site and where notified interest features of the Natura site are also qualifying interest features of the nationally designated sites (e.g. SSSIs which under-pin a Natura 2000 site)), only the international site has been taken forward for assessment. This is because potential effects on the integrity and conservation status of the nationally designated site are assumed to be inherent within the assessment of the internationally designated site (i.e. a separate assessment for the national site is not undertaken). However, where a nationally designated site falls outside the boundaries of an international site, but within the terrestrial ecology study area, an assessment of the impacts on the overall site is made in this chapter using the EIA methodology.

17.9 Measures adopted as part of the mWave Project

- 17.9.1.1 As part of the project design process, a number of designed-in measures have been proposed to reduce the potential for impacts on terrestrial ecology. Those which are relevant to the onshore ecology are shown in Table 17.10 below, whilst the full list is provided in Chapter 2, section 2.6.2. As there is a commitment to implementing these measures, they are considered inherently part of the design of the project and have therefore been considered in the assessment presented in section 17.10 below. These measures are considered standard industry practice for this type of development.

Table 17.3: Designed-in measures adopted as part of the mWave project.

Measures adopted as part of the mWave project	Justification
No external moving parts which may cause impact to marine life (section 2.5.2).	mWave operated using air-filled membranes cells with no elements which may impact on marine life such as otter.
Cable laid on surface and not trenched (Section 2.5.3).	Laying cable on surface will minimise impact on surrounding area.
Onshore cable route selection (Chapter 3, section 3.3.5).	Onshore cable route selected to minimise potential impact on ecological features.
Minimal requirement for vehicles during all phases of project (Chapter 2 Tables 2.3 - 2.5)	Limited vehicles using access track thereby minimising disturbance to ecological receptors.
Control site on agricultural land with natural screening (section 2.5.4).	Use of existing agricultural land minimises effects on undisturbed habitat.
Minimal site preparation works at control station. Control station delivered to site as units (section 2.5.4).	Limited site preparation and delivery of units to site shortens installation period and reduces potential for impact.
Existing gates and access track available to control station site (section 2.5.4)	Use of existing access minimises effects on ecological receptors.
No external lighting (section 2.5.4)	No external lighting will minimise potential effects on ecological receptors such as bats.
EMP - Environmental Management Plan. The Environmental Management Plan (EMP) will cover both the offshore and onshore elements of the project (Chapter 2: Project Description, Appendix 2.2).	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 (Chapter 2: Project Description, Appendix 2.3).	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.

17.10 Assessment of significance

17.10.1 Installation phase

- 17.10.1.1 This section describes the potential impacts on terrestrial VERs resulting from installation of the onshore element of the mWave project. Where impacts are identified, mitigation measures are outlined and residual impacts assessed.
- 17.10.1.2 Significant pre-mitigation impacts likely to result from installation of the Project may include:

- habitat loss or modification (temporary or permanent);
- killing, injury or disturbance of protected or notable species; and
- pollution events.

17.10.1.3 A description of the potential effect on terrestrial ecology receptors resulting from each identified impact is given below.

17.10.2 Designated sites

17.10.2.1 Four Internationally designated sites are located within 10km of the study area at East Pickard Bay. An additional three Nationally designated sites occur within 2km. In terms of terrestrial ecology, a number of species are associated with these sites and their assessment in the closest of the designated sites, has direct relevance to the species in the designated sites which are further away. For this reason, and to prevent repetition, consideration is given to the following species and habitats rather than to each designated site in turn:

Table 17.4: Relationship of species to designated sites.

Feature	Relevant designated site
Shore dock	Pembrokeshire Marine SAC
Otter	Pembrokeshire Marine SAC
	Limestone Coast of South Wales SAC
	Pembrokeshire Bat Sites SAC
Greater horseshoe bat	Limestone Coast of South Wales SAC
	Pembrokeshire Bat Sites SAC
	Angle Peninsula Coast SSSI
	Milford Haven SSSI
Lesser horseshoe bat	Limestone Coast of South Wales SAC
	Pembrokeshire Bat Sites SAC
	Angle Peninsula Coast SSSI
	Milford Haven SSSI
Chough	Castlemartin Coast SPA
	Angle Peninsula Coast SSSI
	Milford Haven SSSI

Shore dock

17.10.2.2 King (2006) describes shore dock as being “...quite catholic in its habitat requirements, in that it can occur wherever three critical features are present, namely within a few metres of high water, with fresh-water available all year round, and a lack of competition from other perennial species, notably *Phragmites australis* in damp areas and *Rubus fruticosus* in drier places”.

17.10.2.3 A sheltered bench above the rock strewn interface between the high intertidal and terrestrial environment at East Pickard Bay offers potential for shore dock. However, a search of this location during site visits in March and April 2019 failed to find any plants of this species. Shore Dock has been recorded at two locations within the Pembrokeshire Marine SAC, both distant from East Pickard Bay. Shore dock is not considered to form a constraint to the project and is not considered further in the assessment.

Otter

17.10.2.4 The requirement for a limited number of vessels during the installation phase of mWave will result in a small increase in underwater noise, a risk of collision or propeller strike, possible increases in suspended solid concentration during cable-laying or mWave gravity foundation deployment, as well as accidental pollution incidents.

17.10.2.5 The installation of mWave device is expected to take up to 3 days and cable-laying up to 3 days (including across intertidal area). Installation will be restricted to daylight hours with the largest vessels being up to 50m in length with a draught of 6m and smallest vessels would be a RIB. Pre-installed moorings will be used and a seabed footprint of the mWave, ADCP, SUTU and communication cable will be up to 1900m². In terms of underwater sound pressure, a theoretical worst case source level at 1 m of 179 dB re 1 µPa (rms) / 229 SEL (24h) dB re 1 µPa²s is possible (for cable laying vessels used for the mWave installation vessels (using measurements of McCauley (1998))).

17.10.2.6 The impact of exposure to anthropogenic sound on marine mammals, particularly cetaceans has been well documented, and effects may include physical damage, disorientation and impact on navigation; communication masking; and reduced ability to locate prey. It is now recognised that some of the more ubiquitous noise sources, such as ships, can either individually or cumulatively mask communication signals of, and pose a threat to marine mammals (Chen *et al.*, 2017).

17.10.2.7 However, the effects of underwater noise on otters is not well understood, and no hearing data is available. Since the acuity of otters is significantly less than for marine mammals, the masking of biologically relevant sounds is not expected to occur (Ghoul and Reichmuth, 2012).

17.10.2.8 Otters produce a range of vocalisations in different social contexts, however vocalisations have never been observed beneath the water's surface (Ghoul and Reichmuth, 2012), thus communication masking is unlikely to occur. Studies on sea otters show an audible range of 0.125 kHz and 32 kHz, which are relatively comparable to terrestrial mustelids (Ghoul and Reichmuth, 2012). Peak underwater hearing sensitivity lies in the range 7 kHz to 16 kHz while overall sensitivity levels are somewhat reduced compared with pinniped species such as seals.

- 17.10.2.9 Otters within range of increased vessel noise are likely to leave the water (Ghoul and Reichmuth, 2012). However, since the hearing acuity of otters is significantly less than for many marine mammal species, it is unlikely that disturbance ranges for otter will extend as far underwater as predicted for other marine mammals (Chapter 9, Marine Mammals).
- 17.10.2.10 Otters primarily utilise a narrow strip of water along the shore for foraging, and rarely venture more than 2 km from the shoreline (Kruuk, 2006). An observational survey of 500 dives off the coast of Shetland revealed that coastal otters dive for food within 80m of the shore 62% of the time, within 50m 84% of the time, and within 20m 98% of the time (Kruuk and Moorhouse, 1991). Otters prefer to dive in shallow waters of 0–3m and rocky intertidal areas where benthic prey are more abundant; it has been theorised this is also a method of conserving body heat, reducing thermoregulatory costs and reducing travel time (Kruuk and Moorhouse, 1991; Nolet *et al.*, 1993). The deployment site for mWave is over 415m from MLWS and has a depth of 11m below chart datum. As such the potential for disturbance to otter foraging areas is unlikely.
- 17.10.2.11 Whilst vessel strike has been identified in sea otters (Ballachey and Bodkin, 2015), there are no available reports of vessel strike in European otter, which is less due to their preference for inshore waters. Vessels travelling at 7m/s or faster are those most likely to cause death or serious injury to marine mammals or otters (Wilson *et al.*, 2007). Vessels involved in the installation phase are likely to be travelling considerably slower than this, in particular the vessels which will tow mWave to site and those involved with cable laying activities.
- 17.10.2.12 In terms of suspended solids, Freshwater West Bay is a relatively high energy environment characterised by deposits of coarse sand away from the boulders and cobbles of the shoreline. Otters possess sensitive muzzles with sensory whiskers used to detect prey items either through direct contact or due to receiving vibrations in the water column (Denhardt *et al.*, 2001). The suspended solid load associated with any disturbance of the sediments in proximity to East Pickard Bay is unlikely to compare to the normal higher loads found in local estuaries and rivers which successfully support otters.
- 17.10.2.13 Other potential hazards included entrapment and accidental pollution. Buoy ropes are unlikely to pose a threat to small and manoeuvrable animals such as otters. Potential pollutants are largely restricted to fuel oil within the few vessels used during installation. Given that a period of stable weather and sea conditions will be chosen for installation, an accidental collision which might cause a vessel to leak fuel oil is not considered likely.
- 17.10.2.14 In addition to the marine environment, inland of East Pickard Bay a minor watercourse and scrub habitat provide additional foraging habitat and potential resting sites or holts. Conroy and Kruuk (1995) found coastal holts were often within 100m of the shoreline but other researchers have found holts as far as 500m away (Moorhouse, 1988). Although unpublished observations by Kruuk suggest otters do not avoid resting sites close to human activity or noise, such sites tend to be in locations where the risk of direct physical disturbance is low (Chanin, 2003).
- 17.10.2.15 Site visits in March and April 2019 failed to find any field sign suggesting the presence of otters inland of East Pickard Bay. However, given the short duration of cable deployment activities and avoidance of habitat potentially providing cover, the risk of disturbing otters is considered unlikely.
- 17.10.2.16 Considering that otters are largely a nocturnal animal (Strachan, 2015), less sensitive to anthropogenic noise than marine mammals such as cetaceans and that they tend to forage close to the shoreline, suggests limitations to any receptor-impact pathway.
- 17.10.2.17 Additionally, the short and controlled timespan required for installation of the mWave device suggests a negligible risk of adverse impact to individual otters. Given that otters are thought to be at carrying capacity in the Cleddau region, the impact of the mWave project on individual otters or an impact to the favourable conservation status at even a local level would appear to be negligible.
- 17.10.2.18 **In summary, a high level of certainty exists that the short term and localised impact brought about by installation of the mWave device, cable and control station will not result in any significant impact on otters within or associated with the Pembrokeshire Marine SAC, Limestone Coast of South Wales SAC or Pembrokeshire Bat Sites SAC.**
- Greater horseshoe bats**
- 17.10.2.19 Greater horseshoe bats are a large but manoeuvrable species largely associated with landscapes supporting woodland and pasture with well-structured hedgerows and treelines. Prey items vary throughout the year but mainly consist of chafers, dung beetles and moths although seasonally, Hymenoptera, crane-flies, caddis flies and spiders will be taken (Dietz *et al.*, 2009).
- 17.10.2.20 Habitat loss and as well as persistent agrichemicals including timber treatments (such as Lindane and DDT) in roosts and cattle worming treatments (such as Ivermectin) are believed to have led to a population decline since the 1950s (Dietz *et al.*, 2009; Jones, 1990). Remaining populations are concentrated in areas with favourable roost sites and habitats.
- 17.10.2.21 During the summer months, warm roof spaces entered through open flyways are used whilst in winter, cellars and caves with stable temperatures and humid conditions are utilised. Dietz *et al.* (2009) note that in Britain and Central Europe foraging usually occurs within 5km of a roost (2.1km on average). Winter roosts are often only a few kilometres from summer roosts although in England they have been recorded from distances of up to 30km. In Pembrokeshire, larger sea caves not fully immersed at high tide can provide temporary roosts or even winter hibernation sites (CCW, 2008).

- 17.10.2.22 The ability of bats to access foraging areas from roost sites is also important and light spill can have a negative impact leading to spatial avoidance and ultimately habitat fragmentation. Research by Jones and Morton (1992) found that despite the presence of street lit areas within their home range, lit areas were never used by *Rhinolophus ferrumequinum*. Recent guidance by Stone (2018) categorised the horseshoe bat species as particularly susceptible to the impact of lighting.
- 17.10.2.23 Clearly the wooded valleys, extensive areas of unimproved grassland as well as availability of roost sites including sea caves influences the presence of greater horseshoe bats in southern Pembrokeshire. The National Trust property at Stackpole supports the largest known colony of greater horseshoe bats in Wales and outlying roosts such as Oriulton lies less than 10km from the study area.
- 17.10.2.24 In terms of sensitivity, greater horseshoe bats of Pembrokeshire are of International importance. Greater horseshoe bats have been recorded on the Angle Peninsula and are likely to use habitat within the study area. However, neither buildings or sea caves with potential for roosting bats occur in close proximity to the study area. The only potential impact pathway involves impact on foraging resources or disruption of commuting routes.
- 17.10.2.25 The control station infrastructure is centred around self-contained shipping containers in a small compound (approximately 28m x 20m) located within an area of rank improved grassland. The area will not be lit at night nor will its installation involve the removal of linear features including vegetation that may form a focus for commuting bats. Cable installation will involve directly laying a 150mm reinforced cable on top of existing rock and vegetation between the high intertidal and the control station. Approximately 200m of this will be within unimproved coastal grassland and low scrub vegetation. This equates to approximately 30m² which is roughly equivalent to the poached area of a typical agricultural field entrance. The remaining length of cable will be located at the base of a boundary fence at the edge of an improved grassland whilst the control station compound (560m²) will also impact an area of improved grassland. The potential reduction of foraging resources brought about by these impacts is considered to be negligible when consideration is given to availability of habitat locally as well as the temporary and reversible nature of the impact.
- 17.10.2.26 **In summary, a high level of certainty exists that the short term and localised impact brought about by deployment of the cable and installation of the control station will not result in any significant impact on greater horseshoe bats associated with the Limestone Coast of South Wales SAC, Pembrokeshire Bat Sites SAC, Angle Peninsula Coast SSSI or Milford Haven SSSI.**
- Lesser horseshoe bats**
- 17.10.2.27 In similar with greater horseshoe bats, lesser horseshoes are also found in lowland areas of un-intensive agriculture with well-connected hedgerows and treelines. Summer day roosts are often found in stone buildings with slate roofs accessed directly through unobstructed openings, whilst caves, mines and cellars are used during the winter (Schofield, 2008). The negative effects of artificial light on lesser horseshoe use of the landscape has also been well-documented (Stone, 2014).
- 17.10.2.28 Lesser horseshoes are smaller bats than greater horseshoes and as such, prey items tend to be smaller. Prey items include crane-flies, Hymenoptera, lace-wings and small moths as well as mosquitos, small beetles, aphids and spiders (Dietz et al, 2009).
- 17.10.2.29 In common with the assessment of potential impacts on greater horseshoe bats and given the absence of available of roost sites within the study area, potential impacts have to focus on disturbance of commuting routes or reduction in foraging resources. For the reasons set out in the consideration of potential impacts on greater horseshoe bats, no significant adverse effects are considered likely with lesser horseshoe bats.
- 17.10.2.30 **In summary, a high level of certainty exists that the impact brought about by deployment of the cable and installation of the control station will not result in any significant impact on lesser horseshoe bats associated with the Limestone Coast of South Wales SAC, Pembrokeshire Bat Sites SAC, Angle Peninsula Coast SSSI or Milford Haven SSSI.**
- Chough**
- 17.10.2.31 The (red-billed) chough (*Pyrrhocorax pyrrhocorax*) is one of the smallest members of the UK crow family (Mullarney et al, 1999).
- 17.10.2.32 Chough favour low intensity livestock farming practices close to suitable nesting sites on rock faces, or in caves and old buildings. They prefer short grassland swards of 5cm or less and soft soils where they can probe for invertebrates. Prey items include beetles, beetle larvae, leatherjackets, ants, spiders, sand hoppers, and earthworms. In the winter, cereal grains may be taken, especially before birds go to roost. Dung invertebrates are an important food source and stubble fields can provide a source of cereals during the autumn and winter (RSPB, 2019).
- 17.10.2.33 The coastline of Pembrokeshire provides the habitat characteristics required by chough and as such, parts of the county have been recognised and protected through site designation. In Wales, the chough population has increased in recent years and it is green-listed by the RSPB as a bird of least conservation concern (Eaton *et al*, 2015). The annual assessment of Pembrokeshire chough in 2018 provided confirmatory evidence of breeding in 67 pairs (Haycock, 2018). The survey found no evidence of breeding at East Pickard Bay.

- 17.10.2.34 Walkover survey in December 2018 and January 2019 recorded no chough in the East Pickard Bay area. Notwithstanding this, a site visit on the 19 March 2019 revealed a flock of 16 chough feeding in the coastal grassland around East Pickard Bay and these appeared largely unperturbed by occasional coastal path walkers as well as several surveyors and occasional drone flights going on at the time. A review of data by Jackson (2018) for the Wylfa Newydd project on Anglesey cited a personal communication with Adrienne Stratford of the RSPB stating that *“Chough are considered to be generally resilient to disturbance as long as the disturbing factors are regular and present prior to breeding attempts, or occur later in the breeding period after the initial setting up of breeding territories”*.
- 17.10.2.35 Studies by Whitehead *et al* (2005) which focussed on 15 differing habitat types and 14 chough pairs at 4 breeding sites found preferential use of grassland swards of less than 2cm and strong use of bare earth associated with paths and cloddiau (earth banks). This behaviour was thought to relate to ease of walking on vegetation as well as access to invertebrate prey within the soil. In addition, chough foraging during the breeding season was concentrated within 600m of the nest site. Johnstone *et al* (2011) reported a concentration of foraging activity within 300m of the nest and that habitat quality within this zone appeared to directly influence breeding success.
- 17.10.2.36 The installation phase of mWave will involve cable deployment within habitat used by chough. In particular, the drilling of bolt holes in order to secure the conduit to take the armoured cable to rocks, or installing rock anchors, is a noise chough are unlikely to be accustomed to. The drilling work in the intertidal area and at the top of the cliff is expected to take up to 3 days and will be undertaken using hand tools.
- 17.10.2.37 Potential impacts relating to the installation phase of the mWave project largely involve disturbance due to installation activity at East Pickard Bay (the infrastructure including fixing clamps into rock, installation of rock anchors, as well as the cable pull onshore and up to the control station and personnel involved with this work). In addition, the cable itself (150mm diameter by 200m length) will smother approximately 30m² of coastal grassland vegetation potentially used by chough.
- 17.10.2.38 The potential impact of displacing chough from habitat in the vicinity of the cable needs to be considered. Coastal grassland and semi-improved neutral grassland within 100m of the cable route equates to approximately 30500m². A temporary and reversible loss of 30m² equates to approximately 0.0009% of available habitat within 100m of the cable route. This is a fraction of the available habitat associated with the coastal slopes to the east and west of East Pickard Bay.

- 17.10.2.39 Installation of the cable infrastructure and cable pull is expected to take 9 days in total. The noisiest part of this work is likely to be drilling of holes for attachment of clamps/anchors which will be over 3 days, and intermittent in nature. The displacement of chough from habitat in proximity to the cable route for a maximum time period of 9 days (not continuous) when alternative habitat is available to the east and west is not considered likely to be significant at even a local level.

- 17.10.2.40 **In summary, a high level of certainty exists that the impact brought about by installation of the cable to the control station will not result in any significant impact on chough associated with the Castlemartin Coast SPA, Angle Peninsula Coast SSSI or Milford Haven SSSI.**

Maritime cliff and coastal grassland communities

- 17.10.2.41 Cracks and crevices on the exposed cliff at the western side of East Pickard Bay support tufts of vascular plants dominated by red fescue, golden samphire, common scurvygrass and sea mayweed. These species are a relatively frequent feature on the cliffs of the Angle Peninsula.
- 17.10.2.42 The cable route exits the low intertidal and scales the cliff on the western side of the East Pickard Bay gully. In order to attach the cable securely as well as to facilitate the cable pull from the sea onto land it is proposed that clamps are used. These will be attached to the rock face using 2 rock bolts. These will be drilled using hand tools by specialist contractors using ropes. Clamps will be positioned approximately every 5m.
- 17.10.2.43 This methodology will result in a physical impact to the rock face at the location of each roller as well as limited disturbance due to the activity of specialist workers scaling the cliffs on ropes. Due to the positioning of the cable away from the rock face by the clamps the potential smothering of vegetation beneath the alignment of the 150mm armoured cable may not occur along its entire passage up the cliff.
- 17.10.2.44 The maritime cliff community is a feature noted in the citation for the Angle Peninsula Coast SSSI and is also a Section 7 habitat of the Environment (Wales) Act 2016. In terms of sensitivity, it's value should be considered as National (High). However, the community sits within an exposed high energy environment and should be considered relatively resilient. The community is also associated with the cracks and crevices of rock fractures that will not be chosen as fixing point locations. Given the intermittent nature of vegetation on the rock faces as well as the temporary nature of the impact and recoverability of the community, a significant impact is not considered likely. At a National or even a site level, the conservation status of the maritime cliff community is not likely to be threatened by the proposals.
- 17.10.2.45 **In summary, it is certain that installation phase of the project will not result in significant adverse impact to the maritime cliff community.**

17.10.2.46 Coastal grassland is a further feature of the cliff tops at East Pickard Bay and more widely along the Angle Peninsula Coast. Quadrats taken to sample the vegetation in April 2019 suggested the grassland was a best fit to the *MC9 Festuca rubra-Holcus lanatus maritime grassland* community of the NVC (Rodwell, 2000).

17.10.2.47 Immediately above the clifftop, surveys found that the thin exposed soils were dominated by a narrow (2-3m) fringe of stag's-horn plantain which quickly merged into a more diverse sward where spring squill formed a conspicuous component. A sample of this community supported 18 species of vascular plants in a short 1-5cm high sward (Appendix 3 Quadrat 1). The vegetation reflects a transition from the cliff edge to more stable and less exposed conditions. In terms of NVC, the vegetation close to the cliff edge appeared to best fit the *MC5b Armeria maritima-Cerastium diffusum ssp. diffusum maritime therophyte community Anthyllis vulneraria sub-community* (Rodwell, 2000).

17.10.2.48 The cable route passes through approximately 10m of this community before it passes into a more luxuriant (MC9) red fescue dominated sward for approximately 165m. The MC9 grassland typically supported 12-14 vascular plant species in a 5-15cm high sward (Appendix 3 Quadrats 2-5). The northern end of the cable route within the coastal fringe (Angle Peninsula Coast SSSI) then passes through low (1m high) bramble scrub for approximately 20-25m before reaching agricultural land.

17.10.2.49 A loss of the grassland habitat beneath the 150mm diameter cable for approximately 180m will occur during its deployment. Trampling will also occur in the vicinity of the cable route during installation. The impact will be temporary in nature and akin to an animal trail. A high level of certainty exists that the temporary loss of coastal grassland habitat (approximately 30m²) within a resource that is present along the length of the Angle Peninsula coastline will not threaten the conservation status of the resource or constitute anything more than a minor impact at a site level.

17.10.2.50 **In summary, it is certain that installation phase of the project will not result in more than a temporary minor impact at a local level to the coastal grassland community. This is not considered significant in terms of the favourable conservation status of the SSSI.**

Watercourses

17.10.2.51 A minor watercourse discharges into the sea at East Pickard Bay (Chapter 16 Geology, Hydrology and Land Quality). The watercourse is distant (forms >100m) from the control station and at negligible risk from pollution incidents or suspended solids resulting from ground disturbance. However, cable route installation may necessitate access via the gully during installation of rollers rather than abseiling down the cliff face during which some trampling of vegetation may occur.

17.10.2.52 **It is probable that the installation phase of the project will result in a temporary minor impact (by trampling) at a local level to vegetation beside the watercourse at East Pickard Bay.**

Invertebrates

17.10.2.53 Black oil-beetle was noted during site visits in March and April 2019. The short-grazed maritime turf also provides habitat for notable invertebrates including the ground weevils *Trachyploeus rectus* and *Trichosirocalus dawsoni* (CCW, 2003). The ground weevils are associated with coastal grassland habitat due to the presence of their foodplants (including *Plantago coronopus* and *Lotus corniculatus*).

17.10.2.54 Oil beetles are strongly associated with unimproved wildflower-rich habitats because they are parasites on solitary mining bees. Females lay eggs which hatch into louse-like larvae (triungulins) which lay in wait for bees on flowers, which unwittingly transport them to the nests where they can feed on pollen and nectar stores (Buglife, 2012).

17.10.2.55 The coastal grassland and scrub fringe to the Angle Peninsula is likely to support a diverse assemblage of invertebrates of which few are discussed here. However, the short timescale associated with installation of the communication cable and unobtrusive installation strategy (laying the cable onto the ground) will minimise impact to invertebrate habitat and individuals. As such, the impact is considered to be negligible within the habitats associated with the study area.

17.10.2.56 **It is probable that the impact on invertebrates by installation activities will be temporary and negligible in scale.**

Reptiles

17.10.2.57 Four reptile species are known to occur locally and common lizard was observed during a site visit in April 2019. Reptiles are mobile species and highly unlikely to be adversely impacted during cable installation. It is possible that common and widespread species are associated with rough grassland at the site of the control station. However, standard mitigation measures, such as phased removal of vegetation under ecological supervision, can be used to displace any reptiles from the site to adjacent habitat.

17.10.2.58 **The temporary loss of habitat associated with the footprint of the control station is considered to represent a minor adverse impact at a site level.**

Birds (excluding chough)

- 17.10.2.59 Three Section 7 species of the Environment (Wales) Act 2016 were noted during a survey in April 2019 (song thrush, skylark and linnet) as well as one red-listed species of conservation concern (grasshopper warbler). With the exception of skylark all of the species noted nest within scrub or woodland cover. In addition, farmland used by skylark will be accessed along existing tracks and deployment of the cable will occur beside a fenceline, both unlikely to be used by nesting birds (Please refer to Appendix 17.1 TN13, 15 and 20).
- 17.10.2.60 Given that very limited impact will occur in habitats associated with nesting, the likelihood of any significant impact on birds is considered negligible. Good practice including seasonal timing of works, or pre-check by an ecologist prior to scrub clearance, can also be used to mitigate any potential impact.
- 17.10.2.61 It is probable that no impact will occur to birds during the installation phase of the project

Future monitoring

- 17.10.2.62 No terrestrial ecology monitoring to test the predictions made within assessment of the installation phase is considered necessary.

17.10.3 Operational and maintenance phase

Designated sites

Otter

- 17.10.3.1 The mWave device is a contained system without any external access to moving parts (such as turbine blades) which may injure marine life and ropes associated with any navigational markers (if needed) are unlikely to pose a threat to small and manoeuvrable animals such as otters.
- 17.10.3.2 Potential pollutants are largely restricted to fuel oil within the few vessels used during the operational maintenance requirements. A maximum of two visits of two days each month by a multicat vessel is envisaged. Given that a period of stable weather and sea conditions will be chosen for maintenance, an accidental collision which might cause a vessel to leak fuel oil is not considered likely. For reasons set out in the discussion surrounding installation, the likelihood of vessel strike or noise disturbance is considered to be negligible.
- 17.10.3.3 During operation, it is anticipated that a generator and a compressor will be located at the control station. The low speed/noise 1500 rpm generator will be used to drive the compressor and they will operate approximately 3hrs in every 6hr periods, with the operation time being related to tidal level. The generator and compressor will be secured in sound proof enclosures, if need be.

- 17.10.3.4 Fuel will be stored in a self-bunded fuel tank and a chemical toilet will also be present. The distance of the potential pollution sources from watercourses as well as limited volume of pollutants within self-bunded assets significantly limits the potential for pollution incidents.

- 17.10.3.5 **A high level of certainty exists that operation of the mWave project will not result in any significant impact on otters within or associated with the Pembrokeshire Marine SAC, Limestone Coast of South Wales SAC or Pembrokeshire Bat Sites SAC.**

Greater horseshoe bats

- 17.10.3.6 Visits to the control station will be undertaken once weekly during daylight hours. The control station compound will not be lit. No impact pathways have been identified during operation.
- 17.10.3.7 **A high level of certainty exists that operation of the mWave control station will not result in any significant impact on greater horseshoe bats associated with the Limestone Coast of South Wales SAC, Pembrokeshire Bat Sites SAC, Angle Peninsula Coast SSSI or Milford Haven SSSI.**

Lesser horseshoe bats

- 17.10.3.8 Visits to the control station will be undertaken once weekly during daylight hours. The control station compound will not be lit. No impact pathways have been identified during operation.
- 17.10.3.9 **A high level of certainty exists that operation of the mWave control station will not result in any significant impact on greater horseshoe bats associated with the Limestone Coast of South Wales SAC, Pembrokeshire Bat Sites SAC, Angle Peninsula Coast SSSI or Milford Haven SSSI.**

Chough

- 17.10.3.10 No impact pathways have been identified during operation. Visits to the control station are remote from habitat favoured by chough and occasional walkover visits to inspect the condition of the communication cable will be of a short and limited duration akin to disturbance by walkers of the coastal path. Visits to the control station are expected once per week.
- 17.10.3.11 **A high level of certainty exists that operation of the control station will not result in any significant impact on chough associated with the Castlemartin Coast SPA, Angle Peninsula Coast SSSI or Milford Haven SSSI.**

Maritime cliff and coastal grassland communities

17.10.3.12 The presence of the 150mm wide cable on cliff and coastal grassland habitats will lead to the smothering of plant species beneath its bulk. Robust species such as spring squill located within a few cm's of the cable edge may grow laterally to reach the light and survive. However, a loss of vegetation in the region of 30m² is considered insignificant in terms of the available resource.

17.10.3.13 **It is certain that the operational phase of the project will result in a negligible impact at a local level to the cliff and coastal grassland communities.**

Watercourses

17.10.3.14 Fuel will be stored in a self-bunded fuel tank and a chemical toilet will also be present at the control station. The distance of the potential pollution sources from watercourses as well as limited volume of pollutants within self-bunded assets, deployment of spill kits and a Environmental Management Plan (EMP) significantly limits the potential for pollution incidents.

17.10.3.15 **A high level of certainty exists that the operation phase of the project will not result in a significant impact to watercourses.**

Invertebrates

17.10.3.16 A loss of vegetation in the region of 30m² is considered insignificant in terms of the available resource.

17.10.3.17 **A high level of certainty exists that the operation phase of the project will not result in a significant impact to invertebrates.**

Reptiles

17.10.3.18 **No impact pathways have been identified during operation.**

Birds

17.10.3.19 **No impact pathways have been identified during operation.**

Future monitoring

17.10.3.20 No terrestrial ecology monitoring to test the predictions made within assessment of the operational phase is considered necessary.

17.10.4 Decommissioning phase

17.10.4.1 The impacts associated with decommissioning of the mWave device, cable route and control station are envisaged as being comparable to those considered during installation. Often the methodologies that will be employed and the potential impacts associated with project decommissioning are unknown due to timescales involved as well as technological advances.

17.10.4.2 The project timescale of mWave is known, up to 12 months testing of the mWave device prior to removal and 18 months prior to cable and onshore control station removal. As such, a higher level of certainty can be assigned to the predicted impacts of the decommissioning phase.

Future monitoring

17.10.4.3 No terrestrial ecology monitoring to test the predictions made within assessment of the decommissioning phase is considered necessary.

17.11 Cumulative Impact Assessment

17.11.1 Consideration of other plans and projects and plans

17.11.1.1 Cumulative Impact Assessment (CIA) takes into account the impact associated with other plans and projects on the VERs of the mWave project. The zone of influence of the project is an important factor relating to this assessment. The zone of influence associated with the terrestrial elements of mWave are considered to be very localised (within 100m) with the exception of some of the more mobile species. However, no significant impacts have been identified for mobile species including otter, greater horseshoe bats, lesser horseshoe bats and chough. The most significant factors affecting VERs in proximity to mWave are considered to be ongoing agricultural practices and tourism to which the project has little influence.

17.11.1.2 **No impact pathways have been identified for the cumulative impact assessment.**

Future monitoring

17.11.1.3 No terrestrial ecology monitoring is considered necessary.

17.12 Transboundary effects

17.12.1.1 No impact pathways for transboundary impacts have been identified in regard to terrestrial ecology.

17.13 Inter-related effects

17.13.1.1 Inter-relationships are considered to be the impacts and associated effects of different aspects of the proposal on the same receptor. These are considered to be:

- **Project lifetime effects:** Assessment of the scope for effects that occur throughout more than one phase of the project (installation, operational and maintenance, and decommissioning), to interact to potentially create a more significant effect on a receptor than if just assessed in isolation in these three key project stages; and
- **Receptor led effects:** Assessment of the scope for all effects to interact, spatially and temporally, to create inter-related effects on a receptor. As an example, the cumulated effect on terrestrial ecology of habitat loss/disturbance may interact to produce a different, or greater effect on this receptor than when the effects are considered in isolation. Receptor-led effects might be short term, temporary or transient effects, or incorporate longer term effects.

17.13.1.2 A description of the likely inter-related effects arising from the mWave project on terrestrial ecology is provided in here.

17.13.2 Project lifetime effects

17.13.2.1 The effects on terrestrial VERs are not anticipated to interact in such a way as to result in combined effect that is of greater significance than the assessments presented for each individual phase.

17.13.3 Receptor-led effects

17.13.3.1 No significant receptor-led effects have been identified.

17.14 Conclusion and summary

17.14.1.1 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.

17.14.1.2 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 30m² 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.

17.14.1.3 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.

Table 17.12: Summary of potential impacts of mWave on terrestrial ecology VERs.

Valuable Ecological Receptor (VER)	Unmitigated impact characterisation	Effect without mitigation	Mitigation	Significance of effect of residual impacts after mitigation
Installation phase				
Designated sites				
Pembrokeshire Marine SAC	Shore dock and otter are included as reasons for SAC designation. Shore dock is absent at East Pickard Bay. Otters are likely to forage along the coast and may use cover associated with rocks of the upper beach as well as undisturbed scrub habitat as resting places. Potential exists for disturbance and exclusion of otters from the vicinity of East Pickard Bay during installation.	Shore dock will not be impacted by proposals. No field sign suggesting current use by otters found. No habitat with potential to provide resting places lost. Installation boat traffic noise and risk of strike considered negligible. The short timescale associated with installation is considered to provide a negligible risk of significant disturbance.	None required unless evidence of otters is found immediately prior to installation.	Shore dock – No impact (insignificant). Otters - A high level of certainty exists that the short term and localised impact brought about by installation of the mWave device, cable and control station will not result in any significant impact on otters within or associated with the Pembrokeshire Marine SAC, Limestone Coast of South Wales SAC or Pembrokeshire Bat Sites SAC.
Limestone Coast of South Wales SAC	Greater horseshoe bats, lesser horseshoe bats and otter are included as reasons for SAC designation. Greater and lesser horseshoe bats use sea caves associated with the coastline and forage within suitable habitat of the coastline and inland.	No sea caves are present in the immediate vicinity of East Pickard Bay. No significant short or long term habitat loss will occur as a result of the project. Terrestrial elements of the project will not be illuminated at night. No impact pathways identified.	None required.	Greater and lesser horseshoe bats - a high level of certainty exists that the short term and localised impact brought about by deployment of the cable and installation of the control station will not result in any significant impact on greater or lesser horseshoe bats associated with the Limestone Coast of South Wales SAC, Pembrokeshire Bat Sites SAC, Angle Peninsula Coast SSSI or Milford Haven SSSI.
Pembrokeshire Bat Sites SAC	Greater horseshoe bats, lesser horseshoe bats and otter are included as reasons for SAC designation.	No significant impact pathways identified.	None required.	
Castlemartin Coast SPA	The SPA is designated for its population of breeding and over-wintering chough.	No recent nesting activity is known from East Pickard Bay. Chough are resilient to disturbance unless nesting. Coastal grassland habitat forms an important foraging resource. The short term impact (1 week) and small area of temporary habitat loss (30m ² cable footprint) resulting from the project is considered insignificant compared to the available resource.	None required.	Chough - a high level of certainty exists that the impact brought about by installation of the cable to the control station will not result in any significant impact on chough associated with the Castlemartin Coast SPA, Angle Peninsula Coast SSSI or Milford Haven SSSI.
Angle Peninsula Coast SSSI	The site is noted for its maritime cliff and coastal grassland habitats supporting a range of invertebrates, chough and horseshoe bats.	The short term impact (1 week) and small area of temporary habitat loss (30m ² cable footprint) resulting from the project is considered insignificant compared to the available resource.	None required.	
Milford Haven SSSI	A site noted for habitat supporting a range of invertebrates, chough and horseshoe bats.	No significant impact pathways identified.	None required.	
Broomhill Burrows SSSI	A rich dune system reliant on sand input brought about by tidal currents and storm events.	No significant impact pathways identified.	None required.	Insignificant.
Habitats				
Rocky shore and maritime cliff	Vascular plants and lichens associated with rock crevices could be dislodged or smothered by infrastructure associated with the communication cable.	Clamps will be positioned every 5m which will lift the 15cm wide cable from the rock face. Clamp are unlikely to be positioned on the fractured rock associated with cracks and crevices.	Careful and sensitive working practices in order to minimise habitat disturbance during installation.	It is certain that the installation phase of the project will result in a temporary minor impact at a local level to the maritime cliff community but will not threaten conservation status.
Coastal grassland	Plants within the coastal grassland will be smothered beneath the communication cable.	The 15cm wide cable passes through approximately 200m of coastal grassland habitat varying in species richness. Loss of approximately 30m ² of coastal grassland equates to approximately 0.0009% of the available resource within 100m of the cable alignment which is relatively insignificant even at a local level.	Care and sensitivity during cable installation.	It is certain that the installation phase of the project will result in a temporary minor impact at a local level to the coastal grassland community but will not threaten conservation status.

Valuable Ecological Receptor (VER)	Unmitigated impact characterisation	Effect without mitigation	Mitigation	Significance of effect of residual impacts after mitigation
Species-rich semi-improved neutral grassland	Works avoid the species-rich grassland.	No impact pathway identified.	None required.	No impact (insignificant).
Marshy grassland	Works avoid the marshy grassland.	No impact pathway identified.	None required.	No impact (insignificant).
Improved grassland	The communication cable route will pass along the edge of two improved fields.	The temporary loss of improved grassland habitat with high recoverability is insignificant.	None required.	Insignificant.
Hedgerows, scrub and tree cover	The cable will cross limited sections of low bramble scrub habitat.	The small scale of loss associated with the works has minor significance at a local level.	Seasonal timing to ensure absence of nesting birds or pre-check by ecologist.	Insignificant.
Water courses	Trampling by workers installing rollers for the cable pull may occur. Potential exists for pollution events brought about by fuel or chemical spills.	Trampling will be short-lived and recoverability is high. Fuel is the only significant pollutant likely to be stored on site (at the control station). Fuel will be stored within a self-bunded tank approximately 170m from the watercourse minimising potential risk.	Care and sensitivity during cable installation. Standard pollution prevention measures including spill kits.	It is probable that the installation phase of the project will result in a temporary minor impact (by trampling) at a local level to vegetation beside the watercourse.
Species				
Lichens and bryophytes	Potential for trampling or smothering of relatively common and widespread species.	Temporary and localised impact of little significance even at a local level.	Care and sensitivity during cable installation.	Minor and temporary impact at a local level.
Flowering plants	Plants within the coastal grassland will be smothered beneath the communication cable.	The 15cm wide cable passes through approximately 200m of coastal grassland habitat varying in species richness. Loss of approximately 30m ² of coastal grassland equates to approximately 0.0009% of the available resource within 100m of the cable alignment which is relatively insignificant even at a local level.	Care and sensitivity during cable installation.	It is certain that the installation phase of the project will result in a temporary minor impact at a local level to the coastal grassland community but will not threaten conservation status.
Invertebrates	Invertebrates are particularly associated with flower-rich habitats.	The loss of habitat to the cable footprint is insignificant in terms of the available habitat resource. The deployment methodology (laying on top of the ground) also minimises ground disturbance.	Care and sensitivity cable installation.	It is probable that the impact on invertebrates will be temporary and insignificant in scale.
Amphibians	No potential amphibian breeding sites were identified in proximity to the proposed works. However, wide-ranging amphibians may be present in low numbers.	Amphibians are unlikely to be present in any significant number.	Standard mitigation measures including phased vegetation removal.	Insignificant.
Reptiles	Reptiles are known to occur in the study area and could be impacted by ground disturbance such as creation of the control station.	The loss of habitat to the control station is negligible compared to available habitat locally.	Standard mitigation measures including phased vegetation removal.	Possible minor adverse impact at a site level.
Birds (excluding cough)	Installation activities have potential to disturb nesting birds including Section 7 species.	Bird-nesting habitat is largely avoided by works. Negligible temporary impact likely.	Seasonal timing or pre-installation checks.	No impact probable.
Bats (excluding greater and lesser horseshoes)	Bats	No sea caves are present in the immediate vicinity of East Pickard Bay. No significant short or long term habitat loss will occur as a result of the project. Terrestrial elements of the project will not be illuminated at night. No impact pathways identified.	None required.	No impact (insignificant).
Badger	Installation activities have potential to obstruct or disturb badger setts.	Badger surveys have identified sett locations and these are avoided by works. No impact pathway identified.	None required.	No impact (insignificant).
Other	Otter common and widespread are likely to occur.	The cable route and control station have a limited footprint and are likely to result in a temporary and localised impact of little significance even at a local level.	None required.	No impact (insignificant).

Valuable Ecological Receptor (VER)	Unmitigated impact characterisation	Effect without mitigation	Mitigation	Significance of effect of residual impacts after mitigation
Operation and maintenance				
Designated sites				
Pembrokeshire Marine SAC Limestone Coast of South Wales SAC Pembrokeshire Bat Sites SAC Castlemartin Coast SPA Angle Peninsula Coast SSSI Milford Haven SSSI	Otter Greater horseshoe bats Lesser horseshoe bats Chough	No impact pathway identified.	None required	Insignificant.
Angle Peninsula Coast SSSI	Maritime cliff and grassland plus associated invertebrates			
Broomhill Burrows SSSI	The dune system is reliant on sand input brought about by tidal currents and storm events which could be disrupted by the physical presence of the mWave device.	The small size of the mWave device (75m x 15m x 7m) and short deployment timescale is such that any significant disruption to sand supply is highly unlikely (Chapter 5 Coastal Processes).	None required	Insignificant.
Habitats				
Rocky shore and maritime cliff Coastal grassland Species-rich semi-improved neutral grassland Marshy grassland Improved grassland Hedgerows, scrub and tree cover Watercourses	Habitats will remain unaffected by operation of the mWave device.	No impact pathway identified.	None required	Insignificant.
Species				
Lichens and bryophytes Flowering plants Invertebrates	Species beneath the footprint of the communication cable may die or become stressed.	The loss of habitat beneath a 15cm cable is insignificant in comparison to the available resource even at a local level.	None required	Insignificant.
Amphibians Reptiles Birds (except chough) Bats (except horseshoe bats) Badger Other	Habitats will remain unaffected by operation of the mWave device.	No impact pathway identified.	None required	Insignificant.
Decommissioning				
All receptors	Comparable to installation phase	Comparable to installation phase	Comparable to installation phase	Comparable to installation phase

17.15 References

Ballachey, B. E. and J. L. Bodkin (2015) Chapter 4: Challenges to sea otter recovery and conservation in *Sea Otter Conservation*. Elsevier, 63-96.

Bosanquet, S.D.S. (2010). *The Mosses and Liverworts of Pembrokeshire*. Sam Bosanquet. ISBN: 9780955202216.

Buglife (2012). *Oil beetle species management sheet*. Buglife – The Invertebrate Conservation Trust, Peterborough. www.buglife.org.uk

CEH (2014). Modular Analysis of Vegetation Information System (MAVIS) version 1.03. Centre for Ecology and Hydrology.

Chanin P (2003). *Ecology of the European Otter Lutra lutra*. Conserving Natura 2000 Rivers Ecology Series No. 10. English Nature, Peterborough.

Chartered Institute of Ecology and Environmental Management (2018) *Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine*. September 2018.

Conroy, J.W.H. & Kruuk, H. (1995). Changes in otter numbers in Shetland between 1988 and 1993. *Oryx* 29,3, 197–204.

Chen, F., Shapiro, G. I., Bennett, K. A., Ingram, S. N., Thompson, D., Vincent, C., Russell, D., and Embling, C. B. (2017) Shipping noise in a dynamic sea: a case study of grey seals in the Celtic Sea. *Marine Pollution Bulletin*, 114 (1), 372-383.

Countryside Council for Wales (CCW) (2003). *Angle Peninsula Coast SSSI Citation*. Countryside Council for Wales.

Countryside Council for Wales (CCW) (2008). *Conservation Plan including Conservation Objectives for Limestone Coast of South Wales SAC (incorporating Castlemartin Coast SPA). Version 10 – 20/05/2008*. Countryside Council for Wales.

Countryside Council for Wales (CCW) (2009). Pembrokeshire Marine European Site. Advice provided by the Countryside Council for Wales in fulfilment of Regulation 33 of the Conservation (Natural Habitats, &c.) regulations 1994. February 2009.

Dehnhardt, G., B. Mauck, W. Hanke and H. Bleckmann. 2001. Hydrodynamic trail-following in harbor seals (*Phoca vitulina*). *Science* 293:102-104. Dehnhardt, G., B. Mauck, W. Hanke and H. Bleckmann. 2001. Hydrodynamic trail-following in harbor seals (*Phoca vitulina*). *Science* 293:102-104.

Dietz, C., von Helversen, O. & Nill, D. (2009). *Bats of Britain, Europe & Northwest Africa*. A & C Black, London.

Durbin, L.S. (1998). Habitat selection by five otters *Lutra lutra* in rivers of northern Scotland. *Journal of Zoology* 245, 1,85–92.

Eaton MA, Aebischer NJ, Brown AF, Hearn RD, Lock L, Musgrove AJ, Noble DG, Stroud DA and Gregory RD (2015) Birds of Conservation Concern 4: the population status of birds in the United Kingdom, Channel Islands and Isle of Man. *British Birds* 108, 708–746. Available online at britishbirds.co.uk/wp-content/uploads/2014/07/BoCC4.pdf

Ghoul A., and Reichmuth C. (2012) Sound Production and reception in southern sea otters (*Enhydra lutris nereis*). In: Popper A.N., Hawkins A. (eds) *The Effects of Noise on Aquatic Life. Advances in Experimental Medicine and Biology*, vol 730. Springer, New York, NY.

Green, J. Green, R. & Jefferies, D.J. (1984.) A radio-tracking survey of otters *Lutra lutra* on a Perthshire river system. *Lutra* 27,85–145.

Haycock (2018). Unpublished data relating to Annual Surveillance of Choughs in the Pembrokeshire Coast National Park.

Hodges, J.E. & Haycock, R.J. (2018). Annual Surveillance of Choughs in the Pembrokeshire Coast National Park. A short report to the Pembrokeshire Coast National Park Authority and Natural Resources Wales – January 2018. <http://pembbsbirds.blogspot.com/2018/03/2017-pembrokeshire-coast-chough-report.html>

Institute of Environmental Assessment (1995) *Guidelines for Baseline Ecological Assessment*. Chapman and Hall, London.

Jackson, J. (2018). Wylfa Newydd Project – 6.4.47 ES Volume D – WNDA Development App D9-14 – Chough Baseline Report – WN034-JAC-PAC-MEM-00015. Jacobs UK Ltd.

Johnstone, I., Thorpe, R., Moore, A. and Finney, S. 2007. Breeding status of choughs *Pyrrhonorax pyrrhonorax* in the UK and Isle of Man in 2002: Capsule – Choughs have increased in numbers and range in recent decades, but vary regionally in their apparent trends. *Bird Study*. 54(1): 23-24.

Joint Nature Conservation Committee (2010). *Handbook for Phase 1 Habitat Survey: a technique for environmental audit*. JNCC, Peterborough.

Jones, G. (1990). Prey selection by the Greater Horseshoe Bat (*Rhinolophus ferrumequinum*): optimal foraging by echolocation? *Journal of Animal Ecology* 59: 587-602.

Jones, G. & Morton, M. (1992). Radio-tracking studies and habitat use by greater horseshoe bats *Rhinolophus ferrumequinum*. In *Wildlife Telemetry, Remote Monitoring and Tracking of Animals* (eds Priede, I.G. & Swift, S.M.), pp. 521–537. Ellis Horwood, Chichester, England.

King, M. (2006). *Rumex rupestris dossier*. Plantlife International, Salisbury, UK. https://www.plantlife.org.uk/application/files/3514/7913/4086/Rumex_rupestris_dossier.pdf

Kruuk, H. (1995). *Otters – ecology, behaviour and conservation*. Oxford University Press.

Kruuk, H. (2006). *Otters – ecology, behaviour and conservation*. Oxford University Press.

Kruuk, H & Moorhouse, A. (1991) The spatial organization of otters (*Lutra lutra*) in Shetland. *Journal of Zoology* 224, 41 – 57.

Marchant, J.H. (1983). *Common Birds Census instructions*. British Trust for Ornithology (BTO), Tring.

McCauley, R. (1998). *Radiated Underwater Noise Measured from the Drilling Rig Ocean General, Rig Tenders Pacific Ariki and Pacific Frontier, Fishing Vessel Reef Venture and Natural Sources in the Timor Sea, Northern Australia. Project CMST, Report C98-20*. Prepared for Shell Australia, Melbourne by the Centre for Marine Science and Technology, Curtin University of Technology, Western Australia 6102.

Moorhouse, A. (1988). *Distribution of holts and their utilisation by the European otter (Lutra lutra L) in a marine environment*. Unpublished MSc thesis, University of Aberdeen.

Mullarney, K., Svensson, L., Zetterstrom, D. and Grant, P.J. (1999). *Bird Guide*. Harper Collins: London.

Nolet, B. A., Wansink, D. E. H., and H. Kruuk (1993) Diving of otters (*Lutra lutra*) in a marine habitat: use of depths by a single-prey loader, *Journal of Animal Ecology*, 62, 22 – 32.

Rodwell, J.S. (ed.) (2000). *British plant communities. Volume 5. Maritime communities and vegetation of open habitats*. Cambridge University Press.

Schofield, H.W. (2008). *The Lesser Horseshoe Bat Conservation Handbook*. The Vincent Wildlife Trust, Ledbury, Herefordshire.

Stone, E.L. (2013). *Bats and lighting: Overview of current evidence and mitigation guidance*. University of Bristol.

Strachan, R. (2015). *Otter Survey of Wales 2009-10*. Natural Resources Wales 2015.

Whitehead, S., Johnstone, I. and Wilson, J. 2005. Choughs *Pyrrhocorax pyrrhocorax* breeding in Wales select foraging habitat at different spatial scales. *Bird Study*. 52(2): 193-203.

Wilson, B., Batty, R. S., Daunt, F. and Carter, C. (2007) *Collision risks between marine renewable energy devices and mammals, fish and diving birds*. Report to the Scottish Executive. Scottish Association for Marine Science, Oban.