AQUIND Limited

PEIR CHAPTER 10

Marine Mammals and Basking Sharks

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10 MARINE MAMMALS AND BASKING SHARK

10.1 SCOPE OF THE ASSESSMENT

10.1.1 INTRODUCTION

10.1.1.1 This chapter provides the preliminary information regarding the environmental impacts on marine mammals and basking shark as a result of the Proposed Development.

10.1.1.2 This chapter outlines the potential impacts associated with the construction, operation (including repair and maintenance) and decommissioning of the Proposed Development, as known at the time of publication.

10.1.2 STUDY AREA

10.1.2.1 The Entire Marine Cable Corridor extends from the Landfall at Eastney, near Portsmouth to Pourville in Normandy, France.

Marine Cable Corridor

10.1.2.2 The Marine Cable Corridor encompasses the location of the Landfall and extends from Eastney, from MHWS, out to the UK/France EEZ boundary line (see Figure 3.1. of Chapter 3 Description of the Proposed Development).

Landfall

10.1.2.3 The marine cables will make Landfall through the use of HDD methods which will travel underneath the intertidal areas at Eastney from an exit/entry point in the marine environment approximately 1 km seaward from the transition joint bays located in the car park behind Fraser Range (Figure 3.3 in Chapter 3 Description of the Proposed Development).

10.1.2.4 HDD is now also proposed to be undertaken at Langstone Harbour to enable the cables to cross underneath Langstone Harbour from Portsea Island to the mainland (see Figure 3.9 of Chapter 3 Description of the Proposed Development). It is anticipated that no HDD works will occur within the marine environment of Langstone Harbour as the drilling will be underneath seabed of the harbour area. The entry/exit points of the drill will be located above the MHWS mark.

10.1.2.5 For the purposes of this chapter, baseline data are relevant for UK and French waters within the Channel, however the assessment is focussed on the Marine Cable Corridor and Landfall within the UK marine area (as this comprises the Proposed Development to be assessed). Where impacts arise as a result of the combination of the impacts of the Proposed Development and the impacts of projects in the UK marine area and/or other EEA states, these are also identified and will be assessed.

10.1.2.6 Because marine mammals and basking sharks are mobile and range widely, the study area is considered to be the eastern Channel. The western extent of the study area reaches west of the Isle of Wight to Swanage and is demarcated by the western extent of the marine mammal Management Units ('MU') located within the Channel (Inter-Agency Marine Mammal Working Group ('IAMMWG'), 2015) as shown in Plate 10.1.

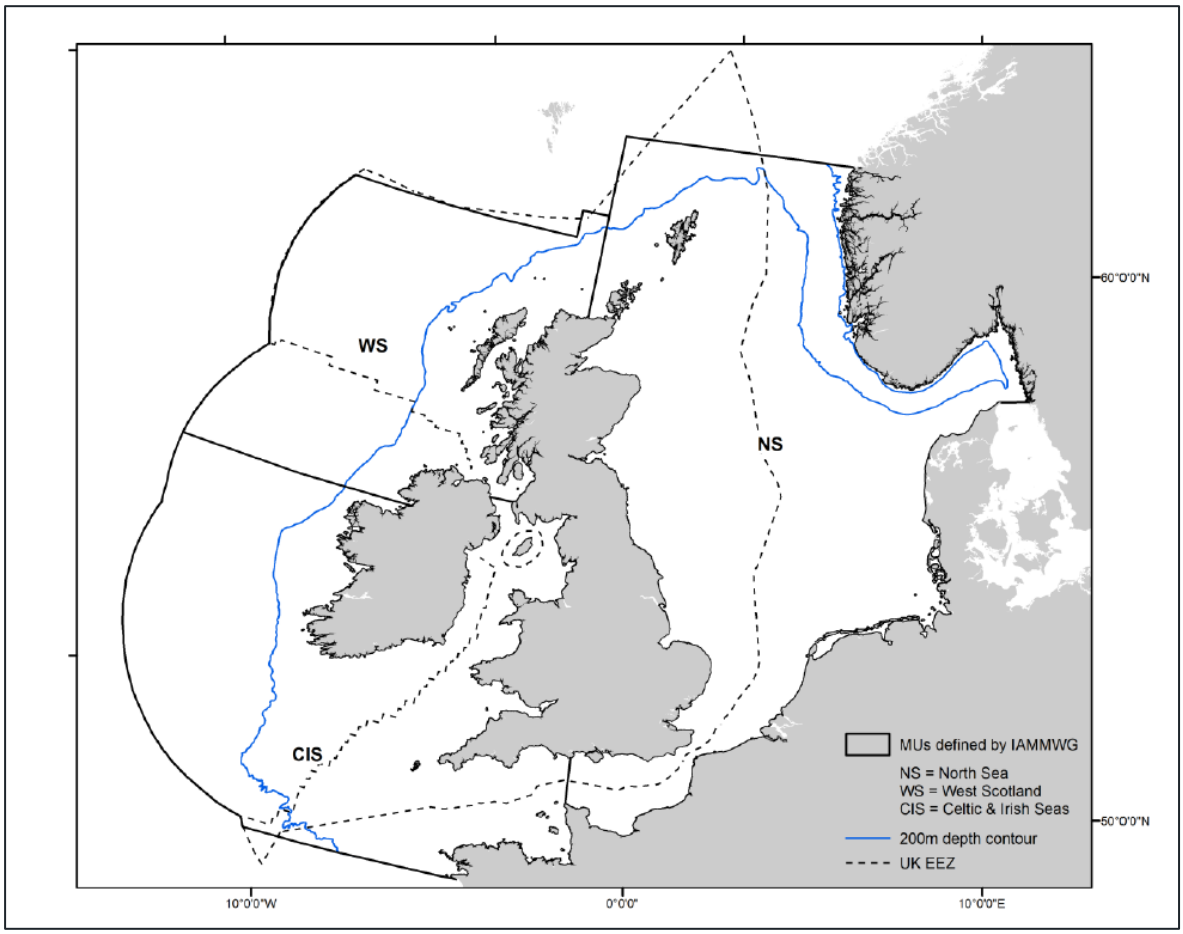

Plate 10.1 - Harbour porpoise MU (image taken from IAMMWG, 2015)

10.1.2.7 The eastern extent of the study area reaches to the narrowest part of the Channel towards Folkestone and is demarcated by the eastern extent of the SCANS III survey area known as Block C (Plate 10.2).

Plate 10.2 - SCAN III Block C survey area location (image taken from Hammond *et al.*, 2017)

10.2 LEGISLATION, POLICY AND GUIDANCE

10.2.1.1 This assessment has taken into account the current legislation, policy and guidance relevant to marine mammals and basking sharks. These are listed below.

10.2.2 LEGISLATION

- EC Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Fauna and Flora (known as the Habitats Directive);
- The Conservation of Habitats and Species Regulations 2017 (known as the Habitats Regulations) which transpose the Habitats Directive into national law. This legislation covers waters within the 12 nmi limit (known as territorial waters);
- The Conservation of Offshore Marine Habitats and Species Regulations 2017 (known as the Offshore Regulations) which transpose the Habitats Directive into UK law for all offshore activities. This legislation covers UK waters beyond the 12 nmi limit;
- Agreement on the Conservation of Small Cetaceans of the Baltic, North East Atlantic, Irish and North Seas 1994 ('ASCOBANS'). ASCOBANS entered into force in 1994 under the auspices of the Convention on Migratory Species (or Bonn Convention), with additional areas (the north-east Atlantic and Irish Sea) included in the Convention in 2008;
- Conservation of Seals Act, 1970;

- Wildlife and Countryside Act, 1981; and
- OSPAR (1992).

10.2.3 PLANNING POLICY

National Policy

- EN-1 Overarching NPS for Energy (2011).
  - Paragraph 5.3.3 states: 'Where the development is subject to EIA the applicant should ensure that the ES clearly sets out any effects on internationally, nationally and locally designated sites of ecological or geological conservation importance, on protected species and on habitats and other species identified as being of principal importance for the conservation of biodiversity. The applicant should provide environmental information proportionate to the infrastructure where EIA is not required to help the Infrastructure Planning Commission ('IPC') consider thoroughly the potential effects of a proposed project.'
- UK MPS (2011).
  - The UK MPS is the framework for preparing Marine Plans and taking decisions affecting the marine environment. This policy aims to contribute to the achievement of sustainable development and ensure that development aims to avoid harm to marine ecology and biodiversity through consideration of issues such as impacts of noise, ecological resources and water quality.

Regional Policy

- South Inshore and South Offshore Marine Plan (2018).
  - Objective 10 includes policies to avoid, minimise or mitigate adverse impacts on marine protected areas;
  - Objective 11 includes policies to avoid, minimise or mitigate significant adverse impacts on highly mobile species as a consequence of the generation of underwater noise (impulsive or ambient); and
  - Policy S-DIST - 1 requires proposals to avoid, minimise or mitigate significant cumulative adverse disturbance or displacement impacts on highly mobile species.

Guidance

- Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine (CIEEM, 2018);
- The protection of marine European Protected Species from injury and disturbance: Guidance for the marine area in England and Wales and the UK offshore marine area (JNCC *et al.*, 2010); and

- JNCC guidelines for minimising the risk of injury to marine mammals from geophysical surveys (JNCC, 2017).

10.3 SCOPING OPINION AND CONSULTATION

10.3.1 SCOPING OPINION

10.3.1.1 As detailed within Chapter 1 Introduction, a Scoping Opinion was received by the Applicant from PINS on 7 December 2018. The Scoping Opinion comments from PINS in relation to marine mammals and how they have been addressed in this chapter of the PEIR are set out below in Table 10.1.

Table 10.1 – Scoping Opinion responses

Consultee	Scoping Opinion ID / Page	Summary of Comment Received	How this has been addressed by the Applicant in this PEIR
PINS	4.5.1	The Scoping Report contains very little information on the likely numbers and types of vessels to be used for the Proposed Development and the baseline with which to compare. In the absence of sufficient justification, the Inspectorate cannot agree to scope out this matter. The ES should clearly describe the likely type and number of vessels to be utilised during construction and the risk to marine mammals. An assessment of collision impacts on marine mammals and basking sharks should be included, where significant effects are likely to occur.	Table 3.6 within Chapter 3 Description of the Proposed Development of the PEIR describes the likely type and numbers of vessels. This chapter describes the risks to marine mammals and basking sharks in Section 10.3. Further justification is provided as to why this matter can be scoped out.
PINS	4.5.2	As noted at point 4.5.1 above, the Scoping Report contains very limited information regarding the likely numbers and type of vessels, together with the likely noise generated from such vessels. The Inspectorate considers that insufficient justification has been provided as to why this matter can be scoped out. The ES should therefore include an	Table 3.6 within Chapter 3 Description of the Proposed Development of the PEIR describes the likely type and numbers of vessels. This chapter describes the risks to marine mammals and basking sharks in Section 10.3. Further justification is provided as to why this matter can be scoped out.

Consultee	Scoping Opinion ID / Page	Summary of Comment Received	How this has been addressed by the Applicant in this PEIR
		assessment of effects on marine mammals and basking sharks arising from increased vessel noise, where significant effects are likely to occur.	
PINS	4.5.3	The Scoping Report contains limited information with regards to the equipment involved and noise levels for these activities, together with baseline noise levels, to support the scoping out of this matter. Reference is made to the relatively low densities of species known to occur in the Channel; however, information on population densities for species has similarly not been provided in the Scoping Report to support this statement. Therefore, the Inspectorate does not agree to scope out these matters. The ES should include an assessment of effects on marine mammals and basking sharks arising from these activities, where significant effects are likely.	This chapter describes the baseline information and abundance densities for marine mammals and basking sharks in Section 10.5. This chapter assesses the potential effects of noise from construction/installation activities in Section 10.3. Further justification is provided as to why this matter can be scoped out.
PINS	4.5.4	The Scoping Report contains no information regarding marine mammal and basking shark populations within the likely Zone of Influence (ZoI) for the Proposed	This chapter describes the baseline information and population densities for marine mammals and basking sharks in Section 10.5.

Consultee	Scoping Opinion ID / Page	Summary of Comment Received	How this has been addressed by the Applicant in this PEIR
		Development, or evidence to support the statements made, in respect of basking sharks in particular. The Inspectorate considers that limited justification has been provided and therefore does not agree to scope out this matter. The ES should include an assessment of EMF effects on marine mammals and basking sharks, where significant effects are likely.	This chapter describes the risks from EMF to marine mammals and basking sharks in Section 10.3. Further justification is provided as to why this matter can be scoped out.
PINS	4.5.5	The Scoping Report does not define the study area and/or Zone of Influence (ZoI) for the assessment of effects on marine mammals and basking sharks. This should be clearly stated and justified in the ES.	The study area is described within Section 10.1.2 of this chapter, and the ZoI within Section 10.6 and Appendix 10.1 (Marine Mammal Cumulative Assessment Matrix).
PINS	4.5.6	This aspect refers to basking sharks within the title and in Table 10.2 scoping out of matters; however, no other reference is made to basking sharks. It is also unclear which data sources will be used to inform the baseline and assessment of impacts on basking sharks.	Chapter 10 describes the baseline information and population densities for marine mammals and basking sharks in Section 10.5. Data sources are listed in Table 10.5.

Consultee	Scoping Opinion ID / Page	Summary of Comment Received	How this has been addressed by the Applicant in this PEIR
		The ES should clearly identify the data sources used to inform the assessment.	
PINS	4.5.7	The Scoping Report does not clearly state whether an assessment will be included in the ES of potential significant impacts to sensitive receptors as a result of the detonation/removal of UXO from the marine environment. The Applicant should ensure that significant effects to marine mammals and basking sharks associated with UXO removal or detonations are assessed. The Applicant should make effort to agree the approach to the assessment with relevant consultation bodies.	Paragraph 2.1.13 of the Scoping Report stated that UXO surveys and any required UXO removal/detonation would be undertaken pre-construction and the works would be consented through a separate stand-alone marine licence. It is the intention of the Applicant to submit European Protected Species ('EPS') risk assessments, an application for EPS licence (if required) and all relevant environmental information required for these works to support the marine licence application. Accordingly, future UXO surveys, investigations and removals are not covered by this DCO application.
Natural England	Page 4	Natural England notes that the following impacts have been scoped out for further assessment; Marine mammals; Collision with vessels; and Increased vessel noise; and	Further information relating to these impacts is presented within Section 10.3 of this chapter.

Consultee	Scoping Opinion ID / Page	Summary of Comment Received	How this has been addressed by the Applicant in this PEIR
		Increased anthropogenic noise from geotechnical investigations, seabed preparation, route clearance, cable lay and burial; and Presence of EMF.	
JNCC	Page 3	We understand that this consultation at the moment involves a preliminary scoping report. However, we wish to reiterate, if it is found at a later date that avoiding UXO entirely is not achievable and UXO operations are to be carried out during the course of the project we would ask that the following would need to be included in a detailed assessment: • Consideration of the types of UXO likely to be present, the number of detonations likely in a single day, and the season over which these operations are due to occur; • An informed estimate of potential injury zones and marine mammal numbers within those zones (per species); • Details of marine mammal monitoring methods e.g. visual detection, PAM, designated person;	Paragraph 2.1.13 of the Scoping Report stated that UXO surveys and any required UXO removal/detonation would be undertaken pre-construction and the works would be consented through a separate stand-alone marine licence. It is the intention of the Applicant to submit EPS risk assessments, an application for EPS licence (if required) and all relevant environmental information required for these works to support the marine licence application. This information to support the marine licence would include those items listed by the JNCC. Accordingly, future UXO surveys, investigations and removals are not covered by this DCO application.

Consultee	Scoping Opinion ID / Page	Summary of Comment Received	How this has been addressed by the Applicant in this PEIR
		• Details of the deployment of acoustic deterrent devices; • Details of monitoring procedures e.g. mitigation vessel, mitigation zone, predetonation monitoring, timings and delay procedures; • Explosive charge sequencing and post detonation searches; • A communication protocol and a reporting protocol	

10.3.2 FURTHER JUSTIFICATION FOR SCOPING OUT POTENTIAL IMPACTS

10.3.2.1 The Scoping Opinion received from PINS identified that the potential impacts resulting from construction activities such as collision with vessels, increased vessel noise, noise from route clearance and cable installation could be not scoped out in the absence of sufficient justification. Accordingly, the impacts considered in the following paragraphs are afforded further consideration within this PEIR chapter in order to provide sufficient justification that the potential effects from these impacts are not considered to be significant and will therefore not require further detailed assessment.

10.3.2.2 For construction (and decommissioning) this includes the following impacts:

- Increased vessel noise;
- Collision with vessels; and
- Anthropogenic noise from geotechnical surveys, HDD works, seabed preparation, and cable installation activities.

10.3.2.3 For operation (including repair/maintenance) this includes:

- Increased vessel noise;
- Collision with vessels; and
- EMF.

Construction (and Decommissioning)

10.3.2.4 The potential effects of decommissioning are, in the worst case considered to be equivalent to the effects associated with construction in this section and are considered on this basis, though may potentially be less than those associated with construction/installation depending on the decommissioning activities undertaken (for instance, where the marine cable is left in situ).

Increased Vessel Noise

10.3.2.5 The presence of construction vessels will result in the generation of some subsea and airborne noise and vibration. General construction vessel noise will cause a temporary local increase in ambient noise levels, with the potential to lead to subsequent avoidance behaviour. Table 3.6 within Chapter 3 Description of the Proposed Development provides the likely indicative types and numbers of vessels proposed for the construction of the Proposed Development.

10.3.2.6 Prideaux (2017) has shown that the greater portion of sound produced by small vessels is mainly above 1 kHz, and the underwater sound intensity level produced is approximately 160-180 dB (rms[1]) re 1µPa at 1 m, with frequencies ranging from 20 Hz to >10 kHz. Medium vessels tend to have slower revving engines and frequencies produced tend to mimic large vessels[2] with the majority of sound energy below 1 kHz. The sound intensity level produced is approximately 165-180 dB (rms) re 1µPa at 1 m. Large vessels, depending on type, size and operational mode, produce their strongest sound intensity level, of approximately 180-190 dB (rms) re 1µPa at 1 m, at a few hundred Hz (Prideaux, 2017 and references therein).

10.3.2.7 While it is recognised that the majority of the support vessels shown in Table 3.6 of Chapter 3 Description of the Proposed Development may be classified as small, it is considered that medium and large are suitable "worst case" categorisations for vessels proposed to be utilised during the construction works.

10.3.2.8 Noise modelling undertaken for Inch Cape OWF examined the potential impact ranges of different vessel sizes for marine mammals. This revealed that the maximum noise impact ranges for harbour porpoise, bottlenose dolphin, humpback whale and harbour seal are likely to be very small (<1 m to 22 m), even for large vessels i.e. > 100 m in length (Table 10.2 – Strong avoidance reaction impact range (m) predicted for vessel noise from medium and large sized vessels) (Inchcape Offshore Ltd [ICOL] 2013).

Table 10.2 – Strong avoidance reaction impact range (m) predicted for vessel noise from medium and large sized vessels

Species	Medium vessels (<100 m)	Large Vessels (>100 m)
Harbour porpoise	11	22
Bottlenose dolphin	4	12
Humpback whale (used as a proxy for minke whale)	2	6
Harbour Seal	<1	<1

[1] RMS (root mean squared) is the formula used to calculate the mean of a sound wave over time. RMS values should be provided with constant non-impulsive (also known as non-plosive or continuous) sounds like shipping propeller and engine noise.

[2] "Large" vessels are those over 100m in length, while "Medium" vessels are considered to be those between 50 and 100m in length, for example tug-boats and crew-boats. Small vessels are <50m.

10.3.2.9 Chapter 3 Description of the Proposed Development provides the likely types and numbers of vessels proposed for the construction of the Proposed Development. An indicative worst-case for number of vessels at any one time is 62. This is the scenario whereby two post lay installation campaigns were running simultaneously within the UK marine area. The indicative number of vessel movements is 4,160 for the works to be completed. For context, Chapter 13 Shipping, Navigation and Other Marine Users identifies that within the 5 nmi buffer around the Proposed Development, daily marine traffic numbers typically ranged between 299 and 444 unique vessels each day with cargo ships, tankers and recreational vessels being the most frequently recorded.

10.3.2.10 Paragraph 575 of the South Marine Plan Technical Annex recognises that the English Channel and Dover Strait has some of the busiest shipping traffic worldwide alongside noise caused by other activities such as dredging and piling. Figure 20 within the South Marine Plan (Plate 10.3) illustrates that annual background levels of noise within the vicinity of the Proposed Development experience noise exposures above 100 dB for longer periods than other areas to the west and east of the Proposed Development within the UK marine area.

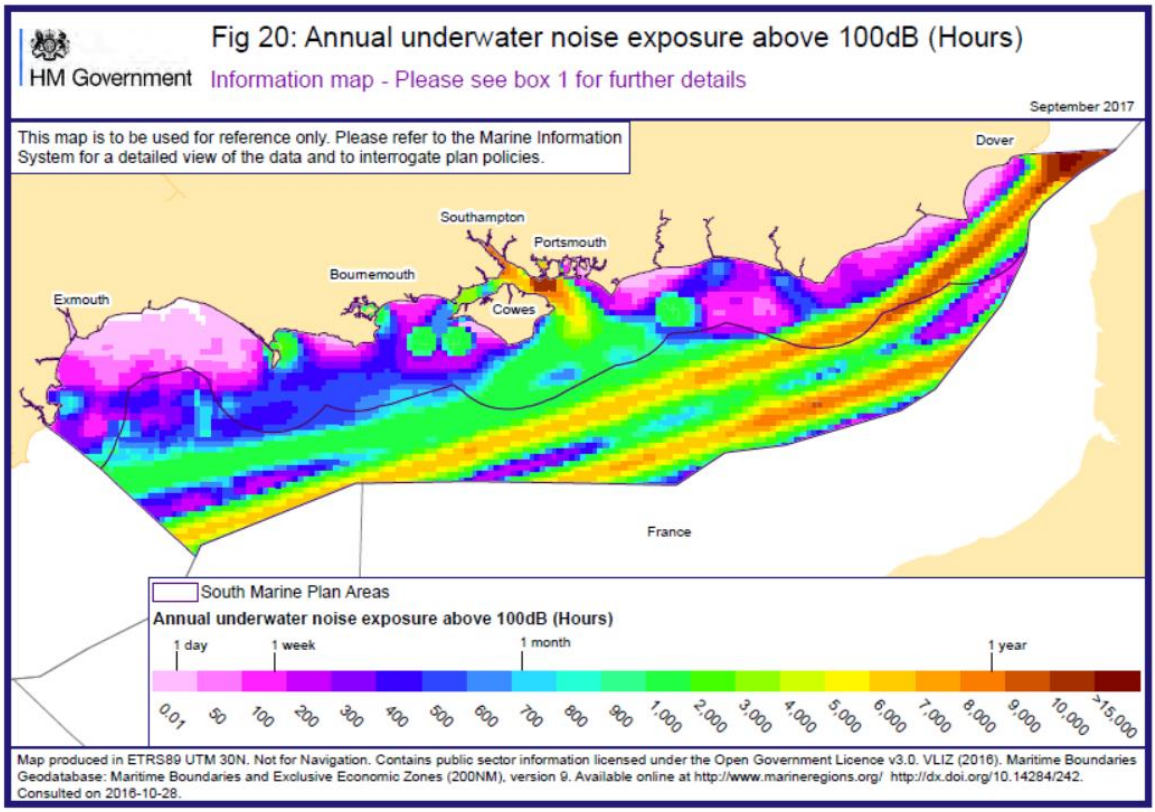

Plate 10.3 - Annual underwater noise exposure above 100 dB (hours) within the vicinity of the Proposed Development (image taken from HM Government South Marine Plans Technical Annex, 2018)

10.3.2.11 It is important to note therefore, that the area surrounding the Proposed Development is regularly used by large commercial shipping vessels that travel to and from the Southampton and Portsmouth and thus, the level of change in noise emissions resulting from the Proposed Development compared to background shipping will be negligible. In addition, working speeds of construction vessels will be slow-moving and marine mammals and basking sharks will be easily able to move away from the noise source.

10.3.2.12 In addition, the area of the Proposed Development is not an area of high use or importance for marine mammal species (see Section 10.5). The predicted effects are of very low severity and highly limited in extent therefore noise and vibration associated with the presence and movement of construction vessels is not considered likely to result in a significant effect with respect to marine mammals.

10.3.2.13 Although less is known about the impacts of anthropogenic noise on basking sharks, it is widely recognised that fish are generally less sensitive to noise than marine mammal species (e.g. ICOL, 2013). Prideaux (2017) suggests that elasmobranchs might suffer more from impacts from noise indirectly, i.e. through the effects on prey species and through acute events that impact concentration sites, and that pulsed sound emissions (vessel noise is not considered a pulsed sound source) are more likely to have the most impact. As basking sharks are zooplanktivorous, no impacts on prey are predicted. Furthermore, the area is not considered an area of particular importance for this species and as such noise impacts from vessels on basking shark are not considered likely to result in significant effects.

10.3.2.14 As such, no further assessment is considered necessary for this potential impact.

Collision with Vessels

10.3.2.15 Vessel strikes are a known cause of mortality in marine mammals and basking sharks (Laist *et al.*, 2001). Non-lethal collisions have also been documented (Laist *et al.*, 2001; Van Waerebeek *et al.*, 2007). Avoidance behaviour by cetaceans is often associated with fast, unpredictable boats such as speedboats and jet-skis (Bristow & Reeves, 2001; Gregory & Rowden, 2001; Leung Ng & Leung, 2003; Buckstaff, 2004), while neutral or positive reactions have been observed with larger, slower moving vessels such as cargo ships (Leung Ng & Leung, 2003; Sini *et al.*, 2005).

10.3.2.16 Cetaceans and basking sharks are species vulnerable to collisions with vessels through hull or propeller collisions. During construction, the marginal relative increase in vessel traffic movements (compared with the wider context of vessel movements within this area of the Channel) are unlikely to significantly increase the risk of collisions with marine mammals or basking sharks given that:

- Vessels will routinely be travelling at low speeds;
- Construction activity will represent only a small and localised increase in the very high levels of existing shipping activity in the area; and

- Marine mammals occur at relatively low abundance in the area of the Proposed Development and basking sharks are very infrequent visitors.

10.3.2.17 A small number of harbour seals do use the Proposed Development area for foraging, with local haul outs at Langstone and Chichester Harbours (Chesworth *et al.*, 2010). As described in the previous section, marine traffic levels in the English Channel and Solent are already very high with between 299 and 450 vessels typically transiting the vicinity of the Proposed Development daily (see Chapter 13 Shipping, Navigation and Other Marine Users). As such, it is likely that seals present will already be habituated to high levels of vessel movements. The increased level of vessel traffic resulting from the project is negligible in the context of the wider vessel activity in the area, and accordingly it is predicted that collisions between project vessels and seals are extremely unlikely.

10.3.2.18 Accordingly, it is predicted that collisions between construction vessels and marine mammals and/or basking sharks are extremely unlikely and there is no risk of significant effects presenting. As such no further assessment is considered necessary.

Increased Anthropogenic Noise from Geotechnical Surveys, HDD Works, Route Preparation and Cable Installation Activities

10.3.2.19 The use of construction equipment (e.g. ploughs and suction dredgers) will generate some underwater noise although no high-impact percussive works (e.g. piling or blasting) are proposed.

10.3.2.20 The main geotechnical survey work for the Proposed Development has already been completed. An EPS Risk Assessment (Natural Power, 2017) was submitted to relevant consultees for these works prior to the commencement of works. If any further geotechnical survey work is required for the Proposed Development, it is considered that similar methods and typical specifications of the equipment would be employed (Table 10.3)..

Table 10.3 – Proposed specification of geotechnical sampling equipment

Equipment Type	Purpose	Frequency Range	Maximum Source Pressure Level (dB (rms) re 1 µPa @1 m)
Vibrocore	Used to determine the sediment structure and composition of the sea bed.	30 Hz	188
CPT	Used to determine the geotechnical engineering properties of sediments.	28 Hz	118 - 145

Source: Vibrocore frequency LGL (2010); CPT frequency from Campanella et al. (1986); SPL values from EIRGRID (2014)

10.3.2.21 The maximum source pressure levels for the potential two types of geotechnical investigation (Table 10.3) are well below the permanent threshold shift ('PTS') thresholds of 230 dB re 1 µPa at 1 m for all cetaceans and 218 dB re 1 µPa at 1 m for pinnipeds (in water) (Southall *et al.*, 2007) and therefore there is no potential for physical or auditory injury to marine mammals[3]. It is possible that the geotechnical equipment may be detected by cetaceans, but its use is not expected to cause disturbance. Sound measurements carried out on various subsea survey equipment noted that the CPT sound emissions were so low it was not distinguishable from the vessel noise (LGL, 2010).

10.3.2.22 General construction noise will cause a temporary local increase in ambient noise. Activities will include the seabed preparation works, the cable trenching, laying and burial, and placement of rock or mattressing where cable burial depths cannot be achieved or where a cable crossing is required.

10.3.2.23 HDD methods will be used within Langstone Harbour and in the nearshore area at Eastney with the HDD exit/entry point expected to be located approximately 1 to 1.6 km from shore. In the main, HDD rigs operate many metres below the surface/seabed. At these depths, noise levels at the surface/seabed will be negligible. At the exit/entry point, when the drill reaches the surface/seabed, noise levels are likely to be higher but only short in duration.

[3] They are also well below the NOAA (2018) PTS thresholds which are detailed in Table 10.6.

10.3.2.24 Noise modelling undertaken for Inch Cape OWF examined the impact ranges of key construction activities relevant to the Proposed Development for marine mammals. Trenching activities included jetting and rock cutting which tended to be the most noise generating activities that could initiate avoidance reactions from species, with suction dredging and drilling producing the least noise.

10.3.2.25 The Sound Exposure Level (SEL) modelling indicated that the maximum impact range for auditory injury to occur from these activities is < 1 m (Inch Cape Offshore Ltd ('ICOL'), 2013). Therefore, it is unlikely that marine mammals will receive a level of noise sufficient to induce auditory injury.

10.3.2.26 The maximum noise ranges for behavioural responses from harbour porpoise, bottlenose dolphin, humpback whale and harbour seal are relatively low i.e. 140 m or less for all activities or species (Table 10.4). These small potential impact ranges should be considered within the context of the low SCANS-III abundance estimates shown in Section 10.6 (and the existing high background noise within the area illustrated in Plate 10.3 which is reflective of the busy commercial ports and shipping routes in the area. As such they are likely to be highly conservative.

Table 10.4 – Strong avoidance reaction impact range (m) predicted for different construction activities (ICOL, 2013)

Species	Trenching	Rock placement	Cable Laying	Suction Dredging/Drilling
Harbour porpoise	140	99	29	< 21
Bottlenose dolphin	81	31	9	< 7
Humpback whale (used as a proxy for minke whale)	59	70	18	< 16
Harbour Seal	12	17	2	< 2

10.3.2.27 General construction noise will cause a temporary local increase in ambient noise however, the different activities are likely to be intermittent throughout the construction programme and will not be long term. In addition, working speeds of construction vessels will be predictable and slow-moving and marine mammals and basking sharks will be able to easily move away from the noise source.

10.3.2.28 In summary, the area of the Proposed Development is not an area of high use or importance for marine mammal species and the predicted effects are of very low severity and highly limited in extent. Therefore, increased anthropogenic noise from construction activities is not considered likely to result in a significant effect with respect to marine mammals.

10.3.2.29 Although less is known about the impacts of anthropogenic noise on basking sharks, it is widely recognised that fish are generally less sensitive to noise than marine mammal species (e.g. ICOL, 2013). Prideaux (2017) suggests that elasmobranchs might suffer more from impacts from noise indirectly, i.e. through the effects on prey species and through acute events that impact concentration sites, and that pulsed sound emissions (construction noise is not considered a pulsed sound source) are more likely to have the most impact. As basking sharks are zooplanktivorous, no impacts on prey are predicted. Furthermore, the area is not considered an area of particular importance for this species and as such increased anthropogenic noise from construction activities on basking shark is not considered likely to result in significant effects.

10.3.2.30 As such no further assessment of this impact is considered necessary.

Operation (including Repair and Maintenance)

Operational Noise and Collision with Vessels

10.3.2.31 Subsequent to the installation of the marine cables, geophysical surveys will be required to monitor cable burial depth and integrity, although these maintenance surveys are predicted to be undertaken only once, or maximum, twice a year for the first five years and then reducing in frequency every subsequent five years of the lifetime of the Project. The potential effects of noise from these routine surveys are, in the worst case, considered to be equivalent to the effects associated with construction and are assessed on this basis (although they may potentially be less than those associated with construction/installation depending on the extent of monitoring undertaken for each survey).

10.3.2.32 Should non-routine events arise, such as damage to the cable requiring repair or replacement, then the potential of effects of noise from work vessels and activities would be expected to be similar to those generated during the construction stage, but within a smaller, localised area.

10.3.2.33 Accordingly, noise and vibration effects associated with any operational activities are not expected to represent a noteworthy significant increase in underwater sound levels and will not be assessed any further.

10.3.2.34 During the operational life of the Proposed Development, occasional maintenance and survey works could result in temporary increases in vessel numbers. However, this increase will be minor in relation to the high volume of existing commercial and recreational vessel traffic within the area (see Chapter 13 Shipping, Navigation and Other Marine Users).

10.3.2.35 Accordingly, vessels used for maintenance or repair work are not expected to result in a noteworthy significant increase in the potential for collision risk between vessels and marine mammals and basking sharks and will not be assessed any further.

EMF

10.3.2.36 The magnetic field produced by each cable within the bundle would be equal and opposite, therefore the magnetic fields would cancel each other out, producing a very low magnetic field. Furthermore, the marine cables will be buried as bundled pairs throughout approximately 90% of the Marine Cable Corridor which will further reduce the magnetic field at the surface of the seabed. Chapter 3 Description of the Proposed Development provides estimates of resultant magnetic fields that would occur at maximum load (directly above each bundled pair) at seabed level for various cable depths. Cable burial depth is anticipated to range from 0.6 m – 5.1 m along the Marine Cable Route and where cable burial depth is not achieved non-burial protection will be employed to protect the marine cables.

10.3.2.37 Although behavioural responses by electro-sensitive species such as basking sharks to the presence of EMF have been demonstrated, it is very unlikely that basking sharks will be impacted by EMF emissions from the marine cable(s) of the Proposed Development. The potential impacts of EMF on elasmobranchs, which are considered to be more sensitive to EMF, are considered more generally within Chapter 9 Fish and Shellfish which concludes that there is no evidence to suggest that EMF poses a significant threat to elasmobranchs at the site or population level, and little uncertainty remains (MMO, 2014).

10.3.2.38 Although the strength of EMF directly over the marine cable at the shallowest burial depth is likely to be higher than the earth's natural magnetic field (25-60 µT), the EMF strength will attenuate to baseline within a few metres from the cable. As such, the potential ZoI on this species is likely to be very small (i.e. within a small number of metres from the marine cable's surface), the marine cable(s) will be buried or protected, and as basking sharks are a pelagic species they will generally be distant from the seabed where the marine cable(s) will be located and are therefore highly unlikely to be affected.

10.3.2.39 There is no evidence of electro-sensitivity in marine mammals however, there is some limited evidence for magneto-sensitivity in cetaceans but not pinnipeds (Gill *et al.*, 2005; Normandeau *et al.*, 2011). Evidence suggests that the EMF strengths produced by direct current marine cables might have the potential to affect navigation. However, most marine mammals, if they could sense the cable's magnetic field and this altered the direction of travel, once outside the influence of the cable in a matter of metres, the marine mammal would likely correct orientation (Normandeau *et al.*, 2011).

10.3.2.40 This information, along with the evidence that marine mammals occur at relatively low abundance in the area of the Proposed Development and basking sharks are very infrequent visitors, suggests that any changes to behaviour within these species is likely to be corrected within a few metres and therefore have a negligible effect that is not significant. Therefore, it is proposed that the effects of EMF on these species will not require further detailed assessment.

10.3.3 CONSULTATION

10.3.3.1 Consultation is a key part of the DCO application process. Further consultation will be undertaken after views have been sought on the PEIR, including as part of further pre-application engagement and following submission of the DCO application.

10.3.3.2 Full details of consultation undertaken to date and planned future consultation for all disciplines are presented within Chapter 5 Consultation.

10.4 METHODS OF ASSESSMENT

10.4.1.1 The assessment methodology used for marine mammals will follow that recommended by CIEEM for marine and coastal developments (CIEEM, 2018). These guidelines set out the process for assessment through the following stages:

- Describing the baseline within the study area;
- Identifying the receptors;
- Determining the nature conservation importance of the receptors present within the study area that may be affected by the Proposed Development;
- Identifying and characterising the potential impacts, based on the nature of the installation, operation, maintenance and decommissioning activities associated with the Proposed Development;
- Determining the significance of the impacts;
- Identifying the counter effect of any mitigation measures to be undertaken, that may be implemented in order to address significant adverse effects;
- Determining the residual impact significance after the effects of mitigation have been considered; and
- Assessing cumulative effects (with mitigation where applicable).

10.4.2 CHARACTERISING THE IMPACT

10.4.2.1 Each impact will be characterised in accordance with CIEEM (2018) guidelines. Wherever possible and relevant, the following criteria will be used to characterise each impact:

- Positive or Negative – direction of change in accordance with nature conservation objectives and policy;
- Extent – geographical area over which the impact will extend;
- Magnitude – size, amount, intensity, or volume of any change;
- Duration – time over which the impact will occur;
- Timing – co-incidence with receptor activities;
- Frequency – how often the impact will occur; and
- Reversibility – recovery potential.

10.4.3 DETERMINING SIGNIFICANCE OF EFFECT

10.4.3.1 The evaluation of whether an effect is ecologically significant will be undertaken in line with CIEEM (2018) guidance. In determining whether an effect is of ecological significance, the following shall be considered:

- Any removal or change of any process or key characteristic;
- Any effect on the nature, extent, structure, and function of the component habitats; and
- Any effect on the average population size or viability of component species.

10.4.3.2 Any assessment will be undertaken in the context of the wider conservation status of that receptor, and where uncertainty exists this will be acknowledged.

10.4.3.3 Embedded mitigation and, where appropriate, additional mitigation measures will be identified and described where they will avoid, reduce and/or compensate for potentially significant effects. This includes avoidance through the design process. It is also good practice to propose mitigation measures to reduce negative effects that are not significant.

10.4.4 LIMITATIONS

10.4.4.1 This chapter of the PEIR provides information as it relates to the Proposed Development to date, and to data currently available at this point in the assessment process.

10.4.4.2 The information contained herein is intended to inform consultation responses at this stage. A more detailed assessment of potential significant impacts as a result of the Proposed Development on identified sensitive receptors may be required to be undertaken at subsequent stages to inform the ES.

10.4.4.3 The information in respect of construction installation methods presented within Chapter 3 Description of the Proposed Development is the most recent emerging information on the most likely construction methods for the Proposed Development. As the design and construction methods for the Proposed Development are still evolving at the time of writing of this PEIR, not all of the proposed construction methods have been assessed. Accordingly, assessments within this chapter do not give consideration to the following construction methods that are described in Chapter 3 Description of the Proposed Development:

- Use of flotation pits to enable installation vessels to approach closer to shore;
- Grounding of installation vessels on the seabed at low tide;
- Sheet piling at the HDD onshore exit/entry points.
- Potential driving of four ducts into the seabed at HDD marine exit/entry at Eastney landfall (approx. 1-1.6 km off the coast at Eastney).

10.4.4.4 Any gaps in information identified at this PEIR stage will be considered and addressed along with specific mitigation measures as part of the assessments for the production of the ES.

10.5 BASELINE ENVIRONMENT

10.5.1.1 The baseline environment for marine mammals and basking sharks has been described using information from the literature shown in Table 10.5. This information is considered to be sufficient to describe the baseline within the study area which contains the Marine Cable Corridor. This information is also considered to be sufficient to conduct a proportionate assessment given the nature of the Proposed Development. Therefore, no project-specific marine mammal/megafauna surveys are required.

10.5.2 DATA SOURCES

10.5.2.1 A variety of marine mammal data sources were examined in order to describe the baseline and inform the assessment. Those considered most relevant to the Proposed Development are listed in Table 10.5 below.

Table 10.5 – Data Sources

Data Source	Data Type	Details of Data Available
IAMMWG (2015)	Cetacean abundance estimates	Abundance estimates (derived from the Small Cetaceans in European Atlantic waters and the North Sea ('SCANS-II') and Cetacean Offshore Distribution and Abundance in the European Atlantic ('CODA') surveys (which were conducted in 2005 and 2007 respectively) for the MUs for the seven most common cetacean species in UK waters – harbour porpoise, common dolphin, bottlenose dolphin, white-beaked dolphin, white-sided dolphin, Risso's dolphin, minke whale.
Hammond *et al.* (2017)	Cetacean density and abundance estimates	Density and abundance estimates from the SCANS-III surveys which were conducted in 2016 – data for Block C are relevant to the Proposed Development as the Marine Cable Corridor is located within it (see Plate 10.2). Estimates are available for harbour porpoise and minke whale.
Pettex *et al.* (2014)	Cetacean abundance	Distribution of the pelagic megafauna in French Metropolitan waters (The Suivi Aérien de la Mégafaune Marine 'SAMM')

Data Source	Data Type	Details of Data Available
	estimates and distribution	gathered through aerial and ship based surveys for all cetacean species encountered.
McClellan *et al.* (2014)	Distribution of marine megafauna	Marine megafauna in the English Channel region using geographically- and temporally-referenced marine megafauna datasets including data from the CHARM III project including turtles and basking sharks.
Evans (2006)	Desktop study of cetacean distribution	Main species present in the Channel and information on their wider UK/European ranges.
Jones *et al.* (2004)	Descriptive regional profile	Eastern Channel marine natural area profile.
Reid *et al.* (2003)	Quantitative description of cetacean distribution in the region	JNCC Atlas of cetacean distribution in north-west European waters giving a snapshot of the distribution of all 28 cetacean species compiled using visual sightings data.
Brereton *et al.* (2016)	Photo-identification studies of white-beaked dolphins	Analysis of photos for identification of individuals and comparison against other white-beaked dolphin catalogues around the UK and other parts of Europe.
E.ON (2012)	Baseline marine mammal presence data	Marine mammal presence across the Rampion OWF site, an adjacent reference area and a buffer compiled using data from boat-based marine mammal line transect surveys (2010–2012).
Navitus Bay Development Limited (2014)	Baseline marine mammal presence data	Navitus Bay OWF development area baseline marine mammal surveys using boat-based and aerial visual survey methods and Chelonia Porpoise Detector (‘C-POD’) acoustic surveys.
Vincent *et al.* (2017)	Census of seal populations on land and telemetry data	Grey and harbour seal count data from sites along the French coast of the English Channel carried out using visual observations from land, boat and aerial surveys over haul-out sites as well as tracking using telemetry.

Data Source	Data Type	Details of Data Available
Chesworth *et al.* (2010)	Solent Seal Tagging Project	Information on the Solent harbour seal population using visual counts of seals at haul-out sites, data from a public sightings scheme, photo-identification and telemetry data.
Russell *et al.* (2017)	Grey and harbour seal density	Sea Mammal Research Unit ('SMRU') seal count and telemetry data combined to produce total and at-sea usage maps of the UK.
Witt *et al.* (2012)	Basking shark sightings	Public records of surface sightings of basking sharks from around the UK used to assess spatio-temporal trends.

10.5.3 CETACEANS

10.5.3.1 The cetacean (whales, dolphins and porpoises) diversity of the eastern Channel is poor, both in numbers of animals and diversity of species. Twelve cetacean species have been recorded along the coasts or in the nearshore waters since 1975 (Evans, 2006). Of these, only two species are either present throughout the year or recorded annually as regular seasonal visitors to the region. These are harbour porpoise (*Phocoena phocoena*) and bottlenose dolphin (*Tursiops truncatus*). Both of these species are frequently associated with relatively shallow continental seas (i.e. waters less than 50 m deep). A further three species occur on a more casual basis. These are short-beaked common dolphin (*Delphinus delphis*), long-finned pilot whale (*Globicephala melas*) and minke whale (*Balaenoptera acutorostrata*). No species is abundant; the most frequently observed in nearshore waters being the bottlenose dolphin and in offshore waters the common dolphin, whilst the harbour porpoise is seen nearshore and the long-finned pilot whale is seen offshore. There is some evidence that the minke whale is rare in the Channel but is occurring increasingly frequently in study area though only in very small numbers (Evans, 2006).

10.5.3.2 Surveys undertaken in the eastern Channel include surveys commissioned for the Rampion OWF. Thirty boat-based marine mammal line transect surveys were conducted over a 24-month period in 2010–2012 covering the Rampion OWF site, an adjacent 'reference' area and a buffer of 5 km beyond it (E.ON, 2012). These surveys covered the area of the Proposed Development. The surveys recorded four species of cetacean: harbour porpoise, bottlenose dolphin, white-beaked dolphin (*Lagenorhynchus albirostris*) and minke whale. Of these, the harbour porpoise was recorded most frequently (E.ON, 2012).

10.5.3.3 Surveys commissioned for the Navitus Bay OWF located between Dorset and the Isle of Wight included 24 boat-based visual surveys conducted between December 2009 and November 2011 with transects approximately covering from the Isle of Portland to the Isle of Wight and including the wind park development area and a section of the cable route. Very few marine mammals were encountered, with only 14 visual sightings (Navitus Bay Development Limited, 2014). Cetaceans positively identified to species level were harbour porpoise and common dolphin. Additional data on cetaceans was collected using Chelonia Porpoise Detector ('C-POD') passive acoustic monitoring at 10 sites between November 2011 and January 2013; four C-PODs were placed within the proposed wind park site and an additional six were deployed between the boundary of the proposed site and the coast at Swanage (Booth and Lacey, 2014). Acoustic monitoring recorded very low levels of porpoise activity, much lower than similar studies around the UK. The furthest offshore monitoring sites located in the centre of the proposed wind park had relatively greater detection rates. Porpoise detection rates peaked between December and March and were lowest between July and October (Navitus Bay Development Limited, 2014).

10.5.3.4 Bottlenose dolphins have a near-global distribution (except the polar regions). They are primarily an inshore species, with most sightings within 10 km of land, but they can also occur offshore. There are two main areas of UK territorial waters where there are semi-resident groups of bottlenose dolphin: Cardigan Bay, Wales and the Moray Firth, Scotland. Away from these two areas there are smaller groups off south Dorset and around Cornwall (Brereton *et al.*, 2016a) and in the Sound of Barra, Outer Hebrides (Grellier and Wilson, 2003). Bottlenose dolphins in the Channel are observed most commonly during summer (July–September), with the majority of sightings being around the Solent, and also around the West and East Sussex coasts in late summer (August-September; Jones *et al.*, 2004). The IAMMWG (2015) marine mammal MU abundance estimate for bottlenose dolphins is 4,956 (combined Offshore Channel and SW England (OCSW) and Coastal West Channel (CWC) unit abundance estimates). The SAMM (Aerial Monitoring of Marine Megafauna) survey undertaken between 2012–2014 of the entire Channel showed an abundance estimate of 1,412 bottlenose dolphins in winter and 2,317 in summer, although this difference is not considered a significant increase (Pettex *et al.*, 2014). The highest densities of bottlenose dolphin were found on the continental slope in the Bay of Biscay, but the species was present in low densities in the whole region except for the eastern Channel and the north-western coast of Brittany, where it is mostly absent (Pettex *et al.*, 2014).

10.5.3.5 Harbour porpoises are the most common cetacean species across the whole of Europe. As a species, they demonstrate a strong preference for cooler, shallow (<200 m) coastal waters. Harbour porpoise distribution is known to vary seasonally according to the abundance of key prey species such as herring, cod and mackerel, but it is possible to observe them throughout the year in some locations. In the UK, they can be seen in most coastal areas, especially off the west coasts, although the species is relatively absent from the south coast and the English Channel. Harbour porpoises in the study area are seen in nearshore areas during April and between the months of August and October and generally occur in small numbers (Jones *et al.*, 2004). The SCANS-III survey produced an abundance estimate of 17,323 harbour porpoise (with 95% confidence intervals: 8,853 – 29,970) for survey Block C where the Proposed Development is located (Hammond *et al.*, 2017).

10.5.3.6 This abundance estimate was, however, produced for the entire survey block which covers a much greater area than the Proposed Development. The IAMMWG (2015) MU reference population for harbour porpoise is 227,298 (with the MU covering the entire North Sea; Plate 10.1). The SCANS-III Block C density estimate for harbour porpoise is 0.213 individuals per km^2 (Hammond *et al.*, 2017).

10.5.3.7 Common dolphins are observed mostly offshore, however small numbers have been observed around Durlston Head and Poole Bay (Dorset) between October and January (Jones *et al.*, 2004). Sightings of long-finned pilot whales are more frequent in the western channel, although there is an easterly movement around October, with whales remaining in the area until December or January and a secondary peak during April (Jones *et al.*, 2004).

10.5.3.8 Minke whales are rare in the study area and occur almost exclusively in the western parts of the Channel; there is a concentration of sightings around the Brittany coast as well as on the northern edge of the Bay of Biscay (Reid *et al.*, 2003). The IAMMWG (2015) MU reference population for minke whales is 23,528 (with the MU covering the Celtic and Greater North Seas (CGNS); Plate 10.4). The SCANS-III Block C density estimate for minke whale is 0.002 individuals per km^2 (Hammond *et al.*, 2017). White-beaked dolphins are also present off south-west England e.g. in the central/western Lyme Bay area with an estimated total population size of around 130 individuals (Brereton *et al.*, 2016). No sightings were recorded during the SCANS-III surveys in Block C.

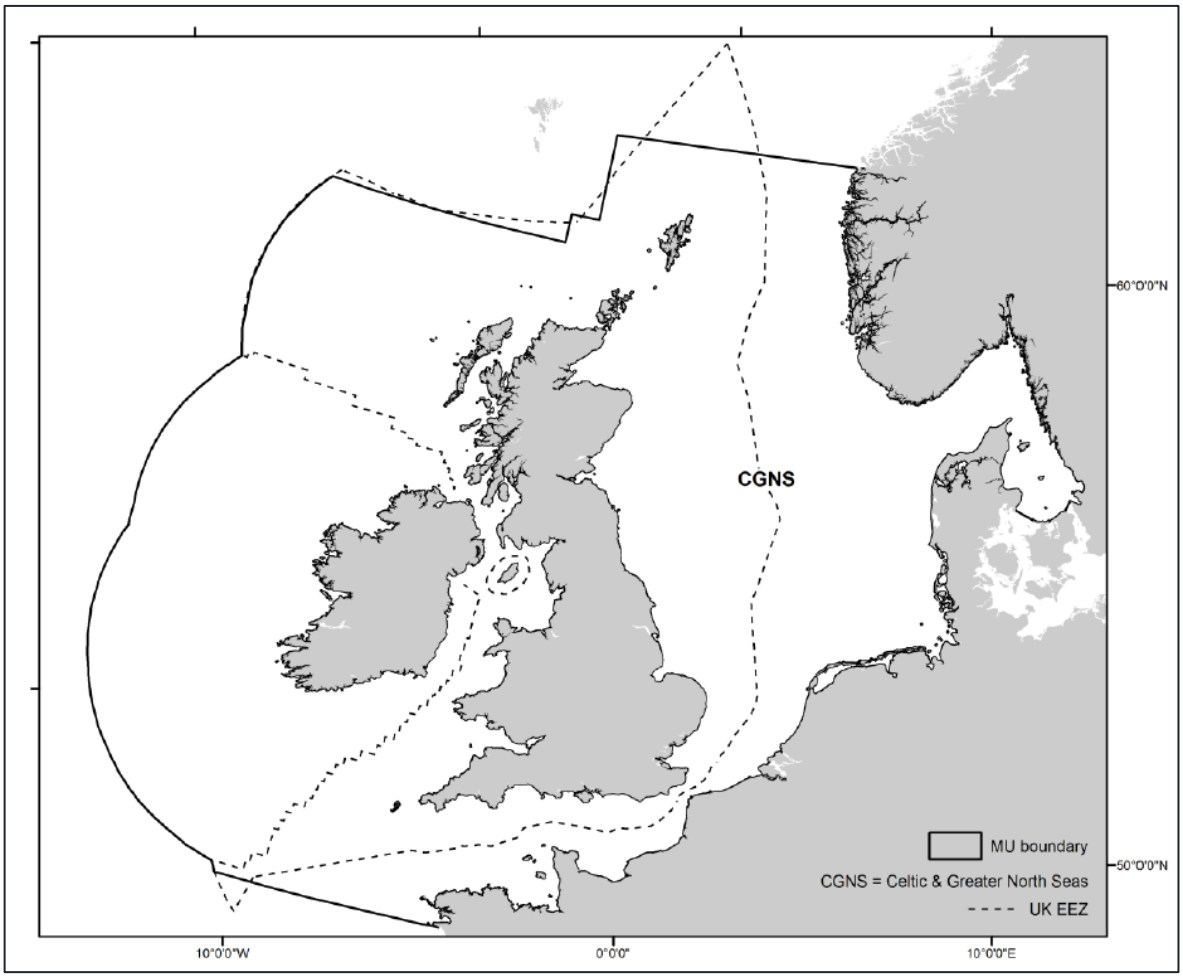

Plate 10.4 - MU for minke whale (image taken from IAMMWG, 2015)

10.5.3.9 Other cetacean species recorded in the study area include Atlantic white-sided dolphin (*Lagenorhynchus acutus*), striped dolphin (*Stenella coeruleoalba*), Risso's dolphin (*Grampus griseus*), humpback whale (*Megaptera novaeangliae*), sei whale (*Balaenoptera borealis*), and fin whale (*Balaenoptera physalus*), although some of these have been reported only as strandings (E.ON, 2012).

10.5.3.10 There are no UK designated sites (i.e. SAC) which have cetacean species as a primary reason for site selection within likely foraging range of the Proposed Development. Therefore, it is unlikely that any species of cetacean that is a feature of a UK SAC will forage or be present within the Proposed Development and the potential for connectivity is considered to be negligible. Since the potential for connectivity is considered to be negligible, it is determined that UK cetacean SACs will not need to be considered as part of the HRA which will be conducted for the Proposed Development.

10.5.3.11 There is potential for connectivity to some cetacean (harbour porpoise and bottlenose dolphin) SACs located on the north coast of France because these SACs are considered to be within likely foraging range of the Proposed Development. This will be considered in Section 10.6 of this chapter in relation to transboundary effects.

10.5.4 PINNIPEDS

10.5.4.1 Two species of seal breed in British Waters: the harbour seal (*Phoca vitulina*; also known as the common seal) and the grey seal (*Halichoerus grypus*). Both these seal species are listed under Annex II[4] of the Habitats Directive. The abundance of pinniped species in the Channel is very low in comparison to other areas around the UK. Grey and harbour seals are seen occasionally in the Channel but there are no known significant breeding/haul-out areas for either species in this region (Jones *et al.*, 2013; Vincent *et al.*, 2017). Aerial surveys conducted across the Channel showed that most seal observations at sea were concentrated in the north-eastern Channel. In the eastern Channel, as in other parts of their range, the two species' ranges overlap (Vincent *et al.*, 2017).

10.5.4.2 Surveys commissioned for the Rampion OWF recorded both grey and harbour seals, although only on a handful of occasions (E.ON, 2012). Surveys commissioned for the Navitus Bay OWF only recorded grey seals in very low numbers; harbour seals were not recorded (Navitus Bay Development Limited, 2014). In the SMRU/Marine Scotland Updated Seal Usage Maps (Russell *et al.*, 2017) the eastern Channel is an area where seals are sparse at sea and rarely haul out. The predicted mean number of grey and harbour seals across this area is generally less than one per 5 x 5 km grid cell (Russell *et al.*, 2017).

10.5.4.3 Grey seals occur throughout the temperate waters of the North Atlantic. In the Northeast Atlantic, the species breeds in the British Isles, Iceland, the Faroe Islands and along the north-west coast of mainland Europe. Approximately 38% of the world's grey seals breed in the UK and 88% of these breed at colonies in Scotland with the main concentrations being in Orkney and the Outer Hebrides (SCOS, 2017). Smaller clusters are located in south-west Britain in Wales, Cornwall and the Scilly Isles, and there are small breeding groups off the north-west and south coasts of Ireland. The species in rare in the Channel east of Dorset with only casual records occurring.

[4] Animal and plant species of community interest whose conservation requires the designation of SACs.

10.5.4.4 Harbour seals are widely distributed throughout the temperate and sub-arctic waters of the North Atlantic (and North Pacific). They are common around the coasts of Scotland and eastern England but are rare in the central and eastern Channel. They are frequently seen in inshore waters and estuaries and are often observed hauled out close to areas with substantial human populations (e.g. in the Wadden Sea). Large concentrations occur in the sheltered, shallow waters of the Wash, the Moray Firth in eastern Scotland and in the Wadden Sea where large groups haul out on tidal mudflats and sandbanks. They are also abundant along sheltered rocky shores throughout their range, but especially around Shetland, Orkney, and off the west coast of Scotland. Studies undertaken as part of the Solent Seal Tagging Project identified haul-out sites in Langstone and Chichester Harbours which are used regularly by an estimated 25 seals. These seals are not thought to be associated with an SAC (Chesworth *et al.*, 2010). Public sightings reported to the project show sightings of seals extending as far as Lymington, and around the coast of the Isle of Wight. Telemetry studies of five harbour seals caught and tagged in Chichester and Langstone Harbours showed that these particular seals used the eastern Solent, crossing to the Isle of Wight, but did not record any activity to the west of the Isle of Wight (Chesworth *et al.*, 2010). Harbour seals tagged in the Thames Estuary occasionally used the eastern end of the Channel (Russell *et al.*, 2017).

10.5.4.5 There are no UK designated sites (i.e. SACs) which have pinniped species as the primary reason for site selection within likely foraging range of the Proposed Development. Therefore, it is unlikely that any species of pinniped that is a feature of a UK SAC will forage or be present within the Proposed Development and the potential for connectivity is considered to be negligible. Since the potential for connectivity is considered to be negligible, it is determined that UK pinniped SACs will not need to be considered as part of the HRA which will be conducted for the Proposed Development.

10.5.4.6 There is potential for connectivity to some grey seal SACs located on the north coast of France because these SACs are considered to be within likely foraging range of the Proposed Development. This will be considered in Section 10.6 of this chapter in relation to transboundary effects.

10.5.4.7 There is no potential connectivity for harbour seal SACs located on the north coast of France because the foraging range of harbour seals is relatively small (those tagged in the Thames had average foraging trip distances of around 20 km; Sharples *et al.*, 2012).

10.5.5 OTHER MARINE FAUNA

10.5.5.1 Although turtles are reptiles, they are similar to marine mammals in that they are large, air-breathing marine vertebrates which are considered to be highly sensitive. The most frequently occurring species in UK waters is the leatherback turtle (*Dermochelys coriacea*). While most UK records of this species are from the south-west and west coasts, they have occasionally been recorded in the eastern English Channel. The vast majority of sightings, however, occur in the western Channel. Although small numbers of leatherback turtles have been documented year-round, the majority of sightings occur in the summer months (McClellan *et al.*, 2014). The leatherback turtle is highly protected and afforded legal protection (e.g. under Schedule 5 of the Wildlife and Countryside Act 1981 and listed under Annex IV of the Habitats Directive) and is on the OSPAR list of Threatened and/or Declining Species and Habitats.

10.5.5.2 Basking sharks (*Cetorhinus maximus*), which are strictly protected under wildlife legislation within 12 nmi of the Isle of Man and Guernsey (United Kingdom dependent territories) and in British waters, are among the largest marine species and one of the few zooplanktivorous sharks. UK waters form part of the basking shark's normal range but there are relatively few sightings in the Channel compared with other 'hotspots' such as the West of Scotland, the Isle of Man and south-west England (Witt *et al.*, 2012). Peak sightings of these animals across the Channel and southern bight of the North Sea were recorded during the summer months with fewest sightings during winter (McClellan *et al.*, 2014). It appears that much of the Channel provides suitable habitat for basking sharks throughout the year, but that their presence is concentrated in the western Channel (McClellan *et al.*, 2014) much further to the west of the Proposed Development.

10.5.6 IDENTIFICATION OF RECEPTORS

10.5.6.1 For the quantitative aspects of the assessment, data on harbour porpoise and minke whale will be used. These are the only species for which Channel-specific density estimates (from the SCANS-III survey) are available. This is because marine mammal species occurrence and density are low in the Channel compared to other areas around the UK. There are no density estimates available for mid frequency cetaceans (i.e. the dolphin species).

10.5.6.2 Although this assessment will focus on the main species, any resulting findings (and proposed mitigation) are also considered to be appropriate for other, less commonly occurring, marine mammal species and for basking shark.

10.5.7 FUTURE BASELINE

10.5.7.1 Baseline data have been obtained from the collation of existing information. The existing baseline is informed by data that are 'current' and a future baseline is informed by an extrapolation of the currently available data by reference to policy, other proposal applications and expert judgement. Large changes in baseline data on abundance are unlikely to occur in the short term because marine mammals are long-lived species.

10.5.7.2 Information is constantly being updated and available data are therefore time dependent. For example, the SCANS III studies were undertaken in 2016 (see Table 10.5) and reported on in 2017. These studies are usually undertaken every decade and therefore, it is considered that abundance estimates for marine mammals employed within this chapter will remain valid until after 2025.

10.5.7.3 Future baseline conditions are also considered where relevant, with reference to conservation objectives for designated coastal and marine sites and management plans in place of designated sites.

10.5.7.4 In addition, further information to the existing environmental conditions may evolve where there is linkage to and/or reliance upon other projects/plans being implemented prior to the construction of the Proposed Development under assessment. Section 10.6 identifies the projects/plans that are ongoing, projects that are approved but uncompleted, and also includes projects that are planned and/or which are reasonably foreseeable. Consideration of these projects is undertaken through cumulative effects assessment in Section 10.6 and in doing so, their ability to modify the existing baseline is also considered

10.6 IMPACT ASSESSMENT

10.6.1 CONSTRUCTION (AND DECOMMISSIONING)

10.6.1.1 The potential effects of decommissioning are, in the worst case considered to be equivalent to the effects associated with construction and are assessed on this basis, though may potentially be less than those associated with construction/installation depending on the decommissioning activities undertaken (for instance, where the marine cable is left in situ).

Increased anthropogenic noise from geophysical survey and positioning equipment which emits sound

10.6.1.2 Geophysical survey and positioning equipment is routinely used during route preparation and clearance, cable laying, cable burial/protection and post-lay surveys.

10.6.1.3 For the purposes of this assessment, the term 'geophysical survey and positioning equipment' will potentially include, but is not limited to, the following types of equipment:

- Sub-bottom profilers (pingers, sparkers, boomers and chirps);

- Ultra Short Baseline ('USBL') transceivers/transducers and transponders/responders/beacons;
- Scanning sonars; and
- Multi beam echo sounders.

10.6.1.4 Any geophysical surveys and investigations relating to UXO survey or safe removal of UXO will be undertaken and assessed separately as part of a separate stand-alone marine licence application.

Permanent Threshold Shift

10.6.1.5 The sound emitted by some geophysical survey and positioning equipment has the potential to induce the onset of PTS, i.e. auditory injury, at very close range if source levels are high (see Table 10.6 for PTS thresholds).

Table 10.6 – Comparison of PTS thresholds in response to a single pulse exposure (dB re 1 µPa at 1 m; assesses the potential for auditory injury to occur instantaneously

Hearing group	PTS onset threshold Southall *et al.* (2007)	PTS onset threshold NOAA (2018)
Low frequency cetaceans e.g. minke whale	230	219
Mid frequency cetaceans e.g. bottlenose dolphin	230	230
High frequency cetaceans e.g. harbour porpoise	230	202
Phocid seals in water e.g. grey seal	218	218

10.6.1.6 Marine mammals are unlikely to be present at such very close range to vessels, i.e. within a few metres of the vessels carrying the equipment; there is negligible potential for the sound emitted by geophysical survey and positioning equipment to induce the onset of PTS. The duration is considered to be temporary (short term) and the effect is therefore considered to be not significant.

Disturbance

10.6.1.7 The sound emitted by some geophysical survey and positioning equipment has the potential to disturb marine mammals if the frequency/frequencies used fall within their hearing ranges (see Table 10.7 for details of marine mammal hearing ranges).

Table 10.7 – Generalised hearing ranges for the different functional marine mammal hearing groups. Values presented drawn from Southall *et al.* (2007) and NOAA (2018)

Hearing group	Generalised hearing range (kHz)
Low frequency cetaceans	0.007-35
Mid frequency cetaceans	0.15-160
High frequency cetaceans	0.2-180
Phocid seals in water	0.05-86

10.6.1.8 The only available information on disturbance of marine mammals from geophysical survey noise comes from Thompson *et al.* (2013), who found:

- Evidence of harbour porpoise group responses to airgun noise over ranges of 5 to 10 km (airguns, rather than other types of geophysical survey equipment, were used because this was a high energy (seismic) survey for oil and gas);
- That animals were typically detected again at affected sites within a few hours; and
- That the level of response declined through the 10-day survey.

10.6.1.9 Because these findings relate to a high energy (seismic) survey for oil and gas (peak to peak airgun source levels were estimated to be 242 to 253 dB re 1 µPa at 1 m), they are considered to be greater than those effects likely to occur as a result of the use of geophysical survey and positioning equipment used for the Proposed Development (in this case, typical source levels fall within the 149 to 225 dB re 1 µPa at 1 m range).

10.6.1.10 Taking a precautionary approach, it has been assumed that the maximum range over which animals may respond is 5 km i.e. the lower end of the range reported by Thompson *et al.* (2013). This range has been deemed suitable due to the lower sound levels predicted when compared to those recorded by Thompson *et al.* (2013). This range has been used as the radius in the simple calculation of area (of potential impact) πr2. The number of harbour porpoises and minke whales within this area of potential impact was then estimated using the SCANS-III density estimates for Block C and expressed as a percentage of the species' reference population (Table 10.8). These are the only species for which Channel-specific density estimates are available.

Table 10.8 – A precautionary estimate of the number of animals which have the potential to be disturbed by sound emitted by some geophysical survey and positioning equipment

Species	SCANS-III density estimate (animals per km^2)	Number of individuals estimated to have the potential to be impacted	Reference population abundance (IAMMWG, 2015)	Number of individuals expressed as a percentage of the reference population
Harbour porpoise	0.213	17	227,298	0.007
Minke whale	0.002	<1	23,528	0.0007

10.6.1.11 Given the small number of animals (and percentage of reference population) which have the potential to be disturbed, and the fact that any disturbance is likely to be temporary (short term) in duration and suitable alternative habitat is available, the significance of this effect is considered to be not significant.

10.6.2 CUMULATIVE EFFECTS ASSESSMENT

10.6.2.1 The potential for cumulative effects on marine mammals from use of geophysical survey and positioning equipment which emits sound during the construction/installation phase of the Proposed Development (currently scheduled for 2021-2023; see Chapter 3 Description of the Proposed Development) has been considered.

10.6.2.2 The ZoI of the Proposed Development on marine mammals is considered to be within 5 km of the Marine Cable Corridor during the construction/installation phase. This is because 5 km has been used to represent the maximum range over which animals may respond to noise from the geophysical survey and positioning equipment likely to be used for the Proposed Development.

10.6.2.3 As detailed in Chapter 28 Cumulative Effects, the CEA is to be undertaken with regards to PINS Advice Note Seventeen – Cumulative Effects Assessment (PINS, 2015).

10.6.2.4 A list of projects within the vicinity of the Proposed Development that have the potential to give rise to cumulative effects has been considered and presented in Appendix 10.1 Marine Mammal Cumulative Assessment Matrix. The list of projects compiled were refined for marine mammals as follows:

- First a spatial assessment was conducted. Any project identified in the long list of cumulative projects falling within the ZoI for marine mammals (5 km) was screened in for further consideration. If a cumulative project was thought to be likely/have the potential to also be conducting sound-emitting activities, a 5 km

ZoI from the Proposed Development and a 5 km ZoI from the cumulative project was considered (i.e. the ZoI was doubled to 10 km).

- A temporal, nature and scale-based assessment was conducted for those projects where a potential spatial overlap was identified.

10.6.2.5 Of the initial list of projects (presented in Appendix 10.1) considered, 24 were shortlisted as having potential spatial and temporal overlap. However, due to the lack of significant effects due to the scale and nature of these projects, none were progressed to detailed CEA (i.e. progressed to Stage 3 and 4 of the PINS advice note) for marine mammals (see Appendix 10.1).

10.6.3 TRANSBOUNDARY IMPACTS

10.6.3.1 Given the location, nature and scale of the Proposed Development, it is considered that potential impacts are unlikely to lead to any significant transboundary effects on marine mammals.

10.6.3.2 However, there may be potential impacts on French SACs where marine mammals (specifically harbour porpoise, bottlenose dolphin and grey seal) are a feature and for which there is potential for connectivity to the Proposed Development. Accordingly, the potential impacts from the Proposed Development on the integrity and conservation status of these sites will be considered as part of the HRA process which will be presented as a HRA Report that will accompany the final DCO application.

10.7 PROPOSED MITIGATION

10.7.1 CONSTRUCTION, OPERATION AND DECOMMISSIONING

10.7.1.1 At this stage, the approach to assessment in this chapter assumes that mitigation measures embedded into the design (e.g. routing the cable to avoid constraints, use of appropriate construction techniques, pollution prevention measures) or which constitute industry standard environmental plans and best practice will be in place. As the final design evolves further detail on embedded mitigation measures will be provided and the assessment within the ES will reflect all the embedded and proposed mitigation measures.

10.7.1.2 As cetaceans are EPS, an EPS Risk Assessment will be conducted prior to work starting in order to determine whether an EPS licence will be required. It is however considered at this stage, that an EPS licence for use of geophysical survey and positioning equipment is unlikely to be required. This is because the risk of an injury offence is considered to be negligible, with potential for further reduction with appropriate mitigation if required. Furthermore, any disturbance is likely to be short term without any likely significant negative impact on the species, i.e. trivial, and therefore not likely to result in an offence being committed.

10.7.1.3 Current guidance (JNCC *et al.*, 2010) will be used to inform the EPS risk assessment and best practice (JNCC, 2017) will be used in situations where the potential to induce the onset of auditory injury exists in order to reduce any risk to a satisfactory level.

10.7.1.4 These mitigation measures will be detailed and secured through a Marine Mammal Mitigation Protocol that would be agreed with relevant consultees.

10.7.1.5 Mitigation or best practice measures that could be implemented may include (a) pre-work searches to ensure that no marine mammals are present within the zone of potential effect when work commences and (b) the use of soft starts where possible (i.e. if equipment specifications allow, power should be built up gradually, in uniform stages from a low energy start-up such that this provides opportunity for marine mammals to move away from the sound source).

10.8 RESIDUAL EFFECTS

10.8.1.1 Potential impacts due to increased anthropogenic noise from geophysical survey and positioning equipment which emits sound were not considered to be significant (Table 10.9).

10.8.1.2 As noted above, an EPS Risk Assessment will be undertaken once full details of the equipment are known and this assessment will recommend any required mitigation (as defined under the JNCC (2017) guidance) in order to ensure any risks to EPS are within acceptable limits.

10.8.1.3 These mitigation measures will be detailed and secured through the Marine Mammal Mitigation Protocol and would be agreed with relevant consultees.

Table 10.9 – Summary of the assessment, mitigation and significance of residual effects.

Predicted Impact	Effect	Significance	Mitigation	Significance of Residual Effect
Construction, Operation (including repair/maintenance) and Decommissioning				
Increased anthropogenic noise from geophysical survey and positioning equipment which emits sound	PTS	Not significant	As required under the JNCC (2017) guidance, and included within a Marine Mammal Mitigation Protocol	Not significant
	Disturbance	Not significant	None required	n/a

10.9 SUMMARY AND CONCLUSIONS

BASELINE

10.9.1.1 In comparison with the rest of the UK, marine megafauna species richness and abundance in the study area of the eastern Channel is low. The main species present include harbour porpoise, bottlenose dolphin, common dolphin, minke whale, grey seal and harbour seal. SCANS-III density estimates are available for harbour porpoise and minke whale.

ASSESSMENT

10.9.1.2 Potential effects to marine mammals and basking sharks during construction, operation (including repair and maintenance) and decommissioning (where relevant) resulting from collision with vessels, increased vessel noise, increased anthropogenic noise from geotechnical investigations, HDD, seabed preparation, route clearance and cable installation activities and EMF have been given consideration within this chapter and information has been provided evidencing that the potential effects from these impacts are not considered to be a significant risk to these species as to warrant further investigation.

10.9.1.3 Disturbance and onset of auditory injury to marine mammals from potential noise impacts resulting from use of geophysical survey and positioning equipment occurring during construction, operation (including repair and maintenance) and decommissioning stages have been assessed.

10.9.1.4 This assessment of increased anthropogenic noise from geophysical survey and positioning equipment concluded that there was negligible potential for the sound to induce the onset of auditory injury (PTS). Therefore, this effect was considered to be not significant.

10.9.1.5 The potential for disturbance from noise impacts was also considered to be not significant due to the small number of animals estimated to have the potential to be disturbed, and the fact that any disturbance is likely to be temporary and suitable alternative habitat is available.

10.9.1.6 Chapter 3 Description of the Proposed Development also includes the possible option that at the marine entry/exit point locations, four 36” casings may be driven in to the seabed to facilitate the HDD works. At this time, adequate detail on the works and duration of the works is not available to undertake an assessment of any potential effects. However, the assessment process is ongoing and when further design parameters are available, these will be presented and assessed as part of the final ES.

MITIGATION

10.9.1.7 Because cetaceans are EPS, mitigation required as outlined by the JNCC (2017) guidance will be applied. The details of these mitigation measures will be secured through agreement of a Marine Mammal Mitigation Protocol with relevant stakeholders.

RESIDUAL EFFECTS

10.9.1.8 Taking into consideration embedded design mitigation, industry best practice and the proposed mitigation measures, there will be no potential for the sound emitted by geophysical survey and positioning equipment to induce the onset of PTS. Therefore, there is no potential for residual effects.

10.9.1.9 Of the initial list of projects considered as part of the cumulative effects assessment (presented in Appendix 10.1), 24 projects were shortlisted and considered to have a potential spatial overlap with the Proposed Development. However, due to the timing, scale and nature of these shortlisted projects, none were considered as required for detailed cumulative effects assessment (i.e. Stage 3 and Stage 4 of PINS advice note Seventeen) for marine mammals.

10.9.1.10 It is considered that potential impacts are unlikely to lead to any significant transboundary effects from the Proposed Development on marine mammals. However, potential impacts on French SACs with which there is potential for connectivity will be considered as part of the ongoing HRA process for the DCO application.

CONCLUSION

10.9.1.11 The potential for the Proposed Development (as described in Chapter 3 Description of the Proposed Development and accounting for activities excluded from assessment (Section 10.4.4)) to have a detrimental effect on marine megafauna is considered to be negligible and not significant.

10.10 ASSESSMENTS AND SURVEYS STILL TO BE UNDERTAKEN

10.10.1.1 No surveys are being undertaken for this receptor (existing baseline information is considered adequate).

10.10.1.2 The further work and next steps to be completed for the ES include:

- Further consultation as required;
- Consideration of potential impacts on any features of French SACs designated for harbour porpoise, bottlenose dolphin and grey seal; and
- Updating the information presented above to reflect the final design parameters and should any relevant new literature or guidance become available.

REFERENCES

Booth, C.G. and Lacey, C. (2014). Static Acoustic Monitoring around the proposed Navitus Bay Offshore Wind Farm using C-PODs. SMRU Ltd report (SMRUL-ENO-2013-015). March 2014 (Unpublished).

Brereton, T., Kitching. M., Davies. R., McNie, F. and Walker, R. (2016). Photo-identification Analysis of White-beaked Dolphins off South west and North east England 2007-2014. Report number RP03082 commissioned by Natural England. Available from: http://publications.naturalengland.org.uk/publication/5712940125126656 [Accessed 02/01/2019]

Brereton, T., Jones, D., Leeves, K., Davies, R., McNie, F. and Russell, T. (2016a). Population structure, mobility and conservation of bottlenose dolphins in south west England from photo-identification studies 2007-2013. Report number RP01679 commissioned by Natural England.

Campanella R.G., Robertson P.K., Gillespie D. (1986) A Seismic Cone Penetrometer for Offshore Applications. In: Oceanology. Advances in Underwater Technology, Ocean Science and Offshore Engineering, vol 6. Springer, Dordrecht

Chesworth, J.C., Leggett, V.L. and Rowsell, E.S. (2010). Solent Seal Tagging Project Summary Report. Wildlife Trusts' South East Marine Programme, Hampshire and Isle of Wight Wildlife Trust, Hampshire.

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

EIRGRID PLC. (2014). Celtic Interconnector Project: Marine Mammal Risk Assessment. Produced by Intertek Energy & Water consultancy services. Report Reference: Attachment F_P1812_R3691_REV1.

E.ON. (2012). Rampion Offshore Wind Farm. Environmental Statement. Section 10 – Marine Mammals. Document 6.1.10.

Evans, P.G.H. (2006). Marine mammals in the English Channel in relation to proposed dredging scheme. Sea Watch Foundation. 20 pp. Available from http://seawatchfoundation.org.uk/wp-content/uploads/2012/08/36.-marine-mammals-in-the-English-Channel-in-relation-to-proposed-dredging-scheme.pdf [Accessed 02/01/2019]

Gill, A.B., Gloyne-Phillips, I., Neal, K.J. & Kimber, J.A., 2005. The potential effects of electromagnetic fields generated by sub-sea power cables associated with offshore wind farm developments on electrically and magnetically sensitive marine organisms – a review. Report to Collaborative Offshore Wind Research into the Environment (COWRIE) group, Crown Estates.

Grellier, K. and Wilson, B. (2003). Bottlenose dolphins using the Sound of Barra, Scotland. Aquatic Mammals 29(3): 378-382.

Hammond, P.S., Lacey, C., Gilles, A., Viquerat, S., Börjesson, P., Herr, H., Macleod, K., Ridoux, V., Santos, M.B., Scheidat, M., Teilmann, J., Vingada, J. and Øien, N. (2017). Estimates of cetacean abundance in European Atlantic waters in summer 2016 from the SCANS-III aerial and shipboard surveys.

IAMMWG. (2015). Management units for cetaceans in UK waters (January 2015). JNCC Report No. 547, JNCC Peterborough.

ICOL. (2013). Underwater noise chapter (Chapter 11) of the Inch Cape Offshore Wind Farm Environmental Statement. Available at: http://www.inchcapewind.com/publications/environmental-statement/introduction [Accessed: 26/09/18].

Jones, L.A., Irving, R., Cosgrove, A.R.P., Coyle, M.D., Gilliland, P.M. and Murray, A.R. (2004). Eastern Channel Marine Natural Area Profile: A contribution to regional planning and management of the seas around England. English Nature, Peterborough. 108 pp.

JNCC, NE and CCW. (2010). The protection of marine European Protected Species from injury and disturbance. Guidance for the marine area in England and Wales and the UK offshore marine area.

JNCC. (2017). JNCC guidelines for minimising the risk of injury to marine mammals from geophysical surveys.

LGL Alaska Research Associates and Jasco Applied Sciences (2010), Marine Mammal Monitoring and Mitigation During Marine Geophysical Surveys by Shell Offshore Inc. in the Alaskan Chukchi and Beaufort Seas, July – October 2010:90-Day Report.

McClellan, C.M., Brereton, T., Dell'Amico, F., Johns, D.G., Cucknell, A-C., Patrick, S.C., Penrose, R., Ridoux, V., Solandt, J-L., Stephan, E., Votier, S.C., Williams, R. and Godley, B.J. (2014). Understanding the Distribution of Marine Megafauna in the English Channel Region: Identifying Key Habitats for Conservation within the Busiest Seaway on Earth. PLoS ONE 9(2): e89720. doi: 10.1371/journal.pone.0089720.

MMO (2014). Review of post-consent offshore wind farm monitoring data associated with licence conditions. A report produced for the Marine Management Organisation, pp 194. MMO Project No: 1031.

Natural Power (2017). EPS Risk Assessment for nearshore and offshore geophysical and geotechnical survey. AQUIND Ltd.

Navitus Bay Development Ltd. (2014). Navitus Bay Wind Park Environmental Statement Volume B – Offshore. Chapter 11 – Marine Mammals.

NOAA. (2018). 2018 Revisions to: Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing (Version 2.0): Underwater Thresholds for

Onset of Permanent and Temporary Threshold Shifts. U.S. Dept. of Commer., NOAA. NOAA Technical Memorandum NMFS-OPR-59, 167 p.

Normandeau, Exponent, T. Tricas, and A. Gill. 2011. Effects of EMFs from Undersea Power Cables on Elasmobranchs and Other Marine Species. U.S. Dept. of the Interior, Bureau of Ocean Energy Management, Regulation, and Enforcement, Pacific OCS Region, Camarillo, CA. OCS Study BOEMRE 2011-09.

Pettex, E., Lambert, C., Laran, S., Ricart, A., Virgili, A., Falchetto, H., Authier, M., Monestiez, P., Van Canneyt, O., Dorémus, G., Blanck, A., Toison, V. and Ridoux, V. (2014). Suivi Aérien de la Mégafaune Marine en France métropolitaine - Rapport final. Univ. Rochelle UMS 3462 - 169p. DOI: 10.13140/2.1.2698.5287 ftp://ftpaamp.aires-marines.fr/PACOMM/Volet1_SAMM/Rapport/SAMM-ME_rapport_final.pdf [Accessed 02/01/2019]

PINS (2015) Advice Note Seventeen: Cumulative Effects Assessment. Available online from: https://infrastructure.planninginspectorate.gov.uk/legislation-and-advice/advice-notes/ [Accessed 02/01/2019]

Prideaux G. (2017) Technical Support Information to the CMS Family Guidelines on Environmental Impact Assessments for Marine Noise-generating Activities, CMS, Bonn

Reid, J.B., Evans, P.G.H. and Northridge, S.P. (2003). Atlas of Cetacean distribution in north-west European waters. 76 p. Paperback, ISBN 1 86107 550 2 – Updated 2016.

Russell, D.J.F., Jones, E.L. and Morris, C.D. (2017). Updated seal usage maps: The estimated at-sea distribution of grey and harbour seals. Scottish Marine and Freshwater Science 8(25): 25pp.

SCOS. (2017). Scientific advice on matters related to the management of seal populations: 2017. Main advice.

Sharples, R.J., Moss, S.E., Patterson, T.A. and Hammond, P.S. (2012). Spatial variation in foraging behaviour of a marine top predator determined by a large-scale satellite tagging programme. PLoS ONE 7(5): e37216.

Southall, B.L., Bowles, A.E., Ellison, W.T., Finneran, J.J., Gentry, R.L., Greene Jr., C.R., Kastak, D., Ketten, D.R., Miller, J.H., Nachtigall, P.E., Richardson, W.J., Thomas, J.A. and Tyack, P.L. (2007). Marine mammal noise exposure criteria: Initial scientific recommendations. Aquatic Mammals 33(4): 411-521.

Thompson, P.M., Brookes, K.L., Graham, I.M., Barton, T.R., Needham, K., Bradbury, G. and Merchant, N.D. (2013). Short-term disturbance by a commercial two-dimensional seismic survey does not lead to long-term displacement of harbour porpoises. Proceedings of the Royal Society B 280: 20132001.

Vincent, C., Huon, M., Caurant, F., Dabin, W., Deniau, A., Dixneuf, S., Dupuis, L., Elder, J-F., Fremau, M-H., Hassani, S., Hemon, A., Karpouzopoulos, J., Lefeuvre, C., McConnell, B.J., Moss, S.E.W., Provost, P., Spitz, J., Turpin, Y. and Ridoux, V. (2017). Grey and

harbour seals in France: Distribution at sea, connectivity and trends in abundance at haulout sites. Deep Sea Research Part II: Topical Studies in Oceanography 141: 294-305.

Witt, M.J., Hardy, T., Johnson, L., McClellan, C.M., Pikesley, S.K., Ranger, S., Richardson, P.B., Solandt, J.L., Speedie, C., Williams, R. and Godley, B.J. (2012). Basking sharks in the Northeast Atlantic: spatio-temporal trends from sightings in UK waters. Marine Ecology Progress Series 459: 121–34.