Morecambe Offshore Windfarm: Generation Assets

Examination Documents

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Marine Mammal Technical Note 1 (EIA)

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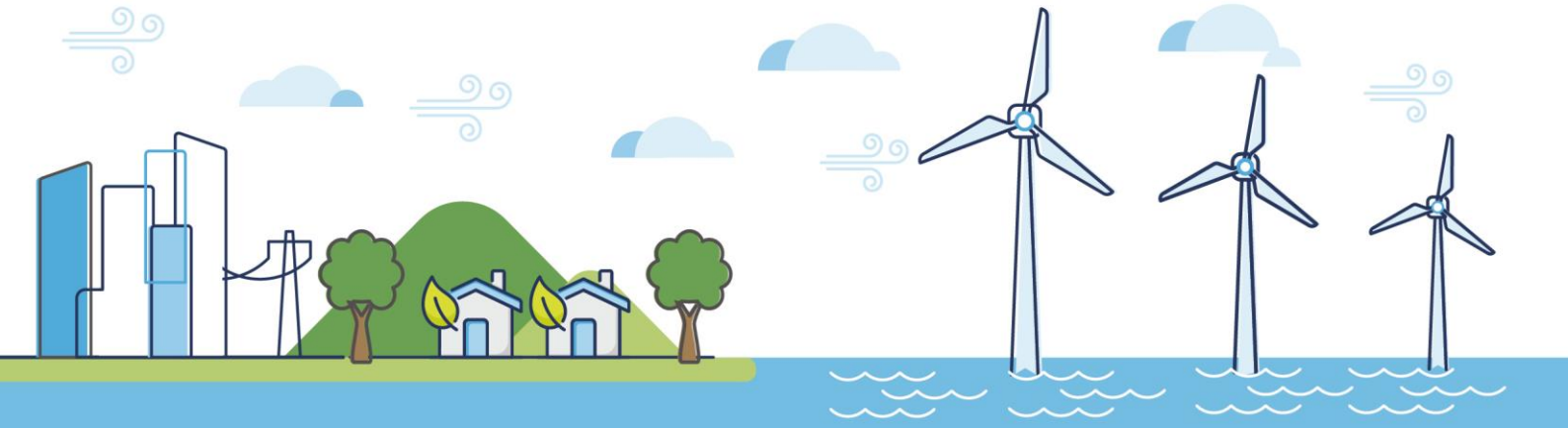

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Glossary of Acronyms

ADD	Acoustic Deterrent Device
AIS	Automatic Identification System
CEA	Cumulative Effect Assessment
Cefas	Centre for Environment, Fisheries and Aquaculture Science
CGNS	Celtic and Greater North Sea
CIS	Celtic and Irish Sea
CSIP	Cetacean Stranding Investigation Programme
DCO	Development Consent Order
DRC	Dose-Response Curve
EDR	Effective Deterrence Range
EIA	Environmental Impact Assessment
ES	Environmental Statement
HF	High-Frequency
IoM	Isle of Man
iPCoD	Interims Population Consequences of Disturbance
IS	Irish Sea
IWC	International Whaling Commission
MMMP	Marine Mammal Mitigation Protocol
MMO	Marine Management Organisation
MU	Management Unit
NE	Natural England
NEQ	Net Explosive Quantity
NI	Northern Ireland
NOAA	National Oceanic and Atmospheric Administration
NPS	National Policy Statement
NW	North-West
OBS	Offshore Booster Station
OSP	Offshore substation platforms
OWF	Offshore Wind Farm
PEIR	Preliminary Environmental Information Report
PINS	Planning Inspectorate
PTS	Permanent Threshold Shift
RIAA	Report to Inform Appropriate Assessment
RMS	Root Mean Squared

RR	Relevant Representation
SAC	Special Area of Conservation
SPL	Sound Pressure Level
SPL_{RMS}	Sound Pressure Level Root Mean Squared
TTS	Temporary Threshold Shift
UK	United Kingdom
UXO	Unexploded Ordnance
VHF	Very-High Frequency
WTG	Wind turbine generator

Glossary of Unit Terms

dB	Decibel
dB re 1 µPa	Underwater dB are referenced to a pressure of 1 micro Pascal (µPa), which is abbreviated as dB re 1 µPa
Hz	Hertz
kHz	Kilohertz
km^2	square kilometre
µPa	Micro pascal

Glossary of Terminology

Agreement for Lease (AfL)	Agreements under which seabed rights are awarded following the completion of The Crown Estate tender process.
Applicant	Morecambe Offshore Windfarm Ltd
Application	This refers to the Applicant's application for a Development Consent Order (DCO). An application consists of a series of documents and plans which are published on the Planning Inspectorate's (PINS) website.
Generation Assets (the Project)	Generation assets associated with the Morecambe Offshore Windfarm. This is infrastructure in connection with electricity production, namely the fixed foundation wind turbine generators (WTGs), inter-array cables, offshore substation platform(s) (OSP(s)) and possible platform link cables to connect OSP(s).
Sound Pressure Level (SPL)	The sound pressure level or SPL is an expression of the sound pressure using the decibel (dB) scale, and the standard reference pressures of 1 µPa for water and 20 µPa for air.
The Planning Inspectorate	The agency responsible for operating the planning process for Nationally Significant Infrastructure Projects.
Windfarm site	The area within which the WTGs, inter-array cables, OSP(s) and platform link cables would be present.

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1 Introduction

1. This document presents an update to the assessment of effects on marine mammal receptors presented in Chapter 11 Marine Mammals of the Environmental Statement (ES) (APP-048) submitted as part of the assessment of the Morecambe Offshore Windfarm Generation Assets (the Project) by Morecambe Offshore Windfarm Ltd (the Applicant).

2. This has been undertaken in response to comments provided by Natural England (NE), who in their Relevant Representation (RR) (RR-061), indicated that further information, updates and clarifications were required. Commentary on a relevant comment from the Marine Management Organisation (MMO) (RR-047) is also included. This technical note follows the Applicant's Response to RR's (PD1-011) submitted for Procedural Deadline A. It is noted that some of the information has also been provided in The Applicant's Response to the Rule 9 Letter for Morecambe Offshore Windfarm Generation Assets (PD1-010), as indicated in **Table 1.1**.

Table 1.1 RRs that have been addressed within this technical note

RR ID (as stated in PD1-010)	Section where the RR is addressed	Provided as part of the Rule 9 response (PD1-010)
RR-061-180 (NE Ref D16)	**Section 2.1**	n/a
RR-061-185 (NE Ref D21)	**Section 2.2**	Incorporated into Section 5.1
RR-061-189 (NE Ref D25)	**Section 2.3**	n/a
RR-061-190 (NE Ref D26)	**Section 2.4**	Section 5.2
RR-047-30 (MMO Ref 3.2.2)	**Section 2.5**	n/a
RR-061-168 & RR-061-196 (NE Ref D4 & NE Ref D32)	**Section 2.6**	Section 5.1 and 5.3
RR-061-168 & RR-061-192 (NE Ref D4 & NE Ref D28)	**Section 64**	Section 5.1
RR-061-214 (NE Ref D50)	**Section 2.8**	Section 5.1.3

2 Updates and amendments for the Marine Mammal Assessment (Chapter 11 Marine Mammals (APP-048))

3. The following updates and amendments for marine mammals have been based on the methodology outlined in the ES Chapter 11 Marine Mammals (APP-048):

   - For permanent and temporary impacts, refer to Section 11.4.2.1 Table 11.8 and 11.10 in ES Chapter 11 Marine Mammals (APP-048) for detailed information; and
   - For population modelling, if there is a continued decline of >1% per year (versus a modelled unimpacted reference population) over a set period of time (e.g. the first 6 years, based on the former Favourable Conservation Status reporting period), then there is a high likelihood that there is a significant level of effect (NRW, 2023) (see Section 11.6.3.2 in ES Chapter 11 Marine Mammals (APP-048) for further information).

2.1 Additional information to baseline noise levels (NE Ref D16)

4. The following information is provided in response to NE's comment (NE Ref D16, RR-061-180):

   "*The baseline noise levels have not been presented, despite the NPS requirement".*

5. The Applicant notes the National Policy Statement (NPS) EN-3 requirements (paragraph 2.8.131) (Department for Energy Security & Net Zero, 2023) state 'where necessary'. The Applicant considers that baseline noise levels do not contribute to the underwater noise assessment, which relies entirely on absolute noise thresholds as criteria. The Applicant has, however, prepared additional information (**Section 2.1.1**) regarding baseline noise levels to supplement Appendix 11.1 Underwater Noise Assessment (APP-065) and provide justification of the assessments with the Development Consent Order (DCO) Application.

2.1.1 Baseline ambient noise

6. The baseline noise level in open water, in the absence of any specific anthropogenic noise source, is generally dependent on a mix of the movement of the water and sediment, weather conditions and shipping. There is a component of biological noise from marine mammal and fish vocalisation, as well as an element from invertebrates.

7. Outside of the naturally occurring ambient noise, anthropogenic noise dominates the background. The Irish Sea is heavily shipped by fishing, cargo, and passenger vessels, which contribute to the ambient noise in the water. The larger vessels are not only louder, but the noise tends to have a lower frequency, which travels more readily, especially in the deeper open water. Other vessels such as dredgers and small fishing boats have a lower overall contribution. There are no known dredging areas, active dredge zones, or dredging application options or prospective dredging areas within the windfarm site, with the nearest aggregate production area being 9.7km away (Liverpool Bay aggregate production area (Area 457)).

8. Other sources of anthropogenic noise include oil and gas platforms, other drilling activity and military exercises and operational windfarms. Drilling, including oil and gas drilling, may contribute some low frequency noise at the region around the windfarm site, although due to its low-level nature, this is unlikely to contribute to the overall ambient noise. Little information is available on the scope and timing of military exercises, but they are not expected to last for an extended period and so would have little contribution to the long-term ambient noise in the area. Operational windfarms have a very localised disturbance effect and are not generally audible outside the array area; therefore, they are unlikely to contribute to the overall ambient noise.

9. Typical underwater noise levels show a frequency dependency in relation to different noise sources; the classic curves are given in Wenz (1962) and are reproduced in **Figure 2.1** below. **Figure 2.1** shows that any unweighted overall (i.e., single-figure non-frequency-dependent) noise level is typically dependent on the very low frequency element of the noise. The introduction of a nearby anthropogenic noise source (such as piling or sources involving engines) will tend to increase the noise levels in the 100 Hz to 1 kHz region, but to a lesser extent will also extend into higher and lower frequencies.

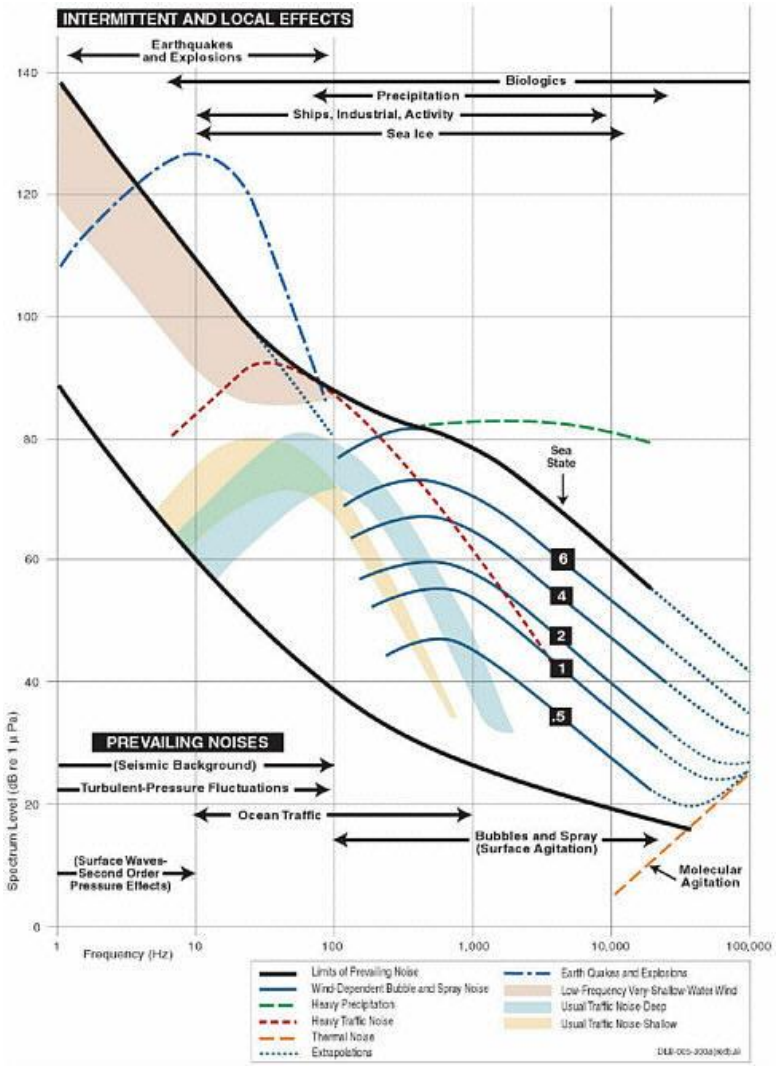

Figure 2.1 Ambient underwater noise following Wenz (1962) showing frequency dependency from different noise sources

10. Searching Subacoustech's underwater noise measurement database showed a comprehensive baseline noise survey was undertaken in the Irish Sea using an underwater noise monitoring station installed in the middle of the Burbo Bank Extension Offshore Wind Farm (OWF) (approximately 29km from the Project), which continuously monitored the ambient noise levels between 23rd March 2016 and 25th April 2016. The measurements taken during this survey identified the main contributing sources of noise that make up the ambient noise environment in the vicinity. Although this survey was undertaken in 2016, it is expected to represent a reasonable approximation of the subsea noise levels in the Irish Sea regions.

11. The overview of the entire monitoring period in **Figure 2.2** below shows that the range of underwater noise levels typically lay, with isolated exceptions, between 95 dB and 130 Decibel (dB) re 1 µPa Sound Pressure Level Root Mean Squared (SPL_{RMS}) (displayed as 10-minute averages). Although there were clear instances of times when the noise levels reached or approached

the upper and lower extremes on most days, a trend can be identified when looking at this timeframe. The logarithmic average noise level over this period was 120.4 dB re 1 µPa SPL_{RMS}.

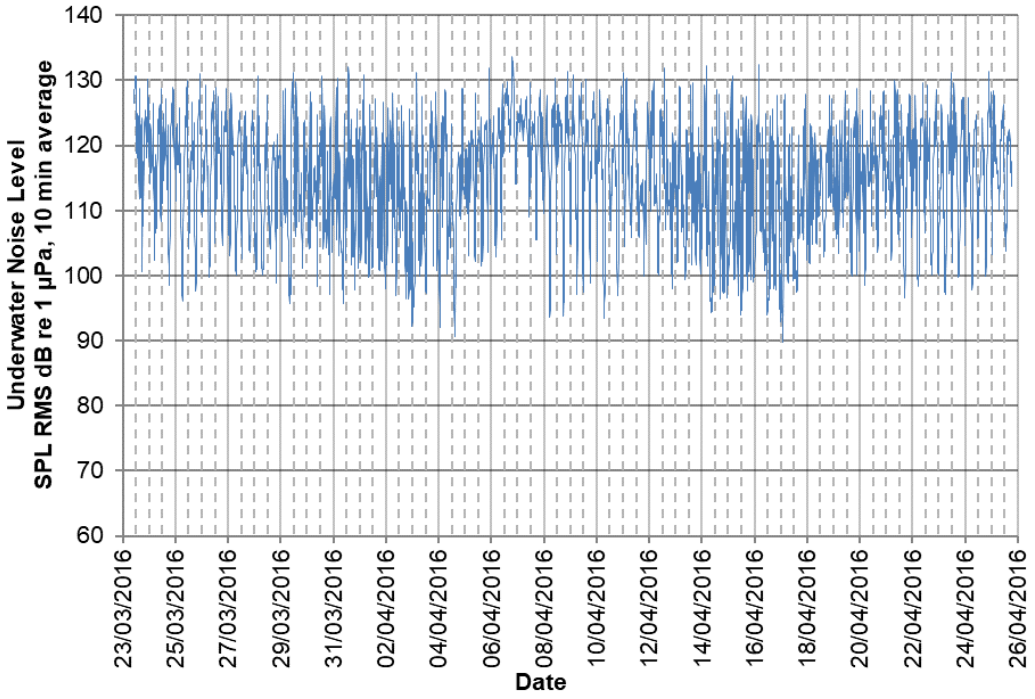

Figure 2.2 Overall sampled underwater noise levels at Burbo Bank Extension site, March-April 2016

12. Two primary sources influenced the noise levels in the Irish Sea: flow-related noise associated with tides moving material on the seabed and vessel noise. The highest noise levels recorded above were produced at times of greatest currents and the passing of vessels, whereas the quietest noise levels were at slack water with no significant anthropogenic influence.

13. Another underwater noise dataset was recorded at Gwynt y Môr OWF (approximately 29km from the Project) over four days in August 2012 during construction of the OWF, but in the absence of, and away from any specific construction activity in the vicinity. Noise levels were measured on a survey vessel and were 88 – 132 dB SPL_{RMS} with mean daily noise levels of 92 – 119 dB SPL_{RMS}. This was lower than that measured at the Burbo Bank Extension site, although benefited from being measured while drifting on the vessel, which minimised any flow noise on the hydrophone.

14. In principle, when noise introduced by anthropogenic sources propagates far enough it will reduce to the level of ambient noise, at which point it can be considered negligible. In practice, as the underwater noise thresholds defined by Southall *et al.* (2019) and Popper *et al*. (2014) in the Appendix 11.1 Underwater Noise Assessment (APP-065) were all considerably above the level of background noise, any noise baseline would not influence an assessment to these criteria.

15. In response to NE's comment on baseline noise levels (NE Ref D16, RR-061-180), the Applicant has undertaken a review of available evidence and data sources, including data collected for historic OWF in the Irish Sea, to meet the requirement of NPS EN-3 paragraph 2.8.131. The Applicant considers that the information presented is sufficient to demonstrate that the level of background noise is below the threshold at which it would influence the assessments, and therefore that the information in Appendix 11.1 Underwater Noise Assessment (APP-065) is unchanged.

2.2 Updates to sensitivities for disturbance (NE Ref D21)

16. This section provides additional information in response to NE's comment (NE Ref D21; RR-061-185):

"*Natural England does not agree that sensitivity of dolphin and seal species to disturbance effects is low. Whilst there may not be as much evidence for these species group, it would be precautionary to consider them as having medium sensitivity. Appendix 5.2.11.2 states that dolphin species are assumed to have the same sensitivity as harbour porpoise (medium); Chapter 11 should align with this.*

We consider that seals can be disturbed by piling over similar ranges to harbour porpoise (~25km), therefore it is appropriate to assign a similar level of sensitivity i.e. medium. Change the sensitivity of seals and dolphin species to disturbance to Medium, and revise the assessment RR-061-185)".

17. The sensitivity assigned to dolphin and seal species for disturbance effects has been presented as medium, to show a more precautionary assessment. The following assessments were therefore updated in **Section 2.6.1** for Project-alone and **Section 2.6.2** for cumulative effects.

18. **Table 2.1** presents a summary of all assessments regarding the disturbance of marine mammals caused by underwater noise from the Project-alone, while **Table 2.2** covers the cumulative disturbance effects.

19. **Table 2.1** presents the updated significance of effect from the Project-alone assessment for disturbance from underwater noise, and all changes in the significance of effect with the updated sensitives is coloured in red.

20. The Project-alone significance of effect for all marine mammals for disturbance from Acoustic Deterrent Device (ADD) activation, piling (using results from Interims Population Consequences of Disturbance (iPCoD) modelling), construction activities, disturbance from vessels, maintenance noise and operational noise from the wind turbine generators (WTG) is **minor adverse,** therefore **not significant in Environmental Impact Assessment (EIA) terms (Table 2.1)**. This conclusion is in line with the ES Chapter 11 Marine Mammals (APP-048), where the worst-case conclusions were

assessed as **negligible** to **minor adverse**, which is **not significant in EIA terms** (**Table 2.1**).

21. **Table 2.2** presents the updated significances of effect from the cumulative effects of underwater noise caused by piling at other OWF and other noisy activities (including piling). The updated sensitives are highlighted in red. The significance of effect is **minor adverse**, and therefore **not significant in EIA terms.** The overall conclusion of effects is not significant in EIA terms in line with that the results presented in ES Chapter 11 Marine Mammals (APP-048).

22. In response to NE's comment on the sensitivity of dolphin and seal species to disturbance effects (NE Ref D21, RR-061-185) the Applicant has provided updated assessments applying an increased level of sensitivity (Medium increased from Low). For all species and impacts considered, the worst-case significance of effect remains **minor adverse** or increases from **negligible to minor adverse**, which is **not significant in EIA terms**. Consequently, the overall conclusion regarding the assessment of the significance of effect from disturbance impacts on dolphin and seal species is unchanged from that presented in Chapter 11 Marine Mammals (APP-048).

Table 2.1 Updated sensitivities for dolphin and seals for the Project-alone assessment for disturbance of marine mammals from underwater noise (updates to the ES are shown in red)

Species/ receptor	Impact	Sensitivity (updated from low*)	Magnitude	Significance of effect (as presented in Chapter 11 Marine Mammals (APP-048))	Significance of effect (based on the updated sensitivity levels)
Bottlenose dolphin	Disturbance during ADD activation	Medium	Negligible	Not Significant (Negligible adverse)	Not Significant (Minor adverse)
	iPCoD modelling (piling)	Medium	Negligible	Not Significant (Negligible adverse)	Not Significant (Minor adverse)
	Disturbance during all construction activities	Medium	Negligible	Not Significant (Negligible adverse)	Not Significant (Minor adverse)
	Disturbance from all construction vessels (maximum area of 285.4km^2)	Medium	Low	Not Significant (Minor adverse)	Not Significant (Minor adverse)
	Disturbance from maintenance activities	Medium	Negligible	Not Significant (Negligible adverse)	Not Significant (Minor adverse)
	Operational WTGs	Medium	Low	Not Significant (Minor adverse)	Not Significant (Minor adverse)
	Disturbance from all operation and maintenance vessels	Medium	Low	Not Significant (Minor adverse)	Not Significant (Minor adverse)
Common dolphin	Disturbance based on dose-response curve (DRC)	Medium	Negligible	Not Significant (Negligible adverse)	Not Significant (Minor adverse)

Species/ receptor	Impact	Sensitivity (updated from low*)	Magnitude	Significance of effect (as presented in Chapter 11 Marine Mammals (APP-048))	Significance of effect (based on the updated sensitivity levels)
	Disturbance during ADD activation	Medium	Negligible	Not Significant (Negligible adverse)	Not Significant (Minor adverse)
	Disturbance during all construction activities	Medium	Negligible	Not Significant (Negligible adverse)	Not Significant (Minor adverse)
	Disturbance from all construction vessels (maximum area of 285.4km^2)	Medium	Negligible	Not Significant (Negligible adverse)	Not Significant (Minor adverse)
	Disturbance from maintenance activities	Medium	Negligible	Not Significant (Negligible adverse)	Not Significant (Minor adverse)
	Operational WTGs	Medium	Low	Not Significant (Minor adverse)	Not Significant (Minor adverse)
	Disturbance from all operation and maintenance vessels	Medium	Negligible	Not Significant (Negligible adverse)	Not Significant (Minor adverse)
Risso's dolphin	Disturbance based on DRC	Medium	Negligible	Not Significant (Negligible adverse)	Not Significant (Minor adverse)
	Disturbance during ADD activation	Medium	Negligible	Not Significant (Negligible adverse)	Not Significant (Minor adverse)
	Disturbance during all construction activities	Medium	Negligible	Not Significant (Negligible adverse)	Not Significant (Minor adverse)
	Disturbance from all construction vessels	Medium	Negligible	Not Significant (Negligible adverse)	Not Significant (Minor adverse)

Species/ receptor	Impact	Sensitivity (updated from low*)	Magnitude	Significance of effect (as presented in Chapter 11 Marine Mammals (APP-048))	Significance of effect (based on the updated sensitivity levels)
	(maximum area of 285.4km^2)				
	Disturbance from maintenance activities	Medium	Negligible	Not Significant (Negligible adverse)	Not Significant (Minor adverse)
	Operational WTGs	Medium	Low	Not Significant (Minor adverse)	Not Significant (Minor adverse)
	Disturbance from all operation and maintenance vessels	Medium	Negligible	Not Significant (Negligible adverse)	Not Significant (Minor adverse)
White-beaked dolphin	Disturbance based on DRC	Medium	Negligible	Not Significant (Negligible adverse)	Not Significant (Minor adverse)
	Disturbance during ADD activation	Medium	Negligible	Not Significant (Negligible adverse)	Not Significant (Minor adverse)
	Disturbance during all construction activities	Medium	Negligible	Not Significant (Negligible adverse)	Not Significant (Minor adverse)
	Disturbance from all construction vessels (maximum area of 285.4km^2)	Medium	Negligible	Not Significant (Negligible adverse)	Not Significant (Minor adverse)
	Disturbance from maintenance activities	Medium	Negligible	Not Significant (Negligible adverse)	Not Significant (Minor adverse)
	Operational WTGs	Medium	Low	Not Significant (Minor adverse)	Not Significant (Minor adverse)

Species/ receptor	Impact	Sensitivity (updated from low*)	Magnitude	Significance of effect (as presented in Chapter 11 Marine Mammals (APP-048))	Significance of effect (based on the updated sensitivity levels)
	Disturbance from all operation and maintenance vessels	Medium	Negligible	Not Significant (Negligible adverse)	Not Significant (Minor adverse)
Grey seal	Disturbance during ADD activation	Medium	Low (negligible)**	Not Significant (Minor adverse)	Not Significant (Minor adverse)
	iPCoD modelling (piling)	Medium	Negligible (negligible)**	Not Significant (Negligible adverse)	Not Significant (Minor adverse)
	Disturbance during all construction activities	Medium	Negligible (negligible)**	Not Significant (Negligible adverse)	Not Significant (Minor adverse)
	Disturbance from all construction vessels (maximum area of 285.4km^2)	Medium	Low (negligible)**	Not Significant (Minor adverse)	Not Significant (Minor adverse)
	Disturbance from maintenance activities	Medium	Negligible	Not Significant (Negligible adverse)	Not Significant (Minor adverse)
	Operational WTGs	Medium	Low	Not Significant (Minor adverse)	Not Significant (Minor adverse)
	Disturbance from all operation and maintenance vessels	Medium	Low (low)**	Not Significant (Minor adverse)	Not Significant (Minor adverse)
Harbour seal	Disturbance during ADD activation	Medium	Negligible (negligible)**	Not Significant (Negligible adverse)	Not Significant (Minor adverse)

Species/ receptor	Impact	Sensitivity (updated from low*)	Magnitude	Significance of effect (as presented in Chapter 11 Marine Mammals (APP-048))	Significance of effect (based on the updated sensitivity levels)
	iPCoD modelling	Medium	Negligible (negligible)**	Not Significant (Negligible adverse)	Not Significant (Minor adverse)
	Disturbance during all construction activities	Medium	Negligible (negligible)**	Not Significant (Negligible adverse)	Not Significant (Minor adverse)
	Disturbance from all construction vessels (maximum area of 285.4km^2)	Medium	Negligible	Not Significant (Negligible adverse)	Not Significant (Minor adverse)
	Disturbance from maintenance activities	Medium	Negligible	Not Significant (Negligible adverse)	Not Significant (Minor adverse)
	Operational WTGs	Medium	Low	Not Significant (Minor adverse)	Not Significant (Minor adverse)
	Disturbance from all operation and maintenance vessels	Medium	Low (negligible)**	Not Significant (Negligible adverse)	Not Significant (Minor adverse)

**In response to RR-061-185, sensitivities have been updated since the ES from low to medium.*

***Magnitudes in brackets are for the wider Management Units (MU)*

Table 2.2 Updated sensitivities for dolphin and seals for the cumulative effects assessment of marine mammals from underwater noise during piling and other noisy projects and activities (updates to the ES are shown in red).

Marine mammal species/receptor	Impact	Sensitivity (updated from low*)	Magnitude	Significance of effect (as presented in Chapter 11 Marine Mammals (APP-048))	Significance of effect
Bottlenose dolphin	iPCoD modelling	Medium	Low	Not Significant (Minor adverse)	Not Significant (Minor adverse)
	Other noisy projects and activities	Medium	Low	Not Significant (Minor adverse)	Not Significant (Minor adverse)
Risso's dolphin	Piling assessment	Medium	Low	Not Significant (Minor adverse)	Not Significant (Minor adverse)
	Other noisy projects and activities	Medium	Low	Not Significant (Minor adverse)	Not Significant (Minor adverse)
Common dolphin	Piling assessment	Medium	Low	Not Significant (Minor adverse)	Not Significant (Minor adverse)
	Other noisy projects and activities	Medium	Low	Not Significant (Minor adverse)	Not Significant (Minor adverse)
White-beaked dolphin	Other noisy projects and activities	Medium	Negligible	Not Significant (Negligible adverse)	Not Significant (Minor adverse)
Grey seal	iPCoD modelling (piling)	Medium	Negligible	Not Significant (Negligible adverse)	Not Significant (Minor adverse)
	Other noisy projects and activities	Medium	Negligible	Not Significant (Negligible adverse)	Not Significant (Minor adverse)
Harbour seal	iPCoD modelling (piling)	Medium	Negligible	Not Significant (Negligible adverse)	Not Significant (Minor adverse)
	Other noisy projects and activities	Medium	Negligible	Not Significant (Negligible adverse)	Not Significant (Minor adverse)

**In response to RR-061-185, sensitivities have been updated since the ES from low to medium.*

2.3 Additional information on ship strike sensitivity (NE Ref D25)

23. This section provides additional information in response to NE's comment RR-061-189 (NE Ref D25);

"*The Applicant has not presented information to justify why minke whale has a medium sensitivity to collision risk, compared to low sensitivity for other marine mammals. We advise that sensitivity to collision risk should be medium for all species. We consider this appropriate based on the statement in paragraph 11.475*".

24. Additional information regarding collision risk has been outlined to provide justification for the sensitivity levels for marine mammal receptors.

25. Marine mammals have some ability to detect and avoid vessels (National Oceanic and Atmospheric Administration (NOAA), 2021).

26. Research shows that larger vessels, such as cruise ships and cargo vessels over 80 meters in length, are more likely to cause severe or fatal injuries to marine mammals (Laist *et al*., 2001; Keen *et al*., 2023) in comparison to smaller vessels. High speeds are a key factor in collisions with cetaceans; for instance, the likelihood of a lethal injury to large whales, specifically the North Atlantic right whale in this study, increased from around 20% to 80% when vessel speeds increased from 8 to 15 knots (Vanderlaan & Taggart, 2007). Serious injuries have also been documented at lower speeds of 2 and 5.5 knots (Conn & Silber, 2013). Conversely, vessels traveling at speeds below 10 knots rarely cause serious injuries, making reduced speed one of the most effective mitigation strategies (Laist *et al*., 2001; Conn & Silber, 2013; Laist *et al*., 2014; Keen *et al*., 2023).

27. The predictability of vessel movements by marine mammals is crucial in minimising the risks posed by vessel traffic (Nowacek *et al*., 2001, Lusseau, 2003; 2006). Reducing vessel speed not only allows more time for marine mammals to move away but also significantly reduces emitted vessel noise. This reduction in noise enables marine mammals to hear approaching ships and prevents interference with intra-species communication (Leaper, 2019).

28. An analysis of the International Whaling Commission (IWC) Ship Strike Database reveals that baleen whales, specifically fin and humpback whales, followed closely by right whales, constitute the majority of ship strike victims (Winkler *et al*., 2020). However, a significant proportion of reported cases (12.1%) lacked species identification. Reports of collisions involving smaller cetacean species are generally scarce due to reporting biases, such as unnoticed collisions, quickly sinking carcasses, or less concern for smaller species (Schoeman *et al*., 2020). The IWC report underscores that the lack of

species identification and the mis- or underreporting of ship strikes remain global issues, leading to uncertainties in the numbers and species affected (Van Waerebeek *et al*., 2007; Winkler *et al*., 2020).

29. In the United Kingdom, approximately 4-6% of stranded small cetaceans (harbour porpoise, common dolphin, white-beaked dolphin and Risso's dolphin) showed evidence of physical trauma during postmortem examinations, potentially attributable to ship strikes. This is compared to 15-20% of stranded whales, based on data from the Cetacean Strandings Investigation Programme (CSIP) database (1990-2010) (Evans *et al*., 2011).

30. Harbour porpoises, being small and highly mobile, are generally expected to avoid vessels due to their responses to vessel noise (e.g., Thomsen *et al*., 2006; Polacheck & Thorpe, 1990). Predictive modelling indicated a negative relationship between the number of ships and the distribution of harbour porpoises in the Irish and Celtic Seas, and North Sea during summer. This suggests that harbour porpoises may exhibit avoidance behaviour, thereby reducing the risk of collisions with vessels (Heinänen & Skov, 2015).

31. Vessel activity influences dolphin behaviour, with socialising and foraging often occurring in the presence of various vessel sizes, as demonstrated in a study conducted by Mills *et al.* (2023) in a busy shipping channel in the Gulf of Mexico. It has been suggested in this study that vessel movements enhanced nutrient mixing, thereby increasing prey abundance. Locally, bottlenose dolphins in Cardigan Bay exhibit responses to vessels that vary based on the type of vessel and their degree of habituation (Koroza & Evans, 2022). Observations indicated that the resident bottlenose dolphins in Cardigan Bay were more likely to tolerate disturbances compared to more transient dolphins in the region (Hudson, 2014). At the time of writing this technical note, there was no information or recorded instances of ship strikes for bottlenose dolphin in Cardigan Bay.

32. In a telemetry study of harbour and grey seals, alongside vessel Automatic Identification System (AIS) information across the British Isles, data indicated vessel and seal co-occurrence was high and that spatial overlap with ships occurred within 50km of the coast close to haul-out sites (Jones *et al*., 2017). Areas with high risk of vessel exposure included 11 Special Areas of Conservation (SAC). In an attempt to determine the likelihood of harbour seal injury occurring due to co-presence with large vessels within the Moray Firth, there appeared to be to be no relationship between areas in high co-occurrence and incidences of injury (Onoufriou *et al*., 2016). In fact, seals were observed not to react to close passing vessels.

33. The information provided above highlights that larger whale species, such as minke whales, are at a greater risk of vessel collisions compared to smaller cetaceans. Evidence shows a lower incidence of physical trauma in strandings

of smaller species, like dolphins and seals, which often display normal behaviour around vessels or even habituate to their presence. In contrast, harbour porpoises exhibit strong avoidance behaviour due to their sensitivity to noise and movement. However, minke whales, being less agile and more prone to ship strikes, do not demonstrate the same avoidance capabilities. Given their size, behaviour, and the documented increase in collisions, baleen whales, such as minke whale, should be considered to have a higher sensitivity to vessel strikes than dolphins, seals, or porpoises.

34. In response to NE's comment on ship strike sensitivity (NE Ref D25; RR-061-189), the Applicant has undertaken a review of available literature and data sources. In addition to the information presented in Chapter 11 Marine Mammals (APP-048) and based on the recent supporting information presented in this section, the Applicant considers that the approach set out in Chapter 11 Marine Mammals (APP-048) is precautionary and proportional to the impact taking into account the behaviour and sensitivity of each species. Therefore, the sensitivities to collision risk remain unchanged.

2.4 Updates to the collision risk assessment (NE Ref D26)

35. This section provides additional information in response to NE's comment RR-061-190 (NE Ref D26):

"*The values in the collision risk rate (%) do not appear correct. For example, for harbour porpoise: the number of deaths due to physical trauma of unknown cause (n=69) plus the deaths due to physical trauma following probable impact from vessel (n=14), totalling 83, is equivalent to 6.90% of the total necropsies where cause of death was established (n=1203); not the 5.6% presented. Review the numbers in this table and update, and/or clarify how the collision risk rate has been calculated"*.

36. The Applicant has reviewed the data used to calculate the collision risk rate which has been updated in **Table 2.3**.

37. Discrepancies identified in Table 11.55 of the Environmental Statement (ES) Chapter 11 Marine Mammals (APP-048) were due to issues in the pivot table of the original datasheet. These discrepancies have not affected the collision risk rate, and therefore the assessment outcomes remain unchanged. The risk rate was estimated by dividing the sum of the number of deaths due to physical trauma of unknown cause plus the deaths due to physical trauma from vessels with the number of necropsied with known causes of death.

38. Based on the information presented in ES Chapter 11 Marine Mammals (APP-048) and the amended values in **Table** 2.3, the Applicant considers that the assessment set out in ES Chapter 11 Marine Mammals (APP-048) is still valid.

Table 2.3 Summary of strandings in the whole of the United Kingdom (UK) and causes of death of marine mammals from physical trauma of unknown cause and physical trauma following possible collision with a vessel (updates to the ES in red)

Species	Number of strandings	Number of necropsies where cause of death established	Cause of death: physical trauma of unknown cause	Cause of death: physical trauma following probable impact from vessel	Collision risk rate: (deaths from vessels strike or physical trauma) / (total known cause of death)	Collision risk rate (%)
Harbour porpoise	5582	1617	75	16	0.056	5.6
Bottlenose dolphin	152	45	1	0	0.022	2.2
Common dolphin	1805	628	17	13	0.048	4.8
Risso's dolphin	139	41	2	1	0.073	7.3
White-beaked dolphin	186	110	5	0	0.045	4.5
Minke whale	236	86	0	6	0.07	7.0
Grey seal	1909	417	18	0	0.043	4.3
Harbour seal	624	179	6	0	0.034	3.4

2.5 Updates to the indicative Unexploded Ordnance (UXO) assessment (RR-047-30)

39. This section provides an updated to a change in magnitude in response to the MMO's comment in reference to Section 3.2.2 in their RR (RR-047-30): *"Further, Table 5-1 confirms that 616 individual harbour porpoise are at risk of PTS (Permanent Threshold Shift) during high-order detonation (353.6 kg Net Explosive Quantity (NEQ) plus donor charge) but this has been assessed as having a 'Medium' magnitude. For Low-Order clearance, 7 individual harbour porpoise are at risk of PTS, and this has also been assessed as having 'Medium' magnitude. The MMO and Cefas (*Centre for Environment, Fisheries and Aquaculture Science) *question whether 'Medium' magnitude is appropriate for the high-order assessment. The MMO* (Marine Management Organisation) *and Cefas understand that this scoring is based on the fact that 1% of the reference population is anticipated to be exposed (which is 0.986 % of the Celtic and Irish Sea (CIS) Management Unit (MU) according to Table 5-1)."*

40. For harbour porpoise, the maximum number of marine mammals potentially at risk of Permanent Threshold Shift (PTS), as outlined in Table 5.1 in Appendix 11.3 Marine Mammal Unexploded Ordnance Assessment (APP-067), was estimated to be 616 animals, or 0.986% of the Celtic and Irish Seas (CIS) MU for a high-order detonation. For a low-order clearance, 7 harbour porpoise, or 0.012% of the CIS MU, were assessed to be at risk of PTS. The magnitude for both high and low-order clearance was assessed as medium, as it falls within the 'medium' threshold limits of 0.01 – 1% of the reference population affected. Although these percentages represent the lowest and the highest ends of this 'medium' threshold range, the number of harbour porpoise at risk of PTS (7 and 616) varies significantly. Consequently, 0.986% has been rounded up to 1% and the assessment of magnitude for PTS from high-order clearance in Table 5.1 in Appendix 11.3 Marine Mammal Unexploded Ordnance Assessment (APP-067) has been revised from medium to high, to conservatively encompass the upper end of the threshold range (**Table 2.4**).

41. In response to NE's comment to update a change in magnitude (reference to Section 3.2.2 in their RR (RR-047-30)), the Applicant has assigned a higher magnitude for harbour porpoise risk to PTS based on the information presented. For harbour porpoise, the effect of PTS from high-order UXO clearance has been assessed as **major adverse** (**significant in EIA terms**), in line with the conclusion in Appendix 11.3 Marine Mammal Unexploded Ordnance Assessment (APP-067). The UXO assessment presented is only indicative and UXO clearance (if required) would be undertaken as part of a separate future marine licence application. Mitigation measures, following the hierarchy outlined in the Draft Marine Mammal Monitoring Protocol (APP-149), would reduce the significance of effect.

Table 2.4 Assessment of PTS from UXO harbour porpoise (updates to ES are shown in red) (updates to Table 5.2 of the Appendix 11.3 Marine Mammal Unexploded Ordnance Assessment (APP-067))

Maximum impact range (and area)	Maximum number of individuals	% of reference population as presented in the Appendix 11.3 Marine Mammal Unexploded Ordnance Assessment (APP-067)	% of reference population	Sensitivity	Magnitude (permanent Impact) as presented in the Appendix 11.3 Marine Mammal Unexploded Ordnance Assessment (APP-067)	Magnitude (permanent impact) and Significance of effect
High-order detonation (353.6kg (NEQ) + donor charge) 11km (380.13km^2)	616 (1.621/km^2 based on the site-specific survey density)	0.986% of the Celtic and Irish Sea (CIS) MU	1% of the Celtic and Irish Sea (CIS) MU	High	Medium	High Significant (Major adverse)
(Low-order clearance (0.5kg (NEQ)) 1.2km (4.52km^2)	7 (1.621/km^2 based on the site-specific survey density	0.012% of the CIS MU	0.012% of the CIS MU	High	Medium	Medium Significant (Major adverse)

2.6 Clarification for iPCoD modelling (NE Ref D4 & D32)

42. This section provides additional information in response to NE's comment (D4; RR-061-168):

> "*Natural England does not agree with the project-alone assessment of disturbance impacts from piling. We have concerns with how the results of the iPCoD modelling are presented. We also require that the impact significance should be presented based on each approach taken to assessing disturbance, not just based on the iPCoD modelling. We cannot agree with the assessment conclusions of the project-alone disturbance effects at this stage. (See Natural England Refs 19 and 23)*
>
> *Update how the iPCoD modelling results are presented in line with comments. Present impact significance for all approaches used to assess disturbance impact.*
>
> *Commit to further mitigation of project-alone impacts, should they be significant*."

43. This section also provides additional information in response to NE's comment (D32; RR-061-196):

> "*The values in the median impacted as percentage of unimpacted column of this table do not correspond to the difference between the un-impacted population mean and the impacted population mean. For example, 288 as a percentage of 293 is 98.29%, not 100.00%. Indeed, Plate 11.3 shows a visible difference in the population size between the two, which is not reflected in Table 11.39.*
>
> *We advise that the difference between the two presented means is included in the table, alongside the median values. The Applicant can provide information to support the value they consider to be most appropriate. Note this comment applies to all tables which present the iPCoD modelling results, including in the CEA. This is of particular importance in the CEA assessment of bottlenose dolphin, where in 2031 the impacted population mean is >5% lower than the un-impacted population mean, and so potentially significant.*
>
> *Present the difference between the two means in each table that presents iPCoD modelling results, including in the CEA. The Applicant can provide information to support the value they consider to be most appropriate".*

44. In relation to the assessment of the population consequences of pile driving noise disturbance on marine mammal receptors, further information and clarification is provided in this section. The iPCoD modelling results presented in Sections 11.6.3.2 and 11.7.3.2 in ES Chapter 11 Marine Mammals (APP-048) and in the Report to Inform Appropriate Assessment (RIAA) (APP-027) considered the median of the ratio of impacted: unimpacted population sizes

for the relevant marine mammal populations as the key metric to determine effect significance using the iPCoD method. This is due to the fact that the median of the ratio of impacted: unimpacted population sizes is considered more statistically robust to the effects of extreme outliers than the mean value, particularly with lower sample sizes (Sinclair *et al*., 2019).

45. In addition, this metric is considered least sensitive to mis-specification of demographic parameters, therefore enabling more robust assessment of offshore renewable effects (Jital *et al*., 2017; Sinclair *et al*., 2019). Evaluations of the sensitivity of outputs to misspecification of demographic parameters have demonstrated that the ratio output metric of the counterfactual of population size (the median of the ratio of the impacted to un-impacted population size across all simulated matched replicate pairs) is a robust metric, and is therefore recommended for population viability type analyses that compare modelled populations with counterfactual populations in the context of offshore wind EIA (Jital *et al*., 2017; Sinclair *et al*., 2019). The approach taken in the ES Chapter 11 Marine Mammals (APP-048) and the RIAA (APP-027) is therefore in line with the guidance set out by the iPCoD developers (Sinclair *et al.,* 2019) and others (Jitlal *et al.,* 2017).

46. This rationale, developed by the authors of the iPCoD code, has resulted in the median of the ratio of impacted:unimpacted population sizes being used and accepted for other recent OWF EIAs, such as Moray West, Seagreen Alpha and Bravo Wind farms, the Sheringham and Dudgeon Extension Projects, North Falls and the Dogger Bank South Projects which all presented the median of the ratio of impacted to un-impacted population size.

47. It is important to note that iPCoD runs 1,000 permutations of a population growth projection for impacted and unimpacted populations. This results in 1,000 impacted: unimpacted population pairs for each time-point in the modelling period (often 25 years). Calculating the ratio between each pair and then taking the median of all ratios results in the “median of the ratio of impacted: unimpacted population sizes”, which is expressed in percentage terms in the iPCoD results tables: Table 11.38 to Table 11.44 for Project-alone assessment and Tables 11.86 to 11.92 for cumulative disturbance of the ES Chapter 11 Marine Mammals (APP-048) and RIAA (APP-027). Crucially, this is not the same process as taking the median of the 1,000 impacted populations at a given time point, the median of the unimpacted population, and then comparing their ratio. In short, one method results in the median of all modelled population differences, the other method results in the difference between the medians of all modelled impacted and unimpacted populations. Therefore, it is not possible to use the average (mean or median) population values presented within iPCoD tables to calculate the median of the ratio of impacted: unimpacted population sizes, which is also presented in the same tables and is the primary metric for assessing effect significance.

48. For completeness, and at the request of NE in their comment (Ref. D32), the mean and median ratios of impacted: unimpacted population sizes are presented for the iPCoD simulation runs conducted for the Project-alone (**Section 2.6.1**) and cumulatively (**Section 2.6.2**) in relation to reference populations used in the ES Chapter 11 Marine Mammals (APP-048). In line with this comment, updates to the RIAA (APP-027) have been made separately in a Technical Note (Document Reference 9.26) submitted alongside this Technical Note at Deadline 1. Once again, it is important to note that it should not be expected that calculating the percentage difference between the mean impacted and unimpacted population sizes at a given timepoint (presented in the result tables) will result in the same value as the mean ratio of impacted: unimpacted population sizes presented in the same tables.

49. In terms of the Project-alone, the modelled impact of piling from the Project falls below the threshold of a 1% annual decline in population (regardless of whether median or mean values are used) which was considered not significant in the ES Chapter 11 Marine Mammals (APP-048).

50. For the cumulative assessment, for all species assessed, the modelled impact of piling from the Project fell below the threshold of a 1% annual decline in population (regardless of whether median or mean values are used) which was considered insignificant. The greatest impact of cumulative disturbance using median values occurs for minke whale, with a predicted 3.2% decline in population size over a 25-year period, which is below the 1% annual decline mark (as presented in ES Chapter 11 Marine Mammals (APP-048). When considering the mean values presented here, the greatest impact of cumulative disturbance for minke whale is a predicted 3.75% decline in population size over a 25-year period, which is also below the 1% annual decline mark (**Table 2.14**), and not materially different to the median values presented in the ES Chapter 11 Marine Mammals (APP-048). When considering the mean population sizes, the greatest impact of cumulative disturbance occurs for bottlenose dolphin, with a predicted 4.73% decline in population size over a 25-year period (**Table 2.13**), which is below the 1% annual decline mark.

51. For the reasons set out above, comparison of the median ratio of impacted: unimpacted populations is considered to be a measure more robust to the influence of outliers and mis-specification of demographic parameters than the mean. However, the additional information presented here in this section demonstrates that the choice of using median or mean values to compare population sizes does not materially affect the outcomes of the assessment presented in ES Chapter 11 Marine Mammals (APP-048), with all modelling results showing less than 1% annual decline for the first six years, whether the mean or median values are used.

2.6.1 Clarifications to the Project-alone from underwater noise due to piling

2.6.1.1 Harbour porpoise

52. For harbour porpoise, iPCoD results were presented for Project-alone effects in Section 11.6.3.2 in the ES Chapter 11 Marine Mammals (APP-048). The results have been presented again here, with both median and mean population sizes, and the mean and median ratios of impacted: unimpacted population sizes displayed (**Table 2.5**). The results show a less than 1% average[1] annual decline over the first six years and over the 25 year period for both the mean and median, assessed as negligible magnitude, therefore **minor adverse** significance of effect, **not significant in EIA terms**, in line with the results presented within ES Chapter 11 Marine Mammals (APP-048).

[1] This was determined by dividing the overall percentage change for the 6 and 25 year timepoints by 6 and 25, respectively, to obtain an annual average change.

Table 2.5 Results of the iPCoD modelling for the Project, giving the mean population size of the harbour porpoise population (CIS MU) for years up to 2052 for both impacted and un-impacted populations, in addition to the mean and median ratio between their population sizes (clarifications to Table 11.38 of the ES Chapter 11 Marine Mammals (APP-048))

Year	Un-impacted population mean	Impacted population mean	Mean impacted as % of un-impacted	Un-impacted population median	Impacted population median	Median impacted as % of un-impacted
Start	62,516	62,516	100.00%	62,516	62,516	100.00%
End 2028	62,451	62,451	100.00%	62,590	62,590	100.00%
End 2029	62,424	62,268	99.75%	62,431	62,304	99.89%
End 2032	62,524	62,403	99.81%	62,317	62,191	99.89%
End 2037	62,307	62,180	99.80%	61,858	61,698	99.89%
End 2047	62,036	61,908	99.80%	61,274	61,197	99.89%
End 2052	61,876	61,750	99.80%	60,910	60,745	99.89%

2.6.1.2 Bottlenose dolphin

53. For bottlenose dolphin, iPCoD results were presented for Project-alone effects in Section 11.6.3.2 in the ES Chapter 11 Marine Mammals (APP-048). The results have been presented again here, with both median and mean population sizes, and the mean and median ratios of impacted: unimpacted population sizes displayed (**Table 2.6**). The results show a less than 1% average annual decline over the first six years and over the 25 year period for both mean and median, assessed as negligible magnitude, therefore **minor adverse** significance of effect, **not significant in EIA terms**, in line with the results presented within ES Chapter 11 Marine Mammals (APP-048).

Table 2.6 Results of the iPCoD modelling for the Project, giving the mean population size of the bottlenose dolphin population (IS MU) for years up to 2052 for both impacted and un-impacted populations in addition to the mean and median ratio between their population sizes (clarifications to Table 11.39 of the ES Chapter 11 Marine Mammals (APP-048))

Year	Un-impacted population mean	Impacted population mean	Mean impacted as % of un-impacted	Un-impacted population median	Impacted population median	Median impacted as % of un-impacted
Start	296	296	100.00%	296	296	100.00%
End 2028	295	295	100.00%	296	296	100.00%
End 2029	293	288	98.30%	294	290	100.00%
End 2032	287	283	98.69%	288	284	100.00%
End 2037	278	275	98.85%	278	274	100.00%
End 2047	262	259	98.75%	258	256	100.00%
End 2052	255	252	98.73%	252	250	100.00%

2.6.1.3 Minke whale

54. For minke whale, iPCoD results were presented for Project-alone effects in Section 11.6.3.2 in the ES Chapter 11 Marine Mammals (APP-048). The results have been presented again here, with both median and mean population sizes, and the mean and median ratios of impacted: unimpacted population sizes displayed (**Table 2.7**). The results show a less than 1% average annual decline over the first six years and over the 25 years period for both the mean and median, assessed as negligible magnitude, therefore **minor adverse** significance of effect, **not significant in EIA terms**, in line with the results presented within ES Chapter 11 Marine Mammals (APP-048).

Table 2.7 Results of the iPCoD modelling for the Project, giving the mean population size of the minke whale population (Celtic and Greater North Sea (CGNS MU) for years up to 2052 for both impacted and un-impacted populations in addition to the mean and median ratio between their population sizes (clarifications to Table 11.40 of ES Chapter 11 Marine Mammals (APP-048))

Year	Un-impacted population mean	Impacted population mean	Mean impacted as % of un-impacted	Un-impacted population median	Impacted population median	Median impacted as % of un-impacted
Start	20,120	20,120	100.00%	20,120	20,120	100.00%
End 2028	20,188	20,188	100.00%	20,256	20,256	100.00%
End 2029	20,222	20,203	99.91%	20,236	20,217	99.94%
End 2032	20,193	20,145	99.76%	20,148	20,078	99.81%
End 2037	20,189	20,114	99.63%	20,032	19,944	99.70%
End 2047	20,115	20,026	99.56%	19,857	19,784	99.63%
End 2052	19,976	19,887	99.56%	19,407	19,320	99.63%

2.6.1.4 Grey seal

55. For grey seal, iPCoD results were presented for Project-alone effects in Section 11.6.3.2 in the ES Chapter 11 Marine Mammals (APP-048). The results have been presented again here, for both the smaller 'combined population' (North-West (NW) England MU and Isle of Man (IoM) population) (**Table 2.8**) and for the wider reference population (**Table 2.9**), with both median and mean population sizes, and the mean and median ratios of impacted: unimpacted population sizes. The results show no annual decline over the first six years and over the 25 years period for both the mean and median, assessed as negligible magnitude, therefore **minor adverse** significance of effect, **not significant in EIA terms**, in line with the results presented within ES Chapter 11 Marine Mammals (APP-048).

Table 2.8 Results of the iPCoD modelling for the Project, giving the mean population size of the grey seal combined population (NW England MU and IoM population) for years up to 2052 for both impacted and un-impacted populations in addition to the median and mean ratio between their population sizes (clarifications to Table 11.42 of the ES Chapter 11 Marine Mammals (APP-048))

Year	Un-impacted population mean	Impacted population mean	Mean impacted as % of un-impacted	Un-impacted population median	Impacted population median	Median impacted as % of un-impacted
Start	1,592	1,592	100.00%	1,592	1,592	100.00%
End 2028	1,605	1,605	100.00%	1,612	1,605	100.00%
End 2029	1,617	1,617	100.00%	1,620	1,617	100.00%
End 2032	1,650	1,649	100.00%	1,654	1,649	100.00%
End 2037	1,701	1,701	100.00%	1,692	1,701	100.00%
End 2047	1,814	1,814	100.00%	1,806	1,814	100.00%
End 2052	1,876	1,876	100.00%	1,868	1,876	100.00%

Table 2.9 Results of the iPCoD modelling for the Project, giving the mean population size of the grey seal population (wider population (see Section 11.5.9) for years up to 2052 for both impacted and un-impacted populations in addition to the median and mean ratio between their population sizes (clarifications to Table 11.41 of the ES Chapter 11 Marine Mammals (APP-048))

Year	Un-impacted population mean	Impacted population mean	Mean impacted as % of un-impacted	Un-impacted population median	Impacted population median	Median impacted as % of un-impacted
Start	13,288	13,288	100.00%	13,288	13,288	100.00%
End 2028	13,388	13,388	100.00%	13,454	13,454	100.00%
End 2029	13,443	13,444	100.00%	13,501	13,501	100.00%
End 2032	13,735	13,736	100.00%	13,811	13,811	100.00%
End 2037	14,202	14,203	100.00%	14,243	14,244	100.00%
End 2047	15,116	15,118	100.00%	15,011	15,015	100.00%
End 2052	15,583	15,585	100.00%	15,431	15,434	100.00%

2.6.1.5 Harbour seal

56. For harbour seal, iPCoD results were presented for Project-alone effects in Section 11.6.3.2 in the ES Chapter 11 Marine Mammals (APP-048), the results have been presented again here for both the NW MU (**Table 2.10**) and the NW and Northern Ireland (NI) MU (**Table 2.11**), with both median and mean population sizes, and the mean and median ratios of impacted: unimpacted population sizes displayed. The results show no annual decline in the first six years and over the 25 years period for both the mean and median, assessed as negligible magnitude, therefore **minor adverse** significance of effect, **not significant in EIA terms**, in line with the results presented within ES Chapter 11 Marine Mammals (APP-048).

Table 2.10 Results of the iPCoD modelling for the Project, giving the mean population size of the harbour seal population (North West MU) for years up to 2052 for both impacted and un-impacted populations in addition to the median and mean ratio between their population sizes (clarifications to Table 11.44 of the ES Chapter 11 Marine Mammals (APP-048))

Year	Un-impacted population mean	Impacted population mean	Mean impacted as % of un-impacted	Un-impacted population median	Impacted population median	Median impacted as % of un-impacted
Start	4	4	100.00%	4	4	100.00%
End 2028	3	3	100.00%	4	4	100.00%
End 2029	3	3	100.00%	4	4	100.00%
End 2032	3	3	100.00%	4	4	100.00%
End 2037	3	3	100.00%	2	2	100.00%
End 2047	3	3	100.00%	0	0	100.00%
End 2052	3	3	100.00%	0	0	100.00%

Table 2.11 Results of the iPCoD modelling for the Project, giving the mean population size of the harbour seal population (NW England MU and NI MU) for years up to 2052 for both impacted and un-impacted populations in addition to the median and mean ratio between their population sizes (clarifications to Table 11.43 of the ES Chapter 11 Marine Mammals (APP-048))

Year	Un-impacted population mean	Impacted population mean	Mean impacted as % of un-impacted	Un-impacted population median	Impacted population median	Median impacted as % of un-impacted
Start	1,412	1,412	100.00%	1,412	1,412	100.00%
End 2028	1,413	1,413	100.00%	1,416	1,416	100.00%
End 2029	1,413	1,413	100.00%	1,414	1,414	100.00%
End 2032	1,417	1,417	100.00%	1,412	1,412	100.00%
End 2037	1,425	1,425	100.00%	1,421	1,421	100.00%
End 2047	1,428	1,428	100.00%	1,406	1,406	100.00%
End 2052	1,426	1,426	100.00%	1,406	1,406	100.00%

2.6.2 Clarifications to cumulative effects from underwater noise due to piling

57. Section 11.7.3.2 in ES Chapter 11 Marine Mammals (APP-048) presents the assessment of the potential cumulative effects of other projects that could occur at the same time as the Project. Population modelling was deemed the best tool to use to assess the potential impacts of cumulative disturbance as it considers the consequences of disturbance and hearing damage (worst-case numbers) that might result from the construction of the Project and other projects.

58. The results have been presented again here, with both median and mean population sizes, and the mean and median ratios of impacted: unimpacted population sizes. A greater than 1% average annual decline is not found for any species, regardless of whether mean or median metric are used, and therefore the conclusions within ES Chapter 11 Marine Mammals (APP-048) remain valid.

2.6.2.1 Harbour porpoise

59. For harbour porpoise, iPCoD modelling resulted in no significant effect on the population (**Table 2.12**). Whether the mean or median value is used to inform the results, the results show a less than 1% average annual decline over the first six years and over the 25 year period for both the mean and median. Therefore, disturbance from cumulative underwater noise from piling is assessed as negligible magnitude, with **minor adverse** significance of effect which is **not significant in EIA terms**. There would be no significant effect on the harbour porpoise population due to piling, and the conclusions of ES Chapter 11 Marine Mammals (APP-048) therefore remain valid.

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Table 2.12 Results of the iPCoD modelling for the cumulative assessment, giving the mean population size of the harbour porpoise population (CIS MU) for years up to 2051 for both impacted and un-impacted populations in addition to the median and mean ratio between their population sizes (clarifications to Table 11.86 of the ES Chapter 11 Marine Mammals (APP-048))

Year	Un-impacted population mean	Impacted population mean	Mean impacted as % of un-impacted	Un-impacted population median	Impacted population median	Median impacted as % of un-impacted
Start	62,516	62,516	100.00%	62,516	62,516	100.00%
End 2027	62,574	62,569	99.99%	62,730	62,721	100.00%
End 2028	62,509	62,278	99.63%	62,837	62,508	99.78%
End 2031	62,389	61,703	98.91%	62,426	61,650	99.22%
End 2036	62,482	61,818	98.95%	62,299	61,505	99.26%
End 2046	62,436	61,770	98.95%	61,605	60,900	99.27%
End 2051	62,564	61,897	98.95%	61,739	61,130	99.26%

2.6.2.2 Bottlenose dolphin

60. For bottlenose dolphin, iPCoD modelling resulted in no significant effect on the population (**Table 2.13**). Whether the mean or median value is used to inform the results, the results show a less than 1% average annual decline over the first six years and over the 25 year period for both the mean and median. Hence, disturbance from cumulative underwater noise from piling is assessed as negligible magnitude, therefore **minor adverse** significance of effect and **not significant in EIA terms**. There would be no significant effect on the bottlenose dolphin population due to piling, and therefore the conclusions of ES Chapter 11 Marine Mammals (APP-048) remain valid.

Table 2.13 Results of the iPCoD modelling for the cumulative assessment, giving the mean population size of the bottlenose dolphin population (IS MU) for years up to 2051 for both impacted and un-impacted populations in addition to the median and mean ratio between their population sizes (clarifications to Table 11.87 of the ES Chapter 11 Marine Mammals (APP-048))

Year	Un-impacted population mean	Impacted population mean	Mean impacted as % of un-impacted	Un-impacted population median	Impacted population median	Median impacted as % of un-impacted
Start	296	296	100.00%	296	296	100.00%
End 2027	295	289	98.13%	296	292	100.00%
End 2028	292	281	96.14%	294	284	98.61%
End 2031	286	271	94.85%	288	272	97.71%
End 2036	277	264	95.64%	276	262	97.87%
End 2046	261	249	95.32%	260	245	97.80%
End 2051	254	242	95.27%	250	236	97.97%

2.6.2.3 Minke whale

61. For minke whale, iPCoD modelling resulted in no significant effect on the population (**Table 2.14**). Whether the mean or median value is used to inform the results, the results show a less than 1% average annual decline over the first six years and over the 25 year period for both the mean and median. Hence, disturbance from cumulative underwater noise from piling is assessed as negligible magnitude. Significance of effect is assessed as **minor adverse** and **not significant in EIA terms**. There would be no significant effect on the minke whale population due to piling, and therefore the conclusions of ES Chapter 11 Marine Mammals (APP-048) remain valid.

Table 2.14 Results of the iPCoD modelling for the cumulative assessment, giving the mean population size of the minke whale population (CGNS MU) for years up to 2051 for both impacted and un-impacted populations in addition to the median and mean ratio between their population sizes (clarifications to Table 11.88 of the ES Chapter 11 Marine Mammals (APP-048)))

Year	Un-impacted population mean	Impacted population mean	Mean impacted as % of un-impacted	Un-impacted population median	Impacted population median	Median impacted as % of un-impacted
Start	20,118	20,118	100.00%	20,118	20,118	100.00%
End 2027	20,125	20,123	99.99%	20,293	20,289	100.00%
End 2028	20,185	20,140	99.78%	20,378	20,348	99.87%
End 2031	20,226	19,885	98.31%	20,406	20,129	98.75%
End 2036	20,270	19,691	97.13%	20,451	19,834	97.63%
End 2046	20,472	19,724	96.33%	20,513	19,746	96.88%
End 2051	20,525	19,757	96.25%	20,355	19,707	96.80%

2.6.2.4 Grey seal

62. For grey seal, iPCoD modelling resulted in no significant effect on the population (**Table 2.15** (NW England and IoM MU)) and (**Table 2.16** (wider population)). Whether the mean or median value is used to inform the results, the results show a less than 1% average annual decline over the first six years and over the 25 year period for both the mean and median. Hence, disturbance from cumulative underwater noise from piling is assessed as negligible magnitude with **minor adverse** significance of effect which is **not significant in EIA terms**. There would be no significant effect on the grey seal population due to piling, and therefore the conclusions of ES Chapter 11 Marine Mammals (APP-048) remain valid.

Table 2.15 Results of the iPCoD modelling for the cumulative assessment, giving the mean population size of the grey seal combined population (NW England MU and IoM population) for years up to 2051 for both impacted and un-impacted populations in addition to the median and mean ratio between their population sizes (clarifications to Table 11.90 of the ES Chapter 11 Marine Mammals (APP-048)))

Year	Un-impacted population mean	Impacted population mean	Mean impacted as % of un-impacted	Un-impacted population median	Impacted population median	Median impacted as % of un-impacted
Start	1,592	1,592	100.00%	1,592	1,592	100.00%
End 2028	1,603	1,603	100.00%	1,608	1,608	100.00%
End 2029	1,612	1,611	99.98%	1,616	1,616	100.00%
End 2032	1,645	1,642	99.82%	1,654	1,652	99.88%
End 2037	1,711	1,708	99.78%	1,708	1,706	99.86%
End 2047	1,834	1,830	99.77%	1,826	1,822	99.96%
End 2052	1,896	1,892	99.78%	1,872	1,870	100.00%

Table 2.16 Results of the iPCoD modelling for the cumulative assessment, giving the mean population size of the grey seal population (wider reference population) for years up to 2051 for both impacted and un-impacted populations in addition to the median and mean ratio between their population sizes (clarifications to Table 11.89 of the ES Chapter 11 Marine Mammals (APP-048))

Year	Un-impacted population mean	Impacted population mean	Mean impacted as % of un-impacted	Un-impacted population median	Impacted population median	Median impacted as % of un-impacted
Start	13,288	13,288	100.00%	13,288	13,288	100.00%
End 2027	13,393	13,393	100.00%	13,458	13,458	100.00%
End 2028	13,473	13,475	100.02%	13,547	13,548	100.01%
End 2031	13,727	13,732	100.04%	13,759	13,767	100.04%
End 2036	14,192	14,197	100.04%	14,148	14,154	100.04%
End 2046	15,049	15,054	100.04%	14,984	14,986	100.03%
End 2051	15,557	15,563	100.03%	15,450	15,448	100.03%

* Note that the marginal increase in the impacted population in comparison to the un-impacted population is a result of the environmental stochasticity built into the model

2.6.2.5 Harbour seal

63. For harbour seal, iPCoD modelling resulted in no significant effect on the population (**Table 2.17** (NW England MU) and **Table 2.18** (NW England and NI MU)). Whether the mean or median value is used to inform the results, the results show a less than 1% average annual decline over the first six years and over the 25 year period for both the mean and median. Hence, disturbance from cumulative underwater noise from piling is assessed as negligible magnitude, with **minor adverse** significance of effect, which is **not significant in EIA terms**. There would be no significant effect on the harbour seal population due to piling, and therefore the conclusions of ES Chapter 11 Marine Mammals (APP-048) remain valid.

Table 2.17 Results of the iPCoD modelling for the Project, giving the mean population size of the harbour seal population (North West MU) for years up to 2051 for both impacted and un-impacted populations in addition to the median and mean ratio between their population sizes (clarifications to Table 11.92 of the ES Chapter 11 Marine Mammals (APP-048))

Year	Un-impacted population mean	Impacted population mean	Mean impacted as % of un-impacted	Un-impacted population median	Impacted population median	Median impacted as % of un-impacted
Start	4	4	100.00%	4	4	100.00%
End 2028	3	3	100.00%	4	4	100.00%
End 2029	3	3	100.00%	4	4	100.00%
End 2032	3	3	100.00%	4	4	100.00%
End 2037	3	3	100.00%	2	2	100.00%
End 2047	3	3	100.00%	0	0	100.00%
End 2052	3	3	100.00%	0	0	100.00%

Table 2.18 Results of the iPCoD modelling for the cumulative assessment, giving the mean population size of the harbour seal population (North West MU and NI MU) for years up to 2051 for both impacted and un-impacted populations in addition to the median and mean ratio between their population sizes (clarifications to Table 11.91 of the ES Chapter 11 Marine Mammals (APP-048))

Year	Un-impacted population mean	Impacted population mean	Mean impacted as % of un-impacted	Un-impacted population median	Impacted population median	Median impacted as % of un-impacted
Start	1,412	1,412	100.00%	1,412	1,412	100.00%
End 2027	1,415	1,415	100.00%	1,418	1,418	100.00%
End 2028	1,413	1,413	100.00%	1,414	1,414	100.00%
End 2031	1,416	1,416	100.00%	1,416	1,416	100.00%
End 2036	1,420	1,420	100.00%	1,414	1,414	100.00%
End 2046	1,430	1,430	100.00%	1,420	1,420	100.00%
End 2051	1,436	1,436	100.00%	1,420	1,420	100.00%

64. In response to NE's comment (D4; RR-061-168) and D32; RR-061-196) on the presentation of iPCoD modelling results, particularly with regard to the mean and median of the ratio of impacted: unimpacted population sizes, the Applicant considers that the additional information provided in this section is sufficient to determine that the median is the most appropriate key metric to evaluate the significance of a population level effect. Having calculated both the mean and the median values to compare population sizes, the assessment conclusions presented for Project-alone and cumulatively in Chapter 11 Marine Mammals (APP-048) remain unchanged.

2.7 Clarification on disturbance assessments (NE Ref D4 & D28)

65. This section provides additional information in response to NE's comment (D4; RR-061-168):

"*Natural England does not agree with the project-alone assessment of disturbance impacts from piling. We have concerns with how the results of the iPCoD modelling are presented. We also require that the impact significance should be presented based on each approach taken to assessing disturbance, not just based on the iPCoD modelling. We cannot agree with the assessment conclusions of the project-alone disturbance effects at this stage. (See Natural England Refs 19 and 23)*

Update how the iPCoD modelling results are presented in line with comments. Present impact significance for all approaches used to assess disturbance impact.

Commit to further mitigation of project-alone impacts, should they be significant."

66. This section also provides additional information in response to NE's comment (D28; RR-061-192):

"*The significance of the disturbance impact must be presented for each of the approaches used to determine disturbance distance. Each approach and subsequent assessment of impact significance provides necessary information for Natural England to inform its advice. For example, the magnitude of impact to harbour porpoise using the EDR* (Effective Deterrence Range) *approach is Medium, which when combined with a Medium sensitivity, leads to a Moderate impact significance which is Significant in EIA terms. Information such as this is currently missing. It is not appropriate to only present the significance of the disturbance impact after population modelling has been undertaken. This also applies to the CEA* (Cumulative Effect Assessment). *We advise that an assessment of cumulative impacts to cetacean species is presented using the approach that*

generates the worst-case numbers disturbed. The Applicant should not only present the iPCoD modelling results.

Present the impact significance for each approach used to determine the disturbance range, using the combination of sensitivity and magnitude (percentage of reference population within the disturbance range). Present the cumulative impact significant for each species using the worst-case numbers disturbed i.e. not only the iPCoD modelling results."

67. As outlined in **Section 2.2**, the amended sensitivities in response to NE Ref. D21 (RR-061-185) have been incorporated into the updated assessment in **Sections 2.7.1** and **2.7.2**, which present information on the significance for each assessment method.

2.7.1 Clarifications to the Project-alone assessment

68. This section provides information in response to NE's comment (D4; RR-061-168).

69. Harbour porpoise Table 2.19 presents the magnitude and significance of effect for all assessment methods used in the ES Chapter 11 Marine Mammals (APP-048) to assess for potential disturbance to harbour porpoise from piling, including the Effective Deterrence Range (EDR) approach, the DRC approach, and the population modelling (iPCoD) approach.

70. For the EDR approach, the significance of effect is moderate adverse (significant in EIA terms). Whereas for the other two methods, the DRC and the iPCoD population modelling shows that there is minor adverse and negligible adverse effect respectively (not significant in EIA terms) for the potential of disturbance to harbour porpoise.

71. Brown *et al*. (2023) highlights the approach used to produce the current 26km EDR likely overestimates the response because it does not account for underlying seasonal variation during baseline and piling periods. In addition, findings in the latest PrePared report looking at harbour porpoise response to piling at Ocean Winds Moray West OWF found evidence of an EDR of 10km, providing a strong case for reducing the current 26 km EDR for unabated impact piling of monopiles (Benhemma-Le Gall *et al*., 2024).

72. As stated by NE within their Phase III Best Practice guide[2] "*a dose-response curve is recommended to assess behavioural responses as a matter of best practice, where possible and relevant. This is the most recent approach, is a*

[2] Offshore Wind Marine Environmental Assessments: Best Practice Advice for Evidence and Data Standards; Phase III: Expectations for data analysis and presentation at examination for offshore wind applications (Parker *et al*., 2022)

more realistic representation of animal response, and is based on empirical at-sea monitoring data".

73. Therefore, the resultant significance level using the DRC approach is considered the most realistic assessment for harbour porpoise and based on the latest research and knowledge, while the EDR approach, as outlined above, can be considered to be over-precautionary. Regardless, the resultant iPCoD modelling used the results from the EDR approach to investigate the validity of the indicated a significant effect on the harbour porpoise population, with no population level effect expected, even using the over-precautionary EDR approach.

74. Taking into account all considerations above, it has been concluded that the potential for disturbance from the Project for harbour porpoise would be **minor adverse, therefore not significant in EIA terms,** and in line with the assessment set out in ES Chapter 11 Marine Mammals (APP-048).

Table 2.19 Assessment of potential disturbance of harbour porpoise (updates to ES are shown in red)

Assessment Method	Maximum number of individuals (% of reference population)	Sensitivity	Magnitude (temporary effect)	Significance of effect (as presented in the ES Chapter 11 Marine Mammals (APP-048))	Significance of effect (changes compared to ES highlighted in red)
26km EDR for monopiles (2,124km^2)	3,443 (5.5% of CIS MU)	Medium	Medium	Not provided	Significant (Moderate adverse) *Significance is further investigated through iPCoD modelling*
DRC	1,857.9 (2.97% of CIS MU)	Medium	Low	Not provided	Not Significant (Minor adverse)
iPCoD modelling	<1% of CIS MU	Medium	Negligible	Not Significant (Minor adverse)	Not Significant (Minor adverse)

2.7.1.1 Bottlenose dolphin

75. **Table 2.20** presents the results from all methods used to assess for potential disturbance from underwater noise due to piling to bottlenose dolphin. Results from the DRC (with the harbour porpoise DRC used as a proxy) show that there could be a major adverse effect (significant in EIA terms), however taking into account the difference in hearing sensitivity between harbour porpoise (Very-High Frequency (VHF) cetaceans) and bottlenose dolphin (High-Frequency (HF) cetaceans (see Table 11.20 in ES Chapter 11 Marine Mammals (APP-048); Southall *et al.,* 2019), this would be over-precautionary. DRC should be used where the species and sound type combination is available, which is lacking for all dolphin species (Sinclair *et al*., 2023). In addition, the resultant iPCoD modelling used the results from the DRC approach to investigate the validity of the indicated significant effect on the bottlenose dolphin population, with no population level effect expected, even with the over-precautionary use of the harbour porpoise DRC.

76. Using a temporary hearing threshold (TTS) as a proxy for disturbance or results from the iPCoD population assessment generate an effect of minor adverse (not significant in EIA terms). It is also important to note that bottlenose dolphin have a predominantly coastal distribution (see ES Appendix 11.2 Marine Mammal Information and Survey Data (APP-066)). They are primarily an inshore species, with most sightings within 10km of land. The Project windfarm site would be located approximately 30km from the nearest point on the coast; therefore, bottlenose dolphin are unlikely to be significantly disturbed.

77. It is therefore concluded that the significance of effect for bottlenose dolphin to potential underwater noise disturbance from piling is **minor adverse (not significant in EIA terms)** whereas it was assessed as negligible adverse in the ES Chapter 11 Marine Mammals (APP-048). Increasing the sensitivity (in line with NE Ref. D21) would result in an increase in the significance of effect, but it would remain as not significant in EIA terms.

Table 2.20 Assessment of potential disturbance of bottlenose dolphin (updates to ES are shown in red)

Assessment Method	Maximum number of individuals (% of reference population)	Sensitivity (updated from low*)	Magnitude (temporary effect)	Significance of effect (as presented in the ES Chapter 11 Marine Mammals (APP-048))	Significance of effect
TTS 0.1km^2	0.001 (0.0004% of Irish Sea (IS) MU)	Medium	Negligible	Not provided	Not Significant (Minor adverse)
DRC	56.3 (19.2% of IS MU)	Medium	High	Not provided	Significant (Major adverse) *Significance is further investigated through iPCoD modelling*
iPCoD modelling	<2% of IS MU	Medium	Negligible	Not Significant (Minor adverse)	Not Significant (Minor adverse)

**In response to RR-061-185, sensitivities have been updated since the ES from low to medium.*

78. Common dolphin **Table 2.21** presents the results from all methods used to assess for potential disturbance to common dolphin from underwater noise due to piling. Using TTS as a proxy for disturbance or results from the DRC assessment (using the harbour porpoise DRC as a proxy) results in a significance effect of minor adverse (not significant in EIA terms).

79. Amending the sensitivity of disturbance from underwater noise for common dolphin from low to medium (in line with NE Ref. D21) changes the significance of effect from negligible adverse (not significant in EIA terms) to **minor adverse, not significant in EIA terms (Table 2.21),** and therefore the overall conclusions are in line with the with the ES Chapter 11 Marine Mammals (APP-048).

Table 2.21 Assessment of potential disturbance of common dolphin (updates to ES are shown in red)

Assessment Method	Maximum number of individuals (% of reference population)	Sensitivity (updated from low)*	Magnitude (temporary effect)	Significance of effect (as presented in the ES Chapter 11 Marine Mammals (APP-048))	Significance of effect
TTS 0.1km^2	0.003 (0.000003% of CGNS MU)	Medium	Negligible	Not provided	Not Significant (Minor adverse)
DRC	127.6 (0.12% of CGNS MU)	Medium	Negligible	Not Significant (Negligible adverse)	Not Significant (Minor adverse)

**In response to RR-061-185, sensitivities have been updated since the ES from low to medium.*

80. Risso's dolphin **Table 2.22** presents the results from all methods used to assess for potential disturbance to Risso's dolphin from underwater noise due to piling. Using TTS as a proxy for disturbance or results from the DRC assessment (using the harbour porpoise DRC as a proxy) results in a significance effect of minor adverse (not significant in EIA terms).

81. Amending the sensitivity of disturbance from underwater noise for Risso's dolphin from low to medium changes the significance of effect from negligible adverse (not significant in EIA terms) to **minor adverse, not significant in EIA terms (Table 2.22)** and therefore the overall conclusions are in line with the ES Chapter 11 Marine Mammals (APP-048)).

Table 2.22 Assessment of potential disturbance of Risso's dolphin (updates to ES are shown in red)

Assessment Method	Maximum number of individuals (% of reference population)	Sensitivity (updated from low)*	Magnitude (temporary effect)	Significance of effect (as presented in the ES Chapter 11 Marine Mammals (APP-048))	Significance of effect
TTS 0.1km^2	0.0006 (0.0000005% of CGNS MU)	Medium	Negligible	Not provided	Not Significant (Minor adverse)
DRC	2.4 (0.02% of CGNS MU)	Medium	Negligible	Not Significant (Negligible adverse)	Not Significant (Minor adverse)

**In response to RR-061-185, sensitivities have been updated since the ES from low to medium.*

82. White-beaked dolphin **Table 2.23** presents the results from all methods used to assess for potential disturbance to white-beaked dolphin from underwater noise due to piling. Using TTS as a proxy for disturbance or results from the DRC assessment (using the harbour porpoise DRC as a proxy) results in a significance effect of minor adverse (not significant in EIA terms).

83. Amending the sensitivity of disturbance from underwater noise for white-beaked dolphin from low to medium (in line with NE Ref. D21) changes the significance of effect from negligible adverse (not significant in EIA terms) to **minor adverse, which is not significant in EIA terms** (**Table 2.23**), and therefore the overall conclusions are in line with the ES Chapter 11 Marine Mammals (APP-048).

Table 2.23 Assessment of potential disturbance of white-beaked dolphin (updates to ES are shown in red)

Assessment Method	Maximum number of individuals (% of reference population)	Sensitivity (updated from low)*	Magnitude (temporary effect)	Significance of effect (as presented in the ES Chapter 11 Marine Mammals (APP-048))	Significance of effect
TTS 0.1km^2	0.001 (0.000002% of CGNS MU)	Medium	Negligible	Not provided	Not Significant (Minor adverse)
DRC	17.9 (0.04% of CGNS MU)	Medium	Negligible	Not Significant (Negligible adverse)	Not Significant (Minor adverse)

**In response to RR-061-185, sensitivities have been updated since the ES from low to medium.*

84. Minke whale **Table 2.24** presents the results from assessing any potential disturbance to minke whale from underwater noise due to piling, including using the 30km EDR approach (Richardson *et al*., 1999) based on the literature review in Section 6.1.3 in Appendix 11.2 Marine Mammal Information and Survey Data (APP-066) and iPCoD modelling. Both methods result in a significance of effect of **minor adverse (not significant in EIA terms),** and therefore the overall conclusions are in line with the ES Chapter 11 Marine Mammals (APP-048).

Table 2.24 Assessment of potential disturbance of minke whale (updates to ES are shown in red)

Assessment Method	Maximum number of individuals (% of reference population)	Sensitivity	Magnitude (temporary effect)	Significance of effect (as presented in the ES Chapter 11 Marine Mammals (APP-048))	Significance of effect
30km disturbance range (2827.43km^2)	24.9 (0.12% of CGNS MU)	Medium	Negligible	Not provided	Not Significant (Minor adverse)
iPCoD modelling	<1% of CGNS[3] MU	Medium	Negligible	Not Significant (Minor adverse)	Not Significant (Minor adverse)

[3] An error involving the incorrect Management Unit has been identified and corrected in The Applicant's Response to the Rule 9 Letter (PD1-010).

2.7.1.2 Grey seal

85. **Table 2.25** presents all methods used to assess for potential disturbance to grey seal. Using the 25km disturbance range (Russel *et al*., 2016) the significance of effect is major adverse (which is significant in EIA terms). The 25km disturbance range is the only accepted range for assessing disturbance to seals from piling. However, it is unknown how appropriate the 25km disturbance range is as the study was conducted on harbour seal only.

86. The 25km disturbance range for grey seal could be considered over precautionary because it stems from a single study on harbour seal response to OWFs. This study did not account for variations in piling characteristics or the effects of bathymetry on sound propagation. Consequently, the displacement distance of grey seal could vary significantly across sites (Madsen *et al*., 2006, Russel *et al*., 2016).

87. The results from the iPCoD modelling used the results from the 25km disturbance range approach to investigate the validity of the indicated significant effect on the grey seal population, with no population level effect expected.

88. The DRC assessment and the iPCoD modelling result in a minor adverse significance of effect (not significant in EIA terms).

89. Therefore, taking all three assessments into account, it is concluded that the potential for disturbance to grey seal from underwater noise due to piling would be **minor adverse (not significant in EIA terms),** in line with the conclusions of the ES Chapter 11 Marine Mammals (APP-048).

90. In the ES Chapter 11 Marine Mammals (APP-048), the significance of effect was assessed as negligible adverse (not significant in EIA terms). Increasing the sensitivity (in line with NE Ref. D21) has increased the significance of effect, but it remains not significant in EIA terms.

Table 2.25 Assessment of potential disturbance of grey seal (updates to ES are shown in red)

Assessment Method	Maximum number of individuals (% of reference population)	Sensitivity (updated from low)**	Magnitude* (temporary effect)	Significance of effect (as presented in the ES Chapter 11 Marine Mammals (APP-048))	Significance of effect
25km disturbance range (1963.5 km^2)	196.4 (12.3% of the combined MU; or 1.5% of the wider reference population)	Medium	High (Low)	Not provided	Significant (Major adverse) *Significance is further investigated through iPCoD modelling*
DRC	0.151 (0.009% of the combined MU; 0.00001% of the wider reference population)	Medium	Negligible (negligible)	Not provided	Not Significant (Minor adverse)
iPCoD modelling	<1% of the combined and wider reference population[3]	Medium	Negligible (negligible)	Not Significant (Negligible adverse)	Not Significant (Minor adverse)

**Magnitudes in brackets are for the wider MU.*

***In response to RR-061-185, sensitivities have been updated since the ES from low to medium.*

2.7.1.3 Harbour seal

91. **Table 2.26** presents all methods used to assess for potential disturbance to harbour seal. Using the 25km EDR (Russel *et al*., 2016) which is the only accepted disturbance range for seals, could be again considered as over precautionary as it is a result from one study. Disturbance ranges can vary amongst different projects, due to pile designs, bathymetry on sound propagation. Using the 25km disturbance range, the effect would be minor adverse, and under the DRC and iPCoD modelling approach, the assessments are also minor adverse (both not significant in EIA terms). In ES Chapter 11 Marine Mammals (APP-048), the effect was assessed as negligible adverse (not significant in EIA terms), but due to increasing the sensitivity from low to medium to disturbance (NE Ref. D21), the significance of effect would be minor adverse (not significant in EIA terms).

92. Therefore, taking all three assessments into account, it is concluded that the potential for disturbance to harbour seal from underwater noise due to piling would be minor adverse (not significant in EIA terms), in line with the overall conclusions of ES Chapter 11 Marine Mammals (APP-048). Again, the iPCoD modelling is the most appropriate tool to assess the potential impacts of disturbance to consider the longer term population consequences of harbour seal.

Table 2.26 Assessment of potential disturbance of harbour seal (updates to ES are shown in red)

Assessment Method	Maximum number of individuals (% of reference population)	Sensitivity (updated from low)**	Magnitude* (temporary effect)	Significance of effect (as presented in the ES Chapter 11 Marine Mammals (APP-048))	Significance of effect
25km disturbance range (1963.5 km^2)	0.22 (3.1% of the NW MU; or 0.015% of wider reference population)	Medium	Low (negligible)	Not provided	Not Significant (Minor adverse)
DRC	0.001 (0.0084% of the NW MU; or <0.00001% of the wider reference population)	Medium	Negligible (negligible)	Not provided	Not Significant (Minor adverse)
iPCoD modelling	<1% of the NW MU, and the wider reference population[3])	Medium	Negligible	Not Significant (Negligible adverse)	Not Significant (Minor adverse)

**Magnitudes in brackets are for the wider MU*

***In response to RR-061-185, sensitivities have been updated since the ES from low to medium.*

2.7.2 Clarifications to cumulative effects from underwater noise due to piling

93. This section provides information in response to NE's comment (NE Ref. D28; RR-061-192).

94. The following section applies to harbour porpoise, bottlenose dolphin, minke whale, grey seal and harbour seal, where a quantitative assessment (beyond population modelling) has not been presented previously in the ES. Within the ES, following the initial screening of UK and European OWFs, further screening was undertaken to identify those OWF projects that have the potential for overlapping construction phases with the Project. This screening considered known piling activities and/or construction timings, in order to determine a more realistic, but still worst-case, list of UK and European OWF projects that may have the potential for overlapping piling activities with the Project (see Appendix 11.4 Marine Mammal CEA Project Screening (APP-068) for further details).

95. The potential disturbance from underwater noise during piling activities has been assessed based on the worst-case numbers of animals disturbed taken from assessments either using disturbance ranges or EDRs or the DRCs (Project-alone). The worst-case numbers of animals disturbed used for the cumulative assessment is presented in Table 7.6 in Appendix 11.2 Marine Mammal Information and Survey Data (APP-066) from other OWF projects' ESs and Preliminary Environmental Information Report (PEIR)s. These numbers were only presented in the iPCoD modelling, however, to address NE's comment (NE Ref. D28), these numbers are presented in **Table 2.27, Table 2.29, Table 2.31**, **Table 2.33** and **Table 2.35** and quantitatively assessed by adding the numbers of potentially disturbed animals together to get the total estimated number and estimated effect on the population. The total estimates of the number of animals that could be potentially disturbed from underwater noise from other piling projects is presented with and without the Project, with the significance of effect.

96. There were six OWFs screened in as having a construction period that could potentially overlap with the construction of the Project, that could be undertaking piling activities at the same time as the Project (Table 11.84, in the ES Chapter 11 Marine Mammals (APP-048)). These other projects were included in individual marine mammal assessments if the projects were within the marine mammal MU. The numbers of animals potentially disturbed were added together to get an overall estimated impact on the population.

97. For common dolphin, Risso's dolphin and white-beaked dolphin, the quantified assessments using disturbance ranges or DRC have already been provided within Table 11.85 of the ES Chapter 11 Marine Mammals (APP-048) (note

that white-beaked dolphin are not included in this cumulative assessment (for disturbance from piling) as no project screened in for assessment included this species as a receptor).

2.7.2.1 Harbour porpoise

98. **Table 2.27** provides a quantified assessment of magnitude of cumulative disturbance due to piling overlap with other OWF, utilising project-specific data from published PEIRs and ESs as outlined in Appendix 11.2 Marine Mammal Information and Survey Data (APP-066).

Table 2.27 Quantified Cumulative Effects Assessment (CEA) for the potential disturbance for harbour porpoise during single piling at the OWF projects which could be piling at the same time as the Project

Harbour porpoise			
Project	**Harbour porpoise density (/km$^{2)}$**	**Impact area (km^2)**	**Maximum number of individuals potentially disturbed during single piling**
The Project	1.621	2123.7	3,442.5
Awel y Môr	1.00	DRC	2,112
Mona	0.097	DRC	429.0
Morgan Generation Assets	0.274	DRC	979.0
Morgan and Morecambe Transmission Assets[4]	0.560	DRC	1,793.0
Erebus	0.400	DRC	1,967.0
White Cross	0.92	2123.7	1,949.6
Total number of harbour porpoise (*without the Project*)			**12,672.1**
			9,229.6
Percentage of CIS MU (*without the Project*)			**20.3%**
			14.8%
Magnitude of cumulative effect (*without the Project*)			**High**
			High

[4] At the time of writing the ES, a decision had been taken that the offshore substation platforms (OSPs) would not be included within the DCO Application for the Transmission Assets. This decision post-dated the Transmission Asset PEIR (within which the OSPs are also assessed). The final ES for the Transmission Assets will therefore not include the OSPs or associated interconnector cables. Additionally, a decision had been taken since the PEIR that the Morgan Offshore Booster Station (OBS) would no longer be required. Whilst the OSPs, OBS and interconnector cables will not form part of the DCO Application for the Transmission Assets, they are included here as they were contained within the Transmission Asset PEIR which has been used to inform the ES.

99. **Table 2.28** presents the assessment of significance of effect for harbour porpoise due to cumulative effects from piling and using data such as EDRs and DRC assessments from other projects. With or without the project, the significance of effect on harbour porpoise is major adverse (**Table 2.28**). This is considered very precautionary as it does not take into account any mitigation measures, and it is unlikely that all projects would pile on the same day for various reasons such as project timings, technical and mechanical issues, port calls, and varying weather restraints affecting vessels and equipment. In addition, the potential for a significant effect was further investigated through iPCoD modelling to determine the validity of the indicated significant effect on the harbour porpoise population. The results of the population modelling, using the same data as shown in **Table 2.27**, found that there is no population level effect expected as presented in Section 11.7.3.2. in the ES Chapter 11 Marine Mammals (APP-048).

100. In the ES Chapter 11 Marine Mammals (APP-048), impact significance results were presented as minor adverse due to the results from the population modelling. The Applicant still considers iPCoD to be the best approach. The model requires detailed demographic information and an understanding of the relationship between days of disturbance and individual survival and reproduction rates (Sinclair *et al*., 2023) by taking the worst-case numbers of disturbance, models a thousand scenarios, and looks at population effects on an annual and longer term basis. Therefore, it is considered to be the most appropriate tool to assess cumulative disturbance. For harbour porpoise the effect of cumulative disturbance from piling has been assessed as **minor adverse (not significant in EIA terms)**, in line with ES Chapter 11 Marine Mammals (APP-048).

Table 2.28 Assessment of significance of effect for disturbance of harbour porpoise from cumulative effects from underwater noise (updates to ES are shown in red)

Assessment Method	Sensitivity	Magnitude (temporary effect)	Significance of effect (as presented in the ES Chapter 11 Marine Mammals (APP-048))	Significance of effect
Quantified assessment (see **Table 2.27**)	Medium	High	Not provided	Significant (Major adverse) *Significance is further investigated through iPCoD modelling*
iPCoD modelling	Medium	Negligible	Not Significant (Minor adverse)	Not Significant (Minor adverse)

2.7.2.2 Bottlenose dolphin

101. **Table 2.29** provides a quantified assessment of disturbance to bottlenose dolphin due to piling overlap with other OWF, utilising project-specific data from PEIRs and ESs as outlined in Table 7.6 in ES Appendix 11.2 Marine Mammal Information and Survey Data (APP-066). **Table 2.29** shows that a high percentage of bottlenose dolphins would be at risk of potential disturbance. However, this assessment does not consider the distance to the piling activity nor the unlikelihood of all activities taking place on the same day. This is due to factors such as project timings, technical and mechanical issues, port calls, and varying weather constraints affecting vessels and equipment. Therefore, population modelling was used by the Applicant which takes into account the detailed demographic information and an understanding of the relationship between days of disturbance and individual survival and reproductive rates (Sinclair *et al*., 2023). This method is, therefore, regarded as the most appropriate for evaluating potential cumulative disturbances and the population consequences for bottlenose dolphin from the IS MU.

Table 2.29 Quantified CEA for the potential disturbance for, bottlenose dolphin during single piling at the OWF projects which could be piling at the same time as the Project

Bottlenose dolphin			
Project	**Bottlenose Dolphin density (/km^2)**	**Impact area (km^2)**	**Maximum number of individuals potentially disturbed during single piling**
The Project	0.0104	DRC	56.3
Awel y Môr	0.0350	DRC	23
Mona	0.0350	DRC	13
Morgan Generation Assets	0.0350	DRC	11
Morgan and Morecambe Transmission Assets[4]	0.0010	DRC	4
Total number of bottlenose dolphin *(without the Projects)*			**107.3**
			51.0
Percentage of IS MU *(without the Project)*			**36.6%**
			17.4%
Magnitude of cumulative effect *(without the Project)*			**High**
			High

102. **Table 2.30** presents the significance of effect from cumulative disturbance due to piling for bottlenose dolphin. Again, it is considered that using the DRC assessments from other projects is over precautionary, as these assessments are not specifically designed for dolphin species. Furthermore, the population

modelling incorporated the worst-case numbers of disturbance and auditory injury and provided data on how that could impact the IS bottlenose dolphin population.

103. Therefore, for bottlenose dolphin the effect of cumulative disturbance from piling has been **assessed as minor adverse (not significant in EIA terms)** which is no change to the significance of effect presented in ES Chapter 11 Marine Mammals (APP-048) as the Applicant still considers population modelling to be the best approach.

Table 2.30 Assessment of significance of effect for disturbance of bottlenose from cumulative effects from underwater noise (updates to ES are shown in red)

Assessment Method	Sensitivity (updated from low)*	Magnitude (temporary effect)	Significance of effect (as presented in the ES Chapter 11 Marine Mammals (APP-048))	Significance of effect
Quantified assessment (**see Table 2.29**)	Medium	High	Not provided	Significant (Major adverse) *Significance is further investigated through iPCoD modelling*
iPCoD modelling	Medium	Negligible	Not Significant (Minor adverse)	Not Significant (Minor adverse)

**In response to RR-061-185, sensitivities have been updated since the ES from low to medium*

104. Minke whale Table 2.31 provides a quantified assessment of disturbance to minke whale due to piling overlap with other OWF, utilising project-specific data from PEIRs and ESs as outlined in Table 7.6 in ES Appendix 11.2 Marine Mammal Information and Survey Data (APP-066), and results in a minor adverse effect (not significant in EIA terms).

Table 2.31 Quantified CEA for the potential disturbance for, minke whale during single piling at the OWF projects which could be piling at the same time as the Project

Minke whale			
Project	**Minke whale density (/km$^{2)}$**	**Impact area (km^2)**	**Maximum number of individuals potentially disturbed during single piling**
The Project	0.0088	2827.43	24.9
Awel y Môr	0.0170	DRC	36
Mona	0.0173	DRC	77
Morgan Generation Assets	0.0173	DRC	69
Morgan and Morecambe Transmission Assets[4]	0.0050	DRC	17
Erebus	0.0112	DRC	53
White Cross	0.0112	TTS 100m	0.0004
Total number of minke whale (*without the Project*)			**276.9**
			252.0
Percentage of CGNS MU (*without the Project*)			**1.38%**
			1.25%
Magnitude of cumulative effect (*without the Project*)			**Low**
			Low

105. **Table 2.32** presents the significance of effect for minke whale from cumulative disturbance due to underwater noise from piling, and the significance of effect is minor adverse, therefore, not significant in EIA terms; this is in line with the conclusions of the assessment provided in ES Chapter 11 Marine Mammals (APP-048). A number of minke whale would be at risk of potential disturbance, yet this assessment does not account or the distance to the piling activity or the unlikelihood of all activities occurring simultaneously. Factors such as project schedules, technical and mechanical issues, port calls, and varying weather conditions affecting vessels and equipment contribute to this. Consequently, the Applicant used population modelling, which incorporates detailed demographic information and an understanding of the relationship between days of disturbance and individual survival and reproductive rates (Sinclair *et al*., 2023). This method is considered the most appropriate for assessing potential cumulative disturbance and its population consequences for minke whale from the CGNS MU.

Table 2.32 Assessment of significance of effect for disturbance of minke whale from cumulative effects from underwater noise (updates to ES are shown in red)

Assessment Method	Sensitivity	Magnitude (temporary effect)	Significance of effect (as presented in the ES Chapter 11 Marine Mammals (APP-048))	Significance of effect
Quantified assessment (**see Table 2.31**)	Medium	Low	Not provided	Not Significant (Minor adverse)
iPCoD modelling	Medium	Negligible	Not Significant (Minor adverse)	Not Significant (Minor adverse)

106. Grey seal **Table 2.33** provides a quantified assessment of disturbance to grey seal due to piling overlap with other OWF, utilising project-specific data from PEIRs and ESs as outlined in ES Appendix 11.2 Marine Mammal Information and Survey Data (APP-066) and results in a **minor adverse effect (not significant in EIA terms)**. A large number of grey seal could be at risk of potential disturbance, although the assessment does not consider the unlikelihood of all activities occurring simultaneously, nor the distances to the piling activities. Factors such as project schedules, technical and mechanical issues, port calls, and varying weather conditions affecting vessels and equipment contribute to this. Consequently, the Applicant used population modelling, which incorporates detailed demographic information and an understanding of the relationship between days of disturbance and individual survival and reproductive rates (Sinclair *et al*., 2023). This method is considered the most appropriate for assessing potential cumulative disturbance and its population consequences for grey seal.

Table 2.33 Quantified CEA for the potential disturbance for grey seal during single piling at the OWF projects which could be piling at the same time as the Project

Grey seal			
Project	**Grey seal density (/km²)**	**Impact area (km²)**	**Maximum number of individuals potentially disturbed during single piling**
The Project	0.1	1963.5	196.4
Awel y Môr	0.070	DRC	81
Mona	0.196	DRC	45
Morgan Generation Assets	0.041	DRC	45
Morgan and Morecambe Transmission Assets[4]	0.106	DRC	28
Erebus	0.070	DRC	18
Total number of grey seal			**413.4**
(without the Projects)			***217***
Percentage of wider reference population			**3.11%**
(without the Project)			***1.63%***
Magnitude of cumulative effect			**Low**
(without the Project)			***Low***

107. Assessment of significance of effect for disturbance of grey seal from cumulative effects of underwater noise (updates to ES are shown in red) provides the significance of effect for grey seal from cumulative disturbance due to underwater noise from piling, and the significance of effect is **minor adverse, therefore not significant in EIA terms,** in line with the overall conclusions presented in ES Chapter 11 Marine Mammals (APP-048).

108. In the ES Chapter 11 Marine Mammals (APP-048), the significance of effect was assessed as negligible adverse (not significant in EIA terms), therefore amending the sensitivity (in line with NE Ref. D21) increases the significance of effect to minor adverse (not significant in EIA terms).

Table 2.34 Assessment of significance of effect for disturbance of grey seal from cumulative effects of underwater noise (updates to ES are shown in red)

Assessment Method	Sensitivity (updated from low)*	Magnitude (temporary effect)	Significance of effect (as presented in the ES Chapter 11 Marine Mammals (APP-048))	Significance of effect
Quantified assessment (see **Table 2.33**)	Medium	Low	Not provided	Not Significant (Minor adverse)
iPCoD modelling	Medium	Negligible	Not Significant (Negligible adverse)	Not Significant (Minor adverse)

**In response to RR-061-185, sensitivities have been updated since the ES from low to medium.*

2.7.2.3 Harbour seal

109. **Table 2.35** provides a quantified assessment of cumulative disturbance to harbour seal due to piling overlap with other OWFs, utilising project-specific data from PEIRs and ESs for other OWFs as outlined in ES Appendix 11.2 Marine Mammal Information and Survey Data (APP-066), and results in a **minor adverse effect (not significant in EIA terms)**. Despite the small number of harbour seals that could be at risk of potential disturbance, the assessment in Table 5.17 assumes that all activities would occur simultaneously and does not consider the distances to the piling sites. Factors such as project schedules, technical and mechanical issues, port calls, and varying weather conditions affecting vessels and equipment contribute to this. Consequently, the Applicant used population modelling, which incorporates detailed demographic information and an understanding of the relationship between days of disturbance and individual survival and reproductive rates (Sinclair *et al*., 2023). This method is considered the most appropriate for assessing potential cumulative disturbance and its population consequences for harbour seal.

Table 2.35 Quantified CEA for the potential disturbance of harbour seal during single piling event at the OWF projects which could be piling at the same time as the Project

Harbour seal			
Project	**Harbour seal density (/km^2)**	**Impact area (km^2)**	**Maximum number of individuals potentially disturbed during single piling**
The Project	0.22	1963.5	0.22
Awel y Môr*	0.22	n/a	0.22
Mona	1	DRC	1
Morgan Generation Assets	1	DRC	1
Morgan and Morecambe Transmission Assets[4]	1	DRC	1
Total number of harbour seal *(without the Project)*			**3.44**
			3.22
Percentage of wider reference population *(without the Project)*			**0.30%**
			0.28%
Magnitude of cumulative effect *(without the Project)*			**Negligible**
			Negligible

**This project did not assess harbour seal. However, due to the proximity to the Project, the same values as the Project have been applied as a precautionary measure.*

110. **Table 2.36** presents the significance of effect for grey seal from cumulative disturbance due to underwater noise from piling, and the significance of effect is **minor adverse, therefore not significant in EIA terms,** in line with the overall conclusions presented in the ES Chapter 11 Marine Mammals (APP-048).

111. In the ES Chapter 11 Marine Mammals (APP-048), the significance of effect was assessed as negligible adverse (not significant in EIA terms), therefore amending the sensitivity (in line with NE Ref. D21) increases the significance of effect to **minor adverse**, but it remains **not significant in EIA terms**.

Table 2.36 Assessment of significance of effect for disturbance of harbour seal from cumulative effects of underwater noise (updates to ES are shown in red)

Assessment Method	Sensitivity (updated from low)*	Magnitude (temporary effect)	Significance of effect (as presented in the ES Chapter 11 Marine Mammals (APP-048))	Significance of effect
Quantified assessment (see **Table 2.35**)	Medium	Negligible	Not provided	Not Significant (Minor adverse)
iPCoD modelling	Medium	Negligible	Not Significant (Negligible adverse)	Not Significant (Minor adverse)

**In response to RR-061-185, sensitivities have been updated since the ES from low to medium.*

112. In response to NE's comment on the insufficient presentation of disturbance assessments (D4; RR-061-168) for Project-alone and cumulatively with other plans and projects, the Applicant has undertaken a review and a comparison of all methods used to assess for potential disturbance from underwater noise due to piling. The Applicant considers that the results presented in the ES Chapter 11 Marine Mammals (APP-048) were the most appropriate and remain unchanged.

2.8 Cumulative effects from underwater noise from all noisy activities (NE Ref D50)

113. This section provides additional information in response to NE's comment (Ne Ref. D50; RR-061-214) which is linked to NE's RR Ref. RR-061-192 (NE Ref. D28):

"*The Applicant does not appear to have presented the number of animals impacted from all cumulative disturbance pathways (piling at other OWFs; construction activities (other than piling) at other OWFs; other industries and activities). This combined disturbance impact should be presented.*

Present the combined cumulative effect of disturbance from underwater noise, across the three pathways that are currently assessed only separately."

114. **Table 2.37** lists all noisy activities that could coincide with piling at the Project, including piling and construction activities at other OWFs, which are likely to coincide with construction of the Project as well as any other potential noisy activities mentioned in paragraph 11.812 in ES Chapter 11 Marine Mammals (APP-048). The Applicant would also like to highlight that the other noisy activities such as geophysical surveys, seismic surveys, aggregate extraction, dredging and UXO clearance are indicative as it is difficult to know when these

projects may occur. Impacts of these activities would need to be licensed separately, taking account of the Project's consented activities in their licence applications.

115. Therefore, taking this indicative approach determines the associated potential magnitude of cumulative effect of the listed noisy activities should they all occur at the same time. This table is an expanded version of Table 11.107 in ES Chapter 11 Marine Mammal (APP-048).

116. **Table 2.37** presents the magnitude of the potential for cumulative disturbance taking account of all of the piling and other OWF construction activities described in Section 11.7.3.1 in ES Chapter 11 Marine Mammals (APP-048) as well as other noisy activities (i.e. seismic, geophysical, UXO clearance and aggregates and dredging) indicatively as described in Section 11.7.3.2 in ES Chapter 11 Marine Mammals (APP-048). **Table 2.38** presents the same assessment as **Table 2.37** but uses the population modelling results to showcase the difference in magnitudes and effect significances, compared to those in **Table 2.37**. Only those species for which population modelling was conducted in the ES Chapter 11 Marine Mammals (APP-048) are presented in **Table 2.38**.

117. The significance of effect for these updated noisy activities (based both on data from other projects' published PEIRs and ESs only and on population modelling results) has then been evaluated and has been updated from those set out in ES Chapter 11 Marine Mammals (APP-048). **Table** 2.39 represents an extended version based on Table 11.108 in ES Chapter 11 Marine Mammals (APP-048). It includes all disturbance assessments provided in the cumulative effects assessment.

118. Based on the assessment using other projects' published PEIRs and ESs only (**Table 2.39**) the results of the CEA for disturbance from all noisy activities including piling are major adverse for harbour porpoise and bottlenose dolphin and moderate adverse for grey seal (which are significant in EIA terms). However, for all three species, a large proportion of the number of individuals potentially disturbed is from piling at both the Project and other OWFs without any mitigation applied. These activities have been further investigated through population modelling, and the resultant magnitudes (taking into account the modelling results) indicate that the significance of effect would be major adverse for bottlenose dolphin, and moderate adverse for minke whale and grey seal (significant in EIA terms) (**Table 2.39**). All other species were assessed as having a **minor adverse significance (not significant in EIA terms**).

119. **Table 2.37** and **Table 2.38** both include an assessment of magnitudes, if the indicative activities (geophysical and seismic surveys, and UXO clearance) are removed from the overall assessment. These activities are included on a

worst-case and precautionary approach, however, none are currently consented or applied for, and therefore their inclusion represents a currently unrealistic future prediction of activities. If these were to be removed from the assessments, the resultant significance would be reduced to minor adverse for harbour porpoise, minke whale and grey seal (when also taking account the population modelling results (**Table 2.39**). Another factor to take into account is that not all activities are likely to occur at the same time, and this level of significance of effect does not include any mitigation.

120. The sensitivities have been amended from low to medium for all dolphin and seal species. This change was requested by NE, within their RR (NE Ref. D21) who did not agree that the disturbance effects for these species are low. For harbour porpoise and minke whale, the sensitivities remained as medium, as defined in Section 11.6.2 in ES Chapter 11 Marine Mammals (APP-048).

121. Taking into account the population modelling results, because the iPCoD takes the worst case numbers for disturbance and permanent auditory injury along with detailed demographic information and an understanding of the relationship between days of disturbance and individual survival and reproductive rates (Sinclair *et al*., 2023), it is deemed as the most representative method. In addition, the indicative nature of some activities, and that it is unlikely that all activities would take place at the same time, the overall effect significance for all species would be **minor adverse (not significant in EIA terms)**, in line with ES Chapter 11 Marine Mammals (APP-048).

122. Further, while it is not considered that commitment to specific additional mitigation is yet required, it is noted the Applicant will commit to the production of an Underwater Sound Management Strategy as a mechanism to consider further mitigation measures when further details of the Project and other cumulative projects are developed. This approach of developing a Strategy to mitigate underwater noise impacts is in line with the other Irish Sea Round 4 projects.

Table 2.37 Quantitative assessment for all overlapping piling and construction at other OWFs, as well as other industry noisy activities with the potential for cumulative disturbance effects for marine mammals, based on data from other Projects' published PEIRs and ESs only (activities in grey are indicative only; no formal application has been made) (magnitude levels based on the percentage of the reference population affected, as set out in Table 11.10 in ES Chapter 11 Marine Mammals (APP-048)

Impact	Number of individuals (based on published PEIRs and ESs only)							
	Harbour porpoise	Bottlenose dolphin	Common dolphin	Risso's dolphin	White-beaked dolphin	Minke whale	Grey seal	Harbour seal
Worst-case disturbance from the Project (piling)	3,442.5	56.3	127.6	2.4	17.9	24.9	196.4	0.2
Piling at other OWFs	9,233.8	51.0	2,387.0	333.0	0.0	252.0	226.5	3.66
Construction activities at other OWFs	146.7	35.5	15.8	0.5	2.4	14.5	40.5	0.0
Geophysical surveys	613.9	7.4	19.8	0.4	5.0	6.2	64.5	0.05
Aggregates and dredging	0.035	-	1.9	0.01	-	0.02	0.2	-
Seismic surveys	872.6	15.8	42.5	3.3	10.6	11.9	405.4	0.3
UXO clearance	1,134.2	1.6	4.4	0.1	1.1	219.5	122.6	0.097
Total number of individuals	**15,439.5**	**167.6**	**2,599.0**	**339.7**	**37.0**	**529.0**	**1,056.1**	**4.3**
(without indicative activities)	*12,818.9*	*142.8*	*2,532.3*	*336.0*	*20.3*	*291.4*	*463.6*	*3.86*
Percentage of MU	**24.7%**	**57.2%**	**2.5%**	**2.8%**	**0.08%**	**2.6%**	**7.9%**	**0.4%**
(without indicative activities)	*20.5%*	*48.7%*	*2.4%*	*2.7%*	*0.05%*	*1.5%*	*3.5%*	*0.3%*
Magnitude of cumulative effect	**High**	**High**	**Low**	**Low**	**Negligible**	**Low**	**Medium**	**Negligible**
(without indicative activities)	*High*	*High*	*Low*	*Low*	*Negligible*	*Low*	*Low*	*Negligible*

Table 2.38 Illustrative assessment for all overlapping piling and construction activities at other OWFs, as well as other industry noisy activities with the potential for cumulative disturbance effects for harbour porpoise, bottlenose dolphin, minke whale and seals based on population modelling results (activities in grey are indicative only; no formal application has been made) (magnitude levels based on the percentage of the reference population affected, as set out in Table 11.10 in ES Chapter 11 Marine Mammals (APP-048)

Impact	**Number of individuals (based on population modelling results)**				
	Harbour porpoise	**Bottlenose dolphin**	**Minke whale**	**Grey seal**	**Harbour seal**
Worst-case disturbance from the Project (piling) and piling at other projects*	0.74% reduction in population**	2.03% reduction in population**	3.2% reduction in population**	0% change in population**	0% change in population**
Construction activities at other OWFs	146.7	35.5	14.5	40.5	0.0
Geophysical surveys	*613.9*	*7.4*	*6.2*	*64.5*	*0.05*
Aggregate extraction and dredging	0.035	-	0.02	0.2	-
Seismic surveys	*872.6*	*15.8*	*11.9*	*405.4*	*0.3*
UXO clearance	*1,134.2*	*1.6*	*219.5*	*122.6*	*0.097*
Total number of individuals	**2,767.4**	**60.3**	**252.1**	**633.2**	**0.5**
(without indicative activities)	*146.7*	*35.5*	*14.5*	*40.7*	*0*
Percentage of MU	**4.4%**	**20.6%**	**1.3%**	**4.8%**	**0.04%**
(without indicative activities)	*0.2%*	*12.1%*	*0.07%*	*0.3%*	*0%*
Magnitude of cumulative effect	**Low**	**High**	**Low**	**Low**	**Negligible**
(without indicative activities)	*Negligible*	*High*	*Negligible*	*Negligible*	*Negligible*

Worst-case disturbance has been presented as the median ratio of unimpacted: impacted population change over 25 years taken from the tables and figures in **Section 5.3.2 or in Section 11.7.3.2 in ES Chapter 11 Marine Mammals (APP-048).*

***The percentages were not added to the calculations and are for illustrative purposes only as no value was assigned to it.*

Table 2.39 Updated Assessment of effect significance for the potential of a cumulative disturbance effect due to piling and other noisy projects and activities

Marine mammal species/receptor	Sensitivity	Results of assessment based on published PEIRs and ESs		Results of assessment based on population modelling	
		Magnitude	Significance of effect	Magnitude	Significance of effect
Harbour porpoise	Medium	High	Significant (Major adverse)	Negligible	Not significant (Minor adverse)
Bottlenose dolphin	Medium*	High	Significant (Major adverse)	Low	Not Significant (Minor adverse)
Common dolphin	Medium*	Low	Not Significant (Minor adverse)	*n/a*	*n/a*
Risso's dolphin	Medium*	Low	Not Significant (Minor adverse)	*n/a*	*n/a*
White-beaked dolphin	Medium*	Negligible	Not Significant (Minor adverse)	*n/a*	*n/a*
Minke whale	Medium	Negligible	Not Significant (Minor adverse)	Negligible	Not Significant (Minor adverse)
Grey seal	Medium*	Medium	Significant (Moderate adverse)	Negligible	Not Significant (Minor adverse)
Harbour seal	Medium*	Negligible	Not Significant (Minor adverse)	Negligible	Not Significant (Minor adverse)

**In response to RR-061-185, sensitivities have been updated since the ES from low to medium.*

123. In response to NE's comment on the insufficient presentation of all cumulative disturbance pathways (NE Ref. D50; RR-061-214), the Applicant has provided a quantified assessment for each marine mammal receptor. Although the Applicant believes the quantified assessment may not accurately represent disturbed animals due the indicative nature of most activities, the most representative method using iPCoD has not changed the assessment conclusion in ES Chapter 11 Marine Mammals (APP-048).

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