MARINE ENERGY WALES

MARINE ENERGY TEST AREA (META)

Environmental Impact Assessment

Chapter 9:

Marine Mammals, Basking Shark and Otter

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Glossary

Term	Definition
Haul-out	Hauling-out is a behaviour associated with pinnipeds (e.g. grey seal (*Halichoerus grypus)* temporarily leaving the water. Hauling-out typically occurs between periods of foraging activity. Rather than remain in the water, pinnipeds haul-out onto land or sea-ice for reasons such as reproduction and rest.
Ovoviviparous	A mode of reproduction in animals in which embryos that develop inside eggs remain in the mother's body until they are ready to hatch

Acronyms

Acronym	Description
ADD	Acoustic Deterrent Devices
CCW	Countryside Council for Wales
CIEEM	Chartered Institute of Ecology and Environmental Management
CGNS MU	Celtic and Greater North Seas MU
DMS	dimethyl sulphide
DP	Dynamic Positioning
EEA	European Economic Area
EMP	Ecological Management Plan
EMMP	Environmental Mitigation and Monitoring Plan
HF	High Frequency
IAMMWG	Inter-Agency Marine Mammal Working Group
IS MU	Irish Sea MU
IUCN	International Union for the Conservation of Nature
JNCC	Joint Nature and Conservation Committee
LF	Low Frequency
MarLIN	Marine Life and Information Network
MCZ	Marine Conservation Zones
MF	Medium Frequency
MMO	Marine Mammal Observer
MPS	Marine Policy Statement
MRESF	Marine Renewable Energy Strategic Framework for Wales
MSFD	Marine Strategy Framework Directive
MU	Management Units
OCWS MU	Offshore Channel, Celtic Sea and South West England MU
ORED	Offshore Renewable Energy Devices
PTS	Permanent Threshold Shift
Rms	root-mean squared
SCOS	Special Committee on Seals
SEL	Sound Exposure Level
SI	Serious Injury
SMRU	Sea Mammal Research Unit
SSC	Suspended Sediment Concentration
TTS	Temporary Threshold Shift
UXO	Unexploded Ordinance
VER	Valued Ecological Receptor
WWBIC	West Wales Biodiversity Information Centre
ZOI	Zone of Impact

Units

Unit	Description
%	Percentage
cm	Centimetre
dB	Decibels
GW	Gigawatt (power)
kW	Kilowatt (power)
m	Metre
m^2	Metres squared
mg/l	Milligrams per litre
μPa	micropascal

9. MARINE MAMMALS, BASKING SHARK AND OTTER

9.1 Introduction

9.1.1.1 This chapter of the Environmental Statement presents the results of the Environmental Impact Assessment (EIA) for the potential impacts of the META project on marine mammals, basking shark (*Cetorhinus maximus*) and European otter (*Lutra lutra)*. Specifically, this chapter considers the potential impact of the META project during its installation, operation and maintenance, and decommissioning phases.

9.1.1.2 The assessment presented is informed by the following technical chapters:

- Coastal processes (chapter 5);
- Underwater noise (chapter 6);
- Fish and shellfish (chapter 8); and
- Shipping and navigation (chapter 12).

9.2 Purpose of this chapter

9.2.1.1 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.

9.2.1.2 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.

9.2.1.3 In particular, this Environmental Statement chapter:

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

9.3 Study area

9.3.1.1 Two study areas have been defined for this chapter in order for baseline characterisation of marine mammal receptors in the META project area to be assessed in the context of a wider geographic area.

9.3.1.2 The two study areas defined are:

- The 'local marine mammal, basking shark and otter study area'; and
- The 'regional marine mammal, basking shark and otter study area'.

9.3.1.3 The local marine mammal, basking shark and otter study area has been defined for baseline characterisation of marine mammals (within this chapter, marine mammals means cetaceans and pinnipeds), basking shark and European otter (henceforth 'otter') in the vicinity of the META project. The local marine mammal, basking shark and otter study area includes the Waterway and extends south-west to St. Ann's Head and south-east to Crow Rock (Figure 9.1). This study area captures the magnitude of impact identified in coastal processes and underwater noise.

9.3.1.4 The regional marine mammal, basking shark and otter study area is defined by a 100 km buffer from the centre of the Waterway (Figure 9.2). The regional marine mammal, basking shark and otter study area provides a wider geographic context for comparison with the local marine mammal, basking shark and otter study area in terms of the species present and their relative abundance. Sites designated for the conservation of marine mammal, basking shark and/or otter features within this region provide a useful context for understanding the relative importance of the species found within the regional marine mammal, basking shark and otter study area, and consequently within the local marine mammal, basking shark and otter study area. It should be noted that the regional marine mammal, basking shark and otter study area does not delineate populations of marine mammals, basking sharks or otters but does provide a sufficiently large area within which ecological patterns of the key species can be understood.

9.3.1.5 The bathymetry of the regional and local marine mammal, basking shark and otter study areas is given in Figure 9.3.

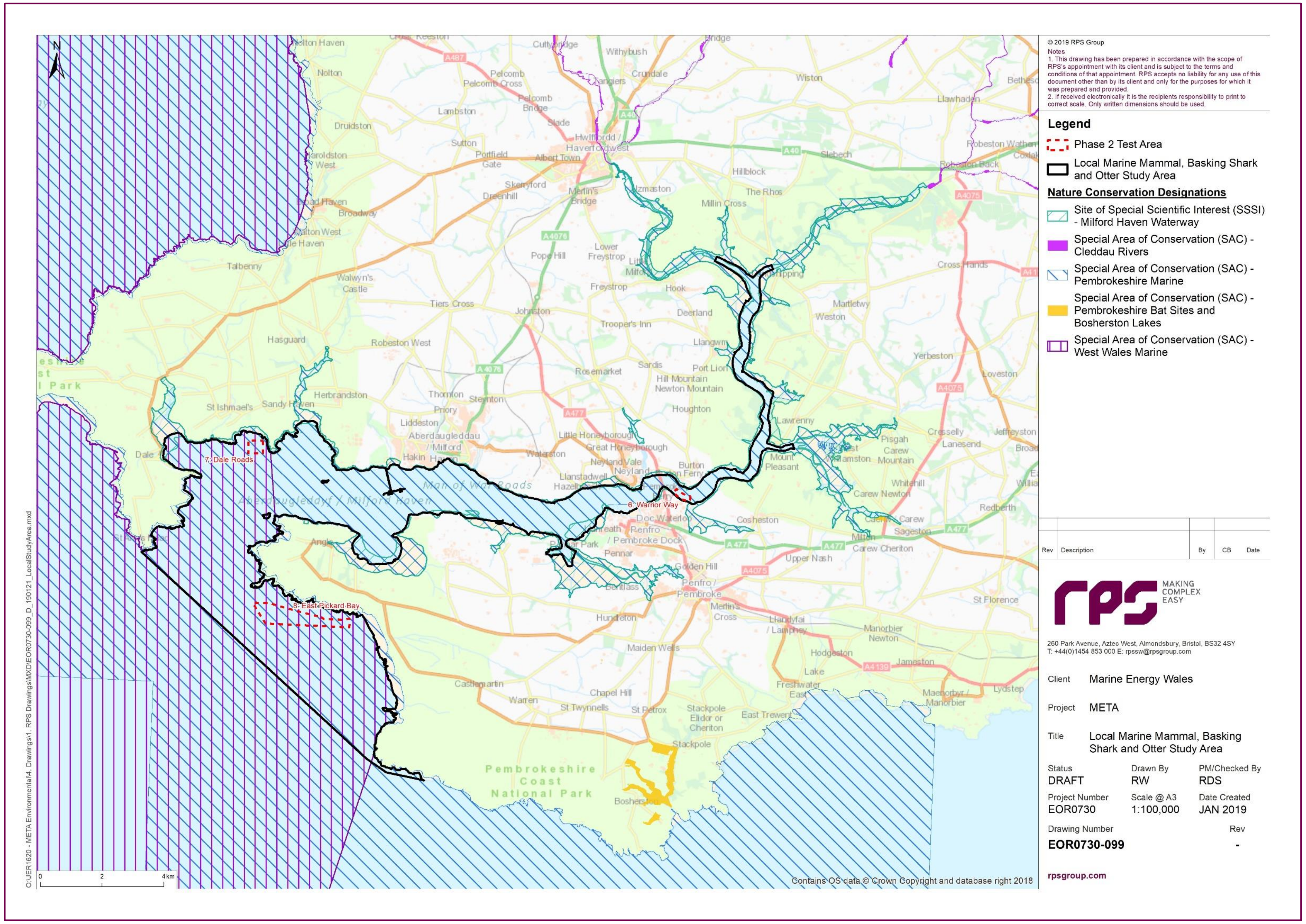

Figure 9.1: Local marine mammal, basking shark and otter study area.

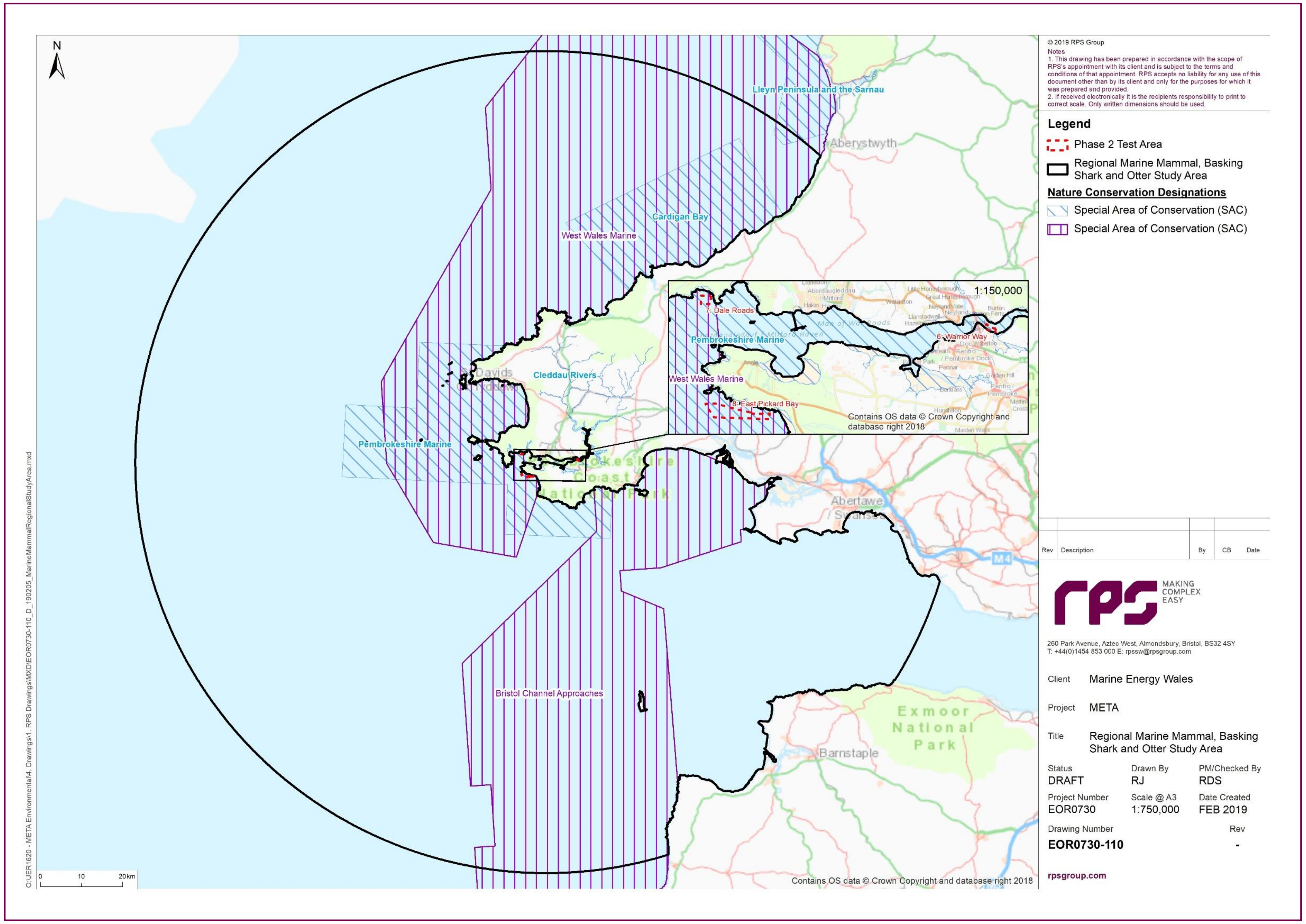

Figure 9.2: Regional marine mammal, basking shark and otter study area.

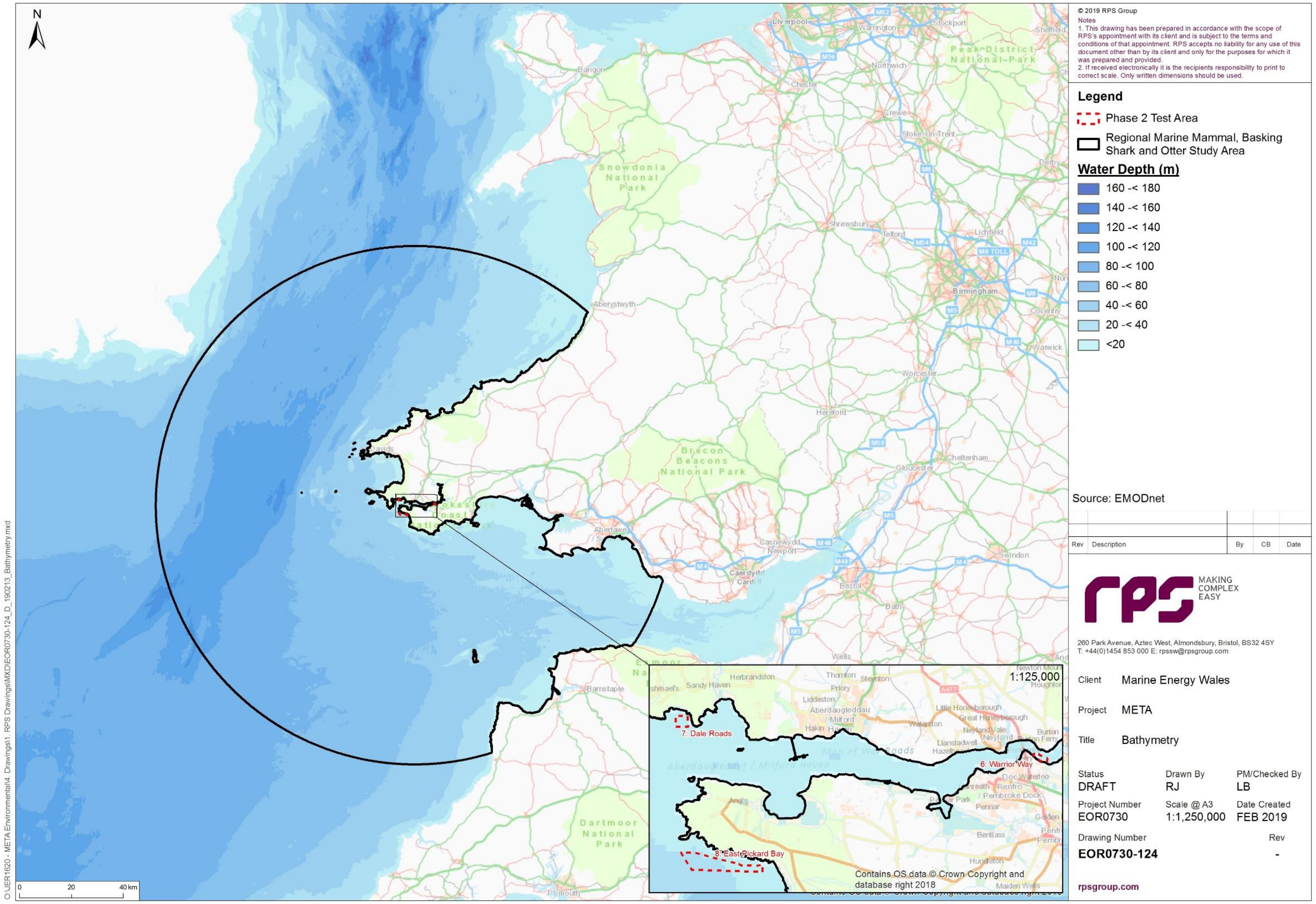

Figure 9.3: Bathymetry within and beyond the regional marine mammal, basking shark and otter study area.

9.4 Policy context

9.4.1 National Policy Statements

9.4.1.1 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 ES. Chapter 3: Needs and Alternatives outlines the policy context for the META project, and how the META project has adhered to the UK Marine Policy Statement and the draft Welsh National Marine Plan (dWNMP) (Welsh Government, 2018). Table 9.1 below summarises the guidance specific to marine mammals.

Table 9.1: Summary of NPS EN-3 policy relevant to marine mammals, basking sharks and otters.

Summary of relevant policy framework	How and where considered in the Environmental Statement
Marine mammals	
Where necessary the assessment of the effects on marine mammals should include details of: likely feeding areas; known birthing areas/haul out sites; nursery grounds; known migration or commuting routes; duration of potentially disturbing activity including cumulative/in-combination effects; baseline noise levels; predicted noise levels in relation to mortality, Permanent Threshold Shift (PTS) and Temporary Threshold Shift (TTS); soft-start noise levels; and operational noise (NPS EN-3; paragraph 2.6.92).	All of the specified marine mammal ecology details are included in this chapter (9.7). The META project assessment has considered the relevant marine mammal behaviour for key species present in the regional marine mammal, basking shark and otter study area. An assessment of installation and operational noise impacts and their likely effects upon marine mammal behaviour and ecology has been undertaken (section 9.11). This assessment also considers the cumulative impacts of the META project and other relevant plans or projects (section 9.13). Chapter 6: Underwater noise considers the underwater noise impacts of drilled pin piling; impulsive noise will not be employed for the META project (see chapter 2: Project Description).
The conservation status of marine European Protected Species, and seals, are of relevance to the Secretary of State. The Secretary of State should take into account the views of the relevant statutory advisors (paragraph 2.6.95 of NPS EN-3).	The conservation status of species has been factored into the assessment of significance (Table 9.6).

9.4.2 Other relevant policies

9.4.2.1 A number of other policies are relevant to the marine mammal, basking shark and otter assessment.

9.4.2.2 The UK Marine Policy Statement (MPS) notes that marine planning authorities should be mindful of the high-level marine objectives set out by the UK in order to ensure due consideration of marine ecology and biodiversity interests. It also recognises the role of conservation of ecologically sensitive areas throughout the planning process and mitigation or compensatory actions where significant harm cannot be avoided (paragraph 2.6.1 of the MPS). The MPS also considers the effects of noise and vibration on wildlife and how these can be mitigated and minimised taking account of known sensitivities to particular frequencies of sound (paragraph 2.6.3 of the MPS).

9.4.2.3 The dWNMP introduces a framework to support sustainable decision-making for the marine environment. Details of how the META project adhere to the guidance set out in the dWNMP is outlined in chapter 3: Needs and Alternatives

9.4.2.4 The dWNM includes guidance on what matters are to be considered in a marine mammal, basking shark, and otter assessment. These are summarised in Table 9.2.

Table 9.2: Summary of the Draft Welsh National Marine Plan relevant to marine mammals, basking sharks and otters

Summary of relevant policy framework	How and where considered in the Environmental Statement
Introduction of energy, including underwater noise: proposals should demonstrate that they have considered man-made noise impacts on the marine environment and, in order of preference: *a) avoid adverse impacts; and/or* *b) minimise impacts where they cannot be avoided; and/or* *c) mitigate impacts where they cannot be minimised.* If significant adverse impacts cannot be adequately addressed, proposals should present a clear and convincing justification for proceeding.	The META project assessment has considered installation and operational noise impacts and their likely effects upon marine mammal behaviour and ecology (see sections 9.11 through to 9.13).
Implementation guidance: if marine mammals could potentially be impacted, assessment should take into account impacts within the appropriate Marine Mammal Management Units (MMMUs) identified by the UK Statutory Nature Conservation Bodies (NRW in Wales). If necessary, proposals should set out noise avoidance, minimisation or mitigation measures to manage the impact of man-made noise.	• Appropriate marine mammal Management Units (MU) have been identified (see section 9.7.2 *et seq.*) and the assessment has taken into account impacts within these appropriate MUs (see impact assessment sections, section 9.11 through to 9.13) • The META project assessment has considered installation and operational noise impacts and their likely effects upon marine mammal behaviour and ecology (see section 9.11 through to 9.13).
Ecosystem interaction: removal of species that act as a food source for other species may have wider food-chain impacts; other fish and marine mammal species can be caught incidentally; physical impacts on the seabed and benthic habitats can occur. These impacts, if not properly managed, can affect the future productivity of the resource for future generations by undermining ecosystem resilience.	This assessment has taken into account the following potential impacts: • Changes in fish and shellfish communities (see section 9.11.2.143 *et seq.*, 9.11.3.100 *et seq.*, and section 9.13.1.18 *et seq.*); • Entanglement risk (see section 9.11.3.142 *et seq.)*; and • Increases in suspended sediment concentration (SSC) (see section 9.11.2.111 onwards; and section 9.13.1.27 onwards)

9.4.2.5 Guidance provided within the Marine Strategy Framework Directive (MSFD), adopted in July 2008 (Defra, 2014) has also been considered in the META project assessment for marine mammals, basking sharks and otters. The relevance of the MSFD to the META project is described in full in Appendix 3.1.

9.5 Consultation

9.5.1.1 A summary of the key issues raised during consultation specific to marine mammals and otter is outlined below, together with how these issues have been considered in the production of this Environmental Statement chapter. No issues related to basking shark were raised during consultation for the META project.

9.5.1.2 Table 9.3 below summarises the issues raised relevant to marine mammals and otter, which have been identified during consultation activities undertaken to date.

Table 9.3: Summary of key consultation issues raised during consultation activities undertaken for the META project relevant to marine mammals and otter.

Date	Consultee and type of response	Issues raised	Response to issue raised and/or where considered in this chapter
12 Oct 2017	NRW – meeting with James Moon (NRW Advisory)	Marine mammal: Interactions with wave device - NRW raised that interactions are likely to be relatively benign and more of a concern with tidal devices, and it was suggested that these sites should be consented separately.	Following subsequent conversations with the relevant authority, it was decided that wave and tidal should be consented together
18 December 2018	NRW – preliminary scoping opinion	Otter: NRW notes that the application site includes part of Pembrokeshire Marine SAC, and advises that the EIA considers the impacts on otters in the context of EPS as well as a feature of the SAC and underpinning SSSI (full details can be seen in Appendix 4.2: Scoping Opinion)	The Marine Mammals, Basking Shark and Otter EIA considers the impacts on otters in response to this scoping opinion (9.7.5). Any EPS licencing requirements will be considered on a device-specific basis (see META Environmental Mitigation and Monitoring Plan). Sightings data has been obtained to support the assessment of impacts on otters in the marine environment
1 March 2019	NRW – preliminary scoping opinion	Increased Underwater Noise – installation and decommissioning activities: Disagree that this can be scoped out. The predicted noise levels from installation could potentially cause injury at close range or disturbance to marine mammals. We don't agree that this can be scoped out as a potential impact at this stage.	As above, this potential impact has now been included in impact assessment (see 9.11.2.10 *et seq.*))
1 March 2019	NRW – preliminary scoping opinion	Increased anthropogenic noise –tidal turbines during operation and maintenance phase – we disagree that this can be scoped out at this phase. There is limited published literature on the noise levels from operational tidal turbines. Furthermore, there is no information in this report on the likely device types to allow any comparison with the existing knowledge on operational devices, so it is impossible to rule out a potential impact from operational noise from tidal turbines.	As above, this potential impact has now been included in impact assessment (see 9.11.3.11 *et seq.)*
1 March 2019	NRW – preliminary scoping opinion	We note that basking sharks have been included in the marine mammal, basking shark and otter chapter rather than fish ecology. This should be changed for the final EIA.	Marine mammal chapter now termed 'Marine Mammals, Basking Shark and Otter' for clarity. Based on ecology and migratory movements, basking sharks included in this study area.
1 March 2019	NRW – preliminary scoping opinion	NRW agree with the conclusion of the most likely marine mammal species to be found in the area, and the relative importance of the area for those species. However, the baseline description fails to note that the study area overlaps with the largest and most important breeding colony of grey seals in the Celtic & Irish sea; Greater consideration should be given to the presence of grey seals (papers to download suggested). No data collection required if the data sources provided by NRW are taken into consideration.	Further information on grey seals have been provided in the baseline section, (9.7.3); Suggested data sources have been accessed and taken into consideration in informing baseline (Table 9.4) and therefore also within the impact assessment. As per NRW comment, no additional data collection is proposed.
1 March 2019	NRW – preliminary scoping opinion	Collision risk – Assessment based on a literature review of available evidence and assessment of swept area of operation tidal turbines in relation to channel available, will be undertaken: Although a review of available evidence, and swept area of operational tidal turbines will allow a broad assessment of the likely risk of the project, it will not be possible to conduct a detailed collision risk assessment without data on local densities of marine mammals. However, given the small scale, and inshore location resulting in likely low level of risk from the project, we are satisfied that this level of detail is unlikely to be necessary	Comment noted – no further action required
1 March 2019	NRW – preliminary scoping opinion	More information on device types required	Appendix 2.1 (chapter 2: Project Description) describes range of device types, installation methodologies and vessel types that might be used for wave and/or tidal projects. This is referenced in this chapter (see 9.11.3.15)
1 March 2019	NRW – preliminary scoping opinion	Depending on the outcome of the noise assessments – there may be a requirement to use marine mammal observers to minimise risk of injury to marine mammals during construction. However, this will depend on the outcome of noise assessments.	Consideration of the appropriateness of using marine mammal observers during installation activities (for example during pin piling) will be undertaken on a device-specific basis and will be set-out in device-specific EMPs.
28 March 2019	NRW/MMO Scoping Opinion	The scoping report states that potential effects on marine mammals from the noise generated during the installation and decommissioning of devices are proposed to be scoped out of the EIA on the basis that the expected sound pressures levels of drilled piling (which are lower than expected from miscellaneous small vessels) are unlikely to result in injury to marine mammals. Potential effects on marine mammals during the operation of tidal turbines are also proposed to be scoped out on the basis that available data suggest the levels of noise generated by these devices is low and, in the context of existing high levels of baseline noise present within the Waterway, are unlikely to be a significant issue. This does not correspond with the underwater noise section of the Scoping Report (Section 6.7) which presents a proposed approach to assessing the effects of the installation and operation of devices on marine mammals. We disagree with the proposed scoping out of installation and decommissioning activities, and tidal turbines during the operation and maintenance phase. The potential effects of noise on marine mammals during installation, operation and maintenance and	These two impacts have been included in the Marine Mammals, Basking Shark and Otter chapter for assessment (see 9.11.2.10 *et seq.* and 9.11.3.11 *et seq.*, respectively) and have clearly referenced the underwater noise assessment. No geophysical surveys are proposed as part of the META project description and therefore have not been assessed within the underwater noise assessment.

Date	Consultee and type of response	Issues raised	Response to issue raised and/or where considered in this chapter
		decommissioning must be assessed in the EIA (see comments in section 6.7). If geophysical surveys are proposed, then a noise impact of these activities should be considered.	
28 March 2019	NRW/MMO Scoping Opinion	The underwater noise assessment must include a desk-based review of the latest available scientific evidence of the observed responses of marine fauna (fish, marine mammals and benthic invertebrates) to different types of underwater sounds for context.	The Marine Mammal, Basking Shark and Otter chapter includes recent and relevant peer-reviewed journal articles on observed responses to different types of underwater sounds (section 9.11).
28 March 2019	NRW/MMO Scoping Opinion	Overall, we are satisfied with the identification of impact pathways, and the environmental features (marine mammals) that could potentially be affected. However, changes to hydrodynamics resulting in potential impairment of foraging opportunities for marine mammals must be included in the EIA/ES as an impact pathway. This should be informed by an assessment of coastal processes.	This potential impact is assessed within section 9.11.3 – informed by new impact under chapter 5: Coastal Processes (see 9.11.3.110 *et seq.)*
28 March 2019	NRW/MMO Scoping Opinion	Consideration must be given to all marine mammal SACs within the relevant management unit. While most sites have been included in the assessment, for completeness the assessment should also list North Anglesey Marine SAC. Potential impacts should be considered on harbour porpoise from all 3 SACs within the management unit.	All harbour porpoise SACs within the Celtic and Irish Sea Marine Mammal Management Unit (MMMU) are considered (Figure 9.6 and in Table 9.5.. All SACs for grey seals within the relevant MMMU are considered (**Figure 9.11**, Table 9.5). All SACs with bottlenose dolphin as a notified interest feature within the Offshore channel, Celtic Sea and SW England MMMU and Irish Sea MMMU are considered (Figure 9.7, Table 9.5).
28 March 2019	NRW/MMO Scoping Opinion	Table 6-9 'Designated sites' has omitted Cardigan Bay SAC – suggest this is a typo, since it does appear in the preceding list of sites for consideration.	Cardigan Bay SAC is considered in this chapter (Table 9.5)
28 March 2019	NRW/MMO Scoping Opinion	The potential for transboundary impacts has not been considered in the Scoping Report. The nearest other Member State to the META Sites is the Republic of Ireland[14]. There are unlikely to be any transboundary effects in relation to marine noise given the scale and nature of the activities proposed at the Phase 2 sites. The potential for cross-border impacts with England is also considered unlikely.	Potential for transboundary effects are considered in section 9.14, and NRW's comment relating to lack of cross-border impacts is noted.
28 March 2019	NRW/MMO Scoping Opinion	Potential disturbance effects on marine mammals as a result of increased underwater noise due to vessels involved in installation, operation and maintenance activities are proposed to be scoped into the EIA. The proposed approach for further assessment is to determine the potential increase in baseline levels of vessel traffic during these activities and to undertake a desk-based review of the types of vessels to be utilised and the potential for noise disturbance. Given the likely scale and nature of vessel activity associated with the META Project, this proposed approach is considered appropriate.	No change made – consultee agrees with approach
28 March 2019	NRW/MMO Scoping Opinion	Collision risk – Although a review of available evidence, and swept area of operational tidal turbines will allow a broad assessment of the likely risk of the project, it will not be possible to conduct a detailed collision risk assessment without data on local densities of marine mammals. However, given the small scale, and inshore location resulting in likely low level of risk from the project, we are satisfied that this level of detail is unlikely to be necessary.	Comment noted – no further action required

9.6 Methodology to inform the baseline

9.6.1 Desktop study

9.6.1.1 Information on marine mammals, basking sharks and otters within the local marine mammal, basking shark and otter study area was collected through a detailed desktop review of existing studies and datasets. These are summarised in Table 9.4 below. Where reports and data are over ten years old, up-to-date data and information have been used to ensure these sources are still valid.

Table 9.4: Summary of key desktop reports.

Title	Source	Year	Author
Aerial surveys of cetaceans and seabirds in Irish waters: Occurrence, distribution and abundance in 2015-2017.	Department of Communications, Climate Action & Environment, Irish Government	2018	Rogan *et al.*
Bottlenose Dolphin Monitoring in Cardigan Bay 2014 - 2016	Natural Resources Wales	2018	Lohrengel *et al.*
Grey Seal Breeding Census Skomer Island 2017	Natural Resources Wales	2018	Büche and Stubbings
Skomer MCZ Grey Seal Survey, Marloes Peninsula 1992-2016	Natural Resources Wales	2017	Lock *et al.*,
Long-term satellite tracking reveals variable seasonal migration strategies of basking sharks in the north-east Atlantic	Scientific Reports	2017	Doherty *et al.*
Estimates of cetacean abundance in European Atlantic waters in summer 2016 from the SCANS-III aerial and shipboard surveys	SCANS III	2017	Hammond *et al.*
Scientific Advice on Matters Related to the Management of Seal Populations	Special Committee on Seals (SCOS)	2011, 2012, 2013, 2014, 2015, 2016, 2017	SCOS
The identification of discrete and persistent areas of relatively high harbour porpoise density in the wider UK marine area	JNCC Report No. 544	2015	Heinänen and Skov
The use of harbour porpoise sightings data to inform the development of Special Areas of Conservation in UK waters	JNCC Report No. 565	2015	IAMMWG
Management Units for cetaceans in UK waters	JNCC Report No. 547	2015	IAMMWG.
Otter Survey of Wales. Natural Resources Wales	Natural Resources Wales (NRW	2015	Strachan, R.
Atlas of the Marine Mammals of Wales. 2nd Ed.	Countryside Council for Wales (CCW)	2012	Baines and Evans
RPS Studies of Marine Mammals in Welsh High Tidal Waters	Marine Renewable Energy Strategic Framework for Wales (MRESF)	2011	Gordon *et al.*
Atlas of the Marine Mammals of Wales	Countryside Council for Wales	2009	Baines and Evans
Distributions of Cetaceans, Seals, Turtles, Sharks and Ocean Sunfish recorded from Aerial Surveys 2001-2008	Wildfowl and Wetland Trust aerial surveys	2009	WWT Consulting Ltd.
Marine Conservation Society Outer Bristol Channel Megafauna Surveys	Marine Conservation Society and Environment Agency	2007	Solandt
Cetacean abundance and distribution in European Atlantic shelf waters to inform conservation and management	SCANS II	2006	Hammond *et al.*
RPS Shore-based Observational Marine Mammal Survey 2006	RPS on behalf of RWE nPower	2006	Shepherd and Rowson
Pembrokeshire marine SAC grey seal monitoring report 2005	Countryside Council for Wales	2006	Strong *et al.*
Basking shark population assessment. Final project report	Global Wildlife Division, Department for Environment	2005	Sims *et al.*
Spatial distribution patterns of basking sharks on the European shelf: preliminary comparison of satellite-tag geolocation, survey and public sightings data.	Journal of the Marine Biological Association of the United Kingdom	2005	Southall *et al.*
UK Cetacean Status Review	Sea Watch Foundation	*2003*	Evans *et al.*
Atlas of cetacean distribution in north-west European waters	JNCC	2003	Reid *et al.*
Seasonal movements and behaviour of basking sharks from archival tagging: no evidence of winter hibernation	Marine Ecology Progress Series	2003	Sims *et al.*
Abundance of Harbour Porpoise and other Cetaceans in the North Sea and Adjacent Waters	SCANS I	2002	Hammond *et al.*
The West Wales Grey Seals Census CCW Monitoring Report No. 131	The West Wales Grey Seals Census	1995	Baines *et al.*
The Marine Conservation Society Basking Shark Watch 20 Year Report (1987 – 2006).	Marine Conservation Society	2006	Bloomfield and Solandt

9.6.2 Identification of designated sites

9.6.2.1 All designated sites within the local marine mammal, basking shark and otter study area which list marine mammals or otter as a qualifying interest feature that could be affected by the installation, operation and maintenance, and decommissioning phases of the META project were identified using the three-step process described below. No designated sites within the regional marine mammal, basking shark and otter study area list basking shark as a qualifying interest features therefore this species has not been considered in identification of designated sites. The proposed North of Celtic Deep MCZ, which falls inside the regional marine mammal, basking shark and otter study area recognises that this area as a feeding ground for passing whales and dolphin, however no marine mammal species, basking shark or otter is listed as a feature of this proposed MCZ.

- Step 1: All designated sites of international, national and local importance within the regional marine mammal, basking shark and otter study area were identified using a number of sources. These included international, national and local designations including MCZs, SACs, SPAs, and SSSIs identified by examining the JNCC's website, the European Site European Nature Information

System (EUNIS) database, 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 qualifying marine mammal or otter features for each of these sites. The known occurrence of each of the relevant species within the regional marine mammal, basking shark and otter study area was based on relevant desktop information;
- 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;
  - Marine mammal or otter qualifying 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 a national site falls outside of an international site, but within the local marine mammal, basking shark and otter 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 and as such is the only one considered for assessment.

9.6.3 Management Units

9.6.3.1 The Interagency Marine Mammal Working Group (IAMMWG) has recommended Management Units (MU) for the most common species of marine mammals in the UK (IAMMWG, 2013), with a supplementary report provided in 2015 providing revised cetacean MUs (IAMMWG, 2015). MUs are transboundary areas. For each MU, IAMMWG recommend reference populations (abundance and geographic area) against which to measure potential effects of development and these are presented in the individual species accounts. There are no MUs defined for basking sharks or otters therefore potential impacts on these species are considered at a local and regional scale.

9.6.3.2 A special Committee on Seals (SCOS) was appointed to formulate scientific advice on matters related to the management of seal populations in the UK. Management Units were defined based on the presence of known populations, with divisions proposed on the basis of ecological evidence. There have been 11 management units defined for seal species in the UK. The boundaries of the MUs outside of Scotland have been defined to accommodate the Conservation of Seals (England) Order 1999 (IAMMWG, 2013).

9.6.4 Site specific surveys

9.6.4.1 No site-specific surveys were deemed necessary to characterise the marine mammal, basking shark and otter baseline for the META project due to the availability of existing data and reports. Should a need for monitoring be identified as a result of this impact assessment (see section 9.11), these will be carried out pre-deployment.

9.7 Baseline environment

9.7.1 Key species

9.7.1.1 The following species are most likely to be encountered in the regional and local marine mammal, basking shark and otter study areas:

- 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 (*Cetorhinus maximus*); and
- European otter (*Lutra lutra*).

9.7.2 Cetaceans (whales and dolphins)

9.7.2.1 The regional marine mammal, basking shark and otter study area consists mainly of inshore waters less than 80 m deep. Western parts however, approach deeper water habitats of the Celtic Sea consisting of waters up to 145 m deep (see Figure 9.3) which support a more diverse cetacean community than coastal waters (Hammond et al. 1995; (Reid et al. 2003; Evans et al. 2003; Baines and Evans, 2012). The Celtic Deep is an area of particularly deep water (< 145 m deep) and lies inside and to the south west of the regional marine mammal, basking shark and otter study area, and can be seen on Figure 9.3. This area, along with waters off the western end of the Lleyn peninsula and Anglesey supports the highest cetacean species diversity in Welsh waters. The high species diversity likely results from the possible influence of two major frontal systems in the Irish Sea, the Celtic Sea and Irish Sea Fronts (Baines and Evans, 2012).

Harbour porpoise (Phocoena phocoena)

9.7.2.2 The harbour porpoise has a widespread distribution throughout the north Atlantic, occurring in temperate waters, largely found over the North Atlantic continental shelf. The species is the most numerous marine mammal in north-western European shelf waters (Reid *at al.* 2006).

9.7.2.3 Harbour porpoise normally live for approximately 12 years, although they have been recorded to reach a maximum age of 24. Harbour porpoise reach sexual maturity at between three and four years of age; reproduction is highly seasonal, with mating occurring between June and August and a corresponding peak in birth rates in June to July around the British Isles, following a 10 to 11-month gestation period (Lockyer, 1995; Boyd *et al*., 1999). There is little data on the inter-birth interval of harbour porpoises, but Lockyer *et al*. (2001) reported an ovulation interval of between 1 and 2.4 years.

9.7.2.4 Often associated with near-shore headlands and strong tidal currents, porpoise are commonly observed within shallow bays, estuaries and narrow tidal channels (Pierpoint, 2008; Baines and Earl, 1999). They are however known to exhibit strong vessel avoidance. Harbour porpoise exhibit diet flexibility, feeding on a varied diet of fish, cephalopods and crustaceans, thought to help this species to avoid being adversely affected by local anthropogenic over-exploitation of any one fish species.

9.7.2.5 The harbour porpoise is the most common and widespread species of cetacean in Welsh waters (Baines and Evans, 2012) with hot spots identified off the Pembrokeshire coast; the Lleyn Peninsula (to a lesser extent); in southern Cardigan Bay; and in the Bristol Channel off the south coast of Wales (around the Gower Peninsula and in Newport Bay) (Baines and Evans, 2012) (see Figure 9.4).

9.7.2.6 Along the Pembrokeshire coast, the harbour porpoise is the most commonly encountered cetacean (Reid et al., 2003a, Baines and Evans, 2012) and the species is present throughout the year (Pierpoint, 2001, Evans et al., 2003). The whole of the West Wales Marine SAC (see Figure 9.2) has been identified as an important summer area for harbour porpoise, and a smaller section to the south of the site, around Cardigan Bay, has also been identified as winter habitat for this species. Survey data has identified the West Wales Marine SAC as an area with persistently higher density of porpoises in relation to other areas (IAMMWG, 2015). Survey data from 2006 – 2011, supporting the designation of the West Wales Marine SAC, identifies the regional marine mammal, basking shark and otter study area as hosting a discrete and persistent area of relatively high harbour porpoise density in comparison to the wider marine area, with concentrations of animals identified off Strumble Head, Pembrokeshire Islands, and in the vicinity of Cemaes Head and the Teifi Estuary at Cardigan (Heinänen and Skov, 2015; Pierpoint, 2001). Surveys carried out between March and November (2015) on Skomer Island show that harbour porpoise were sighted almost daily for much of this time, which is fairly typical of this species (noted to be 'abundant' in Skomer waters) (Büche and Stubbings, 2015).

9.7.2.7 Data obtained from incidental sightings (1979 - 2018) and small vessel surveys from Neyland (just north-west of Warrior Way) to the Celtic Deep, provided by the West Wales Biodiversity Information Centre (WWBIC, 2019) (see Appendix 9.1 for full dataset) show that harbour porpoise have been sighted at the mouth of the Waterway and within the local marine mammal, basking shark and otter study area. This data shows that harbour porpoise have been sighted as far east as South Hook Pier, east of Dale Roads (site 7) (see Figure 9.5).

9.7.2.8 Harbour porpoise in most of the eastern North Atlantic are generally considered to behave as a 'continuous' biological population that extends from the French coasts of the Bay of Biscay, northwards to the arctic waters of Norway and Iceland (IAMMWG, 2015). The IAMMWG, for practical management purposes however, has identified three Management Units (MU) as appropriate for harbour porpoise: North Sea (NS), West Scotland (WS) and Celtic and Irish Seas (CIS). The regional and local marine mammal, basking shark and otter study areas falls within the CIS MU which extends from the north west coast of France, to north west coast of the Republic of Ireland and east from South west coast of Scotland, including the entirety of Welsh waters (see Figure 9.6).

9.7.2.9 Four candidate SACs (cSACs) – West Wales Marine/Gorllewin Cymru Forol SAC, Bristol Channel Approaches/Dynesfeydd Môr Hafren SAC, North Anglesey Marine / Gogledd Môn Forol SAC, and North Channel SAC were proposed within the UK waters portion of the CIS MU, based on sea-based and land-based sightings data, formalised in February 2019 as SACs (see Table 9.5 for full details on relevant designated sites) (IAMMWG, 2015). In addition, the following SACs also occurring within the CIS MMMU are considered within the META Report to Inform Appropriate Assessment (RIAA).

- Rockabill to Dalkey Islands SAC;
- Blasket Islands SAC;
- Roaringwater Bay and Islands SAC;
- Nord Bretagne DH sites proposition de classement du Site d'Importance Communautaire (pSIC);
- Côte de Granit rose-Sept-Iles zone spéciale de conservation (ZSC);
- Tregor Goëlo ZSC;
- Baie de Morlaix ZSC;
- Abers - Côtes des legends ZSC;
- Chaussée de Sein ZSC;
- Ouessant-Molène ZSC; and
- Mers Celtiques - Talus du golfe de Gascogne pSIC.

9.7.2.10 Given that harbour porpoise are generally considered to behave as a 'continuous' biological population, any harbour porpoise observed within the local marine mammal, basking shark and otter study area are likely to have connectivity to one or more of these SACs. The total harbour porpoise abundance for the CIS MU was estimated as 104,695 animals (95% Confidence Interval 25,611 to 87,092) (IAMMWG, 2015). Where a quantitative assessment of impact is possible, the MU abundance estimate has been used as the reference population against which to assess the impact. Where only qualitative assessment has been undertaken, the MU reference population has been used to put any potential impacts into context.

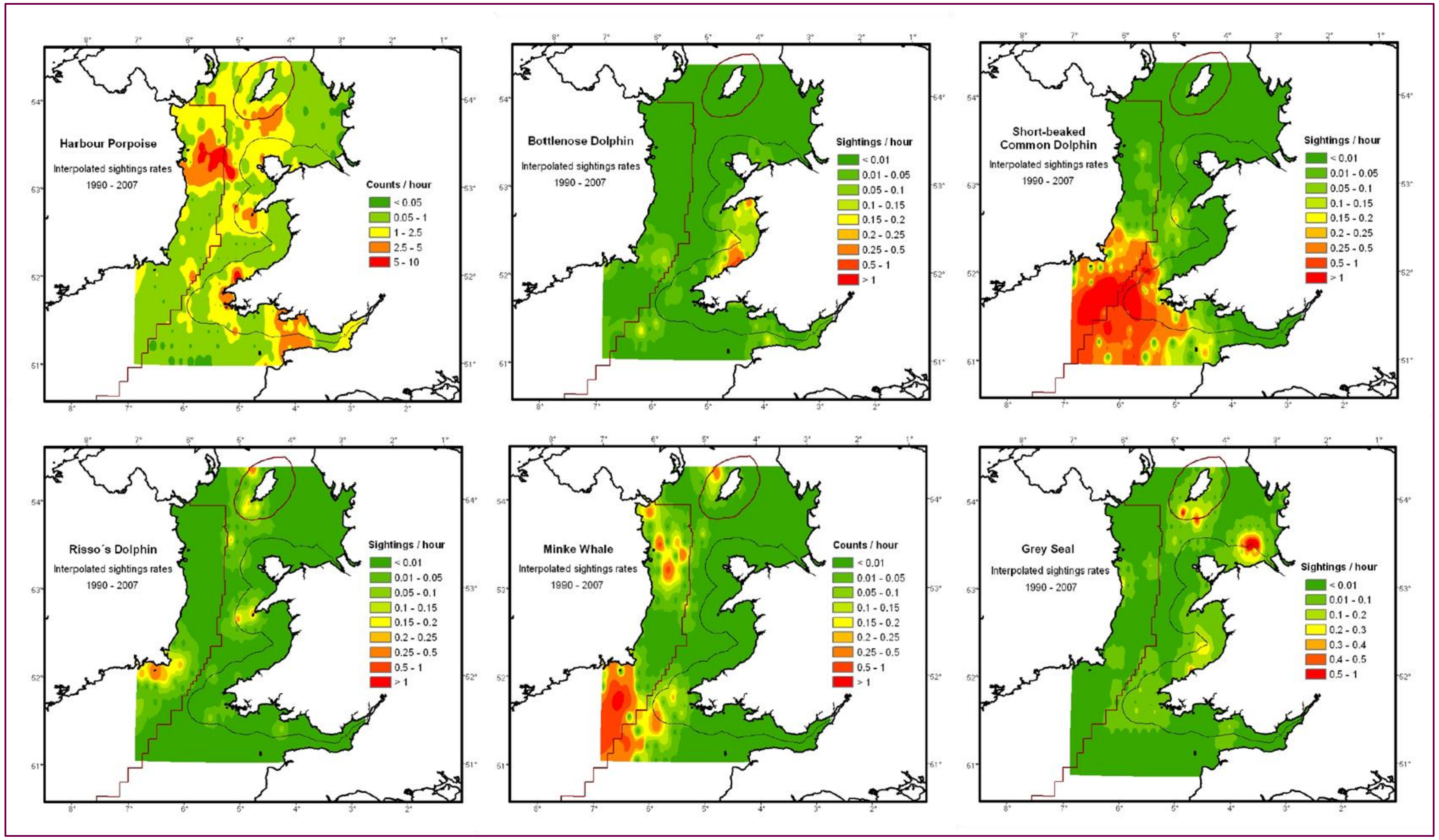

Figure 9.4: Marine mammal distribution in Welsh waters, based on long-term interpolated sightings data (Baines and Evans, 2009).

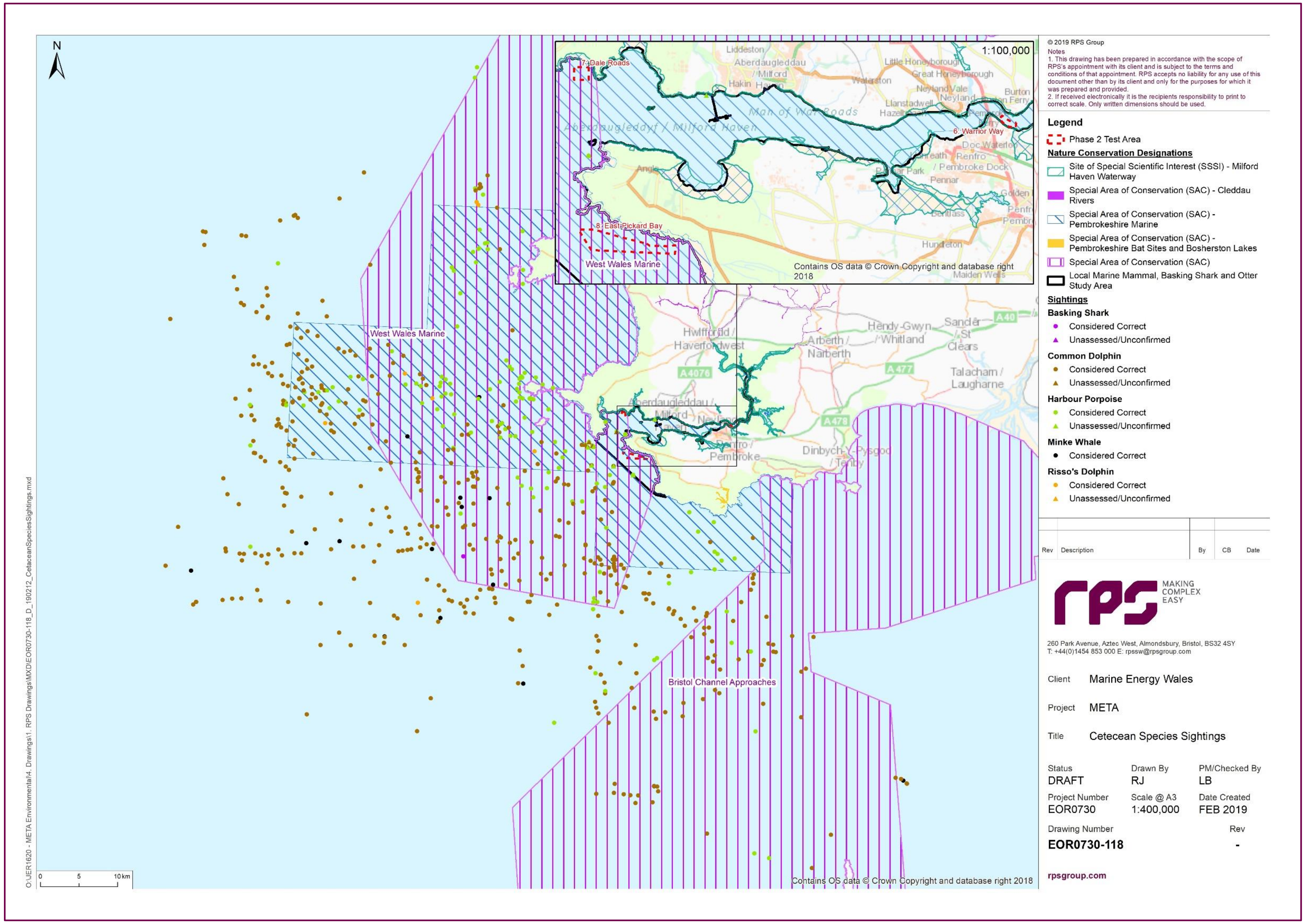

Figure 9.5: Cetacean and basking shark sightings from small-vessel surveys (2005-2015) and incidental sightings (1979 – 2018) (WWBIC, 2019).

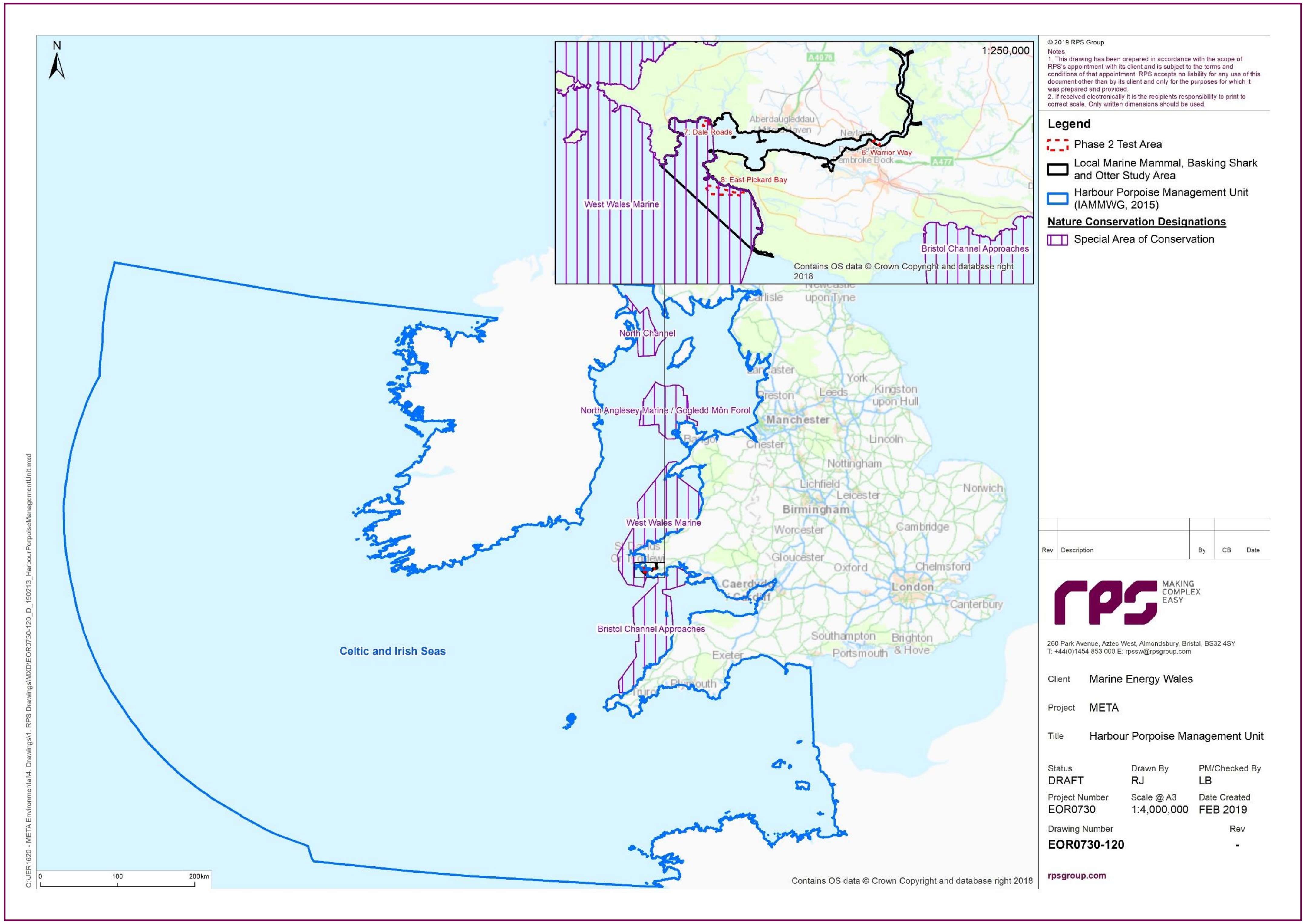

Figure 9.6: Harbour porpoise Management Unit.

Bottlenose dolphin (Tursiops truncatus)

9.7.2.11 The bottlenose dolphin has a worldwide distribution, occurring in tropical and temperate waters. The species occurs in a diverse range of habitats from shallow estuaries and bays, to the continental shelf and beyond into deeper waters. Bottlenose dolphins in the north east Atlantic have a predominantly coastal distribution (Baines and Evans, 2012). Female bottlenose dolphins typically begin breeding at five to 13 years of age, with gestation lasting for 12 months. Bottlenose dolphins give birth to a single individual which will remain with its mother for several years. This species feeds on a wide variety of fish (including herring), cephalopods and occasionally shrimp and small rays and sharks. They pursue schooling prey and solitary prey throughout the water column as well as into the air above and into the sand below (Mann *et al.,* 2000).

9.7.2.12 Bottlenose dolphins, after harbour porpoise, are the next most frequently recorded cetacean species in Welsh waters Identified hot spots are located in southern Cardigan Bay; Tremadog bay; and north and east of Anglesey (Baines and Evans, 2009, see Figure 9.4). The species is present throughout the year in Welsh waters but animals are more likely to be found in small groups in coastal waters in summer (centred around Cardigan Bay), dispersing widely and generally north in winter, forming much larger groups (Baines and Evans, 2012). Bottlenose dolphin are the primary feature of Cardigan Bay SAC and a qualifying feature of Pen Llŷn a'r Sarnau SAC in northern Cardigan Bay. The semi-resident population of bottlenose dolphins found in Cardigan Bay is one of two major coastal populations in the UK (Lohrengel *et al*., 2018), occurring in the regional marine mammal, basking shark and otter study area; the population is thought to be composed of transients, occasional visitors and resident animals (Feingold and Evans, 2014). Any bottlenose dolphins sighted within the local marine mammal, basking shark and otter study area are likely to have connectivity to one or both of these SACs. The second semi-resident population in the UK is found in the Moray Firth, Scotland.

9.7.2.13 Abundance estimates for the Cardigan BAY SAC produced an estimate of 64 individuals (CI = 19-220; CV = 0.65) in 2015 and 84 (CI = 44-160; CV = 0.33) in 2016; and for the wider Cardigan Bay, 277 (CI = 138-555; CV = 0.36) in 2015, 289 (CI = 184-453; CV = 0.23) in 2016 (Lohrengel *et al.,* 2018). Some individuals move north to the Isle of Man in winter months (the northernmost confirmed limit of the population's range), however it is believed that a proportion of the Cardigan Bay population remains within the SAC year-round (Lohrengel *et al*., 2018). Bottlenose dolphin births have been recorded throughout the year with a peak July and September, when 65% of births occur.

9.7.2.14 Whilst bottlenose dolphins are likely to be sighted within the regional marine mammal, basking shark and otter study area, sightings within and in the vicinity of the local marine mammal, basking shark and otter study area are extremely limited; the WWBIC data does not identify bottlenose dolphin as a sited species in either incidental sightings data or small vessel survey data (see Figure 9.5) (WWBIC, 2019, see Appendix 9.1 for full dataset). However, given that bottlenose dolphin is considered to be a wide-ranging species, known movements include that of coastal regions, and they are a qualifying interest feature of the Cardigan Bay SAC (which is within foraging range of bottlenose dolphin from the META project) a precautionary approach has been taken, and bottlenose dolphins will be included in the impact assessment.

9.7.2.15 The IAMMWG has identified two MUs for bottlenose dolphin which dissect the regional marine mammal, basking shark and otter study area: The Irish Sea (IS) MU and the Offshore Channel, Celtic Sea and South West England (OCSW) MU (see Figure 9.7). The IS MU occurs to the east of the Republic of Ireland, from south west Scotland to the northern coast of Pembrokeshire. The OCSW MU is found at the bottom edge of the IS MU, from the north coast of Pembrokeshire, to the east coast of the Republic of Ireland, and to the north coast of France. The total bottlenose dolphin abundance for the IS MU was estimated as 397 animals (95% Confidence Interval 362 to 414); The total bottlenose dolphin abundance for the OCSW MU was estimated as 4,856 animals (95% Confidence Interval 1,638 to 14,398 (IAMMWG, 2015). Where a quantitative assessment of impact is possible, the MU abundance estimate for both MUs has been combined and will be used as the reference population against which to assess the impact.

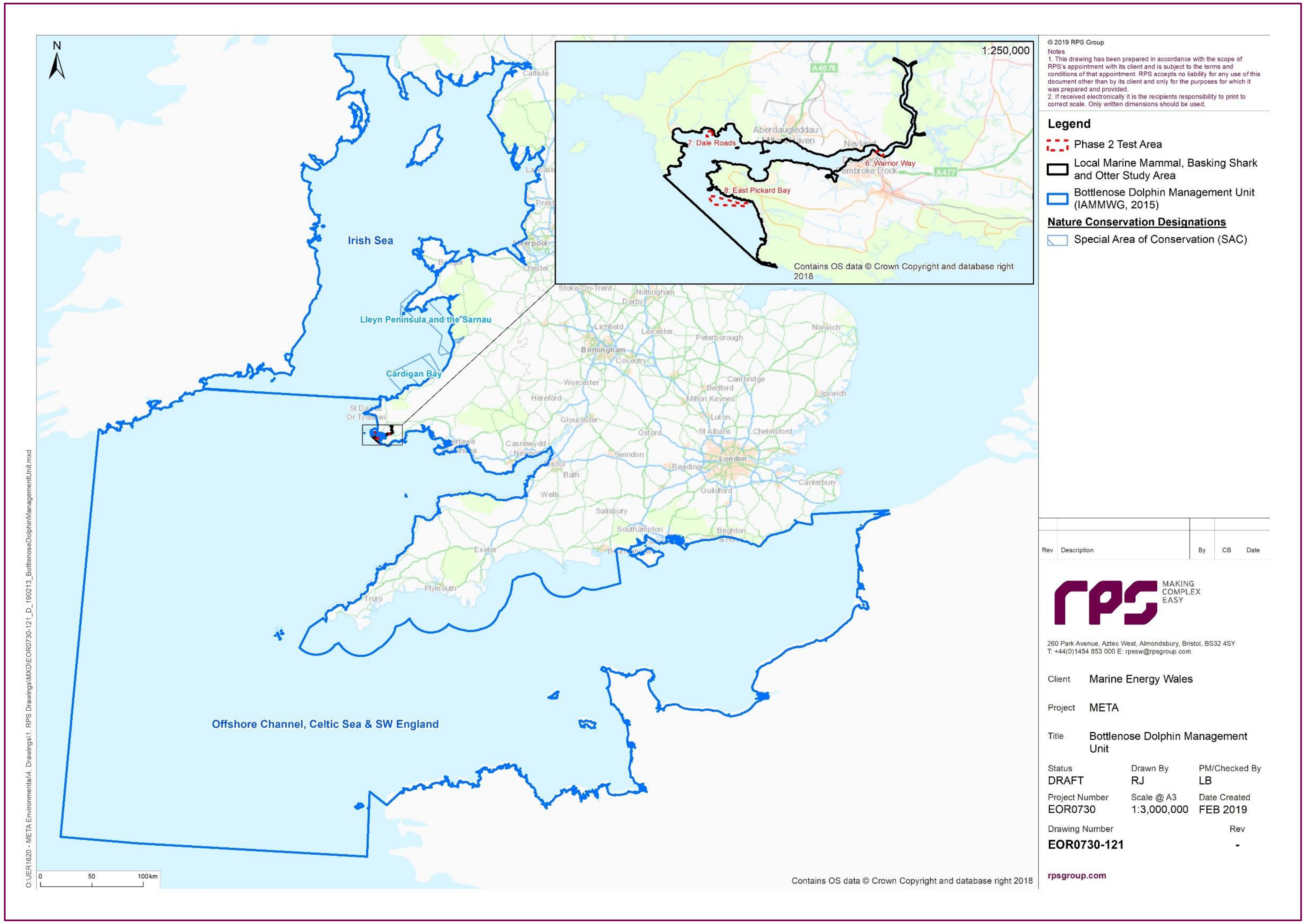

Figure 9.7: Bottlenose dolphin Management Unit.

Short-beaked common dolphin (Delphinus delphis)

9.7.2.16 The short-beaked common dolphin has a worldwide distribution and is amongst the most abundant of the world's cetacean species. This species has a largely offshore distribution and occurs in warm-temperate and tropical waters (Reid *et al.* 2006).

9.7.2.17 In Welsh waters, distribution is centred upon the Celtic Deep at the southern end of the Irish Sea, in water depths ranging from 50-150 metres (see Figure 9.3), which extends eastwards towards the coast and islands of west Pembrokeshire (see Figure 9.4). The species also occurs in low densities in the Irish sea in a central band which extends northwards towards the Isle of Man (Baines and Evans, 2012). The short-beaked common dolphin is primarily a summer visitor although persists in the Celtic Deep until November (Baines and Evans, 2012).

9.7.2.18 Common dolphins in the north-east Atlantic exhibit reproductive seasonality, with a uni-modal calving/mating period extending from April to September, with gestation periods lasting up to 12 months. The diet of common dolphin, over continental shelves, consists largely of a combination of the locally most abundant species of small pelagic shoaling fish or, rarely, cephalopod (Murphy *et al.,* 2013). This species has been recorded diving, presumably whilst feeding, of up to 260 m, however most dives are thought to be less than 100 m deep (Evans 1994; Perrin 2002).

9.7.2.19 Sightings data provided by the WWBIC (WWBIC, 2019, see Appendix 9.1 for full dataset) show that common dolphins have been sighted frequently within and throughout the regional marine mammal, basking shark and otter study area. A cluster of sightings occurred just outside the local marine mammal, basking shark and otter study area, with one (unconfirmed) sighting occurring inside the local marine mammal, basking shark and otter study area (see Figure 9.5) (WWBIC, 2019).

9.7.2.20 Both the local marine mammal, basking shark and otter study area and the regional marine mammal, basking shark and otter study area fall within the Celtic and Greater North Seas (CGNS) MU which extends from the north of the Shetland Isles, to the west of the Irish landmass, and east to mainland Europe (see Figure 9.8). The total common dolphin abundance for the CGNS MU was estimated as 56,556 animals (95% Confidence Interval 33,014 to 96,920) (IAMMWG, 2015).

Risso's dolphin (Grampus griseus)

9.7.2.21 Risso's dolphins occur in almost all of the world's oceans between 60° south and 60° north. In UK waters, Risso's have largely been recorded over depths of 50-100m (Reid *et al.* 2006) (see Figure 9.3) showing preference for habitats over steep slopes. Knowledge on reproductive seasonality is limited however reports of births are year-round, occurring mostly from April to September (Pereira, 2008).

9.7.2.22 Clusters of sightings have been identified in the southern Irish Sea (Reid *et al.* 2006) and a relatively localised distribution has been identified in Welsh waters, forming a wide band which runs SW-NE, encompassing west Pembrokeshire; the western end of Lleyn Peninsula and Anglesey, the south-east coast of Ireland in the west and the waters around the Isle of man in the north (Baines and Evans, 2009, see Figure 9.4).

9.7.2.23 Risso's dolphin have a temporal distribution; they are mainly summer and autumn visitors to the regional marine mammal, basking shark and otter study area with highest numbers of sightings in July to September. They are also known to breed in the regional marine mammal, basking shark and otter study area (Baines and Evans, 2012).

9.7.2.24 Sightings data provided by the WWBIC (WWBIC, 2019, see Appendix 9.1 for full dataset) show that Risso's dolphin have been sighted within the regional marine mammal, basking shark and otter study area. The closest sighting (considered correct) to the local marine mammal, basking shark and otter study area, occurred due south of Skomer Island, due west of East Pickard Bay (site 8), outside of this study area (WWBIC, 2019) (Figure 9.5).

9.7.2.25 The local marine mammal, basking shark and otter study area and regional marine mammal, basking shark and otter study area fall within the Celtic and Greater North Seas (CGNS) MU which extends from the north of the Shetland Isles, to the west of the Irish landmass, and east to mainland Europe (see Figure 9.8). Due to lack of data, there is no current abundance estimate for Risso's dolphin for this MU (Hammond, 2017).

Minke whale (Balaenoptera acutorostrata)

9.7.2.26 The common (or northern) minke whale is extensively distributed throughout the northern hemisphere in tropical, temperate and polar seas. High densities are known to occur in relatively cool waters over the Atlantic continental shelf (< 200m). (Reid *et al.* 2003; 2006). The minke whale is the most frequently recorded baleen whale (or mysticete) in British shelf waters (Evans, 2008). Although fin whales and humpback whales have been occasionally sighted in the regional marine mammal, basking shark and otter study area, minke whale is the only baleen whale sighted with any regularity within UK waters and is therefore the only species of baleen whale being carried forward for assessment.

9.7.2.27 Minke whale typically live up to 60 years. Male minke whale reach sexual maturity at approximately 6.9 m in length (aged five to eight years) and females at about 7.3 m in length (aged six to eight years). Gestation occurs over a ten-month period. In the UK, minke whale tend to feed on sandeels predominantly, followed by clupeids and, to a lesser extent, mackerel (Anderwald and Evans, 2007).

9.7.2.28 The species has a largely offshore distribution with highest densities occurring in the Celtic Deep (see Figure 9.3), although the species is found in lower concentrations northwards towards the Isle of Man (Baines and Evans, 2012; Reid *et al.* 2006) (see Figure 9.4). Minke whale have a temporal distribution, and are mainly sighted in summer months, with few sightings in winter, however it is noted that this could be affected by higher sighting effort in summer (Baines and Evans, 2012).

9.7.2.29 Sightings data provided by the WWBIC (WWBIC, 2019, see Appendix 9.1 for full dataset) show that minke whale have been sighted within the regional marine mammal, basking shark and otter study area. The closest sighting (considered correct) to the local marine mammal, basking shark and otter study area, occurred about 16 km north-east of the western edge of this study (WWBIC, 2019) (see Figure 9.5).

9.7.2.30 Both the local marine mammal, basking shark and otter study area and the regional marine mammal, basking shark and otter study area fall within the Celtic and Greater North Seas (CGNS) MU which extends from the north of the Shetland Isles, to the west of the Irish landmass, and east to mainland Europe (see Figure 9.8). The total minke whale abundance for the CGNS MU was estimated as 23,528 animals (95% Confidence Interval 13,989 to 39,572) (IAMMWG, 2015).

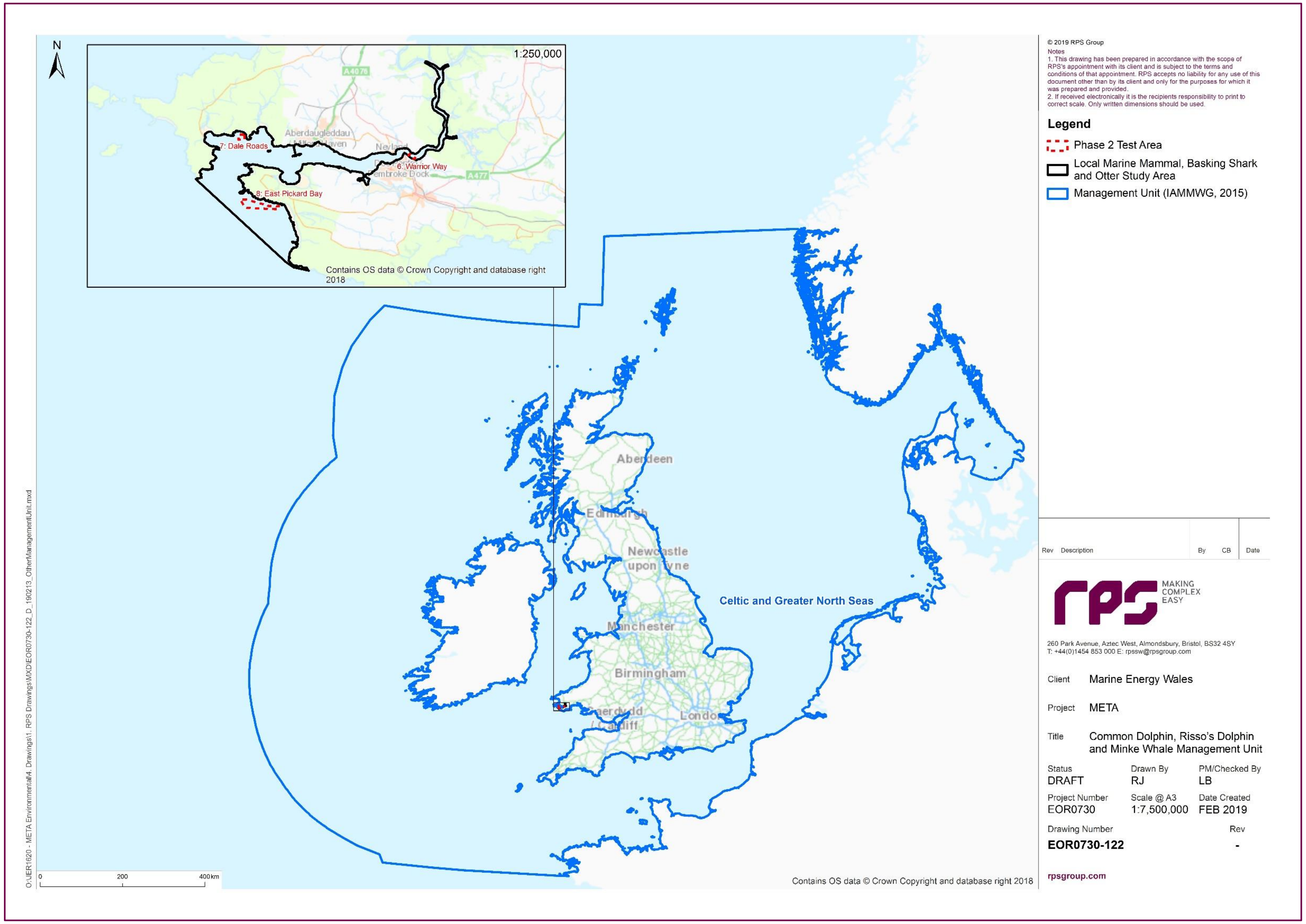

Figure 9.8: Common dolphin, Risso's dolphin and minke whale Management Unit.

9.7.3 Pinnipeds (seals)

9.7.3.1 Grey seal is the only pinniped species which breeds in Wales. Whilst harbour seals (*Phoca vitulina*) are prevalent on the east coast of England and throughout the Scottish coast, there are no resident or breeding populations in Wales (IAMMWG, 2013). As such, harbour seal has not been considered for this assessment.

Grey seal (Halichoerus grypus)

9.7.3.2 Globally, there are three hotspots of grey seal abundance; one in eastern Canada and north-east USA; a second smaller population in the Baltic Sea; and the third along the coast of the UK (38% of the World's grey seals breed in the UK) (SCOS, 2017). Grey seals can live for over 20 to 30 years, with females tending to live longer than males (SCOS, 2015). Sexual maturity is reached at approximately ten years in males, and five years in females (SCOS, 2015) and gestation occurs over 10 to 11 months.

9.7.3.3 While grey seals are known to travel up to 2,100 km on foraging trips, most foraging trips remain within 145 km from haul-out sites (SCOS, 2015). Seals are highly mobile and feed mainly at the benthos in shelf seas (Thompson, 2012; Chen *et al.,* 2017). Telemetry studies of animals tagged on Welsh haul-out sites indicate that grey seals may make foraging trips to very localised areas, with animals from a particular locality tending to remain in that region (Strong *et al.,* 2006).

9.7.3.4 Grey seals are widely distributed in Welsh waters. Breeding colonies in northwest Pembrokeshire, particularly on Ramsey Island, extending southwards to Skomer Island and northwards to southern Ceredigion (see Figure 9.9) (Baines and Evans, 2009). Small concentrations occur around the Lleyn Peninsula and the coast of Anglesey. These breeding colonies act as haul-out sites in the non-breeding season. Approximately 5,000 grey seals use habitats on the Welsh coast, with colonies in north Pembrokeshire and Skomer Island being the most important breeding colony for grey seal in the south of the UK (SCOS, 2017); these colonies overlap with the local marine mammal, basking shark and otter study area. Approximately 5% of UK grey seal pups are born on the coasts of SW Wales and SW England each year (Duck, 1995; Baines *et al*., 1995; SCOS, 2017). Grey seals are a feature of the Skomer Marine Conservation Zone (MCZ) (see Figure 9.10) and seal pupping sites are found at both Skomer Island and Marloes peninsula sites (Lock *et al.,* 2017). The Marloes peninsula contributes, on average, 41% of the total pup production in the Skomer MCZ.

9.7.3.5 In 2015, 465 pups were born in North Pembrokeshire and 379 pups born on Skomer and adjacent mainland sites in 2015 (SCOS, 2017). In 2017, 383 pups were born within the Skomer Marine Conservation Zone (the highest number of seal births within the whole of the MCZ since records began) with 225 pups born on Skomer Island (the second highest total ever recorded) and 158 born on Marloes Peninsula (Büche and Stubbings, 2018),Pupping occurs between July and November, and in 2017 the highest number of pups were born in September (n = 146) and October (n = 57). Büche and Stubbings (2018) identified Castle Bay, North Haven and Matthew's Wick (all on east Skomer Island, see Figure 9.10) as the most important haul-out sites within the MCZ, with average daily numbers of seals recorded as 44, 33 and 24 seals respectively. The Garland Stone does not appear to play a major role as a haul-out sire during the autumn, however seals use it all year round. Weather conditions are most likely the most significant determining factor on number of seals hauled-out per site day to day (Büche and Stubbings, 2018).

9.7.3.6 The Grey Seal Breeding Census Skomer Island 2017 (Büche and Stubbings, 2018) identified two seals hauled-out on North Haven beach, with tags which identified them as having originated at 105 km distance. Two seals which originated from the Skomer MCZ were identified in Cornwall, 147 km and 131 km away.

9.7.3.7 Sightings data provided by the WWBIC (WWBIC, 2019, see Appendix 9.1 for full dataset) show that grey seal have been sighted within both the regional marine mammal, basking shark and otter study area and throughout the local marine mammal, basking shark and otter study area (see Figure 9.10).

9.7.3.8 Both the local marine mammal, basking shark and otter study area and the regional marine mammal, basking shark and otter study area fall within the Wales MU which extends from south of the Isle of Man, the length of the coast of Wales to the Severn Estuary (see Figure 9.11). The total grey seal pup production estimate in 2014 for this MU was 1,650 (SCOS, 2017). Where a quantitative assessment of impact is possible, the MU abundance estimate has been used as the reference population against which to assess impact.

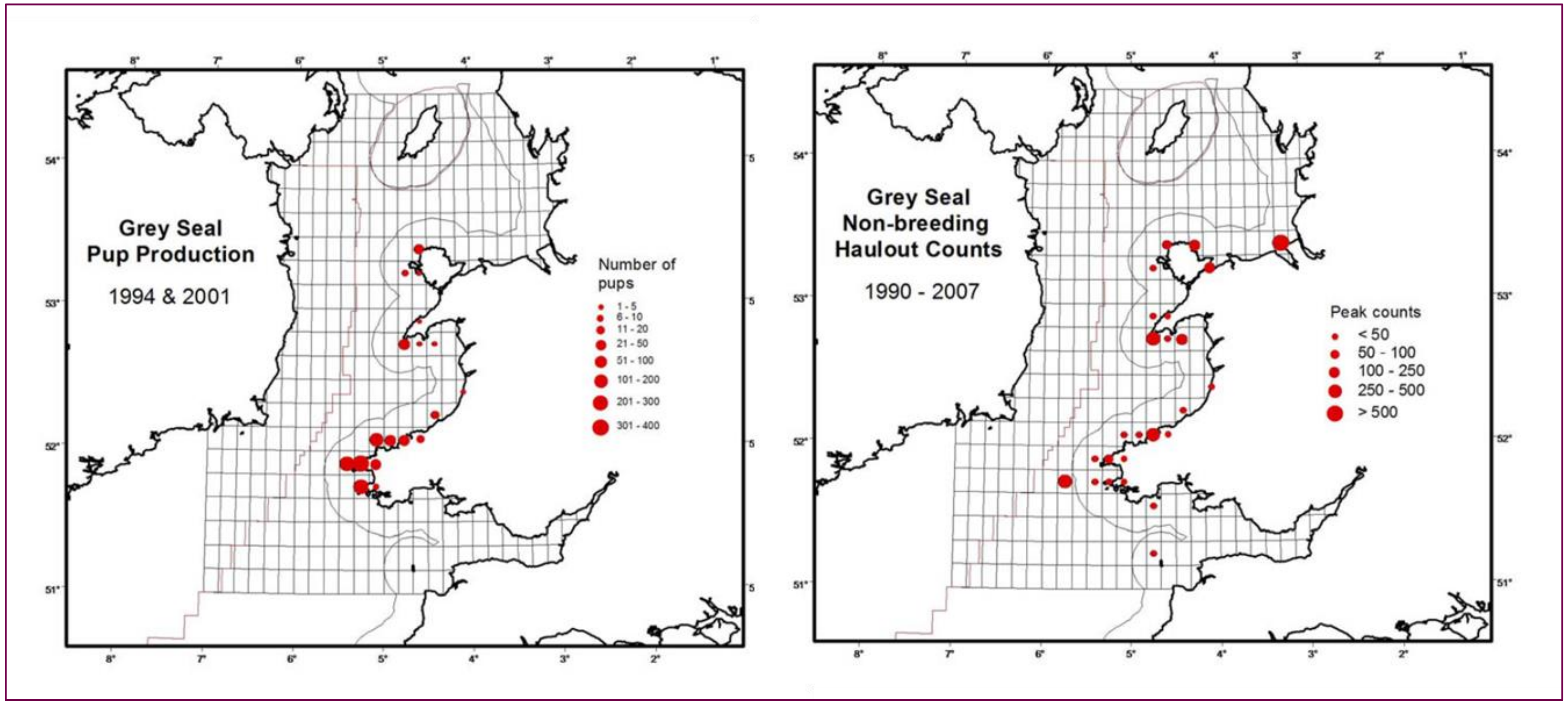

Figure 9.9 Grey seal pup production (1994 and 2001) and grey seal non-breeding haulout counts (1990 - 2007) in Welsh waters (Baines and Evans, 2009.

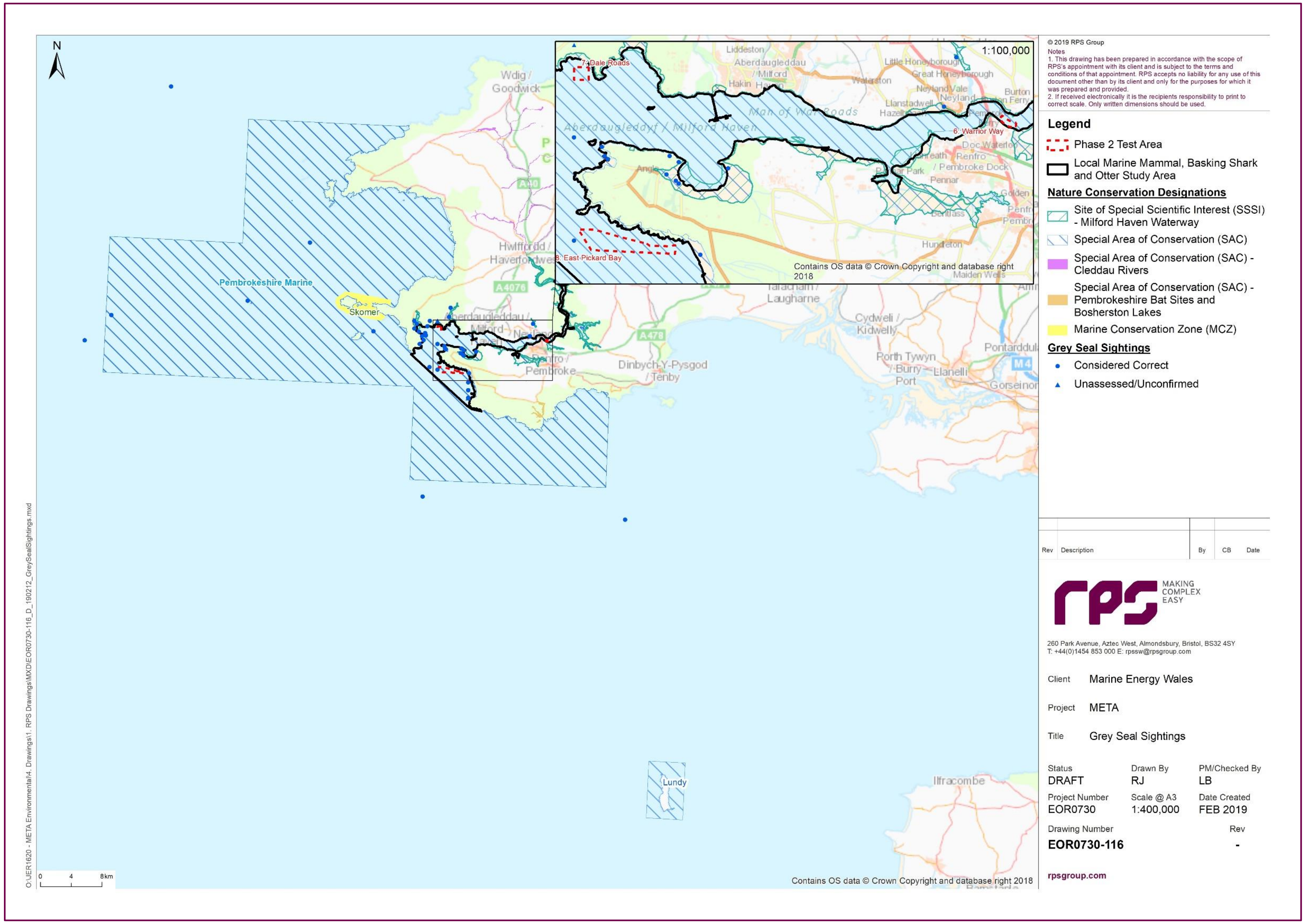

Figure 9.10: Grey seal sightings from small-vessel surveys (2005-2015) and incidental sightings (1979 – 2018) (WWBIC, 2019).

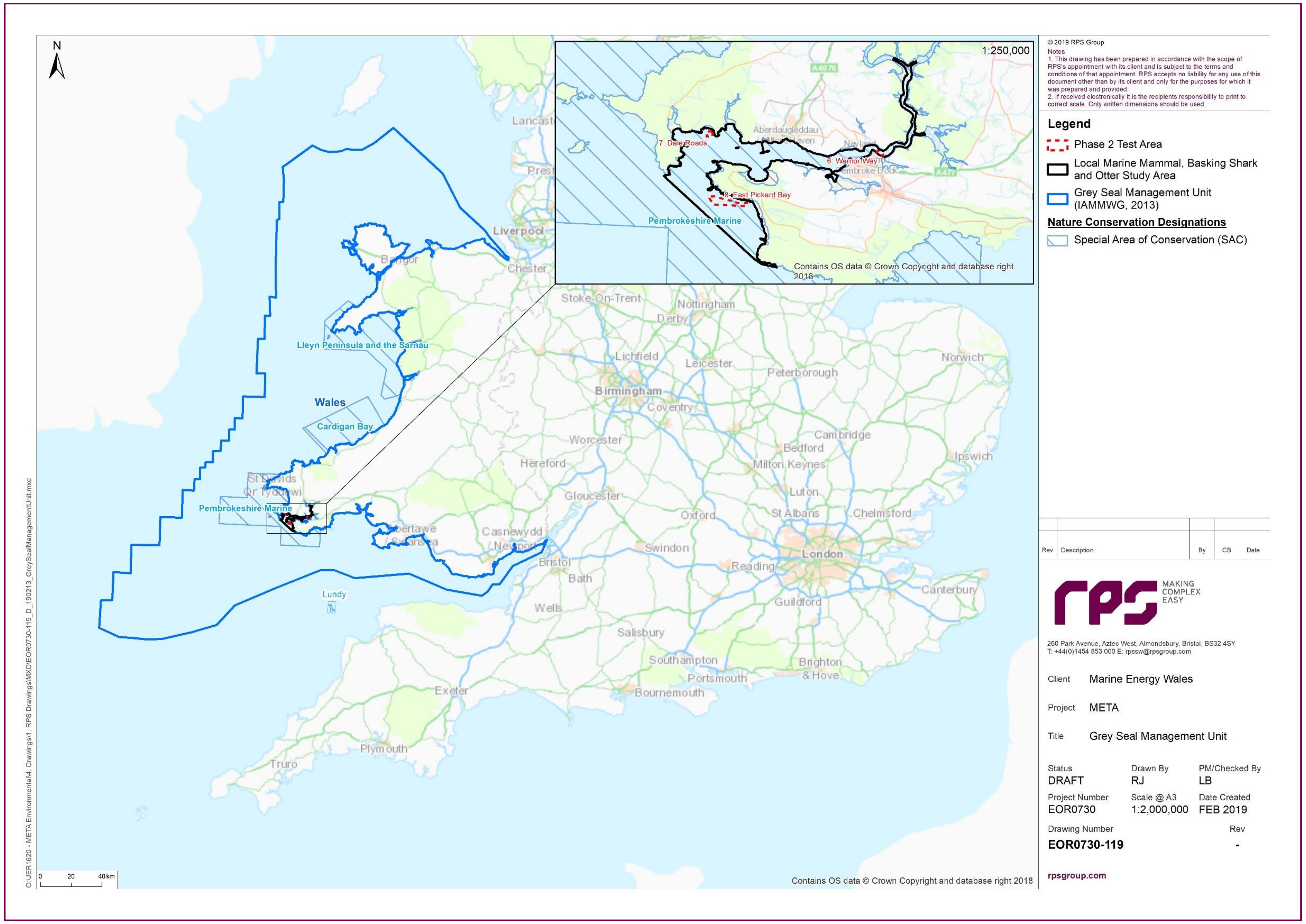

Figure 9.11: Grey seal Management Unit.

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9.7.4 Basking shark (*Cetorhinus maximus*)

9.7.4.1 The basking shark has a circumglobal distribution and can undertake extensive trans-ocean basin migrations (Witt *et al.,* 2012). Data (sightings, geotag and survey data) suggest a restricted range for basking sharks around Britain, with the majority of sightings falling between the Hebrides and the north coast of Brittany, with relatively few occurrences on the west coast of Ireland and east coast of the UK (see Appendix 9.2 for a UK-wide distribution map of basking sharks). This suggests the western region of the European shelf is a particularly important habitat for basking sharks within the north-east Atlantic (Southall *et al.,* 2005). Highest densities of basking sharks are recorded along western facing shores. High density hotspots (through sightings data) appear to be western Scotland, the Isle of Man and south west England, with lower concentrations off the coast of Pembrokeshire and western Ireland, where they can be observed surface-feeding on dense zooplankton patches (Miller *et al.,* 2015).

9.7.4.2 Basking sharks are thought to pair in early summer and are likely to be ovoviviparous. Estimates for gestation period are 12 – 36 months, and there is an estimated 24 months between litters. Basking sharks are often associated with surface aggregations of zooplankton, particularly along tidal and shelf-break fronts where they feed on small fish, fish eggs and zooplankton (Fowler, 2009).

9.7.4.3 Although spatio-temporal data is still limited, in UK waters, basking sharks are known to exhibit distinct seasonality, with peak sighting periods between June and September each year (Witt *et al.,* 2012).

9.7.4.4 Basking sharks have been documented feeding in the Celtic Deep (see Figure 9.3), on the south west side of the regional study area (https://www.mcsuk.org/mpa/show-1481456).Tag geolocations suggest individual basking sharks spend considerable time in the Celtic Sea undertaking persistent ranging movements near the Celtic Sea front (Southall *et al,* 2005) (see Figure 9.3). Sightings of basking sharks and tagged basking sharks show that individuals frequent the waters off the Pembrokeshire coast, within the regional marine mammal, basking shark and otter study area (Miller *et al.,* 2015, Witt *et al.,* 2012), supported by Sightings data provided by the WWBIC (WWBIC, 2019) (see Figure 9.5). Population size and structure estimates for the basking shark in the north-east Atlantic however are currently unknown.

9.7.5 European otter (*Lutra lutra*)

9.7.5.1 The otter is one of only a few European carnivores that has evolved the ability to actively forage both in water and on land (Oliveira *et al.,* 2008) and is highly capable of hunting in both freshwater (Carss *et al.,* 1990; Copp and Roche, 2003) and marine environments (Kruuk and Moorhouse, 1991; Heggberget, 1993; Parry *et al.,* 2010)). The European otter is largely solitary and adult otters tend not to associate with other adults except for reproduction. Sexual maturity is attained at around 18 months in males and 24 months in females. They are non-seasonally polyoestrous, and gestation period is approximately 63-65 days, the litter size varies from one to five, and the life expectancy is around 17 years. Fish is the major prey of otters, sometimes exceeding more than 80% of their diet, which also consists of aquatic insects, reptiles, amphibians, birds, small mammals, and crustaceans (Roos *et al.,* 2015).

9.7.5.2 Otter are found across the UK and following a rapid decline in the 1950s (Mason and McDonald, 2004) has shown recovery in the last two decades across most of its western European distribution (Van Looy *et al.,* 2014).

9.7.5.3 Coastal otter populations are not well defined in Wales and the prevalence of otter marine activity within this species' European range is currently also poorly defined. However, the coastline of South Wales provides a wealth of opportunities for otters, with large sections of remote or inaccessible coastline that provide potential foraging, resting and breeding sites (Parry *et al.,* 2010).

9.7.5.4 It is known that otters are widely distributed in Pembrokeshire (Jones and Jones, 2004) and records indicate that otters utilise coastal areas for foraging and breeding at some locations (Liles, 2003a). Accordingly, Pembrokeshire may represent one of the most important areas for otters in Wales. The Milford Haven Waterway SSSI supports nationally important numbers of otter (NRW – Marine character Areas MCA 21 Milford Haven). In 2004 the population estimate for otter in Wales was given as 762 (JNCC, 2007).

9.7.5.5 Sightings data provided by the WWBIC (WWBIC, 2019) show that otter have been sighted throughout the local marine mammal, basking shark and otter study area, up into the Cleddau rivers, with sightings predominantly occurring within a few metres of the MLWS (WWBIC, 2019) (see Figure 9.12).

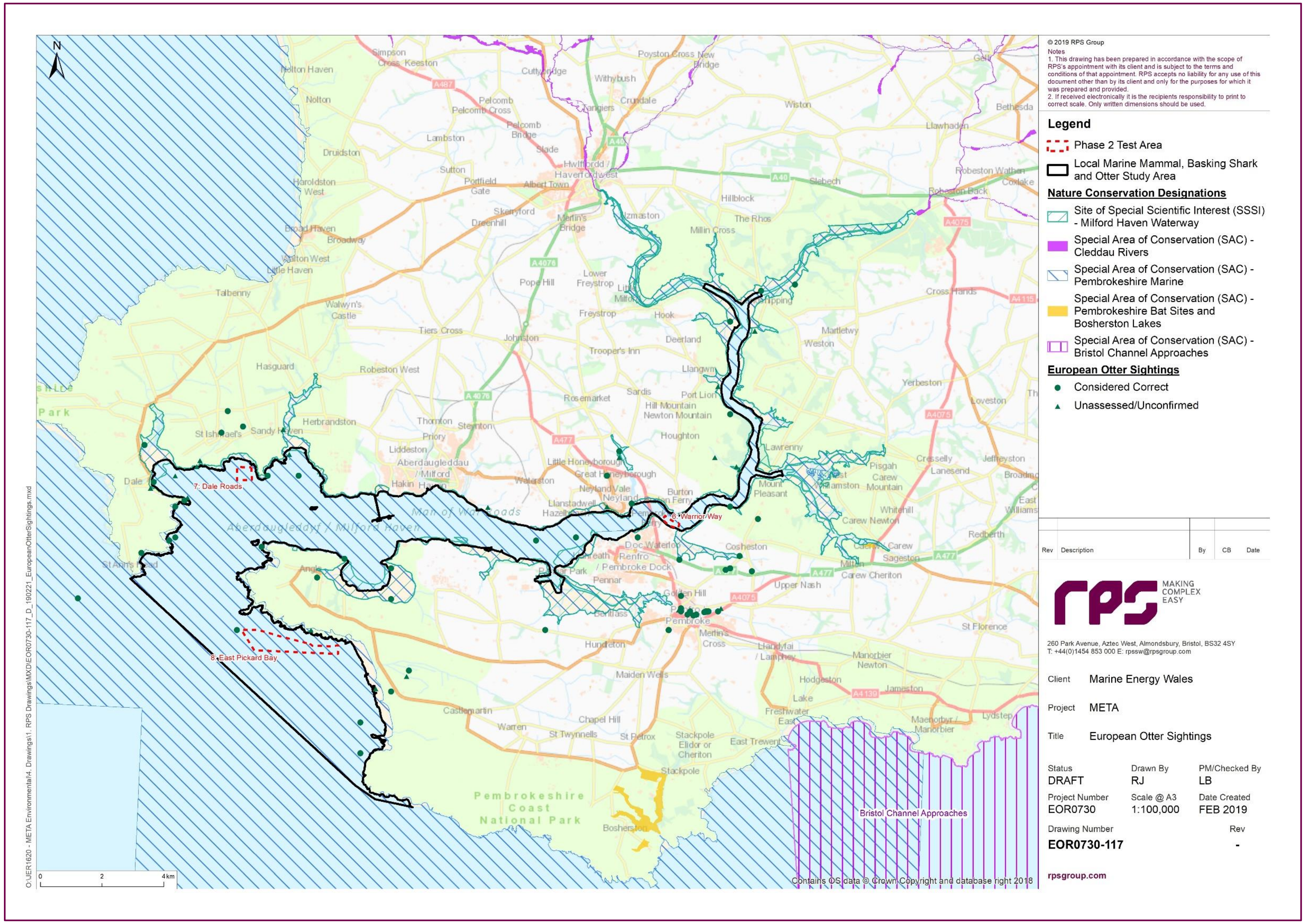

Figure 9.12: European otter sightings from small-vessel surveys (2005-2015) and incidental sightings (1979 – 2018) (WWBIC, 2019).

9.7.6 Designated sites

9.7.6.1 Designated sites identified for the marine mammal, basking shark and otter assessment are described in Table 9.5 below. The META Habitats Regulations Assessment (HRA): Stage 1 Screening Report (HRA Report) details how sites and features have been screened into the need for HRA (with the assessment on the site itself deferred to the META report to inform Appropriate Assessment (RIAA).

Table 9.5: Designated sites and relevant qualifying interest features for the META project marine mammals, basking shark and otter 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 II Species • Grey seal (*Halichoerus grypus*) • Otter (*Lutra lutra*)
West Wales Marine / Gorllewin Cymru Forol SAC	13	0	0	Annex II Species • Harbour porpoise (*Phocoena phocoena*)
Cleddau Rivers / Afonydd Cleddau SAC	11	16	17	Annex II Species • Otter (*Lutra lutra*)
Milford Haven Waterway SSSI	0	< 0.1	2.2	The SSSI support nationally important numbers of otter (*Lutra lutra*)
Bristol Channel Approaches / Dynesfeydd Môr Hafren SAC	19	7	15	Annex II Species • Harbour porpoise (*Phocoena phocoena*)
Lleyn Peninsula and the Sarnau / Pen Llyn a`r Sarnau SAC	91	98	102	Annex II Species • Bottlenose Dolphin (*Tursiops truncatus*) • Grey seal (*Halichoerus grypus*)
Cardigan Bay / Bae Ceredigion SAC	43	47	50.5	Annex II Species • Bottlenose dolphin (*Tursiops truncatus*) • Grey seal (*Halichoerus grypus*)
Pembrokeshire Bat Sites and Bosherston Lakes SAC	8	15.7	11.2	Annex II Species • Otter (*Lutra lutra*)
North Anglesey Marine / Gogledd Môn Forol Site of Conservation Importance (SCI)	170	170	174	Annex II Species • Harbour porpoise (*Phocoena phocoena*)
North Channel SAC	277	275	281	Annex II Species • Harbour porpoise (*Phocoena phocoena*)
Lundy Island SAC	59.2	64.8	58.1	Annex II Species • Grey seal (*Halichoerus* grypus)

9.7.7 Valued Ecological Receptors

9.7.7.1 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. The following table shows the criteria applied to determining the value of ecological receptors (VERs) within the geographic frame of reference applicable to the regional marine mammal, basking shark and otter study area (Table 9.6)

Table 9.6: Valued Ecological Receptors categorisation for marine mammals, basking sharks and otters

Value of VER	Criteria to define value
Very high	• Internationally protected species that are listed as a qualifying interest feature of an Internationally protected site (i.e. Annex II protected species designated feature of a European designated site i.e. Natura 200 site).
High	• Internationally protected species (including EPS) that are not qualifying features of a candidate or designated European Site but are regularly recorded within the regional marine mammal study area, but in relatively low densities and therefore the area is not considered to be important for the species in an international context. • Internationally protected species that are not qualifying features of a European designated site but are recognised as a Biodiversity Action Plan (BAP) priority species either alone or under a grouped action plan, and are listed on the local action plan relating to the regional marine mammal study area.
Medium	• Internationally protected species that are not qualifying features of a European designated site and are infrequently recorded within the regional study area in very low numbers compared to other regions of the British Isles.
Low	• There are no criteria given for local due to the high level of protection under international law for all marine mammal species which makes this category irrelevant.

9.7.7.2 The eight species presented in section 9.7 are very high or high VERs. The valuation is based on their protected status and their abundance and distribution within the regional marine mammal, basking shark and otter study area, as well as their wider distribution and abundance within their natural range. Table 9.7 presents the VERs identified for the marine mammal, basking shark and otter impact assessment.

Table 9.7: Marine mammal, basking shark and otter VERs identified for the META project impact assessment.

Receptor	Value	Justification
Harbour porpoise	Very High	Annex II species protected under international legislation and designated feature of West Wales Marine / Gorllewin Cymru Forol SAC and Bristol Channel Approaches / Dynesfeydd Môr Hafren SAC.
Bottlenose dolphin	Very high	Annex II species protected under international legislation and designated feature of Lleyn Peninsula and the Sarnau / Pen Llyn a`r Sarnau SAC and Cardigan Bay / Bae Ceredigion SAC.
Short-beaked common dolphin	High	Internationally protected species regularly sighted in the regional marine mammal, basking shark and otter study area
Risso's dolphin	High	Internationally protected species regularly sighted in the regional marine mammal, basking shark and otter study area

Receptor	Value	Justification
Minke whale	High	Internationally protected species regularly sighted in the regional marine mammal, basking shark and otter study area
Grey seal	Very high	Large haul out to the south west of the marine mammal study area. Annex II species protected under international legislation and designated feature of Pembrokeshire Marine SAC, Cardigan Bay / Bae Ceredigion SAC and the Lleyn Peninsula and Sarnau / Pen Llyn a`r Sarnau SAC
Basking shark	High	Internationally protected species / European Protected Species recorded migrating through the regional study area on an annual basis
Otter	Very high	Regularly uses coastline of marine mammal study area for foraging. Annex II species protected under international legislation and designated feature of Pembrokeshire Marine SAC, Pembrokeshire Bat Sites and Bosherston Lakes/ Safleoedd Ystlum Sir Benfro a Llynnoedd Bosherston SAC and Cleddau Rivers / Afonydd Cleddau SAC. Milford Haven Waterway SSSI supports nationally important numbers of otter

9.7.8 Future baseline scenario

9.7.8.1 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.

9.7.8.2 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.

9.7.8.3 Marine mammal populations naturally fluctuate over space and time, however given the temporary nature of the META project, identifiable fluctuations are unlikely to occur over the lifetime of the project. Their distribution is, to a large extent, mediated by the distribution and abundance of prey species. Many species range over large distances and, to a certain extent, can adapt to gradual changes in the environment, such as those that may occur as a result of climate change (Hoegh-Guldberg and Bruno, 2010). This is not the case for all species. Those that have more restricted habitat ranges are likely to be more vulnerable to changes in their environment. For the marine mammal VERs identified in Table 9.7, species such as grey seal, whose natural foraging range is more restricted than cetacean species (most foraging trips remain within 145 km from haul-out sites (SCOS, 2015)), may be more sensitive to long-term changes.

9.7.8.4 The impact of anthropogenic-induced climate change has so far been recorded as decreased productivity of the oceans, altered food-web dynamics, reduced abundance of habitat-forming species, shifting species distributions and a greater incidence of disease (Hoegh-Guldberg and Bruno, 2010). Temperature changes in northern Europe may affect cold-water shelf species such as harbour porpoise. Increased sea levels modifying shallow seas could affect the availability of protected cave sites for breeding seals, as well as low-lying areas and other haul out sites (e.g. grey seal) (Evans *et al*., *2010*).

9.7.8.5 Anthropogenic activities in the marine environment can influence the distribution and abundance of marine mammal populations. In the regional marine mammal, basking shark and otter study area, potential impacts include: probable mortality due to bycatch from fisheries (particularly for harbour porpoise); direct or indirect effects of contamination (from pollution incidents, sewage discharge, or litter disposal at sea); injury or disturbance from introduced noise into the marine environment (e.g. from shipping, drilling, piling, seismic surveys, military activity, dredging and disposal, aggregate extraction, Unexploded Ordinance (UXO) detonations, and Acoustic Deterrent Devices (ADD)); death or injury due to collision with physical objects (vessels or renewable energy devices); and removal of prey species by anthropogenic impacts such as overfishing.

9.7.8.6 For grey seals, population trend objectives have been based on pup production, since that metric has been long established as the most robust for determining changes in population dynamics (SCOS, 2017).

9.7.8.7 A current population trend for otter by the International Union for the Conservation of Nature (IUCN) red list is decreasing, however this is given for a global distribution (IUCN, 2015). Population recovery of otters in the UK following widespread anthropogenic persecution in the late 19th and early 20th centuries, commenced in the 1980s, showing an upwards trend largely as a result of European protection which prevents hunting and persecution, and improved water quality (JNCC, 2007; Battersby, 2005). The otter population along the banks of the Cleddau Rivers has shown '*excellent signs of recovery over the last 10 – 20 years'* (JNCC, Undated).

9.7.8.8 The current population trend given for basking shark by the IUCN (Fowler, 2009), globally, is decreasing, with continuing decline of subpopulations. The north east Atlantic stock is assessed as Endangered by the IUCN, based primarily on past records of rapidly declining local populations of basking sharks as a result of short-term fisheries exploitation and very slow population recovery rates.

9.7.9 Data limitations

9.7.9.1 Mobile species, such as marine mammals, basking sharks and otters exhibit varying spatial and temporal patterns. All historic surveys across the regional marine mammal, basking shark and otter study area represent snapshots of the species considered at the time of sampling. Abundance and distribution of species is likely to vary both seasonally and annually.

9.7.9.2 Baines and Evans (2012) note that south Pembrokeshire would benefit from greater marine mammal survey effort.

9.7.9.3 Sightings data and population information for basking sharks are limited therefore quantitative and qualitive assessments of effect in the context of the population level will not be possible.

9.7.9.4 The majority of sightings within the local marine mammal, basking shark and otter study area are incidental and as such abundance estimates are unavailable. This means an estimate of abundance within the local marine mammal, basking shark and otter study area has not been possible.

9.8 Key parameters for assessment

9.8.1 Maximum and most likely design scenario

9.8.1.1 The maximum design scenarios identified in Table 9.8 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.

9.8.1.2 The most likely design scenarios identified in Table 9.8 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.

9.8.1.3 Although information of impacts of wave and tidal devices, particularly on varying scales, on marine mammals, basking sharks and otters is limited, this assessment draws on available desk-based studies and expert advice.

9.8.1.4 Where relevant there is consideration of the outcome of assessments undertaken to inform the consenting of other UK wave and tidal energy projects at the European Marine Energy Centre (EMEC), in the Sound of Islay, in Strangford Lough, at the Skerries, off the coast of Anglesey, North Wales, and in Shetland. Environmental monitoring of some tidal turbine prototypes is currently underway and where results are available these have been used (e.g. biannual reporting from Strangford Lough, MCT deployment in Northern Ireland and TGL deployment at EMEC). Environmental information will be reviewed when made publicly available to ensure that this assessment and the associated mitigation measures are aligned with the most recent relevant data.

9.8.1.5 The marine mammal assessment has been informed by the following assessments:

- Coastal Processes (chapter 5);
- Underwater Noise (chapter 6);
- Fish and Shellfish (chapter 8); and
- Shipping and Navigation (chapter 12).

9.8.2 Impacts scoped out of the assessment

9.8.2.1 On the basis of the characterisation of the baseline environment and the project description outlined in chapter 2: Project Description, a number of potential impacts are proposed to be scoped out of the assessment for marine mammals, basking shark, and otter. These impacts are outlined, together with a justification for scoping them out, in Table 9.9.

Table 9.8: Maximum and most likely design scenarios considered for the assessment of potential impacts on marine mammals, basking shark and otter.

Potential impact	Maximum design scenario	Most likely design scenario	Justification
Installation and decommissioning phases			
Increased anthropogenic underwater noise	**Warrior Way** • Up to 5 vessels utilised at any one time for deployment and retrieval operations • Up to 20 deployment and 20 retrieval vessel movements in a 12-month period, restricted to daylight hours, wherever possible. • Vessel size - up to 35 m in length and 6.8 m draught • No use of DP vessels • Source sound pressure level at 1 m = 172 dB re 1 µPa (rms) / 221 SEL (24h) dB re 1 µPa²s **Dale Roads** • Up to five vessels utilised at any one time for deployment and retrieval operations. • Up to 20 deployment and 20 retrieval vessel movements in a 12-month period, restricted to daylight hours, wherever possible. • Potential use of DP vessels • Vessel size - up to 164 m in length and 6.8 m draught • *Vessel* - source sound pressure level at 1 m = 183 dB re 1 µPa (rms) / 232 SEL (24h) dB re 1 µPa²s • Use of drilled pin piling - up to 4 four drilled pin piles per device (each pin pile up to 100 mm diameter installed to a depth of 10 – 20 m) • Pin piles - source sound pressure level at 1 m = 163 dB re 1 µPa (rms) / 212 SEL (24h) dB re 1 µPa²s • **East Pickard Bay** *Device installation and decommissioning* • Up to five vessels utilised at any one time for device deployment and retrieval operations. • Up to 40 deployment and 40 retrieval vessel movements in a 12-month period, restricted to daylight hours, wherever possible. • Vessel size - up to 200 m in length and 8 m draught • Potential use of DP vessels • Use of drilled pin piling - up to 4 four drilled pin piles per device (each pin pile up to 100 mm diameter installed to a depth of 10 – 20 m) • Pin piles - source sound pressure level at 1 m = 163 dB re 1 µPa (rms) / 212 SEL (24h) dB re 1 µPa²s	**Warrior Way** • Up to three vessels utilised at any one time for device deployment and retrieval operations. • Up to 20 deployment and 20 retrieval vessel movements in a 12-month period, restricted to daylight hours, wherever possible. • Vessel size up to 30 m in length and 6.8 m draught • No use of DP vessels • Source sound pressure level at 1 m = 172 dB re 1 µPa (rms) / 221 SEL (24h) dB re 1 µPa²s **Dale Roads** • Up to three vessels utilised at any one time for device deployment and retrieval operations. • Up to 20 deployment and 20 retrieval vessel movements in a 12-month period, restricted to daylight hours, wherever possible. • Potential use of DP vessels • Vessel size - up to 164 m in length and 6.8 m draught • Source sound pressure level at 1 m = 183 dB re 1 µPa (rms) / 232 SEL (24h) dB re 1 µPa²s **East Pickard Bay** *Device installation and decommissioning* • Up to three vessels utilised at any one time for device deployment and retrieval operations. • Up to 20 deployment and 20 retrieval vessel movements in a 12-month period. • Vessel size - up to 164 m in length and 6.8 m draught • Potential use of DP vessels •	Maximum design scenario Maximum vessel traffic movements (five) and maximum vessel size *will* be associated with the greatest increase in anthropogenic noise, given sound source levels, thereby having the potential to have the greatest impact on marine mammals, basking shark and otter Most Likely design scenario The most likely number of vessels and most likely size of vessels transiting to and from each site, with most likely scenario of no pin piling required, will result in the most likely impact on marine mammals, basking shark and otter

Potential impact	Maximum design scenario	Most likely design scenario	Justification
Increased collision risk - vessels	**Warrior Way** • Up to 5 vessels utilised at any one time for deployment and retrieval operations • Up to 20 deployment and 20 retrieval vessel movements in a 12-month period, restricted to daylight hours, wherever possible. • Vessel size - up to 35 m in length and 6.8 m draught • No use of DP vessels **Dale Roads** • Up to five vessels utilised at any one time for deployment and retrieval operations. • Up to 20 deployment and 20 retrieval vessel movements in a 12-month period, restricted to daylight hours, wherever possible. • Vessel size - up to 164 m in length and 6.8 m draught **East Pickard Bay** *Device installation and decommissioning* • Up to five vessels utilised at any one time for device deployment and retrieval operations. • Up to 40 deployment and 40 retrieval vessel movements in a 12-month period, restricted to daylight hours, wherever possible. • Vessel size - up to 200 m in length and 8 m draught • Potential use of DP vessels	**Warrior Way** • Up to three vessels utilised at any one time for device deployment and retrieval operations. • Up to 20 deployment and 20 retrieval vessel movements in a 12-month period, restricted to daylight hours, wherever possible.. • Vessel size up to 30 m in length and 6.8 m draught • No use of DP vessels **Dale Roads** • Up to three vessels utilised at any one time for device deployment and retrieval operations. • Up to 20 deployment and 20 retrieval vessel movements in a 12-month period, restricted to daylight hours, wherever possible. • Vessel size - up to 164 m in length and 6.8 m draught **East Pickard Bay** *Device installation and decommissioning* • Up to three vessels utilised at any one time for device deployment and retrieval operations. • Up to 20 deployment and 20 retrieval vessel movements in a 12-month period. • Vessel size - up to 164 m in length and 6.8 m draught • Potential use of DP vessels	• Increased vessel traffic has been identified as presenting an increased risk to marine mammals through collision between a vessel and an animal and through potential collision of vessel propeller with an animal. <u>Maximum design scenario</u> Maximum vessel traffic movements (five) and maximum vessel size will have the potential to have the greatest impact on marine mammals, basking shark and otter at each site. <u>Most Likely design scenario</u> The most likely number of vessels and most likely size of vessels transiting to and from port will result in the most likely impact on marine mammals, basking shark and otter
Increases in suspended sediment concentration (SSC)	**Warrior Way** • Up to 5 vessels utilised at any one time for deployment and retrieval operations • Up to 20 deployment and 20 retrieval vessel movements in a 12-month period, restricted to daylight hours, wherever possible. • Up to four device deployments in a 12-month period. • Total maximum number of vessel movements over a 12-month period equals 40. • Up to 330 m^2 from a 5 m buffer around device footprint (200 m^2) for seabed clearance activities **Dale Roads** • Up to 5 vessels utilised at any one time for deployment and retrieval operations • Up to 20 deployment and 20 retrieval vessel movements in a 12-month period, restricted to daylight hours, wherever possible. • Up to two devices deployed in a 12-month period. • Total maximum number of vessel movements over a 12-month period equals 40. • Up to 510 m^2 from a 5 m buffer around device footprint for seabed clearance activities	**Warrior Way** • Up to three vessels utilised at any one time for device deployment and retrieval operations. • Up to 20 deployment and 20 retrieval vessel movements in a 12-month period, restricted to daylight hours, wherever possible. • Up to two device deployments in a 12-month period. • Total maximum number of vessel movements over a 12-month period equals 40. • No seabed clearance required **Dale Roads** • Up to three vessels utilised at any one time for device deployment and retrieval operations. • Up to 20 deployment and 20 retrieval vessel movements in a 12-month period, restricted to daylight hours, wherever possible. • Up to one device deployed in a 12-month period. • Total maximum number of vessel movements over a 12-month period equals 40. • No seabed clearance required **East Pickard Bay**	• Suspended sediments are likely to derive from the installation/positioning and retrieval of marine energy devices • Sediment disturbance may arise from a range of installation activities within the site, such as foundation installation and drilled pin pilling. Elevations in SSC and subsequent deposition of disturbed 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 structure(s) • Foundations used for marine energy devices may interrupt sediment transport pathways <u>Maximum design scenario</u> Maximum seabed area and number of devices disturbing fine sediment plus the maximum number of associated vessel movements will result in maximum increases in SSC, thereby having the potential to have the greatest impact on marine mammals, basking shark and otter <u>Most likely design scenario</u> Most likely seabed area and number of devices disturbing fine sediment, plus the most likely number of associated vessel movements will result in most likely increases in SSC, thereby resulting in the most likely impact on marine mammals, basking shark and otter

Potential impact	Maximum design scenario	Most likely design scenario	Justification
	East Pickard Bay • Up to five vessels utilised at any one time for device deployment and retrieval operations. • Up to 40 deployment and 40 retrieval vessel movements in a 12-month period, restricted to daylight hours, wherever possible • Up to two deployments per berth in a 12-month period therefore up to four moored or gravity base device deployments in a 12-month period, 50 % of which may touch the seabed. • Total maximum number of vessel movements over a 12-month period equals 80. • Up to 3,486 m^2 from a 10 m buffer around device footprint for seabed clearance activities; and • Up to 120,000 m^2 from mooring spread for deployment vessels for up to two test activities at any one time	• Up to three vessels utilised at any one time for device deployment and retrieval operations. • Up to 20 deployment and 20 retrieval vessel movements in a 12-month period. • Up to one device deployment within the test site in a 12-month period. • Total maximum number of vessel movements over a 12-month period equals 40. • Up to 70,000 m^2 of temporary disturbance at East Pickard Bay from mooring spread for deployment vessels per test activity	
Changes in fish and shellfish communities	• Up to 150 installation events occurring intermittently over the 15-year lifetime of the META project, 50 % of which may touch the seabed. – 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; – 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 – 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. • Combined (Warrior Way + Dale Roads + East Pickard Bay) total subtidal temporary habitat disturbance at any one time of up to 124,679 m^2 comprising: – Up to 480 m^2 of temporary disturbance at Warrior Way per testing scenario broken down as follows: ○ Up to 330 m^2 from a 5 m buffer around device footprint (200 m^2) for seabed clearance activities; and ○ Up to 150 m^2 from a single mooring spread for deployment vessels. – Up to 713 m^2 of temporary disturbance at Dale Roads per testing scenario broken down as follows: ○ Up to 513 m^2 from a 5 m buffer around device footprint (600 m^2) for seabed clearance activities; and ○ Up to 200 m^2 from a single mooring spread for deployment vessels. – Up to 123,486 m^2 of temporary disturbance at East Pickard Bay per testing scenario broken down as follows: ○ Up to 3,485 m^2 from a 10 m buffer around device footprint (8,000 m^2) for seabed clearance activities; and	• Up to 60 installation events occurring intermittently over the 15-year lifetime of the META project, 50 % of which may touch the seabed. – 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; – Dale Roads: up to one device deployments in a 12-month period (i.e. up to 15 deployments over the project lifetime), 50% of which may touch the seabed; and – East Pickard Bay: up to one device deployments in a 12-month period (i.e. up to 15 deployments over the project lifetime), 50% of which may touch the seabed. • Combined (Warrior Way + Dale Roads + East Pickard Bay) total subtidal temporary habitat disturbance at any one time of up to 124,679 m^2 comprising: – Up to 480 m^2 of temporary disturbance at Warrior Way per testing scenario broken down as follows: ○ Up to 330 m^2 from a 5 m buffer around device footprint (200 m^2) for seabed clearance activities; and ○ Up to 150 m^2 from a single mooring spread for deployment vessels. – Up to 713 m^2 of temporary disturbance at Dale Roads per testing scenario broken down as follows: ○ Up to 513 m^2 from a 5 m buffer around device footprint (600 m^2) for seabed clearance activities; and ○ Up to 200 m^2 from a single mooring spread for deployment vessels. – Up to 123,486 m^2 of temporary disturbance at East Pickard Bay per testing scenario broken down as follows: ○ Up to 3,485 m^2 from a 10 m buffer around device footprint (8,000 m^2) for seabed clearance activities; and ○ Up to 120,000 m^2 from mooring spread for deployment vessels for up to two test activities at any one time.	• The introduction of hard structures, such as marine energy devices, gravity base, and rock ballasting, have the potential to result in temporary habitat loss, disturbance to habitat or creation of habitat. The structures will be placed directly on the seafloor, resulting in potential changes to fish and shellfish supporting habitat. Hard structures also represent a novel substrate for pioneer species to recruit to. This can result in new species communities forming, representing a potential positive effect on fish and shellfish by providing potential new supporting habitat. • 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 installation phase. <u>Maximum design scenario</u> • The maximum design scenario assumes that the footprint beneath the device/component is considered as habitat change for the duration of the deployment. • The maximum design scenario assumes the greatest habitat change 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 (site 6). • Rock ballasting may be required for scour protection/moorings of devices at East Pickard Bay (site 8) 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. <u>Most likely design scenario</u> • The maximum design scenario assumes that the footprint beneath the device/component on the seabed is considered as habitat change for the duration of the deployment. • The most likely design scenario assumes that gravity bases may be required at Dale Roads (site 7) and East Pickard Bay (site 8), but not at Warrior Way (devices to be deployed from vessel or attached to test support buoy).

Potential impact	Maximum design scenario	Most likely design scenario	Justification
	○ Up to 120,000 m^2 from mooring spread for deployment vessels for up to two test activities at any one time. • A total of up to 160 test installation and removal vessel movements (which may involve anchoring) in a 12-month period broken down as follows: – up to 20 installation and 20 retrieval vessel movements in a 12-month period at Warrior Way (site 6) and Dale Roads (site 7). • Up to 40 installation and 40 retrieval vessel movements in a 12-month period at East Pickard Bay (site 8).	• A total of up to 120 test installation and removal vessel movements (which may involve anchoring) in a 12-month period broken down as follows: – up to 20 installation and 20 retrieval vessel movements in a 12-month period at Warrior Way (site 6) Dale Roads (site 7) and East Pickard Bay (site 8). •	
Accidental Pollution	• A total of up to 160 test installation and removal vessel movements (which may involve anchoring) in a 12-month period broken down as follows: – Up to 20 installation and 20 retrieval vessel movements in a 12-month period at Warrior Way (site 6) and Dale Roads (site 7). – Up to 40 installation and 40 retrieval vessel movements in a 12-month period at East Pickard Bay (site 8).	• A total of up to 120 test installation and removal vessel movements (which may involve anchoring) in a 12-month period broken down as follows: – up to 20 installation and 20 retrieval vessel movements at each site in a 12-month period.	• There is a risk of accidental pollution from vessel spills <u>Maximum design scenario</u> Maximum number of vessels and vessel movements has the potential to cause greatest impact on marine mammals, basking shark and otter <u>Most likely design scenario</u> Maximum number of vessels and vessel movements will result in most likely impact on marine mammals, basking shark and otter
Operation and maintenance phase			
Increased anthropogenic underwater noise - vessels	**Warrior Way** • Up to four device deployments in a 12-month period. • Up to one device deployed at any one time. • Up to 104 vessel visits within a 12-month period associated with up to four device deployments. • Vessel size - up to 35 m in length and 6.8 m draught • No use of DP vessels • Source sound pressure level at 1 m = 183 dB re 1 μPa (rms) / 232 SEL (24h) dB re 1 $\mu Pa^2 s$ **Dale Roads** • Up to two devices deployed in a 12-month period • Up to one device deployed at any one time • Up to 104 vessel visits associated with up to two device tests in a 12-month period. • Vessel size - up to 164 m in length and 6.8 m draught • Source sound pressure level at 1 m = 183 dB re 1 μPa (rms) / 232 SEL (24h) dB re 1 $\mu Pa^2 s$ **East Pickard Bay** • Up to four device deployments in a 12-month period • Up to two devices deployed at any one time	**Warrior Way** • Up to two device deployments in a 12-month period. • Up to one device deployed at any one time. • Up to 52 vessel visits within a 12-month period associated with up to two device deployments • Vessel size up to 30 m in length and 6.8 m draught • No use of DP vessels • Source sound pressure level at 1 m = 172 dB re 1 μPa (rms) / 221 SEL (24h) dB re 1 $\mu Pa^2 s$ **Dale Roads** • Up to one device deployed in a 12-month period • Up to one device deployed at any one time • Up to 52 vessel visits associated with up to one device tests in a 12-month period. • Vessel size - up to 164 m in length and 6.8 m draught • Source sound pressure level at 1 m = 183 dB re 1 μPa (rms) / 232 SEL (24h) dB re 1 $\mu Pa^2 s$ **East Pickard Bay** • Up to one device deployed in a 12-month period • Up to 104 O&M visits in a 12-month period.	<u>Maximum design scenario</u> Maximum vessel traffic movements (five) and maximum vessel size will be associated with the greatest increase in anthropogenic noise, thereby having the potential to have the greatest impact on marine mammals, basking shark and otter <u>Most Likely design scenario</u> The most likely number of vessels and most likely size of vessels transiting to and from port will result in the most likely impact on marine mammals, basking shark and otter

Potential impact	Maximum design scenario	Most likely design scenario	Justification
	• Up to 150 O&M visits associated with up to four device deployments. • Vessel size - up to 200 m in length and 8 m draught • Source sound pressure level at 1 m = 183 dB re 1 µPa (rms) / 232 SEL (24h) dB re 1 µPa²s	• Vessel size - up to 164 m in length and 6.8 m draught • Source sound pressure level at 1 m = 183 dB re 1 µPa (rms) / 232 SEL (24h) dB re 1 µPa²s	
Increased anthropogenic underwater noise – operation of tidal turbines	• Tidal device testing will only be supported at Warrior Way (site 6). • Tidal components may occupy all or part of the water-column. A minimum clearance of 2 m will be maintained between turbine blade tips and the surface of the water. • • Up to 20 m width and 10 m length. • Rotor diameter up to 5 m. with a tip speed of up to 5 m/s and a swept area of 19.63 m² • Maximum duration of device testing: up to 6 months	• Tidal device testing will only be supported at Warrior Way (site 6). • Tidal components may occupy all or part of the water-column. A minimum clearance of 2 m will be maintained between turbine blade tips and the surface of the water. • Up to 5 m width and 5 m length. • Rotor diameter up to 5 m, with a tip speed of up to 2 m/s and a swept area of 19.63 m² • Maximum duration of device testing: up to 3 months	Maximum design scenario Likely to be represented by the largest scale tidal device with the largest swept area and the maximum speed, as this is likely to lead to the greatest increase in underwater noise. Most Likely design scenario Likely to be represented by the most likely scale tidal device with the most likely swept area and the most likely speed, as this is likely to lead to a reduced increase in underwater noise.
Increased collisions risk with vessels	• As above for increased anthropogenic underwater noise – vessels	• As above for increased anthropogenic underwater noise – vessels	• Increased vessel traffic has been identified as presenting an increased risk to marine mammals through collision between a vessel and an animal and through potential collision of vessel propeller with an animal Maximum design scenario Maximum vessel traffic movements (five) and maximum vessel size will have the potential to have the greatest impact on marine mammals, basking shark and otter Most Likely design scenario The most likely number of vessels and most likely size of vessels transiting to and from port will result in the most likely impact on marine mammals , basking shark and otter
Collision risk – tidal turbines	• Tidal testing will only be supported at Warrior Way (site 6) • Tidal components may occupy all or part of the water-column however a minimum clearance of 2 m will be maintained between turbine blade tips and the surface of the water. • Rotor diameter up to 5 m with a tip speed of up to 5 m/s and a swept area of 19.63 m² • One device at any one time • Up to four device deployments in a 12-month period	• Tidal testing will only be supported at Warrior Way (site 6). • Tidal components may occupy all or part of the water-column however a minimum clearance of 2 m will be maintained between turbine blade tips and the surface of the water. • Rotor diameter up to 5 m with a tip speed of up to 2 m/s and a swept area of 19.63 m² • One device at any one time • Up to two device deployments in a 12-month period	• There is a risk of collision between a moving turbine blade and a marine mammal, which could cause injury Maximum design scenario Maximum size and speed of rotor blades has the potential to cause greatest impact on marine mammals, basking shark and otter Most likely design scenario Most likely size and speed of rotor blades will result in most likely impact on marine mammals, basking shark and otter
Changes in hydrodynamic regime	• As per 'Collision risk – tidal turbines'	• As per 'Collision risk – tidal turbines'	Maximum design scenario Likely to be represented by the largest scale tidal device with the largest swept area as this is likely to result in the greatest changes in hydrodynamic regime.

Potential impact	Maximum design scenario	Most likely design scenario	Justification
			Most Likely design scenario Likely to be represented by the most likely scale tidal device with the most likely swept area as this is likely to result in reduced changes in hydrodynamic regime.
Changes in fish and shellfish communities	• Combined (Warrior Way + Dale Roads + East Pickard Bay) total subtidal habitat loss of up to 11,050 m^2 at any one time comprising: – Up to 200 m^2 of habitat loss at Warrior Way per testing scenario broken down as follows: ○ Up to 200 m^2 from device or component footprint on the seabed (including mooring/pin pile footprint). – Up to 600 m^2 of long-term habitat loss at Dale Roads per testing scenario broken down as follows: ○ Up to 600 m^2 from device or component footprint on the seabed (including mooring/pin pile footprint) – Up to 10,250 m^2 of habitat loss at East Pickard Bay broken down as follows: ○ Up to 10,250 m^2 from up to two device or component footprints on the seabed (including mooring/pin pile footprint). • Deployment durations: – Moored/gravity base deployment duration at Warrior Way: up to 6 months; – Moored/gravity base deployment duration at Dale Roads: up to 12 months; and – Moored/gravity base deployment duration at East Pickard Bay: up to 18 months.	• Combined (Warrior Way + Dale Roads + East Pickard Bay) total subtidal habitat loss of up to 2,000 m^2 at any one time comprising: – Up to 100 m^2 of habitat loss at Warrior Way per testing scenario from device or component footprint on the seabed; – Up to 200 m^2 of habitat loss at Dale Roads per testing scenario from device or component footprint on the seabed; – Up to 1,700 m^2 of habitat loss at East Pickard Bay per testing scenario from device or component footprint on the seabed. • Deployment durations: – Moored/gravity base deployment duration at Warrior Way: up to 3 months; – Moored/gravity base deployment duration at Dale Roads: up to 6 months; and – Moored/gravity base deployment duration at East Pickard Bay: up to 6 months.	Maximum design scenario The longest consented length for a structure to be in the marine environment at each site will represent the maximum period of time that could lead to changes in fish and shellfish communities. Most Likely design scenario The duration of a structure in the marine environment will represent the most likely changes in fish and shellfish communities. • 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.
Entanglement risk	**Warrior Way** • Mooring/attachment method - Up to 4 drag anchors with associated slack lines, catenary mooring system. • One device deployment at any one time • Up to four device deployments in a 12-month period **Dale Roads** • Up to 10 drag anchors with associated slack lines, catenary mooring system. • One device deployment at any one time • Up to two device deployments in a 12-month period **East Pickard Bay** • Mooring/attachment method - Up to 10 drag anchors with associated slack lines, catenary mooring system • Up to two device deployments at any one time • Up to four device deployments in a 12-month period	**Warrior Way** • Mooring/attachment method - deployed from vessel or attached to test support buoys • One device deployment at any one time • Up to two device deployments in a 12-month period **Dale Roads** • Mooring/attachment method - dynamic tether mooring system or up to 4-standard drag embedment anchors. • One device deployment at any one time • Up to one device deployment in a 12-month period **East Pickard Bay** • Mooring/attachment method - dynamic tether mooring system or up to 4-standard drag embedment anchors. • One device deployment at any one time • Up to one device deployment in a 12-month period	• Entanglement risk due to the presence of mooring lines is recognised as a risk to marine mammals Maximum design scenario Maximum number of slack lines associated with mooring of deployments will result in maximum likelihood of risk of entanglement, thereby having the potential to have the greatest impact on marine mammals, basking shark and otter Most likely design scenario Most number of slack lines associated with mooring of deployments will result in most likely risk of entanglement, thereby resulting in the most likely impact on marine mammals, basking shark and otter

Potential impact	Maximum design scenario	Most likely design scenario	Justification
Accidental Pollution	• Physical presence of single devices or components at the Warrior Way (site 6) and Dale Roads (sit 7) sites and up to two devices or components at the East Pickard Bay site (site 8). • A total of up to 358 vessel movements/round trips to port, involving up to 15 vessels, associated with test deployments per year comprising: – 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; – 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 – 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.	• Physical presence of single devices or components at the Warrior Way, Dale Roads and East Pickard Bay sites. • A total of up to 208 vessel movements/round trips to port, involving up to 15 vessels, associated with test deployments per year comprising: – 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; – 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 – 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.	• There is a risk of accidental pollution from vessel spills Maximum design scenario Maximum number of vessels and vessel movements has the potential to cause greatest impact on marine mammals, basking shark and otter Most likely design scenario Maximum number of vessels and vessel movements will result in most likely impact on marine mammals, basking shark and otter

Table 9.9: Impacts scoped out of the assessment for marine mammals, basking shark and otter.

Potential impact	Justification
Electro-magnetic Field (EMF) during operation and maintenance phase	There is no marine cabling associated with the META Project Description (chapter 2), therefore there is no potential for EMF from META project activities. Should device-specific deployments have marine cabling requirements, these will be assessed on a device-specific basis.

9.9 Impact assessment methodology

9.9.1 Overview

9.9.1.1 The marine mammal EIA has followed the methodology set out in chapter 4: Environmental Impact Assessment Methodology. Specific to the marine mammal, basking shark and otter EIA, the following guidance documents have also been considered:

- Consenting, EIA and HRA Guidance for Marine Renewable Energy Developments in Scotland. Part Four – Wave and Tidal Annex (EMEC and Xodus, 2010);
- IEEM guidelines for marine ecological impact assessment (IEEM, 2010);
- MarLIN species and ecosystem sensitivities guidelines (Tyler-Walters *et al*., 2001);
- Environmental Impact Assessment (EIA): Guidance for developers at the European Marine Energy Centre (EMEC Orkney, 2010); and
- Towards best environmental practice for cetacean conservation in developing Scotland's marine renewable energy (Dolmans, S and M. Simmonds (2010).

9.9.1.2 In addition, the marine mammal EIA has considered the legislative framework as defined by:

- EC Habitats Directive 92/43/EEC;
- Wildlife and Countryside Act 1981;
- Marine and Coastal Access Act, 2009;
- Conservation (Natural Habitats, &c.) Regulations 1994 (as amended);
- Bern Convention; and
- The Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention).

9.9.2 Impact assessment criteria

Sensitivity

9.9.2.1 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 used in the Design Manual for Roads and Bridges methodology, which are described in further detail in chapter 4: Environmental Assessment Methodology.

9.9.2.2 The criteria for defining sensitivity in this chapter are outlined in Table 9.10.

9.9.2.3 The sensitivity of marine mammal, basking shark and otter VERs has been determined by an assessment of the combined vulnerability of the receptor to a given impact, and the likely rate of recoverability to pre-impact conditions. Vulnerability is defined as the susceptibility of a species to disturbance, damage or death, from a specific external factor. Recoverability is the ability of the same species to return to a state close to that which existed before the activity or event which caused change. It is dependent on its ability to recover or recruit subject to the extent of disturbance/damage incurred. Information on these aspects of sensitivity of the marine mammal VERs to given impacts has been informed by the best available evidence. These assessments have been combined with the assessed status (i.e. the level of designation/importance resulting in a valuation) of the affected receptor as presented in Table 9.6. The overall sensitivity of a receptor/receptor group to an impact has been identified from a five-point scale as presented in Table 9.10.

Table 9.10: Definition of terms relating to the sensitivity of the receptor.

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

Magnitude

9.9.2.4 The criteria for defining magnitude in this chapter are outlined in Table 9.11.

Table 9.11: 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 (positive).
Moderate	Loss of resource, but not adversely affecting integrity of resource; partial loss of/damage to key characteristics, features or elements (adverse).

Magnitude of impact	Definition
	Benefit to, or addition of, key characteristics, features or elements; improvement of attribute quality (positive).
Minor	Some measurable change in attributes, quality or vulnerability, minor loss of, 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 adverse impact occurring (positive).
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 (positive).
No change	No change from baseline conditions.

Significance

9.9.2.5 The significance of the effect upon marine mammals, basking shark and otter 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 9.12. Where a range of significance of effect is presented in Table 9.12. 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 9.12: Matrix used for the assessment of the significance of the effect.

Sensitivity of receptor	Magnitude of impact: No change	Negligible	Minor	Moderate	Major
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

9.9.3 Designated sites

9.9.3.1 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 9.6.2 of this chapter (with the assessment on the site itself deferred to the HRA Report for the META project).

9.9.3.2 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 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 regional marine mammal, basking shark and otter study area, an assessment of the impacts on the overall site is made in this chapter using the EIA methodology.

9.9.3.3 The META 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 consent and licence applications for the META project.

9.10 Measures adopted as part of the META project

9.10.1.1 As part of the project design process, a number of designed-in measures have been proposed to reduce the potential for impacts on marine mammals, basking shark and otter (see Table 9.13). 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 9.11 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.

9.10.1.2 It should be noted that the principles of the JNCC guidance on protection of marine European protected species from injury and disturbance (JNCC, 2010) and of relevant guidelines on minimising the risk of injury to marine mammals will be adopted as necessary (for example, reducing the duration of noise emitting activities).

Table 9.13: Designed-in measures adopted as part of the META project.

Measures adopted as part of the META project	Justification
An Ecological 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 Maritime and Coastguard Agency (MCA)).	Measures will be adopted to ensure that the potential for release of pollutants from installation, operation and maintenance, and decommissioning phases 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.

Measures adopted as part of the META project	Justification
An Environmental Mitigation and Monitoring Plan (EMMP) will also be produced. The EMMP will outline the post consent monitoring requirements and mitigation measures for marine renewable devices at the META project. The EMMP will detail different monitoring and mitigation requirements for each generic device type to be deployed.	Measures will be adopted to ensure that the potential for any adverse impacts to environmental receptors are prevented, based on the assessment of significance made in section 9.11

9.11 Assessment of significance

9.11.1.1 The potential impacts of the installation, operation and maintenance, and decommissioning phases of the META project have been assessed on marine mammals, basking sharks and otters. The potential impacts arising are listed in Table 9.8, along with the maximum and most likely design scenarios against which each potential impact has been assessed. It has not been possible to make a conclusion for each META project site individually, as no significant differences between marine mammals, basking shark and otter ecology were identified between META project sites.

9.11.2 Installation phase

Increased anthropogenic underwater noise – installation activities

9.11.2.1 Marine mammals, particularly cetaceans, are capable of generating and detecting sound (Au *et al., 1974;* Bailey *et al.,* 2010) and are dependent on sound for many aspects of their lives, i.e. prey-identification; predator avoidance; communication and navigation. Increases in anthropogenic noise may consequently pose a risk within the marine environment (Parsons *et al.,* 2008; Bailey *et al.,* 2010).

9.11.2.2 The impact of exposure to anthropogenic sound on marine mammals, particularly cetaceans has been well documented, and effects may include physical damage, disorientation and impact on navigation; communication masking; and reduced ability to locate prey.

9.11.2.3 It is now recognised that some of the more ubiquitous noise sources, such as ships, can either individually or cumulatively mask communication signals of, and pose a threat to marine mammals (Clark *et al.,* 2009; Ellison *et al.,* 2011; Chen *et al.,* 2017; Simpson *et al.,* 2016, Rolland *et al.,* 2012). The overall increase in oceanic background noise can alter acoustic habitats over large regions in ways which may be detrimental to marine animals that rely on sound for basic life functions (Ellison *et al.,* 2011). It is now emerging that non-injurious effects can accumulate at the population level (Williams *et al.,* 2015).

9.11.2.4 Marine mammals may be grouped according to the peak frequencies of their hearing and vocalising ranges, further information for which may be found in chapter 6: Underwater Noise. These groupings are as follows:

- **Low frequency (LF)** (such as minke whale, with an estimated functional hearing range between 7 Hz and 35 kHz);
- **Mid-frequency (MF) cetaceans** (such as bottlenose dolphin, short-beaked common dolphin, Risso's dolphin, with an estimated functional hearing range between 150 Hz and 160 kHz);
- **High frequency (HF) cetaceans** (such as harbour porpoise, with an estimated functional hearing range between 275 Hz and 160 kHz);
- **Phocid pinnipeds (PW)** (true seals such as grey seal, with an estimated functional hearing range between 50 Hz and 86 kHz); and

9.11.2.5 The effects of underwater noise on elasmobranchs is not well understood, however it is expected that noise produced by vessels is likely to mask the detection of biologically relevant sounds (Casper et al., 2012). The effects of underwater noise on otters is also not well understood, and no hearing data is available for otters. Since the acuity of otters is significantly less that than for marine mammals however, masking of biologically relevant sounds is not expected to occur (Ghoul and Reichmuth, 2014).

9.11.2.6 Richardson and Thompson (1985) defined four zones of noise influence which vary with distance from the source and level:

- Injury/hearing loss;
- Responsiveness;
- Masking; and
- Audibility.

9.11.2.7 Behavioural responses of marine mammals are highly variable, which makes it extremely difficult to predict likely responses to underwater noise and therefore impact assessments only predict the likelihood of responses to underwater noise. JNCC (2010) define disturbance in terms of animals incurring a sustained or chronic disruption of behaviour or undergoing a significant change from their expected distribution.

9.11.2.8 This assessment adopts a conservative approach to behavioural response thresholds and uses NMFS (2005) Level B harassment threshold of 120 dB re 1 μPa (root-mean squared (rms)) for continuous (non-impulsive) sound (vessel noise) for all marine mammal auditory frequency groups (see Table 9.14 and chapter 6 – Underwater Noise). Level B harassment is defined as:

"having the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of behavioural patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering but which does not have the potential to injure a marine mammal or marine mammal stock in the wild" (NMFS, 2005).

9.11.2.9 The relevant criteria for marine mammals are summarised in Table 9.14. This includes the thresholds for non-impulsive sound based on the relevant guidelines (NMFS 2018, NMFS 2005). In Table 9.14 the Sound Exposure Levels (SEL) are expressed as dB re 1 μPa2s and RMS sound pressure levels are in dB re 1 μPa (rms).

Table 9.14: Summary of acoustic thresholds for marine mammals for non-impulsive sound.

Hearing group	Parameter	PTS	TTS	Disturbance
Low-frequency (LF) cetaceans	SEL, LF weighted dB re 1 μPa²s	199	179	-
	RMS_{T90} dB re 1 μPa (rms)	-	-	120
Mid-frequency (MF) cetaceans	SEL, MF weighted dB re 1 μPa²s	198	178	-
	RMS_{T90} dB re 1 μPa (rms)	-	-	120
High-frequency (HF) cetaceans	SEL, HF weighted dB re 1 μPa²s	173	153	-
	RMS_{T90} dB re 1 μPa (rms)	-	-	120
Phocid pinnipeds (PW)	SEL, PW weighted dB re 1 μPa²s	201	181	-
	RMS_{T90} dB re 1 μPa (rms)	-	-	120
	RMS_{T90} dB re 1 μPa (rms)	-	-	120

Magnitude of impact

9.11.2.10 There is potential for installation vessels, drilled piling and other equipment to produce noise during installation of marine energy devices.

9.11.2.11 According to the Navigational Risk Assessment, baseline levels of vessel traffic (AIS derived vessel density, recorded in 2018) in the local marine mammal, basking shark and otter study area are as follows:

- Warrior Way (site 6) – Density Grids = 10 – 20 (all vessels);
- Dale Roads (site 7) – Density Grids (Wales marine planning portal) = 1 – 10 (all vessels); and
- East Pickard Bay (site 8) — Density Grids (Wales marine planning portal) = 1 – 10 (all vessels).

9.11.2.12 According to Wales Marine Planning Portal, baseline levels of vessel traffic in the local marine mammal, basking shark and otter study area are as follows:

- Warrior Way (site 6) – Density Grids = 25 – 50 (all vessels);
- Dale Roads (site 7) – Density Grids = 10 – 25 (all vessels); and
- East Pickard Bay (site 8) — Density Grids = 5 – 10.

Warrior Way (site 6)

9.11.2.13 The installation phase of the META project at Warrior Way (site 6) requires up to five vessels to be involved in the deployment and retrieval of devices. Up to 20 test deployment vessel operations and 20 test retrieval vessel operations in a 12-month period will be required (in total up to 40 per year). The maximum size of vessels used at Warrior Way (site 6) may be up to 35 m in length with up to 6.8 m draught. The most likely vessel size is up to 30 m length and 6.8 m (source sound pressure level at 1 m = 172 dB re 1 μPa (rms) / 221 SEL (24h) dB re 1 μPa²s).

Dale Roads (site 7)

9.11.2.14 The installation phase of the META project at Dale Roads (site 7) may require up to five vessels to be involved at any one time for deployment and retrieval operations. Up to 20 test deployment vessel operations and 20 test retrieval vessel operations in a 12-month period will be required (in total up to 40 per year), restricted to daylight hours, wherever possible. The maximum size of vessels at Dale Roads (site 7) is is up to 164 m length and 6.8 m draught (source sound pressure level at 1 m = 183 dB re 1 μPa (rms) / 232 SEL (24h) dB re 1 μPa²s if operating on dynamic positioning).

East Pickard Bay (site 8)

9.11.2.15 The installation phase of the META project device installation and decommissioning at East Pickard Bay (site 8) may require up to five vessels to be involved at any one time for deployment and retrieval operations. Up to 40 test deployment vessel operations and 40 test retrieval vessel operations in a 12-month period will be required (in total up to 80 per year), restricted to daylight hours, wherever possible. The maximum size of vessels at East Pickard Bay (site 8) is 200 m length and 8 m draught (source sound pressure level at 1 m = 183 dB re 1 μPa (rms) / 232 SEL (24h) dB re 1 μPa²s if operating on dynamic positioning).

9.11.2.16 The noise emissions from the types of vessels that may be used in the META project are quantified in Table 9.15, along with pin pile drilling noise emissions (relevant to Dale Roads (site 7) and East Pickard Bay (site 8), based on a review of publicly available data (see chapter 6: Underwater Noise).

Table 9.15: Source noise data for installation vessels.

Item	Description/assumptions	Data source	Source sound pressure level at 1 m	
			Rms, dB re 1 μPa	SEL(24h), dB re 1 μPa²s
Anchor handling vessel	Tug used as proxy	Richardson (1995)	172	221
Installation / construction vessel (using DP)	DP drilling rig used as proxy	McCauley (1998)	183	232
Support vessel / tug	Tug used as proxy	Richardson (1995)	172	221
Pin pile drilling	Pile drilling for Oyster 800 project	Kongsberg (2011)	163	212

9.11.2.17 For pin pile drilling, noise will be transmitted into the water through the interface between the bedrock and drill bit directly via ground borne noise, and also directly from the drill bit into the water. Source noise levels have been based on noise measurements undertaken during drilling activities for the Oyster 800 project at the EMEC test site at Billia Croo, Orkney (Kongsberg, 2011). On the basis that the expected sound pressures levels of drilled piling (which are lower than expected from miscellaneous small vessels, see Table 9.15) an assessment of potential impacts from noise from pin pile drilling has not been carried out.

9.11.2.18 As stated in chapter 6: Underwater Noise, it is important to understand that baseline noise levels will vary significantly depending on, amongst other factors, seasonal variations and different sea states, meaning that the usefulness of establishing baseline noise levels can be limited. Nevertheless, it can be useful (when undertaking an assessment of underwater noise impacts on ecological receptors), to have an understanding of the range of noise levels likely to be prevailing in the area so that any noise predictions can be placed in the context of the baseline. It is important to note however, that even if an accurate baseline noise level could be determined, there is a paucity of scientific understanding regarding how various receptor species distinguish anthropogenic sound relative to masking noise.

9.11.2.19 Baseline noise measurements were not undertaken for this project. In place of this, a review of baseline noise studies carried out in UK waters for other similar projects was carried out in order to determine the likely magnitude of noise encountered. A review of noise data relating to other marine energy sites in UK waters was undertaken for the Beatrice Wind Farm including a review of baseline underwater noise measurements in UK coastal waters (Brooker *et al.,* 2012). These noise data are summarised in Table 9.16.

Table 9.16: Summary of average background levels of noise around the UK coast (Brooker *et al.*, 2012)

	Overall (Un-Weighted) Average Background Noise Levels, dB re 1 µPa (rms)	
	Sea State 1	Sea State 3
Minimum	92	94
Maximum	126	132
Mean	111	112

9.11.2.20 An assessment of the distance to the potential onset of injury from each vessel category is presented in Table 9.17 based on the SEL cumulative exposure criterion. As noted previously, the potential radii for injury are based on exposure levels over a 24-hour period. Thus, for example, a seal would need to stay within 7 m of support vessel operation for a period of 24 hours to experience any injury. This is considered to be an unrealistically pessimistic scenario and therefore it is not thought likely that any marine mammals will be injured as a result of installation activities. Table 9.17 also presents the potential radius of disturbance for marine mammals based on the conservative 120 dB re 1 µPa (rms) criterion. It is important to bear in mind when viewing these potential disturbance radii that the 120 dB re 1 µPa (rms) criterion is very precautionary and that ambient noise levels could well exceed this value, particularly during periods with high tidal flow.

Table 9.17: Calculated effects of continuous vessel / installation noise

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	
Anchor handling vessel	20 m	2 m	46 m	7 m	2 km
Installation / construction vessel (using DP)	88 m	0 m	3 m	8 m	12 km
Support vessel / tug	20 m	2 m	46 m	7 m	2 km
Pin pile drilling	5 m	2 m	45 m	3 m	0.5 km

9.11.2.21 In Low Frequency (LF) cetaceans (minke whale VER), a conservative assessment estimates that animals may be exposed to underwater noise that has the potential to result in the onset of injury (installation phase vessel movement) up to (maximum scenario) 88 m from the vessel (DP vessel). It is more likely that low frequency cetaceans may be exposed to underwater noise up to 20 m (support vessel/tug) from the sound source.

9.11.2.22 In Medium Frequency (MF) cetaceans (Risso's dolphin VER, bottlenose dolphin VER, short-beaked common dolphin VER), a conservative assessment estimates that animals may be exposed to underwater noise that has the potential to result in the onset of injury (installation phase vessel movement) up to two metres from the vessel (support vessel/tug).

9.11.2.23 In High Frequency (HF) cetaceans (harbour porpoise VER), a conservative assessment estimates that animals may be exposed to underwater noise that has the potential to result in the onset of injury (installation phase vessel movement) up to 46 m from the sound source (anchor handling vessel or support vessel).

9.11.2.24 In pinnipeds in water (grey seal VER), a conservative assessment estimates that animals may be exposed to underwater noise that has the potential to result in the onset of injury (installation phase vessel movement) up to 8 m from the sounds source (DP vessel).

9.11.2.25 No assessment has been undertaken for basking sharks or otters, as information required to estimate disturbance distance is currently unavailable.

9.11.2.26 For all cetacean species groups, the maximum radius of potential disturbance is 12 km (DP vessel), and the most likely is 2 km (support vessel).

9.11.2.27 Baseline vessel activity at the three META sites (see 9.11.2.10 *et seq.*) is likely to be very similar during the installation phase, therefore increases in underwater noise through increased vessel movement associated with the installation phase of the META project is unlikely to differ significantly at the three sites. Whilst the most likely size of vessels at Warrior Way is up to 30 m with a 6.8 m draught, the impact assessment will be carried out on the maximum likely vessel size of up to 35 m length with a 6.8 m draught (in comparison to a maximum vessel size of 164 m and 6.8 m draught at Dale Roads (site 7) and 200 m length with an 8 m draught at East Pickard Bay (site 8)); all zones of potential impact are small. Vessels involved in the installation of devices at all three sites are likely to be present within the local study area for a matter of days at any one time therefore potential impacts will be of a short-term duration.

Cetacean VERs

9.11.2.28 Low numbers of both harbour porpoise and common dolphin are likely to occur on the south edge of the marine mammal study area (see Figure 9.5). Although sightings data for bottlenose dolphin, Risso's dolphin and minke whale suggest animals may be present in very small numbers within the local marine mammal, basking shark and otter study area (Figure 9.5), a precautionary approach would be to assume that individuals have the potential to enter the local marine mammal, basking shark and otter study area. However, considering the potential zone of the impact (injury) is very small, and the local/regional density estimates for all cetacean species are very low (9.7.2), few animals are expected to enter the zones of impact (ZOI).

9.11.2.29 Though the potential range for disturbance of cetaceans VERs is higher (0.5 - 2 km, Table 9.17), the likelihood of an animal entering the ZOI is very low. Duration of individual vessel movements is predicted to be short-duration but long-term when considered over the period (15 years) of the META project.

9.11.2.30 The potential impact for all cetacean VERs is predicted to be of local spatial extent, long-term duration, but intermittent (short-term individual vessel movements) and reversible. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be minor (adverse).

Grey Seal VER

9.11.2.31 Whilst grey seals are likely to be observed in the local marine mammal, basking shark and otter study area (see Figure 9.10), and this population is deemed important in the scale of the MU, the number of animals are relatively low in the local marine mammal, basking shark and otter study area when compared to the regional marine mammal, basking shark and otter study area (see 9.7.3). Grey seals are only likely to be disturbed up to 2 km from each of the three META sites (Table 9.17), which falls more than 10 km outside known grey seal haul out sites, therefore limited numbers of animals are expected to be foraging within potential disturbance ranges (see 9.7.3).

9.11.2.32 In addition, given that seals are not thought to communicate underwater, the impact will not mask communication and any disturbance impact which does occur will individually be of short duration, but long-term when considered over the period (15 years) of the META project.

9.11.2.33 The potential impact for grey seal VER is predicted to be of local spatial extent, long-term duration, but intermittent (short-term vessel movements) and reversible. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be minor (adverse).

Basking shark VER

9.11.2.34 Although there are no records of basking sharks within the local marine mammal, basking shark and otter study area, a precautionary approach would be to assume that individuals have the potential to enter the local marine mammal, basking shark and otter study area. However, considering the regional marine mammal, basking shark and otter study area is unlikely to support high densities of basking shark, even during summer months (see 9.7.4), few animals are expected to enter the zones of impact and thus, few, if any, will be negatively impacted.

9.11.2.35 The potential impact for all basking shark VER is predicted to be of local spatial extent, long-term duration, but intermittent (short-term vessel movements) and reversible. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be minor (adverse).

Otter VER

9.11.2.36 Although otters utilise the coastline of the local study area, based on lack of receptor-pathway (see section 9.11.2.51) it is expected that no animals will be negatively affected by this impact.

9.11.2.37 The potential impact for all otter VERs is predicted to be of local spatial extent, short term duration, intermittent and reversible. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be minor (adverse).

Sensitivity of the receptor

Cetacean VERs

9.11.2.38 Odontocete species such as common dolphins may exhibit behavioural response to vessel noise, however given that the Waterway hosts a high number of vessels year round (see 9.11.2.10), it is highly likely that habituation of all animals which enter the Waterway has occurred (Nowacek *et al.,* 2007). Marine mammals can both be attracted to, and avoid, vessels. Harbour porpoise are particularly sensitive to high frequency noise and are more likely to avoid vessels (Heinanen and Skov, 2015). Other species such as common dolphin are regularly sighted near vessels and may also approach vessels (e.g. bow-riding). However, dolphins are also known to show aversion behaviours to vessel presence, including increased swimming speed, avoidance, increased group cohesion and longer dive duration (Miller *et al.,* 2008). Sensitivity to vessel noise is most likely related to the marine mammal activity at the time of disturbance (ICW, 2006, Senior *et al*., 2008). For example, resting dolphins are likely to avoid vessels, foraging dolphins will ignore them and socialising dolphins may approach vessels (Richardson *et al*., 1995).

9.11.2.39 Based on information provided in chapter 6: Underwater Noise, the disturbance ranges of cetaceans and pinnipeds at all three sites is up to 2 km (Table 9.17). The potential zones of injury for vessel activities likely to be involved in this project, given in Table 9.17, range from 2 m to 50 m, however this assumes that animals would remain within these ranges continuously for 24 hours, and as such it is highly likely that animals would be disturbed, resulting in them moving away from the noise impact.

9.11.2.40 The harbour porpoise 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.

9.11.2.41 The bottlenose dolphin 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.

9.11.2.42 The common dolphin VER is deemed to be of low vulnerability, high recoverability and high value. The sensitivity of the receptor is therefore, considered to be low.

9.11.2.43 The Risso's dolphin VER is deemed to be of low vulnerability, high recoverability and high value. The sensitivity of the receptor is therefore, considered to be low.

9.11.2.44 The minke whale VER is deemed to be of low vulnerability, high recoverability and high value. The sensitivity of the receptor is therefore, considered to be low.

Grey seal VER

9.11.2.45 Whilst pinnipeds do not critically rely on hearing to survive, they are highly vocally active under water and can use sounds passively to forage (Chen *et al.,* 2017). Their repertoires extend across a wide range of frequencies, usually from 0.1 kHz to 3 kHz, but upsweeps can go up to 4.7 kHz (Chen *et al.,* 2017). Their hearing ranges from very low frequencies (~ 100 Hz) to high frequencies (~ 30 kHz) and it is therefore likely that shipping noise is within the hearing range of grey seals (Chen *et al.,* 2017).

9.11.2.46 Grey seals are likely to exhibit avoidance behaviour in response to vessel noise (Anderwald *et al.,* 2013) and are likely to exhibit behavioural responses to vessel noise.

9.11.2.47 The grey seal 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.

Basking shark VER

9.11.2.48 Elasmobranchs detect sound using inner ear end organs; they do not have a swim bladder or any other air-filled cavity, therefore they can only sense sound as pressure through their lateral line system (McFarlane *et al.,* 2008). They do however use hearing to detect prey. The hearing bandwidth for elasmobranchs is from ~ 20 Hz up to 1 kHz, however no species-specific data is available for basking sharks. It is anticipated that high levels of anthropogenic noise can cause TTS and (more likely) barotrauma as a result of impulsive energy produced in activities such as pile driving (Halvorsen *et al.,* in Casper *et al.,* 2012). The impacts of exposure to anthropogenic sound on basking sharks is not likely to be TTS but the effects of underwater noise could potentially disrupt normal behaviours such as feeding, mating or migrating (McFarlane *et al.,* 2008).

9.11.2.49 The basking shark VER is deemed to be of low vulnerability, high recoverability and high value. The sensitivity of the receptor is therefore, considered to be low.

European otter VER

9.11.2.50 Otters produce a range of vocalisations in different social contexts, however vocalisations have never been observed beneath the water's surface (Ghoul and Reichmuth, 2012), thus communication masking is unlikely to occur. Studies on sea otters show an audible range of 0.125 kHz and 32 kHz, which are relatively comparable to terrestrial mustelids (Ghould and Reichmuth, 2012). Peak underwater hearing sensitivity lies in the range 7 kHz to 16 kHz while overall sensitivity levels are somewhat reduced compared with pinniped species. The pinniped behavioural response thresholds have therefore been used as a proxy for otter behavioural response thresholds, though this is assumed to be an over-precautionary assessment of the likely impact of underwater noise on otters.

9.11.2.51 Otters within range of increased vessel noise are likely to leave the water (Ghoul and Reichmuth, 2012). However, since the hearing acuity of otters is significantly less than for many marine mammal species, it is unlikely that disturbance ranges for otter will extend as far underwater as predicted for other marine mammals.

9.11.2.52 The otter VER is deemed to be not vulnerable to impacts regardless of value/importance. The sensitivity of the receptor is therefore, considered to be negligible.

Significance of the effect

Harbour porpoise VER

9.11.2.53 The sensitivity of the receptor is considered to be low and the magnitude of the impact is deemed to be minor (adverse). The effect will therefore be of **minor (adverse)** significance, which is not significant in EIA terms.

Bottlenose dolphin VER

9.11.2.54 The sensitivity of the receptor is considered to be low and the magnitude of the impact is deemed to be minor (adverse). The effect will therefore be of **minor (adverse)** significance, which is not significant in EIA terms.

Short-beaked common dolphin VER

9.11.2.55 The sensitivity of the receptor is considered to be low and the magnitude of the impact is deemed to be minor (adverse). The effect will, therefore, be of **minor (adverse)** significance, which is not significant in EIA terms.

Risso's dolphin VER

9.11.2.56 The sensitivity of the receptor is considered to be low and the magnitude of the impact is deemed to be minor (adverse). The effect will, therefore, be of **minor (adverse)** significance, which is not significant in EIA terms.

Grey seal VER

9.11.2.57 The sensitivity of the receptor is considered to be low and the magnitude of the impact is deemed to be minor (adverse). The effect will, therefore, be of **minor (adverse)** significance, which is not significant in EIA terms.

Basking shark VER

9.11.2.58 The sensitivity of the receptor is considered to be low and the magnitude of the impact is deemed to be minor (adverse). The effect will, therefore, be of **minor (adverse)** significance, which is not significant in EIA terms.

9.11.2.59 For the reasons discussed at section 9.11.2.48 above there is a level of uncertainty attached to this level of significance. This uncertainty has been addressed through the adoption of precautionary thresholds.

European otter VER

9.11.2.60 The sensitivity of the receptor is considered to be negligible and the magnitude of the impact is deemed to be minor (adverse). The effect will, therefore, be of negligible significance, which is not significant in EIA terms.

9.11.2.61 As no differences in assessment has been noted between META sites, the overall significance of the effect for all sites has been assessed. 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.

9.11.2.62 For all META sites together, the sensitivity of the VERs is considered to be negligible – low, and the magnitude of the impact is deemed to be minor (adverse). The effect will therefore be of **negligible - minor (adverse)** significance, which is not significant in EIA terms.

Further mitigation and residual effect

9.11.2.63 No further mitigation is suggested.

Increased collision risk - vessels

9.11.2.64 Increased vessel traffic during the installation phase presents an increased risk of marine mammals colliding with vessels. Wilson *et al*., (2007) identifies the main drivers in influencing the number and severity of strikes as a result of shipping as:

- Vessel type and speed;
- High levels of ambient noise resulting in difficulty in detection of approaching vessels;
- Weather conditions and time of navigation affecting the ability of crew to locate marine mammals; and
- Marine mammal behaviour, which is species-specific (but appears to affect juveniles and sick individuals more often than animals in good health as juveniles are inexperienced in how to respond to ship presence and sick animals may be unable to remove themselves from an impact situation and may be less able to recover).

9.11.2.65 Marine mammal collision (ship strike) is well documented, particularly in busy ports and harbours, and collision is a known cause of injury and mortality in marine mammals (Laist *et al*., 2001).

9.11.2.66 There are different potential outcomes of vessel collision with marine mammals; both fatal injuries and non-fatal injuries have been documented. Fatal collisions can be seen through carcasses washing up on beaches; carcasses draped on vessel bows; and floating carcasses which have evidence of propeller strike. There will be a number of ship strike fatalities which of course cannot be identified and animals which have survived ship strikes but which have no discernible injury. Animals which survive propeller strikes have also been widely documented.

9.11.2.67 Guidance provided by NOAA have defined serious injury to marine mammals as '*any injury that will likely result in mortality*' (50 CFR 229.2). NMFS clarified its definition of 'serious injury' (SI) in 2012 and stated their interpretation of the regulatory definition of serious injury as any injury that is 'more likely than not' to result in mortality, or any injury that presents a greater than 50% chance of death to the marine mammal (77 Federal Register 3233, 23 January 2012; NMFS 2012a)" (Helker *et al.,* 2017).

9.11.2.68 Non-serious injury is likely to result in short-term impacts and may also have long-term effects on health and lifespan.

Magnitude of impact

9.11.2.69 As described in section 9.11.2.10 (*et seq.)* the sites (Warrior Way (site 6) and Dale Roads (site 7)) within the Waterway have a high level of existing vessel traffic. Lower existing vessel traffic occurs at East Pickard Bay (site 8).

Warrior Way (site 6)

9.11.2.70 The installation phase of the META project at Warrior Way (site 6) requires up to five vessels to be involved in the deployment and retrieval of devices. Up to 20 test deployment vessel operations and 20 test retrieval vessel operations in a 12-month period will be required (in total up to 40 per year), restricted to daylight hours, wherever possible. The maximum size of vessels used at Warrior Way (site 6) may be up to 35 m in length with a 6.8 m draught. The most likely vessel size is up to 30 m length and 6.8 m.

Dale Roads (site 7)

9.11.2.71 The installation phase of the META project at Dale Roads (site 7) requires up to five vessels to be involved in the deployment and retrieval of devices. Up to 20 test deployment vessel operations and 20 test retrieval vessel operations in a 12-month period will be required (in total up to 40 per site per year), restricted to daylight hours, wherever possible. The maximum size of vessels used at Dale Roads (site 7) is 164 m length and 6.8 m draught, and vessels may operate a dynamic positioning system.

East Pickard Bay (site 8)

9.11.2.72 The installation phase of the META project device installation and decommissioning at East Pickard Bay (site 8) required up to five vessels to be involved at any one time for deployment and retrieval operations. Up to 40 test deployment vessel operations and 40 test retrieval vessel operations in a 12-month period will be required (in total up to 80 per year), restricted to daylight hours, wherever possible. The maximum size of vessels at East Pickard Bay (site 8) is 200 m length and 8 m draught.

9.11.2.73 Vessels travelling at 7 m/s or faster are those most likely to cause death or serious injury to marine mammals, basking sharks and otters (Wilson *et al.,* 2007). Vessels involved in the installation phase are likely to be travelling considerably slower than this, in accordance with the high levels of traffic expected within the META project area, and therefore collision risk is expected to be lower than that posed by commercial shipping activity.

9.11.2.74 Larger vessels, such as the maximum size expected at Dale Roads (site 7) and East Pickard Bay (site 8) (see 9.11.2.71), are less likely to be involved in vessel collisions, based on their predictable movements and larger volume of noise produced, making them more detectable to marine mammals, basking shark and otter than the smaller, most likely size of vessels at Warrior Way (see 9.11.2.70).

9.11.2.75 Vessels involved in the installation of devices at all three sites are likely to be present within the local marine mammals, basking shark and otter study area for a matter of days therefore potential impacts will individually be of short-term duration but long-term duration when considered over the period (15 years) of the META project.

Cetacean VERS

9.11.2.76 Considering local/regional density estimates for all cetacean species (see section 9.7.2), regardless of size of vessel, few animals are expected to enter the zones of impact and thus, few, if any, will be affected by potential increased collision risk associated with increased vessel movement associated with the META project.

9.11.2.77 The impact is predicted to be of local spatial extent, long-term duration, but intermittent (short-term vessel movements) and irreversible. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be minor (adverse).

Grey Seal VER

9.11.2.78 Vessel strike in seals is likely related to a combination of increased vessel speed and size (Moore *et al.,* 2013). Whilst grey seals are likely to be observed in the local marine mammal, basking shark and otter study area (see Figure 9.10), and this population is deemed important in the scale of the MU, the number of animals are relatively low in the local marine mammal, basking shark, and otter study area when compared to the regional marine mammal, basking shark, and otter study area (see 9.7.3). In addition, it is highly likely that grey seals will have habituated to presence of vessels in the META project area and will therefore likely exhibit vessel avoidance.

9.11.2.79 The impact is predicted to be of local spatial extent, long-term duration, but intermittent (short-term vessel movements) and irreversible. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be minor (adverse).

Basking shark VER

9.11.2.80 Whilst basking shark vessel strike has been identified (Speedie *et al.,* 2009), sightings data would suggest a lack of receptor-impact pathway (Figure 9.5) and therefore it is expected that no animals will be negatively affected by this impact.

9.11.2.81 The impact is predicted to be of local spatial extent, long-term duration, but intermittent (short-term vessel movements) and irreversible. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be minor (adverse).

Otter VER

9.11.2.82 Whilst vessel strike has been identified in sea otters (Ballachey and Bodkin, 2015), there are no available reports of vessel strike in European otter, which is likely due to expected occurrence of otters far from shore (see section 9.7.5). As such, there is an expected lack of receptor-impact pathway.

9.11.2.83 The impact is predicted to be of local spatial extent, long-term duration, but intermittent (short-term vessel movements) and irreversible. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be minor (adverse).

Sensitivity of the receptor

Cetacean VERs

9.11.2.84 As stated in section 9.11.2.38 a likely response of odontocete species to vessels is to move away. Small, fast moving odontocetes are less likely to be struck by large commercial vessels producing loud noise and moving in predictable directions. Odontocetes are more likely to be struck by small, fast moving vessels, due to unpredictability of direction of movement, and engine noise which is masked by ambient noise. Mysticetes, such as minke whale are more likely to be struck by fast moving larger vessels.

9.11.2.85 Whilst the most likely size of vessels at Warrior Way (site 6) during the installation phase are smaller than the maximum size of vessels at both Dale Roads (site 7) and East Pickard Bay (site 8), the slow speed of all vessels used in installation operations at the META project means that vessel strike is unlikely. Individual animals which enter the local marine mammal, basking shark and otter study area, in particular the Waterway, are likely to exhibit some habituation to high levels of traffic, therefore the potential increase in vessel collision risk associated with increased vessel movements associated with the installation phase of the META Project, regardless of ambient noise in the Waterway, are considered unlikely to significantly increase potential for vessel strike. Although animals which are found near to East Pickard Bay (site 8) may be less habituated to vessel traffic due to the lower levels of existing vessel movement, the likely ambient noise in this area will be lower and therefore individual vessels will be more acoustically discernible.

9.11.2.86 Although presence of vessels is individually of short-duration the impact of vessel collision would be permanent in nature, and irreversible.

9.11.2.87 The harbour porpoise VER is deemed to be of medium vulnerability, low recoverability and very high value. The sensitivity of the receptor is therefore, considered to be medium.

9.11.2.88 The bottlenose dolphin VER is deemed to be of medium vulnerability, low recoverability and very high value. The sensitivity of the receptor is therefore, considered to be medium.

9.11.2.89 The common dolphin VER is deemed to be of medium vulnerability, low recoverability and very high value. The sensitivity of the receptor is therefore, considered to be medium.

9.11.2.90 The Risso's dolphin VER is deemed to be of medium vulnerability, low recoverability and high value. The sensitivity of the receptor is therefore, considered to be medium.

9.11.2.91 The minke whale VER is deemed to be of medium vulnerability, low recoverability and high value. The sensitivity of the receptor is therefore, considered to be medium.

Grey seal VER

9.11.2.92 Collisions between vessels and pinnipeds can have adverse effects on health of individual animals; the severity and type of trauma depends on a number of factors including vessel speed and size (Moore *et al.,* 2013).

9.11.2.93 The vessels involved in the installation phase of the META project are described in paragraph 9.11.2.84 and have not been reiterated here.

9.11.2.94 The grey seal VER is deemed to be of medium vulnerability, low recoverability and very high value. The sensitivity of the receptor is therefore, considered to be medium.

Basking shark VER

9.11.2.95 Basking sharks feeding at the surface may be vulnerable to collision. Reports of collision with small vessels have been documented (Speedie *et al.,* 2009). Whilst feeding and courtship is occurring at the surface, sharks are more vulnerable to vessel strike due to this distraction (Speedie *et al.,* 2009). In addition, sharks occupying shallow, inner shelf waters near thermal front display reverse diel vertical migration (DVM) patterns, making them more likely to be at the surface during that day, than in deep, well-stratified waters. Sharks may remain at the surface for considerable periods in this circumstance (*et al.,* 2009), therefore collision risk would be higher.

9.11.2.96 Fatal collisions with vessels have been documented (Speedie *et al.,* 2009) and altercations between boat propellers and basking sharks, which were non-fatal may also be common. The habit of the animals of feeding slowly at the surface in shallow water increases the likelihood of this occurring (McFarlane *et al.,* 2008).

9.11.2.97 The basking shark VER is deemed to be of medium vulnerability, low recoverability and high value. The sensitivity of the receptor is therefore, considered to be medium.

European otter VER

9.11.2.98 Otters primarily utilise a narrow strip of water along the shore for foraging, and rarely venture more than 2 km from the shoreline (Kruuk, 2006). An observational survey of 500 dives off the coast of Shetland revealed that coastal otters dive for food within 80 m of the shore 62% of the time, within 50 m 84% of the time, and within 20 m 98% of the time (Kruuk and Moorhouse, 1991). Otters prefer to dive in shallow waters of 0 – 3 m and rocky intertidal areas where benthic prey are more abundant; it has been theorised this is also a method of conserving body heat, reducing thermoregulatory costs and reducing travel time (Kruuk and Moorhouse, 1991; Nolet *et al.,* 1993).

9.11.2.99 Although it is highly unlikely that there is a receptor-impact pathway, and that otters will come in to contact with vessels involved in the installation phase, individuals have been sighted diving 2 km from shore, thus a precautionary approach to this assessment will be taken, particularly as audibility in otters and thus ability to detect vessels is less sensitive than pinnipeds or cetaceans.

9.11.2.100 The otter 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

Harbour porpoise VER

9.11.2.101 The sensitivity of the receptor is considered to be medium and the magnitude of the impact is deemed to be minor (adverse). The effect will, therefore, be of **minor (adverse)** significance, which is not significant in EIA terms.

Bottlenose dolphin VER

9.11.2.102 The sensitivity of the receptor is considered to be medium and the magnitude of the impact is deemed to be minor (adverse). The effect will, therefore, be of **minor (adverse)** significance, which is not significant in EIA terms.

Short-beaked common dolphin VER

9.11.2.103 The sensitivity of the receptor is considered to be medium and the magnitude of the impact is deemed to be minor (adverse). The effect will, therefore, be of **minor (adverse)** significance, which is not significant in EIA terms.

Risso's dolphin VER

9.11.2.104 The sensitivity of the receptor is considered to be medium and the magnitude of the impact is deemed to be minor (adverse). The effect will, therefore, be of **minor (adverse)** significance, which is not significant in EIA terms.

Grey seal VER

9.11.2.105 The sensitivity of the receptor is considered to be medium and the magnitude of the impact is deemed to be minor (adverse). The effect will, therefore, be of **minor (adverse)** significance, which is not significant in EIA terms.

Basking shark VER

9.11.2.106 The sensitivity of the receptor is considered to be medium and the magnitude of the impact is deemed to be minor (adverse). The effect will, therefore, be of **minor (adverse)** significance, which is not significant in EIA terms.

European otter VER

9.11.2.107 The sensitivity of the receptor is considered to be low and the magnitude of the impact is deemed to be low (adverse). The effect will, therefore, be of **negligible (adverse)** significance, which is not significant in EIA terms.

9.11.2.108 As no differences in assessment has been noted between META sites, the overall significance of the effect for all sites has been assessed. 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.

9.11.2.109 For all META sites together, the sensitivity of the VERs is considered to be low – medium, and the magnitude of the impact is deemed to be minor (adverse). The effect will therefore be of **negligible – minor (adverse)** significance, which is not significant in EIA terms.

Further mitigation and residual effect

9.11.2.110 No further mitigation is suggested.

Increases in suspended sediment concentration (SSC)

9.11.2.111 Marine mammals use vision to navigate in their environment, detect prey and avoid obstacles. Increases in SSC arising from construction activities may affect marine mammals through visual impairment.

Magnitude of impact

9.11.2.112 The substrate at Warrior Way (site 6) has been described as coarse gravely sand, Dale Roads (site 7) as coarse sand with muddy sediment and at East Pickard Bay (site 8) as poorly sorted coarse sand (chapter 7: Benthic Subtidal and Intertidal Ecology). All three sites therefore have the potential for temporary increases in suspended sediments due to proposed testing activities.

9.11.2.113 Anchoring/attachment of marine energy devices and navigational marker buoys, may lead to temporary disturbance of sediment within the test deployment areas. The main activities that will contribute to increases in suspended sediments include the placement of seabed-mounted marine energy devices, drilled pin pilling and placement of gravity anchors or drag anchors for marine energy devices or navigational marker buoys. Vessel movements may also lead to very short-term increases in suspended sediment due to vessel manoeuvring/anchoring or dynamic positioning.

9.11.2.114 All activities proposed at all three test areas are of a temporary and intermittent nature with devices and ancillary equipment such as navigational marker buoys and marine energy devices placed in the marine environment for a maximum of 1-3 months (Warrior Way – site 6), 3-12 months (Dale Roads – site 7), and 12-18 months (East Pickard Bay – site 8) and under the most likely scenario for of 3-6 months (Warrior Way – site 6), 6-12 months (Dale Roads – site 7), and 6-12 months (East Pickard Bay – site 8). Warrior Way (site 6) and Dale Roads (site 7) will support only single device testing at any one time, and East Pickard Bay (site 8) will support up to two concurrent device tests.

9.11.2.115 Testing activity dimensions at the three sites are as follows: 20 m x 10 m with a swept area (tidal only) of 19.63 m^2 at Warrior Way (site 6); 30 m x 20 m at Dale Roads (site 7); and 147 m x 230 m at East Pickard Bay (site 8).

9.11.2.116 Drilled pin pilling may only occur at Dale Roads (site 7) and East Pickard Bay (site 8); at Dale Roads (site 6) up to four drilled pin piles per device installed to a depth of 10 – 20 m will be required, with up to 10 drag anchors with associated slack lines for mooring. A gravity base may be required, which will be up to 500 m^2, with a total mooring spread of 200 m^2 per test deployment; at East Pickard Bay (site 8), up to four drilled pin piles per device installed to a depth of 10 – 20 m will be required, with a 3-point catenary mooring system. A gravity base may be required, which will be up to 1125 m^2, with a total mooring spread of 250,000 m^2 per test deployment. Drilled pin piles will be of small diameter (100 mm) therefore minimising sediment disturbance.

9.11.2.117 Vessel movements have been described in paragraphs 9.11.2.13 *et seq.* and have not been reiterated here.

9.11.2.118 Seabed disturbance and associated temporary increases in suspended sediments due to placement of devices or anchoring is therefore considered to be occasional and of very short-duration for individual deployments.

9.11.2.119 Due to the meso-tidal range of Warrior Way (site) and Dale Roads (site 7) and the high energy environment at East Pickard Bay (site 8), it can be expected that any suspended sediments will quickly dissipate and disperse according to the sites' hydrological regimes (chapter 5: Coastal Processes).

9.11.2.120 Chapter 5: Coastal Process has reported sediment types and estimated volume of sediment plume generated by back hoe dredging. Warrior Way (site 6) bed sediment has been characterised by mixed coarse gravely marine sand. Calculated sediment plumes would give rise to approximately 40 mg/l of material which would be expected to settle in a relatively short period of time (one hour) following cessation of works. Dale Roads (site 7) bed sediment has been characterised as coarse sand with muddy sediment with expected sediment plumes of approximately 50 mg/l and expected to settle within two hours of cessation of works. East Pickard Bay (site 8) has been characterised as coarse sand with expected sediment plumes of 70 mg/l which again would be expected to settle following cessation of works after one hour.

9.11.2.121 The potential impact of temporary increases in suspended sediment is therefore predicted to be of local spatial extent, long-term duration, but intermittent (short-duration over period of device installation) and reversible for all META sites. It is predicted that the impact will affect the receptor directly. The magnitude is therefore considered to be minor (adverse).

Sensitivity of the receptor

9.11.2.122 Marine mammals regularly occur in turbid environments and therefore are adapted to finding prey in such conditions. Marine mammals forage through the diel cycle and can therefore successfully forage in low light conditions, including at night. Most marine mammals rely on vision to some extent: the large forward pointing eyes of seals gives them binocular vision and suggests that this is an important sense for detecting prey.

9.11.2.123 The use of echolocation by odontocetes enables these species to locate prey that is out of sight. Prey capture may be more difficult for non-echolocating species, such as seals, in turbid environments. Most marine mammals, however, have an acute sense of touch. Seals and otters possess sensitive muzzles with vibrissae or sensory whiskers that these species use to detect prey items either through direct contact or due to receiving vibrations in the water column (Denhardt *et al*., 2001). Minke whale also use vibrissae to sense their prey and olfactory receptors may also be important in detecting prey. These senses are also used to navigate in the marine environment, allowing animals to avoid obstacles if undetected using their visual sense.

9.11.2.124 Basking sharks feed by obligate ram filter-feeding. Although it is not certain how basking sharks locate their prey it is thought that sight is not important in locating high concentrations of prey, but it is hypothesised that they may smell the dimethyl sulphide (DMS) which is given off by phytoplankton when it is being grazed by zooplankton. It is also hypothesised that basking sharks can detect the muscle activity of prey using electro receptors (MBSW, 2019).

Cetacean VERs

9.11.2.125 The harbour porpoise 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.

9.11.2.126 The bottlenose dolphin 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.

9.11.2.127 The common dolphin VER is deemed to be of low vulnerability, high recoverability and high value. The sensitivity of the receptor is therefore, considered to be low.

9.11.2.128 The Risso's dolphin VER is deemed to be of low vulnerability, high recoverability and high value. The sensitivity of the receptor is therefore, considered to be low.

9.11.2.129 The minke whale VER is deemed to be of low vulnerability, high recoverability and high value. The sensitivity of the receptor is therefore, considered to be low.

Grey seal VER

9.11.2.130 The grey seal 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.

Basking shark VER

9.11.2.131 The basking shark VER is deemed to be of low vulnerability, high recoverability and high value. The sensitivity of the receptor is therefore, considered to be low.

European otter VER

9.11.2.132 The otter 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

Harbour porpoise VER

9.11.2.133 The sensitivity of the receptor is considered to be low and the magnitude of the impact is deemed to be minor (adverse). The effect will, therefore, be of **minor (adverse)** significance, which is not significant in EIA terms.

Bottlenose dolphin VER

9.11.2.134 The sensitivity of the receptor is considered to be low and the magnitude of the impact is deemed to be minor (adverse). The effect will, therefore, be of **minor (adverse)** significance, which is not significant in EIA terms.

Short-beaked common dolphin VER

9.11.2.135 The sensitivity of the receptor is considered to be low and the magnitude of the impact is deemed to be minor (adverse). The effect will, therefore, be of **minor (adverse)** significance, which is not significant in EIA terms.

Risso's dolphin VER

9.11.2.136 The sensitivity of the receptor is considered to be low and the magnitude of the impact is deemed to be minor (adverse). The effect will, therefore, be of **minor (adverse)** significance, which is not significant in EIA terms.

Grey seal VER

9.11.2.137 The sensitivity of the receptor is considered to be low and the magnitude of the impact is deemed to be minor (adverse). The effect will, therefore, be of **minor (adverse)** significance, which is not significant in EIA terms.

Basking shark VER

9.11.2.138 The sensitivity of the receptor is considered to be low and the magnitude of the impact is deemed to be minor (adverse). The effect will, therefore, be of **minor (adverse)** significance, which is not significant in EIA terms.

European otter VER

9.11.2.139 The sensitivity of the receptor is considered to be low and the magnitude of the impact is deemed to be minor (adverse). The effect will, therefore, be of **minor (adverse)** significance, which is not significant in EIA terms.

9.11.2.140 As no differences in assessment has been noted between META sites, the overall significance of the effect for all sites has been assessed. 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.

9.11.2.141 For all META sites together, the sensitivity of the VERs is considered to be low, and the magnitude of the impact is deemed to be minor (adverse). The effect will therefore be of **minor (adverse)** significance, which is not significant in EIA terms.

Further mitigation and residual effect

9.11.2.142 No further mitigation is suggested.

Changes in fish and shellfish communities

9.11.2.143 Fish and shellfish receptors are vulnerable to a number of impacts during construction including temporary habitat loss and increased SSC during installation works (chapter 8: Fish and Shellfish Ecology).

9.11.2.144 The nature of marine renewable devices means that from installation through to decommissioning, devices will occupy an area of sea, resulting in a reduction water-column availability. Anchoring or attachment methods may also result in temporary disturbance to or loss of seabed habitat or compaction of sediment (i.e. during anchor placement or gravity base foundation placement). These changes have the potential to reduce the availability of marine habitat, including spawning, nursery of feeding habitats. These changes may result in a temporary reduction in fish and shellfish species abundance or diversity with affected areas, thought demersal fish and shellfish species and demersal spawning species are likely to be affected to the greatest extent. Substratum loss will only directly affect species utilising the seabed, including shellfish and demersal species listed in Table 8.10 and 8.11 of chapter 8: Fish and Shellfish, and a temporary reduction in sections of water column will only directly affect pelagic species.

9.11.2.145 The key prey species for marine mammals include a number of clupeids (e.g. herring), gadoids (e.g. cod, whiting), flatfish and sandeels. These species have been identified as important components of the fish community within the META project fish and shellfish study area and subsequently negative effects on the fish assemblages identified in the META project impact assessment may have indirect negative effects on marine mammal receptors.

Magnitude of impact

9.11.2.146 The magnitude of the impact on fish and shellfish receptors was assessed as being minor (chapter 8 – Fish and shellfish section 8.11.29) and the sensitivity of fish and shellfish receptors ranged from negligible to medium (chapter 8 – Fish and Shellfish section 8.11.2.11 *et seq.*); consequently, the effects of temporary habitat loss was assessed as negligible to minor adverse significance (chapter 8 – Fish and Shellfish section 8.11.2.20 *et seq.*)

9.11.2.147 No significant adverse effects are predicted to occur to fish and shellfish as a result of the installation of the META project; therefore, the magnitude of the impact on marine mammals is deemed to be minor.

Sensitivity of the receptor

9.11.2.148 Marine mammals exploit a suite of different prey items and can travel great distances to forage. It is likely that the effects described for fish and shellfish (chapter 8) will occur over a similar, or lesser, extent and duration as those for marine mammals. For example, avoidance behaviour of fish during the installation phase will lead to displacement over potentially smaller ranges than those given for most marine mammals. In addition, as prey moves out of the areas of potential impact, so marine mammals are likely to follow in order to exploit these resources.

9.11.2.149 The communities found within the META project fish and shellfish study area were characteristic of the fish and shellfish assemblages in the regional marine mammal, basking shark and otter study area and therefore, whilst META project sites are located within and close to spawning and nursery grounds (e.g. herring spawning ground) (see chapter 8: Fish and Shellfish, paragraph 8.11.2.13) and could potentially be adversely affected by impacts such as increased SSC, or loss of habitat, due to the highly mobile nature of marine mammals, it is likely that these animals will be able to exploit similar resources elsewhere. There could, however, be an energetic cost if animals have to travel further to alternative foraging grounds.

Harbour porpoise VER

9.11.2.150 The harbour porpoise 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.

Bottlenose dolphin VER

9.11.2.151 The bottlenose dolphin 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.

Short-beaked common dolphin VER

9.11.2.152 The short-beaked common dolphin VER is deemed to be of low vulnerability, high recoverability and high value. The sensitivity of the receptor is therefore, considered to be low.

Risso's dolphin VER

9.11.2.153 The Risso's dolphin VER is deemed to be of low vulnerability, high recoverability and high value. The sensitivity of the receptor is therefore, considered to be low.

Minke whale VER

9.11.2.154 The minke whale VER is deemed to be of low vulnerability, high recoverability and high value. The sensitivity of the receptor is therefore, considered to be low.

Grey seal VER

9.11.2.155 The grey seal is VER deemed to be of low vulnerability, high recoverability and very high value. The sensitivity of the receptor is therefore, considered to be low.

Basking shark VER

9.11.2.156 The basking shark VER is deemed to be of low vulnerability, high recoverability and high value. The sensitivity of the receptor is therefore, considered to be low.

European otter VER

9.11.2.157 The European otter VER is deemed to be of low vulnerability, high recoverability and high value. The sensitivity of the receptor is therefore, considered to be low.

Significance of the effect

Harbour porpoise VER

9.11.2.158 The sensitivity of the receptor is considered to be low and the magnitude of the impact is deemed to be minor (adverse). The effect will, therefore, be of **minor (adverse)** significance, which is not significant in EIA terms.

Bottlenose dolphin VER

9.11.2.159 The sensitivity of the receptor is considered to be low and the magnitude of the impact is deemed to be minor (adverse). The effect will, therefore, be of **minor (adverse)** significance, which is not significant in EIA terms.

Short-beaked common dolphin VER

9.11.2.160 The sensitivity of the receptor is considered to be low and the magnitude of the impact is deemed to be minor (adverse). The effect will, therefore, be of **minor (adverse)** significance, which is not significant in EIA terms.

Risso's dolphin VER

9.11.2.161 The sensitivity of the receptor is considered to be low and the magnitude of the impact is deemed to be minor (adverse). The effect will, therefore, be of **minor (adverse)** significance, which is not significant in EIA terms.

Minke whale VER

9.11.2.162 The sensitivity of the receptor is considered to be low and the magnitude of the impact is deemed to be minor (adverse). The effect will, therefore, be of **minor (adverse)** significance, which is not significant in EIA terms.

Grey seal VER

9.11.2.163 The sensitivity of the receptor is considered to be low and the magnitude of the impact is deemed to be minor (adverse). The effect will, therefore, be of **minor (adverse)** significance, which is not significant in EIA terms.

Basking shark VER

9.11.2.164 The sensitivity of the receptor is considered to be low and the magnitude of the impact is deemed to be minor (adverse). The effect will, therefore, be of **minor (adverse)** significance, which is not significant in EIA terms.

European otter VER

9.11.2.165 The sensitivity of the receptor is considered to be low and the magnitude of the impact is deemed to be minor (adverse). The effect will, therefore, be of **minor (adverse)** significance, which is not significant in EIA terms.

Further mitigation and residual effect

9.11.2.166 No further mitigation is suggested.

Accidental pollution

9.11.2.167 Although marine mammals, basking shark and otter are all highly mobile with the ability to detect and thus avoid pollutants in the marine environment, general concerns with regards to spills are:

- Ingestion of contaminated prey;
- Potential irritation of skin and eyes; and
- Abandonment of polluted feeding habitat (Clapham *et al.,* 1999).

Magnitude of impact

9.11.2.168 This assessment focuses on the maximum potential accidental pollution scenario, which is considered to be the release of a large inventory of fuel oil from a vessel. The impacts and potential consequences of other significantly smaller inventories of polluting substances will be discussed and managed in the Marine Pollution Contingency Plan (MCPC).

9.11.2.169 As stated in 9.11.2.13 during the installation phase, the maximum size of vessels used at Warrior Way (site 6) may be up to 35 m in length with a 6.8 m draught. As stated in 9.11.2.14 the maximum size of vessels used at Dale Roads (site 7) is 164 m in length and 6.8 m draught, and at East Pickard Bay (site 8) is 200 m length and 8 m draught.

9.11.2.170 The magnitude of impact on marine mammal, basking shark and otter receptors is likely to be affected by a number of factors, including the volume and type of oil released as well as the sea and weather conditions at the time of the spill. However the potential of an accidental pollution event occurring is considered to be unlikely due to operations occurring within the parameters of the META MPCP.

9.11.2.171 As stated in 9.11.2.28, given that numbers of cetaceans and basking sharks are relatively low in the local marine mammal, basking shark, and otter study area when compared to the regional marine mammal, basking shark, and otter study area, few animals are expected to enter the zone of impact and thus, few, if any, would be negatively impacted in the event of an accidental release of pollutants.

9.11.2.172 Given that haul out sites within the Skomer MCZ support important numbers of grey seal, with approximately 5% of UK grey seal pups being born on the coasts of SW Wales and SW England each year (Duck, 1995; Baines *et al*., 1995; SCOS, 2017), any pollutant accumulating at haul out sites could have the potential for significant impacts on this breeding colony.

9.11.2.173 Given that the Milford Haven SSSI supports nationally important numbers of otter, and otter are a designated feature of the Pembrokeshire Marine/ Sir Benfro Forol SAC, Pembrokeshire Bat Sites and Bosherston Lakes/ Safleoedd Ystlum Sir Benfro a Llynnoedd Bosherston SAC and Cleddau Rivers/ Afonydd Cleddau SAC. Therefore, any pollutant accumulation in otter supporting habitat has the potential to have significant impacts on otter feeding activities within the SACs and SSSI, with the potential to displace animals from traditional foraging areas.

9.11.2.174 The potential for a spill to occur is considered to be extremely unlikely based on management measures in place through various legislation, and specifically to this project in the MPCP.

9.11.2.175 The impact is predicted to be of local spatial extent, short-term duration, intermittent and reversible and it is predicted that the impact would affect the receptor directly. The likelihood of an accidental pollution event occurring is considered unlikely. The magnitude is therefore considered to be minor.

Sensitivity of the receptor

9.11.2.176 Marine mammals, basking shark and otter are highly mobile species and are likely to be able to detect pollutants and as a result are expected to avoid areas where there has been an accidental release of pollutants.

9.11.2.177 The most likely impact will be where a pollutant washes up and accumulates on seal haul out sites and areas where otter may enter the water for foraging.

9.11.2.178 Seals may be displaced from preferred haul out sites, which would be more of a concern during grey seal pupping season, since juveniles do not initially have a waterproof coat and movement from a haulout site could negatively impact on pup survival rates.

9.11.2.179 As stated in section 9.7.3.4, known haul-out site for grey seals exist at Ramsey Island, extending southwards to Skomer Island and northwards to southern Ceredigion (see Figure 9.9) (Baines and Evans, 2009). The nearest grey seal haul-out sites to the META project occur within the Skomer MCZ, on the Marloes Peninsula and Skomer Island, with 47.2% of pup production on Skomer Island occurring on the western tip of the Marloes peninsula. The total pup production at haulout sites within the Skomer MCZ from 1992 to 2008 (Lock *et al.,* 2017) remained fairly consistent with expected fluctuation across the period. The average pup production per year was 208, with a steady increase since 2009; average pup production between 2012 and 2016 was 345. Pup births occur mainly from August to November although there are occasional records of pups born outside of this period.

9.11.2.180 Marine mammals, basking shark and otter may also be indirectly affected if prey species (fish and shellfish) are adversely affected by accidental release of contaminants. Section 8.11.3.99 *et seq.* of chapter 8: Fish and Shellfish however concludes that the magnitude of the potential impact of accidental release of pollutants is negligible, the sensitivity of receptors is negligible to medium and the significance of the effect for VERs will be of negligible or minor (adverse) significance.

Harbour porpoise VER

9.11.2.181 The harbour porpoise VER is deemed to be of low vulnerability, low recoverability and very high value. The sensitivity of the receptor is therefore, considered to be medium.

Short-beaked common dolphin VER

9.11.2.182 The short-beaked common dolphin VER is deemed to be of low vulnerability, low recoverability and very high value. The sensitivity of the receptor is therefore, considered to be low to medium.

Bottlenose dolphin VER

9.11.2.183 The bottlenose dolphin VER is deemed to be of low vulnerability, low recoverability and very high value. The sensitivity of the receptor is therefore, considered to be low to medium.

Risso's dolphin VER

9.11.2.184 The Risso's dolphin VER is deemed to be of low vulnerability, low recoverability and very high value. The sensitivity of the receptor is therefore, considered to be low to medium.

Minke whale VER

9.11.2.185 The minke whale VER is deemed to be of medium vulnerability, low recoverability and very high value. The sensitivity of the receptor is therefore, considered to be medium.

Grey seal VER

9.11.2.186 The grey seal VER is deemed to be of high vulnerability, low recoverability and very high value. The sensitivity of the receptor is therefore, considered to be high.

Basking shark VER

9.11.2.187 The basking shark VER is deemed to be of low vulnerability, low recoverability and very high value. The sensitivity of the receptor is therefore, considered to be low to medium.

European otter VER

9.11.2.188 The European otter VER is deemed to be of high vulnerability, low recoverability and very high value. The sensitivity of the receptor is therefore, considered to be high.

Significance of the effect

Harbour porpoise VER

9.11.2.189 The sensitivity of the receptor is considered to be medium and the magnitude of the impact is deemed to be minor (adverse). The effect will, therefore, be of **minor** significance, which is not significant in EIA terms.

Bottlenose dolphin VER

9.11.2.190 The sensitivity of the receptor is considered to be medium and the magnitude of the impact is deemed to be minor (adverse). The effect will, therefore, be of **minor** significance, which is not significant in EIA terms.

Short-beaked common dolphin VER

9.11.2.191 The sensitivity of the receptor is considered to be medium and the magnitude of the impact is deemed to be minor (adverse). The effect will, therefore, be of **minor** significance, which is not significant in EIA terms.

Risso's dolphin VER

9.11.2.192 The sensitivity of the receptor is considered to be medium and the magnitude of the impact is deemed to be minor (adverse). The effect will, therefore, be of **minor** significance, which is not significant in EIA terms.

9.11.2.193 **Minke whale VER**

The sensitivity of the receptor is considered to be medium and the magnitude of the impact is deemed to be minor (adverse). The effect will, therefore, be of **minor** significance, which is not significant in EIA terms.

Grey seal VER

9.11.2.194 The sensitivity of the receptor is considered to be high and the magnitude of the impact is deemed to be minor (adverse). The effect will, therefore, be of **minor** significance, which is not significant in EIA terms.

Basking shark VER

9.11.2.195 The sensitivity of the receptor is considered to be low to medium and the magnitude of the impact is deemed to be minor (adverse). The effect will, therefore, be of **minor** significance, which is not significant in EIA terms.

European otter VER

9.11.2.196 The sensitivity of the receptor is considered to be high and the magnitude of the impact is deemed to be minor (adverse). The effect will, therefore, be of **minor** significance, which is not significant in EIA terms

Further mitigation and residual effect

9.11.2.197 No further mitigation is suggested.

Future monitoring

9.11.2.198 No marine mammal, basking shark or otter monitoring to test the predictions made within the installation phase impact assessment is considered necessary.

9.11.3 Operation and maintenance phase

9.11.3.1 The impacts of the operation and maintenance of the META project have been assessed on marine mammals, basking sharks and otters. The environmental impacts arising from the operation and maintenance of the META Project are listed in Table 9.7 along with the maximum and most likely design scenarios 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)).

Increased anthropogenic underwater noise – vessels

9.11.3.2 See sections 9.11.2.112 to 9.11.2.2 for overview of the relationship between underwater vessel noise and marine mammals, basking sharks and otter.

Magnitude of the impact

Warrior Way

9.11.3.3 The operation and maintenance phase of the META project at Warrior Way (site 6) may support up to four device deployments in a 12-month period, with up to one device deployed at any one time. Up to 104 vessel visits over a 12-month period are associated with these four device deployments. The maximum size of vessels used at Warrior Way (site 6) may be up to 35 m in length with a 6.8 m draught. The most likely vessel size is up to 30 m length and 6.8 m draught (source sound pressure level at 1 m = 172 dB re 1 μPa (rms) / 221 SEL (24h) dB re 1 μPa^{2}s).

Dale Roads

9.11.3.4 The operation and maintenance phase of the META project at Dale Roads (site 7) may support up to two device deployments in a 12-month period, with up to one device deployed at any one time. Up to 104 vessel visits over a 12-month period are associated with these two device deployments. The maximum size of vessels used at Dale Roads (site 7) may be up to 164 m in length with a 6.8 m draught (source sound pressure level at 1 m = 183 dB re 1 μPa (rms) / 232 SEL (24h) dB re 1 μPa^{2}s when operating on Dynamic Positioning (DP)).

East Pickard Bay

9.11.3.5 The operation and maintenance phase of the META project at East Pickard Bay (site 8) may support up to four device deployments in a 12-month period, with up to two devices deployed at any one time. Up to 150 vessel visits over a 12-month period are associated with these four device deployments. The maximum size of vessels used at East Pickard Bay (site 8) may be up to 200 m in length with an 8 m draught (source sound pressure level at 1 m = 183 dB re 1 μPa (rms) / 232 SEL (24h) dB re 1 μPa^{2}s when operating on Dynamic Positioning (DP)). Maximum vessel sizes are given in paragraphs 9.11.2.13 *et seq.* and are not reiterated here.

9.11.3.6 Whilst vessel movements during the operatiol and maintenance phase increases by almost double that of the installation phase, these numbers remain small in comparison to the existing levels of traffic in the local marine mammal, basking shark and otter study area (see 9.11.2.10). The magnitude of impact of the operation and maintenance phase therefore, is not expected to differ from the installation phase. A review of likely baseline noise levels, assessment of distance to onset of injury assessment and radius of potential disturbance is given in section 0 *et seq.* and is not reiterated here.

9.11.3.7 In accordance with the magnitude of impact of the installation phase, the impact is predicted to be of local spatial extent, long-term duration, but intermittent (short-term duration of individual vessel movements) and reversible. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be minor (adverse).

Sensitivity of the receptor

9.11.3.8 The sensitivity of the receptor in the operation and maintenance phase is not expected to differ from the sensitivity of receptor of the installation phase. An assessment of sensitivity and behavioural response is given in sections 9.11.2.38 to 9.11.2.52 and as such is not reiterated here.

Significance of the effect

9.11.3.9 The significance of the effect of the operation and maintenance phase is not expected to differ from the significance of the effect of the installation phase (see sections 9.11.2.38 to 9.11.2.52).

Further mitigation and residual effect

9.11.3.10 No further mitigation is suggested.

Increased anthropogenic underwater noise – tidal turbine operation

9.11.3.11 The effect of exposure to anthropogenic sound on marine mammals, basking shark and otter has been described in section 9.11.2.1 *et seq.* and has not been reiterated here.

9.11.3.12 This assessment adopts a conservative approach to behavioural response thresholds and uses NMFS (2005) Level B harassment threshold of 120 dB re 1 µPa (root-mean squared (rms)) for continuous (non-impulsive) sound (tidal turbine operation) for all marine mammal auditory frequency groups (see Table 9.18: Summary of acoustic thresholds for marine mammals for non-impulsive sound. and chapter 6 – Underwater Noise). Level B harassment is defined as:

"having the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of behavioural patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering but which does not have the potential to injure a marine mammal or marine mammal stock in the wild" (NMFS, 2005).

9.11.3.13 The relevant criteria for marine mammals are summarised in Table 9.18: Summary of acoustic thresholds for marine mammals for non-impulsive sound.. This includes the thresholds for non-impulsive sound based on the relevant guidelines (NMFS 2018, NMFS 2005). In Table 9.14 the Sound Exposure Levels (SEL) are expressed as dB re 1 µPa2s and RMS sound pressure levels are in dB re 1 µPa (rms).

Table 9.18: Summary of acoustic thresholds for marine mammals for non-impulsive sound.

Hearing group	Parameter	PTS	TTS	Disturbance
Low-frequency (LF) cetaceans	SEL, LF weighted dB re 1 µPa²s	199	179	-
	RMS_{T90} dB re 1 µPa (rms)	-	-	120
Mid-frequency (MF) cetaceans	SEL, MF weighted dB re 1 µPa²s	198	178	-
	RMS_{T90} dB re 1 µPa (rms)	-	-	120
High-frequency (HF) cetaceans	SEL, HF weighted dB re 1 µPa²s	173	153	-
	RMS_{T90} dB re 1 µPa (rms)	-	-	120
Phocid pinnipeds (PW)	SEL, PW weighted dB re 1 µPa²s	201	181	-
	RMS_{T90} dB re 1 µPa (rms)	-	-	120
	RMS_{T90} dB re 1 µPa (rms)	-	-	120

Magnitude of the impact

9.11.3.14 Tidal device testing will only be supported at Warrior Way (site 6), and tidal components may occupy all or part of the water column. The maximum dimensions of the tidal device will be up to 20 m width and 10 m length, with a maximum rotor diameter of 5 m. The maximum tip speed is up to 5 m/s and will have a maximum swept area of 19.63 m². The maximum duration of device testing is up to six months.

9.11.3.15 As stated in chapter 6: Underwater Noise, noise modelling for this study has been undertaken based on noise measurements of an OpenHydro tidal turbine at the EMEC facility in Orkney (Parvin and Brooker 2008) and the Pelamis P2 measured at Billia Croo (Lepper and Robinson 2016). Whilst it is recognised that this potential impact is associated with tidal turbines, details relating to wave devices is provided for context. Further information on likely devices to be installed at the META project sites can be seen in chapter 2: Project Description, Appendix 2.1. Whilst it would be preferable to carry out modelling for a wider range of potential devices, the ability to do so is limited by the lack of sufficient data reported in the available literature. Nevertheless, it is considered that the range of source noise levels modelled (162 to 180 dB re 1 µPa at 1 m) is representative of the potential noise output from renewable energy convertors that might be used. The noise source data used in the modelling is summarised in Table 9.19.

Table 9.19: 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
Pelamis P2 WEC	EMEC facility in Orkney	Lepper *et al.* (2012)	180	229

9.11.3.16 As stated in chapter 6: Underwater Noise, it is important to understand that baseline noise levels will vary significantly depending on, amongst other factors, seasonal variations and different sea states, meaning that the usefulness of establishing baseline noise levels can be limited. Nevertheless, it can be useful (when undertaking an assessment of underwater noise impacts on ecological receptors), to have an understanding of the range of noise levels likely to be prevailing in the area so that any noise predictions can be placed in the context of the baseline. It is important to note however, that even if an accurate baseline noise level could be determined, there is a paucity of scientific understanding regarding how various receptor species distinguish anthropogenic sound relative to masking noise.

9.11.3.17 As stated in 9.11.2.19, baseline noise measurements were not undertaken for this project. In place of this, a review of baseline noise studies carried out in UK waters for other similar projects was carried out in order to determine the likely magnitude of noise encountered. A review of noise data relating to other marine energy sites in UK waters was undertaken for the Beatrice Wind Farm including a review of baseline underwater noise measurements in UK coastal waters (Brooker et al., 2012). These noise data are summarised in Table 9.16.

9.11.3.18 An assessment of the distance to onset of injury from each operational device is presented in Table 9.20 based on the SEL cumulative exposure criterion, along with an assessment of potential disturbance zones. As noted previously, the potential radii for injury are based on exposure levels over a 24-hour period. In reality, an animal is highly unlikely to spend 24 hours within a short range of an operating device and the radii can therefore be considered as a maximum scenario, highly precautionary zone.

Table 9.20: 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
Pelamis P2 WEC	76 m	1 m	18 m	23 m	7 km

9.11.3.19 In Low Frequency (LF) cetaceans (minke whale VER), a conservative assessment estimates that animals may be exposed to underwater noise that has the potential to result in the onset of injury (tidal turbine operation) up to (maximum scenario) 3 m from the OpenHydro tidal turbine. Given that values in Table 9.20 are based on devices which are full scale, comprised of multiple turbines, which are likely to produce greater volumes of noise than tidal devices at Warrior Way (site 6), it is more likely that low frequency cetaceans may be exposed to lower ranges at which onset of injury may occur.

9.11.3.20 In Medium Frequency (MF) cetaceans (Risso's dolphin VER, bottlenose dolphin VER, short-beaked common dolphin VER), a conservative assessment estimates that animals may be exposed to underwater noise that has the potential to result in the onset of injury (tidal turbine operation) up to one metre from the sound source (OpenHydro tidal turbine). As stated in 9.11.3.16,

9.11.3.21 In High Frequency (HF) cetaceans (harbour porpoise VER), a conservative assessment estimates that animals may be exposed to underwater noise that has the potential to result in the onset of injury (tidal turbine operation) up to 2 m from the sound source (OpenHydro tidal turbine)..

9.11.3.22 In pinnipeds in water (grey seal VER), a conservative assessment estimates that animals may be exposed to underwater noise that has the potential to result in the onset of injury (tidal turbine operation) up to 0 m from the sound source (OpenHydro tidal turbine).

9.11.3.23 No assessment has been undertaken for basking sharks or otters, as information required to estimate disturbance distance is currently unavailable.

9.11.3.24 For all cetacean species groups, the maximum radius of potential disturbance is 0.57 km (based on OpenHydro tidal turbine)..

9.11.3.25 On the basis of the above and taking into account the very low likelihood of an animal being exposed to noise from a device within the injury radii over a 24-hour period, it is considered highly unlikely that injury would occur to any marine mammal as a result of operational noise from test devices.

Cetacean VERs

9.11.3.26 Based on sightings data (see Figure 9.5), it is predicted that short-beaked common dolphin, bottlenose dolphin, minke whale, Risso's dolphin, and basking shark would not be found as far into the Waterway as Warrior Way (site 6) and as such there is a lack of receptor-impact pathway. Although it is highly unlikely that harbour porpoise would be found within the Warrior Way (site 6) site area, sightings suggest that they do occasionally enter the Waterway (local marine mammal, basking shark and otter study area) (see Figure 9.5), a precautionary approach would be to assume that individuals have the potential to enter this area. However, given that numbers of animals are relatively low in the local marine mammal, basking shark, and otter study area when compared to the regional marine mammal, basking shark, and otter study area, few harbour porpoise are expected to enter the zones of impact and thus, few, if any, will be negatively impacted. The population level effects are therefore expected to be inconsequential.

9.11.3.27 Though the potential range for disturbance of cetaceans VERs is slightly higher (0.5 - 7 km, Table 9.20), based on sightings data (see Figure 9.5) the likelihood of an animal entering the ZoI is very low.

9.11.3.28 The potential impact for all cetacean VERs is predicted to be of local spatial extent, long-term duration, but intermittent (short-term turbine operation) and reversible. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be minor (adverse).

Grey Seal VER

9.11.3.29 Whilst grey seals are likely to be observed in the local marine mammal, basking shark and otter study area (see Figure 9.10), and this population is deemed important in the scale of the MU, the number of animals are relatively low in the local marine mammal, basking shark and otter study area when compared to the regional marine mammal, basking shark and otter study area (see 9.7.3). Grey seals are only likely to be disturbed up to 7 km from the tidal turbine at Warrior Way (site 6) (Table 9.20), which falls more than 18 km out with known grey seal haul out sites. Whilst some avoidance behaviour may occur up to 7 km from a full-scale operational tidal turbine, limited numbers of animals are expected to be foraging within potential disturbance ranges (see 9.7.3 and Figure 9.10) of Warrior Way (site 6), and potential disturbance distances are considered highly like to be significantly smaller given the micro-scale and/or scaled nature of tidal devices proposed to be tested at Warrior Way (site 6).

9.11.3.30 In addition, given that seals are not thought to communicate underwater, the impact will not mask communication and any disturbance impact which does occur will individually be of short duration, but long-term when considered over the period (15 years) of the META project.

9.11.3.31 The potential impact for grey seal VER is predicted to be of local spatial extent, long-term duration, but intermittent (short-term turbine operation) and reversible. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be minor (adverse).

Basking shark VER

9.11.3.32 Although there are no records of basking sharks within the local marine mammal, basking shark and otter study area, a precautionary approach would be to assume that individuals have the potential to enter the local marine mammal, basking shark and otter study area. However, considering the regional marine mammal, basking shark and otter study area is unlikely to support high densities of basking shark, even during summer months (see 9.7.4), few animals are expected to enter the ZoI for disturbance and thus, few, if any, will be negatively impacted.

9.11.3.33 The potential impact for all basking shark VER is predicted to be of local spatial extent, long-term duration, but intermittent (short-term vessel movements) and reversible. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be minor (adverse).

Otter VER

9.11.3.34 Although otters utilise the coastline of the local marine mammal, basking shark and otter study area, based on lack of receptor-pathway (see section 9.11.2.51) it is expected that no animals will be negatively affected by this impact.

9.11.3.35 The potential impact for all otter VERs is predicted to be of local spatial extent, short term duration, intermittent and reversible. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be minor (adverse).

Sensitivity of the receptor

Cetacean VERs

9.11.3.36 Odontocete species such as common dolphins may exhibit behavioural response to tidal turbine noise, however given that the Waterway hosts a high number of vessels year round (see 9.11.2.10), it is likely that habituation of all animals which enter the Waterway has occurred (Nowacek *et al.,* 2007). Harbour porpoise are particularly sensitive to high frequency noise and are more likely to avoid tidal turbine noise (Heinanen and Skov, 2015).

9.11.3.37 Based on information provided in chapter 6: Underwater Noise, the disturbance ranges of cetaceans and pinnipeds at all three sites is up to 7 km (Table 9.20). The potential zones of injury for tidal turbine noise likely to be involved in this project, given in Table 9.20, range from 0 m to 76 m, however this assumes that animals would remain within these ranges continuously for 24 hours, and as such it is highly likely that animals would be disturbed, resulting in them moving away from the noise impact.

9.11.3.38 The harbour porpoise 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.

9.11.3.39 The bottlenose dolphin 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.

9.11.3.40 The common dolphin VER is deemed to be of low vulnerability, high recoverability and high value. The sensitivity of the receptor is therefore, considered to be low.

9.11.3.41 The Risso's dolphin VER is deemed to be of low vulnerability, high recoverability and high value. The sensitivity of the receptor is therefore, considered to be low.

9.11.3.42 The minke whale VER is deemed to be of low vulnerability, high recoverability and high value. The sensitivity of the receptor is therefore, considered to be low.

Grey seal VER

9.11.3.43 Whilst pinnipeds do not critically rely on hearing to survive, they are highly vocally active under water and can use sounds passively to forage (Chen *et al.,* 2017). Their repertoires extend across a wide range of frequencies, usually from 0.1 kHz to 3 kHz, but upsweeps can go up to 4.7 kHz (Chen *et al.,* 2017). Their hearing ranges from very low frequencies (~ 100 Hz) to high frequencies (~ 30 kHz) and it is therefore likely that tidal turbine noise is within the hearing range of grey seals (Chen *et al.,* 2017).

9.11.3.44 A study carried out on Harbour seals in 2017 (Hastie *et al.,* 2017) which measured behavioural responses to simulated tidal turbine sound, showed that there was a localised impact, whereby tagged seals exhibited significant spatial avoidance of the sound, which resulted in a reduction in the usage by seals of between 11% and 41% at the playback location. The significant decline in usage extended to 500 m from the playback location at which usage decreased by between 1% and 9% during playback. As such, grey seals are expected to exhibit avoidance behaviour, and as such (as stated in paragraph 9.11.3.37 it is highly unlikely that that animals would remain within the 0 – 23 m range (given in Table 9.20) continuously for 24 hours.

9.11.3.45 The grey seal 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.

Basking shark VER

9.11.3.46 Elasmobranchs detect sound using inner ear end organs; they do not have a swim bladder or any other air-filled cavity, therefore they can only sense sound as pressure through their lateral line system (McFarlane *et al.,* 2008). They do however use hearing to detect prey. The hearing bandwidth for elasmobranchs is from ~ 20 Hz up to 1 kHz, however no species-specific data is available for basking sharks. It is anticipated that high levels of anthropogenic noise can cause TTS and (more likely) barotrauma as a result of impulsive energy produced in activities such as pile driving (Halvorsen *et al.,* in Casper *et al.,* 2012). The impacts of exposure to anthropogenic sound on basking sharks is not likely to be TTS but the effects of underwater noise could potentially disrupt normal behaviours such as feeding, mating or migrating (McFarlane *et al.,* 2008).

9.11.3.47 The basking shark VER is deemed to be of low vulnerability, high recoverability and high value. The sensitivity of the receptor is therefore, considered to be low.

European otter VER

9.11.3.48 Otters produce a range of vocalisations in different social contexts, however vocalisations have never been observed beneath the water's surface (Ghoul and Reichmuth, 2012), thus communication masking is unlikely to occur. Studies on sea otters show an audible range of 0.125 kHz and 32 kHz, which are relatively comparable to terrestrial mustelids (Ghould and Reichmuth, 2012). Peak underwater hearing sensitivity lies in the range 7 kHz to 16 kHz while overall sensitivity levels are somewhat reduced compared with pinniped species. The pinniped behavioural response thresholds have therefore been used as a proxy for otter behavioural response thresholds, though this is assumed to be an over-precautionary assessment of the likely impact of underwater noise on otters.

9.11.3.49 Otters within range of increased underwater noise are likely to leave the water (Ghoul and Reichmuth, 2012). However, since the hearing acuity of otters is significantly less than for many marine mammal species, it is unlikely that disturbance ranges for otter will extend as far underwater as predicted for other marine mammals.

9.11.3.50 The otter VER is deemed to be not vulnerable to impacts regardless of value/importance. The sensitivity of the receptor is therefore, considered to be negligible.

Significance of the effect

Harbour porpoise VER

9.11.3.51 The sensitivity of the receptor is considered to be low and the magnitude of the impact is deemed to be minor (adverse). The effect will therefore be of **minor (adverse)** significance, which is not significant in EIA terms.

Bottlenose dolphin VER

9.11.3.52 The sensitivity of the receptor is considered to be low and the magnitude of the impact is deemed to be minor (adverse). The effect will therefore be of **minor (adverse)** significance, which is not significant in EIA terms.

Short-beaked common dolphin VER

9.11.3.53 The sensitivity of the receptor is considered to be low and the magnitude of the impact is deemed to be minor (adverse). The effect will, therefore, be of **minor (adverse)** significance, which is not significant in EIA terms.

Risso's dolphin VER

9.11.3.54 The sensitivity of the receptor is considered to be low and the magnitude of the impact is deemed to be minor (adverse). The effect will, therefore, be of **minor (adverse)** significance, which is not significant in EIA terms.

Grey seal VER

9.11.3.55 The sensitivity of the receptor is considered to be low and the magnitude of the impact is deemed to be minor (adverse). The effect will, therefore, be of **minor (adverse)** significance, which is not significant in EIA terms.

Basking shark VER

9.11.3.56 The sensitivity of the receptor is considered to be low and the magnitude of the impact is deemed to be minor (adverse). The effect will, therefore, be of **minor (adverse)** significance, which is not significant in EIA terms.

9.11.3.57 For the reasons discussed at section 9.11.2.48 above there is a level of uncertainty attached to this level of significance. This uncertainty has been addressed through the adoption of precautionary thresholds.

European otter VER

9.11.3.58 The sensitivity of the receptor is considered to be negligible and the magnitude of the impact is deemed to be minor (adverse). The effect will, therefore, be of negligible significance, which is not significant in EIA terms.

Further mitigation and residual effect

9.11.3.59 No further mitigation is suggested.

Increased collision risk - vessels

Magnitude of the impact

9.11.3.60 The level of vessel movement related to the operation and maintenance phase is described above in paragraphs 9.11.3.3.

9.11.3.61 Whilst vessel movements during the operation and maintenance phase increases by almost double that of the installation phase, these numbers remain small in comparison to the existing levels of traffic in the local marine mammal, basking shark and otter study area (see 9.11.2.10). The magnitude of impact of the operation and maintenance phase therefore, is not expected to differ from the installation phase. An overview of the likely magnitude of impact of increased collision risk with vessels is given in section 9.11.2.69 to 9.11.2.75.

9.11.3.62 In accordance with the installation phase (section 9.11.2.77) the impact is predicted to be of local spatial extent, long- term duration, but intermittent (short-term duration of individual vessel movements) and irreversible. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be minor (adverse).

Sensitivity of the receptor

9.11.3.63 The sensitivity of the receptor of the operation and maintenance phase is not expected to differ from the sensitivity of the installation phase (see sections 9.11.2.84 to 9.11.2.100).

Significance of the effect

9.11.3.64 The significance of the effect of the operation and maintenance phase is not expected to differ from the significance of the effect of the installation phase (see sections 9.11.2.101 to 9.11.2.107).

Further mitigation and residual effect

9.11.3.65 The further mitigation is suggested.

Collision risk – tidal turbines at Warrior Way (site 6)

9.11.3.66 Introduction of scaled or micro-scale marine tidal turbines poses a potential risk to marine mammal, basking shark and otter receptors at Warrior Way (site 6). Risk of collision between a moving turbine blade and a marine mammal, basking shark or otter is thought to be a key potential effect of tidal turbine operation and it is considered that all species of marine mammals, basking shark and otter that are known to occur in the local marine mammal, basking shark and otter study area may be at potential risk of collision impact, which could ultimately result in death or injury. Whilst a distinction can be drawn between species that forage in the water column or at the seabed they all must return to the surface to breathe and so regularly transit the water column.

9.11.3.67 Device components, specifically the terminal end of the rotating blade, pose the greatest risk of potential injury in the event of a collision (Turnpenny *et al.,* 2000).

Magnitude of impact

9.11.3.68 The maximum number of tidal turbines to be installed at Warrior Way (site 6) at any time is one. Tidal turbines will be scaled/micro-scale devices with no full-scale devices to be tested (see Appendix 2 for further details of potential devices to be installed at the META project sites). The maximum rotor diameter (maximum scenario) will be up to 5 m, with tip speeds of 5 m/s or less. This equates to a swept area of 19.63 m^2 (maximum scenario). The maximum dimensions of tidal components will be 20 m x 10 m, with the most likely scenario of 5 m x 5 m.

9.11.3.69 The most likely scenario is rotor diameter of up to 5 m, with a tip speed of up to 2 m/s which equates to a swept area of 19.63 m^2.

9.11.3.70 In the context of the cross-section of sea area in the Waterway at the mid-point of Warrior Way (site 6) (11,570 m^2), this equates to 0.17 % (maximum and most likely scenarios) of the tidal stream cross-sectional area at this location. The maximum duration of scaled tidal device testing at Warrior Way (site 6) is 6 months, and the most likely is 3 months.

9.11.3.71 A number of factors including the visibility, audibility, dimensions and rotation speed of the turbine blades, how important the location is for feeding or breeding and the extent of long-range avoidance and close-range evasion all interact to determine the likelihood of collision.

9.11.3.72 Wilson *et al.* (2007) report that responses to the tidal devices are likely to occur on two spatial scales; at long range the marine mammals have the option to avoid the area of device placement (i.e. swim around) and at closer range they can evade the particular structures (i.e. dodge or swerve). Research conducted by the Sea Mammal Research Unit (SMRU) on the SeaGen commercial tidal device, showed that tagged harbour seals exhibited avoidance behaviour up to 250 m from the tidal device, and the tidal device did not act as a barrier to expected transiting behaviour. Telemetry information however showed that whilst the turbine was operating, some individual seals were reducing the frequency of transit by between 10 and 50% (Sparling *et al.,* 2017). Data also showed that for the duration on environmental monitoring, no seals were reported to collide with the turbine.

9.11.3.73 It has long been recognised that elasmobranch species may be affected by Offshore Renewable Energy Devices (OREDs) (Gill, 2005; Gill & Kimber, 2005). In the case of the basking shark Speedie *et al.* (2009) determined that there was clear potential for collision with underwater turbine devices (Speedie *et al,* 2009). However, basking shark were recorded in Strangford Lough whilst the Seagen tidal device was deployed, and observations recorded no collision (Carol Sparling - Pers. Comms.).

9.11.3.74 It is highly likely that animals within the Waterway are habituated to high levels of traffic and are adept at avoiding obstacles in the water column. In daytime and high visibility, underwater structures will be visible at ranges of tens of metres, giving sufficient warning. Collision risk is also expected to be higher in waters of high turbidity; chapter 5: Coastal Processes reports that Warrior Way (site 6) does not hold high sediment content and it is not likely that turbines will resuspend any sediment themselves.

9.11.3.75 Based on sightings data (see Figure 9.5), it is predicted that short-beaked common dolphin, bottlenose dolphin, minke whale, Risso's dolphin, and basking shark would not be found as far into the Waterway as Warrior Way (site 6) and as such there is a lack of receptor-impact pathway. Although it is highly unlikely that harbour porpoise would be found within the Warrior Way (site 6) site area, sightings suggest that they do occasionally enter the Waterway (local marine mammal, basking shark and otter study area) (see Figure 9.5), a precautionary approach would be to assume that individuals have the potential to enter this area. However, given that numbers of animals are relatively low in the local marine mammal, basking shark, and otter study area when compared to the regional marine mammal, basking shark, and otter study area, few harbour porpoise are expected to enter the zones of impact and thus, few, if any, will be negatively impacted. The population level effects are therefore expected to be inconsequential.

9.11.3.76 Whilst grey seals are likely to be observed in the local marine mammal, basking shark and otter study area (see Figure 9.10), and this population is deemed important in the scale of the MU, the number of animals are relatively low in the local marine mammal, basking shark, and otter study area when compared to the regional marine mammal, basking shark, and otter study area (see 9.7.3).

Cetacean and basking shark VERs

9.11.3.77 The potential impact for all cetacean and basking shark VERs is predicted to be of local spatial extent, long-term duration, but intermittent (short-term duration of individual scaled device deployments) and reversible. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be minor (adverse).

Grey seal VER

9.11.3.78 Grey seals have been sighted within the Waterway and as far east as Neyland (see Figure 9.10), as such it is assumed that individuals have the potential to enter the vicinity of Warrior Way (site 6). Based on the information provided in sections 9.11.3.66 to 9.11.3.72 however, it is highly likely that seals would exhibit avoidance and as such, few animals are expected to be negatively affected.

9.11.3.79 The potential impact for the grey seal VER is predicted to be of local spatial extent, long-term duration, but intermittent (short-term duration of individual scaled device deployments) and reversible. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be minor (adverse).

Otter VER

9.11.3.80 Otters are found throughout the Waterway (see Figure 9.12) and as such it is assumed that individuals have the potential to enter the vicinity of Warrior Way (site 6).

9.11.3.81 Based on the information provided in sections 9.11.3.66 to 9.11.3.72 it is highly likely that otters would exhibit avoidance. In addition, Hung and Law (2016) observed that otters usually forage less than 50 m from shore and less than 8 m water depth, bringing prey one at a time back to the surface, with dives lasting less than 96 seconds. This is corroborated by Heggbergettet (1993) who describes a 0 – 10 m foraging depth zone for otters, and by Kruuk and Moorhouse, 1991 (as stated in 9.11.2.98) who observed that otters forage within 80 m of the shore 62% of the time, within 50 m 84% of the time, and within 20 m 98% of the time. Otters are thought to prefer to dive in shallow waters of 0 – 3 m and rocky intertidal areas where benthic prey are more abundant (Kruuk and Moorhouse, 1991; Kruuk, 2006). Given that the expected rotor diameter of the tidal turbine is 5 m, and the maximum scenario of device diameters is 20 m x 10 m the water depth required to deploy the device would far exceed 3 m, and would most likely be deployed at a distance from the shoreline that otters would not expect to be found foraging at. However, given that the Waterway supports important numbers of otters, there remains a small potential for otters to be affected by collision with operational scaled tidal turbines at Warrior Way (site 6).

9.11.3.82 The impact is predicted to be of local spatial extent, long-term duration, but intermittent (short-term duration of individual scaled device deployments) and irreversible. The likelihood of impact is predicted to be low. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be minor (adverse).

Sensitivity of the receptor

9.11.3.83 Although avoidance of the tidal turbines is highly likely, it is possible that some marine mammals may encounter the turbine blades. It is however unclear as to the expected extent of the injuries as a result of collision. Wilson *et al.*, (2007) comment that effects may include:

- Minor injuries (abrasions);
- Temporary or permanent debilitation (internal injuries, surface wounds, damage to delicate organs such as eyes); and
- More significant injuries (major cuts, amputations or internal trauma).

9.11.3.84 Wilson *et al.,* (2007) also reported that dependent on the severity or location, these injuries could result in recoverable injuries, permanent debilitation, delayed or instant mortality.

Harbour porpoise VER

9.11.3.85 The harbour porpoise VER is deemed to be of medium vulnerability, low recoverability and very high value. The sensitivity of the receptor is therefore, considered to be medium.

Bottlenose dolphin VER

9.11.3.86 The bottlenose dolphin VER is deemed not vulnerable to impacts regardless of value/importance. The sensitivity of the receptor is therefore, considered to be negligible.

Short-beaked common dolphin VER

9.11.3.87 The short-beaked common dolphin VER is deemed not vulnerable to impacts regardless of value/importance. The sensitivity of the receptor is therefore, considered to be negligible.

Risso's dolphin VER

9.11.3.88 The Risso's dolphin VER is deemed not vulnerable to impacts regardless of value/importance. The sensitivity of the receptor is therefore, considered to be negligible.

Grey seal VER

9.11.3.89 The grey seal VER is deemed to be of medium vulnerability, low recoverability and very high value. The sensitivity of the receptor is therefore, considered to be medium.

Basking shark VER

9.11.3.90 The basking shark VER is deemed not vulnerable to impacts regardless of value/importance The sensitivity of the receptor is therefore, considered to be negligible.

European otter VER

9.11.3.91 The European otter VER is deemed to be of medium vulnerability, low recoverability and very high value. The sensitivity of the receptor is therefore, considered to be medium.

Significance of the effect

Harbour porpoise VER

9.11.3.92 The sensitivity of the receptor is considered to be medium and the magnitude of the impact is deemed to be minor (adverse). The effect will, therefore, be of **minor (adverse)** significance, which is not significant in EIA terms.

Bottlenose dolphin VER

9.11.3.93 The sensitivity of the receptor is considered to be negligible and the magnitude of the impact is deemed to be minor (adverse). The effect will, therefore, be of **negligible (adverse)** significance, which is not significant in EIA terms.

Short-beaked common dolphin VER

9.11.3.94 The sensitivity of the receptor is considered to be negligible and the magnitude of the impact is deemed to be minor (adverse). The effect will, therefore, be of **negligible (adverse)** significance, which is not significant in EIA terms.

Risso's dolphin VER

9.11.3.95 The sensitivity of the receptor is considered to be negligible and the magnitude of the impact is deemed to be minor (adverse). The effect will, therefore, be of **negligible to minor (adverse)** significance, which is not significant in EIA terms.

Grey seal VER

9.11.3.96 The sensitivity of the receptor is considered to be medium and the magnitude of the impact is deemed to be minor (adverse). The effect will, therefore, be of **minor (adverse)** significance, which is not significant in EIA terms.

Basking shark VER

9.11.3.97 The sensitivity of the receptor is considered to be negligible and the magnitude of the impact is deemed to be minor (adverse). The effect will, therefore, be of **negligible (adverse)** significance, which is not significant in EIA terms.

European otter VER

9.11.3.98 The sensitivity of the receptor is considered to be medium and the magnitude of the impact is deemed to be minor (adverse). The effect will, therefore, be of **minor (adverse)** significance, which is not significant in EIA terms.

Further mitigation and residual effect

9.11.3.99 No future mitigation is suggested.

Changes in fish and shellfish communities

9.11.3.100 Fish and shellfish receptors may be vulnerable to a number of impacts during the operation and maintenance phase including tidal turbine collision risk, and barriers to movement of known migratory routes due to presence of tidal device (see chapter 8: Fish and Shellfish).

Magnitude of impact

9.11.3.101 During the operation and maintenance phase of the META project the presence of tidal turbines has the potential to pose a collision risk and to act as a physical barrier to migratory routes of fish and shellfish receptors.

9.11.3.102 The key prey species for marine mammals include a number of clupeids (e.g. herring), gadoids (e.g. cod, whiting), flatfish and sandeels. These species have been identified as important components of the fish community within the META project fish and shellfish study area and subsequently negative effects on the fish assemblages identified in the META project impact assessment may have indirect negative effects on marine mammal receptors.

9.11.3.103 The magnitude of the potential impact of turbine collision was assessed as being negligible (section 8.11.3.49 and the sensitivity of fish and shellfish receptors ranged from negligible to medium (section 8.11.3.52 *et seq.*); consequently, the effects of collision risk was of negligible to minor adverse significance (section 8.11.3.64 *et seq.*).

9.11.3.104 The magnitude of the potential impact of the disruption of migration pathways due to the physical presence of the turbine was assessed as being negligible (section 8.11.3.77 and the sensitivity of fish and shellfish receptors ranged from negligible to low (section 8.11.3.78 *et seq.*); consequently, the effects of temporary habitat loss was of negligible to minor adverse significance (section 8.11.3.91 *et seq.*).

9.11.3.105 No significant adverse effects are predicted to occur to fish and shellfish as a result of the operation and maintenance of the META project; therefore, the magnitude of the impact on marine mammals is deemed to be minor.

Sensitivity of the receptor

9.11.3.106 The sensitivity of the receptor of the operation and maintenance phase is not expected to differ from the sensitivity of the installation phase (see sections 9.11.2.148 to 9.11.2.157).

Significance of the effect

9.11.3.107 The significance of the effect of the operation and maintenance phase is not expected to differ from the significance of the effect of the installation phase (see sections 9.11.2.158 to 9.11.2.165).

Further mitigation and residual effect

9.11.3.108 No future mitigation is suggested.

Changes in hydrodynamic regime

9.11.3.109 As stated in chapter 5: Coastal Processes, tidal current devices which employ impeller or turbine technology extract kinetic energy from the tidal flow. They therefore have the potential to change the hydrodynamic regime where they are deployed and operational. Warrior Way (site 6) is the only META site where this type of device will be deployed. This site will enable the testing of scaled and micro tidal power devices on a short-term basis. Studies of offshore resources have determined that installations at full scale with a limited number of devices have a marginal influence on tidal flows, and large-scale arrays are required to produce significant changes.

Magnitude of impact

9.11.3.110 Under chapter 5: Coastal Processes, an analysis was undertaken using the maximum design proposed for Warrior Way (site 6) (see Table 9.8); the maximum duration of scaled tidal device testing at Warrior Way (site 6) is 6 months, and the most likely is 3 months. The maximum swept area of scaled tidal devices is 19.63 m2.

9.11.3.111 An assessment of a 5 m diameter turbine placed at Warrior Way (site 6) determined that the swept area of the blade constituted 0.17% of the cross-sectional area of the channel, at the mean water level. Applying a normalised power, the drag co-efficient for a turbine working within optimal parameters would be 0.4, i.e. extraction of 40% of the energy passing through the swept area. Applying this parameter to the proposed device showed a reduction in the energy across the channel of < 0.15% (see chapter 5: Coastal Processes for details).

9.11.3.112 The localised reduction in current speed in the immediate sweep area was 2 % which is in the order of 0.035 m/s at peak current speeds. Therefore, there would not be any change in the flow regime, with indiscernible changes in current speed outside the immediate area. With respect to the Strangford Study (Marine Current Turbines, 2005 in chapter 5: Coastal Processes), results of CFD suggested that the downstream influence (wake) of the entire structure is unlikely to cover an area greater than 1.5 times the diameter. Therefore, if this principle is applied to Warrior Way (site 6), any minor flow disruption would lie within the test area.

9.11.3.113 The Copelands Study (Shannon, 2011) compared the flow behaviour of single deployment and a range of array types. It demonstrated that where flow is unconfined, tidal currents will take the path of least resistance, and will flow around a single tidal structure. Therefore, the energy extraction potential may be reduced and a co-efficient of 0.4 would be considered conservative. In reality, the reduction in stream energy would also be lower, particularly when current speeds are reduced around slack water and optimum operational conditions are no longer maintained.

Cetacean and basking shark VERs

9.11.3.114 Based on sightings data (see Figure 9.5), it is predicted that short-beaked common dolphin, bottlenose dolphin, minke whale, Risso's dolphin, and basking shark would not be found as far into the Waterway as Warrior Way (site 6) and as such there is an absence of receptor-impact pathway. Although it is highly unlikely that harbour porpoise would be found within the Warrior Way (site 6) site area, sightings data suggest that they do occasionally enter the Waterway (local marine mammal, basking shark and otter study area) (see Figure 9.5), a precautionary approach would be to assume that individuals have the potential to enter the test area. However, given that numbers of animals are low in the local marine mammal, basking shark, and otter study area when compared to the regional marine mammal, basking shark, and otter study area, few harbour porpoise are expected to enter the zone of impact.

9.11.3.115 In addition, based on the information provided in the magnitude section of *Collision risk – tidal turbines at Warrior Way (site 6)* (sections 9.11.3.66 to 9.11.3.72) it is highly likely that animals would exhibit avoidance of the tidal turbines, and therefore any changes to hydrodynamic regime within the test area would have little or no affect on harbour porpoise.

9.11.3.116 The analysis performed in chapter 5: Coastal Processes deemed the magnitude of the impact as minor (adverse).

Harbour porpoise VER

9.11.3.117 The potential impact for harbour porpoise VER is predicted to be of local spatial extent, long-term duration, but intermittent (short-term duration of individual scaled device deployments) and reversible. The likelihood of impact is predicted to be low. It is predicted that the impact will affect the receptor indirectly. The magnitude is therefore, considered to be minor (adverse).

Grey seal VER

9.11.3.118 Grey seals have been sighted within the Waterway and as far east as Neyland (see Figure 9.10), as such it is assumed that individuals have the potential to enter the vicinity of Warrior Way (site 6) and thus the potential to forage within the test area.

9.11.3.119 The relative importance of the Warrior Way (site 6) test area for feeding, and availability of alternative foraging areas within the local and regional study area will determine the likelihood of grey seals foraging within the test area. Based on the information provided in the magnitude section of *Collision risk – tidal turbines at Warrior Way (site 6)* (sections 9.11.3.66 to 9.11.3.72), it is highly likely that seals would exhibit avoidance of the tidal turbines. In particular research conducted by the Sea Mammal Research Unit (SMRU) on the SeaGen commercial tidal device, showed that tagged harbour seals exhibited avoidance behaviour up to 250 m from the tidal device. As such a receptor-impact pathway is unlikely, and few animals are expected to be negatively affected by impairment of foraging opportunities as a result of changes in hydrodynamic regime at Warrior Way (site 6).

9.11.3.120 The potential impact on the grey seal VER is predicted to be of local spatial extent, long-term duration, but intermittent (short-term duration of individual scaled device deployments) and reversible. The likelihood of impact is predicted to be low. It is predicted that the impact will affect the receptor indirectly. The magnitude is therefore, considered to be minor (adverse).

Otter VER

9.11.3.121 Otters are found throughout the Waterway (see Figure 9.12) and as such it is assumed that individuals have the potential to enter the vicinity of Warrior Way (site 6).

9.11.3.122 Based on the magnitude section of *Collision risk – tidal turbines at Warrior Way (site 6)* (sections 9.11.3.66 to 9.11.3.72) it is highly likely that otters would exhibit avoidance. In addition, Hung and Law (2016) observed that otters usually forage less than 50 m from shore and in less than 8 m water depth, bringing prey one at a time back to the surface, with dives lasting less than 96 seconds. This is corroborated by Heggbergettet (1993) who describes a 0 – 10 m foraging depth zone for otters, and by Kruuk and Moorhouse, 1991 (as stated in 9.11.2.98) who observed that otters forage within 80 m of the shore 62% of the time, within 50 m 84% of the time, and within 20 m 98% of the time. Otters are thought to prefer to dive in shallow waters of 0 – 3 m and rocky intertidal areas where benthic prey are more abundant (Kruuk and Moorhouse, 1991; Kruuk, 2006). Given that the expected rotor diameter of the tidal turbine is 5 m, and the maximum scenario of device diameters is 20 m x 10 m the water depth required to deploy the device would far exceed 3 m, and would most likely be deployed at a distance from the shoreline that otters would not expect to be found foraging at. However, given that the Waterway supports important numbers of otters, there is the potential for otters to be affected by impairment of foraging opportunities as a result of changes in hydrodynamic regime at Warrior Way (site 6).

9.11.3.123 The impact is predicted to be of local spatial extent, long-term duration, but intermittent (short-term duration of individual scaled device deployments) and irreversible. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be minor (adverse).

Sensitivity of the receptor

Harbour porpoise VER

9.11.3.124 Marine mammals regularly occur in turbid environments, exploiting energetic tidal-stream habitats (Benjamins *et al.,* 2016). Harbour porpoise in particular tend to forage in high energy habitat; in Pembrokeshire, preferred foraging for harbour porpoise is high-energy habitat in South Ramsey Sound where a tide race, overfalls and upwelling zones form during the ebb phase of the tide. Tidal currents and the steep walls of a trench are believed to concentrate prey which is funnelled towards the waiting porpoises. harbour porpoi and therefore are adapted to finding prey in such conditions.

9.11.3.125 Changes to hydrodynamic regime in important high-energy feeding habitat for harbour porpoise could lead to a reduction in foraging opportunities, however Warrior Way (site 6) has not been recorded as an important foraging area for harbour porpoise and therefore any change to hydrodynamic regime is not likely to reduce foraging availability, particularly when high-energy tidal-stream habitat is located nearby at Ramsey Sound (Pierpoint, 2008).

9.11.3.126 The harbour porpoise 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.

Grey seal VER

9.11.3.127 Grey seal foraging strategies have also been linked to areas categorised by complex hydrodynamic processes, driven by irregular topography and strong tidal currents; physical processes and variety in substrates lead to high biodiversity (Vincent *et al.,* 2016). As stated in 9.11.3.125 changes to hydrodynamic regime in important high-energy feeding habitat for grey seal could lead to a reduction in foraging opportunity, however Warrior Way (site 6) has not been recorded as an important foraging area for grey seal and therefore any change to hydrodynamic regime is not likely to reduce foraging availability, particularly when high-energy tidal-stream habitat is located nearby at Ramsey Sound (Pierpoint, 2008).

9.11.3.128 The grey seal 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.

European otter VER

9.11.3.129 Foraging strategies in European otter have not been directly linked to areas of particularly high-energy water but are more likely driven by substrate, depth and access to intertidal areas. It is therefore unlikely that any changes in hydrodynamic regime would have an effect on foraging opportunities in otter.

9.11.3.130 The otter 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

Harbour porpoise VER

9.11.3.131 The sensitivity of the receptor 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.

Grey seal VER

9.11.3.132 The sensitivity of the receptor 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.

European otter VER

9.11.3.133 The sensitivity of the receptor 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.

Entanglement risk

9.11.3.134 Incidental mortality of marine mammals caught in ropes, lines and fishing gear, is recognised as a significant conservation problem (Benjamins *et al*., 2014). Whilst less is known about the likelihood of marine mammal, basking shark or otter entanglement in offshore renewable mooring lines, particularly those which attach to floating devices, the potential for this impact is becoming widely recognised (Benjamins *et al.,* 2014; Harnois *et al.,* 2015).

Magnitude of impact

9.11.3.135 At Warrior Way (site 6) mooring of testing devices will require up to four drag anchors with associated slack lines, with one device deployed at any one time. At Dale Roads (site 7) mooring of testing devices will require up to ten drag anchors with associated slack lines, with one device deployed at any one time. At East Pickard Bay (site 8) mooring of testing devices will require up to ten standard drag embedment anchors with associated slack lines, with up to two devices deployed at any one time, and up to four device deployments in a 12-month period.

9.11.3.136 The most likely scenario at Dale Roads (site 7) and East Pickard Bay (site 8) is up to four standard drag embedment anchors with associated slack lines, and at Warrior Way (site 6) the most likely scenario is that no slack lines will be required as the device will be deployed from vessels or a test support buoy.

9.11.3.137 A number of factors including the visibility, dimensions, how important the location is for feeding or breeding and the extent of close-range evasion all interact to determine the likelihood of entanglement.

9.11.3.138 At Warrior Way (site 6) the presence of operating scaled tidal turbines and associated noise may contribute to marine mammals, basking shark and otter avoiding the testing site (see sections 9.11.3.71 to 9.11.3.74), and therefore avoiding entanglement. However, as previously reported, sightings of cetaceans and basking shark within the Waterway are low (see Figure 9.5). Sightings of grey seal and otter within the Waterway are more common (see Figure 9.10 and Figure 9.12).

9.11.3.139 Cetaceans, grey seal and basking shark are more likely to be foraging closer to East Pickard Bay (site 8). As stated in 9.11.2.28, given that numbers of animals are relatively low in the local marine mammal, basking shark, and otter study area when compared to the regional marine mammal, basking shark, and otter study area, few animals are expected to enter the ZoIs and thus, few, if any, will be negatively impacted.

9.11.3.140 Whilst otter are found throughout the Waterway (see Figure 9.12), there is no available evidence of otter entanglement in ropes, and therefore this potential impact is expected to have no impact on otters.

9.11.3.141 The impact is predicted to be of local spatial extent, medium-term duration, intermittent and reversible. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be minor.

Sensitivity of the receptor

9.11.3.142 The potential outcomes of entanglement in slack lines for a marine mammal can include low level injury such as abrasions, to long-term severe injury and even mortality. Worldwide, fatal entanglement in fishing gear is a source of anthropogenically induced mortality in cetaceans, pinnipeds and elasmobranchs (Cassoff *et al.,* 2011), however much less is known of the potential risks for incidental mortality associated with marine renewable energy developments.

9.11.3.143 Baleen whales appear to be particularly vulnerable to entanglement due to their size. Fewer comparable records exist of entanglements involving small cetaceans (e.g. dolphins), which are more vulnerable to bycatch in nets than to rope entanglement due to their smaller size. In addition, scarring in baleen whales has shown that some individuals are able to disentangle themselves, however long-term injury is a likely outcome regardless.

9.11.3.144 Rope entanglement has been reported to be the cause of many incidental mortalities of pinnipeds worldwide (Harnois *et al.,* 2015). Allen *et al.* (2012) report rope as one of several types of marine debris found on grey seals at a haul-out site in Cornwall, suggesting that this problem could occur elsewhere in UK waters.

9.11.3.145 Basking sharks have been recorded in ropes associated with stationary gear and there is evidence of individuals being washed ashore, entangled in ropes (Harnois *et al.,* 2015).

9.11.3.146 There is a distinct lack of evidence that otter are vulnerable to rope entanglement which is likely due to the species' small size, and agility. It is therefore unlikely that otter would be impacted by entanglement risk.

Harbour porpoise VER

9.11.3.147 The harbour porpoise VER is deemed to be of low vulnerability, low recoverability and very high value. The sensitivity of the receptor is therefore, considered to be medium.

Short-beaked common dolphin VER

9.11.3.148 The short-beaked common dolphin VER is deemed to be of low vulnerability, low recoverability and very high value. The sensitivity of the receptor is therefore, considered to be low to medium.

Bottlenose dolphin VER

9.11.3.149 The bottlenose dolphin VER is deemed to be of low vulnerability, low recoverability and very high value. The sensitivity of the receptor is therefore, considered to be low to medium.

Risso's dolphin VER

9.11.3.150 The Risso's dolphin VER is deemed to be of low vulnerability, low recoverability and very high value. The sensitivity of the receptor is therefore, considered to be low to medium.

Minke whale VER

9.11.3.151 The minke whale VER is deemed to be of medium vulnerability, low recoverability and very high value. The sensitivity of the receptor is therefore, considered to be medium.

Grey seal VER

9.11.3.152 The grey seal VER is deemed to be of low vulnerability, low recoverability and very high value. The sensitivity of the receptor is therefore, considered to be low to medium.

Basking shark VER

9.11.3.153 The basking shark VER is deemed to be of low vulnerability, low recoverability and very high value. The sensitivity of the receptor is therefore, considered to be low to medium.

European otter VER

9.11.3.154 The European otter VER is deemed to be not vulnerable to impacts regardless of value/importance. The sensitivity of the receptor is therefore, considered to be negligible.

Significance of the effect

Harbour porpoise VER

9.11.3.155 The sensitivity of the receptor is considered to be low to medium and the magnitude of the impact is deemed to be minor (adverse). The effect will, therefore, be of **minor (adverse)** significance, which is not significant in EIA terms.

Bottlenose dolphin VER

9.11.3.156 The sensitivity of the receptor is considered to be medium and the magnitude of the impact is deemed to be minor (adverse). The effect will, therefore, be of **minor (adverse)** significance, which is not significant in EIA terms.

Short-beaked common dolphin VER

9.11.3.157 The sensitivity of the receptor is considered to be low to medium and the magnitude of the impact is deemed to be minor (adverse). The effect will, therefore, be of **minor (adverse)** significance, which is not significant in EIA terms.

Risso's dolphin VER

9.11.3.158 The sensitivity of the receptor is considered to be low to medium and the magnitude of the impact is deemed to be minor (adverse). The effect will, therefore, be of **minor (adverse)** significance, which is not significant in EIA terms.

Minke whale VER

9.11.3.159 The sensitivity of the receptor is considered to be medium and the magnitude of the impact is deemed to be minor (adverse). The effect will, therefore, be of **minor (adverse)** significance, which is not significant in EIA terms.

Grey seal VER

9.11.3.160 The sensitivity of the receptor is considered to be low to medium and the magnitude of the impact is deemed to be minor (adverse). The effect will, therefore, be of **minor (adverse)** significance, which is not significant in EIA terms.

Basking shark VER

9.11.3.161 The sensitivity of the receptor is considered to be low to medium and the magnitude of the impact is deemed to be minor (adverse). The effect will, therefore, be of **minor (adverse)** significance, which is not significant in EIA terms.

European otter VER

9.11.3.162 The sensitivity of the receptor is considered to be low to medium and the magnitude of the impact is deemed to be negligible (adverse). The effect will, therefore, be of **negligible** significance, which is not significant in EIA terms.

Further mitigation and residual effect

9.11.3.163 No future mitigation is suggested.

Accidental pollution

Magnitude of impact

9.11.3.164 The maximum size of vessels used at East Pickard Bay (site 8) is 200 m length and eight m draught, at Dale Roads (site 7) is up to 164 m in length with a 6.8 m draught, and at Warrior Way (site 6) is up to 35 m length and 6.8 m draught. The most likely vessel size is up to 164 m length and 6.8 m draught at East Pickard Bay (site 8) and Dale Roads (site 7), and up to 30 m length and 6.8 m draught at Warrior Way (site 6).

9.11.3.165 Whilst vessel movements during the operation and maintenance phase increases by almost double that of the installation phase, the same management measures, implemented by the MPCP, will be placed on all vessels during the operation and maintenance phase. The magnitude of impact of the operation and maintenance phase therefore, is not expected to differ from the installation phase. A review of the likely oil inventory to be involved in a spill, and the likely impact on marine mammal, basking shark and otter receptors is outlined in 9.11.2.168 *et seq.* and is not reiterated here.

9.11.3.166 In accordance with the magnitude of impact of the installation phase, in the event a large spill does occur, the impact is predicted to be of local spatial extent, long-term duration, intermittent and irreversible. The likelihood of an accidental pollution event occurring is considered unlikely It is predicted that the impact would affect the receptor directly. The magnitude is therefore, considered to be minor.

Sensitivity of the receptor

9.11.3.167 The sensitivity of the receptors in the operation and maintenance phase is not expected to differ from the sensitivity of receptors of the installation phase. An assessment of sensitivity and behavioural response is given in section 9.11.2.181 *et seq.* and as such is not reiterated here.

Significance of the effect

9.11.3.168 The significance of the effect of the operation and maintenance phase is not expected to differ from the significance of the effect of the installation phase (see section 9.11.2.189 *et seq.*).

Further mitigation and residual effect

9.11.3.169 No further mitigation is suggested.

Future monitoring

9.11.3.170 No marine mammal, basking shark or otter monitoring to test the predictions made within the operation and maintenance phase impact assessment is considered necessary.

9.11.4 Decommissioning phase

9.11.4.1 The impacts of the decommissioning of the META project have been assessed on marine mammals, basking shark and otter. The environmental effects arising from the decommissioning of the META project are listed in Table 9.8 along with the maximum and most likely design scenarios against which each decommissioning phase impact has been assessed. The impacts during the decommissioning phase are expected to be of the same nature and magnitude as those predicted from the installation phase of the META project, therefore the assessment of potential impacts on marine mammals, basking shark and otters presented within Sections 9.11.2.1 to 9.11.2.198 have been assumed for the decommissioning phase and are not reiterated here.

9.11.5 Additional Measures

9.11.5.1 No survey, mitigation or monitoring relating to the META project have been made in relation to marine mammals, basking shark or otter. However the following measures are recommended in relation to device-specific deployments.

Otter walkover surveys

9.11.5.2 There was no site-specific information on the European otter *Lutra lutra* for the META sites, however historical records show that this species is distributed widely throughout Pembrokeshire and this region may be a stronghold for otter in the UK. The Milford Haven Waterway Site of Special Scientific Interest (SSSI) supports nationally important numbers of otter and otter is a designated feature of several Special Areas of Conservation (SACs) within the region, including Pembrokeshire Marine/ Sir Benfro Forol SAC, Pembrokeshire Bat Sites and Bosherston Lakes/ Safleoedd Ystlum Sir Benfro a Llynnoedd Bosherston SAC and Cleddau Rivers/ Afonydd Cleddau SAC.

9.11.5.3 The majority of sightings of otter for the local marine mammal, basking shark and otter study area are incidental and therefore there are uncertainties in the distribution and abundance of this species in relation to the META sites. The most recent population estimate for otter in Wales is from 2004 data and is given as 762 (JNCC, 2007), but there are no estimates given for the Waterway. There may be the requirement for device-specific activities to obtain an EPS licence to support their testing activities. Warrior Way (site 6) is considered most likely to have habitats likely to support otter.

9.11.5.4 Therefore, whilst there were no significant impacts on otter identified in this Environmental Statement it is proposed that device-specific surveys are undertaken prior to device-deployment, to provide further site-specific and deployment specific information to support any EPS licencing requirements.

9.11.5.5 The key objectives of a device-specific otter survey are:

- To determine whether otter regularly use the habitats around Warrior Way (site 6) at the time of proposed device-deployment and testing activities; and
- To determine whether otter breed within or near to the habitats around Warrior Way (site 6).

9.11.5.6 Should otter activity be recorded in proximity to proposed activities at Warrior Way (site 6), further discussion with relevant stakeholders will be carried out to determine appropriate and proportionate measures that may be required.

Marine Mammal Observer (MMO)

9.11.5.7 Should the provision of device-specific information (through device-specific EMPs) lead to a concern in relation to potential impacts on marine mammals during the installation and decommissioning phases of any device-specific activities, consideration will be given to the need for a Marine Mammal Observer (MMO) during such activities. The need for an MMO will be discussed with the relevant stakeholders on a case-by-case basis.

9.12 Cumulative Impact Assessment methodology

9.12.1 Methodology

9.12.2 Screening of other projects and plans into the Cumulative Effect Assessment

9.12.2.1 The Cumulative Impact Assessment (CIA) takes into account the impacts 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 and are presented in Table 9.21. 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.

9.12.2.2 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.

Table 9.21: List of other projects and plans considered within the CIA.

Phase	Developer - Reference	Distance from Warrior Way (site 6) (km)	Distance from Dale Roads (site 7) (km)	Distance from East Pickard Bay (site 8) (km)	Spatial/temporal overlap with the META project	Details	Date of Construction	Further Assessment required?	Taken further for assessment
Plans									
Draft Welsh National Marine Plan (dWNMP) (Welsh Government, 2017)	NRW	0.00	0.0	0.0	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 dWNMP. The dWNMP applies to the Welsh marine area which consists of around 32,000 km^2 of sea, as well as 2,120 km of coastline.	The dWNMP will be implemented over a 20-year period, with 3 yearly reviews.	Yes – Benthic Subtidal and Intertidal habitats, Coastal and supralittoral habitats, Marine Mammals, Diadromous fish, Pelagic seabirds (breeding and wintering); and Wildfowl and waders (breeding and wintering)	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).
Dredging sites									
Installation/ operation and maintenance	Neyland Yacht Haven ltd. - DML1743	1.1	12.3	10.5	No spatial overlap with consented areas. Potential for temporal overlap.	Dredge and disposal from Neyland Marina - annual volume 5500 m^3.	13/12/2017-12/12/2020	Yes	Given the distances to META phase 2 sites and the potential for temporal overlap, this project cannot be excluded from further consideration in the CIA. Vessel operation and therefore potential for collision risk and increased underwater noise, may present potential cumulative impacts with the META project.
Installation/ operation and maintenance	Milford Haven Port Authority - DML1646	1.3	1.5	2.5	No spatial overlap with consented areas Temporal overlap with all sites.	Maintenance dredging throughout the Milford Haven. Annual volume 362500 m^3.	09/03/2017-08/03/2022	Yes	
Dredge disposal sites									
Installation/ operation and maintenance	Neyland dredge disposal site - LU190	0.5	12.4	10.5	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	Not applicable	Yes	Given the distances to META phase 2 sites and the potential for temporal overlap, this project cannot be excluded from further consideration in the CIA. Vessel operation and therefore potential for collision risk and increased underwater noise, may present potential cumulative impacts with the META project.
Research									
Installation	Greenlink Interconnector Ltd. - RML1827	10.4	6	0	Spatial overlap with East Pickard Bay (site 8).	Ground investigations	07-2018 - no end date given	Yes	Research operations are likely to have vessels present, with equipment for undertaking ground

Phase	Developer - Reference	Distance from Warrior Way (site 6) (km)	Distance from Dale Roads (site 7) (km)	Distance from East Pickard Bay (site 8) (km)	Spatial/temporal overlap with the META project	Details	Date of Construction	Further Assessment required?	Taken further for assessment
					Temporal overlap with East Pickard Bay (site 8).				truthing surveys. Vessels may present potential cumulative impacts for collision risk and both vessels and ground investigation equipment may present potential cumulative impacts for increased underwater noise
Installation	University College of Swansea - DEML1861	~4-5	~8-9	~6-7	Location is assumed to be by the Pembroke Power station. No spatial overlap with any of the consented areas. Temporal overlap.	Pembroke Power bubble barrier experiment Investigation into the effectiveness of bubble curtains in sediment management	Band 2 licence issued 12/12/2018 - three-year study	No	Due to the nature of the research operations, it is highly unlikely to present overlap with impacts assessed above.
Installation	University College of Swansea - DEML1845	12.7	5.4	0	Spatial overlap with East Pickard Bay (site 8). Temporal overlap with East Pickard Bay (site 8).	Deposition and subsequent removal of marker buoys with environmental monitoring and mid-water settlement plates.	30/08/2018-29/08/2019	Yes	Vessels and equipment will be required for the placement of marker buoys. It is highly likely to have overlap with impacts. Vessel operation and therefore potential for collision risk and increased underwater noise, may present potential cumulative impacts with the META project
Infrastructure									
Installation/ operation and maintenance	Neyland Yacht Haven Ltd - CML1658	1.1	12.3	10.5	No spatial overlap with consented areas Temporal overlap with Warrior Way (site 6)	Pile replacement in Neyland Marina.	21/11/2016-20/11/2019	No	Pile replacement is currently ongoing until 2019, which does not overlap with the installation and operational phases of the META project. Operational phases of this project may overlap with operation and installation phases of META therefore this project cannot be excluded from further consideration in the CIA.
Installation/ operation and maintenance	Mixed use developments - Local Planning Authority Reference: 14/0158/PA	7.3	5.3	5.6	No spatial overlap with any consented areas. Temporal overlap remains unknown due to insufficient information on start and end dates.	Undetermined planning application. Demolition of several existing buildings and the mixed-use redevelopment of Milford Waterfront comprising up to 26,266 m2 of commercial, hotel, leisure, retail and fishery related floorspace. Up to 190 residential properties, up to 70 additional marina berths, replacement boat yards, landscaping, public realm enhancements, access and ancillary works. A decision on this application is yet to be made by the local planning authority.	EIA screening decision was returned on the 30/04/2018 - no further information has been provided	Yes	Given the distance from the project and likely impact pathways, there is potential for cumulative impacts to affect marine mammals, basking shark and otter due to increased vessels and therefore increased underwater noise
Installation/ operation and maintenance / decommissioning	Greenlink Interconnector Ltd. - Government reference: qA1296053	10.4	6	0	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	07/2018 - ongoing	Yes	Given potential for temporal and spatial overlap with META phase 2 sites this project can not be excluded from further consideration in the CIA. There is the potential for cumulative effects on marine mammals, basking shark and otter due

Phase	Developer - Reference	Distance from Warrior Way (site 6) (km)	Distance from Dale Roads (site 7) (km)	Distance from East Pickard Bay (site 8) (km)	Spatial/temporal overlap with the META project	Details	Date of Construction	Further Assessment required?	Taken further for assessment
						Landfall at Fresh Water West beach to the south of the mouth of the Waterway.			to increased suspended sediment and/or changes in habitat availability.
Installation/ operation and maintenance/ decommissioning	Bombora Wave Energy	11.6	5.0	0	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^2 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.	Q1 2020	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.
Ministry of Defence Sites									
	Ministry of Defence	8.1	5.5	0.0	Temporal overlap	The Castlemartin Range is located immediately south of the entrance to the Waterway and extends for up to 12 NM from the coast between Little Furznip (at the southern extent of Freshwater West) and St Govan's Head (Milford Haven Port Authority 2019). The southern boundary of the East Pickard Bay (Site 8) site is located adjacent to the northern boundary of the Castlemartin Military Practice Area D113A. The range at Castlemartin supports the training of military personnel (Army) in the firing of a range of munitions at land based targets. The seaward danger area provides a safety zone for overfire and shrapnel which may result from the striking of targets (RPS, 2010). The Castlemartin Range is used every day of the week and on some weekends (RPS, 2010).	N/A	Yes	There is a high level of uncertainty as to timing of MOD activities at the MOD site, however on-going activity is likely therefore there is the potential for cumulative impacts with the META project. Vessel operation and therefore potential for collision risk and increased underwater noise, may present potential cumulative impacts with the META project
Aquaculture projects									
Installation/ operation and maintenance	Tehthys Oysters	8.9	5.1	2.6	Temporal overlap	The oyster farm is located on the eastern side of Angle Bay, whereby oysters are grown in baskets on metal supports. The farm will be serviced from the shore by foot.	Oct 2017 – Oct 2020 (possible renewal of licence)	Yes	There is potential for temporal overlap with the META project and as such will be included for assessment.

Phase	Developer - Reference	Distance from Warrior Way (site 6) (km)	Distance from Dale Roads (site 7) (km)	Distance from East Pickard Bay (site 8) (km)	Spatial/temporal overlap with the META project	Details	Date of Construction	Further Assessment required?	Taken further for assessment
Installation/ operation and maintenance	Pembrokeshire Scallops	15.3	1.8	3.9	Temporal overlap	The scallop farm is located within Castlebeach Bay, whereby a system of weighted ropes will be deployed for growing scallops and mix species of native algae. The farm will be serviced by vessels and divers.	Jan 2019 – Q4 2020 (possible renewal of licence)	Yes	There is potential for temporal overlap with Dale Roads (site 7) and as such will be taken forward for assessment.
Pembroke Dock Marine Projects									
Installation/ operation and maintenance	Milford Haven Port Authority - SC1810	2	11.3	8.8	No spatial overlap with consented sites. Potential for temporal overlap.	Pembroke Dock redevelopment Scoping Report submitted. 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.	Q3 2019 – Q3 2023	Yes	Port activity as a result of Pembroke Dock Port operations could cause an increase in vessels and underwater noise emissions, increased potential for suspended sediments, and impacts on shipping and navigation. There is therefore the potential for cumulative impact with activities associated the META Project.
Installation/ operation and maintenance / decommissioning	Marine Energy Wales - DEML1875	1.7	11.7	9.4	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	21/04/2019-21/04/2029	Yes	Vessel use, and some testing activities could result in an increase in vessels and underwater noise. There is therefore the potential for cumulative impact with activities associated the META Project.
Installation/ Operation and Maintenance/Decommissioning	Wave Hub Ltd. - SC1082	31.4	31.1	25.8	No spatial overlap with any consented areas. Potential for temporal overlap as the projects are linked.	Pembroke 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.	Jul-18	Yes	There is the potential for temporal overlap with this project therefore this project cannot be excluded from further consideration in the CIA.

9.12.2.3 The potential impacts identified for assessment as part of the marine mammal, basking shark and otter cumulative impact assessment (CIA) are*:*

- Increased underwater noise emissions;
- Vessel collision;
- Increase in SSC; and
- Changes to fish and shellfish communities.

9.12.2.4 Considering the information presently available in the public domain on the projects for which there is a potential for cumulative impacts, those that are considered to have the potential to result in cumulative impacts have been assessed further.

9.12.2.5 The nature of the possible cumulative impact will depend on the nature of the development; for example, there will be no cumulative operational effects with cable projects. However, the potential for cumulative impact exists in the installation phase with all other project types. The scope for such cumulative impact will however be limited to projects for which the installation schedule is similar to that of the META project.

9.12.2.6 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.

9.12.2.7 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.

9.13 Cumulative Impact Assessment

9.13.1.1 A description of the significance of cumulative impacts upon marine mammal, basking shark and otter receptors arising from each identified impact is given below.

Increased underwater noise emissions

9.13.1.2 Increased underwater noise emissions may occur as a result of cumulative impacts arising from projects that spatially or temporally overlapping with the META project, as listed in Table 9.21. These include dredging operations at Neyland Yacht Haven, and MHPA in proximity to Warrior Way (site 6), and dredge disposal at dredge disposal sites LU170 and LU180 in proximity to East Pickard Bay (site 8). Research activities are not considered likely to result in potential for cumulative noise impacts. Pile replacement at Neyland Marina is scheduled to have completed by the time the META project is installed therefore there is no potential for cumulative impact. Installation of the Greenlink Interconnector and Bombora Wave Energy temporary communications cable may result in very short-duration increases in underwater noise in proximity to East Pickard Bay (site 8), however other infrastructure projects are land based and therefore considered unlikely to result in increased underwater noise. In addition, in relation to East Pickard Bay (site 8), MOD activities are on-going and considered to constitute part of the baseline. Pembroke Dock Infrastructure may result in short-term increases in underwater noise in proximity to Warrior Way (site 6), however META phase 1 is not considered likely to result in increased underwater noise and WaveHub is considered to be of sufficient distance from the META project not to have the potential for cumulative impact.

9.13.1.3 The potential impacts of increased underwater noise from vessels have been outlined in Section 9.11.2.1 and are not re-iterated here.

Magnitude of impact

9.13.1.4 The impact ranges from installation vessels for other projects are likely to be of a similar scale as predicted for the META project and therefore the scope for cumulative impact is minimal since each project will have minimal potential to cause injury or disturbance , and uplift in noise emissions is therefore expected to be low.

9.13.1.5 The significance of increased underwater vessel noise for the META project was predicted to be of minor (adverse) effect.

9.13.1.6 The potential cumulative impact of a small number of projects resulting in small potential injury or disturbance zones due to increased underwater noise might make a slightly larger proportion of suitable habitat unavailable for a particular marine mammal species, basking shark or otter to use. As described previously however, the local/regional density estimates for all marine mammal, basking shark and otter species are very low. The geographic ranges of marine mammals, basking shark using the local marine mammal, basking shark and otter study area are large, and as a result it is unlikely that cumulative impacts of temporary increased disturbance due to increased underwater noise will have result in detectable changes in spatial or temporal disturbance to marine mammal species or basking sharks. The home range of otters using the local marine mammal, basking shark and otter study area is smaller, therefore there is the potential for greater impact of noise on otters. However, since the hearing acuity of otters is significantly less than for many marine mammal species, it is unlikely that disturbance ranges for otter will extend as far underwater as predicted for other marine mammals" - Underwater Noise sensitivity is considered to be negligible for otters.

9.13.1.7 The dWMNP concludes no adverse effect on site integrity of any European site due to the plans included within the dWNMP.

9.13.1.8 The impact is predicted to be of local spatial extent, long-term duration, but intermittent (short-duration of vessel movements) and reversible. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be minor (adverse).

Sensitivity of receptor

9.13.1.9 As summarised in Table 9.17, the potential for behavioural disturbance as a result of vessel noise activity of the META projects is likely to extend out to a maximum of 2 km. Whilst this may overlap with noise emissions resulting in behavioural disturbance from other projects, such as Pembroke Dock Port Operations (MHPA) the sensitivity of marine mammal, basking shark and otter VERs is not expected to increase from the predicted negligible to low, as reported in sections 9.11.2.40 to 9.11.2.52.

Significance of effect

9.13.1.10 Overall, it is predicted that the sensitivity of the receptor is considered to be **negligible** to **low** and the magnitude is deemed to be **minor**. The significance of the effect will, therefore, be of **minor** (adverse) significance, which is not significant in EIA terms.

Further mitigation and residual effect

9.13.1.11 No further mitigation is suggested.

Increased collision risk – vessels

9.13.1.12 A cumulative increased risk of collision with vessels may occur as a result of interactions with projects that spatially or temporally overlapping with the META project, as listed in Table 9.21. The potential impacts of increased vessel collision risk have been outlined in Section 9.11.2.64 and are not re-iterated here.

Magnitude of impact

9.13.1.13 Installation and maintenance vessels for all projects assessed will be slow moving, and the number of vessels involved will be low, particularly in comparison the existing levels of traffic within the Waterway.

9.13.1.14 The dWMNP concludes no adverse effect on site integrity of any European site due to the plans included within the dWNMP.

9.13.1.15 Animals are likely to show some degree of habituation to already high levels of existing traffic therefore a small cumulative increase in vessels is considered unlikely to result in an increased number of collisions. In addition, local/regional density estimates for all marine mammal and basking shark species are low and therefore the impact on marine mammals and basking shark is predicted to be of local spatial extent, long-term duration but intermittent (short-duration of vessel movements) and reversible. It is predicted that the impact will affect the receptor directly. The magnitude is therefore considered to be minor (adverse).

Sensitivity of receptor

9.13.1.16 The sensitivity of marine mammal VERs to vessel collision risk is not expected to change from assessment of sensitivity described in sections 9.11.2.84 to 9.11.2.100. The overall sensitivity of the receptors is medium.

Significance of effect

9.13.1.17 Overall, it is predicted that the sensitivity of the receptors is considered to be **medium** and the magnitude is deemed to be **minor**. The significance of the effect will, therefore, be of **minor** (adverse) significance, which is not significant in EIA terms.

Changes to fish and shellfish communities

9.13.1.18 For potential effects on fish and shellfish as prey items for marine mammals, basking shark and otter, the extent of the cumulative assessment was based upon the screening and CIA undertaken for chapter 8: Fish and Shellfish.

Magnitude of impact

9.13.1.19 The cumulative impacts on temporary changes to fish and shellfish habitat, and temporary increases in suspended sediments are discussed in chapter 8: Fish and Shellfish (section 8.13.1.2 *et seq.*) and are not re-iterated here.

9.13.1.20 The dWMNP concludes no adverse effect on site integrity of any European site due to the plans included within the dWNMP.

9.13.1.21 The magnitude of impact of temporary changes to fish and shellfish habitat in the Fish and Shellfish CIA is reported to be moderate, due to the presence of projects within the Waterway.

9.13.1.22 The magnitude of impact of temporary increases in SSC in the Fish and Shellfish CIA is reported to be minor.

9.13.1.23 In accordance with the marine mammal, basking shark and otter assessment, no significant adverse effects are predicted to occur to fish and shellfish as a result of cumulative effects; therefore, the magnitude of the impact on marine mammals, basking shark and otter is deemed to be minor.

Sensitivity of receptor

9.13.1.24 The sensitivity of marine mammal, basking shark and otter VERs to changes to fish and shellfish communities is not expected to change from the assessment of sensitivity described in sections 9.11.2.150 to 9.11.2.157. The overall sensitivity of the receptors is low.

Significance of effect

9.13.1.25 Overall, it is predicted that the sensitivity of the receptors is considered to be **low** and the magnitude is deemed to be **minor**. The significance of the effect will, therefore, be of **minor** (adverse) significance, which is not significant in EIA terms.

Increase in suspended sediment concentration

9.13.1.26 Increased suspended sediments may occur as a result of cumulative impacts arising from projects that spatially or temporally overlapping with the META project, as listed in Table 9.21 .The potential impacts of an increase in SSC have been outlined in Sections 9.11.2.112 to 9.11.2.121 and are not re-iterated here.

Magnitude of impact

9.13.1.27 Dredging activities and dredge disposal may result in temporary increases in suspended sediment within the Waterway. Activities are very short duration (days) and are considered to have negligible potential to result in increase in suspended sediment. Mixed use development of the Milford Haven Waterfront, development of the Pembroke Dock Infrastructure project, and activities associated with Phase 1 of the META project may result in temporary increases in suspended sediment in close proximity to Warrior way (site 6), but is unlikely to result in increased suspended sediment at Dale Roads (site 7) or East Pickard bay (site 8). Cabling works associated with the Greenlink interconnector and the proposed Bombora Wave Energy project may lead to temporary increases of suspended sediment at East Pickard bay (site 8), but these will be of short-duration (days).

9.13.1.28 Though a number of projects which could lead to increases in suspended sediment within the local marine mammal, basking shark and otter study area are predicted to overlap with the installation, operation and maintenance, or decommissioning phases of the META project, potential increases in suspended sediment are not predicted to be extensive or long-term due to the high energy environment and meso-tidal environments present within the Waterway and associated waters. It is considered that increases in suspended sediment could occur in the medium-term.

9.13.1.29 The dWMNP concludes no adverse effect on site integrity of any European site due to the plans included within the dWNMP.

9.13.1.30 The impact is therefore predicted to be of local spatial extent, short- term duration, to be intermittent and reversible. It is predicted that the impact will affect the receptor directly. The magnitude is therefore considered to be **minor**.

Sensitivity of the receptor

9.13.1.31 The META project assessment of sensitivity for marine mammal, basking shark and otter VERs are assessed as low (see sections 9.11.2.125 to 9.11.2.132), and it is assumed that this is the same for the CIA.

Significance of the effect

9.13.1.32 The overall sensitivity of the receptors is considered to be low and the magnitude of the impact is deemed to be minor (adverse). The effect will, therefore, be of **minor (adverse)** significance, which is not significant in EIA terms.

Future monitoring

9.13.1.33 No monitoring is proposed to validate the assessment of the CIA.

9.14 Transboundary effects

9.14.1.1 A screening of transboundary impacts has been carried out and has identified that there was no potential for significant transboundary effects with regards to marine mammals, basking sharks and otters from the META project upon the interests of other EEA States.

9.15 Inter-related effects

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

9.15.1.2 There are not considered to be any potential marine mammal, basking shark and otter inter-related effects.

9.16 Conclusion and summary

9.16.1.1 Table 9.22 summarises the assessment of impacts on marine mammal, basking shark and otter associated with the installation, operation and maintenance, and decommissioning phases of the META project, alone and cumulatively with other plans or projects.

Table 9.22: 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
Installation phase							
Increased anthropogenic underwater noise – installation activities	EMP and EMMP	Minor	Negligible - Low	Minor (not significant in EIA terms)	Device-specific consideration of requirement for MMO and pre-deployment otter survey	n/a	None
Increased collision risk with vessels	EMP and EMMP	Minor	Medium	Minor (not significant in EIA terms)	Device-specific consideration of requirement for MMO and pre-deployment otter survey	n/a	None
Increases in SSC	EMP and EMMP	Minor	Low	Minor (not significant in EIA terms)	Device-specific consideration of requirement for MMO and pre-deployment otter survey	n/a	None
Changes in fish and shellfish communities	EMP and EMMP	Minor	Low	Minor (not significant in EIA terms)	Device-specific consideration of requirement for MMO and pre-deployment otter survey	n/a	None
Accidental pollution	EMP, MPCP and EMMP	Minor	Low - Minor	Minor (not significant in EIA terms)	None	n/a	None
Operation and maintenance phase							
Increased anthropogenic underwater noise – vessels	EMP and EMMP	Minor	Negligible - Low	Minor (not significant in EIA terms)	Device-specific consideration of pre-deployment otter survey	n/a	None
Increased anthropogenic underwater noise – tidal turbine operation	EMP and EMMP	Minor	Low	Minor (not significant in EIA terms)	Device-specific consideration of pre-deployment otter survey	n/a	None
Increased collision risk with vessels	EMP and EMMP	Minor	Medium	Minor (not significant in EIA terms)	Device-specific consideration of pre-deployment otter survey	n/a	None
Collision risk – tidal turbines at Warrior Way (site 6)	EMP and EMMP	Minor	Medium	Negligible - minor (not significant in EIA terms)	Device-specific consideration of pre-deployment otter survey	n/a	None
Changes in fish and shellfish communities	EMP and EMMP	Minor	Low	Minor (not significant in EIA terms)	Device-specific consideration of pre-deployment otter survey	n/a	None
Changes in hydrodynamic regime	EMP and EMMP	Minor	Low	Minor (not significant in EIA terms)	Device-specific consideration of pre-deployment otter survey	n/a	None
Entanglement risk	EMP and EMMP	Minor	Negligible - medium	Minor (not significant in EIA terms)	Device-specific consideration of pre-deployment otter survey	n/a	None
Accidental pollution	EMP, MPCP and EMMP	Minor	Low - Minor	Minor (not significant in EIA terms)	None	n/a	None
Decommissioning phase							

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
Increased anthropogenic underwater noise – decommissioning activities	EMP and EMMP	Minor	Negligible - Low	Minor (not significant in EIA terms)	Device-specific consideration of requirement for MMO and pre-deployment otter survey	n/a	None
Increased collision risk with vessels	EMP and EMMP	Minor	Medium	Minor (not significant in EIA terms)	Device-specific consideration of requirement for MMO and pre-deployment otter survey	n/a	None
Increases in SSC	EMP and EMMP	Negligible	Low	Minor (not significant in EIA terms)	Device-specific consideration of requirement for MMO and pre-deployment otter survey	n/a	None
Changes in fish and shellfish communities	EMP and EMMP	Minor	Low	Minor (not significant in EIA terms)	Device-specific consideration of requirement for MMO and pre-deployment otter survey	n/a	None
Accidental pollution	EMP, MPCP and EMMP	Major	Low - Minor	Minor (not significant in EIA terms)	None	n/a	None

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