MARINE ENERGY TEST AREAS – PHASE 2

Clarification Report

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Glossary

Term	Meaning
Anthropogenic	Originating in human activity
Backscatter	**Backscatter** data provides information on the 'hardness' of the sea floor and is used to differentiate between different types of sea floor, such as hard rock or soft sediment.
Barrier effect	A phenomenon by which the natural movement of an animal is impeded
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.
Benthic habitats	Ecological region at lowest level of a water body including sediment surface and some sub-surface layers
Catenary	The curve a hanging flexible wire or chain assumes when supported at its ends and acted upon by a uniform gravitational force
Cetacean	Aquatic mammals constituting the infraorder Cetacea (whales, porpoises, dolphins)
Mechanosensitivity	The specific response to mechanical stimulation
Microsite	The process through which the specific location for device deployment is determined
SEACAMS	The SEACAMS project is a partnership between Bangor University and Swansea University, part-funded by the European Regional Development Fund. It supports developing economic opportunities in Low Carbon, Energy and Environment through specialisation in commercial application of research and innovation in marine renewable energy
Spring tides	Tide following a new or full moon during which the tidal range is maximum
Suspended sediment	Solid particles uplifted by the fluid's flow
Vibrissae	Whiskers

Acronyms

Term	Meaning
ADCP	Acoustic Doppler Current Profiler
DIOMS	Device Installation and Operation Method Statement
EMP	Environmental Management Plan
EMMP	Environmental Mitigation and Monitoring Plan
ES	Environmental Statement
MarESS	Marine Evidence Based Sensitivity Assessment
MDS	Maximum Design Scenario
MEW	Marine Energy Wales
MLWS	Mean Low Water Springs
MMO	Marine Management Organisation
MRE	Marine Renewable Energy
NRW	Natural Resources Wales
PAH	Polyaromatic Hydrocarbon
PCF	Pembroke Coastal Forum
SPL	Sound Pressure Level
SSC	Suspended Sediment Concentrations
SEACAMS2	Sustainable
THC	Total Hydrocarbon Concentration
VER	Valuable Ecological Receptors
WEC	Wave Energy Converter
WFD	Water Framework Directive
WWBIC	West Wales Biodiversity Information Records Centre
ZoI	Zone of Impact

Units

Unit	Description
cm	Centimetre
dB	Decibel
gcm^{-3}	Grams per centimetre cubed
ha	hectares
≤	Less than or equal to
<	Less than
km	Kilometre
kHz	Kilohertz
m	metre
m^2	metres cubed
m/s	metres per second
μPa	micro pascal
Rms	root mean squared
s^{-1}	per second

INTRODUCTION

The information included in this Clarification Report is a response to NRW's request for clarification/further information (dated 15 May 2020) on the Environmental Statement (ES) and supporting documents in support of an application for a Marine Licence (Licence Application No. ORML1957, submitted [19th December 2019]) for the META Project Phase 2 sites at Warrior Way (site 6), Dale Roads (site 7) and East Pickard bay (site 8).

1. GENERAL

1.1 NRW Clarification Query

There are inconsistencies between the maximum number of device deployments. In Warrior Way, it is stated that there will be 4 in a 12-month period (Chapter 5, WFD assessment), while in Chapters 2 and 8 there are said to be up to 20. Dale Roads appears to be consistent between chapters, but East Pickard Bay varies between the two Chapters. Please clarify.

1.2 Response/clarification

1.2.1.1 The inferred discrepancy between Chapter 2: Project Description, Chapter 5: Coastal Processes, Chapter 8: Fish and Shellfish Ecology and the Water Framework Directive (WFD) Assessment of the META Project Phase 2 ES lies in the difference between the number of testing activities and the number of vessel movements associated with deployment and retrieval of devices. Marine Energy Wales (MEW), on behalf of Pembroke Coastal Forum (PCF) ('**the Applicant**') can therefore confirm, following review of the highlighted chapters, that there are no genuine discrepancies in numbers between the chapters. Further explanation is provided below.

1.2.1.2 For Warrior Way (site 6), Chapter 2: Project Description (Table 2.3) and Chapter 8: Fish and Shellfish Ecology (Table 8.12) both state ≤ 20 test deployments and 20 retrieval vessel movements in a 12-month period. These relate to the number of vessel movements rather than the number of device deployments in a 12-month period. Table 8.12 in Chapter 8: Fish and Shellfish Ecology and Table 2.4 in Chapter 2: Project Description state up to four device deployments in a 12-month period in relation to device testing. Table 5.3 of Chapter 5: Coastal Processes also states up to four device deployments in a 12-month period which relates to the maximum number of devices that can be tested in a 12-month period. These sections do not make reference to the number of vessel movements as this information is not required for the Maximum Design Scenario (MDS) for this chapter. The MDS is specific to each chapter, as each technical area will use different parameters of the Project Description as the basis of what constitutes the MDS. Paragraph 5.3.8.5 in the WFD Assessment also states up to four device deployments in a 12-month period, but again does not make reference to the number of vessel movements as this information is not required for the MDS for this chapter.

1.2.1.3 For East Pickard Bay (site 8), Chapter 2: Project Description (Table 2.9) and Chapter 8: Fish and Shellfish Ecology (Table 8.12) both state ≤ 40 deployments and 40 retrieval vessel movements in a 12-month period. Again, this relates to the number of vessel movements rather than the number of potential device deployments in a 12-month period. Table 8.12 in Chapter 8: Fish and Shellfish Ecology states up to two device deployments in a 12-month period at each berth therefore up to four device deployments in a 12-month period. Table 2.10 in Chapter 2: Project Description confirms this position. Table 5.3 of Chapter 5: Coastal Processes also states up to four devices deployed in a 12-month period which relates to device testing rather than vessel movements associated with device testing, but does not make reference to the number of vessel movements as this information is not required for the MDS for this chapter.

2. BENTHIC HABITAT

2.1 NRW Clarification Query

Whilst the ES states that there is no "overlap with known extent of Annex I rocky reef" there remains potential for reef features to be present within the sites (shown within Figure 7.2 and at www.lle.gov.wales). Given that this potential exists, and reef species sensitive to suspended sediments may thus be present, we seek clarification as to the justification for assessing sensitivity as low in 7.11.1.55 and the subsequent impact as negligible.

2.2 Response/clarification

2.2.1.1 The Applicant acknowledges that, whilst there is no overlap of the boundaries of any of the META Project Phase 2 sites with known extent of Annex I rocky reef, Figure 7.2 of chapter 7: Benthic Ecology of the META Project Phase 2 ES does indicate that there is potential for reef features to be present elsewhere in the Waterway and in proximity to all three META Project Phase 2 sites. It is however, important to note that this data (taken from www.lle.gov.wales) was augmented with multibeam backscatter data available for each site (as presented in Appendix 7.1 of the META Project Phase 2 ES) in order to inform the benthic ecology assessment. Paragraphs 7.7.2.10, and 7.7.2.17 of Chapter 7: Benthic Ecology highlight that a preliminary inspection of this site-specific data provided no indication of any areas of potential hard substrate which were deemed to correspond with potential reef habitat within the boundaries of Warrior Way (site 6) or East Pickard Bay (site 8). The Applicant would further note that, as outlined in Table 7.3 of Chapter 7: Benthic Ecology, in response to NRWs pre-application advice, the boundary of the East Pickard Bay test area (site 8) was specifically revised to avoid the designated reef feature at this location. As discussed in paragraph 7.7.2.14 of Chapter 7 Benthic Ecology of the META Project Phase 2 ES, at Dale Roads (site 7), the multibeam backscatter data indicated soft sediments likely across the majority of the site with the potential for an area of possible harder substrate in the south west corner of the site.

2.2.1.2 In acknowledgement of the potential for Annex I reef habitat to occur in the vicinity of the META Project Phase 2 test sites (and potentially within Dales Roads (site 7)), and as discussed in Table 7.13 of Chapter 7: Benthic Ecology of the META Project Phase 2 ES, the Applicant has committed to fully reviewing and interpreting the multibeam backscatter data post-consent/pre-deployment, to identify any areas of potential reef features that may be present. In the event that acoustic signatures synonymous with potential reef presence are identified from this 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. These surveys will ensure that measures can be designed, if necessary, (e.g. micrositing of moorings etc.) to avoid direct impacts to reef habitats at these sites. The Applicant is confident that the likelihood of Annex I reef features being present within the META Project Phase 2 test sites is low, however, the measures committed to within the META Phase 2 ES and summarised again above, will further mitigate any potential for direct impacts to this habitat should the comprehensive review of the multibeam data indicate that any areas of reef are present.

2.2.1.3 With respect to specific impacts associated with increased suspended sediment concentrations (SSC) and sediment deposition, paragraph 7.11.1.27 of Chapter 7: Benthic Ecology of the META Project Phase 2 ES concludes that for all installation activities, the coarsest fraction of the material disturbed is anticipated to settle relatively quickly in the immediate vicinity of the works. The greatest increases in SSC and deposition above background levels are therefore predicted to be spatially restricted to within the boundaries of the META Project Phase 2 sites. Given the commitment for Developers to avoid any areas of reefs within the META Project Phase 2 test sites, should they be identified during the post-consent/pre-deployment phase, the Applicant is confident that this substantially reduces the likelihood of impacts to reef features and the magnitude of impacts associated with increased SSC and deposition should they occur.

2.2.1.4 As discussed in paragraph 7.11.1.30 of Chapter 7: Benthic Ecology of the META Project Phase 2 ES, plumes of fine sediments which may extend beyond the META Project site boundaries, and therefore to any areas of reef habitat further afield, are predicted to quickly dissipate and disperse 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). Furthermore, any increases in SSC are likely to be within the ranges typically expected during storm conditions. For these reasons, and as concluded in paragraph 7.11.1.31 of Chapter 7: Benthic Ecology of the META Project Phase 2 ES, the magnitude of this impact on benthic habitats including reefs is predicted to be negligible.

2.2.1.5 With regards to the assessment of sensitivity of reef habitats, as outlined in paragraph 7.9.2.4 of Chapter 7: Benthic Ecology of the META Project Phase 2 ES, the Marine Evidence based Sensitivity Assessment (MarESA) was drawn upon to support the assessments made. This evidence was considered in the context of the existing baseline conditions for reef habitats within the study area; an approach which is considered to be standard best practice for the assessment of impacts to benthic habitats. The sensitivity of reef habitats to increased SSC and sediment deposition was fully assessed in paragraphs 7.11.1.41 to 7.11.1.47 of Chapter 7: Benthic Ecology of the META Project Phase 2 ES. The conclusion that reefs are of low sensitivity to the levels of SSC and sediment deposition likely to result from installation activities was made on the basis of consideration of the evidence presented in the MarESA[1] together with knowledge of the site-specific conditions in the Waterway and, in particular, the likely habituation of reef features in the vicinity of META Project sites to increased SSC and sediment deposition. As discussed in paragraph 7.11.1.37 of Chapter 7: Benthic Ecology of the META Project Phase 2 ES, chronic sediment disturbance and resuspension occurs in the Waterway from 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 also include periodic dredging events and less frequent large-scale engineering projects (Little *et al*., 2016). Therefore, it can be assumed that communities associated with reef habitat within the Waterway are routinely exposed to elevated SSC and must therefore have a degree of tolerance to this pressure.

2.2.1.6 The assessment of sensitivity also gave due regard to the fact that the magnitude of the impacts associated with the META Project Phase 2 Project will likely be less than the benchmarks used in MarESA (Marine Evidence Based Sensitivity Assessment) to determine sensitivity. Specifically, the MarESA benchmark for increase SSC is “a change in one rank on the WFD (Water Framework Directive) scale e.g. from clear to intermediate for one year” and for sediment deposition is “deposition of up to 5 cm of fine material added to the habitat in a single, discrete event”. The Applicant is therefore confident that the assessment of sensitivity is sufficiently precautionary and that any impacts to reef habitat arising from increases in SSC and deposition will be less than those predicted in the META Project Phase 2 ES.

2.2.1.7 In summary, multibeam backscatter data available for the META Project test sites indicates that the likelihood of Annex I reef features being present within all sites is low. The Applicant is also confident that, should the post-consent/pre-deployment comprehensive review of the multibeam data indicate that any areas of reef are present, the commitments made within the META Project Phase 2 ES will further mitigate any potential for direct impacts to reef habitat in the wider area. The assessment of sensitivity of reef habitat within the study area to increased SSC and sediment deposition was based upon best available published information of the

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[1] The MarESA assessment for the CR.MCR.CFaVS.CuSpH biotope (Warrior Way (site 6) and Dale Roads (site 7)) concludes that this habitat is ‘not sensitive’ to changes in suspended sediments and is of ‘low’ sensitivity to smothering and siltation rate change (Readman, 2018).

The MarESA assessment for the CR.HCR.XFa.ByErSp biotope (East Pickard Bay (site 8)) concludes that this habitat is of ‘medium’ sensitivity to changes in suspended sediments and is ‘not sensitive’ to smothering and siltation rate change (Readman, 2016).

sensitivity of component species of these habitats together with a consideration of the baseline conditions within the study area to which these species are routinely exposed. On this basis it is considered that the assessment of low sensitivity for reefs is sufficiently precautionary and effects of greater than negligible significance on reef habitats are not predicted to arise.

3. UNDERWATER NOISE

3.1 NRW Clarification Query

From the information presented in Table 9.20 it appears that there is the potential for WEC to cause injury to low frequency cetaceans to a range of 76 m and disturbance to all cetaceans to a range of 7 km. We would therefore expect to see this assessed for sites where WEC are proposed for installation under operation and maintenance impacts both in Section 9.11.3 and Section 6.4.2 of the HRA. We advise that the potential for injury is unlikely to cause a significant effect, however further information is requested on the potential for disturbance.

3.2 Response/clarification

3.2.1.1 Paragraph 9.11.4.16 of Chapter 9: Marine Mammals, Basking Shark and Otter states "*details relating to wave devices is provided for context*". The Applicant would like to highlight that the Pelamis P2 WEC acoustic data was included on the basis that this was the only other data available on operational noise to the Applicant at the time of writing, and was included to provide context to the OpenHydro tidal turbine. Given the nature of the Pelamis P2 WEC device and its operational noise profile, noise effects were thought to be above that which is likely to be deployed at East Pickard Bay (site 8) and not thought to represent a realistic MDS. The potential noise impacts related to the Pelamis P2 WEC were therefore not assessed in the META Project Phase 2 ES. Noise source levels were available for the OpenHydro Tidal Turbine and evidence showed that the noise source levels of the OpenHydro Tidal Turbine represented a realistic MDS (see Table 9.19 of Chapter 9: Marine mammals, Basking Shark and Otter of the META Project Phase 2 ES). The assessment of significance of impacts related to operational noise was therefore carried out on a likely source Sound Pressure Level (SPL) of 162 dB re 1 μPa re 1 m (taken from Lepper *et al.,* 2012, as reference in Table 6.12 of Chapter 6: Underwater Noise, Table 9.19 of Chapter 9: Marine Mammals, Basking Shark and Otter, and shown below in Table 3-1).

Table 3-1: Source noise data for example operational devices.

Item	Description/assumptions	Data source	Source sound pressure level at 1 m	
			Rms, dB re 1 μPa	SEL(24h), dB re 1 μPa2s
OpenHydro tidal turbine	EMEC facility in Orkney	Parvin and Brooker (2008)	162	212

3.2.1.2 Whilst full scale WECs are intended to be deployed at East Pickard bay (site 8), the WECs which will be deployed at this site will not possess the same physical parameters as the Pelamis P2 WEC and therefore do not share the same noise generating mechanisms. Other WEC devices have fewer mechanical moving parts, and engineering solutions for WECs are actively seeking to reduce these further. Evidence suggests that noise source levels for WEC devices which are currently being developed are likely to fall within the envelope of the existing assessment (of 162 dB re 1 μPa re 1 m likely source SPL), as presented in Table 9.19 of Chapter 9: Marine Mammals, Basking Shark and Otter, and below in Table 3-1. In support of this, Haikonen *et al.* (2014) presented estimated noise levels of a WEC at different wave heights; source SPL (root mean square (rms)) was estimated to be between 112 dB re 1 μPa re 1 m (0.0 – 0.05 m wave height) and >145 dB re 1 μPa re 1 m (> 2 m wave height), which falls below that of the OpenHydro tidal turbine (162 dB re 1 µPa re 1 m, as presented in Table 9.19 of Chapter 9: Marine Mammals, Basking Shark and Otter and presented below in Table 3-1 for information). Haikonen *et al.* (2013) also reported source noise levels to be lower than that of the assessed OpenHydro Tidal Turbine; estimated rms source SPL of WECs were given in the range of 149 dB re 1 µPa re 1 m (mean) to 153 dB re 1 µPa re 1 m (maximum). In addition, Chapter 6: Underwater Noise of the Bombora Environmental Statement (Bombora Wavepower, 2019) stated that "there are a number of factors which means that the operating noise from mWave (a full-scale device) is likely to be lower than both the Pelamis P2 WEC and OpenHydro Tidal Turbine".

3.2.1.3 As such, the Applicant is confident, based on the available evidence, that the assessment carried out for the impacts of operational noise is sufficiently precautionary and that any disturbance from noise impacts to cetaceans arising from WEC devices will be less than (i.e. < 0.5 km, as presented in Table 9.20 of Chapter 9: Marine Mammals, Basking Shark and Otter and in Table 3-2 below) or equal to the significance of effect presented for operational noise in the META Project Phase 2 ES (as presented in paragraph 9.11.4.10).

Table 3-2: Calculated effects of continuous operational device noise on marine mammal receptors.

Activity / vessel	Radius of potential injury zone (assuming continuous exposure within that radius over 24-hour period)				Radius of potential disturbance
	LF	MF	HF	PW	
OpenHydro tidal turbine	3 m	0 m	2 m	0 m	0.5 km

3.2.1.4 In conjunction with the deployment of each device, given that the Applicant expects that developers would seek to deploy noise monitoring equipment in order to measure source sound levels of devices, which can be included as part of the META Project EMMP.

3.3 NRW Clarification Query

The ES recognises that noise propagation will depend on several factors such as depth, seabed conditions etc, and that the sound energy may spread in a spherical or cylindrical pattern which affects how the energy decays. Therefore, noise propagation in the shallow constrained channel of Warrior Way is likely to be different to that of the open water sites of Dale Roads and East Pickard Bay. Could you please clarify how the noise propagation was calculated and how the different hydrographical characteristics were considered within the assessments for the different sites?

3.4 Response/clarification

3.4.1.1 The introduction to the subsea noise assessment in Chapter 6: Underwater Noise, the ES (paragraph 6.2.1.4) notes that "*this report provides an overview of the potential effects due to underwater noise from the META project on the surrounding marine environment. Because the exact type, size and installation method for the potential test devices is unknown at this stage, this report presents an overview of likely impacts due to underwater noise from a typical range of marine energy devices and installation methodologies. As such, no detailed underwater noise modelling has been conducted*."

3.4.1.2 Without knowing specific details of the devices which may be installed at META Project Phase 2 test sites, or the specific installation methods of these devices, undertaking detailed subsea noise modelling was considered disproportionate. In this respect, any additional "accuracy" of detailed modelling would be overshadowed by the inaccuracies inherent in the source terms for the noise which would certainly be significantly larger than the improved "accuracy" of detailed modelling. Consequently, detailed noise modelling was considered to be disproportionate to the assessment being undertaken, and would not provide any additional clarity in terms of understanding the potential impact on marine species.

3.4.1.3 The approach taken was therefore to provide a high level review of potential noise sources and the likely range of impacts in terms of potential for disturbance and injury. As stated in Chapter 6: Underwater Noise, sound propagation modelling was based on an established, peer reviewed sound propagation model which utilises the semi-empirical model developed by Rogers (1981). The model provides a robust balance between complexity and technical rigour over a wide range of frequencies, has been validated by numerous field studies and has been benchmarked against a range of other models (e.g. Toso *et. al.,* 2014; Paul, 2013; Schulkin and Mercer, 1985) . Chapter 6: Underwater Noise (paragraph 6.4.4.2) noted that "…*it should be borne in mind that noise levels (and associated range of effects) will vary depending on actual conditions at the time (day-to-day and season-to-season) and that the model predicts a typical maximum scenario. Taking into account factors such as animal behaviour and habituation, any injury and disturbance ranges should be viewed as indicative and probabilistic ranges to assist in understanding potential impacts on marine life…*" Furthermore, Chapter 6: Underwater Noise (paragraph 6.4.4.2) noted that "*Taking into account the relatively low risk associated with noise from the proposed development (no impulsive sound), it is considered that potential errors due to paucity of information on marine mammal and fish criteria thresholds and uncertainties in source data are likely to be greater that the uncertainties inherent in the high-level acoustic modelling.*"

3.4.1.4 The acoustic parameters used as an input to the model are presented in Table 3-3.

Table 3-3: Acoustic parameters used as an input to the underwater noise assessment model.

Parameter	Value
Sound speed gradient, s^{-1}	0.2
Water sound speed, m/s	1521.6
Density of water ρw	1.027
Sediment sound speed, m/s	1836
Density of sediment, gcm^{-3}	2.034
Sediment attenuation coefficient, dB/m/kHz	0.49
Water depth, m	20

3.4.1.5 Due to the high-level nature of the modelling, the different hydrographical characteristics of different sites were not modelled (see paragraph 3.4.1.2). Nevertheless, given that the predicted injury ranges for installation and operation of the devices which were, at most, tens of metres, it is highly unlikely that any more detailed noise modelling would have resulted in a significantly different outcome in Chapter 8: Fish and Shellfish Ecology or Chapter 9: Marine Mammals, Basking Shark and Otter. Furthermore, it is considered that the uncertainties pertaining to the acoustic thresholds for disturbance are so large that they significantly outweigh any uncertainties in the acoustic modelling. As such, it is important to heed the statement in Chapter 6: Underwater Noise (paragraph 6.7.1.11) that *"The potential ranges presented for injury and disturbance are not a hard and fast 'line' where an impact will occur on one side of the line and not on the other side. Potential impact is more probabilistic than that; dose dependency in PTS onset, individual variations and uncertainties regarding behavioural response and swim speed/direction all mean that in reality it is much more complex than drawing a contour around a location. These ranges are designed to provide a way in which a wider audience can understand the potential spatial extent of the impact."*

3.4.1.6 Consequently, the Applicant is confident in the conclusions presented in Chapter 6: Underwater Noise (paragraph 6.8.1.2) that *"…based on the results of the high-level review, it is therefore concluded that it is highly unlikely that injury will occur for any marine mammal or fish species as a result of the project"* and considers it highly unlikely that any more detailed modelling would materially alter this conclusion.

3.5 NRW Clarification Query

It is also noted that Table 9.8 The section in this table on 'Increased anthropogenic underwater noise – operation of tidal turbines' does not in fact address underwater noise, it addresses the swept area, rotor diameter and tip speed which are relevant for collision risk.

3.6 Response/clarification

3.6.1.1 Table 9.8 of Chapter 9: Marine Mammals, Basking Shark and Otter ("Maximum and most likely design scenarios considered for the assessment of potential impacts on marine mammals, basking shark and otter.") sets out the MDS for the project, informed by the project description (Chapter 2 of the META Project Phase 2 ES). The MDS for *Increased anthropogenic underwater noise – operation of tidal turbines* is represented by the physical parameters of the devices. Source noise levels (determined by the device parameters) do not constitute a design scenario. Source sound noise levels were provided in Table 9.8 for *Increased anthropogenic underwater noise - vessels* and *Increased anthropogenic underwater noise* as this data was readily available. In summary, the physical parameters of the vessels and pin piles presented in Table 9.8 are the MDS, the likely source noise levels were provided in Table 9.8 as additional information.

3.7 NRW Clarification Query

Following NRW Technical advisors response we consider that a conclusion must be provided as to the potential for barrier effects and disturbance from operational device noise on fish, particularly in the context of the shallow, constricted channel at Warrior Way, and its proximity to a herring spawning site.

3.8 Response/clarification

3.8.1.1 The META Project Phase 2 ES, in its assessment of operational effects, assessed 'Physical barrier to movement of known migratory routes due to presence of tidal device' but did not draw a conclusion on the likely barrier effects and/or disturbance due to the noise emitted from operational tidal devices because this was considered to be of negligible impact and therefore proposed to be scoped out.

3.8.1.2 Underwater noise effects during the operational phase, including injury and disturbance to fish and shellfish were scoped out of the impact assessment (see Table 8.13 of Chapter 8: Fish and Shellfish Ecology) on the basis that modelled ranges of effect were minimal (see Table 3-4 below, which was presented as Table 6.14 in Chapter 6: Underwater Noise). A maximum range of 78 m was modelled for disturbance as a result of operation of a tidal device. In addition, evidence presented in the META Project Phase 2 ES suggested that visual cues, rather than acoustic, are likely to deter fish away from a device, therefore likely to deter fish prior to them entering this 78 m Zone of Impact (ZoI) (see section 8.11.2.63 of Chapter 8: Fish and Shellfish Ecology stating that "Wilson *et al*. (2006) demonstrated that visual appearance and activity of a marine device is important in fish avoidance behaviour. The study found that fish will predominately use vision as their main stimulus" and that "herring exhibit strong avoidance behaviours of vibrating obstacles in the dark (Blaxter and Batty, 1985)." As such, the Applicant concludes that the existing position presented in the META Project Phase 2 ES that no assessment for noise in terms of disturbance is required is maintained. Whilst these small ranges of effect are therefore also unlikely to result in barrier effects, the Applicant has discussed this further below (paragraph 3.8.1.3 onwards).

Table 3-4: Calculated effects of continuous operational device noise on fish receptors.

Activity / vessel	ASA Radius of potential recoverable injury zone (assuming continuous exposure within that radius over 48-hour period)	Radius of potential disturbance zone (based on WSDOT criteria)
	Fish: swim bladder involved in hearing	All fish
OpenHydro tidal turbine	4 m	78 m
Pelamis P2 WEC	0 m	6 m

3.8.1.3 Section 8.11.2.63 of Chapter 8: Fish and Shellfish Ecology states that “the presence of a single tidal turbine within the Warrior Way site (site 6) at any time, has the potential to cause a barrier to movement of migratory fish, including displacement from known migratory routes”. The assessment concluded that magnitude of effect for ‘Physical barrier to movement of known migratory routes due to presence of tidal device’ was negligible (paragraph 8.11.2.65 of Chapter 8: Fish and Shellfish Ecology). The assessment drew this conclusion because the maximum design scenario of a tidal device at Warrior Way (site 6) will be a 5 m rotor diameter which equates to a maximum swept area of 19.63 m^2. For context at Warrior Way (site 6), the width of the river from Mean Low Water Springs (MLWS) to MLWS equates to circa. 330 m, which equates to 1.51% (maximum scenario) of the tidal stream cross-sectional area at this location. Based on the maximum ranges of disturbance presented in Table 3-4 above (Table 6.14 of Chapter 6: Underwater Noise), operational noise has the potential to extend to 78 m. The sensitivity of all Valuable Ecological Receptors (VER) was assessed as either negligible or low (paragraph 8.11.2.66 onwards of Chapter 8: Fish and Shellfish Ecology). In particular, this conclusion was drawn for migratory species (sea lamprey *Petromyzon marinus*, river lamprey *Lampetra fluviatilis*, allis shad *Alosa alosa,* twaite shad *Alosa fallax,* Atlantic salmon *Salmo salar*, sea trout *Salmo trutta and European eel Anguilla anguilla*) as fish are likely to display some avoidance behaviour in close proximity to an operating turbine and there is sufficient space for migratory species to pass the turbine and species are likely to migrate along areas of low energy i.e. in the lee of a meander, to conserve energy (Hinch, 2000). The assessment highlighted that any marine renewable device will most likely be placed in an area of relatively high energy and any noise coming from the turbine will most likely be far less than vessels commuting through the area (or background noise due to other sources such as pebbles moving in the tide), and is unlikely to pose as a barrier to sensitive species (including herring). The significance of effect for all VERs was considered to be of negligible (adverse) to minor (adverse) significance. Therefore, based on the ecological information presented within this assessment and the ranges of effect presented in Table 3-4, the same conclusions can be drawn for potential barrier effects as a result of operational noise. Therefore, the significance of the effect for ‘barrier effects to movement of known migratory routes due to presence of tidal devices” for all VERs can also be concluded as being of negligible (adverse) to minor (adverse) significance.

3.8.1.4 In summary whilst the ES did not draw a conclusion on the likely barrier effects to fish as a result of operational noise, the Applicant is confident that the assessment of significance included in the ES on physical barrier to movement of known migratory routes due to presence of tidal device’ is sufficiently precautionary and that any barrier to migratory routes arising from operational noise will be equal to or less than those predicted in the ES.

4. ENTANGLEMENT RISK

4.1 NRW Clarification Query

Devices may be secured with drag anchors and catenary mooring, which have the potential to cause entanglement of marine mammals. Grey seals and baleen whales are particularly

vulnerable to this impact, which could be exacerbated should marine debris such as discarded nets become caught on the mooring lines. It is not clear how the conclusion of minor significance has been reached. Please provide further justification as to the assessment of this impact. We recommend that further consideration is given to how mooring lines will be monitored for debris and a mitigation plan should entanglements occur.

4.2 Response/clarification

4.2.1.1 The Applicant acknowledges that devices which are secured with drag anchors and/or catenary mooring have the potential to cause entanglement of marine mammals, with particular concern in relation to grey seals and baleen whales.

4.2.1.2 In assessing the likely impacts of entanglement risk in Chapter 9: Marine Mammals, Basking Shark and Otter, of the META Project Phase 2 ES (paragraph 9.11.2.132 onwards), the Applicant considered that a conclusion of minor significance was appropriate, based on the low likelihood of marine mammals entering the ZoI for entanglement risk and the informed expectation that entanglement is unlikely to occur even if an animal did enter the ZoI.

4.2.1.3 The conclusion that animals were unlikely to enter the ZoI for entanglement risk was drawn based on the most up to date sightings information for the area. Local sightings information was provided by the West Wales Biodiversity Information Records Centre (WWBIC) and was based on small vessel surveys undertaken between 2005 and 2015, and incidental sightings from 1978 to 2018. Figure 9.5 of Chapter 9: Marine Mammals, Basking Shark and Otter of the ES shows that whilst sightings for all species assessed (harbour porpoise *Phocoena phocoena*, bottlenose dolphin *Tursiops truncatus*, short-beaked common dolphin *Delphinus delphis*, Risso's dolphin *Grampus griseus*, minke whale *Balaenoptera acutorostrata*, grey seal *Halichoerus grypus*, basking shark and European otter) are widely distributed in the outer Bristol Channel and Irish Sea, sightings records in the Local Marine Mammal, Basking Shark and Otter Study Area (hereafter referred to as '**the Study Area**') are extremely low. Based on WWBIC data, no sightings of any cetacean species exist for Warrior Way (site 6) or its surrounding area. Four confirmed sightings over a 40 year period between 1978 to 2018 (incidental sightings and small vessel surveys) of harbour porpoise within the Study Area exist, but none of these sightings are within the boundaries or in close proximity of either Dale Roads (site 7) or East Pickard Bay (site 8). A single (unconfirmed) sighting of common dolphin (over the same period) within the Waterway exists. No bottlenose dolphin sightings records exist in the Study Area for these datasets (1978 to 2018). The nearest minke whale sighting to the Waterway is located ~ 18 km south west of East Pickard Bay (site 8) and the nearest Risso's dolphin sighting is located ~ 11 km east of East Pickard Bay (site 8). As such, cetacean density within the Study Area is considered to be extremely low, and potential for occurrence of cetaceans with in the ZoI of the META Project Phase 2 sites over the course of project is considered to be low. Based on WWBIC sightings data, the nearest basking shark sighting to the Waterway is located ~ 20 km south west of East Pickard Bay (site 8). Less than 30 sightings of grey seal and less than 30 sightings of European otter occurred within the Study Area over the 40 year period between 1978 to 2018 (incidental sightings and small vessel surveys). Of these, no grey seal or otter were sighted with the boundaries of any of the three META Project Phase 2 sites. It was therefore concluded that there was a low likelihood of grey seals or otter occurring within the boundaries of any of the META Project Phase 2 sites during operation of devices. No updated sightings data are presented here as the Applicant believes that the information presented on occurrence is sufficient.

4.2.1.4 The Applicant also considered it unlikely that entanglements would occur, even if a marine mammal did occur within the boundary of the META Project Phase 2 sites. Chapter 9 Marine Mammals, Basking Shark and Otter of the ES states that incidental mortality of marine mammals caught in ropes, lines and fishing gear, is recognised as a significant conservation problem (Benjamins *et al.,* 2014), however Chapter 9 Marine Mammals, Basking Shark and Otter also states that much less is known of the potential risks for incidental mortality associated with marine renewable energy developments. The Applicant confirms that the assessment of significance took into account that entanglement in stationary mooring lines (as associated with Phase 2 of the META Project) typically occur far more infrequently than active mobile gear or debris (Benjamins *et al.,* 2014), however the Applicant acknowledges that the provision of details on the methodology followed in coming to this conclusion would support the justification for assessing this impact as minor.

4.2.1.5 In considering the potential risks posed by entanglement, the Applicant reviewed the literature available which related directly to entanglement risk from mooring lines and associated gear at Marine Renewable Energy (MRE) device deployments. Benjamins *et al.,* (2014) (as referenced in Chapter 9 Marine Mammals, Basking Shark and Otter of the META Project Phase 2 ES) provided guidance on the approach to this assessment. In the absence of sector-specific empirical data, the Applicant considered biological risk, in terms of body size, animal's ability to detect moorings, animals body flexibility and general feeding style, along with physical risk, in terms of mooring characteristics and geographical overlap. The Applicant assessed the maximum design scenario as per Chapter 2: Project Description of the META Project Phase 2 ES, and physical risk was largely determined by the likelihood of an animal entering the ZoI for entanglement risk. The biological risk and physical risk factors were combined to assess the overall likely significance of effect. Benjamins *et al.* (2014) considers that for most megafauna, MRE mooring devices will likely pose a relatively modest risk but that baleen whales were considered to be at greatest relative risk overall, largely due to their size and foraging habits. However, as stated above (paragraph 4.2.1.3) no baleen whale has been sighted within the Study Area, and therefore, whilst biological risk is higher in minke whale, physical risk was considered to be extremely low and therefore it was considered extremely unlikely that entanglement would occur. Given that toothed cetaceans are not considered to be at high risk of entanglement from MRE mooring devices, whilst there are low numbers of sightings of harbour porpoise and common dolphin in the Study Area, based on very low biological risk, it was considered that entanglement is extremely unlikely for these species. This is supported by Benjamins *et al.* (2014) which states that fewer comparable records exist of entanglements involving small cetaceans (e.g. dolphins), which are more vulnerable to bycatch in nets than to entanglement. Both biological risk and physical risk (due to very low likelihood of occurrence within the Study Area) for bottlenose dolphin and Risso's dolphin is considered extremely low, therefore the Applicant considered it extremely unlikely that entanglement would occur.

4.2.1.6 Grey seal are considered to be vulnerable to entanglement risk however the evidence for this largely relates to fishing debris, rather than moored gear (Raum-Suryan *et al.,* 2009; Allen *et al.,* 2012; Benjamins *et al.,* 2014). There is no evidence to suggest that grey seal are more vulnerable to MRE-associated mooring lines than toothed cetaceans. Whilst pinnipeds cannot use echolocation to detect MRE mooring gear, pinnipeds possess acute mechanosensitivity through their vibrissae (Dehnhardt *et al.,* 2001; Hanke *et al.,* 2013) allowing them to detect wakes formed downstream of a rope or mooring line (Benjamis *et al.,* 2014). The Applicant therefore considers that the biological risk for grey seal is extremely low, due to the ability of grey sea to detect vibrations, and therefore avoid mooring lines and associated gear. As such, the risk of entanglement is again extremely low.

4.2.1.7 In assessing the significance of effect, consideration was also given to the temporary, intermittent nature of all proposed deployments at the META Project Phase 2 sites. Well-established, extensive mooring systems which result in changes to the benthic environment, replacing comparatively species poor sediment communities are likely to attract fish and subsequently present foraging opportunities for marine megafauna (Langhamer *et al.,* 2009). However, as all deployments proposed at the META Project Phase 2 sites are temporary (maximum deployment period is 18 months at East Pickard Bay (site 8)), this attraction of marine mammal prey species is considered unlikely. In addition, Benjamins *et al.* (2014) highlight that "intuitively, taut moorings (under high tension, by definition) are much less likely to cause entanglement than flexible ones (under low tension)". Moorings at the META Project Phase 2 sites, because of the nature of deployments and for reasons of device safety will have relatively taught moorings, and therefore entanglement risk is even more unlikely.

4.2.1.8 Consideration has also been given to the risk of entanglement as a result of fishing debris being caught on mooring lines, or associated gear. The Applicant is confident that the assessment of significance presented in Chapter 9: Marine Mammals, Basking Shark and Otter of the ES, is sufficiently precautionary even when considering this risk. The risk is considered to be extremely unlikely, given the temporary nature of the deployments (maximum deployment period is 18 months at East Pickard Bay (site 8) with all associated mooring and gear retrieved at the same time). In addition, commercial fishing activity (shellfish potting with some fixed netting) is relatively high at the mouth of the Waterway but decreases further up-stream of the Waterway (see paragraph 11.6.3.4 of chatter 11: Commercial Fisheries) and no trawling or drift nets are present in the area, which given their size and mobile nature, are more likely to pose a risk of marine mammal entanglement.

4.2.1.9 In summary, minor significance was concluded based on the low likelihood of an entanglement occurring in the event of an animal entering the ZoI for entanglement, the likelihood of which is also considered low. Current, peer-reviewed evidence informed the assessment that likelihood of entanglement was low, and an extensive and robust sightings dataset informed the assessment that the likelihood of an animal entering the ZoI for entanglement was low. The Applicant is therefore confident that the assessment of significance is sufficiently precautionary.

4.2.1.10 Furthermore, regular device inspections will be carried out by developers, from an engineering perspective, under device-specific Device Installation and Operation Method Statements (DIOMS). The production of DIOMS are a requirement under the META Project Environmental Management Plan (EMP). Adherence to DIOMS will address concerns in the first instance for snagged fishing gear and for monitoring and responding to potential marine mammal entanglements.

5. SUSPENDED SEDIMENT

5.1 NRW Clarification Query

5.9.1.9 - States that the very finest material (0.06 mm) would travel in the order of 600 m from the Dale Roads site during an average tide based on the average site current speed (100m for Warrior Way, 50m at East Pickard Bay). This figure is important in assessing subsequent impacts on environmental receptors. Please provide clarity and justification as to the origin of these figures, including consideration of the impact of spring tides and the calculations used to ascertain these results. If consideration of spring tides significantly increases the distance of the sediment plumes, please could you assess the impact of this on potential environmental receptors (including but not limited to Seagrass, Maerl, Bathing Waters).

5.2 Response/clarification

5.2.1.1 The characteristics of the bed material at the Dale Roads (site 7) and Warrior Way (site 6) sites were ascertained from published site investigation reports (Germano and Associates Ltd, 2012) whilst the information for East Pickard Bay (site 8) was provided from sampling undertaken as part of the SEACAMS2 project update. Both of these sources were cited in Table 5.2 of Chapter 5: Coastal Processes of the META Project Phase 2 ES.

5.2.1.2 The tidal currents within Milford Haven (i.e. for Dale Roads (site 7) and Warrior Way (site 6)) were quantified using a calibrated tidal model which had been developed by RPS for previous projects within the estuary (South Hook LNG terminal & CHP station and Pembroke Power Station). The parameters used in the assessment at East Pickard Bay (site 8) utilised site monitoring Acoustic Doppler Current Profiler (ADCP) data provided by Bombora Wavepower for the WEC application as specified in section 5.5.1.2 of Chapter 5: Coastal Processes of the META Project Phase 2 ES.

5.2.1.3 In each case the settlement characteristics were derived for the smallest sediment size at each site and the distance travelled calculated using the average current speed during a spring tide. In each instance it was assumed that a particle would be released at the surface at the deepest part of the site, hence travelling the furthest from the site prior to reaching the bed. In reality, if required, the task of bed clearance would be limited to mobilising material close to the bed and transport would therefore generally be more localised. As such, the

Applicant confirms that the MDS was considered in the META Project Phase 2 ES Coastal Processes assessment, utilising spring tide data.

5.2.1.4 In the case of Dale Roads (site 7) there is a large amount of variability both in sediment distribution and current speed across the site therefore the assessment was undertaken at each of the four extremities and the greatest distance reported, i.e. distance travelled < 600 m. It should be noted that the deepest areas with the greatest current speeds are located at the south of the site where the bed material contains a larger proportion of granular material. Therefore, sediment transport would likely be more limited in extent than was accounted for in Chapter 5: Coastal Processes of the META Project Phase 2 ES.

5.2.1.5 Should average or neap tide conditions be experienced the distance travelled would be significantly less. Similarly, the larger particles present within the graded sediment would not be transported to this extent and much of the granular material would settle within the vicinity of the site. Therefore, the Applicant is confident that the assessment was carried out on the outer envelope of the plume extent, providing an assessment of the worst case scenario.

5.2.1.6 In summary, the META Project Phase 2 ES Coastal Processes assessment considered the MDS for current speed and potential sediment plume extent. As such, this assessment supplied the associated receptor group's assessments with appropriate MDS data in order for an assessment be conducted which was sufficiently precautionary, as presented in section 7.11 (Assessment of Significance) of Chapter 7: Benthic Subtidal and Intertidal Ecology of the META Project Phase 2 ES.

5.3 NRW Clarification Query

In 5.9.1.3 it is stated that "the greatest level of disturbance would be created by the installation of gravity bases or bed mounted devices where the seabed is levelled." However, under the maximum design scenario for seabed clearance at all three sites, an associated buffer has also been mentioned which would increase sediment disturbance for bed mounted devices that require seabed levelling. Therefore, we feel that this should also have been considered with regards to increases in SSC and that the calculated SSC underestimates the worst-case scenario. Please provide an updated set of calculations with a review of the impact on the outcome of the assessments (including for Herring spawning grounds at Warrior Way) or justification that the worst-case scenario has been considered.

5.4 Response/clarification

5.4.1.1 The suspended sediment calculations provided within the assessment were designed to provide an indication of the likely site conditions to occur during the device installation in a credible scenario. At each site the use of both maximum device dimensions for seabed levelling is unlikely, whilst the additional clearing of a buffer around this site is also unlikely. As such, an assumption that clearance of the entire seabed domain (device footprint plus associated buffer) would occur at the same time is not a realistic MDS. Therefore, the Applicant considers that the MDS and therefore the 'worst-case scenario' considered in paragraph 5.9.1.3 of Chapter 5: Coastal Processes was sufficiently precautionary for assessment by the associated receptor groups (as stated in paragraph 5.9.1.18 of Chapter 5: Coastal Processes).

5.4.1.2 The SSC experienced during the installation of any device will depend strongly on the size of the device (bed area), the location within the site (the amount of levelling required in the vertical plane) and the mechanism used to undertake the works. Greater extents of site preparation will require longer periods of time to undertake the works, therefore the elevation of SSC will be dependent on work rate. The plume extents are however prescribed by the nature of the bed material. For example, at Dale Roads (site 7) where the plume extent may be up to 600 m from the particle release point, this distance will remain constant, relative to the outer edge of the clearance work, regardless of the need for site buffer clearance. The assessment undertaken here is therefore generic and as stated previously, the Applicant is therefore confident that the assessment was carried out on the MDS.

5.4.1.3 Furthermore, for each deployment, micositing will be undertaken to determine the most suitable location for a specific device as outlined in the Environmental Mitigation and Monitoring Plan (EMMP). For bed mounted devices one such criteria would be the foundation specification and the amount of site preparation (if any) required. This would be minimised during the selection process which would also reduce the disturbance of bed material and limit elevations in SSC.

6. COASTAL PROCESSES

6.1 NRW Clarification Query

5.9.2.10 – It is stated that "the maximum extraction of energy from any wave device considered for use in the META site is 20%", however it's not clear what device type would result in this or how the value of 20% has been derived. Similarly the figures in 5.9.2.11 are not evidenced e.g. the assumption that the wave front would return to uniformity within two wavelengths of the extraction. Please clarify these points.

6.2 Response/clarification

6.2.1.1 The magnitude of the energy extraction at 20% was established in Fairley (2012) "Wave resources in South Wales and a comparison with Wave Climate at the Wave Hub", a report prepared by Marine Energy Research Group at Swansea University and cited in Table 5.2 of Chapter 5: Coastal Processes of the META Project Phase 2 ES. Fairley (2012) presents measured capacity factors for three devices at three sites which range from 9-17% therefore 20% was applied to the META Project Phase 2 Coastal Processes assessment as a conservative parameter.

6.2.1.2 The assessment undertaken drew on information from the ABPmer study entitled "Wave and Flow Modelling: Conditions for Wave Energy Converter Deployment" (ABPmer Ltd. *et al.,* 2018) and cited in Table 5.2 of Chapter 5: Coastal Processes of the META Project Phase 2 ES. The analysis undertaken on behalf of Bombora Wavepower in 2018 (ABPmer Ltd. *et al.,* 2018) specifies that more than 70% of the waves at the WEC site have wave periods between three and seven seconds with wave heights less than 2.5 m. These would be characterised with wave lengths between 20 and 60 m. A 20% reduction in wave energy has a relatively limited impact as the energy is a function of the square of wave height and would not greatly affect the wave period for a device in unconfined water. This information was clarified in Chapter 5: Coastal Processes in paragraph 5.9.2.11, stating that "a 1.5 m wave would be reduced by less than 200 mm" (by a 20% reduction in energy). It is therefore reasonable that the wave front would return to uniformity within a short distance of the device and this would be in the order of a couple of wavelengths.

6.2.1.3 The precise length of disturbance will be dependent on device type and surface piercing structures will exhibit greater levels than bed mounted structures which cause more subtle changes.

6.3 NRW Clarification Query

5.9.2.15 - NRW TE disagree with the conclusion that "The incoming waves at East Pickard Bay (site 8) approach from the south west therefore any disruption due to energy extraction within this site would occur between the wave device and the adjacent cliffs/coastline to the north of the site". The wave climate in this location although dominated by waves from the SW will also have incident waves from the West. The assumption also does not take account of refraction and diffraction processes

around larger devices. Please provide consideration of the impact of this on your assessments.

6.4 Response/clarification

6.4.1.1 The assessment of wave climate was based on the SEACAMS2 study undertaken at Swansea University (Yin *et al.,* 2018) cited in Table 5.2 of Chapter 5: Coastal Processes of the META Project Phase 2 ES. The study analysed the wave climate along the Pembroke coast and focussed on Freshwater West and St. Bride's Bay. East Pickard Bay (site 8) is limited to a relatively narrow northerly stretch aligned with the coastline. The wave roses presented for East Pickard Bay (site 8) in Chapter 5: Coastal Processes do not exhibit waves approaching from due west. An example wave rose for East Pickard bay (site 8), to support this existing position, is shown in Figure 6-1 below.

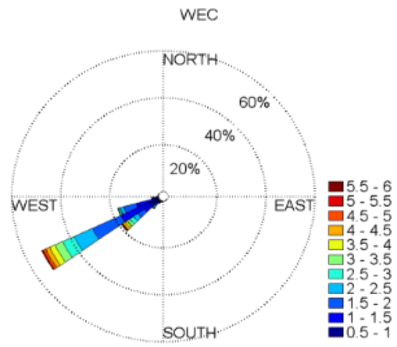

Figure 6-1: Example wave rose for East Pickard Bay (site 8).

6.4.1.2 Wave devices would also be aligned to capture energy from the principle wave direction (i.e. southwest). The wave climate to the south, beyond the boundary of East Pickard Bay (site 8), has increasing proportion of waves from the west with increasing distance.

6.4.1.3 In general terms, refraction and diffraction would be undesirable around wave power devices. For floating devices such as heave wave absorbers and attenuators this would reduce the efficiency of the device. Other floating devices are often articulated to move with the water surface and therefore disturbance is limited by the design criteria itself. For this reason, it was not included in the assessment as device selection and design would mitigate these parameters. Furthermore, some of the largest devices are bed mounted, such as the Bombora device which is proposed for the site, therefore this does not become an issue. The Applicant is therefore confident that the information considered and presented within Chapter 5: Coastal Processes of the META Project Phase 2 ES is sufficiently precautionary to inform the assessment of significance.

7. MARINE FISH

7.1 NRW Clarification Query

Please provide justification/clarification regarding potential for impacts on seahorses, particularly around how you can be clear there is "no preferred seahorse habitat present within any of the META sites.

7.2 Response/clarification

7.2.1.1 The baseline characterisation of Chapter 8: Fish and Shellfish Ecology of the ES considered seahorses within the local fish assemblage on the basis that the sheltered estuarine conditions have the potential to provide a safe environment for small species such as seahorses (paragraph 8.7.3.6).

7.2.1.2 As presented in Table 8.4 of Chapter 8: Fish and Shellfish Ecology, in response to an NRW/Marine Management Organisation (MMO) Scoping Opinion that "Seahorses must also be considered as they are Schedule 5 species under the Wildlife and Countryside Act, with *Hippocampus guttulatus* recorded in the Milford Haven" the ES stated that there is "no preferred seahorse habitat present within any of the META Project sites and a lack of data suggesting their presence within the Waterway." The Applicant therefore presents clarification below to support the existing position that there is no preferred seahorse habitat present within any of the META Project sites and therefore justifies the approach taken, in not including seashore within the impact assessment (section 8.11 of Chapter 8: Fish and Shellfish Ecology).

7.2.1.3 The long-snouted seahorse *Hippocampus guttulatus* has historically been recorded in Pembrokeshire; no records of the short-snouted seahorse *Hippocampus hippocampus* occurring in Wales exist (NBN Atlas, 2020). The NBN Atlas holds a single record of long-snouted seahorse, recorded off St David's Head (~ 27 km north west of the mouth of the Waterway) in 1986, taken from Marine Records from Pembrokeshire Marine Species Atlas (records held between 1899 and 1998) (NBN Atlas, 2017). The lack of records of seahorse in the Waterway was stated in paragraph 8.7.3.23 of Chapter 8 of the ES, which goes on to clarify that for this reason, seahorse "are not included further within the assessment". As such potential for impacts as a result of the META Project were not considered in Chapter 8: Fish and Shellfish Ecology.

7.2.1.4 Long-snouted seahorses are found in shallow waters, especially amongst algae and seagrasses (Neish, 2007). They are usually found on the peripheral edge of eel grass beds, depending on these habitats to offer them protection against predators and camouflage against prey (Garrick-Maidment and Jones, 2004). Seahorses are known to be vulnerable to stress, often manifested as disease, and have found to be significantly less abundant in polluted seagrass beds and in areas of water with changes in water treatment practices (Vincent *et al.,* 2011) and significant behavioural changes have been observed in *Hippocampus guttulatus* as a result of ocean acidification (Faleiro *et al.,* 2015).

7.2.1.5 Chapter 8 of the ES established that there is no preferred seahorse habitat within any of the three META Project site boundaries, informed by ES Chapter 7: Benthic Ecology, which presented the distribution of seagrass (*Zostera spp.*) within the waterway. Section 7.7.2 presents baseline data on seagrass: two species of seagrass are present within the Waterway, subtidal eelgrass *Zostera marina* and intertidal dwarf eelgrass *Z. noltii.* Two main populations of *Z. marina* occur in 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). A further review of the literature supports the view that seagrass habitat is not found within the META Project sites.

7.2.1.6 In establishing the likelihood that additional, unrecorded seagrass habitats exist in the Waterway, the authors considered whether the Waterway presents a suitable environment for additional seagrass populations. Whilst dwarf eelgrass is commonly found in estuaries and sheltered bays, poor water quality is thought to be one of the biggest threats to seagrass decline (Bertelli *et al.,* 2018). As discussed in paragraph 7.11.1.37 of Chapter 7: Benthic Ecology of the META Project Phase 2 ES, chronic sediment disturbance and resuspension occurs in the Waterway from 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 also include periodic dredging events and less frequent large-scale engineering projects (Little *et al*., 2016). In addition, the WFD Assessment, in support of the META Project Phase 2 ES (section 5.3: Water Quality) demonstrated a low to higher Total Hydrocarbon Concentrations (THCs) from the lower Waterway to the inner estuary and central tributaries and concentrations of polyaromatic hydrocarbons (PAHs) and other contaminants (e.g. metals) have generally been shown to be elevated throughout the Waterway. As such, in considering the potential for additional seagrass populations, it was assumed that the Waterway does not present suitable habitat with good water quality. As such, the statement presented in Table 8.4 of Chapter 8: Fish and Shellfish Ecology that "no preferred seahorse habitat is present within any of the META Project sites" is supported by existing seagrass records, the forecasting of likely additional seagrass habitat, and the known water quality of the Waterway.

7.2.1.7 In summary, whilst Table 8.4 of Chapter 8: Fish and Shellfish Ecology of the ES (NRW/MMO Scoping Opinion) suggested that historical records of long-snouted seahorse exist in the Waterway, the ES was informed by publicly available data, which supports the existing position that the occurrence of suitable seahorse habitat and associated long-snouted seahorse in the Waterway is highly unlikely. Therefore, given the very low likelihood of either seahorse or suitable seahorse habitat to occur within or in proximity to any of the META Project Phase 2 sites, seahorses were not assessed for impacts related to activities at the META Project Phase 2 sites.

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