



MARINE ENERGY WALES

## MARINE ENERGY TEST AREA (META)

Environmental Impact Assessment

Chapter 7:

# Benthic Subtidal and Intertidal 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.
Biotope	The combination of physical environment (habitat) and its distinctive assemblage of conspicuous species.
Circalittoral	The subzone of the rocky sublittoral below that dominated by algae (i.e. the infralittoral) and dominated by animals.
Epibenthic	Organisms living on the surface of the seabed.
Epifauna	Animals living on the surface of the seabed.
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.
Infauna	The animals living in the sediments of the seabed.
Infralittoral	A subzone of the sublittoral in which upward-facing rocks are dominated by erect algae.
Intertidal	An area of a seashore that is covered at high tide and uncovered at low tide.
Mollusc	Invertebrate animal belonging to the phylum <i>Mollusca</i> that includes the snails, clams, chitons, tooth shells, and octopi.
Polychaete	A class of segmented worms often known as bristleworms.
Sublittoral	Area extending seaward of low tide to the edge of the continental shelf.
Subtidal	Area extending from below low tide to the edge of the continental shelf.

## Acronyms

Acronym	Description
BAP	Biodiversity Action Plan
CCW	Countryside Council for Wales
dWNMP	Draft Welsh National Marine Plan
Defra	Department for Environment, Food and Rural Affairs
EMODnet	European Marine Observation Data Network
FOCI	Features of Conservation Importance
GPP	Guidance for Pollution Prevention
HRA	Habitats Regulations Assessment
IMO	International Maritime Organization
INNS	Invasive Non-Native Species
JNCC	Joint Nature Conservation Committee

Acronym	Description
MarESA	Marine Evidence based Sensitivity Assessment
MCA	Maritime and Coastguard Agency
MCAA	Marine and Coastal Access Act
MCZ	Marine Conservation Zone
MHWESG	Milford Haven Waterway Environmental Surveillance Group
MMO	Marine Management Organisation
OSPAR	Oslo-Paris Commission
PAH	Polyaromatic Hydrocarbons
PDZ	Pembrokeshire Demonstration Zone
PEL	Probable Effect Level
SEACAMS	Sustainable Expansion of the Applied Coastal and Marine Sectors
SQG	Sediment Quality Guideline
SPI	Sediment Profile Imaging
SSC	Suspended Sediment Concentrations
TEL	Threshold Effect Level
Zol	Zone of Impact

## Units

Unit	Description
%	Percent
ha	Hectare
km	Kilometre
l	Litres
m	Metres
m <sup>2</sup>	Metre squared
m <sup>3</sup>	Metre cubed
mg/l	Milligrams per litre

## 7. BENTHIC SUBTIDAL AND INTERTIDAL ECOLOGY

### 7.1 Introduction

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

7.1.1.2 The assessment presented within this chapter has interrelationships with, and/or is informed by, the following technical chapters which are cross referenced as appropriate:

- Chapter 5 - Coastal Processes; and
- Chapter 8 - Fish and Shellfish Ecology.

7.1.1.3 Where technical reports are provided as part of the assessment, this chapter summarises information contained within these technical reports, and technical reports are included in Appendix 7.1: Benthic Ecology.

### 7.2 Purpose of this chapter

7.2.1.1 The primary purpose of the Environmental Statement is to support the marine consent applications for the META project, which are outlined in chapter 1: Introduction.

7.2.1.2 It is intended that the Environmental Statement will provide statutory and non-statutory consultees with sufficient information to determine the potential significant impacts of the META project on the receiving environment and will inform the issue of appropriate consent and/or licences by the regulatory authorities. It will also inform any consent conditions.

7.2.1.3 In particular, this Environmental Statement chapter:

- Presents the existing environmental baseline established from desk studies, and consultation;
- Presents the potential environmental effects on benthic subtidal and intertidal ecology arising from the META project, based on the information gathered and the analysis and assessments undertaken;
- Identify any assumptions and limitations encountered in compiling the environmental information; and
- Highlight any necessary monitoring and/or mitigation measures which could prevent, minimise, reduce or offset the possible environmental effects identified in the EIA process.

### 7.3 Study area

7.3.1.1 The META benthic subtidal and intertidal ecology study area is defined as the seabed encompassing the META Phase 2 sites (Warrior Way (site 6), Dale Roads (site 7) and East Pickard Bay (site 8)). To capture indirect effects such as those associated with suspended sediments for example, this study area is extended to cover the wider Milford Haven Waterway (hereafter referred to as the Waterway) and the area within up to one tidal excursion from the mouth of the Waterway (see Figure 7.1). The former Countryside Council for Wales (CCW; now replaced by Natural Resources Wales (NRW)) (2009) Advice in Fulfilment of Regulation 33 of the Conservation (Natural Habitats, &c.) Regulations 1994, states that the tidal excursion up the Waterway is 8 to 10 km on mean spring tides and 4 to 5 km on mean neap tides. Therefore, a precautionary buffer of 10 km has been adopted.

### 7.4 Policy context

#### 7.4.1 National Policy Statements

7.4.1.1 While it is recognised that the META project does not constitute a Nationally Significant Infrastructure project (NSIP), the National Policy Statements (NPS) available to support NSIPs are considered to provide useful context to the production of a benthic subtidal and intertidal ecology environmental assessment.

7.4.1.2 Planning policy on renewable energy infrastructure, specifically in relation to benthic subtidal and intertidal ecology, is contained in the Overarching National Policy Statement (NPS) for Energy (EN-1; DECC, 2011a) and the NPS for Renewable Energy Infrastructure (EN-3, DECC, 2011b).

7.4.1.3 NPS EN-1 and NPS EN-3 include guidance on what matters are to be considered in the assessment. These are summarised in Table 7.1 and Table 7.2, respectively.

**Table 7.1: Summary of NPS EN-1 policy framework provisions relevant to benthic subtidal and intertidal ecology.**

Summary of NPS EN-01 provisions	How and where considered in the Environmental Statement
<b>Biodiversity (Section 5.3)</b>	
Where the development is subject to EIA the applicant should ensure that the Environmental Statement clearly sets out any effects on internationally, nationally and locally designated sites of ecological or geological conservation importance, on protected species and on habitats and other species identified as being of principal importance for the conservation of biodiversity (paragraph 5.3.3 in NPS EN-1).	Effects on benthic features, including habitats and species of conservation importance, including those listed as features of designated sites, are fully considered in sections 7.11.1 (installation phase), 7.11.2 (operation and maintenance phase) and 7.11.3 (decommissioning phase). Baseline information on these receptors is presented in section 7.7, with valuation of these receptors in the context of their conservation importance considered in section 7.7.6.

Summary of NPS EN-01 provisions	How and where considered in the Environmental Statement
The applicant should show how the project has taken advantage of opportunities to conserve and enhance biodiversity and geological conservation interests (paragraph 5.3.4 in NPS EN-1).	Measure adopted as part of the META project to conserve benthic biodiversity are outlined in Table 7.13.
Development should aim to avoid significant harm to biodiversity and geological conservation interests, including through mitigation and consideration of reasonable alternatives; where significant harm cannot be avoided, then appropriate compensation measures should be sought (paragraph 5.3.7 in NPS EN-1).	Measures designed to avoid significant harm to benthic biodiversity are outlined in Table 7.13. No significant effects, in EIA terms, are predicted on benthic ecology as a result of the installation, operation and maintenance or decommissioning of the META project (see summary in Table 7.15).
The most important sites for biodiversity are those identified through international conventions and European Directives (paragraph 5.3.9 in NPS EN-1).	Effects on benthic features, including habitats and species of conservation importance, including those listed as features of designated sites, are fully considered in sections 7.11.1 (installation phase), 7.11.2 (operation and maintenance phase) and 7.11.3 (decommissioning phase). These effects have also been assessed within the Report to Inform Appropriate Assessment (RIAA) Report for the META project.
Many Sites of Special Scientific Interest (SSSI) are also designated as sites of international importance; those that are not, should be given a high degree of protection (paragraph 5.3.10 of NPS EN-1). Where a proposed development within or outside an SSSI is likely to have an adverse effect on an SSSI (either individually or together with other developments), development consent should not normally be granted. Where an adverse effect, after mitigation, on the site's notified special interest features is likely, an exception should only be made where the benefits (including need) of the development at this site clearly outweigh both the impacts on site features and on the broader network of SSSIs. The Secretary of State should use requirements and/or planning obligations to mitigate the harmful aspects of the development, and where possible, ensure the conservation and enhancement of the site's biodiversity or geological interest (paragraph 5.3.11 of NPS EN-1).	Where SSSIs are within Natura 2000 sites these have been considered as part of that site in this chapter.
Marine Conservation Zones (MCZs) introduced under the Marine and Coastal Access Act (MCAA) 2009 are areas that have been designated to conserve marine flora and fauna, marine habitat, or features of geological or geomorphological interest. The Secretary of State is bound by the duties in relation to MCZs imposed by sections 125 and 126 of the MCAA 2009 (paragraph 5.3.12 in NPS EN-1).	The Skomer MCZ lies within the benthic subtidal and intertidal ecology study area has been considered within the assessment (see section 7.7.5).
Development proposals provide many opportunities for building-in beneficial biodiversity or geological features as part of good design. When considering proposals, the Infrastructure Planning Commission (IPC) now Planning Inspectorate (PINS) should maximise such opportunities in and around developments, using requirements or planning obligations where appropriate (paragraph 5.3.15 in NPS EN-1).	Designed-in measures to be adopted as part of the META project are presented in Table 7.13.
Other species and habitats have been identified as being of principal importance for the conservation of biodiversity in England and Wales and thereby requiring conservation action (paragraph 5.3.17 in NPS EN-1).	All species and habitat receptors, including those listed under Section 7 of the Environment (Wales) Act 2016 are considered in section 7.7, with valuation of these receptors in the context of their conservation importance considered in section 7.7.6.

Summary of NPS EN-01 provisions	How and where considered in the Environmental Statement
The applicant should include appropriate mitigation measures as an integral part of the proposed development. In particular, the applicant should demonstrate that: <ul style="list-style-type: none"> <li>during construction, they will seek to ensure that activities will be confined to the minimum areas required for the works;</li> <li>during construction and operation best practice will be followed to ensure that risk of disturbance or damage to species or habitats is minimised, including as a consequence of transport access arrangements;</li> <li>habitats will, where practicable, be restored after construction works have finished; and</li> <li>opportunities will be taken to enhance existing habitats and, where practicable, to create new habitats of value within the site landscaping proposals (paragraph 5.3.18 in NPS EN-1).</li> </ul>	Mitigation measures proposed for the META project are presented in Table 7.13.

**Table 7.2: Summary of NPS EN-3 policy framework provisions relevant to benthic subtidal and intertidal ecology.**

Summary of NPS EN-03 provisions	How and where considered in the Environmental Statement
<b>Biodiversity</b>	
Applicants should assess the effects on the offshore ecology and biodiversity for all stages of the lifespan of the proposed project (paragraph 2.6.64 of NPS EN-3).	Installation, operation and maintenance, and decommissioning phases of the META project have all been assessed in section 7.11.
Consultation on the assessment methodologies should be undertaken at early stages with the statutory consultees as appropriate (paragraph 2.6.65 of NPS EN-3).	Consultation with relevant statutory and non-statutory stakeholders has been carried out from the early stages of the META project (see Table 7.3).
Applicants should assess the potential for the scheme to have both positive and negative effects on marine ecology and biodiversity (paragraph 2.6.67 of NPS EN-3).	Both the positive and negative effects of the META project have been assessed in section 7.11.
<b>Benthic subtidal and intertidal ecology</b>	
Applicants should assess the (paragraph 2.6.113 of NPS EN-3) and effects on the intertidal zone (paragraph 2.6.81 of NPS EN-3).	These assessment has included likely effects from temporary and long term habitat loss (see paragraphs 7.11.1.3 <i>et seq.</i> and 7.11.2.3 <i>et seq.</i> respectively) and the effects of changes in physical processes (see paragraph 7.11.1.24 <i>et seq.</i> ).
Applicants should assess the effects of increased suspended sediment loads during construction on subtidal habitats (paragraph 2.6.113 of NPS EN-3) and intertidal habitats (paragraph 2.6.81 of NPS EN-3).	Effects associated with increased SSC are fully assessed in paragraphs 7.11.1.24 <i>et seq.</i> during the installation phase.
Applicants should assess the predicted rates for subtidal habitat recovery (paragraph 2.6.113 of NPS EN-3) and intertidal zone recovery from temporary disturbance effects (paragraph 2.6.81 of NPS EN-3).	The likely rates of recovery of benthic species/habitats have been assessed for each impact and have been used to inform each assessment of the significance of the effect (see section 7.11).

## 7.4.2 Other relevant policies

- 7.4.2.1 The Marine Policy Statement (MPS) and the draft Welsh National Marine Plan (Welsh Government, 2017) are also relevant to benthic ecology. Consideration of the UK MPS in relation to the META project is made within Table 3.1 of chapter 3: Needs and Alternatives. Consideration of the draft Welsh National Marine Plan (dWNMP) (Welsh Government, 2017) is outlined in Table 3.2, chapter 3: Need and Alternatives.

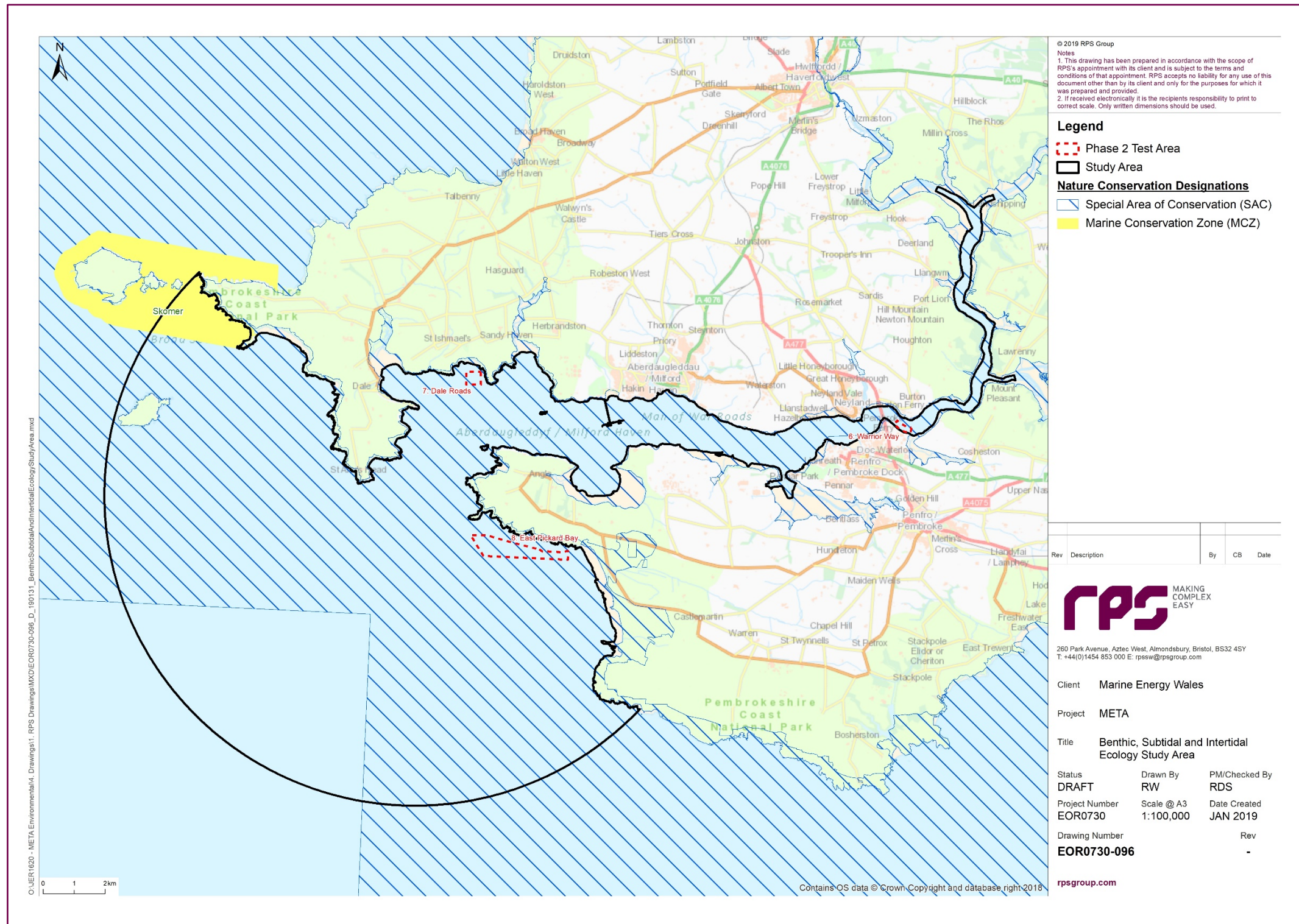


Figure 7.1: The benthic subtidal and intertidal ecology study area and designated sites with relevant benthic ecology features.

## 7.5 Consultation

- 7.5.1.1 A summary of the key issues raised during consultation specific to benthic subtidal and intertidal ecology is outlined below, together with how these issues have been considered in the production of this Environmental Statement chapter.
- 7.5.1.2 Table 7.3 below summarises the issues raised relevant to benthic subtidal and intertidal ecology, which have been identified during consultation activities undertaken to date. Table 7.3 also indicates either how these issues have been addressed within this Environmental Statement or how the Applicant has had regard to them.

**Table 7.3: Summary of key consultation issues raised during consultation activities undertaken for the META project relevant to benthic subtidal and intertidal 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 benthic subtidal and intertidal ecology characterisation presented in section 7.7 and will also be used in the Report to inform Appropriate Assessment (RIAA) for the project.
		Survey work is required to identify the habitats and biotopes present at the Warrior Way (site 6) and Dale Roads (site 7) sites.	The baseline characterisation presented in section 7.7 has been based on a comprehensive desktop review. However, as outlined in Table 7.13, post-consent/pre-deployment surveys will be undertaken by Developers at Warrior Way (site 6) and Dale Roads (site 7), if required on the basis of the outcomes of a full review of the geophysical data presented in Appendix 7.1: Benthic Ecology, in order to identify and avoid direct impacts to sensitive reef habitats.
		The East Pickard Bay site (site 8) boundary should be revised to avoid the designated reef feature and instead focus the area on sand substrate only.	On the basis of NRW's advice, the boundary of the East Pickard Bay test area (site 8) has been revised to avoid the designated reef feature at this location. The East Pickard Bay test area (site 8) therefore only covers the sand substrate at this location.
		Drop-down camera surveys are proposed for the cable route which we consider will be sufficient for micro siting of the cable lay.	Since the submission of the Scoping Report, the PDE has changed such that there is no longer a marine cable at East Pickard Bay (site 8).
19 January 2019	Pembrokeshire County Council (PCC)	Concern relating to the lack of marine surveys undertaken to support the proposals and that further surveys are not being proposed. No seabed drop down or marine surveys have been undertaken of the three marine test sites. Without knowing what species and habitats are present within the sites it is not possible to undertake any kind of impact assessment. For example, are there seagrass beds within the Dale Roads site? Are there areas of reef, a feature of the Pembrokeshire Marine SAC within the East Pickard Bay site? The presence or otherwise of these features has not been established so it is not possible to assess the extent to which the proposed developments may cause harm.	The benthic ecology assessment has been informed by the results of the comprehensive desktop review outlined in section 7.7 including results of the Sustainable Expansion of the Applied Coastal and Marine Sectors (SEACAMS) multibeam backscatter survey undertaken in 2017 covering the Waterway and META sites (see Table 7.4). As detailed in Table 7.13, post-consent/pre-deployment benthic surveys will be undertaken at Warrior Way (site 6) and Dale Roads (site 7). In the first instance, these surveys will comprise a comprehensive review and interpretation of the geophysical survey data available for these sites (as presented in Appendix 7.1: Benthic Ecology) by a suitably qualified and experienced marine ecologist / geophysicist, to identify any areas of potential reef features or sensitive habitat features that may be present. In the event that acoustic signatures synonymous with potential reef presence for example, are identified from the geophysical data, it is proposed that these would be subject to further ground-truthing via a pre-deployment survey, the exact format of which would be agreed with NRW at the time. The pre-deployment survey, if required, would likely utilise remote sampling techniques (e.g. drop-down video) to establish the presence or absence of any reef features, and where present to determine their extent. These surveys will ensure that measures can be designed, if necessary, (e.g. micrositing of moorings etc.) to avoid direct impacts to sensitive habitats such as reefs and seagrass at these sites.  As detailed above in this table, on the basis of NRW's advice, the boundary of East Pickard Bay (site 8) has been revised to avoid the designated reef feature at this location.
21 January 2019	ABPmer	Potential impacts on benthic ecology from underwater noise will need to be considered, with a particular focus on SAC qualifying habitat features.	Underwater noise has been scoped out for benthic ecology; see Table 7.9 for a full justification.
21 January 2019	NRW	Drop-down video surveys should be undertaken to identify the habitats affected by the project, in particular for sites encompassing Annex I habitats. These should be informed by bathymetric data. Milford Haven Port Authority (MHPA) may have access to bathymetry data to cover the Warrior Way and Dale Roads test sites.	See Table 7.13, post-consent/pre-deployment surveys at Warrior Way (site 6) and Dale Roads (site 7) will be undertaken by Developers, if required on the basis of the outcomes of a full review of the geophysical data presented in Appendix 7.1: Benthic Ecology, to ensure that measures can be designed, if necessary, (e.g. micro siting of moorings etc.) to avoid direct impacts to sensitive habitats such as reefs at these sites.
		It would have been useful to include the recent multibeam bathymetry data within this scoping report in order to help inform the review of the project design envelope.	The multibeam backscatter data for the META sites is presented in Appendix 7.1: Benthic Ecology and will be used to inform the need for, and design of, post-consent/pre-deployment surveys at Warrior Way (site 6) and Dale Roads (site 7).
		The description of the baseline environment within the three test areas is quite limited at present and we would expect to see more detail in the final Environmental Statement informed by the proposed site-specific monitoring.	A full description of the benthic baseline is presented in section 7.7 based on a comprehensive desktop review. Site-specific monitoring, as outlined in Table 7.13, will be presented when available.
		Milford Haven Waterway Environmental Surveillance Group (MHWESG) have previously commissioned a sediment profile imaging (SPI) survey of the Waterway.	A range of reports commissioned by the MHWESG have been referenced within this Environmental Statement chapter as outlined in Table 7.4, including the Germano and Associates (2013) SPI study, the results of which are fully discussed in paragraphs 7.7.2.2, 7.7.2.10 and 7.7.2.14.
Seacaves and Atlantic Salt-Meadows are also Annex I habitat features of the SAC. There is not enough information to exclude the Atlantic salt-meadows from the EIA.	These features are considered in paragraphs 7.7.2.8 and 7.7.4.7, respectively and included as VERs for the benthic ecology assessment in Table 7.7.		

Date	Consultee and type of response	Issues raised	Response to issue raised and/or where considered in this chapter
		Dwarf eelgrass should be included.	Dwarf eelgrass is considered in paragraphs 7.7.4.6 and included as a VER for the benthic ecology assessment in Table 7.7.
		Loss of habitat should be included as an impact, not just disturbance.	Loss of benthic habitat during the operation of devices at META sites is fully assessed in paragraph 7.11.2.3 <i>et seq.</i>
		Impacts from repeated devices should also be considered, including the repeated loss and disturbance of habitat.	Repeated habitat disturbance and loss are considered and assessed in paragraphs 7.11.1.14 and 7.11.2.11, respectively.
		Cable impacts should be considered in the impact pathways such as the cable burial and protective measures (armouring, rock bags).	Since the submission of the Scoping Report, the PDE has changed such that there is no longer a marine cable at East Pickard Bay (site 8).
		Construction impacts associated with debris and accidental pollution should also be included.	Effects associated with accidental pollution events are assessed in paragraphs 7.11.1.95 <i>et seq.</i> for installation, paragraph 7.11.2.75 <i>et seq.</i> for operation and maintenance and paragraph 7.11.3.7 for decommissioning.
		Other research and work carried out at other tidal and wave devices should be reviewed; this may identify potential impact pathways which have not yet been identified.	Impacts assessed within section 7.11 are consistent with potential impacts identified in the report for Scottish Government on Consenting, EIA and HRA Guidance for Marine Renewable Energy Developments in Scotland (EMEC and Xodus, 2010).
		We do not consider that the benthic footprint of the three test areas has been adequately considered.	The footprint associated with the deployment of devices at the META sites is clearly detailed in Table 7.8 and assessed as habitat loss in paragraph 7.11.2.3 <i>et seq.</i>
		Effects of accidental pollutants on benthic habitats has been scoped out. We would expect further detail on this before being able to scope it out.	Effects associated with accidental pollution events are assessed in paragraphs 7.11.1.95 <i>et seq.</i> for installation, paragraph 7.11.2.75 <i>et seq.</i> for operation and maintenance and paragraph 7.11.3.7 for decommissioning.
		Detail is lacking on the scale of the devices to be deployed and the anticipated benthic footprint.	The footprint associated with the deployment of devices at the META sites is clearly detailed in Table 7.8 and assessed as habitat loss in paragraph 7.11.2.3 <i>et seq.</i>
		All relevant policy and legislation has been identified.	No response required.
		Given the proposed timescale for deployments, the potential impacts to coastal processes are likely to be short term and recoverable. However, the suggested refinement of the PDE above will help to resolve potential issues around multiple deployments over a wide area	Impacts to benthic receptors as a result of changes to coastal processes are assessed in paragraph 7.11.2.37 <i>et seq.</i> and paragraph 7.11.2.52 <i>et seq.</i>
		A change in the hydrodynamic regime as the result of tidal device installation at the Warrior Way test site should be assessed as an operational impact.	Changes to the hydrodynamic regime have been assessed in paragraph 7.11.2.52 <i>et seq.</i> and is informed by the assessed change in hydrodynamic regime as a result of tidal device installation at Warrior Way (site 6) in chapter 5: Coastal Processes.
		Multiple impact pathways identified have the potential to affect designated habitat features.	Features of designated sites have been identified and included as VERs (see Table 7.7) and assessed as appropriate within section 7.11.
		Impact pathways that have been scoped out have not been included so it is difficult to determine if everything has been considered.	Impacts scoped out for benthic subtidal and intertidal ecology are outlined and justified in Table 7.9.
		Coastal lagoons can be scoped out due to the fact that the features are not within or adjacent to any of the test areas and we do not consider there to be any impact pathways to these features.	See paragraph 7.7.2.5 for discussion on coastal lagoons within the benthic subtidal and intertidal ecology study area. As discussed in paragraph 7.11.1.32, coastal lagoons are not predicted to be affected due to their distance from the META sites.
		The impact of repeated mooring and anchorage associated with vessels on benthic habitats should be assessed.	Impacts associated with vessels mooring are outlined in Table 7.8 and assessed in paragraph 7.11.1.3 <i>et seq.</i>
		Impacts on features of the Milford Haven Waterway SSSI should be assessed.	As outlined in paragraph 7.6.2.2, where a nationally designated sites (e.g. Milford Haven Waterway SSSI) falls within the boundaries of an internationally designated site (i.e. Pembrokeshire Marine SAC), only the international site has been considered, as 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. All features of the Milford Haven Waterway SSSI have been considered as VERs in the assessment (see Table 7.7).
		More detailed information on the baseline environment must be presented in the Environmental Statement.	A full description of the benthic baseline is presented in section 7.7 based on a comprehensive desktop review. Site-specific monitoring, as outlined in Table 7.13, will be presented when available.
28 March 2019	NRW/MMO Scoping Response	Site specific subtidal survey data is likely to be required. We recommend that this survey work includes multi-beam bathymetry of Dale Roads and Warrior Way with ground truthing of the areas with either drop-down video or grab samples. The survey work should characterise the test sites to identify the habitats potentially affected by the project, in particular for areas encompassing Annex I habitats (all of Warrior Way and Dale Roads, partial for East Pickard Bay). Up to date evidence must be presented in the Environmental Statement.	See Table 7.13, post-consent/pre-deployment surveys at Warrior Way (site 6) and Dale Roads (site 7) will be undertaken by Developers, if required on the basis of the outcomes of a full review of the geophysical data presented in Appendix 7.1: Benthic Ecology, to ensure that measures can be designed, if necessary, (e.g. micro siting of moorings etc.) to avoid direct impacts to sensitive habitats such as reefs at these sites.
		Benthic surveys should be undertaken in accordance with the following guidelines:	The post-consent/ pre-deployment benthic surveys outlined in Table 7.13 will be undertaken in line with all relevant guidance.

Date	Consultee and type of response	Issues raised	Response to issue raised and/or where considered in this chapter
		<p>Saunders, G., Bedford, G.S., Trendall, J.R., and Sotheran, I. (2011). Guidance on survey and monitoring in relation to marine renewables deployments in Scotland. Volume 5. Benthic Habitats. Unpublished draft report to Scottish Natural Heritage and Marine Scotland.</p>	
		<p>Hitchin, R., Turner, J.A., Verling, E. (2015) Epibiota remote monitoring from digital imagery: Operational guidelines.</p>	
		<p>The following impact pathways must be assessed in the EIA/Environmental Statement:</p> <ul style="list-style-type: none"> <li>• Loss of habitat (not just disturbance). This is especially important for sensitive habitats with low resilience and recoverability;</li> <li>• Impacts from repeated device deposits and removals, including the repeated loss and disturbance of habitat;</li> <li>• Cable impacts such as cable burial and protective measures (armouring, rock bags);</li> <li>• Effects of accidental pollutants;</li> <li>• Repeated vessel mooring and anchorage.</li> </ul>	<p>Loss of habitat is assessed in para 7.11.2.3 <i>et seq.</i></p> <p>The effects of repeated habitat disturbance are discussed and assessed in paragraph 7.11.1.14 and 7.11.2.11.</p> <p>Since the submission of the Scoping Report, the requirements for a marine cable have been removed from the META project and, as such, are not assessed within this chapter.</p> <p>Effects on benthic receptors associated with accidental pollution events are assessed in para 7.11.1.95 <i>et seq.</i> for installation, paragraph 7.11.2.75 <i>et seq.</i> for operation and maintenance and paragraph 7.11.3.7 for decommissioning.</p> <p>Impacts associated with repeated vessel mooring and anchorage are outlined in Table 7.8 and assessed in paragraph 7.11.1.3 <i>et seq.</i></p>

## 7.6 Methodology to inform the baseline

7.6.1.1 The META project is located with the Waterway and its adjacent waters, for which extensive data and knowledge regarding benthic subtidal and intertidal ecology is already available. This extensive data/knowledge has been acquired through the following sources which are outlined in section 7.6.2:

- Publicly available journals;
- NRW survey reports;
- The Milford Haven Waterway Environmental Surveillance Group (MHWESG);
- University studies; and
- Benthic characterisation surveys undertaken for other projects within the Waterway.

7.6.1.2 Due to the availability of a number of suitable data sources for the Waterway and in the vicinity of the META sites, additional data collection through site-specific surveys have not been required to adequately characterise the benthic subtidal and intertidal ecology baseline for the purposes of undertaking the EIA (see chapter 4: Environmental Assessment Methodology).

### 7.6.2 Desktop study

7.6.2.1 Information on benthic subtidal and intertidal ecology within the benthic subtidal and intertidal ecology study area was collected through a detailed desktop review of existing studies and datasets. These are summarised at Table 7.4 below.

Table 7.4: Summary of key desktop reports.

Title	Source	Year	Author
<b>Intertidal ecology</b>			
Countryside Council for Wales (CCW) Phase 1 Intertidal habitat mapping survey between 1996 and 2005.	<a href="http://lle.gov.wales/">http://lle.gov.wales/</a>	2019	NRW
Intertidal site visit of proposed landfall for the Bombora temporary communications cable at East Pickard Bay.	Bombora Wave Energy	2019	Gill Lock <i>pers. comm.</i>
Rocky Shore Surveillance 2013.	MHWESG	2014	Morrell
Reestablishment of intertidal rocky surveillance.	MHWESG	2011	Mieszkowska
Milford Haven salt-marsh survey 2002.	MHWESG	2003	Prosser and Wallace
Rocky shore transect monitoring in Milford Haven.	MHWESG	1997	Moore
The macrobenthos of the foreshore soft sediments of Milford Haven, 1994.	MHWESG	1995	Rostron
<b>Subtidal ecology</b>			

Title	Source	Year	Author
Seasearch 2018 dive summaries for two survey site clusters south of Angle Peninsula.	Pers. Comm.	2019	Blaise Bullimore
Pembrokeshire Marine SAC Regulation 37 Document.	NRW	2018a	NRW
Pembrokeshire Marine SAC Indicative site level feature condition assessments 2018.	NRW	2018b	NRW
Bombora camera drop down video survey.	SEACAMS	2018	SEACAMS.
Multibeam backscatter survey data of Milford Haven.	SEACAMS	2017	SEACAMS.
Status review and surveillance recommendations for seagrass ( <i>Zostera</i> species) in Milford Haven Waterway.	MHWESG	2017	Unsworth <i>et al.</i>
Sediment contaminant concentrations in Milford Haven waterway: data conversion and timeline.	MHWESG	2017	Little
EUSeaMap broad-scale predictive model.	<a href="http://www.emodnet.eu/seabed-habitats">http://www.emodnet.eu/seabed-habitats</a>	2016	EUSeaMap
Sediment contaminant surveillance in Milford Haven Waterway.	Environmental Monitoring and Assessment: 2016, 1881(1): 34	2016	Little <i>et al.</i>
Milford Haven Waterway sediment macrobenthos data analysis and review 2008-15.	MHWESG	2016	Warwick
Marine habitat mapping of the Milford Haven Waterway, Wales, UK: Comparison of facies mapping and EUNIS classification for monitoring sediment habitats in an industrialized estuary.	Journal of Sea Research, 100, 99-119	2015	Carey <i>et al.</i>
Analysis of Sediment Contaminants in Milford Haven Waterway Total Hydrocarbon (THC) concentration in sediments.	MHWESG	2015	Rumney <i>et al.</i>
Milford Haven sediment hydrocarbon and metals contamination: supplemental report on recent contaminant trends.	MHWESG	2014	Little and Galperin
Sediment-Profile Imaging Survey of Milford Haven Waterway, Wales, UK - May 2012.	MHWESG	2013	Germano and Associates
EUNIS Habitat maps from the Mapping European Seabed Habitats (MESH) project.	<a href="http://www.emodnet.eu/seabed-habitats">http://www.emodnet.eu/seabed-habitats</a>	2008	MESH Project

Title	Source	Year	Author
Review of benthic and intertidal sediment macrofauna data and development of a surveillance programme.	MHWESG	2006	Warwick
A survey of subtidal <i>Zostera</i> beds in Milford Haven.	MHWESG	2000	Posford Duvivier

### Identification of designated sites

7.6.2.2 All designated sites within the benthic subtidal and intertidal ecology study area with qualifying interest features that could be affected by the installation, operation and maintenance, and decommissioning of the META project were identified using the process described below:

- Sites with relevant benthic ecology features which overlap with the META project and therefore have the potential to be directly affected by the META project (e.g. by temporary and/or long-term habitat loss); and
- Sites with relevant benthic ecology features with the potential to be indirectly affected by the META project (i.e. by changes in suspended sediment concentrations and/or sediment deposition as determined by the assessment presented in chapter 5: Coastal Processes).
- Step 1: All designated sites of international, national and local importance within the benthic subtidal and intertidal ecology study area were identified using a number of sources. These included international, national and local designations including SACs, SSSIs and LNRs identified by examining the Joint Nature Conservation Committee's (JNCC's) website, the Department for Environment, Food and Rural Affairs (Defra) MAGIC interactive map applications (<http://magic.defra.gov.uk/>) and the Wales Marine Planning Portal interactive map application (<http://lle.gov.wales/apps/marineportal>).
- Step 2: Information was compiled on the relevant benthic subtidal and intertidal features for each of these sites as follows:
  - The known occurrence of benthic subtidal and intertidal habitats within the META project was based on the relevant desktop information on the benthic subtidal and intertidal communities of the benthic subtidal and intertidal study area.
- Step 3: Using the above information and expert judgement, sites were included for further consideration if:
  - A designated site directly overlaps with the META project;
  - Sites and associated features were located within the potential Zone of Impact (Zoi) for impacts associated with the META project (e.g. habitat loss/disturbance, increase in suspended sediments and deposition);
  - Notified interest species features of a designated site were either recorded as present during historic surveys within the META project area, or identified during the desktop study as having the potential to occur within the META project area;
  - Where national and locally designated sites (i.e. SSSIs, MCZs, NNRs and LNRs) fall within the boundaries of an internationally designated site (e.g. SAC), only the international site has been considered, as 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). In some

cases, however, where a national site forms a component of an international site, but the latter designation does not list a qualifying interest feature that is present on the SSSI citation, the individual SSSI will be taken forward for further assessment for that particular feature or the species;

- Where a national site falls outside of an international site, but within the benthic subtidal and intertidal ecology study area, the national site will be taken forward for further assessment for a particular feature; and
- Skomer MCZ is the only MCZ designated in Wales waters and as such is the only one considered for assessment.

### 7.6.3 Site specific surveys

7.6.3.1 As discussed in paragraph 7.6.1.2, due to the availability of a number of suitable data sources for the Waterway and in the vicinity of the META sites, additional data collection through site-specific surveys were not required to adequately characterise the benthic subtidal and intertidal ecology baseline for the purposes of undertaking the EIA (see chapter 4: Environmental Assessment Methodology).

7.6.3.2 As discussed in Table 7.3 and outlined in Table 7.13, in response to pre-application consultation with NRW advisory, it is proposed that post-consent/pre-deployment benthic surveys will be undertaken by developers at Warrior Way (site 6) and Dale Roads (site 7). These surveys will be undertaken prior to the installation of any infrastructure or devices/components at these sites, to ensure that direct impacts to any sensitive reef habitats recorded will be avoided. In the first instance, these surveys will comprise a comprehensive review and interpretation of the geophysical survey data available for these sites (as presented in Appendix 7.1: Benthic Ecology) by a suitably qualified and experienced marine ecologist / geophysicist, to identify any areas of potential reef features or sensitive habitat features that may be present. In the event that acoustic signatures synonymous with potential reef presence for example, are identified from the geophysical data, it is proposed that these would be subject to further ground-truthing via a pre-deployment survey, the exact format of which would be agreed with NRW at the time. The pre-deployment survey, if required, would likely utilise remote sampling techniques (e.g. drop down video) to establish the presence or absence of any reef or other sensitive habitat features, and where present to determine their extent. These surveys will ensure that measures can be designed, if necessary, (e.g. micrositing of moorings etc.) to avoid direct impacts to sensitive habitats such as reefs and seagrass at these sites.

## 7.7 Baseline environment

7.7.1.1 This section characterises the existing environment within the benthic subtidal and intertidal ecology study area as illustrated in Figure 7.1 and outlined in section 7.3. A description is provided for the benthic subtidal and intertidal ecology study area as a whole and then separate sections outline a more detailed description for each of the META sites in turn.

7.7.1.2 Upfront it is important to note that the Pembrokeshire Marine SAC designation covers the entire Waterway (see Figure 7.1) and the Annex I habitats 'Estuary' and 'Large shallow inlets and bays' which are a primary reason for the selection of the site are extensively distributed throughout the Waterway and encompass both the Warrior Way (site 6) and Dale Roads (site 7) sites (see Figure 7.2). Where subtidal and intertidal habitats discussed in the following sections correspond with other Annex I features of this site, this is discussed in the text.

## 7.7.2 Subtidal benthic ecology

7.7.2.1 A detailed map of the sedimentary habitats within the Waterway was compiled for the MHWESG from images of the sea floor collected in 2012 using sediment-profile and plan-view imaging (SPI/PV) survey techniques (Germano and Associates, 2013; Carey *et al.*, 2015). The Waterway contains large numbers of shells on the surface, generally of the slipper limpet *Crepidula fornicata* and overall the sediments are highly variable ranging from cobbles to silts/clays.

7.7.2.2 Despite the variation, major groupings of sediment types were recorded during the Carey *et al.* (2015) survey. The channel at the mouth of the Waterway is characterised by medium to very coarse sand and gravel, while the surrounding subtidal banks and intertidal flats grades from very fine sand, to very fine sand over silt/clay to silt clay. The channel in the middle Waterway from Sandy Haven Bay through Angle Bay and Gelliswick Bay is dominated by very fine to fine sand, often overlying silt/clay. The central channel near Pembroke Dock is lined with very coarse cobbles, pebbles, and shell over-sand or mud while the flats of the Pembroke River contained silt/clay. Past Pembroke Dock the channel is dominated by very coarse sand and gravel (a few shells) with little deposition of silt. In addition to *C. fornicata*, other macrofauna and macroflora found throughout the channel included lugworm *Arenicola marina*, sand mason worm *Lanice conchilega*, anemones *Cerianthus* sp., eelgrass *Zostera* sp., sea lettuce *Ulva lactuca*, Montagu shell *Kurtiella bidentata* and clams *Thyasira* sp.

7.7.2.3 Historic benthic sampling within the Waterway has demonstrated that the benthic faunal communities associated with the sediment described above can be divided into three relatively distinct regions along the length of the Waterway, which relate primarily to the balance between estuarine and marine conditions (Hobbs and Smith, 1998). Annelids were found to be the most abundant organisms in all three areas making up 75% of the individuals and, molluscs and crustaceans followed contributing six to 11% of the individuals. Upriver of the Cleddau Bridge, communities were numerically dominated by tubificid oligochaetes and the polychaete *Paradoneis lyra*, with *Pholoe synophthamica*, *Sphaerosyllis* spp. and the amphipod *Corophium sextonae* also abundant. The central reaches of the Waterway were dominated by cirratulid polychaetes including *Chaetozone gibber* and *Caulleriella zetlandica*. Towards the mouth of the Waterway, communities characterised by other cirratulid polychaetes *Aphelochaeta* spp., *Tharyx* spp. and *Caulleriella* spp. and bivalves such as the white furrow shell *Abra alba* were more prominent (Hobbs and Smith, 1998). Similar sequential changes in community composition through the Waterway have been reported more recently by Warwick (2016) in a review of the sediment and macrobenthic data of the Waterway for the MHWESG which also demonstrated a general decrease in species diversity from the outer to inner reaches.

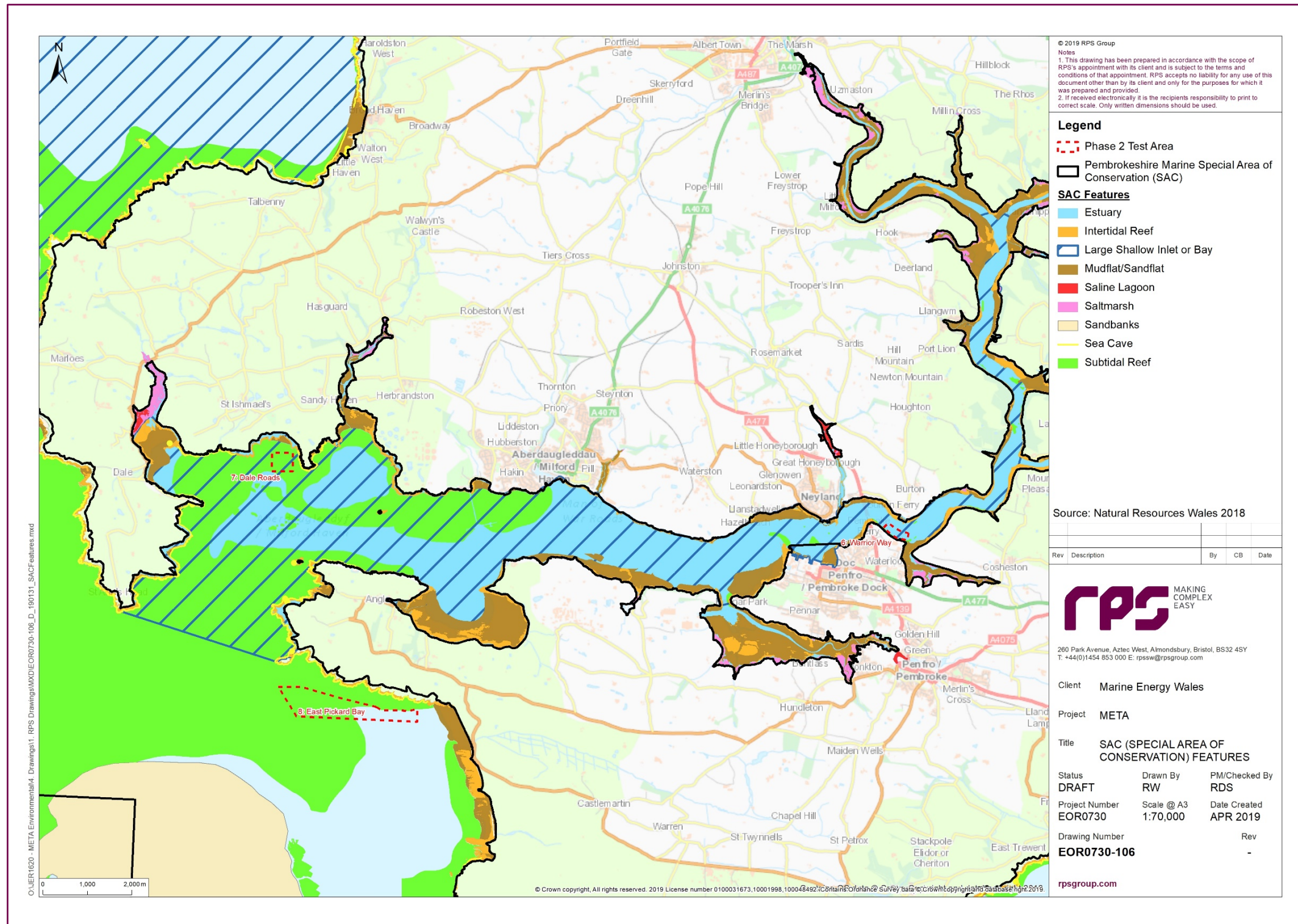


Figure 7.2: Annex I designated habitats of the Pembrokeshire Marine SAC.

- 7.7.2.4 Data available on EMODnet which was generated as part of the MESH project from sample points collected and analysed by the Marine Nature Conservation Review (MNCR) surveys suggests potential biotopes associated with the infaunal communities within the Waterway. The sediments from the mouth of the Waterway to Milford Haven Port are characterised by the '*Abra alba* and *Nucula nitidosa* in circalittoral muddy sand or slightly mixed sediment' biotope (SS.SSa.CMuSa.AalbNuc). South of the Dragon LNG Terminal, the community changes to one characterised by the '*Mysella bidentata* and *Thyasira* spp. in circalittoral muddy mixed sediment' biotope (SS.SMx.CMx.MysThyMx). Beyond the Cleddau bridge, the biotope is classified as red seaweeds and kelps on tide-swept mobile infralittoral cobbles and pebbles (SS.SMp.KSwSS.LsacR.CbPb) up to Lawrenny Quay where the biotope is predominately classified as *C. fornicata* and *Mediomastus fragilis* in variable salinity infralittoral mixed sediment (SS.SMx.SMxVS.CreMed).
- 7.7.2.5 There are two species of seagrass present in the Waterway; subtidal eelgrass *Zostera marina* and intertidal dwarf eelgrass *Z. noltii*. There are two main populations of the subtidal seagrass *Z. marina* within the Waterway, the largest of which (22.17 ha) occurs 2.8 km to the east of Dale Roads (site 7), in Littlewick Bay, on the northern shore of the Waterway. The smaller population of *Z. marina* (0.96 ha) lies approximately 520 m to the east of Dale Roads (site 7) in Longoar Bay (Unsworth *et al.*, 2017; see Figure 7.3). *Zostera marina* is typically found on sand to fine gravel in depths of up to 5 m. Unsworth *et al.* (2017) also report that a very small patch (6 m<sup>2</sup>) of *Z. marina* was recorded at Dale, approximately 2.7 km to the west of Dale Roads (site 7) in 2017. Also, within the vicinity of Dale, in the Gann Estuary, there is a small coastal lagoon (Pickleridge Lagoon; see Figure 7.2). Coastal lagoons are an Annex I priority habitat feature of the Pembrokeshire Marine SAC, with the only two other occurrences of this habitat occurring within the Carew River and inland at Westfield Pill (NRW, 2018a). Pickleridge Lagoon sediments consist of mud, gravel, shingle and poorly sorted sand mosaic. Pickleridge Lagoon has a typically estuarine/marine sandy substratum fauna at the south western end and sparse fauna at north east end. The lagoon cockle, *Cerastoderma glaucum* is present and there is fringing saltmarsh (see paragraph 7.7.4.7).
- 7.7.2.6 Maerl beds are formed by slow-growing coralline algae and typically occur either on the open coast or in tide-swept channels of marine inlets. Maerl forms a unique habitat that supports a diverse assemblage of infauna and epifaunal species. A well-established maerl bed has been mapped between the Warrior Way (site 6) and Dale Roads (site 7) sites, in the vicinity of Littlewick Bay to Stack Rock (see Figure 7.3). This is the only known living maerl bed in Wales. Maerl is listed as a UK Biodiversity Action Plan (BAP) priority habitat and is protected as a priority habitat under Section 7 of the Environment (Wales) Act 2016.
- 7.7.2.7 Extensive areas of sublittoral rocky reefs, which qualify as the Annex I 'reef' habitat feature of the Pembrokeshire Marine SAC stretch offshore from the west Pembrokeshire coast and around the islands and many small rocky islets (NRW, 2018a). This is also reflected in the EuSeaMap (2016) data which predicts high energy circalittoral rock extending out from the mouth of the Waterway. West Dale Bay and the south-eastern coast of Freshwater West predominantly comprise reef habitat (see Figure 7.2). Subtidal reef habitat is typically characterised by algae and bivalves; for example, the biotope red seaweeds and kelps on tide-swept mobile infralittoral cobbles and pebbles (SS.SMp.KSwSS.LsacR.CbPb) has been recorded at reef habitat near the Cleddau bridge. The Skomer MCZ has the best studied reef habitat within the benthic subtidal and intertidal ecology study area. The steep subtidal walls off the north coast of Skomer are covered with soft corals including *Alcyonium digitatum* and *A. glomeratum*, pink sea-fans *Eunicella verrucosa* (a biodiversity action plan species), and turfs of seamats, hydroids, sponges and anemones. On the south side of Skomer Island, large silted boulders and rock plateaux display rich sponge communities and the nationally scarce scarlet and gold star coral *Balanophyllia regia*.
- 7.7.2.8 Seacaves are also widely distributed throughout the Pembrokeshire Marine SAC and qualify as the Annex I habitat '*Submerged or partially submerged sea caves*'. Sea caves are predominantly a feature of exposed coasts, and within the benthic subtidal and intertidal ecology study area, seacaves are concentrated around Skomer Island and around the mouth of the Waterway, including the coast to the north of the East Pickard Bay site (site 8) (see Figure 7.2). Some of the Welsh sea caves are used as pupping sites by grey seals *Halichoerus grypus* (see chapter 9: Marine Mammals). Very little is known about the benthic species colonising sea caves, but populations will include those tolerant of scour, of extreme wave surge and cryptic, apparent cave specialist species, including the rare snail *Palludinea littorina* (NRW, 2018a).
- 7.7.2.9 The circalittoral rock that extends from the mouth of the Waterway, as described above, grades into circalittoral coarse sediments with increasing distance from the shore (EUSeaMap, 2016). Offshore of the East Pickard Bay site (site 8) an area of this coarse sediment corresponds with an area of identified Annex I habitat 'sandbanks which are slightly covered by seawater all the time' which is a feature of the Pembrokeshire Marine SAC (see Figure 7.2). As outlined in the NRW Regulation 37 advice for the site (NRW, 2018a), the sandbank features of the Pembrokeshire Marine SAC are of sub-types gravelly and clean sands, and muddy sands. Within the benthic subtidal and intertidal ecology study area there are also sandbanks in the vicinity of Skokholm (The Knoll) as shown in Figure 7.2.

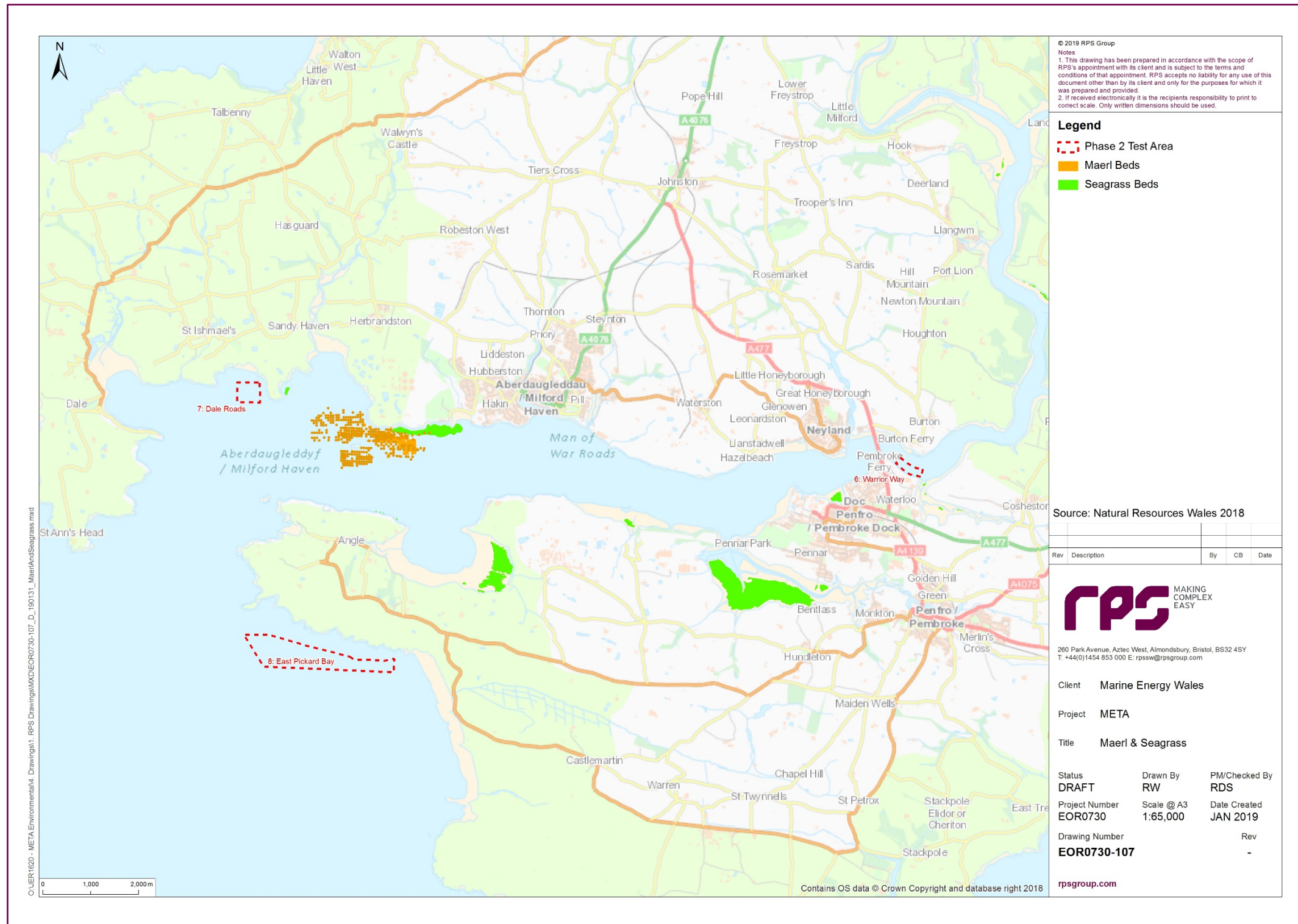


Figure 7.3: Distribution of maerl and seagrass beds in the Waterway.

### Warrior Way (site 6)

- 7.7.2.10 A preliminary review of the SEACAMS multibeam backscatter data for Warrior Way (site 6), as presented in Appendix 7.1: Benthic Ecology, indicates soft sediments are likely to be present across the entire site with no indication of any area of potential hard substrate which could correspond with reef habitat within the boundary of Warrior Way (site 6). As discussed in paragraph 7.6.3.2 and Table 7.13, this data will however be fully reviewed and interpreted by a suitably qualified and experienced marine ecologist / geophysicist post-consent/pre-deployment, to identify any areas of potential reef features or sensitive habitat features that may be present. In the event that acoustic signatures synonymous with potential reef presence for example, are identified from the geophysical data, it is proposed that these would be subject to further ground-truthing via a pre-deployment survey by Developers, the exact format of which would be agreed with NRW at the time. The pre-deployment survey, if required, would however likely utilise remote sampling techniques (e.g. drop down video) to establish the presence or absence of any reef or other sensitive habitat features, and where present to determine their extent. These surveys will ensure that measures can be designed, if necessary, (e.g. micrositing of moorings etc.) to avoid direct impacts to sensitive habitats such as reefs and seagrass at these sites.
- 7.7.2.11 EUSeaMap (2016) data predict low energy infralittoral seabed sediments coinciding with Warrior Way (site 6). With respect to the SPI survey data discussed in paragraph 7.7.2.1, three SPI sample locations (439, 440 and 745; Germano and Associates, 2013) coincide with Warrior Way (site 6). These samples identify the sediments within Warrior Way (site 6) as the “*Channel Mixed Physical*” sediment facies with a surface grain size of gravelly mud and gravel according to the Folk Classification (Germano and Associates, 2013).
- 7.7.2.12 As shown in Figure 7.4, Warrior Way (site 6) coincides with the Annex I habitats ‘estuaries’ and ‘large shallow inlets and bay’, which are both primary reasons for the designation of the Pembrokeshire Marine SAC. Data available on EMODnet which was generated as part of the MESH project from sample points collected and analysed by the MNCR surveys indicate that the coarse sands in this area are characterised by the ‘*Hesionura elongata* and *Protodorvillea kefersteini* in offshore coarse sand’ biotope (SS.SCS.OCS.HeloPkef).
- 7.7.2.13 The landward extent of the Warrior Way (site 6) boundary is adjacent to the mapped extent of the Annex I ‘reef’ habitat feature within the Pembrokeshire Marine SAC, as shown on the Wales Marine Planning Portal interactive map; the site does not, however, overlap with the mapped extent of reef habitat in this area (see Figure 7.4). This is also consistent with the SEACAMS multibeam backscatter data for Warrior Way (site 6), as presented in Appendix 7.1: Benthic Ecology, which indicates potential areas of hard substrate adjacent to the landward boundary of the site. Sample point data available on EMODnet indicate that the communities associated with the areas of rocky reef as representative of the ‘cushion sponges, hydroids and ascidians on turbid tide-swept sheltered circalittoral rock’ biotope (CR.MCR.CFaVS.CuSpH).

### Dale Roads (site 7)

- 7.7.2.14 A preliminary review of the SEACAMS multibeam backscatter data for Dale Roads (site 7), as presented in Appendix 7.1: Benthic Ecology, indicates soft sediments, potentially comprising rippled sands, are likely to be present across the majority of the site with the potential for an area of possible harder substrate in the south west corner of the site. As discussed in paragraph 7.7.2.10 and Table 7.13, this data will however be fully reviewed and interpreted by a suitably qualified and experienced marine ecologist / geophysicist post-consent/pre-deployment, to identify any areas of potential reef features or sensitive habitat features that may be present. In the event that acoustic signatures synonymous with potential reef presence for example, are identified from the geophysical data, it is proposed that these would be subject to further ground-truthing via a pre-deployment survey by Developers, the exact format of which would be agreed with NRW at the time.
- 7.7.2.15 EUSeaMap (2016) data predict largely high energy infralittoral seabed sediments coinciding with Dale Roads (site 7) with some areas of Atlantic and Mediterranean high energy infralittoral rock. With respect to the SPI survey data, four SPI sample locations (85, 98, 99 and 816; Germano and Associates, 2013) coincide with Dale Roads (site 7). The data from these samples identify the sediments within this site as a combination of the ‘*Central Mixed Physical*’, ‘*Central Sand Physical*’ and ‘*Marginal Physical*’ habitats corresponding to the ‘Poorly sorted muddy sand, shells, pebbles’, ‘wave rippled sand’ and ‘mixed rounded talus, sand mud’ facies, respectively. The surface grain size classification, according to the Folk Classification, at these sites within Dale Roads (site 7) was predominately gravelly mud, with one sample corresponding to sand (Germano and Associates, 2013).
- 7.7.2.16 Similar to Warrior Way (site 6), Dale Roads (site 7) overlaps with the mapped distribution of the following Annex I habitat features of the Pembrokeshire Marine SAC: ‘estuaries’ and ‘large shallow inlets and bays’ (see Figure 7.4). NRW data shown on the Wales Marine Planning Portal interactive map also indicates that the site map overlaps with the possible occurrence of Annex I ‘reef’ habitat (see Figure 7.4) although there is poor confidence in this data. This may however, be consistent with the multibeam backscatter data for the site as discussed in paragraph 7.7.2.14 which indicates an area of coarser/harder substrate in the south west corner of the site. JNCC data available on EMODnet indicate that communities in the vicinity of Dale Roads (site 7) are characterised by the ‘*Abra alba* and *Nucula nitidosa* in circalittoral muddy sand or slightly mixed sediment’ biotope (SS.SSa.CMuSa.AalbNuc).

### East Pickard Bay (site 8)

- 7.7.2.17 A preliminary review of the SEACAMS multibeam backscatter data for East Pickard Bay (site 8), as presented in Appendix 7.1: Benthic Ecology, indicates predominantly soft sandy sediments are likely to be present across the entire site. EUSeaMap (2016) data predict Atlantic and Mediterranean high energy circalittoral rock in the nearshore area to the north of the East Pickard Bay (site 8) boundary which overlaps with the mapped distribution of the Annex I 'reef' habitat feature of the Pembrokeshire Marine SAC in this area. This is also consistent with the multibeam backscatter data. The NRW data layer also predicts that this sediment type extends offshore coinciding with the mapped extent of 'possible' Annex I reef habitat (see Figure 7.4) although this is not reflected in the multibeam backscatter data shown in Appendix 7.1: Benthic Ecology which, as outlined above, points towards soft sediments across the site.
- 7.7.2.18 Data available on EMODnet which was generated as part of the MESH project from sample points collected and analysed by the MNCR surveys indicate that biotopes in the area may include the 'Foliose red seaweeds on exposed lower infralittoral rock' biotope (IR.HIR.KFaR.FoR), *Laminaria hyperborea* park and foliose red seaweeds on moderately exposed lower infralittoral rock (IR.MIR.KR.Lhyp.Pk) biotope and the 'Bryozoan turf and erect sponges on tide-swept circalittoral rock' (CR.HCR.XFa.ByErSp) biotope.
- 7.7.2.19 The Seasearch diver surveys undertaken in 2018 at Pickard Point recorded a dominance of dense short bryozoan turfs with both *Scrupocellaria* spp and abundant *Crisia* spp. on the vertical faces of old red sandstone bedrock outcrops. Large patches of encrusting sponges with occasional erect sponges and cushion sponges including yellow staghorn sponge, *Axinella dissimilis* and mash potato sponge *Thyrosia gurnei* were also recorded (Bullimore pers. comm. 2019). In the gullies between the ridges, boulders and coarse sand and pebbles were recorded, sometimes devoid of marine life and in other places characterised by ascidian turf and in particular teapot seaquirt *Polycarpa scuba* and *Mogula* sp. The Devonshire cup coral *Caryophyllia smithii* was prolific and the cup coral barnacle *Adna anglica* and ginger tiny anemone *Isozoanthus sulcatus* were found on silty ledges in high abundances. The horizontal surfaces varied, some were heavily encrusted with similar life to the vertical rocks and occasional red algae, whilst other areas were heavily silted and very little life present.
- 7.7.2.20 The 2018 Seasearch dive surveys south east of Sheep Island recorded red algae meadows on the upward facing bedrock interspersed with bryozoans, occasional boring sponge *Cliona celata*, common urchin *Echinus esculentus* and bloody Henry *Henricia oculata*. The vertical steep faces were densely packed with bryozoan turf and erect sponges, as described above for Pickard Point and the bryozoan *Pentapora foliacea* (Bullimore pers. comm. 2019).

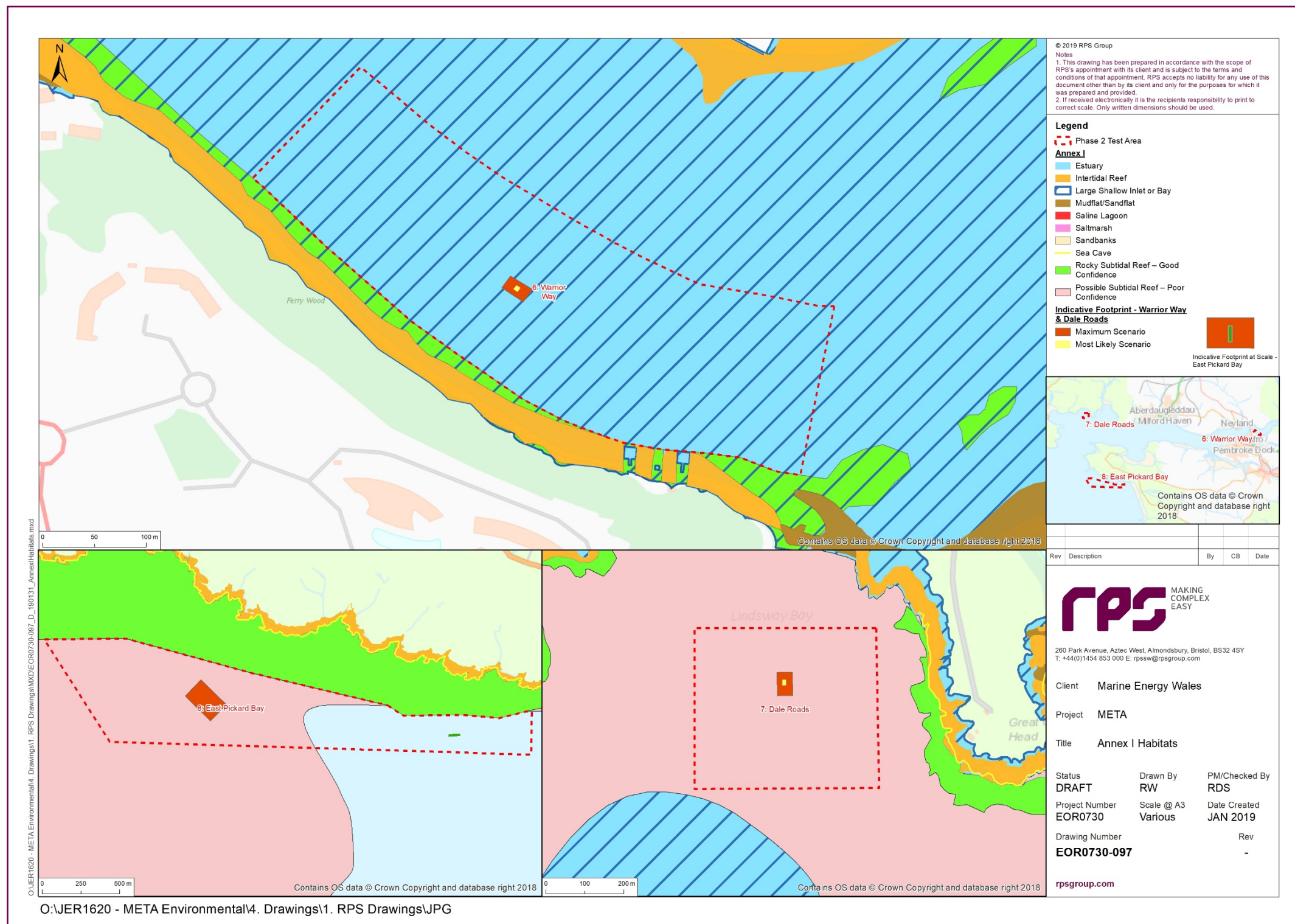


Figure 7.4: Annex I habitats of the Pembrokeshire Marine SAC overlapping within each of the META sites.

7.7.2.21 The majority of the seabed within East Pickard Bay (site 8) is predicted to correspond with Circalittoral coarse sediment. Data available on EMODnet which was generated as part of the MESH project from sample points collected and analysed by the MNCR surveys indicate that the coarse sands in this area are characterised by the *Nephtys cirrosa* and *Bathyporeia* spp. in infralittoral sand' biotope (SS.SSa.IFiSa.NcirBat) and the 'Fabulina fabula and Magelona mirabilis with venerid bivalves and amphipods in infralittoral compacted fine muddy sand' biotope (SS.SSa.IMuSa.FfabMag). This correlates with the observations from baited drop-down video surveys undertaken at East Pickard Bay (site 8) by SEACAMS in 2018 to identify fish species in the area (which are described in full in chapter 8: Fish and Shellfish), which confirms the presence of sediments rather than rocky reef within the site. The site itself does not overlap with any Annex I habitat features of the Pembrokeshire.

### 7.7.3 Sediment contamination

7.7.3.1 The Waterway has been a major oil port since 1960 with up to four refineries, associated jetties and pipelines, and one of the largest UK terminals for crude oil, diesel, gasoline, and jet fuel (Little *et al.*, 2016). Although only one refinery is now in operation (Valero), over the last decade two new liquefied natural gas plants (Dragon LNG and South Hook LNG) and a large combined cycle gas-turbine power plant (RWE npower) have been built. The largest oil spill in the Waterway occurred after the grounding of the 'Sea Empress' in 1996 when 72,000 tonnes (t) of crude oil and 480 t of heavy fuel oil were released. More recently, a leak from the Valero jetty was estimated to have released 10,000 litres of oil into the Waterway. Hydrocarbon concentrations were generally at their highest during World War II, in the period between the 1960s and peak oil throughput in 1974, as the oil refineries developed but before modern effluent treatment standards were applied, and following the Sea Empress spill (Little, 2017). Therefore, the benthic communities of the Waterway have been exposed to historical sources of contamination for many decades.

7.7.3.2 Sediment contaminants have been monitored in the Waterway since 1978, however, due to differing methods the results have not always been comparable between years. A review by Little (2017) demonstrated a low to higher THC concentrations from the lower Waterway to the inner estuary and central tributaries. Another review by Little *et al.* (2016) of data collected in the Waterway between 2007 and 2012 demonstrated that concentrations of polyaromatic hydrocarbons (PAHs) and other contaminants (e.g. metals) were generally elevated throughout the Waterway in 2007 after contaminated sediments were disturbed by construction and dredging operations, which had peaked in 2006. Many of the PAHs exceeded sediment quality guidelines (SQGs; e.g. Threshold Effect Levels (TEs) and Probable Effect Levels (PELs)) in 2007 which Little *et al.* (2016) concluded was likely to have had biological effects. Since then, from 2007 to 2010 most of the sediment contaminant concentrations have generally decreased by dilution (and depuration) and have reduced to below SQG levels. Concentrations have increased between 2010 and 2012 only when sediment has continued to be disturbed and where sediment transport pathways lead to depositional sinks (Little *et al.*, 2016).

7.7.3.3 Bioaccumulation studies undertaken for the MHWESG have also demonstrated a gradient in metal bioaccumulation, increasing upstream in the Waterway, with sites near the mouth being more similar to reference sites (Langston *et al.*, 2012). For the majority of metals and species combinations, concentrations in the Waterway biota were at the lower-middle part of the UK range. It is therefore likely that the sediments present in the Warrior Way site (site 6) are likely to have a higher level of contamination than the Dale Roads (site 7) and East Pickard Bay (site 8) sites.

### 7.7.4 Intertidal benthic ecology

7.7.4.1 There are a variety of intertidal habitats present within the Waterway with intertidal mudflat habitats dominating, particularly within the innermost reaches of the Waterway and along the southern boundary (see Figure 7.5). These habitats are representative of the Annex I habitat 'Mudflats and sandflats not covered by seawater at low tide' which is a qualifying feature of the Pembrokeshire Marine SAC (see Figure 7.2). Shores dominated by rocky substrate characterised by furoid seaweeds have a greater predominance along the northern shores of the Waterway (see Figure 7.5).

7.7.4.2 Data hosted by EMODnet for the Phase 1 intertidal surveys undertaken by CCW between 1996 and 2006 (NRW, 2019) indicate that the intertidal communities associated with the mudflats in the Waterway are typically characterised by the EUNIS 'Hediste diversicolor and Streblospio shrubsolii in littoral sandy mud' habitat (LMU.MU.HedStr). Further up the shore, the mudflats are often backed by mosaics of shingle and sand or rocky substrate typically characterised by the seaweeds such as *Fucus serratus* and *Ascophyllum nodosum*. The intertidal mudflats within the Pembroke River are predominantly characterised by the LMU.MU.HedStr habitat on the fringes and either sides of the channel, and *Z. noltii* beds in upper to mid shore muddy sand.

7.7.4.3 Other habitats including within the mid to inner Waterway, including those on the north shore, are typically moderately or low exposed rocky shores within the upper littoral zone. Dominant fauna in these areas include furoid seaweeds, the acorn barnacles *Semibalanus balanoides* and *Austrominius modestus*. The rock substrate on the more exposed shores bear the mouth of the Waterway, such as those around Dale Point, are characterised by lichens in the upper shore and barnacles and limpets mid to low shore (Moore, 1997). Much of the intertidal zone is classified as Annex I 'reef' habitat.

7.7.4.4 Unsworth *et al.* (2017) outline that the available data for the Waterway show that seagrass covers a total area of 181 ha within the Waterway, with the majority comprising intertidal *Z. noltii* meadows, the largest of which occurs in Pembroke River and covering an area of 97 ha. Another large meadow of *Z. noltii* is present in Angle Bay. Other small patches of intertidal *Z. noltii* have been recorded at Hobbs Point in 2014 (3.49 ha) and in Cosheston Pill in 2016 (0.69 ha; Unsworth *et al.*, 2017). The distribution of seagrass within the Waterway is shown in Figure 7.3.

7.7.4.5 Atlantic salt-meadow habitat, representative of the Annex I habitat ‘*Atlantic salt-meadow (Glaucopuccinellietalia maritimae)*’ which is a qualifying feature of the Pembrokeshire Marine SAC occurs together with lower saltmarsh and adjacent transitional / freshwater marsh throughout the Waterway (NRW, 2018a). Tributary estuaries and lagoons within the Waterway are characterised by extensive pioneer saltmarsh and Atlantic salt-meadows and the habitat is distributed discontinuously on upper shores throughout and flanking both sides of the central and lower reaches of the Waterway. Saltmarsh habitat extends into the large shallow bays of Dale, Angle Bay and Sandy Haven (see Figure 7.2).

#### **Warrior Way (site 6)**

7.7.4.6 The intertidal habitat in the vicinity of the Warrior Way site (see

7.7.4.7 Figure 7.6) comprises tide-swept rock, the lower reaches of which are characterised by the ‘*Laminaria digitata*, ascidians and bryozoans on tide-swept sublittoral fringe rock’ biotope (IR.MIR.KT.LdigT). The eulittoral zone is characterised by the ‘*Fucus serratus*, sponges and ascidians on tide-swept lower eulittoral rock’ biotope (LR.HLR.FT.FserT) and the ‘*Fucus spiralis* on full salinity sheltered upper eulittoral rock’ biotope (LR.LLR.F.Fspi.FS) with upper littoral fringe rock characterised by the lichen *Verrucaria maura* (NRW, 2019).

#### **Dale Roads (site 7)**

7.7.4.8 In the vicinity of Dale Roads (site 7), the intertidal is similarly rocky habitat with the sublittoral fringe communities as described above for Warrior Way (site 6) and a eulittoral zone characterised by barnacles *Chthamalus* spp (see

7.7.4.9 Figure 7.6). The littoral fringe rock is also similarly characterised by lichens. To the north of Dale Roads (site 7), the soft sandy sediment of Lindsay Bay is characterised by polychaetes (NRW, 2019).

#### **East Pickard Bay (Site 8)**

7.7.4.10 The intertidal habitat in the vicinity of East Pickard Bay (site 8) is characterised by steep rocky sandstone cliffs dropping down to exposed intertidal rocky shore. As identified in the NRW Phase 1 survey map (

7.7.4.11 Figure 7.6) and confirmed by a site visit commissioned by Bombora of the intertidal area to the north of East Pickard Bay (site 8; Gill Lock *pers. comm.*), mussel *Mytilus edulis* and/or barnacle dominated communities characterise the mid shore typical of the ‘*Semibalanus balanoides* on exposed to moderately exposed or vertical sheltered eulittoral rock’ (LR.HLR.MusB.Sem) biotope. In the upper shore, yellow and grey lichens dominate on supralittoral rock (NRW, 2019).

7.7.4.12 At low water, the intertidal habitats are characterised by communities of ‘*Laminaria digitata* on the moderately exposed sublittoral fringe bedrock’ biotope in the sublittoral fringes (MIR.KR.Ldig.Ldig) (see

7.7.4.13 Figure 7.6) and the biotope ‘*Saccorhiza polyschides* and other opportunistic kelps on disturbed sublittoral fringe rock’ (MIR.SEDK.Sac).

7.7.4.14 Species noted during the site visit commissioned by Bombora of their potential marine cable landfall to the north of East Pickard Bay (site 8) included *Osmundea pinnatifida*, *Lomentaria articulata*, *Palmaria palmata*, *Gigartina stellata*, *Chondrus crispus*, articulated coralline algae and *Ceramium rubrum* (Gill Lock *pers. comm.*). Within rockpools and on the sides of rocks or under overhangs were snakelock anemone *Anemonia sulcata*, breadcrumb sponge *Halichondria panicea*, edible crab *Cancer pagurus*, limpets *Patella vulgata*, dog whelks *Nucellus lapillus*, and flat top shell *Gibbula umbilicalis*. With progression further up the shore *littorina* species, the beadlet anemone and young fucoids were also observed (Gill Lock *pers. comm.*).

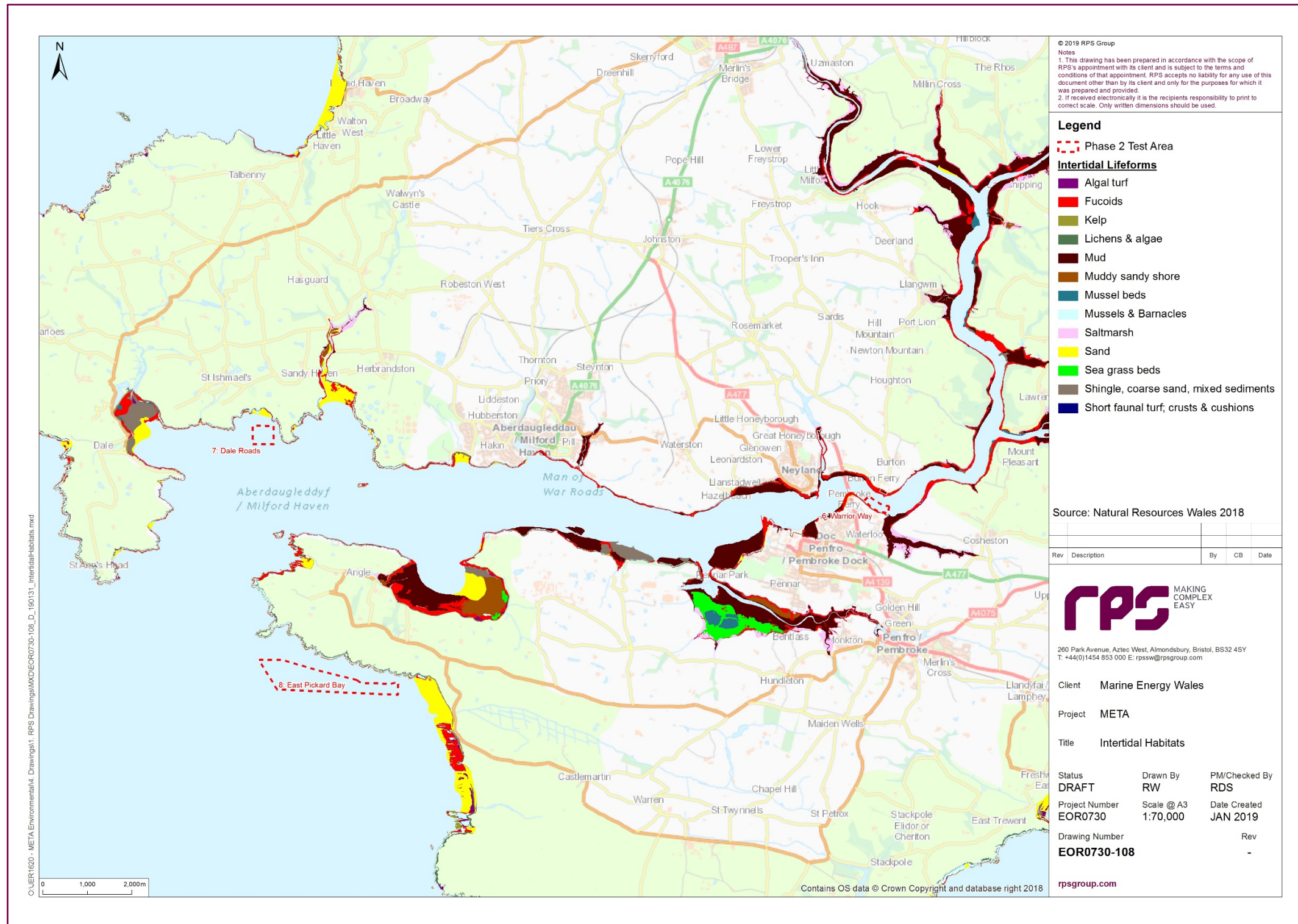


Figure 7.5: Intertidal habitats within the benthic subtidal and intertidal ecology study area, as mapped by NRW.

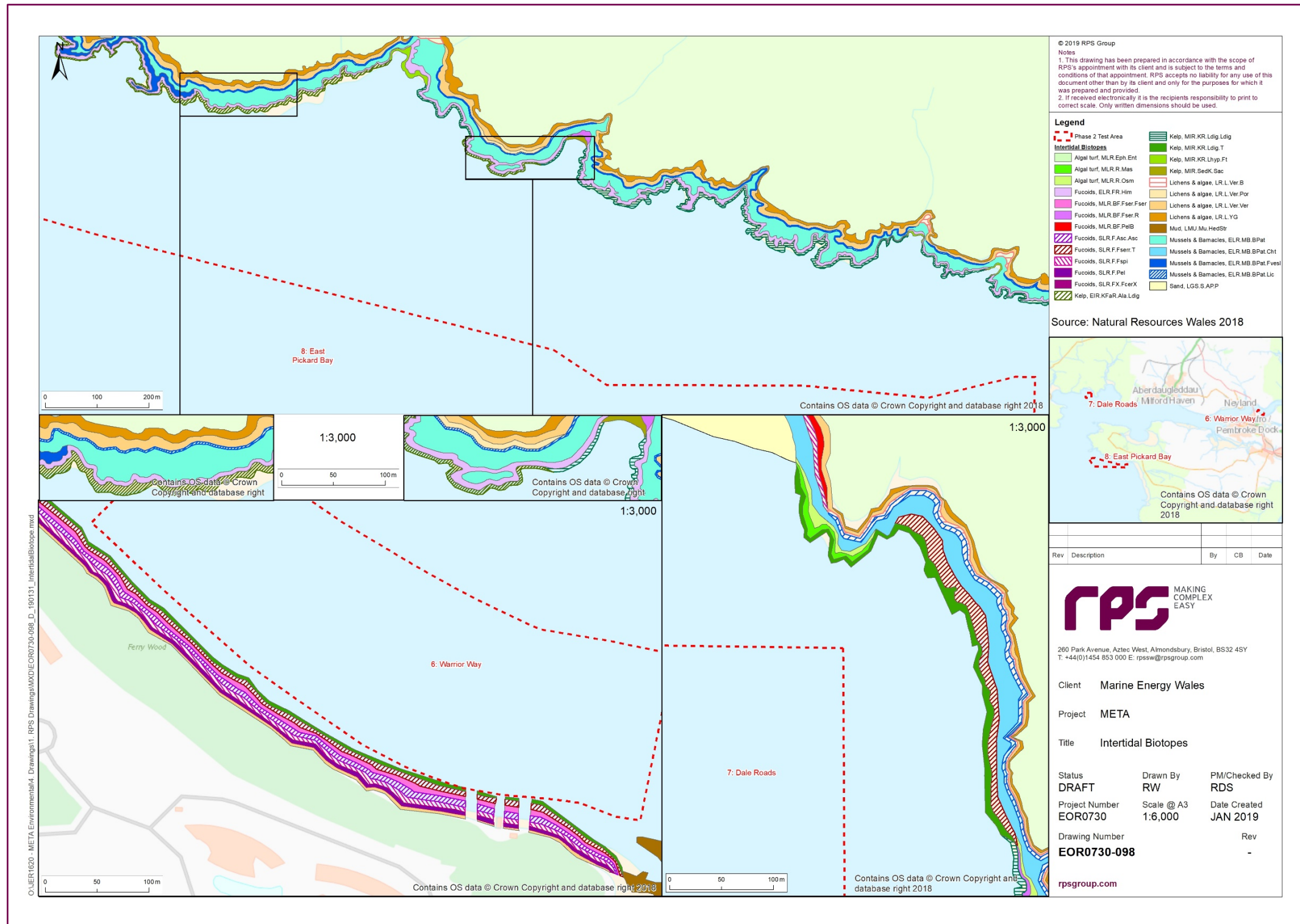


Figure 7.6: Intertidal biotopes within the benthic subtidal and intertidal ecology study area, as mapped by NRW.

## 7.7.5 Designated sites

7.7.5.1 Designated sites, which have relevant benthic notified interest features, identified for the META project benthic subtidal and intertidal ecology chapter are described in Table 7.5 below. The META Habitat Regulations Assessment (HRA) Screening Report details how Natura 200 sites and features have been screened into the need for HRA (with the assessment on the site itself deferred to the META project RIAA).

Table 7.5: Designated sites and relevant qualifying interest features for the META project benthic subtidal and intertidal ecology chapter.

Designated Site	Closest Distance to META sites (km)			Relevant Qualifying Interest Feature
	Warrior Way	Dale Roads	East Pickard Bay	
Pembrokeshire Marine/ Sir Benfro Forol SAC	0	0	0	Annex I habitats: <ul style="list-style-type: none"> <li>• Estuaries;</li> <li>• Large shallow inlets and bays;</li> <li>• Reefs;</li> <li>• Sandbanks which are slightly covered by sea water all the time;</li> <li>• Mudflats and sandflats not covered by seawater at low tide;</li> <li>• Coastal lagoons (*Priority feature);</li> <li>• Atlantic salt meadows (<i>Glauco-Puccinellietalia maritima</i>); and</li> <li>• Submerged or partially submerged sea caves.</li> </ul>
Limestone Coast of South West Wales SAC/Arfordir Calchfaen de Orllewin Cymru	10	6.5	2	Annex I habitats: <ul style="list-style-type: none"> <li>• Submerged or partially submerged sea caves.</li> </ul>
Skomer MCZ	20.3	6.6	9.1	<ul style="list-style-type: none"> <li>• Infaunal sediment communities</li> <li>• Epifaunal mixed sediment communities</li> <li>• <i>Zostera marina</i> population</li> <li>• Sponge assemblages</li> <li>• Nudibranch species assemblages</li> <li>• <i>Pentapora foliacea</i> (ross coral) population</li> <li>• Lusitanian anthozoan populations (pink sea fan <i>Eunicella verrucosa</i>, red sea fingers <i>Alcyonium glomeratum</i>, yellow cluster anemone <i>Parazoanthus axinellae</i>, cup corals <i>Balanophyllia regia</i> and <i>Caryophyllia smithii</i>)</li> <li>• Rocky reef faunal communities</li> <li>• Algal communities associated with major sublittoral habitat</li> <li>• Littoral communities on bedrock shores</li> </ul>

Designated Site	Closest Distance to META sites (km)	Relevant Qualifying Interest Feature
		<ul style="list-style-type: none"> <li>• Littoral communities on boulder shores</li> <li>• Rock-pool communities</li> <li>• Nationally rare and scarce hydroid populations</li> <li>• <i>Echinus esculentus</i> population</li> <li>• Algal species of recognised importance</li> </ul>

## 7.7.6 Valued Ecological Receptors

7.7.6.1 An assessment of the ecological effects of a proposed development focusses on 'valued ecological receptors' (VERs) (CIEEM, 2016; 2018). These are species and habitats that are valued in some way and could be affected by a proposed development; other valued ecological features may occur on or in the vicinity of the site of a proposed development but do not need to be considered because there is no potential for them to be affected significantly.

7.7.6.2 The value of ecological features is dependent upon their biodiversity, social, and economic value within a geographic framework of appropriate reference (CIEEM, 2016). The most straightforward context for assessing ecological value is to identify those species and habitats that have a specific biodiversity importance recognised through international or national legislation or through local, regional or national conservation plans (e.g. Annex I habitats under the Habitats Directive, Oslo-Paris Commission (OSPAR), BAP habitats and species, priority habitats and species under Section 7 of the Environment (Wales) Act 2016 and habitats/species listed as features of MCZs). However, only a very small proportion of marine habitats and species are afforded protection under the existing legislative or policy framework and therefore evaluation must also assess value according to the functional role of the habitat or species. For example, some features may not have a specific conservation value in themselves but may be functionally linked to a feature of high conservation value. Table 7.6 shows the criteria applied to determining the ecological value of VERs for the META project.

Table 7.6: Valued Ecological Receptors categorisation for benthic subtidal and intertidal ecology.

Value of VER	Criteria to define value
Very high	<ul style="list-style-type: none"> <li>• Internationally designated sites.</li> <li>• Habitats and species protected under international law (i.e. Annex I habitats within an SAC boundary).</li> </ul>
High	<ul style="list-style-type: none"> <li>• Nationally designated sites.</li> <li>• Species protected under national law.</li> <li>• Annex I habitats not within an SAC boundary.</li> <li>• Nationally important populations of a species (particularly within the context of habitats/species that may be rare or threatened within the UK<sup>a</sup>) that occur within the benthic subtidal and intertidal 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; MCZ features (species classified as features of conservation importance and broad scale habitats) or priority habitats and species under Section 7 of the Environment (Wales) Act 2016.</li> </ul>

Value of VER	Criteria to define value
	<ul style="list-style-type: none"> <li>Habitats and species that are features of MCZs (i.e. broad-scale habitats and Features of Conservation Importance (FOCI)).</li> </ul>
Medium	<ul style="list-style-type: none"> <li>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 benthic subtidal and intertidal ecology 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, MCZ features (species classified as features of conservation importance and broad scale habitats) or priority habitats and species under Section 7 of the Environment (Wales) Act 2016.</li> <li>Habitats or species that provide important prey items for other species of conservation or commercial value.</li> </ul>
Low	<ul style="list-style-type: none"> <li>Habitats and species which are not protected under conservation legislation which form a key component of the benthic assemblages within the benthic subtidal and intertidal ecology study area.</li> </ul>

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

7.7.6.3 Based on the EIA baseline characterisation described in section 7.7, the habitats and species present within the benthic subtidal and intertidal ecology study area have been grouped in 13 broad habitat/community types as presented in Table 7.7. These VERs have been used to assess impacts associated with the installation, operation and maintenance and decommissioning of the META project on benthic subtidal and intertidal ecology within the benthic subtidal and intertidal ecology study area.

Table 7.7: Benthic subtidal and intertidal ecology VERs in the benthic subtidal and intertidal ecology study area.

Benthic subtidal and intertidal ecology VERs	Representative habitats/biotopes/species	Value within the study area	Justification
<b>Intertidal VERs</b>			
Annex I habitat 'Mudflats and sandflats not covered by seawater at low tide'	<ul style="list-style-type: none"> <li>LMU.MU.HedStr</li> <li>LS.LMS.ZOS.Znol</li> </ul>	Very high	Annex I habitat protected under international legislation and designated feature of the Pembrokeshire Marine SAC. OSPAR threatened and/or declining habitat. UK BAP Priority habitat. Includes features of the Milford Haven Waterway SSSI. Priority habitat under Section 7 of the Environment (Wales) Act 2016.
Annex I intertidal 'Reefs' habitat	<ul style="list-style-type: none"> <li>IR.MIR.KT.LdigT</li> <li>MIR.KR.Ldig.Ldig</li> <li>LR.HLR.FT.FserT</li> <li>LR.LLR.F.Fspi.FS</li> <li>Intertidal underboulder communities</li> </ul>	Very high	Annex I habitat protected under international legislation and designated feature of the Pembrokeshire Marine SAC. Component feature are features of Skomer MCZ. UK BAP Priority habitat. Includes features of the Milford Haven Waterway SSSI. Priority habitat under Section 7 of the Environment (Wales) Act 2016.
Intertidal seagrass	<ul style="list-style-type: none"> <li><i>Z. noltii</i> (intertidal distribution)</li> </ul>	High	Nationally important population of an OSPAR threatened or declining habitat. UK BAP Priority habitat. Feature of the Milford Haven Waterway SSSI. Priority habitat under Section 7 of the Environment (Wales) Act 2016.
Annex I habitat 'Atlantic salt-meadow ( <i>Glauco-Puccinellietalia maritima</i> )'	<ul style="list-style-type: none"> <li><i>Salicornia</i> spp.</li> <li><i>Glauco-Puccinellietalia maritima</i></li> </ul>	Very high	Annex I habitat protected under international legislation and designated feature of the Pembrokeshire Marine SAC. UK BAP Priority habitat. Features of the Milford Haven Waterway SSSI. Priority habitat under Section 7 of the Environment (Wales) Act 2016.
<b>Subtidal VERs</b>			
Annex I subtidal 'Reef' habitat	<ul style="list-style-type: none"> <li>SS.SMp.KSwSS.LsacR.CbPb</li> <li>Estuarine rocky habitats</li> <li>Fragile sponge and anthozoan communities on subtidal rocky habitats</li> <li>Subtidal mixed muddy sediments</li> <li>Tide swept channels</li> </ul>	Very high	Annex I habitat protected under international legislation and designated feature of the Pembrokeshire Marine SAC. Component feature are features of Skomer MCZ. UK BAP Priority habitat. Priority habitat under Section 7 of the Environment (Wales) Act 2016.
Annex I 'Estuaries'	<ul style="list-style-type: none"> <li>Estuarine rocky habitats</li> <li>Intertidal mudflats</li> <li>Intertidal underboulder communities</li> <li>Maerl</li> <li>Seagrass beds</li> <li>Sheltered muddy gravels</li> <li>Subtidal mixed muddy sediments</li> <li>Tide swept channels</li> </ul>	Very high	Annex I habitat protected under international legislation and designated feature of the Pembrokeshire Marine SAC. Estuaries are a feature of the Milford Haven Waterway SSSI.
Annex I 'Large shallow inlets'	<ul style="list-style-type: none"> <li>Estuarine rocky habitats</li> <li>Fragile sponge and anthozoan communities on subtidal rocky habitats</li> <li>Intertidal mudflats</li> </ul>	Very high	Large shallow inlets and bays are included as an Annex I habitat in the Habitats Directive and form a primary feature of Pembrokeshire Marine SAC.

Benthic subtidal and intertidal ecology VERs	Representative habitats/biotopes/species	Value within the study area	Justification
	<ul style="list-style-type: none"> <li>Intertidal underboulder communities</li> <li>Maerl</li> <li>Seagrass beds</li> <li>Subtidal mixed muddy sediments</li> <li>Tide swept channels</li> </ul>		
Subtidal seagrass	<ul style="list-style-type: none"> <li><i>Z. marina</i> (subtidal distribution)</li> </ul>	High	Nationally important population of an OSPAR threatened or declining habitat. Feature of Skomer MCZ. UK BAP Priority habitat. Priority habitat under Section 7 of the Environment (Wales) Act 2016.
Maerl beds	<ul style="list-style-type: none"> <li><i>Phymatolithon calcareum</i></li> </ul>	High	Nationally important population of an OSPAR threatened or declining habitat. UK BAP Priority habitat. Priority habitat under Section 7 of the Environment (Wales) Act 2016.
Annex I 'Sandbanks which are slightly covered by sea water all the time' habitat	<ul style="list-style-type: none"> <li>Gravelly and clean sands</li> <li>Muddy sands</li> </ul>	Very high	Annex I habitat protected under international legislation and designated feature of the Pembrokeshire Marine SAC. UK BAP Priority habitat. Priority habitat under Section 7 of the Environment (Wales) Act 2016.
Circalittoral coarse sediment		Medium	UK BAP Priority habitat. Priority habitat under Section 7 of the Environment (Wales) Act 2016.
Coastal lagoons		Very high	Annex I priority habitat protected under international legislation and designated feature of the Pembrokeshire Marine SAC. UK BAP Priority habitat. Feature of the Milford Haven Waterway SSSI. Priority habitat under Section 7 of the Environment (Wales) Act 2016.
Submerged or partially submerged sea caves.		Very high	Annex I habitat protected under international legislation and designated feature of the Pembrokeshire Marine SAC and Limestone Coast of South West Wales SAC.

### 7.7.7 Future baseline scenario

7.7.7.1 The (Marine Works (EIA) Regulations 2007 (as amended)) requires that “a description of the relevant aspects of the current state of the environment (baseline scenario), and an outline of the likely evolution thereof without implementation of the project, as far as natural changes from the baseline scenario can be assessed with reasonable effort on the basis of the availability of environmental information and scientific knowledge” is included within the Environmental Statement.

7.7.7.2 In the event that the META project does not come forward, an assessment of the future baseline conditions has been carried out and is described within this section. Variability and long-term changes on physical influences may bring direct and indirect changes to benthic habitats and communities in the mid to long-term future (UK Offshore Energy Strategic Environmental Assessment 3 (OESEA3), 2016). A strong base of evidence indicates that long-term changes in the benthic ecology may be related to long-term changes in the climate or in nutrients (OESEA3, 2016), with climatic process driving shifts in abundances and species composition of benthic communities (Marine Climate Change Impacts Partnership (MCCIP), 2015). Studies of the benthic ecology over the last three decades have shown that biomass has increased by at least 250 to 400%; opportunistic and short-lived species have increased; and long-living sessile animals have decreased (Krönke, 1995; Krönke, 2011). Modelling sea surface temperature in relation to climate change in the UK has shown that the rate of temperature increase over the previous 50 years has been greater in waters off the east coast of the UK compared to the west and this is predicted to continue for the next 50 years (MCCIP, 2013). As such, the baseline in the META benthic subtidal and intertidal study area described in section 7.3 can only be considered as a 'snapshot' of the present benthic ecosystem within a gradual yet continuously changing environment. Any changes that may occur during the lifetime of the META project should be considered in the context of both greater variability and sustained trends occurring on national and international scales in the marine environment.

### 7.7.8 Data limitations

7.7.8.1 As discussed in paragraph 7.6.3.1, due to the availability of a number of suitable data sources for the Waterway and in the vicinity of the META sites, additional data collection through site-specific surveys were not undertaken to characterise the benthic subtidal and intertidal ecology baseline for the purposes of undertaking the EIA (see chapter 4: Environmental Assessment Methodology). The assessment presented within this chapter is therefore based on a baseline informed by desktop data only.

## 7.8 Key parameters for assessment

### 7.8.1 Maximum and most likely design scenario

7.8.1.1 The maximum design scenarios identified in Table 7.8 have been selected as those having the potential to result in the greatest effect on an identified receptor or receptor group. These scenarios have been selected from the details provided in the project description (chapter 2: Project Description). Effects of greater adverse significance are not predicted to arise should any other development scenario, based on details within the Project Design Envelope (e.g. different infrastructure layout), to that assessed here be taken forward in the final design scheme.

7.8.1.2 The most likely design scenarios identified in Table 7.8 have been selected as those having the potential to result in the most likely effect on an identified receptor or receptor group. These scenarios have been selected from the details provided in the project description (chapter 2: Project Description). Effects of greater adverse significance are outlined under the maximum design scenario.

7.8.1.3 The benthic subtidal and intertidal ecology assessment has been informed by the assessment presented within chapter 5: Coastal Processes and will, in turn, be used to inform the following assessments:

- Chapter 8: Fish and Shellfish Ecology;
- Chapter 9: Marine Mammals, Basking Shark and Otter; and
- Chapter 10: Marine Ornithology.

### 7.8.2 Impacts scoped out of the assessment

7.8.2.1 On the basis of the baseline environment and the project description outlined in chapter 2: Project Description, a number of impacts are proposed to be scoped out of the assessment for benthic subtidal and intertidal ecology. These impacts are outlined, together with a justification for scoping them out, in Table 7.9.

Table 7.8: Maximum and most likely design scenarios considered for the assessment of potential impacts on benthic subtidal and intertidal ecology.

Potential impact	Maximum design scenario	Most likely design scenario	Justification
Installation phase	<ul style="list-style-type: none"> <li>Testing scenarios: <ul style="list-style-type: none"> <li>Warrior Way and Dale Roads: one testing activity/device deployment at any one time;</li> <li>East Pickard Bay: two testing activities/device deployments at any one time; and</li> <li>Up to 150 installation events occurring intermittently over the 15-year lifetime of the META project, 50% of which may touch the seabed, comprising: <ul style="list-style-type: none"> <li>Warrior Way: up to four device deployments in a 12-month period (i.e. up to 60 deployments over the project lifetime), 50% of which may touch the seabed;</li> <li>Dale Roads: up to two device deployments in a 12-month period (i.e. up to 30 deployments over the project lifetime), 50% of which may touch the seabed; and</li> <li>East Pickard Bay: up to two device deployments in a 12-month period at each berth therefore up to four device deployments in a 12-month period (i.e. up to 60 deployments over the project lifetime), 50% of which may touch the seabed.</li> </ul> </li> </ul> </li> <li>Combined (Warrior Way + Dale Roads + East Pickard Bay) total subtidal temporary habitat disturbance at any one time of up to 124,679 m<sup>2</sup> comprising: <ul style="list-style-type: none"> <li>Up to 480 m<sup>2</sup> of temporary disturbance at Warrior Way per testing scenario broken down as follows: <ul style="list-style-type: none"> <li>Up to 330 m<sup>2</sup> from a 5 m buffer around device footprint (200 m<sup>2</sup>) for seabed clearance activities; and</li> <li>Up to 150 m<sup>2</sup> from a single mooring spread for deployment vessels.</li> </ul> </li> <li>Up to 713 m<sup>2</sup> of temporary disturbance at Dale Roads per testing scenario broken down as follows: <ul style="list-style-type: none"> <li>Up to 513 m<sup>2</sup> from a 5 m buffer around device footprint (600 m<sup>2</sup>) for seabed clearance activities; and</li> <li>Up to 200 m<sup>2</sup> from a single mooring spread for deployment vessels.</li> </ul> </li> <li>Up to 123,486 m<sup>2</sup> of temporary disturbance at East Pickard Bay per testing scenario broken down as follows: <ul style="list-style-type: none"> <li>Up to 3,485 m<sup>2</sup> from a 10 m buffer around device footprint (8,000 m<sup>2</sup>) for seabed clearance activities; and</li> <li>Up to 120,000 m<sup>2</sup> from mooring spread for deployment vessels for up to two test activities at any one time.</li> </ul> </li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>Testing scenarios: <ul style="list-style-type: none"> <li>Warrior Way, Dale Roads and East Pickard Bay: one testing activity/device deployment at any one time; and</li> <li>Up to 60 installation events occurring intermittently over the 15-year lifetime of the META project, comprising: <ul style="list-style-type: none"> <li>Warrior Way: up to two device deployments in a 12-month period (i.e. up to 30 deployments over the project lifetime), 50% of which may touch the seabed;</li> <li>Dale Roads: up to one device deployment in a 12-month period (i.e. up to 15 deployments over the project lifetime), 50% of which may touch the seabed; and</li> <li>East Pickard Bay: up to one device deployment in a 12-month period (i.e. up to 15 deployments over the project lifetime), 50% of which may touch the seabed.</li> </ul> </li> </ul> </li> <li>Combined (Warrior Way + Dale Roads + East Pickard Bay) total subtidal temporary habitat disturbance of up to 70,175 m<sup>2</sup> comprising: <ul style="list-style-type: none"> <li>Up to 75 m<sup>2</sup> of temporary disturbance at Warrior Way from a single mooring spread for deployment vessels at any one time;</li> <li>Up to 100 m<sup>2</sup> of temporary disturbance at Dale Roads from a single mooring spread for deployment vessels at any one time; and</li> <li>Up to 70,000 m<sup>2</sup> of temporary disturbance at East Pickard Bay from mooring spread for deployment vessels per test activity.</li> </ul> </li> </ul>	<p>These parameters are considered to represent the maximum and most likely design scenarios with respect to effects on benthic receptors from temporary habitat disturbance during installation.</p> <p><u>Maximum design scenario</u> The maximum design scenario assumes a circular footprint of the device on the seabed for the purposes of calculating the temporary habitat loss associated with the buffer area for seabed clearance activities. The area associated with the footprint of the device itself is considered as long-term habitat loss below (i.e. is not double counted as temporary habitat loss).</p> <p>Maximum design scenario assumes that vessels may need to moor during deployment activities at all META sites.</p> <p>Disturbance associated with the presence of pin piles and foundations on the seabed are assessed as long-term habitat loss during the operation and maintenance phase below.</p> <p><u>Most likely scenario</u> The most likely scenario assumes no seabed clearance is required, therefore temporary habitat disturbance may arise from mooring activities only.</p>
Temporary habitat disturbance due to installation activities, may affect benthic ecology.			
Temporary increases in suspended sediment concentrations (SSCs) and associated sediment	<ul style="list-style-type: none"> <li>As per installation activities outlined above for temporary habitat disturbance arising from gravity base installation.</li> </ul>	<ul style="list-style-type: none"> <li>As per installation activities outlined above for temporary habitat disturbance arising from gravity base installation.</li> </ul>	<p>These parameters are considered to represent the maximum and most likely design scenarios with respect to effects on benthic receptors associated with increased SSC and sediment deposition during installation.</p>

Potential impact	Maximum design scenario	Most likely design scenario	Justification
deposition due to installation activities, may affect benthic ecology.	<ul style="list-style-type: none"> <li>Drilling for pin pile installation as follows: <ul style="list-style-type: none"> <li>Dale Roads: up to four pin piles per device. Each pin pile up to 100 mm diameter installed to a depth of 10 to 20 m; and</li> <li>East Pickard Bay: up to four pin piles per device. Each pin pile up to 100 mm diameter installed to a depth of 10 to 20 m.</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>No drilling for pin pile installation.</li> </ul>	<p><u>Maximum design scenario</u> The maximum design scenario for increases in SSC and sediment deposition considers both seabed clearance works prior to gravity base installation and drilling to install pin piles.</p> <p><u>Most likely scenario</u> The most likely scenario assumes that drilling to install pin piles will not be required.</p>
Sediment disturbance leading to the potential for resuspension of contaminated sediments may affect benthic ecology.	<ul style="list-style-type: none"> <li>As per installation activities outlined above for temporary increases in SSC and sediment deposition.</li> </ul>	<ul style="list-style-type: none"> <li>As per installation activities outlined above for temporary increases in SSC and sediment deposition.</li> </ul>	As outlined above for temporary increases in SSC and sediment deposition.
Risk of installation activities facilitating the introduction of marine invasive non-native species (INNS).	<ul style="list-style-type: none"> <li>A total of up to 80 vessel movements/round trips to port, involving up to 15 vessels, associated with test deployments per year comprising: <ul style="list-style-type: none"> <li>Up to 20 vessel movements/round trips to port, involving up to five vessels, associated with test deployments at Warrior Way and Dale Roads; and</li> <li>Up to 40 vessel movements/round trips to port, involving up to five vessels, associated with test deployments at East Pickard Bay.</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>A total of up to 60 vessel movements/round trips to port, involving up to nine vessels, associated with test deployments per year comprising: <ul style="list-style-type: none"> <li>Up to 20 vessel movements/round trips to port, involving up to three vessels, associated with test deployments per year for each META test site.</li> </ul> </li> </ul>	These parameters are considered to represent the maximum and most likely design scenarios with respect to effects on benthic receptors associated with the introduction of INNS as a result of an increase in vessel movements during the installation phase.
Accidental release of pollutants (e.g. accidental spillage) during installation activities.	<ul style="list-style-type: none"> <li>As per installation activities outlined above for the risk of installation activities facilitating the introduction of marine INNS.</li> </ul>	<ul style="list-style-type: none"> <li>As per installation activities outlined above for the risk of installation activities facilitating the introduction of marine INNS.</li> </ul>	As outlined above for the introduction of marine INNS.
<b>Operation and maintenance phase</b>			
Habitat loss through presence of infrastructure on the seabed resulting in potential effects on benthic ecology.	<ul style="list-style-type: none"> <li>Testing scenarios: <ul style="list-style-type: none"> <li>Warrior Way and Dale Roads: one testing activity/device deployment at any one time;</li> <li>East Pickard Bay: two testing activities/device deployments at any one time; and</li> <li>150 deployments occurring over the 15-year lifetime of the META project, 50% of which may touch the seabed (breakdown of deployments/installation events is as per that outlined above for temporary habitat disturbance during installation).</li> </ul> </li> <li>Combined (Warrior Way + Dale Roads + East Pickard Bay) total subtidal habitat loss of up to 11,050 m<sup>2</sup> at any one time comprising: <ul style="list-style-type: none"> <li>Up to 200 m<sup>2</sup> of habitat loss at Warrior Way per testing scenario broken down as follows: <ul style="list-style-type: none"> <li>Up to 200 m<sup>2</sup> from device or component footprint on the seabed (including mooring/pin pile footprint).</li> </ul> </li> <li>Up to 600 m<sup>2</sup> of long-term habitat loss at Dale Roads per testing scenario broken down as follows: <ul style="list-style-type: none"> <li>Up to 600 m<sup>2</sup> from device or component footprint on the seabed (including mooring/pin pile footprint)</li> </ul> </li> <li>Up to 10,250 m<sup>2</sup> of habitat loss at East Pickard Bay broken down as follows:</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>Testing scenarios: <ul style="list-style-type: none"> <li>Warrior Way, Dale Roads and East Pickard Bay: one testing activity/device deployment at any one time; and</li> <li>60 installation events occurring over the 15-year lifetime of the META project, 50% of which may touch the seabed (breakdown of deployments/installation events is as per that outlined above for temporary habitat disturbance during installation).</li> </ul> </li> <li>Combined (Warrior Way + Dale Roads + East Pickard Bay) total subtidal habitat loss of up to 2,000 m<sup>2</sup> at any one time comprising: <ul style="list-style-type: none"> <li>Up to 100 m<sup>2</sup> of habitat loss at Warrior Way per testing scenario from device or component footprint on the seabed;</li> <li>Up to 200 m<sup>2</sup> of habitat loss at Dale Roads per testing scenario from device or component footprint on the seabed; and</li> <li>Up to 1,700 m<sup>2</sup> of habitat loss at East Pickard Bay per testing scenario from device or component footprint on the seabed.</li> </ul> </li> <li>Deployment durations: <ul style="list-style-type: none"> <li>Moored/gravity base deployment duration at Warrior Way: up to 3 months;</li> </ul> </li> </ul>	<p>These parameters are considered to represent the maximum and most likely design scenarios with respect to effects on benthic receptors from habitat loss during the operation and maintenance phase.</p> <p><u>Maximum design scenario</u> The maximum design scenario assumes that the footprint beneath the device/components on the seabed is considered as habitat loss for the duration of the deployment. The maximum design scenario assumes the greatest habitat loss is associated with the presence of gravity base mooring systems rather than pin piles. There will be no requirement for drilling to install pin piles at Warrior Way. Rock ballasting may be required for scour protection/moorings of devices at East Pickard Bay assuming up to 100 rock bags each with a diameter of up to 2 m. However, rock ballasting will only be placed directly on the device footprint, therefore representing no further loss of habitat.</p> <p><u>Most likely design scenario</u> The maximum design scenario assumes that the footprint beneath the device/components on the seabed is considered as habitat loss for the duration of the deployment. The most likely design scenario assumes that gravity bases would only be required at the East Pickard Bay site.</p>

Potential impact	Maximum design scenario	Most likely design scenario	Justification
Temporary habitat disturbance during the operation and maintenance phase, may affect benthic ecology.	<ul style="list-style-type: none"> <li>Up to 10,250 m<sup>2</sup> from up to two device or component footprints on the seabed (including mooring/pin pile footprint).</li> <li>Deployment durations: <ul style="list-style-type: none"> <li>Moored/gravity base deployment duration at Warrior Way: up to 6 months;</li> <li>Moored/gravity base deployment duration at Dale Roads: up to 12 months; and</li> <li>Moored/gravity base deployment duration at East Pickard Bay: up to 18 months.</li> </ul> </li> <li>Testing scenarios: <ul style="list-style-type: none"> <li>Warrior Way and Dale Roads: one testing activity/device deployment at any one time;</li> <li>East Pickard Bay: two testing activities/device deployments at any one time; and</li> <li>Up to 150 installation events occurring intermittently over the 15-year lifetime of the META project (breakdown of deployments/installation events is as per that outlined above for temporary habitat disturbance during installation).</li> </ul> </li> <li>Combined (Warrior Way + Dale Roads + East Pickard Bay) total subtidal temporary habitat disturbance at any one time of up to 500,350 m<sup>2</sup> comprising: <ul style="list-style-type: none"> <li>Up to 150 m<sup>2</sup> of temporary disturbance at Warrior Way per testing scenario from a single mooring spread at any one time.</li> <li>Up to 200 m<sup>2</sup> of temporary disturbance at Dale Roads per testing scenario broken from a single mooring spread at any one time.</li> <li>Up to 500,000 m<sup>2</sup> of temporary disturbance at East Pickard Bay per testing scenario from mooring spread for up to two test activities at any one time.</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>Moored/gravity base deployment duration at Dale Roads: up to 6 months; and</li> <li>Moored/gravity base deployment duration at East Pickard Bay: up to 6 months.</li> <li>Testing scenarios: <ul style="list-style-type: none"> <li>Warrior Way, Dale Roads and East Pickard Bay: one testing activity/device deployment at any one time; and</li> <li>Up to 60 installation events occurring intermittently over the 15-year lifetime of the META project (breakdown of deployments/installation events is as per that outlined above for temporary habitat disturbance during installation).</li> </ul> </li> <li>Combined (Warrior Way + Dale Roads + East Pickard Bay) total subtidal temporary habitat disturbance at any one time of up to 1,425 m<sup>2</sup> comprising: <ul style="list-style-type: none"> <li>Up to 75 m<sup>2</sup> of temporary disturbance at Warrior Way from a single mooring spread at any one time;</li> <li>Up to 100 m<sup>2</sup> of temporary disturbance at Dale Roads from a single mooring spread at any one time; and</li> <li>Up to 1,250 m<sup>2</sup> of temporary disturbance at East Pickard Bay from a single mooring spread at any one time.</li> </ul> </li> </ul>	<p>These parameters are considered to represent the maximum and most likely design scenarios with respect to effects on benthic receptors from temporary habitat disturbance during the operation and maintenance phase resulting from the presence of mooring spreads.</p> <p>The maximum design scenario assumes that there is the potential for temporary habitat disturbance within the whole area of the anchor spread, although this is likely to be over-precautionary.</p>
Alteration of seabed habitats arising from changes in physical processes, including scour effects and changes to sediment transport, may have effects on benthic ecology.	<p><b>Warrior Way</b></p> <ul style="list-style-type: none"> <li>Installation of gravity base 25 m<sup>2</sup>. Up to four drag anchors.</li> <li>Up to four devices deployed in a 12-month period, 50% of which may touch the seabed.</li> </ul> <p><b>Dale Roads</b></p> <ul style="list-style-type: none"> <li>Up to 10 drag anchors or gravity base up to 500 m<sup>2</sup>.</li> <li>100 mm pin piles.</li> <li>Up to two devices deployed in a 12-month period of which 50% may touch the seabed.</li> </ul> <p><b>East Pickard Bay</b></p> <ul style="list-style-type: none"> <li>Up to three-point catenary mooring system, or up to 10 standard drag embedment anchors or gravity base up to 1,125 m<sup>2</sup>.</li> <li>100 mm pin piles.</li> <li>Up to four devices deployed in a 12-month period of which 50% may touch the seabed.</li> </ul>	<p><b>Warrior Way</b></p> <ul style="list-style-type: none"> <li>Device supported by test support buoy or vessel.</li> <li>Up to two devices deployed in a 12-month period.</li> </ul> <p><b>Dale Roads</b></p> <ul style="list-style-type: none"> <li>No pin piles.</li> <li>Dynamic tether mooring system of up to four standard drag embedment anchor or gravity base 75 m<sup>2</sup>.</li> <li>Up to one device deployed in a 12-month period. Up to 50% of devices may touch the seabed.</li> </ul> <p><b>East Pickard Bay</b></p> <ul style="list-style-type: none"> <li>Up to 4 standard drag embedment anchors or gravity base up to 1,125 m<sup>2</sup>.</li> <li>No pin piles.</li> <li>Up to one device deployed in a 12-month period. Up to 50% of devices may touch the seabed.</li> </ul>	<p>These parameters are considered in chapter 6: Coastal Processes to represent the maximum and most likely design scenarios with respect to effects on the metocean regimes and sediment transport pathways.</p>

Potential impact	Maximum design scenario	Most likely design scenario	Justification
Alteration of benthic habitats resulting from changes to the hydrodynamic regime at Warrior Way (site 6)	<b>Warrior Way</b> <ul style="list-style-type: none"> <li>• Rotor diameter ≤ 5 m.</li> <li>• Speed of moving parts &lt; 2 m/s.</li> <li>• Swept area up to 19.63 m<sup>2</sup>.</li> <li>• Up to four devices deployed in a 12-month period, 50% of which may touch the seabed.</li> <li>• May occupy all of the water-column.</li> </ul>	<b>Warrior Way</b> <ul style="list-style-type: none"> <li>• Rotor diameter ≤ 5 m.</li> <li>• Speed of moving parts &lt; 2 m/s.</li> <li>• Swept area up to 19.63 m<sup>2</sup>.</li> <li>• Up to two devices deployed in a 12-month period, 50% of which may touch the seabed.</li> <li>• May occupy all of the water-column.</li> </ul>	
Risk of operational activities facilitating the introduction of marine INNS.	<ul style="list-style-type: none"> <li>• Physical presence of single devices or components at the Warrior Way and Dale Roads sites and up to two devices or components at the East Pickard Bay site.</li> <li>• A total of up to 358 vessel movements/round trips to port, involving up to 15 vessels, associated with test deployments per year comprising: <ul style="list-style-type: none"> <li>– Up to 104 vessel movements/round trips to port, involving up to five vessels, associated with test deployments per year at the Warrior Way site;</li> <li>– Up to 104 vessel movements/round trips to port, involving up to five vessels, associated with test deployments per year at the Dale Roads site; and</li> <li>– Up to 150 vessel movements/round trips to port, involving up to five vessels, associated with test deployments per year at the East Pickard Bay site.</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Physical presence of single devices or components at the Warrior Way, Dale Roads and East Pickard Bay sites.</li> <li>• A total of up to 208 vessel movements/round trips to port, involving up to 15 vessels, associated with test deployments per year comprising: <ul style="list-style-type: none"> <li>– Up to 52 vessel movements/round trips to port, involving up to three vessels, associated with test deployments per year at the Warrior Way site;</li> <li>– Up to 52 vessel movements/round trips to port, involving up to three vessels, associated with test deployments per year at the Dale Roads site; and</li> <li>– Up to 104 vessel movements/round trips to port, involving up to three vessels, associated with test deployments per year at the East Pickard Bay site.</li> </ul> </li> </ul>	These parameters are considered to represent the maximum and most likely design scenarios with respect to effects on benthic receptors associated with the introduction of INNS as a result of an increase in vessel movements during the operation and maintenance phase.
Accidental release of pollutants (e.g. accidental spillage) during operation and maintenance activities.	<ul style="list-style-type: none"> <li>• As per operational activities outlined above for the risk of installation activities facilitating the introduction of marine INNS.</li> </ul>	<ul style="list-style-type: none"> <li>• As per operational activities outlined above for the risk of installation activities facilitating the introduction of marine INNS.</li> </ul>	As outlined above for the introduction of marine INNS.
<b>Decommissioning phase</b>			
Temporary habitat disturbance due to decommissioning activities, may affect benthic ecology.	<ul style="list-style-type: none"> <li>• Retrieval scenarios: <ul style="list-style-type: none"> <li>– Warrior Way and Dale Roads: one retrieval activity at any one time;</li> <li>– East Pickard Bay: two retrieval activities at any one time; and</li> <li>– Retrieval events occurring intermittently over the 15-year lifetime of the META project.</li> </ul> </li> <li>• Combined (Warrior Way + Dale Roads + East Pickard Bay) total subtidal temporary habitat disturbance at any one time of up to 131,400 m<sup>2</sup> comprising: <ul style="list-style-type: none"> <li>– Up to 350 m<sup>2</sup> of temporary disturbance at Warrior Way per retrieval comprising: <ul style="list-style-type: none"> <li>○ 200 m<sup>2</sup> from removal of infrastructure outlined under long-term habitat loss above; and</li> <li>○ Up to 150 m<sup>2</sup> from a single mooring spread for retrieval vessels.</li> </ul> </li> <li>– Up to 800 m<sup>2</sup> of temporary disturbance at Dale Roads per retrieval comprising:</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Testing scenarios: <ul style="list-style-type: none"> <li>– Warrior Way, Dale Roads and East Pickard Bay: one testing activity/device retrieval event at any one time; and</li> <li>– Retrieval events occurring intermittently over the 15-year lifetime of the META project.</li> </ul> </li> <li>• Combined (Warrior Way + Dale Roads + East Pickard Bay) total subtidal temporary habitat disturbance of up to 72,175 m<sup>2</sup> comprising: <ul style="list-style-type: none"> <li>– Up to 175 m<sup>2</sup> of temporary disturbance at Warrior Way per retrieval event comprising: <ul style="list-style-type: none"> <li>○ 100 m<sup>2</sup> from removal of infrastructure outlined under long-term habitat loss above; and</li> <li>○ Up to 75 m<sup>2</sup> a single mooring spread for retrieval vessels.</li> </ul> </li> <li>– Up to 300 m<sup>2</sup> of temporary disturbance at Dale Roads per retrieval event comprising: <ul style="list-style-type: none"> <li>○ 200 m<sup>2</sup> from removal of infrastructure outlined under long-term habitat loss above; and</li> </ul> </li> </ul> </li> </ul>	These parameters are considered to represent the maximum and most likely design scenarios with respect to effects on benthic receptors from temporary habitat disturbance during decommissioning activities. Temporary habitat disturbance is only anticipated to arise as a result of the removal of infrastructure from the seabed and from mooring spreads for retrieval vessels.

Potential impact	Maximum design scenario	Most likely design scenario	Justification
	<ul style="list-style-type: none"> <li>○ 600 m<sup>2</sup> from removal of infrastructure outlined under long-term habitat loss above; and</li> <li>○ Up to 200 m<sup>2</sup> from a single mooring spread for retrieval vessels.</li> <li>– Up to 130,250 m<sup>2</sup> of temporary disturbance at East Pickard Bay per retrieval scenario from mooring spread for up to two test activities at any one time.</li> <li>○ 10,250 m<sup>2</sup> from removal of infrastructure outlined under long-term habitat loss above; and</li> <li>○ Up to 120,000 m<sup>2</sup> from mooring spread for retrieval vessels for up to two retrieval operations at any one time.</li> </ul>	<ul style="list-style-type: none"> <li>○ Up to 100 m<sup>2</sup> from a single mooring spread for retrieval vessels.</li> <li>– Up to 71,700 m<sup>2</sup> of temporary disturbance at East Pickard Bay per retrieval scenario at any one time comprising: <ul style="list-style-type: none"> <li>○ 1,700 m<sup>2</sup> from removal of infrastructure outlined under long-term habitat loss above; and</li> <li>○ Up to 70,000 m<sup>2</sup> from mooring spread for retrieval vessels.</li> </ul> </li> </ul>	
Temporary increases in SSCs and associated sediment deposition due to decommissioning activities, may affect benthic ecology.	<ul style="list-style-type: none"> <li>● As per installation activities outlined above for increased SSC and sediment deposition but with no drilling.</li> </ul>	<ul style="list-style-type: none"> <li>● As per installation activities outlined above for increased SSC and sediment deposition but with no seabed levelling.</li> </ul>	These parameters are considered to represent the maximum and most likely design scenarios with respect to effects on benthic receptors associated with increased SSC and sediment deposition during decommissioning.
Sediment disturbance leading to the potential for resuspension of contaminated sediments may affect benthic ecology.	<ul style="list-style-type: none"> <li>● As per installation activities outlined above for increased SSC and sediment deposition but with no drilling.</li> </ul>	<ul style="list-style-type: none"> <li>● As per installation activities outlined above for increased SSC and sediment deposition but with no seabed levelling.</li> </ul>	As outlined above for temporary increases in SSC and sediment deposition.
Risk of decommissioning activities facilitating the introduction of marine INNS.	<ul style="list-style-type: none"> <li>● As per installation activities outlined above for introduction of INNS.</li> </ul>	<ul style="list-style-type: none"> <li>● As per installation activities outlined above for introduction of INNS.</li> </ul>	These parameters are considered to represent the maximum and most likely design scenarios with respect to effects on benthic receptors associated with the introduction of INNS as a result of an increase in vessel movements during the decommissioning phase.
Accidental release of pollutants (e.g. accidental spillage) during decommissioning activities.	<ul style="list-style-type: none"> <li>● As per installation activities outlined above for the introduction of marine INNS.</li> </ul>	<ul style="list-style-type: none"> <li>● As per installation activities outlined above for the introduction of marine INNS.</li> </ul>	As outlined above for the introduction of marine INNS.

**Table 7.9: Impacts scoped out of the assessment for benthic subtidal and intertidal ecology.**

Potential impact	Justification
<b>Installation phase</b>	
Underwater noise associated with vessels and drilled pin piling during installation may have effects on benthic ecology.	Understanding of the potential effects of underwater noise on invertebrates is relatively underdeveloped (Hawkins <i>et al.</i> , 2015). There is, however, increasing evidence to suggest that benthic invertebrates are sensitive to particle motion (Roberts <i>et al.</i> , 2016; Spiga <i>et al.</i> , 2016; Tidau and Briffa, 2016). The vibration levels at which these responses have been observed, however, generally correspond to levels measured near anthropogenic operations such as pile driving and up to 300 m from explosives testing (blasting) (Roberts <i>et al.</i> , 2016). However, population level and mortality effects are considered unlikely. Furthermore, no blasting or impact pile driving will be undertaken during installation and, therefore, this impact has been scoped out of the benthic ecology assessment.
<b>Operation and maintenance phase</b>	
Underwater noise associated with operation of wave and tidal devices may have effects on benthic ecology.	This impact has been scoped out of the benthic ecology assessment; see justification provided above for installation phase.
Alteration of intertidal habitats arising from changes in the wave regime associated with wave devices.	As outlined in paragraph 6.9.2.10 <i>et seq.</i> of chapter 6: Coastal Processes, although the deployment of wave devices at Dale Roads (site 7) and East Pickard Bay (site 8) is predicted to have localised effects on the wave climate, the wave climate is predicted to return to uniformity within the site boundaries and therefore not impact on the intertidal zone and associated benthic receptors.
Temporary increases in SSCs and associated sediment deposition due to operation of tidal devices, may affect benthic ecology.	As outlined in paragraph 6.9.2.3 <i>et seq.</i> of chapter 6: Coastal Processes, the proposed testing of scale or micro-scaled tidal devices at Warrior Way (site 6) is unlikely to impact on seabed sediment. Therefore, impacts on benthic communities are not anticipated and have been scoped out of the assessment.
<b>Decommissioning phase</b>	
Underwater noise associated with vessels during decommissioning may have effects on benthic ecology.	This impact has been scoped out of the benthic ecology assessment; see justification provided above for installation phase.

## 7.9 Impact assessment methodology

### 7.9.1 Overview

7.9.1.1 The benthic subtidal and intertidal ecology EIA has followed the methodology set out in chapter 4: Environmental Impact Assessment Methodology. Specific to the benthic subtidal and intertidal ecology EIA, the following guidance documents have also been considered:

- Guidelines for Ecological Impact Assessment (EclA) in the UK and Ireland. Terrestrial, Freshwater, Coastal and Marine (CIEEM, 2018); and
- Consenting, EIA and HRA Guidance for Marine Renewable Energy Developments in Scotland. Part Four – Wave and Tidal Annex (EMEC and Xodus, 2010).

7.9.1.2 In addition, the benthic subtidal and intertidal ecology EIA has considered the legislative framework as defined by the Wildlife and Countryside Act 1981 (as amended), the EC Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Flora and Fauna (the Habitats Directive), the Marine and Coastal Access Act, 2009, and the Conservation of Habitats and Species Regulations 2017 (consolidates and updates the Conservation of Habitats and Species regulations 2012).

### 7.9.2 Impact assessment criteria

7.9.2.1 The criteria for determining the significance of effects is a two-stage process that involves defining the sensitivity of the receptors and the magnitude of the impacts. This section describes the criteria applied in this chapter to assign values to the sensitivity of receptors and the magnitude of potential impacts. The terms used to define sensitivity and magnitude are based on those which are described in further detail in chapter 4: Environmental Assessment Methodology.

#### Magnitude

7.9.2.2 The criteria for defining magnitude in this chapter are outlined in Table 7.10 below.

**Table 7.10: Definition of terms relating to the magnitude of an impact.**

Magnitude of impact	Definition
Major	Loss of resource and/or quality and integrity of resource; severe damage to key characteristics, features or elements (Adverse). Large scale or major improvement or resource quality; extensive restoration or enhancement; major improvement of attribute quality (Beneficial).
Moderate	Loss of resource, but not adversely affecting integrity of resource; partial loss of/damage to key characteristics, features or elements (Adverse). Benefit to, or addition of, key characteristics, features or elements; improvement of attribute quality (Beneficial).
Minor	Some measurable change in attributes, quality or vulnerability, minor loss or, or alteration to, one (maybe more) key characteristics, features or elements (Adverse). Minor benefit to, or addition of, one (maybe more) key characteristics, features or elements; some beneficial impact on attribute or a reduced risk of negative impact occurring (Beneficial).
Negligible	Very minor loss or detrimental alteration to one or more characteristics, features or elements (Adverse). Very minor benefit to, or positive addition of one or more characteristics, features or elements (Beneficial).
No change	No loss or alteration or characteristics, features or elements; no observable impact in either direction.

### Sensitivity

- 7.9.2.3 The criteria for defining sensitivity in this chapter are outlined in Table 7.11 below.
- 7.9.2.4 The sensitivity of benthic subtidal and intertidal ecology VERs has been defined as a product of the likelihood of damage (termed intolerance or resistance) due to a pressure and the rate of (or time taken for) recovery (termed recoverability or resilience once the pressure has abated or been removed). Information on these aspects of sensitivity of the benthic subtidal and intertidal ecology VERs to given impacts has been informed by the best available evidence following environmental impact or experimental manipulation in the field and evidence from analogous activities such as those associated with aggregate extraction and Oil and Gas industries. Where applicable, the outputs of the Marine Evidence based Sensitivity Assessment (MarESA) has been drawn upon to support the assessments of sensitivity. These assessments have been combined with the assessed status (i.e. the level of designation/importance) of the affected receptor as defined in Table 7.6 and as presented in Table 7.7.

**Table 7.11: Definition of terms relating to the sensitivity of the receptor.**

Sensitivity	Definition
Very High	VER of Very High or High value with high vulnerability and no ability for recovery.
High	VER of Medium value with high vulnerability and no ability for recovery. VER of Very High or High value with high vulnerability and low recoverability.
Medium	VER of Low value with high vulnerability and no ability for recovery. VER of Medium value with medium to high vulnerability and low recoverability. VER of Very High or High value with medium vulnerability and medium recoverability.
Low	VER of Low value with medium to high vulnerability and low recoverability. VER of Medium value with medium vulnerability and medium to high recoverability. VER of Very High or High value with low/medium vulnerability and high recoverability.
Negligible	VER is not vulnerable to impacts regardless of value/importance. VER of Low value with low vulnerability and medium to high recoverability. VER of Medium value with low vulnerability and high recoverability.

### Significance

- 7.9.2.5 The significance of the effect upon benthic subtidal and intertidal ecology is determined by correlating the magnitude of the impact and the sensitivity of the receptor. The particular method employed for this assessment is presented in Table 7.12. Where a range of significance of effect is presented in Table 7.12, the final assessment for each effect is based upon expert judgement.
- 7.9.2.6 For the purposes of this assessment, any effects with a significance level of minor or less have been concluded to be not significant in terms of the EIA Regulations.

**Table 7.12: Matrix used for the assessment of the significance of the effect.**

		Magnitude of impact				
		No change	Negligible	Minor	Moderate	Major
Sensitivity of receptor	Negligible	Negligible	Negligible	Negligible or minor	Negligible or minor	Minor
	Low	Negligible	Negligible or minor	Negligible or minor	Minor	Minor or moderate
	Medium	Negligible	Negligible or minor	Minor	Moderate	Moderate or major
	High	Negligible	Minor	Minor or moderate	Moderate or major	Major or substantial
	Very high	Negligible	Minor	Moderate or major	Major or substantial	Substantial

### 7.9.3 Designated sites

- 7.9.3.1 Where Natura 2000 sites (i.e. internationally designated sites) are considered, this chapter summarises the assessments made on the interest features of internationally designated sites as described within section 7.7.5 of this chapter (with the assessment on the site itself deferred to the META project RIAA).
- 7.9.3.2 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 benthic subtidal and intertidal ecology study area, an assessment of the impacts on the overall site is made in this chapter using the EIA methodology.
- 7.9.3.3 The META project RIAA has been prepared in accordance with Advice Note Ten: Habitats Regulations Assessment Relevant to Nationally Significant Infrastructure Projects (PINS, 2016) and will be submitted as part of the Marine Licence, Marine Works and Section 36 Licence applications.

## 7.10 Measures adopted as part of the META Project

7.10.1.1 As part of the project design process, a number of designed-in measures have been proposed to reduce the potential for impacts on benthic subtidal and intertidal ecology (see Table 7.13). As there is a commitment to implementing these measures, they are considered inherently part of the design of the META project and have therefore been considered in the assessment presented in section 7.11 below (i.e. the determination of magnitude and therefore significance assumes implementation of these measures). These measures are considered standard industry practice for this type of development.

Table 7.13: Designed-in measures adopted as part of the META project.

Measures adopted as part of the META project	Justification
An Environmental Management Plan (EMP) will be produced and followed. The EMP will cover the installation, operation and maintenance, and decommissioning phases of the META project and will include planning for accidental spills, address all potential contaminant releases and include key emergency contact details (e.g. Environment Agency, Natural England and MCA). The EMP will also contain an Invasive Species Management Plan (see below) to limit the spread of marine INNS.	Measures will be adopted to ensure that the potential for release of pollutants from installation, operation and maintenance, and decommissioning plant is minimised. In this manner, accidental release of potential release of contaminants from vessels will be strictly controlled, thus providing protection for marine life across all phases of the project development.
An Invasive Species Management Plan will be produced and agreed in consultation with statutory consultees.	A document detailing how the risk of potential introduction and spread of INNS will be minimised is to be produced. The plan will outline measures to ensure vessels comply with the International Maritime Organization (IMO) ballast water management guidelines, it will consider the origin of vessels and contain standard housekeeping measures for such vessels as well as measures to be adopted in the event that a high alert species is recorded.
Post-consent/pre-deployment surveys at Warrior Way (site 6) and Dale Roads (site 7).	NRW have raised concerns (see Table 7.3) that Annex I reef habitat may occur at Warrior Way (site 6) and Dale Roads (site 7) and that seagrass beds have been recorded in the vicinity of Dale Roads (site 7). A post-consent/pre-deployment benthic survey will be undertaken by Developers at these sites. In the first instance, these surveys will comprise a comprehensive review and interpretation of the geophysical survey data available for these sites (as presented in Appendix 7.1: Benthic Ecology) by a suitably qualified and experienced marine ecologist / geophysicist, to identify any areas of potential reef features or sensitive habitat features that may be present. In the event that acoustic signatures synonymous with potential reef presence for example, are identified from the geophysical data, it is proposed that these would be subject to further ground-truthing via a pre-deployment survey, the exact format of which would be agreed with NRW at the time. The pre-deployment survey, if required, would likely utilise remote sampling techniques (e.g. drop-down video) to establish the presence or absence of any reef features or other sensitive habitats features, and where present to determine their extent. These surveys will ensure that measures can be designed, if necessary, (e.g. micrositing of moorings etc.) to avoid direct impacts to sensitive habitats such as reefs and seagrass at these sites.

## 7.11 Assessment of significance

### 7.11.1 Installation phase

7.11.1.1 The impacts of the installation of the META project have been assessed on benthic subtidal and intertidal ecology. The potential impacts arising from the installation of the META project are listed in Table 7.8, along with the maximum and most likely design scenarios against which each installation phase impact has been assessed. A conclusion of significance of effect will be made for the META project and for each META phase 2 site individually where appropriate (Warrior Way (site 6), Dale Roads (site 7); East Pickard Bay (site 8)).

7.11.1.2 A description of the potential effect on benthic subtidal and intertidal ecology receptors resulting from each identified impact is given below.

#### **Temporary habitat disturbance due to installation activities, may affect benthic ecology**

7.11.1.3 Seabed clearance activities (e.g. boulder and debris clearance) within a 5 m buffer of the device/mooring footprints (10 m buffer at East Pickard Bay (site 8)), prior to the installation of the devices and moorings, have the potential to result in the temporary disturbance of benthic habitats at each of the META test sites. It should be noted that there is not anticipated to be any requirement for seabed levelling using ploughs or other similar technologies. There may also be temporary habitat disturbance as a result of mooring/anchor spreads for vessels employed in device/component installation.

7.11.1.4 This disturbance of benthic habitats is likely to constitute abrasion/disturbance of the surface of the substratum. Any small epifaunal or other sessile species present on the surface of the seabed may potentially be damaged or destroyed although infauna species are likely to be largely unaffected.

7.11.1.5 Habitat loss associated with the actual footprint of the devices and moorings on the seabed, for the duration of their deployment, is considered separately as an operation and maintenance phase impact in paragraph 7.11.2.3 *et seq.* Temporary habitat disturbance associated with moorings/anchors for the duration of the deployment of devices and components is also assessed separately as an operation and maintenance impact in paragraph 7.11.2.21 *et seq.*

#### **Magnitude of impact**

7.11.1.6 As outlined in Table 7.8, the total combined temporary habitat disturbance predicted to occur at any one time, across all three META test sites, is up to 124,679 m<sup>2</sup>. Of this, the predicted extents of temporary habitat disturbance at Warrior Way (site 6) of 480 m<sup>2</sup> and 713 m<sup>2</sup> at Dale Roads (site 7) will affect only a very small proportion of the total area of these test sites at any one time; 0.52% for Warrior Way (site 6) and 0.36% for Dale Roads (site 7).

- 7.11.1.7 The majority of the total combined temporary habitat disturbance (123,486 m<sup>2</sup>) is predicted to occur at East Pickard Bay site (site 8) but affecting only approximately 10% of the total consented area of the site at any one time. It should however be noted that of this total at East Pickard Bay (site 8), the majority of disturbance (120,000 m<sup>2</sup>) results from the mooring spread for installation vessels and for the maximum design scenario it has been assumed that all the habitat within the footprint of the mooring spread may be affected. This is, however, considered to be a highly precautionary scenario with the actual extent of disturbance much less than this and restricted to the immediate vicinity of the anchors and lines. It should also be highlighted that the most likely scenario for the META project would not require any seabed clearance activities and the associated temporary habitat disturbance for the project would be much less than this, as discussed in paragraph 7.11.1.9.
- 7.11.1.8 As also outlined in Table 7.8, the maximum design scenario assumes that there may be up to 150 installation events occurring intermittently across all three META test sites over the 15-year lifetime of the project. There is therefore the potential for repeat disturbance to areas of seabed affected by seabed clearance and vessel mooring during previous installations.
- 7.11.1.9 As outlined in Table 7.8, the most likely scenario assumes that no seabed clearance will be required at any of the META sites and, therefore, temporary habitat disturbance of up to 70,175 m<sup>2</sup> per test activity would be predicted to occur at East Pickard Bay (site 8) from the mooring spread required for deployment vessels only. The most likely design scenario assumes that there may be up to 60 installation events occurring intermittently across all three META test sites over the 15-year lifetime of the project.
- 7.11.1.10 The impact of temporary disturbance to benthic habitats from seabed clearance and vessel mooring activities during the installation phase is predicted to be of local spatial extent, restricted to be the META test sites, of short-term duration, intermittent over the 15-year lifetime of the META project (although only a small proportion of the total area will be affected at any one time) and reversible. It is predicted that the impact will affect the benthic receptors directly. The magnitude is therefore, considered to be minor (adverse).

#### Sensitivity of the receptor

- 7.11.1.11 The benthic subtidal VERs with the potential to be affected by temporary habitat disturbance during installation activities are Annex I 'estuaries' and Annex I 'large shallow inlets' at the Warrior Way (site 6) and Dale Roads (site 7) sites, and circalittoral coarse sediment habitats at the East Pickard Bay site (site 8). As discussed in paragraph 7.7.2.10 *et seq.* the META sites do not overlap with the mapped extent of known Annex I reef habitat, or any other VERs. Furthermore, as outlined in Table 7.13, if Annex I reef is recorded pre-deployment, measures have been adopted as part of the project design (i.e. micro-siting of testing infrastructure) to ensure that direct impacts to this VER are avoided.

#### Annex I estuaries, Annex I large shallow inlets and circalittoral coarse sediment VERs

- 7.11.1.12 As discussed in paragraph 7.7.2.10 *et seq.*, the subtidal biotopes which have been recorded in association with these broad habitat types (VERs) at the META sites include the SS.SCS.OCS.HeloPkef, SS.SSa.IFiSa.NcirBat and SS.SSa.IMuSa.FfabMag biotopes in areas of sand, the SS.SSa.CMuSa.AalbNuc biotope in areas of muddier fine sand and SS.SMx.CMx.MysThyMx biotope in areas of mixed sediments within the Waterway.
- 7.11.1.13 Despite the differing sediment types underlying these biotopes, a review of the MarESA assessment for the pressure '*abrasion/disturbance of the surface of the substratum or seabed*' for these biotopes concludes that the overall sensitivity for all to temporary habitat disturbance of this nature is considered to be low (Tillin and Budd, 2016; Tillin and Ashley, 2016; De-Bastos and Marshall, 2016; Tillin and Rayment, 2016a; Tillin, 2016). This is on the basis that many of the characterising species of these sediments and habitats are infaunal and will therefore be largely unaffected by disturbance of the seabed surface during seabed clearance. Any epifauna and epiflora may, however, be damaged/displaced by seabed clearance and vessel anchoring and resistance is therefore likely to be medium. The resilience/recovery of these biotopes following cessation of the disturbance is likely to be high (i.e. recovery within two years) for these communities as opportunistic species will likely recruit rapidly back to disturbed areas and some damaged characterising species may recover or recolonise.
- 7.11.1.14 As discussed in paragraph 7.11.1.8 above, there is the potential for repeat disturbance to habitats within the META sites over the lifetime of the project as a result of repeated deployments within the same area of seabed within each test site. If this scenario were to occur (i.e. subsequent developers were to use previously cleared areas of seabed rather than undertaking seabed clearance in a different area), this would effectively limit the seabed disturbance over the lifetime of the project to a very small area of each test site. Whilst this may hinder the recovery of the benthic habitats within each of these small areas it would also effectively leave large areas of each site undisturbed. Although this scenario is feasible, it is also considered realistic to assume that sequential installations will affect different areas of seabed within the sites rather than the same footprint. This is on the basis that different developers (and therefore devices/components) will have different requirements in terms of location within each site. Under this scenario, it is therefore anticipated that this will allow sufficient time between any potential repeat disturbance events for the communities to fully recover.
- 7.11.1.15 The conclusions made below for the Annex I habitat VERs are made on the basis of the MarESA assessment described above for the likely component biotopes present in association with these features at the META sites.
- 7.11.1.16 The Annex I 'estuaries' VER is deemed to be of medium vulnerability, high recoverability and very high value. The sensitivity of the receptor is therefore, considered to be low.
- 7.11.1.17 The Annex I 'large shallow inlets' VER is deemed to be of medium vulnerability, high recoverability and very high value. The sensitivity of the receptor is therefore, considered to be low.

7.11.1.18 The circalittoral coarse sediment VER is deemed to be of medium vulnerability, high recoverability and medium value. The sensitivity of the receptor is therefore, considered to be low.

#### Significance of the effect

7.11.1.19 No differences in the magnitude of the impact or the sensitivity of the receptors has been concluded between the three META sites, and therefore the overall significance of the effect for each VER below is made for all META sites. For the reasons discussed at section 7.7.8 above there is a level of uncertainty attached to the level of significance assigned to VERs on the basis that the assessment has been based on desktop data only. This uncertainty has been addressed through the adoption of precautionary thresholds.

7.11.1.20 In addition, no difference in assessment has been made between maximum and most likely design scenarios, therefore the overall significance of effect for maximum and most likely design scenarios is the same.

#### **Annex I estuaries VER**

7.11.1.21 Overall, the sensitivity of the Annex I 'estuaries' VER is considered to be low and the magnitude of the impact is deemed to be minor. The effect will, therefore, be of **minor adverse significance**, which is not significant in EIA terms. Conclusions on the effects of on the conservation objectives of the Pembrokeshire Marine SAC are presented in full within the META project RIAA.

#### **Annex I large shallow inlets VER**

7.11.1.22 Overall, the sensitivity of the Annex I 'large shallow inlets' VER is considered to be low and the magnitude of the impact is deemed to be minor. The effect will, therefore, be of **minor adverse significance**, which is not significant in EIA terms. Conclusions on the effects of on the conservation objectives of the Pembrokeshire Marine SAC are presented in full within the META project RIAA.

#### **Circalittoral coarse sediment VER**

7.11.1.23 Overall, the sensitivity of circalittoral coarse sand is considered to be low and the magnitude of the impact is deemed to be minor. The effect will, therefore, be of **negligible significance**, which is not significant in EIA terms.

### **Temporary increases in SSCs and associated sediment deposition due to installation activities, may affect benthic ecology**

7.11.1.24 Sediment disturbance may arise from a range of installation activities within the site, such as gravity base installation and drilling to install pin piles (drilling at Dale Roads (site 7) and East Pickard Bay (site 8) sites only; see Table 7.8). In terms of increased SSC, the greatest level of disturbance would be created by the installation of gravity bases or bed mounted devices (see chapter 5: Coastal Processes). The placement of gravity anchors or drag anchors for marine energy devices or navigational marker buoys, and vessel movements may also lead to very short-term increases in SSC due to vessel manoeuvring/anchoring or dynamic positioning in shallow water.

7.11.1.25 This sediment disturbance has the potential to result in temporary changes in the levels of suspended sediment within the water column (i.e. increased turbidity levels) which, under certain conditions, have adverse effects on the marine flora and fauna. Increased SSC can affect filter feeding organisms through clogging and damaging feeding and breathing apparatus (Frid and Caswell, 2017). Disturbance of sediments will also cause some sediment deposition potentially resulting in the smothering of benthic species and habitats.

#### Magnitude of impact

7.11.1.26 All activities proposed at all three test areas are of a temporary and intermittent nature with the Warrior Way (site 6) and Dale Roads (site 7) sites supporting only single device testing at any one time, and East Pickard Bay (site 8) supporting up to two concurrent device tests according to the maximum design scenario (see Table 7.8). Drilling to install pin piles may only occur at Dale Roads (site 7) and East Pickard Bay (site 8) under the maximum design scenario and will be of low number (i.e. up to four per device) and small diameter (100 mm), therefore minimising sediment disturbance and the resulting increased SSC and deposition.

7.11.1.27 For all installation activities, the coarsest fraction of the material disturbed would be anticipated to settle relatively quickly to the seabed in the immediate vicinity of the works, and would therefore be expected to be spatially restricted to within the boundaries of the META sites. At Warrior Way (site 6), all but the finest material from the sediment plume would settle within a relatively short period after the works are complete i.e. less than one hour (see chapter 5: Coastal Processes). The plume itself would give rise to an average increase in SSC of up to 40 mg/l and would settle within two hours. The finest material may be expected to travel up to 100 m from the site and at levels which are within the range of reported background levels for the Waterway (i.e. 15 mg/l; see chapter 5: Coastal Processes).

7.11.1.28 At Dale Roads (site 7), the very finest material is predicted to travel in the order of 600 m from the site during an average tidal cycle (see chapter 5: Coastal Processes) with increases in SSC of up to 50 mg/l which is within the order of those experienced during storm conditions. Given the silty nature of the bed and the circulatory current it is anticipated that the material would be deposited within the bay from which it originated.

- 7.11.1.29 At East Pickard Bay (site 8), as the sediment has a lower fines content than sites within the Waterway, increases in SSC above background of 70 mg/l may occur but would settle within a relatively short period after the works are complete (i.e. within one hour) and within a short distance of the works (i.e. the very finest material would travel in the order of 50 m from the site during an average tide).
- 7.11.1.30 Due to the meso-tidal range of Warrior Way (site 6) and Dale Roads (site 7) and the high energy environment at East Pickard Bay (site 8), it can be expected that any plumes of fine sediments will quickly dissipate and disperse according to the sites' hydrological regimes (see chapter 5: Coastal Processes).
- 7.11.1.31 The impact of temporary increases in SSC and associated sediment deposition is therefore predicted to be of local spatial extent, short-term duration, intermittent and reversible for all META sites. It is predicted that the impact will affect the receptors indirectly. The magnitude is therefore considered to be negligible.

### Sensitivity of the receptor

- 7.11.1.32 The benthic subtidal VERs with the potential to be affected by temporary increases in SSC and sediment deposition during installation activities are: Annex I 'estuaries' and Annex I 'large shallow inlets' at Warrior Way (site 6) and Dale Roads (site 7), Annex I subtidal 'reef' at all three META sites and circalittoral coarse sediment habitats at East Pickard Bay (site 8). On the basis of the predicted extents of any plumes of fine suspended sediments, as described in paragraphs 7.11.1.26 to 7.11.1.31 (i.e. a maximum of 600 m from the release site), the subtidal seagrass, maerl beds, Annex I 'Sandbanks which are slightly covered by sea water all the time', Annex I 'coastal lagoon' and Annex I 'Submerged or partially submerged sea caves' VERs are not predicted to be affected by increased SSCs at any of the META sites due to their distance from the potential release sites.
- 7.11.1.33 The benthic intertidal VERs with the potential to be affected by temporary increases in SSC and sediment deposition during installation activities are: Annex I habitat 'Mudflats and sandflats not covered by seawater at low tide' and Annex I intertidal 'Reefs'. On the basis of the predicted extents of any plumes of fine suspended sediments, as described in paragraphs 7.11.1.26 to 7.11.1.31 (i.e. a maximum of 600 m from the release site), the intertidal seagrass and Annex I habitat '*Atlantic salt-meadow (Glauco-Puccinellietalia maritimae)*' VERs are not predicted to be affected by increased SSCs at any of the META sites due to their distance from the potential release sites.

### **Annex I estuaries, Annex I large shallow inlets and circalittoral coarse sediment VERs**

- 7.11.1.34 As discussed in paragraph 7.7.2.10 *et seq.*, the subtidal biotopes which have been recorded in association with the Annex I 'estuaries', Annex I 'large shallow inlets' and circalittoral coarse sediment VERs include the SS.SCS.OCS.HeloPkef, SS.SSa.IFiSa.NcirBat and SS.SSa.IMuSa.FfabMag biotopes in areas of sand, the SS.SSa.CMuSa.AalbNuc biotope in areas of muddier fine sand and SS.SMx.CMx.MysThyMx biotope in areas of mixed sediments within the Waterway.

- 7.11.1.35 Despite the differing sediment types underlying these biotopes, a review of the MarESA assessment for the pressures 'changes in suspended solids (water clarity)' and 'smothering and siltation rate changes (light)' for these biotopes concludes that the overall sensitivity for all to increased SSC and smothering is low (Tillin and Budd, 2016; Tillin and Ashley, 2016; De-Bastos and Marshall, 2016; Tillin and Rayment, 2016a; Tillin, 2016). This is on the basis that many of the characterising species of these sediments and habitats are infaunal and will therefore be largely unaffected by changes to the water clarity. The characterising polychaetes are deposit feeders and are therefore unlikely to be affected in changes in the light penetration in the water column and would recover rapidly following changes to food availability. The characterising bivalves of the SS.SSa.CMuSa.AalbNuc and SS.SSa.IMuSa.FfabMag biotopes are tolerant of short-term increases in turbidity following sediment mobilisation by storms and other events for example (Tillin and Budd, 2016; Tillin and Rayment, 2016a) and so are considered likely to be tolerant of the short term increases in SSC from disturbance events at the META sites. Resistance/vulnerability to increased SSC is considered to be low and recoverability high following a return to baseline conditions.
- 7.11.1.36 With respect to sediment deposition, as the local hydrodynamic conditions are not predicted to be affected by the installation works, it is expected that fine particles will be removed by wave or tidal action moderating the impact of this pressure. Furthermore, most infaunal bivalves and polychaete species are capable of burrowing through sediment to feed and although there may be an energetic cost to species as a result of this, is not likely to be significant (Tillin and Budd, 2016; Tillin and Rayment, 2016a). Resistance/vulnerability to increased SSC is considered to be low and recoverability high following a return to baseline conditions.
- 7.11.1.37 It should be noted that chronic sediment disturbance and resuspension occurs in the Waterway by propeller wash and bow-waves of tankers, tugs, ferries, cargo and fishing vessels and by small vessel mooring. Major anthropogenic causes of mud resuspension within the Waterway are periodic dredging events and less frequent large-scale engineering projects (Little *et al.*, 2016). Therefore, it must be assumed that the communities present at Warrior Way (site 6) and Dale Roads (site 7) are routinely exposed to elevated SSC and must therefore have a degree of tolerance to this pressure.
- 7.11.1.38 The Annex I 'estuaries' VER is deemed to be of medium vulnerability, high recoverability and very high value. The sensitivity of the receptor is therefore, considered to be low.
- 7.11.1.39 The Annex I 'large shallow inlets' VER is deemed to be of medium vulnerability, high recoverability and very high value. The sensitivity of the receptor is therefore, considered to be low.
- 7.11.1.40 The circalittoral coarse sediment VER is deemed to be of medium vulnerability, high recoverability and medium value. The sensitivity of the receptor is therefore, considered to be low.

### Annex I subtidal reef VER

- 7.11.1.41 With respect to the Annex I subtidal reef VER, the predominant subtidal biotope which is likely to be present in association with the Annex I subtidal reef VER in the vicinity of East Pickard Bay (site 8) is the CR.HCR.XFa.ByErSp biotope and at the sites within the Waterway is the CR.MCR.CFaVS.CuSpH biotope (see paragraphs 7.7.2.10 to 7.7.2.21).
- 7.11.1.42 It is predicted that the benthic communities associated with the rocky substrate in the vicinity of East Pickard Bay (site 8) will have a low resistance (high vulnerability) and medium recoverability to temporary increases in SSCs. Characterising species such as bryozoans (e.g. *F. foliacea*) are suspension feeders that may be adversely affected by increases in suspended sediment, due to clogging of their feeding apparatus although many encrusting sponges appear to be able to survive in highly sedimented conditions (Readman, 2016a). As this habitat tends to occur in areas of high energy, an increase in suspended sediment will result in an increase in scour. While some sponges and *Flustra* are probably resistant of scour, other fragile sponges, and bryozoans may be removed. Smothering is likely to cause limited mortality amongst some of characterising species, particularly the smaller sponges. However, due to the moderate to strong water movement at East Pickard Bay (site 8), the removal of the deposited sediment is likely to be rapid. Furthermore, as discussed in paragraph 7.11.1.37, benthic communities in the Waterway are likely to be habituated to periodic elevations in SSC and sediment deposition as a result of routine operations in the Waterway. The benthic communities are considered to have a high resistance (low vulnerability) and high recoverability from smothering.
- 7.11.1.43 The communities associated with the subtidal reef habitats within the Waterway are more sheltered from wave action and exposed to moderately strong tidal streams. The communities of cushion sponges and hydroids are unlikely to be sensitive to the increased SSCs predicted as many cushion sponges can survive in highly turbid conditions and as the species occur in estuarine conditions, they are likely to be well adapted to turbid conditions (Readman, 2016b). Many of the sponges have also been recorded in turbid conditions and overall resistance is considered to be high (vulnerability low) and recoverability is high (Readman, 2016b). Smothering is likely to impact hydroids, ascidian and sponge species, however it is likely that enough of the population would survive to recover quite rapidly should the thin layer of sediment deposited be removed. Therefore, resistance/vulnerability is assessed as medium and recoverability is high (Readman, 2016b).
- 7.11.1.44 Overall, the Annex I subtidal 'reefs' VER is deemed to be of medium to high vulnerability, medium to high recoverability and very high value. The sensitivity of the receptor is therefore, considered to be low.

### Annex I 'Mudflats and sandflats not covered by seawater at low tide' VER

- 7.11.1.45 Using the '*Hediste diversicolor* and *Limecola balthica* in littoral sandy mud' (LS.LMu.MEst.HedLim) and 'Polychaetes in littoral fine sand' (LS.LSa.FiSa.Po) biotopes as proxies for the communities associated with the mudflats and sandflats occurring in the vicinity of Warrior Way (site 6) and Dale Roads (site 7), the MarESA concludes that benthic communities associated with muddy intertidal sediments are not likely to be sensitive to increased SSC on the basis that high levels of turbidity are typical of these muddy environments (Tillin and Rayment, 2016b). Similarly, with respect to smothering, most of the characterising polychaete species will be able to burrow through sediment to reposition; resistance/vulnerability is assessed as medium and recoverability is high (Tillin and Rayment, 2016b).
- 7.11.1.46 For the sandier communities, characterising species live within the sand and are unlikely to be directly affected by an increased concentration of suspended matter in the water although any associated increase in organic matter may result in an increase in the abundance of opportunistic species in the habitats. Mobile and/or burrowing species (including molluscs and polychaetes such as *Nephtys* spp., and *Scoloplos armiger*) are generally considered to be able to reposition following periodic siltation events such that none of the characterising species are considered likely to be significantly affected by the levels of deposition anticipated as a result of the META installation activities. Furthermore, as discussed in paragraph 7.11.1.37, benthic communities in the Waterway are likely to be habituated to periodic elevations in SSC and sediment deposition as a result of routine operations in the Waterway. Resistance is predicted to be high (vulnerability low) and recoverability high (Ashley, 2016).
- 7.11.1.47 Overall, the Annex I 'mudflats and sandflats not covered by seawater at low tide' VER is deemed to be of low vulnerability, high recoverability and very high value. The sensitivity of the receptor is therefore, considered to be low.

### Annex I intertidal reef VER

- 7.11.1.48 As discussed in paragraphs 7.7.4.8 to 7.7.4.12, the predominant intertidal biotopes which are likely to be present in association with the Annex I intertidal reef VER are the furoid dominated biotopes within the Waterway (i.e. LR.HLR.FT.FserT and LR.LLR.F.Fspi.FS) and the IR.HIR.KFaR.Ala.Ldig/MIR.KR.Ldig.Ldig and LR.HLR.MusB.Sem biotopes at East Pickard Bay (site 8). The MarESAs for these biotopes (Perry and d'Avack, 2015; d'Avack and Marshall, 2015a; Stamp, 2015; Tillin and Hill, 2016) indicates the resistance/vulnerability is medium and recoverability high. Increased SSC can reduce the photosynthetic capacity of algal species and, in turbid waters the feeding apparatus of suspension feeders (e.g. barnacles and limpets) may become clogged. However, once baseline conditions return to normal, photosynthesis and growth rates of furoids and kelps will resume.

7.11.1.49 With respect to sensitivity to smothering, fucoids are attached to the substratum by a holdfast and are thus not able to relocate in response to increased sedimentation and smothering of bedrock can impede attachment of *Fucus* embryos as well as decrease survival and growth of juveniles. However, the state of the tide will determine the extent of the impact as if smothering occurs at low tide when the algae are lying flat on the substratum, then most of the organism as well as the associated community will be covered by the deposition of fine material. If smothering occurs whilst the alga is submerged standing upright then the photosynthetic surfaces of adult plants will be left uncovered (Perry and d'Avack, 2015; d'Avack and Marshall, 2015a). However, adverse effects within the Waterway are not anticipated on the basis that the tidal flows will likely wash away any deposited sediment. Furthermore, as discussed in paragraph 7.11.1.37, benthic communities in the Waterway are likely to be habituated to periodic elevations in SSC and sediment deposition as a result of routine operations in the Waterway. Resistance is considered to be high (vulnerability low) and recoverability high to the levels of deposition anticipated.

7.11.1.50 Overall, the Annex I intertidal 'reefs' VER is deemed to be of low vulnerability, high recoverability and very high value. The sensitivity of the receptor is therefore, considered to be low.

#### Significance of the effect

7.11.1.51 No differences in the magnitude of the impact or the sensitivity of the receptors has been concluded between the three META sites, and therefore the overall significance of the effect for each VER below is made for all META sites. For the reasons discussed at section 7.7.8 above there is a level of uncertainty attached to the level of significance assigned to VERs on the basis that the assessment has been based on desktop data only. This uncertainty has been addressed through the adoption of precautionary thresholds.

7.11.1.52 In addition, no difference in assessment has been made between maximum and most likely design scenarios, therefore the overall significance of effect for maximum and most likely design scenarios is the same.

#### Annex I estuaries VER

7.11.1.53 Overall, the sensitivity of the Annex I 'estuaries' VER is considered to be low and the magnitude of the impact is deemed to be negligible. The effect will, therefore, be of **negligible significance**, which is not significant in EIA terms. Conclusions on the effects of on the conservation objectives of the Pembrokeshire Marine SAC are presented in full within the META project RIAA.

#### Annex I large shallow inlets VER

7.11.1.54 Overall, the sensitivity of the Annex I 'large shallow inlets' VER is considered to be low and the magnitude of the impact is deemed to be negligible. The effect will, therefore, be of **negligible significance**, which is not significant in EIA terms. Conclusions on the effects of on the conservation objectives of the Pembrokeshire Marine SAC are presented in full within the META project RIAA.

#### Annex I subtidal reef VER

7.11.1.55 Overall, the sensitivity of the Annex I subtidal 'reef' VER is considered to be low and the magnitude of the impact is deemed to be negligible. The effect will, therefore, be of **negligible significance**, which is not significant in EIA terms. Conclusions on the effects of on the conservation objectives of the Pembrokeshire Marine SAC are presented in full within the META project RIAA.

#### Circalittoral coarse sediment VER

7.11.1.56 Overall, the sensitivity of circalittoral coarse sand is considered to be low and the magnitude of the impact is deemed to be negligible. The effect will, therefore, be of **negligible significance**, which is not significant in EIA terms.

#### Annex I 'Mudflats and sandflats not covered by seawater at low tide' VER

7.11.1.57 Overall, the sensitivity of the Annex I 'Mudflats and sandflats not covered by seawater at low tide' VER is considered to be low and the magnitude of the impact is deemed to be negligible. The effect will, therefore, be of **negligible significance**, which is not significant in EIA terms. Conclusions on the effects of on the conservation objectives of the Pembrokeshire Marine SAC are presented in full within the META project RIAA.

#### Annex I intertidal reef VER

7.11.1.58 Overall, the sensitivity of the Annex I intertidal 'reef' VER is considered to be low and the magnitude of the impact is deemed to be negligible. The effect will, therefore, be of **negligible significance**, which is not significant in EIA terms. Conclusions on the effects of on the conservation objectives of the Pembrokeshire Marine SAC are presented in full within the META project RIAA.

#### **Sediment disturbance leading to the potential for resuspension of contaminated sediments may affect benthic ecology**

7.11.1.59 The installation activities described in paragraph 7.11.1.24 above, which have the potential to result in disturbance of the seabed also have the potential to result in a release of contaminated sediments which may cause detrimental effects on benthic subtidal and intertidal receptors.

### Magnitude of impact

- 7.11.1.60 As discussed in paragraph 7.11.1.26, all installation activities with the potential to disturb sediments will be short-term and temporary, affecting only discrete areas of seabed at any one time. As outlined in paragraph 7.7.3.1 *et seq.* the sediments within the Waterway have been exposed to historic levels of contamination, associated with the industries in the Waterway, with levels of hydrocarbons and metals at Dale Roads (site 7) and East Pickard Bay (site 8) likely to be lower than those at Warrior Way (site 6). It is also likely, based on the available desktop information, that levels of contaminants are, on the whole, below SQGs and levels which would result in adverse effects to benthic receptors. A precautionary approach has however been adopted for this assessment, which assumes some background contamination in the sediments present at the META sites. On the basis that the area of seabed affected during each installation activity will be small, this is expected to reduce the potential for resuspension of sediment-bound contaminants.
- 7.11.1.61 The impact of resuspension of contaminated sediments is therefore predicted to be of local spatial extent, short-term duration, intermittent and irreversible for all META sites. It is predicted that the impact will affect the receptors indirectly. The magnitude is therefore considered to be negligible.

### Sensitivity of the receptor

- 7.11.1.62 All of the benthic subtidal and intertidal VERs outlined in paragraphs 7.11.1.32 and 7.11.1.33 for impacts associated with increased SSC and sediment deposition Table 7.7 have the potential to be affected by the resuspension of contaminated sediments during installation activities.

#### **Annex I estuaries, Annex I large shallow inlets, Annex I sandbanks, circalittoral coarse sediment VERs**

- 7.11.1.63 Polychaetes are largely expected to be tolerant of heavy metal contamination and although they may be adversely affected by hydrocarbon contamination (e.g. from oil spills) they are generally the first organisms to recolonise sediments polluted by hydrocarbons (Tillin and Rayment, 2016; Tillin and Budd, 2016). Whilst echinoderms are also regarded as being tolerant of heavy metals, the capacity for bivalves to accumulate heavy metals in their tissues is well documented. Reactions to sub-lethal levels of heavy metals include siphon retraction, valve closure, inhibition of byssal thread production, disruption of burrowing behaviour, inhibition of respiration, inhibition of filtration rate, inhibition of protein synthesis and suppressed growth (Tillin and Rayment, 2016; Tillin and Budd, 2016). Similarly, with respect to exposure to oil, contact generally results in an increase in energy expenditure and a decrease in feeding rate, resulting in less energy available for growth and reproduction. Echinoderms are similarly intolerant of hydrocarbon contamination.
- 7.11.1.64 Given the historic levels of anthropogenic impact and input to the Waterway, the subtidal benthic communities associated with these VERs are expected to be tolerant to the existing levels of contaminants within the sediments at the META sites.

- 7.11.1.65 The Annex I 'estuaries', 'large shallow inlets', 'sandbanks' and 'subtidal reefs' VERs are deemed to be of medium vulnerability, medium recoverability and very high value. The sensitivity of the receptor is therefore, considered to be medium.
- 7.11.1.66 The circalittoral coarse sediment VER is deemed to be of medium vulnerability, medium recoverability and medium value. The sensitivity of the receptor is therefore, considered to be low.

#### **Annex I subtidal reef VER**

- 7.11.1.67 Although the evidence available on the MarESA for effects of this VER is sparse, it is suggested that hydroids associated with subtidal reef habitat may suffer sub-lethal effects and possibly morphological changes and reduced growth due to heavy metal contamination (Readman, 2016b). Given the historic levels of anthropogenic impact and input to the Waterway, the benthic communities associated with this VER are expected to be tolerant to the periodic increases in contaminated sediments. The Annex I 'reef' VER is deemed to be of low vulnerability, medium recoverability and very high value. The sensitivity of the receptor is therefore, considered to be low.

#### **Annex I 'Mudflats and sandflats not covered by seawater at low tide' VER**

- 7.11.1.68 The 'Mudflats and sandflats not covered by seawater at low tide' habitat within the wider Waterway is represented by the *Hediste diversicolor* biotope. *Hediste diversicolor* has been found living in estuarine environments with high levels of copper and its resistance to toxicity is likely to depend on its ability to detoxify the metal and store it in the tissues (Tillin and Rayment, 2016). Other estuarine species such as polychaetes are also resilient to heavy metals whilst bivalves, such as *Cerastoderma edule*, may decline in abundance if concentrations exceed a critical level (Tillin and Marshall, 2016).
- 7.11.1.69 Given the likely tolerance of the community to existing levels of contaminants, the Annex I 'Mudflats and sandflats not covered by seawater at low tide' VER is deemed to be of medium vulnerability, medium recoverability and very high value. The sensitivity of the receptor is therefore, considered to be medium.

#### **Annex I intertidal reef VER**

- 7.11.1.70 Macroalgal communities are likely to be relatively tolerant of contamination but the MarESA notes that metal-impacted intertidal communities can have low diversity assemblages dominated by opportunistic and fast growing species (Stamp, 2015). Barnacles and gastropods are also likely to be tolerant of fairly high levels of heavy metals (Tillin and Hill, 2016) but grazing gastropods such as limpets are well documented as being highly intolerant of hydrocarbon contamination, with lower littoral populations likely to be the most vulnerable to this sort of contamination (Stamp, 2015). Any disturbance to limpets and barnacles on reef habitat is likely to result in rapid recolonisation although this will depend on processes such as larval supply and recruitment between populations.

7.11.1.71 Given the likely tolerance of the community to existing levels of contaminants, the Annex I intertidal 'reef' VER is deemed to be of medium vulnerability, medium recoverability and very high value. The sensitivity of the receptor is therefore, considered to be medium.

#### Significance of the effect

7.11.1.72 No differences in the magnitude of the impact or the sensitivity of the receptors has been concluded between the three META sites, and therefore the overall significance of the effect for each VER below is made for all META sites. For the reasons discussed at section 7.7.8 above there is a level of uncertainty attached to the level of significance assigned to VERs on the basis that the assessment has been based on desktop data only. This uncertainty has been addressed through the adoption of precautionary thresholds.

7.11.1.73 In addition, no difference in assessment has been made between maximum and most likely design scenarios, therefore the overall significance of effect for maximum and most likely design scenarios is the same.

#### **Annex I estuaries VER**

7.11.1.74 Overall, the sensitivity of the Annex I 'estuaries' VER is considered to be medium and the magnitude of the impact is deemed to be negligible. The effect will, therefore, be of **negligible significance**, which is not significant in EIA terms. Conclusions on the effects of on the conservation objectives of the Pembrokeshire Marine SAC are presented in full within the META project RIAA.

#### **Annex I large shallow inlets VER**

7.11.1.75 Overall, the sensitivity of the Annex I 'large shallow inlets' VER is considered to be medium and the magnitude of the impact is deemed to be negligible. The effect will, therefore, be of **negligible significance**, which is not significant in EIA terms. Conclusions on the effects of on the conservation objectives of the Pembrokeshire Marine SAC are presented in full within the META project RIAA.

#### **Annex I subtidal reef VER**

7.11.1.76 Overall, the sensitivity of the Annex I subtidal 'reef' VER is considered to be low and the magnitude of the impact is deemed to be negligible. The effect will, therefore, be of **negligible significance**, which is not significant in EIA terms. Conclusions on the effects of on the conservation objectives of the Pembrokeshire Marine SAC are presented in full within the META project RIAA.

#### **Circalittoral coarse sediment VER**

7.11.1.77 Overall, the sensitivity of circalittoral coarse sand is considered to be medium and the magnitude of the impact is deemed to be negligible. The effect will, therefore, be of **negligible significance**, which is not significant in EIA terms.

#### **Annex I 'Mudflats and sandflats not covered by seawater at low tide' VER**

7.11.1.78 Overall, the sensitivity of the Annex I 'Mudflats and sandflats not covered by seawater at low tide' VER is considered to be medium and the magnitude of the impact is deemed to be negligible. The effect will, therefore, be of **negligible significance**, which is not significant in EIA terms. Conclusions on the effects of on the conservation objectives of the Pembrokeshire Marine SAC are presented in full within the META project RIAA.

#### **Annex I intertidal reef VER**

7.11.1.79 Overall, the sensitivity of the Annex I intertidal 'reef' VER is considered to be medium and the magnitude of the impact is deemed to be negligible. The effect will, therefore, be of **negligible significance**, which is not significant in EIA terms. Conclusions on the effects of on the conservation objectives of the Pembrokeshire Marine SAC are presented in full within the META project RIAA.

#### **Risk of installation activities facilitating the introduction of marine INNS**

7.11.1.80 There is a risk of the introduction and spread of marine INNS during installation activities as a result of increased vessel movements. Vessels can act as a vector for INNS by allowing the colonisation of species from other geographical areas either as marine fouling on the vessel hull or following entrainment into the vessel through seawater intakes (for ballast water) that can in turn upset the ecological balance of local communities.

#### Magnitude of impact

7.11.1.81 As outlined in Table 7.8, the maximum design scenarios for installation activities at Warrior Way (site 6) and Dale Roads (site 7) are anticipated to require up to 20 vessel movements/round trips to port per site, involving up to five vessels at any one time, per year. At East Pickard Bay (site 8), up to 40 vessel movements/round trips to port may be required per year, involving up to five vessels at any one time. For all three META sites combined, this equates to a maximum design scenario of an additional 80 vessel movements/round trips to port per year. The most likely design scenario, as outlined in Table 7.8, would require up to 60 vessel movements/round trips to port per year, involving up to three vessels at any one time.

7.11.1.82 As outlined in chapter 12: Shipping and Navigation, the current baseline level of vessel traffic within the Waterway, and in particular in the vicinity of Warrior Way (site 6) and Dale Roads (site 7), is high throughout the year with the baseline in Appendix 12.1: Navigational Risk Assessment (NRA) with the MHPA recording 5,004 commercial vessel movements within the Waterway per year (although this does not include tug vessel or recreational vessel movements which would further increase this total). Much of this traffic (~58%) comprises commercial oil/chemical tankers, with the routes to the main hydrocarbon berths (South Hook LNG, Valero refinery on the south bank, and Valero Oil Terminal & Dragon LNG), Milford Haven Dock and Pembroke Dock contributing to the high-density shipping movements in the Waterway. The Irish Ferry also contributes to the high levels of vessel traffic (~26% of the total commercial vessel movements). Both of these sources demonstrate the international nature of vessel movement within the Waterway. Therefore, the uplift in vessel traffic associated with META installation activities on the existing baseline levels is considered to be very small. Although current levels of vessel traffic are lower at East Pickard Bay (site 8), the vessels employed in installation activities are likely to be local to the Waterway or Wales, thereby limiting the potential for the introduction of new marine INNS to the area via this pathway. As detailed in Table 7.13, an Invasive Species Management Plan for the project will also be developed and agreed in consultation with the statutory consultees which will further reduce the likelihood of a marine INNS being introduced to the waterway as a result of vessel movements associated with the META installation activities.

7.11.1.83 The impact of introduction of marine INNS associated with vessel traffic is therefore predicted to be of local spatial extent and, if it occurs, of long-term duration, continuous and irreversible for all META sites. It is predicted that the impact will affect the receptors indirectly. The magnitude is therefore considered to be negligible.

#### Sensitivity of the receptor

7.11.1.84 All benthic subtidal VERs outlined in Table 7.7 have the potential to be affected by the introduction of marine INNS during installation activities.

7.11.1.85 Few invasive non-indigenous species may be able to colonise mobile sediments such as those associated with sandy sediments, due to the high-levels of sediment disturbance. One of the key species of concern for the subtidal VERs in the benthic subtidal and intertidal study area is the slipper limpet *C. fornicata* which may settle on stones/gravels in substrates and on hard surfaces such as bivalve shells. For example, dense aggregations of *C. fornicata* trap suspended silt, faeces and pseudofaeces altering the benthic habitat. Beds of invasive *C. fornicata* have been reported on maerl beds in Brittany, killing the maerl thalli and clogging the bed with silt and pseudo-faeces (Perry and Tyler-Walters, 2018).

7.11.1.86 However, it should be noted that the slipper limpet is well established in the Waterway, particularly in the inner reaches, since it was first introduced in 1953 (Bohn *et al.*, 2015). Therefore, although the sensitivity of the component biotopes to INNS on MarESA is considered to be high, on the basis of their very low resistance (i.e. high vulnerability) and very low resilience/recoverability to colonisation by slipper limpet, the additional risk posed by other INNS is considered to be low.

#### **Annex I estuaries, Annex I large shallow inlets, Annex I sandbanks and Annex I subtidal reefs VERs**

7.11.1.87 The Annex I 'estuaries', 'large shallow inlets', 'sandbanks' and 'subtidal reefs' VERs are deemed to be of high/very high vulnerability, very low recoverability and very high value. The sensitivity of the receptor is therefore, considered to be high.

#### **Maerl beds and seagrass beds VERs**

7.11.1.88 The maerl beds and seagrass beds VERs are deemed to be of high/very high vulnerability, very low recoverability and high value. The sensitivity of the receptor is therefore, considered to be high.

#### **Circalittoral coarse sediment VER**

7.11.1.89 The circalittoral coarse sediment VER is deemed to be of high/very high vulnerability, very low recoverability and medium value. The sensitivity of the receptor is therefore, considered to be medium.

#### Significance of the effect

7.11.1.90 No differences in the magnitude of the impact or the sensitivity of the receptors has been concluded between the three META sites, and therefore the overall significance of the effect for each VER below is made for all META sites. For the reasons discussed at section 7.7.8 above there is a level of uncertainty attached to the level of significance assigned to VERs on the basis that the assessment has been based on desktop data only. This uncertainty has been addressed through the adoption of precautionary thresholds.

7.11.1.91 In addition, no difference in assessment has been made between maximum and most likely design scenarios, therefore the overall significance of effect for maximum and most likely design scenarios is the same.

#### **Annex I estuaries, Annex I large shallow inlets, Annex I sandbanks and Annex I subtidal reefs VERs**

7.11.1.92 Overall, the sensitivity of these VERs is considered to be high and the magnitude of the impact is deemed to be negligible. The effect will, therefore, be of **minor adverse significance**, which is not significant in EIA terms. Conclusions on the effects of on the conservation objectives of the Pembrokeshire Marine SAC are presented in full within the META project RIAA.

### Maerl beds and seagrass beds VERs

- 7.11.1.93 Overall, the sensitivity of the Annex I 'large shallow inlets' VER is considered to be high and the magnitude of the impact is deemed to be negligible. The effect will, therefore, be of **minor adverse significance**, which is not significant in EIA terms. Conclusions on the effects of on the conservation objectives of the Pembrokeshire Marine SAC are presented in full within the META project RIAA.

### Circalittoral coarse sediment VER

- 7.11.1.94 Overall, the sensitivity of circalittoral coarse sand is considered to be medium and the magnitude of the impact is deemed to be negligible. The effect will, therefore, be of **negligible significance**, which is not significant in EIA terms.

### Accidental release of pollutants (e.g. accidental spillage) during installation activities

#### Magnitude of impact

- 7.11.1.95 There is the potential for the accidental release of pollutants and debris into the marine environment during installation works, as a result of accidental spillage or leakage for example. Pollution may include diesel oil from installation vessels, chemicals and lubricants.
- 7.11.1.96 This risk of pollution events will, however, be minimised by the implementation of an EMP during installation. As outlined in Table 7.13, the EMP will include planning for accidental spills via a Marine Pollution Contingency Plan (MPCP), which will address all potential contaminant releases and include key emergency contact details (e.g. NRW, MHPA and MCA). Furthermore, any lubricants used will be EU/internationally approved for use in marine environments (chapter 2: Project Description). Adherence to the measures outlined in the EMP, as well as standard best practice guidance and Guidance for Pollution Prevention (GPP), would significantly reduce the likelihood of an accidental pollution incident occurring and impacting the waters of the Waterway. Measures adopted as part of the META project to reduce the potential for impacts on shipping and navigation (see chapter 12: Shipping and Navigation), such as the issue of Notices to Mariners before and during each deployment, and vessels complying with the International Regulations for Preventing Collisions at Sea (COLREGs) will further reduce the likelihood of an accident between vessels resulting in an accidental diesel spill during installation activities.
- 7.11.1.97 In the unlikely event that pollutants did enter the waters of the Waterway, they would be rapidly dispersed on the surface and in the water column and subject to twice daily tidal flushing, and so any effects on water quality would likely be limited. This dispersal mechanism is likely to be higher at East Pickard Bay (site 8) which is out with the Waterway and therefore in more exposed, high energy, waters.

- 7.11.1.98 The impact of an accidental pollution event occurring during installation activities is therefore predicted to be of local spatial extent, of short-term duration (i.e. in the unlikely event that a spillage occurs, the impact would last hours to days), intermittent, and reversible for all META sites. It is predicted that the impact will affect the receptors indirectly. The magnitude is therefore considered to be negligible.

#### Sensitivity of the receptor

- 7.11.1.99 All benthic subtidal and intertidal VERs outlined in Table 7.7 have the potential to be affected by an accidental spill event during installation activities. The sensitivity of most benthic receptors to the range of contaminants likely to occur during accidental pollution has been described previously in paragraph 7.11.1.62 *et seq.* Where additional VERs are included in this assessment of accidental pollution (i.e. seagrass, maerl beds, and Atlantic salt meadows), information on their likely sensitivity is presented in the relevant sections.

#### Annex I estuaries, Annex I large shallow inlets, Annex I sandbanks VERs

- 7.11.1.100 The Annex I 'estuaries', 'large shallow inlets' and 'sandbanks' VERs are deemed to be of medium vulnerability, medium recoverability and very high value. The sensitivity of these receptor is therefore, considered to be medium.

#### Circalittoral coarse sediment VER

- 7.11.1.101 The circalittoral coarse sediment VER is deemed to be of medium vulnerability, medium recoverability and medium value. The sensitivity of the receptor is therefore, considered to be low.

#### Annex I subtidal reef VER

- 7.11.1.102 The Annex I 'reef' VER is deemed to be of low vulnerability, medium recoverability and very high value. The sensitivity of the receptor is therefore, considered to be low.

#### Maerl beds VER

- 7.11.1.103 Available general information on the vulnerability of maerl beds to various human activities, and information on the toxicity of oil to red algae would suggest that maerl beds are highly vulnerable to oil and accidental spills. For example, they are particularly sensitive to low oxygen concentrations and smothering and have slow growth and recovery potential (Perry and Tyler-Walters, 2018; Povlsen and Hjorth, 2015).
- 7.11.1.104 The maerl beds VER is deemed to be of high/very high vulnerability, very low recoverability and high value. The sensitivity of the receptor is therefore, considered to be high.

### Subtidal and Intertidal seagrass VERs

7.11.1.105 Subtidal seagrass (i.e. *Z. marina*) may be partially protected from direct contact with potential contaminants such as oil due to its submerged location. Furthermore, the historic occurrence of *Zostera* beds within the Waterway indicate a likely tolerance of long-term, low level, hydrocarbon effluent (Hiscock, 1987 in d'Avack *et al.*, 2015b). The Amoco Cadiz oil spill off Roscoff caused *Z marina* leaves to blacken for up to two weeks but had little effect on growth, production or reproduction after the leaves were covered in oil for six hours (Jacobs, 1980 in d'Avack *et al.*, 2015b). However, amphipods, *Tanaidacea* and *echinodermata* associated with the seagrass beds virtually disappeared although the numbers of most groups recovered within a year (Jacobs, 1980). Removal of oil intolerant gastropod grazers may also result in smothering of seagrasses by epiphytes (Davison and Hughes, 1998 in d'Avack *et al.*, 2015b). Experimental treatment of *Zostera* sp. with crude oil and dispersants has been shown to halt growth but have little effect on cover Davison and Hughes, 1998 in d'Avack *et al.*, 2015b).

7.11.1.106 The subtidal and intertidal seagrass VERs are therefore deemed to be of medium vulnerability, medium recoverability and high value. The sensitivity of these receptor is therefore, considered to be medium.

### Annex I 'Mudflats and sandflats not covered by seawater at low tide' VER

7.11.1.107 Low energy intertidal sediments are generally more susceptible to chemical pollution than high energy coastal environments. Furthermore, the low dispersion within these areas may result in them acting as sinks for pollutants and heavy metals, as a result of them becoming adsorbed onto fine sediments and organic particulates (Clark, 1997). Hydrocarbon contamination from oil spills in particular, often results in large-scale damage to intertidal communities due to smothering of sediments which prevents oxygen exchange and leads to anoxia and subsequent death of infauna (Tyler-Walters and Marshall, 2006).

7.11.1.108 The Annex I 'Mudflats and sandflats not covered by seawater at low tide' VER is deemed to be of medium vulnerability, medium recoverability and very high value. The sensitivity of the receptor is therefore, considered to be medium.

### Annex I intertidal reef VER

7.11.1.109 The Annex I intertidal 'reef' VER is deemed to be of medium vulnerability, medium recoverability and very high value. The sensitivity of the receptor is therefore, considered to be medium.

### Significance of effect

7.11.1.110 No differences in the magnitude of the impact or the sensitivity of the receptors has been concluded between the three META sites, and therefore the overall significance of the effect for each VER below is made for all META sites. For the reasons discussed at section 7.7.8 above there is a level of uncertainty attached to the level of significance assigned to VERs on the basis that the assessment has been based on desktop data only. This uncertainty has been addressed through the adoption of precautionary thresholds.

7.11.1.111 In addition, no difference in assessment has been made between maximum and most likely design scenarios, therefore the overall significance of effect for maximum and most likely design scenarios is the same.

### Annex I estuaries, Annex I large shallow inlets, Annex I sandbanks VERs

7.11.1.112 Overall, the sensitivity of these VERs is considered to be medium and with the mitigation measures adopted as part of the project, the likelihood of a pollution event occurring is extremely low so the magnitude of the impact is deemed to be negligible. The effect will, therefore, be of **negligible significance**, which is not significant in EIA terms. Conclusions on the effects of on the conservation objectives of the Pembrokeshire Marine SAC are presented in full within the META RIAA.

### Circalittoral coarse sediment VER

7.11.1.113 Overall, the sensitivity of this VER is considered to be low and with the mitigation measures adopted as part of the project, the likelihood of a pollution event occurring is extremely low so the magnitude of the impact is deemed to be negligible. The effect will, therefore, be of **negligible significance**, which is not significant in EIA terms.

### Annex I subtidal reef VER

7.11.1.114 Overall, the sensitivity of this VER is considered to be low and with the mitigation measures adopted as part of the project, the likelihood of a pollution event occurring is extremely low so the magnitude of the impact is deemed to be negligible. The effect will, therefore, be of **negligible significance**, which is not significant in EIA terms. Conclusions on the effects of on the conservation objectives of the Pembrokeshire Marine SAC are presented in full within the META RIAA.

### Maerl beds VER

7.11.1.115 Overall, the sensitivity of this VER is considered to be high and with the mitigation measures adopted as part of the project, the likelihood of a pollution event occurring is extremely low so the magnitude of the impact is deemed to be negligible. The effect will, therefore, be of **minor adverse significance**, which is not significant in EIA terms.

### Subtidal and Intertidal seagrass VERs

7.11.1.116 Overall, the sensitivity of these VERs is considered to be medium and with the mitigation measures adopted as part of the project, the likelihood of a pollution event occurring is extremely low so the magnitude of the impact is deemed to be negligible. The effect will, therefore, be of **minor adverse significance**, which is not significant in EIA terms.

### Annex I 'Mudflats and sandflats not covered by seawater at low tide' VER

7.11.1.117 Overall, the sensitivity of this VER is considered to be medium and with the mitigation measures adopted as part of the project, the likelihood of a pollution event occurring is extremely low so the magnitude of the impact is deemed to be negligible. The effect will, therefore, be of **minor adverse significance**, which is not significant in EIA terms. Conclusions on the effects of on the conservation objectives of the Pembrokeshire Marine SAC are presented in full within the META RIAA.

### Annex I intertidal reef VER

7.11.1.118 Overall, the sensitivity of this VER is considered to be medium and with the mitigation measures adopted as part of the project, the likelihood of a pollution event occurring is extremely low so the magnitude of the impact is deemed to be negligible. The effect will, therefore, be of **minor adverse significance**, which is not significant in EIA terms. Conclusions on the effects of on the conservation objectives of the Pembrokeshire Marine SAC are presented in full within the META RIAA.

### Future monitoring

7.11.1.119 No benthic ecology and subtidal ecology monitoring to test the predictions made within the installation phase impact assessment is considered necessary.

### 7.11.2 Operation and maintenance phase

7.11.2.1 The impacts of the operation and maintenance of the META project have been assessed on benthic subtidal and intertidal ecology. The environmental impacts arising from the operation and maintenance of the META Project are listed in Table 7.8 along with the maximum design scenario against which each operation and maintenance phase impact has been assessed. A conclusion of significance of effect will be made for the META project as a whole, and for each META phase 2 site individually where appropriate (Warrior Way (site 6), Dale Roads (site 7); East Pickard Bay (site 8)).

7.11.2.2 A description of the potential effect on benthic subtidal and intertidal ecology receptors resulting from each identified impact is given below.

### **Habitat loss through presence of infrastructure on the seabed resulting in potential effects on benthic ecology**

7.11.2.3 Benthic subtidal habitat loss will occur directly under all foundation structures (i.e. gravity bases or pin piles) and within the footprints of the devices/components themselves on the seabed.

### Magnitude of impact

7.11.2.4 As outlined in Table 7.8, the maximum design scenario results in a total combined subtidal habitat loss at any one time within the footprint of devices/components and moorings/attachments, across all three META test sites, of up to 11,050 m<sup>2</sup>. Of this, up to 200 m<sup>2</sup> of habitat loss is predicted at Warrior Way (site 6; equating to 0.22% of the total area of the site), 600 m<sup>2</sup> at Dale Roads (site 7; equating to 0.3% of the total area of the site) and 10,250 m<sup>2</sup> at East Pickard Bay (site 8; equating to 0.83% of the total area of the site). It should also be noted that the maximum design scenario assumes that only 50% of deployments will require contact with the seabed, which will further limit the potential for habitat loss during the deployment of devices. Therefore, only a very small proportion of the seabed within the sites will be affected at any one time. It is also important to recognise that the maximum design scenarios for deployment durations are very short-term: for Warrior Way (site 6) deployment may be up to six months, for Dale Roads (site 7) up to 12 months and East Pickard Bay (site 8) up to a maximum of 18 months. Therefore, the habitat loss during the operation/testing of the components and devices will only be short-term and temporary.

7.11.2.5 As also outlined in Table 7.8, the maximum design scenario assumes that there may be up to 150 installation events occurring intermittently across all three META test sites over the 15-year lifetime of the project. There is therefore the potential for repeat habitat loss as a result of device and foundation presence over the lifetime of the project.

7.11.2.6 The most likely design scenario, as outlined in Table 7.8, predicts temporary subtidal habitat loss of up to 2,000 m<sup>2</sup> at any one time across the three META sites, with up to 60 installation events occurring intermittently across the 15-year lifetime of the project.

7.11.2.7 The impact of habitat loss to benthic subtidal habitats from the presence of devices or components on the seabed and the presence of moorings/attachment throughout the operational phase is predicted to be of local spatial extent, restricted to be the META test sites, of short-term duration, intermittent over the 15-year lifetime of the META project (although only a small proportion of the total area will be affected at any one time) and reversible. It is predicted that the impact will affect the benthic receptors directly. The magnitude is therefore, considered to be minor (adverse).

### Sensitivity of the receptor

7.11.2.8 The benthic subtidal VERs with the potential to be affected by habitat loss during device/component operation at the META sites are Annex I 'estuaries' and Annex I 'large shallow inlets' at Warrior Way (site 6) and Dale Roads (site 7) and circalittoral coarse sediment habitats at East Pickard Bay (site 8). As discussed in paragraph 7.7.2.10 *et seq.* the META sites do not overlap with the mapped extent of known Annex I reef habitat, or any other VERs. Furthermore, as outlined in Table 7.13, if Annex I reef is recorded pre-deployment, measures have been adopted as part of the project design (i.e. micro-siting of testing infrastructure) to ensure that direct impacts to this VER are avoided.

### Annex I estuaries, Annex I large shallow inlets and circalittoral coarse sediment VERs

- 7.11.2.9 As discussed in paragraph 7.7.2.10 *et seq.*, the subtidal biotopes which have been recorded in association with the subtidal sediments, at the META sites include the SS.SCS.OCS.HeloPkef, SS.SSa.IFiSa.NcirBat and SS.SSa.IMuSa.FfabMag biotopes in areas of sand, the SS.SSa.CMuSa.AalbNuc biotope in areas of muddier fine sand and SS.SMx.CMx.MysThyMx biotope in areas of mixed sediments within the Waterway. It is anticipated that the benthic infaunal and epifaunal species associated with these sediments would be lost along with the substratum within the footprints of the infrastructure described above and therefore the resistance of these habitats is considered to be none or vulnerability high (Tillin and Budd, 2016; Tillin and Ashley, 2016; De-Bastos and Marshall, 2016; Tillin and Rayment, 2016; Tillin, 2016).
- 7.11.2.10 However, whereas impacts such as habitat loss are often considered as a permanent impact, in the case of the META project the impact is only short-term as infrastructure will be removed within the timescales outlined in Table 7.8 and paragraph 7.11.2.4. Therefore, the resilience/recoverability of the underlying communities is relevant to this impact. The resilience/recoverability of the component biotopes of the affected VERs is as described previously for temporary habitat disturbance during the installation phase in paragraph 7.11.1.13 (i.e. recoverability is likely to be high following removal of the infrastructure).
- 7.11.2.11 As discussed in paragraph 7.11.2.5 above, there may be some areas within the META sites which, over the 15-year lifetime of the project, are exposed to repeated temporary habitat loss for the duration of device/component deployment. However, as described previously in paragraph 7.11.1.14 it is unrealistic to assume that sequential installations would repeatedly affect the same area of seabed within the sites. It is therefore anticipated that this will allow sufficient time between any potential repeat deployment events which result in temporary habitat loss for the benthic communities to recover.
- 7.11.2.12 The conclusions made below for the Annex I habitat VERs are made on the basis of the MarESA assessment described above for the likely component biotopes present in association with these features at the META sites.
- 7.11.2.13 The Annex I 'estuaries' VER is deemed to be of high vulnerability, high recoverability and very high value. The sensitivity of the receptor is therefore, considered to be low.
- 7.11.2.14 The Annex I 'large shallow inlets' VER is deemed to be of high vulnerability, high recoverability and very high value. The sensitivity of the receptor is therefore, considered to be low.
- 7.11.2.15 The circalittoral coarse sediment VER is deemed to be of medium vulnerability, medium recoverability and medium value. The sensitivity of the receptor is therefore, considered to be low.

### Significance of the effect

- 7.11.2.16 No differences in the magnitude of the impact or the sensitivity of the receptors has been concluded between the three META sites, and therefore the overall significance of the effect for each VER below is made for all META sites. For the reasons discussed at section 7.7.8 above there is a level of uncertainty attached to the level of significance assigned to VERs on the basis that the assessment has been based on desktop data only. This uncertainty has been addressed through the adoption of precautionary thresholds.
- 7.11.2.17 In addition, no difference in assessment has been made between maximum and most likely design scenarios, therefore the overall significance of effect for maximum and most likely design scenarios is the same.

### Annex I estuaries VER

- 7.11.2.18 Overall, the sensitivity of the Annex I 'estuaries' VER is considered to be low and the magnitude of the impact is deemed to be minor. The effect will, therefore, be of **minor adverse significance**, which is not significant in EIA terms. Conclusions on the effects of on the conservation objectives of the Pembrokeshire Marine SAC are presented in full within the META project RIAA.

### Annex I large shallow inlets VER

- 7.11.2.19 Overall, the sensitivity of the Annex I 'large shallow inlets' VER is considered to be low and the magnitude of the impact is deemed to be minor. The effect will, therefore, be of **minor adverse significance**, which is not significant in EIA terms. Conclusions on the effects of on the conservation objectives of the Pembrokeshire Marine SAC are presented in full within the META project RIAA.

### Circalittoral coarse sediment VER

- 7.11.2.20 Overall, the sensitivity of circalittoral coarse sand is considered to be low and the magnitude of the impact is deemed to be minor. The effect will, therefore, be of **negligible significance**, which is not significant in EIA terms.

### **Temporary habitat disturbance during the operation and maintenance phase, may affect benthic ecology**

- 7.11.2.21 As outlined in Table 7.8, the use of mooring spreads to anchor devices/components at the META sites has the potential to result in temporary disturbance to benthic habitats and communities for the duration of the deployment of devices/components at the META sites as a result of the movement of the mooring lines/chains on the surface of the sediment and/or anchors penetrating the substratum surface for example. The disturbance of benthic habitats is likely to constitute abrasion/disturbance of the surface of the substratum. Any small epifaunal or other sessile species present on the surface of the seabed may potentially be damaged or destroyed although infauna species are likely to be largely unaffected.

### Magnitude of impact

- 7.11.2.22 As outlined in Table 7.8, the total combined temporary habitat disturbance predicted to occur at any one time, across all three META test sites, during the operation and maintenance phase is up to 500,350 m<sup>2</sup>. Of this, the predicted extents of temporary habitat disturbance at Warrior Way (site 6) of 150 m<sup>2</sup> and 200 m<sup>2</sup> at Dale Roads (site 7) will affect only a very small proportion of the total area of these test sites at any one time; 0.16% for Warrior Way (site 6) and 0.10% for Dale Roads (site 7).
- 7.11.2.23 The majority of the total combined temporary habitat disturbance (500,000 m<sup>2</sup>) is predicted to occur at East Pickard Bay (site 8) affecting up to approximately 40.7% of the total area of the site at any one time. It should however be noted that this value is highly precautionary for East Pickard Bay (site 8) as it assumes that the entire area within each of the mooring footprints associated with the maximum design scenario would be subject to disturbance, which is highly unlikely to occur. In reality, the actual extent of disturbance will be much less than this and restricted to the immediate vicinity of the anchors and mooring lines/chains.
- 7.11.2.24 As also outlined in Table 7.8, the maximum design scenario assumes that there may be up to 150 installation events occurring intermittently across all three META test sites over the 15-year lifetime of the project. There is therefore the potential for repeat disturbance to areas of seabed affected during previous installations.
- 7.11.2.25 The most likely design scenario, as outlined in Table 7.8, predicts a much reduced footprint of temporary habitat disturbance during the operation and maintenance phase of up to 1,425 m<sup>2</sup> at any one time during the operation and maintenance phase as a result of mooring spreads for devices/components. This habitat disturbance would be restricted to the boundaries of the META sites and there may be up to 60 installation events occurring intermittently across the 15-year lifetime of the project.
- 7.11.2.26 The impact of temporary disturbance to benthic habitats from seabed clearance and vessel mooring activities during the installation phase is predicted to be of local spatial extent, restricted to be the META test sites, of short-term duration, intermittent over the 15-year lifetime of the META project (although only a small proportion of the total area will be affected at any one time) and reversible. It is predicted that the impact will affect the benthic receptors directly. The magnitude is therefore, considered to be minor (adverse).

### Sensitivity of the receptor

- 7.11.2.27 The benthic subtidal VERs with the potential to be affected by temporary habitat disturbance during the operation and maintenance phase are the same as those described in paragraph 7.11.1.3 *et seq.* for the installation phase activities i.e. Annex I 'estuaries' and Annex I 'large shallow inlets' at Warrior Way (site 6) and Dale Roads (site 7) and circalittoral coarse sediment habitats at East Pickard Bay (site 8). As discussed in paragraph 7.7.2.10 *et seq.* the META sites do not overlap with the mapped extent of known Annex I reef habitat, or any other VERs. Furthermore, as outlined in Table 7.13, if Annex I reef is recorded pre-deployment measures have been adopted as part of the project design (i.e. micrositing of testing infrastructure) to ensure that direct impacts to this VER are avoided.

#### **Annex I estuaries, Annex I large shallow inlets and circalittoral coarse sediment VERs**

- 7.11.2.28 The sensitivity of the VERs to temporary habitat disturbance is as described previously in paragraph 7.11.1.11 *et seq.*
- 7.11.2.29 The Annex I 'estuaries' VER is deemed to be of medium vulnerability, high recoverability and very high value. The sensitivity of the receptor is therefore, considered to be low.
- 7.11.2.30 The Annex I 'large shallow inlets' VER is deemed to be of medium vulnerability, high recoverability and very high value. The sensitivity of the receptor is therefore, considered to be low.
- 7.11.2.31 The circalittoral coarse sediment VER is deemed to be of medium vulnerability, high recoverability and medium value. The sensitivity of the receptor is therefore, considered to be low.

### Significance of the effect

- 7.11.2.32 No differences in the magnitude of the impact or the sensitivity of the receptors have been concluded between the three META sites, and therefore the overall significance of the effect for each VER below is made for all META sites. For the reasons discussed at section 7.7.8 above there is a level of uncertainty attached to the level of significance assigned to VERs on the basis that the assessment has been based on desktop data only. This uncertainty has been addressed through the adoption of precautionary thresholds.
- 7.11.2.33 In addition, no difference in assessment has been made between maximum and most likely design scenarios, therefore the overall significance of effect for maximum and most likely design scenarios is the same.

### Annex I estuaries VER

- 7.11.2.34 Overall, the sensitivity of the Annex I 'estuaries' VER is considered to be low and the magnitude of the impact is deemed to be minor. The effect will, therefore, be of **minor adverse significance**, which is not significant in EIA terms. Conclusions on the effects of on the conservation objectives of the Pembrokeshire Marine SAC are presented in full within the META project RIAA.

### Annex I large shallow inlets VER

- 7.11.2.35 Overall, the sensitivity of the Annex I 'large shallow inlets' VER is considered to be low and the magnitude of the impact is deemed to be minor. The effect will, therefore, be of **minor adverse significance**, which is not significant in EIA terms. Conclusions on the effects of on the conservation objectives of the Pembrokeshire Marine SAC are presented in full within the META project RIAA.

### Circalittoral coarse sediment VER

- 7.11.2.36 Overall, the sensitivity of circalittoral coarse sand is considered to be low and the magnitude of the impact is deemed to be minor. The effect will, therefore, be of **negligible significance**, which is not significant in EIA terms.

### **Alteration of seabed habitats arising from changes in physical processes, including scour effects and changes to sediment transport, may have effects on benthic ecology**

#### Magnitude of impact

- 7.11.2.37 As outlined in chapter 6: Coastal Processes, interaction between the metocean regime (wave, sand and currents) and marine energy devices has the potential to cause localised scouring of seabed sediments leaving a depression around the structures. As also outlined in chapter 5: Coastal Processes, foundations used for marine energy devices may also interrupt sediment transport pathways which may have effects on benthic receptors.
- 7.11.2.38 Those structures most prone to scour are long-term installations such as piles; due to the limited nature of the installation and testing at Warrior Way (site 6) seabed scour has been scoped out for this META site. At Dale Roads (site 7), the extent of the predicted scour depth around pin piles, associated with the maximum design scenario, would be in the order of 200 mm, although it is likely to be much less than this due to the low current speeds in this area. These low current speeds are also unlikely to cause significant scour should gravity bases be deployed. For East Pickard Bay (site 8) the predicted depth of scour would be the same, however due to the coarse bed material at this site the actual extent of scour would be less.

- 7.11.2.39 With respect to changes to sediment transport pathways, on the basis that deployments at all META sites will be temporary and, after decommissioning, the pathway will be restored, the coastal processes assessment concluded that the magnitude of the impact on sediment transport pathways is considered to be minor.

- 7.11.2.40 The impact of changes to physical processes on benthic receptors is therefore predicted to be of local spatial extent, of short-term duration, continuous and reversible. It is predicted that the impact will affect the receptors indirectly. The magnitude is therefore considered to be negligible.

#### Sensitivity of the receptor

- 7.11.2.41 The benthic receptors likely to be affected by any changes in physical processes will be those within the META sites i.e. Annex I 'estuaries' and Annex I 'large shallow inlets' at Warrior Way (site 6) and Dale Roads (site 7) and circalittoral coarse sediment habitats at East Pickard Bay (site 8).

#### **Annex I estuaries, Annex I large shallow inlets and circalittoral coarse sediment VERs**

- 7.11.2.42 As discussed in paragraph 7.7.2.10 *et seq.*, the subtidal biotopes which have been recorded in association with the subtidal sediments at the META sites include the SS.SCS.OCS.HeloPkef, SS.SSa.IFiSa.NcirBat and SS.SSa.IMuSa.FfabMag biotopes in areas of sand, the SS.SSa.CMuSa.AalbNuc biotope in areas of muddier fine sand and SS.SMx.CMx.MysThyMx biotope in areas of mixed sediments within the Waterway.

- 7.11.2.43 According to the MarESA assessments for these biotopes, the benthic infaunal and epifaunal species associated with these sediments are not sensitive to local changes in water flow at the benchmark level (which is a change in peak mean spring bed flow velocity of between 0.1 m/s to 0.2 m/s for more than one year) (Tillin and Budd, 2016; Tillin and Ashley, 2016; De-Bastos and Marshall, 2016; Tillin and Rayment, 2016; Tillin, 2016). These biotopes typically occur in areas naturally subject to moderately strong and weak water flows and resistance to changes in flow is likely to be high.

- 7.11.2.44 The Annex I 'estuaries' VER is deemed to be of low vulnerability, high recoverability and very high value. The sensitivity of the receptor is therefore, considered to be low.

- 7.11.2.45 The Annex I 'large shallow inlets' VER is deemed to be of low vulnerability, high recoverability and very high value. The sensitivity of the receptor is therefore, considered to be low.

- 7.11.2.46 The circalittoral coarse sediment VER is deemed to be of low vulnerability, high recoverability and medium value. The sensitivity of the receptor is therefore, considered to be negligible.

### Significance of the effect

- 7.11.2.47 No differences in the magnitude of the impact or the sensitivity of the receptors have been concluded between the three META sites, and therefore the overall significance of the effect for each VER below is made for all META sites. For the reasons discussed at section 7.7.8 above there is a level of uncertainty attached to the level of significance assigned to VERs on the basis that the assessment has been based on desktop data only. This uncertainty has been addressed through the adoption of precautionary thresholds.
- 7.11.2.48 In addition, no difference in assessment has been made between maximum and most likely design scenarios, therefore the overall significance of effect for maximum and most likely design scenarios is the same.

#### Annex I estuaries VER

- 7.11.2.49 Overall, the sensitivity of the Annex I 'estuaries' VER is considered to be low and the magnitude of the impact is deemed to be negligible. The effect will, therefore, be of **negligible significance**, which is not significant in EIA terms. Conclusions on the effects of on the conservation objectives of the Pembrokeshire Marine SAC are presented in full within the META RIAA.

#### Annex I large shallow inlets VER

- 7.11.2.50 Overall, the sensitivity of the Annex I 'large shallow inlets' VER is considered to be low and the magnitude of the impact is deemed to be negligible. The effect will, therefore, be of **negligible significance**, which is not significant in EIA terms. Conclusions on the effects of on the conservation objectives of the Pembrokeshire Marine SAC are presented in full within the META RIAA.

#### Circalittoral coarse sediment VER

- 7.11.2.51 Overall, the sensitivity of circalittoral coarse sand is considered to be negligible and the magnitude of the impact is deemed to be negligible. The effect will, therefore, be of **negligible significance**, which is not significant in EIA terms.

### **Alteration of benthic habitats resulting from changes to the hydrodynamic regime at Warrior Way (site 6)**

- 7.11.2.52 Tidal current devices which employ impeller or turbine technology extract kinetic energy from the tidal flow and therefore have the potential to alter the hydrodynamic regime. Warrior Way site (site 6) is the only META site where scaled and micro-scaled tidal devices may be deployed on a short-term basis.

### Magnitude of impact

- 7.11.2.53 The assessment presented in paragraph 6.9.2.27 *et seq.* of chapter 5: Coastal Processes, demonstrates that the deployment of the maximum design scenario for tidal devices (see Table 7.8) at Warrior Way (site 6) may result in a small reduction in energy across the channel of less than 0.15% and a localised reduction in current speed in the immediate sweep area in the order of 0.035 m/s at peak current speeds, although this is likely to be conservative. The assessment also concludes that any minor flow disruption would occur within the boundaries of the test area only.
- 7.11.2.54 The benchmark for local changes to water flow (tidal current) according to the MarESA assessment is a change in the peak mean spring bed flow velocity of between 0.1 m/s to 0.2 m/s for more than one year. The predicted magnitude of the impact to flow resulting from the deployment of tidal devices is well within the benchmark used to inform the assessment on benthic communities below and, therefore, significant effects on benthic communities are not predicted.
- 7.11.2.55 The impact of changes to the hydrodynamic regime at Warrior Way (site 6) on benthic receptors is therefore predicted to be of local spatial extent, of short-term duration, continuous and reversible. It is predicted that the impact will affect the receptors indirectly. The magnitude is therefore considered to be negligible.

### Sensitivity of the receptor

- 7.11.2.56 The benthic receptors likely to be affected by any changes in current speeds at will be those present within Warrior Way (site 6) i.e. Annex I 'estuaries' and Annex I 'large shallow inlets'.

#### Annex I estuaries and Annex I large shallow inlets VERs

- 7.11.2.57 As discussed in paragraph 7.7.2.10 *et seq.*, the subtidal biotopes which have been recorded in association with the subtidal sediments at the META sites include the SS.SCS.OCS.HeloPkef, SS.SSa.IFiSa.NcirBat and SS.SSa.IMuSa.FfabMag biotopes in areas of sand, the SS.SSa.CMuSa.AalbNuc biotope in areas of muddier fine sand and SS.SMx.CMx.MysThyMx biotope in areas of mixed sediments within the Waterway. The sensitivity of these communities to a reduction in flow is as described previously in paragraph 7.11.2.42 *et seq.*
- 7.11.2.58 The Annex I 'estuaries' VER is deemed to be of low vulnerability, high recoverability and very high value. The sensitivity of the receptor is therefore, considered to be low.
- 7.11.2.59 The Annex I 'large shallow inlets' VER is deemed to be of low vulnerability, high recoverability and very high value. The sensitivity of the receptor is therefore, considered to be low.

## Significance of the effect

### Annex I estuaries VER

- 7.11.2.60 Overall, the sensitivity of the Annex I 'estuaries' VER is considered to be low and the magnitude of the impact is deemed to be negligible. The effect will, therefore, be of **negligible significance**, which is not significant in EIA terms. Conclusions on the effects of on the conservation objectives of the Pembrokeshire Marine SAC are presented in full within the META RIAA.

### Annex I large shallow inlets VER

- 7.11.2.61 Overall, the sensitivity of the Annex I 'large shallow inlets' VER is considered to be low and the magnitude of the impact is deemed to be negligible. The effect will, therefore, be of **negligible significance**, which is not significant in EIA terms. Conclusions on the effects of on the conservation objectives of the Pembrokeshire Marine SAC are presented in full within the META RIAA.

### **Risk of operation and maintenance activities facilitating the introduction of marine INNS**

- 7.11.2.62 There is a risk of the introduction and spread of marine INNS during operation and maintenance activities as a result of the physical presence of infrastructure for the duration of deployments and increased vessel movements associated with the operation and maintenance of the devices/components. In particular, that infrastructure placed in the water column has the potential to act as ecological 'stepping stones' facilitating the spread of pelagic larval particles that would otherwise have been lost offshore and allowing the transgression of natural biogeographical boundaries (Adams *et al.*, 2014)

## Magnitude of impact

- 7.11.2.63 As outlined in Table 7.8, the maximum design scenario assumes that, at any one time, only single devices or components will be *in situ* at Warrior Way (site 6) and Dale Roads (site 7) and that two devices may be *in situ* at East Pickard Bay (site 8). However, the maximum durations of deployment according to the maximum design scenario are short which will limit the opportunity for the infrastructure to facilitate the introduction/spread of INNS. At Warrior Way (site 6), the maximum duration of deployment is six months, for Dale Roads (site 7) up to 12 months and up to 18 months for East Pickard Bay (site 8). For the most likely design scenario, these durations are reduced even further to up to three months for Warrior Way (site 6) and up to 12 months for East Pickard Bay (site 8); see Table 7.8.

- 7.11.2.64 For the maximum design scenario, operation and maintenance activities at the META sites are anticipated to require up to 358 vessel movements/round trips to port, involving up to 15 vessels, per year. Although this is more than those required during installation, as outlined in chapter 12: Shipping and Navigation and discussed previously in paragraph 7.11.1.82, the current baseline level of vessel traffic within the Waterway, and in particular in the vicinity of Warrior Way (site 6) and Dale Roads (site 7), is high throughout the year. For the most likely design scenario, up to 208 vessel movements/round trips to port, involving up to 15 vessels, are likely to be required per year. Therefore, for both the maximum design and most likely design scenarios, the uplift in vessel traffic associated with META operation and maintenance activities on the existing baseline levels is considered to be very small. As also discussed previously in paragraph 7.11.1.82, the vessels employed in operation and maintenance activities are likely to be local to, and originating from, the Waterway or Wales. This will therefore, limit the potential for the introduction of new marine INNS to the area via this pathway. As detailed in Table 7.13, an Invasive Species Management Plan for the project will also be developed and agreed in consultation with the statutory consultees which will further reduce the likelihood of a marine INNS being introduced to the Waterway as a result of the META operation and maintenance activities.

- 7.11.2.65 The impact of introduction of marine INNS associated with the operation and maintenance phase is therefore predicted to be of local spatial extent and, if it occurs, of long-term duration, continuous and irreversible for all META sites. It is predicted that the impact will affect the receptors indirectly. The magnitude is therefore considered to be negligible.

## Sensitivity of the receptor

- 7.11.2.66 The benthic subtidal VERs with the potential to be affected by marine INNS during the operation and maintenance phase are the same as those described in paragraph 7.11.1.84 *et seq.* for the installation phase activities i.e. all subtidal VERs. Furthermore, as discussed in paragraph 7.11.1.86, the habitats present within the benthic subtidal and intertidal ecology study area have been exposed to the invasive slipper limpet for many decades.

### Annex I estuaries, Annex I large shallow inlets, Annex I sandbanks and Annex I subtidal reefs VERs

- 7.11.2.67 The Annex I 'estuaries', 'large shallow inlets', 'sandbanks' and 'subtidal reefs' VERs are deemed to be of high/very high vulnerability, very low recoverability and very high value. The sensitivity of these receptors is therefore, considered to be high.

### Maerl beds and seagrass beds VERs

- 7.11.2.68 The maerl beds and seagrass beds VERs are deemed to be of high/very high vulnerability, very low recoverability and high value. The sensitivity of these receptors is therefore, considered to be high.

#### Circalittoral coarse sediment VER

7.11.2.69 The circalittoral coarse sediment VER is deemed to be of high/very high vulnerability, very low recoverability and medium value. The sensitivity of the receptor is therefore, considered to be medium.

#### Significance of the effect

7.11.2.70 No difference in the magnitude of the impact or the sensitivity of the receptors has been concluded between the three META sites, and therefore the overall significance of the effect for each VER below is made for all META sites. For the reasons discussed at section 7.7.8 above there is a level of uncertainty attached to the level of significance assigned to VERs on the basis that the assessment has been based on desktop data only. This uncertainty has been addressed through the adoption of precautionary thresholds.

7.11.2.71 In addition, no difference in assessment has been made between maximum and most likely design scenarios, therefore the overall significance of effect for maximum and most likely design scenarios is the same.

#### Annex I estuaries, Annex I large shallow inlets, Annex I sandbanks and Annex I subtidal reefs VERs

7.11.2.72 Overall, the sensitivity of these VERs is considered to be high and the magnitude of the impact is deemed to be negligible. The effect will, therefore, be of **minor adverse significance**, which is not significant in EIA terms. Conclusions on the effects of on the conservation objectives of the Pembrokeshire Marine SAC are presented in full within the META project RIAA.

#### Maerl beds and seagrass beds VERs

7.11.2.73 Overall, the sensitivity of the Annex I 'large shallow inlets' VER is considered to be high and the magnitude of the impact is deemed to be negligible. The effect will, therefore, be of **minor adverse significance**, which is not significant in EIA terms. Conclusions on the effects of on the conservation objectives of the Pembrokeshire Marine SAC are presented in full within the META project RIAA.

#### Circalittoral coarse sediment VER

7.11.2.74 Overall, the sensitivity of circalittoral coarse sand is considered to be medium and the magnitude of the impact is deemed to be negligible. The effect will, therefore, be of **negligible significance**, which is not significant in EIA terms.

#### **Accidental release of pollutants (e.g. accidental spillage) during operation and maintenance activities**

#### Magnitude of impact

7.11.2.75 There is the potential for the accidental release of pollutants and debris into the marine environment during operation and maintenance works, as a result of accidental spillage or leakage for example. Pollution may include diesel oil from maintenance vessels and chemicals/lubricants from the devices/components themselves during deployment.

7.11.2.76 As discussed previously in paragraph 7.11.1.95 *et seq.* for the installation phase, the risk of pollution events will be minimised by the implementation of an EMP during the operation and maintenance phase. As outlined in Table 7.13, the EMP will include planning for accidental spills via a MPCP and any lubricants used will be EU/internationally approved for use in marine environments (chapter 2: Project Description). Adherence to the measures outlined in the EMP, as well as standard best practice guidance and GPP will significantly reduce the likelihood of an accidental pollution incident occurring and impacting the waters of the Waterway.

7.11.2.77 In the unlikely event that pollutants did enter the waters of the Waterway, they would be rapidly dispersed on the surface and in the water column and subject to twice daily tidal flushing, and so any effects on water quality would likely be limited.

7.11.2.78 The impact of an accidental pollution event occurring during operation and maintenance activities is therefore predicted to be of local spatial extent, short-term duration (i.e. in the unlikely event that a spillage occurs, the impact would last hours to days), intermittent and reversible for all META sites. It is predicted that the impact will affect the receptors indirectly. The magnitude is therefore considered to be negligible.

#### Sensitivity of the receptor

7.11.2.79 The sensitivity of benthic VERs to an accidental spill event during operation and maintenance activities is as described previously in paragraphs 7.11.1.100 to 7.11.1.109 for impacts during the installation phase and summarised below.

#### Annex I estuaries, Annex I large shallow inlets, Annex I sandbanks VERs

7.11.2.80 The Annex I 'estuaries', 'large shallow inlets', 'sandbanks' and 'subtidal reefs' VERs are deemed to be of medium vulnerability, medium recoverability and very high value. The sensitivity of the receptor is therefore, considered to be medium.

#### Circalittoral coarse sediment VER

7.11.2.81 The circalittoral coarse sediment VER is deemed to be of medium vulnerability, medium recoverability and medium value. The sensitivity of the receptor is therefore, considered to be low.

#### Annex I subtidal reef VER

7.11.2.82 The Annex I 'reef' VER is deemed to be of low vulnerability, medium recoverability and very high value. The sensitivity of the receptor is therefore, considered to be low.

#### Maerl beds VER

7.11.2.83 The maerl beds VER is deemed to be of high/very high vulnerability, very low recoverability and high value. The sensitivity of the receptor is therefore, considered to be high.

#### Subtidal and Intertidal seagrass VERs

7.11.2.84 The subtidal and intertidal seagrass VERs are deemed to be of medium vulnerability, medium recoverability and high value. The sensitivity of these receptor is therefore, considered to be medium.

#### Annex I 'Mudflats and sandflats not covered by seawater at low tide' VER

7.11.2.85 The Annex I 'Mudflats and sandflats not covered by seawater at low tide' VER is deemed to be of medium vulnerability, medium recoverability and very high value. The sensitivity of the receptor is therefore, considered to be medium.

#### Annex I intertidal reef VER

7.11.2.86 The Annex I intertidal 'reef' VER is deemed to be of medium vulnerability, medium recoverability and very high value. The sensitivity of the receptor is therefore, considered to be medium.

#### Significance of effect

7.11.2.87 No differences in the magnitude of the impact or the sensitivity of the receptors has been concluded between the three META sites, and therefore the overall significance of the effect for each VER below is made for all META sites. For the reasons discussed at section 7.7.8 above there is a level of uncertainty attached to the level of significance assigned to VERs on the basis that the assessment has been based on desktop data only. This uncertainty has been addressed through the adoption of precautionary thresholds.

7.11.2.88 In addition, no difference in assessment has been made between maximum and most likely design scenarios, therefore the overall significance of effect for maximum and most likely design scenarios is the same.

#### Annex I estuaries, Annex I large shallow inlets, Annex I sandbanks VERs

7.11.2.89 Overall, the sensitivity of these VERs is considered to be medium and with the mitigation measures adopted as part of the project, the likelihood of a pollution event occurring is extremely low so the magnitude of the impact is deemed to be negligible. The effect will, therefore be of **negligible significance**, which is not significant in EIA terms. Conclusions on the effects of on the conservation objectives of the Pembrokeshire Marine SAC are presented in full within the META RIAA.

#### Circalittoral coarse sediment VER

7.11.2.90 Overall, the sensitivity of this VER is considered to be low and with the mitigation measures adopted as part of the project, the likelihood of a pollution event occurring is extremely low so the magnitude of the impact is deemed to be negligible. The effect will, therefore, be of **negligible significance**, which is not significant in EIA terms.

#### Annex I subtidal reef VER

7.11.2.91 Overall, the sensitivity of this VER is considered to be low and with the mitigation measures adopted as part of the project, the likelihood of a pollution event occurring is extremely low so the magnitude of the impact is deemed to be negligible. The effect will, therefore, be of **negligible significance**, which is not significant in EIA terms. Conclusions on the effects of on the conservation objectives of the Pembrokeshire Marine SAC are presented in full within the META RIAA.

#### Maerl beds VER

7.11.2.92 Overall, the sensitivity of this VER is considered to be high and with the mitigation measures adopted as part of the project, the likelihood of a pollution event occurring is extremely low so the magnitude of the impact is deemed to be negligible. The effect will, therefore, be of **minor adverse significance**, which is not significant in EIA terms.

#### Subtidal and Intertidal seagrass VERs

7.11.2.93 Overall, the sensitivity of these VERs is considered to be medium and with the mitigation measures adopted as part of the project, the likelihood of a pollution event occurring is extremely low so the magnitude of the impact is deemed to be negligible. The effect will, therefore, be of **minor adverse significance**, which is not significant in EIA terms.

#### Annex I 'Mudflats and sandflats not covered by seawater at low tide' VER

7.11.2.94 Overall, the sensitivity of this VER is considered to be medium and with the mitigation measures adopted as part of the project, the likelihood of a pollution event occurring is extremely low, so the magnitude of the impact is deemed to be negligible. The effect will, therefore, be of **minor adverse significance**, which is not significant in EIA terms. Conclusions on the effects of on the conservation objectives of the Pembrokeshire Marine SAC are presented in full within the META RIAA.

#### Annex I intertidal reef VER

7.11.2.95 Overall, the sensitivity of this VER is considered to be medium and with the mitigation measures adopted as part of the project, the likelihood of a pollution event occurring is extremely low, so the magnitude of the impact is deemed to be negligible. The effect will, therefore, be of **minor adverse significance**, which is not significant in EIA terms. Conclusions on the effects of on the conservation objectives of the Pembrokeshire Marine SAC are presented in full within the META RIAA.

#### Future monitoring

7.11.2.96 No benthic subtidal and intertidal ecology monitoring to test the predictions made within the operation and maintenance phase impact assessment is considered necessary.

### 7.11.3 Decommissioning phase

7.11.3.1 The impacts of the decommissioning of the META project have been assessed on benthic subtidal and intertidal ecology. The environmental effects arising from the decommissioning of the META project are listed in Table 7.8 along with the maximum design scenario against which each decommissioning phase impact has been assessed. A conclusion of significance of effect will be made for the META project as a whole, and for each META phase 2 site individually where appropriate (Warrior Way (site 6), Dale Roads (site 7); East Pickard Bay (site 8)).

7.11.3.2 A description of the potential effect on benthic subtidal and intertidal ecology receptors caused by each identified impact is given below.

#### **Temporary habitat disturbance due to decommissioning activities, may affect benthic ecology**

7.11.3.3 The magnitude of the impact associated with temporary habitat disturbance as a result of decommissioning activities (131,400 m<sup>2</sup> as outlined in Table 7.8) is predicted to be similar to that associated with installation activities as described in paragraph 7.11.1.3 *et seq.* The sensitivity of the VERs affected by temporary habitat disturbance during decommissioning is also the same as described previously in paragraphs 7.11.1.11 to 7.11.1.18. The significance of effect is therefore **minor adverse** for all VERs affected (see paragraph 7.11.1.19 to 7.11.1.23).

#### **Temporary increases in SSCs and associated sediment deposition due to decommissioning activities, may affect benthic ecology**

7.11.3.4 The magnitude of the impact associated with temporary increases in SSC and sediment deposition as a result of sediment disturbance during decommissioning activities is predicted to be the same or similar to that associated with installation activities as described in paragraph 7.11.1.24 *et seq.* The sensitivity of the VERs affected by temporary increases in SSC and sediment deposition during decommissioning is also the same as described previously in paragraphs 7.11.1.32 to 7.11.1.50. The significance of effect during the decommissioning phase is therefore **negligible** for all VERs affected (see paragraphs 7.11.1.53 to 7.11.1.58).

#### **Sediment disturbance leading to the potential for resuspension of contaminated sediments may affect benthic ecology**

7.11.3.5 The magnitude of the impact associated with the resuspension of contaminated sediments as a result of sediment disturbance during decommissioning activities is predicted to be the same or similar to that associated with installation activities as described in paragraph 7.11.1.59 *et seq.* The sensitivity of the VERs affected by the resuspension of contaminated sediments during decommissioning is also the same as described previously in paragraphs 7.11.1.62 to 7.11.1.71. The significance of effect during the decommissioning phase is therefore **negligible** for all VERs affected (see paragraphs 7.11.1.74 to 7.11.1.79).

#### **Risk of decommissioning activities facilitating the introduction of marine INNS**

7.11.3.6 The magnitude of the impact associated with the introduction of marine INNS during decommissioning activities is predicted to be the same or similar to that associated with installation activities as described in paragraph 7.11.1.82 *et seq.* The sensitivity of the VERs to the introduction of INNS during decommissioning is also the same as described previously in paragraphs 7.11.1.84 *et seq.* The significance of effect during the decommissioning phase is therefore **negligible to minor adverse** for all VERs affected (see paragraph 7.11.1.92 to 7.11.1.94).

#### **Accidental release of pollutants (e.g. accidental spillage) during decommissioning activities**

7.11.3.7 The magnitude of the impact associated with the potential release of pollutants during decommissioning activities is predicted to be the same or similar to that associated with installation activities as described in paragraph 7.11.1.95 *et seq.* The sensitivity of the VERs to accidental pollution during decommissioning is also the same as described previously in paragraphs 7.11.1.100 *et seq.* The significance of effect during the decommissioning phase is therefore **negligible to minor adverse** for all VERs affected (see paragraphs 7.11.1.112 to 7.11.1.118).

### *Future monitoring*

- 7.11.3.8 No benthic subtidal and intertidal ecology monitoring to test the predictions made within the decommissioning phase impact assessment is considered necessary.

## **7.12 Cumulative Impact Assessment**

### **7.12.1 Methodology**

#### **Screening of other projects and plans into the Cumulative Impact Assessment**

- 7.12.1.1 The Cumulative Impact Assessment (CIA) takes into account the impact associated with the META project together with other projects and plans. The projects and plans selected as relevant to the CIA presented within this chapter are based upon the results of a screening exercise. Each project has been considered on a case by case basis for scoping in or out of this chapter's assessment based upon data confidence, effect-receptor pathways and the spatial/temporal scales involved.
- 7.12.1.2 In undertaking the CIA for the META project, it is important to bear in mind that other projects and plans under consideration will have differing potential for proceeding to an operational stage and hence a differing potential to ultimately contribute to a cumulative impact alongside the META project. For example, relevant projects and plans that are already under construction are likely to contribute to cumulative impact with the META project (providing effect or spatial pathways exist), whereas projects and plans not yet approved or not yet submitted are less certain to contribute to such an impact, as some may not achieve approval or may not ultimately be built due to other factors.
- 7.12.1.3 The specific projects scoped into the CIA for benthic subtidal and intertidal ecology are outlined in Table 7.14. The full list of CIA projects is outlined in Chapter 4: Environmental Assessment Methodology considered in the Environmental Statement.

Table 7.14: List of other projects and plans considered within the CIA for benthic subtidal and intertidal ecology.

Phase	Developer - Reference	Distance from Warrior Way (site 6)	Distance from Dale Roads (site 7)	Distance from East Pickard Bay (site 8)	Dates of Installation/operation	Spatial / temporal overlap with the META project	Details	Further assessment required?	Justification
<b>Plans</b>									
Draft Welsh National Marine Plan (dWNMP) (Welsh Government, 2017)	NRW	0.00	0.0	0.0	The dWNMP will be implemented over a 20-year period, with 3 yearly reviews.	Spatial overlap and temporal overlap.	The dWNMP is being prepared by the Welsh Government in accordance with the Marine and Coastal Access Act 2009 (MCAA). The purpose of marine planning under the MCAA is to help achieve sustainable development in the marine area. Welsh Ministers are the Marine Planning Authority under the MCAA, responsible for creating marine plans for both the inshore region (0-12 nautical miles) and offshore region (beyond 12 nautical miles) of Wales. Plans for both regions will be presented in a single document, the WNMP. The dWNMP applies to the Welsh marine area which consists of around 32,000 km <sup>2</sup> of sea, as well as 2,120 km of coastline.	Yes	As there is the potential for both temporal and spatial overlap of the META project with the dWNMP, it cannot be excluded from further consideration in the CIA. The dWNMP does not need to be considered further for Coastal Processes, Underwater Noise, commercial Fisheries, Shipping and Navigation, Marine Archaeology, Seascape and Landscape, Socio-economic and Tourism and Other Users as the plan does not cover these interests or they have been screened out on the basis that an assessment would be deferred to the project level, or an assessment was not possible at the policy level (Defence, Dredging and disposal, Energy – Oil and Gas, Fisheries, Subsea Cabling, Surface Water and Wastewater Treatment and Disposal, and Tourism and Recreation).
<b>Dredging sites</b>									
Installation / operation and maintenance	Neyland Yacht Haven Ltd. - DML1743	1.1	12.3	10.5	13/12/2017-12/12/2020	No spatial overlap with consented areas. Potential for temporal overlap.	Dredge and disposal from Neyland Marina - annual volume 5500 m <sup>3</sup> .	Yes	Sediment plumes generated during dredging activities may present potential cumulative impacts with the META project.
Installation/ operation and maintenance	Milford Haven Port Authority - DML1646	1.3	1.5	2.5	09/03/2017-08/03/2022	No spatial overlap with consented areas. Temporal overlap with all sites.	Maintenance dredging throughout the Milford Haven. Annual volume 362500 m <sup>3</sup> .	Yes	
<b>Dredge disposal sites</b>									
Installation/ operation and maintenance	Neyland dredge disposal site - LU190	0.5	12.4	10.5	N/A	No spatial overlap with any of the consented areas. Temporal overlap	Location: South of Neyland within the central channel of the Milford Haven, 0.22 nm diameter x 5 m depth. Status: Open.	Yes	Sediment plumes generated from placement of material in identified disposal ground may present potential cumulative impacts with the META project.
<b>Infrastructure</b>									

Phase	Developer - Reference	Distance from Warrior Way (site 6)	Distance from Dale Roads (site 7)	Distance from East Pickard Bay (site 8)	Dates of Installation/operation	Spatial / temporal overlap with the META project	Details	Further assessment required?	Justification
Installation/ operation and maintenance/ decommissioning	Greenlink Interconnector Ltd. - Government reference: qA1296053	10.4	6	0	07/2018 - ongoing	Spatial overlap with East Pickard Bay (site 8). Temporal overlap will occur throughout the duration of the META project.	The Project is a 500MW subsea electricity interconnector linking the power markets in Ireland and Great Britain and is planned for commissioning in 2023. As an EU Project of Common Interest, it is one of Europe's most important energy infrastructure projects. The interconnector is planned to make Landfall at Fresh Water West beach to the south of the mouth of the Waterway.	Yes	There is the potential for cumulative impacts on benthic receptors due to increased suspended sediment and habitat loss/disturbance.
Installation/ operation and maintenance/ decommissioning	Bombora Wave Energy	11.6	5.0	0	Q1 2020	Spatial overlap with East Pickard Bay (site 8) within META test area. Potential for temporal overlap.	Bombora on- and off-shore infrastructure and deployment of Bombora mWave device at East Pickard Bay. This is to include device deployment (mWave device), installation of temporary communications cable between mWave device and temporary onshore control station to be located above East Pickard Bay, and installation and operation of temporary control station onshore. Laying of marine cable to shore and through intertidal area at East Pickard Bay to involve up to 3 days cable laying below MHWS using cable lay vessel and up to four vessels, including guard boat. Cable to be laid on seabed and kept in place in sandy sediment by using six, three tonne rock bags covering an area of 4.5 m <sup>2</sup> per rock bag. Where the marine cable traverses potential reefy habitat, it will follow natural rock channel. In the intertidal area, the cable will be laid through a natural gully, or up the vertical gully side and attached to the semi-vertical rock face with rock bolts using hand held tools. JCB will pull the cable through the intertidal area from a location above MHWS.	Yes	There is the potential for spatial overlap in the META East Pickard Bay test area (site 8) and temporal overlap with all META project sites installation and operation and maintenance phases, therefore this project cannot be excluded from further consideration in the CIA.
<b>Pembroke Dock Marine Projects</b>									
Installation/ operation and maintenance	Marine Energy Wales - DEML1875	1.7	11.7	9.4	21/04/2019-21/04/2029	No spatial overlap with any of the consented areas. Potential for temporal overlap.	Marine Energy Test Area - Phase 1. Band 2 application submitted. The Project aims to create pre-consented test areas within the Pembroke Dock area. The test areas will have licensable activities to suit testing of initial stage marine renewable devices. These include testing of non-operating components and subassemblies. No full-scale testing is to be support within the test areas.	Yes	Vessel use and some testing activities could result in an increase in SSCs or reduction in benthic habitats. There is therefore the potential for cumulative impacts with the META Project.

Phase	Developer - Reference	Distance from Warrior Way (site 6)	Distance from Dale Roads (site 7)	Distance from East Pickard Bay (site 8)	Dates of Installation/operation	Spatial / temporal overlap with the META project	Details	Further assessment required?	Justification
Installation/ operation and maintenance	Milford Haven Port Authority - SC1810: Pembroke Dock Infrastructure	2	11.3	8.8	Q3 2019 – Q3 2023	No spatial overlap with consented sites. Potential for temporal overlap.	Pembroke Dock redevelopment. Scoping Report submitted.	Yes	There will be temporal and spatial overlap of the project with the META Project and there is the potential for cumulative impacts due to increased SSCs and habitat loss/disturbance.
							The intention of the Project is to create a flexible and efficient port-related office, industrial, warehousing and distribution, and ancillary operations infrastructure. This will involve the redevelopment of its existing space to incorporate increased deep-water access, internal and external heavy fabrication areas, construction of MEECE and Education/Skills Facility and the construction of a heavy lift facility.		
Installation/ operation and maintenance/ decommissioning	Pembrokeshire Demonstration Zone. Wave Hub Ltd. - SC1082	31.4	31.1	25.8	2024	No spatial overlap with any consented areas. Potential for temporal overlap as the projects are linked.	Demonstration zone. Scoping Report submitted. The Project entails the development of 90 km2 of seabed with water depths of approximately 50 metres and a wave resource of approximately 19 kW/m; to support the demonstration of wave arrays with a generating capacity of up to 30MW for each project. Consent for this Project could be achieved in 2022, infrastructure could be built by 2024 and the first technology could be installed in 2025.	Yes	There is the potential for temporal overlap with this project therefore this project cannot be excluded from further consideration in the CIA.
<b>Research</b>									
Installation	Greenlink Interconnector Ltd. - RML1827	10.4	6	0	07-2018 - no end date given	Spatial overlap with East Pickard Bay (site 8). Temporal overlap with East Pickard Bay.	Ground investigations.	Yes	Research operations are likely to have vessels present, with equipment for undertaking ground truthing surveys therefore this project cannot be excluded from further consideration in the CIA.
Installation	University College of Swansea - DEM1861	~4-5	~8-9	~6-7	Band 2 licence issued 12/12/2018 - three-year study	No spatial overlap with any of the consented areas. Temporal overlap.	Pembroke Power bubble barrier experiment. Location is assumed to be by the Pembroke Power station. Investigation into the effectiveness of bubble curtains in sediment management.	Yes	to META phase 2 sites and the potential for temporal overlap, these projects cannot be excluded from further consideration in the CIA.
Installation	University College of Swansea - DEM1845	12.7	5.4	0	30/08/2018-29/08/2019	Spatial overlap with East Pickard Bay (site 8). Temporal overlap with East Pickard Bay.	Deposition and subsequent removal of marker buoys with environmental monitoring and mid-water settlement plates.	Yes	Vessels and equipment will be required for the placement of marker buoys. It is highly likely to have temporal or spatial overlap with META phase 2 activities, therefore this project cannot be excluded from further consideration in the CIA.

7.12.1.4 The potential impacts identified for assessment as part of the benthic ecology and subtidal ecology cumulative impacts assessment (CIA) are:

- Cumulative habitat loss/disturbance may affect benthic ecology; and
- Cumulative increases in SSC and sediment deposition may affect benthic ecology.

7.12.1.5 The dWNMP undertook an HRA of the proposed plans included within the dWNMP. The screening exercise for the HRA screened out policies relating to Defence, Dredging and Disposal, Energy – Oil and Gas, Fisheries, Subsea Cabling, Surface Water and Wastewater Treatment and Disposal, and Tourism and Recreation from further consideration in the HRA on the basis that an assessment would be deferred to project level or an assessment was not possible at the policy level. Aggregates, Aquaculture, Energy – Low Carbon (marine renewable energy), and Ports and Shipping were screened in for further assessment. All sites within 50 km (marine buffer area), were considered to be potentially exposed to the effects of the dWNMP.

7.12.1.6 It was concluded within the dWNMP HRA Appropriate Assessment (AA) for screened in policies, that it would be necessary to rely on implementation of general cross-cutting protective policies within the WNMP to safeguard European sites during future assessment of specific schemes/projects. However, it was considered that there would be no adverse effect on site integrity due to the implementation of the policies due to measures that are in place i.e. – the policies are sufficiently caveated and flexible to ensure that adverse effects on site integrity are entirely avoidable at the project-level; the general cross-cutting protective policies within the WMNP will provide safeguards for European sites; evidence from existing schemes suggest that project-level mitigation and avoidance measures are achievable and effective; all projects would require project-level HRA; and Strategic Resource Areas (SRAs) can be modified to reflect best available evidence. For policy on Tidal Lagoons, it was considered that the nature of tidal lagoons means that adverse effects on European sites, particularly habitats, fish and birds, cannot be clearly avoided at the project level, regardless of policy control. However, the AA concludes that there is an over-riding reason of public interest (IROPI) for a Tidal Lagoon policy.

## 7.12.2 Cumulative Impact Assessment

7.12.2.1 A description of the significance of cumulative impacts upon benthic subtidal and intertidal ecology receptors arising from each identified impact is given below.

### **Cumulative habitat loss/disturbance may affect benthic ecology**

7.12.2.2 Temporary habitat loss/disturbance may occur as a result of cumulative impacts arising from projects that spatially or temporally overlapping with the META project, as listed in Table 7.14.

### **Magnitude of impact**

7.12.2.3 There is the potential for cumulative temporary habitat loss and/or disturbance within the benthic subtidal and intertidal ecology study area as a result of installation and operation and maintenance activities associated with the META project together with activities associated with the following projects/activities: META Phase 1, Bombora Wave Energy offshore works, the Pembroke Dock redevelopment project, Wave Hub, dredging and disposal activities in the Waterway, the Greenlink Interconnector project (and associated surveys), and research undertaken by Swansea University.

7.12.2.4 The META Phase 1 project has recently submitted a Marine Licence application to NRW-MLT accompanied by an environmental appraisal (RPS, 2018a) which predicts that temporary habitat loss/disturbance may arise as a result of temporary vessel anchoring and the temporary placement of marine energy components/subassemblies on the seabed. The combined maximum total area affected by META Phase 1 activities is predicted to be up to 4,492 m<sup>2</sup>. However, the META Phase 1 activities will be temporary in nature and spatially restricted to the habitats within Pembroke Dock and out with the boundary of the Pembrokeshire Marine SAC. Therefore, there will be no cumulative loss of features of the SAC as a result of this project and the META project.

7.12.2.5 The Bombora offshore works are predicted to result in cumulative subtidal habitat loss at East Pickard Bay (site 8) as a result of the surface laying of 1,400 m of cable seaward of MLWS and the use of rock bags to secure the cable to the seabed, and the presence of the Bombora mWave device within the East Pickard Bay site (site 8). This habitat loss is however small (up to 237 m<sup>2</sup> for the marine cable and 1,700 m<sup>2</sup> for the mWave device, equating to a total of 1,937 m<sup>2</sup>) and will therefore only represent a marginal increase on the habitat loss associated with the META project alone. The Bombora works are also predicted to be a one-off, short-term event, with the maximum design scenario for the duration of this infrastructure on the seabed being up to 18 months (Bombora Wave Energy, *pers. comm.*).

7.12.2.6 The Pembroke Dock Infrastructure project has submitted a Scoping Report (RPS, 2018b) which outlines that the creation of a new slipway, the infilling of the Graving Dock and capital dredging works may result in habitat loss/disturbance of benthic habitats. Although an EIA for the project was not available at the time of writing this ES, it is understood that all works will be confined to the Pembroke Dock area and will be out with the boundary of the Pembrokeshire Marine SAC. Therefore, there will be no cumulative loss of features of the SAC as a result of this project and the META project.

7.12.2.7 The Greenlink Interconnector project has also submitted a Scoping Report for the UK marine route (Intertek, 2016) which outlines that temporary habitat loss may occur as a result of cable burial and maintenance activities. Although a detailed assessment was not available at the time of writing this ES, the Scoping Report concludes that it is likely that any impacts to species and habitats will be localised and short-term, and once installed, the substratum will be reinstated over the cable.

- 7.12.2.8 There is no information in the public domain relating to the estimated habitat disturbance/loss associated with the Pembrokeshire Demonstration Zone (PDZ) and the two Swansea University research projects. However, it is likely that this will be small scale and localised to these project sites with no potential for spatial overlap with temporary habitat disturbance/loss associated with the META project, with the exception of the marker buoy deployment in East Pickard Bay although this will be temporary and of limited spatial extent.
- 7.12.2.9 The dWMNP HRA concludes no adverse effect on site integrity of any European site due to the plans included within the dWNMP.
- 7.12.2.10 Finally, dredging and associated disposal activities within the Waterway may result in habitat loss and disturbance in the vicinity of these activities. Although the extent of disturbance is difficult to quantify, maintenance dredging activities will remove sediments that have accumulated since the previous dredging event, so these habitats will be disturbed already. Similarly, placement of dredge sediments within disposal grounds will also experience habitat loss/disturbance from the most recent disposal event, but given that these areas will have previously been disturbed the cumulative effect from these activities on benthic habitat loss are considered negligible.
- 7.12.2.11 The cumulative impact is predicted to be of local spatial extent, short to medium-term duration, intermittent and reversible. It is predicted that the impact will affect the benthic receptors directly. The magnitude is therefore, considered to be minor.

#### Sensitivity of receptor

- 7.12.2.12 The benthic subtidal VERs with the potential to be affected by cumulative habitat loss/disturbance are the same as previously described in paragraph 7.11.1.11 *et seq.* and paragraph 7.11.2.27 *et seq.* for the META project alone.
- 7.12.2.13 The Annex I 'estuaries' VER is deemed to be of medium vulnerability, high recoverability and very high value. The sensitivity of the receptor is therefore, considered to be low.
- 7.12.2.14 The Annex I 'large shallow inlets' VER is deemed to be of medium vulnerability, high recoverability and very high value. The sensitivity of the receptor is therefore, considered to be low.
- 7.12.2.15 The circalittoral coarse sediment VER is deemed to be of medium vulnerability, high recoverability and medium value. The sensitivity of the receptor is therefore, considered to be low.

#### Significance of the effect

##### Annex I estuaries VER

- 7.12.2.16 Overall, the sensitivity of the Annex I 'estuaries' VER is considered to be low and the magnitude of the impact is deemed to be minor. The effect will, therefore, be of **minor adverse significance**, which is not significant in EIA terms. Conclusions on the effects of on the conservation objectives of the Pembrokeshire Marine SAC are presented in full within the META project RIAA.

##### Annex I large shallow inlets VER

- 7.12.2.17 Overall, the sensitivity of the Annex I 'large shallow inlets' VER is considered to be low and the magnitude of the impact is deemed to be minor. The effect will, therefore, be of **minor adverse significance**, which is not significant in EIA terms. Conclusions on the effects of on the conservation objectives of the Pembrokeshire Marine SAC are presented in full within the META project RIAA.

##### Circalittoral coarse sediment VER

- 7.12.2.18 Overall, the sensitivity of circalittoral coarse sand is considered to be low and the magnitude of the impact is deemed to be minor. The effect will, therefore, be of **negligible significance**, which is not significant in EIA terms.

#### **Cumulative increases in SSC and sediment deposition may affect benthic ecology**

- 7.12.2.19 Temporary effects to benthic receptors from elevated SSCs and sediment deposition may occur as a result of cumulative impacts arising from projects that spatially or temporally overlapping with the META project, as listed in Table 7.14.

#### Magnitude of impact

- 7.12.2.20 There is the potential for cumulative increases in SSCs and sediment deposition to benthic receptors within the benthic subtidal and intertidal ecology study area as a result of installation/decommissioning activities associated with the META project together with the following projects/activities: construction activities associated with the Pembroke Dock redevelopment project, dredging and disposal activities in the Waterway, Bombora marine cable installation, and the Greenlink Interconnector project.

- 7.12.2.21 As discussed in paragraph 7.12.2.6, the Pembroke Dock Marine Scoping Report (RPS, 2018b) describes that there will be a requirement for some one-off capital dredging works within the footprint of the new slipway and also within the Graving Dock, removing up to approximately 16,000 m<sup>3</sup> of material. The possibility of beneficial use of this material will be assessed and implemented if it is practicable to do so. Otherwise, once cleared, this material will be disposed of at an authorised dredging disposal site. Although an EIA for the Pembroke Dock Infrastructure project was not available at the time of writing this ES, it is understood that all works will be confined to the Pembroke Dock area and dredging works will be temporary and short lived. On this basis it is considered unlikely that the dredging works from Pembroke Dock Infrastructure will temporally overlap with the installation/decommissioning activities from the META project.
- 7.12.2.22 The installation of the Bombora marine cable has the potential to result in very short-term (up to 3 days), temporary increases in SSC within the East Pickard Bay sites (site 8), however any impact to benthic habitats will be highly localised within the immediate vicinity of the cable lay.
- 7.12.2.23 The Scoping Report for the Greenlink Interconnector project outlines that smothering of benthic species may occur as a result of ploughing and trenching operations to install the cable and through the placement of cable protection material on the seabed (Intertek, 2016). However, it is likely that any impacts will be of short duration and temporary and any impacts to benthic habitats from smothering will be highly localised to the immediate vicinity of the cable trench.
- 7.12.2.24 On-going dredging and associated disposal activities within the Waterway also have the potential to result in periodic and short-term elevations in SSC and sediment deposition may result in habitat loss and disturbance in the vicinity of these activities. However, on the basis that the increases in SSC and deposition from the META project alone are predicted to be highly localised and of short duration, they are not considered to interact spatially with any of the cumulative projects/activities in any measurable way.
- 7.12.2.25 The dWMNP HRA concludes no adverse effect on site integrity of any European site due to the plans included within the dWNMP.
- 7.12.2.26 The cumulative impact is therefore predicted to be of local spatial extent, short to medium term duration, intermittent and reversible. It is predicted that the impact will affect the benthic receptors indirectly. The magnitude is therefore, considered to be minor.

#### Sensitivity of receptor

- 7.12.2.27 The benthic subtidal VERs with the potential to be affected by cumulative increases in SSC and sediment deposition are the same as previously described in paragraph 7.11.1.32 *et seq.* for the META project alone.
- 7.12.2.28 The Annex I 'estuaries' VER is deemed to be of medium vulnerability, high recoverability and very high value. The sensitivity of the receptor is therefore, considered to be low.

- 7.12.2.29 The Annex I 'large shallow inlets' VER is deemed to be of medium vulnerability, high recoverability and very high value. The sensitivity of the receptor is therefore, considered to be low.
- 7.12.2.30 The circalittoral coarse sediment VER is deemed to be of medium vulnerability, high recoverability and medium value. The sensitivity of the receptor is therefore, considered to be low.
- 7.12.2.31 The Annex I subtidal 'reefs' VER is deemed to be of medium to high vulnerability, medium to high recoverability and very high value. The sensitivity of the receptor is therefore, considered to be low.
- 7.12.2.32 The Annex I 'mudflats and sandflats not covered by seawater at low tide' VER is deemed to be of low vulnerability, high recoverability and very high value. The sensitivity of the receptor is therefore, considered to be low.
- 7.12.2.33 The Annex I intertidal 'reefs' VER is deemed to be of low vulnerability, high recoverability and very high value. The sensitivity of the receptor is therefore, considered to be low.

#### Significance of effect

##### Annex I estuaries VER

- 7.12.2.34 Overall, the sensitivity of the Annex I 'estuaries' VER is considered to be low and the magnitude of the impact is deemed to be minor. The effect will, therefore, be of **minor adverse significance**, which is not significant in EIA terms. Conclusions on the effects of on the conservation objectives of the Pembrokeshire Marine SAC are presented in full within the META project RIAA.

##### Annex I large shallow inlets VER

- 7.12.2.35 Overall, the sensitivity of the Annex I 'large shallow inlets' VER is considered to be low and the magnitude of the impact is deemed to be minor. The effect will, therefore, be of **minor adverse significance**, which is not significant in EIA terms. Conclusions on the effects of on the conservation objectives of the Pembrokeshire Marine SAC are presented in full within the META project RIAA.

##### Annex I subtidal reef VER

- 7.12.2.36 Overall, the sensitivity of the Annex I subtidal 'reef' VER is considered to be low and the magnitude of the impact is deemed to be minor. The effect will, therefore, be of **minor adverse significance**, which is not significant in EIA terms. Conclusions on the effects of on the conservation objectives of the Pembrokeshire Marine SAC are presented in full within the META project RIAA.

##### Circalittoral coarse sediment VER

- 7.12.2.37 Overall, the sensitivity of circalittoral coarse sand is considered to be low and the magnitude of the impact is deemed to be minor. The effect will, therefore, be of **negligible significance**, which is not significant in EIA terms.

### Annex I 'Mudflats and sandflats not covered by seawater at low tide'

7.12.2.38 Overall, the sensitivity of the Annex I 'Mudflats and sandflats not covered by seawater at low tide' VER is considered to be low and the magnitude of the impact is deemed to be minor. The effect will, therefore, be of **minor adverse significance**, which is not significant in EIA terms. Conclusions on the effects of on the conservation objectives of the Pembrokeshire Marine SAC are presented in full within the META project RIAA.

### Annex I intertidal reef VER

7.12.2.39 Overall, the sensitivity of the Annex I intertidal 'reef' VER is considered to be low and the magnitude of the impact is deemed to be minor. The effect will, therefore, be of **minor adverse significance**, which is not significant in EIA terms. Conclusions on the effects of on the conservation objectives of the Pembrokeshire Marine SAC are presented in full within the META project RIAA.

### Future monitoring

7.12.2.40 No benthic subtidal and intertidal ecology monitoring to test the predictions made within the CIA is considered necessary.

## 7.13 Transboundary effects

7.13.1.1 A screening of transboundary impacts has been carried out and has identified that there was no potential for significant transboundary effects with regard to benthic subtidal and intertidal ecology from the META project upon the interests of other EEA States.

## 7.14 Inter-related effects

7.14.1.1 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, operation 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, all effects on benthic subtidal and intertidal ecology, such as habitat loss/disturbance and sediment plumes 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.

7.14.1.2 A description of the likely inter-related effects arising from the META project on benthic subtidal and intertidal ecology is provided in here.

### 7.14.2 Project lifetime effects

7.14.2.1 The greatest potential for project lifetime effects to occur with respect to benthic subtidal and intertidal ecology is associated with temporary habitat loss/disturbance across the installation, operation and maintenance and decommissioning phases of the META project.

7.14.2.2 When temporary habitat loss/disturbance is considered additively across all phases, the total area of habitat affected is larger than when considered across an individual phase (i.e. just installation). The project lifetime of META is estimated at up to 15 years and therefore there is the potential for repeat habitat disturbance within the boundaries of the META sites for the duration of the project. However, the temporary habitat loss/disturbance will be highly localised to the vicinity of the activity (i.e. limited to the immediate footprints) during each phase and are also likely to be substantially less than the extents predicted for the maximum design scenario when the most likely scenario is considered. Individual activities resulting in temporary habitat loss/disturbance will occur intermittently throughout the project lifetime and all benthic habitats are predicted to recover within a maximum of five years. Therefore, across the project lifetime, the effects on benthic ecology receptors are not anticipated to interact in such a way as to result in combined effects of greater significance than the assessments presented for each individual phase.

### 7.14.3 Receptor-led effects

7.14.3.1 Based upon expert knowledge, it is considered that the greatest potential for inter-related impacts across the lifetime of the META project is predicted to arise through the interaction of temporary habitat loss/disturbance during installation/decommissioning and operation from anchor spreads and the presence of the devices/components on the seabed and indirect habitat disturbance due to sediment deposition arising from the installation of gravity bases and pin piles.

7.14.3.2 These individual impacts were assigned a significance of minor adverse as standalone impacts and although potential combined impacts may arise (i.e. spatial and temporal overlap of direct habitat disturbance), it is predicted that this will not be any more significant than the individual impacts in isolation. This is because the combined amount of habitat potentially affected would be very limited (typically restricted to the META sites), and, where temporary disturbance occurs, full recovery of the benthic receptors is predicted. In addition, any effects due to changes in SSC and deposition will be limited in extent and also in magnitude, with benthic ecology receptors having low sensitivity to the scale of the changes predicted. As such, these interactions are predicted to be no greater than the individual effects assessed in isolation.

## 7.15 Conclusion and summary

- 7.15.1.1 Installation activities associated with the META project have the potential to result in a range of potential impacts on benthic ecology. These include the disturbance of sediments associated with seabed clearance resulting in temporary habitat disturbance and increased SSC, associated deposition and resuspension of contaminated sediments, as well as the potential introduction of INNS. Table 7.15 provides a summary of the potential impacts, mitigation measures and residual effects during the installation phase with respect to benthic ecology. Mitigation measures adopted as part of the project to minimise effects on benthic habitats and specifically Annex I rocky reefs include post-consent/pre-deployment surveys (if deemed necessary on the basis of a full review of the geophysical data) to ensure that measures can be designed, if necessary, (e.g. micro siting of moorings/devices on the seabed) to avoid direct impacts to sensitive habitats such as reefs at these sites. Overall, the impacts associated with installation activities are predicted to result in effects on benthic receptors, including benthic features of designated sites, of negligible or minor adverse significance (not significant in EIA terms).
- 7.15.1.2 The operation and maintenance of the META project may affect benthic subtidal and intertidal ecology through the presence of devices/components on the seabed infrastructure resulting in temporary habitat loss and through the presence of mooring spreads resulting in temporary disturbance. Operation and maintenance activities may also facilitate the introduction/spread of INNS. Table 7.15 provides a summary of the potential impacts, mitigation measures and residual effects during the operation and maintenance phase with respect to benthic ecology. These impacts are predicted to result in effects on benthic receptors and designated features of nature conservation sites of negligible or minor adverse significance (not significant in EIA terms).
- 7.15.1.3 Decommissioning activities are predicted to have effects of negligible or minor adverse significance (not significant in EIA terms) on benthic subtidal and intertidal ecology.
- 7.15.1.4 Cumulative impacts upon benthic subtidal and intertidal ecology from the META project have been considered together with the impacts predicted to arise from the META Phase 1 project as well as from the construction and operation of other planned nearby projects (e.g. Pembroke Dock Infrastructure, Bombora marine works and Greenlink Interconnector) and licenced dredging and disposal activities in the Waterway. Overall, the cumulative impacts on benthic receptors and designated features of nature conservation sites will be of minor adverse significance (not significant in EIA terms).
- 7.15.1.5 A screening of transboundary impacts has been carried out which has identified that there is no potential for significant transboundary effects with regard to benthic subtidal and intertidal ecology from the META project upon the interests of other EEA States.

Table 7.15: Summary of potential environment effects, mitigation and monitoring at the META project.

Description of impact	Measures adopted as part of the project	Magnitude of impact	Sensitivity of receptor	Significance of effect	Additional measures	Residual effect	Proposed monitoring
<b>Installation phase</b>							
Temporary habitat disturbance due to installation activities, may affect benthic ecology.	Post-consent/pre-deployment surveys to facilitate micrositing of infrastructure.	Minor	Low	Negligible to Minor adverse (not significant in EIA terms)	None	n/a	None
Temporary increases in SSCs and associated sediment deposition due to installation activities, may affect benthic ecology.	-	Negligible	Low	Negligible (not significant in EIA terms)	None	n/a	None
Sediment disturbance leading to the potential for resuspension of contaminated sediments may affect benthic ecology.	-	Negligible	Low to medium	Negligible (not significant in EIA terms)	None	n/a	None
Risk of installation activities facilitating the introduction of marine INNS.	Invasive Species Management Plan	Negligible	Medium to high	Negligible to Minor adverse (not significant in EIA terms)	None	n/a	None
Accidental release of pollutants (e.g. accidental spillage) during installation activities.	EMP	Negligible	Low to high	Negligible to Minor adverse (not significant in EIA terms)	None	n/a	None
<b>Operation and maintenance phase</b>							
Habitat loss through presence of infrastructure on the seabed resulting in potential effects on benthic ecology.	Post-consent/pre-deployment surveys to facilitate micrositing of infrastructure.	Minor	Low	Negligible to Minor adverse (not significant in EIA terms)	None	n/a	None
Temporary habitat disturbance during the operational phase, may affect benthic ecology.	Post-consent/pre-deployment surveys to facilitate micrositing of infrastructure.	Minor	Low	Negligible to Minor adverse (not significant in EIA terms)	None	n/a	None
Alteration of seabed habitats arising from changes in physical processes, including scour effects and changes to sediment transport, may have effects on benthic ecology.	-	Negligible	Negligible to low	Negligible	None	n/a	None
Alteration of benthic habitats resulting from changes to the hydrodynamic regime at Warrior Way (site 6).	-	Negligible	Low	Negligible	None	n/a	None
Risk of operational activities facilitating the introduction of marine INNS.	Invasive Species Management Plan	Negligible	Medium to high	Negligible to Minor adverse (not significant in EIA terms)	None	n/a	None

Description of impact	Measures adopted as part of the project	Magnitude of impact	Sensitivity of receptor	Significance of effect	Additional measures	Residual effect	Proposed monitoring
Accidental release of pollutants (e.g. accidental spillage) during operation and maintenance activities.	EMP	Negligible	Low to high	Negligible to Minor adverse (not significant in EIA terms)	None	n/a	None
<b>Decommissioning phase</b>							
Temporary habitat disturbance due to decommissioning activities, may affect benthic ecology.	-	Minor	Low	Negligible to Minor adverse (not significant in EIA terms)	None	n/a	None
Temporary increases in SSCs and associated sediment deposition due to decommissioning activities, may affect benthic ecology	-	Negligible	Low	Negligible (not significant in EIA terms)	None	n/a	None
Sediment disturbance leading to the potential for resuspension of contaminated sediments may affect benthic ecology	-	Negligible	Low to medium	Negligible (not significant in EIA terms)	None	n/a	None
Risk of decommissioning activities facilitating the introduction of marine INNS	Invasive Species Management Plan	Negligible	Medium to high	Negligible to Minor adverse (not significant in EIA terms)	None	n/a	None
Accidental release of pollutants (e.g. accidental spillage) during decommissioning activities.	EMP	Negligible	Low to high	Negligible to Minor adverse (not significant in EIA terms)	None	n/a	None

## 7.16 References

Adams, T.P., Miller, R.G., Aleynik, D. and Burrows, M.T. (2014). Offshore marine renewable energy devices as stepping stones across biogeographical boundaries. *Journal of Applied Ecology*, 51, 33-338.

Ashley, M. (2016). Polychaetes in littoral fine sand. In Tyler-Walters H. and Hiscock K. (eds) Marine Life Information Network: Biology and Sensitivity Key Information Reviews, [on-line]. Plymouth: Marine Biological Association of the United Kingdom. [cited 11-02-2019]. Available from: <https://www.marlin.ac.uk/habitat/detail/1125>.

Blaise Bullimore, (2019). Seasearch 2018 dive summaries for two survey site clusters south of Angle Peninsula.

Bohn, K., Richardson, C.A. and Jenkins, S. R. (2015). The distribution of the invasive non-native gastropod *Crepidula fornicata* in the Milford Haven Waterway, its northernmost population along the west coast of Britain. *Helgoland Marine Research* 2015, 69:439.

Carey, D.A., Hayn, M., Germano, J.D., Little, D.I. and Bullimore, B. (2015). Marine habitat mapping of the Milford Haven Waterway, Wales, UK: Comparison of facies mapping and EUNIS classification for monitoring sediment habitats in an industrialized estuary. *Journal of Sea Research Volume* 100, June 2015, Pages 99-119.

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.

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.

d'Avack, E.A.S. and Marshall, C. (2015a). *Fucus serratus*, sponges and ascidians on tide-swept lower eulittoral rock. In Tyler-Walters H. and Hiscock K. (eds) Marine Life Information Network: Biology and Sensitivity Key Information Reviews, [on-line]. Plymouth: Marine Biological Association of the United Kingdom. [cited 11-02-2019]. Available from: <https://www.marlin.ac.uk/habitat/detail/42>.

d'Avack, E.A.S., Tyler-Walters, H. and Wilding, C. (2015b). *Zostera (Zostera) marina* beds on lower shore or infralittoral clean or muddy sand. In Tyler-Walters H. and Hiscock K. (eds) Marine Life Information Network: Biology and Sensitivity Key Information Reviews, [on-line]. Plymouth: Marine Biological Association of the United Kingdom. [cited 22-03-2019]. Available from: <https://www.marlin.ac.uk/habitats/detail/257>.

Davison, D.M. and Hughes, D.J. (1998). *Zostera* biotopes: An overview of dynamics and sensitivity characteristics for conservation management of marine SACs, Vol. 1. Scottish Association for Marine Science, (UK Marine SACs Project), Scottish Association for Marine Science, (UK Marine SACs Project), Vol. 1.

De-Bastos, E. and Marshall, C.E. (2016). *Kurtiella bidentata* and *Thyasira* spp. in circalittoral muddy mixed sediment. In Tyler-Walters H. and Hiscock K. (eds) Marine Life Information Network: Biology and Sensitivity Key Information Reviews, [on-line]. Plymouth: Marine Biological Association of the United Kingdom. [cited 12-02-2019]. Available from: <https://www.marlin.ac.uk/habitat/detail/374>.

Department for Energy and Climate Change (DECC) (2011a). *Overarching National Policy Statement for Energy (EN-1)*. Presented to Parliament pursuant to Section 5(9) of The Planning Act 2008. July 2011. London: The Stationery Office.

Department for Energy and Climate Change (DECC) (2011b). *National Policy Statement for Renewable Energy Infrastructure (EN-3)*. Presented to Parliament pursuant to Section 5(9) of The Planning Act 2008. July 2011. London: The Stationery Office.

European Marine Energy Centre (EMEC) and Xodus Group (2010). Consenting, EIA and HRA Guidance for Marine Renewable Energy Developments in Scotland. PART FOUR – WAVE & TIDAL ANNEX.

Frid, C. L., & Caswell, B. A. (2017). Marine pollution. Oxford University Press.

Germano and Associates (2013). *Sediment-Profile Imaging Survey of Milford Haven Waterway, Wales, UK - May 2012*. Report to the Milford Haven Waterway Environmental Surveillance Group from Germano & Associates, Inc., Seattle, Washington, USA. vii&34pp + tables, figures and appendices.

Hawkins, A. D., Pembroke, A., and Popper, A. (2015). Information gaps in understanding the effects of noise on fishes and invertebrates. *Reviews in Fish Biology and Fisheries*, 25: 39–64.

Hiscock, S. (1987). A brief account of the algal flora of *Zostera marina* beds in the Isle of Scilly. In Sublittoral monitoring in the Isles of Scilly 1985 & 1986 (ed. R. Irving). Nature Conservancy Council, Peterborough

Hitchin, R., Turner, J.A., Verling, E. (2015). Epibiota remote monitoring from digital imagery: Operational guidelines

Hobbs, G. and Smith, J. (1998). *Macrobenthic monitoring in the coastal waters of Milford Haven following the Sea Empress oil spill of February 1996*. Report to the Environment Agency. CORDAH/OPRU Neyland, Pembrokeshire. Report No. OPRU/28/97.26pp.

Intertek (2016). Greenlink Interconnector. *Environmental Scoping Report – UK Marine Route*.

Jacobs, R.P.W.M. (1980). Effects of the Amoco Cadiz oil spill on the seagrass community at Roscoff with special reference to the benthic infauna. *Marine Ecology Progress Series*, 2, 207-212.

Marine Climate Change Impacts Partnership (2013). Marine Climate Change Impacts Report Card 2013. <http://www.mccip.org.uk/impacts-report-cards/full-report-cards/2013/> [Accessed on 12 February 2019].

Marine Climate Change Impacts Partnership (2015). *Marine climate change impacts; implications for the implementation of marine biodiversity legislation*. (Ed.) Frost M, Bayliss-Brown G, Buckley P, Cox M,

Stoker B and Withers Harvey N. Summary Report. MCCIP, Lowestoft, 16pp. doi:10.14465/2015.mb100.001-016.

Mieszkowska, N. (2011). *Reestablishment of intertidal rocky surveillance*. A report to the MHWESG from the Marine Biological Association of the UK. 54pp + appendices.

Moore, J. (1997). *Rocky shore transect monitoring in Milford Haven 1995*. A Report to the Milford Haven Waterway Environmental Steering Group, Neyland, Pembrokeshire. 101pp.

Morrell, S (2014). *Rocky Shore Surveillance 2013*. Report to Milford Haven Waterway Environmental Surveillance Group from the Field Studies Council Dale Fort Field Centre; 50 pp.

NRW (2019). Intertidal Phase 1 Habitat Survey. Available from <http://lle.gov.wales/catalogue/item/MarineIntertidalPhase1HabitatSurvey/?lang=en>. [Accessed 12 February 2019].

NRW (2018a). Pembrokeshire Marine / Sir Benfro Forol Special Area of Conservation. Advice provided by Natural Resources Wales in fulfilment of Regulation 37 of the Conservation of Habitats and Species Regulations 2017. March 2018.

NRW (2018b). Pembrokeshire Marine / Sir Benfro Forol Special Area of Conservation. Indicative site level feature condition assessments 2018. NRW Evidence Report No: 233

Langston, W.J., Pope, N.D., O'Hara, S., Davey, M., Shortridge, E., Harino, H. and Vane, C.H. (2012). *Bioaccumulation Surveillance in Milford Haven Waterway Phase II (2010)*. On behalf of Milford Haven Waterway Environmental Surveillance Group. Final Report 2012.

Little, D. I. (2017). *Sediment contaminant concentrations in Milford Haven waterway: data conversion and timeline*. Report to the Milford Haven Waterway Environmental Surveillance Group.

Little, D.I. and Galperin, Y. (2014). *Milford Haven sediment hydrocarbon and metals contamination: supplemental report on recent contaminant trends*. Report to Milford Haven Waterway Environmental Surveillance Group.

Little, D.I., Bullimore, B., Galperin, Y. and Langston, W.J. (2016). Sediment contaminant surveillance in Milford Haven Waterway. *Environ. Monit. Assess.* 2016 Jan;188(1):34.

Perry, F. and Tyler-Walters, H. (2018). Maerl beds. In Tyler-Walters H. and Hiscock K. (eds) Marine Life Information Network: Biology and Sensitivity Key Information Reviews, [on-line]. Plymouth: Marine Biological Association of the United Kingdom. [cited 07-02-2019]. Available from: <https://www.marlin.ac.uk/habitat/detail/255>.

Perry, F. and d'Avack, E. (2015). *Fucus spiralis* on full salinity sheltered upper eulittoral rock. In Tyler-Walters H. and Hiscock K. (eds) Marine Life Information Network: Biology and Sensitivity Key Information Reviews, [on-line]. Plymouth: Marine Biological Association of the United Kingdom. [cited 11-02-2019]. Available from: <https://www.marlin.ac.uk/habitat/detail/1029>.

Planning Inspectorate (PINS) (2016). *Advice note ten: Habitat Regulations Assessment relevant to nationally significant infrastructure projects*. Version 3. October 2012.

Povlsen, E. and Hjorth, M. (2015). Bonn Agreement Technical sub-report 2: Environmental and socioeconomic vulnerability. November 2015.

Posford Duvivier (2000). *A survey of subtidal Zostera beds in Milford Haven*. 36pp + appendices.

Prosser, M.V. and Wallace, H.L. (2003). *Milford Haven Saltmarsh Survey: Volume 1*. Report to the Milford Haven Waterway Environmental Surveillance Group.

Readman, J.A.J. (2016a). Mixed turf of bryozoans and erect sponges with *Sagartia elegans* on tide-swept circalittoral rock. In Tyler-Walters H. and Hiscock K. (eds) Marine Life Information Network: Biology and Sensitivity Key Information Reviews, [on-line]. Plymouth: Marine Biological Association of the United Kingdom. [cited 12-02-2019]. Available from: <https://www.marlin.ac.uk/habitat/detail/1086>.

Readman, J.A.J. (2016b). Cushion sponges and hydroids on turbid tide-swept sheltered circalittoral rock. In Tyler-Walters H. and Hiscock K. (eds) Marine Life Information Network: Biology and Sensitivity Key Information Reviews, [on-line]. Plymouth: Marine Biological Association of the United Kingdom. [cited 11-02-2019]. Available from: <https://www.marlin.ac.uk/habitat/detail/1141>.

Roberts, L., Hardig, H.R., Voellmy, I., Brintjes, R., Simpson, S.D., Radford, A.N., Breithaupt, T. and Elliott M. (2016). Exposure of benthic invertebrates to sediment vibration: From laboratory experiments to outdoor simulated pile-driving. *Proc. Mtgs. Acoust.* 27.

Rostron, D M (1995). *The macrobenthos of the foreshore soft sediments of Milford Haven, 1994*. Report from SubSea Survey; 2 vols, 17pp + maps, figures & data appendices.

RPS (2018a). *Marine Energy Test Area (META) Environmental Appraisal Phase 1 sites*. December 2018.

RPS (2018b). *Pembroke Dock Marine. Environmental Impact Assessment Scoping Report*. On behalf of Milford Haven Port Authority. June 2018.

Rumney, H.S., Potter, K., Mellor, P. and Bersuder, P. (2015). *Analysis of Sediment Contaminants in Milford Haven Waterway Total Hydrocarbon (THC) concentration in sediments*. Data report to MHWESG from Centre for Environment, Fisheries & Aquaculture Science, Lowestoft.

Saunders, G., Bedford, G.S., Trendall, J.R., and Sotheran, I., (2011). Guidance on survey and monitoring in relation to marine renewables deployments in Scotland. Volume 5. Benthic Habitats. Unpublished draft report to Scottish Natural Heritage and Marine Scotland.

Spiga, I., Caldwell, G.S., and Brintjes, R. (2016). Influence of Pile Driving on the Clearance Rate of the Blue Mussel, *Mytilus edulis* (L.). *Proc. Mtgs. Acoust.* 27.

Stamp, T.E. (2015). *Alaria esculenta* and *Laminaria digitata* on exposed sublittoral fringe bedrock. In Tyler-Walters H. and Hiscock K. (eds) Marine Life Information Network: Biology and Sensitivity Key Information Reviews, [on-line]. Plymouth: Marine Biological Association of the United Kingdom. [cited 07-02-2019]. Available from: <https://www.marlin.ac.uk/habitat/detail/214>.

Tidau, S., and Briffa, M. (2016). Review on behavioral impacts of aquatic noise on crustaceans. *Proc. Mtgs. Acoust.* 27.

Tillin, H.M. (2016). *Nephtys cirrosa* and *Bathyporeia* spp. in infralittoral sand. In Tyler-Walters H. and Hiscock K. (eds) Marine Life Information Network: Biology and Sensitivity Key Information Reviews, [on-line]. Plymouth: Marine Biological Association of the United Kingdom. [cited 12-02-2019]. Available from: <https://www.marlin.ac.uk/habitat/detail/154>.

Tillin, H.M. and Hill, J.M. (2016). *Semibalanus balanoides*, *Fucus vesiculosus* and red seaweeds on exposed to moderately exposed eulittoral rock. In Tyler-Walters H. and Hiscock K. (eds) Marine Life Information Network: Biology and Sensitivity Key Information Reviews, [on-line]. Plymouth: Marine Biological Association of the United Kingdom. [cited 11-02-2019]. Available from: <https://www.marlin.ac.uk/habitat/detail/140>.

Tillin, H.M. and Ashley, M. (2016). *Hesionura elongata* and *Protodorvillea kefersteini* in offshore coarse sand. In Tyler-Walters H. and Hiscock K. (eds) Marine Life Information Network: Biology and Sensitivity Key Information Reviews, [on-line]. Plymouth: Marine Biological Association of the United Kingdom. [cited 12-02-2019]. Available from: <https://www.marlin.ac.uk/habitat/detail/1113>.

Tillin, H.M. and Budd, G. (2016). *Abra alba* and *Nucula nitidosa* in cirralittoral muddy sand or slightly mixed sediment. In Tyler-Walters H. and Hiscock K. (eds) Marine Life Information Network: Biology and Sensitivity Key Information Reviews, [on-line]. Plymouth: Marine Biological Association of the United Kingdom. [cited 12-02-2019]. Available from: <https://www.marlin.ac.uk/habitat/detail/62>.

Tillin, H.M. and Hill, J.M. (2016). *Semibalanus balanoides* on exposed to moderately exposed or vertical sheltered eulittoral rock. In Tyler-Walters H. and Hiscock K. (eds) Marine Life Information Network: Biology and Sensitivity Key Information Reviews, [on-line]. Plymouth: Marine Biological Association of the United Kingdom. [cited 07-02-2019]. Available from: <https://www.marlin.ac.uk/habitat/detail/199>.

Tillin, H.M. and Rayment, W. (2016a). *Fabulina fabula* and *Magelona mirabilis* with venerid bivalves and amphipods in infralittoral compacted fine muddy sand. In Tyler-Walters H. and Hiscock K. (eds) Marine Life Information Network: Biology and Sensitivity Key Information Reviews, [on-line]. Plymouth: Marine Biological Association of the United Kingdom. [cited 12-02-2019]. Available from: <https://www.marlin.ac.uk/habitat/detail/142>.

Tillin, H.M. and Rayment, W. (2016b). *Hediste diversicolor* and *Limecola balthica* in littoral sandy mud. In Tyler-Walters H. and Hiscock K. (eds) Marine Life Information Network: Biology and Sensitivity Key Information Reviews, [on-line]. Plymouth: Marine Biological Association of the United Kingdom. [cited 11-02-2019]. Available from: <https://www.marlin.ac.uk/habitat/detail/209>.

Unsworth, R. K. F., Bertelli, C. M., Robinson M. and Mendzil, A. (2017). *Status review and surveillance recommendations for seagrass (Zostera species) in Milford Haven Waterway*. Report to the Milford Haven Waterway Environmental Surveillance Group.

Warwick, R.M. (2016). *Milford Haven Waterway sediment macrobenthos data analysis & review 2008-15*. Report to the Milford Haven Waterway Environmental Surveillance Group, Plymouth Marine Laboratory.

Warwick, R. (2006). *Review of benthic and intertidal sediment macrofauna data and development of a surveillance programme*. 105pp + electronic data annex.

Welsh Government (2017) draft Welsh National Marine Plan. WG25663. ISBN: 978-1-4734-5357-9.