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Environmental Statement – Volume 1 – Chapter 10 Marine Mammals and Basking Sharks

The Planning Act 2008

The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009 - Regulation 5(2)(a)

The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017

Document Ref: 6.1.10

PINS Ref.: EN020022

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PINS REF.: EN020022

DOCUMENT: 6.1.10

DATE: 14 NOVEMBER 2019

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DOCUMENT

Document	6.1.10 Environmental Statement – Volume 1 – Chapter 10 Marine Mammals and Basking Sharks
Revision	001
Document Owner	Natural Power Consultants Ltd.
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Date	21 October 2019
Approved By	R. Hodson
Date	25 October 2019

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10. MARINE MAMMALS AND BASKING SHARKS

10.1. SCOPE OF THE ASSESSMENT

10.1.1. INTRODUCTION

10.1.1.1. This chapter provides information regarding the environmental impacts on marine mammals and basking sharks 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.

10.1.1.3. A Habitats Regulations Assessment ('HRA') Report (document reference: 6.8.1) has also been submitted as part of the Application, in which likely significant effects ('LSE') on European sites and their qualifying features have been considered.

10.1.1.4. Where effects arise as a result of the combination of the impacts of the Proposed Development and the effects of other projects in the UK Marine Area and/or other Member States, these are also identified and assessed in Section 10.7.

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. For the purposes of assessment, this chapter focuses on the Landfall and Marine Cable Corridor within the UK Marine Area (as this comprises the Proposed Development; Figure 3.1 of the Environmental Statement ('ES') Volume 2 (document reference 6.2.3.1)).

10.1.2.2. Assessment is also presented on the potential effects from sheet piling works that are associated with onshore Horizontal Directional Drilling ('HDD') construction activities at HDD1 (onshore Landfall works), HDD2 (allotments) and HDD3 (Langstone Harbour crossing) locations. The location of onshore HDD works are presented as a table in Chapter 3 (Description of the Proposed Development) in the ES Volume 1 (document reference 6.1.3) and are shown in Figure 3.9 of the ES Volume 2 (document reference 6.2.3.9).

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 beyond 1 km (between Kilometre Point ('KP') 1 and KP 1.6) seaward from the Transition Joint Bays ('TJB's) located in the car park behind Fraser Range

(Figure 3.3 of the ES Volume 2 (document reference 6.2.3.3). It is not determined yet whether the HDD direction will be onshore to marine, marine to onshore, or drilling from both ends.

10.1.2.4. HDD is also proposed to be undertaken at Langstone Harbour to enable the cables to cross underneath Langstone Harbour from Portsea Island to the mainland (see sheet 2 of Figure 3.9 (Section 7 of this map). No HDD works will occur within the marine environment of Langstone Harbour as the drilling will be underneath the seabed of the harbour area. The entry/exit points of the drill will be located above the Mean High Water Springs ('MHWS') mark. It has been agreed with the Marine Management Organisation ('MMO') that this is considered to be an exempt activity that does not require a Marine Licence, subject to the conditions of Article 35 of Marine Licensing (Exempted Activities) Order 2011 (as amended).

10.1.2.5. The Consultation Report (document reference 5.1) provides further detail on this and other consultations.

Marine Cable Corridor

10.1.2.6. The Marine Cable Corridor encompasses the location of the Landfall within the marine environment extending from MHWS at Eastney out to the United Kingdom ('UK')/France European Economic Zone ('EEZ') Boundary Line (see Figure 3.1).

10.1.2.7. 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).

10.1.2.8. Since marine mammals and basking sharks are mobile and range widely, the study area is considered to be the eastern Channel (see Figure 10.1 of the ES Volume 2 (document reference 6.2.10.1).

10.1.2.9. 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 harbour porpoise marine mammal Management Unit ('MU') located within the Channel (Inter-Agency Marine Mammal Working Group ('IAMMWG'), 2015) as shown in Plate 10.1.

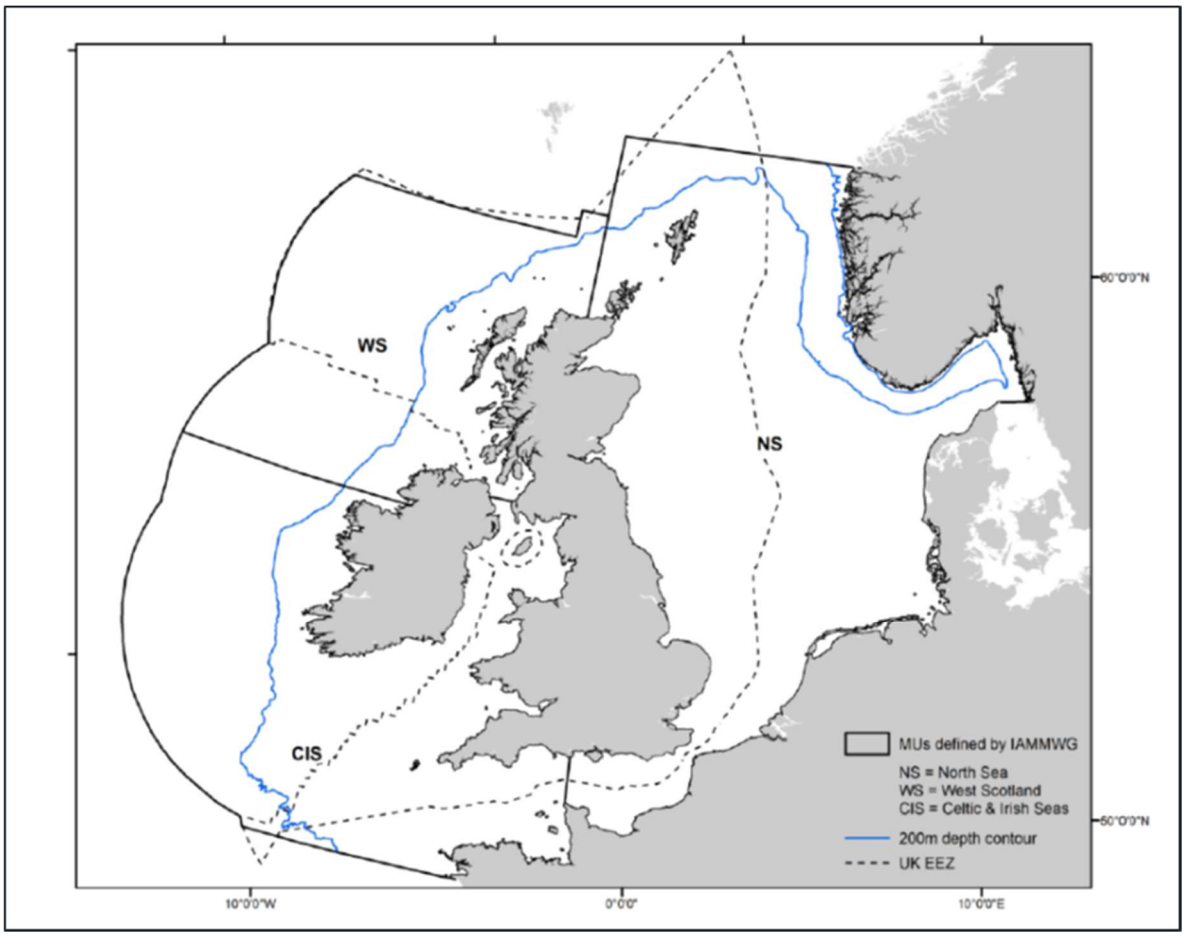

Plate 10.1 – Harbour porpoise MU (image taken from IAMMWG, 2015)

10.1.2.10. 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 Small Cetaceans in European Atlantic Waters and the North Sea ('SCANS')-III survey area known as Block C (Hammond *et al*., 2017; see Figure 10.1).

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

- European Commission ('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 nautical mile (nmi) limit (known as 'UK Territorial Waters'), as amended;

- 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
- Oslo/Paris convention (for the Protection of the Marine Environment of the North-East Atlantic) ('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 Marine Policy Statement (MPS) (2011).
  - The UK MPS is the framework for preparing Marine Plans and taking decisions affecting the marine environment, in the absence of Marine Plans. The South Marine Plan, which covers the spatial extent of the Proposed Development, was adopted in July 2018.

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.

10.2.3.1. Further detail and consideration on how the proposals for the Proposed Development meet the requirements of these policies is presented within the Planning Statement (document reference 5.4) that accompanies the Application.

10.2.4. GUIDANCE

- Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine (Chartered Institute for Ecology and Environmental Management ('CIEEM'), 2019);
- 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 (Joint Nature Conservation Committee ('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 5 Consultation, a Scoping Opinion was received by the Applicant from the Planning Inspectorate ('PINS') on 7 December 2018. The Scoping Opinion comments from PINS and key consultees in relation to marine mammals and how they were addressed is set out in Table 1 of Appendix 10.1 (Marine Mammals and Basking Sharks Consultation Responses) of the ES Volume 3 (document reference 6.3.10.1). Key items that were addressed included:

- PINS commented that the justification provided in the Scoping Opinion regarding scoping out increased vessel noise, collision with vessels, anthropogenic noise from geotechnical surveys, HDD works, seabed preparation and cable installation activities, and Electromagnetic Fields ('EMF') was insufficient. PINS requested that an assessment should be undertaken, where significant effects are likely. Further information relating to these potential impacts and justification for scoping them out was provided in Preliminary Environmental Information Report ('PEIR') Chapter 10. Confirmation that this information/justification was considered to be sufficient was received during post-PEIR consultation (see Section 10.3.4 and the Consultation Report (document reference: 5.1)); and

- PINS required clarification regarding whether assessment of potential Unexploded Ordnance ('UXO') operations (surveys, investigations and removals) would form part of the ES. Clarification was provided as to why this is being considered separately via a stand-alone Marine Licence application. Confirmation that stakeholders considered this approach acceptable was received during the PEIR consultation process (see Table 2 in Appendix 10.1 (Marine Mammal and Basking Sharks Consultation Responses)).

10.3.2. PEIR CONSULTATION

10.3.2.1. Consultation on the PEIR was undertaken between February and April 2019. All of the comments received from the consultation relevant to the assessment are presented in Table 2 in Appendix 10.1 (Marine Mammal and Basking Sharks Consultation Responses) however the key items that were discussed included:

- Use of the National Oceanographic and Atmospheric Administration ('NOAA') (2018) thresholds for auditory injury;
- Consideration of any UXO detonations required (via a stand-alone Marine Licence application because the UXO surveys have yet to be conducted and therefore the number, size and type of potential targets requiring safe removal or detonation is not known at this stage); and
- Provision of advice regarding impacts of the HDD works on marine mammals when more information on those works becomes available.

10.3.3. POST-PEIR CONSULTATION

10.3.3.1. Further consultation with key stakeholders on has been undertaken. This was to ensure all species and impacts are assessed. The key items that have been discussed are presented in Table 10.1.

Table 10.1 – Summary of post-PEIR consultation

Consultee	Date (Method of Consultation)	Discussion
Natural England ('NE')	13 February 2019	Discussion on the approach to HRA and pre-screening of sites for Annex I habitat, marine bird, Annex II migratory fish and marine mammal features.
NE	3 May 2019	Agreement on pre-screening of four UK marine mammal Special Area of Conservation (SAC)s.
NE, MMO and JNCC	7 May 2019 Teleconference	Discussion on the approach to dredge and disposal and the approach to plume dispersion modelling.

Consultee	Date (Method of Consultation)	Discussion
NE	27 June 2019 Teleconference	Discussion on the Applicant's responses to the feedback received from NE on the PEIR. NE confirmed that they agreed with the scope of the assessment and that sufficient evidence had been provided regarding why some potential impacts could be scoped out (see Consultation Report, document reference 5.1).
MMO	18 July 2019 Teleconference	Discussion on the Applicant's responses to the feedback received from MMO on the PEIR.
MMO	24 July 2019 Email	Further recommendation to include MarineSpace *et al*. (2013) methodology for identifying potential spawning habitat for herring.
JNCC	24 July 2019 Email	Consultation feedback received on the draft Deemed Marine Licence (dML)
NE	25 July 2019 Teleconference	Review and discussions on the draft dML.
Environment Agency ('EA')	31 July 2019 Email	Review and feedback on the draft dML
MMO	1 August 2019 Teleconference	Review and discussions on the draft dML.
JNCC	13 August 2019 Email	Review and feedback on the draft dML.
EA	20 August 2019 Email	Review and agreement on the Applicant's responses to EA feedback on the PEIR.
PINS	23 August 2019 Letter	Feedback on draft HRA
MMO	19 September and 02 October 2019 Email	MMO are content with approach to cumulative assessment and requested one new coastal project to be added to long list.
NE	20 September 2019 Email	Feedback on draft HRA
JNCC	28 September 2019 Email	Review and feedback on the draft HRA Report. Further feedback provided on 11 October 2019 in response to query for clarification.

Consultee	Date (Method of Consultation)	Discussion
States of Alderney	01 October 2019 Email	Feedback on draft HRA
NE	09 October 2019 Email	NE are content with the plume dispersion modelling approach taken for disposal activities and the resultant outputs with respect to predicted sedimentation and SSC levels, spatial extent and duration.
MMO	11 October 2019 Email	MMO provided feedback that the rationale for the additional 10% non-burial protection contingency during operation looks satisfactory however further clarity to be provided post submission.
MMO/Cefas	22 October 2019	Review and feedback on the disposal site characterisation report.

10.3.3.2. One key item agreed during the post-PEIR consultation was confirmation from NE (teleconference between NE and Natural Power held on 27/06/2019) that they agreed with the scope of the assessment contained within the PEIR. Sufficient evidence had been provided in the PEIR regarding why increased vessel noise, collision with vessels, anthropogenic noise from geotechnical surveys, the actual HD drilling aspect[1] of the HDD works, seabed preparation and cable installation activities, and EMF could be scoped out of further assessment. The Consultation Report provides further detail on this and other consultations (document reference 5.1).

10.3.3.3. Consultation on the standalone HRA Report was also undertaken with statutory and non-statutory consultees including NE, EA, JNCC and States of Alderney.

10.3.3.4. Comments received from these consultations on the HRA for marine mammals specifically are provided in Appendix 4 (Habitats Regulations Assessment Consultation Responses) of the HRA Report (Document Ref: 6.8.3.4). The key items with relevance to EIA for marine mammals and basking sharks and pertinent to this chapter of the ES included;

- PINS advised that the Applicant is strongly advised to seek agreement with relevant consultation bodies, including NE, on the approach to baseline data appropriate for use in the HRA.
- NE were content with the data sources used to inform the environmental baseline

[1] The HD drilling itself has been considered separately from other work associated with the HDD works, such as the potential vibro-hammering/sheet piling, which has the potential to lead to increased levels of anthropogenic noise.

used for the HRA.

- NE agreed with the UK SACs screened out for the HRA.
- NE agreed with the approach to HRA in combination assessment and were content with the list of projects identified for assessment.
- EA were content with the approach and conclusions made in the HRA.
- States of Alderney are content with the level of detail within the HRA. Advice to include additional data relating to the Channel Islands and consideration of grey seals within Alderney's Ramsar site.

10.3.4. ELEMENTS SCOPED OUT OF THE ASSESSMENT

10.3.4.1. The following elements were scoped out of the assessment:

- Increased vessel noise (construction, operation and decommissioning);
- Collision with vessels (construction, operation and decommissioning);
- Anthropogenic noise from geotechnical surveys, horizontal directional ('HD') drilling (hereafter referred to as HD drilling), seabed preparation and cable installation activities (construction and decommissioning); and
- EMF (operation).

10.3.5. IMPACTS SCOPED INTO THE ASSESSMENT

10.3.5.1. The following elements were scoped into the assessment:

- Increased anthropogenic noise from geophysical survey and positioning equipment which emits sound (relevant to the construction and operational phases);
- Associated HDD work: Increased anthropogenic noise from potential vibro-hammering at the marine HDD location (KP 1.0 – KP 1.6) if the HDD direction is offshore to onshore (relevant to the construction phase only); and
- Associated HDD work: Increased anthropogenic noise from potential sheet piling at three onshore HDD entry point locations (including Landfall) located around Langstone Harbour (includes the scenario if the Landfall HDD direction is onshore to offshore) (relevant to the construction phase only).

10.3.5.2. These potential impacts, which all relate to increased anthropogenic noise, are only relevant to marine mammals and have not been assessed for basking sharks or marine turtles because they are not sensitive to underwater noise changes (e.g. Wilson and Wilding, 2017). Therefore, it is considered that there is no potential for significant effects on these species (basking sharks and marine turtles).

10.4. ASSESSMENT METHODOLOGY

10.4.1.1. The assessment methodology used for marine mammals follows that recommended by CIEEM for ecological impact assessment of marine and coastal developments in the UK (CIEEM, 2019). CIEEM promotes the highest standards of practice for the benefit of nature and society. 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 is characterised in accordance with CIEEM (2019) guidelines. Wherever possible and relevant, the following criteria are 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 is undertaken in line with CIEEM (2019) 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. Assessment has been undertaken in the context of the wider conservation status of that receptor, and where uncertainty exists this has been acknowledged.

10.4.3.3. Embedded mitigation and, where appropriate, additional mitigation measures are 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.

10.4.3.4. In general, a significant effect is considered to be one which changes the structure and function of an ecosystem within the study area, undermines the conservation objectives of a designated site or the conservation status of its qualifying features, or affects the condition of a designated site and/or its qualifying features.

10.4.4. ASSUMPTIONS AND LIMITATIONS

10.4.4.1. This chapter of the ES provides information as it relates to the Proposed Development and as in Chapter 3 (Description of the Proposed Development).

10.4.4.2. The baseline environment has been described using information from the literature, i.e. no project-specific surveys were conducted. This information is considered to be sufficient for describing the baseline and conducting a proportionate, robust assessment given the nature of the Proposed Development and has been consulted upon during the scoping and PEIR consultation exercises.

10.4.4.3. For the quantitative aspects of the assessment, data on harbour porpoise and minke whale, the only species for which Channel-specific density estimates (from the SCANS-III survey) are available, were used. This is because marine mammal species occurrence and density are low in the Channel compared to other areas around the UK. There are no available density estimates for either mid frequency cetaceans (i.e. the dolphin species) or basking sharks/marine turtles (these species are only occasionally recorded in the eastern Channel).

10.4.4.4. Because project-generated noise levels will be relatively low, and durations short, project-specific noise modelling was not considered to be necessary and this approach was agreed with relevant stakeholders through the scoping and PEIR

consultation exercises. Instead, the best available information on source levels and frequencies has been used when conducting the assessment.

10.4.4.5. The use of airguns is not proposed.

10.4.4.6. Any geophysical surveys and investigations relating to UXO surveys or safe removal/detonation of UXO will be undertaken and assessed separately as part of a separate stand-alone Marine Licence application. The reason this process (stand-alone Marine Licence application for safe removal/detonation of UXO) is being followed is because the number, size and type of targets potentially requiring detonation is not known at this stage, and therefore the potential effects on marine megafauna cannot be assessed realistically in this chapter. This approach has been agreed with the MMO in a meeting in September 2018 and with NE in a meeting in February 2019 (see Consultation Report Document Ref: 5.1).

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 10.2.

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 10.2 below.

Table 10.2 – Data Sources

Data Source	Data Type	Details of Data Available
IAMMWG (2015)	Cetacean abundance estimates	Abundance estimates (derived from the 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

Data Source	Data Type	Details of Data Available
		Development as the Marine Cable Corridor is located within it. Estimates are available for harbour porpoise and minke whale.
Pettex *et al*. (2014)	Cetacean abundance estimates and distribution	Distribution of the pelagic megafauna in French Metropolitan waters (The Suivi Aérien de la Mégafaune Marine ('SAMM'), (Aerial Monitoring of Marine Megafauna)) gathered through aerial and ship based surveys for all cetacean species encountered.
McClellan *et al*. (2014)	Distribution of marine megafauna	Marine megafauna in the Channel region using geographically- and temporally-referenced marine megafauna datasets including data from the Channel Integrated Approach for Marine Resource Management ('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.

Data Source	Data Type	Details of Data Available
E.ON (2012)	Baseline marine mammal presence data	Marine mammal presence across the Rampion Offshore Wind Farm ('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 Channel carried out using visual observations from land, boat and aerial surveys over haul-out sites as well as tracking using telemetry.
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.

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*).

10.5.3.2. No cetacean species is abundant; the most frequently observed in nearshore waters being the bottlenose dolphin and further offshore 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).

10.5.3.3. 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 overlapped 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).

10.5.3.4. 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 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 monitoring sites furthest offshore (which were 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).

10.5.3.5. Bottlenose dolphins have a near-global distribution (except the polar regions). They are primarily a coastal 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).

10.5.3.6. 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 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).

10.5.3.7. 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 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).

10.5.3.8. 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).

10.5.3.9. 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).

10.5.3.10. 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 10.2). 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.

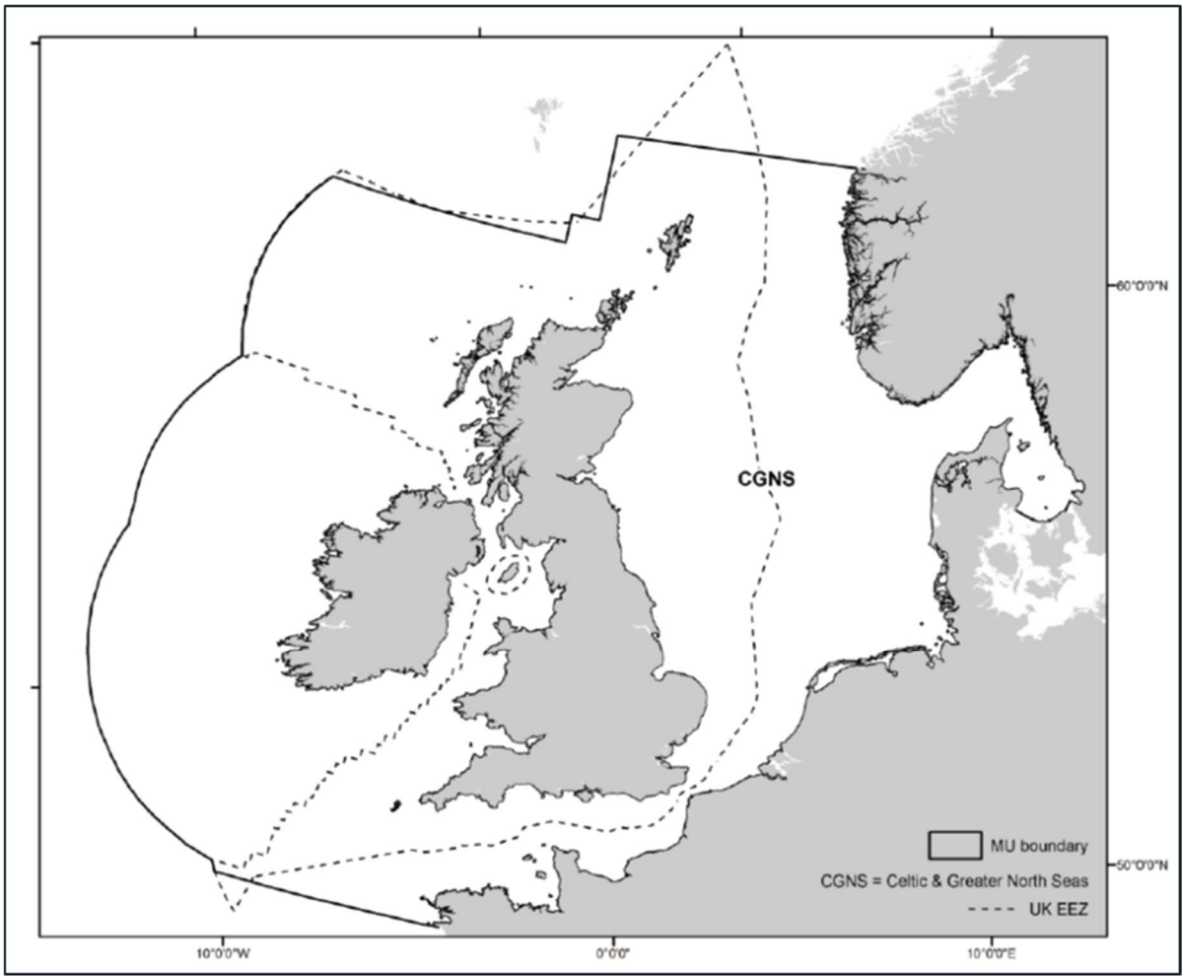

Plate 10.2 – Minke whale MU (image taken from IAMMWG, 2015)

10.5.3.11. 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).

10.5.3.12. There are no UK designated sites (i.e. SACs) 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 will be present within the Marine Cable Corridor and the potential for connectivity is considered to be negligible. Since the potential for

connectivity with UK designated sites is considered to be negligible, it was determined that UK cetacean SACs did not need to be considered as part of the HRA conducted for the Proposed Development, and UK sites were therefore screened out of the HRA in agreement with NE (see Appendix 4 (Habitats Regulations Assessment Consultation Responses) of the HRA Report)

10.5.3.13. 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 is considered in Section 10.7.2 of this chapter in relation to transboundary effects and is also assessed further within the HRA Report (see Figure 4.6 of the HRA Report, document reference: 6.8.2.4.6 for a map showing the French SACs with potential for connectivity).

10.5.4. PINNIPEDS (SEALS)

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[2] 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*., 2004; 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

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

Ireland. The species in rare in the Channel east of Dorset with only casual records occurring.

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.

10.5.4.5. 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 a 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).

10.5.4.6. There are no UK designated sites (i.e. SACs) which have pinniped species as a 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 Marine Cable Corridor and the potential for connectivity is considered to be negligible. Since the potential for connectivity is considered to be negligible, it was determined that UK pinniped SACs did not need to be considered as part of the HRA conducted for the Proposed Development, and UK sites were therefore screened out of the HRA in agreement with NE (Appendix 2 of the HRA Report (Pre-Screening for Marine Mammals; document reference 6.8.2.2) and Appendix 4 (HRA Report (Consultation Responses).

10.5.4.7. 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 is considered further in Section 10.7 in relation to transboundary effects and is also assessed within the HRA Report (see Figure 4.6 of the HRA Report for a map showing the French SACs with potential for connectivity).

10.5.4.8. 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 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 (UK 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. Because marine megafauna are protected by international, European and national legislation (see Section 10.2), they are considered to be of high conservation importance and have been assessed accordingly.

10.5.6.2. For the quantitative aspects of the assessment, data on harbour porpoise and minke whale were 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 either mid frequency cetaceans (i.e. the dolphin species) or basking sharks/marine turtles.

10.5.6.3. It is however considered that any resulting findings (and proposed mitigation) derived from the quantitative aspects of the assessment are also considered to be

appropriate for other, less commonly occurring, marine mammal species (and for basking shark and marine turtles).

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 Tables 10.2 and 10.7) 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 at least.

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 10.7 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 the cumulative effects assessment in Section 10.7 and in doing so, their ability to modify the existing baseline is also considered.

10.6. IMPACT ASSESSMENT

10.6.1.1. This section describes the potential impacts that may arise from the construction, operation (including maintenance and repair) and decommissioning of the Proposed Development and the effects these may have on marine mammal (and other marine megafauna) species.

10.6.2. EMBEDDED MITIGATION

10.6.2.1. General construction best practice will be managed through provision of a Marine Outline Construction Environmental Management Plan (document reference 6.5). This will ensure risk of environmental incidents is minimised as far as practicable.

10.6.3. WORST CASE DESIGN ENVELOPE

10.6.3.1. Table 10.3 gives the worst case design envelope parameters considered for marine mammal and other marine megafauna receptors during construction, operation

(including repair and maintenance) and decommissioning of the Proposed Development. Further details regarding the proposed activities and programme are presented in Chapter 3 (Description of Proposed Development) and Appendix 3.2 (Marine Worst-Case Design Parameters) of the ES Volume 3 (document reference 6.3.3.2).

Table 10.3 – Worst case design envelope parameters

Potential impact	Worst case parameters used in the assessment
Construction	
Increased anthropogenic noise from geophysical survey and positioning equipment which emits sound	**Geophysical survey and positioning equipment** Geophysical survey and positioning equipment is routinely used during route preparation and clearance, cable laying, cable burial/protection and post-lay surveys. 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), typical Sound Pressure Level ('SPL') 149-225 decibel ('dB') re 1 µPa at 1 m, typical frequency range of 500 Hertz ('Hz') to 15 kHz; • Ultra Short Baseline ('USBL') transceivers/transducers and transponders/responders/beacons, typical SPL 190-220 dB re 1 µPa at 1 m, typical frequency range of 18 to 55 kHz; • Scanning sonars, typical SPL 210-224 dB re 1 µPa at 1 m, typical frequency range of 100 to > 400 kHz; and • Multi beam echo sounders, typical SPL 191-221 dB re 1 µPa at 1 m, typical frequency range >200 kHz. In addition, the following may be used: • Obstacle avoidance sonar/multi beam imaging sonar, typical SPL < 207 dB re 1 µPa at 1 m, typical frequency range of 200-1100 kHz; and

Potential impact	Worst case parameters used in the assessment
	• Dual head scanning sonar, typical SPL <210 dB re 1 µPa at 1 m, typical frequency range 200-2250 kHz.
Associated HDD work: Increased anthropogenic noise	**Increased anthropogenic noise from potential vibro-hammering at the marine HDD location (KP 1.0 – KP 1.6)** Marine to onshore HDD: • Vibro-hammer (typically an excavator mounted vibrator (EMV)) to install up to four trestles/lattice frameworks which will be required to support the casings. Vibration methods are non-percussive. Typical EMV SPLs are low at < 90 dB at 5 m, and reduce by 6 dB each time the distance is doubled (Watson & Hillhouse, 2019); and • Pipe driving machine (also known as a hydraulic ram) to install up to four 36" diameter, 24 – 36 m long, temporary steel casing pipes/casings which will be required for HD drilling of each duct. Pipe driving machines also use vibration in order to push in/install casing pipes with an auger inside which removes the sediment. Pipe driving machine SPLs are likely to be similar to EMV SPLs, i.e. < 90 dB at 5 m and reduce by 6 dB each time the distance is doubled (Watson & Hillhouse, 2019). Complete installation of the trestles and casings will take ten 12-hour shifts per duct (this includes vessel repositioning, setting up the trestles and driving them into the seabed and then setting up the casings on the trestles, welding the casings together and then driving them into the seabed). There will be long breaks (9-10 weeks) between the vibro-hammering at each duct. **Sheet piling at the onshore HDD entry point locations** Sheets making up each wall will also be piled using an EMV vibro-hammer, typical SPLs are low at < 90 dB at 5 m and reduce by 6 dB each time the distance is doubled (Watson &

Potential impact	Worst case parameters used in the assessment
	Hillhouse, 2019). Typical sheet piled walls (5 m wide) take approximately 2 hours to install and 1 hour to remove. Sheet piling will not occur at HDD2 or HDD3 locations during October to March inclusive.
Operation (including repair/maintenance)	
Increased anthropogenic noise from geophysical survey and positioning equipment which emits sound	**Geophysical survey and positioning equipment** Geophysical survey and positioning equipment is routinely used during route preparation and clearance, cable laying, cable burial/protection and post-lay surveys. 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), typical SPL 149-225 dB re 1 µPa at 1 m, typical frequency range of 500 Hz to 15 kHz; • USBL transceivers/transducers and transponders/responders/beacons, typical SPL 190-220 dB re 1 µPa at 1 m, typical frequency range of 18 to 55 kHz; • Scanning sonars, typical SPL 210-224 dB re 1 µPa at 1 m, typical frequency range of 100 to > 400 kHz; and • Multi beam echo sounders, typical SPL 191-221 dB re 1 µPa at 1 m, typical frequency range >200 kHz. In addition, the following may be used: • Obstacle avoidance sonar/multi beam imaging sonar, typical SPL < 207 dB re 1 µPa at 1 m, typical frequency range of 200-1100 kHz; and

Potential impact	Worst case parameters used in the assessment
	• Dual head scanning sonar, typical SPL <210 dB re 1 µPa at 1 m, typical frequency range 200-2250 kHz.

10.6.4. CONSTRUCTION

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

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

10.6.4.2. 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);
- USBL transceivers/transducers and transponders/responders/beacons;
- Scanning sonars; and
- Multi beam echo sounders.

10.6.4.3. Magnetometers/gradiometers have not been included because they do not emit sound.

10.6.4.4. The use of geophysical survey and positioning equipment which emits sound has the potential to increase levels of anthropogenic noise in the marine environment (and therefore the potential to affect marine mammals). The potential effects of increased anthropogenic noise from geophysical survey and positioning equipment which emits sound on marine mammals may include:

- Lethal effects and physical injury at very close range (depending on the source levels used);
- Auditory injury at close range (depending on the source levels used); and
- Temporary behavioural responses (if the sound emitted falls within the hearing range of the marine mammal species present in the local area).

10.6.4.5. A summary of typical SPLs and frequency ranges of typical types of geophysical survey and positioning equipment likely used for the Proposed Development is given in Table 10.4 below. This information has been taken from typical equipment specification sheets. An assessment of whether each type of equipment is likely to have the potential to induce the onset of auditory injury or a behavioural response has also been made.

Table 10.4 – A summary of typical SPLs and frequency ranges of typical types of geophysical survey and positioning equipment

Equipment type	Typical SPL (dB re 1 µPa at 1 m)	Potential for auditory injury?	Typical frequency range (kHz unless otherwise stated)	Potential for a behavioural response?
Sub-bottom profiler	149-225	Potential risk	500 Hz to 15 kHz	Y
USBL system	190-220	Potential risk	18-55	Y
Obstacle avoidance sonar/multi beam imaging sonar	< 207	Negligible risk	200-1100	N
Dual head scanning sonar	< 210	Negligible risk	200-2250	N
Side scan sonar	210-224	Potential risk	100 to > 400	Y
Multi beam echo sounder	191-221	Negligible risk	> 200	N

Lethal Effects and Physical Injury

10.6.4.6. The sound emitted by some geophysical survey and positioning equipment has the potential to induce lethal effects and physical injury at very close range (i.e. within 1 m) if source levels are high. Lethal effects may occur where peak to peak levels exceed 240 dB re 1 µPa. Physical injury may occur where peak to peak levels exceed 220 dB re 1 µPa (Parvin *et al*., 2007).

10.6.4.7. It is very unlikely that the sound pressure level of the geophysical survey and positioning equipment required for the Proposed Development will be equivalent to or greater than the criteria for lethal effects or physical injury at anything other than very close range, i.e. within 1 m (see Table 10.4).

10.6.4.8. As marine mammals are unlikely to occur at very close range to the vessels carrying the equipment (strong avoidance reactions (to vessel noise) may occur up to 22 m from large vessels; ICOL, 2013), there is negligible potential for the sound emitted by geophysical survey and positioning equipment to cause lethal effects or physical injury. These effects (lethal effects and physical injury) are therefore considered to be **not significant**.

Auditory Injury (Permanent Threshold Shift)

10.6.4.9. The sound emitted by some geophysical survey and positioning equipment has the potential to induce the onset of Permanent Threshold Shift ('PTS'), i.e. auditory injury, at very close range if source levels (generally given as SPLs; see Table 10.4) are high (see Table 10.5 for PTS onset thresholds).

Table 10.5 – PTS onset thresholds (NOAA, 2018) 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
Low frequency cetaceans e.g. minke whale	219
Mid frequency cetaceans[3] e.g. bottlenose dolphin	230
High frequency cetaceans[4] e.g. harbour porpoise	202
Phocid seals in water[5] e.g. grey seal	218

10.6.4.10. Since marine mammals are unlikely to occur at very close range, 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. In addition, the duration is considered to be temporary (short term). This effect (auditory injury) is therefore considered to be **not significant**.

Disturbance

10.6.4.11. The sound emitted by some geophysical survey and positioning equipment (e.g. sub-bottom profilers and USBL systems; see Table 10.4) has the potential to disturb marine mammals if the frequency/frequencies used fall within their hearing ranges (see Table 10.6 for details of marine mammal hearing ranges).

Table 10.6 – 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 e.g. minke whale	0.007-35
Mid frequency cetaceans e.g. bottlenose dolphin	0.15-160

[3] Southall *et al.* (2019) have since renamed this hearing group high frequency cetaceans.
[4] Southall *et al.* (2019) have since renamed this hearing group very high frequency cetaceans.
[5] Southall *et al.* (2019) have since renamed this hearing group phocid carnivores in water.

Hearing group	Generalised hearing range (kHz)
High frequency cetaceans e.g. harbour porpoise	0.2-180
Phocid seals in water e.g. grey seal, harbour seal	0.05-86

10.6.4.12. 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.

10.6.4.13. As 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).

10.6.4.14. 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) πr^2. 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 10.7). These are the only species for which Channel-specific density estimates are available. Other species which may be present in the Channel, but for which no density estimates are available, are likely to be less numerous (than harbour porpoise and minke whale) and therefore their potential for exposure to sound levels which may induce a behavioural response is less than that estimated for harbour porpoise and minke whale.

Table 10.7 – 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

10.6.4.15. 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 that suitable alternative habitat is available, the significance of this effect (disturbance) is considered to be **not significant**.

10.6.4.16. In conclusion, the significance of lethal effects, physical injury, auditory injury (PTS onset) and disturbance as a result of the sound emitted by geophysical survey and positioning equipment is considered to be **not significant**. This is because animals are very unlikely to occur within close enough range of the sound source to be susceptible (to lethal effects, physical injury or auditory injury). Although there is potential for disturbance as a result of the sound emitted by geophysical survey and positioning equipment, the number of individuals estimated to have the potential to be disturbed is small and any effects are likely to be temporary, and reversible and therefore **not significant**.

Associated HDD work: Increased anthropogenic noise from potential vibro-hammering at the marine HDD location (KP 1.0 – KP 1.6)

10.6.4.17. The HDD direction may be onshore to marine, marine to onshore, or drilling from both ends.

10.6.4.18. Marine to onshore HDD (and this aspect of drilling from both ends) is considered to be the worst case scenario for marine mammals because this approach requires use of:

- A vibro-hammer (typically an EMV) to install up to four trestles/lattice frameworks which will be required to support the casings. Vibration methods are non-percussive; and
- A pipe driving machine (also known as a hydraulic ram) to install up to four 36" diameter, 24 – 36 m long, temporary steel casing pipes/casings which will be required for HD drilling of each duct. Pipe driving machines also use vibration in

order to push in/install casing pipes with an auger inside which removes the sediment.

10.6.4.19. As described in Chapter 3 (Description of the Proposed Development), complete installation of the trestles and casings will take ten 12-hour shifts per duct (this includes vessel repositioning, setting up the trestles and driving them into the seabed and then setting up the casings on the trestles, welding the casings together and then driving them into the seabed). There will be long breaks (9-10 weeks) between the vibro-hammering at each duct.

10.6.4.20. Although noise emissions vary depending on the type of pile being driven, method of installation, site location and ambient noise, typical EMV SPLs are low at < 90 dB (A) at 5 m (Watson & Hillhouse, 2019). Pipe driving machine SPLs are likely to be similar to EMV SPLs.

10.6.4.21. Noise levels in air do not equal noise levels in water. This is due to differences in reference standards (dB re 1 µPa in water versus dB re 20 µPa in air) and acoustic impedance (the characteristic impedance of water is about 3600 times that of air). However, conversions of dB from air to water can be made[6] and an SPL of 90 dB in air is considered to be equivalent to an SPL of 152 dB re 1 µPa in water.

Lethal Effects, Physical Injury and Auditory Injury

10.6.4.22. Given the estimated sound levels, there is no potential for lethal effects (threshold is levels exceeding 240 dB re 1 µPa; Parvin *et al*., 2007), physical injury (threshold is levels exceeding 220 dB re 1 µPa; Parvin *et al*., 2007) or auditory injury (see Table 10.8 below) from the potential vibro-hammering even at source. These effects (lethal effects, physical injury and auditory injury) are therefore considered to be **not significant**.

Table 10.8 – PTS onset thresholds (NOAA, 2018) in response to non-pulsed sound (dB re 1 µPa²s)

Hearing group	PTS onset threshold
Low frequency cetaceans e.g. minke whale	199
Mid frequency cetaceans e.g. bottlenose dolphin	198
High frequency cetaceans e.g. harbour porpoise	173
Phocid seals in water e.g. grey seal, harbour seal	201

[6] https://fas.org/man/dod-101/sys/ship/acoustics.htm#conversion

Disturbance

10.6.4.23. Furthermore, the potential for behavioural responses/disturbance is considered to be negligible. This is because the noise is unlikely to be discernible above background underwater noise levels (median noise levels around the UK range from 81.5 to 95.5 dB re 1 µPa; Merchant *et al*., 2016) by between 512 and 1024 m from source (spreading loss is 6 dB for each doubling of distance from source[7]). This estimate is supported by Nedwell *et al*. (2003) who found that the noise from vibro-piling of 508-914 mm piles at Red Funnel's Southampton Terminal could not be detected above background noise at a range of 417 m. A worst case range of 1.024 km has been used as the radius in the simple calculation of area (of potential impact) πr^2. 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 10.9). These are the only species for which Channel-specific density estimates are available. Other species which may be present in the Channel, but for which no density estimates are available, are likely to be less numerous (than harbour porpoise and minke whale) and therefore their potential for exposure to sound levels which may induce a behavioural response is less than that estimated for harbour porpoise and minke whale. It should be noted that the number of minke whales estimated to have the potential to be impacted is likely to be an over-estimate because, while the SCANS-III density estimate used applies to the whole Channel, their distribution is unlikely to be either uniform across the whole area or predominantly coastal.

Table 10.9 – A precautionary estimate of the number of animals which have the potential to be disturbed by sound emitted by the potential vibro-hammering

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	1	227,298	0.0003
Minke whale	0.002	<1	23,528	0.00003

10.6.4.24. Although noise from the potential vibro-hammering may be detectable above background in the approaches to/at the entrance of Langstone Harbour, the probability of a response by seals transiting to/from haul out sites located within the harbour is considered to be negligible because the noise level will be low (92-98 dB re 1 µPa) at this distance from source. It is possible that noise from the potential

[7] https://www.arc.id.au/SoundLevels.html

vibro-hammering may not be detectable above background at this location. This is because the area is regularly used by large commercial vessels coming in and out of Portsmouth and Southampton therefore existing local background levels may be greater than the median range reported by Merchant *et al*. (2016).

10.6.4.25. Given the low levels of noise anticipated, the small number of animals (and percentage of reference population) which have the potential to be disturbed, and the fact that any disturbance, should noise from the potential vibro-hammering be detectable above background at this location, is likely to be temporary (short term) in duration and that suitable alternative habitat is available, the significance of this effect (disturbance) is considered to be **not significant**.

10.6.4.26. In conclusion, because there is no potential for lethal effects, physical injury or auditory injury even at source, and the potential for behavioural responses/disturbance is considered to be negligible, the significance of this effect (increased anthropogenic noise from potential vibro-hammering at the marine HDD location) is considered to be **not significant**.

Associated HDD work: Increased anthropogenic noise from potential sheet piling at the onshore HDD entry point locations

10.6.4.27. Temporary sheet piled anchor walls may be required at three onshore HDD entry point locations located around Langstone Harbour in order to stabilise the HD drilling rig (HDD1 onshore compound for landfall at Eastney; HDD2 Allotments and HDD3 Portsea Crossing). This will be confirmed during the final design stages of the Proposed Development once the Contractor/s have been commissioned.

10.6.4.28. If temporary anchor walls are required, the sheets making up each wall will also be piled using an EMV vibro-hammer. Typical sheet piled walls (5 m wide) take approximately 2 hours to install and 1 hour to remove, i.e. duration is short. Sheet piling will not occur at HDD2 or HDD3 locations during October to March inclusive.

10.6.4.29. Although noise emissions vary depending on the type of pile being driven, method of installation, site location and ambient noise, typical SPLs are low at < 90 dB (A) at 5 m and reduce by 6 dB each time the distance is doubled (Watson & Hillhouse, 2019).

10.6.4.30. NOAA (2018) and NOAA (2016) provide guidance on underwater thresholds for onset of PTS and Temporary Threshold Shift ('TTS') but not in air thresholds for behavioural responses. Therefore information from Southall *et al*. (2007), who provide the following general statement, has been used:

> "*Pinnipeds exposed to intense (~110 to 120 dB re: 20 µPa) nonpulse sounds tended to leave haulout areas and seek refuge temporarily (minutes to a few hours) in the water, whereas pinnipeds exposed to distant launches at received levels ~60 to 70 dB re: 20 µPa tended to ignore the noise. It is difficult to assess the relevance of either of these observations to naïve individuals, however, given the repeated exposure of study colonies to such noise events and the potential that observed individuals were habituated. Due*

to the limitations of available data, it is not currently possible to make any further general characterizations regarding this condition."

10.6.4.31. The closest seal haul out site (Mallard Sands in Langstone Harbour) is approximately 900 m from the closest onshore HDD location (HDD3 from Kendall's Wharf underneath Langstone Harbour from Portsea Island to the mainland). Given that SPLs from typical EMVs are < 90 dB at 5 m, and reduce by 6 dB each time the distance is doubled (Watson & Hillhouse, 2019), the SPL at the haul out site is likely to be < 50 dB.

10.6.4.32. The potential for disturbance (from increased anthropogenic noise from potential sheet piling at the onshore HDD entry point locations) of the tens of harbour seals and occasional grey seal which use the closest haul out site at low tide is therefore considered to be negligible.

10.6.4.33. Given this, and the fact that any potential disturbance is likely to be temporary (short term) in duration (i.e. less than one low tide period for installation of the sheet piled anchor wall and the same for its removal), the significance of this effect (increased anthropogenic noise from potential sheet piling at the onshore HDD entry point locations) is considered to be **not significant**.

10.6.5. OPERATION (INCLUDING REPAIR AND MAINTENANCE)

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

10.6.5.1. Cable surveys required during the operational phase will likely use the same equipment as the construction phase surveys (see Table 10.3).

10.6.5.2. Additional information in Chapter 3 (Description of the Proposed Development) proposes that the duration of each operational phase survey is likely to be 20 days. The worst-case frequency of surveys is 10 surveys in the first five years followed by one survey every year for the remainder of the project (best-case frequency is two surveys in the first two years followed by one survey every five years for the remainder of the project).

10.6.5.3. As described above for construction, the potential effects of increased anthropogenic noise from geophysical survey and positioning equipment which emits sound on marine mammals may include lethal effects and physical injury at very close range (depending on the source levels used), auditory injury (PTS onset) at close range (depending on the source levels used), and temporary behavioural responses (if the sound emitted falls within the hearing range of the marine mammal species present in the local area).

10.6.5.4. The significance of lethal effects, physical injury, auditory injury (PTS onset) and disturbance as a result of the sound emitted by geophysical survey and positioning equipment is considered to be **not significant**. This is because animals are very unlikely to occur within close enough range of the sound source to be susceptible (to lethal effects, physical injury or auditory injury). Although there is potential for

disturbance as a result of the sound emitted by geophysical survey and positioning equipment, the number of individuals estimated to have the potential to be disturbed is small and any effects are likely to be temporary, and reversible and therefore **not significant**.

10.6.6. DECOMMISSIONING

10.6.6.1. The options for decommissioning include leaving the Marine Cables in situ, removal of the entire cables or removal of sections of the Marine Cables. Current best practice is to leave the inert and environmentally benign cable in situ so as to avoid unnecessary disturbance of the seabed (see Chapter 3 (Description of the Proposed Development)). It is considered that there is no potential for significant effects on marine mammal and other marine megafauna receptors from leaving the inert Marine Cables in place.

10.6.6.2. However, the Crown Estate currently supports removal of cables where practicable for OWFs (BEIS, 2019). In the event that cables are retrieved, decommissioning will be undertaken in line with industry best practice, and any effects are considered to be equivalent to or lesser in nature than those considered for activities undertaken during construction (and should inert cables be left in situ, they are expected to be significantly less). The potential impacts resulting from decommissioning are therefore considered to be **not significant**.

10.7. CUMULATIVE EFFECTS ASSESSMENT

10.7.1. INTER-PROJECT EFFECTS

10.7.1.1. The following section assesses how other plans or projects may result in cumulative effects on marine mammals with the Proposed Development.

10.7.1.2. It has generally been considered that the potential for cumulative effects will be greatest during the construction phase of the Proposed Development. Decommissioning is assumed to have similar (or lesser) impacts than construction. In the event that cables need to be repaired or maintained, the activities required to undertake the works are considered similar to the effects that may arise during construction although much lower in magnitude due to the considerable reduced scale and shorter duration of works.

10.7.1.3. The potential for cumulative effects on marine mammals from increased anthropogenic noise from the following sources 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:

- Geophysical survey and positioning equipment which emits sound;
- Potential vibro-hammering at the marine HDD location (KP 1.0 – KP 1.6); and
- Potential sheet piling at the onshore HDD entry point locations around Langstone Harbour.

10.7.1.4. The Zone of Influence ('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 (in this case from the geophysical survey and positioning equipment likely to be used for the Proposed Development).

10.7.1.5. The zones of potential effect from the potential vibro-hammering of trestles and casings and onshore sheet piling are smaller than 5 km (see Section 10.6.3) therefore 5 km is considered to represent the worst case.

10.7.1.6. As detailed in Chapter 29 (Cumulative Effects) of the ES Volume 1 (document reference 6.1.29), the cumulative effects assessment has been undertaken in line with PINS Advice Note Seventeen – Cumulative Effects Assessment (PINS, 2019).

10.7.1.7. A long list of projects within the vicinity of the Proposed Development that have the potential to give rise to cumulative effects was considered and is presented in Appendix 10.2 (Marine Mammal and Basking Shark Cumulative Assessment Matrix) of the ES Volume 3 (document reference 6.3.10.2). This included major projects (OWFs, interconnector cables, oil and gas), aggregate dredging projects, dredging and disposal projects, and coastal projects. The locations of projects within this list in relation to the Proposed Development are presented in Chapter 29 (Cumulative Effects) and illustrated in Figures 29.1 to 29.5 of the ES Volume 2 (document references 6.2.29.1 to 6.2.29.5). The long list (which numbered 122 projects) was refined for marine mammals as follows. This long list was agreed with the MMO (see Table 10.1).

10.7.1.8. Firstly, a spatial assessment was conducted (Stage 1 of the assessment). 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). Of the long list of 122 projects, 33 projects were shortlisted as having potential spatial overlap with the Proposed Development (see Appendix 10.2 (Marine Mammals and Basking Sharks Cumulative Assessment Matrix)). These included the AQUIND Interconnector in French EEZ and French Territorial Waters, AQUIND Interconnector UXO clearance, Rampion OWF Extension, the IFA 2 Interconnector (three aspects), eight aggregate dredging projects, three dredging and disposal projects, and 16 coastal projects.

10.7.1.9. Secondly, a temporal, nature and scale-based assessment was conducted for the 33 projects where a potential spatial overlap had been identified (Stage 2 of the assessment). Of these, 18 projects were considered to have the potential for temporal overlap with the Proposed Development. These included the AQUIND Interconnector in French EEZ and French Territorial Waters, the IFA 2 Interconnector

(operational phase surveys), eight aggregate dredging projects, two dredging and disposal projects, and six coastal projects.

10.7.1.10. However, the scale and nature of these 18 projects meant that any potential cumulative effects were unlikely to be significant (i.e. no potential for onset of auditory injury, and any disturbance is predicted to be temporary). Therefore, no projects were progressed to a detailed cumulative effects assessment (i.e. Stages 3 and 4) for marine mammals.

10.7.2. INTRA-PROJECT EFFECTS

10.7.2.1. As detailed in Chapter 4 (EIA Methodology) of the ES Volume 1 (document reference 6.1.4), Chapter 29 (Cumulative Effects) presents consideration of potential intra-project effects on marine mammals and basking sharks.

10.7.3. TRANSBOUNDARY EFFECTS

10.7.3.1. 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. Due to the nature of the increased anthropogenic noise from the Proposed Development (small zones of potential impact), and the low diversity of species and numbers of individuals likely to be present in the Channel, no significant effects on animals in UK waters were identified. Due to the small zones of potential impact, and therefore negligible overlap with French waters, the potential for significant transboundary effects is considered to be negligible.

10.7.3.2. In addition, the potential effects on French SACs/Ramsars where marine mammals (bottlenose dolphin, harbour porpoise, grey seal and harbour seal) are a feature and for which there is potential for connectivity to the Proposed Development has been considered. Accordingly, the potential effects from the Proposed Development on the integrity and conservation status of these sites have been considered as part of the HRA process (HRA Report and appendices), and it was concluded that there were no adverse effects on site integrity for any of the French sites considered.

10.8. PROPOSED MITIGATION

10.8.1. CONSTRUCTION, OPERATION AND DECOMMISSIONING

10.8.1.1. As no significant effects have been identified, no additional mitigation measures are required or proposed in relation to the effect on marine mammals, basking sharks and other marine megafauna.

10.9. RESIDUAL EFFECTS

10.9.1.1. Potential effects due to increased anthropogenic noise from geophysical survey and positioning equipment which emits sound, potential vibro-hammering/pipe driving at the marine HDD location and potential sheet piling at the onshore HDD entry point locations were considered to be **not significant** at all stages of the development (Table 10.10).

Table 10.10 – Summary of Effects for Marine Mammals and Basking Sharks

Predicted Impact	Effect	Significance of Effect	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	None required	Not significant
	Disturbance	Not significant	None required	Not significant
Increased anthropogenic noise from potential vibro-hammering at the marine HDD location (KP 1.0 – KP 1.6)	PTS Disturbance	Not significant	None required	Not significant
Increased anthropogenic noise from potential sheet piling at the onshore HDD entry point locations	PTS Disturbance	Not significant	None required	Not significant

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